Request for Proposal
for

Selection of Contractor for Comprehensive O&M for GMDC's 50 MW Wind Power Project at Rojmal, Gujarat

Answer to Pre-Bid Queries and Corrigendum – I

Gujarat Mineral Development Corporation Limited
Khanij Bhavan, 132-Ring Road, Gujarat University Ground, Vastrapur, Ahmedabad- 380052

Pre-Bid Meeting Date: 03rd Nov-2022

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Part A: Responses to pre-bid queries

Sr. No.	Clause No	Description of clause	Pre-bid query/clarification	Response/ Addendum/Corrigendum (if any)
1.	3.1.1 (Part 2)	Handover and takeover of operations	Handover and takeover of operations will be joint responsibility of GMDC and bidder. Prior to the effective or commencement date of the O&M Services, both the Parties shall carry out the joint inspection of Project Site and identify the existing defects and deviations. GMDC shall rectify all such defects and deviations at its own cost prior to the handover of the Project Site for O&M Services. If in case the GMDC intends to carry out rectification of those defects or deviations through the Bidder, then the GMDC and the Bidder shall mutually agree on terms and conditions, timelines, price etc., and the GMDC shall need to issue a requisite purchase/service/work order as per the agreed terms & conditions to enable the Operator to commence the rectification works.	Handover and takeover of operations shall be the **sole responsibility of the bidder** **Technical inspection report previously prepared for Rojmal has been shared with bidders who submitted queries and has also been attached as AnnexureBof this document for reference.**Basis the report, all bidders haveto present their view on the one-time capital expenditures required (excluding operational expenditures such as gearbox oil change, breathers, etc.) to restore plant health. **The same shall be considered for evaluation in the technical criteria** Bidders are also required to **submit the one-time remediation cost**. The same shall be **added as a separate line item in the price bid**, and evaluation shall be done on the consolidated quote for one time remediation cost and O&M charges. Updated indicative format of the price bid has been attached as Annexure A of this document for reference. **The scope of work for one-time remediation activities has been specified in Part C of this document.**
2.	3.1.8 (Part 2)	Forecasting and scheduling	The forecasting and scheduling of the Facility's generation shall be carried out by the QCA. Bidder will share the requisite 10min data log with the QCA. and incase if any penalty then the same shall be in the scope of GMDC.	Bidder will **share the requisite 10min data log with the QCA**, and further be responsible for **WTG level forecasting and scheduling.** In case there are deviations due to the forecast at WTG level vs actual generation leading to penalties, the same shall be addressed by the bidder In case there are deviations on account of QCA outside the control of the bidder, the same shall be addressed by GMDC

Sr. No.	Clause No	Description of clause	Pre-bid query/clarification	Response/ Addendum/Corrigendum (if any)
3.	3.3 (Part 2)	Standards for performance of obligations	Grid norms applicable at the time of commissioning up to scope of Work will be in contractor's scope and any changes in the LAW or Policy shall be applicable to GMDC account.	Agreed
4.	5.2 (Part 2)	Penalties for performance shortfall	As per illustration, dual penalty is applicable in case if any individual WTG is below the contractual performance level and impacting the half yearly performance due to the same WTGs. We propose that in case if any 1 KPI hit the target value then it should not impact the other KPI, and single penalty should be applicable.	As per RfP Bidders to note that in case of high wind and low wind availabilities, **penalties are applicable only at a high wind and annual WTG level**; the low wind threshold defined in the RfP is only for monitoring purposes
5.	5.4 (Part 2)	Compensation for generation loss due to Right of Way (RoW) issues	We are only service provider and project has been developed by other developer. We propose that Legacy ROW will be in GMDC Scope, and all the operational ROW will be handled by Operator. In Legacy ROW resolution Bidder shall support and all the time and cost to be in scope of GMDC. for further clarification all the Row beyond the SCOPE (WTG + USS) shall be in the scope of GMDC.	Since the bidder is solely responsible for availability of security personnel on site, **all RoW related issues (legacy or operational) shall be in the bidder's scope**. In case additional costs are incurred due to legacy RoW issues outside the control of the bidder, the same shall be mutually agreed upon between the winning bidder and GMDC
6.	3.1.6 (Part 2)	Central Monitoring Station	We request that GMDC need to clarify the availability of Hardware and software with GMDC and what bidder will get during the Handover of the assets. Also suggest who will bear the SCADA development cost.	The development cost for segregation of SCADA with installation of associated hardware and software **shall be in bidder's scope**

Sr. No.	Clause No	Description of clause	Pre-bid query/clarification	Response/ Addendum/Corrigendum (if any)
7.	5.1 (Part 2)	Key performance indicators	We request for up to 5% of Reactive Power Drawn should be in GMDC SCOPE and. If Reactive Power Drawn will be more than 5% (up to SCOPE) then Bidder shall compensate for excess of 5%	As per RfP
8.	8.1 (Part 2)	Insurance to be obtained by contractor	Bidder does not work on Insurance Model and does not take any MBD Policy, however this contract is in nature of comprehensive, so it is bidder's Prerogative to take MBD or not. We also propose the Theft & Burglary policy should be in the scope of GMDC.	In case the bidder, at its own discretion prefers not to take breakdown policy, then, **it shall be solely responsible and liable for any loss(es) / damage(s) incurred / suffered by GMDC due to failure to obtain such insurance policy** or due to any shortfall in the insurance cover and the bidder shall undertake to correct / rectify the equipment(s) to resume normal working condition at the earliest possible time at its own cost. **Theft and burglary insurance is also a part of contractor's** responsibility
9.	5.1 (Part 3)	Pre-qualification criteria	We are having framework agreement with the AMSC, and we can share the written mail of AMSC as a NOC. As AMSC sign the agreement with the confidentiality clause and party cannot share the document with any other third party.	Bidder has to submit self-declaration having agreement with AMSC
10.	5.1 (Part 3)	Pre-qualification criteria	We propose that GMDC should consider positive net working capital (current assets less current liability) & positive Net Profit as well as cash profit for FY22 instead of Positive Net Worth. In case GMDC requires Positive Net worth as well, we propose to consider positive net worth as on 30th Sept 2022 instead of 31st March 2022. For positive net worth as on 30th Sept 2022, we shall submit CA certificate for the same.	GMDC shall consider **positivenet worth as on 30th September 2022** and require necessary proofs (CA certificates) for the same.

Sr. No.	Clause No	Description of clause	Pre-bid query/clarification	Response/ Addendum/Corrigendum (if any)
11.	5.2 (Part 2)	Penalties for performance shortfall	Please provide sample calculation for better understanding	Sample calculation already provided on Pg 24-25 of the RfP
12.	5.5 (Part 2)	Overall ceiling on penalties and incentives for performance	Please give the more clarification on overall ceiling for penalty and incentives	As per RfP
13.	3.1.1 (Part 2)	Handover and takeover of operations	1. GMDC shall handover full operations of the wind park along with restored technical health if it is deteriorated 2. GMDC shall make a provision for restoration of technical health of wind park apart from fixed O&M fees 3. Technical health assessment shall be done at the time of O&M commencement and further drive restoration. Bidder would care to provide free technical condition assessment services if it is done along with the O&M period commencement whereas supply of all material and external services needed for restoration of current technical health shall be at extra cost	Same as S. No. 1
14.	3.1.1 (Part 2)	Handover and takeover of operations	1. Has GMDC carried out detailed technical condition assessment of the plant? If yes, please provide reports 2. Said report shall cover last time when full change of oil has been done. The said data is mandatory for cost calculation, for next 3 years O&M services 3. Also provide age of assets to calculate mandatory replacement of life cycle components 4. If above data is not available, then GMDC shall provide full access to the wind park, machine, and service data records to pick up the inputs 5. GMDC can think of taking the life cycle replacement of components in their own scope of work	Technical inspection report previously prepared for Rojmal is attached with this document as Annexure B
15.	3.1.7(Part 2)	On-ground infrastructure	Will GMDC provide a land at wind park for the establishment of the infrastructure?	**Bidder is responsible for obtaining land** at the wind park, support for establishment of infrastructure near WTGs may be provided with prior consent and approval.

Sr. No.	Clause No	Description of clause	Pre-bid query/clarification	Response/ Addendum/Corrigendum (if any)
				It would be at the **discretion of the bidder whether to build a containerized or permanent office** on site
16.	3.3(Part 2)	Standards for performance of obligations	GMDC is the owner of the wind park and associated infrastructure for the same, therefore, GMDC must provide the authorization to access roads. Or said shall be in the scope of shared service agreement with PSS operator	As per RfP
17.	5(Part 2)	Operations and maintenance performance measurement	1. Kindly provide insight on previous bills for cost consideration in Fixed O&M charges 2. Are the charges beyond certain % of consumption or for every single unit of Reactive power to be compensated by the contractor?	1. Bidder may use his/her previous O&M experience to quote for the fixed O&M charges 2. The Contractor shall compensate the Owner for all the reactive power (RKVAH) drawn at the prevailing rate charged by the state distribution utility/ state transmission utility as recorded and certified by the state distribution utility meter reading on an annual basis
18.	5.4(Part 2)	Compensation for generation loss due to Right of Way (RoW) issues	Bidder agrees for all kinds of RoW resolution whereas basic support of following documentation to be provided by GMDC: 1. Land title of WTGs 2. Access to roads 3. RoW agreements of electric lines	As per RfP
19.	5.5(Part 2)	Overall ceiling on penalties and incentives for performance	Bidder proposes to keep overall ceiling of penalties to be kept at 25%	As per RfP
20.	8.1(Part 2)	Insurance to be obtained by contractor	As long as risk is taken care of, is it necessary to keep insurance for machinery breakdown?	Same as S. No. 8

Sr. No.	Clause No	Description of clause	Pre-bid query/clarification	Response/ Addendum/Corrigendum (if any)
21.	5.1 (Part 3)	Pre-qualification criteria	Bidder requests for allowance of consortium for better participation	As per RfP
22.	5.1 (Part 3)	Pre-qualification criteria	Bidder seeks basis / co-relation of INR 40 Cr as pre-qualification criteria For better participation, bidder requests consideration of the following proposition 1. Bidder must have an annual audited revenue of minimum INR 40 Cr during any of the last three years 2. Bidder must have an average annual audited revenue of INR 30 Cr per annum for the last three years	GMDC shall **consider average audited annual revenue of INR 30 crores (thirty crores) per annum, for the last three years**
23.	1.5(Part 2)	Commencement of contract	Required a minimum of 5-8 weeks to deploy manpower and other resources from the date of LOA issue	As per RfP
24.	3.1.1(Part 2)	Handover and takeover of operations	Mention that the contractor is responsible for the takeover of the assets from the existing operator. We request the owner to coordinate a smooth handover and take over. Also, during the takeover, we need to have a tri-party technical audit to ensure the turbines are handed over in healthy condition. Any failure/missing/malfunction materials need to be replaced by the existing service provider or they need to be the owner's responsibility.	Same as S. No. 1
25.	3.1.6(Part 2)	Central Monitoring Station	The owner should facilitate and coordinate access to segregated GMDC turbines. Also, I need clarity on the commercial for doing this. Also, all the old data needs to be collected from the existing service provider, which should be part of the handover. This procedure of bifurcation will take 90 days to complete.	Same as S. No. 6
26.	3.1.3(Part 2)	Curative maintenance of	Painting of the equipment means the PSS yard, or the PSS yard and complete tower, with no timeline fixed.	Painting of equipment refers to internal equipment within WTGs and the Unit Sub-Station (USS) yard; painting of towers, if

Sr. No.	Clause No	Description of clause	Pre-bid query/clarification	Response/ Addendum/Corrigendum (if any)
		WTGs and USS Yard		requires >24 hours, shall be done with prior intimation and consent from the owner
27.	3.1.4(Part 2)	Security services	It requires 48 hours to initiate the CSR in the police station and an insurance surveyor visit to start the restoration. And this time it needs to be considered as FM and excluded from machine availability.	As per RfP
28.	3.1.8(Part 2)	Forecasting and scheduling	We need to understand the arrangement of QCA. The Operator will post the QCA timely on any stoppages longer than 24 hours for their predictions. Any penalty imposed due to QCA inefficiency will not be levied against the operator.	Same as S. No. 2
29.	3.1.9(Part 2)	Crane services	The operator needs a minimum of 2 weeks' time to mobilize the crane (400 T/650) and this time needs to be excluded from the MA availability.	As per RfP
30.	5.1(Part 2)	Key performance indicators	In Inox turbines, power factor and reactive power settings are to take care of the turbine requirements only. So, the RKVAH needs to be managed in SS, which is not in our scope, and the same needs to be excluded from the KPI.	As per RfP
31.	5.2(Part 2)	Penalties for performance shortfall	Could see that penalties for the same turbines are penalized for individual turbines and site availability, which is not preferable. We will provide site availability for each season at 95 % for the first year and from the second year at 97% for HWS and 95% for LWS. As we are aware, the turbines are not properly maintained for some years. We need one complete season(HWS & LWS) to understand and to carry out proper maintenance for the turbine to provide 97% availability.	Same as S. No. 4
32.	5.4(Part 2)	Compensation for generation loss due to Right	The operator will be the front end for any type of ROW and any commercials against land lease and legacy commitment by the owner or the developer. Any legacy	Same as S. No. 5

Sr. No.	Clause No	Description of clause	Pre-bid query/clarification	Response/ Addendum/Corrigendum (if any)
		of Way (RoW) issues	and title issue ROW shall be included in the owner's scope and treated as FM. Any ROW due to operational issues of the operator, then the ROW will be cleared by the operator and the penalty shall be levied.	
33.	5.5(Part 2)	Overall ceiling on penalties and incentives for performance	We request the owner to consider the ceiling of LD to 25%.	As per RfP
34.	11.4(Part 2)	Termination at Owner's convenience	The first year shall be considered a "lock in period". Except for continuous defaults during the lock-in period, the owner may not terminate this agreement.	As per RfP
35.	12.1(Part 2)	Force Majeure	Need to consider the below points in the FM: Design, structural and/or manufacturing defect & Natural phenomenon which is beyond the control of any party	As per RfP
36.	7.4(Part 3)	Commencement of work	We request to extend stabilization period to 3 months	Agreed. Stabilization period to beof**3 months**
37.	9(Part 2)	Responsibility matrix	Whose responsibility is it to maintain the 33kV line and PSS?	Maintenance of internal grid and PSS is under the purview of INOX. However, the contractor shall play a supervisory role and provide manpower as per RfP to proactively highlight any issues related to internal grid and PSS
38.	2.2(Part 2)	Duration of contract	Considering the provisions made for manpower and spare parts for the 50 MW Site, bidder requests GMDC to keep the initial duration of the contract as 5 years. This will help us to economize the cost over a longer period and give a competitive quote.	As per RfP

Sr. No.	Clause No	Description of clause	Pre-bid query/clarification	Response/ Addendum/Corrigendum (if any)
39.	3.1.1(Part 2)	Handover and takeover of operations	We would request GMDC to allow the bidder to do a pre-takeover audit to determine the current health of the wind farm. Since the wind farm is being taken up from another service provider it becomes imperative for us to do a pre-take-over audit to access the assets' health before coming up with a costing of the windfarm.	Technical inspection report previously prepared for Rojmal shall be provided to the bidders.
40.	3.1(Part 2)	Scope of operations and maintenance Contract (Services)	Since the internal grid and PSS is being maintained by other GMDC contractor, the responsibility of successfully evacuating power into the grid cannot be ensured by bidder as its scope is limited to the O&M of WTG+USS. Request GMDC for removal of the statement “generate and evacuate power successfully into the grid for uninterrupted operations of the Wind Farm throughout the term of the Contract”	Same as S. No. 37
41.	3.1.1(Part 2)	Handover and takeover of operations	The contractor shall ensure smooth transition from the existing contractor, however the responsibility of takeover from the existing contract should be in GMDC Scope as GMDC is the asset owner of the wind farm.	Same as S. No. 1
42.	3.1.1(Part 2)	Handover and takeover of operations	Details of SCADA network allied infrastructure arrangement with as built SLD thereof including SCADA login credentials will be required from the existing contractor. Also need any AMC details of RF vendors etc. For server level separation, all hardware (Server, Dongle, UPS etc.) & installation cost to be borne by the employer.	Same as S. No. 6
43.	3.1.2(Part 2)	Preventive maintenance of WTGs and USS	Blade cleaning can be done on need basis	As per RfP

Sr. No.	Clause No	Description of clause	Pre-bid query/clarification	Response/ Addendum/Corrigendum (if any)
		Yard		
44.	3.1.2(Part 2)	Preventive maintenance of WTGs and USS Yard	Disc brake pad inspection and replacement (if required)	As per RfP
45.	3.1.4(Part 2)	Security services	Insurance of WTG and / or the Project including theft, burglary, vandalism, and other force majeure events to be taken by the Owner.	Theft and burglary insurance shall be part of the contractor's scope.
46.	3.1.8(Part 2)	Forecasting and scheduling	Contractor shall only facilitate the Owner in S&F activities; further third party FSP agency has to be appointed by the Owner. It is also worthwhile to mention that the SCADA system including the necessary infrastructure is being provided by the Owner itself and contractor's responsibility shall only be limited to the upkeep and maintenance of the necessary infrastructure. If for some reason if the SCADA system is down for reasons not attributable to the Contractor, in such case Contractor cannot be penalized. Further, the Contractor does not have control on the evacuation infrastructure, wind, forced backdowns, etc. which is beyond the control of the Contractor; hence contractor would not be in a position to absorb any penalties on account of S&F.	Same as S. No. 2
47.	3.1.9(Part 2)	Crane services	Further, the Contractor shall arrange for the crane(s) of requisite capacity required as soon as reasonably practicable in line with industry practice for the addressal of said major breakdowns	As per RfP
48.	5.1(Part 2)	Key performance	As an industry practice would request GMDC to keep penalties for Machine availability damages on a wind	Same as S. No. 4

Sr. No.	Clause No	Description of clause	Pre-bid query/clarification	Response/ Addendum/Corrigendum (if any)
		indicators	farm basis. Individual WTG availabilities should be exempted from penalty if the availability conditions for the Wind Farm are met.	
49.	5.1(Part 2)	Key performance indicators	Any legacy issue in the WTG and/ or windfarm & ROW issue not attributable to the Operator should be excluded from the calculation.	Same as S. No. 5
50.	5.4(Part 2)	Compensation for generation loss due to Right of Way (RoW) issues	The Contractor can assist GMDC in resolving the issues, however, GMDC being the Owner, the documentation for RoW and any RoW due to insufficient documentation or Legacy issues cannot be the responsibility of the Contractor	Same as S. No. 5
51.	8.1(Part 2)	Insurance to be obtained by the Contractor	Theft and burglary policy- For Contractor equipment/ storage yard only.	As per RfP
52.	8.2(Part 2)	Insurance to be obtained by the Owner	Among other coverage as mentioned in point no. 10, theft, and burglary +vandalism policy for owner's asset to be taken by owner	Theft and burglary insurance shall be part of the contractor's scope.
53.	8.2(Part 2)	Insurance to be obtained by the Owner	Short settlement to be under the scope of Owner. Contractor to be reimbursed the total value invoiced.	As per RfP
54.	9(Part 2)	Responsibility matrix	As the Owner has the complete documentation for RoW issues, the responsibility of RoW issues has to be with the Owner, Contractor can assist the owner on best effort basis for resolving the RoW issues	Same as S. No. 5
55.	10(Part 2)	Payment of Operations and Maintenance Charges	O&M Charges are to be paid quarterly in advance	As per RfP

Sr. No.	Clause No	Description of clause	Pre-bid query/clarification	Response/ Addendum/Corrigendum (if any)
56.	11.1(Part 2)	Termination of the Contract (Defaults by either Party)	Bidder requests 60 days for the remedy of the default. If not cured within 60 days, GMDC can terminate the contract by giving 30 days' notice	As per RfP
57.	11.1(Part 2)	Termination of the Contract (Defaults by either Party)	In event of Force Majeure impacting the affected Party continues for more than 120 (One hundred twenty) days, the other Party reserves the right after 120 days from the commencement of the event of Force Majeure to terminate the Contract with 30 (thirty)days' notice after consideration of due responsibilities	As per RfP
58.	12(Part 2)	Termination at Owner's convenience	No termination for convenience.	As per RfP

Part B: Technical evaluation criteria

Revised technical bid criteria

Category	Parameter	Scoring mechanism	Max score
Prior experience	**Number of years in Wind O&M** in India (in-house and third-party O&M services)	5 points - =/>5 years 4 points - =/>4 years 3 points - =/>3 years 2 points - =/>2 years 1 point - =/>1 years	5
	Number of third-party contracts for Wind O&M executed (completed and ongoing) in India till date of bid submission	10 points - =/> 6 8 points - =/> 5 6 points - =/> 4 4 points - =/> 2 3 point - <2	10
	Portfolio of Wind O&M (in-house and third-party) executed (completed and ongoing) in India till date of bid submission (in MW)	15 points - =/>1 GW 12 points - =/>750 MW 9 points - =/>500MW 6 points - =/>250 MW 3 point - <250 MW	15
	Portfolio of Wind O&M (in-house and third-party) executed (completed and ongoing) **in Gujarat** till date of bid submission (in MW)	5 points - =/>500 MW 4 points - =/>400 MW 3 points - =/>300 MW 2 points - =/>200 MW 1 point - =/>100 MW	5

Category	Parameter	Scoring mechanism	Max score
	Portfolio of O&M for INOX WTGs executed (completed and ongoing) till date of bid submission (in MW)	5 points - =/>200 MW 4 points - =/>150 MW 3 points - =/>100 MW 2 points - =/>50 MW 1 point - <50 MW	5
Workforce capabilities	**Number of employees** in Wind O&M services	5 points - =/>300 employees 4 points - =/>250 employees 3 points - =/>200 employees 2 points - =/>200 employees 1 point - <150 employees	5
Supply chain capabilities	Established **operations in Gujarat** with at least one office / warehouse	05 points - Warehouse in Gujarat AND 05 points - =/>4 operational sites in Gujarat 03 points - =/> 3 operational sites in Gujarat 01 point - =/>2 operational site in Gujarat	10
	Central facility / workshop for repairing critical components	5 points – Yes 0 points – No	5

Revised technical presentation criteria

Category	Parameter	Score (RfP)
Turnaround capabilities in Wind O&M	**Successful case studies** incl. key activities for improvement in performance post takeover	**4 points**
	Timelines required for turnaround of asset performance and stabilization	
	Improvement in asset performance (availability and CUF) post turnaround	

Category	Parameter	Score (RfP)
Key personnel	Personnel with **prior experience** in turnaround of Wind assets / prior INOX experience	**4 points**
Deployment and operations	Plan for office setup and **mobilization of personnel** on site post takeover	**12 points**
	Plan for **procurement and storage of critical spares** and consumables on site	
	Plan for **segregation of SCADA** and establishment of associated network infrastructure	
	Reporting and governance mechanism for effective performance monitoring	
Maintenance and spares practices	Annual plan for **preventive maintenance** of WTGs and USS yard	**12 points**
	Deployment of additional workforce for preventive maintenance	
	Spares classification methodology	
	Inventory levels maintained for all categories of spares	
	Network of **regional and central warehouses** and logistics for replenishment	
	Required one-time capital expenditures to restore plant health	
Digital capabilities & value-added services	**Tools / dashboards** for monitoring key performance parameters	**8 points**
	Systems used for tracking **spares inventory levels**	
	Analytics initiatives undertaken for performance improvement	
	Value added services for improvement of asset performance and reliability	

Part C: One-time remediation activities

As a part of the one-time remediation of the 25 WTGs, the Contractor shall be responsible for the following activities:

1. Conduct inspection and tests / analyses required to assess technical health of critical high-value equipment and identify structural one-time deformities
2. Identify corrective actions required to address the one-time deformities for each WTG, to ensure proper operations and maintenance of the asset
3. Assess additional services required to address the one-time deformities across WTGs to enhance lifetime of the asset
4. Prepare a checklist and implementation plan of all corrective actions required to address deformities, with associated timelines for each WTG, to be shared with the Owner
5. Identify and procure capex spares required for one-time remediation as per technical inspection of the WTGs
6. Mobilize and maintain adequate inventory of spares for one-time remediation activities to ensure timely completion and minimum downtime
7. Deploy adequate qualified and trained workforce for time completion of the activities across all 25 WTGs
8. Install, commission, and operate the asset as per the terms of reference of the RfP for the tenure of the contract

Note: Spares and consumables required for day-to-day operations of the WTGs (e.g., breathers, gearbox oil, grease, etc.) shall be considered as part of operating expenses of the WTG and not one-time remediation expenses.

Duration

The Contractor shall execute the one-time remediation activities across all 25 WTGs within a period of 3 (three) months from the date of commencement of the contract. Total duration of 12 (twelve) months from the date of commencement of the contract shall be considered as a warranty period for the Contract.

Evaluation criteria

In addition to the Fixed Operations and Maintenance Payment quoted in the price Bid, the Bidders shall quote an additional one-time remediation cost of rectifying existing defects across all WTGs.

Subsequently, the financial score shall be evaluated as follows:

$$\text{Financial Score (FiS)} = \frac{\text{FiL}}{\text{FiC}} \times 100$$

Where,

FiL is the sum of L1 (Lowest Bidder)'s:

A. Fixed Operations and Maintenance Payment for the tenure of the contract(i.e., sum of quoted values for all 3 years)
AND
B. One-time remediation cost

FiC is the sum of Bidder's:

A. Fixed Operations and Maintenance Payment for the tenure of the contract(i.e., sum of quoted values for all 3 years)
AND
B. One-time remediation cost

The Bidder recording the lowest aggregate Fixed Operations and Maintenance Payment for the tenure of the Contract and one-time remediation cost among all technically qualified Bidders shall be given maximum score of 100.

Payment terms

The payment of one-time remediation cost shall be made as per the following milestones:

Milestone	Payment (as a % of one-time remediation cost)	Proof to be submit for approval of Payment
Mobilization of workforce	10%	Verification sheet of mobilization of workforce
Procurement of spares	30%	Bidder has to submit purchase order along with payment remittance of spares to the bidder's vendors/OEM/OES etc.
Completion of one-time remediation activities	45%	Duly approved verification sheet
Completion of warranty period	15%	

The Contractor shall submit invoices upon achieving milestones, and the Owner shall make payment within 30days of submission of invoices upon verifying the milestone for which invoice has been submitted, subject to deduction of any damages pursuant to the Contract conditions.

Penalties

In case of any delay solely attributable to the Contractor in completion of the one-time remediation within the stipulated duration of 3 (three) months, liquidated damages not exceeding an amount of 0.1% (zero-point one percent) of the one-time remediation cost quoted per day, subject to a maximum of 10% (ten percent) shall be imposed and recovered from the final payment to be made to the Contractor against completion of one-time remediation activities.

Part D: Schedule of bidding

The timelines for online submission of Price Bid and submission of Technical Bid (hard copy), RFP fee and EMD in person have been extended. The revised schedule of bidding is as follows:

Category	Activity	Schedule
Bid submission and evaluation	Online submission of Price Bid	Bidders shall submit their Price Bids online on https://gmdc.nprocure.com on or before **23rd November 2022**
	Submission of Technical Bid (hard copy), RFP Fee and EMD in person	Bidders shall submit their Technical Bids strictly after the submission of the Price Bid but on or before **24th November** up to 1800 hrs. at the following address: Gujarat Mineral Development Corporation Ltd Khanij Bhavan, 132-Ring Road, Gujarat University Ground, Vastrapur, Ahmedabad- 380052 The Technical Bid, RFP fee, and EMD shall be made by Speed Post / RPAD / Hand / Courier
	Technical presentations by Bidders	To be informed to the Bidder in advance
Vendor selection	Evaluation of Technical and Price Bids and selection of vendor	To be informed to the Bidder after the Bid submission date

Annexure A: Indicative format of Price Bid

(This is indicative format for Bidder's reference only. The PRICE PROPOSL SHOULD BE SUBMITTED ONLINE ONLY at designated places through http://gmdc.nprocure.com. Price Bid should not be submitted in hard copy and or placed with Technical Bid. Prices submitted in hard copy and or placed with Technical Bid shall result in outright rejection of Bid)

To,

General Manager (Power),
Gujarat Mineral Development Corporation Ltd
Khanij Bhavan,
132-Ring Road, Gujarat University Ground, Vastrapur,
Ahmedabad- 380052

Subject: Price Bid for Request for Proposal (RFP) for selection of Contractor for comprehensive O&M of GMDC's 50 MW wind power project at Rojmal, Gujarat

Dear Sir,

After thoroughly reading and accepting the RFP terms, understanding the requirements, and scope of work under this RFP, and its terms and conditions, we hereby agree to provide our services at the following rates:

A. **Fixed Operations and Maintenance Payment**

Sr. No	Description	Total Amount (in INR, excl. GST)
1	Fixed Operations & Maintenance Payment for 1st year of comprehensive O&M for 50 MW Rojmal power project (25 WTGs)	
2	Fixed Operations & Maintenance Payment for 2nd year of comprehensive O&M for 50 MW Rojmal power project (25 WTGs)	
3	Fixed Operations & Maintenance Payment for 3rd year of comprehensive O&M for 50 MW Rojmal power project (25 WTGs)	

4	Total of A (Sr. No 1+2+3)	

B. **One-time Remediation Cost**

Sr. No	Description	Total Amount (in INR, excl. GST)
1	One-time remediation cost for 50 MW Rojmal power project (25 WTGs)	

C. **Grand Total**

Sr. No	Description	Total Amount (in INR, excl. GST)
1	Grand Total (A+B)	

Note:

In case of extension of the Contract, as per section 2.2 of Part 2 of the RFP, the Fixed Operations and Maintenance Payment for the period of extension shall be escalated taking the value quoted by the bidder for 3rdYear in the Price Bid. The escalation rate shall be calculated based on the Wholesale Price Index (WPI) and Consumer Price Index (CPI).

For avoidance of doubt and by way of illustration, consider the following scenario:

- The Fixed Operations and Maintenance Payment for 3rdYear quoted during the Price Bid is INR 2 Cr
- Price Index is 200 (two hundred) for the month when 24 (twenty-four) months (i.e., 2 years) is completed from the date of signing the Contract, say October 2024
- Price Index is 220 (two hundred and twenty) for the month when 36 (thirty-six) months (i.e., 3 years) of duration is completed from the date of signing the Contract (i.e., October 2025)

- The Price Index Multiple for 4th Year shall be 1.1, calculated as 220 divided by 200
- The Fixed Operations and Maintenance Payment for 4thYear shall be calculated as the Fixed Operations and Maintenance Payment for 3rdYear multiplied by the Price Index Multiple i.e., INR 2 Cr x 1.1 = INR 2.2 Cr
- Price Index is 240 (two hundred and forty) for the month when 48 months (i.e., 4 years) of duration is completed from the date of signing the Contract (i.e., October 2026)
- The Price Index Multiple for 5thYear shall be 1.2, calculated as 240 divided by 200
- The Fixed Operations and Maintenance Payment for 5th Year shall be calculated as the Fixed Operations and Maintenance Payment for 3rd Year multiplied by the Price Index Multiple i.e., INR 2 Cr x 1.2 = INR 2.4 Cr
- The Price Index for any year shall be a weighted average index as per 70% (seventy percent) of WPI and 30% of CPI (IW), i.e., 70%*WPI + 30%*CPI(IW)
- WPI shall mean the Wholesale Price Index for all commodities as published by the Ministry of Industry (GoI) on http://eaindustry.nic.in/#
- CPI (IW) shall mean the Consumer Price Index for Industrial Workers as published by the Labour Bureau, GoI on http://www.labourbureaunew.gov.in/
- Should the WPI or the CPI (IW) not be published for any time period, the escalation rate proposed by the Managing Director of the Owner shall prevail

The Bidder to quote charges inclusive of all other taxes except applicable GST. Applicable GST, over and above approved Fixed Operations & Maintenance Payment, at the time of invoicing shall be reimbursed by GMDC. The risk of applicability of any taxes, duties, and levies except GST, shall rest with the Bidder.

GMDC shall be entitled to deduct tax at source as may be applicable. The TDS certificate(s) shall be submitted as per the due date specified in the Income Tax Act.

Each Bidder must quote his rates after through reading of this RFP document and estimates of its cost through detailed due diligence of the Site, statutory laws/regulations. GMDC reserves right to seek any clarifications regarding price quoted from Bidders before any decisions.

Annexure B: Technical inspection report

This technical inspection report follows a format where it details the list of components present and found working during inspection in all WTGs. Any issues/ potential interventions required across these components are detailed out equipment-wise in the table below component list. The technical inspection of all 25 WTGs were conducted during the months of June and July 2022.

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Below is a list of components across the WTG, detailed observations, and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name:	GMDC			**Inspection Date**	21.06.2022
Turbine Coordinates	43Q E753833.46 N2443224.43			**HTSC. No**	
Area Details		**WTG Details**			
Name of District	RAJKOT	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	VICHIYA	**WTG Loc No**	RJ7-T-33	**DOC**	30.06.2016
Name of Village	ANKADIYA	**Tower Type**	TUBULAR	**SF. No**	148P1
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	7	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	N1002MGL100175Y15	HUB NUMBER	INOX	NV
GEAR BOX	DHHI	2152219	HUB PANEL	NV	NV
GENERATOR	LERY SOMER	WL15L240B	PITCH MOTOR 1	MOOG	1503120
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	75964990008	PITCH MOTOR 2	MOOG	1503114
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	75964990009	PITCH MOTOR 3	MOOG	1503121
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	75964970054	PITCH DRIVE 1	DHHI	15PYD0256
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	75964970055	PITCH DRIVE 2	DHHI	15PYD0290
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN15026884	PITCH DRIVE 3	DHHI	15PYD0287
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN15026438	BLADE 1	INOX	8113
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15026495	BLADE 2	INOX	7242
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15026496	BLADE 3	INOX	5161
YAW BRAKE 1	SVENDBORG BRAKES	5/200235505 & 5/200235512	POWER PANEL	AMSC	014-0230206
YAW BRAKE 2	SVENDBORG BRAKES	5/200235503 & 5/200235609	CAPACITOR PANEL 1	AMSC	014-0250005
YAW BRAKE 3	SVENDBORG BRAKES	5/200235605 & 5/200235610	POWER TRANSFORMER	ATS ACCORD	NA
YAW BRAKE 4	SVENDBORG BRAKES	5/200235508 & 5/200235517	TOP RADIATOR	NA	NA
BRAKE UNIT	SVENDBORG BRAKES	5-100032542	ROTOR LOCK	SVENDBORG BRAKES	5-100033543
BRAKE UNIT	SVENDBORG BRAKES	5-100032543	COUPLING	KUVAG ISOLA	1520/001/004
SLIPRING	SCHLEIFRING	436603	WINCH MOTOR	CARLSTAHL	CA-2010

				CRAFTSMAN	
TOP CONTROL PANEL	AMSC	014-0220053	GREASE PUMP - GENERATOR	LINCOLN	2015232876/4

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Inadequate oil level in transformer	The quantity of the oil should be 1294 liters where the MID level is about 700 liters which is safest capacity to run the transformer. If the oil level is lower than the MID level, it will affect the performance of the transformer and safety of the unit	No maintenance is happening	Oil filtration to remove debris, breakdown voltage (BDV) test and refilling of oils as per guidelines	High
3	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
4	USS	WTI and OTI meter found open condition and the panel is full of dust	WTI means winding temperature Indicator and OTI means Oil Temperature Indicator which indicates the winding temperature & oil temperature of the transformer and operates the alarm, trip, and cooler control contacts. If the WTI & OTI is not maintained properly, this will impact in the function of the transformer	Limited importance given to maintenance of WTI and OTI by the contractor	Check the working condition of WTI & OTI meter and procure spares for replacement, if needed	Medium
5	USS	"B" phase of Isolator found bypassed	The purpose of ISOLATOR to isolate the current between plant and grid. This is basically a safety product of the plant. If this is getting bypassed, the safety of the plant is questioned.	Potential technical issues on the Isolator alignment	Spares to be procured and replaced	High

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
6	Earthing	**Earthing** 1. Grid earthing found stolen and not connected 2. Earthing for Current Transformer not properly done 3. Earthing in Gear box found improper 4. Earthing is not found in Nosecone 5. Nosecone earthing not available 6. Nacelle earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Unavailability of grid earthing, ground earthing, and copper earthing cables in nacelle and hub to be checked with contractor	All the earthing should have to be provided with high importance	High
7	USS	Found fencing wall damaged in DP Yard	Essential for overall upkeep of the asset	Potential damages due to ROW issues	Fencing wall to be reconstructed	Low
8	USS	Transformer Breather - Silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in color indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium
9	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
10	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium
11	USS	Improper glanding in CT cable	Glanding is very important for the safety of cable and to avoid any electrical incidents such as tripping, fault current etc.	Improper maintenance practices	Cable glanding to be done	Medium
12	USS	Jumper between CT and HV push is not properly tightened, and the PG clamp found in loosen condition	Safety measure and to avoid the productivity loss	No Importance and no skilled team are in the Job	Need to be tighten the PG clamp	Medium
13	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
14	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and first aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
15	Electrical controls	Sleeves melted and cable damages in transformer control panel	Purpose of the control cable is to distribute the power to various components; hence it should be maintained properly	Potential loose connection of the cable lug with the terminal box	Identify root cause for melting of cables and replace as required	Medium
16	Electrical controls	Improper cable glanding in transformer	Glanding is very important for the safety of cable and to avoid any electrical incidents such as tripping, fault current etc.	Limited awareness on severity of issue, and improper maintenance practices	Proper glanding to be done	Medium
17	Tower	Communication cable not properly laid	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
18	Tower	Tube lights are not in working condition in Tower Section 3&4	High safety risk	Improper maintenance practices	Electrical connections shall be checked, and new set of lights can be provided	Low
19	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
20	Tower	Oil spillages found across all the platforms	Potential fire hazard and low oil levels in critical components (e.g., gearbox) can affect overall performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of leakage	Medium
21	Tower	Grease spillages found across all the platforms	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
22	Yaw system	Grease collector in Yaw Bearing is not available	Due to these deviations, grease spillages are found in the platforms	Handling damages	Spares to be replaced	Low
23	Brake unit	Disc Brake pad found in worn out condition	High safety risk due to malfunctioning of rotor brake especially in high wind season during high wind velocity	High wear and tear and potentially due to malfunctioning of brake sensor	Spares to be procured and component to be replaced	High
24	Electrical controls	Control panel lights are not in working condition	Required for routine maintenance and inspection of control panels	Improper maintenance practices	Spares to be replaced	Low
25	Gear Box	Accumulation of dust and corrosion of radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water-cooling system of generator. Corrosion or improper maintenance of radiators will affect performance of the components	Improper cleaning and maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
26	Rotor	Oil and Grease spillages found across the Hub unit	Oil spillage may be from pitch gear unit and grease spillage from pitch bearing. Lubrication is essential to minimize friction in bearings	Potential failure of breathers in gearbox leading to overheating and overflowing of oil / leakages due to improper maintenance	Cleaning of hub, refilling of oil / grease across all systems	Medium
27	Rotor	Earthing cable in blade is in unsafe position - sleeves removed	Sleeves are the protection of any cable and if sleeves are removed, then the connectivity of earthing will not fall in pace. This may impact blade during monsoon period or during surge period	Handling damages	Cable has to be replaced	Medium
28	Generator	Fault in Generator Exhaust Fan - 2 Nos	Purpose of exhaust fan to exhaust the temperature from Generator rotor side and to remove the carbon particles generates from carbon brush	Working problem	Spares to be procured and replaced	High
29	Rotor	Pitch bearing grease passage tube damaged	Lubrication of pitch bearing is essential for smooth operations and minimize friction	Handling damages	Quarterly visual inspection of lubrication unit and immediate replacement as required	Medium
30	Electrical controls	Found Top Anemometer panel 36x0 found in bypass condition	Anemometer controls the yaw mechanism of the WTG, by passing the anemometer will lead to generator loss	Negligence and improper maintenance practices	New Anemometer to be replaced	High
31	Electrical controls	Bypass & looping found in Control Panel - 27x6 looping26f6 25f4 to 26f1to27f1	Applicable for Hub lubrication and hence needs to check with the suitable diagram	Manipulation of the issues and no spares availability	all required spares to be replaced	Medium
32	Others	Slipring found full of metal particles around	Should have been brake bad frictional issues	Poor Maintenance practices	Cleaning to be done and brake pad should be replaced	Medium
33	Others	Improper routing of power cables in wind motor	To avoid cable damages	Improper maintenance practices	Cable routing to be reviewed and corrected	Low
34	Electrical controls	Winch motor operating switch found bypass condition	High safety risk	Unavailability of spares	New switch to be replaced	Medium
35	Gear Box	Oil leakage found in radiator	Oil leakage leads to gear oil loss and also for production losses	Poor Maintenance practices	Leakage to be arrested by using sealant or with suitable spares	Medium
36	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
37	Gear Box	Discoloration of silica gel in gearbox breather	Breathers allow heat to escape and cooling air to enter the system, preventing unnecessary overheating issues.	Overuse of breathers and excess moisture can potentially lead to discoloration	Breathers must be replaced as part of yearly PM activities	Medium
38	Rotor	Rotor lock connector cover not available	Without cover automatic rotor lock will not work	Manipulation of the issues and no spares availability	Lock cover should be replaced and enable auto mode	Medium
39	Generator	Noise level found high of Generator NDE bearing	High noise level indicates failure of bearing. Non drive end bearing is essential for performance of the generator	1. Due to continuous operation 2. Potential design issues with the generator 3. Improper maintenance practices 4. Failure of bearing due to improper earthing	Noise / vibration analysis to be conducted and NDE bearing to be replaced in case of failure	High
40	Electrical controls	Improper glanding of rotor cable	High safety risk	Improper maintenance practices	Glanding to be done	Medium
41	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
42	Nacelle	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
43	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

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Below is a list of components across the WTG, detailed observations, and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name:	GMDC			**Inspection Date**	30.06.2022
Turbine Coordinates				**HTSC. No**	
Area Details		**WTG Details**			
Name of District	RAJKOT	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	VICHIYA	**WTG Loc No**	RJ7T25	**DOC**	30.09.2016
Name of Village	PATIYALI	**Tower Type**	TUBULAR	**SF. No**	136 P10
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 12	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	N1002MGL100185Y15	HUB NUMBER	INOX	H1002MGL100185Y15
GEAR BOX	DHHI	2152190	HUB PANEL		NA
GENERATOR	LEROY SOMER	WL15L239B	PITCH MOTOR 1	MOOG	1512074
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	76384650036	PITCH MOTOR 2	MOOG	1512075
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	76090680031	PITCH MOTOR 3	MOOG	1512076
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	76384650022	PITCH DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15029567
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	NA	PITCH DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15029570
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15029413	PITCH DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15029586
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15029414	BLADE 1	INOX	5160
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15029407	BLADE 2	INOX	6161
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15029415	BLADE 3	INOX	8112
YAW BRAKE 1	SVENDBORG BRAKES	5-200233762 & 5-200233767	POWER PANEL	AMSC	NA
YAW BRAKE 2	SVENDBORG BRAKES	5-200233763 & 5-200233766	CAPACITOR PANEL 1	AMSC	014-0250204
YAW BRAKE 3	SVENDBORG BRAKES	5-200233760 & 5-200233764	POWER TRANSFORMER	SHILCHAR	22243703
YAW BRAKE 4	SVENDBORG BRAKES	5-200233759 & 5-200233765	TOP RADIATOR	HYDRA	FSB700111601136
BRAKE UNIT	SVENDBORG BRAKES	5-100032529	ROTAR LOCK	SVENDBORG BRAKES	5-100032584
BRAKE UNIT	SVENDBORG BRAKES	5-100032530	VCB	ABB	1VYN030216001456
GEAR OIL PUMP	ABB	3G1C15200512731066	CONTROL & RELAY PANEL	TRI SQUARE	TSPL-HT/09-14646-435
SLIPRING	SCHLEIFRING	406640	ACB	TRI SQUARE	BG36107291
TOP CONTROL PANEL	AMSC	014-0240233	GREASE PUMP - GENERATOR	LINCOLN	2015261483/4
WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA 2010	COUPLING	KUVAG ISOLA	494

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
3	USS	Marshaling box glass not available	For the safety of WTI & OTI Meter	Handling damages	Replace with spares	Low
4	USS	WTI and OTI meter found open condition and the panel is full of dust	WTI means winding temperature Indicator and OTI means Oil Temperature Indicator which indicates the winding temperature & oil temperature of the transformer and operates the alarm, trip, and cooler control contacts. If the WTI & OTI is not maintained properly, this will impact in the function of the transformer	Limited importance given to maintenance of WTI and OTI by the contractor	Check the working condition of WTI & OTI meter and procure spares for replacement, if needed	Medium
5	USS	LV cable laying pvc pipe damaged	to avoid cable damages	Handling damages	PVC pipes have to be replaced	Low
6	USS	ACB door open condition	If rainwater gets in, it leads to malfunctioning of the ACB	Handling Damages	Replace with spares	Medium
7	Earthing	**Earthing** 1. Gate earthing found not connected 2. Earthing for Current Transformer not properly done 3.PM 3000 main board earthing found improper 4. Earthing is not found in Nosecone 5. Nosecone earthing not available 6. Nacelle earthing found improper 7. Tower earthing proper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Improper of grid earthing, ground earthing, and copper earthing cables in nacelle and hub to be checked with contractor	All the earthing should have to be provided with high importance	High

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
8	USS	Transformer Breather - Silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in color indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium
9	USS	Found fencing wall damaged in DP Yard	Essential for overall upkeep of the asset	Potential damages due to ROW issues	Fencing wall to be reconstructed	Low
10	USS	Y-phase of lightning arrestor bypassed	Lightning arrestor is the primary protection agent for the DP Yard	Unavailability of spares	Spared to be procured and replaced	High
11	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
12	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium
13	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
14	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and first aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
15	USS	Vegetation found inside the Yard premises	As per the CEIG standard, Yard should be clean from vegetation etc. as a safety measure	Poor Maintenance practices	During preventive maintenance, should be take care.	Medium
16	USS	Radiator fins found damaged in the Transformer	To avoid oil leakage from Radiator	Handling damages	During preventive maintenance, should be take care.	Medium
17	Tower	Communication cable not properly laid	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
18	Electrical controls	690/415 Communication Cable found in Burst condition in Transformer breaker	This is for the power supply to the Yaw, Pitch etc. Hence it is important	Electrical Fault	Immediate corrective action is required	Medium
19	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
20	Tower	Oil spillages found across all the platforms	Potential fire hazard and low oil levels in critical components (e.g., gearbox) can affect overall performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of leakage	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
21	Tower	Grease spillages found across all the platforms	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
22	Yaw system	Corrosion and accumulation of dust in yaw ring	Smooth functioning of yaw pinions and main bearing is essential for proper functioning of yaw mechanism as per wind speed and direction	Insufficient lubrication and improper maintenance practices	Live testing of performance of yaw mechanism should be done and component to be replaced as required	Medium
23	Brake unit	Disc Brake pad found in worn out condition	High safety risk due to malfunctioning of rotor brake especially in high wind season during high wind velocity	High wear and tear and potentially due to malfunctioning of brake sensor	Spares to be procured and component to be replaced	High
24	Gear Box	Gear box brake sensor found in bypass condition	The sensor ensures appropriate positioning of the brake and monitors condition of the brake pad	Brake sensor failure	Spares to be replaced	High
25	Gear Box	Oil leakage found in radiator	Oil leakage leads to gear oil loss and also for production losses	Poor Maintenance practices	Leakage to be arrested by using sealant or with suitable spares	Medium
26	Gear Box	Accumulation of dust on gearbox radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water-cooling system of generator. High temperature will affect performance of the components	Improper cleaning and maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium
27	Yaw system	Grease level found low in Yaw lubrication pump unit	Yaw lubrication pump supplies grease to yaw brake and yaw bearing	Improper maintenance practices and refilling of grease as per guidelines	Refill grease across all lubrication systems as per guidelines and address leakages in systems	Medium
28	Rotor	Grease level found low in Pitch lubrication pump unit and spillages observed throughout the Hub	Lubrication is essential for yaw bearing and main bearing. Low grease levels can lead to increase in friction and malfunctioning of yaw system	Potential leakages from hoses leading to reduction in grease levels	Address root cause for leakage of grease and refill up to appropriate levels	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
29	Gear Box	Discoloration (black) and low oil level found in gearbox	Lubricating oil is like the blood system of any Gearbox. If the oil levels fall too low, the chances for failure of gearbox are high. Moreover, it also affecting the performance of the gearbox	1. No refilling in between during Scheduled Maintenance 2. Leakage from Hydraulic connections 3. Potential loss of Oil during any Major breakdowns, evident from spillage 4. Color changed may be due to high wear and tear in the gears	1. Suggest having Endoscopy Inspection 2. Suggest having Oil Analysis in the reputed NABL accredited lab	High
30	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium
31	Gear Box	Discoloration of silica gel in gearbox breather	Breathers allow heat to escape and cooling air to enter the system, preventing unnecessary overheating issues.	Overuse of breathers and excess moisture can potentially lead to discoloration	Breathers must be replaced as part of yearly PM activities	Medium
32	Others	Top Radiator found in rusted condition	not a serious issue	As it is open atmosphere, happens regularly	Regular maintenance required and during maintenance, dedicated manpower to deputed	Medium
33	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
34	Nacelle	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
35	ALL	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

RJPT40

Below is a list of components across the WTG, detailed observations, and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name:	GMDC			**Inspection Date**	21.06.2022
Turbine Coordinates				**HTSC. No**	
Area Details		**WTG Details**			
Name of District	AMERLI	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	BABRA	**WTG Loc No**	RJPT40	**DOC**	28.09.2016
Name of Village	LALKA	**Tower Type**	TUBULAR	**SF.No**	71
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 04	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	N1002MGL100187Y15	HUB NUMBER	INOX	H1002MGL10-0187Y15
GEAR BOX	DHHI	2152193	HUB PANEL		NA
GENERATOR	ABB	4200313451/428	PITCH MOTOR 1	MOOG	1601088
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	76090680001	PITCH MOTOR 2	MOOG	1601074
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	76384680006	PITCH MOTOR 3	MOOG	1601086
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	76384650026	PITCH DRIVE 1	DHHI	15PYD0154
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	76385680008	PITCH DRIVE 2	DHHI	15PYD0155
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN15029050	PITCH DRIVE 3	DHHI	15PYD0156
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN15029408	BLADE 1	INOX	5191
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15029417	BLADE 2	INOX	7170
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15029415	BLADE 3	INOX	6191
YAW BRAKE 1	SVENDBORG BRAKES	5-200233793 & 5-200233795	POWER PANEL	AMSC	014-0230231
YAW BRAKE 2	SVENDBORG BRAKES	5-200233790 & 5-200233798	CAPACITOR PANEL 1	AMSC	014-0250191
YAW BRAKE 3	SVENDBORG BRAKES	5-200233791 & 5-200233797	POWER TRANSFORMER	ATS ACCORD	NA
YAW BRAKE 4	SVENDBORG BRAKES	5-200233792 & 5-200233796	TOP RADIATOR		NA
BRAKE UNIT	SVENDBORG BRAKES	5-100032380	ROTAR LOCK	SVENDBORG BRAKES	5-100032568
BRAKE UNIT	SVENDBORG BRAKES	5-100032382	VCB	ABB	NA
HYDRAULIC UNIT	SVENDBORG BRAKES	R901185727	CONTROL & RELAY PANEL		NA
SLIPRING	SCHLEIFRING	414787	ACB		NA
TOP CONTROL PANEL	AMSC	014-0210224	GREASE PUMP - GENERATOR	LINCOLN	2015326734/1
WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA-2010	COUPLING	KUVAG ISOLA	200080689/10

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Inadequate oil level in transformer	The quantity of the oil should be 1294 liters where the MID level is about 700 liters which is safest capacity to run the transformer. If the oil level is lower than the MID level, it will affect the performance of the transformer and safety of the unit	No maintenance is happening	Oil filtration to remove debris, breakdown voltage (BDV) test and refilling of oils as per guidelines	High
3	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
4	USS	WTI and OTI meter found open condition and the panel is full of dust	WTI means winding temperature Indicator and OTI means Oil Temperature Indicator which indicates the winding temperature & oil temperature of the transformer and operates the alarm, trip, and cooler control contacts. If the WTI & OTI is not maintained properly, this will impact in the function of the transformer	Limited importance given to maintenance of WTI and OTI by the contractor	Check the working condition of WTI & OTI meter and procure spares for replacement, if needed	Medium
5	Electrical controls	Sleeves melted and cable damages in transformer control panel	Purpose of the control cable is to distribute the power to various components; hence it should be maintained properly	Potential loose connection of the cable lug with the terminal box	Identify root cause for melting of cables and replace as required	Medium
6	USS	Dp pole hoping Found damaged	Quality issues and this may lead to damage of pole hoping	No maintenance is happening, and poor quality of materials used during project initiation	Cleaning and Re-painting to be done	Medium
7	USS	Transformer Breather - Silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in color indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
8	Earthing	**Earthing** 1. Grid earthing found stolen and not connected 2. Earthing for Current Transformer not properly done 3. Earthing in Gear box found improper 4. Earthing is not found in Nosecone 5. Gate earthing not available 6. Nacelle earthing found improper 7. Panel earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Unavailability of grid earthing, ground earthing, and copper earthing cables in nacelle and hub to be checked with contractor	All the earthing should have to be provided with high importance	High
9	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
10	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium
11	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
12	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and first aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
13	Tower	capacitor panel cable routing not done properly	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
14	Electrical controls	Cable dressing / insulation not done properly	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
15	Electrical controls	Improper glanding of rotor cable	High safety risk	Improper maintenance practices	Glanding to be done	Medium
16	Electrical controls	Improper cable glanding in transformer	Glanding is very important for the safety of cable and to avoid any electrical incidents such as tripping, fault current etc.	Limited awareness on severity of issue, and improper maintenance practices	Proper glanding to be done	Medium
17	Tower	Communication cable not properly laid	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
18	Tower	light switch box got not done proper glanding tower section	For O&M activities and people safety	Handling damages	Spares to be replaced	Low

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
19	Tower	Tube lights are not in working condition in Tower Section 3&4	High safety risk	Improper maintenance practices	Electrical connections shall be checked, and new set of lights can be provided	Low
20	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
21	Yaw system	Corrosion and accumulation of dust in yaw ring	Smooth functioning of yaw pinions and main bearing is essential for proper functioning of yaw mechanism as per wind speed and direction	Insufficient lubrication and improper maintenance practices	Live testing of performance of yaw mechanism should be done and component to be replaced as required	Medium
22	Brake Unit	Disc Brake pad found in worn out condition	High safety risk due to malfunctioning of rotor brake especially in high wind season during high wind velocity	High wear and tear and potentially due to malfunctioning of brake sensor	Spares to be procured and component to be replaced	High
23	Rotor	Oil and Grease spillages found across the Hub unit	Oil spillage may be from pitch gear unit and grease spillage from pitch bearing. Lubrication is essential to minimize friction in bearings	Potential failure of breathers in gearbox leading to overheating and overflowing of oil / leakages due to improper maintenance	Cleaning of hub, refilling of oil / grease across all systems	Medium
24	Rotor	Pitch bearing grease passage tube damaged	Lubrication of pitch bearing is essential for smooth operations and minimize friction	Handling damages	Quarterly visual inspection of lubrication unit and immediate replacement as required	Medium
25	Rotor	Low grease levels and spillages in hub due to leakage from tube	Improper grease lubrication of pitch / main bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
26	Others	Improper routing of power cables in wind motor	To avoid cable damages	Improper maintenance practices	Cable routing to be reviewed and corrected	Low
27	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium
28	Gear Box	Discoloration of silica gel in gearbox breather	Breathers allow heat to escape and cooling air to enter the system, preventing unnecessary overheating issues.	Overuse of breathers and excess moisture can potentially lead to discoloration	Breathers must be replaced as part of yearly PM activities	Medium
29	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
30	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
31	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

MKT01

Below is a list of components across the WTG, detailed observations, and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name:	GMDC			**Inspection Date**	27.06.2022
Turbine Coordinates				**HTSC. No**	
Area Details		**WTG Details**			
Name of District	BOTAD	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	GADHADA	**WTG Loc No**	MKT 01	**DOC**	28.09.2016
Name of Village	MOTIKUNDAL	**Tower Type**	TUBULAR	**SF. No**	42P5
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	F04	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	N1002MGL100184Y15	HUB NUMBER	INOX	H1002MGL10-0184Y15
GEAR BOX	DHHI	2152205	HUB PANEL	AMSC	NA
GENERATOR	ABB	4200313451/425	PITCH MOTOR 1	MOOG	NA
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	76090680027	PITCH MOTOR 2	MOOG	NA
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	76090680024	PITCH MOTOR 3	MOOG	NA
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	75760710018	PITCH DRIVE 1	DHHI	00000006
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	75760710013	PITCH DRIVE 2	DHHI	NA
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15028596	PITCH DRIVE 3	DHHI	NA
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15028597	BLADE 1	INOX	6175
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15029058	BLADE 2	INOX	5184
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15029059	BLADE 3	INOX	7163
YAW BRAKE 1	SVENDBORG BRAKES	5-200233779 & 5-200233788	POWER PANEL	AMSC	014-0230194
YAW BRAKE 2	SVENDBORG BRAKES	5-200233781 & 5-200233786	CAPACITOR PANEL 1	AMSC	014-0250197
YAW BRAKE 3	SVENDBORG BRAKES	5-200233782 & 5-200233785	POWER TRANSFORMER	ATS ACCORD	NA
YAW BRAKE 4	SVENDBORG BRAKES	5-200233783 & 5-200233784	TOP RADIATOR	HYDRA	FSB70011-1604-195
BRAKE UNIT	SVENDBORG BRAKES	5-100031122	ROTAR LOCK	SVENDBORG BRAKES	5-100032563
BRAKE UNIT	SVENDBORG BRAKES	5-100031123	VCB	ABB	1VYN030216002520
GEAR OIL PUMP	ABB	3G1C15300512731073	CONTROL & RELAY PANEL	SQURE	TSPL-HT/09-14/646-449
SLIPRING	SCHLEIFRING	406634	ACB	SQURE	BG76105724
TOP CONTROL PANEL	AMSC	014-0240241	WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA 2010

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Oil Leakage found from Transformer LV Pushing	Low oil levels will lead to rise in temperature of the transformer	Internal design of the Transformer	Need to conduct a detailed study	Medium
3	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
4	USS	WTI and OTI meter found open condition and the panel is full of dust	WTI means winding temperature Indicator and OTI means Oil Temperature Indicator which indicates the winding temperature & oil temperature of the transformer and operates the alarm, trip, and cooler control contacts. If the WTI & OTI is not maintained properly, this will impact in the function of the transformer	Limited importance given to maintenance of WTI and OTI by the contractor	Check the working condition of WTI & OTI meter and procure spares for replacement, if needed	Medium
5	USS	LV cable laying pvc pipe damaged	To avoid cable damages	Handling damages	PVC pipes have to be replaced	Low
6	Earthing	**Earthing** 1. Gate earthing disconnected 2. Earthing for Current Transformer not properly done 3.PM 3000 main board earthing improper 4. Earthing not found in nose cone 5. Nacelle earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Improper of grid earthing, ground earthing, and copper earthing cables in nacelle and hub to be checked with contractor	All the earthing systems to be checked and replaced on priority	High
7	USS	Copper earth flat in contact with radiator	High safety risk for transformer in case of surges	Limited awareness on severity of issue	Reposition earth flats to ensure no contact with radiator	High
8	USS	Transformer Breather - Silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in color indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
9	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
10	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium
11	USS	Improper glanding in CT cable	Glanding is very important for the safety of cable and to avoid any electrical incidents such as tripping, fault current etc.	Improper maintenance practices	Cable glanding to be done	Medium
12	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
13	Others	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and first aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
14	Electrical controls	Sleeves melted and cable damages in transformer control panel	Purpose of the control cable is to distribute the power to various components; hence it should be maintained properly	Potential loose connection of the cable lug with the terminal box	Identify root cause for melting of cables and replace as required	Medium
15	Gear Box	Discoloration (black) and low oil level found in gearbox	Lubricating oil is like the blood system of any Gearbox. If the oil levels fall too low, the chances for failure of gearbox are high. Moreover, it also affecting the performance of the gearbox	1. No refilling in between during Scheduled Maintenance 2. Leakage from Hydraulic connections 3. Potential loss of Oil during any Major breakdowns, evident from spillage 4. Color changed may be due to high wear and tear in the gears	1. Suggest having Endoscopy Inspection 2. Suggest having Oil Analysis in the reputed NABL accredited lab	High
16	Others	WTG gate stopper not available	Potential safety risk	Handling damages	Spares to be replaced	Low
17	Electrical controls	Power panel UPS battery bypass	This UPS for the purpose of supplying 24V to the module. If the supply is not proper, there are chances for module failure very soon. Unavailability of UPS also prevents auto-restart of WTGs leading to increase in downtime	UPS Failure	UPS battery in power panel to be replaced	High
18	Tower	Oil spillages over the cables between Tower Section 4	High safety risk	Improper maintenance practices	Tower to be cleaned and source of spillage to be	Low

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
					inspected	
19	Electrical controls	Improper cable glanding in transformer	Glanding is very important for the safety of cable and to avoid any electrical incidents such as tripping, fault current etc.	Limited awareness on severity of issue, and improper maintenance practices	Proper glanding to be done	Medium
20	Tower	Communication cable not properly laid	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
21	Tower	Light switch box damaged in tower section 2&3	High safety risk	Handling damages and improper maintenance	Electrical connections shall be checked, and new set of lights can be provided	Low
22	Tower	Tube lights are not in working condition in Tower Section 3&4	High safety risk	Improper maintenance practices	Electrical connections shall be checked, and new set of lights can be provided	Low
23	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
24	Tower	Oil spillages found across all the platforms	Potential fire hazard and low oil levels in critical components (e.g., gearbox) can affect overall performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of leakage	Medium
25	Yaw system	Grease spillages found across all the platforms	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
26	Gear Box	Gear box brake sensor found in bypass condition	The sensor ensures appropriate positioning of the brake and monitors condition of the brake pad	Brake sensor failure	Spares to be replaced	High
27	Brake unit	Disc Brake pad found in worn out condition	High safety risk due to malfunctioning of rotor brake especially in high wind season during high wind velocity	High wear and tear and potentially due to malfunctioning of brake sensor	Spares to be procured and component to be replaced	High
28	Electrical controls	Control panel lights are not in working condition	Required for routine maintenance and inspection of control panels	Improper maintenance practices	Spares to be replaced	Low

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
29	Gear Box	Accumulation of dust and corrosion of radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water-cooling system of generator. Corrosion or improper maintenance of radiators will affect performance of the components	Improper cleaning and maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium
30	Yaw system	Low grease levels in yaw teeth lubrication pumps	Lubrication is essential for yaw bearing and main bearing. Low grease levels can lead to increase in friction and malfunctioning of yaw system	Potential leakages from hoses leading to reduction in grease levels	Address root cause for leakage of grease and refill up to appropriate levels	Medium
31	Rotor	Low oil level in hydraulic unit	Function of this hydraulic unit is to apply pressure for Disc brake unit, Rotor lock unit and Yaw brake unit. If the oil level is low, it can't build the required pressure which in turn lead to malfunction of the system	Poor maintenance practices	Oil has to be refilled	Medium
32	Others	Improper routing of power cables in wind motor	To avoid cable damages	Improper maintenance practices	Cable routing to be reviewed and corrected	Low
33	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium
34	Gear Box	Discoloration of silica gel in gearbox breather	Breathers allow heat to escape and cooling air to enter the system, preventing unnecessary overheating issues.	Overuse of breathers and excess moisture can potentially lead to discoloration	Breathers must be replaced as part of yearly PM activities	Medium
35	Brake unit	Oil spillage on brake pad	Brake pad should be clean and dry for effective braking. If the oil spilled over brake pad, there are possibility of spillages which impact in braking	Oil leakage from brake caliper and loose hydraulic connections	Visual inspection of brake calipers on quarterly basis, cleaning on half-yearly basis and replacement on yearly basis if required	Medium
36	Generator	Generator lubrication grease passage tube damaged	Lubrication is essential for generator DE and NDE bearings to minimize friction	Handling damages	Visual inspection of lubrication units on quarterly basis, and immediate replacement as required	Medium
37	Others	Heat exchanger bypass	Heat exchanger is essential to extract the heat from tower / control panels	Component failure	Spares to be replaced	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
38	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
39	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
40	ALL	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

RJ4T14

Below is a list of components across the WTG, detailed observations, and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name:	GMDC			**Inspection Date**	18.06.2022
Turbine Coordinates				**HTSC. No**	
Area Details		**WTG Details**			
Name of District	AMERALI	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	BABRA	**WTG Loc No**	RJ4T14	**DOC**	30.09.2016
Name of Village	Untavad	**Tower Type**	TUBULAR	**SF. No**	30
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 13	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	MFHPL/IWL/027	HUB NUMBER	INOX	Not noted
GEAR BOX	DHHI	2152197	HUB PANEL	AMSC	Not noted
GENERATOR	ABB	4200313451/426	PITCH MOTOR 1	MOOG	Not noted
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	75760710016	PITCH MOTOR 2	MOOG	Not noted
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	76090680004	PITCH MOTOR 3	MOOG	Not noted
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	75760710017	PITCH DRIVE 1	DHHI	Not noted
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	76384650034	PITCH DRIVE 2	DHHI	Not noted
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15027622	PITCH DRIVE 3	DHHI	Not noted
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15026497	BLADE 1	INOX	6193
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15029063	BLADE 2	INOX	7172
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15029405	BLADE 3	INOX	NA
YAW BRAKE 1	SVENDBORG BRAKES	5-200234217 & 5-200234210	POWER PANEL	AMSC	NA
YAW BRAKE 2	SVENDBORG BRAKES	5-200234218 & 5-200234209	CAPACITOR PANEL 1	AMSC	014-0250230
YAW BRAKE 3	SVENDBORG BRAKES	5-200234214 & 5-200234213	TOP RADIATOR	HYDRA	FSB70011-1604-194
YAW BRAKE 4	SVENDBORG BRAKES	5-200234215 & 5-200234212	ROTAR LOCK	SVENDBORG BRAKES	NA
BRAKE UNIT	SVENDBORG BRAKES	NA	VCB	ABB	1VYN030216002518
BRAKE UNIT	SVENDBORG BRAKES	NA	CONTROL & RELAY PANEL		NA
GEAR OIL PUMP	ABB	NA	ACB	SQURE	BG75105713
SLIPRING	SCHLEIFRING	NA	GREASE PUMP - GENERATOR	LINCOLN	NA
TOP CONTROL PANEL	AMSC	014-	WINCH MOTOR	CARLSTAHL CRAFTSMAN	NA

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Inadequate oil level in transformer	The quantity of the oil should be 1294 liters where the MID level is about 700 liters which is safest capacity to run the transformer. If the oil level is lower than the MID level, it will affect the performance of the transformer and safety of the unit	No maintenance is happening	Oil filtration to remove debris, breakdown voltage (BDV) test and refilling of oils as per guidelines	High
3	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
4	USS	ACB door found in damaged condition	If rainwater gets in, it leads to malfunctioning of the ACB	Handling Damages	Spares to be replaced	Medium
5	USS	Oil leakage found in "B" phase of CT	Oil leakage leads to CT failure	Due to continuous operation, and improper maintenance	Refilling of oil as per guidelines in the CT	High
6	USS	B-phase lightning arrestor bypassed	Lightning arrestor is the primary protection agent for the DP Yard	Unavailability of spares	Spared to be procured and replaced	High
7	USS	WTI and OTI meter found open condition and the panel is full of dust	WTI means winding temperature Indicator and OTI means Oil Temperature Indicator which indicates the winding temperature & oil temperature of the transformer and operates the alarm, trip, and cooler control contacts. If the WTI & OTI is not maintained properly, this will impact in the function of the transformer	Limited importance given to maintenance of WTI and OTI by the contractor	Check the working condition of WTI & OTI meter and procure spares for replacement, if needed	Medium
8	USS	Transformer Breather - Silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in color indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium
9	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
10	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium
11	Earthing	**Earthing** 1. Grid earthing found stolen and not connected 2. Earthing for Current Transformer not properly done 3. Earthing in Gear box found improper 4. Tower to tower earthing found improper 5. Gate earthing not available 6. Nacelle earthing found improper 7. Isolator earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Unavailability of grid earthing, ground earthing, and copper earthing cables in nacelle, hub, gearbox, and isolator to be checked with contractor	All the earthing should have to be provided with high importance	High
12	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
13	Others	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and first aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
14	Tower	Grease spillages found across all the platforms	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
15	Electrical controls	LVRT bypass	In absence of LVRT, if grid voltage dips, a mismatch is produced between the generated active power and the active power delivered to the grid.	Product failure	LVRT component on panel to be replaced	High
16	Electrical controls	Generator choke cooling fan 1 not available	Cooling fan reducing the temperature of the winding and ensures optimal performance of the equipment	Unavailability of spares	Spares to be procured and replaced	High
17	Electrical controls	Cable dressing / insulation not done properly	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
18	Tower	Oil spillage on ladder	High safety risk	Improper maintenance practice	Cleaning and subsequent visual inspection on	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
					quarterly basis	
19	Electrical controls	Transformer cable breaker in bypass condition and glanding not done properly	High safety risk	Improper maintenance practices	Glanding to be done	Medium
20	Tower	Nacelle communication cable not done proper laying and underground pvc pipe holes open not provide BOP	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
21	Tower	Tube lights are not in working condition in Tower Section 3&4	High safety risk	Improper maintenance practices	Electrical connections shall be checked, and new set of lights can be provided	Low
22	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
23	Tower	Oil spillages found across all the platforms	Potential fire hazard and low oil levels in critical components (e.g., gearbox) can affect overall performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of leakage	Medium
24	Yaw system	Corrosion and accumulation of dust in yaw ring	Smooth functioning of yaw pinions and main bearing is essential for proper functioning of yaw mechanism as per wind speed and direction	Insufficient lubrication and improper maintenance practices	Live testing of performance of yaw mechanism should be done and component to be replaced as required	Medium
25	Gear Box	Oil leakage in Gear box Drain Valve	Low oil levels and improper lubrication will lead to sub-optimal performance of the gearbox	Gasket or Seal might be damaged	Ensure proper sealing of drain valve	Medium
26	Gear Box	Accumulation of dust and corrosion of radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water-cooling system of generator. Corrosion or improper maintenance of radiators will affect performance of the components	Improper cleaning and maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium
27	Yaw system	Low grease levels in yaw teeth lubrication pumps	Lubrication is essential for yaw bearing and main bearing. Low grease levels can lead to increase in friction and malfunctioning of yaw system	Potential leakages from hoses leading to reduction in grease levels	Address root cause for leakage of grease and refill up to appropriate levels	Medium
28	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
29	Gear Box	Discoloration of silica gel in gearbox breather	Breathers allow heat to escape and cooling air to enter the system, preventing unnecessary overheating issues.	Overuse of breathers and excess moisture can potentially lead to discoloration	Breathers must be replaced as part of yearly PM activities	Medium
30	Nacelle	Crack found in Top Nacelle cover	Essential for overall upkeep of the asset	Potentially due to high wind speed / force majeure	Detailed inspection required by OEM for further course of action	High
31	Gear Box	Discoloration (black) and low oil level found in gearbox	Lubricating oil is like the blood system of any Gearbox. If the oil levels fall too low, the chances for failure of gearbox are high. Moreover, it also affecting the performance of the gearbox	1. No refilling in between during Scheduled Maintenance 2. Leakage from Hydraulic connections 3. Potential loss of Oil during any Major breakdowns, evident from spillage 4. Color changed may be due to high wear and tear in the gears	1. Suggest having Endoscopy Inspection 2. Suggest having Oil Analysis in the reputed NABL accredited lab	High
32	Nacelle	Nacelle lights not available	High safety risk	Negligence and improper maintenance practices	Electrical connections shall be checked, and new set of lights can be provided	Low
33	Electrical controls	Improper glanding of rotor cable	High safety risk	Improper maintenance practices	Glanding to be done	Medium
34	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
35	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
36	ALL	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

RJ7T34

Below is a list of components across the WTG, detailed observations, and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name:	GMDC			**Inspection Date**	20.06.2022
Turbine Coordinates				**HTSC. No**	
Area Details		**WTG Details**			
Name of District	RAJKOT	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	VICHIYA	**WTG Loc No**	RJ7T34	**DOC**	30.09.2016
Name of Village	Nadiya	**Tower Type**	TUBULAR	**SF.No**	148 P1
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 7	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	IWISL/2000/16-17/3865	HUB NUMBER		NA
GEAR BOX	DHHI	2152203	HUB PANEL	NA	
GENERATOR	ABB	4200313451/429	PITCH MOTOR 1	MOOG	1512011
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	76384680001	PITCH MOTOR 2	MOOG	1512012
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	76090680021	PITCH MOTOR 3	MOOG	1512013
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	75964990064	PITCH DRIVE 1	DHHI	15PYA0226
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	76384660005	PITCH DRIVE 2	DHHI	15PYA0227
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15028605	PITCH DRIVE 3	DHHI	15PYA0228
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15028606	BLADE 1	INOX	7134
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15029065	BLADE 2	INOX	7135
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15029047	BLADE 3	INOX	8107
YAW BRAKE 1	SVENDBORG BRAKES	5-200234229 & 5-200234238	POWER PANEL	AMSC	014-0250319
YAW BRAKE 2	SVENDBORG BRAKES	5-200234230 & 5-200234237	CAPACITOR PANEL 1	AMSC	014-0330038
YAW BRAKE 3	SVENDBORG BRAKES	5-200234233 & 5-200234234	POWER TRANSFORMER	ATS ACCORD	ATS/A10080152
YAW BRAKE 4	SVENDBORG BRAKES	5-200234232 & 5-200234235	TOP RADIATOR		NA
BRAKE UNIT	SVENDBORG BRAKES	5-100031134	ROTAR LOCK	SVENDBORG BRAKES	5-100033037
BRAKE UNIT	SVENDBORG BRAKES	5-100031132	TOP CONTROL PANEL	AMSC	014-0240261
GEAR OIL PUMP	ROTOMOTIVE	M1215542	WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA- 2010
COUPLING	KUVAG ISOLA	1537/001-014	GREASE PUMP - GENERATOR	LINCOLN	2015326734-2

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Inadequate oil level in transformer	The quantity of the oil should be 1294 liters where the MID level is about 700 liters which is safest capacity to run the transformer. If the oil level is lower than the MID level, it will affect the performance of the transformer and safety of the unit	No maintenance is happening	Oil filtration to remove debris, breakdown voltage (BDV) test and refilling of oils as per guidelines	High
3	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
4	USS	WTI and OTI meter found open condition and the panel is full of dust	WTI means winding temperature Indicator and OTI means Oil Temperature Indicator which indicates the winding temperature & oil temperature of the transformer and operates the alarm, trip, and cooler control contacts. If the WTI & OTI is not maintained properly, this will impact in the function of the transformer	Limited importance given to maintenance of WTI and OTI by the contractor	Check the working condition of WTI & OTI meter and procure spares for replacement, if needed	Medium
5	Earthing	**EARTHING** **1.**Grid earthing found improper 2.Nacelle earthing found improper 3.Panel earthing found improper 4.Earthing found improper in nosecone 5.Transformer and Gate earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Improper of grid earthing, ground earthing, and copper earthing cables in nacelle and hub to be checked with contractor	All the earthing should have to be provided with high importance	High
6	USS	Transformer Breather - Silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in color indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
7	USS	Fitment and alignment of current transformer is deviated	The minimum distance between CT to PT is 425mm to 475mm which is mandate as per the electrical standard	Improper maintenance practices and alignment not conducted as per guidelines	Immediate service is required	Medium
8	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
9	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium
10	USS	Power cable laying in ACB panel is not done properly	To avoid cable damages	Improper maintenance practice	Cable laying to be done properly	Medium
11	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
12	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and first aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
13	USS	PG clamp is not used in "R" phase of lightning arrestor	Lightning arrestor is the primary protection agent for the DP Yard	Unavailability of spares	Spared to be procured and replaced	High
14	Gear Box	Discoloration (black) and low oil level found in gearbox	Lubricating oil is like the blood system of any Gearbox. If the oil levels fall too low, the chances for failure of gearbox are high. Moreover, it also affecting the performance of the gearbox	1. No refilling in between during Scheduled Maintenance 2. Leakage from Hydraulic connections 3. Potential loss of Oil during any Major breakdowns, evident from spillage 4. Color changed may be due to high wear and tear in the gears	1. Suggest having Endoscopy Inspection 2. Suggest having Oil Analysis in the reputed NABL accredited lab	High
15	Electrical controls	Cable routing in capacitor panel found improper	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
16	Electrical controls	Electrical connection in Power panel found improper	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
17	Tower	Power cable dressing found improper	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
18	Electrical controls	LVRT bypass	In absence of LVRT, if grid voltage dips, a mismatch is produced between the generated active power and the active power delivered to the grid.	Product failure	LVRT component on panel to be replaced	High
19	Electrical controls	Cable and laying found improper in 30kva transformer	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
20	Electrical controls	Transformer cable breaker in bypass condition and glanding not done properly	High safety risk	Improper maintenance practices	Glanding to be done	Medium
21	Tower	Light switch box damaged in tower section 2&3	High safety risk	Handling damages and improper maintenance	Electrical connections shall be checked, and new set of lights can be provided	Low
22	Tower	Tube lights are not in working condition	As a safety measure	Poor Maintenance practices	Electrical connections shall be checked, and new set of lights can be provided	Low
23	Tower	Grease and oil spillages over the platforms and flanges	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
24	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
25	Yaw system	Corrosion and accumulation of dust in yaw ring	Smooth functioning of yaw pinions and main bearing is essential for proper functioning of yaw mechanism as per wind speed and direction	Insufficient lubrication and improper maintenance practices	Live testing of performance of yaw mechanism should be done and component to be replaced as required	Medium
26	Brake unit	Disc Brake pad found in worn out condition	High safety risk due to malfunctioning of rotor brake especially in high wind season during high wind velocity	High wear and tear and potentially due to malfunctioning of brake sensor	Spares to be procured and component to be replaced	High
27	Gear Box	Gear box brake sensor found in bypass condition	The sensor ensures appropriate positioning of the brake and monitors condition of the brake pad	Brake sensor failure	Spares to be replaced	High
28	Rotor	Hub lights in top control panel is not working	Essential for visual inspection and safety of the panels	Improper maintenance practices	Spares to be replaced	Low

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
29	Gear Box	Accumulation of dust on gearbox radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water-cooling system of generator. High temperature will affect performance of the components	Poor Maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium
30	Yaw system	Grease level found low in Yaw lubrication pump unit	Yaw lubrication pump supplies grease to yaw brake and yaw bearing	Improper maintenance practices and refilling of grease as per guidelines	Refill grease across all lubrication systems as per guidelines and address leakages in systems	Medium
31	Others	Improper routing of power cables in wind motor	To avoid cable damages	Improper maintenance practices	Cable routing to be reviewed and corrected	Low
32	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium
33	Gear Box	Discoloration of silica gel in gearbox breather	Breathers allow heat to escape and cooling air to enter the system, preventing unnecessary overheating issues.	Overuse of breathers and excess moisture can potentially lead to discoloration	Breathers must be replaced as part of yearly PM activities	Medium
34	Electrical controls	Anemometer found in bypass condition	Anemometer controls the yaw mechanism of the WTG, by passing the anemometer will lead to generator loss	Negligence and improper maintenance practices	New Anemometer to be replaced	High
35	Electrical controls	Rotor cable glanding found improper	High safety risk	Improper maintenance practices	Glanding to be done	Medium
36	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
37	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
38	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

RJ7T60

Below is a list of components across the WTG, detailed observations, and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name:	GMDC			**Inspection Date**	22.06.2022
Turbine Coordinates				**HTSC. No**	
Area Details					
Name of District	AMERELI	**WTG Make**			
Name of Taluk	BABRA	**WTG Loc No**	RJ7T60	**DOC**	30.09.2016
Name of Village	FULZAR	**Tower Type**	TUBULAR	**SF.No**	112
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder-08	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT NAME					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	N1002MGL100199Y15	HUB NUMBER	INOX	H1002MGL100186Y15
GEAR BOX	DHHI	2152223	HUB PANEL	AMSC	NA
GENERATOR	LS	WL15L227B	PITCH MOTOR 1	MOOG	1509156
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	75964970044	PITCH MOTOR 2	MOOG	1509137
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	75964970028	PITCH MOTOR 3	MOOG	NA
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	75964970029	PITCH DRIVE 1	DHHI	15PYD0006
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	76384660033	PITCH DRIVE 2	DHHI	15PYD0004
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15026885	PITCH DRIVE 3	DHHI	15PYD0005
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15026865	BLADE 1	INOX	6151
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15026866	BLADE 2	INOX	5153
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15026883	BLADE 3	INOX	7137
YAW BRAKE 1	SVENDBORG BRAKES	5-200235031 & 5-200235036	POWER PANEL	AMSC	014-0230232
YAW BRAKE 2	SVENDBORG BRAKES	5-200235030 & 5-200235037	CAPACITOR PANEL 1	AMSC	014-0250192
YAW BRAKE 3	SVENDBORG BRAKES	5-200235029 & 5-200235038	TOP RADIATOR	HYDRA	FSB70011-1603-164
YAW BRAKE 4	SVENDBORG BRAKES	5-200235033 & 5-200235034	ROTAR LOCK	SVENDBORG BRAKES	5-100032950
BRAKE UNIT	SVENDBORG BRAKES	5-100032523	VCB	ABB	1VYN030216001069
BRAKE UNIT	SVENDBORG BRAKES	5-100032522	CONTROL & RELAY PANEL	SQURE	TSPL-HT09-14646/436
GEAR OIL PUMP	ABB	3A1G15368519345013	ACB	SQURE	TSPL-LT/09/14/666
SLIPRING	SCHLEIFRING	406637	WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA 2010
TOP CONTROL PANEL	AMSC	014-0240275	GREASE PUMP - GENERATOR	LINCOLN	2015261453/2

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Oil Leakage found from Transformer LV Pushing	Low oil levels will lead to rise in temperature of the transformer	Internal design of the Transformer	Need to conduct a detailed study	Medium
3	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
4	Gear Box	Accumulation of dust on gearbox radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water-cooling system of generator. High temperature will affect performance of the components	Poor Maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium
5	USS	WTI and OTI meter found open condition and the panel is full of dust	WTI means winding temperature Indicator and OTI means Oil Temperature Indicator which indicates the winding temperature & oil temperature of the transformer and operates the alarm, trip, and cooler control contacts. If the WTI & OTI is not maintained properly, this will impact in the function of the transformer	Limited importance given to maintenance of WTI and OTI by the contractor	Check the working condition of WTI & OTI meter and procure spares for replacement, if needed	Medium
6	Earthing	**Earthing** 1.Blade earthing found improper 2. Earthing is not found in Nosecone 3. Nacelle earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Improper of grid earthing, ground earthing, and copper earthing cables in nacelle and hub to be checked with contractor	All the earthing should have to be provided with high importance	High
7	USS	Transformer Breather - Silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in color indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium
8	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
9	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium
10	USS	ACB Panel power cable laying found improper	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
11	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
12	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and first aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
13	Electrical controls	Cable damages found in 690/415 Transformer cable (Cable sleeves is in melt condition) and glanding not done properly	Glanding is very important for the safety of cable and to avoid any electrical incidents such as tripping, fault current etc.	Poor Maintenance practices	Cable glanding to be done	Medium
14	Tower	Capacitor panel cable routing found improper	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
15	Tower	Triple clamp not done proper tightness	to avoid cable damages	Poor Maintenance practices	Spares to be replaced	Low
16	Tower	Tower bottom section - cable dressing found improper	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
17	Electrical controls	Cleanliness of Main panel and Capacitor panel found very dirty	As a safety measure and to ensure protecting the peripheral devices	Poor Maintenance practices	Cleaning of the panel is required.	Medium
18	Electrical controls	Cable and laying found improper in 30kva transformer	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
19	Tower	Tube lights are not working in Tower Section 2&3	As a safety measure	Poor Maintenance practices	Electrical connections shall be checked, and new set of lights can be provided	Low
20	Tower	Grease and oil spillages over the platforms and flanges	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
21	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
22	Gear Box	Oil leakage from Thermo bypass valve	Improper lubrication of gearbox can lead to sub-optimal performance and potential fire hazard	Improper maintenance practices	Appropriate sealing / gasket to be used for the value to arrest leakages	Medium
23	Gear Box	Discoloration (black) and low oil level found in gearbox	Lubricating oil is like the blood system of any Gearbox. If the oil levels falls too low, the chances for failure of gearbox is high. Moreover, it also affecting the performance of the gearbox	1. No refilling in between during Scheduled Maintenance 2. Leakage from Hydraulic connections 3. Potential loss of Oil during any Major breakdowns, evident from spillage 4. Colour changed may due to high wear and tear in the gears	1. Suggest to have Endoscopy Inspection 2. Suggest to have Oil Analysis in the reputed NABL accredited lab	High
24	Brake unit	Disc Brake pad found in worn out condition	High safety risk due to malfunctioning of rotor brake especially in high wind season during high wind velocity	High wear and tear and potentially due to malfunctioning of brake sensor	Spares to be procured and component to be replaced	High
25	Gear Box	Gear box brake sensor found in bypass condition	The sensor ensures appropriate positioning of the brake and monitors condition of the brake pad	Brake sensor failure	Spares to be replaced	High
26	Rotor	Hub lights in top control panel found not working	Required as a mandate	Poor Maintenance practices	Spares to be replaced	Low
27	Yaw system	Grease level found low in Yaw lubrication pump unit	Yaw lubrication pump supplies grease to yaw brake and yaw bearing	Improper maintenance practices and refilling of grease as per guidelines	Refill grease across all lubrication systems as per guidelines and address leakages in systems	Medium
28	Rotor	Grease level found low in Pitch lubrication pump unit and spillages observed throughout the Hub	Lubrication is essential for yaw bearing and main bearing. Low grease levels can lead to increase in friction and malfunctioning of yaw system	Potential leakages from hoses leading to reduction in grease levels	Address root cause for leakage of grease and refill up to appropriate levels	Medium
29	Others	Improper routing of power cables in wind motor	To avoid cable damages	Improper maintenance practices	Cable routing to be reviewed and corrected	Low
30	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium
31	Gear Box	Discoloration of silica gel in gearbox breather	Breathers allow heat to escape and cooling air to enter the system, preventing unnecessary overheating issues.	Overuse of breathers and excess moisture can potentially lead to discoloration	Breathers must be replaced as part of yearly PM activities	Medium
32	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
33	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
34	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

RJ7T70

Below is a list of components across the WTG, detailed observations and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name :	GMSC			**Inspection Date**	20.06.2022
Turbine Coordinates				**HTSC. No**	
Area Details		**WTG Details**			
Name of District	RAJKOT	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	JASDAN	**WTG Loc No**	RJ7T70	**DOC**	30.09.2016
Name of Village	Ambardi	**Tower Type**	TUBULAR	**SF.No**	279 P1
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 9	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	N1002MGL100201Y15	HUB NUMBER		NA
GEAR BOX	DHHI	2152212	HUB PANEL	NA	
GENERATOR	ABB	4200313451/28	PITCH MOTOR 1	MOOG	1602014
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	75964990056	PITCH MOTOR 2	MOOG	1602021
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	76090680032	PITCH MOTOR 3	MOOG	1602022
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	76384680003	PITCH DRIVE 1	DHHI	15PYA0226
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	75964990058	PITCH DRIVE 2	DHHI	15PYA0227
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15028101	PITCH DRIVE 3	DHHI	15PYA0228
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15028606	BLADE 1	INOX	6154
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15028095	BLADE 2	INOX	5110
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15028106	BLADE 3	INOX	5151
YAW BRAKE 1	SVENDBORG BRAKES	5-200233748 & 5-200233741	POWER PANEL	AMSC	014-0330002
YAW BRAKE 2	SVENDBORG BRAKES	5-200233747 & 5-200233742	CAPACITOR PANEL 1	AMSC	014-0250280
YAW BRAKE 3	SVENDBORG BRAKES	5-200233744 & 5-200233745	POWER TRANSFORMER	ATS ACCORD	ATS/A10080152
YAW BRAKE 4	SVENDBORG BRAKES	5-200233746 & 5-200233740	TOP RADIATOR		FSB70011-1603-184
BRAKE UNIT	SVENDBORG BRAKES	5-100031136	ROTAR LOCK	SVENDBORG BRAKES	5-100032948
BRAKE UNIT	SVENDBORG BRAKES	5-100031132	VCB		NA
GEAR OIL PUMP	ROTOMOTIVE	M1215542	CONTROL & RELAY PANEL	square	461
TOP CONTROL PANEL	AMSC	014-0240261	GREASE PUMP - GENERATOR	LINCOLN	2015326734-2
WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA- 2010	COUPLING	KUVAG ISOLA	1537/001-014

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
3	Earthing	**Earthing** 1. Grid earthing found stolen and not connected 2. Earthing for Current Transformer not properly done 3. Earthing in Gear box found improper 4.Tower to tower earthing found improper 5.Gate earthing not available 6. Nacelle earthing found improper 7.Isolator earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Unavailability of grid earthing, ground earthing, and copper earthing cables in nacelle, hub, gearbox, and isolator to be checked with contractor	All the earthing should have to be provided with high importance	High
4	USS	ACB door found in damaged condition	If rain water gets in, it leads to malfunctioning of the ACB	Handling Damages	Spares to be replaced	Medium
5	USS	Marshaling box glanding not done properly	As a safety measure	Poor Maintenance practices	Glanding to be done	Medium
6	USS	Transformer Breather - Silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in colour indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium
7	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
8	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
9	USS	CT R phase damage	A current transformer is designed to maintain an accurate ratio between the currents in its primary and secondary circuits over a defined range.	Due to continuous operation, and improper maintenance	Spares to be procured and replaced	High
10	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
11	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and first aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
12	Tower	Power cable not done proper laying at T1 to T4	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
13	Electrical controls	LVRT bypass	In absence of LVRT, if grid voltage dips, a mismatch is produced between the generated active power and the active power delivered to the grid.	Product failure	LVRT component on panel to be replaced	High
14	Electrical controls	Improper cleaning of main capacitor panel	Accumulation of dust may lead to failure of components in the panel	Improper maintenance practices	Cleaning of panels and subsequent visual inspections on a quarterly basis	Medium
15	Electrical controls	PM 3000 panel cover not available	High safety risk and potential damage to PM3000 due to accumulation of dust	Negligence and improper maintenance practices	Replace panel cover	Low
16	Tower	Water coolant valve missing	as a mandate requirement	Poor Maintenance practices	Spares to be replaced	Low
17	Electrical controls	Cable dressing / insulation not done properly	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
18	Electrical controls	Improper laying of communication cable	To avoid cable damages	Improper maintenance practices	Cable laying to be done properly	Low
19	Tower	Ladder rigid track found cutting	This is very important for the human safety	Poor Maintenance practices	Need to fix it properly	Medium
20	Electrical controls	Transformer cable breaker in bypass condition and glanding not done properly	High safety risk	Improper maintenance practices	Glanding to be done	Medium
21	Tower	Cable laying of communication cable found improper and pipe not covering BOB seal	to avoid cable damages	Poor Maintenance practices	1.Cable laying can be properly done 2.Cleaning to be done and sealant to be provided	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
22	Tower	Tube lights are not in working condition in Tower Section 3&4	High safety risk	Improper maintenance practices	Electrical connections shall be checked and new set of lights can be provided	Low
23	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
24	Yaw system	Corrosion and accumulation of dust in yaw ring	Smooth functioning of yaw pinions and main bearing is essential for proper functioning of yaw mechanism as per wind speed and direction	Insufficient lubrication and improper maintenance practices	Live testing of performance of yaw mechanism should be done and component to be replaced as required	Medium
25	Gear Box	Oil leakage in Gear box Drain Valve	Low oil levels and improper lubrication will lead to sub-optimal performance of the gearbox	Gasket or Seal might be damaged	Ensure proper sealing of drain valve	Medium
26	Rotor	Lights not working in top hub panel	High safety risk	Improper maintenance practices	Electrical connections shall be checked and new set of lights can be provided	Low
27	Rotor	Hub lights in top control panel is not working	Essential for visual inspection and safety of the panels	Improper maintenance practices	Spares to be replaced	Low
28	Gear Box	Accumulation of dust on gearbox radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water cooling system of generator. High temperature will affect performance of the components	Poor Maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium
29	Rotor	Oil and Grease spillages found across the Hub unit	Oil spillage may be from pitch gear unit and grease spillage from pitch bearing. Lubrication is essential to minimize friction in bearings	Potential failure of breathers in gearbox leading to overheating and overflowing of oil / leakages due to improper maintenance	Cleaning of hub, refilling of oil / grease across all systems	Medium
30	Others	Winch chain collector not done proper fixing	As a safety measure	Poor Maintenance practices	Need to fix it properly	Medium
31	Brake unit	Disc Brake pad found in worn out condition	High safety risk due to malfunctioning of rotor brake especially in high wind season during high wind velocity	High wear and tear and potentially due to malfunctioning of brake sensor	Spares to be procured and component to be replaced	High
32	Others	Improper routing of power cables in wind motor	To avoid cable damages	Improper maintenance practices	Cable routing to be reviewed and corrected	Low
33	Generator	Rotor under found dust condition	as a mandate requirement	Poor Maintenance practices	Need to fix it properly	Low
34	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
36	Rotor	Pitch capacitor panel door not functional and closed by using ropes	High safety risk and potential damage to pitch capacitor panel due to accumulation of dust	Improper maintenance practices	Modification / replacement of panel doors	Medium
37	Gear Box	Discoloration (black) and low oil level found in gearbox	Lubricating oil is like the blood system of any Gearbox. If the oil levels falls too low, the chances for failure of gearbox is high. Moreover, it also affecting the performance of the gearbox	1. No refilling in between during Scheduled Maintenance 2. Leakage from Hydraulic connections 3. Potential loss of Oil during any Major breakdowns, evident from spillage 4. Colour changed may due to high wear and tear in the gears	1. Suggest to have Endoscopy Inspection 2. Suggest to have Oil Analysis in the reputed NABL accredited lab	High
38	Nacelle	Nacelle lights not available	High safety risk	Negligence and improper maintenance practices	Electrical connections shall be checked and new set of lights can be provided	Low
39	Electrical controls	Rotor cable glanding found improper	High safety risk	Improper maintenance practices	Glanding to be done	Medium
40	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
41	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
42	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

RJ7T71

Below is a list of components across the WTG, detailed observations and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name :	GMDC			**Inspection Date**	29.06.2022
Turbine Coordinates				**HTSC. No**	
Area Details		**WTG Details**			
Name of District	RAJKOT	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	VICHIYA	**WTG Loc No**	RJ7T71	**DOC**	30.09.2016
Name of Village	HATHSANI	**Tower Type**	TUBULAR	**SF.No**	181 P19
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 08	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	N1002MGL100181Y15	HUB NUMBER	INOX	H1002MGL10-0181-Y15
GEAR BOX	DHHI	2152194	HUB PANEL		NA
GENERATOR	LEROY SOMER	WL15K235	PITCH MOTOR 1	MOOG	1512039
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	76384650039	PITCH MOTOR 2	MOOG	1512037
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	76384680005	PITCH MOTOR 3	MOOG	1511113
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	76384650013	PITCH DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15028630
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	76090680003	PITCH DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15028552
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15029054	PITCH DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15029596
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15029051	BLADE 1	INOX	5156
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15028089	BLADE 2	INOX	7141
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15028091	BLADE 3	INOX	6159
YAW BRAKE 1	SVENDBORG BRAKES	5-200233734 & 5-200233729	POWER PANEL	AMSC	014-0230237
YAW BRAKE 2	SVENDBORG BRAKES	5-200233735 & 5-200233732	CAPACITOR PANEL 1	AMSC	014-0250114
YAW BRAKE 3	SVENDBORG BRAKES	5-200233736 & 5-200233733	POWER TRANSFORMER	ATS ACCORD	NA
YAW BRAKE 4	SVENDBORG BRAKES	5-200233738 & 5-200233730	TOP RADIATOR		NA
BRAKE UNIT	SVENDBORG BRAKES	5-100032372	ROTAR LOCK	SVENDBORG BRAKES	5-100032943
BRAKE UNIT	SVENDBORG BRAKES	5-100032373	VCB	ABB	1VYN030216001474
GEAR OIL PUMP	ABB	3G1C15500512731077	CONTROL & RELAY PANEL	SQUARE	NA
SLIPRING	SCHLEIFRING	414784	WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA 2010
TOP CONTROL PANEL	AMSC	014-0240273	GREASE PUMP - GENERATOR	LINCOLN	2015261496/3

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
3	USS	Oil leakage found transformer radiator butterfly valve	Oil leakage will lead to rise in oil temperature gradually	Design internal of Transformer	Need to have a detailed study	Medium
4	USS	WTI and OTI meter found open condition and the panel is full of dust	WTI means winding temperature Indicator and OTI means Oil Temperature Indicator which indicates the winding temperature & oil temperature of the transformer and operates the alarm, trip, and cooler control contacts. If the WTI & OTI is not maintained properly, this will impact in the function of the transformer	Limited importance given to maintenance of WTI and OTI by the contractor	Check the working condition of WTI & OTI meter and procure spares for replacement, if needed	Medium
5	Earthing	**Earthing** 1. Grid earthing found stolen and not connected 2. Earthing for Current Transformer not properly done 3. Earthing in Gear box found improper 4. Earthing is not found in Nosecone 5. Control panel earthing not available 6. Nacelle earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Unavailability of grid earthing, ground earthing, and copper earthing cables in nacelle and hub to be checked with contractor	All the earthing should have to be provided with high importance	High
6	USS	Acb panel door lock damage	If rain water gets in, it leads to malfunctioning of the ACB	Handling Damages	Cleaning of the panel is required and the new lock to be provided	Medium
7	USS	Marshaling box glanding not done properly	as a safety measure	No awareness on the seriousness of the issues	Proper glanding shall be done	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
8	USS	Transformer Breather - Silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in colour indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium
9	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
10	USS	Current Protection Relay found in bypass	The Current Protection Relay **protects system from the current faults**. Relay protects against undercurrent, over current and unbalance faults.	Poor Maintenance practices	Replace with spares	High
11	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium
12	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
13	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and firt aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
14	Others	WTG step hardware missing	as a mandate requirement	Poor Maintenance practices	Need to fix it properly	Low
15	Others	Heat exchanger fully dust	as a mandate requirement	Poor Maintenance practices	Cleaning is required	Low
16	Tower	Power cable not done proper laying at T1 to T4	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
17	Electrical controls	LVRT bypass	In absence of LVRT, if grid voltage dips, a mismatch is produced between the generated active power and the active power delivered to the grid.	Product failure	LVRT component on panel to be replaced	High
18	Electrical controls	Line chowk one fan not working	Cooling fan reducing the temperature of the winding and ensures optimal performance of the equipment	Improper maintenance practices	Spares to be procured and replaced	High
19	Electrical controls	Improper cleaning of main capacitor panel	Accumulation of dust may lead to failure of components in the panel	Improper maintenance practices	Cleaning of panels and subsequent visual inspections on a quarterly basis	Medium
20	Electrical controls	PM 3000 panel cover not available	High safety risk and potential damage to PM3000 due to accumulation of dust	Negligence and improper maintenance practices	Replace panel cover	Low

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
21	Others	Water coolant valve missing	as a mandate requirement	Poor Maintenance practices	Spares to be replaced	Low
22	Electrical controls	Cable dressing / insulation not done properly	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
23	Electrical controls	Improper laying of communication cable	To avoid cable damages	Improper maintenance practices	Cable laying to be done properly	Low
24	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
26	Tower	Ladder rigid track found cutting	This is very important for the human safety	Poor Maintenance practices	Need to fix it properly	Medium
27	Electrical controls	690/415 Transformer cable breaker bypass and glanding not done properly	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
28	Tower	Tube lights are not in working condition in Tower Section 3&4	High safety risk	Improper maintenance practices	Electrical connections shall be checked and new set of lights can be provided	Low
29	Tower	Oil spillages found across all the platforms	Potential fire hazard and low oil levels in critical components (e.g., gearbox) can affect overall performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of leakage	Medium
30	Tower	Grease spillages found across all the platforms	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
31	Gear Box	Oil leakage in Gear box Drain Valve	Low oil levels and improper lubrication will lead to sub-optimal performance of the gearbox	Gasket or Seal might be damaged	Ensure proper sealing of drain valve	Medium
32	Brake unit	Disc Brake pad found in worn out condition	High safety risk due to malfunctioning of rotor brake especially in high wind season during high wind velocity	High wear and tear and potentially due to malfunctioning of brake sensor	Spares to be procured and component to be replaced	High
33	Gear Box	Accumulation of dust and corrosion of radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water cooling system of generator. Corrosion or improper maintenance of radiators will affect performance of the components	Improper cleaning and maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
34	Rotor	Oil and Grease spillages found across the Hub unit	Oil spillage may be from pitch gear unit and grease spillage from pitch bearing. Lubrication is essential to minimize friction in bearings	Potential failure of breathers in gearbox leading to overheating and overflowing of oil / leakages due to improper maintenance	Cleaning of hub, refilling of oil / grease across all systems	Medium
35	Others	Winch chain collector not done proper fixing	As a safety measure	Poor Maintenance practices	Need to fix it properly	Medium
36	Others	winch motor touch with top control panel door	As a safety measure	Poor Maintenance practices	Need to fix it properly	Medium
37	Others	Improper routing of power cables in wind motor	To avoid cable damages	Improper maintenance practices	Cable routing to be reviewed and corrected	Low
38	Generator	Rotor under found dust condition	as a mandate requirement	Poor Maintenance practices	Need to fix it properly	Low
39	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium
40	Gear Box	Discoloration of silica gel in gearbox breather	Breathers allow heat to escape and cooling air to enter the system, preventing unnecessary overheating issues.	Overuse of breathers and excess moisture can potentially lead to discoloration	Breathers must be replaced as part of yearly PM activities	Medium
41	Nacelle	Crack found in Top Nacelle cover	Essential for overall upkeep of the asset	Potentially due to high wind speed / force majeure	Detailed inspection required by OEM for further course of action	High
42	Rotor	Pitch capacitor panel door not functional and closed by using ropes	High safety risk and potential damage to pitch capacitor panel due to accumulation of dust	Improper maintenance practices	Modification / replacement of panel doors	Medium
43	Generator	Noise level found high of Generator NDE bearing	High noise level indicates failure of bearing. Non drive end bearing is essential for performance of the generator	1. Due to continuous operation2. Potential design issues with the generator3. Improper maintenance practices4. Failure of bearing due to improper earthing	Noise / vibration analysis to be conducted and NDE bearing to be replaced in case of failure	High

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
44	Gear Box	Discoloration (black) and low oil level found in gearbox	Lubricating oil is like the blood system of any Gearbox. If the oil levels falls too low, the chances for failure of gearbox is high. Moreover, it also affecting the performance of the gearbox	1. No refilling in between during Scheduled Maintenance 2. Leakage from Hydraulic connections 3. Potential loss of Oil during any Major breakdowns, evident from spillage 4. Colour changed may due to high wear and tear in the gears	1. Suggest to have Endoscopy Inspection 2. Suggest to have Oil Analysis in the reputed NABL accredited lab	High
45	Nacelle	Nacelle lights not available	High safety risk	Negligence and improper maintenance practices	Electrical connections shall be checked and new set of lights can be provided	Low
46	Electrical controls	Improper glanding of rotor cable	High safety risk	Improper maintenance practices	Glanding to be done	Medium
47	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
48	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
49	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

RJ7T72

Below is a list of components across the WTG, detailed observations and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name:	GMDC			**Inspection Date**	29.06.2022
Turbine Coordinates				**HTSC. No**	
Area Details		**WTG Details**			
Name of District	RAJKOT	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	VICHIYA	**WTG Loc No**	RJ7T72	**DOC**	28.09.2016
Name of Village	HATHSANI	**Tower Type**	TUBULAR	**SF.No**	151 P19/P1
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 8	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	N1002MGL100179Y15	HUB NUMBER	INOX	H1002MGL10-0179Y15
GEAR BOX	DHHI	2152168	HUB PANEL		NA
GENERATOR	LEROY SOMER	NA	PITCH MOTOR 1	MOOG	1512057
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	76384670013	PITCH MOTOR 2	MOOG	1512072
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	76090680023	PITCH MOTOR 3	MOOG	1512082
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	76090680026	PITCH DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15029291
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	76384670015	PITCH DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15029592
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15026868	PITCH DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15028846
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15028086	BLADE 1	INOX	8134
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15026857	BLADE 2	INOX	6182
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15029591	BLADE 3	INOX	7157
YAW BRAKE 1	SVENDBORG BRAKES	5-200235059 & 5-200235067	POWER PANEL	AMSC	014-0230201
YAW BRAKE 2	SVENDBORG BRAKES	5-200235060 & 5-200235064	CAPACITOR PANEL 1	AMSC	014-0250254
YAW BRAKE 3	SVENDBORG BRAKES	5-200235061 & 5-200235066	POWER TRANSFORMER	ATS ACCORD	46166-2
YAW BRAKE 4	SVENDBORG BRAKES	5-200235063 & 5-200235068	TOP RADIATOR	HYDRA	ZB201510170054
BRAKE UNIT	SVENDBORG BRAKES	5-100031137	ROTAR LOCK	SVENDBORG BRAKES	5-100033034
BRAKE UNIT	SVENDBORG BRAKES	5-100031138	VCB	ABB	TVYN030216001066
GEAR OIL PUMP	ABB	3G1C350087601100195	CONTROL & RELAY PANEL	TRI SQUARE	432
SLIPRING	SCHLEIFRING	414782	ACB	TRI SQUARE	BG36110683
TOP CONTROL PANEL	AMSC	014-0240237	GREASE PUMP - GENERATOR	LINCOLN	2015283326/6
WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA 2010	COUPLING	KUVAG ISOLA	KI 0314

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
3	USS	LV cable laying pvc pipe damaged	to avoid cable damages	Handling damages	PVC pipe have to be replaced	Low
4	USS	R,B phase of Lightning Arrestor bypassed	Lightning arrestor is the primary protection agent for the DP Yard	Unavailability of spares	Spared to be procured and replaced	High
5	USS	Inadequate oil level in transformer	The quantity of the oil should be 1294 ltrs where the MID level is about 700 ltrs which is safest capacity to run the transformer. If the oil level is lower than the MID level, it will affect the performance of the transformer and safety of the unit	No maintenance are happening	Oil filtration to remove debris, breakdown voltage (BDV) test and refilling of oils as per guidelines	High
6	USS	Energy meter switch cover not available	as a mandate requirement	Poor Maintenance practices	Need to fix it properly	Low
7	USS	Transformer Breather - Silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in colour indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium
8	USS	CR panel heater burst	as a mandate requirement for maintain the warm temperature for rainy season	Poor Maintenance practices	Need to fix it properly	Low
9	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
10	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium
11	USS	ACB door found in damaged condition	If rain water gets in, it leads to malfunctioning of the ACB	Handling Damages	Spares to be replaced	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
12	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
13	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and first aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
14	Earthing	**Earthing** 1. Grid earthing found stolen and not connected 2. Earthing for Current Transformer not properly done 3. Earthing in tower found improper 4. Earthing is not found in Nosecone 5. Control panel earthing not available 6. Nacelle earthing found improper 7.Anemometer earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Unavailability of grid earthing, ground earthing, and copper earthing cables in nacelle, anemometer, and hub to be checked with contractor	All the earthing should have to be provided with high importance	High
15	Electrical controls	Capacitor panel cable routing not done properly	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
16	Electrical controls	Improper cable glanding in transformer	Glanding is very important for the safety of cable and to avoid any electrical incidents such as tripping, fault current etc..	Limited awareness on severity of issue, and improper maintenance practices	Proper glanding to be done	Medium
17	Electrical controls	Communication cable not properly laid	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
18	Tower	Light switch box damaged in tower section 2&3	High safety risk	Handling damages and improper maintenance	Electrical connections shall be checked and new set of lights can be provided	Low
19	Electrical controls	power panel Cooling fan fully dust	as a mandate requirement	Poor Maintenance practices	Need to cleaning	Low
20	Electrical controls	Tbc 100 panel 50 f5 R phase melted	Purpose of control cable to distribute the power to various components. If the damages found in the cable, which may affect the performance of the various other components	Might be loose connection of the cable lug with the terminal box	The original problem should have been identified and need to resolve by replacing the spares	Medium
21	Others	water coolant pressure gage not available	as a mandate requirement	Poor Maintenance practices	Spares to be replaced	Low

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
22	Electrical controls	LVRT bypass	In absence of LVRT, if grid voltage dips, a mismatch is produced between the generated active power and the active power delivered to the grid.	Product failure	LVRT component on panel to be replaced	High
23	Tower	Tube lights are not in working condition in Tower Section 3&4	High safety risk	Improper maintenance practices	Electrical connections shall be checked and new set of lights can be provided	Low
24	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
25	Tower	Oil spillages found across all the platforms	Potential fire hazard and low oil levels in critical components (e.g., gearbox) can affect overall performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of leakage	Medium
26	Tower	Grease spillages found across all the platforms	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
27	Brake unit	Disc Brake pad found in worn out condition	High safety risk due to malfunctioning of rotor brake especially in high wind season during high wind velocity	High wear and tear and potentially due to malfunctioning of brake sensor	Spares to be procured and component to be replaced	High
28	Electrical controls	Control panel lights are not in working condition	Required for routine maintenance and inspection of control panels	Improper maintenance practices	Spares to be replaced	Low
29	Gear Box	Accumulation of dust and corrosion of radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water cooling system of generator. Corrosion or improper maintenance of radiators will affect performance of the components	Improper cleaning and maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium
30	Rotor	Oil and Grease spillages found across the Hub unit	Oil spillage may be from pitch gear unit and grease spillage from pitch bearing. Lubrication is essential to minimize friction in bearings	Potential failure of breathers in gearbox leading to overheating and overflowing of oil / leakages due to improper maintenance	Cleaning of hub, refilling of oil / grease across all systems	Medium
31	Rotor	Blade sensor pitch 2 blade angle sensor in lose condition	as a mandate requirement	Poor Maintenance practices	Need to fix it properly	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
32	Gear Box	Discoloration of silica gel in gearbox breather	Breathers allow heat to escape and cooling air to enter the system, preventing unnecessary overheating issues.	Overuse of breathers and excess moisture can potentially lead to discoloration	Breathers must be replaced as part of yearly PM activities	Medium
33	Generator	Rotor carbon brush need to be change	as a mandate requirement	Poor Maintenance practices	Need to fix it properly	Medium
34	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium
35	Gear Box	Gear box brake sensor found in bypass condition	The sensor ensures appropriate positioning of the brake and monitors condition of the brake pad	Brake sensor failure	Spares to be replaced	High
36	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
37	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
38	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

RJ7T75

Below is a list of components across the WTG, detailed observations and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name :	GMDC			**Inspection Date**	28.06.2022
Turbine Coordinates				**HTSC. No**	
Area Details		**WTG Details**			
Name of District	RAJKOT	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	VICHIYA	**WTG Loc No**	RJ7T75	**DOC**	30.09.2016
Name of Village	HATHSANI	**Tower Type**	TUBULAR	**SF.No**	181 P19
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 12	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	N1002MGL100202Y15	HUB NUMBER	INOX	H1002MGL10-022Y15
GEAR BOX	DHHI	2152210	HUB PANEL		NA
GENERATOR	ABB	4200313451/422	PITCH MOTOR 1	MOOG	1601027
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	75964970025	PITCH MOTOR 2	MOOG	1601026
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	75964990014	PITCH MOTOR 3	MOOG	1601025
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	75964990015	PITCH DRIVE 1	DHHI	15PYD0222
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	75964970027	PITCH DRIVE 2	DHHI	15PYD0221
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15028100	PITCH DRIVE 3	DHHI	15PYD0220
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15028105	BLADE 1	INOX	6160
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15029055	BLADE 2	INOX	7136
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15029419	BLADE 3	INOX	5139
YAW BRAKES 1	SVENDBORG BRAKES	5-200234208 & 5-200234203	POWER PANEL	AMSC	014-0230311
YAW BRAKES 2	SVENDBORG BRAKES	5-200234207 & 5-200234200	CAPACITOR PANEL 1	AMSC	014-0250205
YAW BRAKES 3	SVENDBORG BRAKES	5-200234204 & 5-200234199	POWER TRANSFORMER	ATS ACCORD	45008/33
YAW BRAKES 4	SVENDBORG BRAKES	5-200234205 & 5-200234201	TOP RADIATOR	HYDRA	FSB70011-1603-160
BRAKE UNIT	SVENDBORG BRAKES	5-100032280	ROTAR LOCK	SVENDBORG BRAKES	5-100032947
BRAKE UNIT	SVENDBORG BRAKES	5-100032279	VCB	ABB	1YN030216001475
GEAR OIL PUMP	ABB	3G1C1553600519345038	CONTROL & RELAY PANEL	TRI SQURE	NA
SLIPRING	SCHLEIFRING	414788	WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA 2010
TOP CONTROL PANEL	AMSC	014-0240272	GREASE PUMP - GENERATOR	LINCOLN	2015326736/8

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
3	USS	LV cable laying pvc pipe damaged	to avoid cable damages	Handling damages	PVC pipe have to be replaced	Low
4	USS	Transformer Breather - Silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in colour indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium
5	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
6	USS	Maintenance of Energy meter is poor - the sealing is not provided in the Cable pipe	As a safety measure and to ensure no energy loss	Poor Maintenance practices	Cleaning to be done and sealant to be provided	Medium
7	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
8	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and first aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
9	Electrical controls	Sleeves melted and cable damages in transformer control panel	Purpose of the control cable is to distribute the power to various components, hence it should be maintained properly	Potential loose connection of the cable lug with the terminal box	Identify root cause for melting of cables and replace as required	Medium
10	Electrical controls	Improper cable glanding in transformer	Glanding is very important for the safety of cable and to avoid any electrical incidents such as tripping, fault current etc..	Limited awareness on severity of issue, and improper maintenance practices	Proper glanding to be done	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
11	Earthing	**Earthing**1. Grid earthing found stolen and not connected2. Earthing for Current Transformer not properly done3. Earthing in tower found improper4. Earthing is not found in Nosecone5. Control panel earthing not available6. Nacelle earthing found improper 7. Carbon brush side earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Unavailability of grid earthing, ground earthing, and copper earthing cables in nacelle, carbon brush and hub to be checked with contractor.	All the earthing should have to be provided with high importance	High
12	Tower	Oil spillages found across all the platforms	Potential fire hazard and low oil levels in critical components (e.g., gearbox) can affect overall performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of leakage	Medium
13	Tower	Grease spillages found across all the platforms	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
14	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
15	Gear Box	Gear box brake sensor found in bypass condition	The sensor ensures appropriate positioning of the brake and monitors condition of the brake pad	Brake sensor failure	Spares to be replaced	High
16	Electrical controls	Control panel lights are not in working condition	Required for routine maintenance and inspection of control panels	Improper maintenance practices	Spares to be replaced	Low
17	Gear Box	Accumulation of dust on gearbox radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water cooling system of generator. High temperature will affect performance of the components	Poor Maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium
18	Yaw system	Low grease levels in yaw teeth lubrication pumps	Lubrication is essential for yaw bearing and main bearing. Low grease levels can lead to increase in friction and malfunctioning of yaw system	Potential leakages from hoses leading to reduction in grease levels	Address root cause for leakage of grease and refill up to appropriate levels	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
19	Generator	Generator lubrication grease passage tube damaged	Lubrication is essential for generator DE and NDE bearings to minimize friction	Handling damages	Visual inspection of lubrication units on quarterly basis, and immediate replacement as required	Medium
20	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium
21	Gear Box	Discoloration of silica gel in gearbox breather	Breathers allow heat to escape and cooling air to enter the system, preventing unnecessary overheating issues.	Overuse of breathers and excess moisture can potentially lead to discoloration	Breathers must be replaced as part of yearly PM activities	Medium
22	Electrical controls	winch motor cover not available one connection removed	As a safety measure	Poor Maintenance practices	Need to fix it properly	Medium
23	Electrical controls	Improper glanding of rotor cable	High safety risk	Improper maintenance practices	Glanding to be done	Medium
24	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
25	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
26	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

RJ7T76

Below is a list of components across the WTG, detailed observations and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name:	GMDC			**Inspection Date**	21.06.2022
Turbine Coordinates				**HTSC. No**	
Area Details		**WTG Details**			
Name of District	RAJKOT	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	Vinchiya	**WTG Loc No**	RJ7T76	**DOC**	28.09.2016
Name of Village	Hathsani	**Tower Type**	TUBULAR	**SF.No**	181P19
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 12	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	N1002MGL100182Y15	HUB NUMBER	INOX	H1002MGL100182Y15
GEAR BOX	DHHI	2152204	HUB PANEL		NA
GENERATOR	ABB	4200313451/421	PITCH MOTOR 1	MOOG	1512161
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	76090680030	PITCH MOTOR 2	MOOG	1512160
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	76090680005	PITCH MOTOR 3	MOOG	1512159
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	76090680033	PITCH DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15028844
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	76384650028	PITCH DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15026155
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15029049	PITCH DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15026161
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15029421	BLADE 1	INOX	8137
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15028608	BLADE 2	INOX	7161
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15029422	BLADE 3	INOX	5185
YAW BREAK 1	SVENDBORG BRAKES	5-200233712 & 5-200233714	POWER PANEL	AMSC	014-0230193
YAW BREAK 2	SVENDBORG BRAKES	5-200233713 & 5-200233718	CAPACITOR PANEL 1	AMSC	014-0250275
YAW BREAK 3	SVENDBORG BRAKES	5-200233709 & 5-200233717	POWER TRANSFORMER	ATS ACCORD	NA
YAW BREAK 4	SVENDBORG BRAKES	5-200233710 & 5-200233715	TOP RADIATOR		NA
YAW BREAK 5	SVENDBORG BRAKES	5-200233711 & 5-200233716	ROTAR LOCK	SVENDBORG BRAKES	5-100032561
BRAKE UNIT	SVENDBORG BRAKES	5-100031126	VCB	ABB	1VYN030216001062
BRAKE UNIT	SVENDBORG BRAKES	5-100031125	CONTROL & RELAY PANEL	TRI SQUARE	TSPL-HT/09-14/646-438
GEAR OIL PUMP	ABB	3G1C15300512731068	ACB	TRI SQUARE	BG36102853
HYDRAULIC UNIT	SVENDBORG BRAKES		WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA 2010
SLIPRING	SCHLEIFRING	414790	GREASE PUMP - GENERATOR	LINCOLN	201530896-5
TOP CONTROL PANEL	AMSC	014-0240265	COUPLING	KUVAG ISOLA	NA

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Inadequate oil level in transformer	The quantity of the oil should be 1294 ltrs where the MID level is about 700 ltrs which is safest capacity to run the transformer. If the oil level is lower than the MID level, it will affect the performance of the transformer and safety of the unit	No maintenance are happening	Oil filtration to remove debris, breakdown voltage (BDV) test and refilling of oils as per guidelines	High
3	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
4	USS	LV cable laying pvc pipe damaged	to avoid cable damages	Handling damages	PVC pipe have to be replaced	Low
5	USS	R,B phase of Lightning Arrestor bypassed	Lightning arrestor is the primary protection agent for the DP Yard	Unavailability of spares	Spared to be procured and replaced	High
6	USS	Transformer Breather - Silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in colour indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium
7	USS	Fitment and alignment of current transformer is deviated	The minimum distance between CT to PT is 425mm to 475mm which is mandate as per the electrical standard	Improper maintenance practices and alignment not conducted as per guidelines	Immediate service is required	Medium
8	Earthing	**EARTHING** **1.**Grid earthing found improper 2.Nacelle earthing found improper 3.Panel earthing found improper 4.Earthing found improper in nosecone 5.Transformer and Gate earthing found improper 6.Gear box low speed side	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Improper of grid earthing, ground earthing, and copper earthing cables in nacelle, gearbox low speed side and hub to be checked with contractor	All the earthing should have to be provided with high importance	High

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
		earthing improper				
9	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
10	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium
11	USS	Acb panel power cable laying not done properly	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
12	USS	VCB panel door and glass damage	If rain water gets in, it leads to malfunctioning of the VCB	Handling Damages	Replace with spares	Medium
13	USS	Vegetation found inside the Yard premises	As per the CEIG standard, Yard should be clean from vegetation etc.. as a safety measure	Poor Maintenance practices	During preventive maintenance, should be take care.	Medium
14	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
15	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and first aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
16	Electrical controls	capacitor panel cable routing not done properly	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
17	Electrical controls	power cable sleeve not done proper	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
18	Electrical controls	Improper cleaning of main capacitor panel	Accumulation of dust may lead to failure of components in the panel	Improper maintenance practices	Cleaning of panels and subsequent visual inspections on a quarterly basis	Medium
19	Electrical controls	30kva transformer not in a proper cable and laying	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
20	Tower	Tower section platform open	As a safety measure	Poor Maintenance practices	Need to fix it properly	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
21	Electrical controls	Cable and laying found improper in 30kva transformer	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
22	Tower	Cable laying of communication cable found improper and pipe not covering BOB seal	As a safety measure	Poor Maintenance practices	Cleaning to be done and sealant to be provided	Medium
23	Tower	Light switch box damaged in tower section 2&3	High safety risk	Handling damages and improper maintenance	Electrical connections shall be checked and new set of lights can be provided	Low
24	Tower	Tube lights are not in working condition in Tower Sections	As a safety measure	Poor Maintenance practices	Electrical connections shall be checked and new set of lights can be provided	Low
25	Nacelle	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
26	Tower	Oil spillages found across all the platforms	Potential fire hazard and low oil levels in critical components (e.g., gearbox) can affect overall performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of leakage	Medium
27	Tower	Grease spillages found across all the platforms	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
28	Yaw system	Corrosion and accumulation of dust in yaw ring	Smooth functioning of yaw pinions and main bearing is essential for proper functioning of yaw mechanism as per wind speed and direction	Insufficient lubrication and improper maintenance practices	Live testing of performance of yaw mechanism should be done and component to be replaced as required	Medium
29	Gear Box	Gear box brake sensor found in bypass condition	The sensor ensures appropriate positioning of the brake and monitors condition of the brake pad	Brake sensor failure	Spares to be replaced	High
30	Electrical controls	Gearbox control panel not available for gland plate	as a mandate requirement	Poor Maintenance practices	Spares to be replaced	Low
31	Rotor	Hub lights in top control panel is not working	Essential for visual inspection and safety of the panels	Improper maintenance practices	Spares to be replaced	Low
32	Gear Box	Accumulation of dust on gearbox radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water cooling system of generator. High temperature will affect performance of the components	Poor Maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
33	Rotor	Oil and Grease spillages found across the Hub unit	Oil spillage may be from pitch gear unit and grease spillage from pitch bearing. Lubrication is essential to minimize friction in bearings	Potential failure of breathers in gearbox leading to overheating and overflowing of oil / leakages due to improper maintenance	Cleaning of hub, refilling of oil / grease across all systems	Medium
34	Others	Top radiator hardware not done proper tightness	as a mandate requirement	Poor Maintenance practices	Need to fix it properly	Low
35	Others	Winch motor cover not available	As a safety measure	Poor Maintenance practices	Spares to be replaced	Low
36	Generator	Rotor dust collector not available	as a mandate requirement	Poor Maintenance practices	Need to fix it properly	Low
37	Generator	Generator base hardware found lose condition	as a mandate requirement	Poor Maintenance practices	Need to fix it properly	Low
38	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium
39	Gear Box	Discoloration of silica gel in gearbox breather	Breathers allow heat to escape and cooling air to enter the system, preventing unnecessary overheating issues.	Overuse of breathers and excess moisture can potentially lead to discoloration	Breathers must be replaced as part of yearly PM activities	Medium
40	Tower	Ladder bottom to top fully oil condition	as a mandate requirement	Poor Maintenance practices	Need to proper clean	Low
41	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
42	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
43	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

RJ7T79

Below is a list of components across the WTG, detailed observations and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name:	GMDC			**Inspection Date**	30.06.2022
Turbine Coordinates				**HTSC. No**	
Area Details		**WTG Details**			
Name of District	RAJKOT	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	Vinchiya	**WTG Loc No**	RJ7T79	**DOC**	30.09.2016
Name of Village	Hathasani	**Tower Type**	TUBULAR	**SF.No**	181 P19
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 12	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	N1002MGL10-0177-Y15	HUB NUMBER	INOX	H1002MGL100197Y15
GEAR BOX	DHHI	2152200	HUB PANEL		014-0200253
GENERATOR	LEROY SOMER	WL15K23OB	PITCH MOTOR 1	MOOG	1602053
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	75974990024	PITCH MOTOR 2	MOOG	1602055
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	75964970034	PITCH MOTOR 3	MOOG	1602054
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	75760710007	PITCH DRIVE 1	DHHI	15PYD0214
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	75964990019	PITCH DRIVE 2	DHHI	15PYD0215
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15026496	PITCH DRIVE 3	DHHI	15PYD0216
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15029052	BLADE 1	INOX	8052
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15026505	BLADE 2	INOX	7096
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15029046	BLADE 3	INOX	8056
YAW BRAKE 1	SVENDBORG BRAKES	5-200234221 & 5-200234224	POWER PANEL	AMSC	014-0230198
YAW BRAKE 2	SVENDBORG BRAKES	5-200234220 & 5-200234226	CAPACITOR PANEL 1	AMSC	014-0250195
YAW BRAKE 3	SVENDBORG BRAKES	5-200234219 & 5-200234228	POWER TRANSFORMER	ATS ACCORD	AEF216-18/8775/136
YAW BRAKE 4	SVENDBORG BRAKES	5-200234222 & 5-200234225	TOP RADIATOR	HYDRA	ZB201510170256
BRAKE UNIT	SVENDBORG BRAKES	5-100031133	ROTAR LOCK	SVENDBORG BRAKES	5-100033039
BRAKE UNIT	SVENDBORG BRAKES	5-100031131	VCB	ABB	1VYN030216001065
GEAR OIL PUMP	ABB	3G1C350037601100105	TOP CONTROL PANEL	AMSC	140240252
SLIPRING	SCHLEIFRING	406632	GREASE PUMP - GENERATOR	LINCOLN	2015261482/7

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Inadequate oil level in transformer	The quantity of the oil should be 1294 ltrs where the MID level is about 700 ltrs which is safest capacity to run the transformer. If the oil level is lower than the MID level, it will affect the performance of the transformer and safety of the unit	No maintenance are happening	Oil filtration to remove debris, breakdown voltage (BDV) test and refilling of oils as per guidelines	High
3	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
4	USS	Oil leakage found in "B" phase of CT	Oil leakage leads to CT failure	Due to continuous operation, and improper maintenance	Refilling of oil as per guidelines in the CT	High
5	USS	LV box hardware missing and rusted	as a mandate requirement	Poor Maintenance practices	Need to fix it proper hardware	Low
6	USS	ACB door damage	If rain water gets in, it leads to malfunctioning of the ACB	Handling Damages	Cleaning of the panel is required and the new lock to be provided	Medium
7	Earthing	**Earthing** 1. Grid earthing found stolen and not connected 2. Earthing for gearbox not properly done 3. Earthing in tower found improper 4. Earthing is not found in Nosecone 5. Control panel earthing not available 6. Nacelle earthing found improper 7.Anemometer earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Unavailability of grid earthing, ground earthing, and copper earthing cables in nacelle, anemometer, and hub to be checked with contractor	All the earthing should have to be provided with high importance	High

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
8	USS	Transformer radiator oil leakage	Oil leakage will lead to rise in oil temperature gradually	Design internal of Transformer	Need to have a detailed study	Medium
9	USS	Transformer Breather - Silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in colour indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium
10	USS	B phase of Lightning Arrestor bypassed	Lightning arrestor is the primary protection agent for the DP Yard	Unavailability of spares	Spared to be procured and replaced	High
11	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
12	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium
13	Electrical controls	Power panel UPS battery bypass	This UPS for the purpose of supplying 24V to the module. If the supply is not proper, there are chances for module failure very soon Unavailability of UPS also prevents auto-restart of WTGs leading to increase in downtime	UPS Failure	UPS battery in power panel to be replaced	High
14	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
15	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and first aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
16	Others	Heat exchanger fully dust and top cover not available	as a mandate requirement	Poor Maintenance practices	1. Need to proper clean 2.Spares to be replaced	Low
17	Electrical controls	PM 3000 panel cover not available	High safety risk and potential damage to PM3000 due to accumulation of dust	Negligence and improper maintenance practices	Replace panel cover	Low
18	Electrical controls	Improper laying of communication cable	To avoid cable damages	Improper maintenance practices	Cable laying to be done properly	Low
19	Electrical controls	Improper cleaning of main capacitor panel	Accumulation of dust may lead to failure of components in the panel	Improper maintenance practices	Cleaning of panels and subsequent visual inspections on a quarterly basis	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
20	Electrical controls	Sleeves melted and cable damages in transformer control panel	Purpose of the control cable is to distribute the power to various components, hence it should be maintained properly	Potential loose connection of the cable lug with the terminal box	Identify root cause for melting of cables and replace as required	Medium
21	Yaw system	Corrosion and accumulation of dust in yaw ring	Smooth functioning of yaw pinions and main bearing is essential for proper functioning of yaw mechanism as per wind speed and direction	Insufficient lubrication and improper maintenance practices	Live testing of performance of yaw mechanism should be done and component to be replaced as required	Medium
22	Electrical controls	LVRT bypass	In absence of LVRT, if grid voltage dips, a mismatch is produced between the generated active power and the active power delivered to the grid.	Product failure	LVRT component on panel to be replaced	High
23	Tower	Communication cable not properly laid	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
24	Tower	Tube lights are not in working condition in Tower Section 3&4	High safety risk	Improper maintenance practices	Electrical connections shall be checked and new set of lights can be provided	Low
25	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
26	Tower	Oil spillages found across all the platforms	Potential fire hazard and low oil levels in critical components (e.g., gearbox) can affect overall performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of leakage	Medium
27	Tower	Grease spillages found across all the platforms	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
28	Brake unit	Disc brake found minor damage	This is important for WTG safety	Regular deviation	Should replace the spares immediately	medium
29	Tower	Light switch box damaged in tower section 2&3	High safety risk	Handling damages and improper maintenance	Electrical connections shall be checked and new set of lights can be provided	Low
30	Rotor	Hub lights in top control panel is not working	Essential for visual inspection and safety of the panels	Improper maintenance practices	Spares to be replaced	Low

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
31	Gear Box	Accumulation of dust on gearbox radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water cooling system of generator. High temperature will affect performance of the components	Poor Maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium
32	Electrical controls	Hydraulic unit control panel gland plate not available for side and bottom	as a mandate requirement	Poor Maintenance practices	Spares to be replaced	Low
33	Rotor	Hub inside cooling fan not working	as a mandate requirement	Poor Maintenance practices	Spares to be replaced	Low
34	Generator	Noise level found high of Generator NDE bearing	High noise level indicates failure of bearing. Non drive end bearing is essential for performance of the generator	1. Due to continuous operation 2. Potential design issues with the generator 3. Improper maintenance practices 4. Failure of bearing due to improper earthing	Noise / vibration analysis to be conducted and NDE bearing to be replaced in case of failure	High
35	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium
36	Gear Box	Discoloration of silica gel in gearbox breather	Breathers allow heat to escape and cooling air to enter the system, preventing unnecessary overheating issues.	Overuse of breathers and excess moisture can potentially lead to discoloration	Breathers must be replaced as part of yearly PM activities	Medium
37	Rotor	Pitch capacitor panel door not functional and closed by using ropes	High safety risk and potential damage to pitch capacitor panel due to accumulation of dust	Improper maintenance practices	Modification / replacement of panel doors	Medium
38	Yaw system	Yaw bearing grease level low	as a mandate requirement	Poor Maintenance practices	Need to refill immediately	Medium
39	Electrical controls	Improper glanding of rotor cable	High safety risk	Improper maintenance practices	Glanding to be done	Medium
40	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
41	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
42	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

RJ7T80

Below is a list of components across the WTG, detailed observations and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name:	GMDC			**Inspection Date**	22.06.2022
Turbine Coordinates				**HTSC. No**	
Area Details		**WTG Details**			
Name of District	RAJKOT	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	Vinchiya	**WTG Loc No**	RJ7T80	**DOC**	28.09.2016
Name of Village	Janada	**Tower Type**	TUBULAR	**SF.No**	66 P 5/P1
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 12	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	N1002MGL100189Y15	HUB NUMBER	INOX	H10025L100187Y15
GEAR BOX	DHHI	2152202	HUB PANEL	AMSC	NA
GENERATOR	ABB	4200313451/422	PITCH MOTOR 1	MOOG	1511079
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	76090680025	PITCH MOTOR 2	MOOG	1511089
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	76090680020	PITCH MOTOR 3	MOOG	1511081
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	76090680028	PITCH DRIVE 1	DHHI	15PYD0238
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	76090680026	PITCH DRIVE 2	DHHI	15PYD0240
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15029056	PITCH DRIVE 3	DHHI	15PYD0239
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15029057	BLADE 1	INOX	5150
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15029064	BLADE 2	INOX	8130
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15029404	BLADE 3	INOX	7158
YAW BRAKE 1	SVENDBORG BRAKES	5-200235057 & 5-200235050	POWER PANEL	AMSC	014-0250194
YAW BRAKE 2	SVENDBORG BRAKES	5-200235055 & 5-200235052	CAPACITOR PANEL 1	AMSC	014-0230199
YAW BRAKE 3	SVENDBORG BRAKES	5-200235056 & 5-200235051	TOP RADIATOR	HYDRA	ZB21510170053
YAW BRAKE 4	SVENDBORG BRAKES	5-200235058 & 5-200235049	ROTAR LOCK	SVENDBORG BRAKES	5-100033038
BRAKE UNIT	SVENDBORG BRAKES	5-100031130	VCB	ABB	1VYN030216001458
BRAKE UNIT	SVENDBORG BRAKES	5-100031129	CONTROL & RELAY PANEL		NA
GEAR OIL PUMP	ABB	3G101536C519345036	ACB	SQURE	BG36102870
SLIPRING	SCHLEIFRING	406635	GREASE PUMP - GENERATOR	LINCOLN	2015326735/4
TOP CONTROL PANEL	AMSC	014-0240271	WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA 2010

Observations

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Inadequate oil level in transformer	The quantity of the oil should be 1294 ltrs where the MID level is about 700 ltrs which is safest capacity to run the transformer. If the oil level is lower than the MID level, it will affect the performance of the transformer and safety of the unit	No maintenance are happening	Oil filtration to remove debris, breakdown voltage (BDV) test and refilling of oils as per guidelines	High
3	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
4	USS	WTI and OTI meter found open condition and the panel is full of dust	WTI means winding temperature Indicator and OTI means Oil Temperature Indicator which indicates the winding temperature & oil temperature of the transformer and operates the alarm, trip, and cooler control contacts. If the WTI & OTI is not maintained properly, this will impact in the function of the transformer	Limited importance given to maintenance of WTI and OTI by the contractor	Check the working condition of WTI & OTI meter and procure spares for replacement, if needed	Medium
5	USS	Transformer Breather - Silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in colour indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium
6	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
7	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
8	Earthing	**Earthing** 1. Bottom tower earthing found improper 2. Earthing is not found in Nosecone 3. Nacelle earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Unavailability of nose cone earthing, and copper earthing cables in tower and nacelle to be checked with contractor	All the earthing should have to be provided with high importance	High
9	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
10	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and first aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
11	Electrical controls	TBC 100 panel Cable and laying found improper	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
12	Electrical controls	Cable and laying found improper in 30kva transformer	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
13	Electrical controls	Power cable dressing found improper	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
14	Electrical controls	Sleeves melted and cable damages in transformer control panel	Purpose of the control cable is to distribute the power to various components, hence it should be maintained properly	Potential loose connection of the cable lug with the terminal box	Identify root cause for melting of cables and replace as required	Medium
15	Electrical controls	slipring communication cable gland and laying not done properly	As a safety measure	Poor Maintenance practices	Glanding to be done	Medium
16	Others	Improper bolting of transformer and loose connections	Essential for overall upkeep of the asset	Improper maintenance practices	Need to fix proper hardware with suitable washers	Low
17	Tower	Tube lights are not in working condition in Tower Section 3&4	High safety risk	Improper maintenance practices	Electrical connections shall be checked and new set of lights can be provided	Low
18	Tower	Grease and Oil spillages over the platforms and flange for the section 1&2	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
19	Tower	Found Cable twist between Tower Section 4	Overwinding can lead to potential damages to cables and post safety risk	Potential malfunctioning of wind vane or yaw sensor leading to overwinding of cables	Ensure functioning of the sensors and procure spares for replacement as required	High
20	Tower	slipring communication cable clamp and laying not done properly for section 2 to 4	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
21	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
22	Tower	Grease and Oil spillages over the platforms	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
23	Nacelle	Nacelle light not available	As a safety measure	Poor Maintenance practices	Electrical connections shall be checked and new set of lights can be provided	Low
24	Rotor	Hup Control panel lights are not in working condition	as a mandate requirement	Poor Maintenance practices	Spares to be replaced	Low
25	Gear Box	Accumulation of dust and corrosion of radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water cooling system of generator. Corrosion or improper maintenance of radiators will affect performance of the components	Improper cleaning and maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium
26	Rotor	Oil and Grease spillages found across the Hub unit	Oil spillage may be from pitch gear unit and grease spillage from pitch bearing. Lubrication is essential to minimize friction in bearings	Potential failure of breathers in gearbox leading to overheating and overflowing of oil / leakages due to improper maintenance	Cleaning of hub, refilling of oil / grease across all systems	Medium
27	Brake unit	Disk brake sensor damage	as a mandate requirement	Poor Maintenance practices	Spares to be replaced	Low
28	Rotor	Pitch bearing grease passage tube damaged	Lubrication of pitch bearing is essential for smooth operations and minimize friction	Handling damages	Quarterly visual inspection of lubrication unit and immediate replacement as required	Medium
29	Electrical controls	Control panel lights are not in working condition	Required for routine maintenance and inspection of control panels	Improper maintenance practices	Spares to be replaced	Low
30	Rotor	Pitch capacitor panel door not functional and closed by using ropes	High safety risk and potential damage to pitch capacitor panel due to accumulation of dust	Improper maintenance practices	Modification / replacement of panel doors	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
31	Others	Winch chain collector not properly fixed	As a safety measure	Poor Maintenance practices	Need to fix it properly	Medium
32	Others	water coolant pump cable gland not done properly	As a safety measure	Poor Maintenance practices	Glanding to be done	Medium
33	Gear Box	Gear box breather colour is changed	Moisture condition of Gear oil should be high	1. Due to the high amount of working, this happens in regular intervals 2. In few cases, if at all radiator damages are observed some excess moisture shall get into the gear box.	Breathe needs to be changed	Medium
34	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
35	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
36	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

RJ7T81

Below is a list of components across the WTG, detailed observations and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name :	GMDC			**Inspection Date**	22.06.2022
Turbine Coordinates				**HTSC. No**	
Area Details		**WTG Details**			
Name of District	RAJKOT	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	Vinchiya	**WTG Loc No**	RJ7T81	**DOC**	28.09.2016
Name of Village	Janada	**Tower Type**	TUBULAR	**SF.No**	66 P 5/P1
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 12	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	N1002MGL100198Y15	HUB NUMBER	INOX	H1002MGL10-0186Y15
GEAR BOX	DHHI	2152225	HUB PANEL	AMSC	NA
GENERATOR	ABB	WL15L2386	PITCH MOTOR 1	MOOG	1512154
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	76090680008	PITCH MOTOR 2	MOOG	1512169
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	75445280008	PITCH MOTOR 3	MOOG	1512191
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	76384680010	PITCH DRIVE 1	DHHI	15PYD0180
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	75964970047	PITCH DRIVE 2	DHHI	15PYD0178
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15028096	PITCH DRIVE 3	DHHI	15PYD0179
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15028097	BLADE 1	INOX	6181
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15028110	BLADE 2	INOX	5181
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15028108	BLADE 3	INOX	8131
YAW BRAKES 1	SVENDBORG BRAKES	5-200235021 & 5-200235025	POWER PANEL	AMSC	014-0230197
YAW BRAKES 2	SVENDBORG BRAKES	5-200235020 & 5-200235024	CAPACITOR PANEL 1	AMSC	014-0250193
YAW BRAKES 3	SVENDBORG BRAKES	5-200235019 & 5-200235026	POWER TRANSFORMER	ATS ACCORD	NA
YAW BRAKES 4	SVENDBORG BRAKES	5-200235022 & 5-200235028	TOP RADIATOR	HYDRA	FSB70011-1512-046
YAW BRAKES 5	SVENDBORG BRAKES	5-200235023 & 5-200235027	ROTAR LOCK	SVENDBORG BRAKES	5-100033040
BRAKE UNIT	SVENDBORG BRAKES	5-100032522	VCB	ABB	1VYN030216001476
BRAKE UNIT	SVENDBORG BRAKES	5-100032521	ACB	SQURE	BG36110684
GEAR OIL PUMP	ABB	3G1C15500512731039	GREASE PUMP - GENERATOR	LINCOLN	2015261483/1
SLIPRING	SCHLEIFRING	406642	COUPLING	KUVAG ISOLA	1537/001-014
TOP CONTROL PANEL	AMSC	014-0230116	WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA 2010

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Inadequate oil level in transformer	The quantity of the oil should be 1294 ltrs where the MID level is about 700 ltrs which is safest capacity to run the transformer. If the oil level is lower than the MID level, it will affect the performance of the transformer and safety of the unit	No maintenance are happening	Oil filtration to remove debris, breakdown voltage (BDV) test and refilling of oils as per guidelines	High
3	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
4	USS	WTI and OTI meter found open condition and the panel is full of dust	WTI means winding temperature Indicator and OTI means Oil Temperature Indicator which indicates the winding temperature & oil temperature of the transformer and operates the alarm, trip, and cooler control contacts. If the WTI & OTI is not maintained properly, this will impact in the function of the transformer	Limited importance given to maintenance of WTI and OTI by the contractor	Check the working condition of WTI & OTI meter and procure spares for replacement, if needed	Medium
5	USS	Transformer Breather - Silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in colour indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium
6	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
7	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium
8	USS	VCB and Energy meter door glass not available	If rain water gets in, it leads to malfunctioning of the VCB & Energy meter	Handling Damages	Replace with spares	Medium
9	USS	Transformer radiator washer damage condition	As a mandate requirement	Poor Maintenance practices	Need to fix it properly	Low

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
10	Earthing	**Earthing** 1. Bottom tower earthing found improper 2. Earthing is not found in Nosecone 3. Nacelle earthing found improper 4. Blade earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Unavailability of nose cone earthing, and copper earthing cables in tower, blade, and nacelle to be checked with contractor	All the earthing should have to be provided with high importance	High
11	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
12	Electrical controls	Cable dressing / insulation not done properly	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
13	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and first aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
14	Electrical controls	Cable and laying found improper in 30kva transformer	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
15	Electrical controls	690/415 Transformer cable d glanding not done properly	As a safety measure	Poor Maintenance practices	Glanding to be done	Medium
16	Tower	Tube lights are not in working condition in all Tower Sections	As a safety measure	Poor Maintenance practices	Electrical connections shall be checked and new set of lights can be provided	Low
17	Tower	Grease and Oil spillages over the platforms	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
18	Tower	Found Cable twist between Tower Section 4	Overwinding can lead to potential damages to cables and post safety risk	Potential malfunctioning of wind vane or yaw sensor leading to overwinding of cables	Ensure functioning of the sensors and procure spares for replacement as required	High
19	Tower	Oil spillages over the cables between tower 4	Safety measure to avoid accidents	Workman Error	Needs to be fixed on priority.	Medium
20	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
21	Yaw system	Corrosion and accumulation of dust in yaw ring	Smooth functioning of yaw pinions and main bearing is essential for proper functioning of yaw mechanism as per wind speed and direction	Insufficient lubrication and improper maintenance practices	Live testing of performance of yaw mechanism should be done and component to be replaced as required	Medium
22	Brake unit	Disc Brake pad found in worn out condition	High safety risk due to malfunctioning of rotor brake especially in high wind season during high wind velocity	High wear and tear and potentially due to malfunctioning of brake sensor	Spares to be procured and component to be replaced	High
23	Electrical controls	Control panel lights are not in working condition	Required for routine maintenance and inspection of control panels	Improper maintenance practices	Spares to be replaced	Low
24	Gear Box	Accumulation of dust and corrosion of radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water cooling system of generator. Corrosion or improper maintenance of radiators will affect performance of the components	Improper cleaning and maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium
25	Yaw system	Low grease levels in yaw teeth lubrication pumps	Lubrication is essential for yaw bearing and main bearing. Low grease levels can lead to increase in friction and malfunctioning of yaw system	Potential leakages from hoses leading to reduction in grease levels	Address root cause for leakage of grease and refill up to appropriate levels	Medium
26	Rotor	Oil and Grease spillages found across the Hub unit	Oil spillage may be from pitch gear unit and grease spillage from pitch bearing. Lubrication is essential to minimize friction in bearings	Potential failure of breathers in gearbox leading to overheating and overflowing of oil / leakages due to improper maintenance	Cleaning of hub, refilling of oil / grease across all systems	Medium
27	Rotor	Pitch bearing grease passage tube damaged	Lubrication of pitch bearing is essential for smooth operations and minimize friction	Handling damages	Quarterly visual inspection of lubrication unit and immediate replacement as required	Medium
28	Rotor	Pitch capacitor panel door not functional and closed by using ropes	High safety risk and potential damage to pitch capacitor panel due to accumulation of dust	Improper maintenance practices	Modification / replacement of panel doors	Medium
29	Gear Box	Gear box breather colour is changed	Moisture condition of Gear oil should be high	1. Due to the high amount of working, this happens in regular intervals 2. In few cases, if at all radiator damages are observed some excess moisture shall get into the gear box.	Breathe needs to be changed	Medium
30	Nacelle	Top control panel not open due to winch motor touch on the panel door	As a safety measure	Poor Maintenance practices	Need to fix it properly	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
31	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
32	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
33	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

RJ7T88

Below is a list of components across the WTG, detailed observations and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name:	GMDC			**Inspection Date**	21.06.2022
Turbine Coordinates				**HTSC. No**	
Area Details		**WTG Details**			
Name of District	RAJKOT	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	Vinchiya	**WTG Loc No**	RJ7T88	**DOC**	28.09.2016
Name of Village	Veraval Bhadali	**Tower Type**	TUBULAR	**SF.No**	125 P 4
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 12	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	NI002NGL100180Y15	HUB NUMBER		NA
GEAR BOX	DHHI	2152205	HUB PANEL		NA
GENERATOR	ABB	4200313451/118	PITCH MOTOR 1	MOOG	1601056
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	76384660024	PITCH MOTOR 2	MOOG	1601077
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	76090680040	PITCH MOTOR 3	MOOG	1601076
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	76384650037	PITCH DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15029580
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	75964990044	PITCH DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15029590
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15028090	PITCH DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15028843
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15028088	BLADE 1	INOX	6175
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15028087	BLADE 2	INOX	8173
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15028082	BLADE 3	INOX	8175
YAW BRAKE 1	SVENDBORG BRAKES	5-200235989 & 5-200235993	POWER PANEL	AMSC	014-0250190
YAW BRAKE 2	SVENDBORG BRAKES	5-200235990 & 5-200235992	CAPACITOR PANEL 1	AMSC	014-0230239
YAW BRAKE 3	SVENDBORG BRAKES	5-200235987 & 5-200235991	POWER TRANSFORMER	ATS ACCORD	NA
YAW BRAKE 4	SVENDBORG BRAKES	5-200235988 & 5-200235994	TOP RADIATOR		NA
BRAKE UNIT	SVENDBORG BREAKS	5-100032371	ROTAR LOCK	SVENDBORG BRAKE	5-100033033
BRAKE UNIT	SVENDBORG BREAKS	5-100032370	VCB		RG36102862
SLIPRING	SCHLEIFRING	414783	CONTROL & RELAY PANEL		NA
TOP CONTROL PANEL	AMSC	014-0240203	WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA-2010

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Inadequate oil level in transformer	The quantity of the oil should be 1294 ltrs where the MID level is about 700 ltrs which is safest capacity to run the transformer. If the oil level is lower than the MID level, it will affect the performance of the transformer and safety of the unit	No maintenance are happening	Oil filtration to remove debris, breakdown voltage (BDV) test and refilling of oils as per guidelines	High
3	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
4	USS	WTI and OTI meter found open condition and the panel is full of dust	WTI means winding temperature Indicator and OTI means Oil Temperature Indicator which indicates the winding temperature & oil temperature of the transformer and operates the alarm, trip, and cooler control contacts. If the WTI & OTI is not maintained properly, this will impact in the function of the transformer	Limited importance given to maintenance of WTI and OTI by the contractor	Check the working condition of WTI & OTI meter and procure spares for replacement, if needed	Medium
5	USS	"B" phase of Lighting arrester found bypassed	Lightning arrestor is the primary protection agent for the DP Yard	Unavailability of spares	Spared to be procured and replaced	High

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
6	Earthing	**Earthing** 1. Grid earthing found stolen and not connected 2. Earthing for Current Transformer not properly done 3. Earthing in Gear box found improper 4. Earthing is not found in nose cone 5. Nose cone earthing not available 6. Nacelle earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Unavailability of grid earthing, ground earthing, and copper earthing cables in nacelle and hub to be checked with contractor	All the earthing should have to be provided with high importance	High
7	USS	Transformer Breather - Silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in colour indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium
8	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
9	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium
10	USS	ACB door not available	If rain water gets in, it leads to malfunctioning of the ACB	Handling Damages	Replace with spares	Medium
11	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
12	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and firt aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
13	Electrical controls	LVRT bypass	In absence of LVRT, if grid voltage dips, a mismatch is produced between the generated active power and the active power delivered to the grid.	Product failure	LVRT component on panel to be replaced	High
14	Electrical controls	Line chock fan cable removed	as a mandate requirement	Poor Maintenance practices	Need to fix it properly	Low
15	Electrical controls	Transformer cable breaker in bypass condition and glanding not done properly	High safety risk	Improper maintenance practices	Glanding to be done	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
16	Tower	Cable laying of communication cable found improper and pipe not covering BOB seal	to avoid cable damages	Poor Maintenance practices	1.Cable laying can be properly done 2.Cleaning to be done and sealant to be provided	Medium
17	Yaw system	Tube lights are not in working condition	As a safety measure	Poor Maintenance practices	Electrical connections shall be checked and new set of lights can be provided	Low
18	Others	Bottom water coolant leakage	as a mandate requirement	Poor Maintenance practices	Spares to be replaced	Low
19	Tower	Grease and oil spillages over the platforms and flanges	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
20	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
21	Yaw system	Corrosion and accumulation of dust in yaw ring	Smooth functioning of yaw pinions and main bearing is essential for proper functioning of yaw mechanism as per wind speed and direction	Insufficient lubrication and improper maintenance practices	Live testing of performance of yaw mechanism should be done and component to be replaced as required	Medium
22	Rotor	Hub lights in top control panel is not working	Essential for visual inspection and safety of the panels	Improper maintenance practices	Spares to be replaced	Low
23	Gear Box	Accumulation of dust on gearbox radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water cooling system of generator. High temperature will affect performance of the components	Poor Maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium
24	Yaw system	Grease level found low in Yaw lubrication pump unit	Yaw lubrication pump supplies grease to yaw brake and yaw bearing	Improper maintenance practices and refilling of grease as per guidelines	Refill grease across all lubrication systems as per guidelines and address leakages in systems	Medium
25	Rotor	Grease level found low in Pitch lubrication pump unit and spillages observed throughout the Hub	Lubrication is essential for yaw bearing and main bearing. Low grease levels can lead to increase in friction and malfunctioning of yaw system	Potential leakages from hoses leading to reduction in grease levels	Address root cause for leakage of grease and refill up to appropriate levels	Medium
26	Gear Box	Hydraulic unit control panel gland plat not available for side and bottom	as a mandate requirement	Poor Maintenance practices	Need to fix it properly	Medium
27	Rotor	Pitch teeth lubrication tube removed	as a mandate requirement	Poor Maintenance practices	Need to fix it properly	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
28	Others	Improper routing of power cables in wind motor	To avoid cable damages	Improper maintenance practices	Cable routing to be reviewed and corrected	Low
29	Rotor	Pitch bearing grease passage tube damaged	Lubrication of pitch bearing is essential for smooth operations and minimize friction	Handling damages	Quarterly visual inspection of lubrication unit and immediate replacement as required	Medium
30	Rotor	Pitch capacitor panel door not functional and closed by using ropes	High safety risk and potential damage to pitch capacitor panel due to accumulation of dust	Improper maintenance practices	Modification / replacement of panel doors	Medium
31	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium
32	Gear Box	Discoloration of silica gel in gearbox breather	Breathers allow heat to escape and cooling air to enter the system, preventing unnecessary overheating issues.	Overuse of breathers and excess moisture can potentially lead to discoloration	Breathers must be replaced as part of yearly PM activities	Medium
33	Gear Box	Oil leakage from Thermo bypass valve	Improper lubrication of gearbox can lead to sub-optimal performance and potential fire hazard	Improper maintenance practices	Appropriate sealing / gasket to be used for the value to arrest leakages	Medium
34	Tower	Top section switch box connection not available	As a safety measure	Poor Maintenance practices	Electrical connections shall be checked and new set of lights can be provided	Low
35	Generator	Rotor dust collector damage	as a mandate requirement	Poor Maintenance practices	Need to fix it properly	Low
36	Electrical controls	Rotor cable glanding found improper	High safety risk	Improper maintenance practices	Glanding to be done	Medium
37	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
38	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
39	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

RJ7T89

Below is a list of components across the WTG, detailed observations and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name :	GMDC			**Inspection Date**	21.06.2022
Turbine Coordinates				**HTSC. No**	
Area Details		**WTG Details**			
Name of District	RAJKOT	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	VICHIYA	**WTG Loc No**	RJ7T89	**DOC**	28.09.2016
Name of Village	Veraval Bhadali	**Tower Type**	TUBULAR	**SF.No**	125 P 4
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 12	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	N1002MGL100175Y15	HUB NUMBER	INOX	H1002MGL0-0175Y15
GEAR BOX	DHHI	2152165	PITCH MOTOR 1	MOOG	1512195
GENERATOR	ABB	4200313451/424	PITCH MOTOR 2	MOOG	1512194
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	76384660023	PITCH MOTOR 3	MOOG	1512175
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	75964990043	PITCH DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15029594
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	76090680022	PITCH DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15029582
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	76090680029	PITCH DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15029593
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN15028094	BLADE 1	INOX	7171
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN15028104	BLADE 2	INOX	8143
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15028055	BLADE 3	INOX	NA
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15028053	POWER PANEL	AMSC	014-0330040
YAW BRAKE 1	SVENDBORG BRAKES	5-200233754 & 5-200233751	CAPACITOR PANEL 1	AMSC	014-02500180
YAW BRAKE 2	SVENDBORG BRAKES	5-200233758 &5-200233752	POWER TRANSFORMER	ATS ACCORD	NA
YAW BRAKE 3	SVENDBORG BRAKES	5-200233757 & 5-200233753	TOP RADIATOR		FSP70011-1601-098
YAW BRAKE 4	SVENDBORG BRAKES	5-200233756 & 5-200233759	ROTAR LOCK	SVENDBORG BRAKES	5-100032951
YAW BRAKE 5	SVENDBORG BRAKES	5-200233755 & 5-200233750	VCB	ABB	1VYN030216001945
BRAKE UNIT	SVENDBORG BRAKES	5-100032535	CONTROL & RELAY PANEL		NA
BRAKE UNIT	SVENDBORG BRAKES	5-100032534	ACB		NA
HYDRAULIC UNIT	SVENDBORG BRAKES	R901185727	GREASE PUMP - GENERATOR	LINCOLN	2015326736/10
SLIPRING	SCHLEIFRING	414787	COUPLING	KUVAG ISOLA	1520/001/004
TOP CONTROL PANEL	AMSC	014-0250080	WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA-2010

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Inadequate oil level in transformer	The quantity of the oil should be 1294 ltrs where the MID level is about 700 ltrs which is safest capacity to run the transformer. If the oil level is lower than the MID level, it will affect the performance of the transformer and safety of the unit	No maintenance are happening	Oil filtration to remove debris, breakdown voltage (BDV) test and refilling of oils as per guidelines	High
3	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
4	USS	WTI and OTI meter found open condition and the panel is full of dust	WTI means winding temperature Indicator and OTI means Oil Temperature Indicator which indicates the winding temperature & oil temperature of the transformer and operates the alarm, trip, and cooler control contacts. If the WTI & OTI is not maintained properly, this will impact in the function of the transformer	Limited importance given to maintenance of WTI and OTI by the contractor	Check the working condition of WTI & OTI meter and procure spares for replacement, if needed	Medium
5	Earthing	**Earthing** 1. Grid earthing found stolen and not connected 2. Earthing in Gear box found improper 3. Earthing is not found in Nosecone 4. Nacelle earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Unavailability of grid earthing, ground earthing, and copper earthing cables in nacelle and gearbox to be checked with contractor	All the earthing should have to be provided with high importance	High
6	USS	Found fencing wall damaged in DP Yard	Essential for overall upkeep of the asset	Potential damages due to ROW issues	Fencing wall to be reconstructed	Low
7	USS	Transformer Breather - Silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in colour indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
8	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
9	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium
10	USS	All phases of lightning arrestor bypassed	Lightning arrestor is the primary protection agent for the DP Yard	Unavailability of spares	Spared to be procured and replaced	High
11	USS	ACB and VCB door found in damaged condition	If rain water gets in, it leads to malfunctioning of the ACB	Handling Damages	Spares to be replaced	Medium
12	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
13	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and firt aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
14	Others	Heat exchanger communication antenna not available	To ensure appropriate cooling of control panels	Unavailability of spares	Spares to be replaced	Medium
15	Electrical controls	Improper cleaning of main capacitor panel	Accumulation of dust may lead to failure of components in the panel	Improper maintenance practices	Cleaning of panels and subsequent visual inspections on a quarterly basis	Medium
16	Electrical controls	30kva transformer not in a proper cable and laying	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
17	Electrical controls	Cable damages found in Transformer control cable (Cable sleeves is in melt condition) breaker bypass	Purpose of control cable to distribute the power to various components. If the damages found in the cable, which may affect the performance of the various other components	Might be loose connection of the cable lug with the terminal box	The original problem should have been identified and need to resolve by replacing the spares	Medium
18	Electrical controls	Improper cable glanding in transformer	Glanding is very important for the safety of cable and to avoid any electrical incidents such as tripping, fault current etc..	Limited awareness on severity of issue, and improper maintenance practices	Proper glanding to be done	Medium
19	Electrical controls	Communication cable not properly laid	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
20	Tower	Tube lights are not in working condition in all Tower Section	As a safety measure	Poor Maintenance practices	Electrical connections shall be checked and new set of lights can be provided	Low

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
21	Tower	Grease spillages found across all the platforms	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
22	Tower	Found Cable twist between Tower Section 4	Overwinding can lead to potential damages to cables and post safety risk	Potential malfunctioning of wind vane or yaw sensor leading to overwinding of cables	Ensure functioning of the sensors and procure spares for replacement as required	High
23	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
24	Tower	Oil spillages found across all the platforms	Potential fire hazard and low oil levels in critical components (e.g., gearbox) can affect overall performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of leakage	Medium
25	Yaw system	Corrosion and accumulation of dust in yaw ring	Smooth functioning of yaw pinions and main bearing is essential for proper functioning of yaw mechanism as per wind speed and direction	Insufficient lubrication and improper maintenance practices	Live testing of performance of yaw mechanism should be done and component to be replaced as required	Medium
26	Brake unit	Disc Brake pad found in worn out condition	High safety risk due to malfunctioning of rotor brake especially in high wind season during high wind velocity	High wear and tear and potentially due to malfunctioning of brake sensor	Spares to be procured and component to be replaced	High
27	Electrical controls	Control panel lights are not in working condition	Required for routine maintenance and inspection of control panels	Improper maintenance practices	Spares to be replaced	Low
28	Gear Box	Accumulation of dust and corrosion of radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water cooling system of generator. Corrosion or improper maintenance of radiators will affect performance of the components	Improper cleaning and maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium
29	Yaw system	Grease level found low in Yaw lubrication pump unit	Yaw lubrication pump supplies grease to yaw brake and yaw bearing	Improper maintenance practices and refilling of grease as per guidelines	Refill grease across all lubrication systems as per guidelines and address leakages in systems	Medium
30	Rotor	Oil and Grease spillages found across the Hub unit	Oil spillage may be from pitch gear unit and grease spillage from pitch bearing. Lubrication is essential to minimize friction in bearings	Potential failure of breathers in gearbox leading to overheating and overflowing of oil / leakages due to improper maintenance	Cleaning of hub, refilling of oil / grease across all systems	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
31	Generator	Generator base hardware fond lose condition	as a mandate requirement	Poor Maintenance practices	Need to fix it proper hardware	Low
32	Generator	Generator lubrication grease passage tube damaged	Lubrication is essential for generator DE and NDE bearings to minimize friction	Handling damages	Visual inspection of lubrication units on quarterly basis, and immediate replacement as required	Medium
33	Rotor	Hub lubrication Grease passage tube is in damaged condition for generator lubrication	It feeds lubrication to Pitch bearing	Handling damages	Spares to be replaced	Medium
34	Others	Improper routing of power cables in wind motor	To avoid cable damages	Improper maintenance practices	Cable routing to be reviewed and corrected	Low
35	Brake unit	Oil spillage on brake pad	Brake pad should be clean and dry for effective braking. If the oil spilled over brake pad, there are possibility of spillages which impact in braking	Oil leakage from brake caliper and loose hydraulic connections	Visual inspection of brake calipers on quarterly basis, cleaning on half-yearly basis and replacement on yearly basis if required	Medium
36	Rotor	Pitch capacitor panel door not functional and closed by using ropes	High safety risk and potential damage to pitch capacitor panel due to accumulation of dust	Improper maintenance practices	Modification / replacement of panel doors	Medium
37	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium
38	Gear Box	Discoloration of silica gel in gearbox breather	Breathers allow heat to escape and cooling air to enter the system, preventing unnecessary overheating issues.	Overuse of breathers and excess moisture can potentially lead to discoloration	Breathers must be replaced as part of yearly PM activities	Medium
39	Electrical controls	Improper glanding of rotor cable	High safety risk	Improper maintenance practices	Glanding to be done	Medium
40	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
41	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
42	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

RJ7T90

Below is a list of components across the WTG, detailed observations and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name :	GMDC			**Inspection Date**	01.07.2022
Turbine Coordinates	42Q E752443 N2449332			**HTSC. No**	NOT AVAILABLE
Area Details		**WTG Details**			
Name of District	BOTAD	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	Vinchiya	**WTG Loc No**	RJ7T90	**DOC**	28.09.2016
Name of Village	Sanali	**Tower Type**	TUBULAR	**SF.No**	160P1
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 12	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	N1002MGL100183Y15	HUB NUMBER	INOX	H1002MGL10-0183Y15
GEAR BOX	DHHI	2152208	PITCH MOTOR 1	MOOG	1601019
GENERATOR	ABB	4200313451/420	PITCH MOTOR 2	MOOG	1601017
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	75760710015	PITCH MOTOR 3	MOOG	1601022
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	NV	PITCH DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15026158
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	76090680006	PITCH DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15029569
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	76090680034	PITCH DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15026159
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15029420	BLADE 1	INOX	8142
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15029409	BLADE 2	INOX	7169
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15029061	BLADE 3	INOX	7164
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15029060	POWER PANEL	AMSC	014-0330027
YAW BRAKE 1	SVENDBORG BRAKES	5-200233706 & 5- 200233699	TOP RADIATOR	HYDRA	FSB70011-1601-062
YAW BRAKE 2	SVENDBORG BRAKES	5-200233707 & 5-200233700	ROTAR LOCK	SVENDBORG BREAKS	5-100032562
YAW BRAKE 3	SVENDBORG BRAKES	5-200233708 & 5-200233703	VCB	ABB	1VYN0302116001731
YAW BRAKE 4	SVENDBORG BRAKES	5-200233704 & 5-200233702	ACB	SQURE	BG36102857
BRAKE UNIT	SVENDBORG BRAKES	5-100031124	COUPLING	KUVAG ISOLA	318
BRAKE UNIT	SVENDBORG BRAKES	5-100031121	WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA 2010
GEAR OIL PUMP	ABB	3G1C15300512731007	TOP CONTROL PANEL	AMSC	014-0240229
SLIPRING	SCHLEIFRING	406641	GREASE PUMP - GENERATOR	LINCOLN	2015308996/5

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
3	USS	WTI and OTI meter found open condition and the panel is full of dust	WTI means winding temperature Indicator and OTI means Oil Temperature Indicator which indicates the winding temperature & oil temperature of the transformer and operates the alarm, trip, and cooler control contacts. If the WTI & OTI is not maintained properly, this will impact in the function of the transformer	Limited importance given to maintenance of WTI and OTI by the contractor	Check the working condition of WTI & OTI meter and procure spares for replacement, if needed	Medium
4	USS	Oil Leakage found from Transformer LV Pushing	Low oil levels will lead to rise in temperature of the transformer	Internal design of the Transformer	Need to conduct a detailed study	Medium
5	USS	Vcb stand not available	Safety measure to avoid accidents during pm time	Poor Maintenance practices	Need to fix it properly	Medium
6	USS	Transformer Breather - Silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in colour indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium
7	USS	Current Protection Relay found in bypass	The Current Protection Relay **protects system from the current faults**. Relay protects against undercurrent, over current and unbalance faults.	Poor Maintenance practices	Replace with spares	High
8	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
9	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
10	Earthing	**EARTHING** **1.** Grid earthing found improper 2. Nacelle earthing found improper 3. Gate earthing found improper 4. Earthing found improper in nosecone 5. Transformer and Gate earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Improper of grid earthing, ground earthing, and copper earthing cables in nacelle and hub to be checked with contractor	All the earthing should have to be provided with high importance	High
11	USS	CT Y Phase found burst	A current transformer is designed to maintain an accurate ratio between the currents in its primary and secondary circuits over a defined range.	1. Due to over current 2. due to low oil level in the CT 3.Poor maintenance practices	1.Need to get RCA report from contractor 2.Replace with spares	High
12	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
13	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and first aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
14	Others	Heat exchanger fully dust	as a mandate requirement	Poor Maintenance practices	Need to cleaning	Low
15	Electrical controls	Line chowk one fan not working	as a mandate requirement	Poor Maintenance practices	Need to fix it properly	Low
16	Electrical controls	LVRT bypass	In absence of LVRT, if grid voltage dips, a mismatch is produced between the generated active power and the active power delivered to the grid.	Product failure	LVRT component on panel to be replaced	High
17	Electrical controls	Cable dressing / insulation not done properly	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
18	Electrical controls	Improper laying of communication cable	To avoid cable damages	Improper maintenance practices	Cable laying to be done properly	Low
19	Tower	Oil spillages for over the power cable at tower entry section and t4	If the oil spillage is due to the oil leakage from Gear box, it is serious.	Oil spillage may due to the reasons of oil leakage from Gear box or hydraulic connections of various parts. Hence it is important	Cleaning of platforms should be done first as it is related to the human safety and then problem identification with right reason is required.	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
20	Electrical controls	690/415 Transformer cable breaker bypass and glanding not done properly	As a safety measure	Poor Maintenance practices	Glanding to be done	Medium
21	Electrical controls	communication cable not done proper laying and underground pvc pipe holes open not provide BOP	to avoid cable damages	Poor Maintenance practices	1.Cable laying can be properly done 2.Cleaning to be done and sealant to be provided	Medium
22	Tower	Tube lights are not in working condition in Tower Section 3&4	High safety risk	Improper maintenance practices	Electrical connections shall be checked and new set of lights can be provided	Low
23	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
24	Tower	Oil spillages found across all the platforms	Potential fire hazard and low oil levels in critical components (e.g., gearbox) can affect overall performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of leakage	Medium
25	Tower	Grease spillages found across all the platforms	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
26	Yaw system	Corrosion and accumulation of dust in yaw ring	Smooth functioning of yaw pinions and main bearing is essential for proper functioning of yaw mechanism as per wind speed and direction	Insufficient lubrication and improper maintenance practices	Live testing of performance of yaw mechanism should be done and component to be replaced as required	Medium
27	Gear Box	Oil leakage in Gear box Drain Valve	Low oil levels and improper lubrication will lead to sub-optimal performance of the gearbox	Gasket or Seal might be damaged	Ensure proper sealing of drain valve	Medium
28	Gear Box	Oil leakage for the hydraulic unit	Function of this hydraulic unit is to apply pressure for Disc brake unit, Rotor lock unit and Yaw brake unit. If the oil level is low, it cant build the required pressure which in turn lead to malfunction of the system	Poor maintenance practices	Oil has to be refilled	Medium
29	Rotor	Hub lights in top control panel is not working	Essential for visual inspection and safety of the panels	Improper maintenance practices	Spares to be replaced	Low

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
30	Gear Box	Accumulation of dust on gearbox radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water cooling system of generator. High temperature will affect performance of the components	Poor Maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium
31	Yaw system	Low grease levels in yaw teeth lubrication pumps	Lubrication is essential for yaw bearing and main bearing. Low grease levels can lead to increase in friction and malfunctioning of yaw system	Potential leakages from hoses leading to reduction in grease levels	Address root cause for leakage of grease and refill up to appropriate levels	Medium
32	Rotor	Grease level found very low and spillages hub due to tube damage	The original root cause will help us have a better maintenance	Poor Maintenance practices	Immediate service is required	Medium
33	Gear Box	Accumulation of dust and corrosion of radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water cooling system of generator. Corrosion or improper maintenance of radiators will affect performance of the components	Improper cleaning and maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium
34	Others	Improper routing of power cables in wind motor	To avoid cable damages	Improper maintenance practices	Cable routing to be reviewed and corrected	Low
35	Generator	Rotor under found dust condition due to dust collector not done proper fixing	as a mandate requirement	Poor Maintenance practices	Need to fix it properly	Low
36	Rotor	Pitch capacitor panel door not functional and closed by using ropes	High safety risk and potential damage to pitch capacitor panel due to accumulation of dust	Improper maintenance practices	Modification / replacement of panel doors	Medium
37	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium
38	Gear Box	Discoloration of silica gel in gearbox breather	Breathers allow heat to escape and cooling air to enter the system, preventing unnecessary overheating issues.	Overuse of breathers and excess moisture can potentially lead to discoloration	Breathers must be replaced as part of yearly PM activities	Medium
39	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
40	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
41	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

RJ7T91

Below is a list of components across the WTG, detailed observations and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name:	GMDC			**Inspection Date**	22.06.2022
Turbine Coordinates	22.129889,71.455953			**HTSC. No**	
Area Details		**WTG Details**			
Name of District	RAJKOT	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	Vinchiya	**WTG Loc No**	RJ7T91	**DOC**	28.09.2016
Name of Village	Sanali	**Tower Type**	TUBULAR	**SF.No**	160P1
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 12	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	N1002MGL10178Y15	HUB NUMBER	INOX	H1002MGL10-0178-Y15
GEAR BOX	DHHI	2152167	PITCH MOTOR 1	MOOG	1601015
GENERATOR	LEROY SOMER	WL15K233B	PITCH MOTOR 2	MOOG	1601013
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	75964970051	PITCH MOTOR 3	MOOG	1601011
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	76384660025	PITCH DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15028845
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	76384660023	PITCH DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15028840
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	75964990007	PITCH DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15028850
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15028595	BLADE 1	INOX	7160
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15025598	BLADE 2	INOX	8132
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15028596	BLADE 3	INOX	5182
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15028594	POWER PANEL	AMSC	014-0250238
YAW BRAKE 1	SVENDBORG BRAKES	5-200235041 & 5-200235047	CAPACITOR PANEL 1	AMSC	014-0330033
YAW BRAKE 2	SVENDBORG BRAKES	5-200235042 & 5-200235048	POWER TRANSFORMER	ATS ACCORD	22228-10
YAW BRAKE 3	SVENDBORG BRAKES	5-200235043 & 5-200235044	TOP RADIATOR	HYDRA	FSB200111512
YAW BRAKE 4	SVENDBORG BRAKES	5-200235039 & 5-200235045	ROTAR LOCK	SVENDBORG BRAKES	5-100033035
YAW BRAKE 5	SVENDBORG BRAKES	5-200235040 & 5-200235046	VCB	ABB	NA
BRAKE UNIT	SVENDBORG BRAKES	5-100031140	CONTROL & RELAY PANEL	SQURE	TSPL/HT/09-14/646-458
BRAKE UNIT	SVENDBORG BRAKES	5-100031139	ACB	SQURE	RG36107292
GEAR OIL PUMP	ABB	3GW18490001666503	GREASE PUMP - GENERATOR	LINCOLN	2015261482/5
SLIPRING	SCHLEIFRING	414781	COUPLING	KUVAG ISOLA	1523/001-009
TOP CONTROL PANEL	AMSC	014-0330033	WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA 2010

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Inadequate oil level in transformer	The quantity of the oil should be 1294 ltrs where the MID level is about 700 ltrs which is safest capacity to run the transformer. If the oil level is lower than the MID level, it will affect the performance of the transformer and safety of the unit	No maintenance are happening	Oil filtration to remove debris, breakdown voltage (BDV) test and refilling of oils as per guidelines	High
3	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
4	USS	WTI and OTI meter found open condition and the panel is full of dust	WTI means winding temperature Indicator and OTI means Oil Temperature Indicator which indicates the winding temperature & oil temperature of the transformer and operates the alarm, trip, and cooler control contacts. If the WTI & OTI is not maintained properly, this will impact in the function of the transformer	Limited importance given to maintenance of WTI and OTI by the contractor	Check the working condition of WTI & OTI meter and procure spares for replacement, if needed	Medium
5	USS	R, phase of Lightning Arrestor bypassed	Lightning arrestor is the primary protection agent for the DP Yard	Unavailability of spares	Spared to be procured and replaced	High
6	Earthing	**Earthing** 1. Grid earthing found stolen and not connected 2. Earthing for Current Transformer not properly done 3. Earthing in Gear box found improper 4. Earthing is not found in Nosecone 5. Nosecone earthing not available 6. Nacelle earthing found	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Unavailability of grid earthing, ground earthing, and copper earthing cables in nacelle, and hub to be checked with contractor	All the earthing should have to be provided with high importance	High

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
		improper				
7	USS	Found fencing wall damaged in DP Yard	Essential for overall upkeep of the asset	Potential damages due to ROW issues	Fencing wall to be reconstructed	Low
8	USS	Transformer Breather - silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in colour indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium
9	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
10	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium
11	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
12	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and firt aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
13	Others	Gate stopper not available	As a safety measure	Poor Maintenance practices	Need to fix it properly	Low
14	Tower	Power Cable trussing not done properly	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
15	Electrical controls	Sleeves melted and cable damages in transformer control panel	Purpose of the control cable is to distribute the power to various components, hence it should be maintained properly	Potential loose connection of the cable lug with the terminal box	Identify root cause for melting of cables and replace as required	Medium
16	Electrical controls	Improper cable glanding in transformer	Glanding is very important for the safety of cable and to avoid any electrical incidents such as tripping, fault current etc..	Limited awareness on severity of issue, and improper maintenance practices	Proper glanding to be done	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
17	Rotor	Low oil level in hydraulic unit	Function of this hydraulic unit is to apply pressure for Disc brake unit, Rotor lock unit and Yaw brake unit. If the oil level is low, it cant build the required pressure which in turn lead to malfunction of the system	Poor maintenance practices	Oil has to be refilled	Medium
18	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
19	Tower	Tube lights are not in working condition in Tower Section 3&4	High safety risk	Improper maintenance practices	Electrical connections shall be checked and new set of lights can be provided	Low
20	Tower	Oil spillages found across all the platforms	Potential fire hazard and low oil levels in critical components (e.g., gearbox) can affect overall performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of leakage	Medium
21	Tower	Grease spillages found across all the platforms	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
22	Brake unit	Disc Brake pad found in worn out condition	High safety risk due to malfunctioning of rotor brake especially in high wind season during high wind velocity	High wear and tear and potentially due to malfunctioning of brake sensor	Spares to be procured and component to be replaced	High
23	Yaw system	Corrosion and accumulation of dust in yaw ring	Smooth functioning of yaw pinions and main bearing is essential for proper functioning of yaw mechanism as per wind speed and direction	Insufficient lubrication and improper maintenance practices	Live testing of performance of yaw mechanism should be done and component to be replaced as required	Medium
24	Electrical controls	Control panel lights are not in working condition	Required for routine maintenance and inspection of control panels	Improper maintenance practices	Spares to be replaced	Low
25	Gear Box	Accumulation of dust and corrosion of radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water cooling system of generator. Corrosion or improper maintenance of radiators will affect performance of the components	Improper cleaning and maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
26	Rotor	Oil and Grease spillages found across the Hub unit	Oil spillage may be from pitch gear unit and grease spillage from pitch bearing. Lubrication is essential to minimize friction in bearings	Potential failure of breathers in gearbox leading to overheating and overflowing of oil / leakages due to improper maintenance	Cleaning of hub, refilling of oil / grease across all systems	Medium
27	Others	Improper routing of power cables in wind motor	To avoid cable damages	Improper maintenance practices	Cable routing to be reviewed and corrected	Low
28	Rotor	pitch capacitor control panel without door and closed on the rope	As a safety measure	Poor Maintenance practices	Need to fix it properly	Medium
29	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium
30	Gear Box	Discoloration of silica gel in gearbox breather	Breathers allow heat to escape and cooling air to enter the system, preventing unnecessary overheating issues.	Overuse of breathers and excess moisture can potentially lead to discoloration	Breathers must be replaced as part of yearly PM activities	Medium
31	Electrical controls	Improper glanding of rotor cable	High safety risk	Improper maintenance practices	Glanding to be done	Medium
32	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
33	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
34	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

ROJT94

Below is a list of components across the WTG, detailed observations and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name :	GMDC			**Inspection Date**	23.06.2022
Turbine Coordinates	22.079702,71.436365			**HTSC. No**	
Area Details		**WTG Details**			
Name of District	Rajkot	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	Vinchiya	**WTG Loc No**	ROJT94	**DOC**	28.09.2016
Name of Village	Bandhali	**Tower Type**	TUBULAR	**SF.No**	157P1/P2
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 7	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	N1002MGL100177Y15	HUB NUMBER	INOX	H1002MGL10-0177Y15
GEAR BOX	DHHI	2152193	HUB PANEL	AMSC	NA
GENERATOR	LEROY SOMER	WL15K234B	PITCH MOTOR 1	MOOG	1512020
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	76384670017	PITCH MOTOR 2	MOOG	1512001
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	76384670014	PITCH MOTOR 3	MOOG	1512029
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	76384670018	PITCH DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15028114
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	76384650040	PITCH DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15028115
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15028084	PITCH DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15028116
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15028609	BLADE 1	INOX	6189
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15028601	BLADE 2	INOX	7168
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15028603	BLADE 3	INOX	8141
YAW BRAKE 1	SVENDBORG BRAKES	5-200233770 & 5-200233777	POWER PANEL	AMSC	014-0250199
YAW BRAKE 2	SVENDBORG BRAKES	5-200233769 & 5-200233778	CAPACITOR PANEL 1	AMSC	014-0230203
YAW BRAKE 3	SVENDBORG BRAKES	5-200233773 & 5-200233774	POWER TRANSFORMER	ATS ACCORD	NA
YAW BRAKE 4	SVENDBORG BRAKES	5-200233772 & 5-200233775	TOP RADIATOR	HYDRA	FSB70011-1603-175
YAW BRAKE 5	SVENDBORG BRAKES	5-200233771 & 5-200233776	ROTAR LOCK	SVENDBORG BRAKES	5-100032360
BRAKE UNIT	SVENDBORG BRAKES	5-100032359	VCB	ABB	1VYN030216001954
BRAKE UNIT	SVENDBORG BRAKES	5-100032357	CONTROL & RELAY PANEL	SQURE	TSPL-HT/09-14/646-3
GEAR OIL PUMP	ABB	3G1C15300512731016	ACB	SQURE	BG36107286
SLIPRING	SCHLEIFRING	414789	WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA2010
TOP CONTROL PANEL	AMSC	014-0240206	GREASE PUMP - GENERATOR	LINCOLN	2015261495/3

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Transformer conservator tank oil level found EMPTY	When transformer is loaded and when ambient temperature rises, the volume of oil inside transformer increases. A conservator tank of transformer provides adequate space to this expanded transformer oil. It also acts as a reservoir for transformer insulating oil.	No maintenance are happening	Need to refill the oil	High
3	USS	Oil Leakage found from Transformer LV Pushing	Low oil levels will lead to rise in temperature of the transformer	Internal design of the Transformer	Need to conduct a detailed study	Medium
4	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
5	USS	WTI and OTI meter found open condition and the panel is full of dust	WTI means winding temperature Indicator and OTI means Oil Temperature Indicator which indicates the winding temperature & oil temperature of the transformer and operates the alarm, trip, and cooler control contacts. If the WTI & OTI is not maintained properly, this will impact in the function of the transformer	Limited importance given to maintenance of WTI and OTI by the contractor	Check the working condition of WTI & OTI meter and procure spares for replacement, if needed	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
6	Earthing	**Earthing** 1. Grid earthing found stolen and not connected 2. Earthing for Current Transformer not properly done 3. Earthing in Gear box found improper 4. Earthing is not found in Nosecone 5. Nosecone earthing not available 6. Nacelle earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Unavailability of grid earthing, ground earthing, and copper earthing cables in nacelle, and hub to be checked with contractor	All the earthing should have to be provided with high importance	High
7	USS	Transformer Breather - silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in colour indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium
8	Others	Door stopper not available	As a safety measure	Poor Maintenance practices	Need to fix it properly	Low
9	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
10	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium
11	USS	VCB and Energy meter door glass not available	If rain water gets in, it leads to malfunctioning of the ACB	Handling Damages	Replace with spares	Medium
12	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
13	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and first aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
14	Electrical controls	(-52f3.1) 40A breaker neutral phase burned	Purpose of control cable to distribute the power to various components. If the damages found in the cable, which may affect the performance of the various other components	Might be loose connection of the cable lug with the terminal box	The original problem should have been identified and need to resolve by replacing the spares	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
16	Electrical controls	Improper cable glanding in transformer	Glanding is very important for the safety of cable and to avoid any electrical incidents such as tripping, fault current etc..	Limited awareness on severity of issue, and improper maintenance practices	Proper glanding to be done	Medium
17	Electrical controls	Communication cable not properly laid	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
18	Tower	Tube lights are not in working condition in Tower Section 3&4	High safety risk	Improper maintenance practices	Electrical connections shall be checked and new set of lights can be provided	Low
19	Electrical controls	Cable and laying found improper in 30kva transformer	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
20	Tower	Grease and oil spillages over the platforms and flanges	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
21	Tower	Oil spillages found across the platform 2	If the oil spillage is due to the oil leakage from Gear box, it is serious.	Oil spillage may due to the reasons of oil leakage from Gear box or hydraulic connections of various parts. Hence it is important	Cleaning of platforms should be done first as it is related to the human safety and then problem identification with right reason is required.	Medium
22	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
23	Tower	Oil spillages found across all the platforms	Potential fire hazard and low oil levels in critical components (e.g., gearbox) can affect overall performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of leakage	Medium
24	Tower	Grease spillages found across all the platforms	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
25	Brake Unit	Disc Brake pad found in worn out condition	High safety risk due to malfunctioning of rotor brake especially in high wind season during high wind velocity	High wear and tear and potentially due to malfunctioning of brake sensor	Spares to be procured and component to be replaced	High

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
26	Yaw system	Corrosion and accumulation of dust in yaw ring	Smooth functioning of yaw pinions and main bearing is essential for proper functioning of yaw mechanism as per wind speed and direction	Insufficient lubrication and improper maintenance practices	Live testing of performance of yaw mechanism should be done and component to be replaced as required	Medium
27	Rotor	Hub lights in top control panel is not working	Essential for visual inspection and safety of the panels	Improper maintenance practices	Spares to be replaced	Low
28	Gear Box	Accumulation of dust and corrosion of radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water cooling system of generator. Corrosion or improper maintenance of radiators will affect performance of the components	Improper cleaning and maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium
29	Yaw system	Low grease levels in yaw teeth lubrication pumps	Lubrication is essential for yaw bearing and main bearing. Low grease levels can lead to increase in friction and malfunctioning of yaw system	Potential leakages from hoses leading to reduction in grease levels	Address root cause for leakage of grease and refill up to appropriate levels	Medium
30	Rotor	Oil and Grease spillages found across the Hub unit	Oil spillage may be from pitch gear unit and grease spillage from pitch bearing. Lubrication is essential to minimize friction in bearings	Potential failure of breathers in gearbox leading to overheating and overflowing of oil / leakages due to improper maintenance	Cleaning of hub, refilling of oil / grease across all systems	Medium
31	Rotor	pitch Grease passage tube is in damaged condition	It feeds lubrication to Pitch bearing	Handling damages	Spares to be replaced	Medium
32	Others	Improper routing of power cables in wind motor	To avoid cable damages	Improper maintenance practices	Cable routing to be reviewed and corrected	Low
33	Electrical controls	Winch motor operating switch found bypass condition	High safety risk	Unavailability of spares	New switch to be replaced	Medium
35	Rotor	Pitch capacitor panel door not functional and closed by using ropes	High safety risk and potential damage to pitch capacitor panel due to accumulation of dust	Improper maintenance practices	Modification / replacement of panel doors	Medium
36	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium
37	Gear Box	Discoloration of silica gel in gearbox breather	Breathers allow heat to escape and cooling air to enter the system, preventing unnecessary overheating issues.	Overuse of breathers and excess moisture can potentially lead to discoloration	Breathers must be replaced as part of yearly PM activities	Medium
38	Others	top panel damage	Handling Damage	Poor Maintenance practices	Correct during PM activities	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
39	Others	Slipring base hardware found lose condition	as a mandate requirement	Poor Maintenance practices	Correct during PM activities	Low
40	Electrical controls	Rotor cable glanding found improper	High safety risk	Improper maintenance practices	Glanding to be done	Medium
41	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
42	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
43	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

ROJ218

Below is a list of components across the WTG, detailed observations and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name :	GMDC			**Inspection Date**	22.06.2022
Turbine Coordinates				**HTSC. No**	
Area Details		**WTG Details**			
Name of District	Bhavnagar	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	Gadhada	**WTG Loc No**	ROJ218	**DOC**	31-03-16
Name of Village	Samadhiyala	**Tower Type**	TUBULAR	**SF.No**	165/1/7/1
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 4	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	N1002MGL00Y15	HUB NUMBER	INOX	H100214MGL1002Y15
GEAR BOX	DHHI	2152209	HUB PANEL	AMSC	014-0220163
GENERATOR	LS	WL11L0028	PITCH MOTOR 1	MOOG	1510056
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	75964990054	PITCH MOTOR 2	MOOG	1510053
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	76964990020	PITCH MOTOR 3	MOOG	1510055
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	75964990060	PITCH DRIVE 1	DHHI	15PYD0164
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	75964990023	PITCH DRIVE 2	DHHI	15PYD0209
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15028604	PITCH DRIVE 3	DHHI	15PYD0210
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15029416	BLADE 1	INOX	8092
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15027632	BLADE 2	INOX	6142
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15027650	BLADE 3	INOX	7404
YAW BRAKE 1	SVENDBORG BRAKES	5-200234195 & 5-200234192	POWER PANEL	AMSC	014-0230145
YAW BRAKE 2	SVENDBORG BRAKES	5-200234196 & 5-200234193	CAPACITOR PANEL 1	AMSC	014-0250151
YAW BRAKE 3	SVENDBORG BRAKES	5-200234197 & 5-200234190	POWER TRANSFORMER	ATS ACCORD	21508-58
YAW BRAKE 4	SVENDBORG BRAKES	5-200234198 & 5-200234191	ROTAR LOCK	SVENDBORG BRAKES	5-100032949
BRAKE UNIT	SVENDBORG BRAKES	5-100031135	GREASE PUMP - GENERATOR	LINCOLN	201232683
BRAKE UNIT	SVENDBORG BRAKES	5-100032526	CONTROL & RELAY PANEL		1419117-A-08
GEAR OIL PUMP	ABB	3Q1015360519345039	ACB	SQURE	BG36106074
HYDRAULIC UNIT	SVENDBORG BRAKES	85398-300105	TOP CONTROL PANEL	AMSC	014-0240164
SLIPRING	SCHLEIFRING	448757	WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA2010

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Transformer oil level EMPTY	The quantity of the oil should be 1294 ltrs where the MID level is about 700 ltrs which is safest capacity to run the transformer. If the oil level is lower than the MID level, then this the question of function of the transformer and also about safety measures of the entire unit.	No maintenance are happening	Suggest to have oil filtration and then doing BDV test and finally refilling	High
3	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
4	USS	WTI and OTI meter found open condition and the panel is full of dust	WTI means winding temperature Indicator and OTI means Oil Temperature Indicator which indicates the winding temperature & oil temperature of the transformer and operates the alarm, trip, and cooler control contacts. If the WTI & OTI is not maintained properly, this will impact in the function of the transformer	Limited importance given to maintenance of WTI and OTI by the contractor	Check the working condition of WTI & OTI meter and procure spares for replacement, if needed	Medium
5	USS	Current transformer Y oil leakage	A current transformer is designed to maintain an accurate ratio between the currents in its primary and secondary circuits over a defined range.	Due to continuous operation, and improper maintenance	Replace with spares	High

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
6	Earthing	**Earthing** 1. Grid earthing found stolen and not connected 2. Earthing for Current Transformer not properly done 3. Earthing in Gear box found improper 4. Earthing is not found in Nosecone 5. Nosecone earthing not available 6. Nacelle earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Unavailability of grid earthing, ground earthing, and copper earthing cables in nacelle and hub to be checked with contractor	All the earthing should have to be provided with high importance	High
7	USS	Transformer Breather - silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in colour indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium
8	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
9	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium
10	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
11	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and first aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
12	Electrical controls	Power Cable trussing not done properly	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
13	Electrical controls	Improper cable glanding in transformer	Glanding is very important for the safety of cable and to avoid any electrical incidents such as tripping, fault current etc..	Limited awareness on severity of issue, and improper maintenance practices	Proper glanding to be done	Medium
14	**Electrical controls**	PM 3000 Not available	Controller for the entire machine operations. Critical element for WTG to operate	Unavailability of spares	Spares to be procured and replaced	High

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
15	Rotor	Low oil level in hydraulic unit	Function of this hydraulic unit is to apply pressure for Disc brake unit, Rotor lock unit and Yaw brake unit. If the oil level is low, it cant build the required pressure which in turn lead to malfunction of the system	Poor maintenance practices	Oil has to be refilled	Medium
16	Tower	Tube lights are not in working condition in All Tower Sections	As a safety measure	Poor Maintenance practices	Electrical connections shall be checked and new set of lights can be provided	Low
17	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
18	Tower	Oil spillages found across all the platforms	Potential fire hazard and low oil levels in critical components (e.g., gearbox) can affect overall performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of leakage	Medium
19	Tower	Grease spillages found across all the platforms	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
20	Yaw system	Corrosion and accumulation of dust in yaw ring	Smooth functioning of yaw pinions and main bearing is essential for proper functioning of yaw mechanism as per wind speed and direction	Insufficient lubrication and improper maintenance practices	Live testing of performance of yaw mechanism should be done and component to be replaced as required	Medium
21	Brake unit	Disc Brake pad found in worn out condition	High safety risk due to malfunctioning of rotor brake especially in high wind season during high wind velocity	High wear and tear and potentially due to malfunctioning of brake sensor	Spares to be procured and component to be replaced	High
22	Electrical controls	Control panel lights are not in working condition	Required for routine maintenance and inspection of control panels	Improper maintenance practices	Spares to be replaced	Low
23	Gear Box	Accumulation of dust and corrosion of radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water cooling system of generator. Corrosion or improper maintenance of radiators will affect performance of the components	Improper cleaning and maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
24	Rotor	Oil and Grease spillages found across the Hub unit	Oil spillage may be from pitch gear unit and grease spillage from pitch bearing. Lubrication is essential to minimize friction in bearings	Potential failure of breathers in gearbox leading to overheating and overflowing of oil / leakages due to improper maintenance	Cleaning of hub, refilling of oil / grease across all systems	Medium
25	Others	Improper routing of power cables in wind motor	To avoid cable damages	Improper maintenance practices	Cable routing to be reviewed and corrected	Low
26	Electrical controls	Winch motor operating switch found bypass condition	High safety risk	Unavailability of spares	New switch to be replaced	Medium
27	Rotor	Pitch capacitor panel door not functional and closed by using ropes	High safety risk and potential damage to pitch capacitor panel due to accumulation of dust	Improper maintenance practices	Modification / replacement of panel doors	Medium
28	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium
29	Gear Box	Discoloration of silica gel in gearbox breather	Breathers allow heat to escape and cooling air to enter the system, preventing unnecessary overheating issues.	Overuse of breathers and excess moisture can potentially lead to discoloration	Breathers must be replaced as part of yearly PM activities	Medium
30	Generator	Slipring rotor encoder Not available	Critical for generator performance	Unavailability of spares	Spares to be procured and replaced	High
31	Generator	Generator stator and rotor cable not available	Critical for generator performance	Unavailability of spares	Spares to be procured and replaced	High
32	Electrical controls	Rotor cable glanding found improper	High safety risk	Improper maintenance practices	Glanding to be done	Medium
33	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
34	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
35	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Low

ROJ217

Below is a list of components across the WTG, detailed observations and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name:	GMDC			**Inspection Date**	22.06.2022
Turbine Coordinates				**HTSC. No**	
Area Details		**WTG Details**			
Name of District	Bhavnagar	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	Gadhada	**WTG Loc No**	ROJ217	**DOC**	31-03-16
Name of Village	Samadhiyala	**Tower Type**	TUBULAR	**SF.No**	165/1/7/1
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 4	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	N1002MGL100203Y15	HUB NUMBER	INOX	H1002MGL10-0203-Y15
GEAR BOX	DHHI	2152220	HUB PANEL	AMSC	NA
GENERATOR	LEROY SOMER	WL15L245B	PITCH MOTOR 1	MOOG	1504056
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	76384650011	PITCH MOTOR 2	MOOG	1504048
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	76384650007	PITCH MOTOR 3	MOOG	1504046
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	76384650008	PITCH DRIVE 1	DHHI	15PYD0224
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	75964990085	PITCH DRIVE 2	DHHI	15PYD0225
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15028109	PITCH DRIVE 3	DHHI	15PYD0229
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15028111	BLADE 1	INOX	6143
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15028103	BLADE 2	INOX	8091
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15028107	BLADE 3	INOX	5141
YAW BRAKE 1	SVENDBORG BRAKES	5-200235655 & 5-200235658	POWER PANEL	AMSC	014-0230147
YAW BRAKE 2	SVENDBORG BRAKES	5-200235656 & 5-200235662	CAPACITOR PANEL 1	AMSC	014-0250146
YAW BRAKE 3	SVENDBORG BRAKES	5-200235654 & 5-200235661	TOP RADIATOR	HYDRA	FSB70011-1512-042
YAW BRAKE 4	SVENDBORG BRAKES	5-200235653 & 5-200235659	ROTAR LOCK	SVENDBORG BRAKES	5-100033545
BRAKE UNIT	SVENDBORG BRAKES	5-100033604	SLIPRING	SCHLEIFRING	414785
BRAKE UNIT	SVENDBORG BRAKES	5-100033603	TOP CONTROL PANEL	AMSC	014-0240166
GEAR OIL PUMP	ABB	301C15360319345032	WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA 2010
GREASE PUMP - GENERATOR	LINCOLN	2015296437/2	COUPLING	KUVAG ISOLA	200078544/10

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Inadequate oil level in transformer	The quantity of the oil should be 1294 ltrs where the MID level is about 700 ltrs which is safest capacity to run the transformer. If the oil level is lower than the MID level, it will affect the performance of the transformer and safety of the unit	No maintenance are happening	Oil filtration to remove debris, breakdown voltage (BDV) test and refilling of oils as per guidelines	High
3	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
4	USS	WTI and OTI meter found open condition and the panel is full of dust	WTI means winding temperature Indicator and OTI means Oil Temperature Indicator which indicates the winding temperature & oil temperature of the transformer and operates the alarm, trip, and cooler control contacts. If the WTI & OTI is not maintained properly, this will impact in the function of the transformer	Limited importance given to maintenance of WTI and OTI by the contractor	Check the working condition of WTI & OTI meter and procure spares for replacement, if needed	Medium
5	USS	Transformer Breather - silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in colour indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium
6	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
7	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium
8	USS	ACB panel door found damage	If rain water gets in, it leads to malfunctioning of the ACB	Handling Damages	Replace with spares	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
9	Earthing	**Earthing** 1. Grid earthing found stolen and not connected 2. Ultrasonic sensor Earthing found improper 3. Nosecone earthing not available 4. Nacelle earthing found improper 5.blade earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Unavailability of grid earthing, ground earthing, and copper earthing cables in nacelle and hub to be checked with contractor	All the earthing should have to be provided with high importance	High
10	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
11	USS	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and firt aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
12	Electrical controls	LVRT bypass	In absence of LVRT, if grid voltage dips, a mismatch is produced between the generated active power and the active power delivered to the grid.	Product failure	LVRT component on panel to be replaced	High
13	Electrical controls	Cable dressing / insulation not done properly	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
14	Electrical controls	Sleeves melted and cable damages in transformer control panel	Purpose of the control cable is to distribute the power to various components, hence it should be maintained properly	Potential loose connection of the cable lug with the terminal box	Identify root cause for melting of cables and replace as required	Medium
15	Electrical controls	30kva transformer not in a proper cable and laying and door not proper	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
16	Electrical controls	Cable glanding is not properly done in 600/415vTransformer	Glanding is very important for the safety of cable and to avoid any electrical incidents such as tripping, fault current etc..	Limited awareness on severity of issue, and improper maintenance practices	Proper glanding to be done	Medium
17	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
18	Tower	slipring communication cable gland and laying not done properly	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
19	Tower	Power cable joint and not done proper laying section 3	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
20	Tower	Tube lights are not working in tower sections 3&4	High safety risk	Improper maintenance practices	Electrical connections shall be checked and new set of lights can be provided	Low
21	Tower	Oil spillages found across all the platforms	Potential fire hazard and low oil levels in critical components (e.g., gearbox) can affect overall performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of leakage	Medium
22	Tower	Grease spillages found across all the platforms	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
23	Tower	Tube Light not available at nacelle	electrical fault	Poor Maintenance practices	During maintenance, it has to be changed	Low
24	Electrical controls	Control panel lights are not in working condition	Required for routine maintenance and inspection of control panels	Improper maintenance practices	Spares to be replaced	Low
25	Gear Box	Accumulation of dust and corrosion of radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water cooling system of generator. Corrosion or improper maintenance of radiators will affect performance of the components	Improper cleaning and maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium
26	Rotor	Oil and Grease spillages found across the Hub unit	Oil spillage may be from pitch gear unit and grease spillage from pitch bearing. Lubrication is essential to minimize friction in bearings	Potential failure of breathers in gearbox leading to overheating and overflowing of oil / leakages due to improper maintenance	Cleaning of hub, refilling of oil / grease across all systems	Medium
27	Brake unit	Disc Brake pad found in worn out condition	High safety risk due to malfunctioning of rotor brake especially in high wind season during high wind velocity	High wear and tear and potentially due to malfunctioning of brake sensor	Spares to be procured and component to be replaced	High
28	Rotor	Pitch bearing grease passage tube damaged	Lubrication of pitch bearing is essential for smooth operations and minimize friction	Handling damages	Quarterly visual inspection of lubrication unit and immediate replacement as required	Medium
29	Yaw system	Corrosion and accumulation of dust in yaw ring	Smooth functioning of yaw pinions and main bearing is essential for proper functioning of yaw mechanism as per wind speed and direction	Insufficient lubrication and improper maintenance practices	Live testing of performance of yaw mechanism should be done and component to be replaced as required	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
30	Gear Box	Discoloration of silica gel in gearbox breather	Breathers allow heat to escape and cooling air to enter the system, preventing unnecessary overheating issues.	Overuse of breathers and excess moisture can potentially lead to discoloration	Breathers must be replaced as part of yearly PM activities	Medium
31	Rotor	Pitch capacitor panel door not functional and closed by using ropes	High safety risk and potential damage to pitch capacitor panel due to accumulation of dust	Improper maintenance practices	Modification / replacement of panel doors	Medium
32	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium
33	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
34	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
35	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

RJ8T156

Below is a list of components across the WTG, detailed observations and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name :	GMDC			**Inspection Date**	19.06.2022
Turbine Coordinates				**HTSC. No**	
Area Details		**WTG Details**			
Name of District	RAJKOT	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	Jasdan	**WTG Loc No**	RJ8T156	**DOC**	30.09.2016
Name of Village	Ambardi	**Tower Type**	TUBULAR	**SF.No**	279 P1
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 9	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	MFHPL/IWL/021	HUB NUMBER	INOX	H1002MGL0-0175Y15
GEAR BOX	DHHI	2152207	HUB PANEL		NA
GENERATOR	LEROY SOMER	WL14D022B	PITCH MOTOR 1	MOOG	1602081
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	76384650019	PITCH MOTOR 2	MOOG	1602082
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	76384650029	PITCH MOTOR 3	MOOG	1602083
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	76384680002	PITCH DRIVE 1	DHHI	15PYD0001
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	75964990086	PITCH DRIVE 2	DHHI	15PYD0002
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN15029412	PITCH DRIVE 3	DHHI	15PYD0003
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN15029418	BLADE 1	INOX	6174
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15029062	BLADE 2	INOX	8135
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15029056	BLADE 3	INOX	6175
YAW BRAKE 1	SVENDBORG BRAKES	5-200233721 & 5-200233726	POWER PANEL	AMSC	014-0250231
YAW BRAKE 2	SVENDBORG BRAKES	5-200233720 & 5-200233725	CAPACITOR PANEL 1	AMSC	014-0230242
YAW BRAKE 3	SVENDBORG BRAKES	5-200233723 & 5-200233724	POWER TRANSFORMER	ATS ACCORD	NA
YAW BRAKE 4	SVENDBORG BRAKES	5-200233722 & 5-200233727	TOP RADIATOR	HYDRA	FSP70011-1601-098
BRAKE UNIT	SVENDBORG BRAKES	5-100032528	ROTAR LOCK	SVENDBORG BRAKES	5-100032567
BRAKE UNIT	SVENDBORG BRAKES	5-100032529	VCB	ABB	NA
SLIPRING	SCHLEIFRING	414767	CONTROL & RELAY PANEL	SQUARE	450
TOP CONTROL PANEL	AMSC	014-0240225	GREASE PUMP - GENERATOR	LINCOLN	2015326838/10
WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA-2010	COUPLING	KUVAG ISOLA	1520/001/004

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Inadequate oil level in transformer	The quantity of the oil should be 1294 ltrs where the MID level is about 700 ltrs which is safest capacity to run the transformer. If the oil level is lower than the MID level, it will affect the performance of the transformer and safety of the unit	No maintenance are happening	Oil filtration to remove debris, breakdown voltage (BDV) test and refilling of oils as per guidelines	High
3	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
4	USS	WTI and OTI meter found open condition and the panel is full of dust	WTI means winding temperature Indicator and OTI means Oil Temperature Indicator which indicates the winding temperature & oil temperature of the transformer and operates the alarm, trip, and cooler control contacts. If the WTI & OTI is not maintained properly, this will impact in the function of the transformer	Limited importance given to maintenance of WTI and OTI by the contractor	Check the working condition of WTI & OTI meter and procure spares for replacement, if needed	Medium
5	USS	LV cable laying pvc pipe damaged	to avoid cable damages	Handling damages	PVC pipe have to be replaced	Low
6	Earthing	**Earthing** 1. Grid earthing found stolen and not connected 2. Earthing in Gear box found improper 3. Earthing is not found in Nosecone 4. Nacelle earthing found improper 5,Gate earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Unavailability of grid earthing, ground earthing, and copper earthing cables in nacelle and hub to be checked with contractor	All the earthing should have to be provided with high importance	High

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
		6.panel earthing improper				
7	USS	Copper earth flat in contact with radiator	High safety risk for transformer in case of surges	Limited awareness on severity of issue	Reposition earth flats to ensure no contact with radiator	High
8	USS	B phase of Lightning Arrestor bypassed	Lightning arrestor is the primary protection agent for the DP Yard	Unavailability of spares	Spared to be procured and replaced	High
9	USS	Transformer Breather - silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in colour indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium
10	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
11	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium
12	USS	Fitment and alignment of current transformer is deviated	The minimum distance between CT to PT is 425mm to 475mm which is mandate as per the electrical standard	Improper maintenance practices and alignment not conducted as per guidelines	Immediate service is required	Medium
13	USS	Power cable laying in ACB panel is not done properly	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Medium
14	USS	Door and Glass damage in ACB panel	If rain water gets in, it leads to malfunctioning of the ACB	Handling Damages	Replace with spares	Medium
15	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
16	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and first aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
17	Gear Box	Discoloration (black) and low oil level found in gearbox	Lubricating oil is like the blood system of any Gearbox. If the oil levels falls too low, the chances for failure of gearbox is high. Moreover, it also affecting the performance of the gearbox	1. No refilling in between during Scheduled Maintenance2. Leakage from Hydraulic connections3. Potential loss of Oil during any Major breakdowns, evident from spillage4. Colour changed may due to high wear and tear in the gears	1. Suggest to have Endoscopy Inspection2. Suggest to have Oil Analysis in the reputed NABL accredited lab	High
18	Electrical controls	Cable routing in capacitor panel found improper	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
19	Tower	Triple clamp not done proper tightness	to avoid cable damages	Poor Maintenance practices	hardware tightness can be properly done	Low
20	Electrical controls	Improper glanding of rotor cable	High safety risk	Improper maintenance practices	Glanding to be done	Medium
21	Electrical controls	Cable and laying found improper in 30kva transformer	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
22	Electrical controls	Sleeves melted and cable damages in transformer control panel	Purpose of the control cable is to distribute the power to various components, hence it should be maintained properly	Potential loose connection of the cable lug with the terminal box	Identify root cause for melting of cables and replace as required	Medium
23	Electrical controls	Improper cable glanding in transformer	Glanding is very important for the safety of cable and to avoid any electrical incidents such as tripping, fault current etc..	Limited awareness on severity of issue, and improper maintenance practices	Proper glanding to be done	Medium
24	Tower	Improper bolting of transformer and loose connections	Essential for overall upkeep of the asset	Improper maintenance practices	Need to fix proper hardware with suitable washers	Low
25	Tower	Communication cable not properly laid	To avoid cable damages	Improper maintenance practices	Cable laying to be properly done	Low
26	Tower	Tube lights are not in working condition in Tower Section 3&4	High safety risk	Improper maintenance practices	Electrical connections shall be checked and new set of lights can be provided	Low
27	Tower	Oil spillages found across all the platforms	Potential fire hazard and low oil levels in critical components (e.g., gearbox) can affect overall performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of leakage	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
28	Tower	Grease spillages found across all the platforms	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
29	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
30	Yaw system	Grease collector in Yaw Bearing is not available	Due to this deviations, grease spillages are found in the platforms	Handling damages	Spares to be replaced	Low
31	Gear Box	Gear box brake sensor found in bypass condition	The sensor ensures appropriate positioning of the brake and monitors condition of the brake pad	Brake sensor failure	Spares to be replaced	High
32	Electrical controls	Control panel lights are not in working condition	Required for routine maintenance and inspection of control panels	Improper maintenance practices	Spares to be replaced	Low
33	Rotor	Pitch capacitor panel door not functional and closed by using ropes	High safety risk and potential damage to pitch capacitor panel due to accumulation of dust	Improper maintenance practices	Modification / replacement of panel doors	Medium
34	Rotor	Hub lights in top control panel not working	as a mandate requirement	During maintenance, it has to be changed	Need to fix it properly	Low
35	Gear Box	Accumulation of dust and corrosion of radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water cooling system of generator. Corrosion or improper maintenance of radiators will affect performance of the components	Improper cleaning and maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium
36	Tower	Found Cable twist between Tower Section 4	Overwinding can lead to potential damages to cables and post safety risk	Potential malfunctioning of wind vane or yaw sensor leading to overwinding of cables	Ensure functioning of the sensors and procure spares for replacement as required	High
37	Yaw system	Low grease levels in yaw teeth lubrication pumps	Lubrication is essential for yaw bearing and main bearing. Low grease levels can lead to increase in friction and malfunctioning of yaw system	Potential leakages from hoses leading to reduction in grease levels	Address root cause for leakage of grease and refill up to appropriate levels	Medium
38	Rotor	Oil and Grease spillages found across the Hub unit	Oil spillage may be from pitch gear unit and grease spillage from pitch bearing. Lubrication is essential to minimize friction in bearings	Potential failure of breathers in gearbox leading to overheating and overflowing of oil / leakages due to improper maintenance	Cleaning of hub, refilling of oil / grease across all systems	Medium
39	Others	Winch chain collector not done properly fixed	As a safety measure	Poor Maintenance practices	Need to fix it properly	Low

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
40	Generator	Rotor dust collector not available	as a mandate requirement	Poor Maintenance practices	Need to fix it properly	Low
41	Others	Improper routing of power cables in wind motor	To avoid cable damages	Improper maintenance practices	Cable routing to be reviewed and corrected	Low
42	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium
43	Gear Box	Discoloration of silica gel in gearbox breather	Breathers allow heat to escape and cooling air to enter the system, preventing unnecessary overheating issues.	Overuse of breathers and excess moisture can potentially lead to discoloration	Breathers must be replaced as part of yearly PM activities	Medium
44	Gear Box	Noise observed in gearbox	Bearing should have been damaged	1. Due to the heavy running period 2. The specific model gearbox should have been design issues 3. Poor maintenance practices 4. If earthing is not proper, this will impact in the bearing as well.	There are different ways to witness the Noise level which have to be done first and if the problem is proven, have to replace the bearing with immediate effect before Wind Season starts.	High
45	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
46	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
47	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

RJ8T154

Below is a list of components across the WTG, detailed observations, and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name :	GMDC			**Inspection Date**	01.07.2022
Turbine Coordinates	42Q N746524 E2439701			**HTSC. No**	
Area Details		**WTG Details**			
Name of District	Rajkot	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	Jasdan	**WTG Loc No**	RJ8T154	**DOC**	30.09.2016
Name of Village	Ambardi	**Tower Type**	TUBULAR	**SF.No**	279 P1
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 9	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	N1002MGL100205Y15	HUB NUMBER	INOX	H1002MGL10-0205Y15
GEAR BOX	DHHI	2152216	HUB PANEL	AMSC	NA
GENERATOR	LS	WL15L241B	PITCH MOTOR 1	MOOG	1512054
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	75964990011	PITCH MOTOR 2	MOOG	1512053
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	75964990090	PITCH MOTOR 3	MOOG	1512052
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	75964970046	PITCH DRIVE 1	DHHI	15PYD0282
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	76384650012	PITCH DRIVE 2	DHHI	15PYD0289
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15029410	PITCH DRIVE 3	DHHI	15PYD0281
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15029411	BLADE 1	INOX	10095
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15029412	BLADE 2	INOX	9088
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15029413	BLADE 3	INOX	10060
YAW BRAKE 1	SVENDBORG BRAKES	5-200236595 & 5-200236539	POWER PANEL	AMSC	014-0230205
YAW BRAKE 2	SVENDBORG BRAKES	5-200236597 & 5-200236540	CAPACITOR PANEL 1	AMSC	014-0230256
YAW BRAKE 3	SVENDBORG BRAKES	5-200236596 & 5-200236603	TOP RADIATOR	HYDRA	FSB70011-1603-152
YAW BRAKE 4	SVENDBORG BRAKES	5-200236595 & 5-200236538	ROTAR LOCK	SVENDBORG BRAKES	5-100033546
BRAKE UNIT	SVENDBORG BRAKES	5-100033577	VCB	ABB	1VYN302160025/3
GEAR OIL PUMP	ABB	3G1C15360519104001	ACB	TRI SQURE	BG76105723
SLIPRING	SCHLEIFRING	416637	TOP CONTROL PANEL	AMSC	014-0240249
GREASE PUMP - GENERATOR	LINCOLN	2015261496/1	WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA 2010

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Inadequate oil level in transformer	The quantity of the oil should be 1294 liters where the MID level is about 700 liters which is safest capacity to run the transformer. If the oil level is lower than the MID level, it will affect the performance of the transformer and safety of the unit	No maintenance is happening	Oil filtration to remove debris, breakdown voltage (BDV) test and refilling of oils as per guidelines	High
3	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
4	USS	WTI and OTI meter found open condition and the panel is full of dust	WTI means winding temperature Indicator and OTI means Oil Temperature Indicator which indicates the winding temperature & oil temperature of the transformer and operates the alarm, trip, and cooler control contacts. If the WTI & OTI is not maintained properly, this will impact in the function of the transformer	Limited importance given to maintenance of WTI and OTI by the contractor	Check the working condition of WTI & OTI meter and procure spares for replacement, if needed	Medium
5	USS	Y B phase of Lightning Arrestor bypassed	Lightning arrestor is the primary protection agent for the DP Yard	Unavailability of spares	Spared to be procured and replaced	High
6	Earthing	**EARTHING** **1.**Grid earthing found improper 2.Nacelle earthing found improper 3.Panel earthing found improper 4.Earthing found improper in nosecone 5.Transformer and Gate earthing found improper 6.Tower earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Improper of grid earthing, ground earthing, and copper earthing cables in nacelle and hub to be checked with contractor	All the earthing should have to be provided with high importance	High

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
7	USS	Transformer Breather - Silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in color indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium
8	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
9	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium
10	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
11	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and first aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
12	Electrical controls	Transformer cable breaker in bypass condition and glanding not done properly	High safety risk	Improper maintenance practices	Glanding to be done	Medium
13	Electrical controls	LVRT bypass	In absence of LVRT, if grid voltage dips, a mismatch is produced between the generated active power and the active power delivered to the grid.	Product failure	LVRT component on panel to be replaced	High
14	Others	Oil spillages over the cables tower entry section	As a safety measure	Poor Maintenance practices	Need to clean	Medium
15	Tower	Transformer under connection hardware hole not in proper and hardware lose	as a mandate requirement	Poor Maintenance practices	Need to be proper hardware with suitable washer	Low
16	Tower	Power cable not done proper laying at T1 and T3	to avoid cable damages	Poor Maintenance practices	Cable laying can be properly done	Low
17	Tower	Tube lights are not in working condition in Tower Section 4	As a safety measure	Poor Maintenance practices	Electrical connections shall be checked, and new set of lights can be provided	Low
18	Gear Box	Oil leakage from Thermo bypass valve	Improper lubrication of gearbox can lead to sub-optimal performance and potential fire hazard	Improper maintenance practices	Appropriate sealing / gasket to be used for the value to arrest leakages	Medium
19	Brake unit	Disk break unit 1 not available	This is important for WTG safety	Poor maintenance practices	Should replace the spares immediately	High

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
20	Tower	Grease and Oil spillages over the platforms and flanges at T3 and T4	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
21	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
22	Yaw system	Low grease levels in yaw teeth lubrication pumps	Lubrication is essential for yaw bearing and main bearing. Low grease levels can lead to increase in friction and malfunctioning of yaw system	Potential leakages from hoses leading to reduction in grease levels	Address root cause for leakage of grease and refill up to appropriate levels	Medium
23	Generator	Rotor cable glanding and routing not done proper	As a safety measure	Poor Maintenance practices	Glanding to be done	Medium
24	Generator	Generator NDE side grease collector not available	Grease trap is required as per guidelines	Improper maintenance practices	Grease collector to be installed	Low
25	Gear Box	Gear box breather found damage condition	Moisture condition of Gear oil should be high	1. Due to the high amount of working, this happens in regular intervals 2. In few cases, if at all radiator damages are observed some excess moisture shall get into the gear box.	Breathe needs to be changed	Medium
26	Rotor	Low oil level in hydraulic unit	Function of this hydraulic unit is to apply pressure for Disc brake unit, Rotor lock unit and Yaw brake unit. If the oil level is low, it can't build the required pressure which in turn lead to malfunction of the system	Poor maintenance practices	Oil has to be refilled	Medium
27	Gear Box	Gear box brake sensor found in bypass condition	The sensor ensures appropriate positioning of the brake and monitors condition of the brake pad	Brake sensor failure	Spares to be replaced	High
28	Gear Box	Noise observed in gearbox low speed side	Bearing should have been damaged	1. Due to the heavy running period 2. The specific model gearbox should have been design issues 3. Poor maintenance practices 4. If earthing is not proper, this will impact in the bearing as well.	There are different ways to witness the Noise level which have to be done first and if the problem is proven, have to replace the bearing with immediate effect before Wind Season starts.	High

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
29	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low
30	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
31	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium

RJPT130

Below is a list of components across the WTG, detailed observations, and key issues, along with root causes and corrective actions have been highlighted in the following table:

DETAILS OF MAIN COMPONENTS					
Customer Name :	GMDC			**Inspection Date**	24.06.2022
Turbine Coordinates	22.079702,71.436365			**HTSC. No**	
Area Details		**WTG Details**			
Name of District	Amreli	**WTG Make**	INOX	**Capacity**	2MW
Name of Taluk	Babra	**WTG Loc No**	RJPT130	**DOC**	28.09.2016
Name of Village	Kariyana	**Tower Type**	TUBULAR	**SF.No**	17/1 P 2
Sub Station Name	SUKHPUR (220/33kV)	**Tower Details**		**Blade Details**	
Feeder Details	Feeder 06	**Hub Height**	80M	**Rotor Diameter**	93M
EQUIPMENT DETAILS					
EQUIPMENT NAME	**MAKE**	**SERIAL NUMBER**	**EQUIPMENT NAME**	**MAKE**	**SERIAL NUMBER**
NACELLE NUMBER	INOX	N1002MGL100176Y15	HUB NUMBER	INOX	H1002MGL10-017178Y15
GEAR BOX	DHHI	2152185	HUB PANEL	AMSC	NA
GENERATOR	LEROY SOMER	WL15K299B	PITCH MOTOR 1	MOOG	1601029
YAW MOTOR 1	BONFIGLIOLI RIDUTTORI	75964970043	PITCH MOTOR 2	MOOG	1601060
YAW MOTOR 2	BONFIGLIOLI RIDUTTORI	73371100009	PITCH MOTOR 3	MOOG	1601049
YAW MOTOR 3	BONFIGLIOLI RIDUTTORI	76384670004	PITCH DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15028611
YAW MOTOR 4	BONFIGLIOLI RIDUTTORI	76384670005	PITCH DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15029595
YAW DRIVE 1	BONFIGLIOLI RIDUTTORI	IN 15026501	PITCH DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15028842
YAW DRIVE 2	BONFIGLIOLI RIDUTTORI	IN 15026492	BLADE 1	INOX	6190
YAW DRIVE 3	BONFIGLIOLI RIDUTTORI	IN 15026855	BLADE 2	INOX	6188
YAW DRIVE 4	BONFIGLIOLI RIDUTTORI	IN 15023842	BLADE 3	INOX	8140
YAW BRAKE 1	SVENDBORG BRAKES	5-200236444 & 5-200236448	POWER PANEL	AMSC	014-0250257
YAW BRAKE 2	SVENDBORG BRAKES	5-200236443 & 5-200236449	CAPACITOR PANEL 1	AMSC	014-0230233
YAW BRAKE 3	SVENDBORG BRAKES	5-200236450 & 5-200236447	POWER TRANSFORMER	ATS ACCORD	46166-4
YAW BRAKE 4	SVENDBORG BRAKES	5-200236451 & 5-200236445	ROTAR LOCK	SVENDBORG BRAKES	5-100032945
BRAKE UNIT	SVENDBORG BRAKES	5-100032532	VCB	ABB	1VYN03021800947
BRAKE UNIT	SVENDBORG BRAKES	5-100032533	CONTROL & RELAY PANEL	SQURE	DSBL-HD-09-14-644-439
GEAR OIL PUMP	ABB	3GC12500644709001005	ACB	SQURE	BG36102863
SLIPRING	SCHLEIFRING	406639	GREASE PUMP - GENERATOR	LINCOLN	2015261483/3
TOP CONTROL PANEL	AMSC	014-0240227	WINCH MOTOR	CARLSTAHL CRAFTSMAN	CA 2010

Observations:

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
1	USS	No connection found in Yard lighting and completely in rusted condition	As a safety measure, Yard lighting is important to access the tower and BoP during the night	Limited importance to overall yard upkeep by contractor	New light with all accessories to be installed	Low
2	USS	Fully rusted Double pole and fencing arrangements, this indicates no maintenance.	Earthing is essential for the DP structure, and must be a part of routine maintenance practice, included as part of the scope of work in the O&M contract	Improper maintenance, and poor quality of materials used during project initiation	Cleaning and painting to be done on a regular basis to minimize corrosion	Medium
3	USS	WTI and OTI meter found open condition and the panel is full of dust	WTI means winding temperature Indicator and OTI means Oil Temperature Indicator which indicates the winding temperature & oil temperature of the transformer and operates the alarm, trip, and cooler control contacts. If the WTI & OTI is not maintained properly, this will impact in the function of the transformer	Limited importance given to maintenance of WTI and OTI by the contractor	Check the working condition of WTI & OTI meter and procure spares for replacement, if needed	Medium
4	USS	Transformer Breather - Silica gel expired and needs to be changed	The purpose of the breather is to measure the moisture level in the Oil.	Change in color indicates water or moisture contamination in oil	Silica gel to be replaced or breather to be changed	Medium
5	Earthing	**Earthing** 1. Grid earthing found stolen and not connected 2. Earthing in Gear box found improper 3. Nosecone earthing not available 4. Nacelle earthing found improper 5.Isolator earthing found improper	Earthing is meant for the protection & safety of the equipment and grid system. If it is not connected then if surge or over voltage occurs, the entire safety of the system is questioned	Unavailability of grid earthing, ground earthing, and copper earthing cables in nacelle, hub, gearbox, and isolator to be checked with contractor	All the earthing should have to be provided with high importance	High
6	USS	Improper maintenance of C&R panel - no provision for locks, gland holes in open condition	Safety measure for protecting peripheral devices and prevent accumulation of dust in panels affecting performance of components	Improper maintenance practices	Cleaning of the panel is required and the new lock to be provided	Medium
7	USS	Improper maintenance of energy meter, no sealing found in cable pipe	Sealing is essential to minimize transmission losses and ensure accuracy in meter readings	Improper maintenance practices	Energy meter to be cleaned and sealant to be provided	Medium

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
8	USS	Fire bucket with all required provision is not available	Presence of fire bucket is mandatory in the USS yard as per CERC guidelines	Negligence and improper maintenance practices	Fire buckets and associated accessories to be provided in the USS yard as per guidelines	Low
9	Tower	Fire Extinguisher and First aid box not available at WTG	Provision of fire extinguishers and first aid boxes are mandatory as per CERC guidelines	Negligence and improper maintenance practices	Requisite set of accessories to be provided as per guidelines	Low
10	Electrical controls	LVRT bypass	In absence of LVRT, if grid voltage dips, a mismatch is produced between the generated active power and the active power delivered to the grid.	Product failure	LVRT component on panel to be replaced	High
11	Tower	light switch box got damaged tower sections	For O&M activities and people safety	Handling damages	Spares to be replaced	Low
12	Gear Box	Oil leakage in Gear box Drain Valve	Low oil levels and improper lubrication will lead to sub-optimal performance of the gearbox	Gasket or Seal might be damaged	Ensure proper sealing of drain valve	Medium
13	Others	water coolant pressure level low	This will decrease the function of cooling efficiency	Poor Maintenance practices	Immediate service is required	Medium
14	Generator	Generators slip ring not done proper cleaning	as a mandate requirement	Poor Maintenance practices	Need to proper cleaning	Low
15	Tower	Improper bolting of transformer and loose connections	Essential for overall upkeep of the asset	Improper maintenance practices	Need to fix proper hardware's with suitable washers	Low
16	Tower	Tube lights are not in working condition in Tower Section 3&4	High safety risk	Improper maintenance practices	Electrical connections shall be checked, and new set of lights can be provided	Low
17	Tower	Unsafe and improper installation of Nacelle ladder	High safety risk for operators climbing the tower / nacelle	Negligence and improper maintenance practices	Ladder to be installed properly	Medium
18	Tower	Oil spillages found across all the platforms	Potential fire hazard and low oil levels in critical components (e.g., gearbox) can affect overall performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of leakage	Medium
19	Tower	Grease spillages found across all the platforms	Improper grease lubrication of yaw pinions or bearings can lead to high friction and sub-optimal performance	Improper maintenance practices	Cleaning of platforms to ensure safety and identification of source of grease spillage, and refilling / replacement as required	Medium
20	Electrical controls	Control panel lights are not in working condition	Required for routine maintenance and inspection of control panels	Improper maintenance practices	Spares to be replaced	Low

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
21	Gear Box	Accumulation of dust and corrosion of radiator fins	Radiator is essential for dissipating heat from oil cooling system of gearbox and water-cooling system of generator. Corrosion or improper maintenance of radiators will affect performance of the components	Improper cleaning and maintenance practices	To be undertaken as part of scheduled maintenance of WTGs	Medium
22	Rotor	Oil and Grease spillages found across the Hub unit	Oil spillage may be from pitch gear unit and grease spillage from pitch bearing. Lubrication is essential to minimize friction in bearings	Potential failure of breathers in gearbox leading to overheating and overflowing of oil / leakages due to improper maintenance	Cleaning of hub, refilling of oil / grease across all systems	Medium
23	Rotor	Hub lubrication control panel door open	As a safety measure	Poor Maintenance practices	Need to fix it properly	Medium
24	Rotor	Pitch bearing grease passage tube damaged	Lubrication of pitch bearing is essential for smooth operations and minimize friction	Handling damages	Quarterly visual inspection of lubrication unit and immediate replacement as required	Medium
25	Nacelle	Crack found in Top Nacelle cover	Essential for overall upkeep of the asset	Potentially due to high wind speed / force majeure	Detailed inspection required by OEM for further course of action	High
26	Others	winch chain collector not proper location	As a safety measure	Poor Maintenance practices	Need to fix it properly	Medium
27	Others	Improper routing of power cables in wind motor	To avoid cable damages	Improper maintenance practices	Cable routing to be reviewed and corrected	Low
28	Rotor	pitch capacitor control panel without door and closed on the rope	As a safety measure	Poor Maintenance practices	Need to fix it properly	Medium
29	Nacelle	Main frame of generator and gearbox coming in contact with nacelle	Main frame is used to hoist components within the nacelle during maintenance. Contact with nacelle top can potentially damage the structure	Improper installation and maintenance practices	Ensure appropriate installation of main frame	Medium
30	Gear Box	Discoloration of silica gel in gearbox breather	Breathers allow heat to escape and cooling air to enter the system, preventing unnecessary overheating issues.	Overuse of breathers and excess moisture can potentially lead to discoloration	Breathers must be replaced as part of yearly PM activities	Medium
31	Others	Top panel door open condition	As a safety measure	Poor Maintenance practices	Need to fix it properly	Medium
32	Nacelle	Improper maintenance of nacelle windows	Safety measure to avoid accidents during wind and monsoon seasons	Improper maintenance practices	Cleaning of windows during quarterly inspection and replacement if broken	Low

S. No	System	List of Observations	Why it is Important?	Root Cause	Corrective Actions	Potential Risk
33	Others	Corrosion in Nacelle top fabrication parts	Essential to maintain the structural integrity of the turbine	Improper maintenance practices	Painting of corroded parts to be undertaken on a half-yearly basis during PM	Medium
34	All	Improper maintenance and cleanliness of nacelle, hub, tower, etc.	Essential for overall upkeep of the asset	Limited visual inspection and improper implementation of PM practices	Quarterly visual inspection and maintenance of the WTGs as per contractual guidelines	Medium