

“Study of Production and Assembly Processes in Compressor Manufacturing Industry under Industrial Training”

Sarthak Pandit Urmude¹, Mahendra Bapurao Jadhav², Ramesh Suryabhan Gadakh³

¹ Student Mechanical Department, Sau. Sundarbai Manik Adsul Polytechnic

² HoD Mechanical Department, Sau. Sundarbai Manik Adsul Polytechnic

³ Principal, Sau. Sundarbai Manik Adsul Polytechnic

Abstract - The compressor manufacturing industry plays an important role in refrigeration and air-conditioning systems, where efficient production and assembly processes are essential for achieving high product quality, reliability, and productivity. This research paper presents a study of the production and assembly processes followed in a compressor manufacturing industry, based on industrial training carried out at GMCC India Pvt. Ltd., Supa. The study focuses on major manufacturing and assembly operations involved in compressor production, including component preparation, welding of the upper case, lower case and base plate, pump body operations, and final assembly activities. The study also examines the sequence of operations, material handling, workstation practices, quality inspection, rework procedures, and the importance of safety in the production environment. Through direct observation and practical exposure to the production line, the overall workflow of compressor manufacturing was analyzed. The study provides an understanding of how different production stages are integrated to achieve consistent product quality and efficient manufacturing. The findings highlight the importance of standardized work procedures, proper welding practices, quality control, skilled manpower, and effective line management in improving production efficiency and reducing defects. This study provides practical industrial knowledge and demonstrates the relationship between theoretical mechanical engineering concepts and their application in an actual compressor manufacturing environment.

Key Words: : Compressor Manufacturing, Production Process, Assembly Process, Welding, Quality Control, Manufacturing Industry, Production Line, GMCC India Pvt. Ltd.

1.INTRODUCTION

The manufacturing industry is an important part of modern engineering and plays a major role in the development of refrigeration, air-conditioning, automotive, and other industrial systems. Among various manufacturing sectors, the compressor manufacturing industry is particularly important because compressors are the main working components of many refrigeration and air-conditioning systems. The performance, efficiency, reliability, and service life of a compressor depend significantly on the quality of its manufacturing and assembly processes.

Compressor manufacturing involves a series of interconnected operations, starting from the preparation and processing of individual components and continuing through welding, machining, sub-assembly, inspection, and final assembly. Each operation must be performed according to specified procedures to maintain dimensional accuracy, structural strength, and product quality. Proper coordination between different production stages is therefore essential for achieving continuous production and minimizing defects.

This research paper presents a study of the production and assembly processes observed during industrial training at GMCC India Pvt. Ltd., Supa. The study mainly focuses on the compressor production line and the practical operations involved in manufacturing compressor components. Particular attention was given to welding operations such as upper case welding, lower case welding, and base plate welding, along with pump body-related operations and assembly activities.

During the industrial training, practical observations were made regarding the sequence of manufacturing operations, material movement, workstation practices,

quality inspection, rework procedures, and safety practices followed on the production floor. The study also helps in understanding how different components and processes are integrated to produce a finished compressor.

2. System Design and Architecture

The production and assembly system observed at GMCC India Pvt. Ltd., Supa consists of a sequence of interconnected manufacturing and assembly operations. The major steps are described below:

Step 1: Raw Material and Component Preparation:

Raw materials and required compressor components are received and prepared for further manufacturing operations. Components are checked for basic quality and suitability before entering the production line.

Step 2: Component Manufacturing: Individual compressor components are manufactured or processed according to their required dimensions and specifications. Different machines and workstations are used for component preparation.

Step 3: Upper Case Welding: The compressor upper case is positioned and welded using the specified welding process. Proper alignment and welding parameters are maintained to obtain a reliable joint.

Step 4: Lower Case Welding: The lower case is processed through the welding workstation. Proper positioning and welding are carried out to achieve the required strength and dimensional accuracy.

Step 5: Base Plate Welding: The base plate is positioned and welded to the required compressor component. This operation is important for providing proper structural support to the compressor assembly.

Step 6: Pump Body Operation: The pump body is processed using dedicated machinery and workstations. The required machining and processing operations are performed according to the component specifications.

Step 7: Component Inspection: Manufactured components are inspected at different stages of production. Inspection helps identify dimensional variations, welding defects, improper fitting, and other manufacturing defects.

Step 8: Rework Operation: If any defect or deviation is identified during inspection, the component is sent for the required rework operation. After rework, the component is inspected again before proceeding further.

Step 9: Sub-Assembly: Various individual components are combined to form sub-assemblies. Proper sequence and standardized work procedures are followed during this stage.

Step 10: Final Assembly: The inspected sub-assemblies and other required components are assembled to produce the complete compressor unit. Proper fitting and assembly sequence are maintained.

Step 11: Final Quality Inspection and Testing: The completed compressor undergoes final inspection and testing to verify its performance, assembly condition, and required quality standards.

Step 12: Packing and Dispatch: After successful completion of final inspection and testing, the finished compressors are prepared for packing and subsequently transferred for storage or dispatch.

System Architecture Summary: The overall system is designed around the principle of sequential production, where each stage adds value to the product and passes it to the next stage. Quality inspection and rework are integrated into the production system to minimize defects and maintain the reliability of the final compressor.

3. Key Components and Working Principles

The major components and processes studied at GMCC India Pvt. Ltd., Supa are:

i. Upper Case: Provides outer protection and structural support to the compressor. It is accurately positioned and welded.

ii. Lower Case: Forms the lower housing of the compressor and is joined by welding to maintain strength and proper alignment.

iii. Base Plate: Provides mechanical support and stability to the compressor assembly. It is positioned and welded accurately.

iv. Pump Body: An important component of the pumping mechanism. It is processed using dedicated machines according to specified dimensions.

v. Welding System: Used for permanent joining of compressor components by controlled heat and proper welding parameters.

vi. Fixtures and Jigs: Hold components in the correct position during welding and machining to maintain accuracy.

vii. Inspection System: Checks dimensions, weld quality, and assembly conditions. Defective components are sent for rework.

viii. Assembly System: Combines individual components in a predefined sequence to produce the complete compressor.

4. Industrial Applications and Observations

4.1 Industrial Applications: The compressor manufacturing processes studied at GMCC India Pvt. Ltd., Supa have applications in:

- Refrigeration systems – Used in domestic and commercial refrigeration equipment.
- Air-conditioning systems – Compressors are essential for AC and cooling applications.
- HVAC systems – Used for efficient heating, ventilation, and air-conditioning operations.
- Industrial cooling systems – Applied in various industrial refrigeration and cooling equipment.
- Manufacturing industries – Welding, machining, inspection, and assembly practices are applicable to other mechanical manufacturing processes.

4.2 Observations

During the industrial training, the following observations were made:

- Production operations were performed in a systematic sequence.
- Proper welding and component positioning were important for product quality.
- Fixtures helped maintain accuracy and repeatability.
- Quality inspection was carried out at different production stages.
- Defective components were subjected to rework and re-inspection.
- Proper material flow and workstation management helped improve production efficiency.
- Safety procedures and PPE were important during manufacturing and welding operations.

Table 1

Skill Mapping – Industrial Experience vs Mechanical Engineering Curriculum			
GMCC Compressor Manufacturing Pvt. Ltd., Supa			
Mapping with Mechanical Engineering Curriculum			
Industrial Experience at GMCC Compressor Manufacturing Pvt. Ltd., Supa	Mechanical Engineering Curriculum	Mapping with Mechanical Engineering Curriculum	Legend – Skill Alignment Level
Production & Manufacturing - Compressor assembly process - Production line operation & maintenance - Load balancing & optimization	Industrial Experience (Actual Skillset) - Assembly line operation - Process flow & set time - Load balancing	Industrial Experience (Actual Skillset) - Manufacturing Process (ME, 100) - Production Engineering (ME, 100) - Production Engineering (ME, 100)	High (Strong alignment) Medium (Moderate alignment) Low (Limited alignment)
Maintenance & Equipment - Machine operation & maintenance - Preventive & breakdown maintenance - Use of measuring instruments	Mechanical Engineering Curriculum - Machine Design (ME) - Machine Dynamics (ME) - Manufacturing Engineering (ME) - Machine Design (ME)	Mechanical Engineering Curriculum - Machine Design (ME) - Machine Dynamics (ME) - Manufacturing Engineering (ME) - Machine Design (ME)	High (Strong alignment) Medium (Moderate alignment) Low (Limited alignment)
Refrigeration & HVAC Systems - Compressor working principle - Refrigerant handling & safety - Refrigerant recovery & charging	Refrigeration & HVAC Systems - Refrigerant handling & safety - Refrigerant recovery & charging - Refrigerant recovery & charging	Refrigeration & HVAC Systems - Refrigerant handling & safety - Refrigerant recovery & charging - Refrigerant recovery & charging	High (Strong alignment) Medium (Moderate alignment) Low (Limited alignment)
Quality & Testing - Quality control (dimensional & functional) - Load testing performance testing - Comprehensive inspection	Quality & Testing - Quality control (dimensional & functional) - Load testing performance testing - Comprehensive inspection	Quality & Testing - Quality control (dimensional & functional) - Load testing performance testing - Comprehensive inspection	High (Strong alignment) Medium (Moderate alignment) Low (Limited alignment)
Technical & Communication - Design & development (CAD) - Production & maintenance (SOP) - Safety & health & environment (SHE) practices	Technical & Communication - Design & development (CAD) - Production & maintenance (SOP) - Safety & health & environment (SHE) practices	Technical & Communication - Design & development (CAD) - Production & maintenance (SOP) - Safety & health & environment (SHE) practices	High (Strong alignment) Medium (Moderate alignment) Low (Limited alignment)
Industry Exposure - Non-physical (documented report) - Industrial exposure & 200+ hours exposure - Exposure to industrial design & production	Industry Exposure - Non-physical (documented report) - Industrial exposure & 200+ hours exposure - Exposure to industrial design & production	Industry Exposure - Non-physical (documented report) - Industrial exposure & 200+ hours exposure - Exposure to industrial design & production	High (Strong alignment) Medium (Moderate alignment) Low (Limited alignment)

Fig -1: Figure

5. CONCLUSIONS: The industrial training at GMCC India Pvt. Ltd., Supa provided practical knowledge of compressor manufacturing and assembly processes. The study covered major operations such as upper case welding, lower case welding, base plate welding, pump body operations, inspection, rework, and final assembly. It was observed that proper process control, accurate component positioning, quality inspection, and standardized work procedures are essential for achieving consistent product quality and production efficiency. The internship also helped bridge the gap between theoretical mechanical engineering knowledge and its practical industrial application.

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The heading should be treated as a 3rd level heading and should not be assigned a number.

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