



# ENGINEERING NEWSLETTER

Vol. 28 No. 2

June 2005

## ENGINEERING, DESIGN DEVELOPMENT AND MANUFACTURING OF FUEL GAS PACKAGE OF V94.2 GAS TURBINE — ACCOMPLISHED FOR THE FIRST TIME IN THE COUNTRY

Fuel gas package of V94.2 GT was hitherto being imported from M/s Siemens, Germany. This time, for the four GT sets of the Libya Project, BHEL has, in-house, designed, developed and manufactured this assembly — to establish self-reliance, reduce cycle time and effect cost saving.

This assembly is mounted on lub oil tank placed on the right side of the turbine. The package connects the outlet of fuel gas conditioning skid and inlet to the combustion chamber pipings. This assembly consists mainly of fuel gas strainer, emergency stop valve, fuel gas control valve, pilot gas control valves and vent valves. The components, along with connecting pipings, are mounted on the base frame of the package. The electrical cables for power supply, limit switches, pressure gauge etc are connected up to the junction box/distributor from where signals are fed to the power control centre.

The filtered fuel gas coming from fuel gas conditioning skid is sent to the combustion chambers through fuel gas package. During GT start-up, the emergency stop valve, pilot gas control valve and then main control valve are opened. For further higher loading, the main control valve



*The fuel gas package assembly*

controls the required amount of fuel gas, depending upon the load condition.

## MICROPROCESSOR-BASED GRAVIMETRIC FEEDER CONTROL SYSTEM FOR BOILERS DEVELOPED

The thermal efficiency of any fossil boiler is measured by the specific consumption of coal. Depending on the load requirements, the combustion demand signal is suitably processed,

and coal of varying quantities is fed to the boiler. In order to optimize the combustion process, gravimetrically controlled feeding of coal is essential to avoid excessive coal or insufficient coal. This optimization results in better boiler thermal efficiency. Towards this end, BHEL has been continuously improving the technology of gravimetric feeding of coal for the boilers, over the years. The latest improvement is the development of microprocessor-based gravimetric feeder control system. This system has been dispatched to Vijayawada Thermal Power Station, where it has been operating satisfactorily.

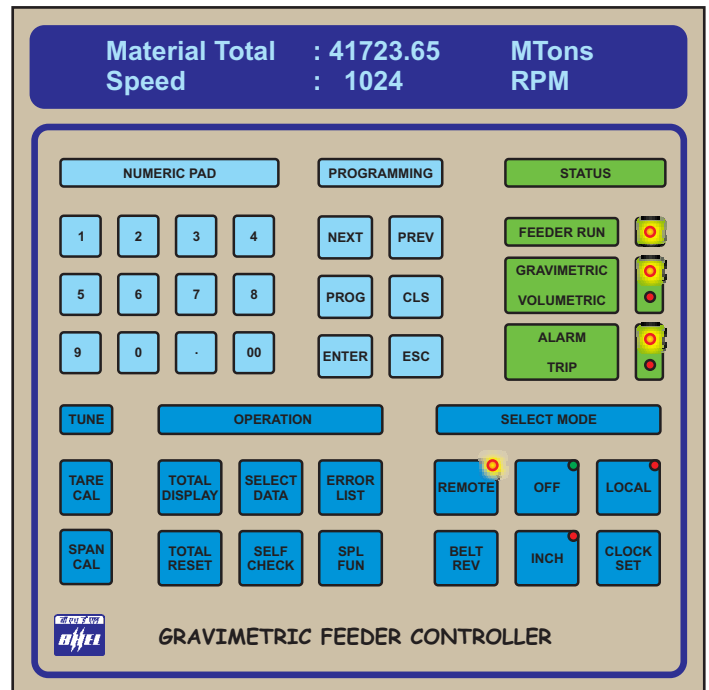


The microprocessor-based gravimetric feeder control panel

Compared to the earlier version of the product, the newly developed system is an advanced system. This is based on 32-bit processor, utilizing the OMEGA platform modules, also developed by BHEL. The system is user-friendly with enhanced features like automatic calibration, self-diagnostics and real time date logging of coal consumption.

### Salient Features:

- Advanced digital control with 32-bit processor.
- User-friendly operator keyboard and display
- Suitable for variable-frequency drives
- Self-test and diagnostics
- Automatic tare and span calibration
- Real time data logging for coal consumption
- DCS interface
- EMI/RFI protected



User-friendly operator keyboard and display

## HIGH-EFFICIENCY SOLAR PHOTOVOLTAIC DEEP WELL WATER PUMPING SYSTEM DEVELOPED

MNES, Govt. of India, has projected a very large business potential for Solar Photovoltaic (SPV) water pumps, mainly envisaged for agricultural sector and remote rural applications, as well as multistoried apartments & buildings, in the next five years. Hence, there is a need to develop a low-cost and high-efficiency SPV pumps through judicious selection of components and proper system engineering. Accordingly, BHEL has developed a high-efficiency SPV deep well water pumping system. Under this project, four SPV water-pumping systems, of different ratings from 140 Wp to 900 Wp and water output heads from 30m to

50m, have been developed, tested and installed at the Corporate R&D Division of BHEL.

The new SPV pumping system uses the following high-efficiency components:

- High-efficiency submersible brushless permanent magnet d.c. motor with electronic controller.
- High-efficiency submersible positive displacement helical rotor pump.
- Maximum Power Point Tracker (MPPT-electronic) to maximize utilization of the solar energy available.



SPV array for pumping water to a 38 m high overhead tank

The system uses mono-crystalline PV modules, also manufactured by BHEL. The SPV pumping systems have been tested, and the performance was found to be very satisfactory. The efficiency (PV array electricity-to-water or wire-to-water, as it is called) of the system was found to be around 71% which is more than double as compared to the earlier versions available.

This increased system efficiency has resulted in considerable reduction in the requirement of PV array size, from 1800 Wp to 900 Wp for the same water output. This, in turn, has resulted in almost 50% reduction in the overall system cost. In addition, the other advantages of the SPV pumping system developed are:

- Increase in the operating hours per day.
- Elimination of battery, resulting in cost saving as well as elimination of battery maintenance/replacement and thereby cost.

With the experience gained, it will also be possible to develop a suitable SPV pumping system for water output heads up to 230m.

## **AUTOMATED PROPOSAL GENERATION SOFTWARE FOR UP TO 132 kV SUBSTATIONS — STAGE-1 MODULE DEVELOPED**

BHEL has taken up, under Knowledge Management, development of Automated Proposal Generation Software for Sub-Station Projects up to 132 kV. The Stage-1 Module, used for pricing of standard equipment of substations, has been already developed.

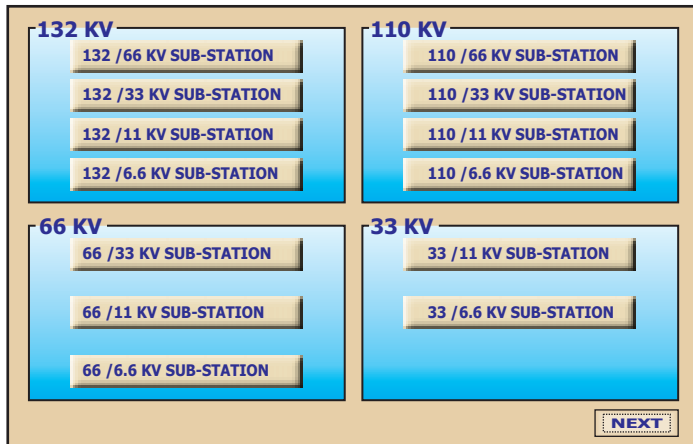
The main objectives of this developmental Project are :-

- To accommodate variations and flexibilities in selection of equipment for customer-specific I/O parameters.
- To reduce cycle time for preparation of technical and price offer.
- To provide reasonable and justifiable pricing comparable with past orders.
- To reduce the human error.

The main activities involved in the development of Stage-I Module were :-

- Codification of Equipment : Unique code is assigned to equipment. This coding has been done to cover all major specifications of the equipment.
- Creation of Equipment Databank and Price Databank : Price for equipment from latest purchase order / budgetary offer has been entered. This databank contains about 1.1 million records as of now.
- Creation of Master Databank : Storing of price details of various products, equipment and services etc. with frequent fluctuations, variations, statutory duties etc., updated and concurrent.
- Software for Generation of Pricing Formats : User-friendly screens have been developed to input the Project details like, substation configuration, equipment selection, commercial aspects, taxes and recoveries etc. Software links the user input data to the databank and generates bill of material, Price Approval Format, Customer Price Format and BHEL format for pricing consisting of

details like, equipment, switchyard structures, equipment foundation and E&C services. All these outputs are saved in Excel for ease of usage. Each set of Project data is stored, based on enquiry number, which can be retrieved to modify the data.



Sub-station voltage selection screen (any one to be selected from the above)

This e-proposal (Stage-1 Module) has been developed using Visual Basic as front-end and Excel for Data Storage. This Module will be integrated in stages with the following :

- Technical Module : Compilation of Qualifying requirement, data sheets and type test certificates. (Creation of Technical data bank partly completed).
- Stage-2 Module : Generation of bill of materials and price data for engineered items like earthing, cables, erection hardware (under progress).
- Stage-3 Module : Generation of bill of materials and price data for civil works.

With completion of the above, the software could be used for preparation of total proposal for sub-station projects.

## **BHEL 280 MILL — INDIGENOUSLY DESIGNED & DEVELOPED — COMMISSIONED AT CHANDRAPUR SUPER THERMAL POWER STATION**

BHEL has recently designed & developed a higher-capacity, state-of-the-art mill — BHEL 280 Mill — which is suitable for 500 MW and 660 MW thermal

sets. The mill has been put on operation at Chandrapur STPS Project Unit-6 of MSEB.

The BHEL 280 Mill has the following salient features :

- Planetary gear box
- Split air inlet housing for better air distribution
- Insert-type grinding rolls, hi-chrome bull ring segments and air port ring
- Hydraulic loading system

This mill was manufactured in a record time of one year, and assembled in the shop. It was erected and commissioned by BHEL, in place of the existing mill — 6C (XRP 1043) — in a record time of 55 days during the capital overhaul period of the Unit-6. The mill has demonstrated output of 91 tons/hr, and the performance has been found to be satisfactory.



The BHEL 280 Mill