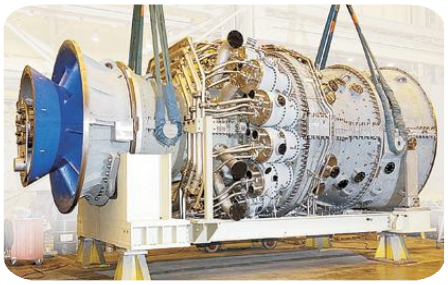
भारत हेवी इलेक्ट्रिकल्स लिमिटेड
BHARAT HEAVY ELECTRICALS LIMITED
(A Govt. of India Undertaking)
Ramachandrapuram, Hyderabad – 502 032
Telangana, India
www.bhelhyderabad.com

PRODUCT PROFILE

ONE STOP SOLUTION
FOR
POWER AND ENERGY NEEDS









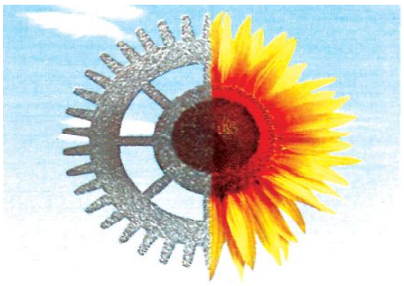
A global engineering enterprise
providing solutions for a better tomorrow

Maharatna Company

Golden Jubilee 1964 - 2014

50 Years

World of BHEL



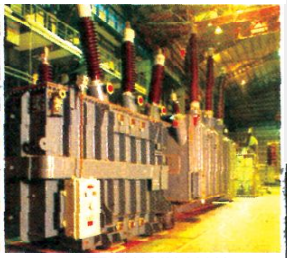
Vision

A Global engineering enterprise providing solutions for a better tomorrow

Mission

Providing sustainable business solutions in the field of Energy, Industry & Infrastructure

POWER



TRANSMISSION

INDUSTRY

TRANSPORTATION

RENEWABLES

OIL & GAS

DEFENCE

WATER

Values

- Governance
- Excellence
- Integrity
- Innovation
- Respect
- Loyalty
- Commitment
- Team Work

Wingspan

Pan India

- 17 Manufacturing Unit
- 1 Subsidiary
- 6 Joint Ventures
- 8 Service Centre
- 2 repair units
- Infrastructure to deal with 150+ project sites

Global Footprints

- First export order for boilers (2x60 MW) from Malaysia,1971
- Commissioned first 120MW BTG & sub-station unit on turnkey basis at Tripoli, Libya in 1980
- References in 76 countries
- Offices in 8 countries
- Contracted power plant equipment around 17,000 MW
- Executing 28 projects spread over 20 countries

The Gentle Giant

- An Indian Maharatna CPSE
- One of the largest engineering & manufacturing companies in india serving core sectors of economy-
- Power
- Industry
- Transmission / Transportation/ Oil & Gas / Renewables/Water/ Defence/Industrial products – Electrical & Mechanical
- One of the few Major Integrated Power Plant Equipment Manufacturers
- Power plant Equipment Manufacturing capacity of 20,000 MW p.a
- 57%share in India's total installed power generation capacity

ISO 9001 BUREAU VERITAS Certification

OHSAS 18001

ISO 14001

ASME U

ASME U2

INTRODUCTION

Heavy Power Equipment Plant (HPEP), Hyderabad is one of the major manufacturing units of BHEL. It was established in 1965 with the objective to design, manufacture and supply small size (12MW to 110 MW) steam turbine generator sets. With a modest beginning, BHEL Hyderabad has been growing steadily and today it caters to diversified customer needs with a product mix of gas turbines, steam turbines, compressors, generators, oil field equipment and other power plant equipment such as pumps, pulverizers and heat exchangers etc.

In the power segment, BHEL Hyderabad offers stand-alone products & packages as well as EPC & turnkey solutions from concept to commissioning including civil works, equipment design, erection, commissioning, trial operation and handing over to customer. BHEL Hyderabad provides the flexibility of plant erection & commissioning by customer with BHEL supervision.

Coal based thermal power plant in India

In the year 2011-12, a separate unit 'Project Engineering & Systems Division' (PE&SD) was formed at Hyderabad with the mandate to provide end-to-end solutions to customers in industrial and international business segments. To effectively address customer needs, PE&SD caters to supply of balance of plant equipment and system engineering for the inhouse products of BHEL Hyderabad.

BHEL Hyderabad supports customers with post-warranty services including supply of spares and extends commissioning and after-sales support.

BHEL always strives to exceed customer expectations and has sophisticated engineering capabilities, manufacturing, testing facilities with a network of high-end engineering work-stations to cater to the specific needs of the products.

BHEL Hyderabad customer profile is a virtual who's-who of the Indian industry with all sectors catered to by BHEL. We have also forayed into the export market by supply of products and equipment from BHEL Hyderabad for power stations and process industry.

CNC machines at BHEL, Hyderabad

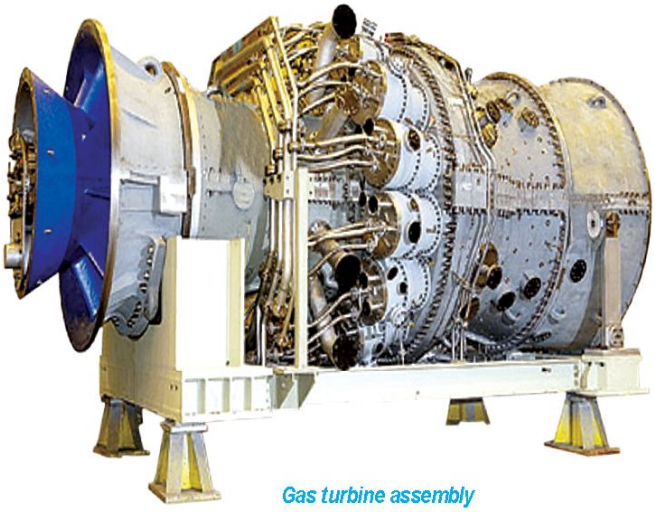
Manufacturing facilities at BHEL Hyderabad are on par with the best in the world with 120 CNC machining centers, 125 ton vacuum balancing tunnel, Cerro-bond technology for steam turbine precision blade forgings, 5 axis milling for 3D impellers etc. BHEL Hyderabad has also established CIM (Computer Integrated Machining).

3000 networked PCs provide enhanced operational efficiency.ERP/SAP systems have been implemented to smoothen the information flow and effective management of business processes. BHEL Hyderabad has a host of instrumentation laboratories and sophisticated quality control facilities. BHEL is equipped with ISO 9001, ISO 14001, OHSAS 18001, ASME U & U2 stamp and API certification for oil rigs which is a testimony of sound and consistent quality and safety practices at BHEL. Customer training is provided for all products to customers in order to have safe and maintenance free operation of products at site.

BHEL is qualified by Fluor-USA, CB&I-USA and Saipem-Italy for supply of critical process equipment to refineries and power plants.

GAS TURBINES

BHEL manufactures a complete line of heavy duty industrial gas turbines for all utility and industry applications with installations in refineries, petrochemicals, fertilizers, steel, gas boosting stations and power generation plants in India and abroad.



Gas turbine assembly

BHEL, Hyderabad has a long-standing experience in manufacturing gas turbines since 1986 with licensing from M/s GE,USA.

A proven combination of sound design and manufacturing processes places these gas turbines among the world's most reliable machines. Gas turbines manufactured by BHEL cover the 25 MW to 299 MW power range.

Gas turbines offered by BHEL-Hyderabad are tailored to meet specific needs of customers with regard to plant layout, type of fuels, emission and noise requirements. The features of these machines include capability to burn a variety of fuels, both gaseous and liquids. Mixed firing of many of these combinations of gases and liquids are also configured.

These turbines are suitable for many indoor and outdoor field layout configurations requiring a very small space envelope. Inlet air temperature suppression systems are available for high ambient installations.

PRODUCT PROFILE

MODEL	APPLICATION	OUTPUT (MW)	HEAT RATE (Kj / KwHr)
F - CLASS			
MS9001FB (9F.05)	SC	297.3	9345
	CC	457.6	6080
MS9001FA (9F.03)	SC	262.8	9610
	CC	396.1	6377
MS6001FA (6F.03)	SC	77.1	10140
	CC	114.9	6795
B & E - CLASS			
MS9001E (9E.03)	SC	128.7	10490
	CC	192.9	7000
MS6001B (6B.03)	SC	42.9	10880
	CC	62.6	7460
MS5001PA (PG5371PA)	SC	26.3	12652
	CC	38.0	8728

Note:

- SC : Simple Cycle, CC: Combined Cycle.
- All the rating indicated are at 15° C, mean sea level with natural gas.

Contd..

BHEL has the largest experience of handling low lubricity and highly volatile fuels like naphtha for power generation. Gas turbines from BHEL are factory tested and packaged before shipment to reduce the field installation cycle time.

BHEL has installed over 200 gas turbines with more than 15 million cumulative fired hours.

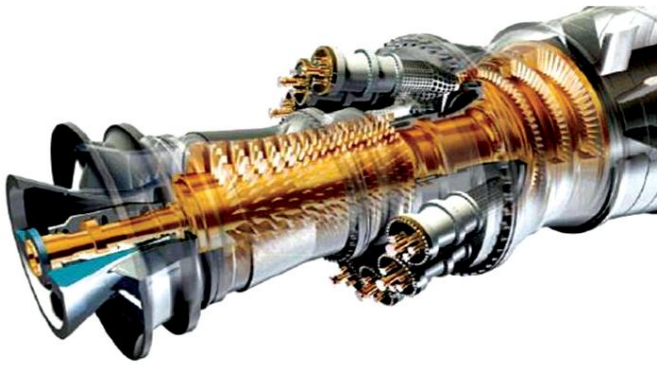
Our esteemed customers include all major establishments in India, Bangladesh, China, Iraq, Malaysia, Oman, Saudi Arabia, Srilanka, Kazakhstan and Belarus. BHEL has worked with world class engineering consultants like Bechtel, EIL, NTPC, Electrowatt, Worley Parsons & Shell.

Fr 9E GTG installed at Rusail, Oman

Salient features of gas turbines from BHEL

- Capability to fire wide range of gaseous fuels (naturalgas, refinery gas, low BTU gases) and liquid fuels (distillate, naphtha, kerosene, LCO, residual heavy fuels like furnace oil, LSHS, crude).
- Co-firing of any combination of the above fuels including naphtha.
- Low exhaust emission levels upto15ppm of NOx with DLN combustors.
- Suitable for simple cycle, combined cycle, cogeneration cycles and, mechanical drive applications.
- Suitable base load, peak load, cyclic load applications.
- Models below 100 MW are suitable for both 50 Hz and 60 Hz application.
- Ideally suited for IGCC application.
- Packaged designs suitable for shorter erection and commissioning periods.
- Suitable for both indoor & outdoor installations.
- Inlet air temperature suppression by evaporative cooling & chilling (both mechanical and vapour absorption)

BHEL also manufactures rotors, combustion and hot gas path components to support the aftermarket. Retrofitting the units for firing additional fuels is also carried out.

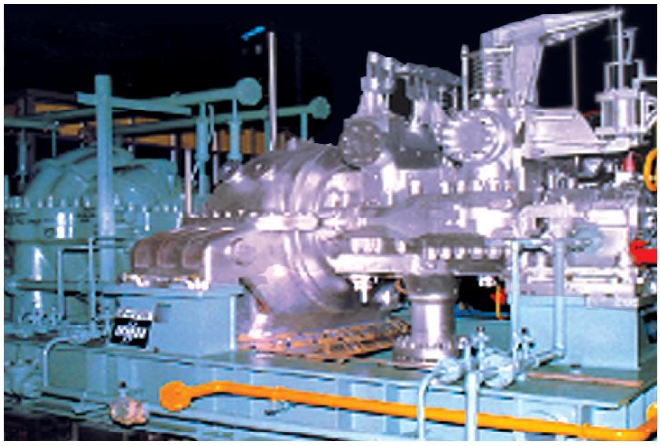


STEAM TURBINES

BHEL Hyderabad with decades of experience and over 1100+ steam turbines, has the know-how and know-why of steam turbines and is in a position to meet any plant specific requirement for captive industry, power plants and process industries.

BHEL is fully equipped to provide comprehensive service to clients covering system design, engineering, manufacturing, turnkey, erection & commissioning and civil works.

BHEL Hyderabad started manufacturing steam turbines in mid-1960's with technology from Skoda, Czechoslovakia and since mid-1970's with collaboration with Siemens, Germany.



Condensing steam turbine assembly

The range of parameters encompass a wide spectrum to cover all requirements for various industries like fertilizer, chemical, petrochemical, petroleum, paper , steel etc. For a given application and for any desired combination of parameters, an optimal solution is found using a "straight flow turbine or a center admission turbine or a two cylinder turbine". This applies for both non-reheat / reheat applications.

BHEL steam turbines are used to drive generators, compressors and pumps.

The design standards applied are IEC-45 and API612.

BHEL steam turbines are based on modular concept of design.

The following concepts are used for total range of steam turbines being offered:

- Straight flow steam turbine with single cylinder up to 60 MW
- Single cylinder counter flow non reheat / reheat steam turbines for 50 MW-150 MW
- 2 cylinder with reheat for 120-150 MW
- 2 cylinder reheat steam turbines for solar application up to 50 MW.

Salient features of BHEL steam turbines

- Building block concept for optimum selection to suit any specific application.
- Standard & proven components
- Highly efficient steam flow path
- Impulse/reaction blading for better efficiency
- Electro/Hydraulic microprocessor based governing system
- Easy integration with cogeneration
- Injection turbines with sliding pressure control for combined cycle plants
- Wide choice of powers & speed to meet any specific requirements

PRODUCT PROFILE

Inlet pressure	4 ata to 140 ata
Inlet temperature	140°C to 540°C
Extraction pressure	Upto 65 ata
Exhaust pressure	Condensing to 45 ata
Speed	3000 to 15000 RPM
Power	3 MW to 200 MW

ELECTRICAL MACHINES

BHEL, Hyderabad manufactures air cooled and hydrogen cooled generators for both steam and gas turbine applications including open cycle and combined cycle plants. BHEL Hyderabad also caters to the requirements of utility, captive power plants and cogeneration plants.

Generator assembly

BHEL currently has technical licensing agreement with M/s Siemens Germany for the turbo-generators.

Manufacture of generators started in the late 1960's and the first generator supplied to site is in operation, as on today. Turbo-generators supplied by BHEL to more than 800 sites are in maintenance-free operation in India and overseas. BHEL generators give value for the money invested by the customers, for duration much longer than that from the machines supplied by many of our competitors.

In the air cooled category, 2 pole turbo-generators in the range of 4 to 160 MW and in the 4 pole version, turbo-generators with laminated round rotors in the range of 4 to 33 MW have been supplied. Hydrogen cooled Generators and its auxiliaries upto 270 MW have been manufactured and supplied by BHEL, Hyderabad.

Knowledge-based engineering initiatives taken up by BHEL Hyderabad has resulted in comprehensive design automation that reduced the design cycle time and enabled us to bring out the most optimized generator design for a given generator specification.

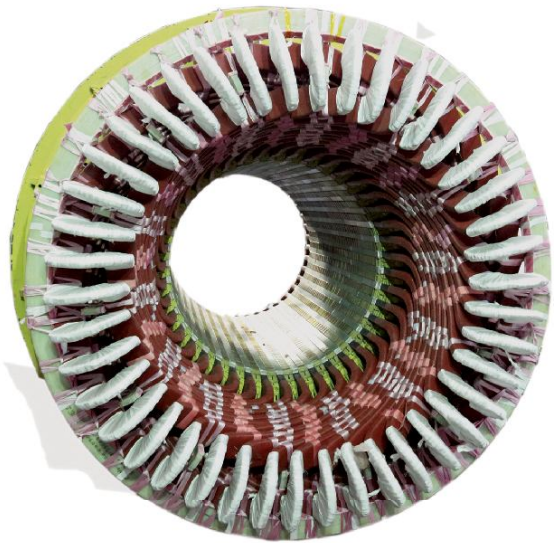
This initiative has also ensured BHEL is ready to offer any generator rating within the manufacturing range.

BHEL machines require minimal maintenance attention from plant personnel.

Through the experience gained over the past five decades, BHEL Hyderabad has been offering solutions to its customers on R&M, life extension and reduction of maintenance costs.

PRODUCT PROFILE

APPLICATION	PRODUCT OFFER	MARKET SIGMENT
Coal based power plants • Utilities • CPPs • Cogeneration	STGs 4-270 MW	Utilities,IPPs & Process industries for Indian & Export markets
Gas based power plants • Open cycle • Cogeneration • Combined cycle	GTGs 4-270 MW	Utilities,IPPs & Process industries for Indian & Export markets



Stator assembly

CENTRIFUGAL COMPRESSORS

BHEL manufactures a complete range of centrifugal compressors for all major compression applications.

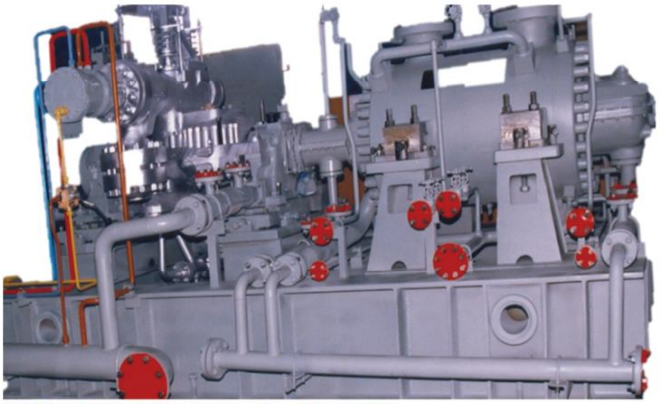
In 2010, BHEL renewed the technology tie-up with GE-Nuovo Pignone for higher capacity compressor models and state-of-the-art technology for existing models. 370+ compressors have been manufactured and supplied by BHEL Hyderabad.

The state-of-the-art centrifugal compressors manufactured by BHEL Hyderabad have become an integral part of ammonia and urea synthesis plants, methanol plants, refineries, petrochemical complexes, pipeline applications, gas booster applications, steel and other process industries.

PRODUCT PROFILE

Horizontally Split	Vertically Split (Process)	Vertically Split (Pipeline)	Integrally geared
MCL 2MCL 3MCL DMCL	BCL 2BCL DBCL	PCL	SRL

Centrifugal compressors find their applications in various services covering the range from a suction capacity of 1000 m^3/hr to 300000 m^3/hr and for discharge pressure upto 350 bar.



BCL centrifugal compressor assembly

Centrifugal compressor for H2 recycle application

The basic features of compressor supplied by BHEL are:

- Designed as per API617
- Gas handled: CO2, syn gas, ammonia, air, nitrogen, hydrogen, H2S, natural gas, inert gas , wet gas etc.
- Max driver rating : 41 MW
- Lube oil and seal gas system : API 614
- Sealing system: Dry gas seal
- Optional tests: FLFSFP (Full Load Full Speed Full Pressure), complete unit test, performance test.
- Drivers: steam turbine motor (constant speed/variable speed) or gas turbine
- Instrumentation: Local panel or DCS
- TSI System: Bently Nevada 3500 or Eqv
- Anti-surge controller: CCC, Petrotech
- PLC: Single or TMR (as per requirement)

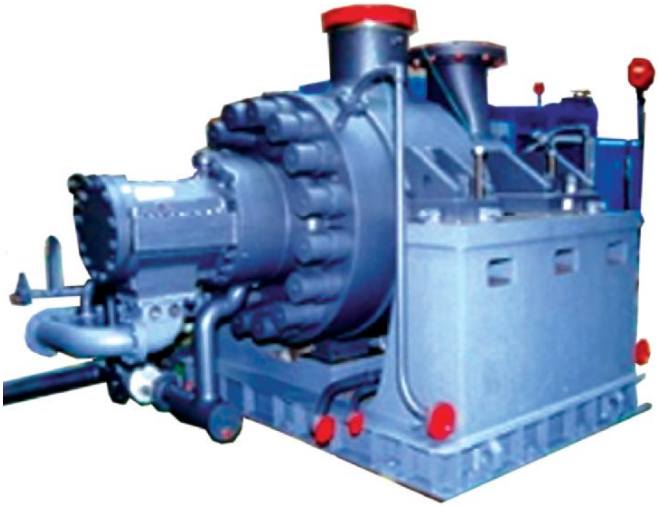
BHEL offers Conversions, Modifications and Upgrades (CM&U's) complementing the traditional service offerings of OEM spare parts, repairs and field services.

Customer training programmes are organized for customer engineers.

PUMPS

BHEL Hyderabad caters to the requirement of pumps required for the thermal power plants – boiler feed pumps, boiler feed booster pumps, condensate extraction pumps and the condenser circulating water pumps.

Starting in 1965 with the design & manufacture of pumps for 60 MW and 110MW rating power projects as per the technology obtained from M/S Sigma Lutin, Czechoslovakia, designs suitable to meet the requirements of higher plant ratings of up to 500MW units were obtained from M/S Weir Pumps Ltd, UK in the year 1980.



Boiler feed water pump assembly

Over the years, numerous pumps have been successfully manufactured and supplied to various power stations in India and for export.

In order to cater to the present needs of bigger size super-critical power projects with unit ratings of 660-1000MW, BHEL has entered into a new technical collaboration with Mitsubishi Heavy Industries, Japan, for the design and manufacture of pumps.

These pumps are provided with state-of-art construction design features and hydraulic efficiency matching global standards.

Pumps manufacturing and shop testing facilities have been augmented to meet the requirements of these new design pumps and BHEL is now geared up to design, manufacture, and shop test and supply boiler feed pumps, boiler feed booster pumps, condensate extraction pumps and condenser circulating water pumps for super critical thermal power plants up to 1000MW rating.

Over the years, the 4850+ pumps manufactured and supplied by BHEL have earned a good reputation for their robust design, trouble-free operation and reliable service in numerous installations in India and abroad.

Condensate extraction pump assembly

BHEL also undertakes R&M of existing pumps by supplying cartridges that result in enhanced efficiency.

HEAT EXCHANGERS & PRESSURE VESSELS

BHEL manufactures following heat exchangers and pressure vessels at Hyderabad plant.

- Surface condenser
- Air evacuation system
- Deaerators
- Feed water heaters
- Generator air & hydrogen coolers
- High pressure air cooled heat exchangers
- Process heat exchangers
- TEMA type shell and tube heat exchangers
- Suction knock out drums
- Moisture separators etc.

Thermal design is carried out as per

- Heat Exchangers Institute standards
- TEMA standards
- HTRI programs
- Programs develop in-house.

Surface condenser assembly

Mechanical design is carried out as per

- Heat Exchangers Institute standards
- TEMA standards
- ASME sec VIII Div 1 & 2
- BS 5500
- AD Merkblatter etc

BHEL Hyderabad is accredited with ASME U & U2 stamp.

Feed water heater assembly

Some critical manufacturing facilities are:

- CNC multi-spindle deep hole drilling machine for drilling upto 1100mm thickness.
- Vernon tube-to-tube sheet expander
- CNC multi-spindle hole drilling machine for drilling baffle/support plates upto 70mm thickness
- 4-Roll plate rolling machine for forming thick shells.
- Narrow-gap welding machine for thick shells

The utmost importance is attached to the quality of the end product by thorough review and monitoring of all aspects of quality by in-house quality personnel.

Additionally, the equipments are also supplied under various third party inspection agencies such as PDIL, EIL, Lloyds, NTPC, and BVQI etc. besides statutory agencies.

With the experience gained over the years, BHEL Hyderabad is fully geared to take up design and supply of feed water heaters and deaerators for 660-1000 MW super critical projects in a big way. Several R&M orders for up-gradation of old heat exchangers are also being executed.

The vast reference list and trouble-free operation of various heat exchangers supplied is a testimony of BHEL's performance.

PULVERISERS

Pulverisers are employed to pulverize the pre-crushed raw coal to the required fineness before it is admitted into the boiler furnace for combustion.

BHEL manufactures mainly two types of pulverisers:
1. Bowl mill
2. Ball tube mill

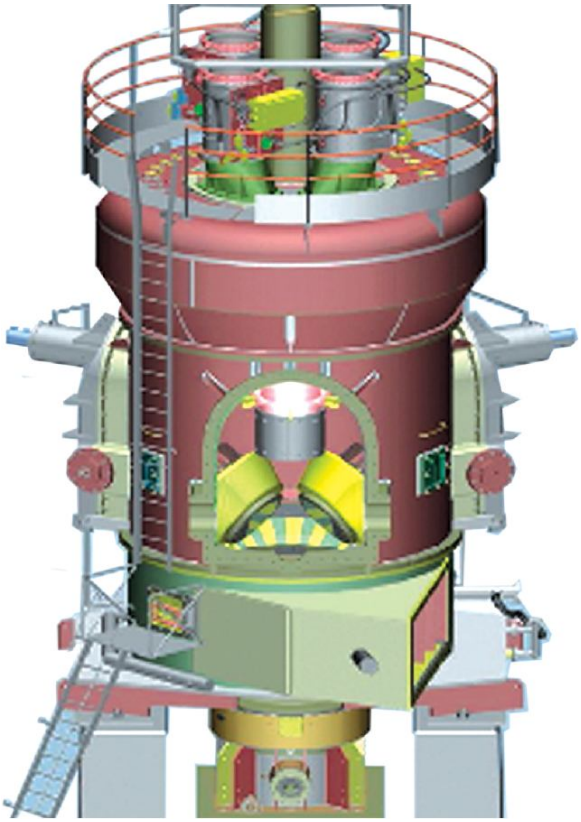
Currently, BHEL has licensing arrangement with M/s Alstom USA for large capacity High Performance (HP) Bowl Mills suitable for 660 MW & above size power plants.

The largest capacity HP 1203 Bowl Mill supplied by BHEL is equipped with the following features:

Bowl mill assembly

- Planetary type gearbox
- Eight (8) outlets from each mill catering to two (2) elevations of boiler
- Improved metallurgy Insert type grinding elements (rolls and bull ring segments) for higher wear life

BHEL has supplied more than 3200 pulverisers of different types and sizes and these pulverisers are performing excellently to the satisfaction of various customers.



Bowl Mill assembly

PRODUCT PROFILE

Mill type	Base Capacity (T/Hr)
XRP 623	18.4
XRP 803	39.6
XRP 903	54.1
XRP1003	68.1
HP 1103	87.2
HP 1203	108.0
BBD 4772	110.0

CIRCUIT BREAKERS

BHEL Hyderabad has been one of the pioneering companies to supply Air Blast Circuit Breakers (ABCBs) ranging from 145kV to 420kV, Minimum Oil Circuit Breakers (MOCBs) ranging from 72.5kV to 420kV and Sf6 circuit breakers ranging from 145kV to 420kV.

Circuit breakers

BHEL make SF6 circuit breakers today constitute over 30% of the total number of HV / EHV Circuit breakers in operation in the country and have been giving exemplary service in grids of all major utilities.

OIL RIGS

BHEL has the capability to manufacture E760, E1400, E2000, E3000 type of AC.SCR rigs and AC VFD 2000 rig along with its associated systems like round bottom mud system, rig electrics, water system, air system, fuel system etc. For drilling depths ranging from 3600 meters to 9000 meters. BHEL make AC VFD rig is equipped with latest art of technology available in worldwide drilling industry. Main advantage of AC VFD rig improved efficiency resulting in less fuel consumption. A great number of such rigs are in operation at various sites in India.

Oil rig assembly at BHEL Hyderabad

BHEL has also supplied E760 type desert rig which is totally mounted on trailers for movement in the desert, and a TBA rig, for drilling wells located in inaccessible hilly terrains to which the equipment might have to be transported by light C-vehicles or helicopters.

BHEL also has the capability to manufacture 1500 meters, 2000 meters, 3000 meters depth capacity mobile rigs and 120 ton hook load capacity work over rigs with the technology transfer from M/s. IRI International, USA

SYSTEM ENGINEERING & EPC SERVICES

BHEL Hyderabad - Project Engineering & Systems Division (PE&SD) provides turnkey EPC services from concept-to-commissioning for GTG, STG based power plants, compressor stations, etc. EPC activities cover feasibility studies to preorder engineering, detailed design, integrated engineering and procurement of balance of plant packages and systems, erection and commissioning with civil works

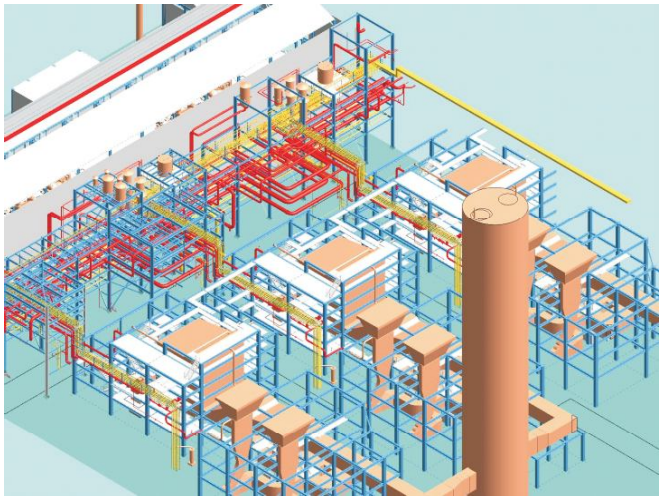
Gas based power plant at PDO Hubara Unit 1

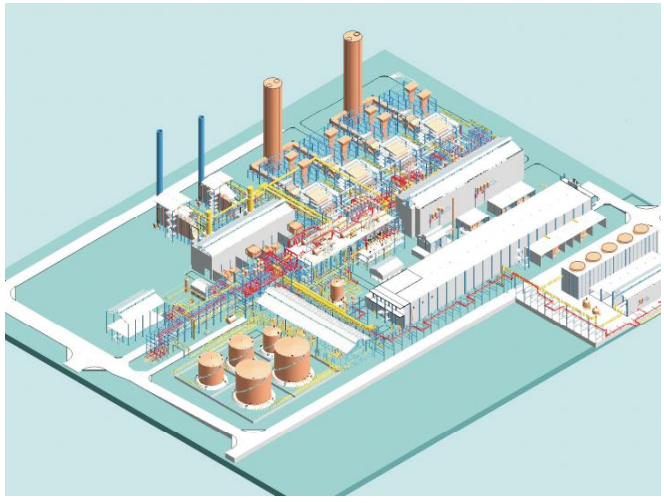
System integration and customization for project specific requirements covering hookups, optimization with respect to design, operation, space, maintenance etc. are performed. Engineering software's like PDMS, CAESER-II, Crappie, Pipe net, GTSTRUDL, STAAD Pro, ETAP, INTools are effectively used for seamless project documentation and interface engineering.

Necessary system & interface engineering including 3D modeling, HAZOP, SAFOP, IPF, dynamic studies, electrical system studies etc. along with HSE requirements are undertaken during project execution.

All these activities are taken care by dedicated project team comprising project leader for single-point contact, supported by dedicated engineering coordination and project procurement groups, site management team for construction, erection and commissioning. Project management tools like Prima vira package, MS projects are used for project scheduling and monitoring.

BHEL Hyderabad has executed following turnkey / BTG solutions:

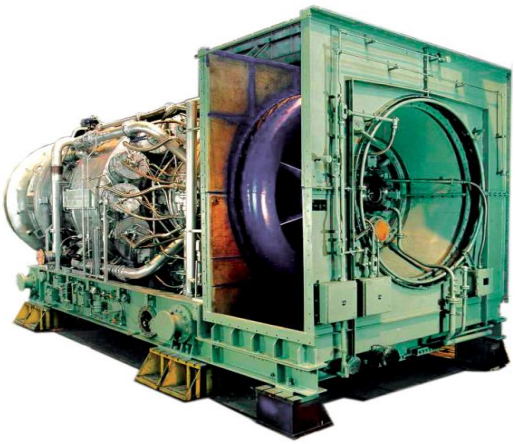




Plant 3D models

- GT based cogeneration plants.
- Combined cycle plants.
- GT based open cycle plant (includes overseas plants in Malaysia, Oman, Saudi, Arabia, Bangladesh, China, Srilanka, Kazakhstan, Iraq etc).
- STG based captive power plants.

QUALITY POLICY



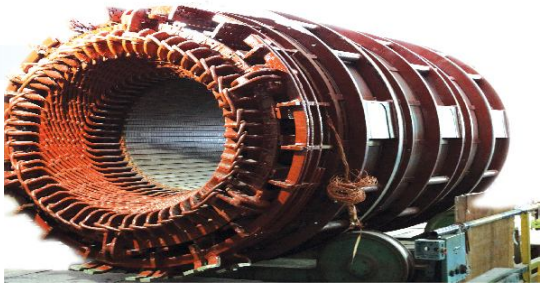
In its quest to be global engineering enterprise, BHEL pursues continual improvement in the quality of its products, services and performance leading to customer delight through commitment, innovation and team work of all employees.

QUALITY OBJECTIVES

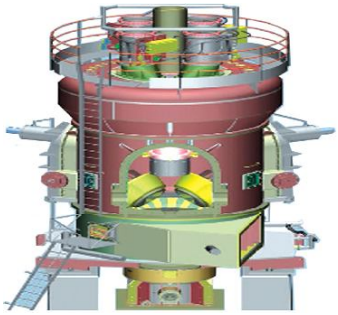
To meet the above quality policy the following objectives are defined, to enhance

- Product / service quality by improving key processes
- Value addition by reducing cost of quality
- Customer satisfaction by ensuring timely completion of projects and improving response
- Performance of suppliers
- Manufacturing capability by capacity augmentation
- Human resources capability by upgrading skill and competence

OCCUPATIONAL HEALTH AND SAFETY POLICY



BHEL, Hyderabad is committed to provide safe and healthy working environment to all employees working under its control as an integral part of business performance through compliance with applicable OH&S legislation and other requirements to which it subscribes.



CERTIFICATIONS

Certified for

- ISO 9001:2008
- Occupational Health and Safety Assessment Series (OHSAS) 18001:2007
- Environment Management System (EMS) ISO-14001 : 2004
- ASME 'U' and 'U2' Stamp for Pressure Vessels

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
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