**Case Study: Assessment Findings**

(Goodwill Equipment Co Ltd)

The following is the flow of Assessment at GEC Ltd conducted by a two member team. Participants are required to read the Company Organizational Profile and the Assessment findings in this document completely before attempting to start rating. This document refers to exhibits that provide evidences in support of the enablers and results.

The Exercises based on this Case study are to be done in Groups.

The company has applied for the following ZED parameters for Assessment.

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| --- | --- | --- | --- |
| 1 | A-1 | Technology Upgradation |  |
| 2 | A-2 | Process Design for Quality | M |
| 3 | A-3 | Low Cost Automation |  |
| 4 | A-4 | Waste Management | M |
| 5 | A-5 | Safe Working Environment | M |
| 6 | B-1 | Process Validation |  |
| 7 | C-1 | Swachh Workplace | M |
| 8 | C-2 | Daily Work Management | M |
| 9 | C-3 | Planned Maintenance | M |
| 10 | C-4 | Process Control | M |
| 11 | D-1 | Design Capability |  |
| 12 | D-2 | Design Process |  |
| 13 | E-1 | Transportation and Storage |  |
| 14 | E-2 | Timely Delivery | M |
| 15 | F-2 | System for abatement of effluents, emissions etc. | M |
| 16 | F-3 | System for Energy Efficiency | M |
| 17 | F-4 | System for Natural Resources Conservation | M |
| 18 | H-1 | Planned Maintenance of environment management systems | M |
| 19 | K-1 | Plant Layout |  |
| 20 | K-3 | Material Handling | M |
| 21 | L-2 | Employee Involvement |  |
| 22 | O-1 | Outgoing Quality | M |
| 23 | O-2 | In-house Quality | M |
| 24 | O-3 | Field Performance Quality |  |
| 25 | P-2 | Scrap Reduction | M |
| 26 | P-4 | OEE |  |
| 27 | Q-1 | Optimal use of Natural Resources | M |
| 28 | Q-2 | Energy Performance | M |
| 29 | Q-3 | Environmental performance | M |
| 30 | R-1 | Turnover Growth |  |
| 31 | R-2 | Profitability Growth | M |
| 32 | R-4 | Inventory Turnover |  |

**Day 1**

**Meeting with Top Management**

1. After the opening meeting , the Assessment team met the Managing Director, accompanied by the Manager (QA). The Team Leader (TL) requested him to explain how well GEC is currently placed in relation to its target of Zero Defect and Zero Effect and what are the steps being undertaken.
2. The MD informed that right from inception, the Company has placed the highest emphasis on product quality, which is essential as they are mostly having institutional customers for their industrial product range. One of the key steps in this regard is to equip GEC with state-of-the- art equipment both for production as well as for testing. The income surplus has been regularly reinvested in capex, including for the IT infrastructure.
3. On Capacity development of the work force, the MD informed that the Company invests heavily in developing technical competence in its key staff, especially those involved in product development. Many senior managers have been sent for training with overseas technical collaborators.
4. On asking about developing partnerships, the MD said that the Company accords high emphasis on regular supplier monitoring, as most of the semi-finished and finished components are bought out items. The company has established a ‘just in time’ arrangement with the suppliers, that has resulted in substantial reduction of inventories and improved delivery performance.
5. With regard to customer engagement, the company enjoys excellent reputation with its customers and continues to retain most of the business ties. The MD said this is due to their technical proficiency and policies of close customer engagement. Because of this, the company has been able to enter the export market, in Gulf and SAARC countries and has ambitious targets to expand the export market.
6. When asked about competition, he said the main competitors are multinationals and large corporates such as KSB, Kirloskar Brothers, Weir Pumps, etc. but GEC is able to compete because of better product pricing.
7. Reviewing the Business Performance report (**EX-1**), shown by the MD, the team leader asked what he would attribute the main factors behind the high growth rate, the MD responded that it was primarily due to marketing strategies and sales efforts and incentives in forms of sales commission. On high receivables, the MD said he has set up a monitoring team for recovery.
8. When asked why the Company had not opted for Environmental Management Systems Certification, the MD expressed surprise and mentioned they are an engineering company and a non-polluting industrial unit. They have the SPCB clearance and have never faced any objection from the SPCB inspector. The Quality Manager however quickly added that, the Company has engaged an environment consultant, who assists them in getting consent from SPCB after performing all statutory checks.
9. The TL asked the MD what are his current concerns in relation to quality of products and services. The MD responded that they are yet to resolve the number of customer complaints. They have recently started mapping quality costs and these were found to be quite high. He has advised the QA team to work on this aspect. The Team Leader thanked the MD and proceeded to meet the Technical Director

**Meeting with Technical Director**

1. The TL requested the Technical Director (TD) to explain steps taken by GEC towards product design, process design and technology augmentation towards production of Zero Defect and Zero Effect milestones. The Technical Director mentioned the company is still on its way to achieve world class quality performance levels, however they have an ambitious technology augmentation plan to sustain this effort. In this regard, he referred to the Production and Testing equipment procured by the Company as provided in the Organizational profile. These have replaced most of the manual controlled machines. With current augmentation of CNC machines and Automatic Stator assembly machine, the Company is now quite at par with the competing MNCs. In the next couple of years, the company plans to expand, and negotiations are already in place for advanced multi operation VMCs and automatic rotor assembly line.
2. When asked, why the company is still receiving high customer complaints, the TD said they are still in the process of stabilizing the processes. There are also some gaps in technical competence in setting and operating the machines, which are being looked into.
3. The TL asked whether there are any plans for technology acquisition for improving the environmental and energy performance, the TD said, the current focus is on quality performance. However as most of the new acquisitions are servo motor and PLC controlled, these are naturally energy efficient. The increase in the curing oven capacity had led to reduced energy consumption per unit. He added there has been a significant improvement in the Energy performance in the last 3 years and showed the Energy Consumption Report (**EX - 17**). The company is also looking at the government subsidies for installation of solar PV panels, and has included these in the long term business plans. The QM added that for the past 3 years, the company had set specific targets for energy savings, and for achieving these, the company had implemented several actions to reduce energy costs such as FRP light refractors on the ceiling, changeover of all lamps from GLS to CFL and now LED. Staff training includes awareness to switch of all idling equipment, lights and fans.
4. The TL asked how the Company has developed the design of its products and the process followed for new design development. The TD informed that the company had technical collaboration with KSB pumps in the initial phase, and most of the product design continues from that period. The Team Leader wanted to see any data on new product development. The TD opened his MIS on the Computer monitor and showed the New Products developed by GEC and the revenues from these (**EX -2**). He also showed another report on Product improvements (**EX-3**). The TL asked whether the products shown in (**EX-2**): Sluice Valves / Foot Valves, slurry pumps and EO pumps were original designs by GEC. The TD responded there are no more original designs for these products. Most companies do a comparative study of products in the market and develop internal design through reverse engineering. The Team Leader asked whether this involved any IPR infringement. The TD said as GEC has added several developmental changes on the product, he doesn’t think there would be IPR issues.
5. The TL asked whether they followed any formal process for product design or development, such as FMEA or Quality Function Deployment. The TD said he was aware of these techniques, but GEC did not follow them fully, although they do carry out a detailed design validation programme for each product developed or changes. The QA Manager added that the Company had included Design and Development in their ISO 9001 Scope, and maintains records of all verifications and validations. For each project a Design group headed by the Manager Product Development is formed depending on processes involved. The Design reviews are conducted by the TD. Complete records of prototype testing, trial runs, the approved process routes, parameters and process controls are maintained.
6. The TL asked whether the customer complaints, field failures are considered in design improvements. The QA manager informed these are addressed through the Corrective and preventive action procedures, and records of any product design changes are maintained in the CAPA register. If required the drawings are amended.
7. Asked how the company has established the process control parameters, the TD informed these are in accordance with the Engineering drawings for all mechanical operations that can be set on the CNC machines. For the stator assembly, the machine parameters are set as per the Technical instructions from the supplier. For the rotor assembly, vacuum impregnation and oven curing the parameters have been decided based on historic data and technical sheets. The Team Leader thanked the TD and requested to meet the DGM Production

**Meeting with DGM Production**

1. The TL asked the DGM how the operations are controlled to ensure Zero defect production and also whether there are measures in the production areas to demonstrate Zero effect on Environment. The DGM informed that GEC has a very robust production system and they have improved it over the years to standardize all processes. The Company has standardized all Process Data sheets linked to Product model No or Part No and these are incorporated in the Company’s ERP system. All production work areas are provided with Computer monitors linked to the ERP server. Based on the Daily production plan, the respective stations receive the job related information as well as the production quantities. Raw materials / components are issued from Stores based on the part requirements generated by the ERP. Each finished part is logged into the system by the operator, that routes it to the next stage. All materials are moved on trolleys and kept in identified bins. Rework and scrap /rejected material are segregated and identified by tags. Visual and written instructions for machine setting are available as part of the Systems menu and can be accessed directly by all operators. Data related to production losses, verification results, rework, rejections are logged into the system.
2. When asked how the communication regarding daily activities takes place, the DGM involved they have a Daily morning meeting of Manager production with all Supervisors on the shop floor and Manager maintenance to review the work status, maintenance related concerns, rework items, etc. Besides there is a shift change meeting and log handover among the supervisors.
3. The Team Leader enquired if the company was implementing any methodology for waste reduction. The Production Manager informed that the Company’s production system and the location set up of the machines were aligned to reduce the job travel distance and material idling time. The company had achieved single piece flow in the Foot valves and smaller pumps and the target was to achieve single piece flow in all lines by 2019. As a result the TAKT time as well as the inventory turnover had improved significantly in the last year and due to this the company was able to improve its delivery performance (**Ex 1**) significantly in the last fiscal and the same was being tracked by him and the MD on daily basis through the ERP. He informed that in-house training of all supervisors and operators included sessions on 3 M and on the importance of reducing material, travel and idling waste and saving energy. He also informed that the Kaizen Championship includes projects on 3 M.

**Visit to Shop floor**

1. The Team Leader requested to see the activities on the shop floor. The DGM production advised the Manager (Production) to accompany him. The Team visited the Machine Shop and requested to see the outcome of the day’s morning meeting. He was shown the meeting log on the ERP system. He confirmed that all Shift Supervisors had attended the meeting. He also confirmed that the approved process job card was on display with details of machine setting parameters, in-process checks etc. He observed that rework material was kept in the earmarked area and was identified with tags. The Team member observed that one of the issues highlighted was high rework rate in motors due to air gap between stator and rotor. The Team member asked whether the data regarding air gap defects and other defects was being logged. The Manager (Production) switched to the Fault Analysis Reports on the monitor. The Assessment team took note that the Fault analysis reports both for motors and pumps (**Ex 9**) displayed the various defects and their numbers observed and these had been tabulated month wise. The Assessment team noted that the highest number of defects were in ‘Air gap’, ‘End ring joints’ in respect of motors and in ‘Impeller imbalance’, ‘Pump efficiency’ and ‘Alignment’ in respect of pumps. The Team member asked the further actions taken by the company to overcome these defects and whether any cause effect analysis or why-why analysis had been done to determine the root causes. The Production manager informed that these were routine production problems in these product lines, and the operators were authorized to analyze the reasons and take initiatives in their work areas in consultation with the supervisors. The actions taken were reported on the system and reviewed by the team on effective implementation.
2. The Team leader asked if the company was following any problem solving methodology. The Quality Manager informed they have a Kaizen championship every year, in which the best kaizen was awarded by the MD. The Assessment Team looked at the Kaizen reports on the System and noted that the Company had attempted 8 Kaizen projects in the last 2 years. Asked how these were selected, the Quality Manager informed that it was the choice of the Shop / Area Supervisor to select the project. The team noted that none of the Kaizen projects were related to the faults noted in the Fault analysis and most of these were related to improving process operations through automation etc.
3. The Team member noticed that many operators were not wearing PPE even though they were working in operations involving overhead material movement. He enquired from the Manager (Production) whether the company practices any safety management systems. The Manager informed that they have decided to implement OHSAS 18001 and for this purpose a consultant has recently been appointed.

**Day 2**

1. The Team reached the motor assembly area. The Manager (Engineering) showed them around the facilities for Stator assembly, rotor assembly, vacuum impregnation, curing oven, motor assembly and test laboratory. The audit team noticed that the automatic stator assembly line was under maintenance. The Manager informed that the machine was under breakdown from the day before and they were awaiting the visit of the supplier’s engineer. He said, even though the machine has improved productivity by more than 50 %, the machine was having teething troubles and frequently had to be stopped. There were also some quality issues with the finished stator. The Team Leader asked whether the stator assembly process was formally approved when the machine was installed. The Engineering Manager opened the system log to show approved process routes and control parameters for different stator types. He informed as the machine is programmable, the preset parameters are fed into the PLC with every change of job and these were set jointly with the supplier’s engineering team.
2. The Team noticed that the work areas are quite clean and all spares, tools are kept in assigned places. Areas for rejected / rework pieces are clearly marked. Scrap bins are kept near each work station. Asked if the company was following 5 S, the manager informed they were not following any formal system, but this was a part of company’s culture and the MD was very particular on systematic and clean workplace. The Audit team could confirm the same in different work areas.

**Visit to Maintenance and Tool Room**

1. The Audit team next moved to the Maintenance and Tool Room bay and met the Manager. The Team Leader enquired how the maintenance support system was leading the company towards zero defects and zero effect. The Team leader also pointed out the team’s observation regarding stator assembly machine and the high amount of rework due to machine performance. The Team Leader asked whether GEC is implementing Total productivity Maintenance. The Manager informed they have not yet started any formal activity towards TPM, however, they have a formal programme in place for preventive maintenance of all machines, the schedules for which have been drawn in consultation with the machine suppliers. He opened his log to demonstrate the schedule and checklist for each machine. The Team Leader noted that the checklist also contained the fulfilment data with dates. When asked about breakdown data, the manager showed machine wise / date wise information on the system. The Team leader asked whether the information was being further analyzed to improve the frequency and plan for preventive maintenance and whether they have carried out any correlation / study on the costs to company due to maintenance. The manager informed that they have not yet analyzed the B/D data, however the company was calculating the Breakdown time (**Ex-16**) Operational Equipment Efficiency (**Ex -15**) of the critical machines. Further the data for cost of poor quality (**Ex -10**) that is related to machine performance was also being tracked. Quality department has also started conducting process capability studies (**Ex – 7** )and this data is also shared with maintenance. Based on this, the department is planning to initiate Autonomous maintenance and for the same a training plan has been prepared. The audit team thanked the Manager and moved to QA Department

**Visit to the QA Department**

1. The TL repeated his question on Environmental abatement to the Quality Manager and also whether any specific action was taken for conservation of natural resources. The QM responded that being an engineering company with mostly mechanical operations, they had not formally acted on environmental aspects. However when applying for ZED certification they had contacted an EMS consultant who has assisted them in mapping the various environmental aspects applicable to them, and actions taken by GEC involuntarily in the past. He showed the analysis to the TL (EX-18). The TL asked whether GEC had assisted the casting supplier in setting up environmental mitigation actions, the QM replied that these were self-adopted by the supplier. The Company has two operations that required controls - spray painting and curing furnace that caused effluent and air emissions. However the discharge levels were way below the threshold as determined through annual test reports of effluent waste water and air samples collected performed in an accredited laboratory. The Team leader verified the reports and found them to be in compliance. For solid waste, the company had an outsourced contracting arrangement with a CPCB approved contractor for disposal to approved landfill site.
2. On conservation of natural resources, the QM informed the company had become totally paper less. Further the GEC building structure incorporated rain water harvesting. The company does not use fossil fuels for any operation.
3. The TL wanted to see the Corrective and Preventive Action record. It was observed that the CAPA Register mostly addressed Non conformities raised during ISO audits and external Complaints. It was seen that the investigations were carried out by the QA department in consultation with the production manager. A few complaints were related to damage of product during transportation and the corrective action showed improving the mounting of larger pumps in the wooden crates.
4. The Team member in the meanwhile requested to see any SPC tools being followed by the Company. The QA Manager requested the QA Engineer to show the Process Capabilities studies **(Ex-7)** carried out as well as the Control Charts **(Ex-8).** The Team member observed that the PC studies have been carried out for Temperature rise, Pump Efficiency and Shaft run out. He requested to correlate the processes that impact the Temperature rise test. The QA engineer informed it was a function of several sub-processes such as rotor assembly – stacking and end ring fittings, air gap as well as curing cycle. The Team member observed that the Cp / cpk value was 0.7 corresponding to NC rate of almost 17000 ppm. He also pointed out low cp / cpk values for Pump efficiency and shaft runout. He enquired if any steps have been taken to improve the ppm levels. The QA Engineer informed that the company has recently compiled Fault Analysis data for past 3 years for Motors and pump sets and based on the findings, Control Charts for pump efficiency and Air Gap have been started since Jan 2016. The Team member observed that the Control Charts were demonstrating in-stability. He also observed that the Control charts were attribute type even though the parameters were measurable.
5. The Team requested to meet the Stores in charge. At the Stores, the Team saw that all materials and stores were kept in order in identified bins / locations and labeled. The stores were equipped with a dehumidifier. In the finished products stores, all pumps, motors were kept in polywraps prior to packaging. The details of all incoming and finished stores were entered into the ERP system and issue decided by first in sequence. The ERP generated triggers for stock levels and for raising purchase demand. The team however noticed that the large sized Sluice Valves were stored in the open and on some of the Valves, the bitumen coating had worn off. The Stores incharge explained these were under dispute due to deferment of supply order last year. On a query, the Stores in charge informed that all transportation was by a single outsourced transport company who was engaged since the past 11 years. Except for rare cases involving accidents, there had been no complaints regarding damage during transit.

The Team leader confirmed that he had covered the entire scope of the Assessment as per the Mandatory and optional parameters applied and informed the Quality Manager that he will be conducting the closing meeting at 4.30 pm

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