

1) 1x800 MW HPGCL Yamunanagar 2) 2x660 MW Koradi & 3) 3x800 MW NLC Talabira.

SCOPE OF WORK
SUMP MODEL STUDIES

1. The scope of work involves conducting Computational Fluid dynamics model studies and Physical sump model studies of the CW sump for 1) 1x800 MW HPGCL Yamunanagar 2) 2x660 MW Koradi & 3) 3x800 MW NLC Talabira.
2. The satisfactory performance of the forebay and CW sump with Concrete volute type Pumps and Vertical turbine type ACW Pump (if applicable) shall first be established through successful CFD analysis and further confirmed through physical sump model study. Final acceptance is subject to the above study and recommendations if any leading to successful outcome.
3. Physical sump model studies involve the construction of a model of the intake system to a scale not lesser than 1:12. The sides and the bottom of the model shall be transparent to enable flow visualization. It would be necessary to view the model from beneath the sump floor.
4. Study of flow conditions in the intake channel from cooling tower, forebay and pump chambers for different water levels and combinations of pump operation is to be done. Flows into forebay channel, emanating from re-circulation lines, make-up lines etc. shall also be considered for modeling.
5. No. of CW Pumps & ACW Pumps for different projects along with their duty and rated flow is mentioned below. Tender Pump house GA is attached as Attachment-1 for all these three projects. The flows through all pumps are to be suitably simulated. Studies to be conducted for all the combinations of CW Pumps. Variations in water levels shall also be considered.

SNo.	Project	No. of CW Pumps	Rated Flow (m ³ /hr)	No. of ACW Pumps	Rated Flow (m ³ /hr)	Tender drawing No.
1	1x800MW Yamunanagar	3 (2 per unit + 1 standby)	39,500	2 (1 per unit + 1 standby)	4600	PE-DG-510-165-W004
2	2x660MW Koradi	5 (2 per unit + 1 common standby)	40,800	1 (ACW fill pump for 2 units)	4000	PE-DG-527-165-W004
3	3x800MW Talabira	6 (2 per unit + no common standby)	36,700	Nil	--	PE-DG-511-165-W004

6. The Draft tube, suction Bellmouth and pump column pipe shall be modelled as per BHEL drawings from transparent acrylic material. Intake screens, Stop Log Gates and other similar devices in the intake structure are also to be modelled as per drawings supplied by BHEL after placement of order.
7. The model shall be studied to ascertain the absence of surface and sub-surface vortices.

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8. Current meters shall be used for recording velocities in the intake channel, forebay and the pump chambers. A Vortimeter shall be located in the bell mouth at the Impeller level, to measure swirl angle.
9. The swirl angle shall be limited to plus or minus 5 degrees under normal (Froude) operating condition.
10. Studies (CFD and Physical sump model tests) shall be conducted for:
 - a) Normal Froude condition
 - b) Two times Froude condition
 - c) Equal velocity criterionEnd customer specification is attached for reference as Attachment-2.
11. Particular attention is to be paid to prevent mass circulation of water in the sump, so as to prevent the pump bell mouth / column pipe from being subjected to unbalanced forces.
12. After order placement, a detailed procedure/methodology of testing of the Sump model for various pump combinations, test layout, details of instruments used for testing shall be submitted to BHEL/Hyderabad. The test shall be conducted in accordance with HIS/BHRA standards. However additional tests shall be done by the Vendor at no extra cost, if found necessary during the course of testing. It is the Vendor's responsibility to determine the worst operating case/worst combination of pumps.
13. The model studies, with modifications proposed and recommended appurtenances in position, shall be witnessed by BHEL, Customer and Consultants of the customer. Comments of the customer shall be incorporated by the Vendor and the model shall be re-run if necessary.
14. The report should graphically represent velocity profiles. Photographs of important events are to be enclosed.
15. Detailed drawings shall be submitted to BHEL by the Vendor for the appurtenances recommended and modifications proposed to ensure good flow conditions in the intake system.
16. The Vendor shall prepare a video CD spanning the complete course of the model studies. This (CD) shall be submitted to BHEL. The video CD shall have a suitable audio commentary explaining the sequence of events.
17. **The time for completion of the above scope of work, including submission of Final Report is 10 weeks from the date of order placement or the date of forwarding approved Sump model studies procedure, whichever is later.**
18. Notwithstanding what may be contained in the Vendor's offer, all clauses listed above shall be held valid unless a written deviation is taken by the vendor.