

HYDRO-TURBINE RUNNERS

KAPLAN

Kaplan turbine runner converts the pressure energy of water into rotation energy, which is converted into electrical energy through generator.

Kaplan Turbine is used when height (head) of the available water in dam is less than 50m.

FRANCIS

Francis turbine runner converts the pressure energy of water into rotation energy, which is converted into electrical energy through generator.

Francis turbine is used when height (head) of the available water in dam is between 50 to 400m.

PELTON

Pelton turbine runner converts the kinetic energy of water jets into rotation energy, which is converted into electrical energy through generator.

Pelton turbine is used when height (head) of the available water in dam is more than 400m.



1200 kV AUTO-TRANSFORMER

BHEL developed 333 MVA, 1150/400/33 kV, 1-phase, Auto-transformer is installed in India's first 1200 kV National Test Station at Bina (MP) established by POWERGRID. The transformer is used to step-up transmission voltage from 400kV to 1200kV to reduce long distance transmission losses. This is one of the first steps towards excellence in the Ultra-High Voltage AC system and establishment of commercial 1200kV transmission line in India. Specification of the 1200 kV transformer:

- ❖ 333 MVA, 1150/400/33 kV, 1-phase, Auto-transformer
- ❖ 2250 kVp Lightning Impulse
- ❖ 1800 kVp Switching Impulse
- ❖ Cooling : 4 x 33.33 % Compact OFAF Coolers
- ❖ Overall Size, (LXWXH) - 10.0 X 9.8 X 14.5 meters
- ❖ Overall Weight : 321 Tonnes



COMPOSITE MONITORING SYSTEM FOR POWER TRANSFORMERS

Composite Monitoring System (CoMoS) are deployed for complete monitoring of Power Transformers.

Capabilities of CoMoS:

- ✓ Provides monitoring and diagnostic function for Power Transformer,
- ✓ 100% redundant system with hot standby feature,
- ✓ Communicates with remote SCADA system & remote monitoring over 3G/4G/5G network with cloud storage facility,
- ✓ Built-in models for transformer condition assessment
- ✓ Provides flexibility to address varied customer requirements



SEAL OIL UNIT

Seal Oil Unit is the most critical system attached to Turbo-Generator for its efficient operation in the power station. It is deployed to seal the Hydrogen gas in the Turbo-Generator and to minimize the intermixing of seal oil at the shaft ends to maintain the purity of Hydrogen gas in the generator.

Seal oil system provides the oil to sealing rings of Turbo-Generator shaft with the minimum pressure differential between the seal oil layers. The pressure of hydrogen gas is utilized as a reference for determining the pressure of the seal oil surrounding the shaft of generator.

Design	:	THRI
TG H ₂ Gas Pressure (kg/cm ²)	:	5
Diff. Pressure (kg/cm ²)	:	1.1
Flow Rate(lpm)	:	40



CORE ASSEMBLY OF 800 MW TURBO-GENERATOR

Core is the heart and heaviest component of a Turbo Generator, providing path to rotating flux. It is made up of 0.5 mm thick laminated stampings of Cold Rolled Non Grain Oriented Steel (CRNGO Steel). The assembly of core is carried out by laying the stampings in spiral way in half over-lapped manner. During manufacturing it is hydraulically pressed & locked (Pressing parameters: Pressure = 200 kg/cm² Temperature = 80 degree C for 48 hours).

Typical statistics of Cores:

Total Number of Stampings	-	130400
Inner Diameter	-	1410 mm
Outer Diameter	-	3280 mm
Total Length	-	6700 mm
Total weight	-	320 Tons



STATOR FRAME OF 800 MW TURBO-GENERATOR

Stator Frame is the outer shell of the Turbo Generator made of mild steel. Initially it is fabricated in three parts and later joined together by welding to make a complete stator frame. Hydraulic Test & Pneumatic Test are conducted to check the healthiness of the stator frame & weld seam.

Hydraulic Test (To check the deformation of the Stator Frame)	-	Pressure: 3, 5, 8, 10 kg/cm ²
Pneumatic Test (To check the leakage from weld seam)	-	Pressure: 6 kg/cm ²

Typical statistics of Stator Frame:

Total Length	-	10015 mm
Outer Diameter	-	4480 mm
Total Weight	-	80 tons



ROTOR OF 800 MW TURBO-GENERATOR

Rotor is a critical component of the Turbo-generator. Basic function of the rotor is to produce a magnetic field of the size and shape necessary to induce the desired output voltage in the stator.

The 800MW TG Rotor weighs around 90 MT and is 13.5 m long. The rotor shaft is a single-piece high strength forging manufactured from vacuum de-gassed steel. Longitudinal Slots are milled over the circumference of the rotor barrel for insertion of the field winding. At the ends of the Rotor Barrel, Retaining Rings are shrink-fitted which keep the winding overhangs in position.

The Rotor Shaft has an axial trepanned hole to accommodate the DC-Lead assembly for supplying excitation current to the winding. The Rotor Shaft is provided with integral couplings at both the ends to couple LP Turbine and Exciter Rotors.



CONDENSING STEAM TURBINE AND GENERATOR

- ❖ Main steam enters High Pressure (HP) section of turbine and steam expand and exit the section and returns to Steam generator. Reheated Intermediate Pressure (IP) steam enters the IP section of turbine and flow through IP section in direction opposite that of HP section. Steam from IP exit section flows through Low Pressure (LP) section.
- ❖ Combined opposite flow HP/IP section and double flow LP section thus high efficiency steam paths, integrally shrouded blades for superior mechanical integrity.
- ❖ Suitable up to 150 MW.



FRAME 9F.05 'ADVANCE CLASS GAS TURBINE'

BHEL has developed and manufactured highest rated first Fr 9F.05 'Advance Class Gas Turbine' of rating 299 MW @ 38.5 % thermal efficiency at Hyderabad plant for KPCL Yelahanka power project.

The Fr 9F.05 Gas turbine is built with 18 stage axial flow compressor, 18 can annular combustors and 3 stage turbine. Both the compressor and turbine are directly connected inline to make a single shaft rotor supported on two pressure lubricated bearings. The combustion system is a Dry Low NO_x 2.6+ combustor providing stable combustion dynamics and controlling the NO_x levels to less than 25 ppmvd@15% O₂ on gas fuel. The turbine weighs about 320 tons and measuring 11m x 5m x 5m.

BHEL manufactured Gas turbines are in service in refineries, petrochemical plants, fertilizer, steel, Gas compression stations and Power generation plants in India and abroad. BHEL has installed over 230 Gas Turbines with cumulative fired hours of over 13 million.



WAG-7 LOCOMOTIVE

Basic Statistics:

Continuous Power	5000 HP
Centenary Voltage Nominal	25.0 kV
Power system	5400 kVA Transformer 2 nos, 3300Amps Bridge Rectifier 6 nos, DC traction motor (HS 15250)
Bogie	Fabricated Bogie with Co-Co configuration
Weight	123± 1% Tonnes with HS TM 15250
Maximum Axle Load	20.5 Tonnes
Speed at Continuous Rating	50 km/hr
Minimum Service Speed	100 km/hr
Continuous/ Max. Tractive Effort	27/ 42 Tonnes
Brake System	Air and Dynamic
Special Feature	Air conditioning system, Crew friendly FRP cabin, EPDM based cable management system



WAG-5HB LOCOMOTIVE

Basic Statistics:

Continuous Power	3850 HP
Centenary Voltage Nominal	25.0 kV
Power system	3900 kVA Transformer 2 nos, 2700Amps Bridge Rectifier 6 nos, DC traction motor (HS 15250)
Bogie	Fabricated Bogie with Co-Co configuration
Weight	119± 1% Tonnes with HS TM 15250
Gear ratio of Transmission	64:18 for HS 15250A Motor
Maximum Axle Load	20 Tonnes
Speed at Continuous Rating	50 km/hr
Minimum Service Speed	100 km/hr
Maximum Starting Effort	33.5 Tonnes
Brake System	Air and Dynamic



660 MW ONCE-THROUGH SUPERCRITICAL STEAM GENERATOR

Scale	1:125
Fuel	Pulverized Coal
Main live steam flow	2120 T/hr
Super-heater steam pressure	255 kg/cm ² (g)
Super-heater steam temperature	568°C
Feed-water temperature	294°C
Re-heat steam flow	1708 T/hr
Re-heat steam pressure	54.7 kg/cm ² (g)
Re-heat steam temperature	596°C
Special features	<ul style="list-style-type: none">❖ Low NO_x Firing System❖ Sliding Pressure❖ Spiral Wall

