15.9.4 Pump can be started only when either at least one of the flow circuits through the respective condenser to the discharge pipe and cooling tower is established or re- circulation line to pump sump is open.

15.9.5 An interlock shall prevent the starting of pump unless bearing lubricating water flow and motor bearing cooling water flow has been established over a period of time. Low flow of either pump or motor bearing cooling water when the pump is running will give alarm(s) and trip the pump with alarm in case of sustained low value over a preset time.

15.9.6 In case of high pressure at pump discharge due to accidental closure of any of the butterfly valves in the CW system, an alarm shall be generated.

15.9.7 In case of normal stopping, when a pump control switch is turned 'OFF', the butterfly valve at its discharge first closes 25-30% before the respective pump motor is de- energized.

15.9.8 On tripping of motor due to any reason, the butterfly valve at the discharge shall close fully automatically.

15.9.9 If water level in pump sump is low, an alarm shall be initiated. Pump shall be tripped in case of very low level of water in the intake sumps and very high discharge header pressure.

15.9.10 Bidder shall provide Duplex temperature elements for bearing & simplex elements for winding temperature monitoring points. Pump shall be tripped from very high winding temperature of motor and very high metal temperature of thrust bearings. Alarm shall be provided for high motor winding temperature and high motor/ pump bearing temperature.

15.9.11 The operation philosophy as detailed above is suggestive only and bidder shall furnish the complete control and interlock scheme for System equipment proposed by him along-with the bid. The control and interlock scheme to be adopted shall be finalised in consultation with the successful bidder after award of contract and shall be subject to Employer's approval.

15.9.12 For detailed specification on instrumentation and control, refer Volume – V.

15.10 VARIOUS STUDIES FOR CW SYSTEM

A) HYDRAULIC TRANSIENT ANALYSIS

For complete CW system, Bidder shall carry out a detailed hydraulic transient analysis study by method of characteristics using a computer programme. Bidder shall decide the following based on the hydraulic transient analysis for entire CW System:

a) Pump discharge valve closing sequence and rate of closure for pump stopping and pump tripping conditions, which shall be incorporated in control system in unit control room.

b) Size, location and quantity of air release valves in the discharge pipe and CW piping.

c) Pump discharge valve opening sequence and rate of opening during pump start-up condition.

Further, study should also consider stopping/ tripping of a working CW pump and starting as an event for analysis of the system.

The report for transient analysis should consist of methodology adopted, characteristic curves/ data for various boundary conditions, complete input data used for execution of software for various events and the complete data and shall be submitted to the Employer approval.

Complete input data, methodology adopted and the results of the programme shall be submitted for approval during detailed engineering. Based on the recommendations of such a study, Bidder shall take corrective measures and provided suitable surge suppression devices in the complete CW System.

B) MODEL TEST OF CW PUMPS

a) For the offered pump, bidder should have carried out the model test. Bidder shall furnish the above test results along with the tender. The model test should have been conducted as per Japanese standard JIS-B-8327 (latest version) and specific speed of the model tested should lie within ± 5% of the specific speed of the pump offered.

b) If the bidder has not conducted such a model test for the offered pump, bidder shall conduct the test as per the procedure given below at no extra cost to the Employer.

c) A homologous model of the CW pump shall be tested at manufacturer's works in the presence of Employer's representative to predict the performance of the prototype. Model test shall include the cavitation test & Net Positive Suction Head Required (NPSHR) test. In general these tests shall be conducted as per Japanese standard JIS-B8327 (latest version).

d) The model pump head should be the same as the head of the prototype pump, and should be run at such a speed that the specific speed is the same as that of the prototype.

e) The model ratio and the procedure to be followed for model test shall be mutually discussed and agreed before conducting the test.

f) Contractor shall submit a procedure for ensuring & demonstrating the similarity of the impeller vane profile/volute profile for the model pump & the prototype.

g) All the relevant dimensions of the diffuser and impeller including clearances and profile shall be measured for model pump and prototype pump and control should be exercised to ensure repeatability of these parameters on all subsequent pumps.

C) Sump Model study

Bidder shall carry out a sump model study at a recognized Institute / Hydraulic research laboratory. Scale of the model shall be minimum 1:12. The hydraulic model study shall be conducted to study flow conditions in approach CW channel, forebay, pump bays, draft tubes for different discharges and different depths of water, different combinations of pump operations and to study velocity distribution in approach channel, forebay area, pump bays, draft tube etc. The model shall be based on Froude's law of similitude and shall be tested for following two more flow conditions, viz.

(a) At twice the prototype maximum Froude number, i.e., the Froude number of the model is two times that of the prototype.

(b) At equal velocity criterion, i.e., the velocity is same both in the model and prototype.

(c) Report of the model study incorporating the recommendations shall be submitted for Employer's approval and final copies of the same shall be submitted to the Employer. The model study shall be carried out in advance, to avoid any delay in the release of construction drawings of pumphouse, forebay and CW channel. Employer shall be intimated in advance to witness the model test.

15.11 PERFORMANCE GUARANTEE TESTS

After the manufacture, all the CW pumps shall be performance tested at the manufacturer's works to determine the power consumption and the head capacity characteristic in the presence of Employer's representative as per requirements of BS:9137, standards of the Hydraulic Institute, USA or equivalent. Performance test at design duty point shall be done keeping minimum submergence of the pump identical to that specified for the site conditions. Bidder shall submit the test procedure for Employer's approval.

Contractor shall submit details of the proposed test facilities available for testing the pumps for OWNER's approval. The details must include the capacity, head, maximum motor rating, voltage level, sanctioned load and permissible starting current.

It may be noted that during the performance tests, no negative tolerance shall be permitted on head, capacity and the pump efficiency.

Calibration of instruments to be used in the test shall be carried out by an independent agency. Calibration of instruments should be carried out prior to test. The calibration certificate of the instruments should be valid for the period of test. The following laboratories are acceptable for calibration of various instruments:

a) Indian Institute of Technology Mumbai / Chennai / Delhi / Kanpur.
b) Institute for design of electrical measuring instruments (IDEMI) Bombay.
c) Electronic Research & Testing laboratory (ERTL), New Delhi.
d) National Physical Laboratory (NPL), New Delhi.
e) National Test House (NTH).
f) Any other equivalent Government Institute / laboratory to be approved by OWNER.

For carrying out performance test at shop, actual motor shall be used. The test result will be evaluated at actual speed achieved and speed correction shall be made only if there is a supply frequency variation with respect to 50 Hz.

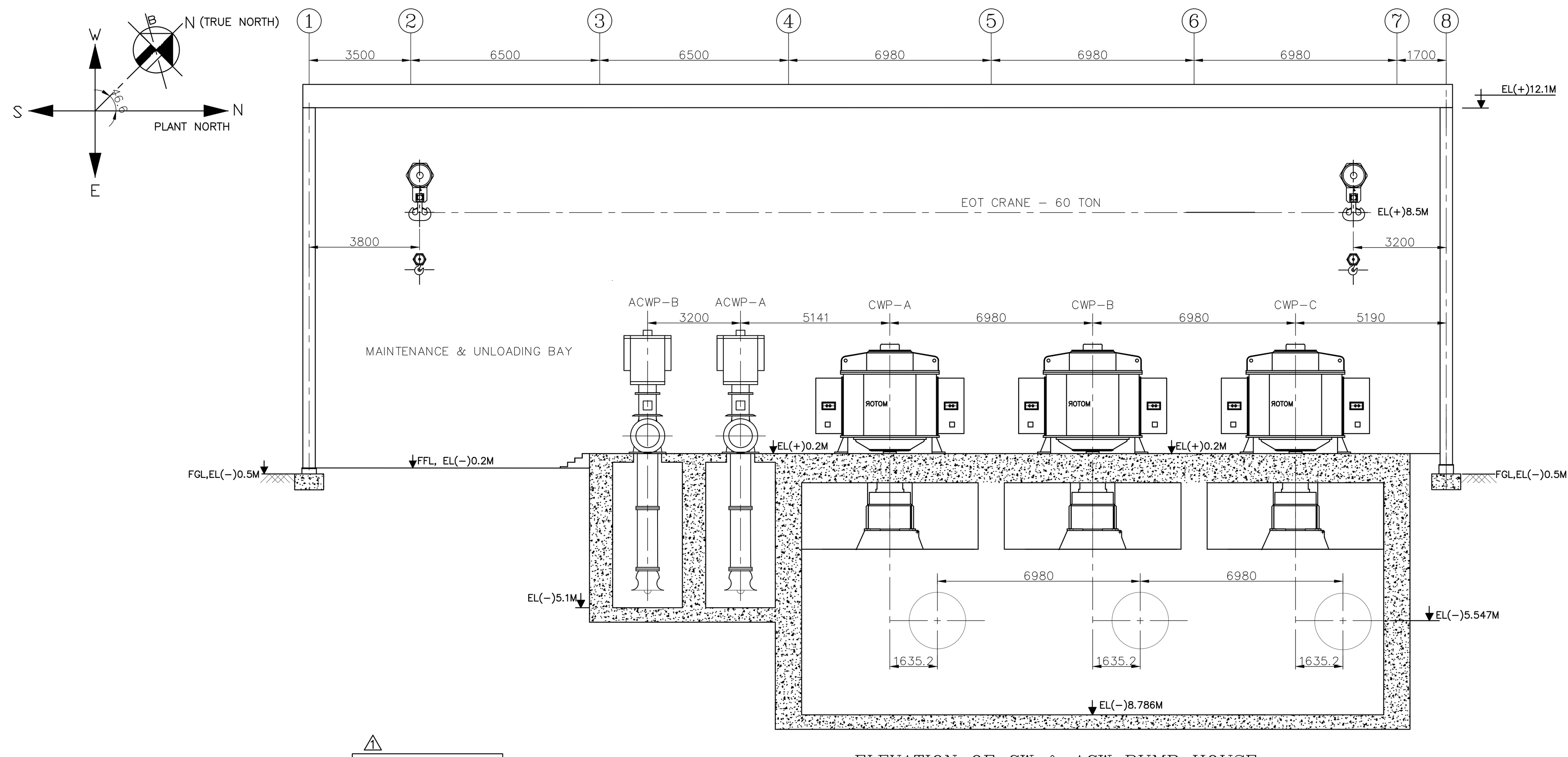
Shop test shall also include measurement of vibration, noise level and bearing temperature rise for reference.

Strip down examination shall be carried out to check visually mechanical damages after performance test.

FIRST ANGLE PRJECTION

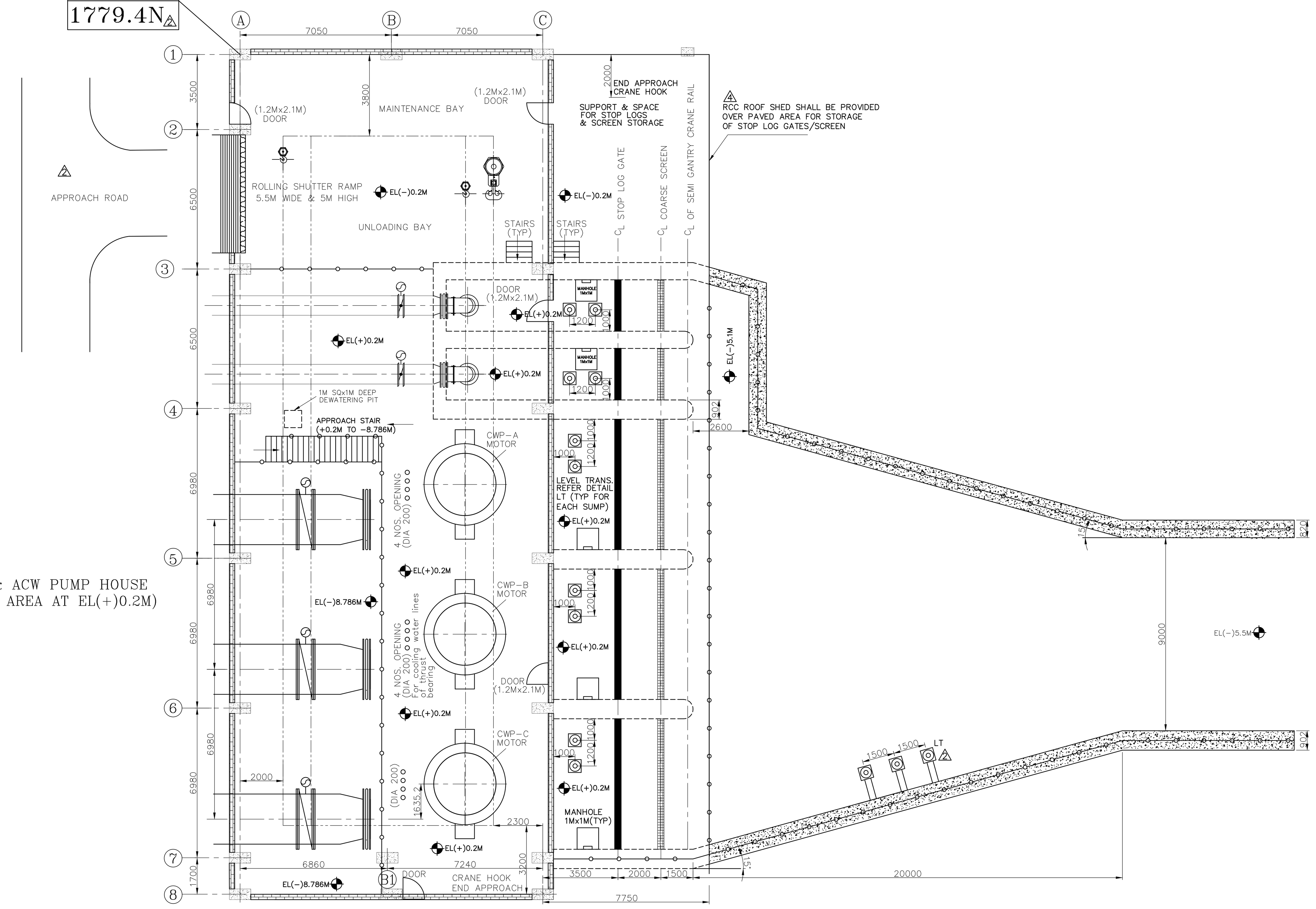
ALL DIMENSIONS ARE IN MM

DRAWING NO. PE-DG-510-165-W004

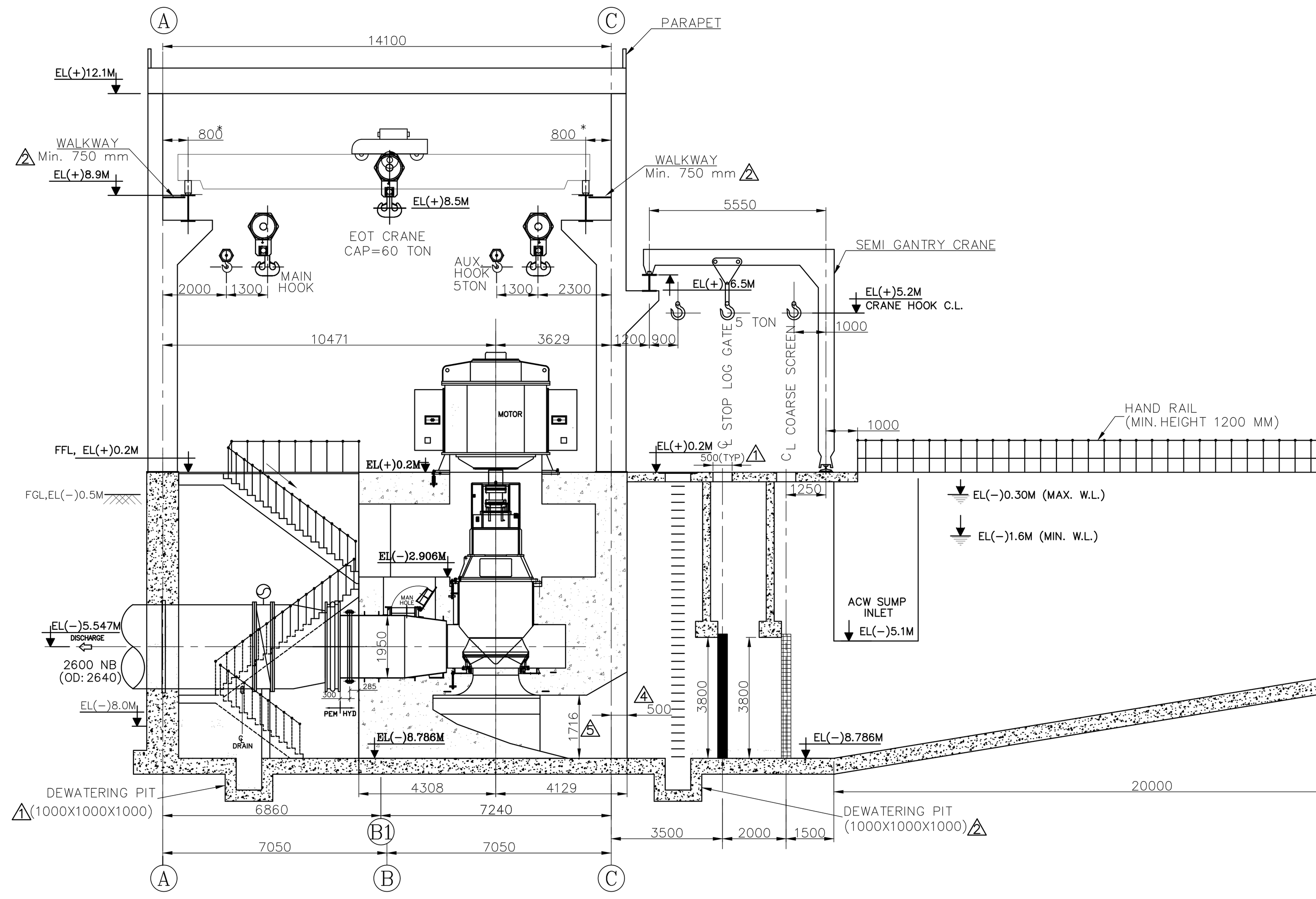


ELEVATION OF CW & ACW PUMP HOUSE

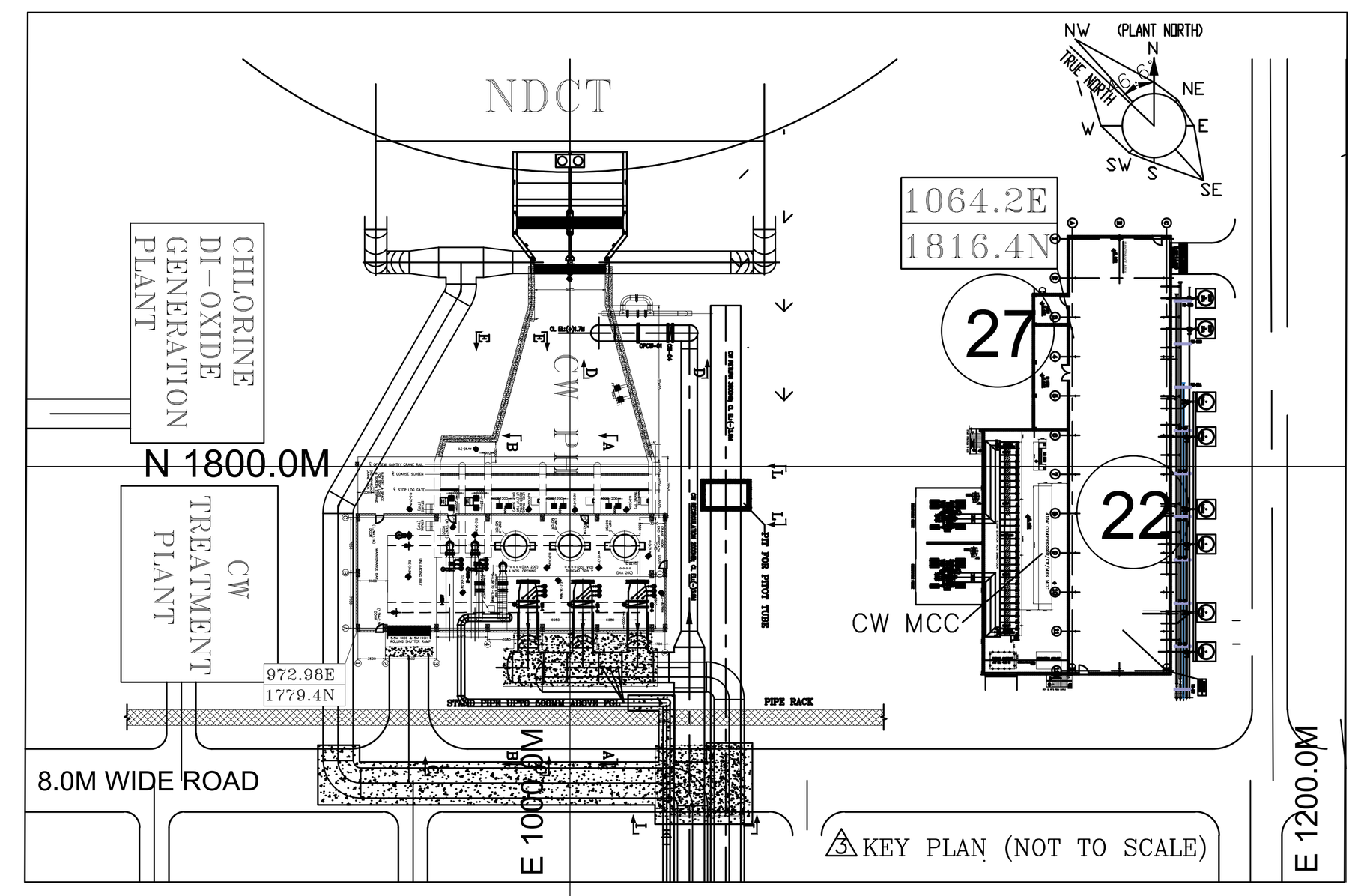
972.98E
1779.4N

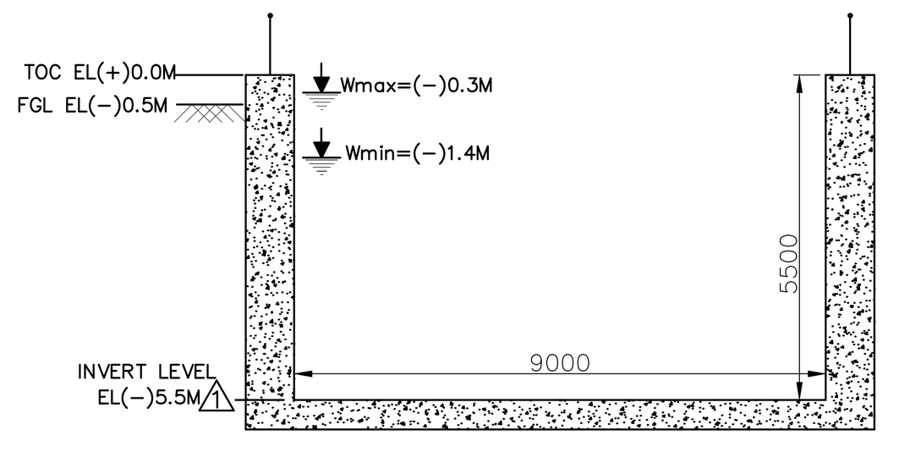


PLAN OF CW & ACW PUMP HOUSE
(CW MOTOR FLOOR AREA AT EL(+)0.2M)

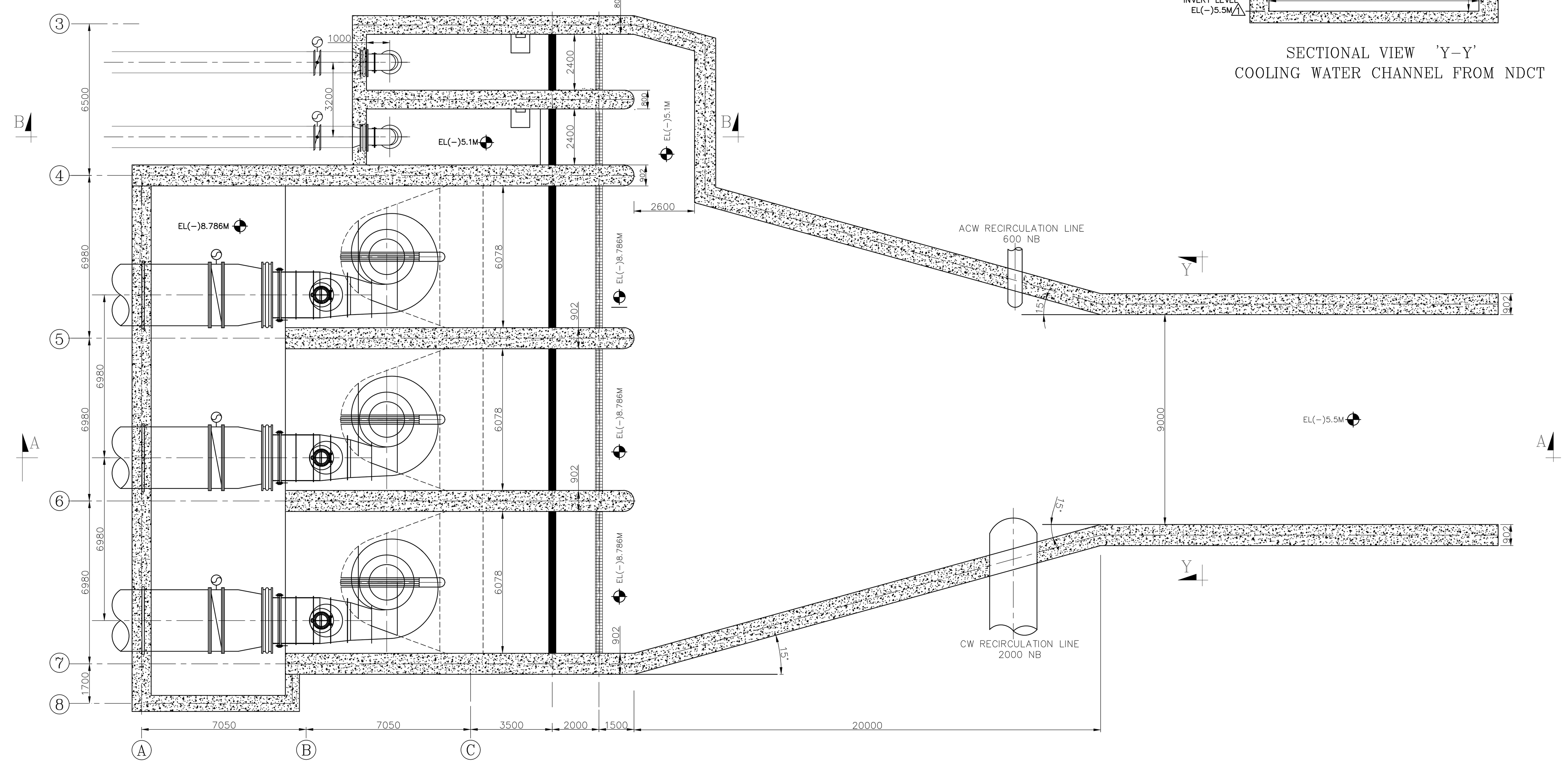


SECTIONAL VIEW 'A-A'
CW PUMPS

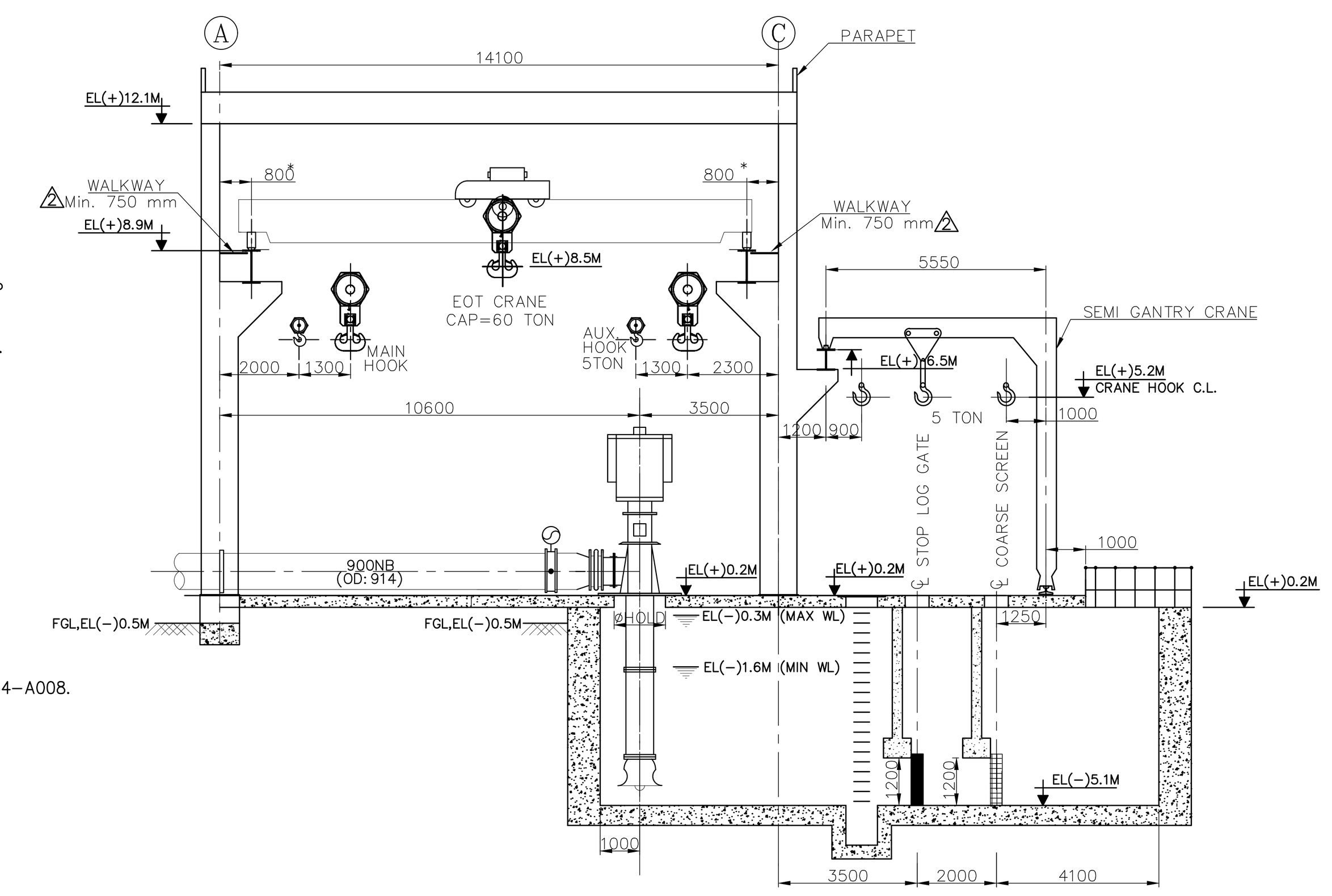




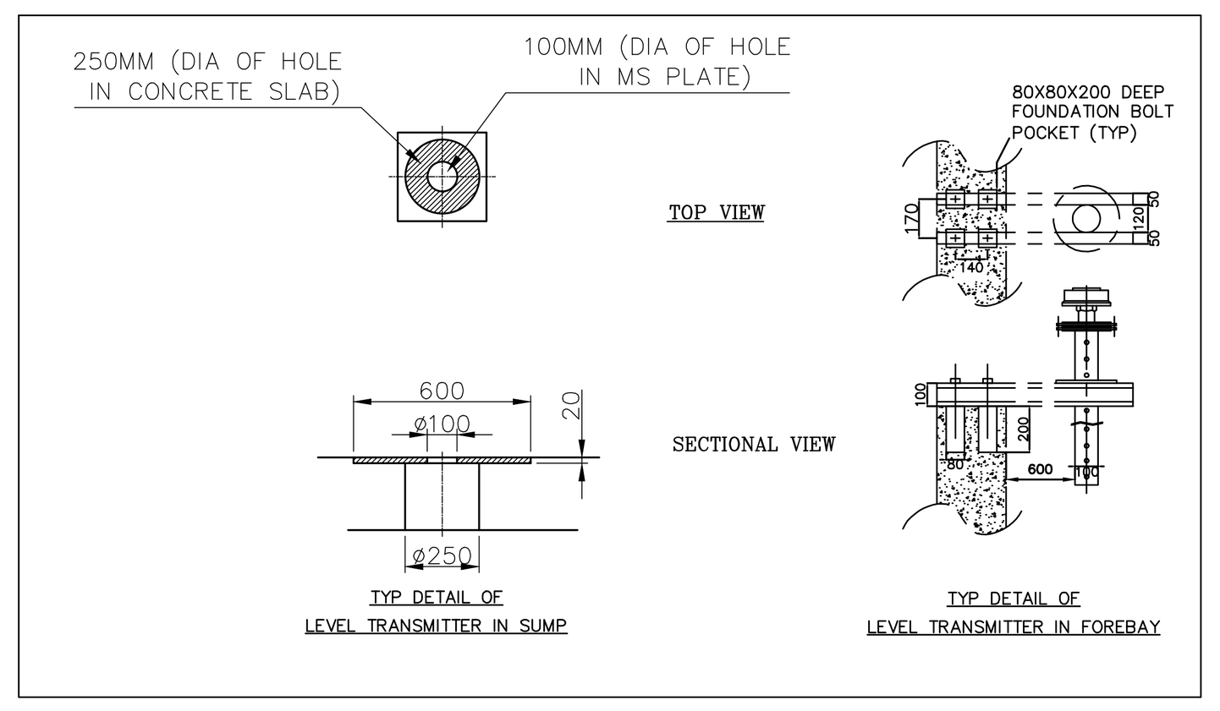
SECTIONAL VIEW 'Y-Y'
COOLING WATER CHANNEL FROM NDCT



PLAN OF CW & ACW PUMP HOUSE (CW PUMP FLOOR AREA AT EL(-)2.906M)



SECTIONAL VIEW 'B-B'
ACW PUMPS



LEVEL TRANSMITTER DETAIL LT

Released for manufacture / fabrication / construction duly approved under Category B vide HPGCL Memo. No. Ch-159/CE/P/M-II/DCRTPP/U-3/12 dated 25.09.2025 subject to incorporation of comments / remarks, if any as mentioned therein. The approval / comments on this drawing / document neither relieves M/s BHEL of its sole contractual obligations in carrying out the design & engineering works correctly and fulfilling the complete requirement of contract nor does it limit the HPGCL's right under the contract.

SE/Projects (Mech.)

Chief Engineer/Projects HPGCL, Panchkula

NOTES :

1. ALL DIMENSIONS ARE IN MM UNLESS STATED OTHERWISE. EL. 0.0M CORRESPONDS TO RL 270.5M WHICH IS FFL OF MAIN POWER HOUSE BUILDING.
2. STOP LOG GATES: TOTAL QUANTIY 2 NOS. (VIZ. 1 NOS. FOR CW SUMP & 1 NOS. FOR ACW SUMP). MATERIAL OF CONSTRUCTION STRUCTURAL STEEL IS 2062, PAINTING & OTHER DETAILS AS PER MECHANICAL GA OF STOP LOG GATES DRAWING. ⚠1
3. COARSE SCREEN: TOTAL QUANTIY 5 NOS. (VIZ. 3 NOS. FOR CW SUMP & 2 NOS. FOR ACW SUMP). MATERIAL OF CONSTRUCTION- STRUCTURAL STEEL IS 2062. SCREEN MESS OPENING/WIRE DIAMETER SHALL BE 20 MM SQUARE WITH 6 MM WIRE DIAMETER. PAINTING & OTHER DETAILS AS PER CIVIL DRAWING.
4. ACCESS TO ROOF SHALL BE PROVIDED BY CAGE LADDER. MS CAGE LADDER IN LINE WITH CONTRACT, VOL-VI, Ch-11, Cl. 11.9.
5. 1 NO. PORTABLE STOOL CUM LADDER SHALL BE PROVIDED FOR ACCESS TO TOP BEARING OF MOTOR
   1 NO. PORTABLE STOOL CUM LADDER SHALL BE PROVIDED FOR ACCESS TO PUMP DISCHARGE VALVE ACTUATOR
6. TREAD OF CONCRETE STAIRCASE SHALL BE MINIMUM 250 MM.
7. STOP LOG GATE HEIGHT SHALL BE DESIGNED FOR SUMP OPENING HEIGHT VIZ 3800 MM. FOR CW SUMP & 1200 MM FOR ACW SUMP
8. COARSE SCREEN HEIGHT SHALL BE DESIGNED FOR SUMP OPENING HEIGHT VIZ 3800 MM. FOR CW SUMP & 1200 MM FOR ACW SUMP
9. SEMI GANTRY CRANE SHALL BE COMMON FOR CW & ACW SUMP, FOR HANDLING OF GATES / COARSE SCREENS.
10. ALL ELEVATION ARE REFERRED TO POWER HOUSE GROUND FLOOR EL(+) 0.00M, WHICH CORRESPOIND TO RL(+) 270.5M ABOVE MSL.
11. "*" CLEAR SPACE FROM FACE OF COLUMN
12. THE SUPERSTRUCTURE OF THE BUILDING SHALL HAVE RCC/STEEL FRAMING AS PER DETAILING ENGINEERING BY CIVIL
13. REFERENCE ENGINEERING DRAWINGS:
   A) P&ID OF CW & ACW SYSTEM: PE-DG-510-165-W001
   B) CW EQUIPMENT SIZING CALCULATION :PE-DC-510-165-W003
   C) GA & FOUNDATION DETAILS FOR CONCRETE VOLUTE TYPE CWP: HY-DG-11820057106. ⚠3
   D) PLOT PLAN, DRG NO: PE-DG-510-100-M001.
   E) DESIGN MEMORANDUM OF DOUBLE GIRDER EOT CRANE : PE-DC-510-501-A001.
   F) GAD OF ACW PUMP, DRG NO: PE-V7-510-100-W002.
   G) LAYOUT OF CW PIPING (B/W A-ROW TO PUMP HOUSE/COOLING TOWER), DRG NO: PE-DG-510-165-M001.
   H) GA OF SINGLE GIRDER CRANE WITH CT DSL ARRANGEMENT OF SG CRANE, DRG NO: PE-V0-510-524-A003.

⚠2 14. LOCATION OF VENTILATION FAN SHALL BE UPDATED AFTER FINALIZATION OF VENTILATION FAN SCHEDULE, DRG NO: ⚠3 PE-V0-510-554-A008.
⚠2 15. SUMP MODEL STUDY SHALL BE CONDUCTED IN LINE WITH THE CONTRACT SPECIFICATION. THE RECOMMENDATIONS OF THE REPORT, IF ANY, SHALL BE INCORPORATED IN THE DRAWING.
⚠2 16. CFD ANALYSIS AND SUMP MODEL STUDY TO BE CARRIED OUT BY BHEL-HYD AS PER CONTRACT REQUIREMENT.
⚠5 17. IT IS CONFIRMED THAT SOLAR PANELS ARE NOT BEING INSTALLED ON CWPH ROOF TOP.

REV.	DATE	ALTD	CHD	APPD
5	16.09.25	GC	RN	JP
1.	DRAWING REVISED BASED ON RESOLUTION DURING MEETING B/W BHEL, HPGCL & DESEIN AT BHEL-PEM NOIDA ON DTD 12.09.2025.			
2.	NO CHANGE IN DRG, W.R.T. REV-4 EXCEPT NOTE NO. 17 ADDED.			
REV.	DATE	ALTD	CHD	APPD
4	08.09.25	GC	RN	JP
1.	DRAWING REVISED BASED ON HPGCL COMMENTS REF. MEMO NO: Ch-135/CE/P/M-II/DCRTPP/U-3/12, DTD 22.08.2025.			
2.	NO CHANGE IN DRG, W.R.T. REV-3 EXCEPT RCC ROOF SHED INSTEAD OF ROOF SHED.			

REV.	DATE	ALTD	CHD	APPD
3	29.07.25	GC	RN	SB
1.	DRAWING REVISED BASED ON RESOLUTION INLINE WITH TELEPHONIC DISCUSSION B/W HPGCL/BHEL/DCPL DTD 24.07.25 AND HPGCL COMMENTS REF. MEMO NO: Ch-118/CE/P/M-II/DCRTPP/U-3/12, DTD 25.07.2025.			
REV.	DATE	ALTD	CHD	APPD
2	02.07.25	GC	RN	SB
1.	DRAWING REVISED BASED ON RESOLUTION DTD 20.06.25 BETWEEN HPGCL/BHEL/DESEIN/DCPL AT PEM NOIDA AGAINST HPGCL COMMENTS REF. MEMO NO: Ch-100/CE/P/M-II/DCRTPP/U-3/12, DTD 12.06.2025.			
	510			
STATUS	CONTRACT			
DISTRIBUTION				
REV.	DATE	ALTD	CHD	APPD
1	19.05.25	GC	RN	SB
1.	DRAWING REVISED BASED ON HPGCL COMMENTS REF. MEMO NO: Ch-75/CE/P/M-II/DCRTPP/U-3/12 DTD 06.05.2025.			
2.	CHANGES DONE ARE MARKED WITH REV. SIGN.			

PROJECT: 1X800 MW ULTRA SUPER CRITICAL EXPANSION UNIT, DEEN BANDHU CHHOTU RAM THERMAL POWER PLANT, YAMUNA NAGAR

OWNER: HARYANA POWER GENERATION CORPORATION LTD.

OWNER'S CONSULTANT: DESEIN PRIVATE LIMITED CONSULTING ENGINEERS, NEW DELHI

OWNER'S REVIEW CONSULTANT: DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS, KOLKATA

EPC CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD, NEW DELHI

BHEL UNIT: BHARAT HEAVY ELECTRICALS LTD, POWER SECTOR PROJECT ENGINEERING MANAGEMENT,NOIDA

DEPT CODE		NAME	SIGN	DATE
W	DRN	GC	-sd-	04.04.2025
	DESN	GC	-sd-	04.04.2025
	CHD	RN	-sd-	04.04.2025
	APPD	SB	-sd-	04.04.2025

TITLE:- VKY

MECHANICAL GA OF CW & ACW PUMP HOUSE

DEPT. SIGN | SCALE

DRAWING NO. PE-DG-510-165-W004

SHEET 1 OF 1 REV.-05

SIZE-A0

MSE FILE NAME:

4.02.00 All the equipments shall be protected against external corrosion by providing suitable painting. The steel surfaces to be supplied with painting shall be thoroughly cleaned before applying painting by brushing, shot blasting etc. Galvanized surfaces shall not be applied with any painting

4.03.00 Minimum design requirements are specified herein.

4.04.00 **CW & ACW System**

4.04.01 The Condenser Cooling Water System shall be designed to meet the cooling water requirement of steam turbine condensers.

4.04.02 The Circulating Water Pumps shall be sized majorly to meet the cooling water requirement of steam turbine condenser.

4.04.03 The rated discharge of each CW pump shall be adequate to meet half of the total cooling water requirement for condensers of one unit and various plant auxiliary coolers/heat exchangers, when the plant is operating at its full rated capacity.

4.04.04 The required cooling water flow for the CW system shall be worked out by the Bidder considering the maximum possible thermal load condition encountered in condenser and CW temperature rise. The design CW flow shall be computed by the bidder considering a minimum of 5% margin over maximum CW flow, as computed out above and shall be substantiated by the Bidder after conducting optimization studies.

4.04.05 The design flow rate of ACW is the maximum flow rate required in all PHEs (of DMCW system) and other auxiliary coolers (if any).

4.04.06 Capacity of ACW pump shall be fixed by taking 10% (minimum) margin on design ACW flow.

4.04.07 The system shall be closed circuit re-circulating type with Induced Draught Cooling Tower (by others). The hot water return from Condenser shall be cooled in the cooling tower.

4.04.08 The system shall be designed to operate at 5 cycles of concentration (CoC).

4.04.09 The minimum level of water for CW and ACW (Start-up) pumps shall be guided by the minimum submergence level required by the respective pumps and shall be obtained and informed by the Bidder. The highest level of water in the CW pump house shall be such as to ensure around 500 mm clearance below the soffit of the lowest floor of the pump house. The dimensions of each respective sump shall be selected in such a manner that under all operating circumstances the net positive suction head available shall be sufficiently greater than the net positive suction head required, for each pump.

4.04.10 The piping sizing shall be calculated considering the design flow and velocity within 2 to 2.5 m/sec. The velocity of water at any point in the CW & ACW system should not exceed 3.0 and 2.5 m/sec respectively.

4.04.11 Friction loss in pipes shall be calculated as per Hazen Williams formula.

4.04.12 C value of 100 shall be considered for pipe friction loss calculation. However, actual C-value of pipe shall be more than 120.

4.04.13 Pressure drop in valves and fittings shall be based on resistance coefficient from Crane Handbook.

4.04.14 The delivery head of the pump shall be selected suitably considering -

i) Static head from minimum water level in CW sump to Cooling tower hot water riser pipe flange, on top of CT.

ii) Pressure drop in condenser

iii) Pressure drop in COLTCS

iv) Flow element pressure drop (If any)

v) Frictional drop in the pipes, pipe fittings, valve etc with 10% margin

4.04.15 The CW pipes shall be designed for full internal vacuum.

4.04.16 Then pumps and equipment shall be designed for the tertiary treated sewage water as specified, (Ref. – Vol.-II, Section-1).

4.04.17 All interconnecting piping and equipment handling CW/ACW shall be designed to withstand a pressure not less than the shut off head of CW/ACW pump respectively.

4.04.18 *CW Studies*

i) CW Sump Model Studies

a) The design of intake, Fore-bay, sump for CW system shall be based on BHRA/HIS. Computer model study for pump and Physical hydraulic model studies for the CW channel, fore-bay and pump sump shall be conducted to achieve streamlined flow for the Pumps.

b) Physical model study shall include all the pumps of CW sump.

ii) CW Transient Analysis

a) The hydraulic transient analysis shall be carried out for complete CW system by method of characteristics for various possible starts/ stop/ trip eventualities of CW pumps to avoid pressure surges/ vacuum in the system.

b) Based on the transient analysis study, suitable remedial features shall be incorporated in the CW system design.

4.04.19 *CW Pumps – General Selection and Design Criteria*

i) The pump shall be directly driven by a constant speed squirrel cage induction motor coupled with suitable coupling and shall be designed for 25 years of life to withstand the seismic loads as specified elsewhere in specification.

ii) The system resistance curves shall be provided to indicate the approximate system resistance for each Unit.

iii) Range of operation of pumps shall be so selected that it can accommodate the following modes of operation at maximum water level in sump (Run- out Condition) and as well as at minimum water level in sump.

a) One pump in operation with one unit in service

b) Two pumps in operation with 1 unit in service

c) Three pumps in operation for two units in service.

iv) The predicted performance for various operating conditions specified above shall also be furnished by superimposing the system resistance curves (both at minimum water level and maximum water level conditions) over the characteristics curves of the pump. It shall be confirmed that the NPSH and submergence requirements are satisfied, and pump shall be capable of sustained running in a trouble-free manner at any water level between minimum and maximum.

4.05.00 **Concrete Volute pump for CW system**

4.05.01 The pumps shall be designed to meet the specified duty conditioned.

4.05.02 Major components of Concrete Volute pump consist of the concrete elements, the embedded parts and the “pull-out” or removable parts.

4.05.03 The design construction and speed of the pumps shall be such as to minimise cavitation and ensure a long and trouble free service. The suction “specific speed required” i.e. specific speed calculated with NPSH required, shall not exceed 12,000 (US units).

4.05.04 The system suction specific speed (i.e. specific speed calculated with NPSH available) shall not be greater than 8500 US units at minimum water level. Pump speed shall be based on the above suction specific speed available. “NPSH required shall be less than NPSH available during all operating conditions including run-out condition.

4.05.05 The pumps shall have stable head capacity characteristic continuously rising towards shut-off conditions. Characteristics of the maximum and minimum diameter impellers, which may be fitted to the volute, shall be indicated by the bidder.

4.05.06 The design shall ensure equal load sharing among the pumps operating in parallel. All pumps shall be identical having identical characteristic curves and shall be capable of running in parallel continuously without restrictions.

4.05.07 Necessary speed switches to detect reverse rotation shall be provided to prevent motor switching on while rotating in reverse direction. The indication shall also be provided for this purpose.

4.05.08 The shaft/rotor shall be designed such that the complete pump and motor assembly satisfies the following – The operating speed shall not be too close to the first critical speed, i.e. N should be less than 0.8NC1 or N should be more than 1.3NC1. Where N is the operating speed & NC1 1st critical speed.

4.05.09 Critical speed of pump motor assembly shall be more than the maximum reverse run away speed.

4.05.10 Material of construction of the pump and accessories shall be such as to resist corrosion/erosion/cavitation and give a long and satisfactory life to the plant, taking in to account the operating conditions, including water quality. MOC selected for various components shall be superior or equivalent to that specified.

4.05.11 *Concrete elements*

i) For concrete volute type design, the suction draft tube and pump volute casing shall be of cast in situ concrete construction. The draft tube and volute construction with prefabricated concrete elements are also permissible.

ii) Metallic volute type design, the volute and the draft tube can either be cast steel/cast iron or fabricated carbon steel construction as per the standard practice of OEM can also be considered. The metallic draft tube shall be embedded on concrete.

iii) The suction duct is integrated into the civil engineering work of the pumping station. Suction duct should be minimized head loss to achieve the overall high pumping efficiency and almost uniform velocity distribution at the impeller inlet to limit the secondary cavitation effects, noise, vibration and loss of efficiency. The suction duct shall be low level designed as shallow as possible to limit the groundwork volume.

iv) The volute should be the double curvature volute to yields optimum efficiency. Below the volute, the suction bell is connected to a pre-formed intake suction box.

v) All are prefabricated /cast in situ concrete elements.

vi) Inside of cast elements must have a smooth and event shape and good surface finish and high degree of water tightness and shall be constructed according to following specifications

Reinforcement steel	Fe-415 conforming to IS 1786
Concrete quality	M25/30 confirming to IS 456
Cement	As specified in civil specifications
Concrete cover	Minimum 50mm inner side and minimum 25mm outside
Wall thickness	According to structural calculation. Minimum 125mm

vii) The outside of prefabricated elements shall be rough in order to get a good grip with the surrounding concrete work.

viii) In case square volute, transition piece should be provided for connecting the pump discharge line.

ix) A manhole (1000mm dia.), with steel cover plate at discharge side, accessible from the operating floor should be provided to permits impeller inspection without removal of the pump unit.

x) Following parts must form an integral part of the prefabricate elements:

a) Cast iron trays of anchor bolts at suction side with steel anchors for suction wear ring.

b) One steel foundation ring on discharge side for fixing the discharge wear ring.

xi) Curves in more than two planes should be avoided in the development of the volute and inlet, with the exception of short radius blending fillets.

xii) Final finishing of the surface of the draft tube and volute shall be carried out by the bidder with mortar to meet the surface finish as required by the OEM and Glass flake based coating similar to as specified for piping.

4.05.12 *Embedded mechanical parts*

i) Suction side designed part sealed in the concrete will be to secure the sealing ring at the pump inlet and upper designed part sealed in the concrete will be to accommodate the bottom of the casing cover.

4.05.13 *Removable parts*

i) Impeller

a) Impeller should be semi open/closed type and material will be Austenitic Stainless Steel.

ii) Shaft

a) Shaft shall be designed to transmit the maximum rated power at the pump operating speed and shall be of ample stiffness to minimise deflection during starting conditions or any abnormal operating condition.

b) The shaft shall preferably have all components key driven.

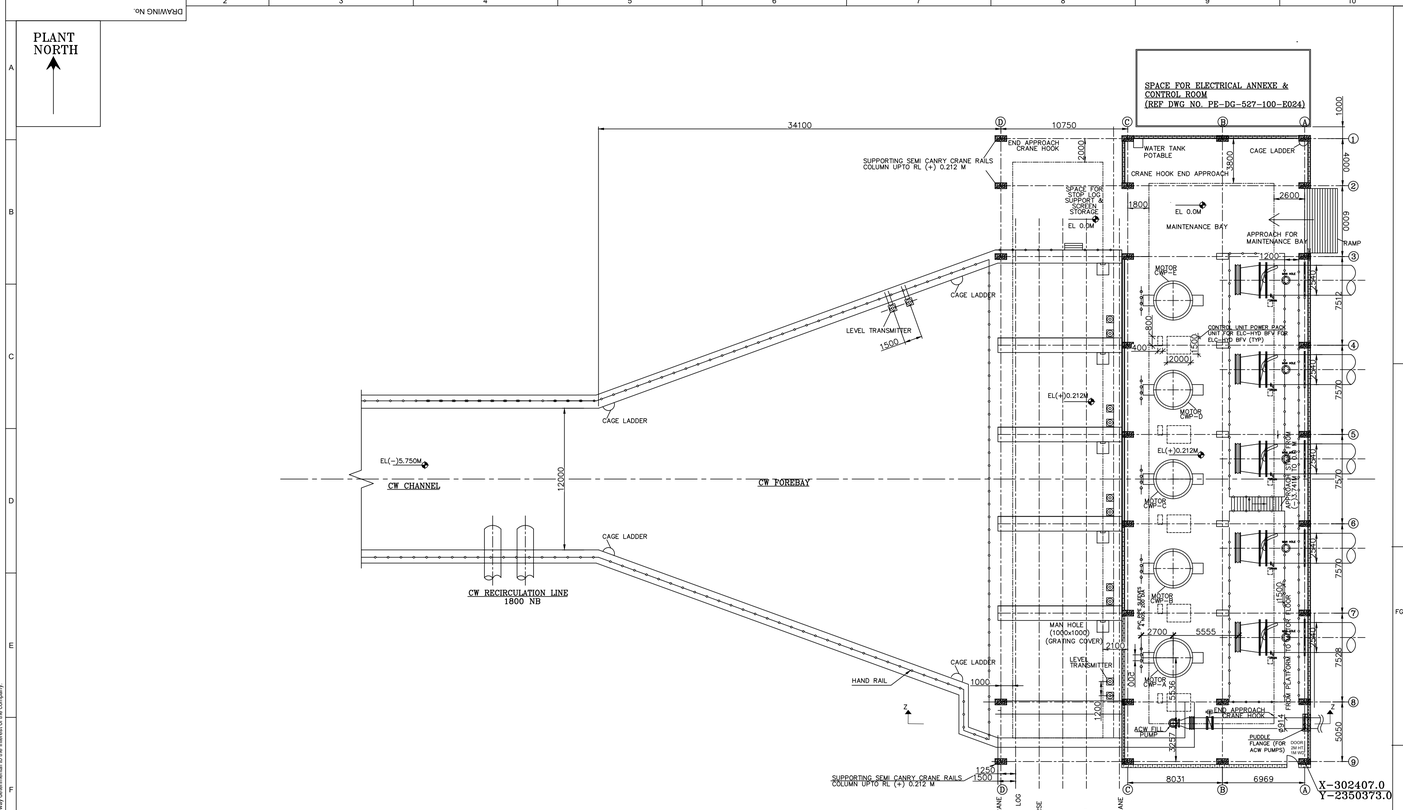
c) Shaft should be never in direct contact with the pumped water, most corrosion or abrasion problems, and maximizing reliability and availability.

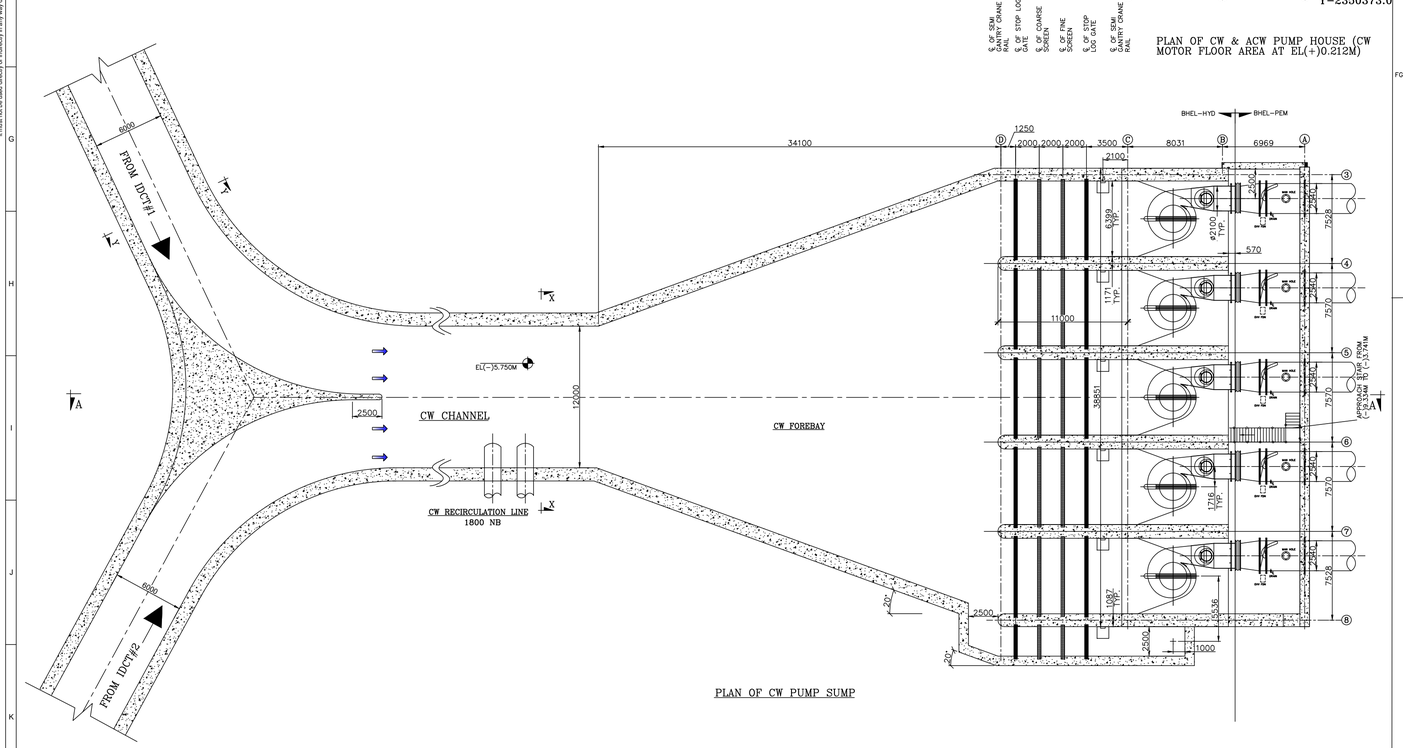
d) Removable/replaceable shaft sleeves should be provided.

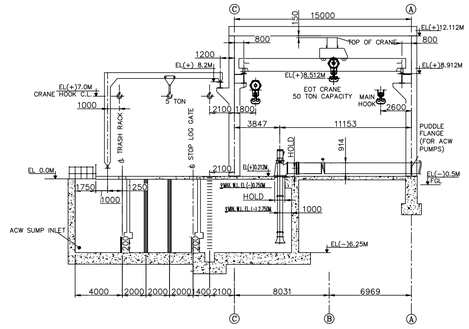
iii) Lubrication system

DRAWING NO.

PLANT NORTH

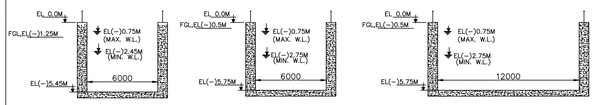


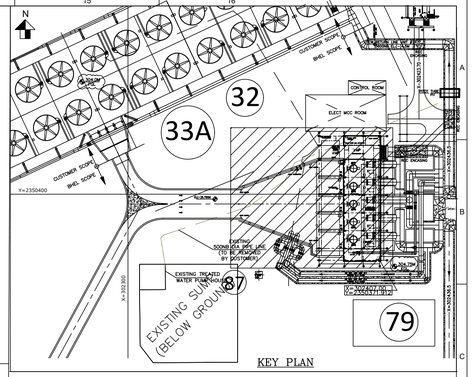




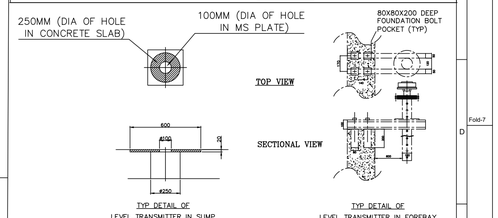
ACWP SECTIONAL VIEW -'Z-Z'

NOTES
1. ALL DIMENSIONS IN MM UNLESS STATED OTHERWISE.
2. STOP LOG GATES: TOTAL QUANTITY 3 NOS.(2 NOS. FOR CW SUMP + 1 NO. OF ACW PUMP) MATERIAL OF CONSTRUCTION STRUCTURAL STEEL IS 2062, PAINTING & OTHER DETAILS AS PER CIVIL DRAWING.
3. COARSE & FINE SCREEN: TOTAL QUANTITY 6 NOS (5 NOS CW SUMP & 1 NOS FOR ACW SUMP) MATERIAL OF CONSTRUCTION- STRUCTURAL STEEL IS 2062
4. APPROACH LADDER & PLATFORM ARRANGEMENT FOR PUMP & MOTOR SHALL BE PROVIDED AS PER GA DRAWING OF CW PUMP.
5. 1 NO SEMI GANTRY CRANE OF 5 TON CAPACITY SHALL BE PROVIDED FOR HANDLING OF GATES /COARSE SCREENS.
6. ALL ELEVATION ARE REFERRED TO POWER HOUSE FINISHED FLOOR EL(+) 0.00M, WHICH CORRESPOND TO FFL 305.25M ABOVE MSL.
7. THE SUPERSTRUCTURE OF THE BUILDING SHALL BE RCC TO CARRY THE EOT CRANE.
8. REFERENCE DRAWINGS/DOCUMENTS : CW EQUIPMENT SIZING CALCULATION (PE-DC-527-165-W003) P&ID – CW & ACW SYSTEM (PE-DG-527-165-W001) GENERAL ARRANGEMENT & FOUNDATION DETAILS OF CONCRETE VOLUTE TYPE CWP+MOTOR (HY-DG-CVP-GA-KORADI) ELECTRICAL EQUIPMENT & CABLING LAYOUT IN CW PUMP HOUSE AREA (PE-DG-527-100-E024)

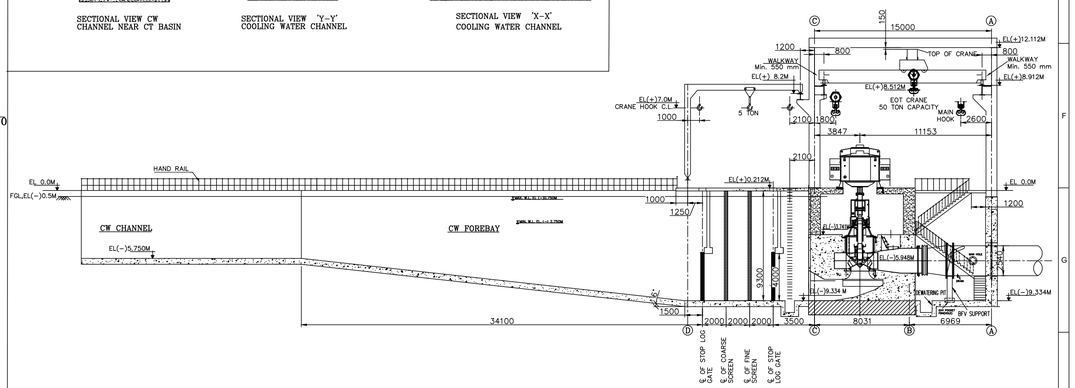




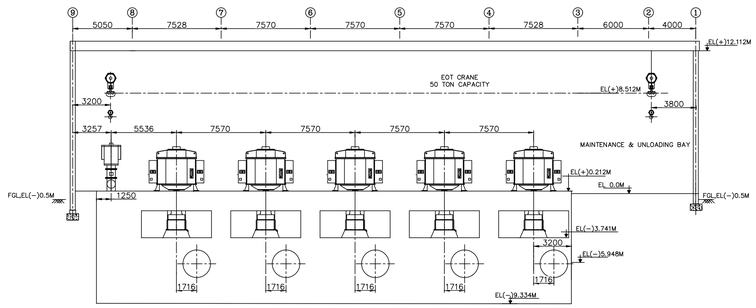
KEY PLAN



LEVEL TRANSMITTER DETAIL LT



SECTIONAL VIEW 'A-A'



ELEVATION OF CW PUMP HOUSE

APPROVED WITH COMMENTS
2
Proceed with fabrication / manufacture / construction considering comments (refer Comment Resolution Sheet) and resubmit for approval and stamping.
steag energy services
Kindly note that approval of the drawing / documents does not absolve the contractor / vendor from its contractual obligations

Digitally signed by Sudeep M Shekhar
Date: 2026.02.10 14:30:44 +05'30'

CUSTOMER	MAHAGENCO	MAHARASHTRA STATE POWER GENERATION CO. LTD. KORADI THERMAL POWER STATION 2x660 MW UNITS –11&12 PROJECT
CONSULTANT	steag energy services	STEAG ENERGY SERVICES (INDIA) PVT. LTD.

JOB NO. 527
STATUS CONTRACT
DISTRIBUTION

BHARAT HEAVY ELECTRICALS LTD
NTPC ETPC/POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA (U.P.)

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD

DEPT CODE		NAME	SIGN	DATE
W	DRN	VM		28.01.2026
	DESN	VM		28.01.2026
	CHD	NG,RN		28.01.2026
	APPD	JP		28.01.2026

TITLE
MECHANICAL GA OF CW PUMP HOUSE

DEPT. | SCALE 1:180 | DRAWING NO. PE-DG-527-165-W004
SIGN | SHEET 1 OF 1 | REV. 00

SIZE-A0

COMPUTER FILE NAME:

- The electrical controls for the valve such as relays, contactors and fuses will be housed in the common control panel (local) for CW pumps or in a separate panel.

- Each butterfly valve will have four limit switches, each capable of being set at any point between full open to full close position to meet desired functions. In addition, one more extra limit switch to be set at an intermediate position will be provided. Each limit switch will have 2 NO + 2 NC contacts. Limit switch enclosure will conform to NEMA 4x standard.

- Each butterfly valve will have two (2) nos. non-contact type 24 V DC 4-20 mA output position transmitters.

b) The CW pump house forebay shall be a common facility and shall be sized to receive water from cold water basins of the cooling towers. The angle of inclination of the side walls of this forebay with the direction of water flow shall not exceed 9 degrees under any circumstances.

b) Each individual sump in the CW Pump house shall be designed in accordance with the recommendations specified in Hydraulic Institute / British Hydraulic Research Association/ equivalent international standard and its dimensions shall be finally selected based on the approved reports of physical sump model tests.

d) Each CW pump shall be located in a separate and single sump.

e) The invert level of the sumps for CW pump shall be guided by the minimum submergence level required by the respective pumps with a margin of 500 mm and shall be obtained and informed by the Bidder. The dimensions of each respective sump shall be selected in such a manner that under all operating conditions the net positive suction head available shall be greater than the net positive suction head required, for each pump. Please refer cl. no. 4.05.00 of Section-III of this volume in this regard.

f) Bidder shall carry out both CFD and sump model study as per HIS for CW pump as well as pump sump up to forebay by qualified agencies as mentioned elsewhere in the specification. In addition to this, Bidder shall also carry out CFD analysis for entire CW channel from cooling tower basin to CW pump sump also. CFD shall be done to analyse the hydraulic condition of the sump and to arrive at any requirement for rectification. The conclusion of CFD will be taken for consideration to verify the sump condition in the physical model study as the physical model study will only be considered for the acceptance criteria.

Transient analysis for entire CW piping system shall be carried out by Bidder through a qualified agency as given elsewhere in the specification. Air release valves of suitable capacity and quantity will be provided as per transient analysis recommendation.

Model study will be conducted either by the successful contractor at their premises or in the premises of a reputed institution. Successful contractor will submit a list of projects for which minimum five (5) model studies have been conducted by them or a list of institutions wherein the model study can be conducted which will be approved by the Owner/Consultant.

g) Adequate provision shall be made in each of the pump sump so as to facilitate insertion of isolation gates. Gates shall be fabricated from mild steel, shall be water tight type and shall preferably be of identical size/dimensions to facilitate interchangeability. Suitable balancing valve shall be provided in the Stop log gate which shall be operated from operating floor level of these stop log gates. Sump gates and screens shall be accessible by a semi gantry crane located outside the pump house. Lifting beam for handling stop log gates and coarse screens shall also be provided with guide shoes for easy operation in the guide channels provided for stop log gates/coarse screens.

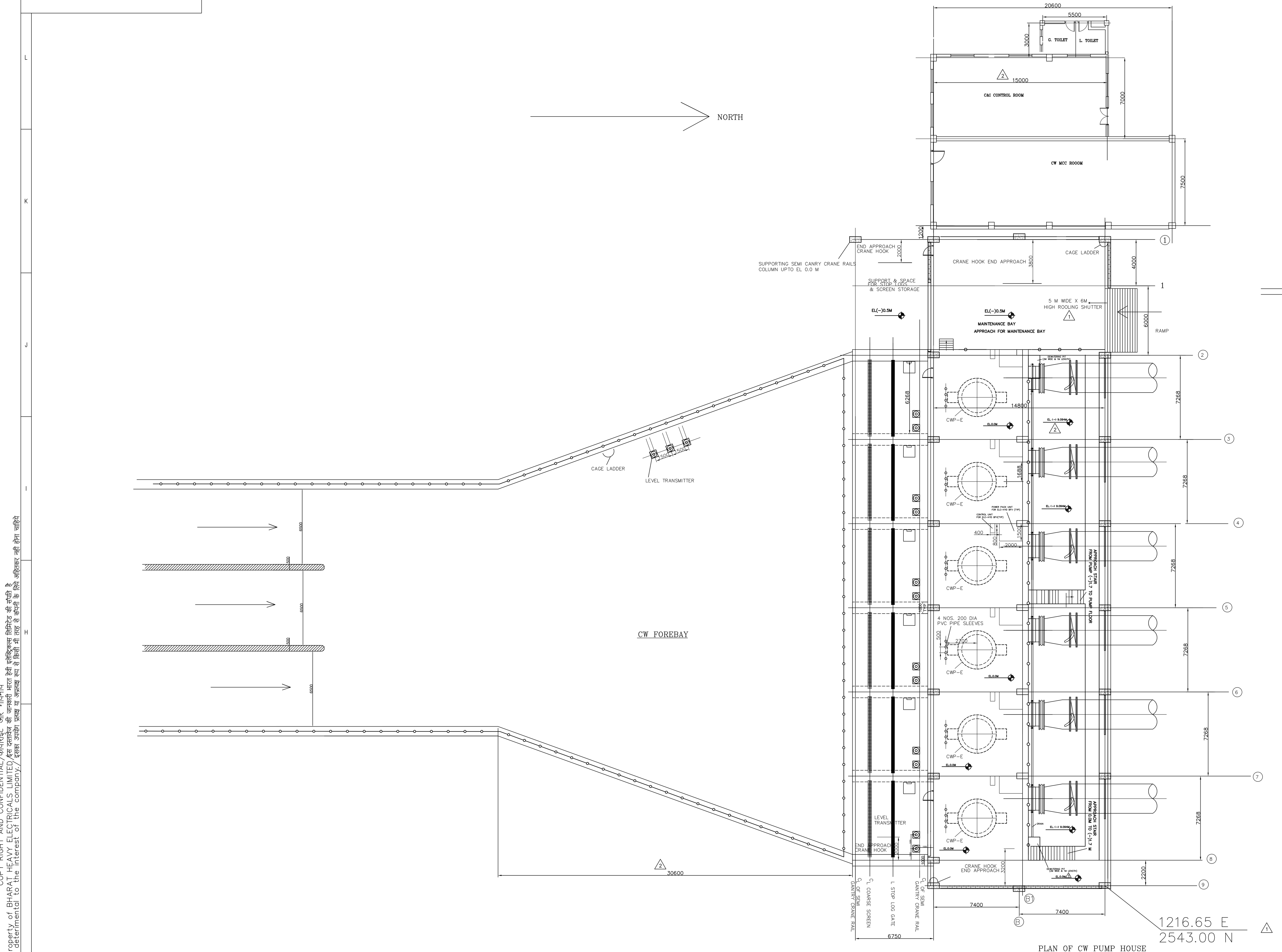
h) Tapping from CW make-up line feeding to CW fore bay shall be provided for empty CW pipe filling during commissioning.

i) Necessary above ground piping on pedestal supports with all valves and pipe fittings. One number CW re-circulation line for each unit, suitable for handling a flow of 50% of one CW pump flow with electrically operated butterfly valve (with actuator) and after interconnecting the line from other units, then the pipe header size shall be designed to handle100% pump flow with flow restricting orifice plate.

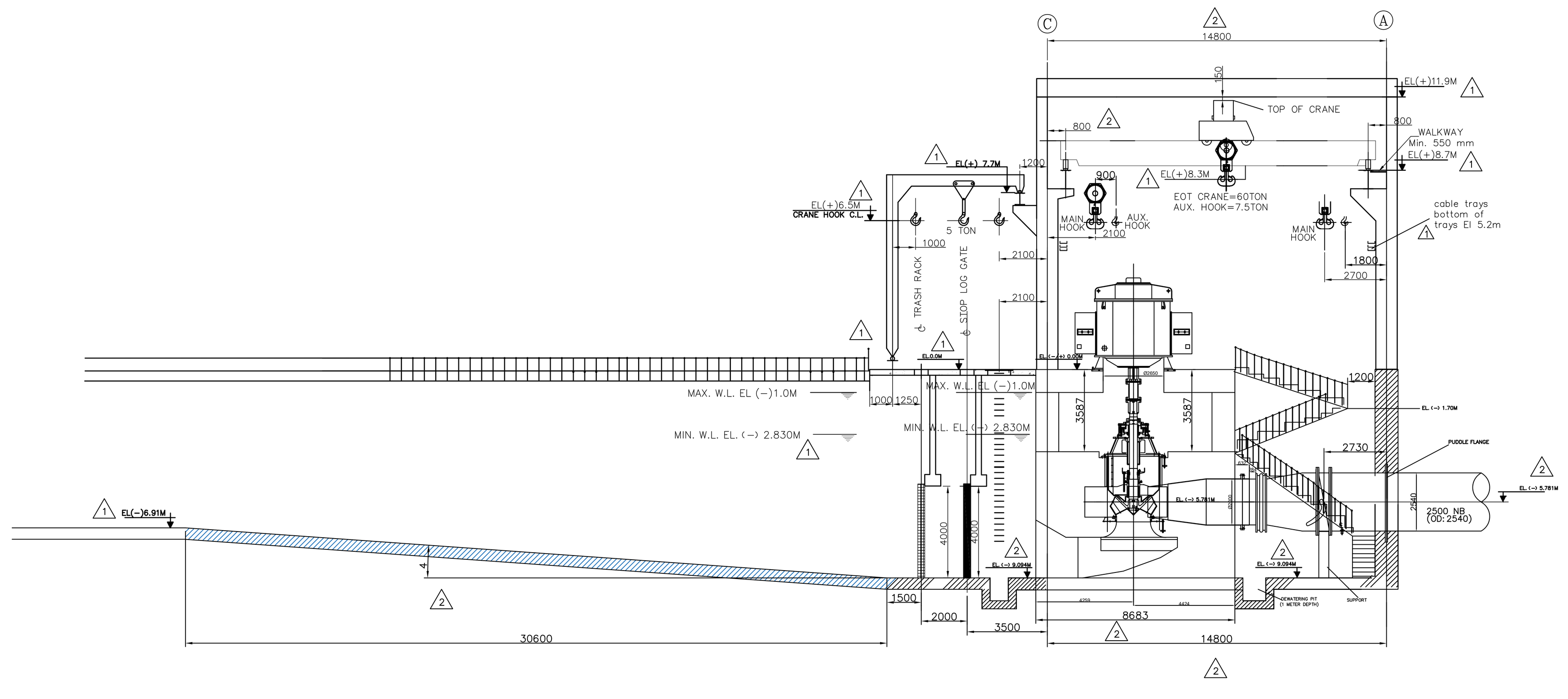
j) RCC box culvert shall be provided for each road/rail crossing for buried CW pipes. During laying of CW pipe necessary sand bedding shall be provided as specified in Clause no 6.00.00 of Volume-II-D2, Section I of this specification.

k) External surfaces of underground pipes shall be suitably wrapped and coated as per IS-10221.In addition to this, cathodic protection to be considered as applicable for the prevailing soil resistivity and as per Lead Specification-Volume-II-A. Provision of cathodic protection for the entire CW piping as per applicable IS standard shall be provided by the Bidder.

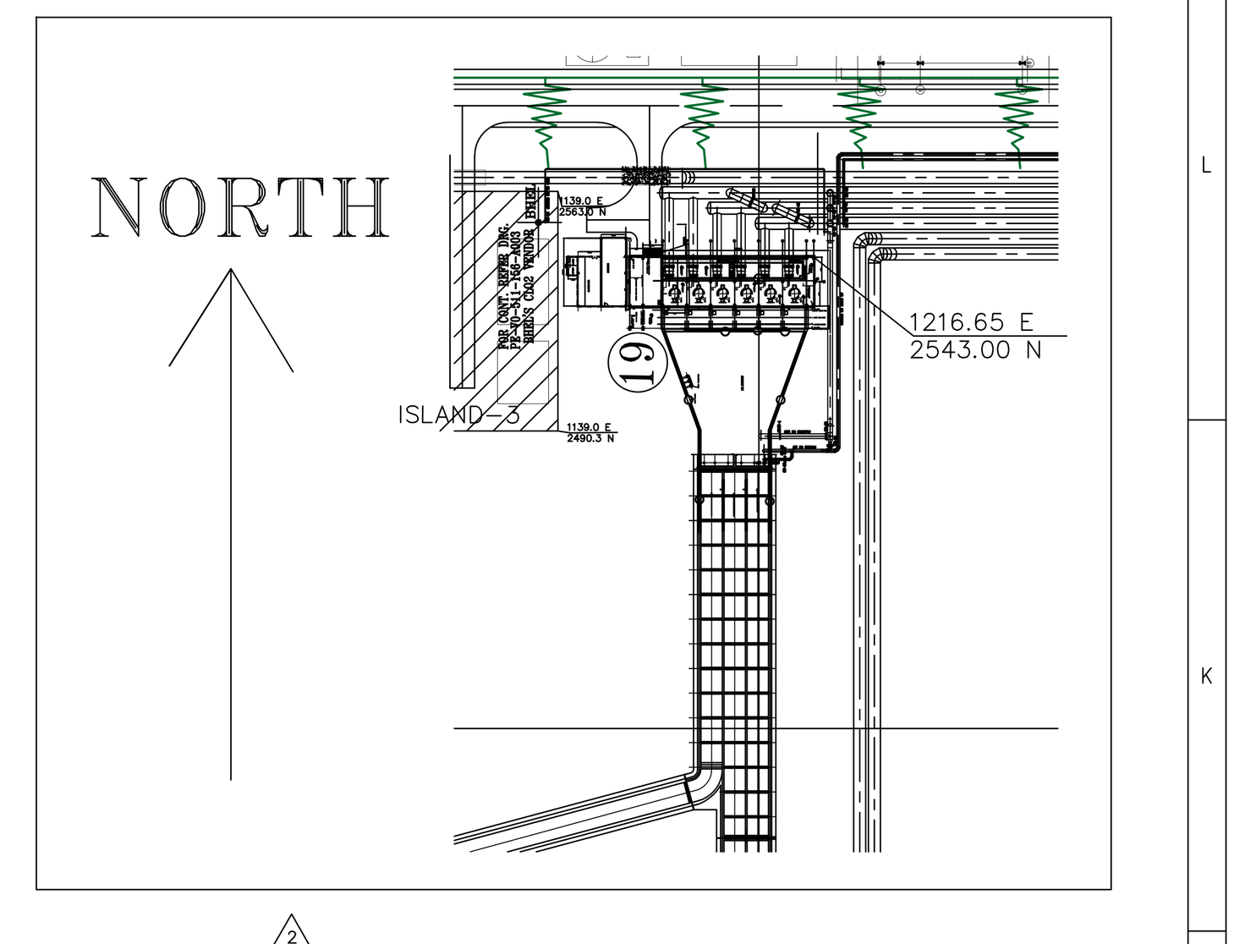
l) In addition to the CW Pump along with their auxiliaries, the CW pump house shall also accommodate the following equipment/facilities:



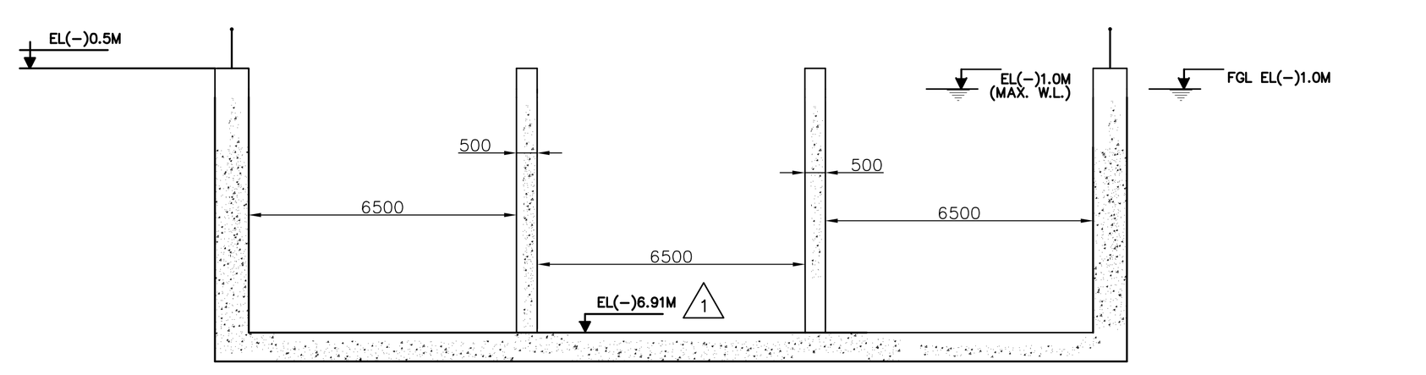
PLAN OF CW PUMP HOUSE
(CW MOTOR FLOOR AREA AT EL 0.0 M)



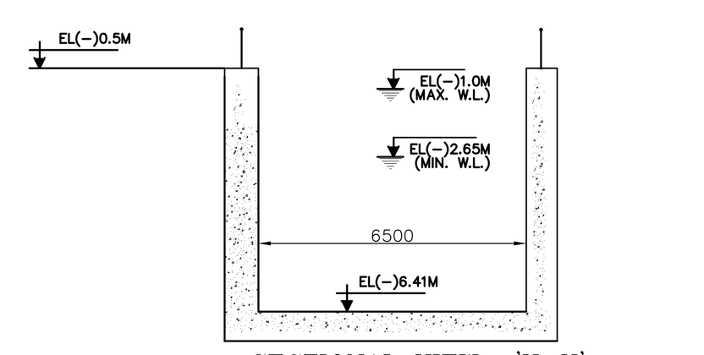
SECTIONAL VIEW 'A-A'



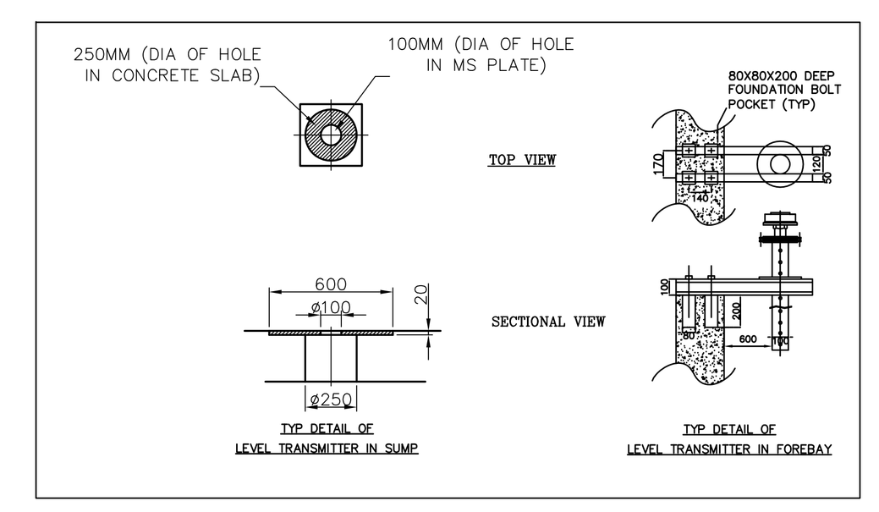
KEY PLAN (NOT TO SCALE)



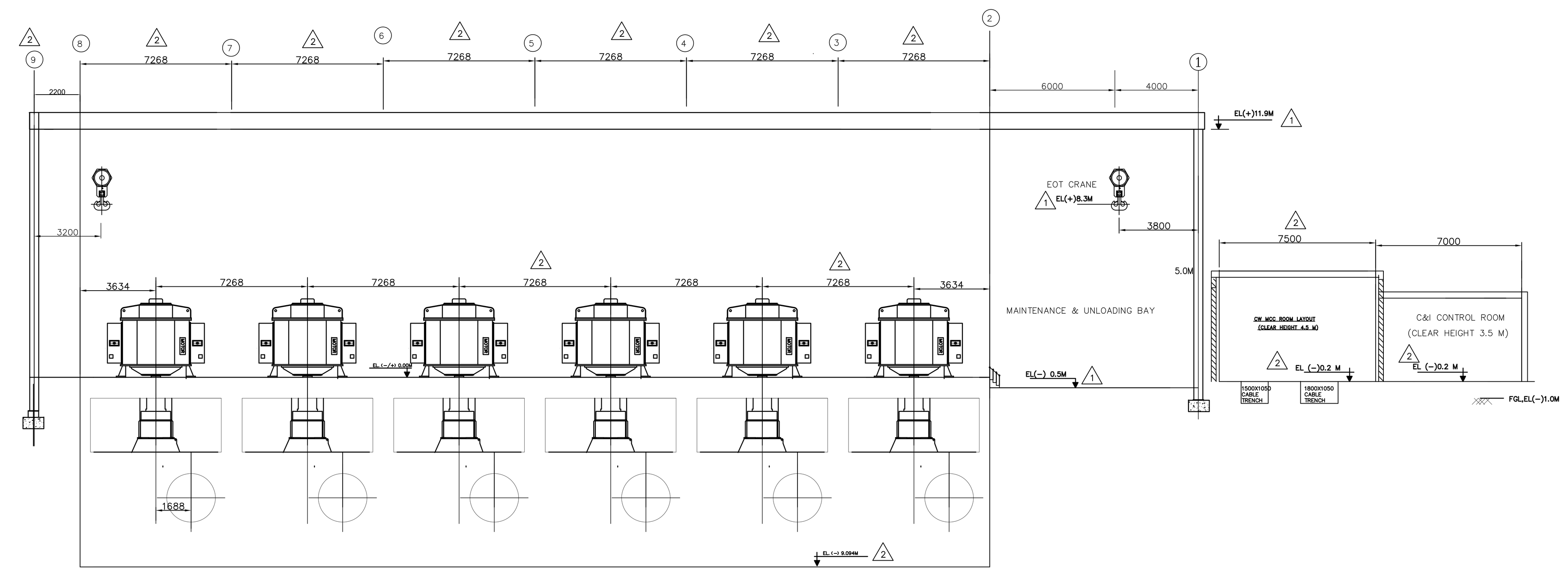
SECTIONAL VIEW 'Y-Y'
COOLING WATER CHANNEL



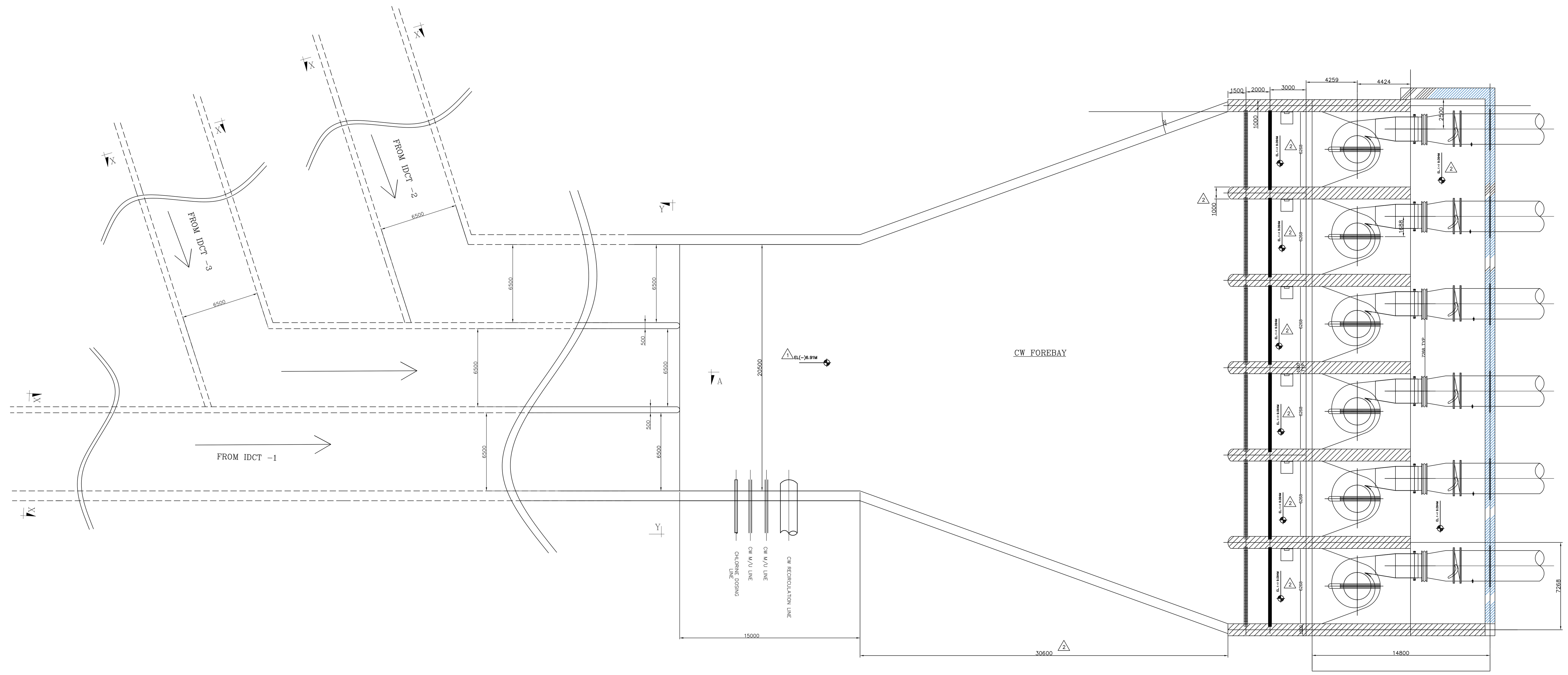
SECTIONAL VIEW 'X-X'
COOLING WATER CHANNEL
(NEAR COOLING TOWER)



LEVEL TRANSMITTER DETAIL LT



ELEVATION OF CW PUMP HOUSE



PLAN OF CW PUMP HOUSE
(CW PUMP FLOOR AREA)

NOTES

1. ALL DIMENSIONS IN MM UNLESS STATED OTHERWISE .
2. STOP LOG GATES: TOTAL QUANTIY 4 NOS. MATERIAL OF CONSTRUCTION STRUCTURAL STEEL IS 2062 WITH EPOXY COATING, PAINTING & OTHER DETAILS AS PER CIVIL DRAWING.
3. COARSE SCREEN: TOTAL QUANTIY 7 NOS (INCLUDING 1 NOS SPARE SCREEN), WITH SCREEN WIRE MESH OF-AISI 316L & WITH SCREEN FRAME OF CARBON STEEL-IS 2062 WITH EPOXY COATING. Screen wire mesh opening :20 MM square, with 6 SWG wire dia.
4. APPROACH LADDER & PLATFORM ARRANGMENT FOR PUMP & MOTOR SHALL BE PROVIDED AS PER GA DRAWING OF CW PUMP.
5. STOP LOG GATE & COARSE SCREEN HEIGHT SHALL BE DESIGNED FOR SUMP OPENING HEIGHT VIZ 4000 MM.
6. 1 NO SEMI GANTRY CRANE OF 5 TON CAPACITY SHALL BE PROVIDED FOR HANDLING OF GATES /COARSE SCREENS.
7. ALL ELEVATION ARE REFERRED TO POWER HOUSE GROUND FLOOR (FFL) EL(+) 0.00M, WHICH CORRESPOIND TO RL (+)203 M ABOVE MSL.
8. THE SUPERSTRUCTURE OF THE BUILDING SHALL BE STEEL STRUCTURE TO CARRY THE EOT CRANE.
9. SIDE CLADDING SHALL BE OF FLY ASH BRICK WALL FOR ANNEX BUILDING AND SINGLE SHEET ZINCALUME CLADDING OVER 1.0M HIGH FLY ASH BRICK WALL FROM FFL FOR MAIN PUMP HOUSE.
10. REFERENCE DRAWINGS/DOCUMENTS
    P & ID OF CW AND ACW SYSTEM: PE-DG-511-165-W001
    GA DRAWING OF CW PUMP: HY-DG-11820057105
    ELECTRICAL EQUIPMENT & CABLING LAYOUT IN CW PUMP HOUSE SWGR ROOM DRAWING NO. PE-DG-511-100-E019

पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जांचकर्ता CHD	अनुमोदनकर्ता APPD	पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जांचकर्ता CHD	अनुमोदनकर्ता APPD	पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जांचकर्ता CHD	अनुमोदनकर्ता APPD
					02	05.9.26	NK	NR/RN	JP	01	23.04.26	NK	NR/RN	JP
						REVISED INLINE WITH CUSTOMER COMMENTS					REVISED INLINE WITH CUSTOMER COMMENTS			

कार्य संख्या- JOB NO. 511
स्थिति STATUS CONTRACT
मुद्रण स्केल मीटर में PRINT SCALE IN METRE

CUSTOMER: 3 X 800 MW NLC TALABIRA TPP
NLC INDIA LTD.

CONSULTANT: DEVELOPMENT CONSULTANTS PRIVATE LIMITED.
KOLKATA

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
BHARAT HEAVY ELECTRICALS LTD
पावर सेक्टर/POWER SECTOR
परियोजना अभियांत्रिकी प्रबंधन
PROJECT ENGINEERING MANAGEMENT
नोएडा (उ॰प्र॰)/NOIDA (U.P.)

DEPT CODE W

	नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
तैयारकर्ता/DRN	NK		07.08.25
डिजाइनकर्ता/DESN	NK/NR		07.08.25
जांचकर्ता/CHD	RN		07.08.25
अनुमोदनकर्ता/APPD	JP		07.08.25

शीर्षक/TITLE
MECHANICAL GA OF CW PUMP HOUSE

MPL	CIVIL	ELEC	S&CE	WSE	MAX	DEPT.
						हस्ताक्षर SIGN दिनांक DATE

ड्राइंग संख्या / DRAWING NO. PE-DG-511-165-W004
शीट SHEET 1 OF 1
पुनरीक्षण REV. R02