

INDUSTRIAL TRAINING REPORT

6 week Industrial Training

At

Godrej and Boyce Mfg. Co. Ltd, Mohali , Punjab

Submitted in partial fulfilment of the

Requirements for the award of

Diploma in Mechatronics and Industrial Automation



Submitted By

Name : Raman Jeet Singh

ISTC Roll no. : 2021-160

SUBMITTED TO:

Department of Mechatronics and Industrial Automation

INDO SWISS TRAINING CENTRE, CHANDIGARH

DECLARATION

I hereby declare that the Industrial Training Report entitled 6 week Industrial Training is an authentic record of my own work as requirements of Industrial Training during the period from 3rd July 2023 to 11th August 2023 for the award of diploma in Mechatronics and Industrial Automation, Indo-Swiss Training Centre, CSIR-CSIO, Chandigarh, under the guidance of **Mr. PRASHANT KHULLAR**.

Date :

Ramanjeet Singh

2021-161

ACKNOWLEDGEMENT

The internship opportunity I had with **Godrej and Boyce Mfg. Co. Ltd.** was a great chance for learning and professional development. Therefore, I consider myself as a very lucky individual as I was provided with an opportunity to be a part of it. I am also grateful for having a chance to meet so many wonderful people and professionals who led me through this internship period.

Bearing in mind previous I am using this opportunity to express my deepest gratitude and special thanks to the HR Manager of **Godrej and Boyce Mfg. Co. Ltd.** who in spite of being extraordinarily busy with his duties, took time out to hear, guide and keep me on the correct path and allow me to carry out my project at their esteemed organisation and extending during the training.

I express my deepest thanks to **MR.PRASHANT KHULLAR** for taking part in useful decisions & giving necessary advice and guidance and arranged all facilities to make life easier. I choose this moment to acknowledge his contribution gratefully.

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CHAPTER 1: INTRODUCTION

1.1 Introduction

As a partial fulfilment of the requirement for the award Advanced Diploma in Mechatronics and Industrial Automation, students are required to undergo practical training under a company of repute after the 4th semester.

This training in the basic electronics, Analog and Digital circuits, Electrical and Embedded systems, PLC, Industrial automation, Mechatronics, Sensors, Instrumentation, Industrial Robotics, Pneumatics & Hydraulics, Electric drives is provided to students for Electronics engineering and MIA courses.

1.2 Industrial Training Objective

The purpose of Industrial Training is to expose students to real work environment experience and at the same time, to gain knowledge through hands-on observation and job execution. From the industrial training, the students will also develop skills in work ethics, communication, management and others. Moreover, this practical training program allows students to relate theoretical knowledge with its application in the manufacturing industry. The objectives of industrial training are:

- To provide students the opportunity to test their interest in a particular career before permanent commitments are made.
- To develop skills in the application of theory to practical work situations.
- To develop skills and techniques directly applicable to their careers.
- Internships will increase a student's sense of responsibility and good work habits.
- To expose students to real work environment, gain knowledge in writing report in technical works/projects.
- Interns will have higher levels of academic performance.

- Internship programs will increase student earning potential upon graduation.
- To build the strength, teamwork spirit and self-confidence in student's life.
- To enhance the ability to improve student's creativity skills and sharing ideas

1.3 The Importance of Industrial Training to Student

It is the organised way of improving and enhancing knowledge and skill set of engineering students. It boosts the performance of students and helps them to meet career objectives. The industrial training program is important for engineering students. It helps them to update and master their skills. If they are not aware of new concepts and technology, the industrial training program lets them master the latest advancements. It not only builds confidence but also helps in taking on complicated projects easily.

It is a comprehensive learning platform for students where they can improve their employability skills. They would become prepared for the job and get sufficient real corporate exposure.

The industrial training program improves students' awareness of a single particular technology.

The learners can obtain hands-on experience and know the real job scenario.

It cultivates the leadership ability of the students and gives them the responsibility to execute and perform the given task.

It helps in increasing self-confidence and identifying their own proficiency.

The students should obtain industrial training in the latest and new technologies

CHAPTER 2 : COMPANY BACKGROUND AND ORGANISATION STRUCTURE

2.1 About Godrej & Boyce

Engineering excellence and a strong pioneering spirit continues to underscore the operating philosophy of Godrej & Boyce Mfg. Co. Ltd. (G&B), the flagship company of the Godrej Group. Since 1897, G&B has played a pivotal role in India's economic growth and created sustainable value for all its stakeholders through its products and services across ten industries.

With revenues of over INR 14,796 crore (FY 2022-23) and over 15,000 committed employees, G&B's diverse presence across 10 industries-from building complex bespoke engineering solutions to making branded consumer goods like appliances, furniture, locks and security solutions. G&B positively impacts the lives of one-third of India's population. Through international subsidiaries and joint ventures, the company's products have also established a strong global footprint across 5 continents.

G&B's B2B businesses have been built through strategic investments in high-end engineering capabilities and manufacturing scale. The company is a key partner for India's space missions and numerous satellites launches as well as a key supplier for complex engineered solutions for renewable energy, power transmission and other critical industrial infrastructure

globally. G&B's security solutions have given the company a key role in securing national borders, cities, bank vaults, institutions and homes across India.

An intrinsic understanding of customers for over 125 years has helped G&B's businesses to constantly innovate and build products and solutions with clarity of purpose. These are manufactured in G&B's quality-driven and technology-led facilities and distributed through a national and international network of partners.

The company engages with millions of consumers and businesses across the world by building effective and efficient household appliances, providing solutions for security, storage as well as interiors with an attention to detail and service that are eponymous with

trust and quality. The company is present in every corner of India, fulfilling aspirations of customers and helping them lead secure and fulfilled lives.

As a values-driven company known for its trust, integrity and social conscience, G&B has built a compassionate corporate culture designed to empower individuals, teams, and communities in order to cater to the requirements of customers and community. For this, G&B has been consistently recognized as one of India's most respected companies. Its robust sustainability practices aptly demonstrated by its Good & Green initiatives have helped preserve the environment and underscores G&B's business operations.

Facing the future with excitement and resolve, the DNA of G&B remains rooted in the vision of the founders, Ardeshir and Pirojsha Godrej. Ardeshir eschewed a legal career to embark on an entrepreneurial journey in the late 19th century driven by his inventiveness and passion for people's needs. Pirojsha's strong business acumen and Ardeshir's inventive mind made them a strong team. They patented the world's first springless lock, built the first indigenously manufactured fire and burglar resistant safe, and later created another global milestone by inventing a process to make soap from vegetable oil. G&B has filed over 209 patents and has been granted 77 patents.

These values were carried forward by Pirojsha's son Naval Godrej who laid the foundation for the urban township of Pirojshanagar in Vikhroli, Mumbai. It is now home to over 10,000 families who live and work at G&B and it is where the company's global headquarters and key operations continue to be located.

To capture new opportunities emerging in a Digital-first, Industry 4.0 world, G&B is reimagining and reengineering its portfolio by investing in digital technologies and processes, building new skill sets among employees and engaging with customers across social and online platforms.

2.2 History

The company initially started as a small locksmith and safe manufacturing business. Over the years, Godrej has evolved and diversified its operations, becoming a leading player in various sectors. In its early years, Godrej gained recognition for its high-quality safes, which became popular among Indian households and businesses. The company's commitment to innovation and customer satisfaction laid the foundation for its success. It expanded its product portfolio to include typewriters, refrigerators, and other consumer goods, catering to the emerging needs of Indian society.

During India's independence movement and subsequent economic development, Godrej played a vital role in nation-building. It embraced the principles of self-reliance and indigenous manufacturing, contributing to the growth of the Indian economy. Godrej's commitment to social

causes and its progressive labour policies further solidified its reputation as a responsible corporate entity.

In the following decades, Godrej continued to diversify its operations into various industries, including chemicals, furniture, appliances, agribusiness, and real estate. The company's commitment to sustainability and environmental conservation became evident with its investments in green technology and renewable energy. Godrej's focus on innovation and continuous improvement propelled its growth, leading to international expansions and partnerships.

Today, Godrej is one of India's largest and most respected conglomerates. It operates in more than 80 countries and employs over 100,000 people worldwide. The company's product portfolio includes a wide range of consumer goods, industrial products, and services. Godrej's commitment to quality, innovation, and ethical business practices has earned it numerous accolades and awards over the years.

Beyond its business success, Godrej remains committed to social responsibility. The company actively supports education, healthcare, and environmental initiatives through its philanthropic arm, the Godrej Foundation. It also promotes gender diversity and inclusion within its workforce, emphasising the importance of equality and empowerment.

In conclusion, Godrej's history is a testament to its resilience, adaptability, and commitment to nation-building and sustainable development. From humble beginnings as a locksmith business, it has grown into a global conglomerate, contributing to India's industrial growth and societal progress. With a focus on Innovation, ethical practices, and social responsibility, Godrej continues to shape the future of business in India and beyond.

2.3 Business Units

- Godrej Aerospace
- Godrej Appliances
- Godrej Construction
- Godrej Electrical & Electronics
- Godrej Interio
- Godrej Locking Solutions & Systems
- Godrej Lawkim Motors
- Godrej Material Handling Godrej Precision Engineering
- Godrej Process Equipment
- Godrej Security Solutions
- Godrej Storage Solutions
- Godrej Tooling
- Godrej Vending
- Godrej Koerber
- Godrej Infotech

2.4 Milestones

- 1909 -Secured the first patent for Springless Locks (Patent No. 15773), under the seal of King Edward VII of England.
- 1918 Introduced the "Chavi Bar", the first soap in the world to be formulated and manufactured only using vegetable fats.
- 1955-Manufactured the first indigenously "Made in India" typewriter, the market for which was then totally dominated by imported brands.
- 1958- Manufactured the seven cubic feet (212 litres) refrigerator-a first for the Indian market. Priced at Rs. 1885, it came equipped with a unique stainless-steel freezer.
- 1963 - Manufactured the first Forklift Truck in India in collaboration with Clarke Material Handling Company of the USA
- 1995 - Introduced electronic security products and Ultra technology locks in India for the first time.
- 1997-Godrej Mangroves becomes the first Indian mangrove forest to be ISO 14001 certified

CHAPTER 3: WEEKLY JOB SUMMARY

DATE	ACTIVITIES
3/07/2023 to 7/07/2023 (week 1)	Introduction to industry Allotment of department Press shop → door manufacturing → cabinet manufacturing (side panels ,door , table top) Sequence of refrigerator manufacturing.

DATE	ACTIVITIES
10/07/2023 To 14/07/2023 (week 2)	Vacuum forming (thermoforming) → liner manufacturing → pdp manufacturing Foaming → cabinet foaming → door foaming Introduction to compressors.

	Refrigerating cycle
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DATE	ACTIVITIES
	Refrigerator final assembly
17/07/2023	Packaging and testing of refrigerator
To	Chest freezer manufacturing
21/07/2023	→ testing
(week 3)	→ packaging
	Logic for scissor lift and turn table.

DATE	ACTIVITIES
24/07/2023	Introduction to electrical drawing of machines (electrical panels).
To	
28/07/2023	Introduction to electrical components.
(week 4)	Clinching machine basics.
	Relay logic of clinching machine.
	Plc logic of clinching machine.

DATE	ACTIVITIES
31/07/2023	Introduction to motors
To	Basics of Vfd powerflex 40
4/08/2023	Test used for motors and drive
(Week 5)	→ continuity and megger test. → cold test for vfd Factory reset vfd and programing

DATE	ACTIVITIES
07/08/2023	
TO	EXPERIMENTS RELATED TO VFDs
11/08/2023	→ quick commissioning
(WEEK 6)	→ changing input source from bop to push buttons. →setting up digital inputs and outputs Observing breakdowns in plant Introduction to hana door panel robotic arm.

CHAPTER 4: TECHNICAL CONTENT

4.1 Safety

1. Wear Safety Equipment
2. Prevent Slips and Trips
3. Keep Work areas and Emergency exits clear
4. Don't take mobile phone to the cabinet foaming area as the chemicals catch fire
5. Don't wear loose clothing
6. Don't run in the premises

Basic Principles Followed in Manufacturing Industries

4.2.1 TPM – Total Productive Maintenance

TPM which stands for Total Productive Maintenance is a holistic approach to equipment maintenance that strives to achieve perfect production:

- No breakdowns
- No small stops or slow running
- No defects
- No accidents

In addition, it values a safe working environment:

TPM emphasises proactive and preventative maintenance to maximise the operational efficiency of equipment. It blurs the distinction between the roles of production and maintenance by placing a strong emphasis on empowering operators to help maintain their equipment. The implementation of a TPM program creates a shared responsibility for equipment that encourages greater involvement by plant floor workers. In the right environment this can be very effective in improving productivity (increasing up time, reducing cycle times, and eliminating defects).

KAIZEN

KAIZEN is a Japanese word made by a combination of two words KAI and ZEN

KAI refers to Change and ZEN refers to Better

Hence KAIZEN is a technique by which new things are always tried and applied for betterment of both the production and the operators and workers

Technically speaking, KAIZEN works for the

- Increase of Productivity
- Betterment of Quality
- Reduction of Cost
- Smooth Delivery
- Ensuring Safety and Moral
- Maintaining good working Environment

Which is all abbreviated as PQCDSM

THE 5S

5S is a workplace organisation method that uses a list of five Japanese words: seiri, seiton, seisō, seiketsu, and shitsuke. These have been translated as "sort", "set in order", "shine", "standardise", and "sustain".^[1] The list describes how to organize a workspace for efficiency and effectiveness by identifying and storing the items used, maintaining the area and items, and sustaining the new organisational system. The decision-making process usually comes from a dialogue about standardisation, which builds understanding among employees of how they should do the work.

There are five 5S phases. They can be translated to English as "sort", "set in order", "shine", "standardise", and "sustain". Other translations are possible.

4.2 Manufacturing of Refrigerators and Chest freezers

1. manufacturing of outer cabinet (press shop)
2. manufacturing of inner cabinet (linar and pdp)
3. cabinet and door foaming process
4. assembly and testing
5. packaging

4.2.1 manufacturing of outer cabinet

in manufacturing of outer cabinet we have to manufacture the door, side panels ,top and bottom of the refrigerator.

Side panel (HANA side panel) :-

This equipment transfers the sheet loaded on the trolley in the appropriate sequence according to the size, so that the process required at each station namely sheet feeder /notching/ 180 turn over / roll forming / parting machine / flange bender / L- bender / unloading through the work of conveyor.

Specifications :-

Electrical power → 415V (10%tolerance) ,50Hz ,3 phase

Control voltage → 24V DC

Air pressure available →72 PSI , 5BAR

Sheet feeder —

This equipment is composed of two loading carts in the sheet feeding process. Sheets loaded in the trolley are transferred to the centering table by transfer and the completed

sheets are inspected with a 2-sheet checking unit. After sheet detection the sheet is transferred to the next process by the shuttle unit.

Notching unit —

This station is the shape processing station defined by the five notching press dies below the sheet conveyed by the shuttle unit after the centering is completed in the sheet feeder. The die of the punching press is manually changed by the operator and moved by using the ball caster of the die table. The scrap of each die is taken by the operator in the scrap cart.

180 turntable —

This station is used to invert the sheet 180 for roll forming. It is a turn device that inverts a sheet to change the reference plane after notching. After centering using the guide cylinder, turn 180 using the air cylinder. The completed sheet is inspected by the 2-sheet checking unit. Sheets that have been detected are transferred to the next process by conveyor.

Roll forming —

This equipment is the process of making the final shape through the shape rolling of the turned sheet over 20 steps. This equipment transfers the notched sheets between the upper and lower rolls and forms them in the profile shape specified. In addition, it is a Roll Forming facility that has the advantage of setting the Roll when managing the initially set data. Each roll is engaged in gear by simultaneous operation. Mode change is divided into left and right width direction, fixed side and moving side, and moving side changes width value by Servo Motor.

Parting machine —

This equipment is to cut one sheet into two sheets according to the product model. The sheet transferred to the feeding conveyor is centred through the gauge and then cut into two upper and lower knives. The finished sheet is transferred to the next process by the conveyor.

Flange bender —

This equipment is the equipment to flange the sheet transferred through conveyor after roll forming and parting. Center the rolled sheet and Bending the roll forming part of the sheet by 90° Change the bending height by moving the side stopper. Bending Tool is Up & Down with Servo Motor The finished sheet is transferred to L-Bender by Conveyor.

L-bender —

This station is the equipment to finally L-bending the sheet. After flange bending is completed, the sheet transferred through the conveyor is centred, and both ends of the sheet in the longitudinal direction are bent 90° with the air cylinder. Bending Tool is up & down by Air Cylinder. The finished sheet is transferred to the unloading conveyor by the conveyor

Unloading conveyor —

This is a conveyor station for final transfer of sheets transferred after L-bending is finished.

Door panel (HANA door panel) :-

This equipment transfers the sheet loaded on the trolley in the appropriate sequence according to the size, so that the process required at each station namely sheet feeder /notching/cnc bender /hydraulic press / unloading through the work of conveyor.

Specifications:-

Electrical power → 415V (10%tolerance) ,50Hz ,3 phase

Control voltage → 24V DC

Air pressure available → 72 PSI , 5BAR

Workstations in hana door panel

→ loading station (sheet feeder)

→ notching station (4 sets of dies used)

→ cnc bender

→ arm for picking and placing

→ 300 ton press

→ unloading station

Vacuum forming :-

Vacuum forming is a simplified version of thermoforming, where PDP sheets are heated to a forming temperature, stretched onto a single-surface mould, and forced against the mould by a vacuum. This process can be used to form plastic into permanent objects. Normally draft angles are present in the design of the mould (a recommended minimum of 3°) to ease removal of the formed plastic part from the mould.

Operations:-

Loader —

The loader takes the sheets from the active hopper, transports these to pinning and centres them. After blowing off the sheet, the chain rail folding mechanism closes. The loader moves to the hopper to take the next sheet.

Pre heating —

After inserting the sheet, it is moved under the preheating, preheated for the heating time to reduce the heating time under the main heating, ensuring more even heating (without burning the surface). After heating, the sheet is transported to the main heating where, immediately after the feed step, the surface temperature is measured via a contact-free thermometer and reported to the control. The temperature in "C is displayed on-screen.

Final heating —

The sheet is heated in the heating station, by means of the upper and lower heating until it reaches the required forming temperature. A non-contact thermometer detect the sheet surface temperatures and reports them to the control. The temperatures in "C are displayed

on-screen. When the adjustable preset target temperature is reached or the adjustable heating time has expired, the sheet is conveyed into the forming station.

Forming station —

The lower clamping frame moves up and the pressure bell with the attached upper clamping frame moves to the lower position. This clamps the sheet and seals the pressure bell for pre-suction. Additionally, the lower table and upper table are pneumatically locked at 4 points..

For improved material distribution, it is pre-sucked (stretched) by the pressure bell. Evacuating the pressure bell stretches the heated sheet up into a bubble until the set effective time expires or the laser sensor stops the process.

The upper table with the forming tool moves up to Operation at top and seals against the lower clamping frame. Then the forming vacuum is activated. Additionally, the pressure bell is briefly aerated and then compressed air is blown in. The heated plate is applied to the forming tool by compressed air and the vacuum.

Better quality material distribution is possible for difficult to form products by using a plug assist.

To avoid leaving impressions, the plug assists must not touch the tool when extended, as this would cause visible pressure points.

After expiry of a specified effective time, the plug assist moves back to the home position. After forming, the forming vacuum and forming air switch off. The product is released from the forming tool by blowing in compressed air.

The lower table, pressure bell and lower clamping frame move back.

If the sheet in the heating station has reached the set temperature or the heating time has expired, the next transport is triggered. The sheets are moved one step along.

Transfer station —

After forming, the product is moved away by one feed step. The chain rail flaps open and

the unloading unit lifts the formed part from the chain rail and transports it to the peripheral trimming station.

Peripheral trimming station —

In this station the formed part is cut to the correct peripheral measurements. After trimming, the transfer carriage moves back, the part is taken by the unloading station.

Unloading station —

The suction pick and place unit of the unloading station takes the trimmed part from the transfer station and transports it to the outfeed transfer conveyor belt.

DOOR FOAMING —

After the vacuum forming the door foaming for two different models take place in two different

ways :

For Axis Model :

- The PDP formed is firstly trimmed and punching is done.
- Then the gasket is fixed to it.
- Then the door sheet and the PDP are filled with foam with the help of a drum.
- Then the screws are fixed to the PDP to fix it to the door firmly.
- Ana bond is also used to fix the gasket.

For Edge Model :

- After trimming and punching, the scrivets are fixed to the PDP.
- Then the foam is filled in the door.
- Then the gasket is snug fit on the door

Introduction to Compressor :-

A **compressor** is a mechanical device that increases the **pressure** of a **gas** by reducing its **volume**. An **air compressor** is a specific type of gas compressor.



The compressor is located at the back of the refrigerator and in the bottom area. The compressor sucks the refrigerant from the evaporator and discharges it at high pressure and temperature. The compressor is driven by the electric motor and it is the major power consuming device of the refrigerator.

Parts of a compressor —

- | | |
|--|--------------------------|
| → base | → cone rod |
| → Pin lock | → Shaft |
| → Bearings and washers (for smoothness of shaft) | |
| → stator / rotor | → muffler (gas receiver) |
| → valve plate , suction read , discharge | → cylinder head |
| → gas cate | → oil pin |

Compressor has three ports:

Suction Port

Discharge Port

RFA (refrigerator final assembly)

The whole Refrigerator is assembled on a moving conveyor belt while workers work standing on the sides of it.. The different models are built on different assembly lines which are according to the order received by the company.

It takes place in two parts. —

→Front assembly

→ Back Assembly

FRONT ASSEMBLY —

1. Removing tapes →Here the tapes on the cabinet of the refrigerator are removed by the workers. These tapes are fixed before the cabinet foaming process.
2. Removing foam → Here the foam on all the comers which is coming out of the liner and side panel intersection is removed.
3. Legs Fitment → Legs are fixed to the front of the refrigerator with the help of pneumatic guns.
4. Thermocol Fitment →Thermocol is placed on the base of the refrigerator. it is a good shock-absorber, absorbs the jerk from the external environment and prevents it from breaking.In addition to that, it is lightweight and durable.
5. Front Piece Fitment → Here the Front piece is placed on the refrigerator. The wires for the thermostat and bulb switch which are in the plastic covers are pulled out. Thermostat and bulb switch are fitted and connected to the wires.
6. Evaporator Insertion → The Evaporator is inserted in its place in the cabinet of the refrigerator with its wire going out of the holes in the back sheet.
7. Evaporator Frame Fitment and Roller Fitment →Evaporator frame is inserted to hold the evaporator in its place firmly. It is inserted with the help of a pneumatic gun. Here the rollers required for the free movement of the chiller tray are also fixed.

8. **Bulb Fitment:** → Then the bulb is fitted in its place with its connector. Its space is formed in the liner during cabinet forming. The wires required for it are also given during cabinet forming. An Aluminum sticker is used and stacked to the wall at the back of the bulb. It helps to reflect the light coming out of the bulb which increases light's intensity. The bulbs used are 10 W and 15 W.

9. Bulb Channel Fitment → The bulb channel is fitted below the evaporator and it is connected to the thermostat. The thermostat works as the device to cut the current supply when the temperature in the refrigerator reaches below a certain limit. Bulb channel is used to sense the temperature in the refrigerator. The thermostat cuts the current supply to a relay which switches off the compressor.

10. Cabinet Accessories Insertion → Here the cabinet accessories are fitted to the refrigerator. The following accessories are fitted:

- Glass Slider
- Chiller Tray
- Liner Shelves Ice Tray

11. Crisper Assembly → Crisper assembly is done here. The crisper is used to keep the vegetables in the refrigerator. Firstly the crisper is placed and then the glass is placed on it. There are two types of crispers used for different models.

- Gpps crisper
- Pp crisper

12. Door Fitment →Door is fitted here. The doors are formed in the door foaming department then they are brought to the door fitment area with the help of the trolleys.

13. Table Top Fitment → Table Top is placed on the already placed thermocol and fitted with the help of the pneumatic gun.

14. Door Accessories Insertion → Here the door accessories are inserted in the door. The space for insertion of door accessories is already given in the PDP. PDP shelves provide the space for placing different things. Egg Racks and keys are also placed here during assembly.

15. Handle Fitment → Door handle is then fitted to the door with the help of a pneumatic gun.

16. Logo Fitment → Then the stickers are placed on the front of the door. There are 3 stickers that are placed on the door:

BACK ASSEMBLY:

1. Base Fitment → Here the base plate is fitted to the bottom of the refrigerator.

2. Compressor Fitment → Here the Compressor fitment takes place. The compressor is fitted to the base plate. Grommet is placed between the compressor and the Base plate so that vibrations are not transferred from the compressor to the refrigerator. Here the relay pin is also fixed. It is used to hold the relay which controls the working of the refrigerator. Compressor works as a pump to control the circulation of the refrigerant and it adds pressure to the refrigerant, heating it up.

3. Capacitor Fitment → Then the Capacitor is fitted at the side. It is used to start the compressor.

4. Condenser Fitment → Then the condenser is fitted at the back of the refrigerator. It is fitted with the help of condenser clamps. Four condenser clamps are used to hold the condenser in its place. Condenser is used for heat transfer. It gives out the heat to the surroundings and cools the refrigerant.

5. Flushing and Drier Fitment → Flushing of the condenser is done once before fitting the drier to it. Then the drier is fitted to the condenser. It also has capillary attached to it.

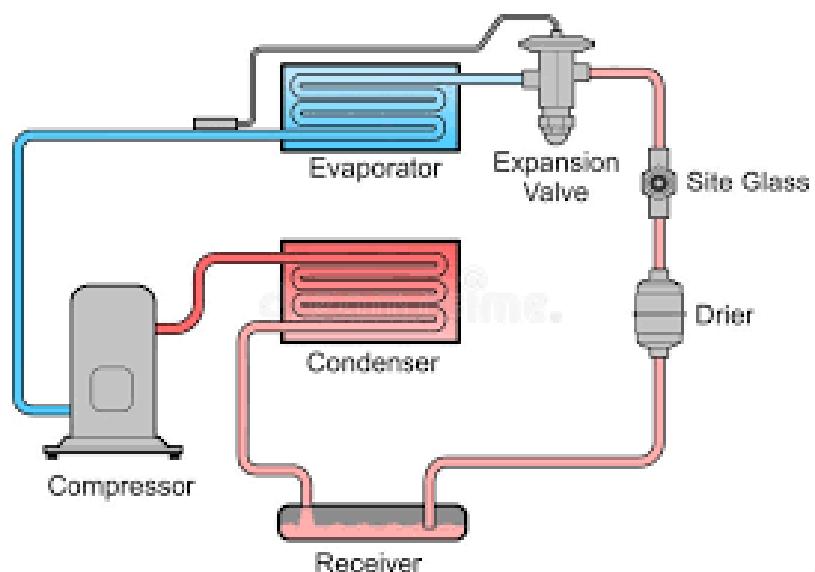
6. Lokring Fitment → The lokrings are fitted to the suction port of the compressor, discharge port of the compressor and drier

7. Supply Chord Fitment → Here the supply chord is fitted to the back of the refrigerator and its wires are fitted to the compressor. It is used to provide electricity to the refrigerator.

8. Coupler Fitment → The couplers are fitted to the charging port and driver. They are fitted as they are used in Leak Detection -1 and Evacuation and Charging Loop for evacuation and charging of refrigerant.

Refrigeration cycle :-

A refrigeration cycle's mission is heat absorption and heat rejection. The refrigeration cycle, sometimes called a heat pump cycle, is a means of routing heat away from the area you want to cool. This is accomplished by manipulating the pressure of the working refrigerant (air, water, synthetic refrigerants, etc.) through a cycle of compression and expansion



The compressor

Compression is the first step in the refrigeration cycle, and a compressor is the piece of equipment that increases the pressure of the working gas. Refrigerant enters the compressor as low-pressure, low-temperature gas, and leaves the compressor as a high-pressure, high-temperature gas.

The condenser

The Condenser, or condenser coil, is one of two types of heat exchangers used in a basic refrigeration loop. This component is supplied with high-temperature high-pressure, vaporised refrigerant coming off the compressor. The condenser removes heat from the hot refrigerant vapour gas vapour until it condenses into a saturated liquid state, a.k.a. condensation. After condensing, the refrigerant is a high-pressure, low-temperature liquid, at which point it's routed to the loop's expansion device.

The expansion device

These components come in a few different designs. the job of a system's expansion device is the same - create a drop in pressure after the refrigerant leaves the condenser. This pressure drop will cause some of that refrigerant to quickly boil, creating a two-phase mixture.

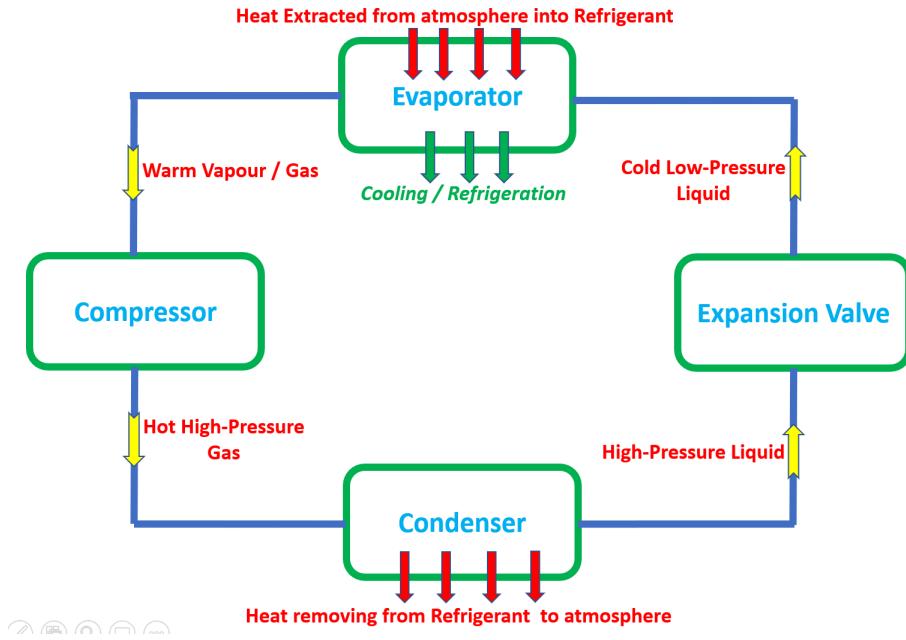
This rapid phase change is called flashing, and it helps tee up the next piece of equipment in the circuit, the evaporator, to perform its intended function.

The evaporator

The evaporator is the second heat exchanger in a standard refrigeration circuit, and like the condenser, it's named for its basic function. It serves as the "business end" of a refrigeration cycle, given that it does what we expect air conditioning to do – absorb heat.

This happens when refrigerant enters the evaporator as a low temperature liquid at low pressure, and a fan forces air across the evaporator's fins, cooling the air by absorbing the heat from the space in question into the refrigerant.

After doing so, the refrigerant is sent back to the compressor, where the process restarts



(project) scissor lift and turn table —

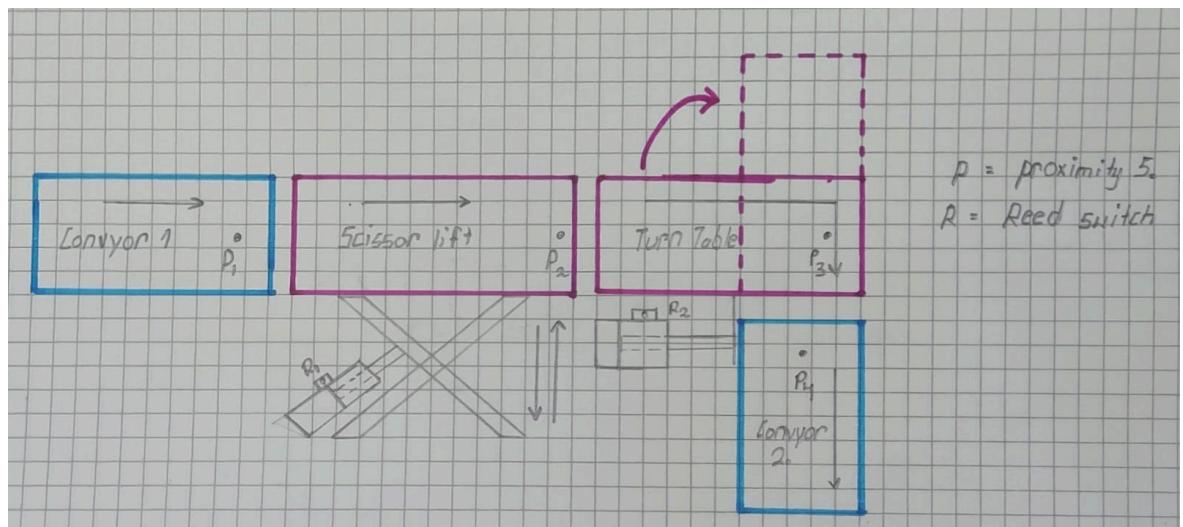
Scissor lift :-

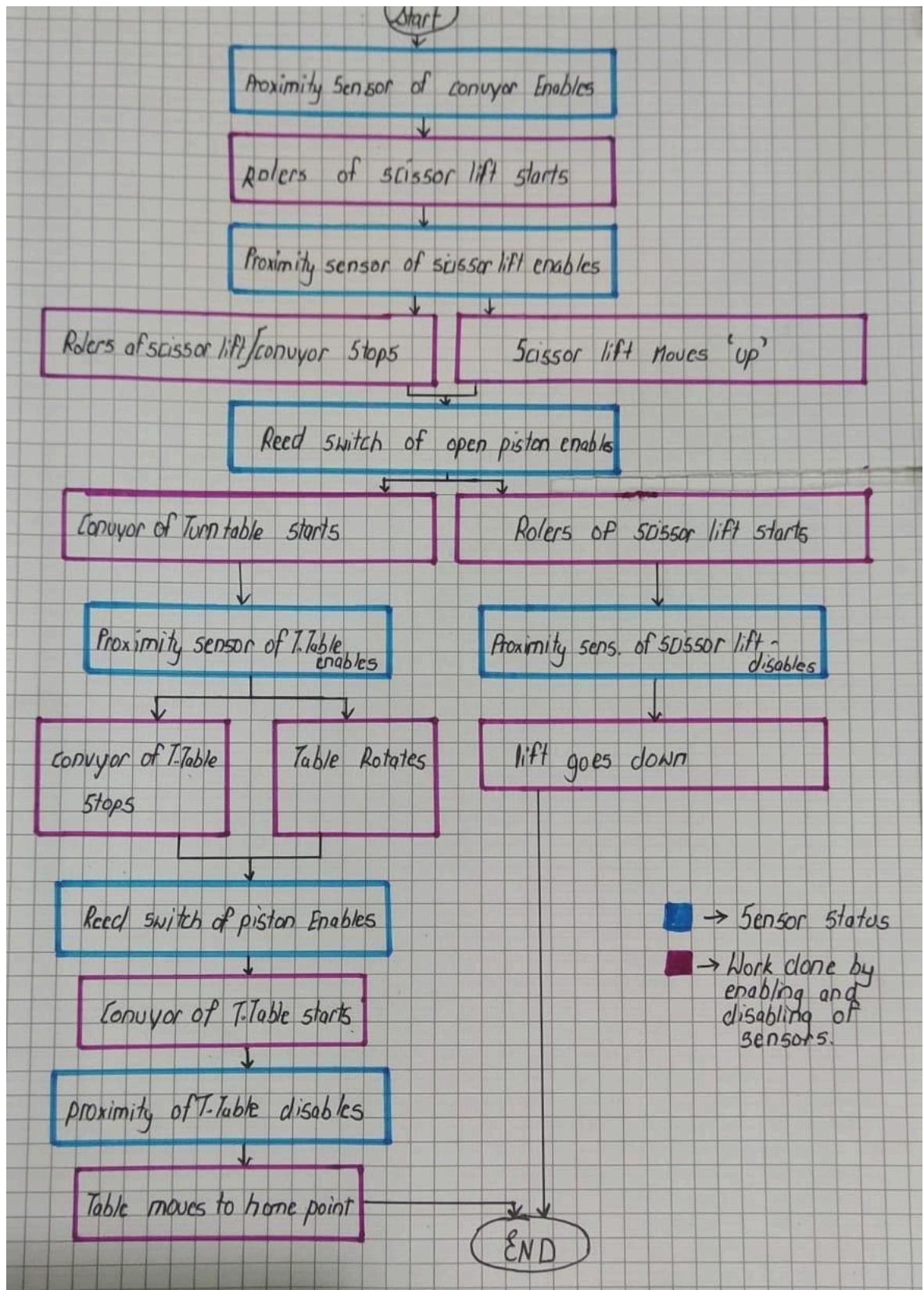
pneumatic scissor lifts are air powered with no electrical or hydraulics resulting in an incredibly clean and maintenance free lift. They use air pressure to raise and lower the lift, this makes them ideal for operations that want to be environmentally friendly and reduce their carbon footprint.



Turtable — A workstation that joins two or more conveyors at different angles.

Positions of scissor lift and turn table with conveyors :-





(Project work) Information of Clinching machine :-

In metalworking, clinching or press-joining is a bulk sheet metal forming process aimed at joining thin metal sheets without additional components, using special tools to form an interlock between two or more sheets. The process is generally performed at room temperature, but in some special cases the sheets can be preheated to improve the material ductility and thereby avoid the formation of cracks during the process.

ADVANTAGES OF CLINCHING —

- Reduced joining time (the joining time is in seconds)
- Reduced cost and weight: the process does not involve additional elements such as screws, rivets or adhesives
- No pre-holes are required
- Can be adopted to join different materials including metals, polymers, wood etc.
- Eco-friendly: doesn't require pretreatments with solvents, acids, and other harmful liquids
- Cleanliness: the process does not produce flashes or fumes
- Repeatability
- Flexibility: the same tools can be employed for a wide series of materials
- Reduced joining forces

Clinching vs Riveting —

Rivet Joint:

- Fasteners are pressed into a pre-pierced/embossed component and form to the panel
- Alloy Range: Aluminum through 1500 MPa
- Watertight joints

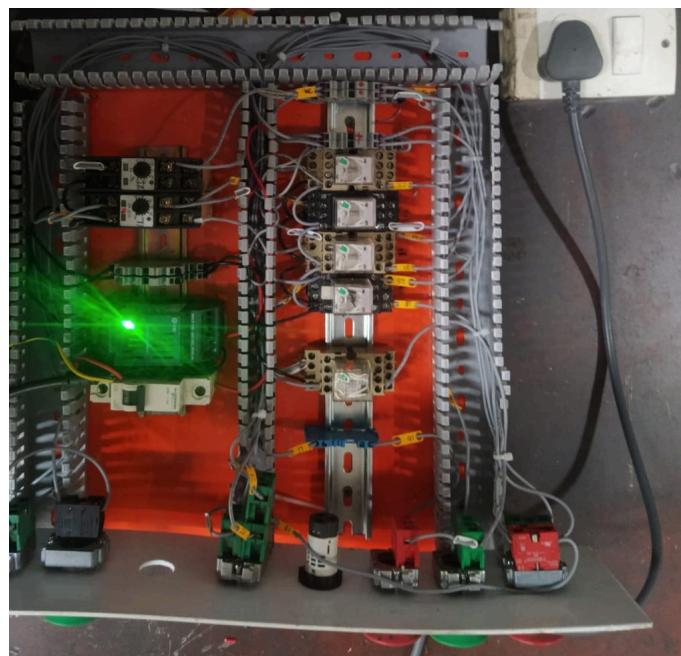
- In-die applications

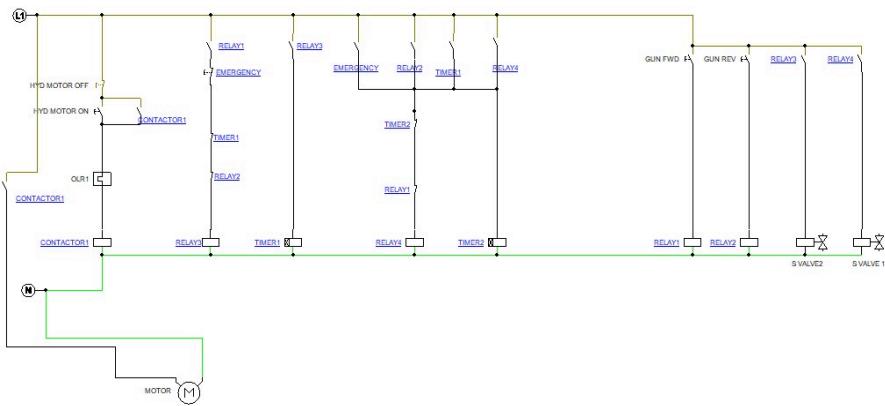
Clinch Joint:

- During the installation process, component material is pressed into the fastener
- Self-piercing or used with a pre-pierced component
- Alloy Range: Aluminum through 600 MPa
- Suitable for a wide range of sheet metal thicknesses
- BIW applications.

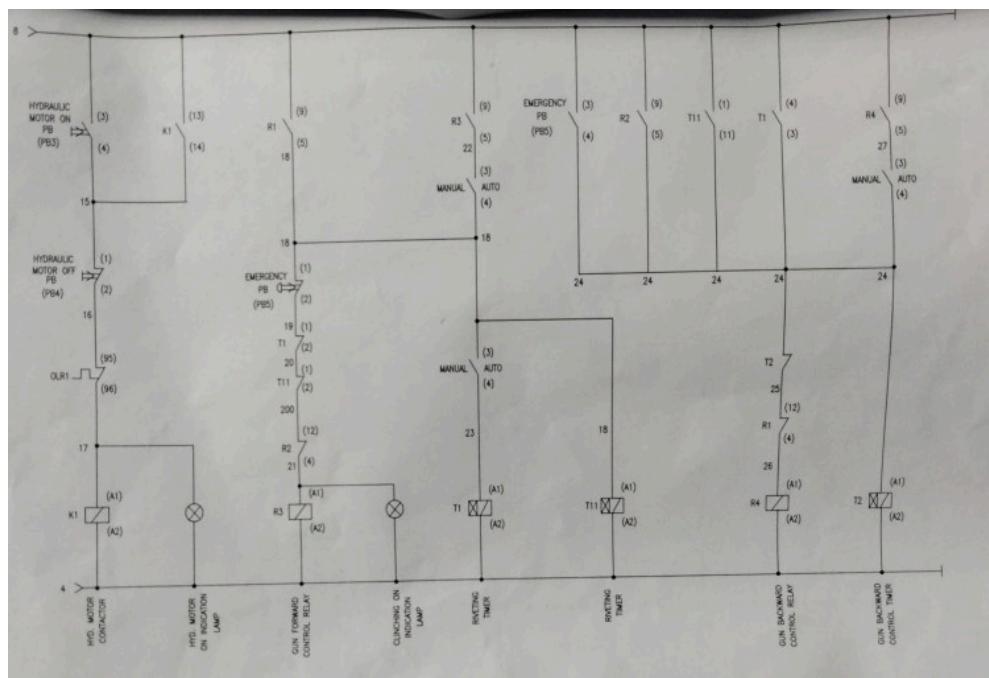
RELAY LOGIC FOR CLINCHING MACHINE

Hardwiring connections of panel —

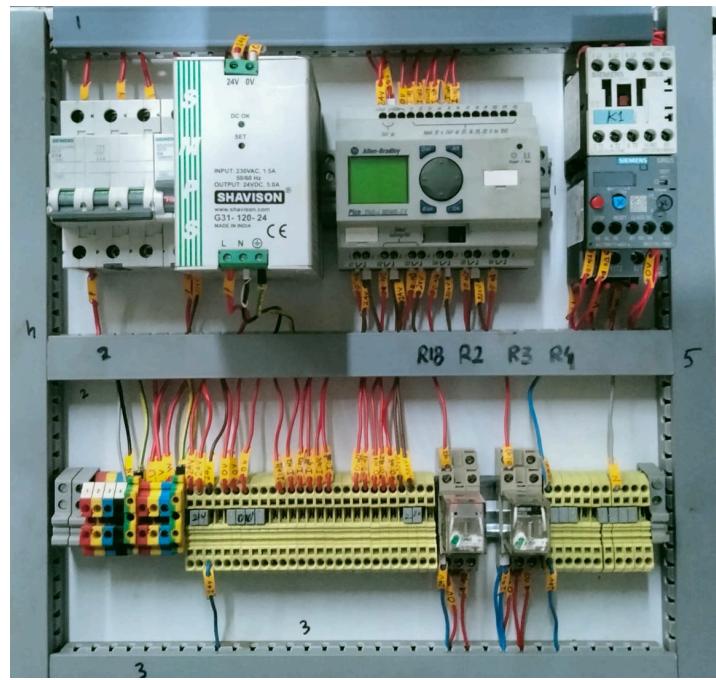




Control connections of panel —



Plc panel for clinching machine —



Why plc is required over hard wiring logic in case of clinching machine—

- Two Hand Safety System
- Photocard Installation for safety
- for reducing the wires complexity
- in relay logic the number of components increases

(Project) KNOWLEDGE OF ELECTRICAL DEVICES —

Parameters of Electrical mortar used for practical:-

- insulation class = F → RPM= 1360
- ingress protection = 5S → Current rating = 0.55 amp
- duty cycle = S1 → Efficiency = 64.7
- weight = 6Kg → Temperature = 50c

→ connection type = Star

→ Power factor = 0.73

→ voltage = 440v

→ Frequency = 50 hz

→KW / HP = 0.18 / 0.25

Test performed in motors before using them —

1. The Hipot Test for Dielectric Strength:

Performed as a detection of weakness and potential for failure within cable or wire insulation, high potential (hipot) testing, also known as dielectric strength testing, should be performed after conducting initial visual inspection and insulation resistance tests.

2. The Surge Test: Isolating Shorts and Detecting Burnout

A critical part of comprehensive, routine motor maintenance, surge testing can reliably detect motor burnout and offers assistance in predicting future motor failure.

3. The Megger Test: Evaluating Critical Insulation Performance

The megohmmeter (or “Megger” by its trade name) insulation resistance tester allows for reliable, periodic testing of the overall insulation performance of tools, appliances, motors, on-the-reel cable, capacitors, power distributions subsystems, and essentially any kind of electrical equipment or high-performance wiring.

4. The Core Loss Test: Ensuring Quality and Reliability

While every motor experiences some inherent energy loss, increased or abnormal power loss can be indicative of a bigger problem — physical damages, overheating, or ineffective winding or rewinding. In fact, core loss can account for some of the greatest energy waste in electric motors and even in entire manufacturing systems.

5. The Voltage Drop Test: Analysing Resistance in High-Amperage Circuits

Of the many motor tests available, a voltage drop test is among the quickest, easiest, and potentially most valuable, allowing for easy evaluation of the quality and efficiency of your circuit’s operation. A voltage drop test can be readily performed with a basic load and a

digital voltmeter (DVM). Once the load is applied, the DVM can measure the live connection for a voltage drop in the circuit under load.

VFD (variable frequency drive) :-

A variable frequency drive (VFD) is a type of motor controller that drives an electric motor by varying the frequency and voltage of its power supply.

Powerflex 40 is used by us for our training.

PARAMETERS OF VFD POWERFLEX 40 —

AC Drive	2.2 kW (3 HP)
240V AC Input	3 PH
50-60 Hz	12 A Output
IP20	UL-NEMA Type Open
Panel Mounting	Omit Brake IGBT, Frame B
0.98PF	
Integral Keypad With Potentiometer	Led Display
Fixed Terminal Block Connections.	

Vfd cold test

The **Input Diode and Output Transistor Check** (static test) is used to check the **input diodes** (rectifier or converter) and **output transistors** (inverter) of a variable frequency drive (VFD) with respect to the **DC bus**.

Step	(+) Positive Multimeter Lead	(-) Negative Multimeter Lead	Multimeter Reading (Diode Test Mode)

1	(-) Terminal	INPUT TERMINALS U/T1 Terminal V/T2 Terminal W/T3 Terminal	0.531 vdc 0.426 vdc 0.426 vdc 0.427 vdc
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Step	(+) Positive Multimeter Lead	(-) Negative Multimeter Lead	Multimeter Reading (Diode Test mode)
2	INPUT TERMINALS OUTPUT TERMINALS	(-) Terminal	OL

Step	(+) Positive Multimeter Lead	(-) Negative Multimeter Lead	Multimeter Reading (Diode Test Mode)
3	INPUT TERMINALS U/T1 Terminal V/T2 Terminal W/T3 Terminal	(+) Terminal	0.470 vdc 0.426 vdc 0.426 vdc 0.427 vdc

Step	(+) Positive Multimeter Lead	(-) Negative Multimeter Lead	Multimeter Reading (Diode Test mode)
4	(+) Terminal	INPUT TERMINALS OUTPUT TERMINALS	OL

FACTORY RESET OF VFD POWERFLEX40 —

STEP 1- Make the power wiring of vfd

STEP 2- Select the parameter option and search for program parameters(P parameters)

STEP 3- Select parameter P041

STEP 4- In parameter p041 select option 1 for factory resetting the vfd.

(NOTE- After selecting 1 vfd automatically turns to 0 which means it is ready)

CHAPTER 6: CONCLUSION

My six weeks training with **Godrej and Boyce Mfg. Co. Ltd.** has been one of the most interesting, productive, and instructive experiences in my life. Through this training, I have gained new insight and more comprehensive understanding about the real industrial working conditions and practice, it also improved my soft and functional skills. All these valuable experiences and knowledge that I have gained were not only acquired through direct involvement in a task but also through other aspects of training such as: work observation, interaction with colleagues, supervisors and other people related to the field. I am sure that the Industrial Training Program has achieved its primary objectives. As a result of this training, I am more confident to build my future carrier