Rajalakshmi Engineering College
Thandalam

FEBRUARY 2021

INTERNSHIP TRAINING ON STUDY OF ELECTRICAL SYSTEM IN THERMAL POWER STATION – 1 EXPANSION (2 x 210 MW) NLC INDIA Ltd.,

AN INTERNSHIP REPORT

Submitted by

AASHISH VIBHU A (180901002)

ADITHYAA CR (180901005)

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KEERTHIKA V (180901054)

Under the guidance of

Dr. J. Kavitha

Head of the Department
Department of Electrical and Electronics Engineering

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Rajalakshmi Engineering College

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Submitted in partial fulfilment of the requirement for the award of the degree of **BACHELOR OF ENGINEERING** in the department of Electrical and Electronics Engineering, Rajalakshmi Engineering college, Thandalam.

SIGNATURE

Dr. J. Kavitha

(Head of the Department)
Department of Electrical and Electronics Engineering,
Rajalakshmi Engineering College,
Thandalam.

NLC INDIA LIMITED, NEYVELI

‘NAVRATNA’ – A Government of India Enterprise
NEYVELI, TAMILNADU

CERTIFICATE

This is to certify that the Internship Training Report entitled “STUDY OF ELECTRICAL SYSTEMS IN THERMAL POWER STATION – 1 EXPANSION, NEYVELI” in Thermal Power Station – 1 Expansion is the Bonafide Internship Work done by the students,

AASHISH VIBHU A (180901002)
ADITHYAA CR (180901005)
AKSHAYA A (180901009)
EZHIL NIYAERU T (180901023)
KEERTHIKA V (180901054)

In partial fulfilment of the requirement for the award of the degree of BACHELOR OF ENGINEERING in the Department of Electrical and Electronics Engineering, Rajalakshmi Engineering College, Thandalam, done during the period from 01-02-2021 to 14-02-2021 at **Thermal Power Station – 1 Expansion, NLCIL, Neyveli**.

MR. K. SUDHIR
CM/ELEC.MTCE
Thermal Power Station – 1 Expansion, NLCIL., Neyveli

Permitted to submit the report to College / University Authorities.

Place: Neyveli
Date: 12-02-2021

DEPUTY GENERAL MANAGER / L&DC,
Learning and Development Center,
NLCIL, Neyveli.

DECLARATION

We hereby declare that the internship training report entitled "INTERNSHIP TRAINING ON STUDY OF ELECTRICAL SYSTEMS IN THERMAL POWER STATION – 1 EXPANSION, NEYVELI" submitted to the Department of Electrical and Electronics Engineering, Rajalakshmi Engineering College, Thandalam, for awarding degree of bachelor of technology. It is the original work done by me under the guidance of Shri. K. Sudhir, Chief Manager, Electrical Maintenance, Thermal Power Station – I Expansion, NLCIL, Neyveli.

This report is only for the reference and no part of the report will be the published or copied anywhere without the written permission from NLC India Ltd, NEYVELI.

Signature of the students,

AASHISH VIBHU A

ADITHYAA CR

AKSHAYA A

EZHIL NIYAERU T

KEERTHIKA V

Place: Neyveli

Date: 12-02-2021

ACKNOWLEDGMENT

We express our sincere thanks to NLC India ltd, for providing us the opportunity to go ahead with the internship.

We sincerely thank to

Shri. SABUTHOMAS KELACHANDRA/DGM/L&D/L&D/L&DC

Shri. TAPAS KUMAR GOSWAMI, DGM/SD/L&DC

Shri. K. SUDHIR, CM/Electrical Maintenance

Shri. G. PIRAMANAYAGAM, DCE/Electrical Maintenance

For providing us the opportunity to carry out the internship in NLC India ltd, NEYVELI.

We would also thank all the EXECUTIVES & TECHNICIANS who helped us to finish this internship trainings.

ABSTRACT

The internship on "STUDY OF ELECTRICAL SYSTEMS IN THERMAL POWER STATION I EXPANSION" was carried out in Thermal Power Station I expansion, NLCIL, Neyveli.

In this internship Training we visited switch yard, switch yard control room, Transformer areas, Switch gear annexe areas (0.4 kV switch gear, 6.6 kV switch gear, Circulating Water Pump switch gear, Lignite Handling System switch gear and Ash Handling System switch gear room) and also visited in Unit Control Board (UCB). In this internship we acquired the wide knowledge of power plant process of thermal power station and its electrical systems

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NLC INDIA LIMITED

NLC India Limited (formerly Neyveli Lignite Corporation Limited) is a government owned lignite mining and power generation company in India. On 14th November 1956, it was formed as a corporate body and was wholly owned by the government of India. It is a '**Navratna**' government of India company in the fossil fuel mining sector and thermal power generation. It annually produced about 30 million tonnes of Lignite from opencast mines. Neyveli's Thermal Power Stations are South Asia's first and only lignite fired Thermal Power Stations. The lignite is used at pithead thermal power stations of 3640 MW installed capacity to produce electricity.

1.1 Mining Projects:

NLC has four open cast lignite mines, namely Mine I, Mine II, Mine IA and Barsingsar Mine. The lignite mined out is used as fuel to the linked pithead power stations. Also, raw lignite is being sold to small scale industries to use it as fuel in their production activities.

Mines	**Capacities (MTPA)**
Mine I	10.5
Mine IA	3.0
Mine II	15.0
Barsingsar Mine	2.1
Total	30.60

1.2 Power Projects:

NLC India has five pithead Thermal Power Station with an aggregate capacity of 4240 MW. Further, NLC India has so far installed 51 wind turbine generators of capacity 1.50 MW each and also commissioned 140 MW solar photo voltaic power plant in Neyveli, resulting in an overall power generating capacity of 4431 MW.

Power Plant	**Units**	**Capacity Per Unit (MW)**	**Capacity (MW)**
Thermal Power Station I Expansion	2	210	420
Thermal Power Station II	7	210	1470
Thermal Power Station II Expansion	2	250	500
Neyveli New Thermal Power Plant	2	500	1000
NLC Tamilnadu Power Limited	2	500	1000
Barsingsar Thermal Power Station	2	125	250
Wind Power Plant	34	1.5	51
Solar Power Plant			1370.06
TOTAL			6061.06

THERMAL POWER STATION – 1:

The **Neyveli Thermal Power Station I** has configuration of 600MW (6x50-MW units and 3x100-MW units). All these units were commissioned between May 1962 and September 1970. The plant is equipped with boiler from the Taganrog Metallurgical Plant, turbines from LMZ and generators from Electrosila, imported from the Soviet Union under Indo-Soviet assistance programme. It was planned that the Neyveli Thermal Power Station I will be decommissioned between 2011 and 2014; however, in 2011 the period of operations was extended for five years.

THERMAL POWER STATION – I EXPANSION:

Thermal Power Station-I has been expanded with the capacity of 420 MW (2 x 210 MW) using the lignite available from Mine-I Expansion. The scheme, TPS I Expansion, was sanctioned by Government of India on 12th February 1996. The first unit of this power station was synchronized on 21st January 2002 and the second one on 22nd July 2003. The power generated from this Thermal Power Station, after meeting the internal requirements, is shared by the Southern States viz., Tamil Nadu, Kerala, Karnataka, and Union Territory of Pondicherry.

The tremendous achievement by TPS – 1 Expansion unit:

- The Station Plant Load Factor (PLF) for the year 2008 – 2009 is 84.96% which is the highest for any Lignite Fired Power Station
- The operating PLF for the year 2008 – 2009 is 96.69%
- 100% Fly Ash conveyed to silo for the month of March 2005 by Dense Phase Conveying Technology and Slurry Disposed to Ash Pond by nil\

Neyveli Thermal Power Station II

The 1470 MW (7x210 MW) Neyveli Thermal Power Station II was built in two stages. At the first stage between March 1986 and March 1988three unit’s capacity of 210 MW each were commissioned. Boilers were supplied by Ganz-Danubius and generators were supplied by Franco Tosi. At the second stage from March 1991 to June 1993 four units with the same capacity, supplied by Bharat Heavy Electricals Limited, were added. Under Stage II expansion, two units of 250MW each were installed by BHEL. These units use circulating fluidized bed combustion (CFBC) boilers. These two units commissioned one year back are facing teething problems and rarely electricity.

NLC Tamil Nadu Power Limited (NTPL) Tuticorin

NLC TAMILNADU POWER LIMITED (NTPL) coal based 2x500 MW thermal power project at Tuticorin in Tamil Nadu is a joint venture company with TANGEDCO.NLC holds 89% of equity and TANGEDCO 11%. The Unit-1 attained commercial operation in June 2015 and Unit-2 in August 2015.NTP has signed a fuel agreement with Mahanadi Coal Fields Limited for supply of 3.0 MTPA of coal and in order to meet the shortfall in requirement, a contract has also been awarded on M/s. MSTC for the supply of imported coal.

Barsingsar Thermal Power Station

Barsingsar Thermal Power station Project is a 250-MW Coal-fired power station operated by Neyveli Lignite Corporation (NLC), located at Barsingsar in Bikaner district, Rajasthan, India. The first 125 MW unit was commissioned on June 28, 2010.The second 125 MW unit was commissioned on January 25,2011.

RENEWABLE ENERGY SOURCES BY NLC:

NLC India Limited (NLCIL), a Lignite Mining cum Power Generation Company under the administrative control of Ministry of Coal has voyaged into the Renewable Energy Sector in 2014 by way of establishing 51 MW Wind Power Project in Tamilnadu. Subsequently, a 10 MW Solar Power Project was established in Neyveli during the year 2015. From the experience gained in the development, NLCIL has established further 130 MW Solar Power Project at Neyveli in 2017.

In this context, in line with the Government of India’s RE target of 175 GW power, NLCIL has contemplated to establish 4000 MW Solar Power Projects and Wind Power Project capacity of 207.5 MW at various locations in India by 2020.

NLCIL has a plan of establishing 50 MW Solar Power Projects in two phases at Andaman & Nicobar Islands integrated with Battery Energy Storage System and pumped hydro storage system. NLCIL is also establishing 500 MW Solar Power Projects in Tamilnadu through Solar Developer Operator (SDO) mode, wherein the responsibility of procurement and transfer of land required for the projects lies with the Contractors.

In the recently floated tender of TANGEDCO under the Tariff based bidding for establishing 1500 MW Solar Power Projects in Tamilnadu, NLCIL has garnered

709 MW capacity Solar Projects and actions are under way to select SDO contractors for establishing the 709 MW solar projects.

NLCIL has been in touch with the Ministry of Railway for supply of Solar Power & Wind Power to the tune of 500 MW each. Actions are under way for the advance action plan such as signing of MoU and PPA for the proposed project.

NLCIL has participated in the TANGEDCO's tender for supply of 500 MW of Wind Power to the State of Tamilnadu and would be in a position to garner 250 MW capacity.

NLCIL has also been in the foray of establishing Solar Projects in the States of Karnataka, Odisha, Uttar Pradesh & Madhya Pradesh. MoU has been signed with Madhya Pradesh's New & Renewable Energy Department for establishing 1000 MW Solar Projects in the State of MP. MoU has been signed with Govt. of Andhra Pradesh for establishing 1000 MW Solar Projects in the State of AP

2.1 THERMAL POWER STATION 1 EXPANSION – AN INTRODUCTION:

The Thermal Power Station – I is an expansion of Neyveli Thermal Station-I (TS-I), located further away on the western side of TS-I as an independent power station.

The primary fuel of the station is lignite, available from Neyveli Mines 1 Expansion and transported up to the Plant by means of feeding conveyors; the other fuels are light diesel oil, used for lighting up of boiler in cold start-up and the heavy fuel oil, used for hot start-up and flame stabilization to support lignite firing during low loads.

The light diesel oil system is designed to meet 15% MCR (Maximum Continuous Rating) heat input, while the heavy fuel oil system is designed to meet 30% MCR heat input.

One steam generator and one turbo generator operate as a unit system basis, however the systems of cooling water, auxiliary steam, service water, instrument air, service air and demi water distribution facilities are interconnected to increase the system flexibility and facilitate the start-up of the units.

Each steam generator includes mainly,1) Fuel system with 8 oil burners and 6 milling systems. 2)steam-water side: a steam drum, a water-cooled membrane wall furnace, economizer tube banks, a super heater system with the relevant desuperheating, a re-heater system with the relevant desuperheating, one intermittent and one continuous blow-down tank. 3) Air-flue gas system includes two forced and two induced draft fans, two rotary air preheaters, two steam coil air preheaters. For each steam generator two electrostatic precipitators are provided.

Each steam turbine-generator unit includes a steam condensing plant, a regenerative feed heating system, a turbine bypass system and the relevant electrics, instrumentation and control systems. The turbine is single reheat, tandem compound dual casing design with separate HP and with a combined IP-LP section driving an alternating current generator.

The HP cylinder receives steam from the steam generator through stop and control valves, after expanding through the HP casing, the cold reheat steam is sent back to the re-heater of the steam generator. Then the reheated steam enters into the IP cylinder through combined valves. The exhaust steam from LP cylinder is finally sent to the condenser, located below the turbine exhaust hood.

The exhaust steam in the condenser is cooled by tower circulating water. The vacuum inside the condenser is maintained by two holding ejectors (one in service, the other in stand-by during Unit in service).

The condenser receives also the heater drains and the thermal cycle system make-up. The condensate is extracted from the hot well by two 100% condensate extraction pumps and sent to the deaerator passing through air ejector condensers, gland steam condenser and the train of LP heaters.

The condensate from the deaerator is pumped as feed water by two of the three 50% boiler feed pumps through the train of HP heaters to the economizer section of the steam generator. The heating steam for the four LP heaters, the deaerator and the two HP heaters is supplied from different non-controlled extraction stages of the turbine, the highest-pressure extraction being from HP turbine exhaust. The deaerator receives also pegging steam from cold reheat line and from auxiliary steam header and initial heating steam from auxiliary steam header.

The heater drains are normally cascaded to low pressure heaters, except for LP2 heater, whose drains are forwarded upstream of LP3 heater using drain pump. All heaters emergency drains are cascaded to the condenser hot well through flash tanks. Each feed water heater is provided with its bypass line.

The steam turbine is equipped with a bypass system, designed to ensure 60% MCR capacity, to assist rapid start-up of plant and to permit independent operation of boiler and turbine in the event of turbine trip or load rejection. The system includes two high pressure and two low-pressure reducing valves with the relevant spray water provided by a branch on the feed water pumps discharge line and CEP discharge line respectively.

The turbine is equipped with a lubrication and control oil system, with provision of continuous purification system for the oil: a centrifugal purifier is provided for each unit and another one is provided as a common facility for the two Units, as well as common clean/dirty lube oil tanks. The make-up water to the thermal cycle is introduced into the condenser through two redundant pumps from two condensate storage tanks, each one 500 m^3 capacity.

The cooling water to steam turbine, boiler, instrument and service air compressors is realised with tower circulating water by means of two redundant auxiliary cooling water pumps, provided in parallel to the condenser cooling circuit.

The cooling water to boiler feed water pumps, generator coolers and sampling desks is realised with closed cycle demineralised water, by means of two redundant pumps and heater exchangers, plate type, and of a surge tank, 8m3 capacity, for the first circuit filling.

The instrument air system is similar for the two units; it includes three reciprocating compressors, one air drying unit, three wet air receivers and one dry air receiver for each unit separately with inter connection facility. Three reciprocating compressors and three air receivers are available for the common service air system.

The drain system consists of two condenser flash tanks, valves, traps, orifices necessary for the collection for the main and auxiliary system drains which can be under vacuum; the other cycle drains are sent to the atmospheric boiler intermittent blow-down tank. The system also provides for the collection of the wastewater drains (industrial, oily drains, etc.), which are discharged to the sewage network.

The service water system distributes service water from a water branch line from Borewell network consisting of 8 bore wells and pumps to the different process users and houses. Three service water pumps are also available.

The fuel systems (LDO and HFO) are common for the two Units. The light fuel oil system is designed to transfer the LDO from the road tankers through flexible hoses and to deliver it to two tanks 100KL capacity each, by means of two screw type unloading pumps.

From the tanks the light fuel oil is supplied by two supply pumps, screw type to boiler house. The heavy fuel oil system function is to unload heavy fuel oil from road tankers through flexible hoses up to two tanks 1000KL capacity each, by means of two unloading pumps, screw type.

The HFO is maintained at the correct temperature inside the storage tank by means of heating coil heated with auxiliary steam and by hot oil circulation. From the tanks HFO is supplied by three supply pumps through the storage tanks suction heaters, to increase HFO temperature to the desired value. Downstream of the supply pumps, three HFO steam heaters are provided to increase the fuel temperature, by means of auxiliary steam, at a value such as to have the adequate viscosity value required by the burners.

Finally, the plant is provided with

- A sampling system for the monitoring of water and steam quality,
- A chemical injection system (hydrazine and sodium phosphate injection) to reduce or prevent corrosion and control the PH value of boiler water,
- A drinking water distribution system,

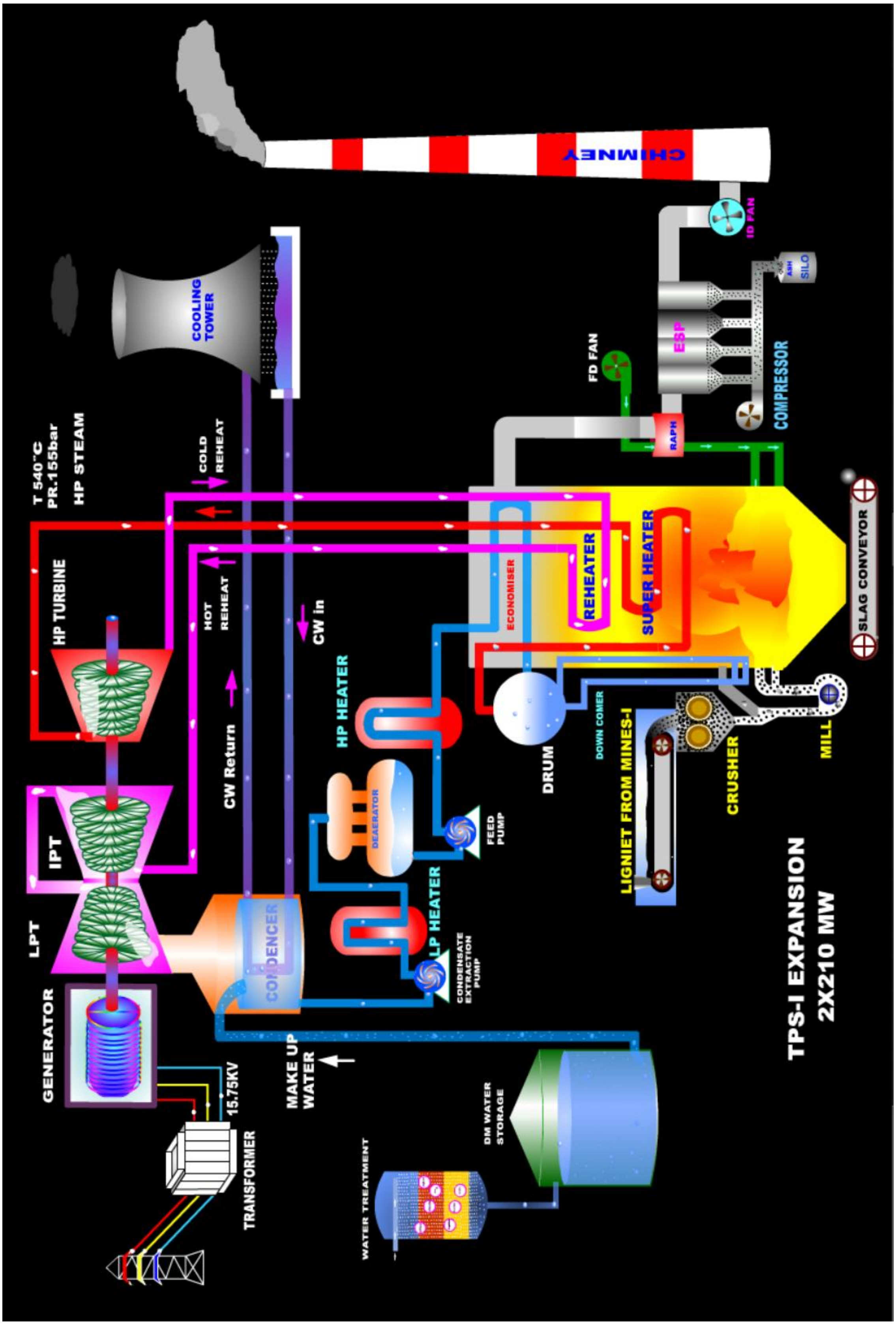
- A H2 2 and CO storage system by means of two racks of bottles for the washing and pressurising of the generators.
- A DG set house comprising 2 DG sets.

The automation system is designed to obtain the greatest plant reliability and maintain full automatic control in the event of an equipment failure, in order to achieve optimum plant performance and overall availability. The operator priorities are oriented to normal operation for power generator; the operator will perform his role using the automation system as a mean to control the plant at the most appropriate functional hierarchical level The automation system priorities are oriented to protection and safety, and to support operator decision-making process and action for power generation. The equipment is designed to meet the vital need to safeguard the plant, control the required output reliability and enable the station to operate efficiently.

Operating items excluded from automatic operation are

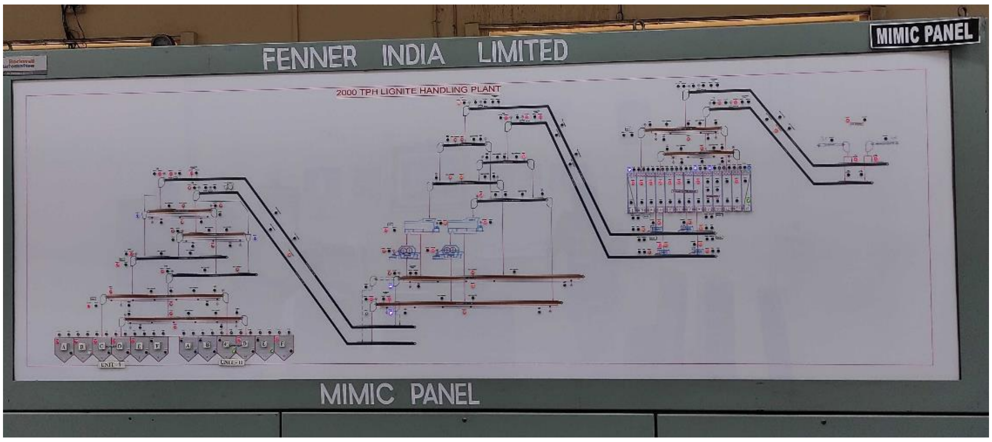
- Preparing operation to initiate automatic operation (e.g., Filling and venting of lines and components).
- Operation for test or check of equipment.
- Operation of isolation for Maintenance.
- Field instrumentation/control room cross checking for process value and equipment status validation.

Layout of Thermal Power Plant



3.1 LIGNITE HANDLING SYSTEM:

Lignite Handling system is executed by Fener India Ltd. The package cost is Rs. 40 crores. There are two streams with 2000 tonnes per hour per stream.



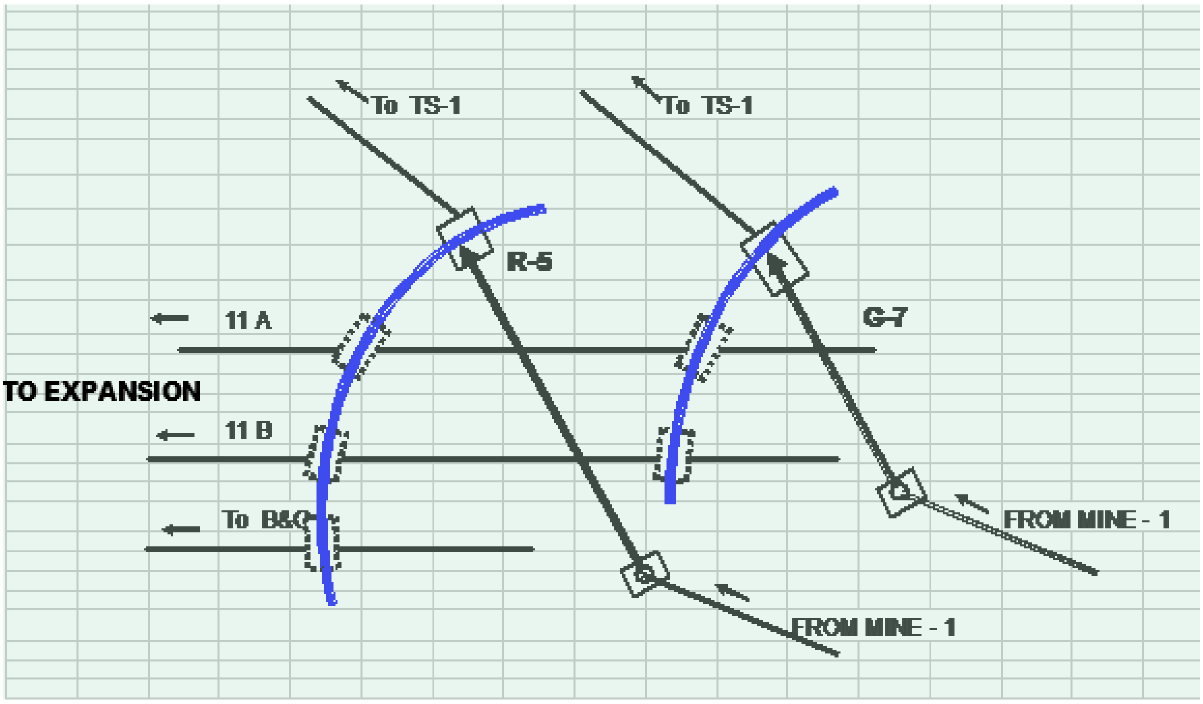
Divisions in Lignite Handling System:

There are two division in Lignite handling system,

- External system
- Internal system

3.2 External System:

In external system, Lignite is transported from mine I expansion to RCC Bunker of TPS – I expansion.



3.3 Internal System:

In Internal System, Lignite is transported from RCC Bunker to Boiler Bunker of TPS – I Expansion

RCC Bunker:

RCC Bunker is also known as Storage slotted bunker. The height of the bunker is 21 meters. There are 13 slots in RCC Bunker. Each bunker holds 800 tonnes of lignite. The overall capacity of the bunker is 10000 tonnes.

In each shift around 3000 tonnes of lignite is transported from RCC Bunker to Boiler bunker for power generation.

Air canon system: Air canon system is also known as Bunker Choke Removal. It pokes manually. Air is supplied at high pressure inside the RCC Bunker to break the lignite blocks. There are openings in the bunker to fix the air blaster nozzle 250mm. There are two types of air blasters with different capacities,

- 150 L Capacity – 28 units
- 350 L Capacity – 32 units

At the top to the bunker charging hatch is provided for dust sealing from the bunker. There are high-level and low-level indicators.

Paddle Feeder:

Louise is the maker of Paddle Feeder. Paddle Feeder is present at the bottom of the RCC Bunker. It is used to pull the lignite out of the RCC Bunker. Paddle Feeder feeds the lignite into the conveyors 12 A/B.

Paddle Feeder is a disk wheel with 6 discharge arms in it. The diameter of disk wheel is 3200mm and it rotates at a speed of 1450 rpm. The travel motor used in paddle Feeder is 415V / 5.5 KW /1450rpm

Each unit has two paddle feeders and four paddle feeders in total. There are three types of motors used in Paddle Feeder, they are,

- Hydraulic motor
- Servo motor
- Travel motor

The travel motor used in paddle feeder is 415V / 5.5 KW /1450rpm. The disk wheel motor used in paddle feeder is 415V/ 45KW /1450rpm

Paddle feeder can feel 200 to 2000 tonnes per hour. It travels at a speed of 1 metre per minute.

Screening:

A.U.B.E.M.A is the make of the screen. It is an Eccentric disc roller type. It can screen 2000 Tonnes per hour. It screens the lignite sized below 80mm. The speed of the rollers is 67 rpm. The motor used in screening is 415V /30KW / 1500 RPM. The gear ratio of screening is 24:1

Crusher Mill:

A.U.B.E.M.A is the make of the crusher mill. It is a spiked roll crusher. The rollers used in crusher mill is 1200 mm in diameter and 2400 mm width. The drive motor used in crusher mill is 110KW /415V / 1500 rpm. The crusher speed is 148 rpm.

The lignite input size is 80mm to 200mm and the lignite output size is 80 mm.

The crusher mill can crush up to 1600 tonnes per hour.

Metal detector:

It detects the iron particles from the running conveyer.

Magnetic separator:

It removes the detected iron particles from the running conveyor.

Dust extraction:

It extracts the dust particles from the running conveyor.

Dust suppression:

To sprinkle water over the lignite dust while conveyor is running.

3.4 Conveyors used in Lignite Handling System:

6.6kV conveyors:

Conveyor	Conveyor detail			Motor detail	
	Length (m)	Speed (m/s)	Width (mm)	Rating (KW)	Speed (RPM)
11A/B	511	4.305	1500	500	1500
12A/B	390	4.305	1500	500	1500
13A/B	303	4.305	1500	500	1500

415V conveyors:

Conveyor	Conveyor detail			Motor detail	
	Length (m)	Speed (m/s)	Width (mm)	Rating (KW)	Speed (RPM)
RSC1A/B	55	3.348	2000	55	1500
RC1A/B	9	2.66	2000	55	1500
RFC1A/B	9	2.66	2000	55	1500
USC2A/B	23	2.66	2000	55	1500
SC1A/B	6	2.66	2000	55	1500
14A/B	78	4.2	1500	55*2	1500
RSC3A/B	66	3.348	2000	55	1500

3.5 Protections in Conveyors:

For protection of conveyors the safety devices are used.

- Belt sway
- Pull cord switch
- Zero speed switch
- Chute jam detector

BELT SWAY:

When the conveyor belt is unstable or when it swings then belt sway detects the movement and stops the conveyor automatically.

PULL CORD SWITCH:

It's a manual device which is pulled under emergency circumstances.

ZERO SPEED SWITCH:

When the speed between the head end and the tail end is varied then the zero-speed sensor detects and stops the conveyor automatically.

EMERGENCY SWITCH:

It is manually pressed during emergency situation.

4.1 TURBINES:

Turbines, condensers, regenerative heaters and other associated equipment were supplied and erected by Ms. ANSALDO ENERGIA S.P.A. ITALY. The Turbine is of two cylinders, tandem compound, single exhaust, condensing, single reheat type designed for high operating efficiency and maximum reliability.

The motive force for rotating the turbine rotor is obtained from the expansion of high pressure and high temperature steam that is supplied by the boiler. The steam works on the modified Rankine cycle. Whenever steam flow varies the torque on turbine rotor changes, which in turn effects change generator stator current, ultimately leading to changes in active power output.

The condenser is of surface type. It is of single shell and rectangular in construction and has divided water box. The vacuum inside the condenser is maintained by holding ejector, while a starting ejector is provided to create vacuum during starting up of the unit. In the condenser the steam is condensed by means of circulating water supplied by circulating water pump. M/s Kirloskar Brothers Lad supplied the circulating water pumps. The hot circulating water from the condenser is sent to Natural draught cooling tower where hot water is cooled by the natural flow of air. The main condensate collected at the condenser hot well is pumped by condensate extraction pump and sent to Deaerator through air ejector condensers, gland steam condenser and a train of LP heaters. At Deaerator, the oxygen present in the main condensate is removed by means of thermal deaeration. The deaerated water is pumped by Boiler feed pump and sent to boiler drum through HP heaters. The heating steam for the LP and HP heaters is supplied from different uncontrolled extraction from different stages of turbine.

The turbine is equipped with a bypass system, designed to ensure 60% BMCR capacity, to assist rapid starting of plant and to permit independent operation of boiler and turbine in the event of turbine trip or load rejection.

4.2 Types of turbines:

There are three turbines in TPS – 1 expansion,

- High Pressure turbine
- Intermediate turbine
- Low Pressure turbine

HIGH PRESSURE TURBINES:

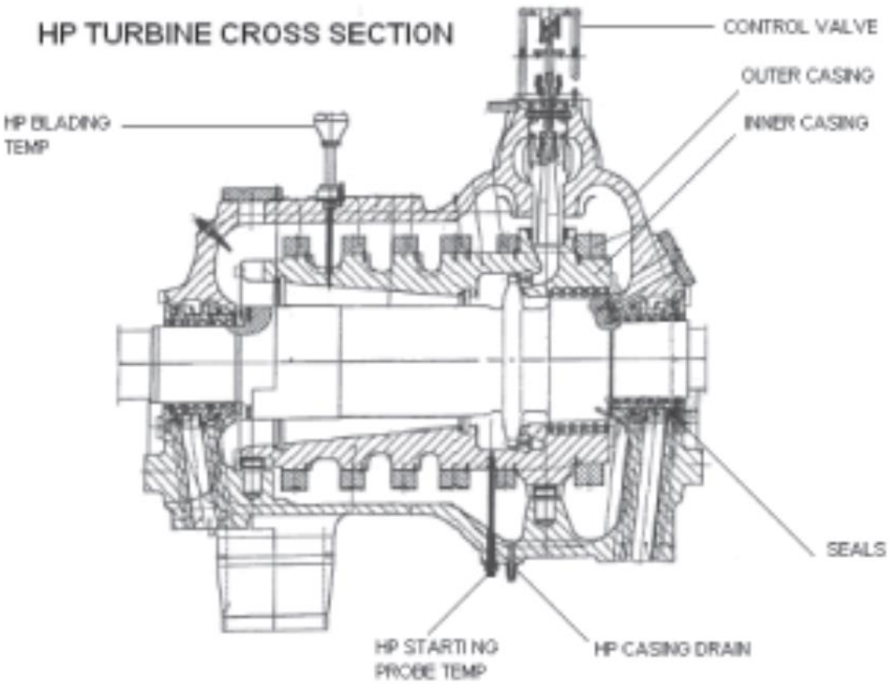
High pressure turbine is a single flow double shell type turbine. The outer casing of the turbine is horizontally split and the inner casing of the turbine is diagonally split. The first stage consists of a nozzle ring divided into 3 segments. It has 1 impulse stage and 22 response stage.

INTERMEDIATE PRESSURE TURBINE:

Intermediate pressure turbine is a single flow double casing turbine. Both the inner and outer casing is horizontally split. Common Intermediate and High-pressure rotor welded from two parts. It has 17 reaction stages

LOW PRESSURE TURBINE:

Low pressure turbine is single flow welded outer casing. The Intermediate pressure and Low-pressure casings are bolted together. It has a rupture diaphragm and a vacuum breaking valve. Water Injection in outer casing is done in 5 reaction stages.



5.1 GENERATORS:

The two-pole hydrogen cooled generators of the THRL type have the following main characteristics

- Stator winding indirectly cooled
- Rotor winding directly cooled with radial system.
- Stator core directly cooled with radial ducts
- Stator and the rotor windings of class F insulating materials
  and the following main features:
- End shield bearings
- Four vertical coolers at the frame ends
- Two axial fans mounted onto the shaft, one at each rotor spindle
- Six terminals on the bottom
- Low losses stator core laminations
- Stator core flexible coupling to the frame structure
- Excitation system of static type.

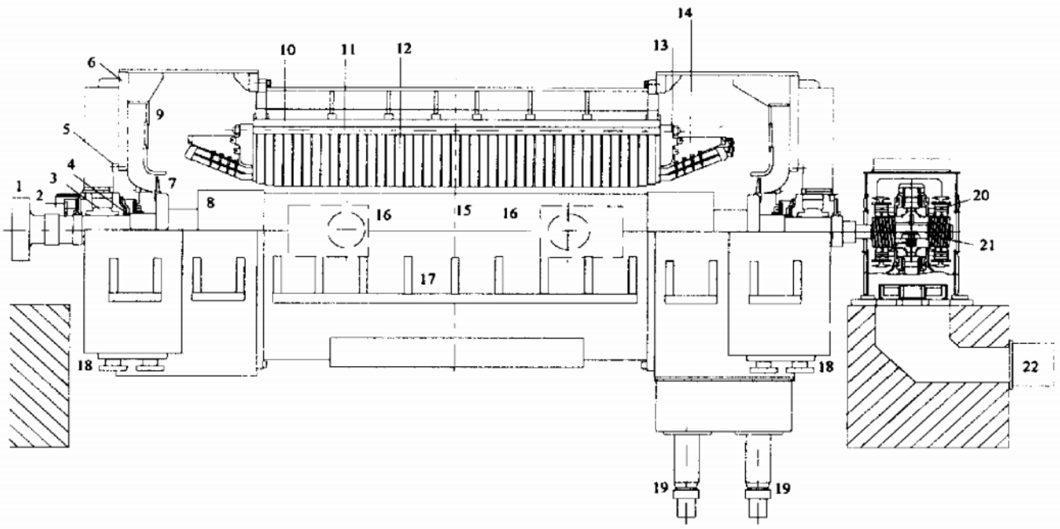


Figure : Generator outline

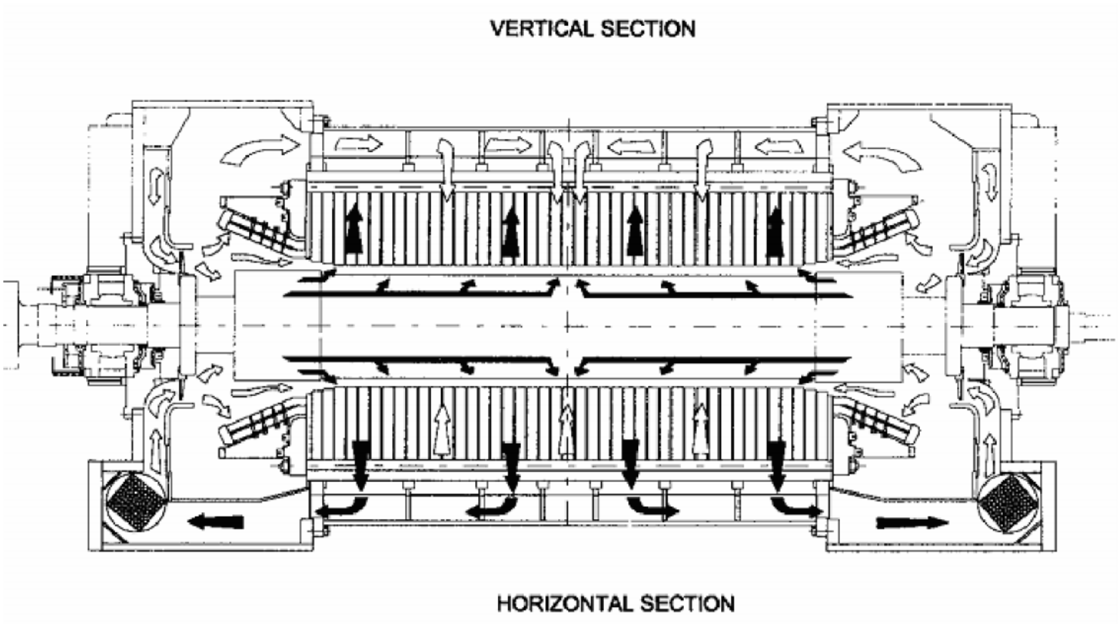
1 Coupling
2 Shaft grounding
3 Bearing
4 Hydrogen seals
5 End shield
6 Stator frame
7 Fan
8 Retaining ring
9 Stator end winding
10 Core flexible coupling
11 Key-bar
12 Stator core
13 Press-plate
14 Stator end winding support
15 Rotor body
16 Trunnions
17 Stator feet
18 Hydrogen coolers
19 Terminals bushings
20 Brushgears
21 Slip-rings
22 Slip rings housing filter

HYDROGEN COOLING:

The losses produced in the active parts of the generator are removed by circulation of pressurized hydrogen gas which brings the losses to the hydrogen to-water heat exchangers.

The rotor winding is directly cooled by hydrogen gas flowing in direct contact with the copper conductors. The stator winding losses are removed indirectly through the insulation, into the core and then to the cooling gas thorough cooling of the stator core is provided by hydrogen flowing in a large number of radial ducts between the lamination packets. The cold hydrogen gas temperature may be regulated from the cooling water circuit which supplies the hydrogen coolers.

Two axial fans, mounted on the rotor, and the rotation of the rotor itself, drive several parallel streams of cooling gas through the generator. The general configuration of these streams is symmetrical for each end toward the centre plane. Each one of the streams includes several parallel flows.



The rotor cooling gas enters the rotor at the end winding region between the retaining ring and the shaft, finding access to the sub slots, milled under the wound slots; through the sub slots the gas flows axially along the rotor body and feeds the radial cooling ducts, which are obtained by milling slits in the copper strands, in the insulating materials and holes in the wedges. This part of gas flows in that way to the air gap all along the rotor body. Under the retaining ring a part of the flow enters the ducts milled along the end turns; while the flow which enters in the straight end windings discharges on suitable radial holes milled in the winding at the two ends of the wound slots, the flow which enters the frontal arcs discharges to the air gap through short ventilation slots milled in the pole regions.

Part of the cooling gas flows directly into the air gap at the ends where, together with the cooling gas coming from the rotor end windings, enters the radial ducts in the stator core. Both core and stator winding are cooled over these ducts. The heated gas emerging from the back of the stator core is led, through axial pipes in the frame, back to the coolers.

The remaining stator cooling gas first cools the end winding conductors and the end parts of the core then flow on the back of the core. From there it flows radially inwards through the radial ducts of the core and reaches the air gap where it divides; the smaller portion flows toward the end of the core and leaves the air gap with the first stream described above, the majority flows along the air gap towards the middle where it joins the flow leaving the rotor slots. The gas from one half of the stator leaving the back of the core in the mid-region is taken in axial pipes to the coolers and subsequently to the fans at both end of the machine. By crossing-over part of the cooling gas flow in this fashion as a more equal temperature distribution of the two machine halves is attained.

The slip-rings and brush gears are air ventilated in open circuit, with filters and silencers, thanks to a radial fan mounted on the shaft between the two collector rings.

5.2 Generator Specifications:

Manufacturer	-	ANSALDO
Type	-	50THR-L45
Serial number	-	2478 / 2479
Prime mover	-	STEAM TURBINE
Rotation direction viewed from prime mover	-	CLOCKWISE
Rated power	-	283.5 MVA
Rated voltage	-	15.75 KV
Rated power factor	-	0.85 Lag.
Rated frequency	-	50 Hz
Voltage variation range	-	± 5%
Frequency variation range	-	± 5%
Combined maximum variation voltage / frequency	-	1.05 p. u.
Rated current	-	10392 A
Rated speed / Over speed (test for 2 minutes)	-	3000 / 3600 rpm
Phase number / phase connection	-	3 / STAR

6.1 SWITCH YARD:

400KV system:

The 400kV Switchyard is located in the outdoor, parallel to the axis of the Power Station on the Northern side. 400kV yard is a double bus system, with Bypass system and the latter may be connected to either Main Bus I or II (A or B) by another circuit breaker. The out-going feeders and units may be taken into bypass, in case of necessity. A bar coupler facilitates transfer of power between the buses. The function of the busbar is to interconnect the generators, load feeders, etc., in the most reliable and flexible manner. It can be seen from the layout of 400kV Switchyard that the generators have their Power Transformers directly connected on the 15.75kV side, while the circuit breaker is located on the high voltage side of the transformer. No circuit breaker is provided between the generator and the Power Transformer, for the reason that the short-circuit current for a fault between the modern high-capacity generator and its transformer will be very high and circuit breakers at the low generation voltage to handle these currents are not available.

6.2 BUS:

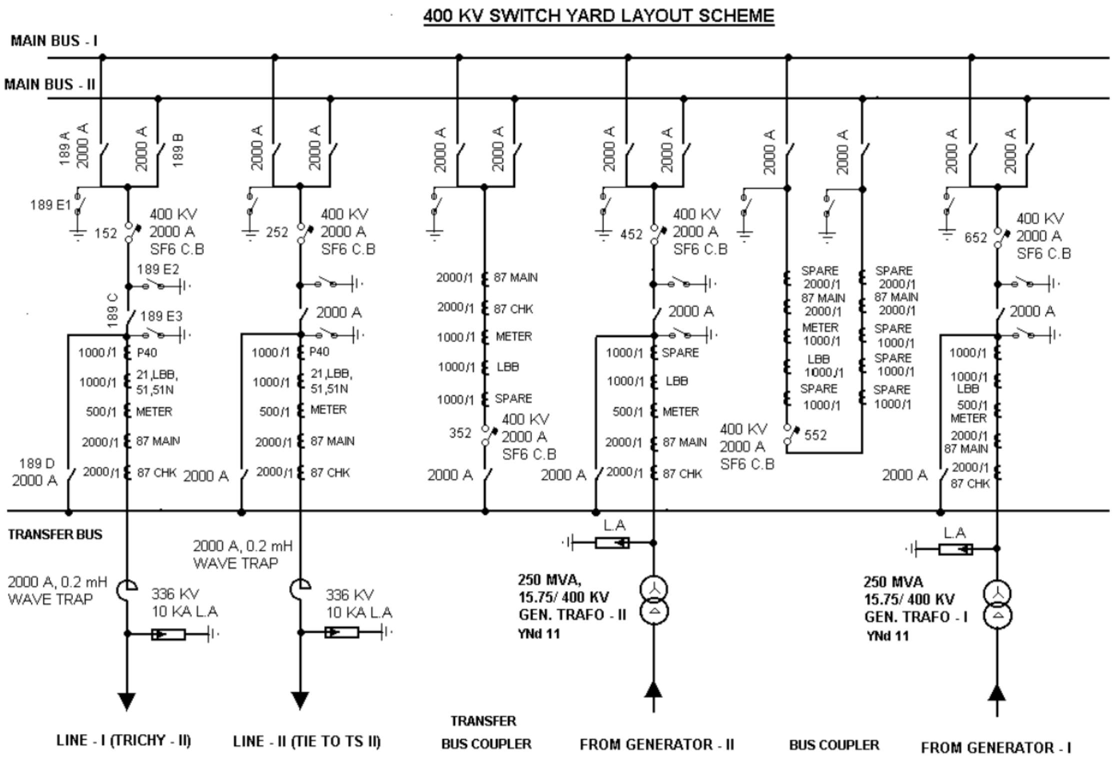
Bus is a transmission line with incoming and outgoing lines. The bus bar system are so designed as to prevent any visual corona formation and possibility of causing radio interference. There are three buses in the switchyard

- A bus
- B bus
- Transfer bus

6.3 BAY:

There are six bays in switch yard

- Incoming bay from generating transformer 1
- Incoming bay from generating transformer 2
- Outgoing bay to nagapattinam pooling station
- Outgoing to thermal station-2
- Transfer bus bay
- Bus coupler bay



6.4 CONTROL PANEL:

The control and protection panels for all the switchyard equipment, 33KV system and 11KV system are located inside the control room and remote operations are carried out for all the above equipment from the control room. Mimic and window annunciations regarding status of the equipment and protection actuations are available in the control panel.

6.5 SF6 Gas Circuit Breaker:

- Single pressure (puffer) type
- With minimum possibility of gas leakage and moisture content.

- In the interrupter assembly, absorption filters provided for absorbing gaseous
- SF6 decomposition products resulting from arcing and for limiting residual moisture content.
- Each pole is filled with SF6 gas independent of the other two poles and the pressure of each pole is monitored and regulated by individual pressure switches.
- Double O-ring seals with test holes for leakage test of the internal seal is provided on each static joint

6.6 ISOLATORS / DISCONNECTING SWITCHES

- Disconnecting blades (ISOLATORS) are capable of carrying rated current continuously as well as specified short-circuit current for the duration stipulated, without causing mechanical damage to any part and undue temperature rise damaging the insulation.
- The switches are capable of making and withstanding the maximum dynamic
  stresses involved.
- They are constructed such that they do not open under the influence of short circuit current.
- Suitable for interrupting small inductive and capacitive currents such as those which occur while disconnecting lines at no-load, bus bars or voltage transformers under energized conditions.
- The earth switches are interlocked so that the earth switch can be operated only when the isolator is open and vice-versa.

6.7 CURRENT TRANSFORMER:

Complete with bushing insulators, adjustable double point arcing horns, oil gauge, pressure relief device, nitrogen filling valve and cover, spark gaps, suitable phase and earthing terminals, power factor testing terminals, drain valve, lifting lugs, rating and diagram plate, secondary terminal box etc.

There are 14 number of current transformers in total. W.S Industries (INDIA)., Bangalore is the make of current transformers in thermal power station I expansion. The type of current transformers is IT – 400

6.8 VOLTAGE TRANSFORMER:

- With bushing insulators, stress rings, oil gauge, pressure relief device, nitrogen filling valve and cover, suitable phase and earthing terminals, drain valve, lifting lugs, rating and diagram plate, secondary terminal box etc.

- Voltage transformers are capacitive voltage divider type with electromagnetic units and will be suitable for carrier coupling.
- Voltage transformers star connected secondaries, have two fuses in parallel on the positive side for monitoring. Two fuses with suitable rating are provided on each secondary. These fuses are located in the individual phase secondary terminal boxes. Temperature - rise, when 1.5 times the rated primary voltage is applied for 30 seconds after achieving stable thermal conditions with the application of 1.2 times the rated voltage continuously will not exceed the value specified, by more than 1- degree Celsius.

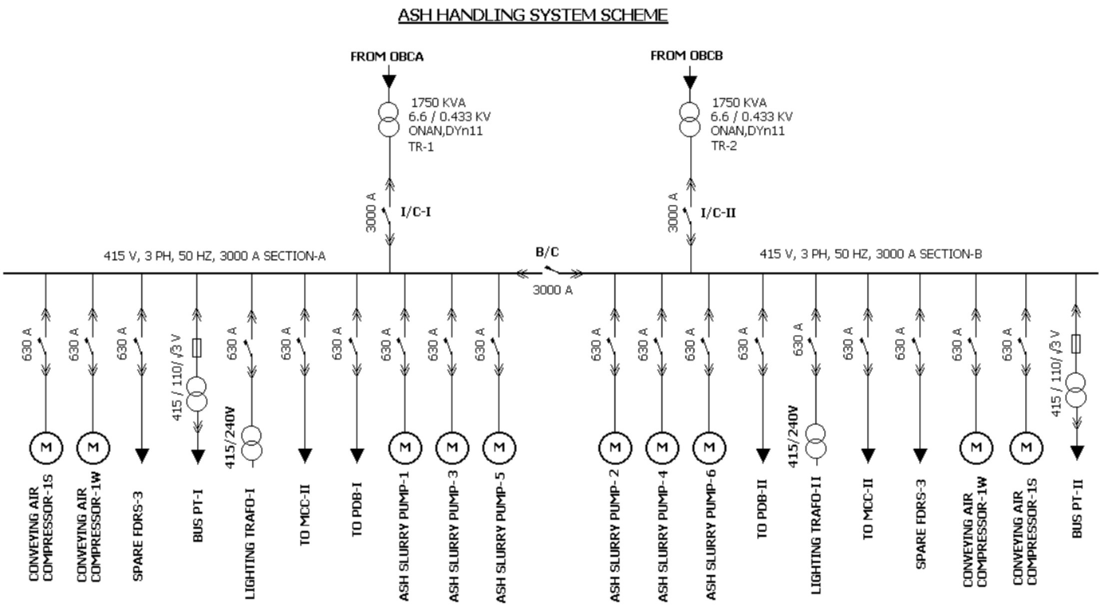
6.9 CAPACITIVE VOLTAGE TRANSFORMER:

The capacitive voltage transformer step-down the high voltage input signal to low voltage signal which can easily measure through the measuring instrument. The capacitive voltage transformer is also called as the capacitive potential transformer.

There are 14 capacitive voltage transformers in total. The type of CVT is CVEB. The total simultaneous output is 450VA. Maximum output is 750VA at 50 degree Celsius.

7.1 ASH HANDLING SYSTEM:

In the pulverized coal firing system used, the pulverized coal burns to a large extent in suspension in the boiler furnace. Part of the produced ash with a portion of unburnt combustibles falls down in the boiler furnace and drops on the burnout grate. During cleaning of the heating surfaces (by soot blowing) rather large amount of ash accumulate on the after burning grate for a short period of time. The after burning grate is arranged horizontally below the boiler furnace and serves for burnout of the unburnt coal particles accumulating together with the ash in the furnace and for ash transport.



Grate drive:

Each travelling grate is provided with a variable-speed gearing for driving the grate chains with grate cover.

Interlocking Condition:

The operation of the submerged ash conveyor is requirement for the drives of the two travelling grates.

Grate Belt:

The grate belt consists of the chain belt and the grate cover. The chain belt consists of 6 individual chain strands. These chain strands are connected with one another by chain axles over the grate width. On the chain axles spacer sleeves (tubes) are arranged between the chain strands. On the spacer sleeves (between the chain strands) the so-called rollers are arranged. In the chain link plates of the individual chain strands the medium and lateral grate link bar bridges are fixed by means of bolts. In the grate link bar bridges the grate bars (swivel bars) are mounted with the conical spigots. In the return zone at the drive shaft the individual grate barss wivel around the spigot shaft. Thus, automatic cleaning of the grate bars is affected.

In the upper strand the grate belt moves on rollers on rails and in the lower strand the grate belt slides with the surface of the grate cover on slide rails of the slide ways.

Slide ways:

The slide rails of the slide way are arranged in alternately interrupted formation in the moving direction of the lower strand. Thus, the grate cover opens and closes, i.e., the individual grate bars swivel to and fro. This swivel movement of the grate bars, too, results in a cleaning of the grate cover.

Grate chain tension:

A periodical check of the grate chain tension is necessary. The chain tension is indicated by the local position indicators. If too low, the chain tension is to be readjusted. The actual position of the grate chain adjusting axles is also indicated by local position indicator.

Under grate Air for the Travelling Grates:

Each travelling grate has 5 air (ash) zones. The air is supplied to the zones from one side through individual stub lines (boiler rear wall). In each stub line one trimming damper HHB10...HHB20 AA101 - AA105 is arranged. By these trimming dampers the air flow distribution can be adjusted to different values locally by hand over the length of the traveling grates. The optimal damper

positions are fixed during initial commissioning.

Cooling water supply to the drive shaft:

The cooling water system of the grate drive shafts should be continuously in service during the entire operating period of the burn out grate. The cooling water flow is adjusted by the manual control valves arranged in the cooling water supply lines. In the process, the temperature indicated at thermometers HHB10 CT001 and HHB20 CT001 installed in the cooling water discharge lines is to be checked and the cooling water flow rate should be adjusted so that a temperature of 45 °C is not exceeded. The water temperatures at the outlets should be periodically checked and, if necessary (temperature too high), the adjustment of the manual control valves corrected.

Cooling water supply to the size reduction bar in the ash hopper:

Here, the same applies as that stated under Cooling water supply to the drive shaft

Ash Gravity Flaps in the Grate Zones:

For opening and closing the ash gravity flaps HHBI0...HHB20 AA210 AA250 the following program run is provided. Before the program starts, all ash gravity flaps are closed. The period of each program step 1 - 5 is 120 seconds. This time can be adjusted between 0 - 300 seconds. The complete program steps run down one after the other. Then there is a break of 4 hours. This time can be adjusted between 0 - 12 hours.

The same program applies to the ash gravity flaps HHB20 AA210 -AA250. If required the program of the ash gravity flaps can also be actuated directly from the control room and for each grate at switch cabinet HHB10 GH001. The program runs for HHB10 and HHB20, however, should not run down simultaneously. The flaps can also be moved “OPEN” and “CLOSED” locally by hand by means of an operating handle on the solenoid valves.

Siftings Deasher

The siftings deashers HHB11... HHB21 AF001 are to be operated in the intermittent mode of operation. Before the program starts for the ash gravity flaps the respective siftings deasher is switched on. The siftings deasher is shut off only 5 minutes after program rundown of the ash gravity flaps. This time is adjusted from 1 - 20 minutes. During this time a possible downtime of the siftings deasher is indicated by HHB11...HHB21 CS001.The siftings deashers can be switched “ON” and/or “OFF” from switch cabinet HHB10 GH001.

7.2 Operation:

- The grate belt speed, i.e., the output speed of the grate drives is to be adjusted according to the ash accumulation on the traveling grates and/or the firing rate.
- During normal operation the maximum bed depth on the grates of 200 mm should not be exceeded.
- The grates always have to be provided with the minimum air flow of the under grate air for cooling. The air is required for cooling the grates and grate belts.

- The under-grate air temperature should not exceed 310°C.
- The water-cooling devices of the grate shafts and the size reduction bar in the ash hopper have to be in operation. Check water temperature.
- The program run of the ash gravity flaps and the siftings deasher is to be monitored.
- The grease supply of the grate shafts, axles and the siftings deashers shafts, axles have to be monitored.
- The oil levels of the grate and ash scraper drives are to be checked at regular intervals
- At monthly intervals the tension of the grate belts is to be checked and adjusted if necessary.

7.3 Shutdown:

- Operation of the grate drives has to be continued for a certain adjustable time after flame “OFF” for emptying the grates and for cooling down the grate chain with cover.
- Rundown time t = 60 - X min., with simultaneous feed of the minimum grate air flow (under grate air).
- The I.D. fan should be in operation during this period of time.
- After flame “OFF” at least one more program run is to be performed for the ash gravity flaps and the siftings deashers.
- Keep l.D. fan, grate air and water cooling in operation until no hazardous heat radiation from the combustion chamber can act on the grates.

7.4 Storage Condition:

- The submerged ash conveyor HDA20...HDA30 AF001 indicates a failure and has to be switched off. Shut down after burning grate, i.e., switch off grate drive motor HHB10 AF 001 - MC and HHB20AF001 - M01.
- If necessary close gate HDA10 AA101...AA102 below ash hopper.
- The maximum downtime of the two travelling grates should not exceed 4 hours. After this time the ash storage capacity above the travelling grates is used up at 100% boiler load. Then the boiler should be shut down.
- Keep ID fan, grate air and water cooling in operation until no hazardous heat radiation from the combustion chamber can act on the grates. General Measures in case of Operating Faults
- Find out cause of failure.\
- Check whether the failure can be eliminated at short notice during operation.

- If this is not the case take the boiler out of operation and shut down the grates.

7.5 Water Management

During normal operation the cooling water outlet temperature should not exceed 55 C which can be monitored on the local thermometer HDA20/30CT001. Accordingly the water quantity has to be adjusted. Only in case of disturbance when conveying the max. amount of ash (25 t/h) the cooling water outlet temperature is allowed to rise to 66 C. The required amount of water has to be increased accordingly. Low cooling water level will be alarmed by the level switch HDA20/30CL001.

7.6 MAINTENANCE:

General

Mechanical conveyors require periodic maintenance and wearing part replacement. Scheduled preventative maintenance and replacement will reduce operations and maintenance costs, decrease repair outage times, and increase boiler unit and conveyor availability. Maintenance to conveyor externals can usually be performed while the unit is operating. Conveyor internals repair and replacement should only be performed when submerged scraper conveyor is de-energized at the motor control centre. Preventative maintenance and worn part replacement should be coordinated with scheduled outages. Trouble-free operation is however only expected, if the plant has been properly installed and the operating instructions contained in this instruction manual are observed. These operating instructions should be carefully read by the operating personnel before start-up of the plant. The complete maintenance work has to be performed by qualified maintenance personnel so that the operating reliability is always ensured. This maintenance personnel has to be instructed by the operator/owner and entrusted with the maintenance of the plant items. Comprehensive knowledge of the complete operation and maintenance documentation is another requirement for the performance of maintenance work.

Preventative Maintenance:

LUBRICATION - Important for a long availability is to follow the recommended lubrication interval.

WEAR PLATES Inspect and replace as necessary. Wear plate thickness should be determined during schedule outages. A hand-held ultrasonic tester is convenient and an accurate method in this determination. A history of measured thickness should be established. Wear plates that are less than 25 percent of their original thickness should be replaced. Replace any broken wear plates if pieces are missing or if the integrity of the connection is questionable.

CORROSION PROTECTION - It is possible for the SSC bath water to become corrosive after a period of operation due to the chemistry of the bottom ash. The pH will probably be a few points above neutral (caustic). Change out the water bath during scheduled outages, and use additives as necessary to control pH.

7.7 Maintenance of the electrical Equipment

Basically, maintenance work only has to be performed by the authorized and instructed electrical specialist technicians. Before maintenance work is carried out on electrical systems they have to be switched off and protected against erroneous or unauthorized switching on. For fault location on the electrical system the circuit diagrams should be used.

Inspection

The conveyor should be inspected during each scheduled plant outage. The following procedure is recommended for the submerged scraper conveyor:

- Drain water from housing.
- Wash down the interior, inspect for signs of corrosion, bumper damage, scraper bar damage and chain link (and master link) wear. Replace all missing or damaged scrapers.
- Release tensioners, remove chain from tension idlers and check for free rotation of all idlers. If any idler cannot be made freely rotate, it should be rebuild/replaced, at this time.
- Install chain over tensioners and re-tension chain.
- Check all field devices for signs of damage and material build-up. Clean and replace as necessary.
- Inspect for broken or extremely worn wear plates. Take thickness measurements and replace as necessary.
- If necessary, the SSC can be rolled out from underneath the boiler outlet. Lateral movement of the SSC is only possible, when the shut-off gate valve HDA10AA10 is closed and the SSC is switched off (interlocked).

7.8 ELECTRO STATIC PRECIPITATOR (ESP):

Each 210 MW Steam Generator is provided with 2 Electrostatic Precipitators (2 x 50% capacity during normal operation) in independent and separate casings, located downstream of the Air preheaters. The flue gases from the Boiler are directed into the ESPs through inlet funnels (2 per ESP) and the cleaned gases at the ESP exit are directed through outlet funnels (2 per ESP) to the ID fans and stack to the atmosphere.

Each ESP is equipped with 6 electrical fields lengthwise named 1 to 6 and 4 sections width wise (A, B & C, D). There are two sperate sections having 12 fields and each field is served by one HV Transformer Rectifier Set. The Fields are named as A1 to A6, B1 to B6, C1 to C6, D1 to D6, Each Section of ESP is provided with 24 Dust Collecting hoppers. The ESPs are mounted through bearings on steel support structure. A system of platforms and stairs are provided for easy access to all parts of the ESP.

The ESPs are designed to achieve an outlet emission level of 100 mg / NM3 (wet) or less with one field out of service in each row.

PRINCIPLE

The Electrostatic Precipitator is and electrical equipment where a DC voltage is imparted, through emitting electrode creating an electrical field around it. Dust particles carried by the gas, while passing though the fields are charged to saturation and migrate towards the collecting electrode, usually in the form of plate curtain, where they are deposited in layers. By suitable rapping, dust is dislodged into the hopper.

The dust-laden gas enters the precipitator at “A” and the cleaned gas leaves at “B”. The electrodes “E” usually known as emitting electrode and “C usually known as collecting electrode form a large number of gas passages. The C-electrodes are usually “curtains” of vertically hung plates. The E-electrodes - usually metal wires mounted in a frame work - are placed in the space between C-electrodes curtains. A rectifier impresses suitable D.C voltage between the electrodes depending on the particular process. Due to the high electrical field around the E-electrodes the gas around the electrode is ionized and the region is filled with negative and positive ions. This is called corona formation.

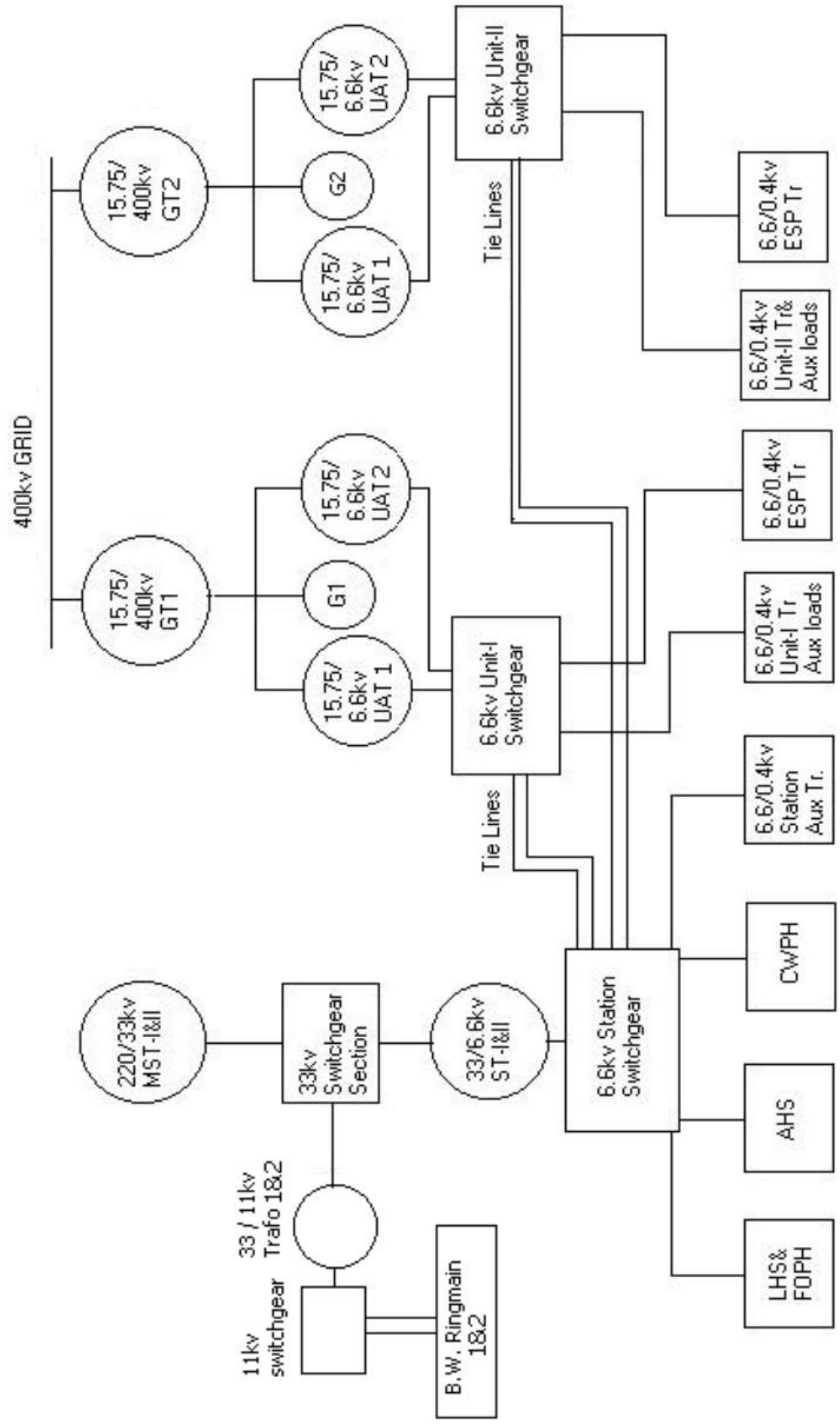
The dust particles carried by the gas between the electrodes are charged to saturation immediately after entering the space. The charged particles are then pulled towards the collecting electrodes. Movement of particles is opposed by the viscous drag and a resultant velocity, called migration or drift velocity is attained by the particles. The dust is then precipitated on to the plate electrodes. Hence a deposit of dust is formed on the plate. When the layer is sufficiently thick and agglomerated it is dislodged from the plates by rapping. The dust cakes slide along the plates down in to the storage hoppers. It is, thus, seen that principle of electrostatic precipitation has four phases:

- Corona formation or ionization
- Charging of particles
- Migration and precipitation of particles
- Removal of deposited dust.

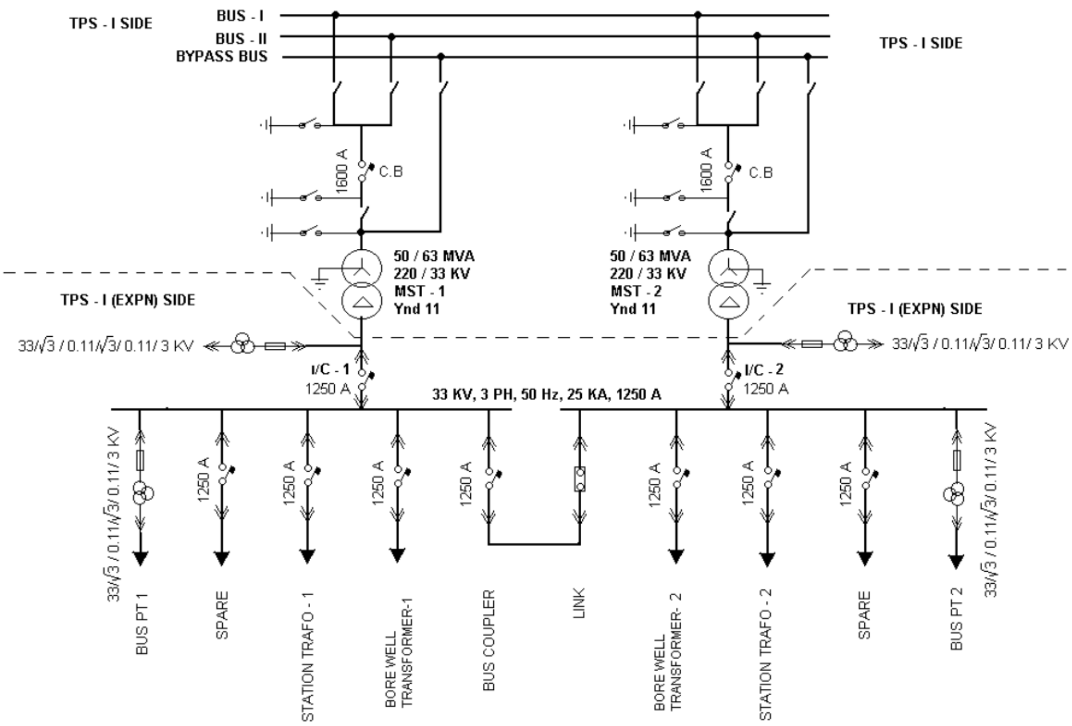
The manifold advantages like low-pressure drop, low sensitivity to high temperature and aggressive gases, high collecting efficiency well in excess of 99.5%, low maintenance etc make electrostatic precipitators popular over other dust collectors

8.1 ELECTRICAL SCHEMES IN TPS – 1 EXPANSION

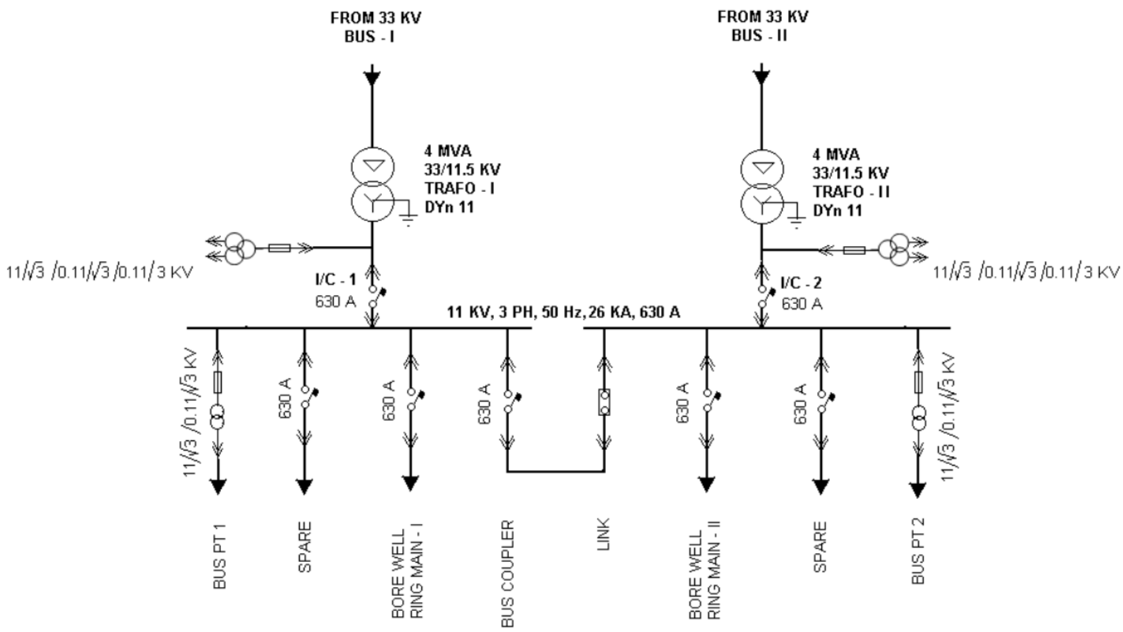
Oveall Electrical Layout of TPS – 1 Expansion



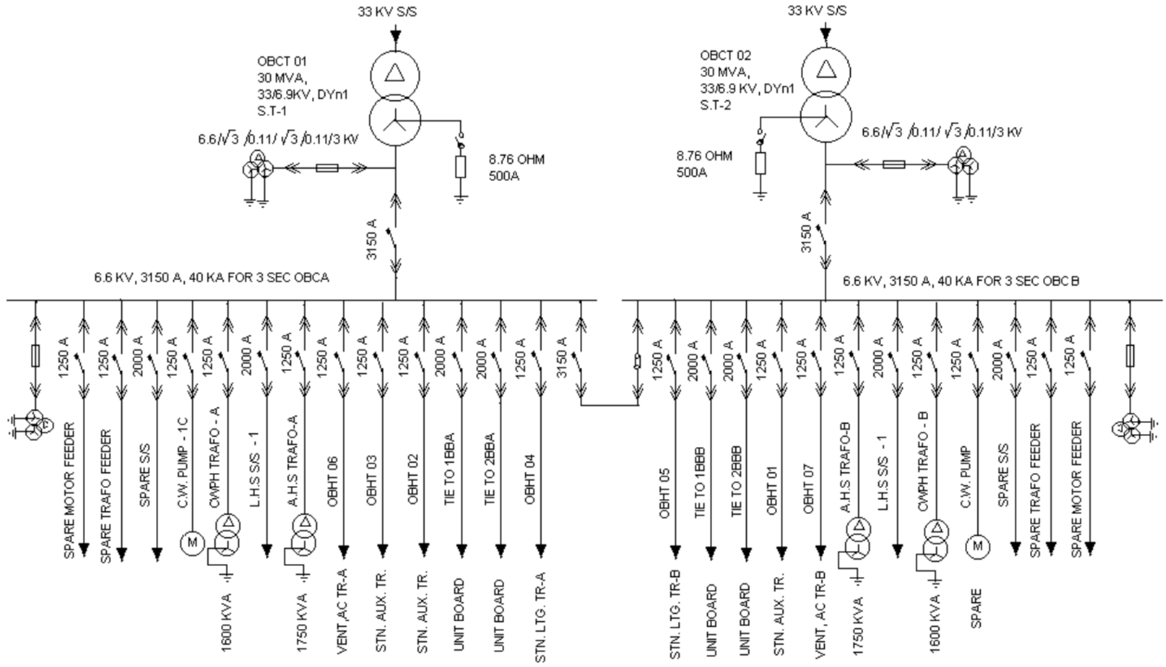
220 / 33 KV SWITCH YARD SCHEME



33 / 11 KV SCHEME

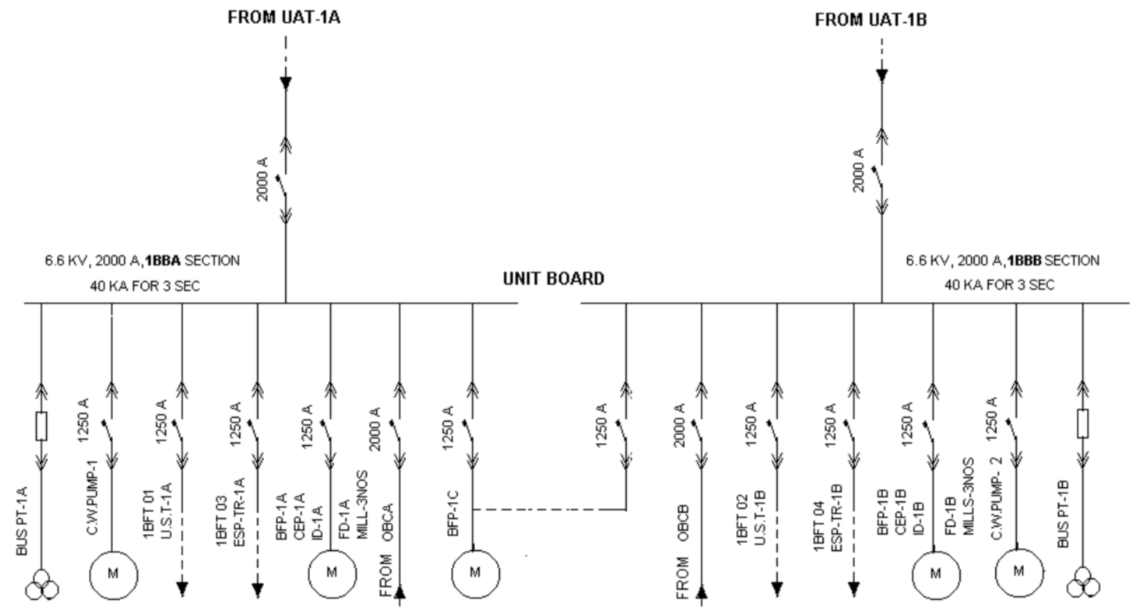


6.6 KV STATION BOARD - SCHEME

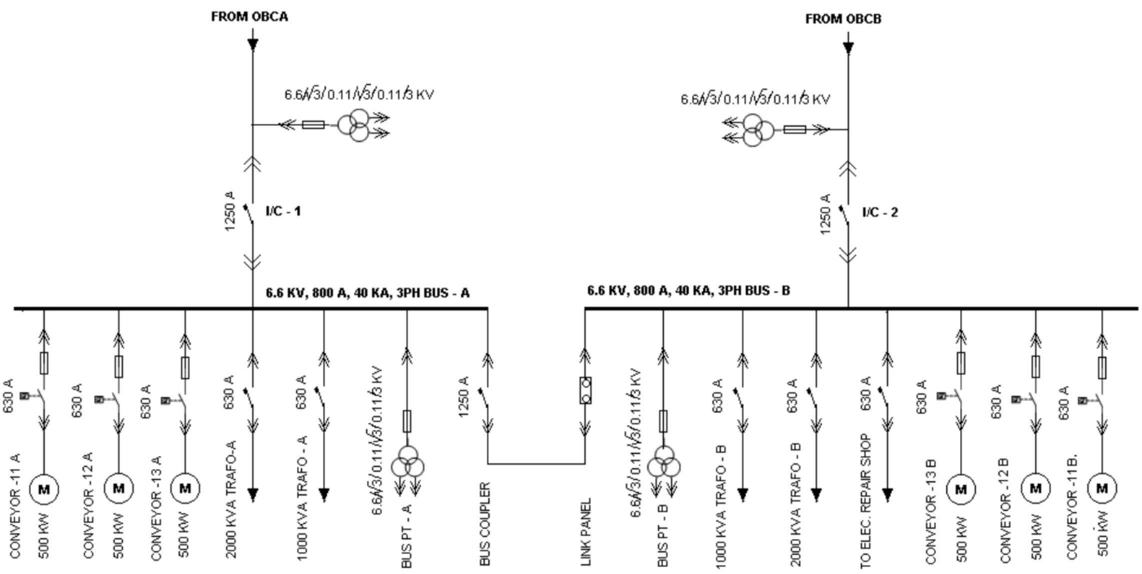


6.6 KV UNIT BOARD SCHEME

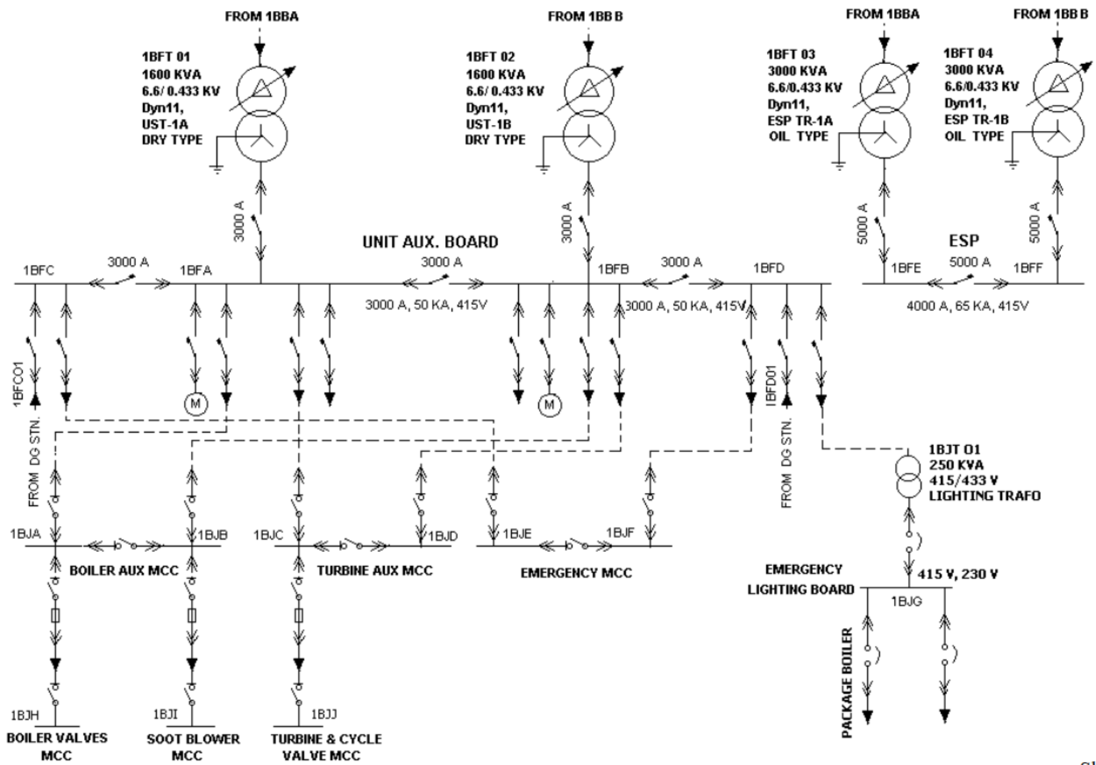
UNIT-I



6.6 KV L.H.S.(SS- I) SWITCHGEAR BOARD



0.4 KV UNIT AUXILIARY BOARD SCHEME UNIT-I



Sheet 8

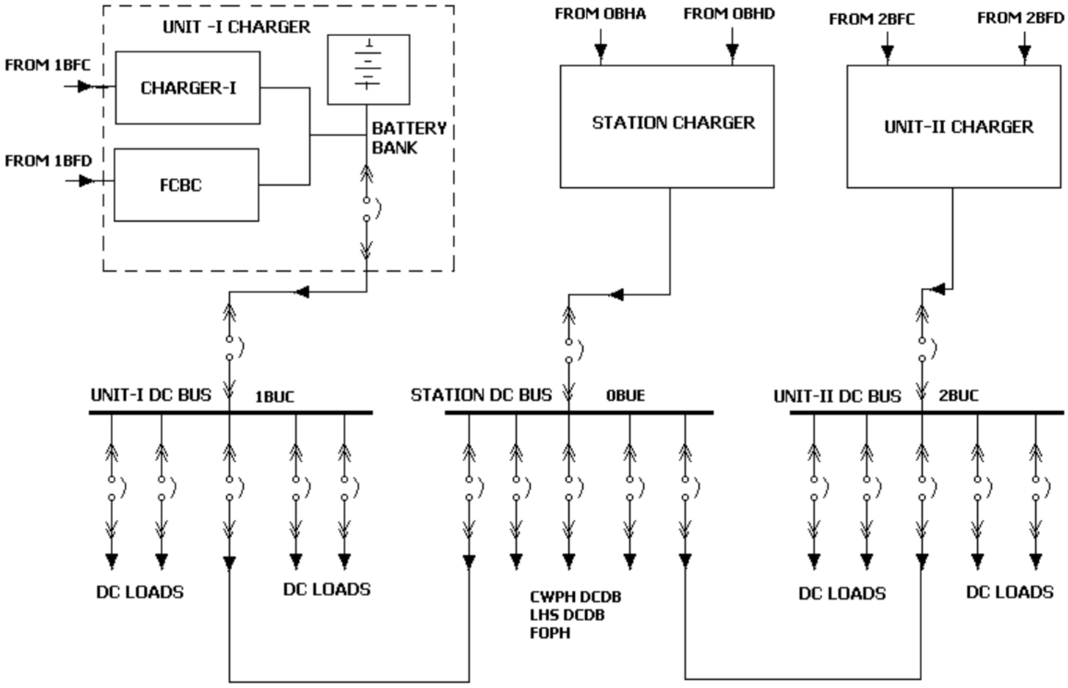
8.2 DIESEL GENERATOR:

There are two Diesel Generator sets in the power station to feed the emergency 415 V AC supply in case of Station Supply failure. DG Set 1 feeds, the 0.4 KV unit section Normal/Emergency buses 1BFC & 1BFD of unit I and DG set 2 for unit II buses of 2BFC & 2BFD. The important loads in emergency buses are Unit battery chargers, UPS chargers, Seal oil pumps, Aux. oil pumps, Jack oil pumps, Air pre heaters, Flame scanners, LOP of ID & FD fans, emergency lighting etc. The A.C. Generators are of salient pole, brushless revolving field type and are excited by an overhauling A.C, exciter (rotating armature type) through a rotating rectifier assembly. The arrangement eliminates the need of sliprings, commutator and brush gear besides offering other advantages over the conventional generators. This machine is provided with separate excitation system which feeds excitation to the generator field in accordance with change in the operating conditions.

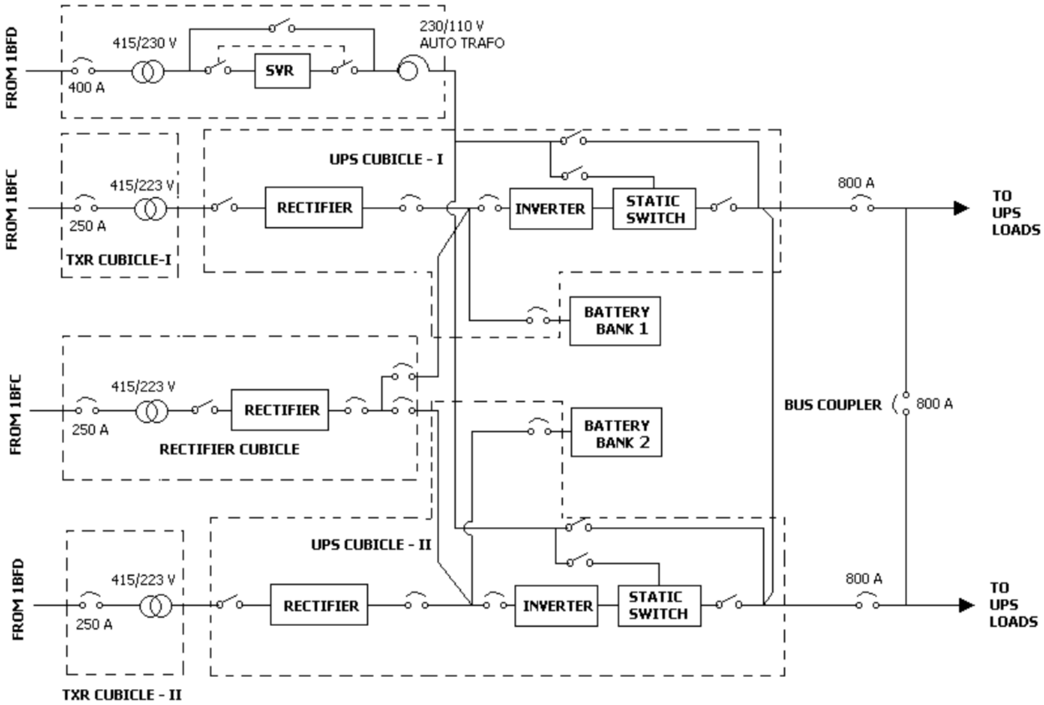
GENERATOR AND ENGINE DETAILS

Engine make	-CUMMINS
Speed	- 1500 rpm
AC Generator make	- KIRLOSKAR limited
Rated capacity	-750 KVA
Voltage	-415 V
Current	-1043.4 A

220 V DC SYSTEM



UPS SCHEME



8.3 TRANSFORMERS:

A transformer in a power system is a vital link between the generating system and the distribution system. Without these transformers the power generated cannot reach the user end. Any failure of this vital equipment will lead to unstable operating conditions.

The grid system and even virtual collapse of the grid. In view of the enormity of the problem effective condition monitoring of the transformers has become essential.

There are totally 119 nos. of transformers in service in TPS - I Expansion. Out of this, 90 nos. are oil filled transformers and the remaining 29 nos. are dry type transformers. 2 nos. of Generator Transformers are step up transformers and all the remaining transformers are step down transformers. Forced air forced oil cooling system is in service in the 2 nos. of Generator Transformers and natural air cooling system is in service in all the remaining transformers. On-Load tap changing arrangement is available in the 2 nos. of 30 MVA Station Transformers and Off Load tap changing arrangement is in service in all the remaining transformers. There are 48 nos. of High Voltage Rectifier Transformers in service in the ESPs.

Transformers in TPS – 1 Expansion:

The transformers in TPS 1 expansion are,

- Generating Transformer
- Excitation Transformer
- Neutral grounding Transformer
- Unit auxiliary Transformer
- Unit service Transformer
- ESP Transformers
- Lighting Transformers
- Station Transformer
- Emergency Lighting Transformer
- ESP Rectifier Transformer
- 2000KVA Transformer
- 1000 KVA Transformer
- Drive type RESIN Cast Transformer
- Ash Handling Substation Transformer
- Borewell Transformer
- CWPH S/S Transformer

Protections in Transformer:

The transformer protection devices are,

BUCHHOLZ RELAYS: The gas actuated buchholz relay is a protective device designed to give indication of faults occurring in oil filled conservator type transformers, on load tap changers, capacitors etc

PRESSURE RELIEF VALVE: The pressure relief valve is a protective device for oil filled transformers. It is designed to relieve the excessive pressure, which may build up, by a fault or an arcing inside the transformer tank

MAGNETIC OIL LEVEL GAUGE: The float movements are conveyed to the driving magnet through a set of bevel gears. The follower magnet follows the driving magnet. The driving magnet remains inside the conservator and the follower magnet is kept outside the conservator.

DEHYDRATING FILTER BREATHER: Dehydrating filter breather is designed to remove moisture and dust contained in the air breathed by a transformer. The breather consists of a container filled with silica gel and a filter cup filled with transformer oil. This is connected to the top of transformer oil conservator by connection pipes.

8.4 BATTERY SYSTEM

Battery system plays a vital role in the Power Station as it is the Ultimate power supply source which gives life to the essential safeguarding equipment besides control & protection functions of the vital equipment and for illumination. There are many systems of Batteries in the power station such as for Unit, Station, Switchyard, Exchange and various UPS systems etc with various voltage levels for different kind of application as detailed below. Most of the Batteries are of Lead Acid Batteries being more advantageous and having longer life.

FLOAT CHARGER:

The method of operation known as “floating” means that the charger, the battery and the load are connected in parallel. The battery voltage of float can, under certain condition, be any value between 2.06 and 2.30 volts per cell. Where the load conditions will allow, the battery should be held constant at a voltage equivalent to 2.25 volts per cell. So that the battery will normally be maintained in a fully charged condition, without the need for regular freshening charges.

FLOAT CUM BOOST CHARGER:

There are two numbers of 220V chargers in the Switchyard. Each charger can be operated in float mode (CV mode) or in boost mode (CC mode).In this system, the float mode is meant for supplying the continuous DC load at constant voltage mode and at the same time trickle charging the battery to keep it in fully charged condition. The boost mode is basically meant for quick charging the battery at constant current mode after a heavy discharge, so as to restore the capacity of the battery within minimum time

9.1 CONCLUSION:

On the whole, this internship was a useful experience. We have gained new knowledge and skills. We achieved several of our learning goals. We got insight into professional practices currently advocated in the industry. We learned the different facets of working within a thermal power plant. Related to our study we learnt the processing of lignite and transporting it to the boiler, burning it and producing stream in the boiler, removing the flue gases and ashes from the furnace, power generation using the stream from the boiler, and feeding the generated power to the power grid using the 400 kV switch yard.

Furthermore, we have experienced that it is of importance that education is objective and that we have to be aware of the industrial aspect of the topics we study. This internship programme was not one sided, but it was a way of sharing knowledge, ideas and opinions.

The internship helped us to define what skills and knowledge we have to improve in the coming time. We can confidently assert that the knowledge we gained through this internship is sufficient to contribute towards our future endeavours. At last, this internship has given us new insights and motivation to pursue a career in core electrical departments.