CHAPTER X: DEPARTMENT OF HEAVY INDUSTRIES

Bharat Heavy Electricals Limited

10.1 Technology Upgradation in Electronics Division-BHEL, Bangalore

Introduction

Bharat Heavy Electricals Limited (Company) established the Control Equipment Division (CED) in Bangalore in July 1976 to take over Radio and Electricals Manufacturing Company (REMCO), a State Government Undertaking. REMCO was merged with CED during May 1980 and renamed as Electronics Division (Division) in May 1987. This Division was formed with the objective of centralizing, coordinating and expanding the manufacture of control equipment required for industries in the fields of Power, Transport, Steel, Aluminum and Copper, etc., which were being manufactured earlier by various units of the Company on a small scale. The product range was enlarged over the years with technology obtained either from collaborators or developed in-house.

Product Profile

The Division manufactures Control Equipment, Semiconductors, Photo Voltaic cells and modules and Defence simulator equipment *etc.* The Control Equipment[♣] are the major products with 98.82 *per cent* share in the total turnover of the Division. The Automation and Control Systems/equipment (also known as Distributed Control Systems or Control and Instrumentation Systems) comprise, mainly, micro processor based electronic modules, assembled and wired in racks and housed in panels which along with requisite system and application software perform the automation and control functions.

Scope of Audit

The present study covers implementation of Technical Collaboration Agreement established with the Technology collaborator for providing state of the art Control and Instrumentation automation platform and for manufacture of high end Digital Processing Units (DPU);

Audit Objectives

Audit was conducted with a view to assess implementation of the Division's plan for expansion of production facilities.

Audit Criteria

The following criteria were used:

- Collaboration agreements with the technical collaborator and execution reports, feedback paper, time schedule for compliance etc.;

♣ ***Control for Boilers, Steam Turbines, Hydro and Gas Turbines, Station Control and Instrumentation, Machine Man Interface and Supervisory Control, and Data Acquisition System (SCADA), Alternate Current and Direct Current drive controls, Static Excitation Systems/Automatic Voltage Regulator, Alternate Current Loco/Electro Motive Units Controls.***

- Feasibility reports, project reports, progress reports of capital investment etc.;
- Agenda and minutes of the meetings of the Board of Directors of the Company; and
- Production records, cost records, order book records etc.

Financial Performance

Working results of the Division for the last three years ended 31 March 2010 are indicated in the ***(Annexure-V)***. The turnover and profit of the Division has shown an increasing trend, which was due to good order book position and execution of order.

Production Performance

The installed capacity of the Division is measured in terms of 'cubicles', 'number of power devices' and 'Kilowatts' (KWs) in respect of the different products *viz.*, control equipment, power devices and photo-voltaic, respectively. The Division's actual production vis-à-vis installed capacity for the last three years was as follows:

Products	2007-08		2008-09		2009-10	
	Installed capacity	Actual production	Installed capacity	Actual production	Installed capacity	Actual production
Control Equipment (in Cubicles)	2,500	3,058	4,300	4,222	4,300	5,897
Power Devices (in Nos.)	12,000	14,994	12,000	18,214	20,000	19,420
Photo Voltaic (in KWs)	3,000	1,155	3,000	1,203	8,000	1,155

Audit Findings

Audit findings and recommendations are discussed in the following paragraphs:

10.1.1 Technical Collaboration Agreement - Phase I

In order to meet the changing demands of customers, the Division entered (December, 2000) into a Technical Collaboration Agreement (TCA) with M/s Max Control Systems Inc., USA, presently known as Metso Automation Inc. (MAF) for obtaining technical know-how for manufacture of Distributed Control Systems (DCS) with Max DNA technology.

The terms of TCA, *inter-alia,* included the following:

- Licensor (MAF) shall furnish to Licensee (Company) all relevant information including technical reports resulting from special studies and experiments carried out by the Licensor in the areas related to DCS and the Licensee shall have the right to use all such information received from the Licensor without any additional payment.
- The Licensor to allow the Licensee's personal access to the research and development laboratories of the Licensor with prior approval to hold discussions with the specialists of the Licensor for developmental activities relating to DCS.
- The Licensor shall automatically furnish at no additional cost any and all improvements and modifications whether patented or not, to the know-how and/or

DCS as soon as the same has been introduced by the Licensor in its current programme for commercial production.

The Division paid a lump sum fee of US$ 2.5 million (₹ 12.14 crore) for the technology. Further, consequent upon transfer of technology, depending on the requirement, the Company placed order on MAF for supply of finished Digital Processing Units (DPU) modules which are printed (fitted) into the Printed Circuit Board of the DCS. In terms of the TCA, the Company was liable to pay royalty (1.5 *per cent* to 3.25 *per cent*) on net sales price from time to time to MAF on the actual sales of the DCS after deduction of cost of DPU modules imported and accordingly, ₹ 20 crore were paid to MAF during the last three years ended 2009-10.

Phase-I investment was completed in 2002-03 by creating a Surface Mount Technology (SMT) line and related facilities for manufacture and testing of Printed Circuit Boards (PCBs) with an investment of ₹ 11.23 crore. Post investment, the Division produced more than 17,000 max control modules and more than 3,000 racks in 2003-04, which was more than the expected load of 10,500 per year production as envisaged in Feasibility Report (FR) and was also successful in absorption of technology offered by MAF. About 500 Digital Processing Units (DPU) (Module DPU 4E with ceramic version) was produced during 2003-04 itself.

The Agreement was renewed (September 2009) for a further period of 10 years.

10.1.2 Technical Collaboration Agreement - Phase II

To meet the increased demand for Metso Automation hardware modules, over and above the facilities created in Phase I investment, the Division proposed (May 2004) augmentation of the manufacturing facilities. The additional investment was necessitated to meet the increased load and to enable manufacture of new version of the processor module (DPU4F). The Division invested a sum of ₹ 7.90 crore during the years 2004-05 and 2005-06 and augmented the facilities as envisaged in the Phase II investment proposal. Audit scrutiny of the implementation of the TCA Phase II revealed the following:

10.1.2.1 Failure to obtain DPU4F technology from Collaborator

During Phase-I, DPU4E (with ceramic geode processor) version of DPU was being produced by the Division. The new version of the processor *viz.,* DPU4F was developed by Metso Automation after implementation of Phase I of the TCA (2002-03), but the Division submitted a proposal for Phase II augmentation only in May 2004. In reply to Audit, the Division admitted (July 2010) that they were not aware of the exact date of commercialisation of the DPU4F module by the collaborator. On review of records relating to TCA and creation of the production facilities, it was observed that:

- The Division did not pursue to obtain the documents from the collaborator for establishing facilities for manufacture of modules with DPU4F (ceramic version) immediately after commercialisation of the product by the collaborator, as per the terms of TCA, but instead obtained a price quote for purchasing DPU4F modules in May 2004 and started importing DPU4F module from the collaborator instead of accelerating creation of facilities for manufacture of the module.

- Corporate office approval (May 2004) to the proposal for augmentation programme was received only on 1 November 2004, *i.e.,* after a gap of five months.
- The Division commenced establishing assembly and inspection facility line in May 2005, completed testing facilities in August 2005, and after trial runs *etc.*, started commercial production of DPU4F module only in January 2006.
- In the meanwhile, to meet production requirement for 2005-06 and first half of 2006-07, the Division imported 1,701 (Nos.) DPU4F modules during March 2005 to January 2006 at a cost of ₹ 29.69 crore as per the price offer of the collaborator. This led to avoidable expenditure of ₹ 21.84 crore when compared to in-house manufacturing cost of ₹ 7.85 crore.

The Management stated (September 2010) that collaborator was responsible for transfer of technology as per the terms of TCA agreement. The collaborator started furnishing the documents from February 2004 and further design changes were made in December 2004, May and December 2005. Accordingly, the Division planned change over from DPU4E to DPU4F in 2005-06 and completed in August 2005 as planned. This being a complex technology, only reasonable time was taken to complete the indigenisation process by January 2006 and modules were imported to meet the production requirement during the interim period. However, the Management assured that in response to audit observation, concerted efforts would be made to further shorten the time required for updation of know-how and manufacturing facilities in future.

Reply of the Management was not acceptable as:

- Efforts were not made by the Division to keep itself abreast of the technological developments made by the collaborator despite a provision in the TCA that allows the Licensee access to the Research and Development facilities of the Licensor.
- Pro-active action was not taken by the Division to obtain the required documentation from the Collaborator (as per Article 5 and 6 of TCA) immediately after introduction of new version modules/components in the market by the collaborator.
- Extra expenditure of ₹ 21.84 crore had to be incurred by the Company in importing the newer version of the module from the same collaborator because of failure of the latter in not supplying the know-how for the new version of the module to the Company as per the provision of the TCA, though the collaborator could manufacture and sell the new version to the Company. This deprived the Company of the saving it could have effected in manufacturing the new version of the module indigenously. However, no action was initiated by the Company against the collaborator for the consequences of breach of contract on the part of the latter.

Had the complete sets of documents been obtained immediately after commercial production by the collaborator, the Division could have completed the indigenisation and production of the DPU4F modules in 2004-05 itself and avoided import of DPU4F module at an extra cost.

10.1.2.2 Delay in establishment of facilities for change in technology

Under Phase I and Phase II expansion, the Division manufactured DPU4E/4F modules using ceramic geode processor chips supplied by M/s AMD Singapore. M/s AMD, Singapore had declared ceramic geode processor as obsolete in October 2005 itself, replacing it with the plastic geode processor[♠] version and intimated (October 2005) the Division accordingly.

It was observed that though the plastic geode processor had replaced the ceramic geode processor in October 2005, the Division placed purchase orders for procurement of re-flow oven (from M/s Vitronics Soltec PTE Limited Singapore in April 2008) and ICT test fixture (from M/s Metso Automation Max Controls, USA in July 2008) required for handling plastic geode processors only in April 2008, after a lapse of 29 months. The equipment costing ₹ 0.58 crore were installed in July 2008 and trial operations started only in August 2008. Meanwhile, as the Division did not have facilities for production of DPU modules with plastic geode processor, it imported (March 2008 and December 2008) 600 (Nos.) DPU4F modules (with plastic geode processor) from the collaborator at a cost of ₹ 19.24 crore. The additional cost of import when compared to in-house manufacture cost was ₹ 9.94 crore.

In reply the Management stated (September 2010) that:

- Complete technical details of DPU4F module version were received in June 2007 and indigenised in August 2008 using plastic geode;
- To meet the production requirements of second quarter of 2008-09, the Division had to import the bare minimum quantity of modules; and
- Concerted efforts would be made to further shorten the time required for updation of know-how and manufacturing facilities in future.

Reply of the Management is not acceptable as the ceramic version of the geode processor was declared obsolete by the supplier in October 2005 itself. The Division failed to immediately obtain documentation from the collaborator. The equipment required for production of modules with plastic geode was installed only in July 2008 leading to avoidable expenditure of ₹ 9.94 crore on import of DPU modules with plastic geode processor which could have been produced in house.

Conclusion

Inability on the part of the Management to enforce the terms and conditions of the Technical Collaboration Agreement and to take pro-active action to obtain technical know-how in time from the Collaborator for improvement /modification of products and failure to keep abreast of the latest developments in the market coupled with delay in creation of facilities resulted in avoidable expenditure of ₹ 31.14 crore (₹ 21.84 crore plus ₹ 9.30 crore).

The matter was reported to Ministry in September 2010, reply was awaited (February 2011).

♠ ***Geode processors (ceramic or plastic) are bought out items used in the manufacture of DPU modules.***

Recommendation

The Company should take pro-active action for (i) obtaining the technical know-how from the collaborator on improvements /modification to the technology and (ii) timely re-designing of manufacturing line to use the alternatives.

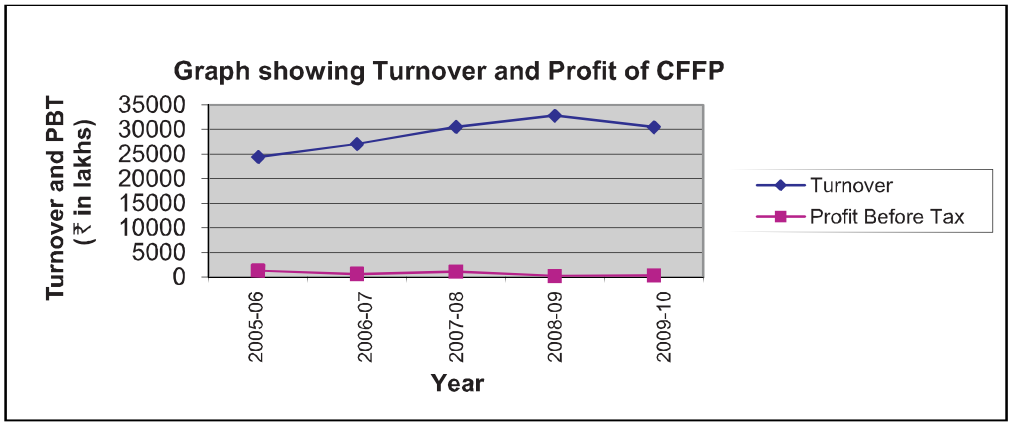
10.2 Forging Capacity Utilisation at CFFP, Haridwar

Introduction

The Bharat Heavy Electricals Limited (Company) is one of the largest engineering and manufacturing enterprise in India in the energy-related/ infrastructure sector set up in November 1964. Amongst 14 of its manufacturing plants spread all over India, the Central Foundry Forge Plant (CFFP) was set up in 1976 at Haridwar in technical collaboration[1] with M/s. Creusot Loire, France to manufacture steel castings[2] and forgings[3] for meeting in-house requirements of other units of the Company. The Technical Collaboration Agreement (TCA) with M/s. Creusot Loire expired on 31 March 1988.

Performance of CFFP

The Turnover as well as Profit Before Tax (PBT) of CFFP during last 5 years (i.e. 2005-06 to 2009-10) is presented in the graph below:



The above graph indicated that although the turnover of CFFP increased progressively over the period from 2005-06 to 2008-09, the profit (PBT) had not increased proportionately. Further, the percentage of PBT to the turnover ranged from 0.63 *per cent* to 5.21 *per cent* only.

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[1] ***The technical collaboration with M/s. Creusot Loire included preparation of detailed project report (DPR), setting up of facilities at CFFP and transfer of technology.***

[2] ***Castings are hollow objects made by giving shape to molten metal by pouring it into sand/clay moulds.***

[3] ***Forgings are solid objects manufactured by pouring molten metal in cast iron moulds, heating in furnace and shaping by press (hammer). Forgings are comparatively better in quality and strength (dense) than castings.***

Manufacturing process of Rotor forgings[1]

The audit examined in detail the manufacturing process of rotor forgings which is having three production shops viz. Steel Melting Shop (SMS), Forge Shop divided in Medium Forge Shop (MFS) & Heavy Forge Shop (HFS) and a Machine Shop.

Making rotor forgings

To manufacture a forging, required quantity of steel scrap is melted in Electric Arc Furnaces (EAFs) and processed in secondary refining facilities[2]. Molten steel is poured & processed under vacuum in cast iron moulds in the vacuum tank. Simultaneously, vacuum is created inside the tank till desired vacuum level is achieved and maintained for some time to diffuse out the gases from the molten metal. Finally, the vacuum cover is removed and ingot is left to solidify and cooled before stripping it for forging. It is mandatory for the forging ingot to have low gas content. The presence of gases beyond certain limit causes hair line cracks, inclusions etc. leading to rejection. Thus, adequate vacuum is essential for making ingots so that gases diffuse out.

What is forging

Forging is a mechanical process through which ingot is forged with the help of Forge Press at pre-determined temperature to shape it in a desired dimension and to avoid irregular microstructure. Quality heat treatment of rotor forging is an essential requirement to avoid the irregular microstructure which becomes a cause of rejection of forging.

Scope of Audit and Audit Methodology

The thematic study covered utilization of capacity of CFFP to manufacture rotor forgings during the period 2005-06 to 2009-10. The production process included quality control and rejection for which a sample of 25 nos. (187 MT) out of 75 nos. (611 MT) rotor forgings rejected during April, 2005 to March, 2010 was selected by using 'Random Sampling Method'. Besides, records relating to five rotor forgings cleared in quality test were also examined.

Audit Objectives

The objectives were to assess whether:

- the capacity of CFFP was utilized optimally taking into account the demand for rotor forgings received;
- the Management took timely action for technological up-gradation;
- norms for rejection of rotor forgings were prescribed to measure the deviation against the standards;
- the reasons of rejections were avoidable or not; and
- effective steps were taken to keep the rejection levels within the norms.

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[1] ***Rotor forging is a type of forging manufactured in CFFP which is used inside steam turbines for producing electricity and can rotate at the rate of 3000 rpm at 1650° C.***

[2] ***Refining facilities constituted Vacuum Arc Degassing (VAD)/ Vacuum Oxygen Decarburization (VOD) furnaces located in SMS.***

Audit Criteria

The performance of the Unit was assessed against the following items:

- Production data sheets;
- Rejection Notes and Ultrasonic Test reports;
- Metallurgical and Root Cause Analysis Reports; and
- Recommendations of various technical consultants and their implementation.

Constraints

Audit encountered following constraints while conducting this study:

Non-availability of Detailed Project Report

The Detailed Project Report (DPR) prepared at the time of setting up of CFFP (1976) was not available with the Management. In the absence of DPR, the operating norms adopted by the CFFP could not be verified in Audit. The actual time taken in different operations was compared with the norms adopted by the Management.

Discrepancy in production/rejection data of rotor forgings

As per initial information furnished by the Management (August 2008, February 2010 and May 2010), rotors equivalent to 3214 MT were produced during 2005-10 out of which 1171 MT were stated to have been rejected. Subsequently, (July2010), while furnishing year wise rejection details, rotors equivalent to 610.569 MT (75 nos.) were stated to have been rejected. This mismatch in the basic production /rejection data was brought to the notice of Management in August 2010. The Management failed to reconcile this mismatch despite several reminders. Further, as per information furnished in January 2011, 364 nos. rotors (3000 MT) were produced out of which 117 nos. (1058 MT) were stated to have been rejected. Since the Management continued to change the data, initial information furnished by the Management was considered in Audit.

Audit findings

10.2.1 Installed capacity and utilization

The installed capacity of the unit (based on annual accounts) for steel forgings (medium and heavy) was 3000 MT and 2410 MT, respectively. Review of actual production vis-à-vis installed capacity during last 5 years revealed that the actual production of medium forgings during the period under review ranged between 53 *per cent* (in 2009-10) and 77 *per cent* (in 2008-09) and heavy forgings between 27 *per cent* (in 2007-08) and 34 *percent* (2009-10). Thus, the capacity utilization of medium forgings was not satisfactory while the capacity utilization of heavy forgings was low.

10.2.2 Reasons for low capacity utilization in respect of the rotor forgings

10.2.2.1 Old and inadequate facilities

Most of the production facilities (EAFs, Transformers and Forge Press), installed in 1976, were not upgraded/ modernized.

Analysis of utilization of two transformers revealed that one transformer (attached with 30 Ton EAF) remained under break down for 18 months while the other transformer (attached with 70 Ton EAF) remained under break down for 25 months during 2005-10.

In the absence of stand by transformers, CFFP continued the production with lower capacity transformers leading to production loss of ₹ 81.98 crore (12919.35 MT liquid metal). This indicated that Management approach was lacking in risk-assessment of unforeseen events as well as alternate measures for un-interrupted production.

It was further observed that HFS was set up (1995) at CFFP with imported second hand 7500/9000 Ton Forge Press. However, all the balancing facilities[1] were not installed resulting in non-production of large size rotors.

Management, while confirming (September 2010) the facts, stated that revamping of 30 Ton EAF could not be carried out due to breakdown of another 70 Ton EAF as the same was forcefully operated on low capacity transformer. Reply was not convincing as no standby arrangement of the production facilities was created for uninterrupted production process.

10.2.2.2 Change in product-mix

The Company attributed (July 2008) reduction in yield of medium forgings from 43.50 *per cent* to 34 *per cent* to change in product mix (from Russian design to German[2] design also known as KWU design) which tapered down over a period during early 1990 and to customers' insistence for supply of forgings close to their finish machined dimensions. Audit observed that no steps were taken to upgrade/modernize the forging technology for better yield.

10.2.2.3 Rejection in rotor forgings

Standard maintained with regard to rejection of rotor forgings by forging units operating internationally was five *percent.* Audit, however, observed that inspite of 34 years' operations, no norms for rejections were fixed at CFFP. Analysis of production data revealed that the rejection level at Forge Shop (producing medium and heavy forgings) ranged from 7.60 *per cent* to 19.21 *percent* which was significantly higher than the international standard. Analysis further revealed that the rejection level of rotor forgings ranged from 28.36 *per cent* to 48.99 *per cent* while rejection level of forgings other than rotor forgings ranged from 1.51 *percent* to 10.10 *percent.* Further, percentage of rotor forging rejections out of total forgings rejected ranged from 43.03 *percent* to 83.92 *percent.*

Thus, major part of the rejections was contributed mainly by rotor forging.

Management stated (September 2010) that rejection norms for rotor forgings could not be fixed until the process was fully established. Management's reply was not acceptable as even after lapse of 34 years time the Management was unable to fix rejection norms which were necessary to have better managerial control over efficient operations.

10.2.2.4 Reasons for rejection

The reasons for rejections during last 5 years, ended in March, 2010, as analyzed by Audit on the basis of the Root Cause Analysis (RCA)/ Metallurgical/Technical Test Reports, made available by the Management, were as detailed below.

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[1] ***Balancing facilities mean use of manipulator.***

[2] ***The rotors required for German design thermal sets require low content of Sulphur and Phosphorous than the Russian design. Thus, the German design was more sophisticated than the other.***

(a) Inadequate vacuum suction capacity and inclusions

Review of records revealed that the vacuum degassing units available with the units did not have sufficient suction capacity (less than 1 milibar) to evacuate gases generated during processing and pouring of steel of very low Aluminum, low Silicon grade required for rotors. An analysis of rejection of rotor forgings in 2006-07 by the Management (July 2007) revealed that of the total rejections of 34 rotors, 33 rotors rejected were due to inclusions in the forgings.

Although the issue of inadequate vacuum suction capacity was flagged by the Management in 1995 and by the metallurgical consultant in 2002 engaged by the Management to pin point the shortcomings in steel melting process and two proposals were sent to the Corporate Office for rectification of the defects noticed, but only in December 2008, a new Vacuum Ejection System (VES) (valuing ₹ 8.78 crore) of required suction capacity was installed.

Audit further observed that out of 25 cases of rejections audited, the basic cause of rejection in 14 cases was inclusions which would have been formed during steel melting process. Test check of production sheets of 30 heats at Steel Melting Shop (SMS), revealed that the average time for melting the scrap by the EAFs was three to seven hours against the technological requirement of three hours.

Management stated (August 2010) that there could be host of factors effecting formation of inclusions but a good vacuum helps in reducing inclusion formation and attributed reasons for higher scrap melting time to low input power to the EAF, setting up electrode movement, intermittent breakdowns, lunch break in between process, delay in readiness of the moulds for pouring etc. However, the fact remained that new VES was installed with a significant delay of 13 years which was avoidable.

(b) Lack of proper heat treatment of the rotor

It was observed from RCA/Metallurgical/Chemical Test Reports that irregular microstructure of the metal in three forges[♣] out of 25 cases examined was due to lack of proper heat treatment of the rotor. As a result, the heating effect at the centre of the rotor got reduced resulting in irregular microstructure and consequential rejection. Further, improper quenching was also observed as one of the reasons for rejections.

Management stated (September 2010) that the rejected rotors did not reach the stage of final heat treatment, as they showed ultrasonic test indications before being subjected to quality tests. Since final heat treatment of rotors was not done, an irregular microstructure was always expected.

Reply was not acceptable because as per root cause analysis above during August 2009 to February 2010 by Corporate R&D, Hyderabad in respect of three forges, irregular microstructure was due to improper heat treatment of the rotor.

10.2.3 Non-availability of technical know-how

Audit observed that despite of the fact that the technological know-how provided by M/s. Creusot Loire was for smaller rotors of Russian design and the TCA had expired in 1988, CFFP switched over to manufacture of bigger rotors of Siemens design by extrapolating

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[♣] *No.4531, 4380,4491*

the know-how provided by M/s. Creusot Loire instead of entering into fresh TCA and/or establishing any specialized R&D facility for rotors. Thus, the manufacturing of rotors was done on trial and error basis.

It was further observed that the Company entered (February, 2010) into an agreement with M/s. Sheffield Forgemasters International Limited (SFIL), UK for acquiring technology for higher weight rotors (up to 1000 MW) after a lapse of 22 years. The Company expected reduction in rejection rate less than 10 *percent* and five *percent,* in case of rotor forgings and other forgings, respectively.

Management stated (September 2010) that all possible options available at the time were used. None of the established forging manufacturers was willing to share its know-how. With great efforts finally SFIL agreed for a tie up in year 2010. The fact, however, remained that acquisition of the appropriate technology was inordinately delayed.

10.2.4 Non availability of Active Oxygen Measuring Instrument

To produce quality steel, checking of oxygen level is an essential activity. Audit observed that since inception, the Unit did not have any Active Oxygen Measuring Instrument, which could provide instant results of oxygen content. Availability of Active Oxygen Measuring Instrument could have reduced the defects in the production. Management confirmed (August 2010) that the process being adopted by CFFP, to ascertain Oxygen level took 2-3 days time, and instant corrective action could not be taken by the Management in the absence of above instrument.

10.2.5 Impact of under utilization of capacity

10.2.5.1 Expenditure on imports

It was observed that due to inability of CFFP to supply rotors timely against requirement of sister units, the Company had to procure 409 rotors worth of ₹ 654.45 crore through imports.

Management stated (September 2010) that CFFP was never designed to make all 100 *per cent* forgings (including increased requirement) needed by BHEL in house. It was only intended to reduce dependence on foreign suppliers and to have control over price of imports. Reply was not acceptable as CFFP was set up to cater to in-house requirement for other sister units but it failed to achieve its intended objective.

10.2.5.2 Delayed delivery of rotors

Impact of delayed delivery as observed in Audit was as below:

- As on 31 March 2010, supply of 69 rotors valuing ₹ 26.05 crore were pending execution where the delivery was overdue. The delay was ranging from two months to 58 months (Wanakbori TPS). It was further observed that at one side the production capacity was not fully utilized and on the other side supply of 69 rotors was behind schedule.
- 60 orders placed by sister units for supply of 117 rotors (₹ 56.58 crore) were cancelled due to inability expressed by CFFP for timely supply. Further, on subsequent procurement of 55 rotors from outside sources with a delayed delivery ranging from 0 to 42 months, Company incurred loss of ₹ 2.68 crore.

- Audit further observed that supply of 6 rotors (Mejia Unit 5 & 6, Chandrapura Unit 7 & 8 and Jindal Raigarh Unit 3 & 4) ordered by its sister units were delayed by three to seven months which contributed to delayed commissioning of these projects.

Conclusion

Due to outdated and inadequate facilities, the CFFP could not achieve optimal utilization of its forging capacity. After expiry of technical collaboration agreement with M/s Cleusot Loirs, France in March 1988 the Company could not find a technology partner for 22 years. In the meantime the Company tried to improve its performance on the basis of experience acquired by it over the period but the percentage of rejections was very high ranging from 28 to 49 percent as compared to standard of five percent maintained by forging units internationally. Thus, CFFP was unable to meet the demand of its sister units for rotors. Eventually, the sister units were forced to cancel their orders placed on CFFP and to procure rotors from the open market. Thus intended purpose of setting up CFFP could not be achieved to a large extent.

The matter was reported to Ministry in September 2010; reply was awaited (February 2011).

Recommendation

Efforts should be made for optimum utilization of the installed capacity by taking necessary corrective measures such as fixing of rejection norms and timely up-gradation/renovation of existing facilities and establishing Research & Development facilities to acquire latest technology.

10.3 Avoidable expenditure on purchase of Gas Turbine

Avoidable expenditure up to ₹ 15.56 crore due to delay in seeking quotation for purchase of Gas Turbines by BHEL

GSPC Pipavav Power Company Limited, Amreli (Pipavav) and Gujarat State Energy Generation Limited, Hazira (Hazira) invited tenders on 26 October 2006 and 15 November 2006 respectively for Engineering, Procurement and Commissioning of power projects which inter-alia included supply of three Gas Turbine Generators (GTG) with a capacity of 350 MW each. Accordingly, Heavy Power Equipment Plant (HPEP), Hyderabad, a unit of Bharat Heavy Electricals Limited (Company) placed Request For Quotation (RFQ) on General Electric Company (GE), USA (22/ 23 January 2007) for one number Flange to Flange Frame 9FA Gas Turbine Generator (F–F GTG)[1] and two number Phase - III rotor kits (Kit)[2] for submitting quotations to Pipavav and Hazira .

In response to RFQ for Pipavav, GE submitted (5 May 2007) proposal for supply of F–F GTG and Kit for US $ 25,725,700 and US $ 19,107,800 respectively which was valid up to 30 November 2007. In the meantime, the delivery schedule in respect of Hazira was curtailed (18 April 2007), forcing HPEP to import F – F GTG. Instead of placing RFQ on GE for F – F GTG immediately, RFQ was placed only on 4 October 2007 with a delay of 6 months for which the price offered (5 October 2007) was US $ 28,807,700 with validity

[1] ***Fully finished Gas Turbine Generator directly imported from General Electric Company***
[2] ***Sub-assemblies imported from GE for in-house manufacture of GTGs***

up to 31 October 2007. Consequently, HPEP placed orders on GE (27 October 2007) for supply of two F–F GTGs and one Kit as per the price quoted by GE on 5 May 2007 and 5 October 2007.

Meanwhile price offer to the tender was submitted (29 June 2007) by the Company to Hazira in line with Pipavav.

The delay in seeking quotation from GE led to increase in price for F–F GTG from US $ 25,725,700 (5 May 2007) to US $ 28,807,700 (5 October 2007) and the reasons for such delay were not on record. The avoidable delay led to an additional expenditure up to ₹ 15.56 crore.

The Management in its reply (September 2010) mainly contended that in view of the excessive load for machining and very long deliveries quoted for casing castings, a critical input for converting Kit to F–F GTG, the Company decided to import a F–F GTG for Hazira.

The contention of the Management is not convincing in view of the following:

- it could have obtained proposal for two F–F GTG machines♥ for a price of US $ 25,725,700 each instead of one F–F GTG before receipt of proposal from GE (5 May 2007) as the amendment for delivery schedule in respect of Hazira was received on 18 April 2007 and
- the Company's decision to procure one F–F GTG for Hazira was mainly based on tight delivery schedule and not on the perceived constraints in machining capacity.

Thus, the avoidable delay in seeking quotation for F–F GTG led to an additional expenditure up to ₹ 15.56 crore.

The matter was reported to Ministry in October 2010, reply was awaited (February 2011).

♥ ***One for Pipavav and one for Hazira***