

**SIX WEEK INDUSTRIAL TRAINING
AT
HINDUSTAN MACHINE TOOL LIMITED (HMT)
PINJORE**



**TRAINING REPORT
SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF DEGREE OF
BACHELOR OF TECHNOLOGY
IN
MECHATRONICS ENGINEERING**

SUBMITTED BY:
XYZ
ROLL NO. *****
5THSEM

SUBMITTED TO
ABCD
(H.O.D.)



**M M ENGINEERING COLLEGE
MAHARISHI MARKANDESHWAR UNIVERSITY MULLANA
AMBALA (Haryana)
2013-14**

INTRODUCTION



The Third Machine Tool Factory of HMT limited located at Pinjore near Chandigarh went into production on 1st October 1963. It was the first HMT factory to be located away from HMT complex at Bangalore, where two machine tools factories and a watch factory had earlier been established.

These factories was designed, build and commissioned by Indian talent without any foreign assistance in a record period of 17 months of breaking the ground on May 2, 1962 at a capital investment of Rs. 750 lakhs (inclusive of the township) and was formally inaugurated by Pt. Jawaharlal Nehru, the Prime Minister of India.

Over the years HMT successfully diversified into other engineering areas to manufacture prosses and press breaks. Die casting and plastic injection molding machine watches, printing machines, lamps and lamp making machinery, Dairy machinery, tractors bearings



HMT MACHINE TOOLS, PINJORE

Pattern Shop

Production Planning & Control

Foundry

Material Testing

Heat Treatment

Design & Development

Small Parts

Heavy Parts

GPM Assembly

CNC Assembly

Pattern Making Shop

Materials Used: Wood, Aluminium and Thermocol.

Wood: Used for pattern making was either of Teak or Deodar or both of them. When both of them are used, then Teak is generally on the inner sides because Teak is harder and retains its shape for longer times as compared to Deodar that secretes a resin that on solidification can affect the shape of the pattern which when used gives defective casting.

Comparison of Teak and Deodar:

Teak is easier to work with for milling operations.

Teak is harder in comparison with Deodar.

Teak has longer life so it's used in making of patterns of those tools which are to be manufactured in large numbers, time and again.



Thermocol: Its main advantage is that it's cheap and is lighter in weight as compared to wood or aluminium.

Aluminium: It is lighter as compared with wood and also it's rigidness and smooth finishing gives better casting. Also it retains its shape for longer times with almost no effect of water on it as compared to wood, which is very sensitive.

MACHINERY:-

Machines used in pattern shop are:-

- i. Blade sharpening machine.
- ii. Band saw machine.
- iii. Wood planer.
- iv. Circular saw.
- v. Wood milling machine.

Foundry Shop

In foundry castings are made according to design provided to them by the designing department.

Foundry is divided into following sections:-

- i. Sand plant systems.
- ii. Core making and baking.
- iii. Moulding section.
- iv. Melting section.
- v. Testing lab.
- vi. Core setting and metal pouring section.
- vii. Fettling and primary section.

The main objectives are of reusing the used products led to the installation of sand plant system. The vital task of sand preparation is performed in this system only.

Terms used in Foundry:

- i. **Moulds:** It is the negative shape of pattern and after pouring is called positive shape casing.
- ii. **Cope:** The upper part of mould and flaks is called cope.
- iii. **Drag:** The bottom part of a flask or mould is called drag.
- iv. **Core:** A body of sand used to form holes or opening through castings.
- v. **Core Sand:** It is more permeable than moulding sand and is able to resist more heat.
- vi. **Core Oven:** An oven in which cores or moulds are baked.

Material Testing

Metals are tested in two labs:

Mechanical Lab

Chemical

Operation in Mechanical Lab:

Universal Testing m/c-

Its components are oil pump, hydraulic press, main piston, fixed crosshead & movable cross head.

It has range according to the load applied.

0-1 tons

0-4 tons

0-10 tons

It is used generally to determine:

Proportional & elastic limit

Yield point

Ultimate tensile strength

Percentage reduction & reduction in area

Brinell Hardness Test:

Hardness measured by this m/c in HBN. In this steel diamond are used to take impression, load applied on the specimen to take impression is given by the formula $30D^2$.

Where, D=Dia of diamond ball (2.5 mm max.)

Impressions formed on the specimen are of round shape.

Rockwell Hardness Test:

Hardness measured by this m/c in HRC. Maximum load applied in this machine is 150 kg. Impressions are of pyramid shape. It is performed when quick and direct reading is desirable in this test the load for making indent are smaller and thus make smaller shallower indent. The specimen is placed on the anvil, and is raised till it comes in contact with the intender. A minor load of 100 kN applied on the specimen and the small pointer indicates set> Now the main pointer is also made to the set position. The load is then applied.

Metal Testing in Chemical Lab:

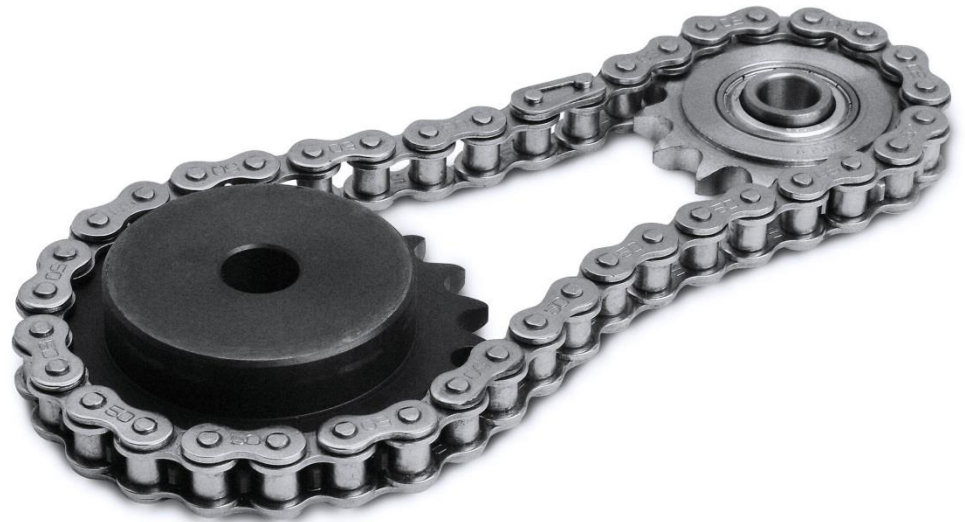
In chemical lab Study takes place on:-

- i. Chemical composition
- ii. Microstructure
- iii. Term observed in chemical composition:-
- iv. Weight per liter
- v. Viscosity
- vi. Solid content

Small Parts

Small parts manufacture those components and accessories that weigh anything below 40 Kg. The small part division is further divided into the following shops:-

- i. Turrets
- ii. Gears
- iii. Accessories
- iv. Round
- v. Non-round
- vi. Spindle
- vii. Sheet metal



The functions of each of the departments have been briefly illustrated in the following pages.

Components manufactured:

Blocks, rectangular strips, Gibs, pump body, stop block, adjustable plate, shift fork, bearing blocks, arm brace, clump levers etc.

Operations performed:

- i. Marketing
- ii. Vertical milling
- iii. Drilling
- iv. Fitting
- v. Grinding

Machines used in this section are:

- 1. Horizontal milling machine
- 2. Vertical milling machine
- 3. Surface grinding machine

HEAT TREATMENT SECTION

In this section, various operations like annealing, normalizing, hardening, carburizing are performed at various temperatures to improve the physical and mechanical properties of the material. This section has the furnaces, hot baths, and various types of tanks containing different salts & chemical to perform the various operations.

Type of Equipments

- i. Natural Bath Tank
- ii. Quenching bath Tank
- iii. Carburising bath Tank
- iv. Preheated Furnaces
- v. Stress relieving furnace
- vi. NaOH bath Tank
- vii. Washing Tank
- viii. Rust Removing Tank
- ix. Low temp. Blocking
- x. Hot water Tank.

GENERAL ASSEMBLY PROCESS


1. Preparation of base plate setup.
2. Column fixation on base plate.
3. Knee mounted on column guide-ways by using Cables, scraping for adjusting knee surface at required angle with Column & Saddle on knee & table on saddle.
4. Bearing & main Spindle mounting.
5. Intermediate Gears & Gear Trains mounting.
6. Mounting of Vertical & Traverse/Longitudinal feed screws with feed nuts in feed nut bracket(s).
7. Mounting of over arm & over arm brackets.
8. Motor of designed BHP is mounted.
9. Coolant motor, coolant circuit & lubrication completed.
10. Accessories mounted.
11. General mountings.
12. Testing & quality assurance.
13. Painting.

HI-TECH ASSEMBLY

INTRODUCTION

It would be incorrect to state that present manufacturing belongs to numerically controlled machines rather computer numerically controlled would be more appropriate to say. With Larger and Larger proportion of manufacturing activity becoming in job or small batch production of a variety of components.

Often complex shapes require high precision, the need for flexible Automation has always been felt. And this is the era of machine tool automation. So, flexible automation is implemented in the machine tools in the form of NC and CNC technology. Today HKT is producing a lot of Conventional Machine Tools with specialized functions and mostly CNC products.



Annealing is the process for making material softer while producing uniform material properties. A material can be annealed by heating it to a specific temperature and then letting the material slowly cool to room temperature in an oven. This process is expensive because the oven is unusable during the cool down process.

Normalizing is also a process for making material softer but does not produce the uniform material properties of annealing. A material can be normalized by heating it to a specific temperature and then letting the material cool to room temperature outside of the oven. This process is less expensive than annealing.

Stress Relieving is also a process for making material softer. However, stress relieving does not change the material properties as does annealing and normalizing. A material can be stress relieved by heating it to a specific temperature that is lower than that of annealing or normalizing and letting it cool to room temperature inside or outside of the oven. This heat treatment is typically used on parts that have been severely stressed during fabrication.

LOCATION

In design of fixtures, the component is very important aspect as correct location influences the accuracies of the finished products particularly in reference to the relationship with other surface on the component.

Part locator for restricting the movement of the part & its proper positioning requires skill & planning.

BASIC RULES FOR LOCATING

1. **3-2-1 PRINCIPLES-** Location of the fixture is always done according to 3-2-1 principle which states that to locate a piece fully, it has to be placed and held against three points in a base plane two points in the vertical plane and one point in the plane with square of first two.
2. **LEAST POINT PRINCIPLE-** According to this principle no more points than necessary should be used to secure the location on any one plane.
3. **EXTREME POINT POSITION-** According to this principle the location point should be chosen as far as possible on any one surface, this ensure minimum misalignment for certain displacement of any point w.r.t. another.
4. **Locator should be placed to** avoid interference with chips or dust.

PLANNING

This section consists essentially of planners mounted on one side of the section. In this section the job planning is one of the basic operations done for machining to large process it is the primarily intended for machining to large flat surfaces. Their surface may be flat or vertical.

DOUBLE HOUSING PLANAR

This is the heavy type of planar it consists of two column one on each side of bed. The cross rail is fitted between the two housings having one or two total heads on the columns according to the specifications.

OPEN SIDE PLANAR

This type of planar consist of one housing situated vertically on one side of the bed and other side is left open without any obstruction. The cross rail is of cauli-lever type and is wholly supported on the single columns only three tool heads can be located as one column is missing rest of the technical features are same as of the double housing planar.

BORING SECTION

Boring section consist of enlarging an already drilled hole. The holes are pre drilled as in castings only the operations of boring can also be done on small scale on lathe whether it may be ----lathe or----type when the operation of boring machines are used according to requirements.

TYPES OF BORING MACHINES

ROTARY TYPE

NON ROTATING TYPE

VERTICAL TYPE

HORIZONTAL TYPE

There are about twenty machines (boring) in this section.

WOTAN is the horizontal type boring machines made in West Germany. It is very precise boring machines they are 5 in number.

HORIZONTAL BORING MACHINE

In the horizontal boring machine operations are performed in which relatively large pieces which cannot be rotated and require operations on its many surfaces. The worktable can be transverse along and across the machine bed. It is possible to machine a flat surface with the bored hole by mounting a facing head over the spindle.

VERTICAL BORING MACHINE

This type of machine is large in size and vertical. They are used to machine work pieces like steam turbines etc. the size of such a machine is given by the diameter of largest work pieces which can be mounted on it.



GRINDING

INTRODUCTION

It is a process of removing material in form of small chips by the abrasive action of revolving wheel on the surface of work piece the wheel used for performing the grinding action is called grinding wheel. It is basically a finishing process used for producing close dimensional and smooth surface finish.

GRINDING WHEEL

In machine tools generally wheel containing SIC as abrasive is used. But Aluminium Oxide can also be used.

GRINDING MACHINES

1. CNC GRINDING MACHINE (made by STIDER)

It is a universal grinding machine. It is used for cylindrical grinding and internal grinding. As the machine is CNC so it produces high accuracy. In this machine grinding up to accuracy of N6 tolerance level can be done. It has another advantage over other machines that it can perform internal grinding. In this machine separate motor for driving wheel and job are there. The jobs come to this machine after all machining process are done and job is hardened.

2. SURFACE GRINDING MACHINE

These machines are used to produce and finish flat surfaces. In addition to this the cylindrical type CNC grinder is used for obtaining finish up to microns by grinding the different types of jobs e.g.- spindles, arbors etc.

Aluminium Silicate grinding wheels are used for grinding HSS (High Speed Steel). Carbide tools are grinded by Diamond cutters.

3. CYLINDER GRINDING MACHINE

In these machines piece is held between the dead centre and rotated by a dog and diver on the face plate. There are movements in cylindrical centre type grinding.

Work must revolve.

Wheel must revolve.

Work must pass the wheel.

Wheel must pass the work.

4.THREAD GRINDING MACHINE

It is one of its unique kinds of machine. There are only three to four in IMDIA. In this machine threads in steel parts are formed by grinding unlike in any other machine where threads are produce by cutting. This machine produces threads of better quality with no pitch to pitch variation. In this machine even taps can be generated, both wheel and job moves and both have their driving motor.

5. MILLING

Milling is the process of removing metal by feeding the work against a rotating multipoint cutter. In milling operation the rate of metal is rapid as cutter rotates at a high speed and has many cutting edges

TOOLS USED

The milling cutter is a multipoint cutter revolving tools. The teeth of milling cutter may be parallel to the axis or at an angle known as helix angle. Helix may be right or left. Various types of cutter used in this machine are:-

- i. Plain milling cutter: These cutters have straight or helical teeth. They are used to machine flat surfaces.
- ii. Face milling cutter: It is also used for machining flat surfaces.
- iii. Plain cutting saw: It resembles plain milling cutter but has small width. It is used for cutting-off and slotting operations.
- iv. Side milling cutter: They have teeth on their periphery and also one of its sides it may have plain, helical or staggered teeth.
- v. Angle milling cutter: The cutters have their cutting teeth at an angle. Single angular cutter is used for cutting dovetail.
- vi. T-slot cutter
- vii. End mill cutter: They have teeth on end as well as periphery the peripheral teeth may be straight or helical these are used for light milling operations like cutting slots, machining accurate holes and for profile milling operations.

GPM ASSEMBLY

SCARPING

Introduction:

Scraping is very useful and significant process of removing metal in very small quantity, which is used in assemble process.

Why Is Scarping Done?

By scraping we get number of bearing points. So load is uniformly distributed.

Scraping provided oil pockets, which hold lubricating oil between the two surfaces in contact.

For alignment with greater accuracy

For having good appearance.

Tools Used

Scraper

Spirit level

Surface plate

Angle gauge

CNC ASSEMBLY

INTRODUCTION

This is one of the most important and lucrative shop for the plant where CNC is assembled. The products prepared at other shops, purchased and imported items from the various countries are combined here and the output is known as 'CNC'. As far discussed about design lab, the o/p of that lab is used here. The design of CNC machine according to application and as per demand is taken and the operation starts. The parts are prepared in Hi-tech Small Parts shops. Then they are combined to form Head, column, bed, ATC Assembly etc. electrical wiring is then made. Electric cabinet of machine is taken from the concern shop and then attached to the machine.

After attaching the operating system and computer hardware then the next job refers to Electronics lab. The concern deptt. Examines the exact circuitry and wiring of the machine. If the machine is working well then the last mode is to check the accuracy of the operation and the minimum time of various operations. After all of these activities it's time to decorate and surround it for its good looking and for safety purposes. Now the machine is ready for SALE.

MAIN PARTS OF CNC MACHINE

MECHANICAL ITEMS

- i. DUCTS
- ii. STABL FLEX
- iii. CRT (continuous rotary table, B-axis)
- iv. PALLET CHANGER
- v. SPINDLE
- vi. HEAD (spindle motor, Y limit switch)
- vii. COLUMN (including Y motor)
- viii. Bed
- ix. Ball screw road
- x. Guide way (THK-JAPAN)
- xi. MAGZINE



CNC LATHE



HYDRAULIC ITEMS USED IN CNC

- i. SINGLE SOLENOID SPRING OFFSET DIRECTIONAL CONTROL VALVE.
- ii. DOUBLE SOLENOID SPRING CENTERED DIRECTIONAL CONTROL VALVE.
- iii. PRESSURE OPERATED CHECK MODULE
- iv. NON PRESSURE COMPENSATED FLOW CONTROL VALVE
- v. NON COMPENSATED DUAL CONSTRUCTION FLOW CONTROL VALVE
- vi. PRESSURE AND TEMPERATURE COMPENSATED FLOW CONTROL VALVE
- vii. PRESSURE RELIEF VALVE
- viii. PRESSURE REDUCING VALVE
- ix. HYDRAULIC MOTOR
- x. ACCUMULATOR
- xi. PRESSURE SWITCH

ELECTRICAL ITEMS

- i. PRS (24 V DC)
- ii. I4 (24V DC)
- iii. SOLENOIDS (110 ac)
- iv. CONTROL TRANSFORMER (I/P 415 V)
- v. SERVO DRIVES AND MOTORS
- vi. CRT SCREEN
- vii. PARTS DISCUSSED IN ELECTRICAL LAB

MISCELLANEOUS

- i. OPERATING SYSTEM
- ii. MACHINE OPERATOR PANNEL
- iii. INDICATING LIGHT
- iv. EMERGENCY PUSH BUTTON
- v. NIZZLES
- vi. SUPPLY (230 V)
- vii. 24 V RECTIFIER CONDENSER
- viii. BRIDGE RECTIFIER (90 V FOR FANUC
24 V FOR SIEMANO
- ix. SURROUNDING CABINE



INTRODUCTION TO ELECTRICAL & ELECTRONICS ITEMS


- i. PROXIMITY SWITCH
- ii. LIMIT SWITCH
- iii. CIRCUIT BREAKER
- iv. OVERLOAD RELAYS
- v. CONTRACTORS
- vi. FUSE PRESSURE SWITCH
- vii. INTRODUCTION TO NC
- viii. FEED BACK DEVICE

CNC ASSEMBLY SECTION

Input Unit: It receive all the command from operator interface (operation station containing all the switches, push button displays etc. required to operate and monitor machine activates) and feedback and status of machine in the form of AC, DC and analog signals. All input signals are made compatible (by unit input) to be understood by control unit like conversion of signal to digital form by A/D converter etc. Software is input by means of paper tape or magnetic devices stored in memory till they are needed by control unit.

Control Unit: It takes instruction from the memory unit and interprets them one at a time. It process information received from the operator and machine interface via the input unit. This information is interpreted and manipulated with hardware logic and computer programs. It then sends appropriate instruction to other unit to cause instruction execution.

Memory Unit: It stores instruction and data received from the input. It also stores the result of arithmetic operations supplies information to the output unit through control unit.



Arithmetic Unit: It performs calculations and makes decision. Its results are stored in memory unit.

Output Unit: It receives data from memory at the command of control unit. The signals are made compatible with output devices so that command issued by output unit can be obeyed by them.

Operator Interface:

Various units which comprise operator interface are follows.

Punched tape is the most commonly used input system for NC system. The instruction for a given operation is contained in several rows of digits 0 to 9 which can be coded from words.

Machine Interface:

It consists of all devices used to monitor and control machine tool, like extreme limit switches, miscellaneous position location, solenoids for hydraulic and air control, control valves, servo mechanism etc.

CNC System: The CNC concept employs a mini computer specially a programmable logic controller for line control of the machine tool and eliminates additional hardware circuits in the control cabinet.



**THANK
YOU**