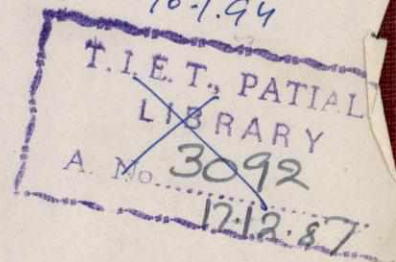
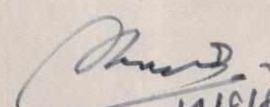


THAPAR INSTITUTE OF ENGINEERING & TECHNOLOGY
PATIALA
DEPARTMENT OF MECHANICAL & INDUSTRIAL ENGINEERING

WORK TERM-I REPORT

CHU
SWARAJ MAZDA LIMITED
VILLAGE ASRON
DISTRICT HOSHIARPUR



Had. 
19/1/87.
Placement & Coordination Deptt.
Thapar Institute of Engineering & Technology.
PATIALA-147001.

Prepared by :

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Roll No. 192/84
72, Bachittar Nagar, PATIALA

72, Bachittar Nagar,

Patiala-147001.

30th July 1987

MR. S. K. SATSANGI

Head: Placement & Co-ordination,

Thapar Institute of Engineering & Technology,

Patiala-147001.

Dear Sir,

This report entitled "Work Term Report" was prepared as my work report for the Industrial Engineering Department of Swaraj Mazda Limited. This is my First Work Term Report.

Swaraj Mazda Limited are the manufactures of Light Commercial Vehicles of horse power 87.

This "Work Term Report" contains the reports

on the following projects, which were undertaken

1. Layout and Material Handling in Spare Parts Division Stores.
 2. Standardization of Packing Cases.
 3. Fixation of Standards for 'A' Class Consumables Used in Paint Shop.
 4. Inspection Standards.
- and the orientation programme.

The first three projects were assigned by the Industrial Engineering Department. The Industrial Engineering Department is headed by Mr. T. A. Ramakrishnan and is primarily involved with the analysis and recommendations of productivity improvements, cost reduction, safety oriented projects and suggestion scheme.

The project titled "Inspection Standards" was assigned to me by the Quality Engineering Department which is headed by Mr. K. K. Malik and is primarily involved with quality assurance at various levels of manufacturing and vending.

This report has been prepared and written by me and has not received any previous academic credit at this or any other institution. I would like to thank Mr. T. A. Ramakrishnan, Mr. B. B. Malhotra, Mr. K. L. Malik, Mr. Naveen Singhal and Mr. K. S. Ahluwalia for their assistance and guidance in preparing this document.

Sincerely,

Sukhpreet Singh Giani

Sukhpreet Singh Giani

Roll No. 192/84

ACKNOWLEDGEMENTS

I find it a matter of honour to have this opportunity to offer feelings of sincere gratitude and indebtedness to Mr. T. A. Ramakrishnan, Manager, Industrial Engineering Department, Swaraj Mazda, under whose competent guidance I had the greatest opportunity of conducting the present investigations during my Work Term -I.

I am extremely grateful to Mr. B. B. Malhotra, Chief Manager Technology Department, Swaraj Mazda, for his ever encouraging words and deep concern for me.

I am highly obliged to Mr. B. P. S. Prathi, Chief Manager Personnel & Administration, Swaraj Mazda for his encouraging advice and hospitality, and Miss Shuchi Sharma, Personnel Officer, Swaraj Mazda, for her dedicated brilliance, untiring zeal and effort, which she contributed in shaping up my work. Words are inadequate to express my thanks to her for giving tremendous help throughout my stay at

Swaraj Mazda.

I am highly grateful to Mr. K. L. Malik Manager Quality Engineering, Swaraj Mazda, for his ever encouraging words and guidance throughout my work on Inspection Standards.

My special thanks are due to Mr. Naveen Singhal and Mr. Ravinder Singh Ahluwalia for their ever ready and willing advice, when ever it was sought.

I am deeply thankful to Mr. Naveen Singhal, Mr. Veerender Kaul, Mr. Sunil Sachdeva, the other members of the team of 4 which was very instrumental in getting the implementation of the Spare Parts Division Stores Layout carried out.

I am highly obliged to Mr. S. K. Satsangi, Head Placement and Co-ordination, Thapar Institute of Engineering & Technology, for his dedicated brilliance, unending efforts which he not only contributed towards my work but to all the concerned students. His unending enthusiasm and guidance was always there whenever

I needed it. Actually his enthusiasm and concern for us was so much that it always made us think to take the work term to best of our use.

I am highly obliged to Mrs. & Mr. Kehli for their affection and their deep concern for me. I am also thankful to my mother for her silent prayers.

I am highly thankful to my nephew and niece for providing me all the needed entertainment and relief after a tiring day, of from 8.20 a.m. to 6.30 p.m. Also I am thankful to Mr. Gurinder Singh and Charanjit Singh for their much needed help during my report writing and typing.

I am also thankful to all the members of the Technology Department for their help.

I hope my seniors and other concerned will appreciate my endeavour of bringing out this report in typed form myself and will overlook certain mistakes which a person is bound to commit if he attempts for the first time.

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ABSTRACT

After initial job orientation in Shop Floor Area for one month, I was assigned the following three projects by Industrial Engineering Department, Swaraj Mazda.

1. Layout and Material Handling in Spare Parts Division Stores.
2. Standardization of Packing Cases.
3. Fixation of Standards for 'A' Class Consumables Used in Paint Shop.

This was followed up by 15 days work on Inspection Standards in Quality Engineering Department and finally completing the Work Term assignment by orientation programme in following departments; Tool Room, Purchase, Material Control and Production Planning Control, and Servicing.

The first project, "Layout and Material Handling in Spare Parts Division Stores" has been implemented. With the new layout, the Spare Parts Division Store can now accommodate 30% more components than that were being stored.

per the previous layout. Also this has resulted in increased picking and hence faster execution of orders.

The second project namely "Standardization of Packing Cases" is under implementation. Previously the packing cases varied in sizes and shapes depending upon the amount of components that were being dispatched. However 5 packing cases have been standardized to cover more than 95% of the components, and 11 special packing cases have been designed to cover such items which cannot be dispatched with other components because of their fragile nature or which can destroy the other components during transit.

For the third project "Fixation of Standards for 'A' Class Consumables Used in the Paint Shop. The 'A' class consumables used in the paint shop include the following, H. G. Top Coat Paints, Stoving Metallic Silver for Wheels, Thermosetting Primer Surface Grey, Stoving Thinner for Primer and Top Coat, and Water Soluble Black.

Swaraj Mazda aims at achieving the indigenisation target of 91.7% by the end of phase III for which the vendors are being developed. The Inspection Standards prepared for some 28 components which include sheet metal components, forgings, and gears, will be used for the inspection of the samples and the lots. These standards give a list of consolidated checks to be carried out on a component to decide the acceptance and rejection of the same without referring to the connected ISI, JIS, and also the manufacturing drawings, which otherwise indicate a lot of additional information for carrying out the production.

7

ABOUT THE ORGANISATION:

Swaraj Mazda-- Corporate Profile :-

Swaraj Mazda Limited was incorporated on the 26th July 1983, promoted by Punjab Tractors Limited for the manufacture of Light Commercial Vehicles in India. The technical and financial agreements were signed with Mazda Motor Corporation of Japan on the 5th October, 1984. The company decided on bringing the latest Mazda products in this line under the name of SWARAJ MAZDA T-3500. Construction at the Rs.50.0 crores plant of Swaraj Mazda Ltd. at Village Asron in the backward Distt. of Hoshiarpur (45 Km. away from Chandigarh) commenced on 16th January, 1985.

The First Vehicle rolled off the production line in a record time of one year of laying the foundation stone. The plant has an installed capacity of 10,000 vehicles per annum, to be achieved in five years. The first 100 Swaraj Mazda T-3500 vehicles were flagged off from Asron Works for delivery to customers on 14th August, 1985.

The Swaraj Mazda collaboration essentially stands and capitalises on two outstanding track records, each a celebrity in its geographical sphere, each expressing

a profound developmental concern for customers, stockholders, business partners and staff.

After the first indigenous tractor manufactured in India by Punjab Tractors was successfully launched in 1974 PTL has been on its way to becoming a blue chip company. Starting with a capacity for 5000 tractors and one model, PTL today has an annual capacity of 12000 tractors making 3 models. Besides tractors, the company also manufactures Swaraj Combine Harvesters, Agricultural Implements, Automotive Castings and Forklifts. A collaboration agreement with Komatsu of Japan for the manufacture of high powered diesel and battery operated fork lifts was also signed recently. PTL has three divisions with 3000 employees. 1980s saw PTL emerge as the largest exporter of tractors in India. Over the years, PTL has won national and international recognition for outstanding performance and contribution in many diverse fields.

Swaraj Mazda found a competent business partner in the internationally reputed Mazda Motor Corporation of Japan. Founded in 1920 as Toyoko Kogyo Company Ltd. Mazda started

manufacturing trucks in 1931. Today they are the only automotive company in the world producing reciprocating Petrol and Diesel Engines, as well as the revolutionary Rotary Engines. Mazda is ever seeking new areas of product excellence and innovation. It unflinchingly adheres to a 2000 check point inspection before any vehicle is declared road worthy. The use of robots and sophisticated production facilities enables Mazda to produce vehicles of outstanding quality. No wonder Mazda has won world recognition for quality products with cars like 'MAZDA 626' and 'MAZDA 323' winning the most prestigious awards through the years.

Swaraj Mazda Ltd. has an equity base of 10.5 creres where PTL has subscribed to 29 percent of the equity capital, Mazda Motor Corporation jointly with Sumitomo Corporation of Japan 26 percent. The Swaraj Mazda Public Issue of Rs.4.72 crore was over subscribed 25 times and Non Resident Indian Issue 7 times.

Swaraj Mazda Plant at Aeron spreads over a picturesque 100 acres site ringed by Shivalik Hills on the three sides. A few years ago, the site where 40,000 Sq.Mtr. production block now stands was a barren hill which was levelled to form 40 Acre terrace for construction. Location in the rural

backward area of Hoshiarpur opens new employment opportunities for the local people and will over the years boost the socio-economic fabric of the neighbourhood.

Light Commercial Vehicles are being produced at the sophisticated Swaraj Mazda Plant with the following as the main products: 3.5 tonnes 14ft. Cargo Deck commercial vehicles; 3 tonnes 10 ft. Cargo Deck commercial vehicles; 26 seater Ordinary and Delux buses; and Windshield Chassis both 10 and 14 ft.

Beneath the design and sleek looks of Swaraj Mazda is the sturdy box section tubular cross-braced chassis. The chassis is more than 3 times stronger than other vehicles on Indian roads. Swaraj Mazda vehicles are not only extra strong and durable but are also fuel efficient. Fully loaded, they give an average of 13.3 Km/Ltr at 40 Km/hr. Low RPM high torque engines ensures long engine life and high lugging capacity for uphill driving. A hydraulic assisted diaphragm clutch reduces clutch pressure by 37 percent. A roomy 3 seater cab with 3 level airvents makes the cab extremely comfortable and driving a pleasure. A short turning radius gives Swaraj

Mazda an excellent manoeuvrability on congested and hill roads. The power assisted brakes are also highly efficient. Swaraj Mazda vehicles were introduced commercially after extensive testing under severe Indian operating conditions for the last one year. The reports received from the customers are highly encouraging.

Swaraj Mazda has already organised a wide spread dealer network. Zonal offices have also been opened in Bombay, Lucknow, Chandigarh, Madras and Calcutta.

Both Swaraj and Mazda are totally committed to quality and performance. Their motto is "PRODUCTS WHICH ARE BETTER THAN THEY HAVE TO BE".

Work Culture of Swaraj Mazda:

Efforts are -- that all employees are treated equally and to uphold the dignity of the individual, the following practices are being carried out in this order

Common uniform.

Same food in the same canteen.

Common offices-- same space for all, no separate cabins for managers.

Common toilets.

Management practices what they preach. The same rules apply to all. Thus even the top management members have to punch time cards on arrival and exit everyday, observe the same lunch hours etc.

Making the employees feel that the company cares for them.

Opportunities for fast growth for capable persons.

Simplification of procedures for availing of medical reimbursement, personal loans etc.

Role of departmental manager as a monitor and guide.

Labour-Management Relations, problem solving approach rather than confrontational attitude.

Emphasis on punctuality and attendance, employees reach the factory before shift starting time and the work on the shop floor begins and ends exactly on time.

No peons are provided.

The stenographers are not supposed to be ordered around.

Mazda Motor Corporation:-

The Mazda Motor Corporation Of Hiroshima, Japan is the third largest automobile manufactures in Japan and the seventh in the world. The company produced the 'Wankel Rotary Engine' in 1967, and is today the only mass producer of three different types of engines- petrol, diesel and rotary. It sells its products in 110 countries and produces an average of 1.2 million vehicles annually. A Mazda Vehicle rolls off the assembly lines every 15 secs. Mazda's R and D; and Quality is of international standards, as it can be gauged by its numerous competitive awards.

Main Products:-

Passenger Cars

RX-7, 929 (Sedan, Hard top and Station Wagon), 626 (Sedan, Hatchback and Station Wagon), 323 (Saloon, Hatchback and Station Wagon)

Vans

T-2000/ T-2600, T-3500, E-1400, E-1800, E-2000, E-2200

Pick Ups

B-1600, B-2000, B-2200, E-1800, E-2000, E-2200,

Trucks	T-2000, T-2600, T-3000, T-3500, T-4100
Other s	Machine Tools, Gauge Blocks, Coated Sand, Rock Drills
<u>Plants:-</u>	<u>Products</u>
Hiroshima	Passenger Cars and Trucks, Machine Tools, Rock Drills
Hofu	Passenger Cars, Transmissions,
Miyoshi	Diesel Engines

Overseas Plants:-

The Mazda Motor Corporation has plants at the following countries,

Korea, Malaysia, Philipines, Indonesia, Burma, Pakistan, Iran, Kenya, Portugal, New Zealand, Trinidad and Tobago, Thailand, Zimbabwe, Colombia, India.

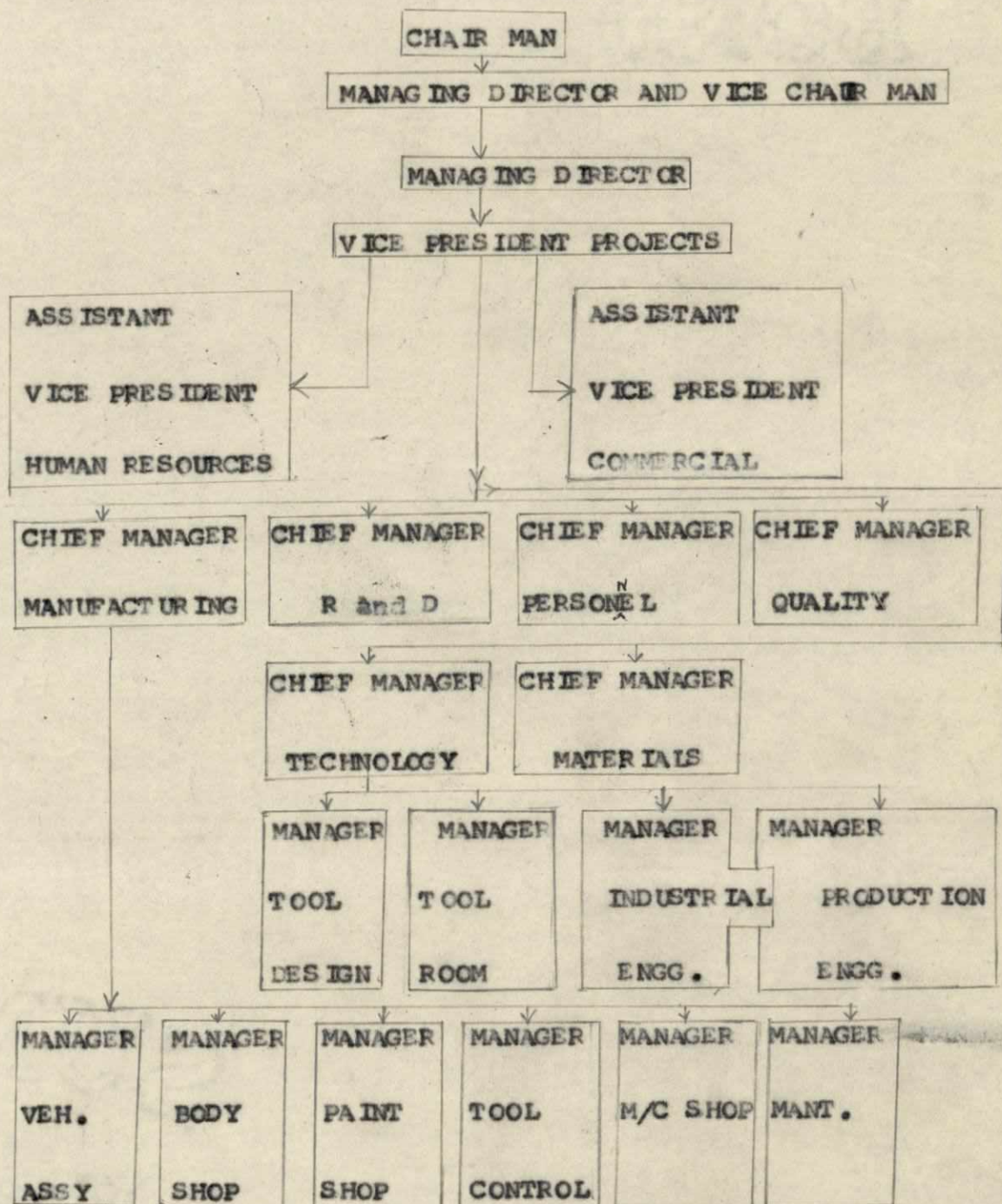
A Brief History:-

1920 Toyo Cork Kogyo Co., founded in Hiroshima

1927 The company was renamed Toyo Kogyo Co. Ltd.

- 1931 The head office and plant moved to the present location, production of thru wheel truck
- 1958 Computer System introduced, Small size four wheel truck Mazda Romper on sale.
- 1965 Technical co-operation was established with Peekins of England for development of diesel engine
- 1970 Total production of Rotary Engine Cars passes the mark of 100,000
- 1971 Total production of Mazda Vehicles reaches the mark of 4,000, 000
- 1972 Low pollution car, 'Luce' (RX-4, Mazda) introduced
- 1973 Mazda 929 introduced, Total number of vehicles exported reach 1,000,000
- 1976 Total export of Mazda Vehicles reaches 2,000,000
- 1977 Mazda 323 introduced
- 1978 Mazda Savanna RX-7 on sale, gets "Car of the Year" award
- 1981 Mazda Familia 323 wins "Japanese Car of the Year" award

Organisation Set Up of Swaraj Mazda Limited:



Swaraj Mazda Products:-Swaraj Mazda Truck:-
—

The truck is an ultimate driving comfort. The wide roomy cab comfortably seats the driver and two passengers. Adjustable fresh-air ventilators are also provided. It has low noise levels comparable with those of a diesel car. Tilt steering wheel in combination with adjustable seat with reclining back for ideal driving posture, is another Swaraj Mazda exclusive.

The new T-3500 is unmatched in styling, innovations, and design excellence too. Twin air deflectors above the grill direct air flow along the indented door panels to keep mud and dirt off doors and door handles.

Optimum windshield and side window area and curved rear too provides maximum allround visibility day and night.

Designed for easy loading and unloading the T-3500 has easy to grab handles for quick, release of tail gate. A fully flat bed ensures maximum loading space. A number of cargo hooks provide steady cargo tie down points and

strong side safety gaurds allow easy bed access.

A torsion resitant, high tensile steel chassis is strenghened with tubular cross member for maximum protection from frame fatigue. Semi elliptic leaf springs mounted on heavy duty rubber and bushings for a comfortable ride when leadedor unloaded.

The vehicle is provided with fully floating rearaxle. Total vehicle weight is carried by the axle for additional protection.

Quick maintance checks can be made via fold back driver and passenger seats. Also the vehicle is provided with tilt cab to allow maximum access to the engine and transmission for quick and efficient maintance.

The exhaust brake also helps a lot while moving down the hills. This exhaust brake when in use stops the exhaust from going to the atmosphere. Thus a form of brake acts on the engine and hence on the vehicle. In this way the brake shoes of the foot brake are not put in the use in the hilly areas and hence the brake shoes have additional life.

It can be concluded that the new T-3500 from Swaraj Mazda has all the rugged features one always expected from the truck, and has the unexpected as well as un seen driving comforts.

SWARAJ MAZDA T-3500 buses have been completely restyled inside and outside. As a result they set new standards of travel within a wide range of applications.

The big news in the introduction of high roof version. It features even more attractive design and functional points such as eye pleasing black framed windows and tinted glasses.

Both high and standard roof buses are designed with eye catching two tone colours and practicable user oriented bodies. Each bus has very large curved windows front, back and sides, so passengers will immediately appreciate the excellent view in each directions. In addition to, it has the extra spacious, bright, cheerful interiors that larger area of the curved glass offer.

As an extra measure of comfort and convenience for the passengers, each seat has its own ashtray and assist grip. Talking about seats, they are covered in easy to clean vinyl.

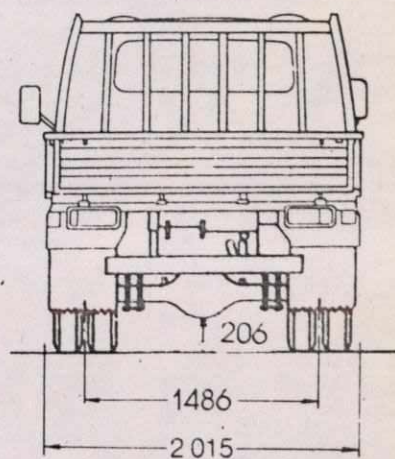
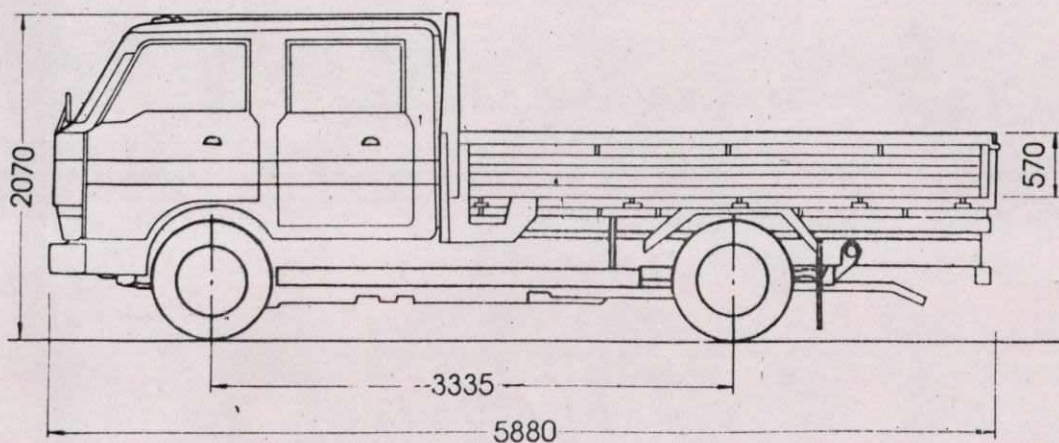
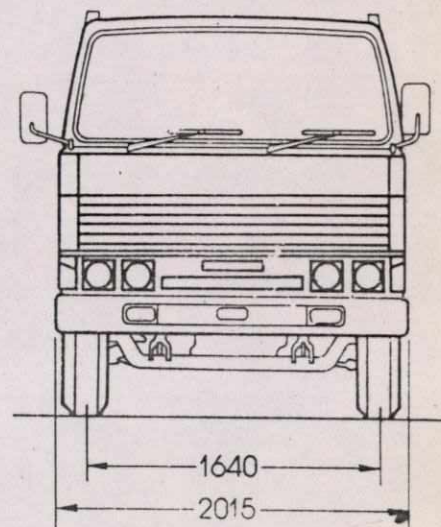
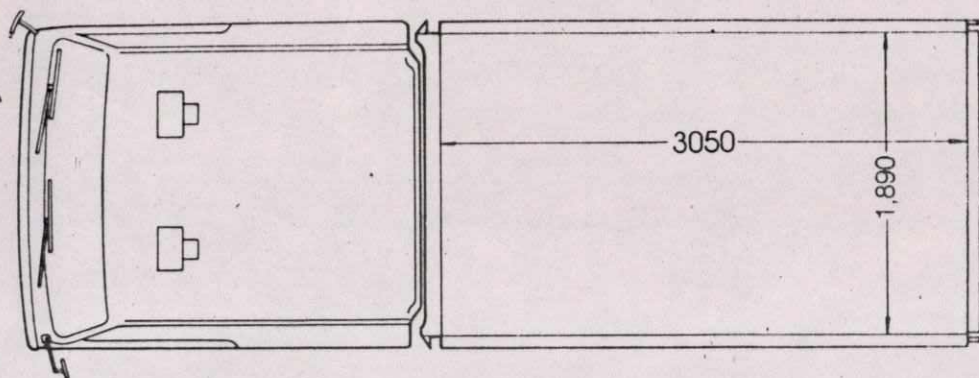
The driver of any SWARAJ MAZDA T-3500 bus is a lucky man indeed. His driving position is extremely roomy with plenty of space around. He gets a marvellous, unobstructed view of the road ahead and to his left and right. This excellent all wind visibility is due to very large windshield and curved side windows. His seat is a comfortable high back buckle seat. To suit his reach the seat can be moved forwards or backwards upto 200 mm.

Also provided is a very practically designed dash board with simulated wood grain panelling. All meters and gauges and switches are placed where he can easily see or reach them. Other standard equipments/items for his comfort and convenience are steering lock, large glove box, cigarette lighter, with illuminated ashtray, coin tray, arm rests and door pockets for maps.

Swaraj Mazda T3500

Dual Cab Truck with Cargo Box

Dimensions



SWARAJ
MAZDA

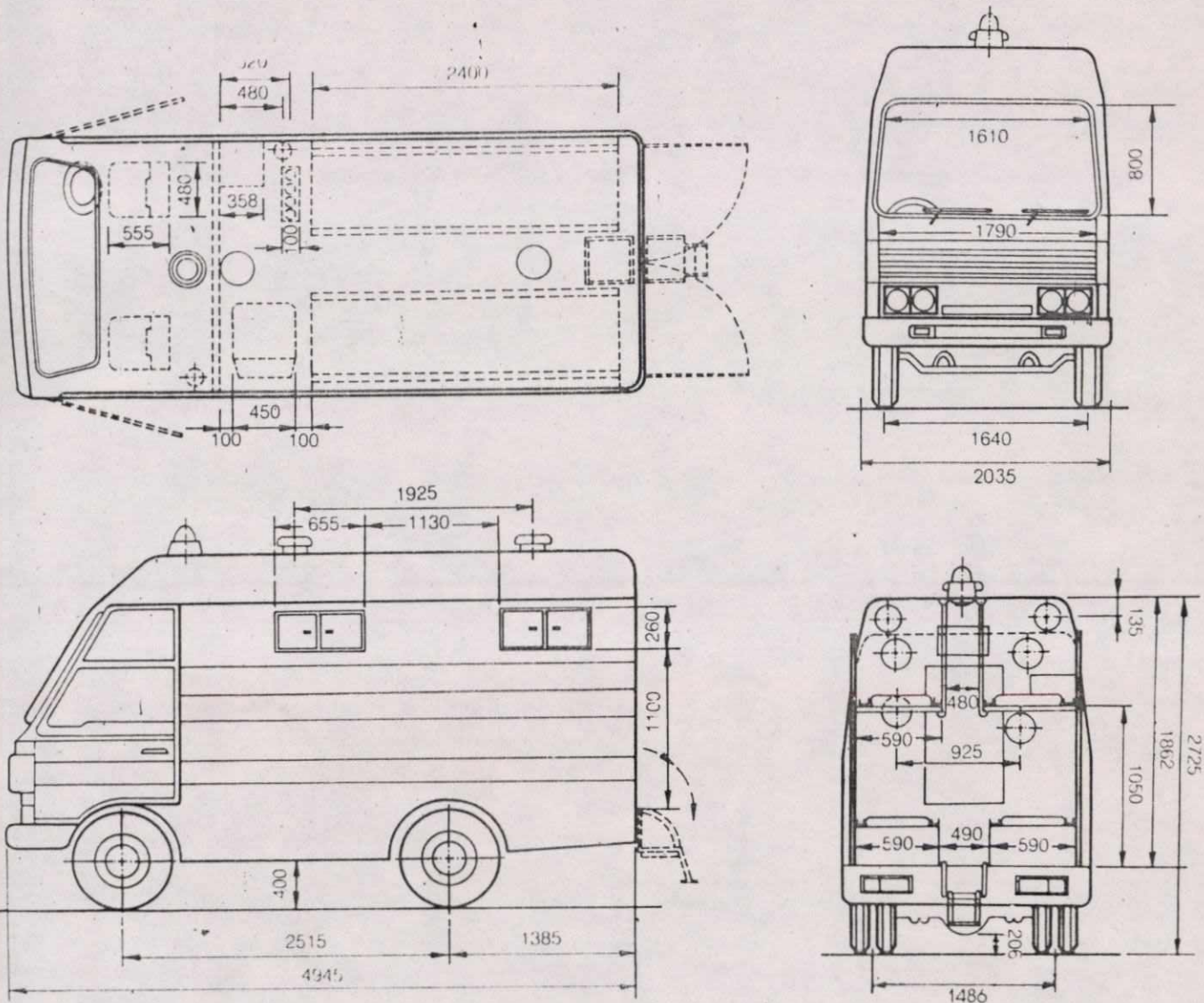
DUAL CABIN :

SWARAJ MAZDA's all new T-3500 dual cabin trucks go to new widths of comfort and practicality to get your job done right. These practical trucks feature an extra wide cabin plus a heavy duty Cargo Box so that you can have your entire crew and your cargo at the same time. Wide, full support seats in front and back and a spacious cabin provide 7 people with roomy comfort and plenty of big room so they will arrive fresh and relaxed and ready to go to work. Then there is the equally roomy cargo deck that lets you carry an amazing amount of cargo with maximum care and protection.

Swaraj Mazda T3500 ²⁶

Ambulance

Dimensions



SWARAJ
MAZDA

Swaraj Mazda T-3500 Ambulance :-

The Swaraj Mazda Ambulance comes on the WT-48 chassis, it has an overall length as 4945mm. Also the gross vehicle weight is 3680 kg.

Provisions:-

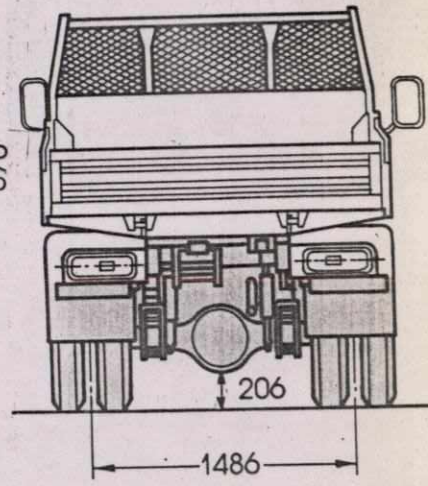
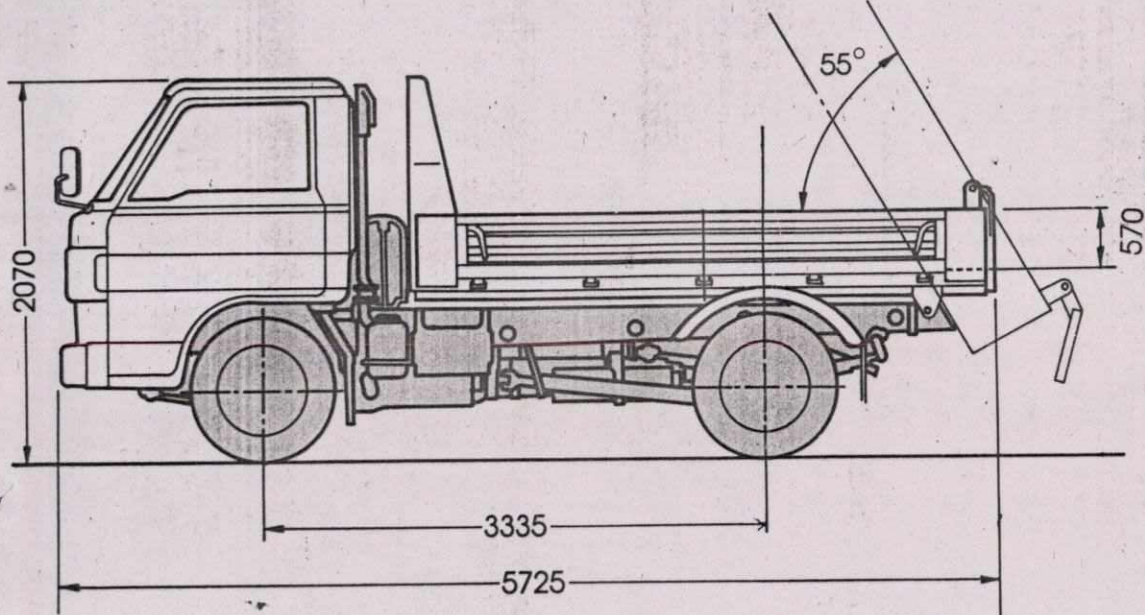
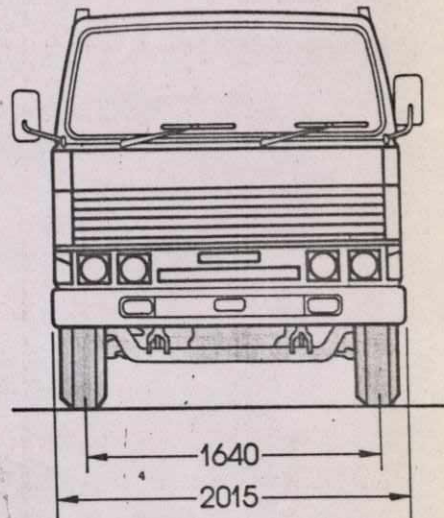
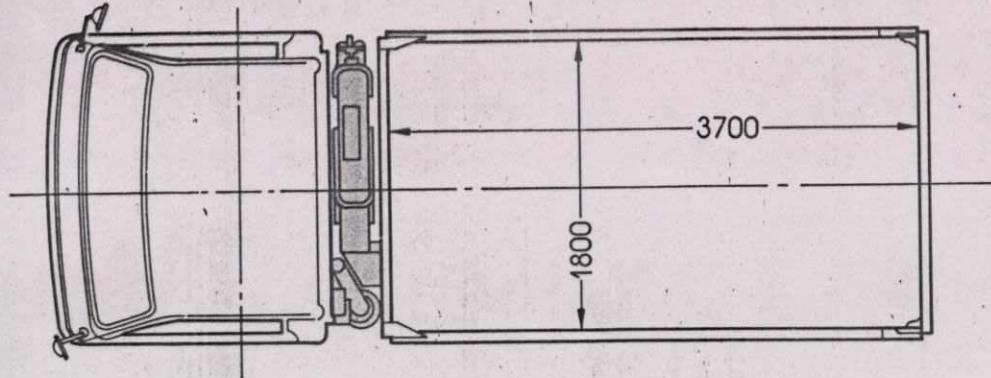
Stretchers	4
Fans	4
Exhaust Fans	4
Buzzer	1
Roof Lamps	2
Drug Cabinet	1
Stand for	1
Glucose Bottle	
Clamp for	1
Oxygen Cylinder	
Rotating Lamp	1
Attendant Seats	1
Doctor Seat	1

Swaraj Mazda T-3500 Dumper :-

The Dumper is being manufactured in two models, namely the T-3500/WT48 and T-3500/WT49.

Swaraj Mazda T3500 Dumper WT49

Dimensions

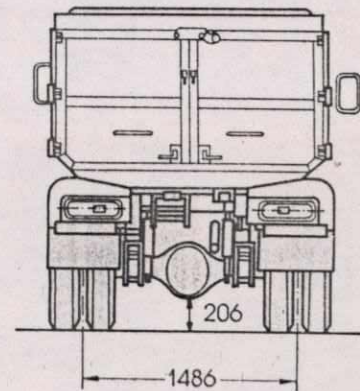
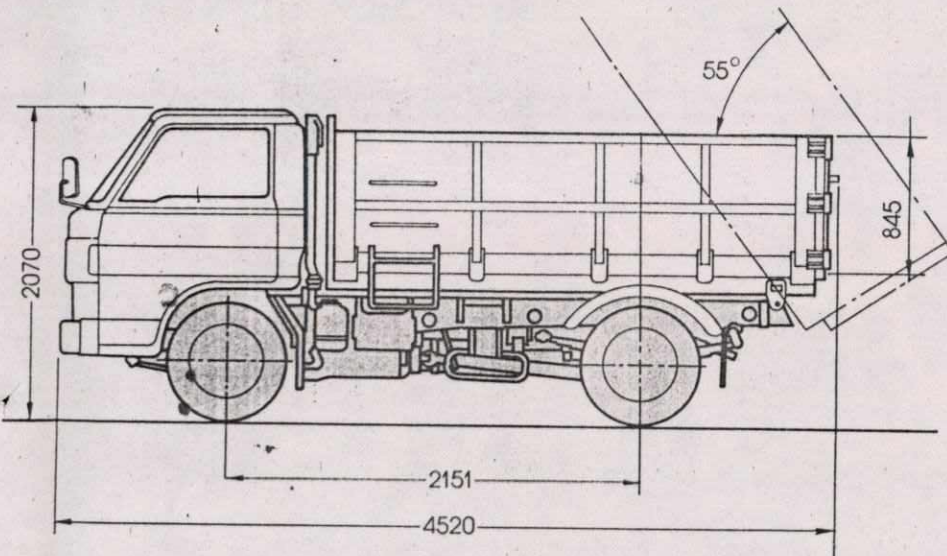
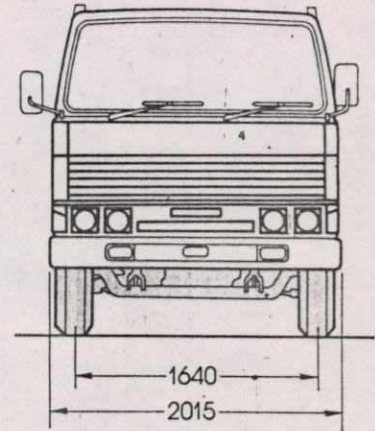
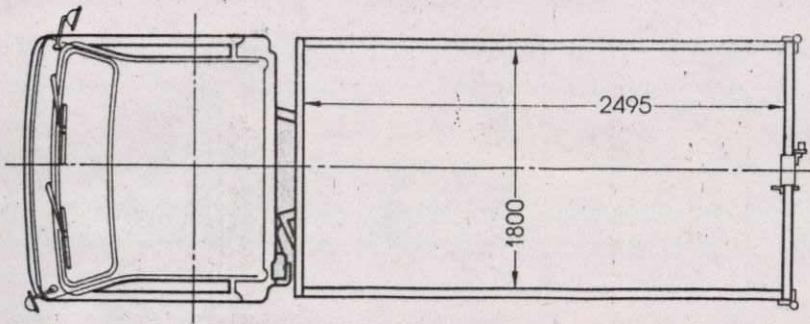


Swaraj Mazda T3500

Dumper WT 48

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Dimensions



SWARAJ
MAZDA

Specifications :-

Description	
Tipping Weight	3.0 Ton
Tipping Angle	55°
Tipping Volume	3.8 Cu.m.
Power source	Power taken from the gear box
Operation System	Hydraulic

OBJECTIVE:

To provide an optimised layout for the Spare Parts Division Stores in order to have increased picking of the components, higher execution of orders, and to optimise the space in order to have the storage space for more components, and to devise the material handling systems for the same. In a broad sense this can be enlisted as below:

1. To Study the Spare parts Division Store's working.
2. To study the existing layout.
3. To study the facilities available for the storage of the components.
4. To decide the facilities required and to arrange the same.
5. To provide a new layout for effective execution of orders, and to provide adequate space for each components.
6. To provide the material transportation facilities to transfer the components from the racks to the Packing Area.
7. To get the Layout implemented.

LAYOUTS -- A STUDY:

Layout embraces the physical arrangements of industrial facilities. This arrangement, either installed or in plan, includes the space needed for material movement, storage, indirect laborers, and all other supporting activities or services, as well as for operating equipment and personnel.

The term "layout" sometimes means the existing arrangement, sometimes the proposed new layout plan, and often the area of study or the work of making a layout. Hence, layout may be an actual installation, plan, or a job.

The planner should aim at certain general objectives in his/her layout. These include

1. Intergation- an intergation of all pertinent factors affecting the layout
2. Utilization- an effective utilization of machinery, people,
3. Expansion-easy to expand
4. Flexibility-easy to rearrange

5. Versatility-readily adaptable to changes in product design, sales requirements, and process improvements
6. Regularity-a regular or straight division of areas and relatively even sizes of areas, especially when separated by building walls, floors, main aisles, and the like
7. Closeness- a practical minimum distance for moving materials, supporting services, and people
8. Orderliness-a sequence of logical work flow and clean work areas with suitable equipment for scrap, trash, and wastes
9. Convenience-for all employees, in both day to day and periodic operations
10. Satisfaction and safety for all employees

Guiding Fundamentals to Successful Layout:

Basically, every layout involves three fundamentals:

1. Relationship-closeness desired between various activities or functional areas
2. Space-in amount, kind, and shape for each activity or functional area
3. Adjustment-of the activity areas into layout plan

Layout for Stores:

The layout of a store requires careful planning. It should be simple and effective and should be governed by the four principal stages of handling stores, viz. receipt, inspection, storage, and issue. The question of bringing the material inside, moving and taking out supplies, and the provision of aisles of proper width for proper handling for the material, must be taken into account.

There are three important phases for layout for storekeeping:

1. Determination of storage space required
2. Determination of optimum location of store keeping areas
3. Determination of optimum allocation of space inside the storekeeping area.

Theoretically, the analyst would have to know the different raw material, parts, and products which will be stored, the unit sizes of these items, the maximum number of units which will be in stock at any one time, and the method of storage.

The method of storage is not easily determined for each of the involved items. Some

may be stored in bins of various sizes, others on the shelves of various sizes, and still others by stacking to various heights. At this point these difficulties preclude the analysts calculating the cubic feet of required floor space for, say, the next five years.

While determining the optimum location of storekeeping areas the following factors have an important role to play;

1. **Material Classification:** It may be useful to store materials of the same classification together e.g., one space may be set for the light components; another space may be earmarked for heavy components/fast moving.
2. **Similarity of Materials:** Articles of similar size, shape, and weight may be kept together regardless of their classification. All small parts may be kept in one place and bulky items in another place.
3. **Material Handling Considerations:** Materials requiring similar handling equipment may be kept together. e.g. liquids may be kept at one place, while item requiring truck handling or conveyerized handling may be kept at another place.
4. **Special Requirement:** It is also necessary to store fragile, explosive, extremely valuable, or materials

requiring special atmospheric controls have to be stored even though they may not be ideally located.

After fixing the degree of centralization of storage of storage areas, sub-grouping of the materials, and approximately determining the relative locations of the areas, there comes the problem of detailed layout of storeroom space. the main objectives of good utilization of space are;

1. Optimum accessibility of materials
2. Maximum flexibility of arrangement
3. Maximum protection of materials
4. Intensive utilization of storage space
5. Biggest base of control of materials

Methods of Approaching Layout Projects:

1. Instinct and Intuition; layout can be planned by instinct and intuition. this is often fast, direct, and time saving; but it is limited generally to simple or emergency situations or where there is deep experience and a record of sound decisions in the past.

2. Find One Ready made; Magazines articles, visits to other plants, discussions with planners from other companies, social events, trade shows, or professional society meetings may lead to finding the layout--one that is spoken of enthusiastically and could be "just the thing." New ideas and methods are essential in this rapid changing days and certainly should be sought out; but this has to be borne in mind that what is good for someone else is not necessarily suitable for a different situation, and without at least some modifications, is likely not to be.

3. "Keep Everyone Happy" Approach: This approach involves the democratic process; get all ideas from everyone, discuss them, and translate them into visual presentation; then call the group together for comment; make changes; and again solicit agreement of the group. This gives everyone involved a chance to participate and therefore to support the ultimate plan.

4. Organized Systematic Methodology: Systematic Layout Planning is termed here as SLP, is a universally applicable approach. It incorporates the benefits of the other approaches and organizes the whole planning process into a rational system. There are four phases of SLP

Phase 1 is that of location.

Phase 2 is that of planning and general overall layout.

Phase 3 is the preparation of detailed layout plans and includes planning where each piece of machinery and equipment will be placed.

Phase 4 is the installation. This involves both planning the installation and physically making the necessary moves.

These phases come in sequencing, and for best results, they should overlap each other.

MATERIAL HANDLING A STUDY:--

Definition:- A search of the literature produces a good many definitions of material handling, most of which are filled with qualifications as to what it is or is not. However the extent of the material handling activity in any company depends on such things as the type of company, its product, the size of the company, activity being performed, the relative importance of handling, the personalities of the individual involved in handling, and the organization of the enterprise. A limited interpretation of material handling deals with the movement of items from one point to another within the confines of a plant. Let us say, the problem is to move something from point A to point B. The concern of the material handling engineer is most commonly with individual, isolated, independent material handling problem situations. The analyst is concerned with interrelating all plants handling problems, establishing a general material handling plan, and typing each problem solution into all others. A broader point of view, called the systems concept, visualizes

handling and disturation as one all-comprising system.

The viewpoint gives consideration to all handling activites involved in (1) the movement of material from all sources of supply, (2) all inplant handling, and (3) the distribution of finished goods to all customers. The goal is to implement these portions of the systems feasible at the mament, while continuing to work on other phases of the system and implementing.

The Industrial Engineer and Material Handling:-

If the industrial engineer is held responsible for efficient material handling, he will be largely be involved in the analysis of material handling operations.

These analyses will not necessarily cover only small sections of the plant's operations; one analysis may cover the entire manufacturing operation. In addition to the material handling activites, the industrial ~~engineer~~ will be involved in the inventory control, safety programs, labor relations, purchasing, layout and transportation. In general his duties will consist of establishing and maintaing the proper flow of material through the plant in the most efficient and economical manner.

Frequently, industrial engineers are given material handling assignments because of their broad background and plant-wide experience. They can however, be specially trained for the job.

Objectives of Material Handling:--

1. Reduced Cost.

- (a) Lower inventory and production control cost.
- (b) Better space utilization and minimum handling.
- (c) Shorter production cycle time.
- (d) Reduced handling cost per piece

2. Reduced Waste.

- (a) Less spoilage and damage because of good handling.
3. Increased Productivity

(a) Continuous Production

- (b) Effective use of manpower, so as no labour wastage
- (c) Better control on materials

4. Improved Working Conditions

- (a) Safety of health.
- (b) No undue fatigue.
- (c) Employees' morale upgraded.

5. Improved Production Distribution

- (a) Quick delivery as per schedule
- (b) More products are sold as the prices are low
- (c) Reduced damage claims
- (d) Improved customer relations

All these objectives can be summarised as:

- (a) The number of handlings and distance travelled are reduced.
- (b) Use of most effective handling equipments.
- (c) Manufacture cycle time is reduced.
- (d) There is improvement in the employee's meral and se the working.
- (e) There is saving of money and time.

Understanding the Parts, Part-Numbers:

One of the important characteristics of a successful layout is the knowledge of the system, the articles to be stored and their classification. Following is the list of group numbers and their description.

<u>GROUP NUMBER</u>	<u>GROUP NAME AND THEIR DESCRIPTION</u>
10	Short Engine and Gasket, Cylinder Head and Cover, Cylinder Block
11	Piston, Crankshaft and Flywheel
12	Valve System
13	Inlet Manifold, Exhaust Manifold Fuel System, Air cleaner, Injection Pump and Sedimentor
14	Oil Pump and Filter
15	Cooling System
16	Clutch Disc and Cover
17	Transmission Gears and Cover
18	Engine Electrical System, Alternator and Battery

GROUP NUMBERGROUP NAME AND THE IR DESCRIPTION

25	Propeller Shaft
26	Rear axle and Rear Brakes
27	Differential
28	Rear Suspension
32	Steering Wheel , Steering Gear Steering Column and Linkage
33	Front Axle and Brakes
34	Front Suspension
37	Tire and Jack
38	Main Frame and Cabin Mounting
39	Engine and Transmission Mounting
40	Exhaust System
41	Clutch Release and Master Cylinder
42	Fuel Tank
43	Clutch and Brake Pedal, Brake Master Cylinder, Power Brake and Brake Pipings
44	Parking Brake System
45	Fuel Pipings

<u>GROUP NUMBER</u>	<u>GROUP NAME AND THEIR DESCRIPTION</u>
46	Change Controls
50	Radiator Grill, Front and Rear Bumpers
51	Front and Rear Combination Lamps License Lamp, Interior Lamp Ornaments
53	Body Panels
55	Dash Board Equipments, Meters, Roof Ventilators,
57	Seat
58	Door and Realeated Parts
63	Window Glasses
65	Cargo Box
66	Switches, parking Lamps, Horn
67	Wire Harness and Wire Hareness Clamps
68	Ceiling Trims, Floor Mats and Service Tools
69	Viser and Mirrors

Spare Parts Division Stores :

The Spare Parts Division Stores known here as S.P.D. is the warehouse which supplies the spare parts to a network of dealers all over India. This S.P.D. Store is the main tank of the spare parts for the customers as well as the dealers. For the sparts marketing dealers have been appointed all over India in the following manner,

- a: North Zone
- b: Central Zone
- c: West Zone

The Central Zone is the largest one of the all, as far as the dealers network is concerned. The Central Zone consists of ten dealers. It has dealers at Agra, Meerut, Bareilly, Lucknow Kanpur, Allahabad, Varanasi, Gwalior, Indore and Kota.

The North Zone has been provided with dealers at Chandigarh, Ludhiana, Jallander, Amritsar, Srinagar, Karnal, Sri Ganganagar and Delhi.

The West Zone has been provided with dealers at Bombay, Kolhapur, Goa, Baroda, Ahmeadabad and Rajkot. The city of Bombay the distinction of having two dealers.

Functions of S.P.D.:

At present this warehouse has been provided with a manpower of four to supervise the various activities that are carried out in it. The various activities can be classified as

- 1: Receiving
- 2: Stocking
- 3: Issuing

The first activie i.e. Receiving, basically deals with the acc-
-eption of the incoming material. the incoming material can
be, from Mazda, and/or from the indian vendors or from the
main stores. The material is received the main store, when
that material or the component is not available in the
Spare Parts Division Stores, but has to be supplied to the
dealers at a short notine. however this material receving
from the Stores does not contribute much towards this activity
of material receving.

The second phase of the activity
i.e. Stocking, basically deals with the physical storage of the
components in the store, After the material has been received
and its entry has been done on the Stock Card, is then taken
for the stocking purposes. The mode of storagr in the store is
is Racks, Slotted Angel Racks, Pallets .

The third phase of the activity de
deals with the issue of thematerial to the dealers. Gernally
two sorts of orders are received, namely the Casual Order and
the V.O.R. . The Casual Order a Has to be executed with in fif
-teen days and contains the folloeing information,

1. Dealer's Name
2. Dealer's Code
3. The location of the dealer
4. The place to which the components have to be supplied

Spare Parts Order

SWARAJ MAZDA LTD. 48

SWARAJ MAZDA LTD.

To *C.No. 107/0008*
 Swaraj Mazda Limited
 (Spare Parts Deptt.) *dat 12/11/87*
 SCO No. 156-160, Sector 8-C
 Madhya Marg, Chandigarh-160 008

Dealer's Name : 160, Industrial Area, Phase-II,
 Dealer's Code : 107 CHANDIGARH.
 Place : *Chandigarh.*
 Ship to Place : *Chandigarh.*
 Order No. : *7110701*
 Date : *12/11/87.*
 Type of Order : Annual/Casual
 Mode of Transport : Road/Rail

Plix 051

For Office Use Only

S. No.	Part Number	Description	Order Qty.	Unit Price	Total Amount	Issue Qty.	Location	Case No.
1	Slot 10 320 E	Block oil pump up	2					
2	Slot 11 402	Pully	2					
3	Slot 23 105	Metal Set-Cov. Rod	5					
4	Slot 23 106	Metal Set-Cov. Rod	5					
5	Slot 23 107	Metal Set-Cov. Rod	5					
6	Slot 23 108	Metal Set-Cov. Rod	5					
7	Slot 23 2106	Ring Set- Piston	5					
8	Slot 23 110	Metal Set-main	5					
9	Slot 23 111	Metal Set-main	5					
10	Slot 23 112	Metal Set-main	5					
11	Slot 23 113	Metal Set-main	5					
12	Slot 23 2100	Piston Set	8					
13	Slot 23 115	Metal Set-Thrust	5					
14	Slot 12 310	Rod Piston	8					
15	Slot 15 125	Hose water	20					

Details of Draft

Number	Date	Amount	Name of Bank

C.S.T No. CHA 9222 Dt. 16/10/85.
 L.S.T No. CHA 9432 Dt. 16/10/85
 Dealer's C.S.T. No.
 L.S.T. No.

For Office use only

Job No.	Freight

Dealer's Authorized Signatory *12-1-87.*

PARTS OFFICE → SPD WAREHOUSE

10/12/87

SML-45-01

5. Order No.
6. The date on which the order was released.
7. The mode of transport, the dealer in the case of a Casual Order is given an option of road transport or the rail.
8. The list of the components, wanted by the dealer, in accordance with the parts number.
9. Quantity of each component.
10. Unit price of each component.
11. An estimate of the total amount for a set of components.

The second class of the order, namely V.O.R. has to be executed within twenty four hours only.

The V.O.R. Order contains the following information,

1. Dealer's Name
2. Dealer's Code
3. The place at which the dealer is located
4. The place to which the components have to be supplied
5. Order No.
6. Date on which the order was released

Spare Parts Order

(V. O. R. Only)

W17-127
30/1/87

PSCC - 151
30/1/87

SWARAJ
MAZDA 50

To, 2106/0074 Dealer's Name : DUGAR DISTRIBUTORS PVT LTD.
Swaraj Mazda Limited Dt. 27/1/87 'Dugar Chambers'
S. C. O. 156-160 Sector 8-C 6/A, Agra Bombay Road, Indore
Madhya Marg, Chandigarh-160 008 Dealer's Code : 2106
Place : INDORE
Ship to Place : INDORE
Order No. : 7/2106/147
Date : 23.01.87
Mode of Transport By Road / Rail / Air / Hand

DETAILS	Model	Date of Failure Reported	Chassis No.	Name & Address of Owner	Brief Nature of Fault
OF	WT49 A	20.01.87	M-500752	Shri Arun Sardar Pundit Indore.	Right-Door- Glass regulating machine teeth gone damaged. Not Lifting glass.
V. O. R.	Regis. No. CIF.742	Km. Failure Reported 60130	Engine No. SLC 2003	Date of Sale 26.02.86	

For Office Use Only

S. No.	Part Number	Description	Order Qty.	Unit Price	Total Amount	Issue Qty.	Location	Case No.
	W023 58 560	Regulator R Window	1	253-00	253-00		1 NOS	
	9958 56 5903	Seal Oil front	2	42-00	84-00		2 NOS	

For Office use only

Job No.	Freight

Dealer's C.S.T. No. IND/IX/XIX/209 For DUGAR DISTRIBUTORS PVT. LTD.,
M.P.S.T. No. IND/IX/XIX/2440

PARTS OFFICE-SPD WAREHOUSE

Signature
Works Manager.

At 23.01.87

SML-45-08

7. The mode of transport, the dealer, in the case of a V.O.R. is given an option of transportation by road, rail, air and hand.
8. Details of V.O.R. that includes
 - (a) Model of the vehicle
 - (b) Registration No.
 - (c) Date on which the failure was reported
 - (d) The distance covered by the vehicle
 - (e) Chassis No.
 - (f) Engine No.
 - (g) Name and address of the vehicle owner
 - (h) Date of sale of vehicle
 - (i) Nature of fault
9. The list of the components wanted by the dealer in accordance with the part number
10. quantity of each component
11. Unit price of each component
12. An estimate of the total amount for a set of components

To facilitate the dealers are provided with necessary literature that includes parts Catalogues ,

P. S - cum CHALLAN

295.

Swraj Mazda Limited
 S. No. 150-150, Sector 8-C
 Badliya Marg, Chandigarh - 160008
 Phones: 26401, 23342
 Telex: MAZDA
 Cable: 2193-181



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Dealers Name & Address	Challan No	432	20/03/87
SWARAJ MAZDA LTD.	Odr. No 7	3	
BABAJI SHIVRAM CLG&CARS P	Date	17/03/87	
REX CHAMBERS, 4TH FLR. WAL-	Mod-Trans	AIR	
CHANDHIRACHAND MRG BOMBAY	Destination	MIRA	
	Dealer Code	3	

No of Cases *(10)* Weight

Sno	Part No.	Description	Qty	C.No.
1	WD23-49-312	LINING	8	
2	SL07-23-206	RING SET, PISTON	1	
3	SL01-11-214	BOLT, CONNECTING ROD	16	
4	WD25-26-310	SHOE, BRAKE-RR	8	

As per the provisions of Section 47 of the Income Tax Act, 1961, the tax specified in this portion of super-cum challan is made by the

checked by
 For Swraj Mazda Limited

Punjab State Sales Tax - LSI-1281/2011-711 dt. 06.11.83
 Registration Nos. - CSF-1283/1 dt. 01.07.1983

M. S. Chauhan
 2/13
 Authorized Signatory

Head Office: Phase IV SAS Nagar, Chandigarh - 160002
 Village Asron (Near Feroz), Dist. Ludhiana

The third phase of the activity i.e. Issuing as such deals with the issue of the components to the dealers and other parties, however this activity doesnot finishes here only. The despatch of the assingment also forms a part of this activity. The dealer is supplied with a form called packing Slip Cum Challan. Two more copies of this slip are made, one of these is retained by the S.P.D. for the records, however the other copy of this slip is handed over to the Security Office when the packing case is given aclearance by the securuty department. The packing Slip Cum Challan contains the necessary information about the following, which otherwise prove to be helpful for the dealer.

1. Dealer's Name and address
2. Challan No.
3. Order No.
4. The mode of transport as requested by the dealer
5. Destination i.e. the place to which the components have to made available

INVOICE

Swara Mazda Limited

SCO 150-160, Sector 8-C

Delhiya M.ry. Chandigarh - 160008

Phone: 2601, 23342

Company: MAZDA

Telex: 0193-381



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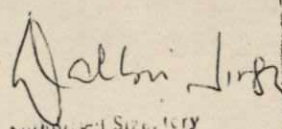
Dealers Name & Address	Inv. No. SP/87/ 428	Date 20/03/87
SWARAJ MAZDA LTD.	Dealer Odr No 7 3	Date 17/03/87
BABAJI SHIVRAM CLG&CARS P	P.B./Ch.No. 432	D:Code 3
REX CHAMBERS, 4TH FLR. WAL-	Mod-Tran: AIR	Date 20/03/87
CHANDHIRACHAND MRG BOMBAY	Destination MIRA	
	GR/RR No.	Date
	Transport Co.	

Dir CST No. MAH/1A/25/86 DT.10.2.86
LST No. NIA 32956 DT.10.2.86

Sno	Ord. Part No. SNo.	Description	Qty	U-Price		Amount	
				Rs.	P.	Rs.	P.
1	W023-49-312	LINING	8	77.00		616.00	
2	SL07-23-206	RING SET, PISTON	1	753.50		753.50	
3	SL01-11-214	BOLT, CONNECTING ROD	16	11.75		188.00	
4	W025-26-310	SHOE, BRAKE-RR	8	163.50		1308.00	

TOTAL : 2865.50
STOCK TRANSFERED
GRAND TOTAL : 2865.50

Rupees Two Thousand Eight Hundred Sixty Five And Paise Fifty Only

I hereby certify that the goods mentioned above are as specified in this packing slip and are in conformity with the invoice.		Checked by For Swara Mazda Limited  Authorised Signatory
Punjab State Sales Tax. LST-1283 dt. 16.10.11.83 Registration No. CST-1283 dt. 16.10.11.83	Head Office: Phase IV SAS Nagar (Near Chandigarh) Distt. Rupn. Punjab Works: Village Asson (Near Papat), Distt. Hoshiarpur	

6. Dealer's Code
7. Part No. and the description of each component in accordance with the part number
8. Quantity of each component that has been dispatched

During the transportation

of the components, it requires clearance at a number of places. For this purpose the transport company is handed over a form called Invoice, the other two copies of this said form are used by the Accounts Department and the Zonal Office.

The Invoice contains the following information,

1. Dealer's Name and address
2. Order Number
3. Dealer's Code
4. Date on which the order was executed
5. Mode of transport
6. Name of the company transporting the components
7. Part number and the description of each component in accordance with the part number

8. Quantity of each component that is being contained by the packing case

9. The unit price of each component and the net amount chargeable to the dealer

The account of the receipt and the issue of each and every component is maintained in a card called the Stock Card, hence there exist a Stock card for every component, tool.

The Stock Card has its own importance in the S.P.D. This gives us the necessary and up to date information regarding the status of the component. The following information can be obtained from the stock card

1. Part number
2. Description
3. Classification
4. Net dealer's price
5. Location of the component
6. The amount of the component received on a particular date
7. The amount of the component of ~~issued~~ issued on a particular date
8. The quantity left in the store as balance

In addition to the activity

of issuing the material to the dealers, sometimes the components are also issued inside the factory for various purposes, which may include the research work and the development work. For this purpose, namely the issue of the components a Material Issue Slip is used, which contains the following information

1. Issue slip number
2. Job number
3. Description of the part/parts required/issued
4. Quantity required
5. quantity issued
6. Date of issue
7. Name and signature of the person / department requiring the part / parts
8. Name and signature of the authority which has been instrumental in issuing the component / components

The physical balance in the store is checked twice in a year.



The Previous Layout:

The layout which existed as on February 2, 1987 was designed for some seven hundred components only, and was done some months ago depending upon the number of components which existed at that time in the Spare Parts Store. Now with the passage of time the number of Components and their quantity has increased. However the storage system does not exist ed for such large number of components. The depth of the problem can be accounted by the fact that the number of the components have crossed the mark of 2,000. This rapid increase in the number of the components had made the picking of the components rather slow, the slow picking of the components had further effected the execution of the orders, which used to create hindrences at the dealers side too.

In this layout the components had been classified in three categories depending upon the size, however it also appered that the quantity to be stored had not been properly taken care of . The components had a classification as following; Large; Medium; Sall.

The components so classified as small were being stored in plastic bins and these plastic bins were further being stored in the slotted angle racks. The components so classified as medium sized, had been provided with steel bins as containers and these steel bins were further being stored in the above said slotted angle racks. The so classified as large, were being stored in racks and pallets. The racks had five channels each and these further contained components as such and the components stored in the corrugated boxes called cartons. The pallets were available in a lot of shapes and sizes which included : Flat Pallets, Flat Pallets With Side Supports Pallets With Mesh Sides, Pallets With Joints, and Rectangular Pallets with Meshed Sides.

Disadvantages:

(a) Classification:

On investigation it was concluded that the classification was not appropriate, it was observed that there were some such components which are otherwise heavy were lying in the plastic bins and the steel bins and thus the slotted angle racks were being

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subjected to excessive loads. Also the wrong placement of Leaf Springs forms the example of the wrong classification and inadequate space. Leaf springs were being stored in the racks (J77006410), and that had caused an ill effect on this particular material handling facility, since the weddeplanks had been under the effect of saging motion.

(b) Layout for few components only:

This layout (previous) had been desinged keeping in view only a few components, but with passage of time the numberof components had increased consinderably and as such no proper storage facilities existed for such components.

(c) Randomness:

On investigation it was found that the components were lying in a random way i.e. proper sequencing was not there. A large number of components had not being according to the group number or the part number. Moreover the same component was observsd to be lying at the more than one place. Also the incomojg cartons were seen to be lying on the floor and these factors were causing a lot of obstructions during the picking activity and other wise also.

(d) Movement restricted:

The placement of the racks, pallets and the material handling equipment was such that enough space was not available for the movement of the workers. Also the aisle between two racks was inadequate for the movement of the hydraulic lift trolley. Also the cartons containing the components and lying on the floor were another unwanted source of obstruction.

(e) Inadequate space for fast moving components:

This category of fast moving components include the various filters, mainly Oil Filter, By Pass Filter, Air Filter. However these were being stored in the racks, also this particular rack was lying at the rear end of the store. As such these consuming a lot of space and were also increasing the material movement. This space was not an optimum one depending upon the nature, inventory and movement of the components.

(f) Damaged storing facilities:

On investigation it was found that most of the slotted angle racks and some of the plastic bins had a sign of being overloaded. This overload on the slotted angle racks had caused the sagging in the

slabs of the above mentioned racks, and as such these were in the need of repair.

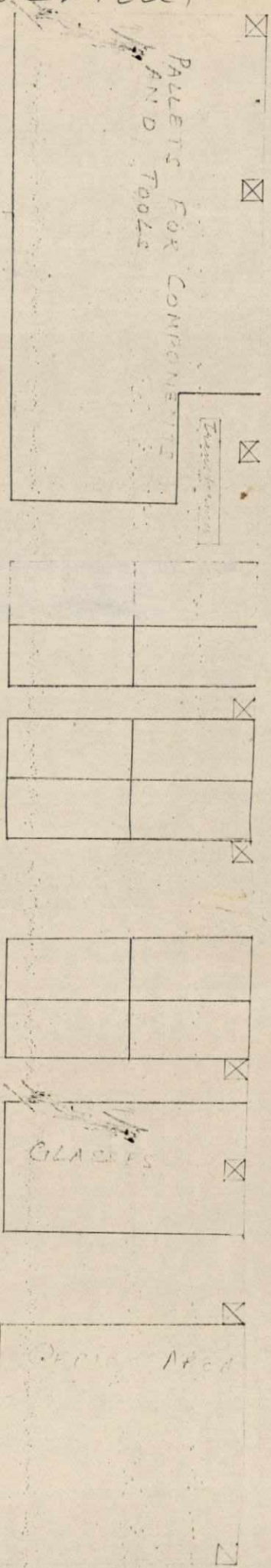
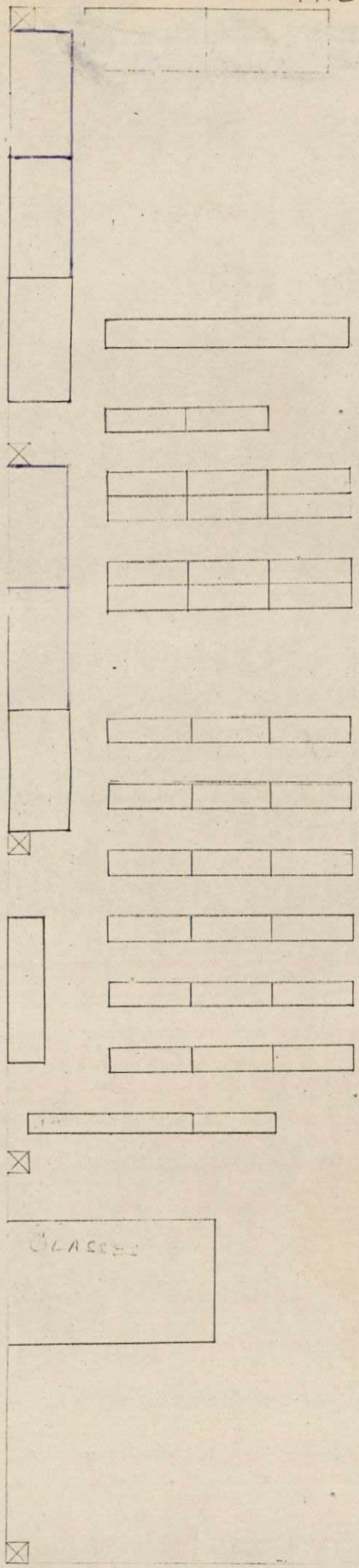
(g) other factors:

The glasses meant for the vehicles (truck and bus) were being stored at two different place as shown in the layout (the previous one).

The pallets containing the components and the special servicing tools were stored in the same area.

No special place /area existed for the storage of engine and trasmission.

There was as such no marking on the stock card for the location of the components.



The proposed and implemented layout:

Main features of the implemented layout are;

- (a) On one side 25 racks (J-77006410) have been provided for storing the cartons.
- (b) On other side (separated by the mid aisle) the material has been kept in plastic / steel bins in suitable racks.
- (c) Materials in pallets have ^{been} kept at the end .

There are two areas in which the pallets have been kept, these include the pallet area for the components and the tool area for the special servicing tools.

- (d) A sheet metal area has been provided for such components that are appreciably large in their size, these include The Cabin Floor, Front Panel, Roof Panel, and Back panel.
^{been}
- (e) An area for the glasses has ^{been} provided at the front and opposite to the packing area. This has minimised the material movement and handling of the glasses when the unpacking and packing has to be carried out.

- (f) All the filters, which are extremely fast moving have been brought at the front (as shown in the layout), in order to provide adequate space for these components and to have the minimum of the material movement.

(g) An area of $1500 \times 4200 \text{ mm}^2$ has been provided in the front for the Engine and transmission.

(h) a packing area of $9000 \times 4000 \text{ mm}^2$ has been provided at the front, near the office area (as shown in the layout) for the packing of the boxes/packing cases which have to be dispatched to the dealers.

Other Characteristics:

An aisle has been provided in between the two set of areas for the racks, this aisle runs parallel to the length of the store.

Each rack has been further provided with two way approach i.e. aisles have been provided on both the sides and along the lengths of the racks.

The racks have been numbered like A; B; C;... In addition to it the channels/slabs in each rack has been marked 1; 2; 3;....in an ascending order from the top.

The location of each and every components and tools have been marked on the stock card, this has increased the picking rate by a considerable amount.

The Aisle which runs parallel to the length of the SPD Stone, has been provided considering the fact that the fork lift can be used for the placement or removal of the pallets. Also the aisles which run parallel to the length of the racks are adequate enough to permit the easy movement of the trolleys. Also 'Nilkamal' Made Bins of dimensions 650 mm x 400 mm x 315 mm and of capacity 75 litre has been provided for the movement of the components from the racks to the Packing area.

Also for despatching packing cases containing heavy components, the fork lift has to be used for stacking the packing cases in the truck, meant for carrying the cases to Chandigarh, City office.

The implementation was carried out in two phases, initially the placing of the plastic bins was done in the slotted racks, a total of 18 such rack were used for the plastic bins. However when the J-77000620 racks [^]were received these 18 slotted angle racks were replaced by these J-777000620 racks, which not only provided an adequate space for expansion in the racks but also in the plastic bin area.

The space for each component has been provided considering the stock and the order, the total quantity of each component that will be stored in the S.P.D. at any time.

Advantages:

(a) Reduction in the Material Handling:

The facilities have been provided in such a way that the material handling has been minimised to a large extent. The aisles on the sides of the racks, the list of the location of the component, the separate areas for the glasses, filters, tools, engine and transmission and packing have proved to be the main factors in reducing the material handling.

The mobile ladder has been designed for the picking of the material from the racks. The purchase requisition and hence the purchase order

were raised in the month of April.

(b) Effective Space for Expansion:

A considerable space has been left between each group number, this is applicable for the cartons and the bins. This has been done considering the fact that more and more components will come into the total inventory, with the passage of time. Also With the indeginisation phase at it's peak , more components and more quantity will have to be stored.

(c) Workers' Convenience:

Every worker wants to work to work in a convenient enviorement. Also it has to be taken care of that the workers are provided with a safe working area. considering these factors, the heavier components have been placed at the bottom channel of the racks, also considering conveyance for the workers a fan has been installed on the coloum in the packing area.

(d) Increased Picking:

It has been observed that the execution of order in the months of April and May has increased considerably as compared to the previous month's

and this can be attributed to the increased picking.

Facilities Available:

Description	Quantity
J-77006410 (Rack)	16
Slotted Angle Racks	
(a) with seven slabs	12
(b) with six slabs	06
(c) with five slabs	16
Pallets	
(a) square	34
(b) rectangular	26
Channel Rack	
(a) with 9 slabs	01
(b) tool room	01

Facilities Required:

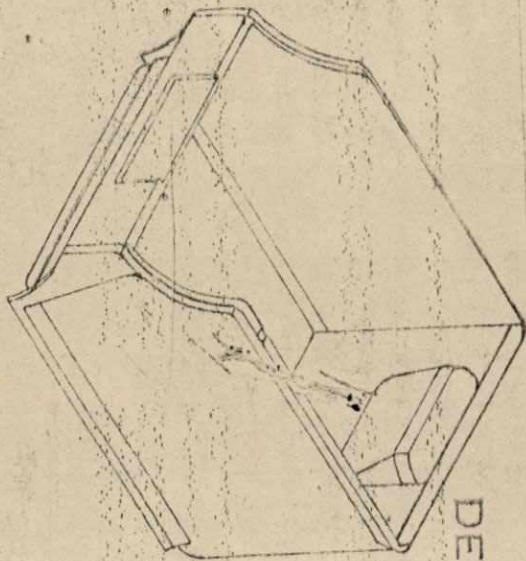
Description	Quantity
J-77006410 (Rack)	09
Pallet (Square)	12
J-7700620 (Rack)	12

Action Taken Regarding the Facilities:

Initially the proposed layout was implemented with the slotted angle racks and 16 J-7700-6410 racks. The purchase requisition and subsequently the purchase order for J-77006410 and J-77000620 were raised in the month of January. These racks started arriving at SML in the month of April. With the arrival of these racks, meant for the plastic bins (J-77000620), and the racks meant for the cartons (J-770006410), were placed at their proper positions and the material was rearranged in them.

The slotted angle racks and the channel rack with 9 slabs were shifted to the main Stores (indigenous components) and the channel rack toolroom, was shifted to the Paint and Chemical Stores.

One slotted angle rack has been shifted over to the office area for storing the stationery.



NE
DEVELO

NILKAMAL - BIN 30

MODEL BIN 30
OUT SIDE 275 (L) x 202 (B) x 150 (H) mm
DIMENSION (10.8" x 7.9" x 5.2")
IN SIDE 205 (L) x 180 (B) x 118 (H) mm
DIMENSION (8.0" x 7.0" x 4.5")
CAPACITY 13 Kg

U

SUGGESTIONS:1. Improvement in The Inventory Levels:

Inventories serve a variety of useful functions in an industrial economy. They can be used to get better prices, reduced costs, cover uncertainty, and reduce the need for organization.

Because investment in inventory can serve a useful purpose, there must be a proper level. Too much inventory is an unprofitable investment-- a truism that leads many managers to try to force the investment down.

During the implementation phase of the project, it was observed that for certain components the quantity was too high. These components as such required a lot of space, not because of their size or shape but due to the large quantity. An example of this is the Panel (R) Out; W023-58-030, and Panel (L) Out; W023-59-030;.

Both these components can be classified as slow moving rather extremely slow moving

however these components have such a high inventory that at present they are occupying six channels of the "H" rack, and as such are creating problems of following nature; these Door Panels are seldom ordered by the dealers since it is hard for the dealer to arrange for the spot welding which is the necessary factor for the assembly of the above said components with the other parts of the door. Also the welding of the door is not being carried out in the Body Shop, thus implying that these Door Panels can not be shifted over to the Main Store so that they can be used in the Body Shop. In brief, these Door Panels will remain a sort of burden on SPD untill and unless the assembly of the door is started in the Body Shop.

Thus excess quantity of the discussed components has proved to be effecting the material handling facilities in addition to the problem of inventory. Thus in this way the excess quantity of a particular component has also effected the industrial economy.

however these components have such a high inventory that at present they are occupying six channels of the "M" rack, and as such are creating problems of following nature; these Door Panels are seldom ordered by the dealers since it is hard for the dealer to arrange for the spot welding which is the necessary factor for the assembly of the above said components with the other parts of the door. Also the welding of the door is not being carried out in the Body Shop, thus implying that these Door Panels can not be shifted over to the Main Store so that they can be used in the Body Shop. In brief, these Door Panels will remain a sort of burden on SPD until and unless the assembly of the door is started in the Body Shop.

Thus excess quantity of the discussed components has proved to be effecting the material handling facilities in addition to the problem of inventory. Thus in this way the excess quantity of a particular component has also effected the industrial economy.

2. Procurement Of Components;

Certain components are being received for SPD from Mazda; Japan, however for the production purposes these are being procured from the approved Indian vendors. Thus for such components being received from Japan the prices may be more because of the freight charges and the Yen to Rupee ratio.

The procurement of Pipe, Fuel Main (WO22- 45-061 and WO23- 45-061) with the AN-AJ order can be considered as an example for the wrong procurement of the components. So here it is suggested that while raising the order for SPD the care should be taken that the indigenous parts are procured from the local vendors only.

OBJECTIVE:

To standardize packing cases for Spare Parts Division Stores in order to minimise the number of packing cases, which exist at present, with an eye on reducing the time that is taken in the execution of orders. Here it has to be noted that the time taken is quite more because of the manufacture of the packing case suitable for a particular set of the order received from the dealer. In a broad way it can be enlisted as follows:

1. To study the present mode of the packing cases being manufactured in the Spare Parts Division Stores for the execution of orders.
2. To study the nature of the orders received from the dealers.
3. To standardize the packing cases for
4. To standardize the packing cases for such components which however cannot be despatched with the other components.
5. To study the packing materials, and to provide the best suited packing materials for the cases.
6. To estimate the cost of each packing case.
7. To decide about the other facilities needed, this include the equipment needed i.e. The Paper Shredding Machine, and the Weighing Machine.

THE PROBLEM :-

The Spare Parts Division Store called SPD supplies the spare parts to a network of dealers all over India. When the order, the document send by the dealer to SML showing his requirements for the components, the components are pickied at the spare parts division stores and are taken over ^{for} the dispatching purposes. This activity of of executing the ordes is rather a long one. The components have to be send in the packing cases or the wooden boxes. For preparing the wooden boxes a carpenter has been employed. Here the carpenter plays a role in making the wooden boxes according to the amount or the quantity of the spareparts being send to the dealer. As such the dimensions of the packing cases vary from order to order, thus there is lot of variation in the shape and sizesof of the packing cases. The shape ,size, and the dimensions are all judged by the carpenter, i.e., there are no proper standards as such for ythese packing cases. In addition to it the making of the packing cases is quite

time consuming, which further delays the execution of the order. The transporter, who carries the packing cases having the spare parts to Chandigarh has to wait for considerable time. Which sometimes further delays the spare parts to reach the destination, i.e. sometimes the dealer also has to face odd situation and problems because of the nonavailability of the spare parts.

It can be concluded that the present case of the packing cases leads to a chain of problems, which can be summarised as

- (1) There exists a lot of packing cases
- (2) No packing cases are available in advance
- (3) The present condition of providing the packing cases is rather too time consuming
- (4) The dealer gets the packing cases and hence the spare parts rather late i.e. the time gap between the order raising and the order receiving is rather too much.

STANDARDIZATION:-

Standardization dates from the remotest antiquity and even extends to the beginning of civilization, the basis of which are speech, writing, weights, measurements and time etc. Fundamentals standards are usually established by the governments through Act of Parliament, while Industrial Standardization is of a very recent origin and depends upon mutual agreement and cooperation of all the interested parties viz, the producer, the seller and the user.

Definition:-

"A standard may be defined as that which is established by the authority, custom, or general consent as a model, criterion, or rule of measurement."

In general, it reflects the present state of development of the particular art or science. It may or may not be the result of scientific investigation, analysis, and synthesis.

Business standards are criteria which enable us to proportion and relate functions, physical factors, and

personnel to business objectives by means of policy.

Standardizing is merely the work of developing and applying such criteria.

Principle of Standardization:-

Principle of standardization is the Natural corollary of the Principle of Investigation. The establishment of a standard for the purpose of management, does not mean an absolute or final standard. It only implies the best current practice based upon advance knowledge and development attained so far and is subject to supersession at any time as a sequence of further advancement of knowledge in future.

During this lag, the standard set will be used to measure the actual performance.

Standardization in brief covers the following:-

1. Standardization of Nomenclature:-

It means the standardization of terminology i.e., of definitions, terms, symbols and abbreviations, without which no standardization is possible.

2. Standardization of Dimensions:-

Assembly and interchangeability, which are mainly responsible for large scale production, are not possible

without standardization of tolerances and allowances. The dimensional specifications of the Indian Standard Institution and British Standard Institution are in common use throughout the country. The standardization of items like Rolled steel sections, Rails, Pipeflanges, Key and keyways, and screw threads has proved to be extremely valueable.

3. Standardization of Materials:-

Specification prescribing the permissible minima with regard to composition and properties of materials are of specific value to all industries because these standards greatly facilitate sampling, buying, and a uniform flow of work during processing.

4. Equipment:-

Standardization not only extends in drilling machines, remers, milling cutt ers, dies, grinding wheels and belting etc, but even to complete motors, engines, cranes, boilers and locomotives etc. It may be classified as folloes

- (a) Plant, Machines, Tools and accesseries and their design.
- (b) Builiding, their size, type, design and layout.
- (c) Standardization of heat, light and ventilation etc. of building.

5. Methods of Manufacture:-

A standardized process implies the most efficient way of doing a job in accordance with the present available knowledge and has a diverse application as given below:-

- (a) Analysis of various tasks
- (b) Routing of the tasks
- (c) Feeds and speeds
- (d) Standardization of preparatory conditions prior to the operations
- (e) Treatment of raw material when in process
- (f) Material consumption and permissible waste

6. Personnel:-

Standardization is particularly applicable to the following:-

- (a) Training and aptitude
- (b) Wage rates
- (c) Operating times based upon time-study

7. Standardization of Finished Products:-

This is specially useful in respect of the following:-

(a) Specifications of raw materials required for a product with to quality and quantity.

(b) Type and dimensions

(c) Performances. Without standard performances compilation of production control boards or charts would be impracticable.

(d) Standardization of cost which makes comparison of prices easy.

8. Standardization of Safety Measures:-

This includes factor of safety in design, construction, and installation of the carriage way, etc.

Advantages of Standardization:-

(a) Standardization suppresses confusion. It simplifies purchase activity because prices can be easily compared and defective material can be guarded against.

(b) Standardization minimises the evil effects of seasonal variations by permitting the accumulation of huge quantities of stock during periods of slack demand, and levelling up the labour load and this stabilizes production and employment.

(c) Standardization enables production of more reliable and improved articles at a comparatively lower cost.

(d) Standardization enables interchangeability and easy assembly which is the key of large scale production.

(e) Standardization enables as well cheapens replacements.

this results in cheaper and easier maintenance and repairs.

(f) The design work becomes simplified because the components are standardized and redundant types and sizes are discarded.

Moreover, the concentration of the designer is on one single

design of and discovers the best possible solution in accordance with present available knowledge .

Disadvantages:-

(a) Standardization may retard invention, design and development.

The reason is that it becomes very cumbersome and expensive to change the design, and hence the standard.

(b) Standardization implies repetition of the same processes, which ultimately results in uniformity, monotony, and disappearance of initiative. It thus, destroys inventiveness, individuality and skilled craftsmanship.

(c) When standardization becomes a routine, it becomes very inconvenient and expensive to obtain unstandardized products.

STANDARDIZATION of PACKING CASES:- THE SOLUTION

The packing cases have been standardized to 5 sizes. These five packing cases will cover about 95 percent of the total components, that are presently available in the spare parts division stores. These cases will be procured in dismantled condition and suitable assembly will be made at works.

In addition to the above said 5 packing cases, a need was felt to provide special packing cases for certain components, which included such components which when sent with other components could harm the components. While the other components were quite fragile in nature and proper safety measures i.e. the packing material was necessary for them. There are 11 special cases which will cover items like

(a) Side Door Glass, Rear Window Glass

(b) Wind Shield Glass (For Bus)

(c) Wind Shield Glass (For Truck) /

(d) Rear Glass (For Bus)

(e) Side glasses (For Bus)

(f) Radiator

(g) Differential

(h) Door

(h) Engine/Transmission

(i) Seat

In other words a total of sixteen packing cases have been standardized, out of which 11 are the special packing cases. The break up is following

Description	Quantity
(a) Standardized Packing Cases	05
(b) Side Door Glass/Rear Window Glass	01
(c) Wind Shield Glass (For Bus)	01
(d) Wind Shield Glass (For Truck)/	01
Rear Glass (For Bus)	
(e) Side Glasses(For Bus)	03
(f) Radiator	01
(g) Differential	01
(h) Door	01
(i) Engine/Transmission	01
(j) Seat	01

For cabin CKD box No.8 will be used. The stores department has been told to preserve it and reuse it for SPD purposes

Packing Materials:

The following packing materials are suggested to be procured:

- (a) Khaki Paper
- (b) Polythene Bags in different size with "Swaraj Mazda Genuine Spare Parts" printed on it
- (c) Polythene Sheets
- (d) Paper Cuttings
- (e) Thermocole (26mm x 40mm x 60mm)
- (f) Packing Staps
- (g) " Multi Pack " stickers

The concerned departments have been instructed to procure the above said packing materials.

Equipments Required:

- (a) Paper Cutting Machine:-

The paper cutting machine will be required for producing the paper cuttings, which will be used as the packing material. This has been observed that the daily consumption of the paper cuttings is quite high, since each and every packing case

requires the paper cuttings as the packing materials.

In this regard enquiries were floated in the month of April 87 to the following companies;

M/s Feco Industries,

Mehta Road,

Maqbool Pura,

Amritsar.

(b)

New Dimensions,

E-401, Greater Kailash-II

New Delhi- 110048

(c)

Welcut Tool Agency,

221, Industrial Area, Phase-1

Chandigarh- 160002

Replies in this regard were received from all the three parties, however the product being manufactured by the first company was a hand operated one, since our requirements at SML is quite high, further negotiations were restricted to the other two parties.

(b) Weighing Machine:-

Weighing machines are also required in the SPD . Nowadays when the packing cases are being send to the dealers the packing cases are being got weighed at other places than SPD.

Also the packing cses have to be marked with , the weight being carried by it . So in this regard the enquiries were in the month of April 87, to the following comp anies;

(a)

Avery India,
28/2 Waterloo Street,
Calcutta.

(b)

Narne Tulaman Manufactures Private Limited,
Balanagar Township,
Hyderabad.

COSTING:-

The costing of the packing cases has been done considering the following.

Article	Cost
Kial Wood	Rs155 per cubic feet
Khaki Paper	Rs. .84 per metre square
Strap	Rs. .27 per 10 cms of length
Thermocole	Rs 100 per metre square (60 mm thick)
<i>plywood</i>	Rs. 56.0 per square metre
Overheads	
Rejection	10 percent of the material cost
Labour Cost	20 percent of total material cost
Profit	15 percent of the packing cost

Packing Case No. 11-

Requirements

Wood	7.346x10 ⁶ mm ³
Strap	1600 mm
Strap Closing Strips	02

Nails

Paper Cuttings

Costs

Wood Rs. 40.17 + 10% = Rs. 44.19

Strap Rs. 4.32 + 10% = Rs. 4.752

Strap closing Strips Rs. 0.50

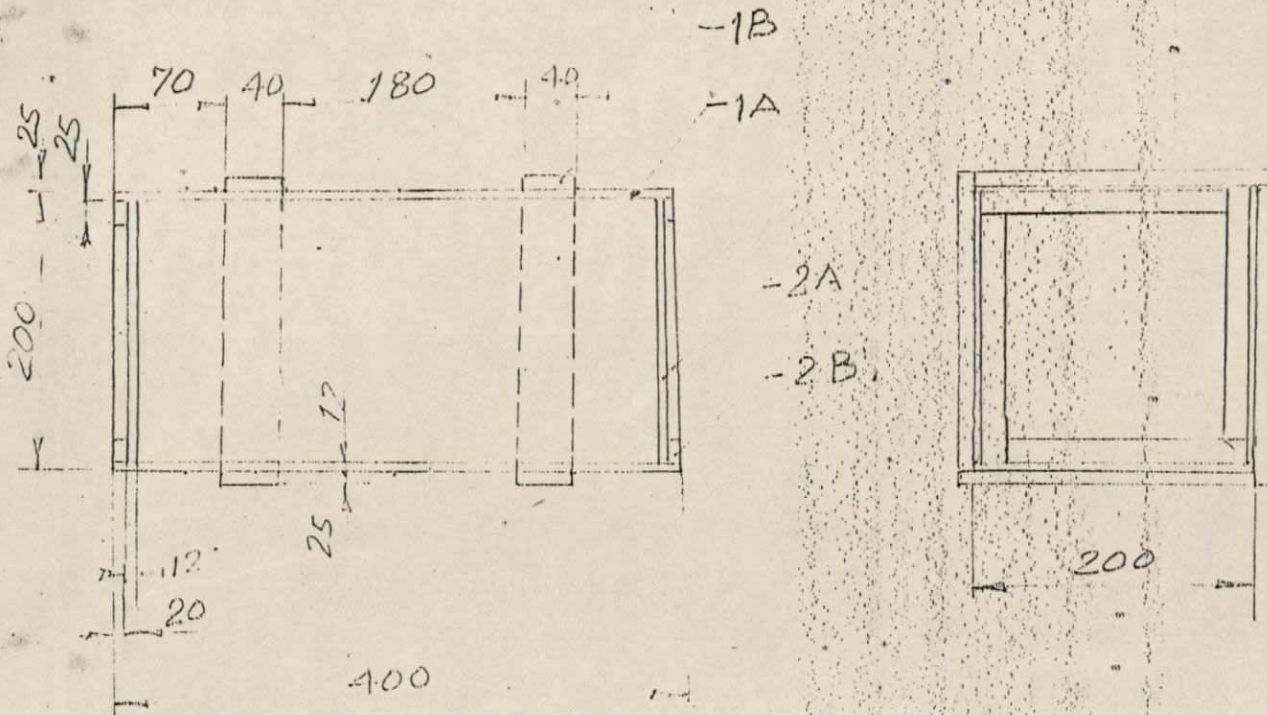
Nails and Paper Cuttings Rs. 2.0

Total Material Cost Rs. 51.44

Labour Cost Rs. 10.28

Profit Rs. 9.26

Total Cost Rs. 70.98



ITEM	QTY	DESC.	SIZE	MATL
1	4	BASE	-	WOODS
1A	4	PLANK	12 X 200 X 400	
1B	8	BATTEN	25 X 40 X 225	
2	2	END	-	
2A	2	PLANK	12 X 200 X 200	
2B	8	SUPPORT	20 X 25 X 175	

PACKING CASE NO 1

SUBJECT FOR SMALL SIZE COMPONENT

Packing Case No. 2:-

Requirements

Wood	2.9 x 10 mm	7 3
Strap	3200 mm	

Strap Closing Strips	02
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Nails

paper Cuttings

Costs

Wood	Rs. 161.91 + 10 % = Rs. 178.10
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Strap	Rs. 8.64 + 10% = Rs. 9.50
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Strap Closing Strip	Rs. 0.50
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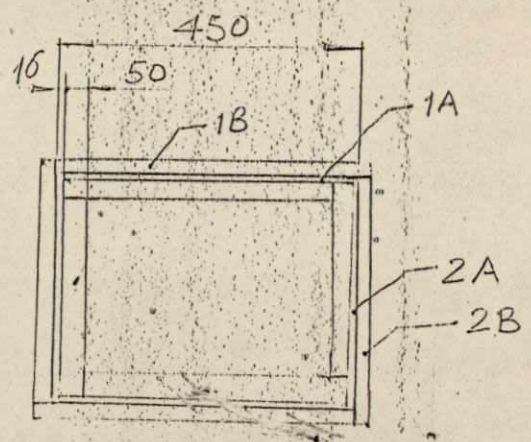
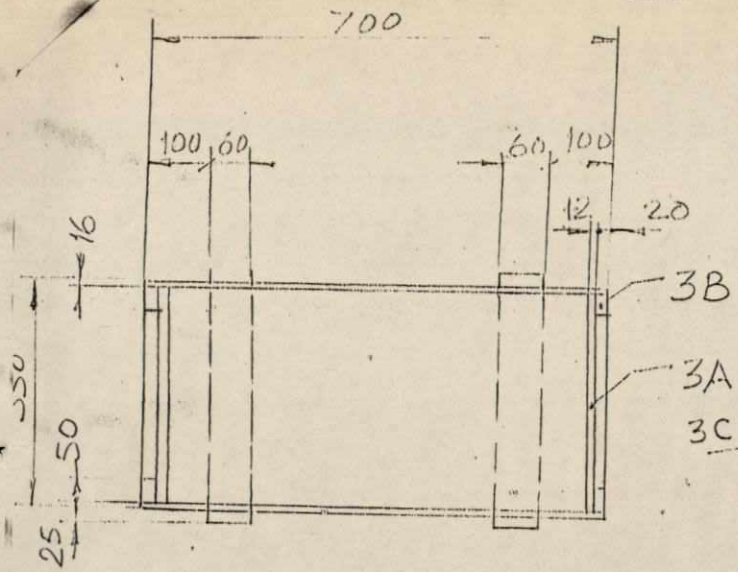
Nail and paper Cuttings	Rs. 5.0
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Total Material Cost	Rs. 193.10
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Labour Cost	Rs. 38.62
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Profit	Rs. 34.75
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Total Cost	Rs. 266.75
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IT NO.	Qty	DESC.	SIZE	ALT.	MAT
1	2	BASE	-		WOC
1A	2	PLANK	16x450x700		"
1B	4	BATTON	25x60x475		"
2	2	SIDE	-		"
2A	2	PLANK	16x350x700 / 16x450x700		"
2B	4	BATTON	25x60x375 / 25x60x475		"
3	2	END	-		"
3A	2	PLANK	12x350x450 / 12x450x450		"
3B	4	SUPPORT	20x50x400		"
3C	4	"	20x50x300 / 20x50x400		"

PACKING CASE NO 2 / 2 ALT.
 FOR MEDIUM SIZE COMPONENTS

Packing Case No. 3:-

Requirements

Wood 4.78 x 10⁷mm³

Strap 3600mm

Strap Closing Strips 02

Nails

Paper Cuttings

Costs

Wood Rs. 261.84 + 10%/. = Rs. 287.84

Strap Rs. 9.72 + 10%/. = Rs. 10.69

Strap Closing Strips Rs. 0.50

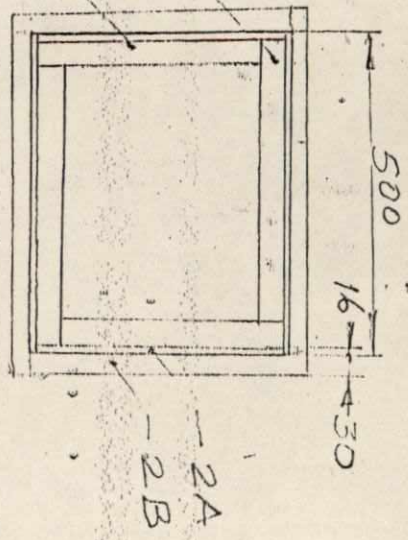
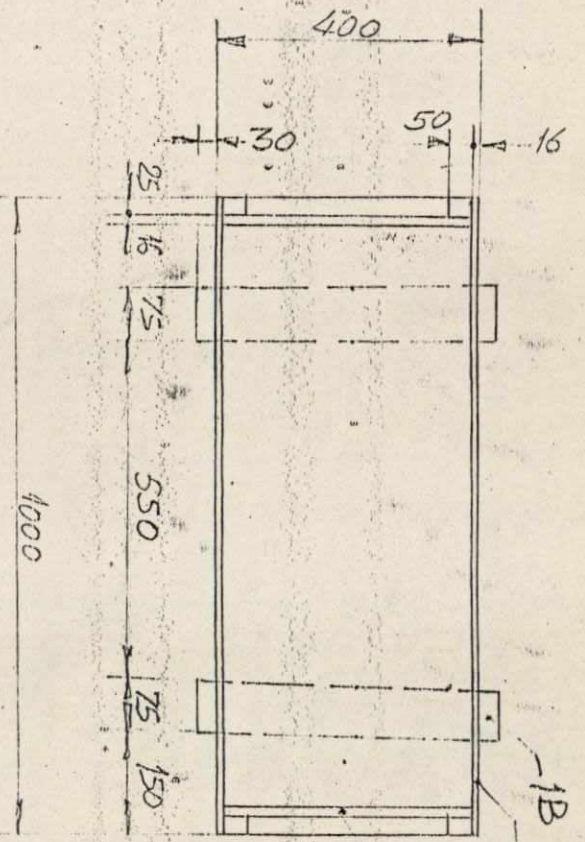
Nails and Paper Cuttings Rs. 7.0

Total Material Cost Rs. 306.03

Labour Cost Rs. 61.20

Profit Rs. 55.08

Total Cost Rs. 422.31



SNO	QTY	DESC.	SIZE / ALT.	MATL.
1A	2	BASE PLANK	16 X 500 X 1000	WOOD
1B	4	BATTON	30 X 75 X 530	"
2A	2	SIDE PLANK	16 X 400 X 1000	WOOD
2B	4	BATTON	30 X 75 X 430	"
3	2	END PLANK	16 X 400 X 500	"
3A	2	PLANK	16 X 400 X 500	"
3B	4	SUPPORT	25 X 50 X 350	"
3C	4	SUPPORT	25 X 50 X 450	"

SUBSTITUTE FOR PROPELLER SHAFT, MAIN SILENCER, DUCT AIR -
 INSTEAD, SHAFTS AND MEDIUM SUPPLIES
 FROM MTS BLET.

Packing Case No. ① :-

Requirements

Wood 7 3
7.44 x 10 mm

Strap 3000

Strap Closing Strips 02

Nails

Paper Cuttings

Costs

Wood Rs. 406.97 + 10% = Rs. 447.66

Strap Rs. 8.30 + 10% = Rs. 8.91

Strap Closing Strips Rs. 0.50

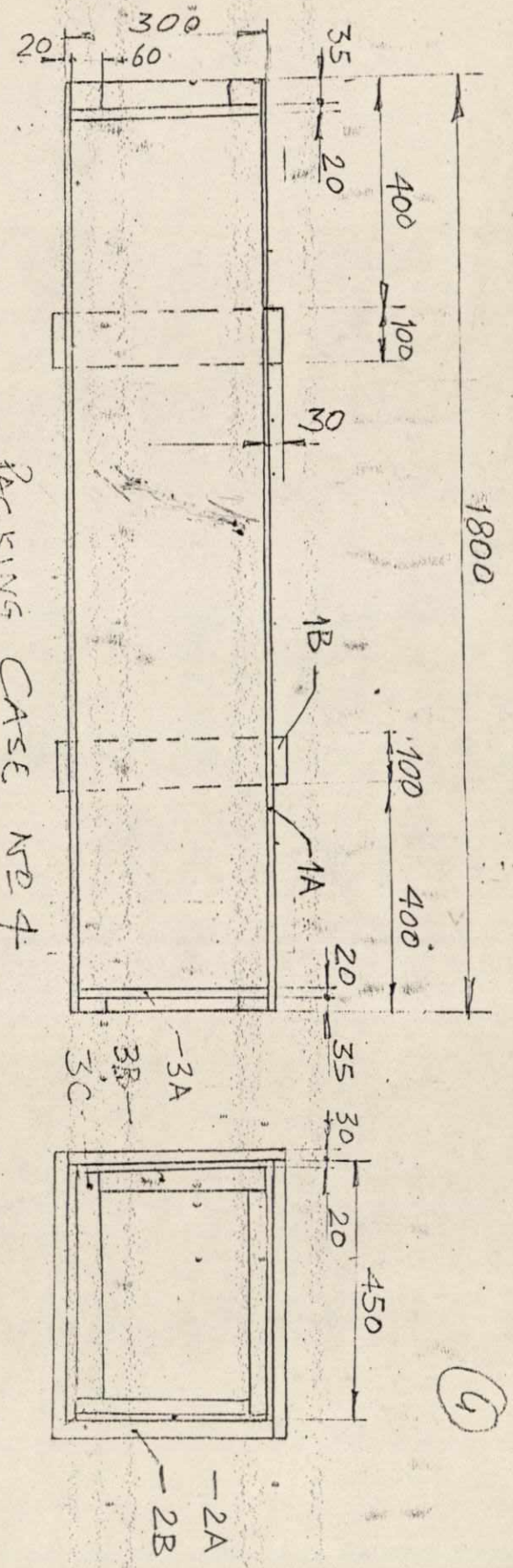
Nails & Paper Cuttings Rs. 8.0

Total Material Cost Rs. 465.07

Labour Cost Rs. 93.02

Profit Rs. 83.71

Total Cost Rs. 641.80



PACKING CASE NO 4

S. NO	QTY	DESC	SIZE	MATL
1A	2	BASE PLANK	20 X 450 X 1800	WOOD
1B	4	BATTON	30 X 100 X 480	"
2A	2	SIDE PLANK	20 X 300 X 1800	"
2B	4	BATTON	30 X 100 X 330	"
3	2	END		
3A	2	PLANK	20 X 300 X 450	"
3B	4	SUPPORT	35 X 60 X 240	"
3C	4	SUPPORT	35 X 60 X 390	"

FOR AXLE / LEAF SPRINGS / LARGE SUPPLIES
CROSS MEMBERS

(4)

Packing Case No. 5:-

Requirements:

Wood $1.37 \times 10^8 \text{ mm}^3$

Strap 3600 mm

Strap Closing Strips 02

Nails

Paper Cuttings

Costs

Wood Rs. 749.39 + 10 % = Rs. 824.33

Straps Rs. 9.72 + 10 % = Rs. 10.69

Strap closing strips Rs. 0.50

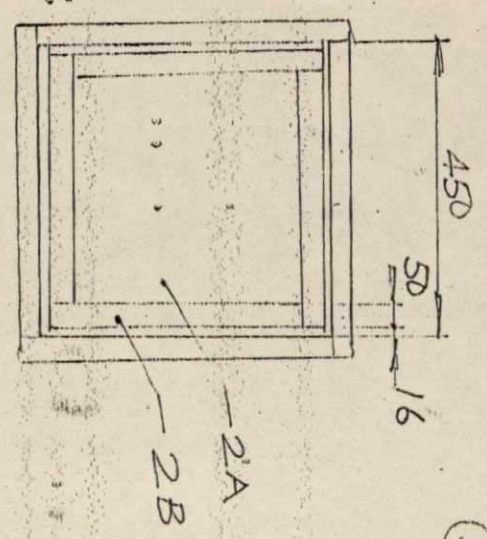
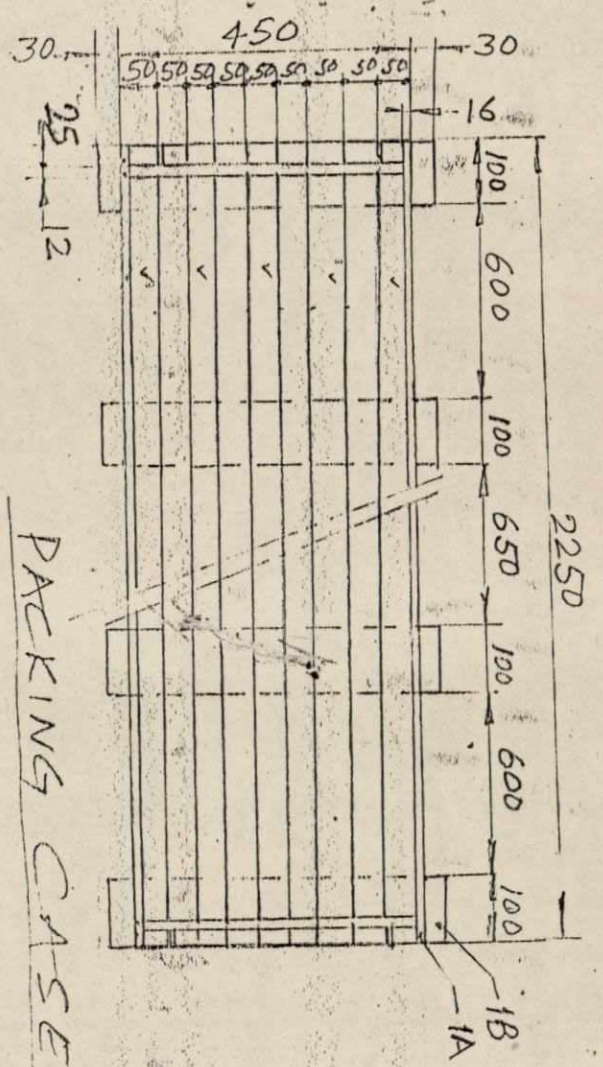
Nails & Paper Cuttings Rs. 10.0

Total Material Cost Rs. 845.52

Labour Cost Rs. 169.10

Profit Rs. 152.29

Total Cost Rs. 1166.81



PACKING CASE N.O. 5

QTY	DESC.	SIZE	MATL
1	SNE		
4	BASE		
20	FLATS	16x50x2250	WOOD
16	BATTON	30x100x480	"
2	END PLANK	12x450x450	"
2	SUPPORT	25x50x400	"

FRONT & REARS, BUMPERS, TAIL PIPE
 RADIATOR GRILL; CROSS-INST. PANEL

Packing Case For Wind Shield (For Truck) /Rear Glass (For Bus);;--

Requirements

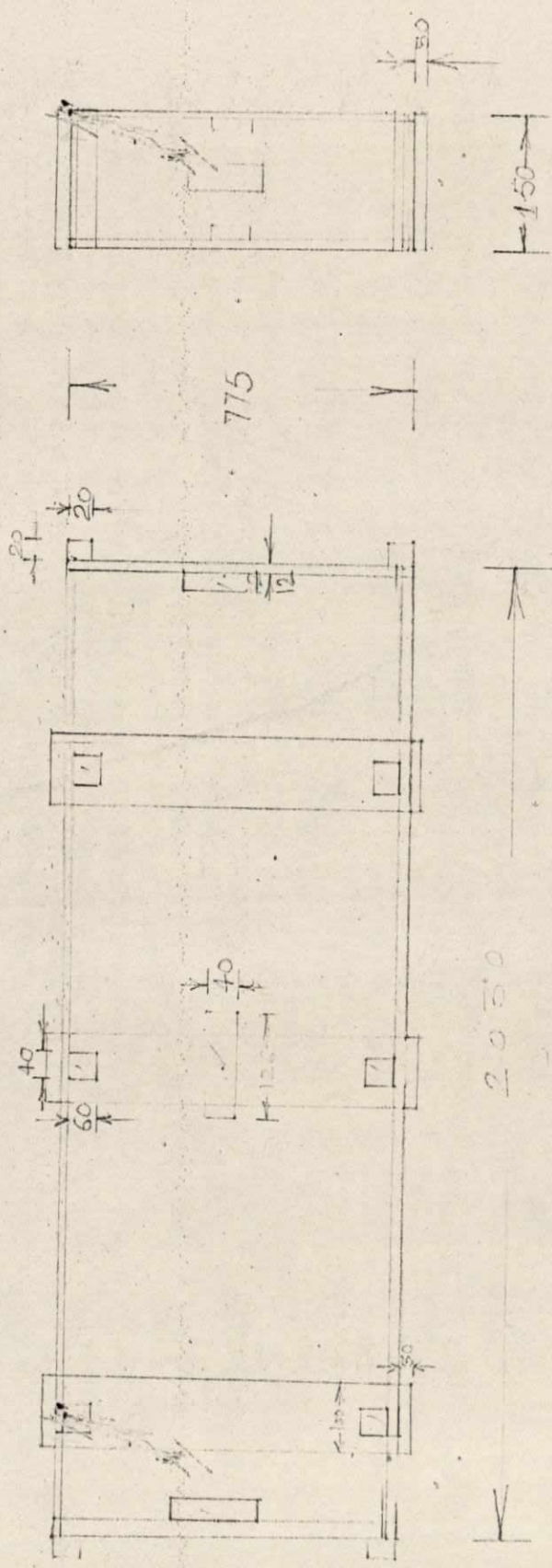
Wood	5.01 x 10 ^{7 3} mm
Brown Paper	4.8 x 10 ^{7 2} mm (for one glass)
S Strap	3940 mm
Thermopack	10 in quantity of dimensions 126mmx40mmx60mm

Nails

Paper Cuttings

Costs

Wood	Rs. 274.04 + 10 [°] / . = Rs. 301.44
Brown Paper	Rs. 1.21 + 10 [°] / . = Rs. 1.33
Strap	Rs. 10.64 + 10 [°] / . = Rs. 11.70
Thermopack	Rs. 5.04 + 10 [°] / . =Rs. 5.54
Nails and Paper Cuttings	Rs. 8.00
Strap Closing Strips	Rs. 0.50
Total Material Cost	Rs. 328.51
Labour Cost	Rs. 65.70
Profit	Rs. 59.13
Total Cost	Rs. 519.04



wind shield truck / Rear glass for bus

Maximum 3

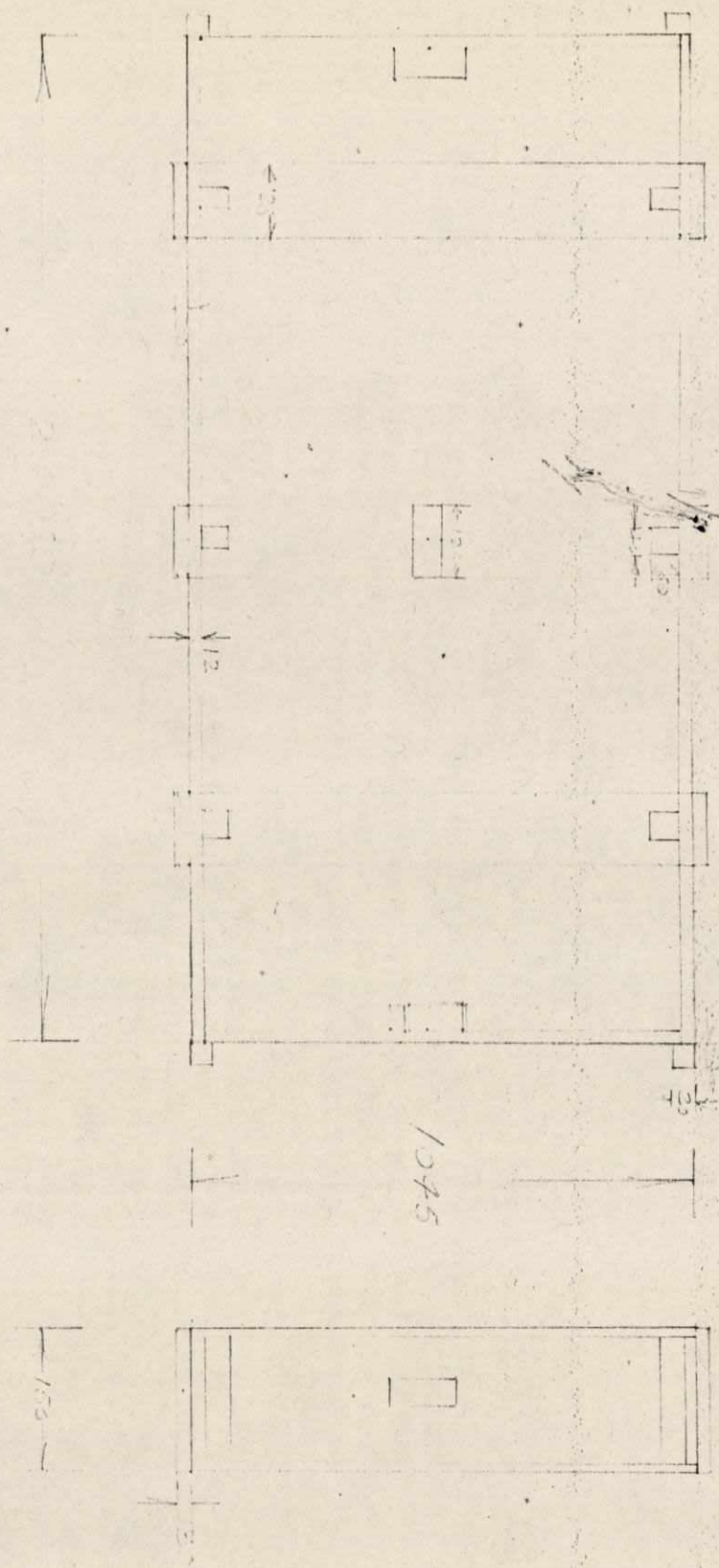
Packing Case for Wind Shield Glass for Bus--

Requirement

Wood	$7.62 \times 10^7 \text{ mm}^3$
Brown Paper	$6.80 \times 10^6 \text{ mm}^2$
Strap	4780 mm
Thermopack	10 in quantity of dimensions 126 mm x 40mmx60
Strap Closing Strips	02
Nails	
Paper Cuttings	

Costs

Wood	$\text{Rs. } 416.81 + 10\% = \text{Rs. } 458.49$
Brown Paper	$\text{Rs. } 17.15 + 10\% = \text{Rs. } 18.86$
Strap	$\text{Rs. } 12.90 + 10\% = \text{Rs. } 14.19$
Thermopack	$\text{Rs. } 5.04 + 10\% = \text{Rs. } 5.54$
Strap Closing Strip	Rs. 0.50
Nails & Paper Cuttings	Rs. 8.00
Total Material Cost	Rs. 505.58
Labour Cost	Rs. 101.12
Profit	Rs Rs. 91.00
Total Cost	Rs. 697.70



1045

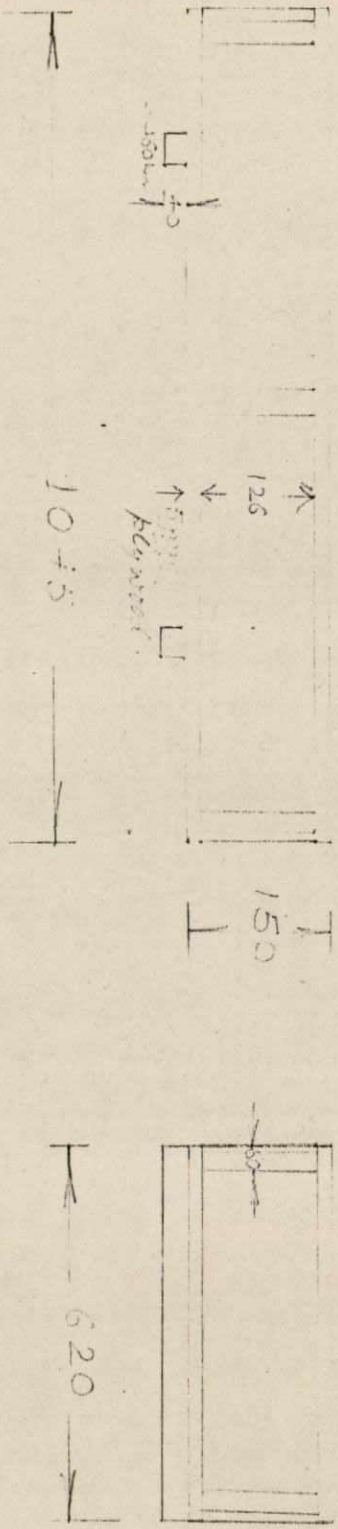
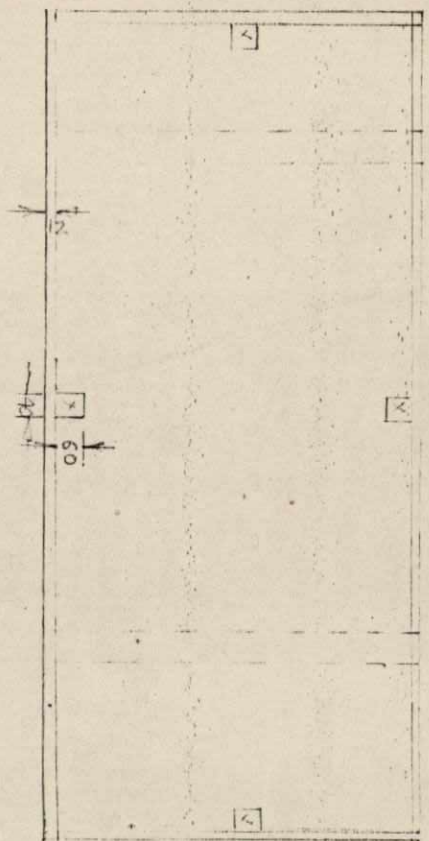
Packing Case for Side Door Glass/ Rear Window Glass:-

Requirements

Wood	$7.87 \times 10^6 \text{ mm}^3$
Plywood	$1.29 \times 10^6 \text{ mm}^2$
Brown Paper	$1.121 \times 10^6 \text{ mm}^2$
Strap	3080 mm
Thermopack	04 in quantity of dimensions 126mmx60mmx40mm

Cost

Wood	Rs. 43.08 + 10%/. = Rs 47.38
Plywood	Rs. 72.24 + 10 / . = Rs 79.46
Brown Paper	Rs. 2.82 + 10 %/. = Rs 3.10
Strap	Rs. 8.316 + 10 %/. = Rs 9.15
Thermopack	Rs. 2.02 + 10 %/. = Rs 2.22
Strap Closing Strips	Rs. 0.50
Nails & Paper Cuttings	Rs. 3.00
Total Material Cost	Rs. 144.81
Labour Cost	Rs. 28.96
Profit	Rs. 26.07
Total Cost	Rs. 199.84



Size of room is 120 x 150
 However
 3

Packing Case for Side Glass For Bus (1):--Requirement^s

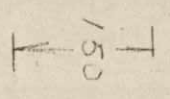
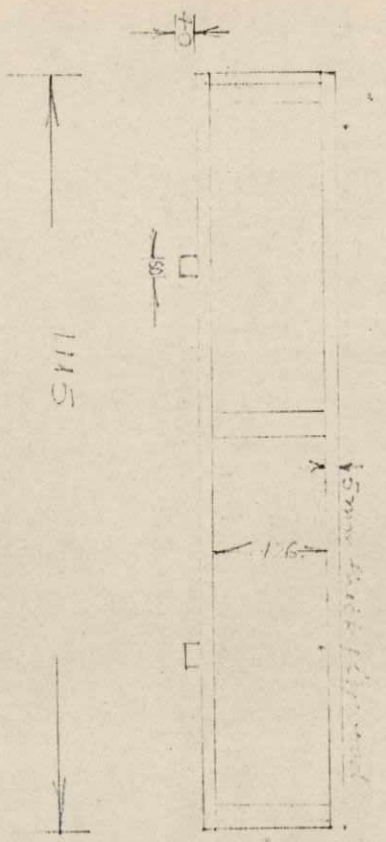
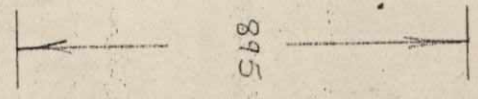
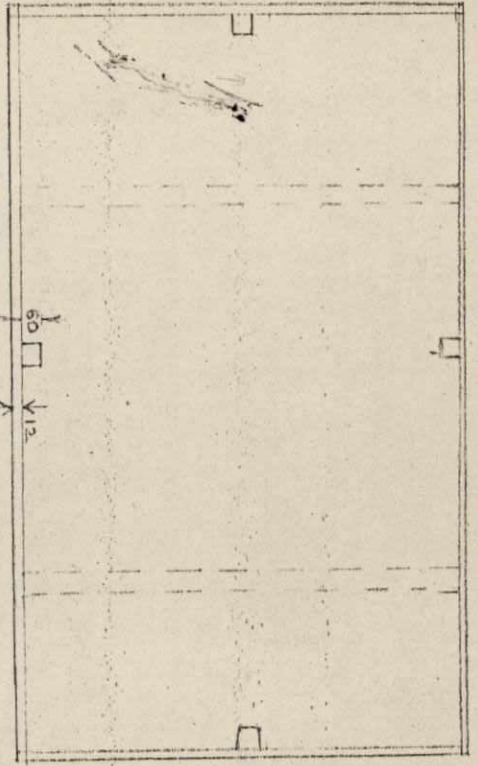
Wood	$3.09 \times 10^7 \text{ mm}^3$
Plywood	$1.99 \times 10^6 \text{ mm}^2$
Brown Paper	$2.92 \times 10^6 \text{ mm}^2$
Strap	4180mm
Thermopack	04 in quantity of dimensions 126mm x 40mm x 60mm
Strap Closing Strips	02

Nails

Paper Cuttings

Costs

Wood	Rs. 168.96 + 10% = Rs. 185.86
Plywood	Rs. 111.77 + 10% = Rs. 122.95
Brown Paper	Rs. 7.35 + 10% = Rs. 8.08
Strap	Rs. 11.28 + 10% = Rs. 12.40
Thermopack	Rs. 2.02 + 10% = Rs. 2.21
Strap Closing Strip	Rs. 0.50
Nails & paper Cuttings	Rs. 8.00
Total material Cost	Rs. 340.00
Labour Cost	Rs. 68.00
Profit	Rs. 61.20
Total Cost	Rs. 469.20



*For Side Plans to be
Maximum 3*

Packing Case for Side Glass for Bus (2) :-**Requirements**

Wood	$7.76 \times 10^6 \text{ mm}^3$
Plywood	$1.43 \times 10^6 \text{ mm}^2$
Brown Paper	$1.97 \times 10^6 \text{ mm}^2$
Strap	3840 mm
Thermo pack	04 in quantity of dimensions 126mm x 40mm x 60mm

Strap Closing Strips 02**Nails****Paper Cuttings****Costs**

Wood	$\text{Rs. } 42.42 + 10\% = \text{Rs. } 46.66$
Plywood	$\text{Rs. } 79.83 + 10\% = \text{Rs. } 87.82$
Strap	$\text{Rs. } 10.37 + 10\% = \text{Rs. } 11.40$
Brown Paper	$\text{Rs. } 4.95 + 10\% = \text{Rs. } 5.45$
Thermopack	$\text{Rs. } 2.0 + 10\% = \text{Rs. } 2.20$

Strap Closing Strips. 0.50

Nails & paper Cuttings Rs. 3.00

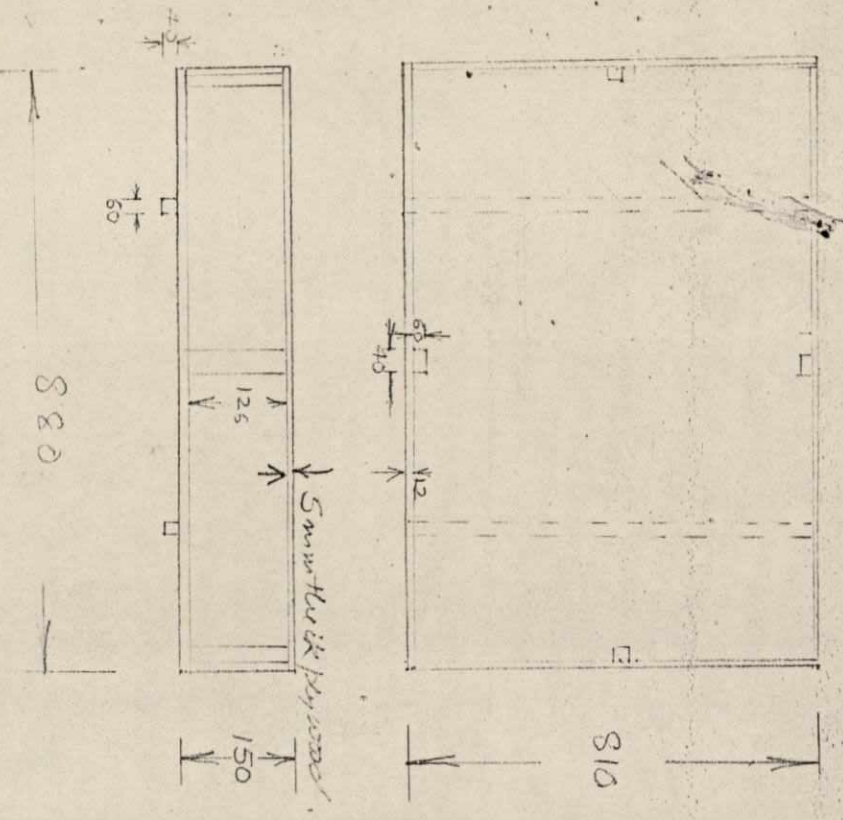
Total Material Cost Rs. 159.03

Labour Cost Rs. 31.47

Profit Rs. 28.27

Total Cost Rs. 216.71

For 2 side glass bus
Maximum 3



Packing Case for Side Glass for Bus (3):-

Requirement

Wood	6.64 x 10 ⁶ x 10 ³ mm
Plywood	7.26 x 10 ⁵ x 10 ² mm
Brown Paper	1.8 x 10 ⁶ x 10 ² mm
Strap 8	2340 mm
Thermopack	04 in quantity of dimensions 126mmx40mmx60mm

Strap Closing Strip 02

Nails

Paper Cuttings

Costs

Wood	Rs. 36.29 + 10 % = Rs. 39.92
Plywood	Rs. 40.65 + 10 % = Rs. 44.72
Strap	Rs. 6.32 + 10 % = Rs. 6.95
Brown Paper	Rs. 4.54 + 10 % = Rs. 5.00
Thermopack	Rs. 2.00 + 10 % = Rs. 2.20

Strap Closing Strip Rs. 0.50

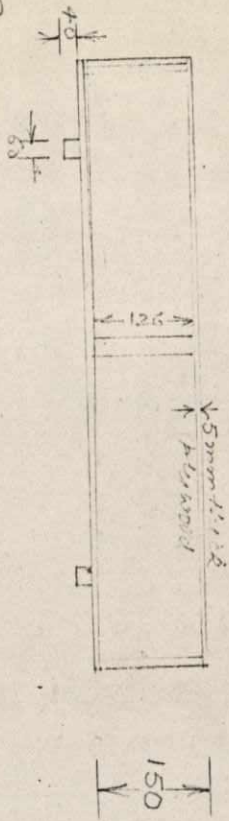
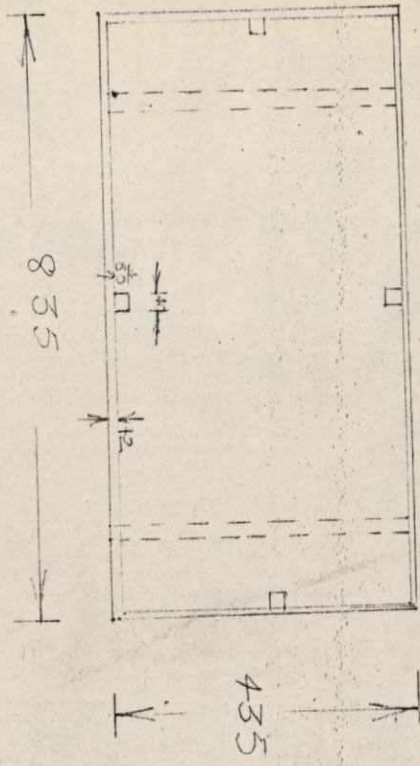
Nails & Paper Cuttings Rs. 2.00

Total Material Cost Rs. 101.29

Labour Cost Rs. 20.26

Profit Rs. 18.23

Total Cost Rs. 139.78



For Side Glass bus (3)
 No. 21 mm x 3

Packing Case for Radiator:-

Requirements

Wood 4.32 x 10⁷ x 3³ mm

Strap 3400mm

Strap Closing strip 02

Nails

Paper Cuttings

Costs

Wood Rs. 236.25 + 10 / . = Rs. 259.88

Strap Rs. 9.18 + 10 / . = Rs. 10.00

Strap Closing Strips. 0.50

Nails & Paper Cuttings Rs. 7.00

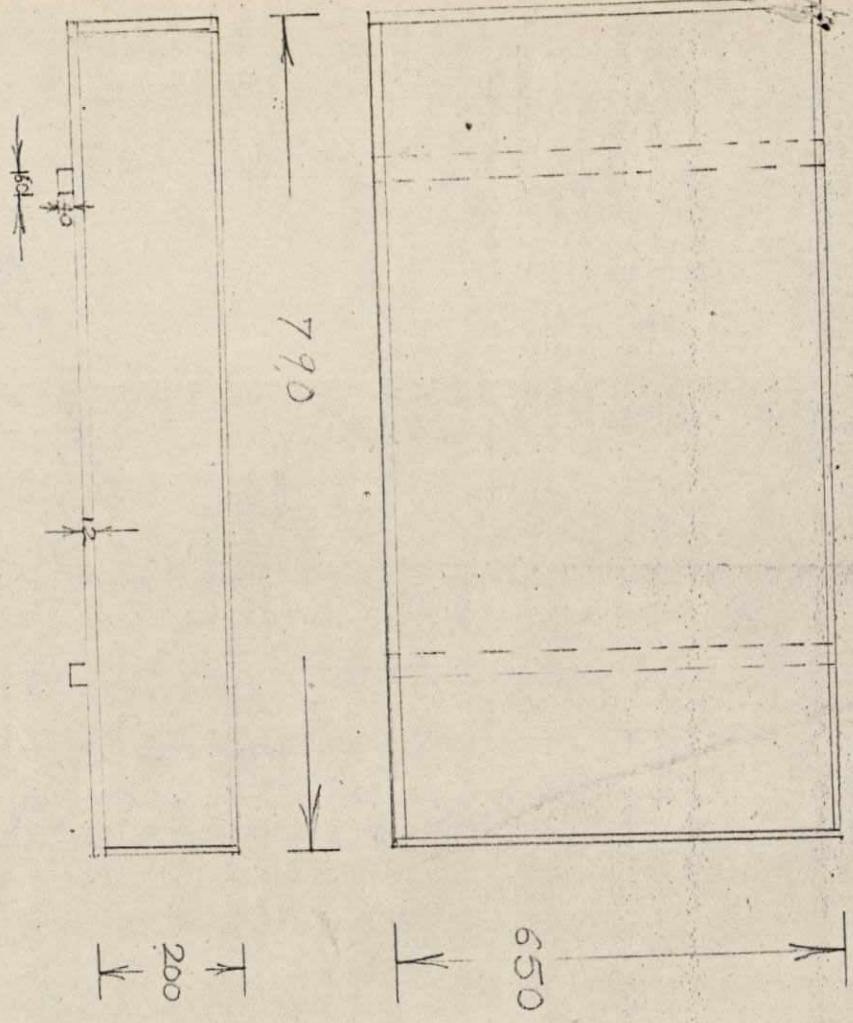
Total Material Cost Rs. 277.48

Labour Cost Rs. 55.50

Profit Rs. 49.95

Total Cost Rs. 382.93

For Radiator



Packing Case for Books-**Requirements**

Wood $6.28 \times 10^7 \text{mm}^3$

Strap 6080mm

Strap Closing Strips 02

Nails

Paper cuttings

Costs

Wood Rs. 343.51 + 10 % = Rs. 377.86

Strap Rs. 8.20 + 10 % = Rs. 9.02

Strap closing Strips Rs. 0.50

Nails & Paper Cuttings Rs. 2.00

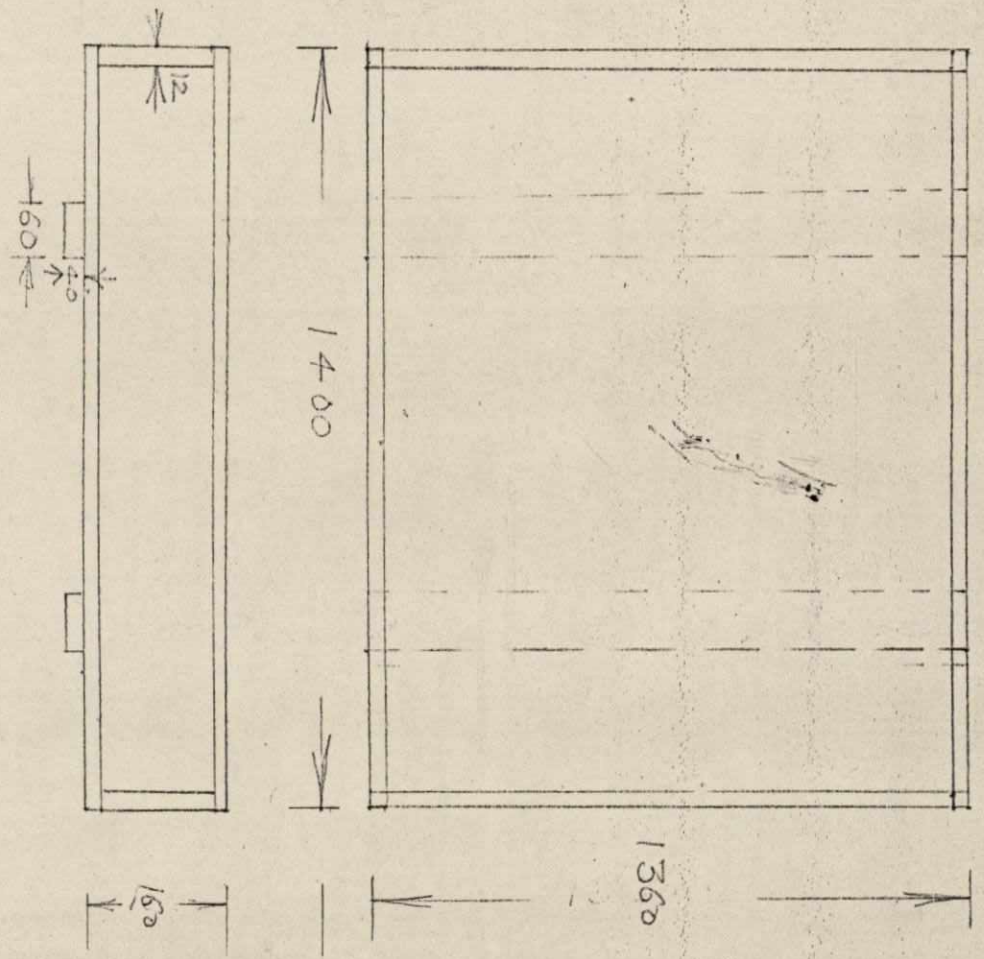
Total Material Costs. 395.38

Labour Cost Rs. 79.08

Profit Rs. 71.17

Total Cost Rs. 545.63

For Door
Maximum: 2



Packing Cases For Differential:-

Requirements

Wood $5.62 \times 10^7 \text{ mm}^3$

Strap 2400mm

Strap Closing Strip 02

Nails

Paper Cuttings

Costs

Wood Rs. 307.35 + 10 / . = Rs. 338.09

Strap Rs. 6.48 + 10 / . = Rs. 7.13

Strap Closing Strip Rs. 0.50

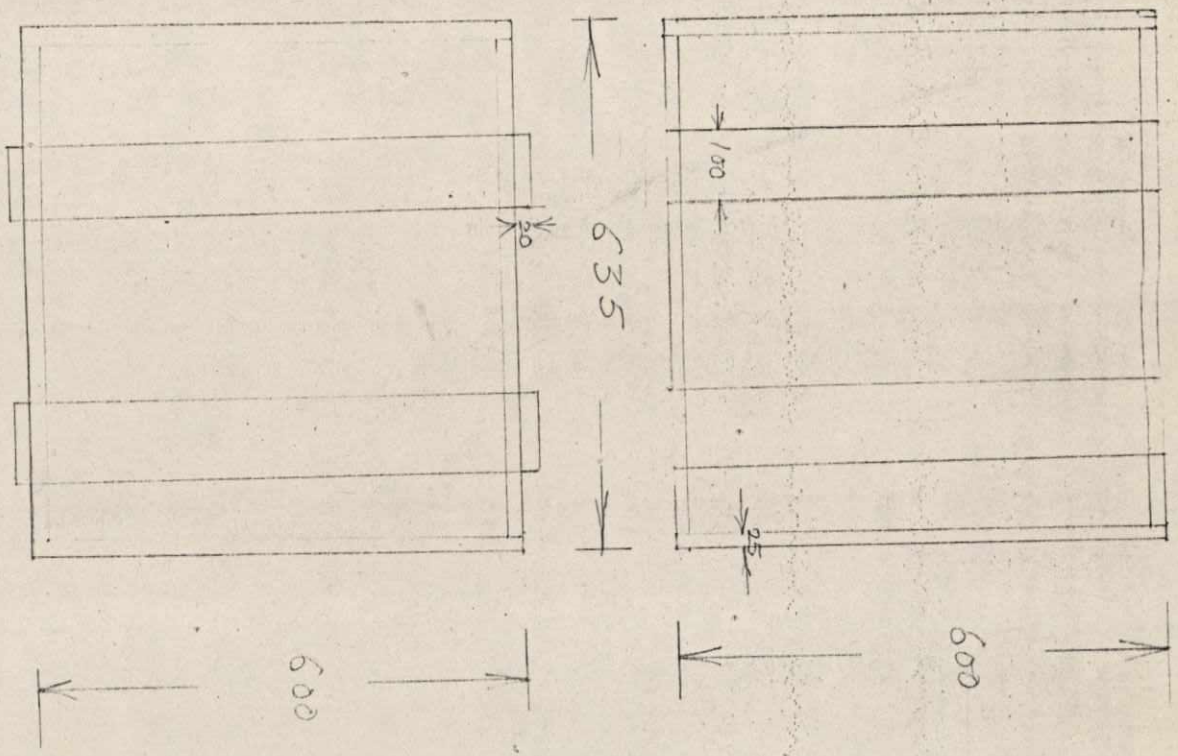
Nails & Paper Cuttings Rs. 8.00

Total Material Costs Rs. 353.72

Labour Cost Rs. 70.75

Profit Rs. 63.67

Total Cost Rs. 488.14



Box for different

Packing Case for Seat :-

Requirements

Wood 5.83 x 10⁷ mm³

Strap 3120mm

Strap Closing Strip 02

Nails

Paper Cuttings

Costs

Wood Rs. 318.90 + 10 /% = Rs. 350.79

Strap Rs. 16.48 + 10 /% = Rs. 18.53

Strap Closing Strips. 0.50

Nails & Paper cuttings Rs. 3.00

Total Material Cost Rs. 377.82

Labour Cost Rs. 75.56

Profit Rs. 68.00

Total Cost Rs. 521.38

Packing Case for Engine & Transmission :-

Requirements

Wood 8 03
1.90 x 10 mm

Strap 8200mm

Strap Closing Strip 02

Nails

Paper Cuttings

Costs

Wood $\text{Rs. } 1040.94 + 10 \%$ = $\text{Rs. } 1145.03$

Strap $\text{Rs. } 22.14 + 10 \%$ = $\text{Rs. } 24.35$

Strap Closing Strips. 0.50

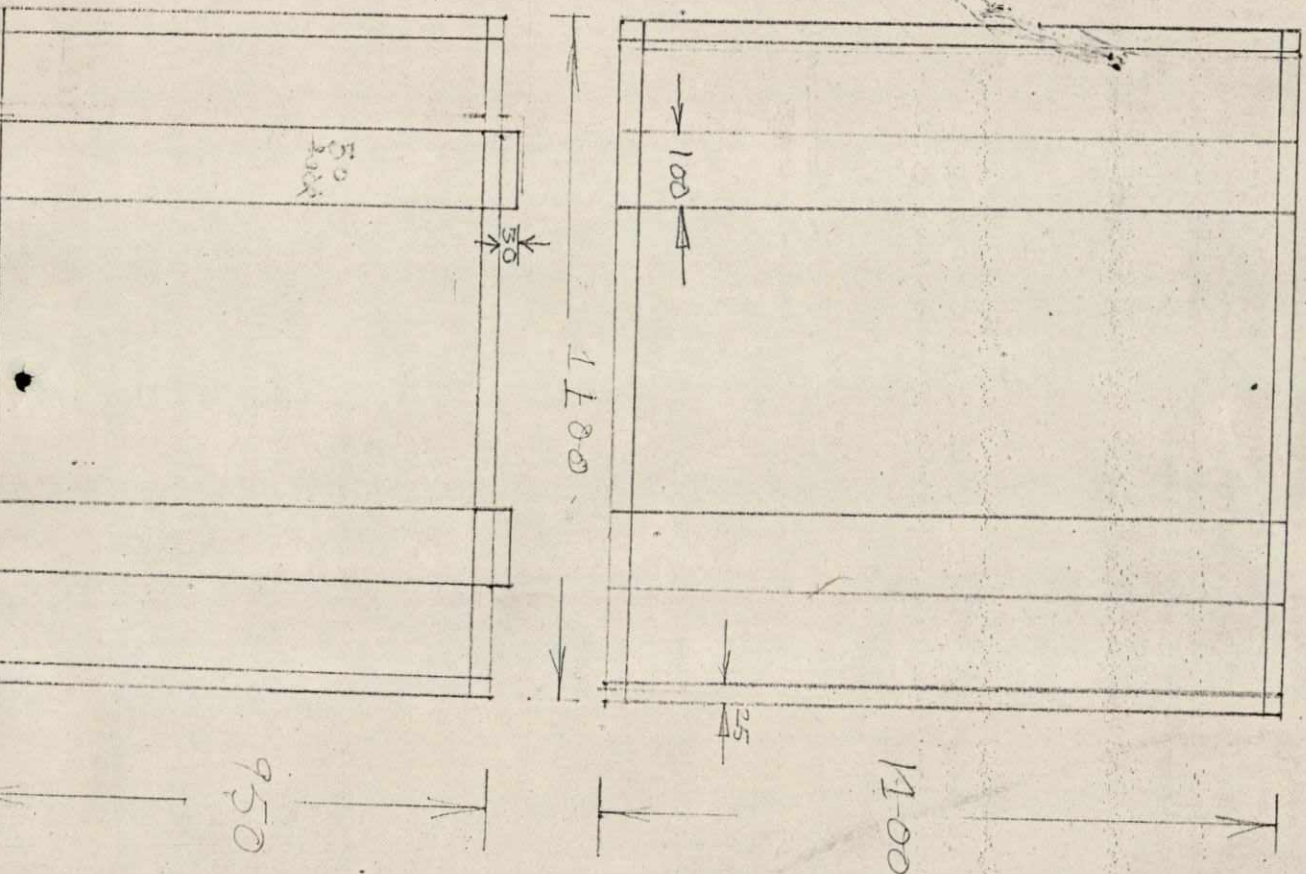
Nails & Paper Cutting $\text{Rs. } 12.00$

Total Material Costs. 1181.88

Labour Cost $\text{Rs. } 236.38$

Profit $\text{Rs. } 212.74$

Total Cost $\text{Rs. } 1630.99$



For
 Engine / Tank
 dimensions -

FIXATION OF STANDARDS
FOR "A" CLASS CONSUMABLES
USED IN PAINT SHOP

OBJECTIVE:

To set the standards for the 'A' class consumables used in the Paint Shop, i.e. to determine the consumption of the consumables which fall in the 'A' class, per vehicle. In a broad way the following can be enlisted:

1. To study the various consumables used in the Paint Shop, i.e. their use, application, area of application, significance, and the source.
2. To determine the cost per vehicle of each consumables.
3. To determine the consumption per vehicle of each consumable.
4. To classify the consumables in three classes namely 'A', 'B', and 'C'; with the help of the ABC Method of Analysis.
5. To separate out the 'A' class of consumables.
6. To determine the specifications of these consumables and the area of cabin and cargo on which they are applied.
7. To set the standards for these above mentioned consumables.

FIXATION of STANDARDS for 'A' CLASS CONSUMEABLES (PAINT SHOP):-

The Paint Shop Is that link of the manufacturing division where the Cabin is received from the Body Shop and are send to the main assembly , after the painting action has been carried over the cab. There are two lines in the paint Shop; The Pretreat^{ment} Line and The Paint Line. The Cabin has to pass through both the lines, however the cargo has to pass through the main line only , and the paint is applied here on the cargo box. The cargo box as received from the vendor is already pretreated and also has the primer coat on it. In addition to cabin and cargo the rims are also painted here; these are then send to the main line, however they chassis parts , which are just black dipped are send to the Body Shop.

There are some 42 consumeables in the Paint Shop. Some of these are used in the pretreatment line while others are used in the main line. Local vendors have been developed for the supply of these consumeables; these vendors are supplying the consumeables for the paint shop; Asian Paints, Anchemco Pyrine Rai, Addisions Paints, Dunlop, Chandigarh Electric company.

In this regard the consumables have been classified in the basic categories namely, Class 'A'; Class 'B'; Class 'C'; this has been done with the help of the main tool of inventory management i.e., The ABC Method of Analysis. In Brief according to this method, a small percentage of items in the stock room make up a large portion of the inventory level. These are classified as class 'A' items. The Class 'B' items have an average importance and receive a normal amount of attention. The class 'C' items are comparatively unimportant, well over half of the consumables are in this class.

The next action was to determine the application of the class 'A' consumables. This action involved the determination of the use and the specifications of each. This class 'A' of the consumables include the following

1. M. G. Top Coat Paints

(a) Nile Blue



(b) Santos Red



(c) Light Beige



2. Water Soluble Black

3. Thermo Setting Primer Surface Grey

4. Stoving Mettalic Silver for Wheels

5. Stoving Thinner for Primer And Top Coat

The next action was to set the standards for the above mentioned consumeables. In this it was supposed to provide the consumption of the consumeable per vehicle.

The ABC Method of Analysis:-

The ABC method of inventory control is used to keep the amount of attention given an item somewhat in proportion to its importance. This method of inventory management was developed by H. Ford Dickie at the General Electric Company. The importance of an item is determined by the value of the use in a period of time, the time required to replenish depleted stocks of the item, and the costs caused by the occurrence of a stock-out. A small percent of the items in a stockroom makes up a large portion of the inventory investment. These are considered to be class A items. Special care is used to maintain the accuracy of the perpetual inventory records of these items. Both the suppliers and the manufacturing division of the company are required to use extra efforts to meet the scheduled dates of delivery. The engineering and manufacturing departments seek designs and methods of processing that will hold the lengths of the delivery cycles of these items to a minimum.

The class B items have average importance and receive the normal amount of attention. It has to be that class B is made up of items that are neither A or C.

The class C items are comparatively unimportant. Usually, well over half the items kept in the stock are in this class. They make up only a small part of the inventory investment. The Inventory control system for these items may be a simple two-bin system. Many companies have realized worthwhile savings from the informed use of this method of inventory control.

Production Record for Period : Feb. '86 to Dec. '86

Nile Blue	
Cabin	703
Cargo Box	607
Santos Red	
Cabin	327
Cargo Box	273
Light Beige	
Cabin	162
Cargo Box	135
Total Cabins	1469
Total Cargo Boxes	1015
Total Wheel Rims	10283

SPECIFICATIONS

<u>S.No.</u>	<u>Description</u>	<u>Specific Gravity</u>	<u>Solid Content</u>	<u>Thickness of dry film</u>
01.	Thermosetting Primer Surface Grey	1.26 \pm 0.03	58% Min.	25 - 35 Micron
02.	Santos Red	1.02 \pm 0.02	48% Min.	25 - 35 Micron
03.	Nile Blue	1.05 \pm 0.02	50% Min.	25 - 35 Micron
04.	Light Beige	1.05 \pm 0.02	50% Min.	25 -35 Micron
05.	Water Soluble Black	1.02 \pm 0.02	28-30	45 Micro

Paint Areas :-Cabin :

<u>Description</u>	<u>Paint Area</u>
Back Panel	3.2 m ²
Roof Panel	3.6 m ²
Doors	3.7 m ²
Floor	2.1 m ²
Panel, Front	1.2 m ²
Panel Pillars & Side Sills	4.3 m ²
Foot Rests	0.29 m ²
Housing Camp	0.095 m ²
Lower Grill	0.21 m ²
Member No.2, Cross	0.8 m ²
Panel Fender	0.2 m ²
Roof Ventilator	0.82 m ²

Cargo Box (WT-49) :-

Load Rest	3.5 m ²
Side Doors	13.9 m ²
Back Doors	2.2 m ²
Floor	17.3 m ²
Closures	0.356 m ²

Primer Areas :-

<u>Description</u>	<u>Areas</u>
Back Panel	3.2 m ²
Roof Panel	3.6 m ²
Doors	3.7 m ^{2**}
Panel Front	1.2 m ^{2*}
Floor	2.1 m ^{2*}
Panel Pillars +Sidesills	4.3 m ² (2.15 m ²)*
Foot Rests	0.29 m ^{2*}
Housing Lamps	0.095 m ^{2*}
Lower Grill	0.21 m ^{2*}
Member No.2 Cross	0.8 m ^{2*}
Panel Fendor	0.2 m ^{2*}
Roof ventilator	0.82 m ²

**Doors are not given the Primer coat for Nile Blue and Santos Red.

* Primer Areas for WT-50.

Black Dip Areas :-Cabin :-

<u>Description</u>	<u>Areas</u>
Floor	4.2 m ²
Frame, Side Front	2.8 m ²
Panel Front	2.4 m ²
Foot Rest	0.29 m ²
Housing Lamps	0.19 m ²
Member No.2 cross	0.75 m ²
Panel Wheel Apron	0.2 m ²

Frame Components :-

A total of 40 components per vehicle are black dipped, these include the chassis parts and brackets.

CALCULATION OF CONSUMPTIVE PAINT

$$\frac{\text{painting area (m}^2\text{)} \times \text{thickness (u)} \times 1000 \times \text{specific gravity of dry film}}{1,000,000}$$

$$= X \text{ (kg)} \text{ ----- solid of paint film}$$

$$\frac{X \text{ (kg)}}{\text{NV of spraying paint}} = Y \text{ (kg)} \text{ ---- weight of paint applied}$$

$$\frac{Y \text{ (kg)}}{\text{painting efficiency}} = Z_1 \text{ (kg)} \text{ ---- weight of total spraid}$$

$$Z_1 \text{ (kg)} \times \frac{\text{NV of spraying paint}}{\text{NV of incoming paint}} = Z_2 \text{ (kg)} \text{ ----weight of incoming paint spraid}$$

CALCULATIONS :-H.G. TOP WAT PAINTS :-1. H.G. Top wat N. Blue and H.G. Top Coat L. Beige.

Solid Content of the covering paint	: 50%
Specific gravity	: 1.05±0.02 = 1.05
Solid content of spraying paint	: 38.46%
Thickness of coated film	: 25-35 Micron = 30 Micron (Say)
Specific gravity of dry film	: 1.06

Cabin Consumption :

Paint Area = 20.515 m²

$$X = \text{Solid of Paint film}$$

$$= \frac{20.515 \times 30 \times 1000 \times 1.06}{1,000,000}$$

$$= 0.6523 \text{ kg.}$$

Y = Weight of Paint applied

$$= X$$

Solid Content of spraying paint.

$$= \frac{0.6523}{0.38} = 1.712$$

Z₁ = Y/Painting efficiency

$$= \frac{1.712}{0.5} = 3.424 \text{ kg.}$$

= Weight of total paint sprayed

Z₂ = Weight of incoming paint

$$= Z_1 \times \frac{\text{Solid Content of spraying paint}}{\text{Solid Content of incoming paint}}$$

$$= 3.424 \times \frac{0.39}{0.50} = 2.67 \text{ kg.}$$

Consumption = 2.54 Litres.

Cargo Box Consumption :

$$\text{Area} = 37.256 \text{ m}^2$$

$$X = \text{Solid of paint film}$$

$$= \frac{37.256 \times 30 \times 1000 \times 1.06}{1,000,000}$$

$$= 1.185 \text{ kg.}$$

$$Y = \text{Weight of paint applied}$$

$$= \frac{X}{\text{Solid Content of spraying paint}}$$

$$= \frac{1.185}{0.38} = 3.12 \text{ kg.}$$

$$Z_1 \text{ (kg.)} = Y / \text{Painting efficiency}$$

$$= \frac{3.12}{0.50} = 6.24 \text{ kg.}$$

$$Z_2 \text{ (kg.)} = \text{Weight of incoming paint.}$$

$$= Z_1 \times \frac{\text{Solid Content of spraying paint}}{\text{Solid content of incoming paint.}}$$

$$= 6.24 \times \frac{0.39}{0.50} = 4.87 \text{ kg.}$$

$$\text{Consumption} = 4.64 \text{ Litres.}$$

H.G. Top Coat S.Red.

Solid content of incoming paint	= 48%
Specific Gravity	= 1.02±0.02
	= 1.02 (Say)
Solid content of spraying paint	= 36.92%
Thickness of the coated film	= 25-35 Micron
	= 30 Micron
Specific Gravity of dry film	= 1.04

Cabin Consumption :

$$\begin{aligned}
 \text{Paint area} &= 20.515 \text{ m}^2 \\
 X &= \text{Solid of Paint film} \\
 &= \frac{20.515 \times 30 \times 1000 \times 1.04}{1,000,000} \\
 &= 0.64 \text{ kg.} \\
 Y &= \text{Weight of paint applied} \\
 &= \frac{X}{\text{Solid content of spraying paint.}} \\
 &= \frac{0.64}{0.3692} = 1.733 \\
 Z_1 &= Y/\text{Painting efficiency} \\
 &= \frac{1.733}{0.50} = 3.466 \text{ kg.} \\
 Z_2 &= \text{Weight of incoming paint} \\
 &= Z_1 \times \frac{\text{Solid content of spraying paint}}{\text{Solid content of incoming paint}} \\
 &= 3.466 \times \frac{0.3692}{0.48} = 2.66 \text{ kg.}
 \end{aligned}$$

Consumption = 2.56 Litres.

Cargo Box Consumption :

$$\text{Area} = 37.256 \text{ m}^2$$

$$\begin{aligned} X &= \text{Solid of paint film} \\ &= \frac{37.256 \times 30 \times 1000 \times 1.04}{1,000,000} \end{aligned}$$

$$= 1.162 \text{ kg.}$$

$$\begin{aligned} Y &= \text{Weight of paint applied} \\ &= \frac{X}{\text{Solid Content of spraying paint}} \end{aligned}$$

$$= \frac{1.162}{0.3692} = 3.147 \text{ kg.}$$

$$\begin{aligned} Z_1 &= \text{Weight of total paint sprayed} \\ &= Y / \text{Paint efficiency.} \end{aligned}$$

$$= \frac{3.147}{0.50} = 6.294 \text{ kg.}$$

$$Z_2 = \text{Weight of incoming paint}$$

$$= Z_1 \times \frac{\text{Solid Content of spraying paint}}{\text{Solid content of incoming paint}}$$

$$= 6.294 \times \frac{0.3692}{0.48} = 4.84 \text{ kg.}$$

Consumption = 4.65 Litres.

Stoving Metallic Silver for wheels :

Solid content	58%
Thickness of film	50 Micron
Area per wheel	1.017 m ²
No. of wheels per vehicle	7

$$\begin{aligned} \text{Consumption per vehicle} &= \frac{7 \times 1.017 \times 50 \times 10^{-6} \times 10^3}{0.58} \\ &= 0.614 \text{ lit.} \end{aligned}$$

Considering 20% wastages = 0.74 litres.

Thermosetting Primer Surface Grey :

Solid content of incoming Primer	= 58%
Specific Gravity	= 1.26
Solid content of spraying primer	= 0.446
Thickness of coated film	= 30 Micron
Specific gravity of dry film	= 1.22

Areas :-

for L.beige	20.515 m ²
for N.Blue	14.665 m ²
for S.Red.	14.665 m ²
for WT-50	7.045 m ²
A	Respective areas.

Consumption :

$$X = \text{Solid of primer film}$$

$$= \frac{A \times 30 \times 1000 \times 1.06}{1,000,000}$$

$$= 0.0318 \times A \text{ kg.}$$

$$Y = \text{Weight of primer applied}$$

$$= \frac{X}{\text{Solid content of spraying primer}}$$

$$= \frac{0.0318 \times A}{0.38}$$

$$= 0.0837 \times A$$

$$Z_1 = Y / \text{Painting efficiency}$$

$$= 0.083 \times A / 0.5$$

$$= 0.166 \times A \text{ kg.}$$

$$Z_2 = \text{Weight of incoming primer}$$

$$= Z_1 \times \frac{\text{Solid content of spraying paint}}{\text{Solid content of incoming paint.}}$$

$$= \frac{0.166 \times A \times 0.3846}{0.50}$$

$$= 0.1277 \times A \text{ kg.}$$

Z ₂ for L.Beige	=	2.62 kg.
Z ₂ for N.Blue	=	2.15 kg.
Z ₂ for S.Red	=	2.15 kg.
Z ₂ for WT-50	=	0.89 kg.

Consumption in Litres:

L.Beige	=	2.49
N.Blue	=	2.05
S.Red	=	2.05
WT-50	=	0.85

Stooing Thinner for Primer and Top Coat

Average Primer consumption	=	1.86 litres
Average Paint consumption	=	7.19 Litres.
Stooing Mettalic silver for wheels consumption	=	0.74 Litres.

30% of stoving Thinner issued

Consumption = 2.937

Considering 20% wastages = 3.5244 litres.

Water Soluble Black :

Solid content = 28-30%

Specific gravity = 1.02 ± 0.02 kg.

Thickness of film to be maintained = 40 to 50 Microns

Cabin Area = 10.83 m^2

Component area = 5.95 m^2

Consumption = $\frac{16.79 \times 45 \times 10^{-6} \times 10^3}{0.29}$
 = 2.61 liters.

Wastages :-Pallets/Hanger.

Surface area of four hangers = 1.37 m^2

Surface Area of four pallets = 8.8 m^2

Surface area of the Pallet = 1.61 m^2

Total surface area = 11.78

Paint consumed by above

$$= \frac{11.78 \times 30 \times 10^{-6} \times 10^3}{0.29}$$

= 1.22 litres/20 vehicles.

Consumption per vehicle = 0.06 litres.

Cabin Carry over :

Tank dimension = 27.60 mm x 24.00 mm

Level difference for 6 cabins = 3.38 m app.

per cabin = 0.56 app.

Consumption/cabin lot:

= 6.62 x 0.560

= 3.71 litres.

However paint consumed by cab

$$= \frac{10.83 \times 45 \times 10^6 \times 10^3}{0.29}$$

= 1.68 lit.

Cabin Carry over = 3.71 - 1.68

= 2.03 litres.

Components carry over :-

$$\text{Component consumption} = \frac{5.95 \times 45 \times 10^6 \times 10^3}{0.29}$$

= 0.923.

Hanger & Pallets consumption = 0.06

Level difference per vehicle components = 0.404

Consumption = 6.624 x 0.404
= 2.67 lit.

Components carry over = 2.67 - (0.923+0.06)
= 1.69 litres.

Total wastages :

Cabin carry over = 2.03 litres.

Pallets/Hangers = 0.06 litres.

Components carryover = 1.69 litres.

Net = 3.78 litres.

Therefore Net consumption = 6.4 litres.

INSPECTION STANDARDS

OBJECTIVE:

To prepare the Inspection Standards for a set of components for the Quality Engineering Department, in order to prepare a list of consolidated checks to be carried out on a components which are to decide the acceptance and rejection of the same without referring to the connected ISI, JIS, and also the manufacturing drawings. In a broad way these can be enlisted;

1. To study the drawing of the component.
2. To study the components i.e. understanding the component, the special purpose of each and critical fitments.
3. To study the major and critical dimensions and separate them.
4. To understand the material of the component and other such related factors.
5. To study the ISI and JIS related with the components.
6. To prepare the consolidated checks that has to be carried out on the components in order to decide the acceptance and rejection of the same.

INSPECTION STANDARDS : A STUDY:--

The term inspection suggests a judiciary function i.e. a comparison of product's specifications with the drawing specifications. It is the manufacturing function which judges productions against the established standards. It is both, -the instrument for quality measurements and a part of the activity of Quality Control department. It is an art of applying tests, preferably by the aid of measuring appliances to observe whether a given item is within the specified limits of variability or not.

Objectives of Inspection :-

1. To detect the errors in manufacturing system which tends towards poor quality and then to report to responsible officials of manufacturing department regarding the defects, so that the action may be taken to prevent the manufacture of defectives products that are not acceptable or below the level of quality of the products.
2. To protect the customer from receiving sub quality level product and permitting only quality goods.
3. To compile informations regarding the performance of the

product with specifications for the use of engineering production, purchasing, quality control and other divisions responsible for quality performance.

Inspection Standards:-

To meet the requirements of quality product, various inspection standards are established. The inspection standards are also established for the following items depending on their use as the following items are very common in industries.

(a) Inspection Standards for raw materials

(b) Inspection Standards for work in process: This includes

Physical condition of the material or its properties.

Form and dimensions of the product.

Degree of finish required.

Functional performance of the product.

(c) Working inspection standards: When the limits and tolerances have been determined, they are inscribed on working drawings.

Commonly these specifications are checked by using various gauges. Gauges are used for fixed dimensions (upper and lower limits). While for variable dimensions, micrometers, etc. are used.

(d) Inspection Standards for finished product are also established on the basis of its value in the assembly.

This relates to the standards established for the sub-assemblies and assemblies. This provides the standards for:

Parts which will fit to make a sub-assembly.

Sub-assemblies that will make a final

assembly.

final assemblies which make the complete

product.

Inspection standards or tests for the

complete product.

INSPECTION STANDARDS PREPARED FOR:--

Sheet Metal

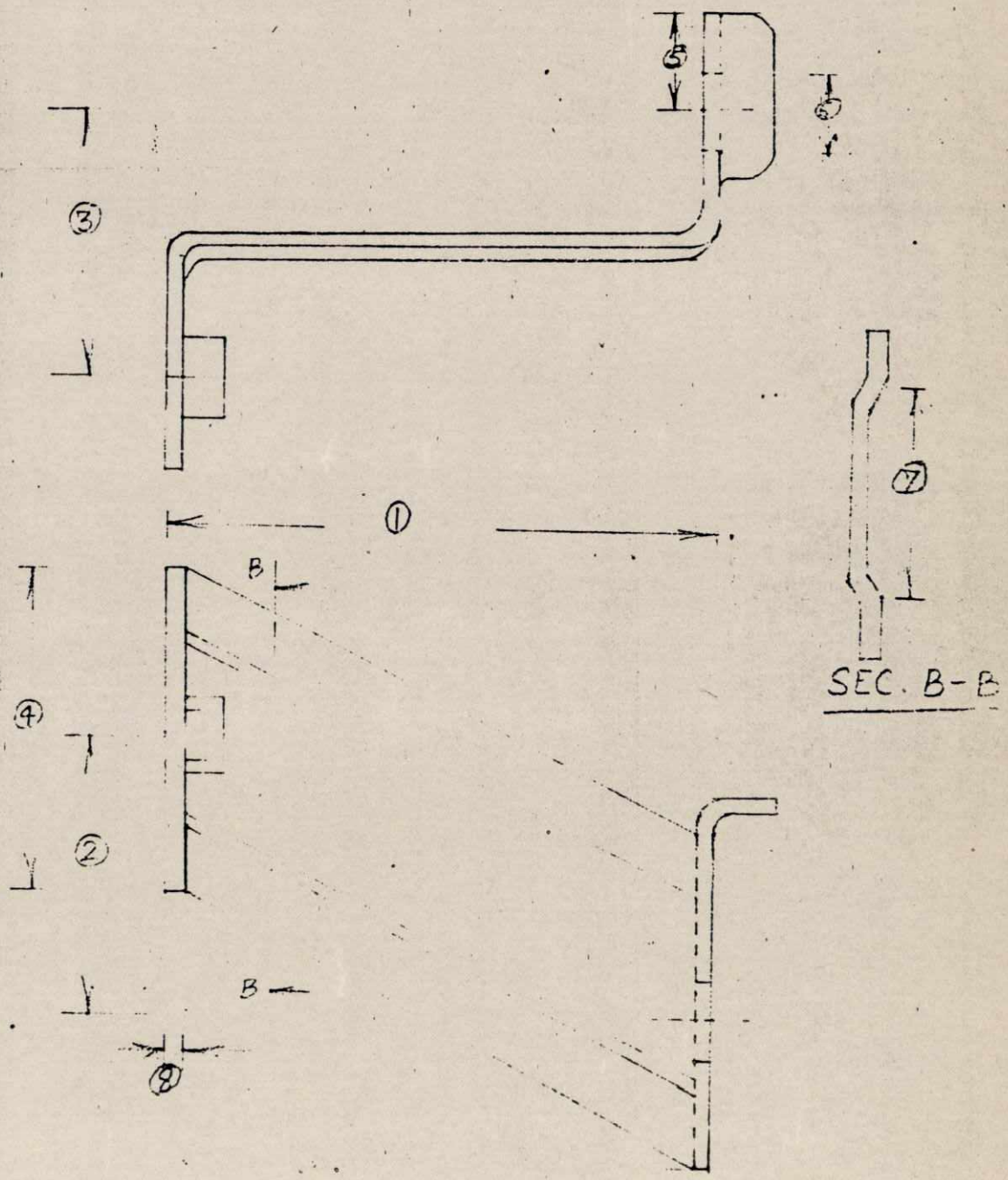
Part No.	Description	Material
W023 50 700	Stay F. Bumper	SL34-1079
S101 40 600	Pipe Assy. Main	STZC
W065 38 830	Brkt. Under Cover	D-1079
W065 38 710	Stay Raditor	IS-1079
Lp01 13 860A	Brkt. Fuel Filter	D-1079
SE08 14 400A	By Pass Filter	D-1079
Lp01 40 841	Brkt. Tail Pipe	IS-1079
W023 38 315	Brkt. Cabin R	IS- 1079
W025 38 940	Holder Brake Hose	IS- 1079

INSPECTION STANDARD

SWARAJ MAZDA

Part/Dwg. No.	W 0 2 3 5 0 0 7 0	Ref./Date	
Part Name	STA-Y-F. BUMPER, CTR	Prepared	Approved

Application	Mat.	Part Rank	Revisions	No.	Rev. No.	Rev. Date	Reasons
	SPHC-DS OR SL3A-1079						



Forgings :-

Part No.	Description	Material
W511 17 201	Gear Main Drive	SAE 5120H
W508 17 308	Gear Over Top counter	SCR 420H
W508 17 271	Gear 1st	SCR 420H
W508 17 231	Gear 3rd	SCR 420H
S201 12 411	Gear Cam Shaft	En 353
	Pinion Forgings	En 353

INSPECTION STANDARD

SWARAJ MAZDA

Part/Dwg. No.

W50817271

Ref./Date

Part Name

Gear Dst Forging

Prepared

Approved

Application

Mat.

Part Rank

Revisions

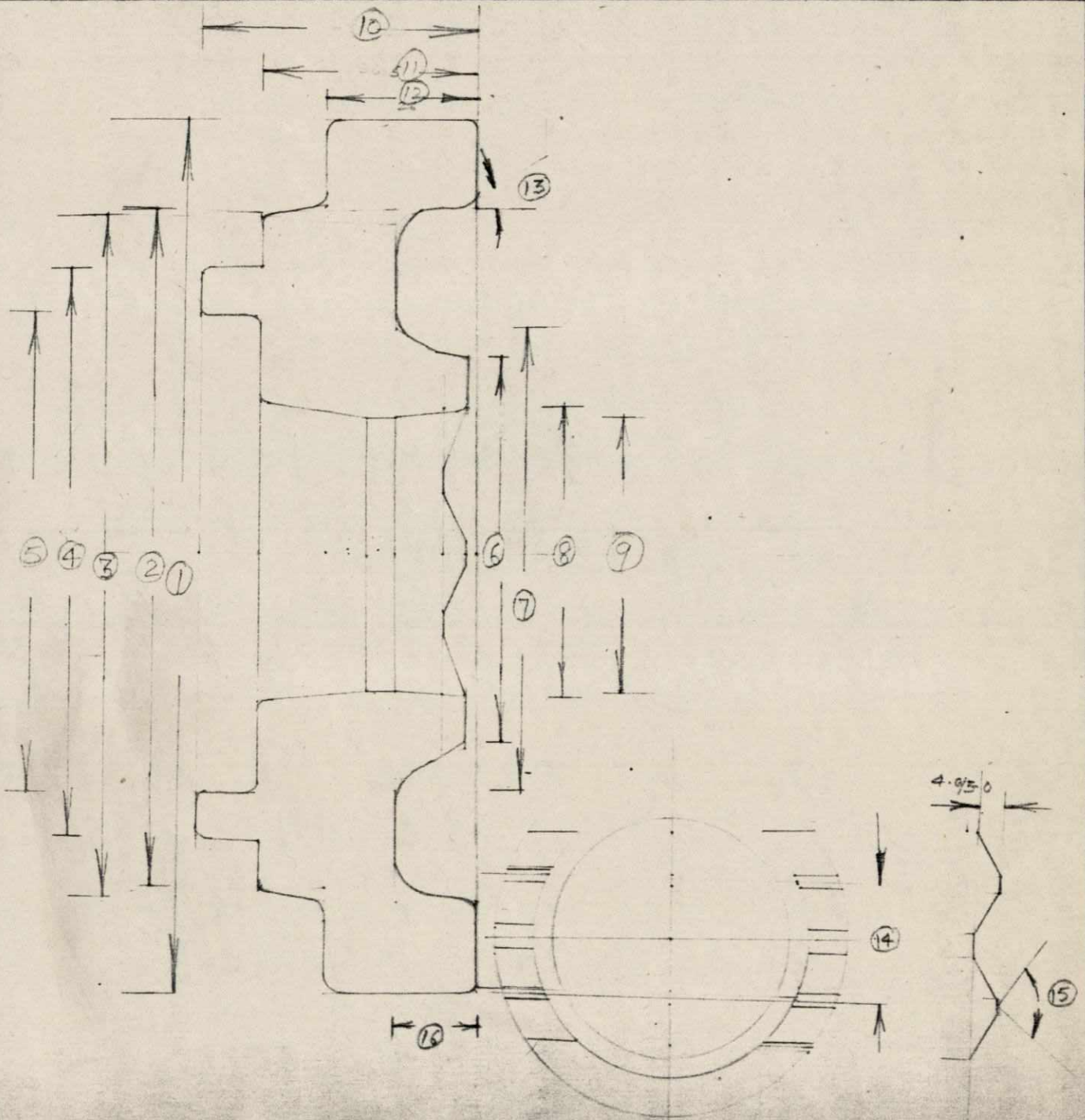
No.

Revn. No.

Revn. Date

Reasons

SC420R



Critical

Major For Reference Only. Specs. must confirm to latest drawings

S. NO.	INSPECTION ITEM	SPECIFICATIONS		QUAL.	MEASURING	REMARKS
		BASIC SIZE	TOL.	RANK	INST.	
01	Diameter	145	+1.5 -0.7	□	Vernier's Caliper	
02	Diameter	116	+1.5 -0.7		Vernier's Caliper	
03	Diameter	115	±0.8		Vernier's Caliper	
04	Diameter	95	+1.5 -0.7	Δ	Vernier's Caliper	
05	Diameter	79	+0.7 -1.5	∩	Vernier's Caliper	
06	Diameter	66	±0.8		Vernier's Caliper	
07	Diameter	76	±0.8		Vernier's Caliper	
08	Diameter	50	+0.7 -1.5		Vernier's Caliper	
09	Diameter	45	+0.7 -1.5		Vernier's Caliper	
10	Thickness	47	+1.1 -0.5	Δ	Height gauge	
11	Thickness	36.5	+1.1 -0.5	.	Height gauge	
12	Thickness	26	+1.1 -0.5	Δ	Height gauge	
13	Angle	15°			Bevel Protractor	
14	oil groove dimension - Si on	10.0	±0.5		Vernier's Caliper	
15	Angle	120°			Bevel Protractor	
16	Depth	13.5			Height gauge	

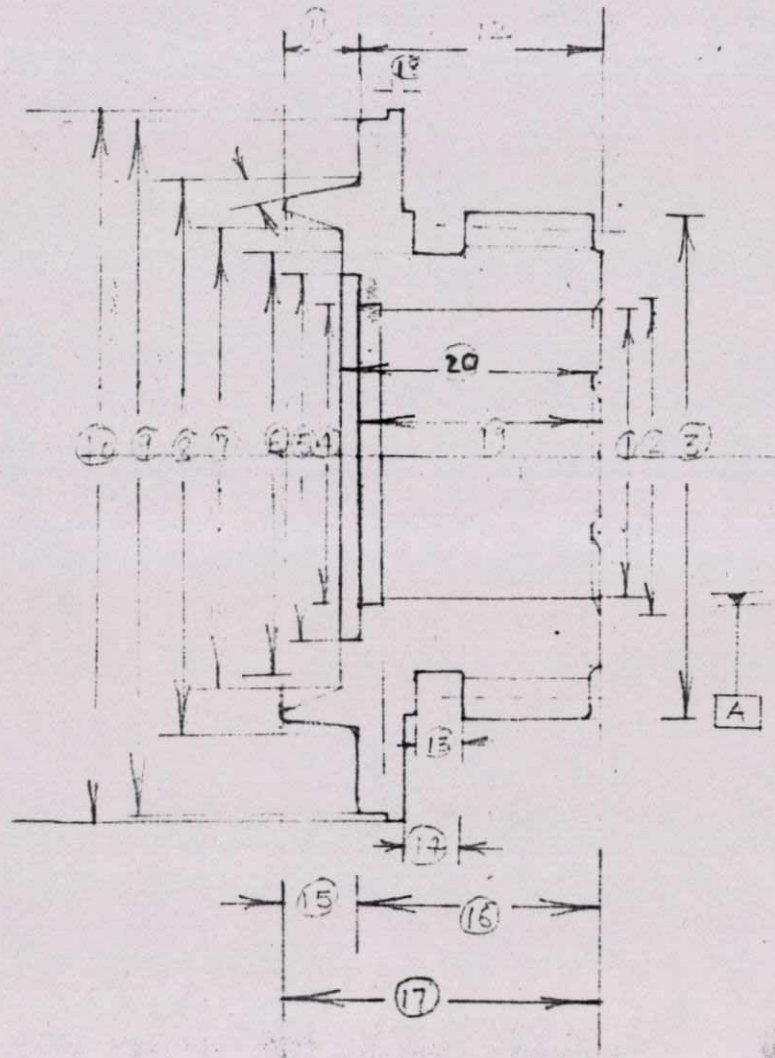
Gears:

Part No.	Description	Material
S101 12 411	Gear Cam Shaft	En 353
S101 12 402	Gear Idle	SCR 22H
S101 11 316	Gear Crank	SCR 22H
W508 17 231	Gear 3rd	SCR 420H
W508 17 251	Gear 2nd	SCR 420H
S101 13 821	Gear FIP	SCR 420H
W508 17 271	Gear 1st	SCR 420H
W508 17 321	Gear Rev.	SCR 420H
W501 17 281	Gear Rev.	SCR 22H
W501 17 611	Gear Over Top	SCR 22H
4080 17 441	Gear Speede Driven	SCR 22H

INSPECTION STANDARD

SWARAJ MAZDA

Part Dwg. No. <u>W501176110</u>		Ref./Date _____					
Part Name <u>Gear-Over Top</u>		Prepared _____	Approved _____				
Application	Mat.	Part Rank	Revisions	No.	Rev. No.	Rev. Date	Reasons
	<u>SCR</u> <u>22H</u>						



NO	INSPECTION ITEM	SPECIFICATIONS		QUAL.	MEASURING	REMARKS
		BASIC SIZE	TOL.	RANK	INST.	
01	Diameter	38	±0.3	Δ	Vernier Caliper	
02	Diameter	39.5	±0.3	Δ	Vernier Caliper	
03	Diameter	61.4	±0.3	□	Vernier Caliper	
04	Diameter	39	±0.3		Vernier Caliper	
05	Diameter	45.5	+0.2 0	Δ	Vernier Caliper	
06	Diameter	48	±0.3		Vernier Caliper	
07	Diameter	60		Δ	Vernier Caliper	check for finish in this area
08	Diameter	73		Δ	Vernier Caliper	
09	Diameter	87.1	±0.1	□	Vernier Caliper	
10	Diameter	90	±0.5	Δ	Vernier Caliper	
11	Thickness	8	±0.2	Δ	Height Gauge	
12	Thickness	35.5	±0.1	Δ	Height Gauge	
13	Thickness	06	±0.2		Height Gauge	
14	Thickness	08	±0.2		Height Gauge	
15	Thickness	9.5	±0.2	Δ	Height Gauge	
16	Thickness	16	±0.2	Δ	Height Gauge	

Materials:**1. En353:-**

Composition	(percent)
Carbon	.20 max.
Nickel	1.25
Molybedeniu m	.08 to 0.15
Specific Gravity	7.85 to 7.87
Specific Heat	0.118
Mean Coefficient Of Thermal Expansion	
11.3 to 14.5 x 10 ⁶ x Mean Coefficient of Thermal Expansion per degree	

Electrical Resistivity

At

20°c	26 to 31.8 Microhm-cm
100°c	36.6 Microhm-cm
200°c	43.2 Microhm-cm

2. SCR 420H

Chemical Composition	(Percent)
Carbon	0.18 to 0.23
Sulphur	Less Than 0.030
Chromium	Less Than 1.20

Heat Treatment °C

Quenching after 850 to 900

Oil Cooling

Tempering 150 to 200 Air Cooling

Notes:

SCR 420H is mainly for case hardening

Major application; Transmission Gears for Cars.

3. SAE 22H

Carbon	0.12-0.22
Maganese	0.70 to 0.90
Sulphur	0.040
Silicen	0.15 to 0.35
Chorimdm	0.70 to 0.90

4. IS 1079 :1973

Hot Rolled Carbon Steel Sheet and Strip

Grades:- Eight Grades of hot rolled carbon steel sheet and strip designated as D-1079, O-1079, DD-1079, EDD-1079, St-34 1079, St-42 1079, St-50 1079, and St-52 1079.

Constituent, Percent Maximum:--

<u>Grade</u>	<u>Carbon</u>	<u>Manganese</u>	<u>Sulphur</u>	<u>Phosphorus</u>
O-			0.060	0.060
D-	0.12	0.50	0.050	0.050
EED	0.10	0.50	0.040	0.040
St34	0.15		0.050	0.050
St42	0.25		0.050	0.050
St50	0.30		0.050	0.050
st52	0.25		0.050	0.050

Strength:-

<u>Grade</u>	<u>Tensile Strength</u> N/mm ²	<u>Yield Strength</u> N/mm ²
D8	260-390	
EED	260-380	
St34	330-410	205
St42	410-490	235
St50	490-590	295
St52	510-610	355

ORIENTATION PROGRAMME

Vendor Development Department:--

Visit Record

Duration	2 Working Days
From	January 2, 1987
To	January 3, 1987

Working of Vendor Development Department:--

By the end of the Phase 3, lasting 2 years SML shall have achieved the licensed capacity of 10,000 ICVs per annum and indigenisation upto 91.7%. This department is looking after the indigenisation programme, it is developing Suppliers or vendors in India so that what ever knocked down components presently are being procured from Mazda, Japan can now be procured from the Indian vendors.

The vendor development activity involves the following actions. In the beginning, for the development of the component, letters are sent to various previously known parties along with drawings. The then parties sent their quotations for that particular component. After the quotations have been received from various parties the next action involves the analysing the various quotations.

This action basically involves the comparing the costing of party and that of the department. Other factors that are compared are, the freight charges, payment due gap, packing charges and many other such factors. Before finally approving a vendor the various facilities available at the vendor's end .

These facilities involve the manpower at vendor's side and the various machines that are available at that place. The developing a vendor basically means providing the necessary development items at the vendor's side. These may be the tools or dies or jigs and fixture.

After the order has been placed at the vendor's side the next course of action is that of follow up. This followup may be in the form of letters, telegrams, telax or visits. This followup has a major role to play in the procurement of the quality approved material at the right time. The other main action of this department is that of overcoming any such hazards that can effect the production rate at the vendor's side and hence at the production line of SML.

Assembly Shop:-visit Record

Duration of Visit	8 Working Days
From	Jan. 7, 1987
To	Jan. 15, 1987
Axle Shop	Jan. 7, 1987
Cabin Assembly	Jan. 8, 1987
Cargo Box Assembly	Jan. 9, 1987
Main Assembly Line	Jan. 10, 1987 to Jan. 15, 1987

ASSEMBLY SHOP

CABIN LINE

CARGO BOX LINE

AXIE SHOP

MAIN LINE

ENGINE & TRANSMISSION SHOP

Axle Shop:-

In This part of the Assembly Shop

the front and the rear axles are being assembled. This

shop has a man power of four. Pneumatic tools and Presses

come under the main tools that are being used.

Various Operations Carried Out:-

Front Axle

1. Steering Knuckle Assembly
2. Shim adjustment of Knuckle
3. King Pin Assembly
4. King Pin Lock Assembly
5. King Pin Cap Assembly
6. Oil Supply
7. Knuckle Arm Assembly
8. Ball Joint Assembly to Tie Rod
9. Tie Rod Assembly
10. Brake Assembly
11. Front Hub Assembly
12. Hub Cap Assembly
13. Brake Drum Assembly
14. Front Brake Adjusting

Rear Axle

1. Hub Bolt Pressin

2. Stop Ring
3. Bearing Press in to Hub
4. Oil Seal Press in to Hub
5. Grease Supply to Hub
6. Differential Casing Assembly
7. Rear Brake Assembly to Casing
8. Rear Wheel Hub Assembly
9. Rear Axle Shaft Assembly

Cabin Assembly:-

In this part of the Assembly Shop, the cabin , in which the customer is made to fill like a Maharaja, is received from the Paint Shop and a number of operations are carried are on it in order to assemble a large number of parts, and is further send to Station F-10 in the main assembly line. The Cabin Assembly Section involves the following sub assemblies.

1. Clutch Pedal
2. Brake Pedal
3. Parking Brake
4. Windshield
5. Rear Window Glass
6. Instrument Panel

There are mainly three stations and has a man power of four.

Various Operations Carried Out:-

1. Accelerator Wire Assembly
2. Wire for Room Lamp Assembly
3. Sun Visor Assembly

4. Room Lamp Assembly
5. Roof Ceiling Trim Assembly
6. Wiper Assembly (consisting of Pipe, Wiper Motor, Wiper Mechanism, Wiper Arm, Wiper Nozzle)
7. Parking Brake Assembly
8. Accelerator Pedal Assembly
9. Clutch Pedal Assembly
10. Brake Pedal Assembly
11. Instrument Panel Assembly
12. Lever Change Assembly
13. Door Assembly (consisting of Door Glass, Door Screen, Door Trim, Arm Rest, Extractor Assembly)
14. Roof Ventilator Assembly
15. Front Windshield Assembly
16. Rear Window Glass Assembly

Cargo Box Assembly:-

As The name itself implies, in this section of the Assembly Shop the Cargo Box, the part of the vehicle

Meant for the carriage of the load or cargo is assembled here. The Floor, Side Doors Rear Door And Load Rest are brought to the Cargo Box Assembly Section after the painting work has been done. The material handling facility provided for the transportation of the above said parts is a trolley, provided with hooks to carry these parts all together. The Cargo Box Assembly Section has a manpower of two. This section is equipped with over head cranes which are four in number. Out of these four ; two have two sided motion while other two have three sided motion i.e. all the cranes can be used to move the parts sideways and upwards or downwards. However the other two can ~~not~~ provide the parts or the cargo box a forward motion with the help of chain sprocket and gears mechanism.

An average of 75-80 minutes are taken for the complete assembly of the cargo box and 6 cargo boxes are being produced every day.

Operations Carried Out:-

1. Floor Assembled with the Sleepers
2. Rubber Step Assembly
3. Side Door Assembly
4. Hinge Assembly
5. Lever Shutter Assembly
6. Lead Rest Assembly
7. Step Assembly
8. Rear Lamp Combination Assembly
9. "SWARAJ MAZDA" Label Painted on the Rear Door
10. Assembled Cargo Box Fitted on the vehicle received from the main line
11. Rear Mud Guard Assembly

Vehicle Assembly:-

This Main Line employs a man power of nine and has a production rate of seven per days. It is assisted by the other shops and other lines of the Assembly Shop. The chassis is delivered at the station F-6, while the cabin is received from the Cabin Assembly Line at the station F-10. The rear and the front axles, assembled in the Axle Shop are delivered to the main line at station F-6. The Workers are provided with Pneumatic tools in addition to the Torque Wrenches. These tools help a lot

in making the production faster.

Various Operations Carried Out:-

Station Number F-6 & F-7

1. Assembly of the Leaf Springs with the Front Axle
2. Assembly of the Leaf Spring with the Rear Axle
3. 2 and 3 both assembled with the chassis
4. Brake Pipe and Brake Hose Assembly

Station Number F-8 & F-9

1. Assembly of Shock Absorbers to the Chassis
2. Assembly of By Pass Filter mounting Bracket
3. Apron Wheel Assembly
4. Parking Brake Wire & Speedo Meter Wire Assembly
5. By Pass Filter Assembly
6. Gear and Pitman Assembly
7. Drag Link Assembly
8. Oil put in the Gear and Pitman
9. Sub Tank Assembly

10. Sub Assembly of Transmission , Clutch and Engine

11. 10 put on the chassis and assembled

12. Fuel Cut Motor Assembly

13. Radiator Assembly put on the chassis.

14. Air Intake Bracket Assembly

Station Number F-10 & F-11:-

1. Air Cleaner Assembly

2. Vacuum Tank Subassembly

3. Oiling of the Bath Cleaner

4. Front Mounting Bracket Assembly with the Cabin

5. Cabin Assembly with the Chassis

6. Steering Column Assembly

7. Front Mud Guard Assembly

8. Battery and Battery Stand Assembly

9. Exhaust Pipe Assembly

10. Propeller Shaft Assembly

11. Molybdenum Grease Poured (pumped) in the Propeller Shaft

Station Number F-12

1. Lamp Connections
2. Accelerator Wire Connections
3. Fuel Pipe Connections
4. Seat Assembly
5. Sub Assembly Of Sub Tank
6. Fuel Tank Assembly
7. Oil Bath Air Cleaner Assembly
8. Tool Box Assembly
9. Subassembly of Stay Number Plate
10. Stay Number Plate Assembly
11. Draw Hook Assembly

Station Number F-13, F-14 & F-15 i--

1. Front Combination Lamp Assembly
2. Horn Assembly
3. Radiator Grill Assembly
4. Stay Mirror (L&R) Assembly
5. Mirrors Assembly
6. Gears Levers Connected

7. Switch Combination Assembly
8. Bumper Assembly
9. Spare Tyre Carrier Assembly
10. Sub Assembly of Wheels
11. Assembly of the Wheels
12. Filling of Fuel Tank
13. Lower Gaurd Assembly
14. Brake Fluid put in the Reserve Tank.

Paint Shop:--

Visit Record

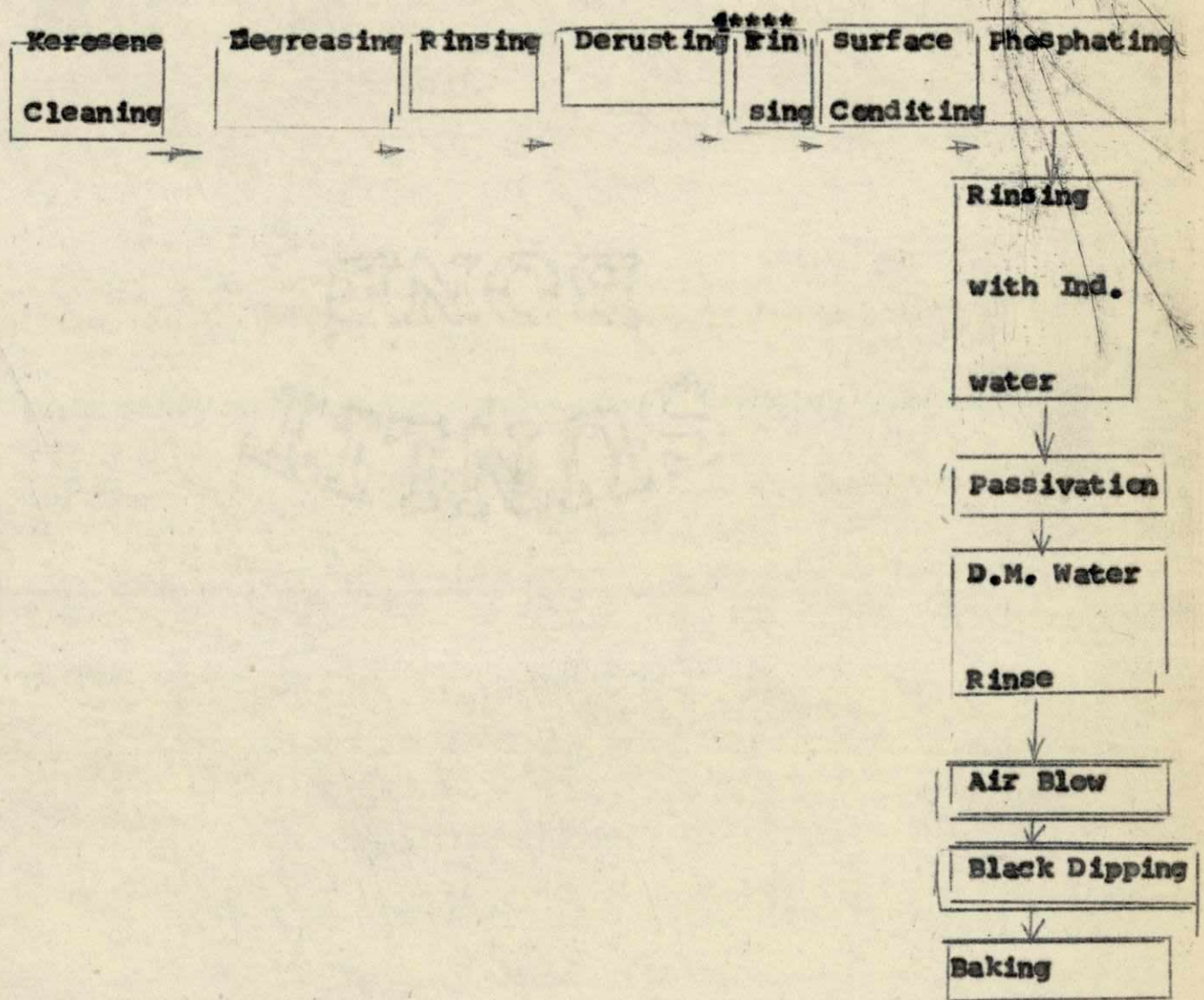
Duration of Visit	6 Working Days
From	Jan. 16 1987
To	Jan. 22 1987
Pretreatment Line	Jan. 16 to Jan. 19
Paint Line	Jan. 22 to Jan. 22

The Paint Shop, as the name itself implies is that part of the production line where the painting process is carried out. The Paint Shop has been divided into two lines, The Pretreatment Line and The Paint Line. The cabin which is received from the Body Shop is first pretreated at the pretreatment line and is then taken to the paint line. However the Cargo Box as it is received from the vendor is already pretreated and has also undergone the primer coating, in other words the cargo box is directly taken to the paint line.

The paint shop has a daily production of the cabins as eight, while that of cargo boxes as six, where as for this production a man power of eighteen is being used.

Pretreatment Line:-

Process Flow Chart



Processes :- Importance and Purpose :-

1. Kerosene Cleaning :- The cabin as received from the Body Shop is first cleaned with the kerosene oil, in order to remove the dust, oil or any such impurities from the cabin. The kerosene cleaning mainly helps in the removal of the above said impurities from the welded joints.

2. Degreasing :- The cabin after the kerosene cleaning is taken to the degreasing tank, which is fitted with the solution being maintained at 55-75 degree centigrade. The cleaner which is being used as the degreaser is an alkaline chemical having a strength of 2-3%. The cabin is dipped in the degreasing tank for an average of four minutes. This process mainly helps in the removal of the grease, oil, from the work piece surface, which enables the proper coating of the paint.

3. Rinsing With Industrial Water :- The cabin after the degreasing process is taken for the rinsing process which is carried out with the help of industrial water being maintained at the room temperature.

The rinsing helps in preventing the alkaline

chemicals of the degreasing unit from entering the other tanks, and in addition to it this ensures the complete degreasing of the cabin or the job.

3.4. Derusting & rinsing:-- These two units are also provided at the Pretreatment Line for the rust removal purpose. However these are not being used nowadays, since the CKD's as received from Mazda are already coated with deruster. The deruster is phosphoric acid, conc. 20-30%.

5. Surface Conditioning:-- The surface conditioning operation is done with the help of alkaline chemical of the titanium salts, having a strength of 0.1 -0.2 % and a pH value of 8.5 -10. The purpose is carried out at room temperature and the operation time is 30secs.

This operation basically helps in the grain refining of the sheet of the cabin, which further helps in the proper adhesion of the paint with the sheet.

6. Phosphating:-- The cabin after the surface conditioning operation has been done is then taken to the phosphating tank. There are

four main chemicals which go into the formation of the
phosphating liquid, these are
phosphating replisher
Phosphating accelerator
Neutrisher
Make Up.

The operation time is 3-7 minutes while the operation
is carried out at 45-55 degree centigrade.

In this operation a non metallic layer of
Zinc Phosphate gets deposited over the sheet of the cabin
which serves as a corrosion resistive layer. In addition to
the above mentioned function, this layer also provides a longer li
life to the paint and helps in adhesion of the paint with cabin.

7. Rinsing With Industrial Water:-- The cabin is then taken
into the rinsing tank having the industrial water in it.
This operation is carried out at room temperature. This
rinsing action prevents the chemicals of one tank to go
into the other tank, here in this case the next tank is that
of passivation.

8. Passivation:- Chromic acid is being used as the passivating solution. This operation is carried out at room temperature. This action of passivation helps in the corrosion resistance.

9. D.M. Water Rinse:- In this operation the cabin is rinsed with the demineralised water. The importance of this process is that at this stage there should be no mineral left on the cabin sheet. If industrial water is used then the deposition of the mineral can affect the paint quality. This operation too is carried at the room temp.

10. Air Blow :- Compressed air is then blown all over the area where the black dipping process has to be carried out. However this helps in the adhesion action of the black paint with the surface. The paint sticks more easily to the dry surface of the cabin.

11. Black Dipping:- The cabin is dipped in the water soluble paint till a level which is little above the floor of the cabin. This paint has a pH of 7.8-8.6 and is being maintained at a tem

which is below 30 degree centigrade.

The dipping action makes the paint to deposit over the complex shape of the floor of the cabin, which otherwise can not be painted with the help of the usual method, i.e. the spray gun. The paint from is wiped off with a brush or a cloth.

12. Baking:- The cabin is then taken to an oven which is being maintained at a temperature of 160 degree centigrade. This temperature helps in the baking of the black paint as the cabin is kept there for 20-25 minutes. The heating is done with the help of Thermic Fluid. The thermic fluid is received through the insulated pipes from the power station. The heating unit is made to control the temperature of the fluid at 160 degree centigrade. The air which is supplied to the oven with the thermic fluid gets heated up and this air helps in the baking of the black paint.

Paint Line:- This line is that part of the Paint Shop which

receives the pretreated parts and is given a paint coat.

The cargo boxes received at this line are previously pretreated and primer coated at the vendor's side, while the cabins coming at this line are received from the pretreatment line directly. The various operations which are carried out at the paint line are as under

1. Coating of the Sound Deadner :--The cabin which is pretreated is given a coat at the wheel curvature, of the sound deadner. This sound deadner performs a main task, as it destroys the sound created by the stones or any such materials, while hitting the mudguard side of the cabin. In this way the sound of the hitting particles is not conveyed to the interior of the cabin. The sound deadner also helps in destroying the ill effects of the hitting particles on the sheet of that area coated with it. This operation is carried out in a booth which is located in between the pretreatment line and the paint line.

2. Cleaning :-- The cleaning area is that open space in the paint line where the pretreated cabin is cleaned. The cleaning

is done with the help of sand papers of different numbers and tack rags.

3. Primer Coating :--After the cleaning action has been done the cabin is taken in another booth for the primer coating. The primer ensures a longer life to the paint and also the shine. The coat of the primer is applied with the help of spray guns working at an air pressure of 4-4.5 kg/cm² and at the primer pressure of 2-2.5 kg/cm² in order to have a thickness of primer as 25 to 35 microns.

4. Flash Off :- The cabin is then taken into another booth and is kept there for 5-10 minutes at normal temperature in order to make the cabin undergo the flash off operation. However this is done in order to give a time gap between the primer coat operation and the baking operation in order to enable the thinner to settle down.

5. Baking :- After the flash off operation the cabin is kept in an oven for the baking action for about 30 minutes and this operation is carried out at 140°C which ensures the proper adhesion of the primer to the cabin sheet.

6. Sealant Application :-- The cabin is applied a sealant at all the welded joints .

7. Baking 1:- The cabin is again taken in the oven for the Baking action in order to make the sealent dry off.

8. Cleaning 1:- The primer coated cabin is then again taken to the cleaning area in order to relieve the cabin of any impurity, what so ever may be present on the primer coated surface.

9. Paint Coat:- The cabin is here given a coat of the paint at an air pressure of 4-4.5 kg/cm². The paint is sprayed with the help of spray guns. The final thickness of the paint is 65 micron.

10. Fish off :- This action is same as for the primer coated cabin.

11. Baking:- This action is same as for the primer coated cabin.

Note After the primer coat action the cabin can also be read as cargo box for the paint action.

BODY SHOP:--

Visit Record

From January 23, 1987
 To January 31, 1987
 Duration 6 Working Days
 Frame Line Jan. 23, 1987 to Jan. 28, 1987
 Cabin Line Jan. 29, 1987 to Jan. 31, 1987

Introduction:-- Body Shop can rightly be called the first link of the chain of operations which finally result in the complete vehicle. This is so because it is in the body shop where components are welded together to form the chassis frame and the cabin. The chassis frame are then sent to the assembly shop and the cabins to the paint shop.

Modus Operandi: Mainly there are two lines in the body shop. They are 1. Line for chassis frame assembly 2. Line for cabin assembly

Chassis Frame Assembly Line :- The line for the chassis frame has five work stations in the following sequence

(a) Station for Positioning the Knocked Down Components :-

In this station the tubular cross members are loosely positioned on the side members on a jig.

(b) Tack Welding Station :- In this station other components such as various brackets, hangers, sills, supporting members etc. are positioned on the loosely fitted side members and cross member assembly. This means that the assembly is first completed in the fixture and subsequently the components are tack welded. After being tack welded the assembly has enough strength and rigidity to be removed from the fixture, transported and positioned for final welding on a rotating jig.

(c) Final Welding Station :- In this station the tack welded assembly is mounted on the rotating jig and final welding is carried out. The rotating jig permits easy welding and is particularly suitable for Mazda chassis frame since tubular cross members are to be welded on the side members.

(d) Station for Relieving Strain :- In this station there is a special fixture which in addition to having clamping arrangements

has hydraulic and mechanical jacks fitted to it. The purpose of the jacks is to relieve the finally welded assembly of the strains developed during final welding. The permissible strain can be read from a scale mounted on the hydraulic jack. Grinding operations are also carried out in this station on the bushes in which the steering rods are housed so that the steering angle is not defective.

(e) Paint Booth:-- The completed chassis frame is first cleaned by pressurized air and then spray painted in the paint booth.

Cabin Assembly Line :-- There are two lines

(a) Main Assembly Line:-- This has the following five stations

Floor Assembly Stations

Side Frame Assembly Station

Cabin Assembly Station

Denting and Grinding Station

(b) Door Panel Assembly Line :-- There are five work stations

in the main cabin assembly line. In four stations the completely

knocked down components are assembled on fixtures and resistance

spot welding is carried out to form the main body of the cabin. The spot welds are made at predetermined positions. The door panel is assembled on a parallel line and is then welded to the main body of the cabin. In the last station of the main assembly line dents and scratches etc. are removed from the various assembled parts and the doors are mounted on to the cabin. Grinding operations are also carried out in the last stations to smoothen out the weld spots.

Process Employed :-- Two types of welding operations are used in the Body Shop.

1. Gas Metal Arc Welding (MIG)
2. Spot Welding

Gas Metal Arc Welding :-- MIG is an arc welding process in which the heat for welding is generated by an arc between a consumable electrode and the work metal. The electrode, a bare solid wire that is continuously fed to the weld area, becomes the filler metal as it is consumed. The electrode, weld puddle, arc and adjacent areas of the base metal are protected from atmospheric contamination by a gaseous shield provided by a stream of gas or

a mixture of gases fed through the electrode holder. The gas shield must provide full protection, because even a small amount of entrapped air can contaminate the weld deposit.

Power Supply :-- Direct current with reverse polarity (i.e. the work piece is made negative) is used. To achieve the high amperage of current, which is 400 amperes at 40 volts, a transformer rectifier is used in our Body Shop.

Electrode Holder :-- Air cooled (shielding gas) holders are in use.

Dip and spray transfer of the consumable electrode takes place.

Resistance Spot Welding :-- Resistance spot welding is a process in which surfaces are joined in one or more spots by the heat generated by resistance to the flow of electric current through workpiece that are held together under force by electrodes. The contacting surfaces are heated, in the region of current concentration by a short time pulse of low voltage, high amperage current to form a fused nugget of weld metal. When the flow of current ceases, the ~~force~~ force is maintained while the weld metal rapidly cools & solidifies. The Electrodes are retraced after each weld, which usually is completed in a fraction of second.

Purchase Department:--**Visit Record**

Duration	3 Working Days
From	June 18, 1987
To	June 20, 1987

Working Of Purchase Department:-- This department places the most significant role in the procurement of the materials.

Purchase Orders are raised to the vendors already approved by the Vendor Development department. These orders are generally based on a year's requirements. However the firm orders are raised after every three months, keeping in view the production programme for that very period.

However the final production programme is supplied to the purchase department in the first week of the month, and as such the purchase order which is raised 10-15 days before that has to be raised on an approximation only. This approximation is generally towards the positive side. This

has to be done keeping in view the various constraints under which the vendor has to make the components.

After the order has been raised the next course of action is that of follow up. The follow up plays a very important role in the procurement of the material at the right at the right time, rather the right material with the specified quality and that also at the right time. The follow up may be in the form of letters, telegrams, telex, visits. The follow up has to be done in order to make the line to follow the line to flow in a smooth way i.e. the assembly being carried out at the plant should not be hindered because of the lack of material in the stores and hence in the line.

Once the material has been procured from the vendor, then the department has a main role to play in the payment to the vendor. The negotiations regarding the payment has to be done by the purchase department and it also has to be seen that the payment is made to the vendor at the right time so as to provide the vendor with the necessary help, in order to make him provide the material the next time at the right time.

implies the month of assembly i.e. January is denoted by 'A'.

February is denoted by 'B'. March by 'C', and so on.

The next five letters denote the number of the Engine being manufactured.

3. Four cylinder liners fitted

The cylinder block is marked A and B at the four bores. The cylinder liner has brown and green colours marked on them. The cylinder block marked 'A' will contain the liner with green mark, however the bore marked 'B' will have the cylinder liner marked with brown colour.

4. Tappets fitted

5. Oil Jets fitted

6. Cam Shaft fitted

7. Crank shaft fitted

There are marks on the crank shaft and the cylinder liners, which make for the selection of the bearings.

8. Crank cap installed

9. Crank Shaft Gear with key installed.

10. Sub assembly of piston, pistonrings and connecting rods.

11. Sub assembly 10 fitted on the cylinder block.

12. Timing Gear Case fitted
13. Oil Pan (upper) fitted
14. Oil Pump fitted
15. Oil Pan (lower) fitted
16. Oil Filter Gasket and Oil Filter fitted
17. Cam Shaft Gear attached
18. Idle Gear & Friction Gear fitted
19. Clutch Wheel and Clutch Disk fitted
20. Crank Shaft Pulley fitted
21. Water Pump fitted
22. Cylinder Head Assembly fitted
23. Casing Thermostat fitted
24. Rocker Arm Assembly to the block
25. Engine Hanger fitted
26. Fuel Filter Bracket, Fuel Filter and pipe attached
27. Subassembly of Inlet Manifold
28. Assembly of 27
29. Water Pump fitted
30. Alternator Bracket, Alternator and Fan Belt fitted
31. Cover assembly of cylinder head fitted.

Transmission Line 1-- The following are the various operations that are carried, in order to assemble a Transmission

1. Subassembly of Main Shaft
2. Subassembly of Parking Brake
3. Main shaft fitted
4. Counter Shaft fitted
5. Subassembly of Cover Transmission (Rear)
6. Subassembly of 5 fitted
7. Gear Shifting Fork fitted
8. Clutch Housing fitted
9. Cover Transmission (Top) fitted
10. Parking Brake fitted
11. Leakage Test conducted
12. Noise Test conducted

Servicing Department:--

Visit record

Duration 2 working Days

From June 25, 1987

To June 26, 1987

Working of servicing Department :-- The Servicing Department, as the name itself implies involves itself in providing the necessary service and spares for the customer and hence for the vehicle on the road. This department also looks into the dealer development. This function involves the critical study of the areas at which the dealer's have to be developed. Also it is taken in account the scope of the vehicle in that region i.e. the number of vehicles around that region.

After a dealer has been developed then it has to be looked into that the dealer is provided with the best facilities namely the service materials, training of the workers, the necessary literature for the dealers.

In addition to it the training of the service workers has to be arranged in the service training centre at the works. This training teaches the workers in gaining working knowledge and experience for all the service procedures, what so ever are carried on the vehicle at the customer's end. It is also taken care that the worker is given such a training that the worker develops into an allrounder rather than a simple electrician or a mechanic.

The other important action is that of providing the special tools to the dealers, so that all the services that are carried out on the vehicle are done in a best possible way and making the time factor very less.

Providing the necessary literature for the dealers is another aspect of the servicing department. This literature includes the Owner's Manual, Part's Catalogue, Workshop Manuals, Warranty Forms, Service Forms. This literature not only helps the dealers in gaining considerable amount of

of knowledge regarding the vehicle but also helps in the eff. of the worker. These literature also helps the customer in a broad sense. The necessary information contained in the Owner's Manual makes the customer have the best knowhow about the vehicle, to name a few, the various systems of the vehicle, the service intervals and the nature of the service that has to be done.

In addition to the above said functions the fields that are looked after by this department is that of service Campains and driver's training.

Also in addition to it, a Service Master File is maintained, which has all the necessary information regarding the vehicles that are on road. This file contains all the following information for a particular vehicle;

1. Chassis No.
2. Gear Box No.
3. Engine No.
4. Make i.e. colour and the model wheter 48/49/50.
5. Battery & Tyre make
6. Dealer & customer's Name And address
7. Dates of Assembly and Dispsatch
8. Various Services Carried out at tht Dealers

Material Control and Production Planning Control:--**Visit Record**

Duration of Visit 3 Working Days
From June 27, 1987
To June 30, 1987

Organisation of Material Control :- Material Control department is headed by manager and comprises of (a) Material Control section (b) Production Planning and Control Section (c) Central Store Section. All sections are headed by sectional heads, supported by supervisors and dealing assistants, reporting to manager material control. The functions of various sections are listed below:-

(a) Material Control:--The primary function of Material Control is material planning, ordering and control. Namely
System for production material requirement planning (MRP).
System for material requirement ordering for items not covered under MRP system for production requirements.

Production, Material Requirement Planning (MRP) :--

MRP is an intergated production and inventory management system. It consists of a set of "time phased requirement " for all the items from the master production plan. In contrast to the traditional inventory control methods where we analyse the past , the MRP system looks into future (Master Production Schedule) to decide the time and quantity of each order. MRP provided a precise scheduling system based on priorities for revising plans as changes occur. Computer is widely used for this system and is basically computerised intergated production and inventory management system. The input and Output are as follows,

Input :-- Master production schedule (MPS), Bill of Material, Item master record or item status

Output:-- Rescheduling notice, Cancellation notice, Item status report, Inventory level, production, Capacity requirements plan, Pegged requirement report.

Production Planning And Control (PPC):—The primary function of PPC is feeding the production line, the follow up with store/purchase department for raw material and preparation of critical item list everyday. The functions are listed below.

1. Feeding material to line as per schedule given by material control department.
2. Monitoring of inflow of material.
3. Generation of critical shortage list everyday.
4. Deletion of consolidated list of critical/shortage items of deletion parts every month.
5. Movement of finished vehicles to despatch store and ensuring all documents/ clearance from Q.E./Production.
6. Accountability of items issued to shop from store.

(c) Central Store Section:— Central Store is primarily responsible for receipt/safe storage/ issue and documentation relating to material accountability is generated from central. The system also looks for the smoothflow of the production line.

Job Responsibilities of Industrial Engineering Department:

1. To set up production norms for all production departments
i.e. time standards for all jobs.
2. To design/improve workplace arrangements to improve productivity and create good working conditions and environment for work force.
3. To design/ improve material handling systems to make it easy to use and optimise cost.
4. Design material storage systems for optimising space utilization & optimise cost.
5. Method study and improvement thereof.
6. To advise on productivity improvement on continuous basis.
7. Introduce suggestion schemes and evaluate suggestions for recommending rewards.
8. Improvement in working conditions to make job enjoyable and less tiring.
9. Calculate efficiency of shop.
10. Assess the surplus & deficit, capacities for each work center, plant balancing.

11. Provide certification systems*
12. Manpower planning.
13. Design formats for managements reports like rejection, manpower status, productivity target vs production, efficiency etc.

Job Responsibilities of Production Engineering:

1. Preparing specifications & selecting suitable machine, tools and equipments for various production shops.
2. Deciding buy or to make.
3. Preparing process sheets.
4. Preparing requirements as standards tools for production shops and ordering.
5. Deciding various test equipment required for production through interaction with Quality Engineering Department.
6. To prove the process layouts at the time of initial production
7. To prepare stage layout drawings e.g. forgings castings etc.
8. To study if any of the existent bar stock components are to made from castings, forging etc.
9. To prepare capital budgets for the year and to ensure that allocated budget is committed in time.
10. Time estimating each process layout.

Job Responsibility of Quality Engineering:

A. Vehicle Assembly

1. To formulate the inspection standard, moving check list.
2. To ensure that all laid down systems are followed by operational execution and records e.g. brake engine, propeller shaft, wheel alignment, oil levels, etc.
3. To carry out critical checks on every assembly at specified stages.
4. To ensure that the vehicle is complete in all respect.

B. Vendering

1. Vender appraisal in association with purchase department.
2. Issue of source appraisal report and action plan for improvement with supplies.
3. Inspection Standards preparation.
4. Process and validation tests schedules with vendors and follow up of action plans and assist vendors.
5. Planning and follow up of inspection gauges/fixtures in association with production engineering.
6. Quality assurance and testing at vendors premises at various stages of manufacturing and at finished products.

7. Approval of initial samples and validation of pilot lot.
8. Regular evaluation of bulk supply & inspection of non standard items.
9. Assist in vendee/ vendors meets and discussions.
10. Interaction with receipt store on various concerned activities.

C. Material Testing

1. Testing and analysis of raw material, metals, rubber, plastic, oils, paints, sealants and consumeables.
2. Assistance in guidelines to the vendors for the effective control over material quality and process etc.
3. Quality assurance in paint shop through paint lab.
4. Trouble shooting and recommending appropriate action for problems related to materials.
5. Co-ordination with warranty and defect analysis cell.

D. Management Feedback

1. Quality audit components, sub assembly and finished vehicle, quality rating of above items.
2. Participation in value analysis
3. To plan & Organise training programme related to quality in association with training department.

SWARAJ MAZDA T-3500

ENGINE

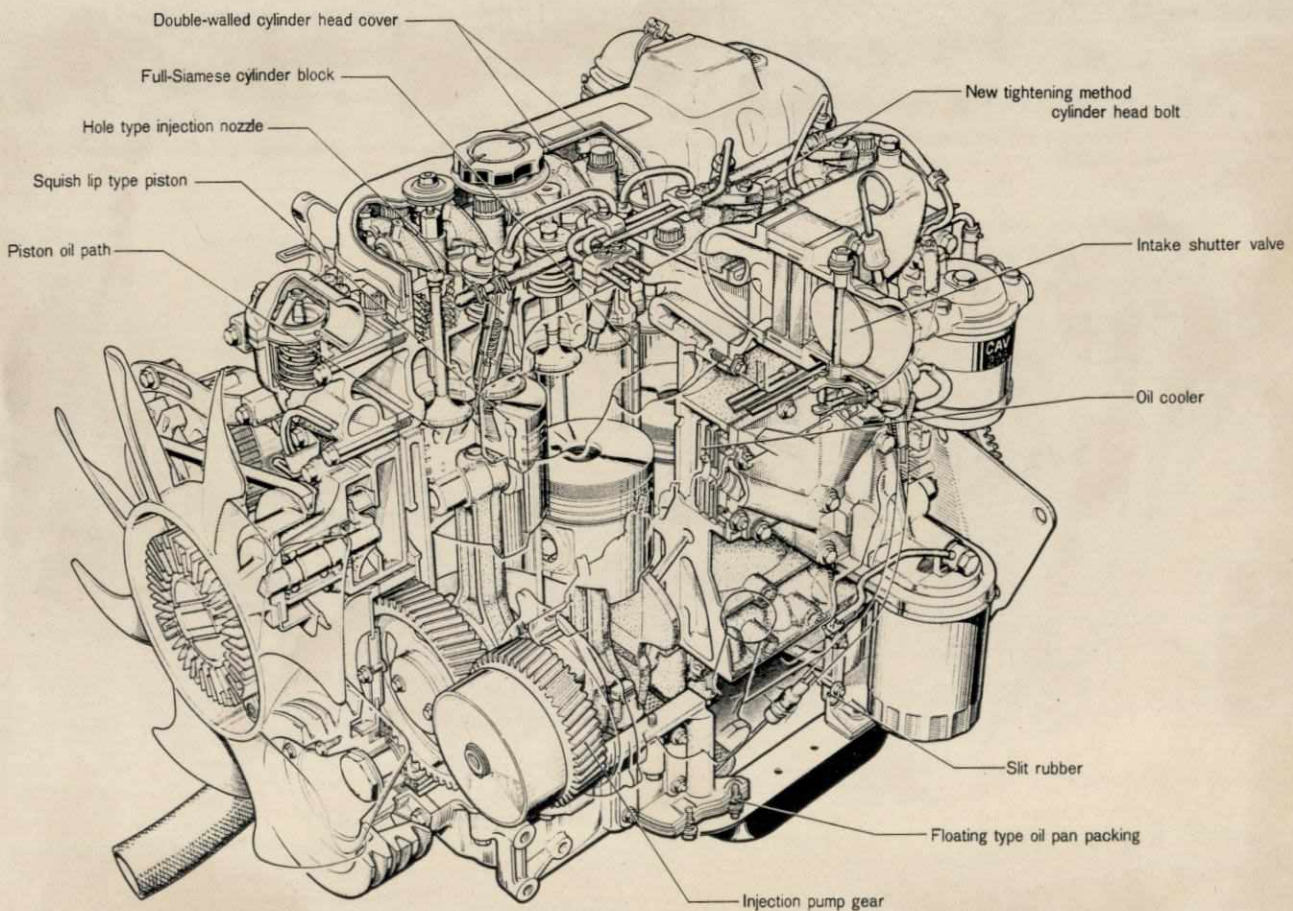
Model	- S L
Type	- Diesel, 4 Cylinder
No. of Cylinders	- 4 Cylinders, in line
Combustion chamber	- Piston Head
Cylinder Liner	- Dry and loose
Displacement (CC)	- 3455
Bore X Stroke (mm)	- 100,0 X 110,0
Compression Ratio	- 18:1
Compression Pressure	- 30 (m/Cm ²)
Valve Timing:-	

Intake:

Open	- 19
Closed	- 47

Exhaust:

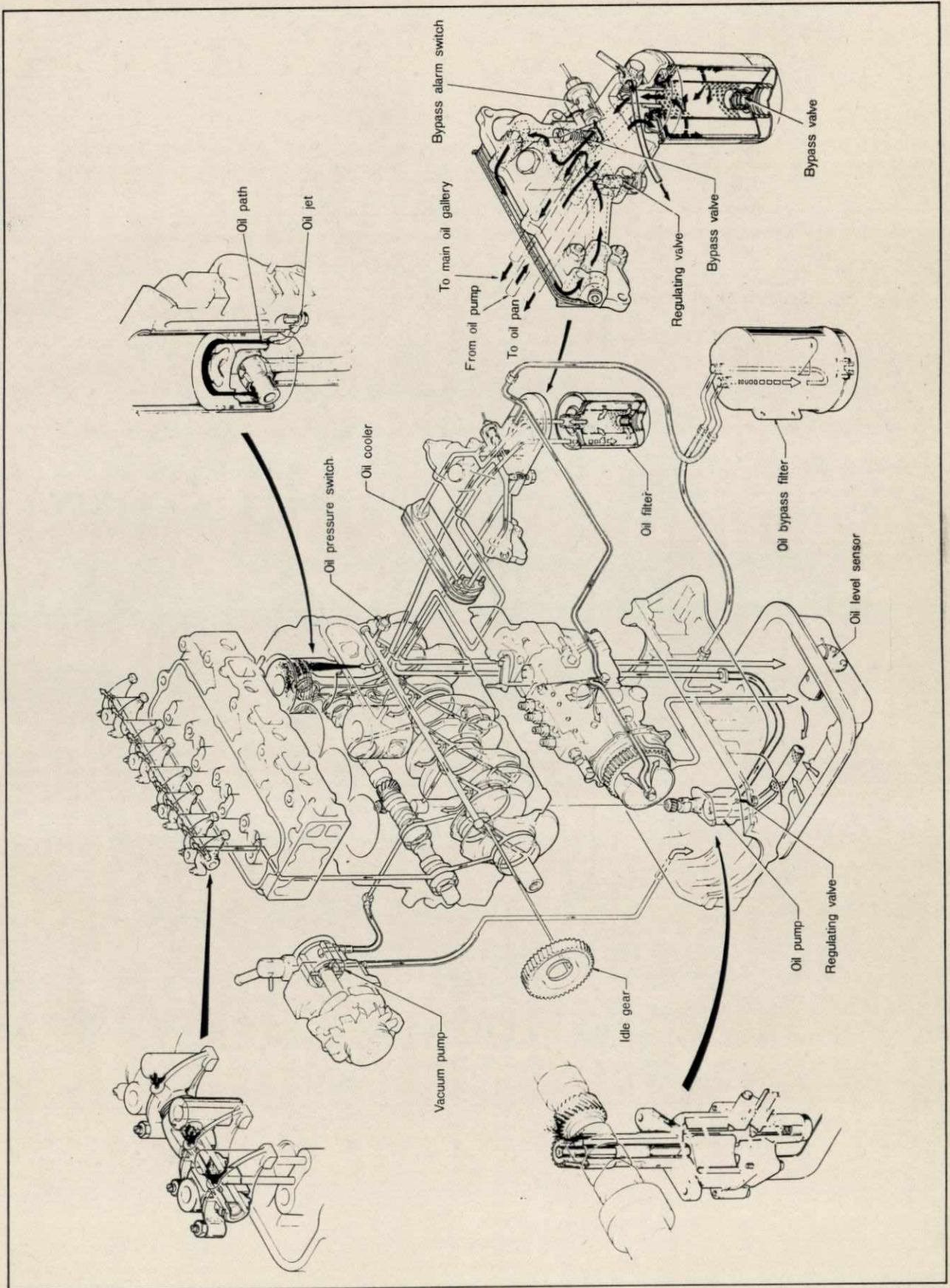
Open	- 52
Closed	- 14



LUBRICATING SYSTEM:

Type	- Force Fed
Oil Pump:-	
Type	-
Regulating Valve opening Pressure	- 6.5 Kg/CM ²
Oil Filter:-	
Type	- Fuel Flow, Paper Filter
Oil Filter valve Operating Pressure	- 1.0 Kg/CM ²
Oil By Pass Filter:-	
Type	- By Pass, Depth Filter
Oil Cooler:-	
Type	- Water cooled type
Oil Filter Body:-	
Regulating Valve opening Pressure	- 4.0 Kg/CM ²
Oil Filter relief Valve opening pressure	- 1.0 Kg/CM ²
Oil Cooler pass valve opening pressure	- 0.6 Kg/CM ²

LUBRICATION CIRCUIT



4TG02X-003

COOLING SYSTEM

Method - Water Cooled

Coolant Capacity - 13.5 Litres

Thermostat:-

Type - Wax Type

Opening Temp. - 86°C

Full Open Temp. - 97°C

Full Open Lift - 8.5 mm

Water Pump:-

Type - Centrifugal

Driving Method - Drive Belt

Radiator:-

Type - Corrugated Fin

Cap Valve Opening - 0.75 - 1.05 Kg/Cm²

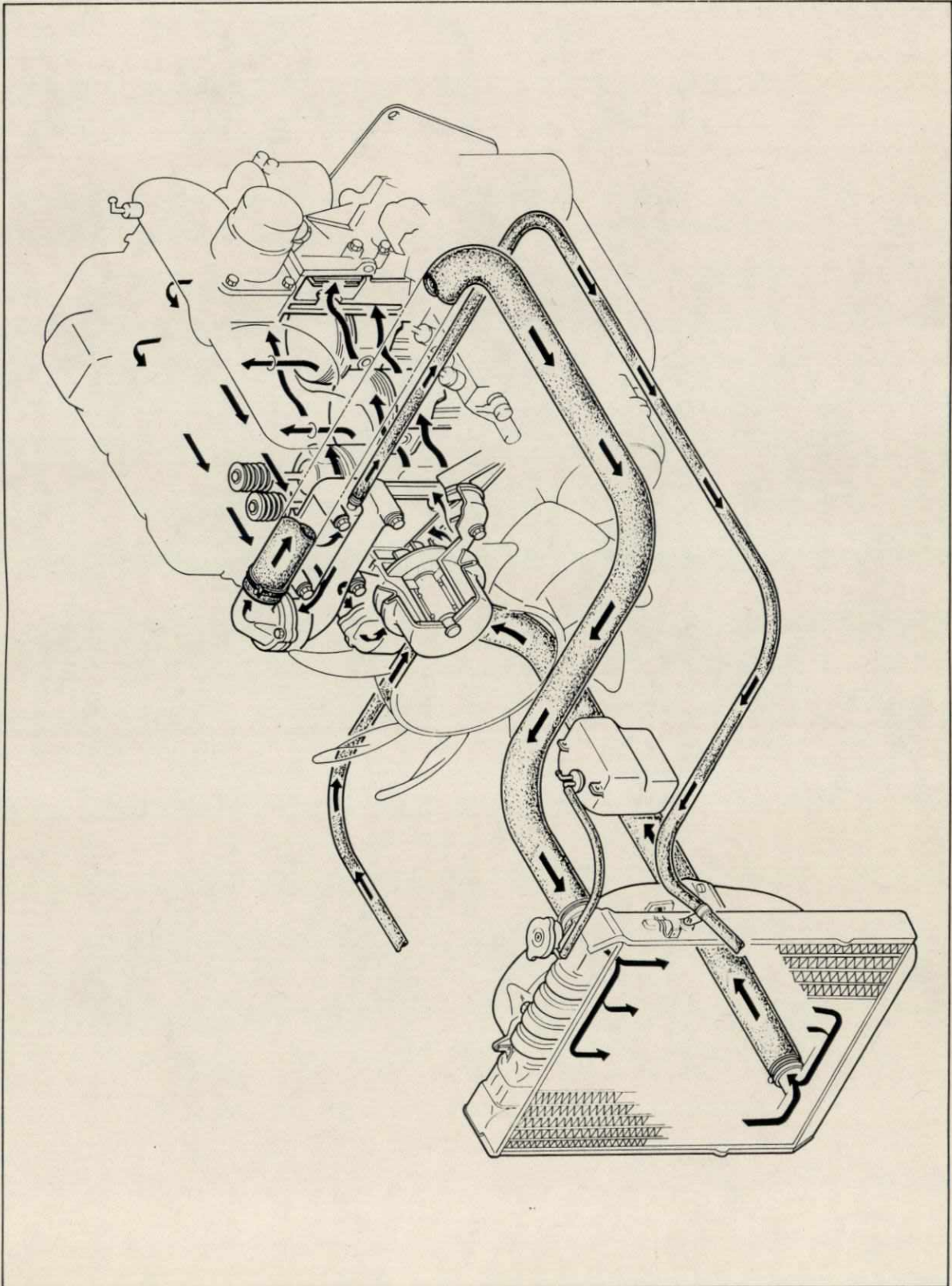
Cooling Fan:-

Type - Direct Coupled

No. of Blades - 8

Outer Dia - 410 mm.

COOLANT CIRCUIT



4TG03X-003

FUEL TANK

Capacity - 75 Litres

Fuel Filter:-

Type - Paper Element

Injection Pump:-

Injection Timing - 12° BTDC

Turning Direction - Clockwise

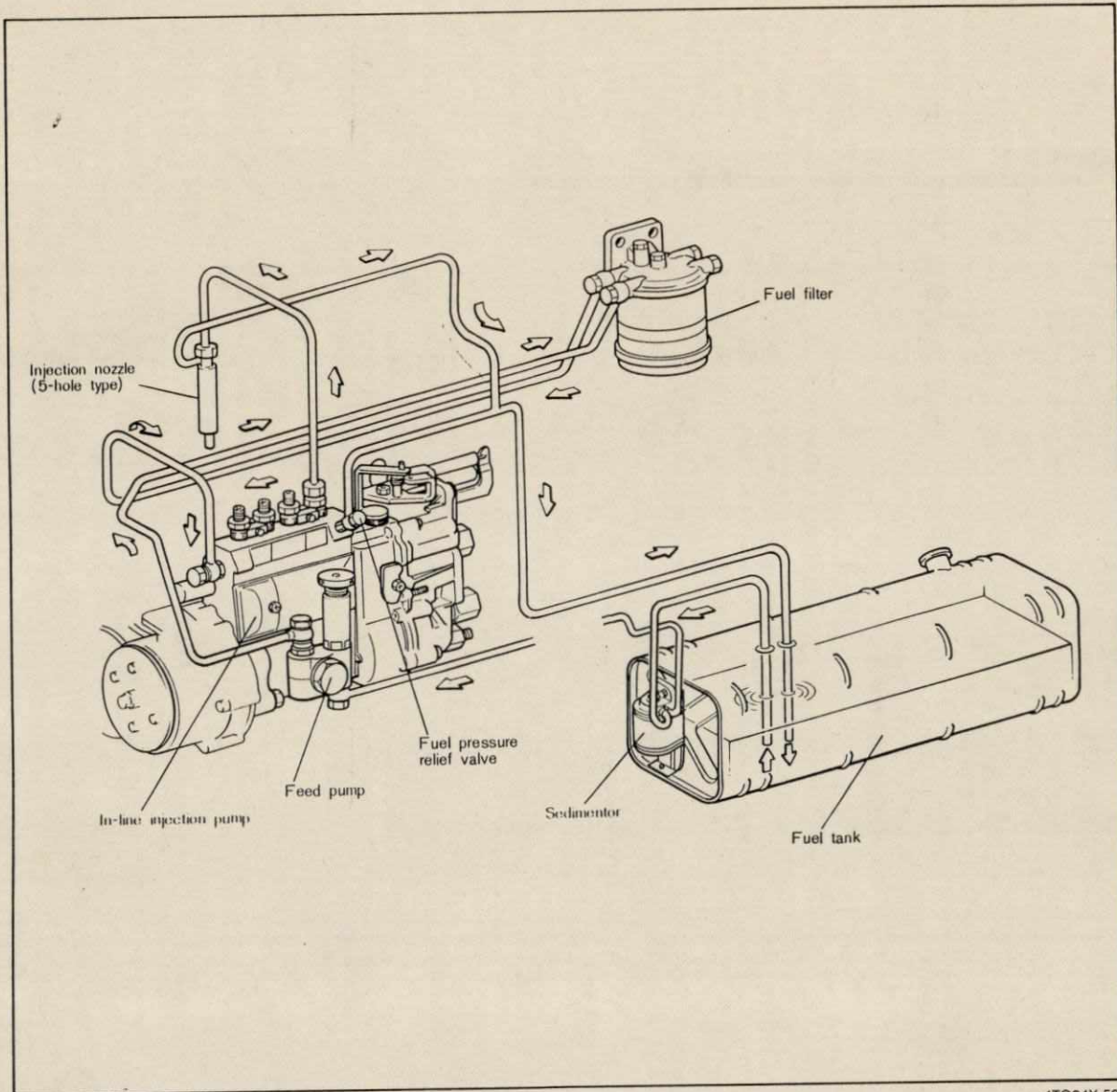
Injection Order - 1 - 3 - 4 - 2

Air Cleaner:-

Type - Filter Paper Element
(Oil Bath Type)

OUTLINE

FUEL SYSTEM



4TG04X-501

1. The fuel system of the direct injection SL engine uses 5-hole type injection nozzles and an in-line injection pump (Bosch type).
The injection pump generates a high injection pressure of 170 kg/cm^2 (2417 lb/in^2) and the fuel is injected from the injection nozzles as a fine spray and at a wide angle into the combustion chamber, improving combustion and increasing power.
2. The fuel, which is pumped up through the sedimentor from the fuel tank, is filtered and then supplied to the injection pump. If the fuel pressure is above 1.6 kg/cm^2 (23 lb/in^2) the fuel pressure relief valve opens and part of the fuel is returned to the fuel tank.

CLUTCHClutch Cover:-

Pressure Force - 635 Kgs.
Form of Spring - Diaphragm Spring

Clutch Disc:-

Spline
Innerdia X No. of Tooth - 24 mm X 12

Clutch Pedal:-

Type - Hanging Type
Full Stroke - 150 mm
Height - 195 - 200 mm

TRANSMISSION

Change Lever Position :

- Floor Shift

Gear Ratio

First

- 5.833

Second

- 2.855

Third

- 1.651

Fourth

- 1.000

Fifth

- 0.800

Reverse

- 5.372

Specified Oil

- API Service GL-4 or
GL-5

(Outside Temperature

-18 degree centrigade

FRONT and REAR AXLES:--Front Axle:--

Wheel Bearing Preload	-	4 to 22 cmkg (Measured by pull scale)
King Pin Diameter	-	29.987 -30.000 mm
King Pin Bush Bore	-	30.007- 30.028 mm

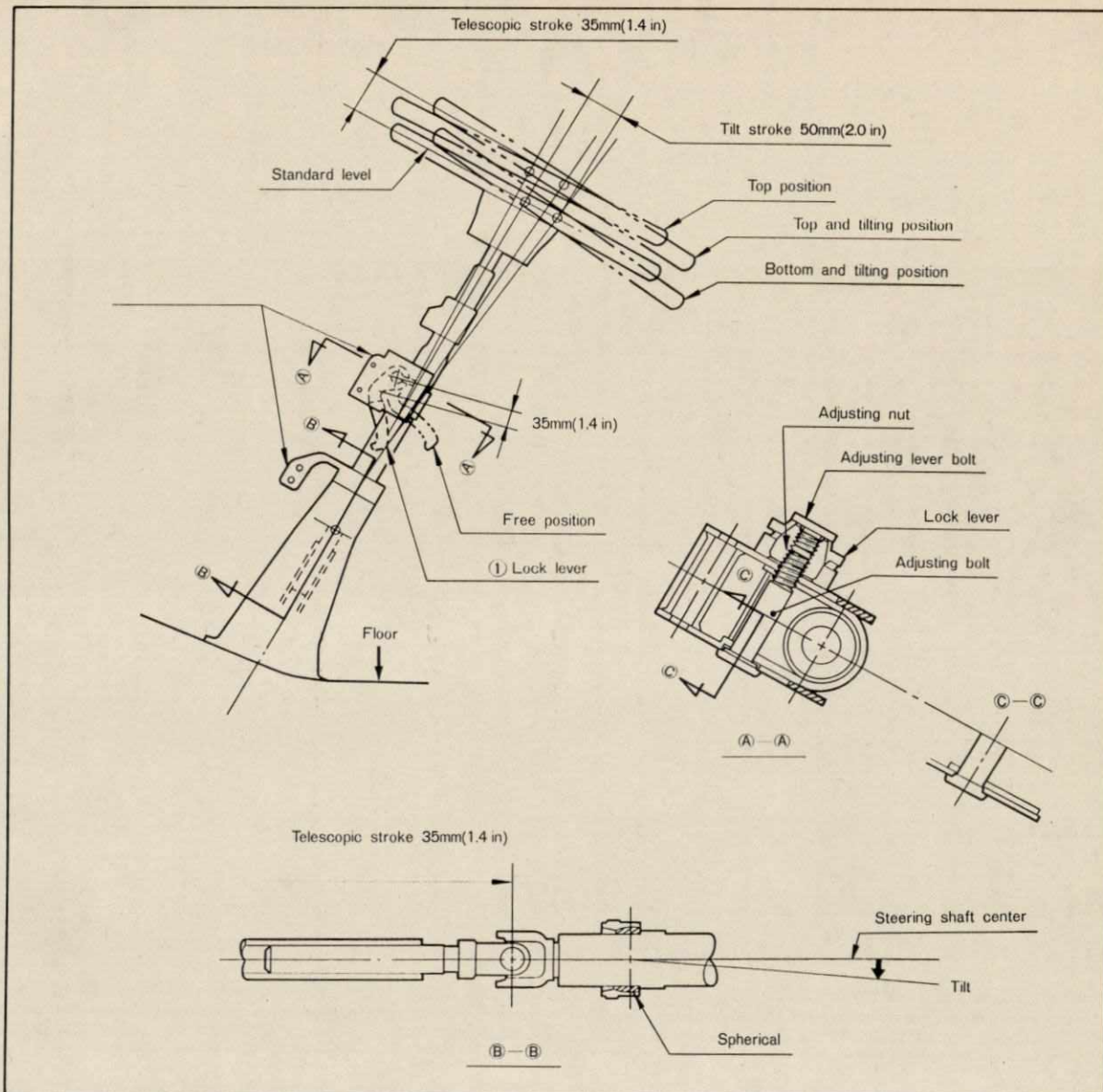
Rear Axle:--

Wheel Bearing Preload	-	4 to 22 cmkg (Measured by pull scale)
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Driving and Differential :--

Type	-	Banjo Type
Final Gear Ratio	-	6.571
Specified Oil	-	API Service GL-5
Capacity (Liters)	-	2.6
Pinion Height	-	0 \pm 0.025mm
Adjust Shim	-	0.10mm

TILT AND TELESCOPIC STEERING (IF SO EQUIPPED)



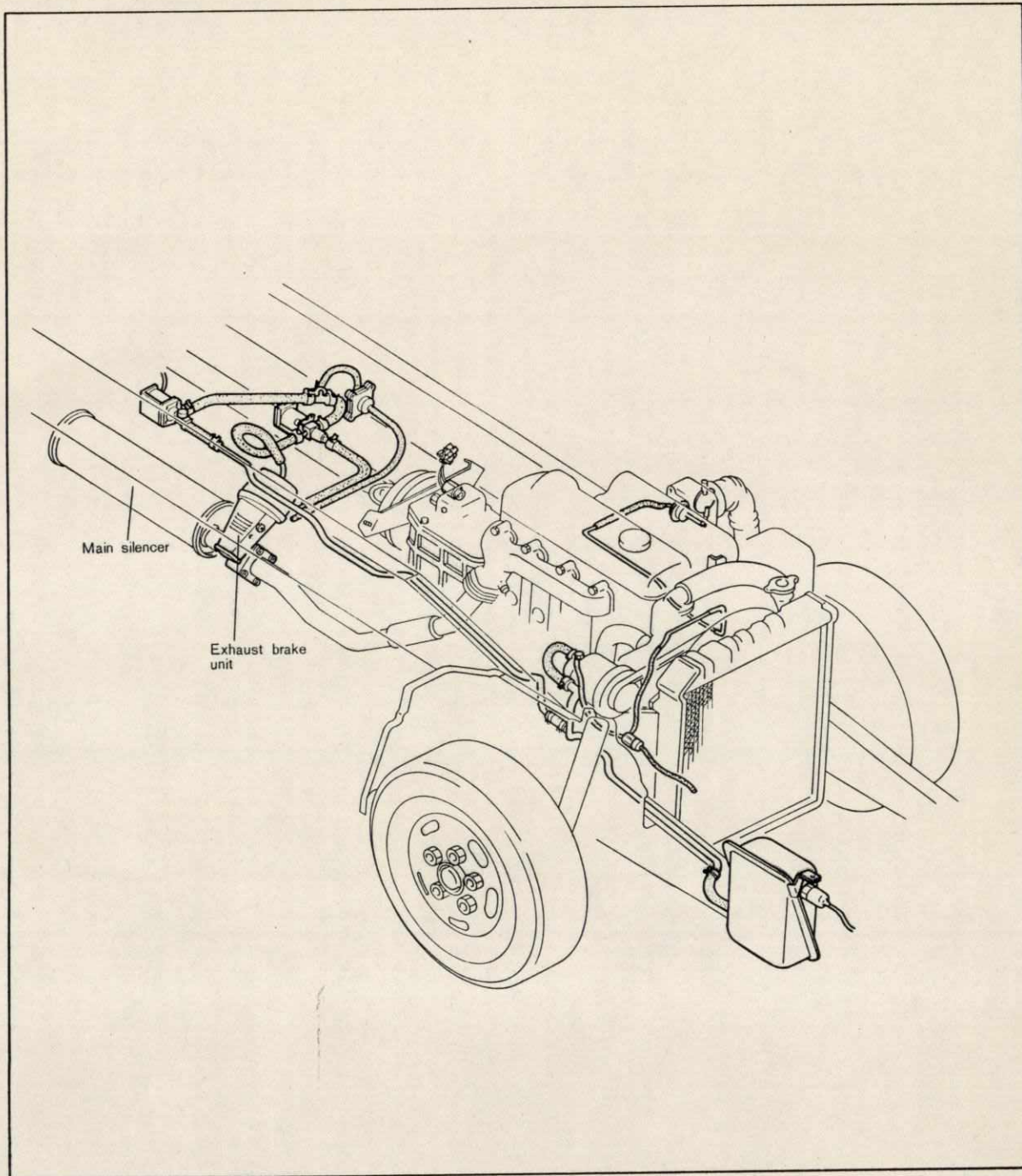
4TG10X-003

Tilt and Telescopic Steering (If so Equipped)

To be able to adjust the position of the steering wheel according to the driver's size or driving conditions, the telescopic option has been added, allowing the steering wheel to be adjusted up and down in the range of **35 mm (1.4 in)** in addition to the tilt feature.

The tilt and telescopic adjustments are both performed by releasing the lock lever.

EXHAUST SYSTEM



4TG04X-503

1. Exhaust controlled heating system has been used to improve heating performance, reduce warming-up time of the engine and minimize the emission of white smoke.
2. An exhaust brake unit, which is used both as an exhaust brake and by the exhaust controlled heating system, has been added.
3. To improve exhausting of combusted gas, the SL engine uses an exhaust pipe of the same diameter as the ZB engine.
4. To reduce exhaust noise, the interior of the main silencer has been modified.

CONCLUSIONS AND RECOMMENDATION

After thorough investigation of the various departments in contact with Spare Parts Division Stores and their basic responsibilities and procedure, the following conclusions can be presented;

Non Existence of the planning of a very high esteem for the determination of the inventory for the components to be stored in the Spare Parts Division Stores has resulted in :

- accumulation of certain slow moving components.
- inadequate quantity of certain fast moving components.

With more emphasis on material management the present improper material levels can be checked. For this the "Material Movement Study--Spare Parts" which is periodically carried out by the Industrial Engineering Department must be taken into consideration.

It has been observed that a large number of paper cuttings are daily being utilized as the packing material. Also a large

number of the papers are going as waste, this include the
note pads, computer papers etc. However all these should
send to the Spare Parts Division Stores, so that the Paper
Shreeding Machine, which has to be installed in the Packing
Area, can use the waste papers for converting it into paper
cuttings.

REFERENCES

1. Maynard H. B. : Industrial Engineering Handbook. Third Edition, McGraw Hill Book Company, New York.
2. Apple James M. Plant Layout and Material Handling, The Ronald Press Company, New York.
3. Dalela Suresh and Ali Manseer: A TextBook of Industrial Engineering and Management System, Standard Publishers, Distributors, New Delhi.
4. Mayer R. Raymond : Production Management, McGraw Hill Book Company, New York.

REFERENCE

90230
Thapar University, Patiala
Central Library

REFERENCE

17.8.87
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