

17. Entire surface of runner blades should be repaired by welding with at least two layers of weld deposit in leading edges and upper & lower vanes. Three layers of weld deposit in trailing edges of blades must be done on the blades to achieve original thickness. Before laying next layer of weld deposit, burnt carbon layer should be removed thoroughly by using peeling tools and grinding should be done wherever required.
18. **Welding shall be carried out using Mo-309 SS electrodes of D&H make only.** SS electrode to be supplied by sub contractor free of cost. All the materials & consumables required for carrying out this job are to be supplied by sub contractor free of cost.
19. **This job shall be under guarantee period for THREE MONTHS AFTER INSTALLATION AT SITE.** In case of any problem arising in the machine, same shall be attended by sub-contractor free of cost during the guarantee period. Any materials & consumables required during the guarantee period in the above job shall be provided by sub-contractor free of cost. Sub-contractor shall have to mobilize their team at site within 48 hours of the reporting of any fault. In case the runner is required to taken to works all the transportation & insurance charges are to be born by the sub contractor free of cost.
20. **The vendor should have proper machining facility or tie up with machining firm/workshop recognized by BHEL.**
21. BHEL RESERVES THE RIGHT TO DISTRIBUTE THE WORK AMONGST MORE THAN ONE PARTY AT THE LOWEST RATE.
22. The REPAIR work of ONE RUNNER SHALL BE COMPLETED WITHIN FIVE MONTHS OF DATE OF ISSUE OF LOI AND THE SUBSEQUENT RUNNER WITHIN SEVEN MONTHS OF DATE OF ISSUE OF LOI IN CASE OF ORDER ON ONE VENDOR FOR BOTH RUNNERS; OTHERWISE THE COMPLETION TIME SHALL BE FIVE MONTHS FROM THE DATE OF ISSUE OF LOI.
23. THE DECISION OF BHEL SHALL BE FINAL AND BINDING ON ALL THE TENDERERS AND ALSO ON THE SUCCESSFUL BIDDER.

8. Sub-contractor shall execute the machining of components, heat treatment and balancing as required at a well equipped factory shop-floor free of cost.
9. All material required as per the details of the work mentioned above shall be arranged by the sub-contractor at his own cost. All T&P like welding generators, transformer, grinders, cutters, chain pulley block, jacks, pull lift machines, D shackles, heating oven, asbestos cloth, etc. required for completion of the job, shall be arranged by the sub-contractor at his own cost.
10. Extreme care should be taken while using the preservatives or inflammables and all safety rules should be observed while lifting/lowering the heavy equipment/material. All safety rules in respect of handling of equipment of material are also to be observed.
11. All welding electrodes should be properly baked before use as per direction of BHEL engineers and welding sequences should be such that there are no distortions. There should be no distortion in the coupling holes of the runner assembly and if there is any such effect observed, same has to be duly rectified as per requirement.
12. Any parts for repair will be allowed to be taken out from the power house to works of the sub-contractor after furnishing indemnity bond of required amount for safe custody of the part. These parts shall be despatched to power house after proper packing so that the same may not get damaged during transportation. The runner should be insured for transit risk and risk at vendor's workshop during repair/refurbishment for a price of Rs 450.00 Lacs for each runner.
13. All welding work to be dye tested for checking proper welding to check any crack etc. DPT kits (Aerosol spray type) to be arranged by the sub-contractor at no extra cost.
14. The sub-contractor at his own cost as per BHEL advice shall do arrangement of pre heating of the jobs.
15. Tightening of fastener should be done by bolt torque spanner as per directions of BHEL engineers. Torque spanner to be arranged by sub-contractor free of cost.
16. The bidders shall make necessary arrangements for 3<sup>rd</sup> party inspection through either of M/s Llyod, M/s DNV, M/s BVQI or any other BHEL approved agency within the quoted price as per BHEL quality plans. However BHEL/NHPC reserves the right to accept the repaired runner. Any rework due to non-compliance of the norms specified or deviation observed in the inspection by 3<sup>rd</sup> party and BHEL and NHPC shall be borne by the sub-contractor within the quoted price.

**ACTIVITY BREAK UP**

SI No	ACTIVITY	% BREAK UP
1	Reverse engineering for the profile of the Blade to prepare the requisite template.	5
2	Metallographic analysis to ascertain the composition of the blade/ skirt/ crown / labyrinth material	5
3	Arrangement of requisite material & consumables as per specification and requirement for repair / replacement or refurbishment.	20
4	Rectification of cracks by gouging/grinding/NDT/Pre heating/post and weld repairs as per scope given above	20
5	Repair of Labyrinth, water path, crown etc	10
6	NDT& testing	10
7	Machining	10
8	Balancing	10
9	Handling at site and To & fro Transportation including transit insurance and also insurance of the runners at works of vendor and assistance in installation at site.	10
	Total	100

**SPECIAL CONDITIONS OF CONTRACT.**

1. The tenderers should read each and every terms of this special conditions before quoting for the subject job.
2. It shall be in interest of sub-contractor to visit the site before quoting for the work.
3. Any other activity not stipulated above but necessary for complete repair of the runners shall also be treated to be in the above scope of work and have to be done by sub-contractor at no extra cost.
4. All measurements shall be recorded at each stage of repair as per direction of BHEL engineers.
5. Test certificate for the material used shall be vetted by BHEL and NHPC vis-à-vis original specifications. BHEL and NHPC reserves the sole right, based on original specifications or other wise, to accord acceptance for the material failing which the entire order may stand cancelled at the risk and cost of sub-contractor without demur.
6. The facilities of EOT crane along with operator shall be provided to sub-contractor at site free of cost.
7. All consumable required for welding, grinding, cutting, welding, thermal chucks, etc. shall have to be arranged by the sub-contractor at his own cost after BHEL approval.

As per the relevant drawings, the material composition shall be as under.

Sl no.	Component	Material designation	Yield Strength.	Elongation	Impact
1.	Runner	ASTM A743 Cr 6NM	520 N/mm <sup>2</sup>	12 percent	20

EOT Crane facility will be provided by NHPC free of charge.

#### Sampling & Testing Procedure for Electrodes

- (i) At least 12 Nos. of Electrodes samples will be taken out minimum from 5 Nos. of vacuum packed boxes, out of each as received on any day at work place jointly by QA & I representative and contractor's representative.
- (ii) In case, if any , discrepancy additional pieces to be drawn out and matter will be referred to QA & I Department for further instructions in that matter.

#### Quality Assurance Programme

As per BHEL Quality Plans.

#### Inspection and Tests

The tests shall be conducted as per the relevant IS/BS standards comprising of the following:-

1. Inspection of templates.
2. NDT clearance.
3. Welding WPS/PQR clearance.
4. UT clearance.
5. MPI/DPT Clearance.
6. Final dimensional Checks.
7. Static balancing Checks.
8. Clearance & dispatch.

Five copies of test report to be submitted.

**TECHNICAL SPECIFICATION & SCOPE OF WORK FOR REPAIR AND  
REFURBISHMENT OF 115MW FRANCIS RUNNERS OF BHEL-MAKE OF  
SALAL HEP , NHPC.**

**Scope of work**

**A. SYNOPSIS:-**

The brief scope of the above work include complete reclamation (Repair and Refurbishment) of 115MW Francis Turbine Runners-two nos. (36MT each) which includes Mapping of Runner Blades for determination of the erosion/damage, NDT of the Runner including MPI) Magnetic Particle Inspection) testing to ascertain the extent of cracks/undercuts/pitting defects, conducting Metallographic/Microscopic and chemical analysis of the parent material, Methodology for welding and heat treatment, stress relieving , grinding of vital surface of the runner blades to achieve the original profile/contour , NDT and Hardness analysis after repair to preclude any lacuna in the repair, machining, testing, Static balancing , dynamic balancing(Optional),transportation and insurance outside Salal.

Selection of welding electrodes suited for welding of runner assembly based on the comprehensive/intricate testing (NDT-Non-Destructive Testing, MPI-Magnetic Particle Inspection testing, Metallographic study using high resolution equipments etc. ,etc) of the metal piece retrieved from runner.

The runner should be insured for transit risk and risk at vendor's workshop during repair/refurbishment for a price of Rs 450.00 Lacs for each runner.

The vendor shall indemnify BHEL and NHPC jointly and severally towards loss during transit and during repair at their works as per the standard format of Indemnity bond of NHPC. The standard format shall be given to the successful bidders only.

**B. SCOPE:-**

The following is required to be carried out for complete reclamation (Repair and Refurbishment of Runners)

- Reverse engineer for the profile of the Blade to prepare the requisite template.
- The repair should involve amongst other prerequisite welding, grinding to bring to original profile.
- Rectification of cracks by gouging/grinding/NDT/Pre heating/post and weld repairs.
- Repair of internal surface of the skirt by weld deposits, grinding and polishing to achieve near design dimensions.
- Repair the labyrinth by weld deposit/ replacement as the case emerges on detailed inspection at our ancilliary/works.
- Repair of water path surface of crown.
- Build up of skirt and crown to achieve fitting, dimensions of the labyrinths.
- Build up of eroded/damaged blades near skirt.
- Grinding and polishing of water path surfaces.
- Machining of runner as per design dimensions.
- Metallographic analysis to as certain the composition of the blade/ skirt/ crown / labyrinth material.
- Any other related activities to ensure reclamation of the damaged runner to original profile and in working condition as per satisfaction of BHEL and NHPC.
- Assistance in installation at site in the event of any problem faced by NHPC.