MECHANIC AUTO BODY PAINTING

NSQF LEVEL - 3

TRADE PRACTICAL

SECTOR: AUTOMOTIVE

(As per revised syllabus July 2022 - 1200 of hrs)

Directorate General of Training

DIRECTORATE GENERAL OF TRAINING
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
GOVERNMENT OF INDIA

NATIONAL INSTRUCTIONAL MEDIA INSTITUTE, CHENNAI

Post Box No. 3142, CTI Campus, Guindy, Chennai - 600 032

Sector : Automotive

Duration : 1 - Year

Trade : Mechanic Auto Body Painting - Trade Practical - NSQF Level - 3 (Revised - 2022)

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FOREWORD

The Government of India has set an ambitious target of imparting skills to 30 crores people, one out of every four Indians, by 2020 to help them secure jobs as part of the National Skills Development Policy. Industrial Training Institutes (ITIs) play a vital role in this process especially in terms of providing skilled manpower. Keeping this in mind, and for providing the current industry relevant skill training to Trainees, ITI syllabus has been recently updated with the help of Mentor Councils comprising various stakeholder's viz. Industries, Entrepreneurs, Academicians and representatives from ITIs.

The National Instructional Media Institute (NIMI), Chennai has now come up with instructional material to suit the revised curriculum for **Mechanic Auto Body Painting - 1 Year - Trade Practical - NSQF Level - 3 (Revised 2022) in Automotive Sector under annual Pattern.** The NSQF Level - 3 (Revised 2022) Trade Practical will help the trainees to get an international equivalency standard where their skill proficiency and competency will be duly recognized across the globe and this will also increase the scope of recognition of prior learning. NSQF Level - 3 (Revised 2022) trainees will also get the opportunities to promote life long learning and skill development. I have no doubt that with NSQF Level - 3 (Revised 2022) the trainers and trainees of ITIs, and all stakeholders will derive maximum benefits from these IMPs and that NIMI's effort will go a long way in improving the quality of Vocational training in the country.

The Executive Director & Staff of NIMI and members of Media Development Committee deserve appreciation for their contribution in bringing out this publication.

Jai Hind

SHRI. ATUL KUMAR TIWARI., I.A.S.,

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PREFACE

The National Instructional Media Institute (NIMI) was established in 1986 at Chennai by then Directorate General of Employment and Training (D.G.E & T), Ministry of Labour and Employment, (now under Directorate General of Training, Ministry of Skill Development and Entrepreneurship) Government of India, with technical assistance from the Govt. of the Federal Republic of Germany. The prime objective of this institute is to develop and provide instructional materials for various trades as per the prescribed syllabi under the Craftsman and Apprenticeship Training Schemes.

The instructional materials are created keeping in mind, the main objective of Vocational Training under NCVT/NAC in India, which is to help an individual to master skills to do a job. The instructional materials are generated in the form of Instructional Media Packages (IMPs). An IMP consists of Theory book, Practical book, Test and Assignment book, Instructor Guide, Audio Visual Aid (Wall charts and Transparencies) and other support materials.

The trade practical book consists of series of exercises to be completed by the trainees in the workshop. These exercises are designed to ensure that all the skills in the prescribed syllabus are covered. The trade theory book provides related theoretical knowledge required to enable the trainee to do a job. The test and assignments will enable the instructor to give assignments for the evaluation of the performance of a trainee. The wall charts and transparencies are unique, as they not only help the instructor to effectively present a topic but also help him to assess the trainee's understanding. The instructor guide enables the instructor to plan his schedule of instruction, plan the raw material requirements, day to day lessons and demonstrations.

IMPs also deals with the complex skills required to be developed for effective team work. Necessary care has also been taken to include important skill areas of allied trades as prescribed in the syllabus.

The availability of a complete Instructional Media Package in an institute helps both the trainer and management to impart effective training.

The IMPs are the outcome of collective efforts of the staff members of NIMI and the members of the Media Development Committees specially drawn from Public and Private sector industries, various training institutes under the Directorate General of Training (DGT), Government and Private ITIs.

NIMI would like to take this opportunity to convey sincere thanks to the Directors of Employment & Training of various State Governments, Training Departments of Industries both in the Public and Private sectors, Officers of DGT and DGT field institutes, proof readers, individual media developers and coordinators, but for whose active support NIMI would not have been able to bring out this materials.

Chennai - 600 032 **EXECUTIVE DIRECTOR**

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National Instructional Media Institute (NIMI) sincerely acknowledges with thanks for the co-operation and contribution extended by the following Media Developers and their sponsoring organisations to bring out this Instructional Material **(Trade Practical)** for the trade of **Mechanic Auto Body Painting** under **Automotive** Sector for ITIs.

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NIMI records its appreciation for the Data Entry, CAD, DTP operators for their excellent and devoted services in the process of development of this Instructional Material.

NIMI also acknowledges with thanks the invaluable efforts rendered by all other NIMI staff who have contributed towards the development of this Instructional Material.

NIMI is also grateful to everyone who has directly or indirectly helped in developing this Instructional Material.

INTRODUCTION

TRADE PRACTICAL

The trade practical manual is intented to be used in practical workshop. It consists of a series of practical exercises to be completed by the trainees during the Course of the **Mechanic Auto Body Painting** Trade supplemented and supported by instructions/ informations to assist in performing the exercises. These exercises are designed to ensure that all the skills in compliance with NSQF LEVEL - 3 (Revised 2022) syllabus are covered.

Module 1 Workshop Safety Practice

Module 2 Measuring and Marking Practice

Module 3 Fastening and Fitting

Module 4 Basic Workshop Practice

Module 5 Basic Electrical and Vehicle Construction Technology

Module 6 Air Compressor and Refinishing Materials

Module 7 Body Fillers and Corrosion Protection

Module 8 Refinishing Equipment Technology

Module 9 Vehicle Masking and Refinishing

Module 10 Paint Colour Matching and Trouble shooting

The skill training in the shop floor is planned through a series of practical exercises centred around some practical project. However, there are few instances where the individual exercise does not form a part of project.

While developing the practical manual a sincere effort was made to prepare each exercise which will be easy to understand and carry out even by below average trainee. However the development team accept that there is a scope for further improvement. NIMI looks forward to the suggestions from the experienced training faculty for improving the manual.

TRADE THEORY

The manual of trade theory consists of theoretical information for the Course of the Mechanic Diesel Trade. The contents are sequenced according to the practical exercise contained in NSQF LEVEL - 3 (Revised 2022) syllabus on Trade practical. Attempt has been made to relate the theoretical aspects with the skill covered in each exercise to the extent possible. This correlation is maintained to help the trainees to develop the perceptional capabilities for performing the skills.

The Trade Theory has to be taught and learnt along with the corresponding exercise contained in the manual on trade practical. The indications about the corresponding practical exercises are given in every sheet of this manual.

It will be preferable to teach/learn the trade theory connected to each exercise atleast one class before performing the related skills in the shop floor. The trade theory is to be treated as an integrated part of each exercise.

The material is not for the purpose of self learning and should be considered as supplementary to class room instruction.

CONTENTS

LEARNING / ASSESSABLE OUTCOME

On completion of this book you shall be able to

S.No	Learning Outcome	Exercise No
1	Check & perform Measuring & marking by using various Measuring & Marking tools(Vernier Calliper, Micrometer, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.) following safety precautions	1.1.01 to 1.2.12
2	Plan & perform basic fastening & fitting operation by using correct hand tools, Machine tools &equipment.	1.2.13 to 1.4.19
3	Trace and Test all Electrical & Electronic components & circuits and assemble circuit to ensure functionality of system.	1.5.20 to 1.5.21
4	Check & Interpret Vehicle Specification data and VIN Select & operate various Service Station Equipments.	1.5.22 to 1.5.26
5	Identify various vehicle parts and Service, Repair and Maintenance of Air compressor and Air Lines.	1.5.27 to 1.5.30 1.6.31 to 1.6.40
6	Demonstrate proper paint shop equipment and pre-paint preparation steps such as proper final sanding, masking, buffing, and detailing skills.	1.6.41 to 1.6.49
7	Acquire skills on the use of basic auto body hand and power tools and application and finishing of body filler materials and undercoats.	1.7.50 to 1.7.56
8	Demonstrate understanding of the causes and effects of corrosion on automobile bodies and methods of corrosion protection.	1.7.57 to 1.7.59
9	Demonstrate how to use different painting tools and equipment including how to disassemble, assemble, and clean paint guns.	1.8.60 to 1.8.65
10	Demonstrate knowledge of correct paint application techniques and be able to identify paint problems along with troubleshooting skills.	1.8.66 to 1.8.75 1.9.76 to 1.9.82
11	Demonstrate finishing process.	1.9.83 to 1.9.87
12	Demonstrate the use of computer color matching systems and the use of tinting solid and metallic colors.	1.10.88 to 1.10.92
13	Demonstrate how to remove minor paint imperfections.	1.10.93 to 1.10.97

SYLLABUS FOR MECHANIC AUTOBODY PAINTING

Duration	Reference Learning Outcome	Professional Skills (Trade Practical) with Indicative hours	Professional Knowledge (Trade Theory)
Professional Skill 105Hrs; Professional Knowledge 25Hrs	Check & perform Measuring & marking by using various Measuring & Marking tools (Vernier Caliper, Micrometer, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge) following safety precautions	1. Familiarization with institute, Job opportunities in the automobile sector.(5 hrs.) 2. Machinery used in Trade.(08 hrs.) 3. Types of work done by the students in the shop floor.(10hrs.)	**Admission & introduction to the trade:** Introduction to the Course duration, course content, study of the syllabus. General rule pertaining to the Institute, facilities available- Hostel, Recreation, Medical and Library working hours and time table (05 hrs)
		4. Practical related to Safety and Health.(10hrs.) 5. Importance of maintenance and cleanliness of Workshop.(5hrs.) 6. Use of fire extinguishers.(10hrs.) 7. Demonstration on safe handling and Periodic testing of lifting equipment. (5hrs.) 8. Safety disposal of Used engine oil/ Paints etc. (05hrs.) 9. Energy saving Tips Usage.(02hrs.)	**Occupational Safety & Health** Importance of Safety and general Precautions to be observed in the shop. Basic first aid, safety signs - for Danger, Warning, caution & personal safety message. Safe handling of Fuel Spillage, Fire extinguishers used for Different types of fire. safe disposal of toxic dust, safe handling and Periodic testing of lifting equipment, Safety disposal of Used engine oil, Electrical safety tips. Hazard identification, spatter hazard etc. and countermeasure to eliminate them & importance of usage of PPEs. (7 hrs)
		10. Practice using all marking aids, like steel rule with spring calipers, dividers, scriber, punches, Chisel etc.(10hrs.) 11. Practice on General workshop tools & power tools and equipments (15hrs.)	**Hand Tools** Marking scheme, Marking material-chalk, Prussian blue. Cleaning tools-Scraper, wire brush, Emery paper, Description, care and use of Surface plates, steel rule, measuring tape, try square. Calipers-inside and outside. Dividers, surface gauges, scriber, punches-prick punch, center punch, pin punch, hollow punch, number and letter punch. Chisel-flat, cross-cut. Hammer- ball pein, lump, mallet, Different type of -body hammers, pick hammers, , Bumping hammers, finishing hammers, dolly block, and body spoon, body picks, body pullers and pull rods, suction cup, scratch awl,Screw drivers-blade screwdriver, Phillips screw driver, Ratchet screwdriver. Allen key, bench vice & C-clamps, Spanners- ring spanner, open end spanner & the combination spanner, universal adjustable open-end spanner. Sockets & accessories, Pliers -Combination pliers, multi grip, long nose, flat-nose, Nippers or pincer pliers, Metal cutting shears- Tin snips, sheet metal cutting pliers, (Aviation snips), panel cutters, trim

			and upholstery tools, Door handle tool (clip pullers), Metal files-reveal file, surform file, sanding board, sanding block, spreaders and squeegees. (8 hrs)
		12. Measuring practice on engine components with aid of instrument studied.(20 hrs.)	**Systems of measurement:** Description, care & use of Micrometers- Outside and depth mirometer, Micrometer adjustments, Vernier calipers, (05 hrs)
Professional Skill 70 Hrs; Professional Knowledge 15Hrs	Plan & perform basic fastening & fitting operation by using correct hand tools, Machine tools &equipment.	13. Practice on General cleaning, checking and use of nut, bolts, & studs etc.(10 hrs.)	**Fasteners-** Study of different types of screws, nuts, studs & bolts, locking devices, Such as lock nuts, cotter, split pins, keys, circlips, lock rings, lock washers and locating where they are used. Washers & chemical compounds can be used to help secure these fasteners. Description of Riveting tools (05 hrs)
		14. Practice on cutting tools like Hacksaw, file,chisel, OFF-hand grinding with sander, safety precautions while grinding.(20 hrs.) 15. Practice on Hacksawing and filing to given dimensions.(25hrs.)	**Cutting tools:-** Study of different type of cutting tools like Hacksaw, File- Definition, parts of a file, specification, Grade, shape, different type of cut and uses., chisel, OFF-hand grinding with sander, safety precautions while grinding. (05 hrs)
		16. Practice on Marking and Drilling clear and Blind Holes. (05 hrs.) 17. Safety precautions to be observed while using a drilling machine.(05 hrs.) 18. Practice on Tapping a Clear and Blind Hole. (02 hrs.) 19. Reaming a hole/ Bush to suit the given pin/ shaft, scraping a given machined surface.(03 hrs.)	**Drilling machine-** Description and study of Bench type Drilling machine, Portable electrical Drilling machine, drill holding devices, Drill bits. **Taps and Dies:** Hand Taps and wrenches, Different type of Die and Die stock. Screw extractors. **Hand Reamers -** Different Type of hand reamers, Lapping, Lapping abrasives, type of Laps. Function of Gaskets, Selection of materials for gaskets and packing, oil seals. (05 hrs)
Professional Skill 20Hrs; Professional Knowledge 05 Hrs	Test various electrical/ electronic components using proper measuring instruments and compare the data using standard parameters.	20. Measuring of current, voltage and resistance. (10 hrs.) 21. Using digital multimeter, practice continuity test for fuses, jumper wires, fusible links, circuit breakers. (10hrs.)	**Basic electricity,** Electricity principles, Ohm's law, Voltage, Current, Resistance, Power, Energy. Voltmeter, ammeter, Ohmmeter Multimeter (05 hrs)
Professional Skill 25 Hrs; Professional Knowledge 05Hrs	Check & Interpret Vehicle Specification data and VIN Select & operate various Service Station Equipment.	22. Identification of different type of Vehicle. (5 hrs.) 23. Demonstration of vehicle specification data; (5 hrs.) 24. Identification of vehicle information Number (VIN). (5 hrs.) 25. Demonstration of Garage, Service station equipment.(5 hrs.) 26. Vehicle hoists - Two post and four post hoist, Engine hoists, Jacks, Stands.(5 hrs.)	Auto Industry- History, leading manufacturers, development in automobile industry, trends, new product. Brief about Ministry of Road transport & Highways, The Automotive Research Association of India (ARAI), National Automotive Testing and R&D Infrastructure Project (NATRIP), & Automobile Association. Definition: - Classification of vehicles on the basis of load as per central motor vehicle rule, wheels, final drive, and fuel used, axles, position of engine and steering transmission, body and load. Brief description and uses of Vehicle hoists - Two post and four post hoist, Engine hoists, Jacks, **Stands**. (05 hrs)

Professional Skill 70 Hrs; Professional Knowledge 12 Hrs	Identify various vehicle parts and Service, Repair and Maintenance of Air compressor and Air Lines.	27. Washing of vehicle.(5 hrs.) 28. Identification of different type body, chassis, Drive lines.(05 hrs.) 29. Identify the location of parts and panels. (5hrs.) 30. Practice on use of computer-based service information, service manuals, refinishing guides, vehicle dimension manual, color matching guides, parts interchange guides. (20 hrs.)	I**ntroduction to Engine:** Description of internal & external combustion engines, Classification of IC engines, Principle & working of 2&4-stroke diesel engine (Compression ignition Engine (C.I)), Principle of Spark Ignition Engine(SI), differentiate between 2-stroke and 4 stroke, C.I engine and S.I Engine, Technical terms used in engine, Engine specification. Body shop & paint shop safety procedures. **Vehicle construction Technology** Definition of body shop, classification of body shop, Description of vehicle Body and Chassis. **Service information, Specifications, and Measurements** Study of Service Information, basic steps to using refinishing materials information, Vehicle paint code, study of service symbols, diagnosis charts. (07 hrs)
		31. Identify the parts of a piston type stationary compressor. (04hrs.) 32. Overhauling of service (FRL) unit. (02 hrs.) 33. Drain the air receiver and the moisture separator/regulator or air transformer. (03 hrs.) 34. Check the level of the oil in the crankcase, replace of compressor oil, clean air filters. (05hrs.) 35. Clean or blow off fins on cylinders, heads, intercoolers, After coolers. (03 hrs.) 36. Check the oil filter in the air line and change the filter element if necessary, Adjust the pressure switch cut-in and cut-out settings if needed. (03hrs.) 37. Check the relief valve for exhausting of head pressure each time the motor stops. (02hrs.) 38. Tighten belts to prevent slippage. (03 hrs.) 39. Check and align a loose motor pulley or compressor Flywheel. (05 hrs.) 40. Check for air leaks on the compressor outfit and air piping system. (05 hrs.)	**Compressor Air system:** Basic requirement for compressed air systems, Type of Compressor- Description and construction of Diaphragm compressor, piton type compressor-single stage and two stage, rotary screw air compressor, Performance of air compressor- Description of Horse power, delivery volume, displacement, Free air delivery, compressor volumetric efficiency, tank size, Air and Fluid Control Equipment - In take air filter, Distribution system, regulator, lubricator, different type air purification method, Compressor Accessories -Hose type, hose size, maintenance of hose, connectors, adapters and couplings, Air System Maintenance . Study the typical piping arrangement found in a body/paint shop, colour coding of airline, water line and fuel line. (05 hrs)
Professional Skill 100Hrs; Professional Knowledge 17 Hrs	Demonstrate proper paint shop equipment and pre-paint preparation steps	41. Identify the different type of refinishing material- paint binders, paint solvents, Paint additives. (10hrs.) 42. Select the right repair materials for a particular job. (5hrs.) 43. Select the right type of primer and paint. (10hrs.) 44. Identify various type masking material available in body shop. (10hrs.)	**Refinishing Materials:-** Merge with using body filters paint material types-Lacquer, enamel, water base, Content of paint-pain pigments, paint binders, paint solvents, Paint additives, Definition of Drying, curing, flash, retarder, accelerator, catalyst, adhesion promoter, blending solvent, Toners, Primers & sealers- self-etching primer, UV primer Primer-surfacer, Epoxy primers, Other paint

		45. Identify different type of body filler, (10hrs.) 46. Identify various type masking material available in body shop. (10hrs.) 47. Identify various type of grit rating available in the workshop. (10hrs.) 48. Identify the open and closed coat grit. (10hrs.) 49. Practice Cleaning, Pre-Treatment, surface conditioning, ED coating of any given panel.(25hrs.)	materials- prep solvent, flattener, fish-eye eliminator, flex agent, Antichip coating (Vinyl coating), Metal conditioner, Paint stripper, tack cloth, Masking materials- Masking paper, Primer masking paper, paint masking paper, masking plastic, masking tape, Fine line masks, Wheel masks. Abrasives- Abrasive material, grit, grit Ratings, open and closed coat grit, Grinding discs, sand paper- dry and wet type, scuff pads, Compounds-Rubbing compound, polishing compound, Adhesives, Epoxies. Composition of Paints, Paint Types. Impact of paint & paint paint component on plastic and rubber parts. Latest paint Techniques. (17 hrs)
Professional Skill 75 Hrs; Professional Knowledge 10 Hrs	Acquire skills on the use of basic auto body hand and power tools and application and finishing of body filler materials and undercoats.	50. Identify the different type of body filler, hardeners, and putties, used in industry. (10 hrs.) 51. Practice on a mixing board for applying Body filler. (15 hrs.) 52. Practice on preparation of damaged surface area of sheet metal. (10 hrs.) 53. Practice on applying the body filler on a damaged sheet metal area. (10 hrs.) 54. Using Hand-block sanding to smooth and level a repair area properly. (10 hrs.) 55. Practice repairing paint surface imperfections, (10 hrs.) 56. Perform Repairing ofpaint scratches, repairing nicks, repairing dings, preparing surface rust free. (10 hrs.).	**Using Body Fillers** Description of Body Fillers (Plastic filler), Body filler ingredients, Body filler hardeners, Putties, light weight fillers, premium fillers, spot putties, polyester glazing putty, applying body filler, preparation surface for filler, Ingredient, characteristics and application of body filler & putties, Rust repair procedures.(10 hrs)
Professional Skill 45 Hrs; Professional Knowledge 06 Hrs	Demonstrate understanding of the causes and effects of corrosion on automobile bodies and methods of corrosion protection.	57. Practice on corrosion treatment of sheet metal, interior and exterior surface. (15hrs.) 58. Preparation of repair estimate information by using an estimating guide book. (15hrs.) 59. Identify how an estimating guide gives part pricing and labour time information. (15 hrs.)	**Corrosion Protection** What Is Corrosion, Causes for Loss of Factory protection, Anticorrosion Materials, Basic Surface Preparation, Corrosion Treatment Areas, Exposed Exterior Surfaces, Exterior Accessories, **Estimating Repair** Costs Description of estimate, Direct repair programs, Estimate time factor, work orders, Using Estimate Guides, Part prices, Labor costs, Job overlap, and Included operation.(06 hrs)
Professional Skill 65 Hrs; Professional Knowledge 15 Hrs	Demonstrate how to use different painting tools and equipment including how to disassemble, assemble, and clean paint guns.	60. Practice on different ways to mix paint or other materials paint mixing sticks, (11 hrs.) 61. Practice on use of viscosity cup. (10 hrs.) 62. Testing Spray Pattern, Effect of Spray on Gun stroke, Gun Speed, Gun Triggering, Gun Direction, Spray	Refinishing equipment Technology Painting environment variable, Steps to keep dirt from finish during body repairs, Description of spray gun and its parts, basic stages of Atomization, High-Volume, Low-Pressure (HVLP) Spray Gun, Type of air spray gun-Gravity feed, Suction (siphon) feed, Pressure feed, Pressure-

		Overlap, Gun Handling Problems - Heeling, Arcing. (13 hrs.) 63. Practice on spray gun cleaning tank, manual spray gun cleaning, and spray gun lubrication. (11 hrs.) 64. Practice on maintains on spray booth. (10 hrs.) 65. Practice on use of Air-supplied respirators. (10 hrs.)	assist feed (gravity or suction cup spray guns) and their paint feed method, advantage and disadvantages. Spray gun air supply system, importance of spraying material viscosity, other spray systems,- airless spray gun system, electrostatic spraying system, touch-up guns, airbrushes, spray booths- one- and two-room spray booths, air makeup or air replacement system-Regular flow booth , Reverse flow booth, Cross draft booth, Downdraft booth, Air Filtration Systems- wet filtration system and the dry filtration system, spray booth maintenance, Description of drying room- types of infrared drying equipment- Near drying equipment. Far drying equipment. Description of Air-supplied respirators, type of air-supplied respirators- hood type and the face shield type. Other paint shop equipment and tools- wet sanding stand, Paint hangers, Panel drying ovens,Paint shakers, blade agitator, Churning knives, Paint scales, Paint cabinets, Tack cloths, purpose of strainer, Masking tape.(15 hrs)
Professional Skill 115 Hrs; Professional Knowledge 20 Hrs	Demonstrate knowledge of correct paint application techniques and be able to identify paint problems along with troubleshooting skills	66. Practice to correcting of an Air Spray Gun- Spray pattern top heavy or bottom heavy, Spray pattern heavy to right or to left, Spray pattern heavy at center, Spray pattern split, Pinholes, Blushing or a whitish coat, Orange peel (surface looks like orange peel), (12 hrs.) 67. Troubleshoot Excessive spray fog or overspray, No control over size of pattern, Sags or runs, (12 hrs.) 68. Troubleshoot Streaks Gun sputters constantly, Uneven spray pattern, Fluid leaks from spray gun, (08 hrs.) 69. Troubleshoot Fluid leaks from packing nut, Fluid leaks through fluid tip when trigger is released, (05 hrs.) 70. Troubleshoot Excessive fluid, Fluid will not come from spray gun, Fluid will not come from fluid tank or canister, (05 hrs.) 71. Troubleshoot Sprayed coat short of liquid material, Spotty, uneven pattern, slow to build,Unable to get round spray, Dripping from fluid tip, (05 hrs.) 72. Troubleshoot Excessive overspray, Excessive fog, will not spray on pressure feed, will not spray on suction feed, (05 hrs.)	Probable causes and remedies for Spray pattern top heavy or bottom heavy, Spray pattern heavy to right or to left, Spray pattern heavy at center, Spray pattern split,Pinholes,Blushing or a whitish coat, Orange peel (surface looks like orange peel), Excessive spray fog or overspray, No control over size of pattern, Sags or runs, Streaks Gun sputters constantly, Uneven spray pattern, Fluid leaks from spray gun, Fluid leaks from packing nut, Fluid leaks through fluid tip when trigger is released, Excessive fluid, Fluid will not come from spray gun, Fluid will not come from fluid tank or canister, Sprayed coat short of liquid material, Spotty, uneven pattern, slow to build, Unable to get round spray, Dripping from fluid tip, Excessive overspray, Excessive fog, Will not spray on pressure feed, Will not spray on suction feed, Air continues to flow through gun when trigger has been released (on non bleeder guns only), Air leak at canister gasket, Leak at setscrew in canister top, Leak between top of canister cover and gun body.(05 hrs)

		73. Troubleshoot Air continues to flow through gun when trigger has been released (on non-bleeder guns only), (05 hrs.) 74. Troubleshoot Air leak at canister gasket, (05 hrs.) 75. Troubleshoot Leak at set-screw in canister top, Leak between top of canister cover and gun body. (05 hrs.)	
		76. Practice on Checking Paint Thickness, (05hrs.) 77. Practice on paint removal using chemical stripping, (12 hrs.) 78. Practice Media blasting, Practice on Preparing Bare Metal using metal conditioners, preparing hard chrome Surfaces, preparing metalReplacement parts, (10hrs.) 79. Practice on applying spot putty, or glazing putty. (10hrs.) 80. Practice on final sanding, using the right grit, power sanding, hand sanding, dry sanding, wet sanding, (05hrs.) 81. Carry out Surface Cleaning. (08 hrs.) 82. Practice to mask the parts of a vehicle by using different masking techniques. (08 hrs.)	**Vehicle surface preparation and masking** Importance of surface preparation, Evaluate Surface Condition, Checking Paint Thickness, Paint Removal method- Chemical stripping, Media blasting- procedure for operating a blaster, type of grit and numbering system. Sanding or grinding, Importance of Preparing Bare Metal-using metal conditioners, preparing hard chrome Surfaces, preparing metal Replacement parts, using self-etch primer, apply seam sealer Prime coat Selection, applying prime coats applying spot putty, or glazing putty. final sanding, using the right grit, Masking, surface sanding methods, power sanding, hand sanding, dry sanding, wet sanding, comparison between wet and dry sanding, surface scuffing, Surface Cleaning. Masking, basic ways to mask the parts of a vehicle, liquid masking material, liquid masking system, Procedure, plastic sheet masking. masking paper and tape, masking aids-wheel masks, masking panel gaps, masking openings, Reverse masking, or blend masking, Masking rope, (aperture tape), surface cleaning, using wax-and-grease remover.(15 hrs)
Professional Skill 50 Hrs; Professional Knowledge 10 Hrs	Demonstrate finishing process.	83. Identify different type of paint for topcoat refinishing, paint used for refinishing. (10 hrs.) 84. Practice on applying Prime coats, Refinishing Plastic Parts, Basecoat/ Clearcoat Repairs. (10hrs.) 85. Practice on applying Single Stage Paints, Panel Repairs, Overall Refinishing. (10hrs.) 86. Removal of Masking Materials. (05 hrs.) 87. Practice paint polishing. (15 hrs.)	**Refinishing Procedures:** Functions of paint, OEM paint finishes procedures, different between OEM and refinish painting types of paint for topcoat refinishing, properties of paint used for refinishing. Topcoats, Prime coats, Preparing Refinish Materials,Pre-painting Preparations, Applying Prime coats, Refinishing Plastic Parts, Flash Times, Basic Spray Coats, Methods of Refinishing, Basecoat/Clearcoat Repairs, Applying Single Stage Paints, Panel Repairs, Overall Refinishing, Removal of Masking Materials.(10 hrs)
Professional Skill 50 Hrs; Professional Knowledge 10Hrs	Demonstrate the use of computer color matching systems and the use of tinting solid and metallic colors.	88. Practice on colour evaluations using sunlight & colour corrected light bulb. (10 hrs.) 89. Practice on matching Basic Paint Colors. (10 hrs.) 90. Practice on Spraying Metallic Colours, Practice on let-	**Color matching and Customized painting** Introduction, ColorTheory, Lighting-colour evaluations using sunlight & colour corrected light bulb, dimensions of colour- Value-lightness or darkness, Hue-color, cast, or tint, Chroma saturation, richness, intensity, or muddiness, standard colour chips, variance colour chips, Matching Basic

		down test panel for a three-stage finish. (10 hrs.) 91. Practice on a repair with a multistage mica or pearl finish. (10 hrs.) 92. Practice on use of Spectrophotometer or electronic colour Analyzer, use of Computerized Paint Matching Custom. (10 hrs.)	Paint Colors- use of colour test panel, spray-out test panel procedure, color spraying variables in the shop, positive and Negative variable, matching solid colors and metallic finishes, Spraying Metallic Colours-Wet Coats of Metallic Colour, Dry Coats of Metallic Colour, importance of metallic colour mixed, Metallic Colour Variables to darken & lighten, steps for spot repair with a fluorine clearcoat system, procedure for a letdown test panel for a three-stage finish, method for a spot or partial repair on a three-stage paint system, steps for a panel repair with a multi-stage mica or pearl finish, mica mid-coat blending procedure for a three-stage paint, Tinting, basic reasons for tinting a paint colour, three angles to determine whether a colour adjustment is necessary, Spectro-photometer or electronic colour Analyzer, Computerized Paint Matching Custom Painting.(10 hrs)
Professional Skill 50 Hrs; Professional Knowledge 10 Hrs	Demonstrate how to remove minor paint imperfections.	93. Practice on removing foreign matter in wet paint, wet sanding between coats. (05 hrs.) 94. Practice to correcting of - paint colour mismatch, orange peel, runs and sags, sand scratch swelling, bull's-eye featheredge , featheredge splitting, water spotting, chemical spotting, curing or drying failure, paint fish-eyes, blushing, bleeding, prime coat show-through, blistering, solvent popping, paint cracking, line checking, crazing, micro checking, lifting, paint wrinkling, mottling, pin holing, peeling, chalking, paint colour fade, dulled finish, debris in the finish, rust under the finish. (20 hrs.) 95. Repairing paint runs, repairing chipped paint, panel detail sanding. (10 hrs.) 96. Practice on visualizing of painted surface in three different angles for final detailing. (10 hrs.). 97. Practice Paint defect identification and area wise defect ranking and tolerance. (5 hrs.)	Paint Problems and Final Detailing Repairing Paint Problems-problems in wet paint, removing foreign matter in wet paint, wet sanding between coats, Causes, prevention and correcting of - paint colour mismatch, orange peel, runs and sags, sand scratch swelling, bull's-eye featheredge , featheredge splitting, water spotting, chemical spotting, curing or drying failure, paint fish-eyes, blushing, bleeding, prime coat show-through, blistering, solvent popping, paint cracking, line checking, crazing, micro checking, lifting, paint wrinkling, mottling, pin holing, peeling, chalking, paint colour fade, dulled finish, debris in the finish, rust under the finish. Final detailing-Detail sanding procedure, Repairing paint runs, repairing chipped paint, panel detail sanding procedure, Paint compounding- purpose, rubbing compound, machine compounding, using buffers and polishers, avoiding paint burn-through, machine buffing procedures, hand and machine Glazing and polishing procedure, Final cleaning, steps for caring for a new finish.(10 hrs)

Familiarisation with institute and auto body painting trade job opportunities in automobile sector

Objectives: At the end of this exercise you shall be able to
- **identify the function of institute**
- **identify the job opportunities in automotive sector.**

Requirements

Tools/Instruments

- I.T.I layout chart - 1 No.
- Video flim soft copy - 1 No.

Equipments/ Machines

- Video projector - 1 No.

Materials

- Wall screen - 1 No.

PROCEDURE

TASK 1 : **Familiarisation with institute**

Instructor brief the function of institute.

1 Introduce the instructor to the trainees.

2 Introduce the trainees to the instructor.

3 Instructor introduce himself to the trainee's.

4 Instructor give brief details about the function of the institute and organisational structure.

5 Visit to all the section of the institute.

6 Introduce the staffs and their designation.

7 Visit to smart classroom and show the video regarding organisation structure and importance autobody painting trade.

8 Explain the job opportunity in automotive sector.

9 Ask the trainees to write the name and designation of the key post staffs in the institute in Table - 1.

10 Ask the trainees to draw the layout of the institute in Table - 2.

11 Ask the trainees to write the job opportunities in the field of automotive in Table - 3.

Key post persons name and designation

Table 1

S.No	Name	Designation	Nature of work
1			
2			
3			
4			
5			

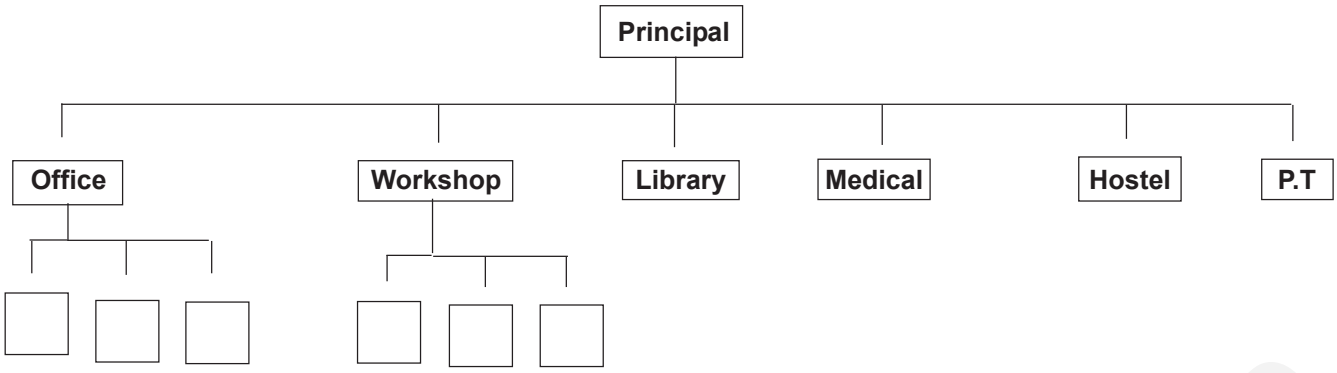
Table 3

Autobody Painter Job Opportunities

S.No	Government sectors	Private sectors
1		
2		
3		

Table 2

Institute Organisation Structure



Identify the machines/equipment in trade

Objective: At the end of this exercise you shall be able to

- **identify the air compressor, jib crane and bench drill.**

Requirements

Tools/Instruments

- Trainee's tool kit - 1 No.

Equipments/Machines

- Air compressor - 1 No.
- Jib crane - 1 No.
- Drilling machine - 1 No.

Materials

- Cotton waste - as reqd.
- Soap oil - as reqd.

PROCEDURE

TASK 1 : **Identify the equipment**

1 Take the participants around the workshop.

2 Identify the major workshop machinery like compressor, drilling machines.

3 Explain the constructional features and the use of compressor, air receiver.

4 Explain the use of compressed air and its applications.

5 Explain bench drilling machine, pillar drilling machine.

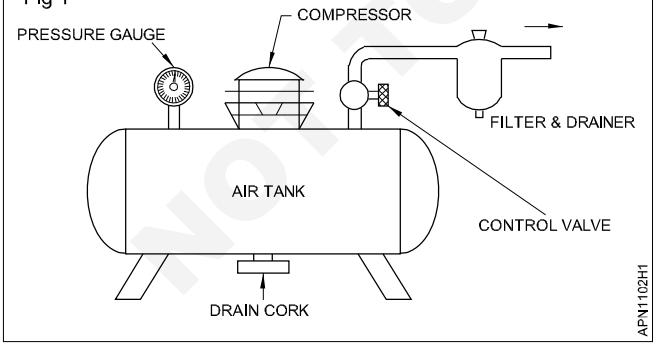
6 Explain through display charts, the features of all equipments in an automobile workshop.

7 Explain the paint booth function.

Air compressor (Fig 1)

- Compressor is an equipment to produce compressed air at required pressure through air hoses.

Fig 1



Jib crane (Fig 2)

- Jib crane is used to transport the objects, from one place to another shop floor.

Sensitive bench drilling machine (Fig 3)

- This machine is capable of drilling holes up to 12.5mm diameter. The drills are fitted in the chuck or directly in the tapered hole of the machine spindle.
- For normal drilling, the work-surface is kept horizontal. If the holes are to be drilled at an angle, the table can be tilted.

Fig 2

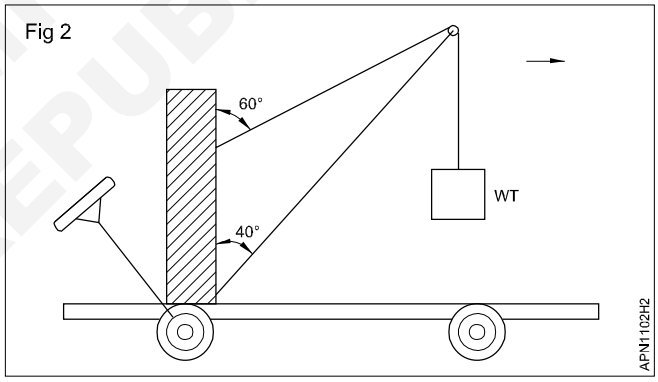
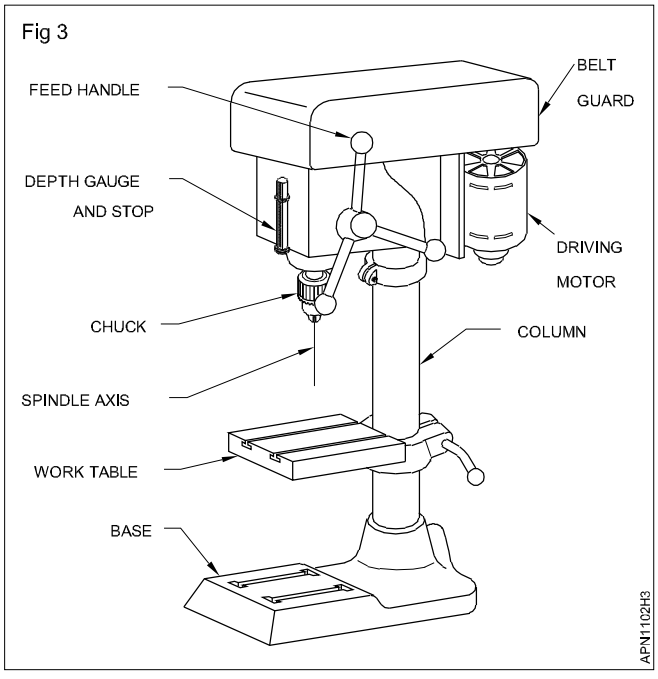


Fig 3



Types of work done in the shop floor

Objectives: At the end of this exercise you shall be able to
- **observe the personal safety during work and dispose the toxic dust**
- **handling and testing the lifting equipments and use the hand and power tools**
- **understand the basic electricity and save the electricity**
- **handle the two and four stroke engine**
- **identify the paint defects and paint colour codes**
- **identify the paint problems and repairing.**

PROCEDURE

TASK 1 : **Work done in the shop floor**

1 Trainees always use the personal protective equipment for personal safety during work in the shop floor.

2 Dispose the used oils/paints and toxic dust.

3 Handling and testing the lifting equipments.

4 Minimize the electricity consumption in the shop floor.

5 Select and use the correct tools in the shop floor.

6 Maintenance and cleanness of the shop floor and paint booth.

7 Maintain and operate the two & four stroke engine and compressors.

8 Wash the vehicle before painting.

9 Identify the vehicle paint type and colour.

10 Match the vehicle paint colour with paint colour code.

11 Removing and refinishing the vehicle paint.

12 Identify the paint defects and remedies.

13 Use the body fillers and repairing the paint problems.

14 Write down the systematic work done in the shop floor and verify it with your instructor.

Table 1

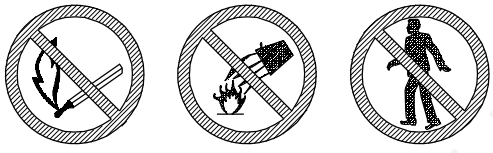
S.No	Work done by the trainees	Remarks
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

— — — — — — — —

Practical related to safety and health

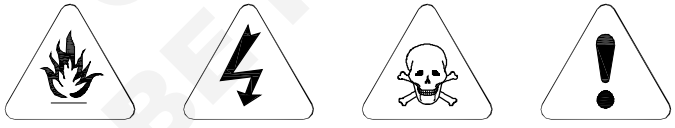
Objectives: At the end of this exercise you shall be able to

- **identify the four basic categories of safety sign**
- **identify the meanings of the safety sign**
- **read and interpret the different types of personal protective equipments from the chart.**

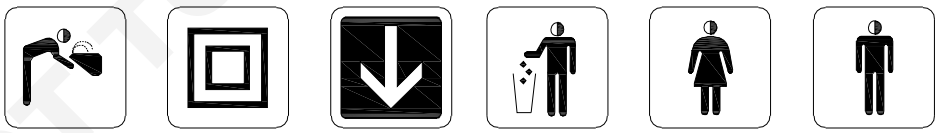


SMOKING AND NAKED FLAMES PROHIBITED | DO NOT EXTINGUISH WITH WATER | PEDESTRIANS PROHIBITED

WEAR HEAD PROTECTION | WEAR EYE PROTECTION | WEAR HEARING PROTECTION



RISK OF FIRE | RISK OF ELECTRIC SHOCK | TOXIC HAZARD | GENERAL WARNING RISK OF DANGER



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NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO:1.1.04
SCALE	**IDENTIFY THE CATEGORIES OF THE SAFETY SIGN**				DEVIATIONS	TIME
					CODE NO. APN1104E1	

TASK 1 : **Safety sign**

Instructor may provide various safety signs chart categories and explain their categories and their meaning, description. Ask the trainee to identify the sign and record in table

1 Identify the safety sign from the chart.

2 Record the name of the category in table1.

3 Mention the meaning description of the safety sign in table1.

Table 1

Fig No.	Basic categories/ safety sign	Meaning - descriptions
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

Get it checked by your instructor

— — — — — — — —

TASK 2 : **Personal protective equipments**

Fig 1

Note: The instructor may provide or arrange the different types of personal protection equipment or chart and explain how to identify and select the PPE devices suitable for the work and ask the trainees to write names in the given table.

1 Read and interpret the personal protective equipments by visually on real devices or from the charts.

2 Identify and select the personal protection equipment used for suitable type of protection.

3 Write the name of the PPE to the corresponding type of protective safety equipments in Table 2.

Table 2

S.No	Name of the PPE	Hazards	Type of protection
1			
2			
3			
4			
5			
6			
7			
8			
9			

Get it checked by your instructor.

— — — — — — — —

TASK 3 : **Identify the occupational hazards**

Instructor may brief the various types of occupational hazards and their causes.

1 Identify the occupational hazard to the corresponding situation with a potential harm given in table3.

Table 3

S.No	Source or potential harm	Type of occupational hazards
1	Noise	
2	Explosive	
3	Virus	
4	Sickness	
5	Smoking	
6	Non control device	
7	No earthing	
8	Poor house keeping	

Fill up and get it checked by your instructor.

— — — — — — — —

TASK 4: **PPE Instruction and uses**

1 Some cleaning agents are toxic. Refer to the information about handling; use and storage of chemicals that may be hazardous, follow any recommendations made by the supplier before using it.

2 Do not use flammable cleaners or water on electrical equipment.

3 Make sure designated walkways are kept clear of any obstructions.

4 Always wear protective clothing and the appropriate safety equipment.

Note: Make sure that you understand and observe all legislative and personal safety procedures when carrying out the following TASKs.

If you are unsure of what are these procedures, ask your instructor to know more.

— — — — — — — —

Practice on workshop maintenance and cleanliness

Objectives : At the end of this exercise you shall be able to
- **carryout the maintenance of equipment**
- **clean the tools and equipment.**

Requirements

Tools/Instruments

- Trainee's tool kit - 1 No.

Materials

- Cleaning solvent - as reqd.
- Washing powder - as reqd.
- Cotton waste - as reqd.
- Brush - as reqd.

PROCEDURE

TASK 1: **Maintenance of tools and equipment**

1 Clean tools and equipment and work more efficiently. At the end of each working day clean the tools and equipment used and check them for any damage. If you note any damage, tag the tool as faulty.

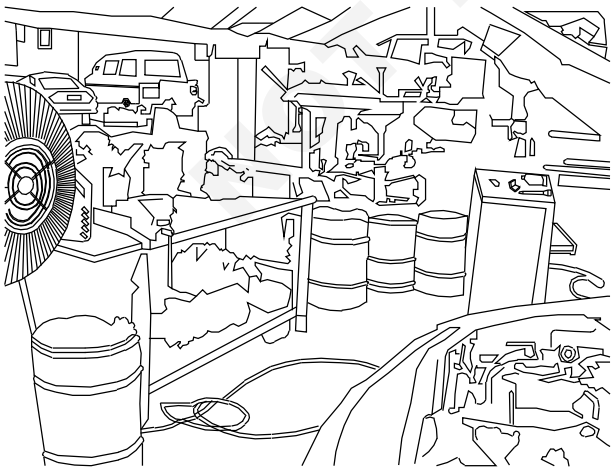
2 Electrical current can travel over oily or greasy surfaces. Keep electrical power tools free from dust and dirt and make sure they are free of oil and grease.

3 All workshop equipment should have a maintenance schedule. Always complete the TASKs described on the schedule at the required time. This will help to keep the equipment in safe working order.

4 Store commonly used tools in an easy-to-reach location.

5 If a tool, or piece of equipment, is too difficult to be returned, it could be left on a workbench or on the floor where it will become a safety hazard. (Fig 1)

Fig 1



UNORGANIZED WORKSHOP

APN1105H1

6 Keep your work area cleanly. This will help you work more efficiently and safely. (Fig 2)

7 Have a waste bin close to your work area and place any waste in it as soon as possible.

8 Dispose of liquid and solid waste, such as oils, coolant and worn components, in the correct manner.

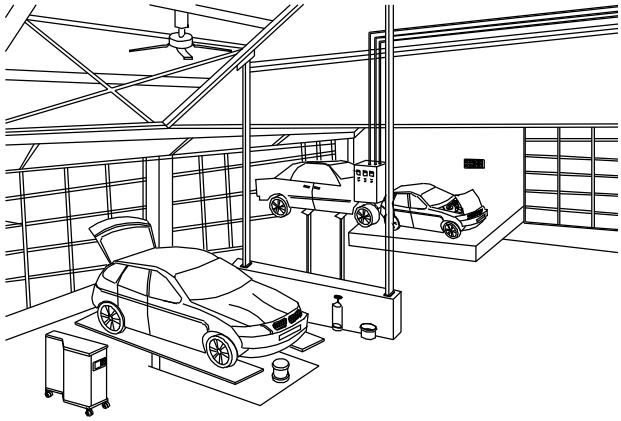
9 Do not pour solvents or other chemicals into the sewage system. This is both environmentally damaging and illegal.

9 Always use chemical gloves when using any cleaning material because excessive exposure to cleaning materials can damage skin.

10 Some solvents are flammable. Never use cleaning materials near an open flame or cigarette.

11 The fumes from cleaning chemicals can be toxic, so wear appropriate respirator and eye protection wherever you are using these products.

Fig 2



ORGANIZED WORKSHOP

APN1105H2

TASK 2: **Clean the hand tools, jack, power tool and machineries**

1 Clean the hand tools

- Keep your hand tools in, clean condition with two sets of cabinet. One cabinet should be lint-free to handle precision instruments or components.
- The other should be oily to prevent rust and corrosion.

2 Clean the floor jacks

- Wipe off any oil or grease on the floor jack and check for fluid leaks. If you find any leaks, rectify the leaks and top up the hydraulic fluid.
- Occasionally, apply a few drops of lubricating oil to the wheels and a few drops to the posts of the safety stands.

3 Clean the electrical power tools

- Keep power tools clean by brushing off any dust and wiping off excess oil or grease with a clean rag.
- Inspect any electrical cables for dirt, oil or grease, and for any chafing or exposed wires.
- With drills, inspect the chuck and lubricate it occasionally with machine oil.

4 Clean the air powered tools

- Apply a few drops of oil into the inlet of your air tools every day. Although these tools have no motor, they need to do regular lubrication of the internal parts to prevent wear.

5 Clean the hoists and heavy machinery

- Locate and checklist or maintenance record for each hoist or other major piece of equipment before carrying out cleaning activities.

Clean operating mechanisms and attachments of excess oil or grease.

— — — — — — — —

Practice on fire extinguishers

Objectives: At the end of this exercise you shall be able to
- **select the fire extinguisher according to the type of fire**
- **operate the fire extinguisher.**

Requirements

Tools/Instruments

- Trainee's tool kit - 1 No.

Equipments

- Cut - Models of fire extinguisher - as reqd.
- Fire extinguisher (different type) - as reqd.

Materials

- Old tyre - as reqd.
- Wood, Paper, Cloth & Grease - as reqd.
- Gas and Liquified gas - as reqd.
- Metal and Electrical equipment - as reqd.

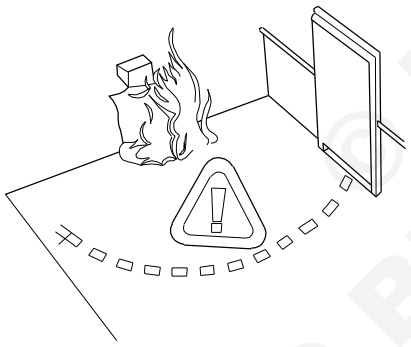
PROCEDURE

TASK 1: **Fire extinguisher according to the type of fire**

1 Alert people surrounding by shouting fire, fire, fire when you observe fire (Fig 1a).

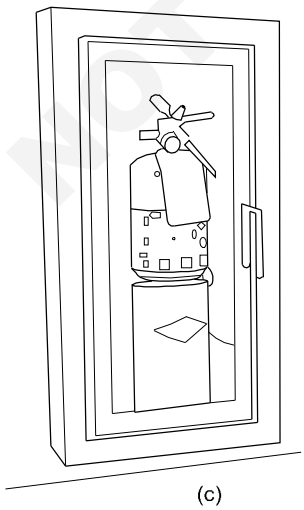
2 Inform to Fire Service or arrange to inform immediately (Fig 1b).

Fig 1

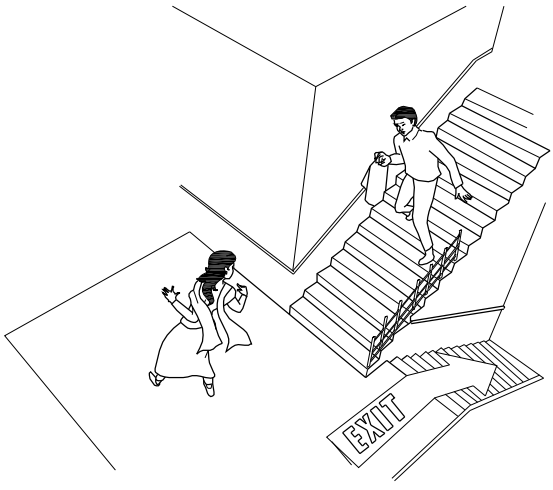


(a)

(b)



(c)



(d)

APN1107H1

3 Open emergency exit and ask them to go away. (Fig 1c & 1d)

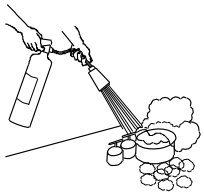
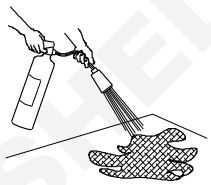
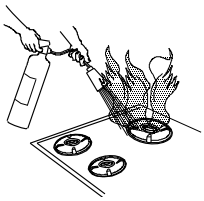
4 Put "Off" electrical power supply.

Do not allow people to go nearer to the fire

5 Analyze and identify the type of fire. Refer Table1.

Assume the fire is 'B' type (flammable liquefiable solids)

Table1

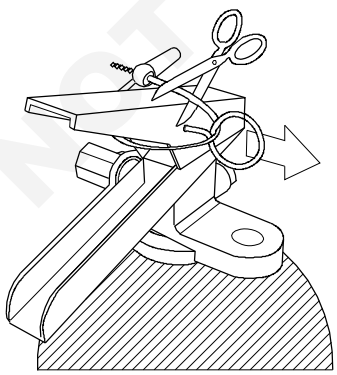
Class 'A'	Wood, paper, cloth, solid material	
Class 'B'	Oil based fire (grease, gasoline, oil) & liquefiable solids	
Class 'C'	Gas and liquefied gases	
Class 'D'	Metals and electrical equipment	

6 Select CO_2 (carbon dioxide) fire extinguisher

7 Locate and pick up CO_2 fire extinguisher. Check for its expiry date.

8 Break the seal. (Fig 2)

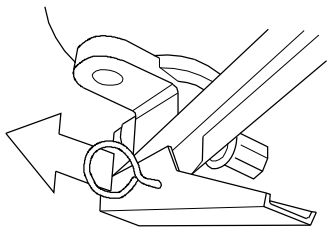
Fig 2



APN1107H2

9 Pull the safety pin from the handle. (Pin located at the top of the fire extinguisher) (Fig 3)

Fig 3



APN1107H3

10 Aim the extinguisher nozzle or hose at the base of the fire. (This will remove the source of fuel fire) (Fig 4)

Keep your self low.

11 Squeeze the handle lever slowly to discharge the agent (Fig 5)

12 Sweep side to side approximately 15 cm over the fuel fire until the fire is put off.

Fire extinguishers are manufactured for use from the distance.

Fig 4

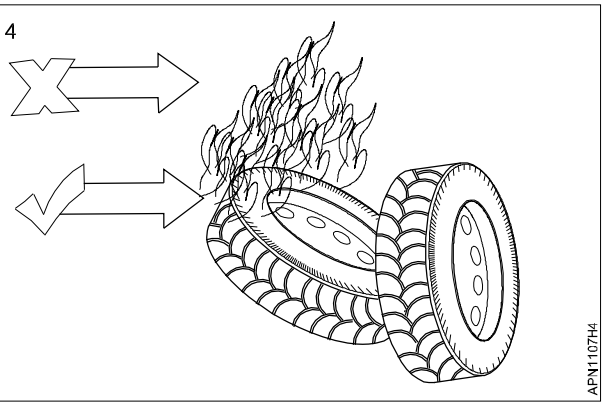
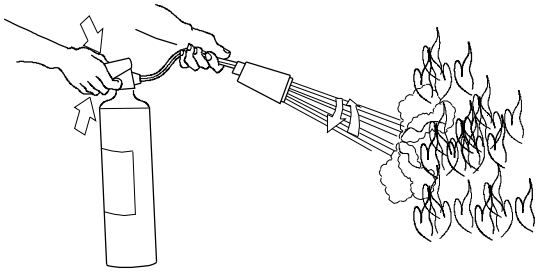


Fig 5



Caution

1 While putting off fire, the fire may flare up.

2 Do not be panic so long as it put off promptly

3 If the fire doesn't respond well after you have used up the fire extinguisher move away your self away from the fire point.

4 Do not attempt to put out a fire where it is emitting toxic smoke, leave it to the professionals.

5 Remember that your life is more important than properly. So don't place yourself or others at risk.

In order to remember the simple operation of fire extinguisher.

Remember.

P.A.S.S. This will help to use fire extinguisher.

P for pull.

A for aim.

S for squeeze.

S for sweep.

Handling and testing of workshop equipments

Objectives: At the end of this exercise you shall be able to
- **demonstrate safe handling of lifting equipments**
- **do the periodic testing of lifting equipments**

Requirements

Tools/Instruments

- Trainee's tool kit - 1 No.

Equipments

- Air compressor - 1 No.
- Vehicle - 1 No.

Materials

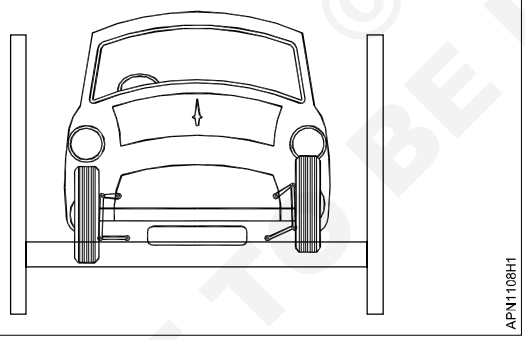
- Oil - as reqd.
- Water - as reqd.
- Kerosene - as reqd.
- Cotton waste - as reqd.

PROCEDURE

TASK 1: **Check the test certificate**

The lifting equipment is subjected to statutory Testing and Certification. (Fig 1) the test calibration certificate should be attached to, or displayed near the lifting equipment that it refers to. Before using this equipment, make sure that the most recent inspection record is still within the prescribed time limit, and ensure that the certificate has not expired.

Fig 1



M/s. ABCD.

Vehicle Hoist Service.

044-12345678.

Chennai - 78.

SERVICE.

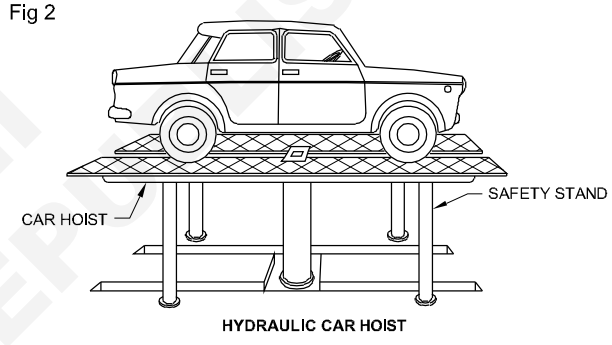
Date Serviced: 20/05/2021

Next Service : 19/05/2022

Check the equipment

1 Carry out regular periodic checks on the service ability of all of the hydraulic lifting equipment. (Fig 2)

Fig 2



HYDRAULIC CAR HOIST

2 Refer to the manufacturer's handbook to find out how often they recommend maintenance tests and make sure that these occur.

3 Check whether the test equipment for its proper functioning.

4 Ensure that there are no leakage in the hose, control valves and oil pump

5 Before operating the lift, ensure that the car is correctly placed in the platform.

6 Check whether it is lifting properly.

7 And also check whether it is holds the oil or not.

Note: Vehicle hoist is not included in the equipments list. This practical can be give at any service station.

8 After the completion of the work, lower the ram to its normal position.

Practice on disposal of used engine oil/paints

Objectives: At the end of this exercise you shall be able to
- **practice the safe disposal of used engine oil/paints.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Personal protective equipments - 1 Set

Equipments/ Machines

- Vehicle - 1 No.
- Air compressor - 1 No.

Materials

- Use/Engine oil - as reqd.
- Paints - as reqd.
- Containers - as reqd.

PROCEDURE

TASK 1 : **Practice the safe disposal of used engine oil/paints**

1 Wear protective clothing, such as gloves, mask, shoes, apron etc,.

2 Do not spill any oil or grease on the ground.

3 Put your used motor oil in a clean plastic container with a tight lid. Never store used oil in a container that once held chemicals, food, or beverages.

4 Do not mix the oil with anything else, such as antifreeze, solvent, or paint.

5 Take used motor oil to a service station or other location that collects used motor oil for recycling.

Recycled used motor oil can be re-refined into new oil, processed into fuel oils and used as raw materials for the petroleum industry.

6 While storing used oil, meant for disposal keep them in a separate place with proper identification mark in the container. (Fig 1)

Never keep the used oil near the hot area or near flame.

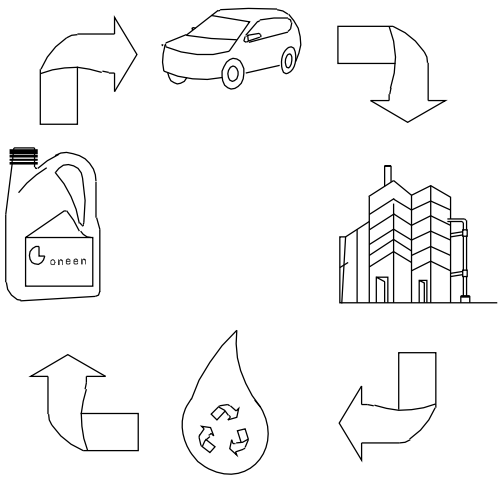
While transporting ensure that there is no spillage of oil. (Fig 2)

7 Maintain a record of oil disposed for reference and record as shown in Table below.

Fig 1

APN1109H1

Fig 2



APN1109H2

Table

Sl. No	Date	Qty per can (litre)	No of cans delivered	Total qty. disposed in litres	Remarks
1	Example 23 - 7 -18	2	05	100	
2	-	-	-	-	
3					
4					
5					

Determine the usage of energy saving

Objectives: At the end of this exercise you shall be able to
- **prepare the table and list the electrically operated devices used in ITI building**
- **calculate the amount of electrical energy that is required in the ITI premises on day to day basis**
- **perform different way of energy conservation tips**

Requirements

Tools/Instruments		Materials	
• Trainee's tool kit	- 1 Set.	• Cotton waste	- as reqd.

PROCEDURE

TASK 1: **Determine the energy conservation**

1 Survey the ITI building premises for lights, fans and other appliances.

2 Use the Table 1 below for listing the devices with their actual energy ratings (wattage) and hours of use.

Table 1

Applications	Approximate Load (watts)	No of equipment	Total load (watts)	Average hours / day	No. of days in a month	Approximate units/months
	A	B	C = A x B	D	E	Unit=CxDxE/1000
CFL bulbs	5 8 11 15 20					
Regular bulbs	25 40 60 100					
Tube lights	36 40					
Table fan	60					
Ceiling fan	100					
Exhaust fan	150					
Air conditioner	1000 1500					
Refrigerator (165 liters)	150					
Refrigerator (210 liters)	270					
Computer	110					
Other	200					

Table 2

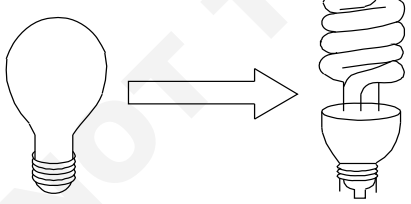
Month	Last year (A)		Current Year (B)		Units saved / Excess (B-A)
	No. of Units	Bill Amount (Rs.)	No. of Units	Bill Amount (Rs.)	Amount Saved / Excess (Rs) (B-A)
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					

TASK 2 : **Perform different way of energy conservation**

1 Make sure you are not still using tungsten light bulbs. Replace them with CFL bulbs. CFLs reduce energy consumption by about 75% completed with tungsten bulbs, and they last longer.

2 Upgrade older fluorescent light fittings with modern high frequency fluorescent fittings. (Fig 1)

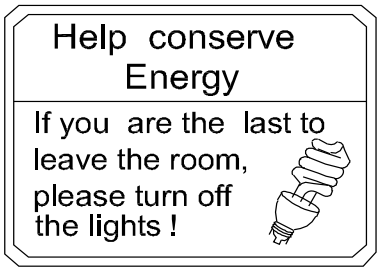
Fig 1



MDN1108H1

3 Post a friendly reminder in each room to prompt students and teachers to turn off lights when not in use. (Fig 2)

Fig 2



MDN1108H2

4 Lighting in class rooms can use a lot of electricity, which costs money. Classrooms can often be lit with daylight instead. (Fig 3)

5 It is best to open the blinds when possible, and switch off the lights whenever there is enough daylight.

6 At the end of every day, turn off computers and screens.

7 Turn off the screens between classes, at break time, and at lunch time.

8 Use the Power-Saving options in your computer operating systems. (Fig 4)

Fig 3

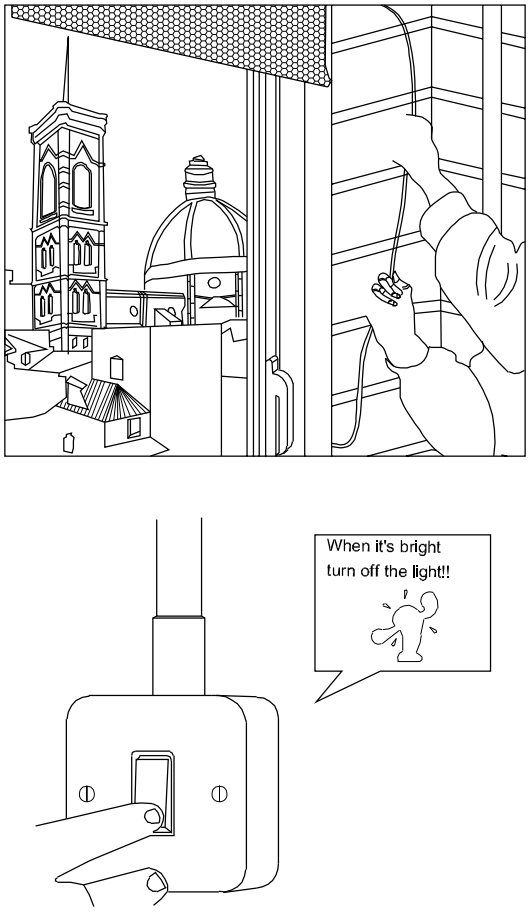
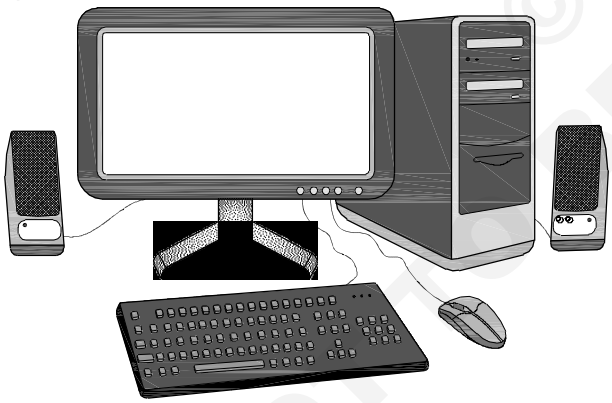


Fig 4

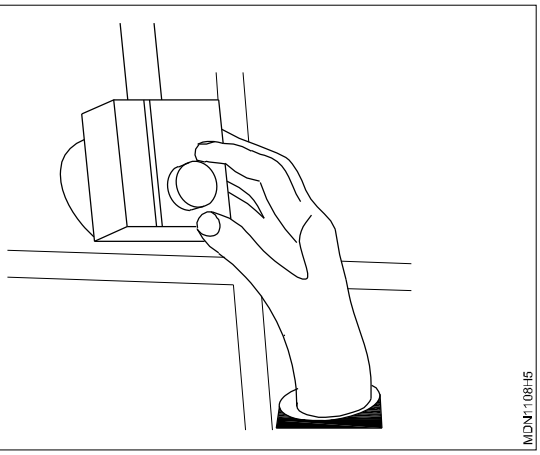


9 If your classroom is too hot and the heating is on, don't open the window to get rid of the heat. Turn the thermostat down instead.

10 Give some thought to what can be switched off before holidays, mid-term breaks and weekends, especially long weekends.

11 Printers, copiers, overhead projectors, computers, electrical water heaters, water boilers, and lots of other things can be switched off. (Fig 5)

Fig 5



12 Read your electricity, gas, oil and water meters often; at least monthly.

13 Start by reading the meters at the beginning and end of each day for the first week, and weekly from then on

14 Make a project to keep records of the meter readings and draw graphs of consumption per month, and compare each month with the same month last year. Compare the total for the year too.

15 By measuring and monitoring your energy and water use, you are more likely to be able to reduce costs.

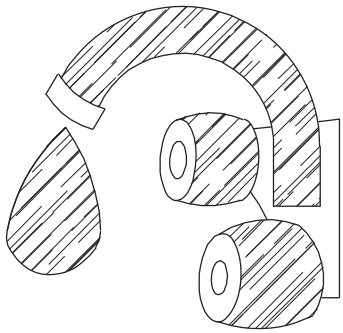
16 use eco-friendly materials and place recycling bins in all rooms.

17 Water costs money, so savings it is a good idea.

18 Install water displacement devices in WC cisterns.

19 Turn off urinals during the holidays, or install automatic systems to turn off the urinals.

Fig 6



20 Repair leaking taps. (Fig 6)

21 Start a ITI sustainability club and promote energy efficiency within the building and community.

22 They are either no-cost or low-cost measures. By implementing the above Top-Ten Energy Saving Tips, your ITI management can save money.

Marking practice on the given job

Objectives: At the end of this exercise you shall be able to
- **draw lines on metallic surfaces by scribers**
- **draw parallel lines on metallic surfaces by jenny calipers.**

Requirements

Tools/Instruments

- Trainee's tool kit - 1 No.

Equipments

- Scriber, Divider, 'V' groove - 1 No each
- Bevel Protector - 1 No.
- Centre punch & Angle plate - 1 No each
- Surface gauge & Depth gauge - 1 No each
- Outside, Inside & Jenny caliper - 1 No each
- Surface plate - 1 No

Materials

- Chalk powder - as reqd.
- MS Plate - as reqd.

PROCEDURE

TASK 1: **Draw lines on metallic surfaces**

Marking 1

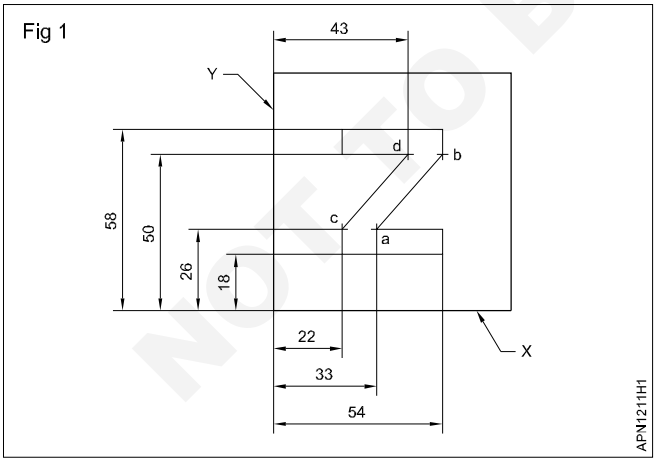
1 Check the raw material for its size and its squareness.

2 Apply copper sulphate solution on one side of the job and allow it to dry.

3 Scribe parallel lines to the edges 'x' and 'y' using a surface gauge. (Fig 1)

To avoid confusion, do not scribe the line longer than necessary.

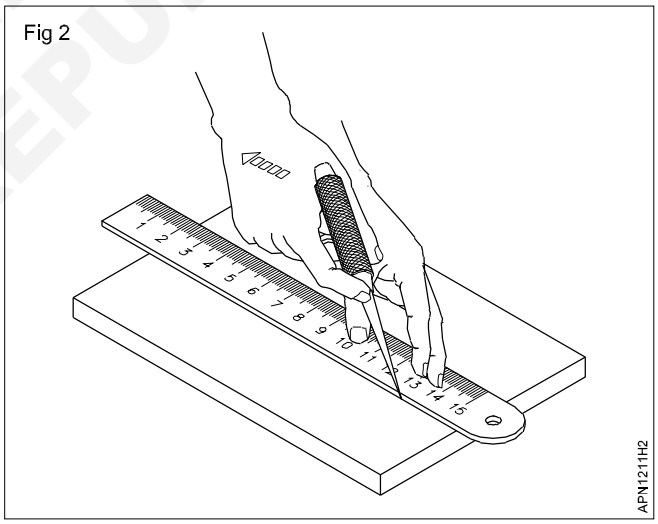
Fig 1



4 Scribe two lines by joining points ab and cd, using a steel rule and scriber. (Fig 2)

5 Punch witness marks and complete 'Z' shape

Fig 2



Marking 2

6 Apply the marking medium on the other side of the job and allow it to dry.

7 Mark the centre lines of three circles and one semicircle using the jenny caliper.

Skill sequence

Marking lines parallel to the edge of the job

Objectives: At the end of the exercise you shall be able to
- **make parallel lines using a jenny caliper.**

Apply marking medium on the surface to be marked.

Set the jenny caliper to the size to be marked (i.e. dimension) with the help of a steel rule. (Fig 1&6)

Transfer the set dimension to the job. (Fig 2 to 5)

Incline slightly and move the jenny caliper with uniform speed and mark lines.

Make witness marks on the lines marked using a 60° prick punch. The witness marks should not be too close to one another.

Note to the instructor: Provide old exercise and models as much as possible to the trainees for acquiring measuring skills with simple measuring instruments.

Fig 1

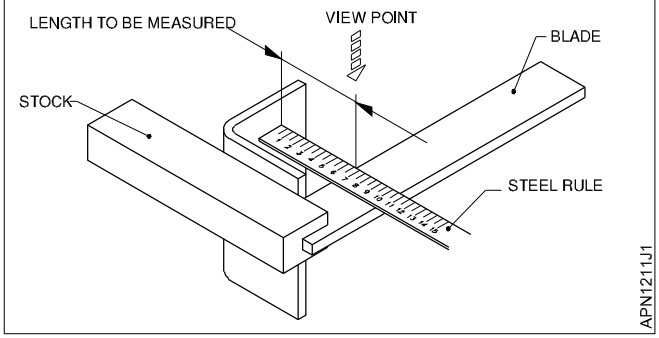


Fig 2

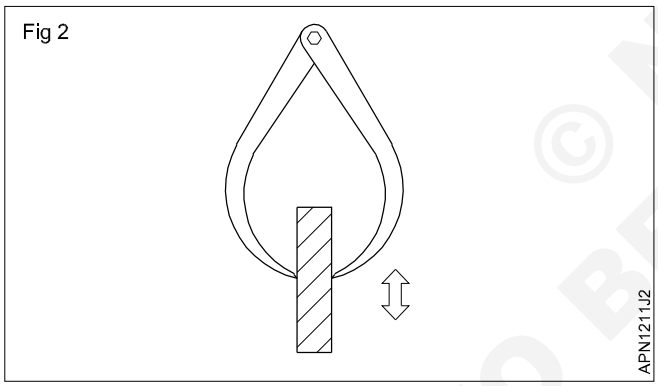


Fig 3

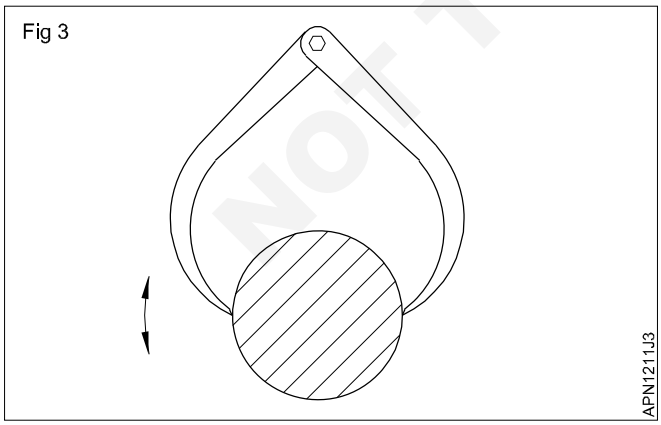


Fig 4

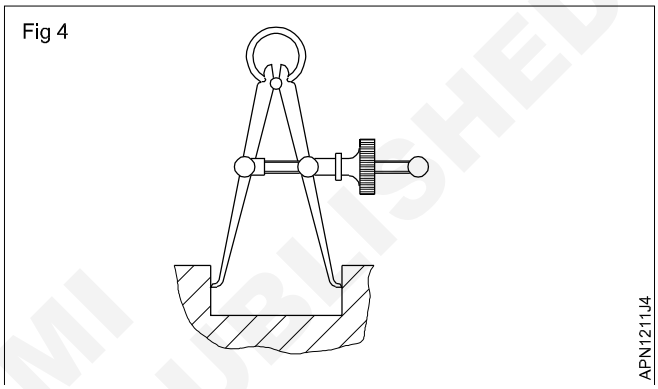


Fig 5

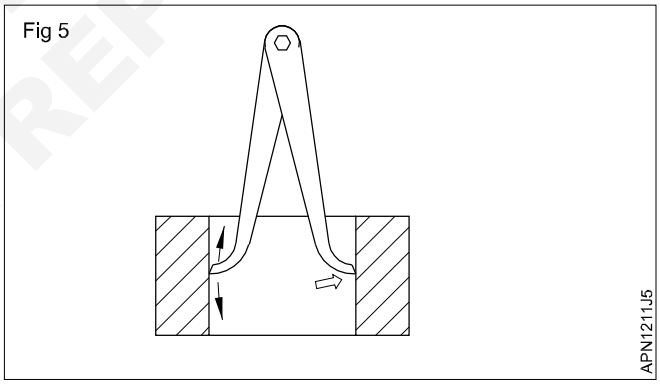
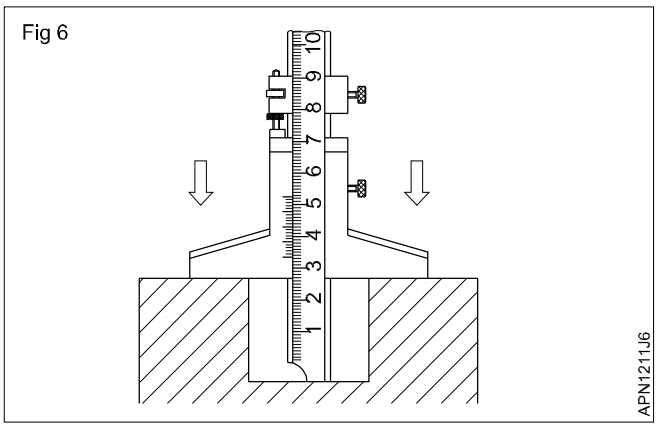


Fig 6



Practice on handling workshop tools and power tools

Objectives: At the end of this exercise you shall be able to
- **identify screw driver, spanner & wrenches, pliers for specific purpose and handle it**
- **tightening locking devices**
- **make flare joints & fittings**
- **select the puller for removing gear and bearing from shaft.**

Requirements

Tools/Instruments

- Trainee's tool kit - 1 No.
- Screw driver - 1 Set.
- Pliers - 1 Set.

Equipments

- Pullers - 1 No.
- Flaring equipments - 1 No.

Materials

- Kerosene - as reqd.
- Cotton waste - as reqd.
- Pipe - as reqd.
- Steel wire - as reqd.

PROCEDURE

TASK 1: **Identify the screw driver for specific purpose**

Checking the condition of the fastener to be removed

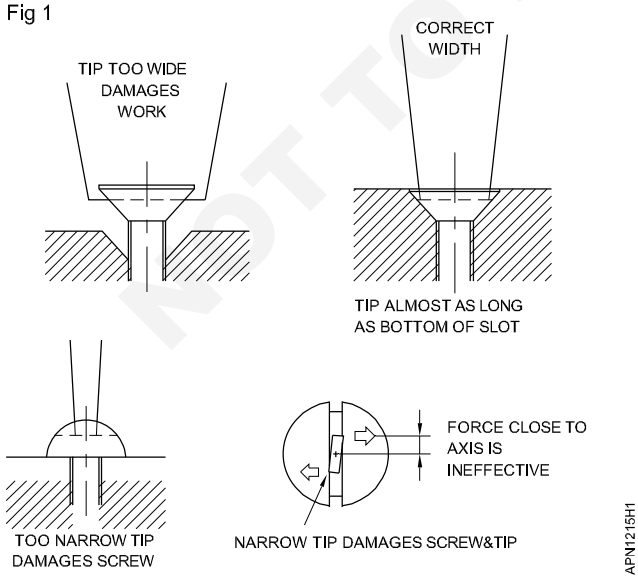
1 Clean the surface of the fastener to be removed by using kerosene, of banian cloth.

2 Check the cornering faces of the fastener for any wear or damage.

3 If it is found good, then proceed as follows

4 Select the correct size screwdriver to suit the screw slot. (Fig 1)

Fig 1

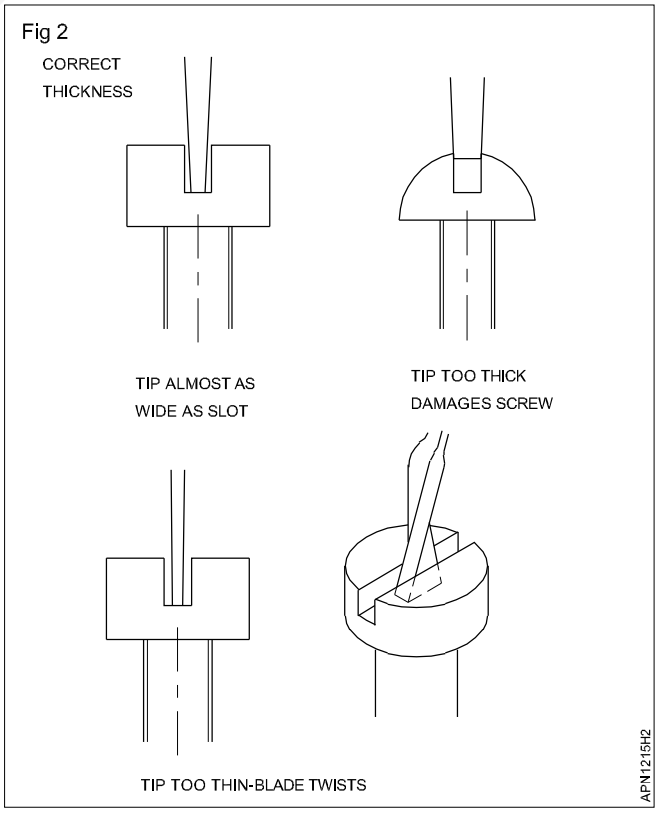


5 Select the longest suitable screwdriver with that size of tip. (Fig 2)

Make sure your hands and the handle are dry and not greasy.

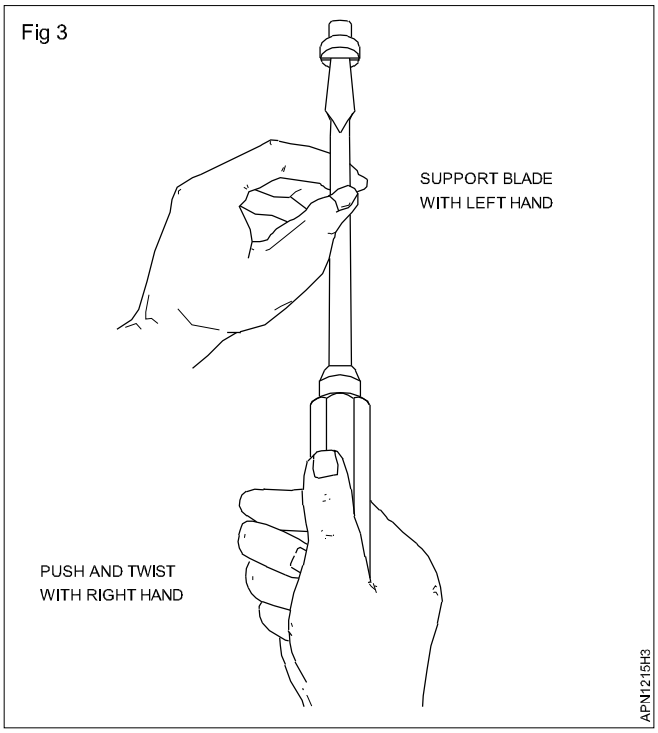
6 Hold the screwdriver with its axis in line with the axis of the screw.

Fig 2



7 Guide the blade with the left hand. Apply a little pressure with the right hand to keep the tip in the slot. (Fig 3)

Fig 3



8 Twist firmly and steadily.

Keep the tip centered in the slot and the axis of the blade in line with the axis of the screw.

Always brace small works against the bench or other firm support before using a screwdriver.

Never hold a small work in your hand while using a screw driver.

9 Turn large screws, use a screwdriver with a square blade. Apply extra twisting force with the aid of a close fitting spanner. (Fig. 4)

Never use pliers or toothed wrenches to apply twisting force to a screwdriver.

10 A Standard screwdriver blade should be ground to 9° so that the faces will be almost parallel with the sides of the screw slot. The end of the blade should be made as thick as the slot in the screw will permit.

Do not grind the blade to a chisel point, as it has a tendency to slip out of the screw slot.

11 Grind the width on both sides to an angle of 11°. The width should be equal to the diameter of the head.

Never grind screwdrivers on a silicon carbide grinding wheel. Standard screwdrivers (Fig 5) can be dressed by filing if they are worn out. Begin filing on the end of the tip.

After dressing, the tip must be symmetrical about the axis of the blade. All corners must be square. The end must be at right angles to the axis in both planes.

Fig 4

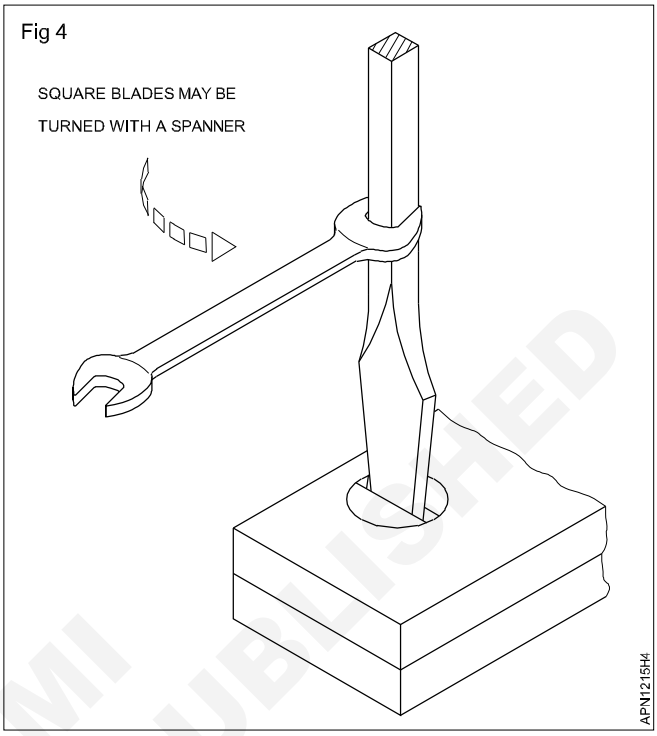
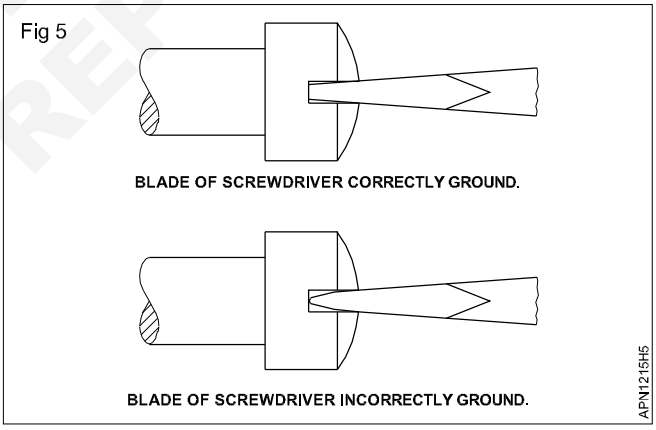


Fig 5

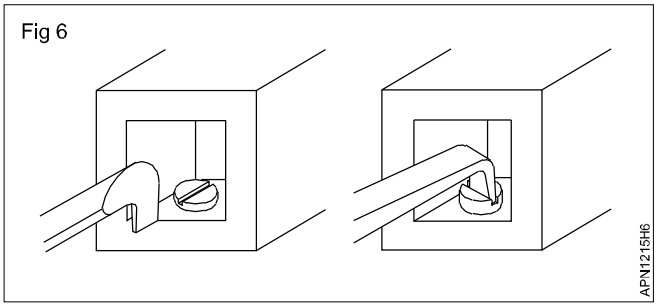


12 Use offset screw driver (Fig 6) in a restricted place.

13 Reverse the screwdriver after one end to get on quarter turn on.

14 Use the other end to get the next quarter turn and so on.

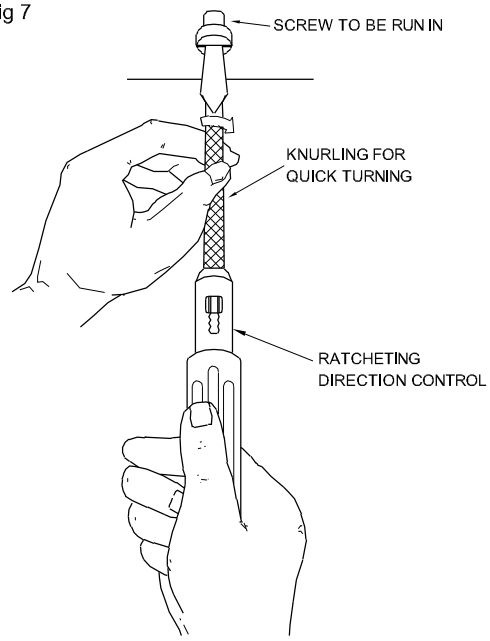
Fig 6



Keep pressing the tip into the slot as you turn.

15 Use ratchet screwdriver (Fig 7) for quick turning.

Fig 7



RATCHET SCREWDRIVER

16 Keep the left hand on knurling, right hand on the ratchet head.

Change the direction of control depending on your movement.

Phillips (cross-recess) screwdrivers (Fig 8 &9)

Fig 8

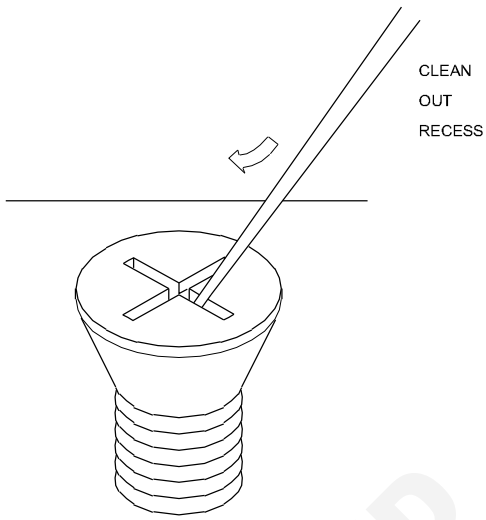
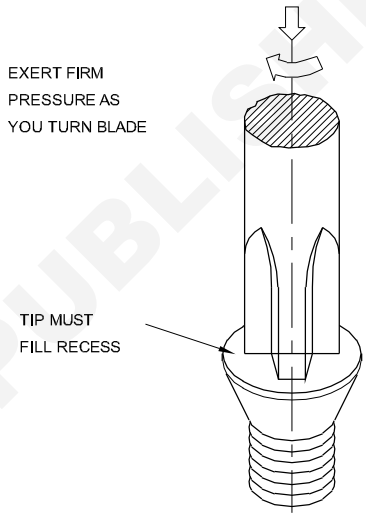


Fig 9



AXES OF SCREW AND THE SCREW DRIVER BE IN LINE

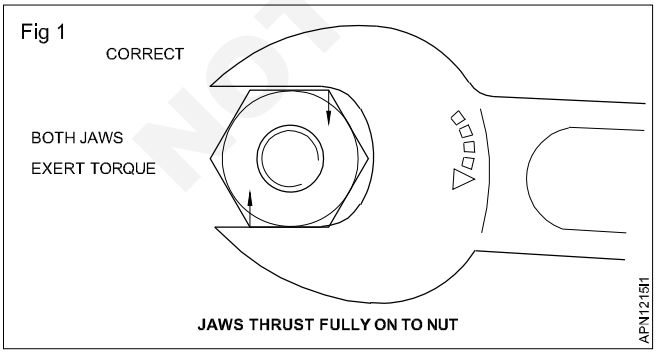
— — — — — — — —

TASK 2 : **Identify spanner & wrenches for specific purpose**

Identifying the correct size of the tool

1 Determine the distance across the flats of a nut or bolt to be removed. (Fig 1)

Fig 1

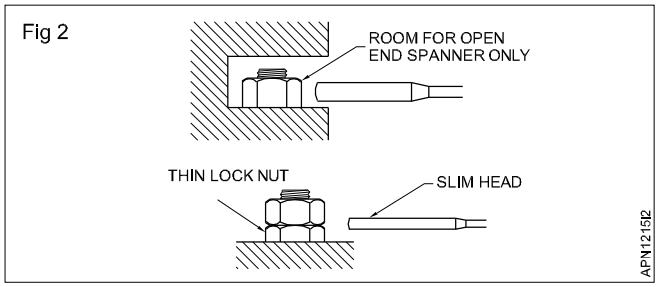


JAWS THRUST FULLY ON TO NUT

2 Decide the size of the spanner.

3 Choose the spanner that allows sufficient room without excess clearance for use. (Fig 2)

Fig 2



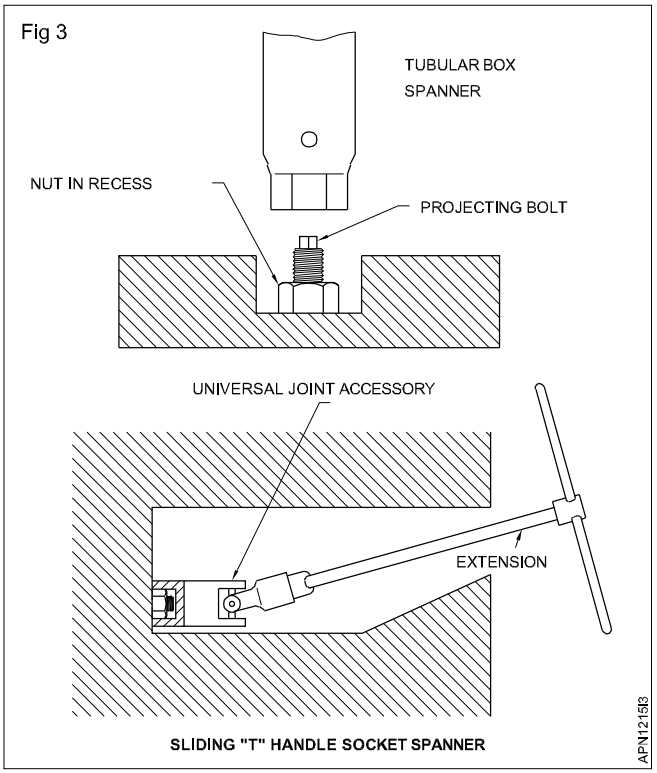
Handling the Tool excess clearance will cause slipping of spanner & fasteners corners gets damaged.

4 Select the correct size of the socket. (Fig 3)

5 Take a sliding offset handle and insert the drive attachment with square driving ends of a socket.

6 Insert the socket wrench on the bolt or nut and confirm whether it inserts fully.

Fig 3



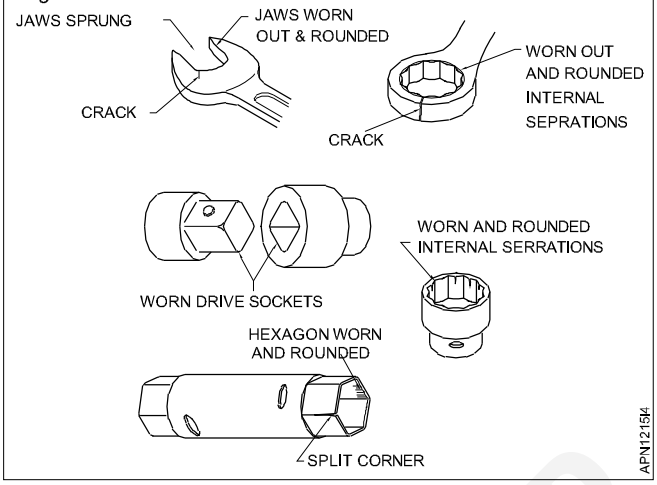
SLIDING "T" HANDLE SOCKET SPANNER

7 Keep the position of the handle perpendicular to your forearm which enables you maximum leverage.

8 Pull the socket handle and drive out the nut/bolt head.

If the socket wrench is not usable for that particular fastener, then use ring spanner. (Fig 4)

Fig 4



9 Insert the ring spanner on the bolt or nut.

10 Keep the position of the shank perpendicular to your forearms which enables you maximum leverage.

11 Use D.E. Spanner where ring spanner is not suitable.

Always try to pull the spanner.

If you are forced to push the spanner, use the base of your hand and keep your hand open.

Use both hands for large spanner.

Keep yourself balanced and firm to avoid slipping.

TASK 3 : **Handling of plier**

1 Select a component with lock wire to nut, which is to be removed.

2 Use the combination plier flat grip for untwist the lock wire.

3 After untwisting, pull the lock wire from the nut.

4 Remove the nut with proper spanner.

5 Select a brake pipe line to be removed from a junction.

6 Hold the brake pipe line with serrated pipe grip portion at combination pliers. (Fig 1)

7 Select proper size of proper double open end spanner & remove the union nut.

8 Select a 3mm electrical wire to be cut.

9 Place the wire between joint cutters at the point which is to be cut. (Fig 2)

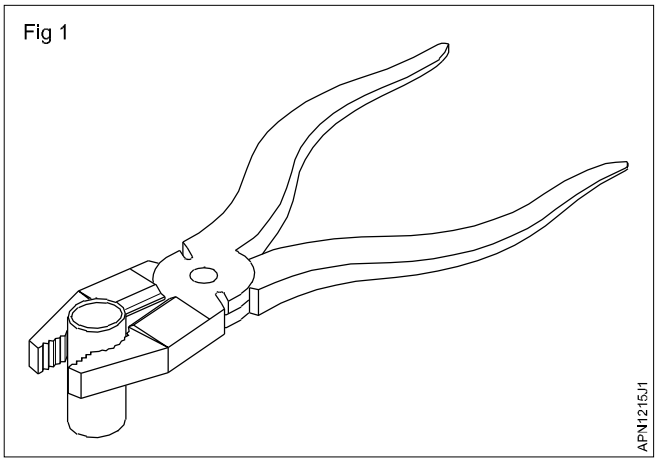
10 Press the handle to cut the wires.

11 Select a steel wire to be cut. (Fig 3)

12 Place the steel wire in between side cutter.

13 Press the handle to cut the wire.

Fig 1



14 Select a nut with tab washer to be removed.

15 Unfold the tab washer with help of flat nose pliers. (Fig 4)

16 Use a proper spanner to remove the nut.

17 Select a cylindrical component with nut.

18 Hold the cylindrical shaft with help of slip joint pliers jaws. (Fig 5)

Fig 2

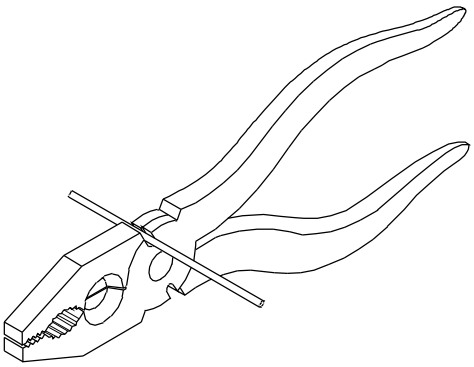


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Fig 3

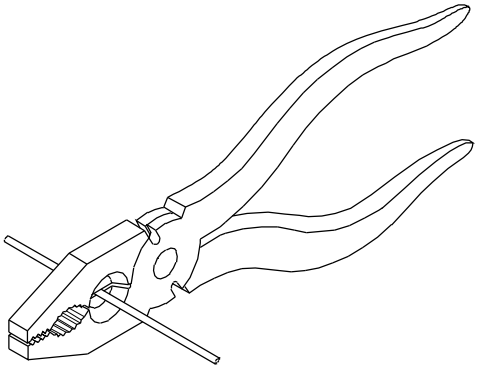

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Fig 4

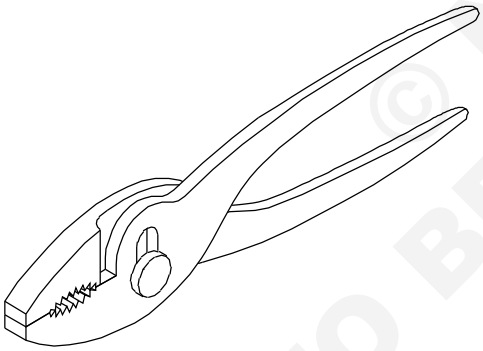

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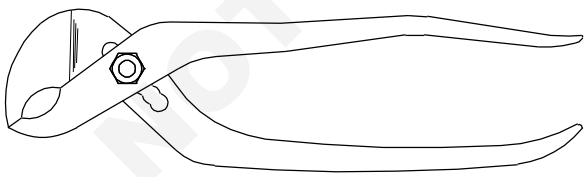
Fig 5



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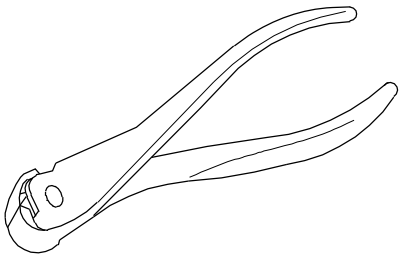
19 Remove the nut with proper spanner.

20 Select a wire to be trimmed.

21 Place the end of the wire to be trimmed by end cutting plier in between the cutting end. (Fig 6)

Fig 6



APN1215J6

22 Apply pressure on handles to cut the wire.

23 Select the steel wire to be cut close to the component surface.

24 Cut the steel wire by slip joint multi gripplier applying pressure on the handles.

25 Use the cutting pliers to spread the cotter pin.

26 Select a stead with lock nut, from which lock nut has to be removed.

27 Hold the stead by locking pliers adjusting the screw in the handle lock with lever.

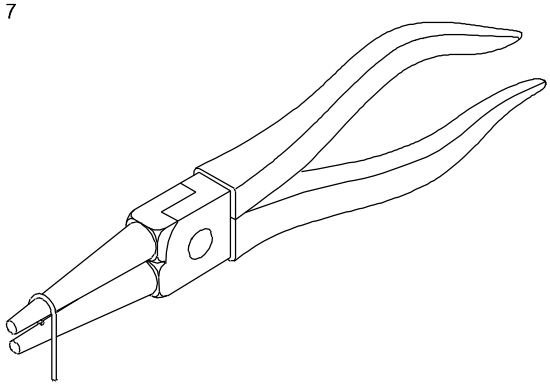
28 Use a proper spanner to remove the locking nut.

29 Select a wire which has to be converted into loop.

30 Hold the wire between the jaws. (Fig 7)

21 Form a loop by tuning the round nose pliers.

Fig 7



APN1215J7

Skill Sequence

Tightening locking devices

Objective: This shall help you to
- **use different types of locking devices correctly.**

Split pin (Fig 1)

Tighten the nut (1) at the specified torque.

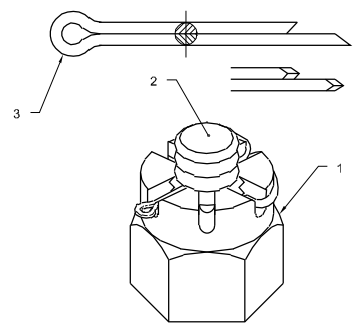
Check the bolt's (2) holes and nut's (1) slot alignment, if not aligned, align the hole by tightening the nut (1) slightly.

Insert a new suitable split pin (3) in the slot and hole. So that the loop on vertical plane.

Drive the split pin (3) fully inside with the help of a copper drift or rod and hammer.

Spread open the long side of the split pin and bend it on the nut.

Fig 1



Inside circlip or snap ring (Fig 2)

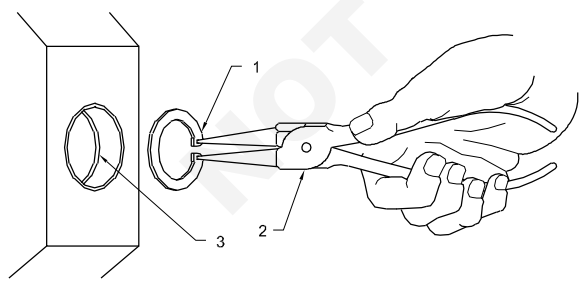
Hold an internal circlip on hole face (1) with the help of an internal circlip plier (2).

Press the circlip (1) with the help of the plier (2) so that its diameter will be smaller than the hole diameter.

In this position insert the circlip in such a manner that it will sit squarely in the groove (3).

Take out the plier (2) after checking rotation of clip.

Fig 2



Outside circlip or snapping (Fig 3)

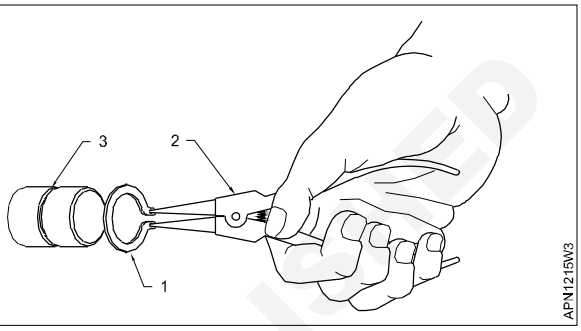
Hold an outside circlip shaft end (1) with the help of an external circlip plier (2).

Press the external circlip plier (2) so that the circlip (1) will enlarge in diameter.

While sliding, set it in the shaft groove (3). Ensure that the circlip sits squarely in groove (3) and rotate freely.

Take out the plier (2).

Fig 3



Wire ring hose clamp (Fig 4)

Clean the outside surface where the hose-pipe is to be set.

Apply grease inside the starting end surface for easy insertion.

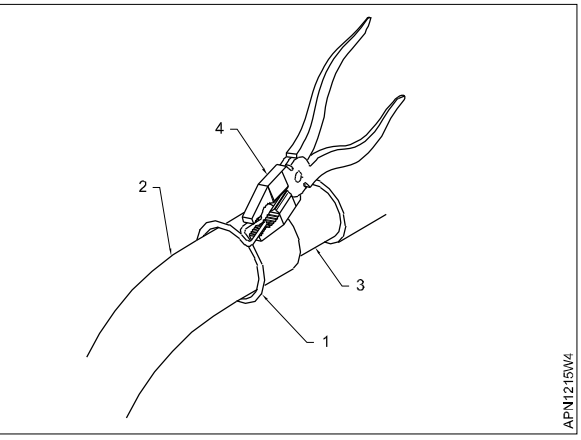
Set the wier spring hose clamp (1) on the hose-pipe (2).

Slide the hose-pipe (2) on the metal pipe (3).

Press the hose clamp (1) with the help of a plier (4) and slide it on the joint of the hose-pipe (2) and metal pipe (3).

Take out the plier (4)

Fig 4



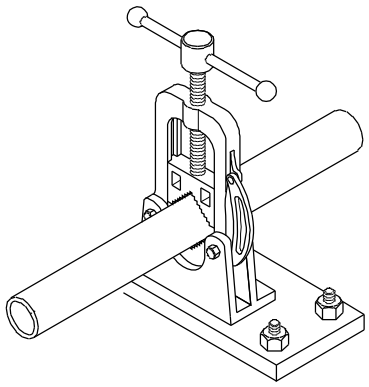
Handling of pipe flaring & cutting tools

Objective: This shall help you to
- **cut a G.I pipe using a pipe cutter.**

Measure the required length of pipe and mark it with chalk.

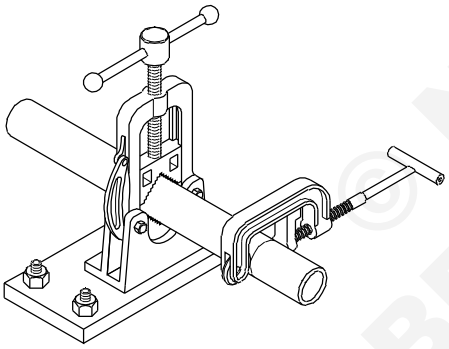
Keep the pipe in the pipe vice and tighten it. (Fig 1)

Fig 1



Fit the pipe cutter on the G.I. pipe (on the scribed line) and tighten the jacking screw so that the cutting wheel is touching the pipe. (Fig 2)

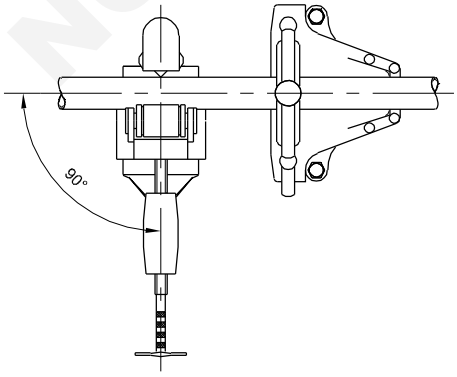
Fig 2



Ensure that the pipe is kept horizontal and parallel to the serrations such that the marking is visible at the top.

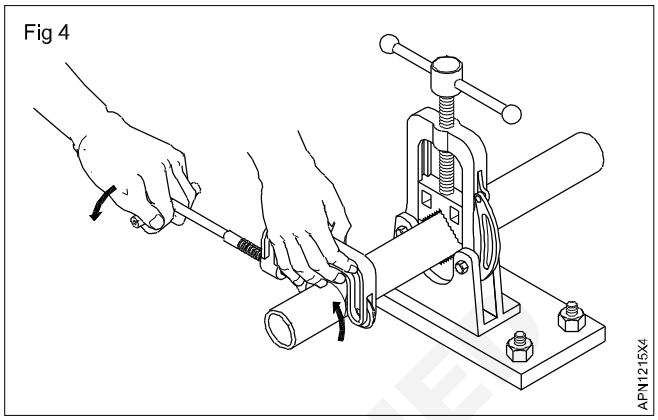
Rotate one or two turns to ensure that the cutting wheel is sitting exactly on the scribed line at 90° to the pipe. (Fig 3)

Fig 3



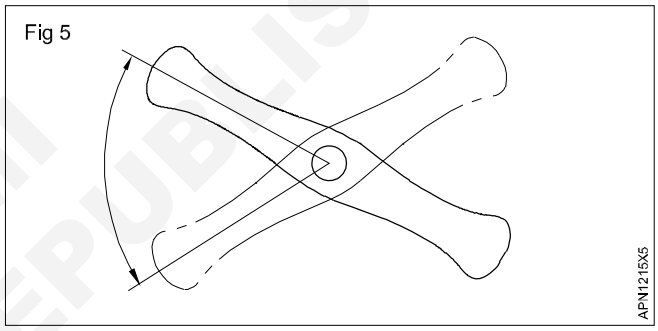
Rotate the pipe cutter around the pipe. (Fig 4)

Fig 4



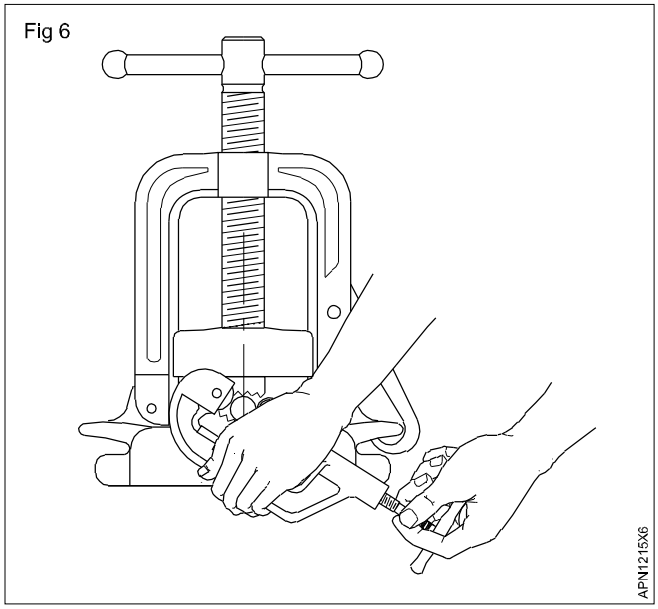
After two or three turns use the jacking screw to apply pressure on the cutting wheel. (Fig 5)

Fig 5



Keep rotating the pipe cutter around the pipe. Increase the pressure to the cutter by repeating the cycle until the pipe is cut through. (Fig 6)

Fig 6



Support the pipe with your left hand so that the free end of the pipe does not fall. (Fig 7)

The cut portion of the pipe will appear as shown in Fig 8.

Fig 7

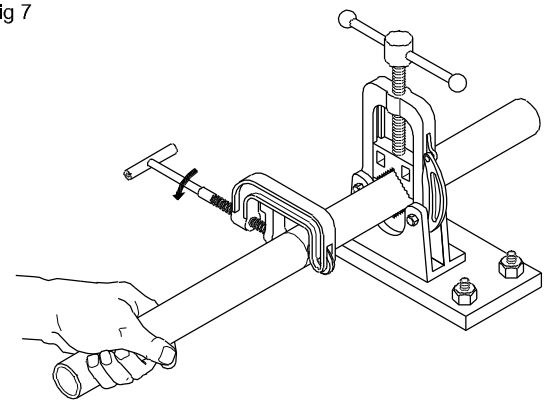


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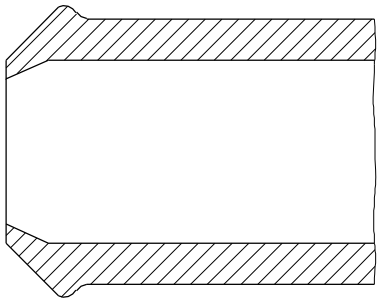
Fig 8

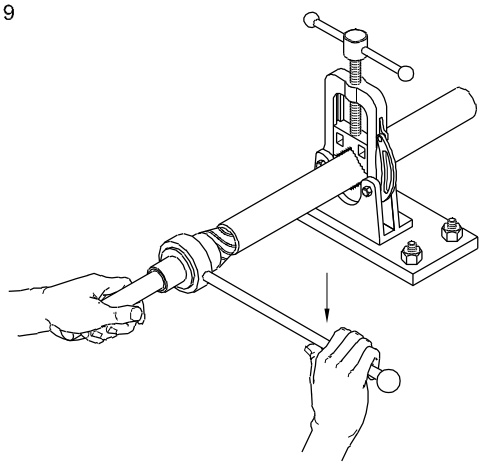


APN1215X8

Remove burrs using a pipe reamer. (Fig 9)

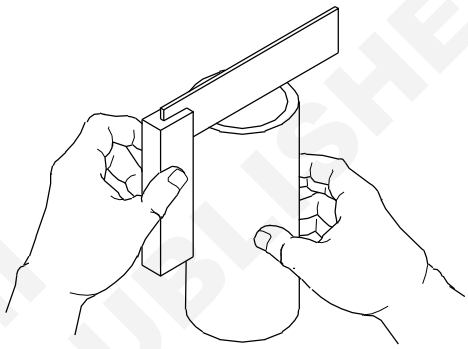
Check that the pipe ends are square. (Fig 10)

Fig 9



APN1215X9

Fig 10



APN1215XA

Make flare joints and test them with flare fittings

Objectives: This shall help you to

- **flare the end pipe**
- **joint the flare nut with flare fitting and test it.**

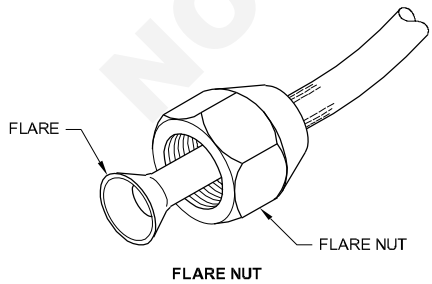
Flaring

Brake line pipes / Fuel pipe lines / Air conditioner pipe lines are sometimes jointed to fittings by making a flared connection.

The end of the pipe is opened out to form a cone (Fig 1).

Always place the special flare nut on the pipe first before flaring.

Fig 1



FLARE NUT

APN1215Y1

Examine the pipe flaring tool. Make sure that you understand how it works before starting to flare the end of a pipe.

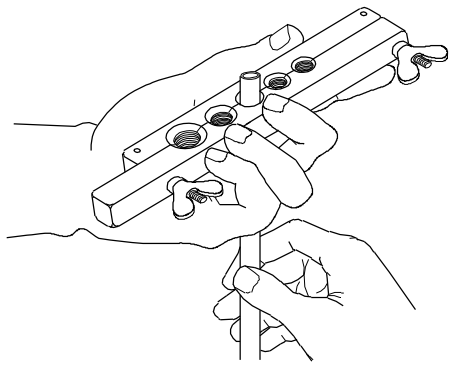
Make sure that the end of the pipe is free of rough edges before flaring

Place the pipe in the tool (Fig 2). Make sure that you have.

a Place the flare nut on the pipe

b Chose the correct size hole in the flaring tool to fit hte pipe; (there are 5 holes to fit different sizes of pipe.)

Fig 2



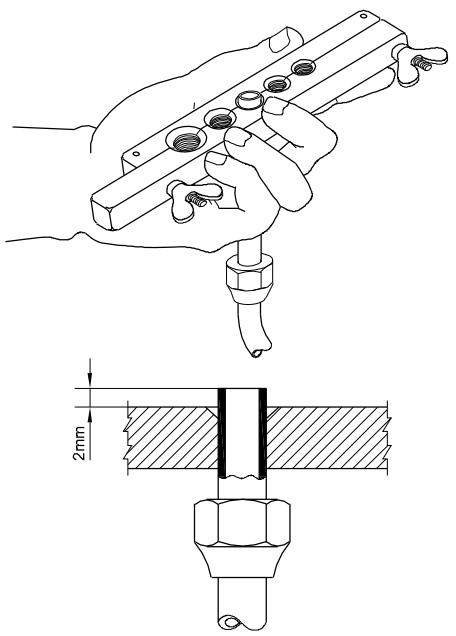
APN1215Y2

If the pipe is 1/4 inch (6mm) in diameter, posititon the pipe so that the end is at least 2 mm above the top of the flaring block (Fig 3). (This distance is calculated as “pipe diameter divided by 3”; i this case, 6mm divided by 3= 2 mm).

Tighten the nuts at each end of the flaring block (see drawing).

Fit the yoke to the flaring block (Fig 3)

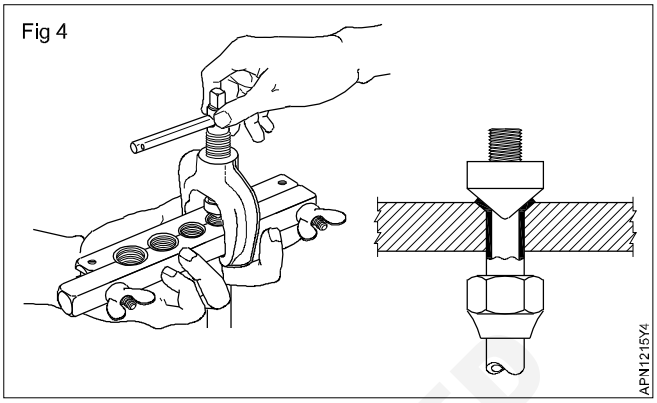
Fig 3



Oil the cone and slowly screw it into the end of the pipe.

The end of the pipe will be formed into a flare (Fig 4).

Fig 4



Unscrew & remove the flaring block remove the flared pipe from the block.

Examine the flare. If it has cracked, the cone was screwed down too quickly.

Make sure that the flare is the correct size. It should just fit inside the flare nut. If it is too loose, cut off the flare and start again

Use 3 mm instead of 2 mm. Repeat until the flare is the correct size for the flare nut - not too loose and not too tight.

Observation Table 1

Sl. No.	Skills	Remarks
1	Check flaring	Cracked/uneven/too small/too long/incorrect
2	Number of attempts	One/two/three
Note: Repate the steps to the sizes of copper tube		

Joining with flare fittings

Put thread seal tape on the thread

Push back the flare nut and place the flared tube on the fitting, then tighten the flare nut using adjustable wrench or suitable double end spanner.

Tighten the one end of the tube to the cylinder with the flare nut. (Fig 5)

Connect a pressure gauge at the other end of the tube with flare nut.

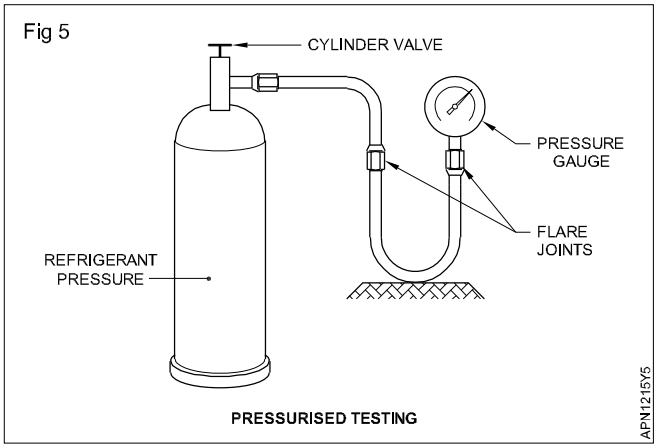
Do not give more pressure while tightening since this will spoil flare.

Make sure that they should not be loose in the tube.

The pressure will be shown in the pressure gauge.

Then close the cylinder valve. Major leaks will make noise and that nut needs to be tightened. If there is no leak, the pressure in the pressure gauge will remain constant. If it decreases, check the joints with soap solution foam. Leak will bubble, then tight the joints. If it stands still then there is no leak.

Fig 5



PRESSURISED TESTING

Observation Table 2

Sl. No.	Skills	Remarks
1	Selection of correct fittings	Correct/not correct
2	Joining method	Excellent/good/fair
3	Time taken	Less/very less/more

Observation Table 3

Sl. No.	Skills	Remarks
1	Selection of tools	Excellent/Good/Average
2	Detecting leak and arresting	Excellent/Good/Average

Handling of puller, gear & bearing

Objectives : At the end of this lesson you shall be able to

- **use a puller to remove gear from shaft and bearing from shaft.**

Identify the object to be removed, i.e Gear / Bearing.

Determine the size of the Gear / Bearing to be removed.

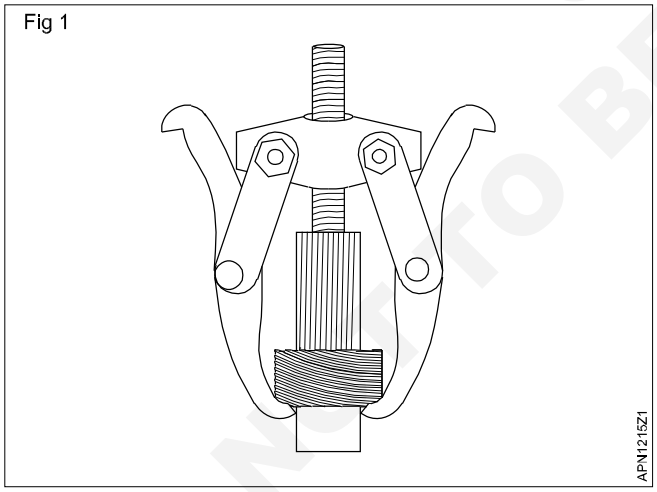
Choose a puller according to Gear / Bearing i.e, 2 or 3 Jaw & External or Internal Jaw puller.

Unscrew the forcing screw of the puller to the optimum length.

Split open the jaw of the puller.

Position the jaws of the puller over gear as shown in the diagram. (Fig 1)

Fig 1



Position the tip of forcing screw on the shaft, as shown in the diagram. (Fig 2)

Tighten the forcing screw till the forcing screw end touches the shaft.

Check the puller is not going to slip of from the center of shaft & readjust if necessary.

Tighten the forcing screw till the gear comes all of the shaft.

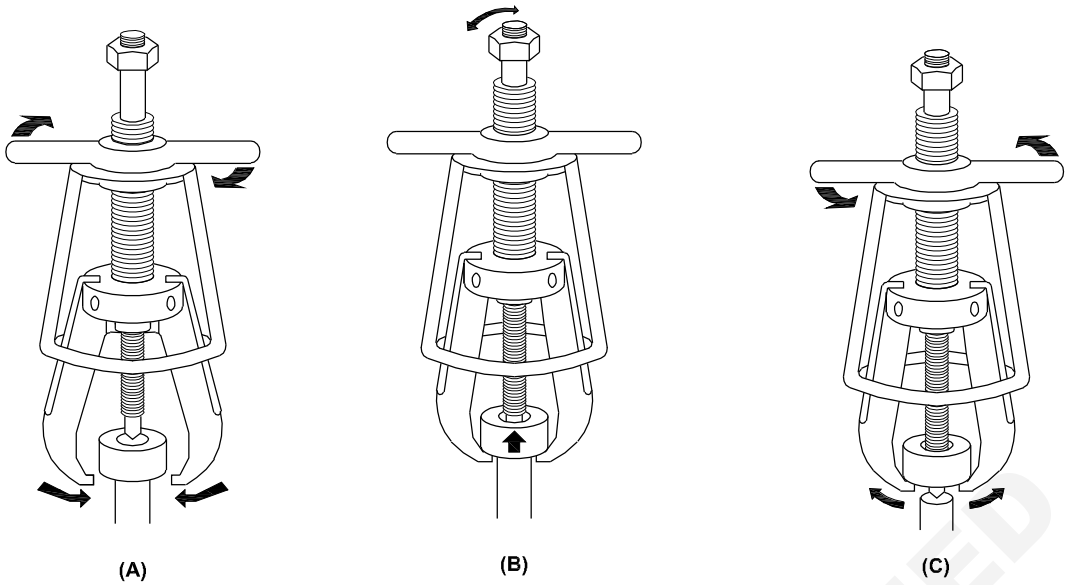
Warnings

Always wear proper personal protective gear (i.e. gloves, safety glasses)

Never use a tool to strike the puller. Hitting the puller may cause if to break.

Applying heat to the puller may damage it,

Fig 2



Practice on measuring engine components with outside micrometer

Objectives: At the end of this exercise you shall be able to
- **measure cam height, camshaft, crankshaft and valve stem journal diameter using outside micrometer**
- **measure piston pin & piston skirt diameter using outside micrometer.**

Requirements

Tools/Instruments

- Outside micrometer - 1 No.

Equipments

- Engine - 1 No.
- Work bench - 1 No.
- V blocks - 1 Pair.

Materials

- Camshaft - 1 No.
- Crankshaft - 1 No.
- Valve - 1 Set.
- Piston - 1 Set.
- Piston pin - 1 Set.
- Cotton waste - as reqd.
- Kerosene - as reqd.

PROCEDURE

TASK 1 : **Check the cam height**

1 Check the camshaft visually for crabs

2 Clean the camshaft using a small brush with recommended cleaning solvent

3 Clear sludge and gum deposit

4 Blow out the passages with compressed air with the help of micrometer measure the reading

5 Before taking the measurement, ensure that micrometer is adjusted for zero setting

6 Record the main scale reading and thimble reading

7 Check the cam shaft at 2 or 3 places on the table and arrive at the observed value.

Measuring on Cam height, Camshaft Journal dia, crankshaft journal dia, Valve stem dia, piston diameter, and piston pin dia with outside Micrometers.

8 Using a micrometer, measure the cam lobe height and record the results in a table 1 below (Fig 1)

Fig 1

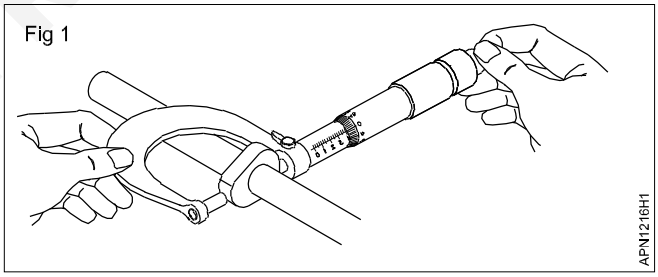


Table 1

Component Name	Main scale Reading	Coinciding Thimble scale (div)	Least count	Result
	(a)	(b)	(c)	R = a + (b x c)
Cam lob height			0.01	

— — — — — — — —

TASK 2 : **Check the cam shaft journal diameter**

1 Inspect the journal diameter of the camshaft and record the results in a table 2 below. (Fig 2)

Fig 2

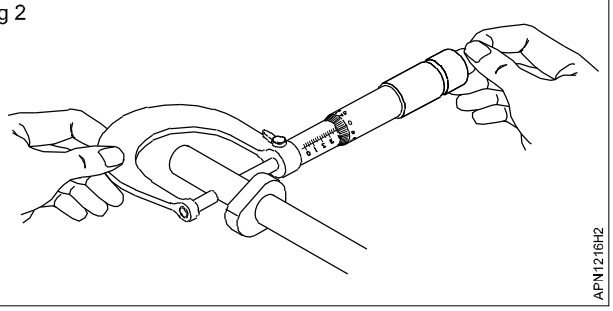


Table 2

Component Name	Main scale Reading	Coinciding Thimble scale (div)	Least count	Result
	(a)	(b)	(c)	R = a + (b x c)
Cam shaft journal diameter			0.01	

— — — — — — — —

TASK 3 : **Check the crankshaft journal diameter**

1 Use a micrometer to measure crankshaft journal diameter at two places, 180° apart and at two points along its length. Record the result in a Table 3.

2 Put the bearing caps at their respective places with the same bolts.

3 Clean the crankshaft using a small brush with the recommended cleaning solvent.

4 Clear sludge and gum deposits from the drilled oil passages in the crankshaft by the wire brush.

5 Blow out the passages with compressed air

With the help of a micrometer measure the journal diameter at '1' '2' '3' & '4'. The difference in reading between '1' & '3' and '2' & '4' will give the ovality. (Fig 1)

6 Measure the oil clearance between the crankshaft main journal and the bearing shell.

Fig 1

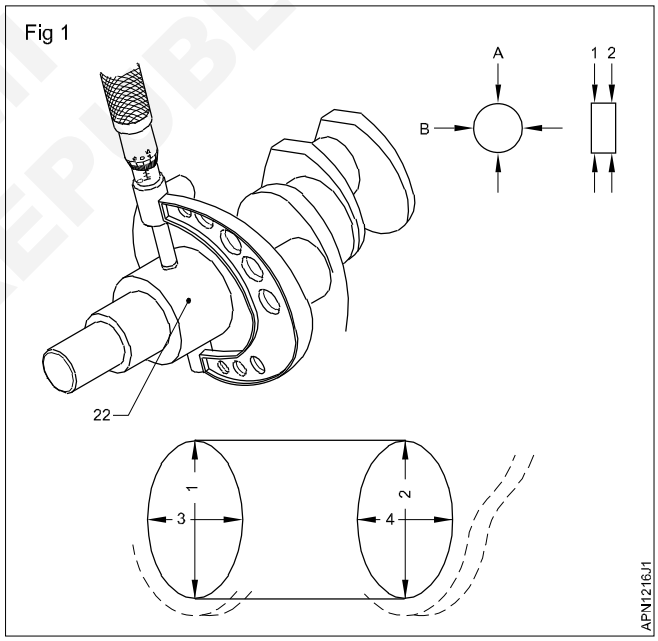


Table 3

Component Name	Main scale Reading	Coinciding Thimble scale (div)	Least count	Result
	(a)	(b)	(c)	R = a + (b x c)
Crank shaft journal Diameter			0.01	

TASK 4 : **Check the diameter of the valve stem**

1 Use a micrometer to measure the diameter of the valve stem and record the results in a table 4 below. (Fig 1)

Fig 1

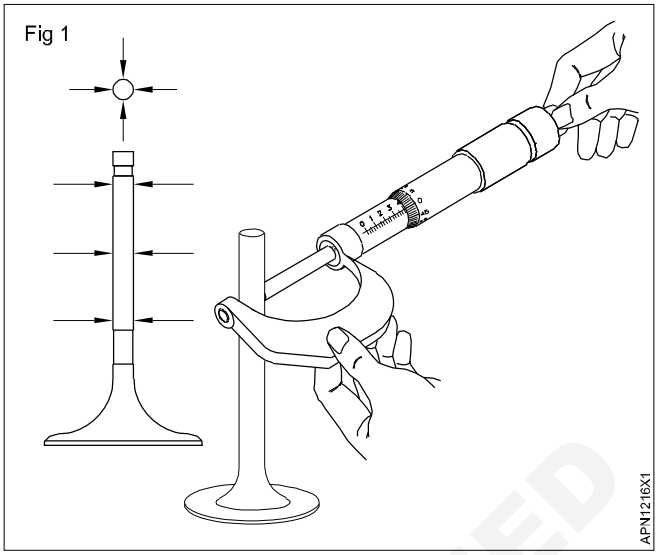


Table 4

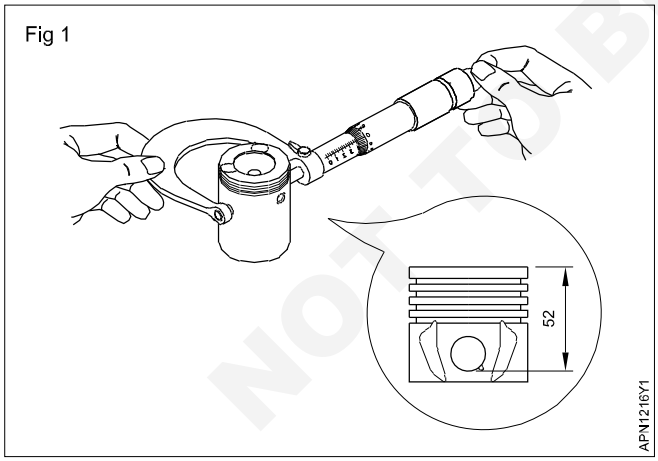
Component Name	Main scale Reading	Coinciding Thimble scale (div)	Least count	Result
	(a)	(b)	(c)	R = a + (b x c)
Valve stem diameter			0.01	

— — — — — — —

TASK 5 : **Check the piston & piston pin (Fig 5 & Fig 6)**

1 Use a micrometer to measure the piston diameter at right angles to the piston pin center line, and at a position 52 mm (2.05 in.) from the top of the piston head and record the results in a table 5 below. (Fig 1)

Fig 1



2 Use a micrometer to measure the external diameter of the piston pin and record the results. (Fig 2)

Fig 2

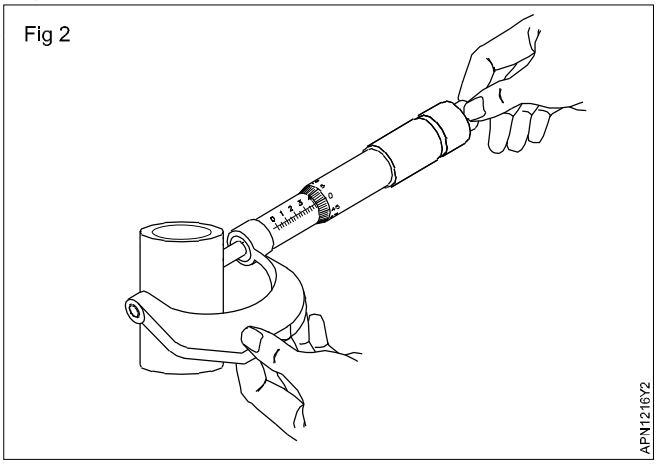


Table 6

Component Name	Main scale Reading	Coinciding Thimble scale (div)	Least count	Result
	(a)	(b)	(c)	R = a + (b x c)
Piston pin diameter			0.01	

Clean and check the fastners

Objectives: At the end of this exercise you shall be able to
- **fasten castle nut on axle shaft**
- **fasten self locking nut on propeller shaft**
- **fasten hexagonal nut on two flat surfaces**
- **fasten hexagonal nut with collar on tappet cover.**

Requirements

Tools/Instruments

- Spanner (DE & Ring) - 1 Set each.
- Nose plier, copper drift - 1 Set each.

Equipments

- Work bench & vice - 1 No.

Materials

- Kerosene & otton waste - as reqd.
- Axle shaft and castle nuts - as reqd.
- Propeller shaft and self locking bolt - as reqd.
- Hexagonal nut with washers - as reqd.

PROCEDURE

TASK 1 : **Fasten castle nut**

1 Clean the Axle Shaft threaded end.

2 Note down the thread size & type of thread.

3 Select the proper size of castle nut. (Fig 1)

4 Tighten the castle nut by hand, one or two threads only.

5 Select proper spanner for tightening the castle nut.

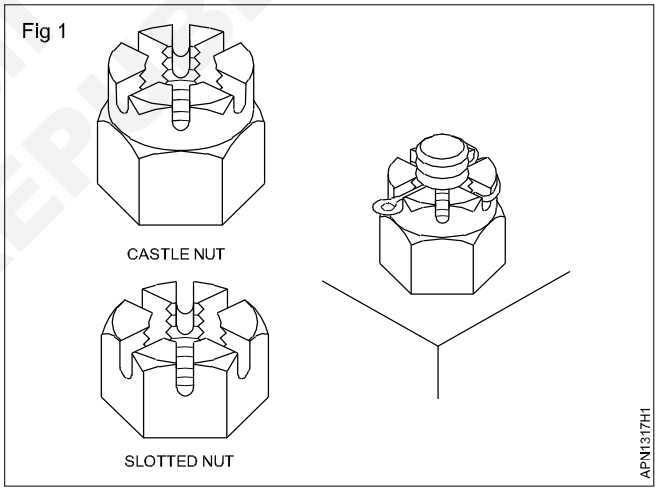
6 Tighten the castle nut.

7 Align the axle shaft hole and slot of the castle nut.

8 Insert a split pin through the Axle Shaft hole & slots of castle nut.

9 Spread the split ends of the split pin.

Fig 1



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TASK 2 : **Fasten self locking nut**

1 Clean the flange of the propeller shaft.

2 Select the proper size of nut & bolt to be fitted.

3 Insert the bolt into the slot of the flange.

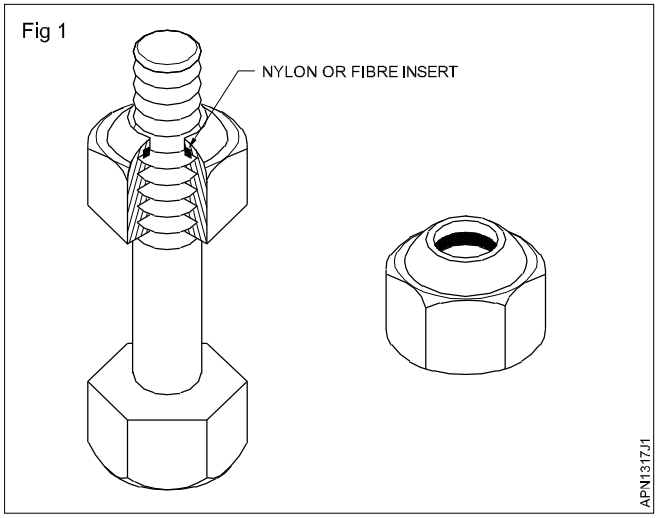
4 Tighten the self locking nut by hand one or two threads only (Fig 1).

5 Select proper spanner for tightening the self locking nut.

6 Tighten the self locking nut.

Do not overtight on the self locking Nut

Fig 1

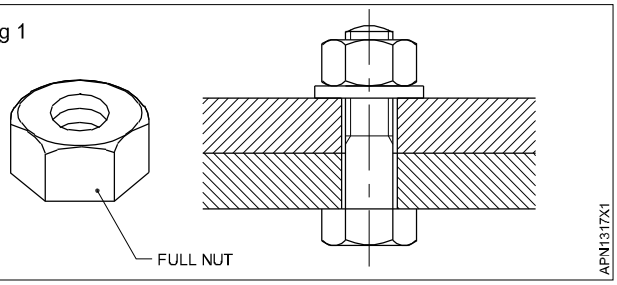


TASK 3 : **Fasten hexagonal nut**

1 Select the two flat surface components to be fastened.

2 Select a proper size of hexagonal Nut & Bolt. (Fig 1)

Fig 1



3 Insert the Bolt in the hole of matching components.

4 Place a flat washer at the threaded end.

5 Select the correct spanner to tighten the particular size of that nut.

6 Tighten the hexagonal nut.

7 Select a same size of hexagonal lock nut.

8 Tighten the lock nut by holding the earlier tighten nut with spanner.

Correct size of ring spanner should be used.

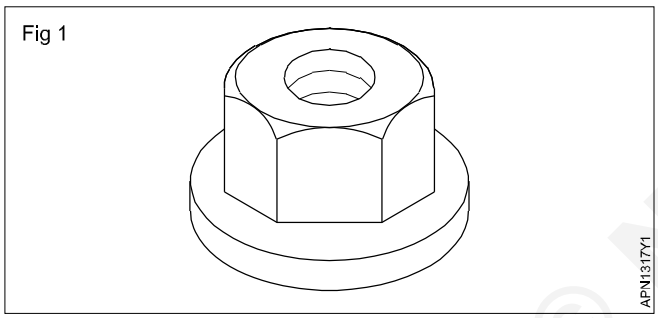
Nut & Spanner should be free of oil and dirt.

TASK 4 : **Fasten hexagonal nut with washer**

1 Clean the Bolts of Tappet cover.

2 Select proper size of hexagonal nut with caller. (Fig 1)

Fig 1



3 Tighten the hexagonal nut with collar by hand one or two threads only.

4 Select proper spanner for tightening the nut.

5 Tighten the nut with specified torque.

Do not overtighten.

Safety: Avoid using oversized spanner from slippage and getting hurt.

Skill sequence

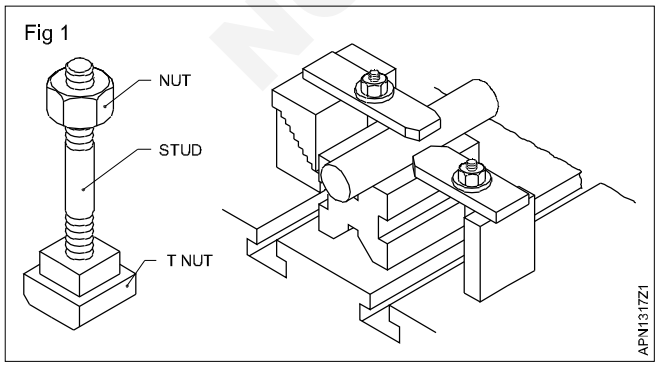
Fasten the stud

Objectives: This shall help you to
- **measures the pitch of the thread**
- **select the correct size of stud**
- **fasten the given jobs with stud.**

Select the components to be joined (Fig 1).

Select the correct size of stud, according to the tapping on the component.

Fig 1



Insert the stud on the tap and turn, the stud use 2 nuts to lock the stud.

Tighten the stud with help of a proper spanner.

After tightening the stud lock the stud shank with the vice grip plier.

Use two spanners to remove the nuts from stud.

Studs are used in assemblies which are to be separated frequently.

Safety precaution

Before inserting the stud. Taps holes & stud threads to be cleaned properly.

Measure the thread with the thread Pitch Gauge (Fig 2)

Select the stud of internal thread to be measured.

Clean the surface of the thread.

Select any one of the blade from the screw pitch gauge.

Place the blade on the thread to be measured. (Fig 3)

If the pitch matches with the thread then the pitch of the thread will be the same as marked on the blade.

If not, select other blades and identify the blade perfectly matches with the thread.

Fig 2

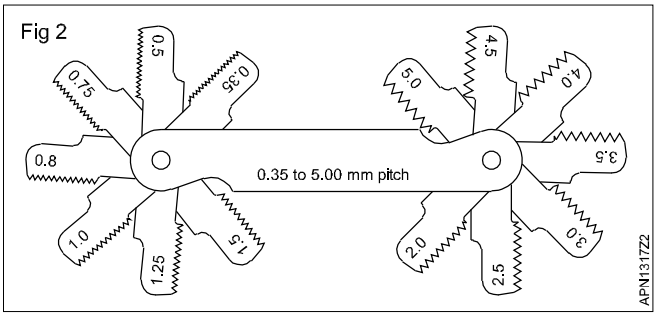
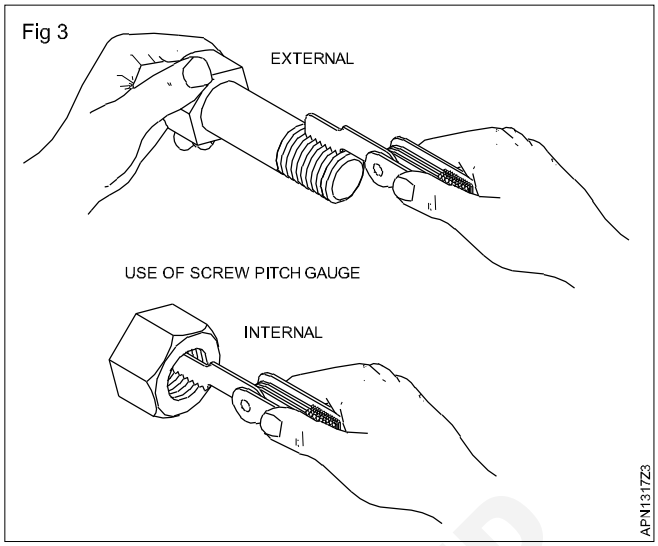


Fig 3



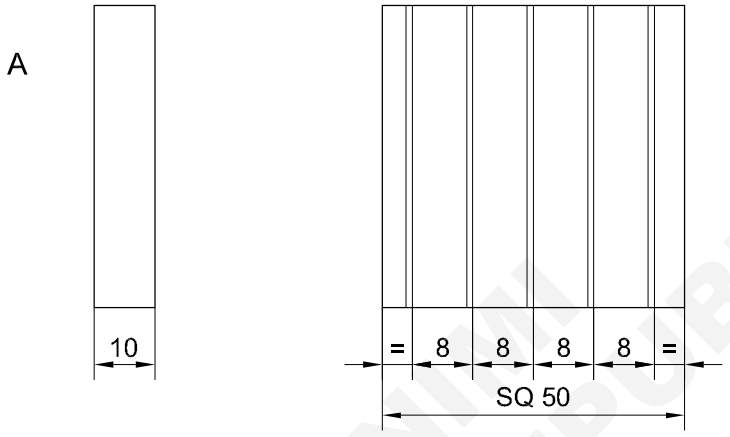
The number marked on the blade which matches perfectly the same will be the pitch of the thread.

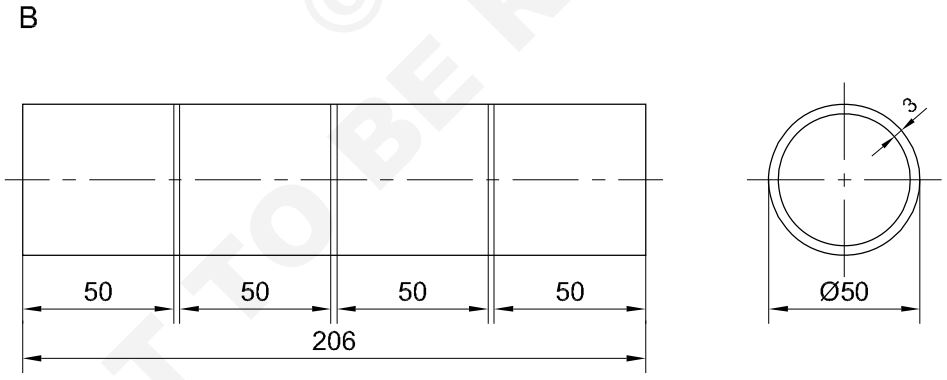
For accurate results, the full length of the stud to be placed on the threads.

Practice on using various cutting tools

Objectives: At the end of this exercise you shall be able to

- **cut a mild steel flat along a straight line using a hack saw**
- **flat filing practice along with flatness checking**
- **cut the given M.S sheet in to two pieces along its length using chisel**
- **sharpening of chisel and center punch in grinder**
- **safety precaution in grinding tools.**





1	Ø50 x 3 - 206		Fe 310		B	
1	50 ISF 10 - 50		Fe 310		A	1.04
NO.OFF	STOCK SIZE	SEMI PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE NTS	HACK SAWING				TOLERANCE ±0.5	TIME 5h
					CODE NO. APN1319E1	

Requirements

Tools/Instruments/Material

• Tools kit	- 1 No.	• Hacksaw	- 1 No.
• M.S sheet	- as reqd.	• Cotton waste	- 1 No.
• Bench vice	- 1 No.		

PROCEDURE

TASK 1: **Using various tools for cutting**

1 Check the size of the given M.S flat Job.

2 Apply copper sulphate solution and allow it to dry

3 Layout lines as per drawing using a scriber taking measurement from the edge and punch mark the lines using a dot punch and hammer.

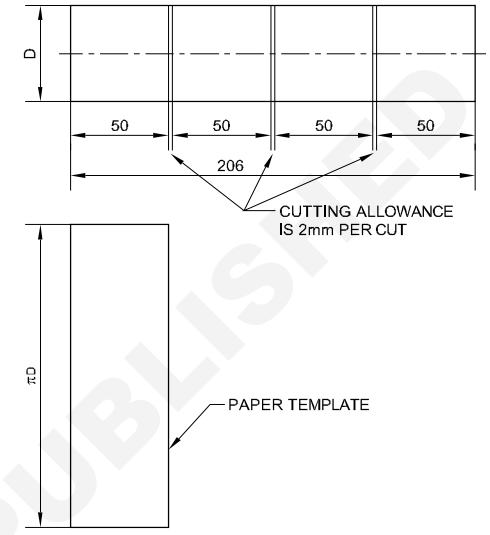
4 Holding the workpiece.

5 Cut by hacksaw along the lines.

6 Remove burrs, if any by filling.

7 Mark lines as per drawing using a paper template and punch mark the line (Fig 1).

Fig 1



Skill Sequence

Holding the workpiece

Objectives: This shall help you to
- **holding the work piece**
- **fixing of hacksaw blades.**

Holding the workpiece

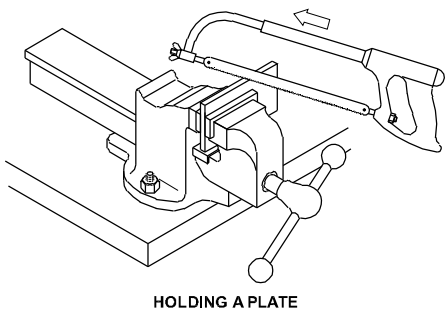
Position the metal to be cut according to the cross-section i.e a plate, a pipe or a channel for hacksawing.

As far as possible the job is held so as to be cut on the flat side rather than the edge or the corner.

This reduces the blade breakages. (Fig 1, 2 &3)

The selection of the blade depends on the shape and hardness of the material to be cut.

Fig 1



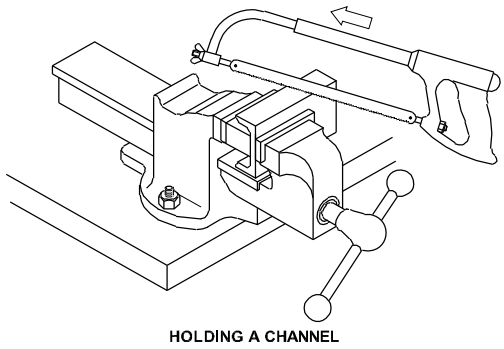
HOLDING A PLATE

Pitch selection: For soft materials such as bronze, brass soft steel, cast iron etc. use a 1.8 mm pitch blade. (Fig 4)

For steel use a 1.4 mm pitch. For angle iron, brass tubing, copper, iron pipe etc. use a 1 mm pitch blade. (Fig 5)

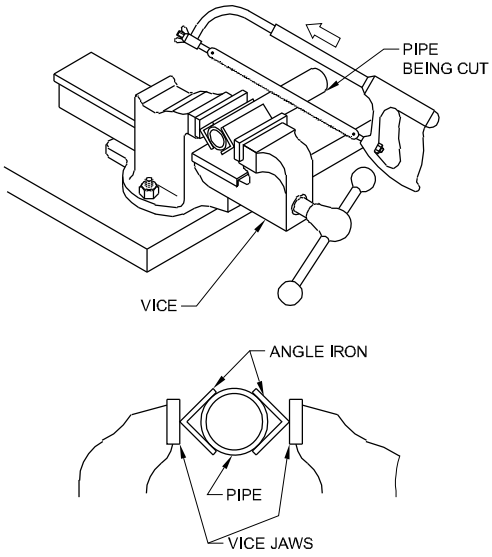
For conduit and other thin tubing, sheet metal work etc. use a 0.8 mm pitch. (Fig 6)

Fig 3



HOLDING A CHANNEL

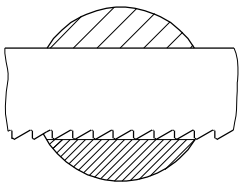
Fig 2



SUPPORT FOR HOLDING THE PIPE

APN1319J2

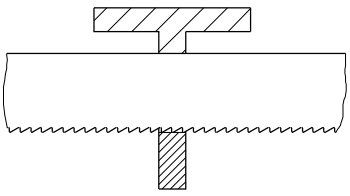
Fig 4



MORE CHIP CLEARANCE

APN1319J4

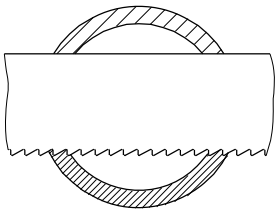
Fig 5



TWO OR MORE TEETH ON SECTION

APN1319J5

Fig 6



TWO OR MORE TEETH ON SECTION

APN1319J6

Fixing of Hacksaw Blades

The teeth of the hacksaw blade should point in the direction of the cut and away from the handle. (Fig 7)

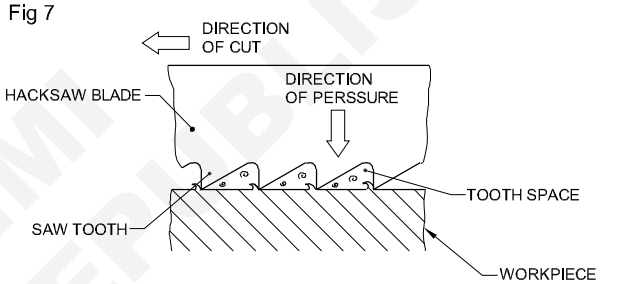
The blade should be held straight, and correctly tightened before starting.

While starting the cut make a small notch. (Fig 2)

Notch means a small groove on the job surface.

The cutting movement should be steady and the full length of the blade should be used.

Fig 7



APN1319J7

Filing and hacksawing

Objectives: This shall help you to
- **file M.S channel**
- **cutting pipe by hacksaw.**

Check the material size 155 x 75 x 40 mm equal angle MS channel (Fig 1).

Remove all the rust from all the surfaces by the edge of file, clean by cotton waste (Fig 2).

Hold the file handle with thumb will be placed firmly to grip the file, left leg will be in forward direction right leg will 300 mm from the front leg.

Also check the height of your vice should be on the level of your elbow as in Fig 3.

Hold the job in bench vice grip firmly from width of the channel (Fig 4).

Place file on the job and start filing while file will go in forward direction develop pressure on job, at return stroke release (Fig 5).

The pressure and changes the place file and go for next area (Fig 6).

Like that complete operation and check flatness with the help of trysqure blade.

Open the job and start on (A) side filing as directed previously. Check the squareness along with (B) (Fig 7).

Fig 1

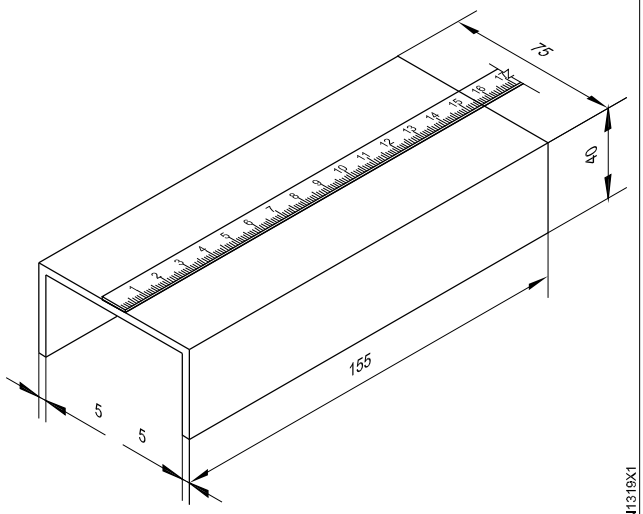


Fig 2

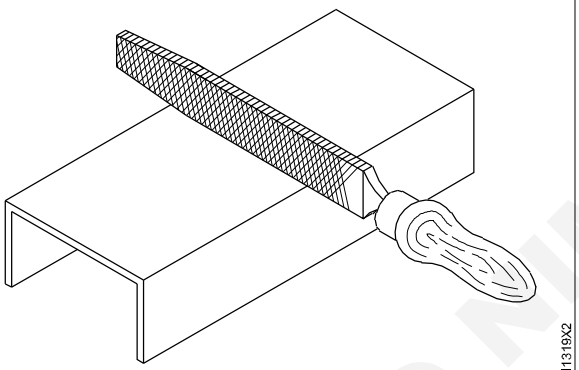


Fig 3

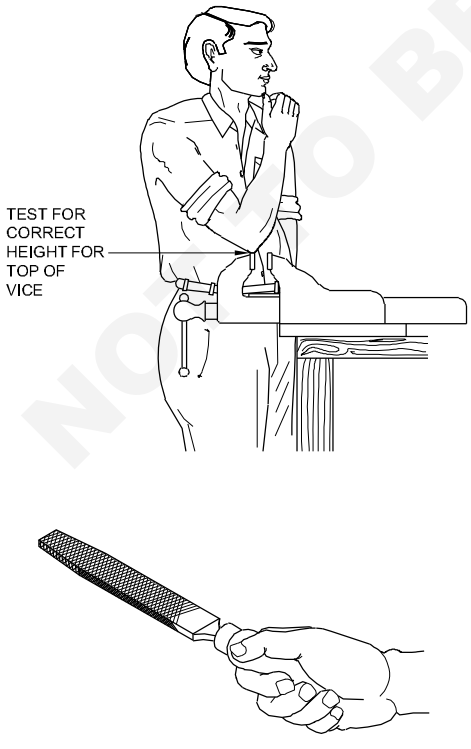


Fig 4

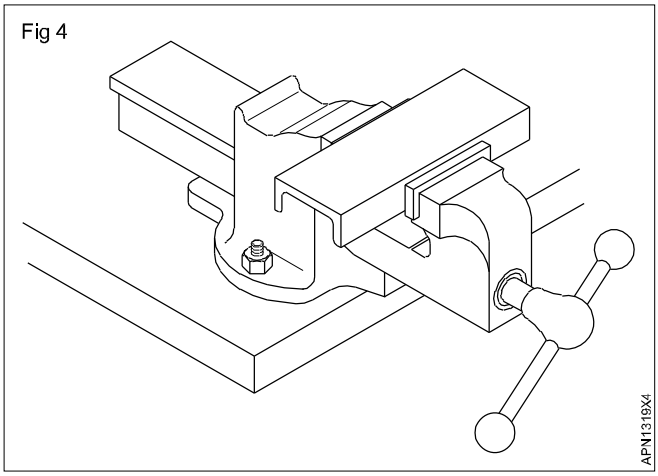


Fig 5

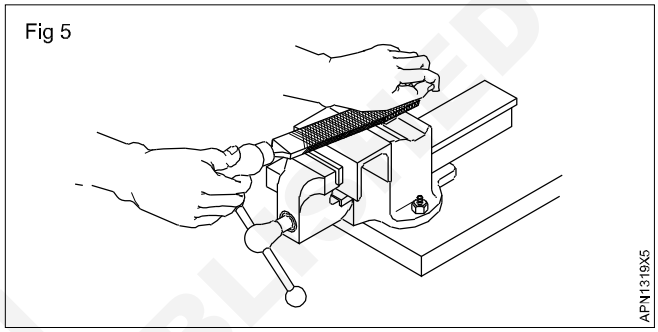


Fig 6

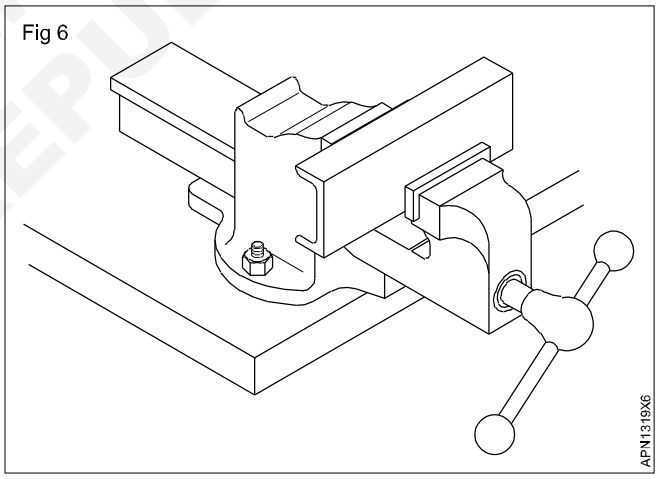
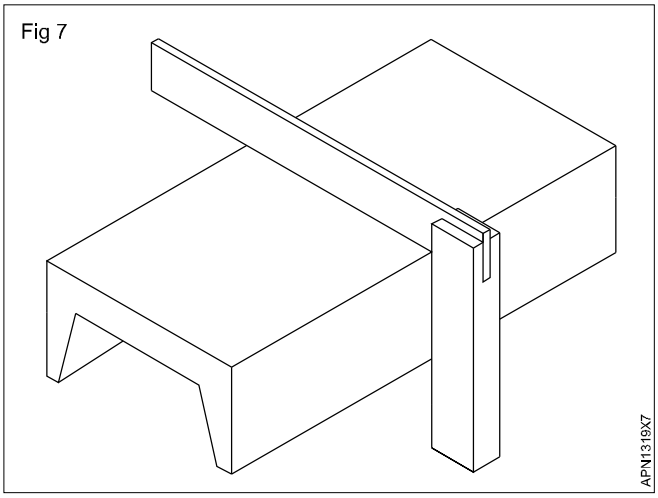
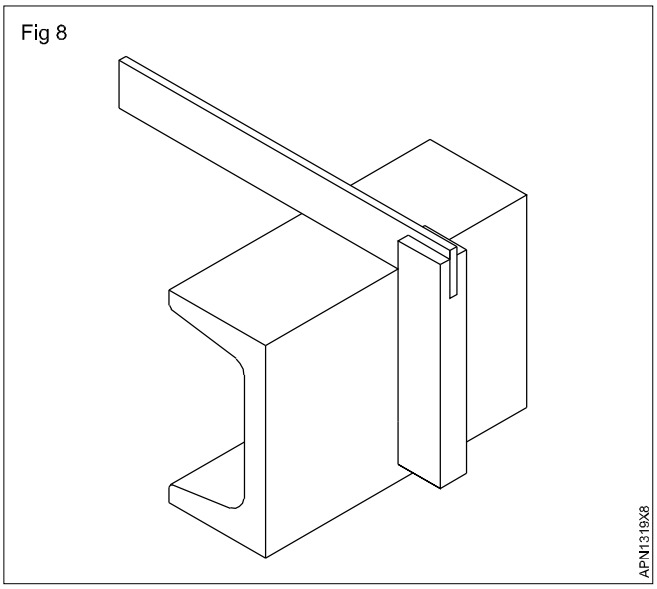


Fig 7



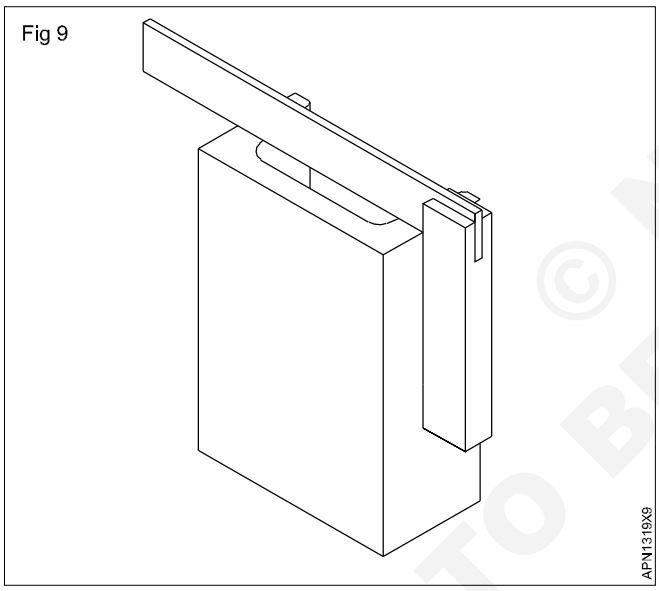
Open the job and start on (D) (Fig 6) side filing as directed previously. Check the squareness along with (A) (Fig 8).

Fig 8



Open the job and start on (C) side filing as directed previously. Check the squareness along with (A,B&D). (Fig 9)

Fig 9



Open the job and start on (F) side filing as directed previously. Check the squareness along with (AB&D). (Fig 10)

Apply pressure only during the forward stroke. (Fig 11)

Atleast two to three teeth should be in contact with the work while cutting. Select fine pitch blade i.e 0.8 or 1 mm pitch for thin work and for cutting pipes. (Fig 12a)

Fig 10

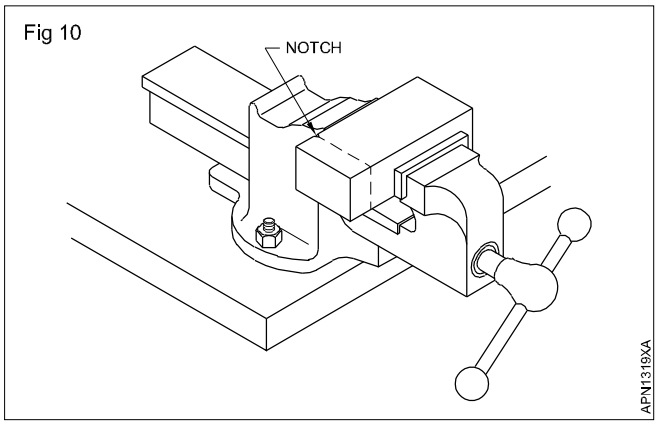
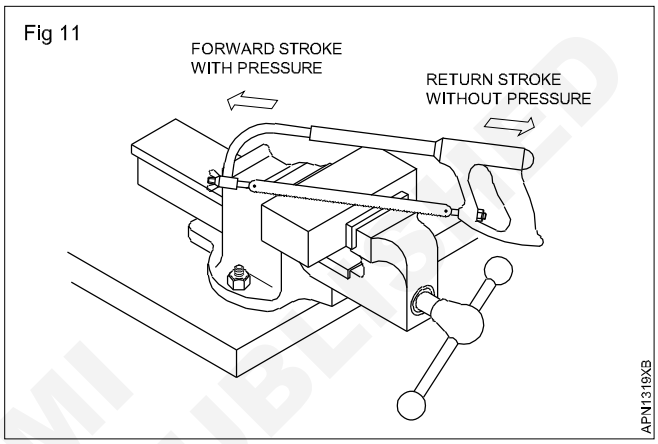


Fig 11



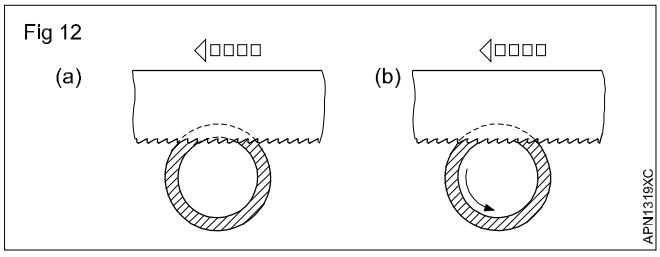
Turn and change the position of the pipe while hacksawing (Fig 12b)

While cutting pipes by hacksawing a paper template is made and wrapped over the pipe to get the line of cut marked on the circumference of the pipe.

Normally, a coolant is not necessary while hacksawing.

Do not move the blade too fast. While finishing a cut, slow down to avoid breakage of the blade and injury to yourself and others.

Fig 12



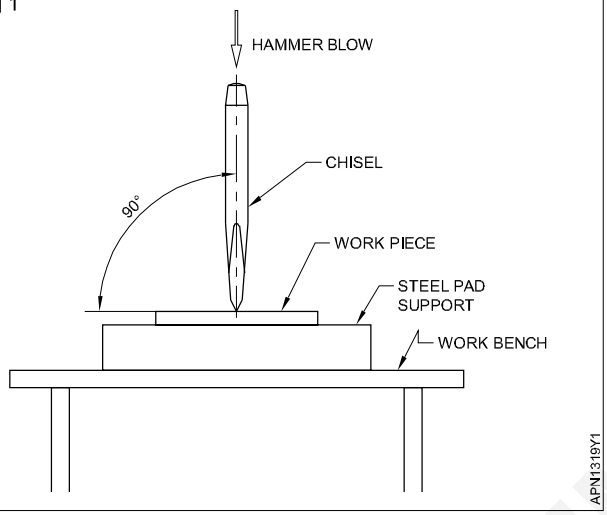
Cutting M.S sheet by chisel

Objectives: This shall help you to
- **cut the M.S sheet by chisel**
- **sharp the chisel and centre punch**
- **check the centre punch angle.**

Cutting M.S sheet by chisel

A hard and strong support is essential under the sheet to ensure the chisel properly penetrates into the job and cuts the sheet (Fig 1).

Fig 1



The chisel has to be held vertically to get an effective cutting action.

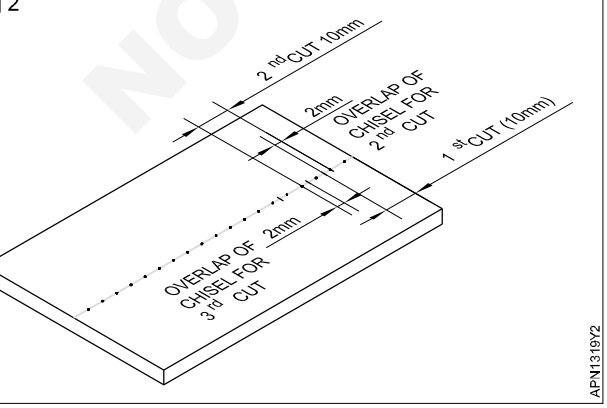
Sometimes the job is clamped to the work bench or to the steel pad by “C” clamps so that the job will not slip while chiselling.

After making cut on the marked line, move the chisel approximately for 80% of the length of the first cut and again make a cut.

This is done to ensure that the cutting action continues progressively along the marked line and no portion of metal will be left uncut.

In addition the cutting edge of the chisel can be positioned properly along the line of cut which will avoid a zig zag cutting. (Fig 2)

Fig 2

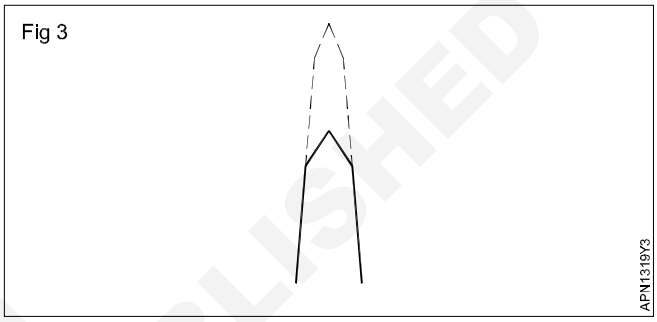


Proceed to make cuts by the flat chisel as explained above until the entire length (i.e 150mm) of the job is cut on the punch marked line.

Sharpening the chisel

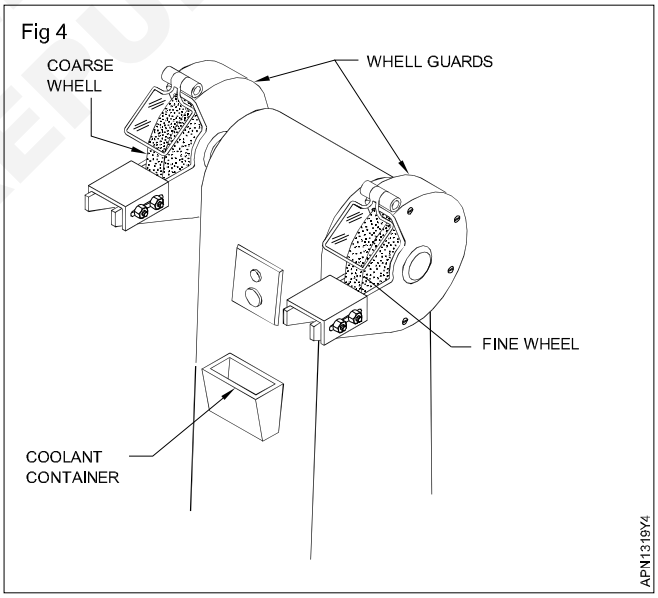
Chisels will become blunt due to use. For efficiency in chipping, the chisels are to be re-sharpened regularly (Fig 3).

Fig 3



Chisels are sharpened on grinding machines (Fig 4).

Fig 4



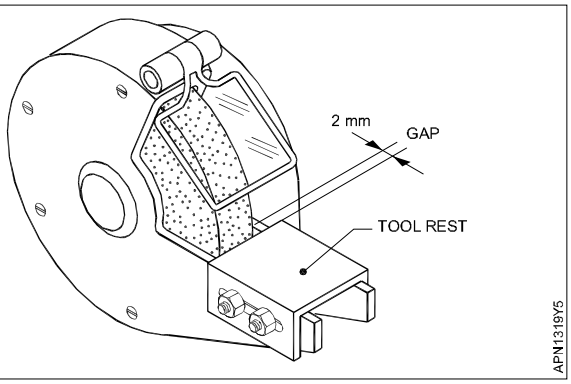
Inspect the tool-rest. If there is too much of a gap between the tool-rest and the wheel, adjust it, and position it as close to the wheel as possible. (Fig 5)

Ensure that there is sufficient coolant in the container.

While grinding, rest the body of the chisel on the tool-rest (A), and allow the point to touch the wheel.

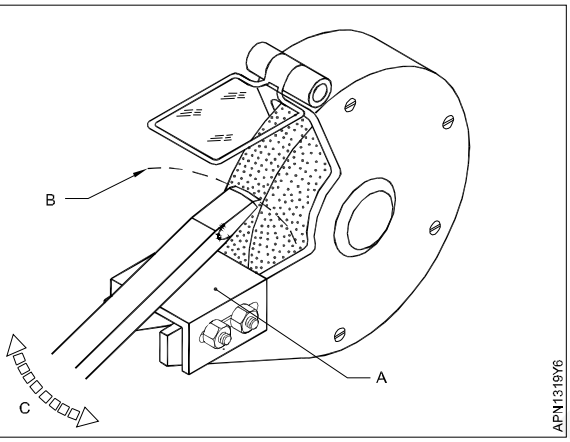
Rock the point slightly on both sides in an arc (B) to provide a slight convexity at the cutting edge. This will help to avoid digging in of the sides while chipping.

Fig 5



Keep moving the chisel across the face (C) to prevent formation of curves and grooves at the cutting edge. (Fig 6)

Fig 6



After re-grinding many times, the cutting edges become too thick. Such chisels are unsuitable for resharpening. They should be forged and brought to shape before grinding.

Check the wheel guards are in place, and are securely fastened.

Inspect the condition of the grinding wheel for breakage and cracks.

Wear safety goggles.

When switching on the grinding machine, stand aside until the wheel reaches the operating speed.

Dip the chisel frequently in the coolant to avoid overheating. Overheating will draw the temper of the chisel.

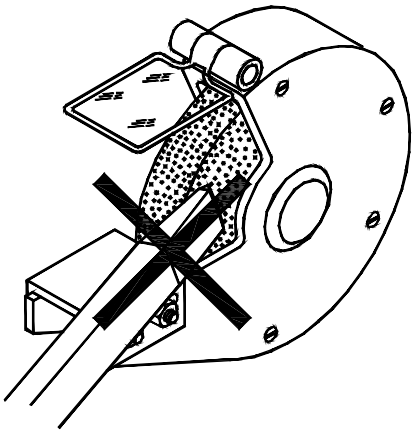
Clean by grinding, If the chisel-head is mushroomed.

Use only the front of the grinding wheel. Do not grind on the sides (Fig 7).

Report to instructor, if any damage to the grinding wheel is noticed.

Do not use cotton waste or other material for holding the chisel while grinding.

Fig 7

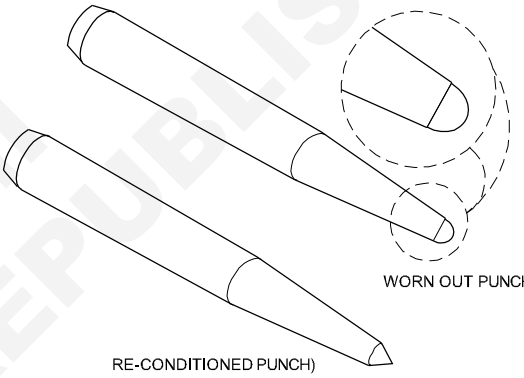


Sharpen the centre punch

Arrange workplace & prepare working material. (Fig 8)

Saw the round material to length (only if a original tool is not available).

Fig 8



Face grind on one face

Press the workpiece in vertical direction against the wheel and turn it slowly around its axis.

Grind 4 mm chamter on face (Horizontal or vertical position)

Press workpiece against the wheel with a setting angle or 45°, in doing so, turn it speedily and uniformly around its axis.

Grind on a 50 mm long taper proceeding from the other face horizontal position:

The right hand guides the workpiece, the left fore finger lies between the workpiece and the grinding support - press workpiece in horizontal direction against the wheel, turn it speedly as well as turn it forward and back.

Grind the point - vertical position (Fig 9)

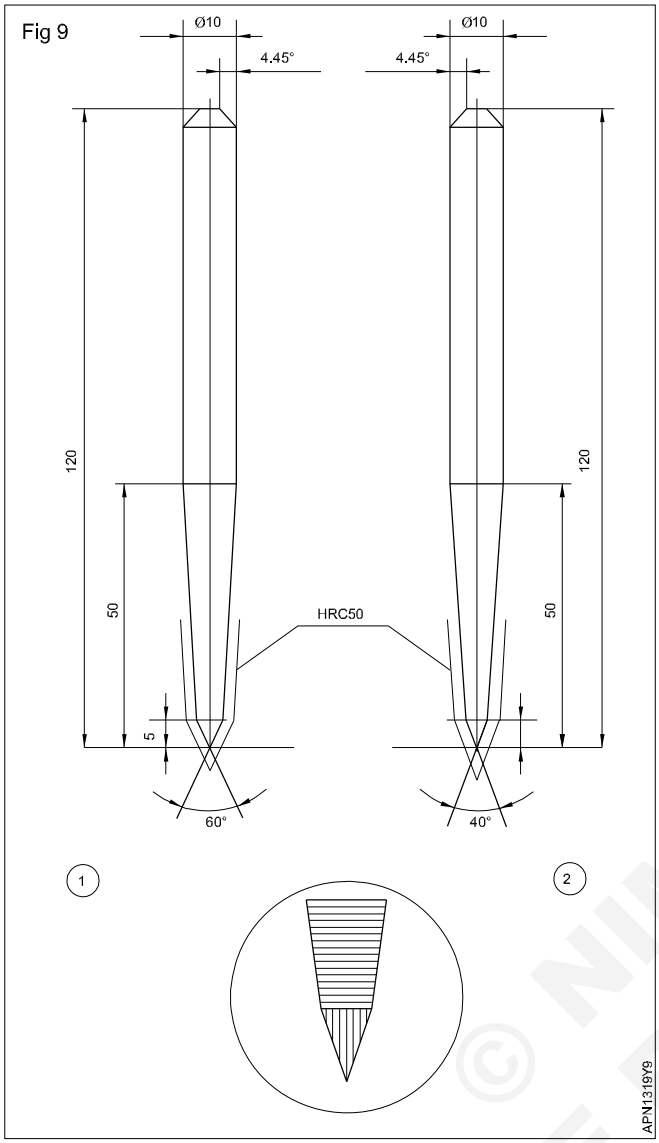
1 Centre punch 60°

2 Scribing / Prick punch 40°

Press against the wheel only slightly with quick turning or it around its axis.

Check it finally for angle accuracy (as per drawing).

Fig 9



Check the centre punch angle

Sharpen a centre punch hold the end of the punch between the index finger and thumb or one hand as shown in Fig 10, resting that hand on the tool rest or the grinder.

Move the punch into light contact with the rotating wheel or the grinder with the centre line or the punch forming about it 45° angle with the face or the wheel.

This will give the approximate 90° included angle required for a centre punch.

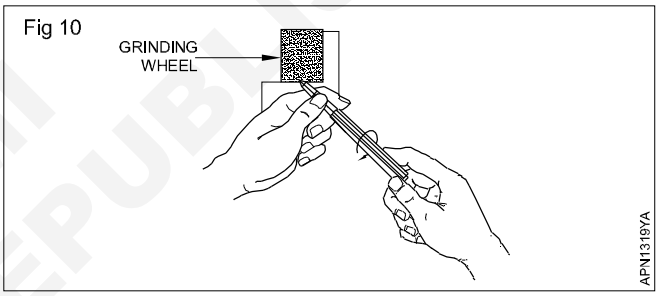
Rotate the punch as shown by the direction arrow in Fig 10 with the thumb & index finger or the other hand.

Keep the point cool by using only light pressure on the wheel and by frequently dipping the punch in a can of cooling water.

Sharpening a prick punch in the same way only with the exception that the included angle should be 30° other than 90°.

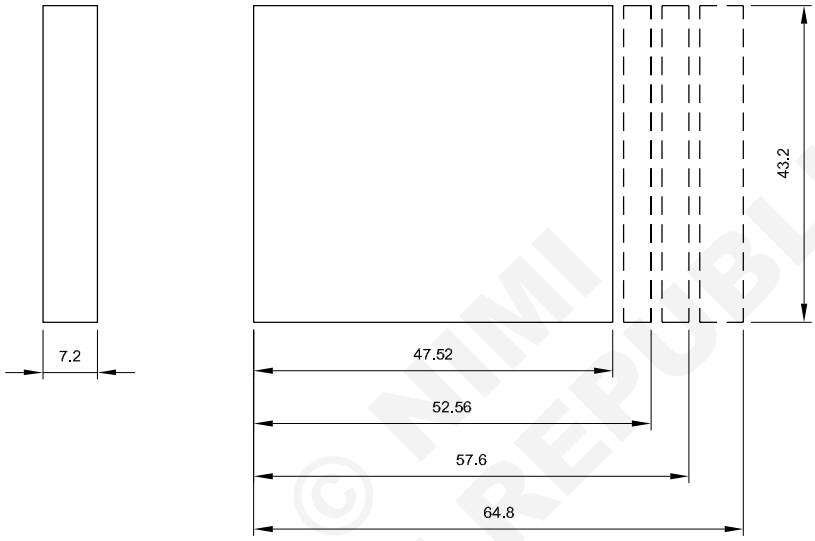
The angle between the centre of this punch and the wheel should be about 15°.

Fig 10



Practice on hacksawing and filing

Objectives: At the end of this exercise you shall be able to
- **mark straight lines using a scribing block**
- **cut on marked lines using a hacksaw blade.**



1		From exercise 2	Fe 310			
NO.OFF	STOCK SIZE	SEMI PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO1.3.20
SCALE NTS	HACK SAWING				TOLERANCE ±0.5	TIME 5h
					CODE NO. MDN1320E1	

Requirements

Tools/Instruments/Material

- Tools kit - 1 No.
- Hacksaw blade - 1 No.
- Cotton waste - 1 No.

PROCEDURE

TASK 1: **Mark lines using a hacksaw blade**

1 Check the raw material for its size.

2 File flat and square to finish the block 55 x 10 x 80.

3 Mark centre lines for the holes as per drawing.

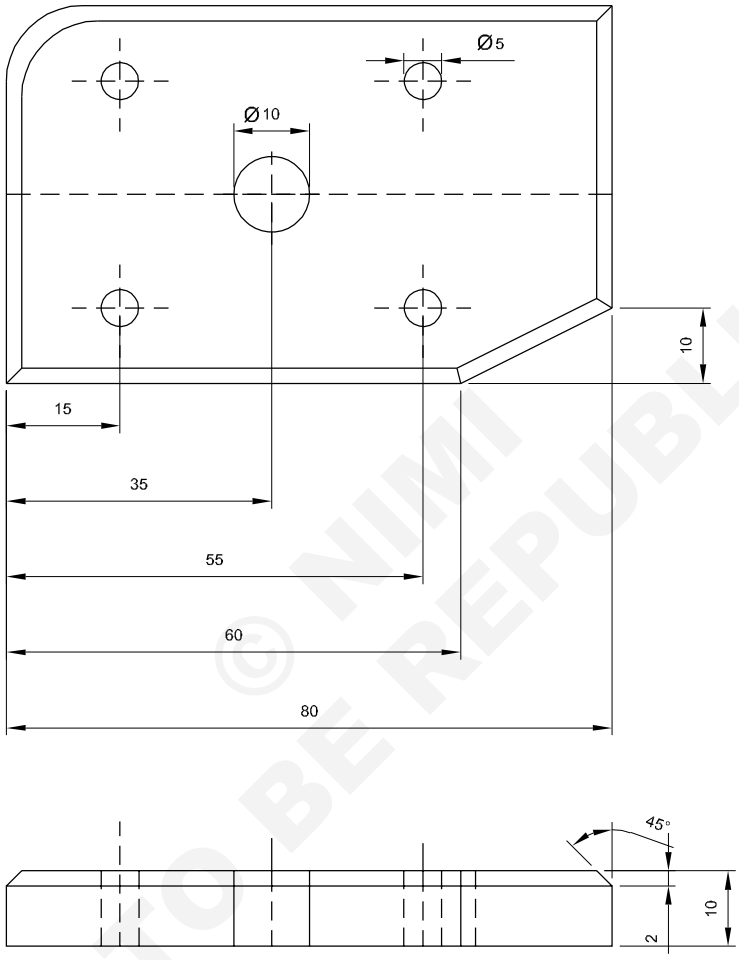
4 Drill a pilot hole for concave profile.

5 Saw cut to remove the excess metal for the profile.

6 File with flat file the two sides.

Practice on marking and drilling

Objectives: At the end of this exercise you shall be able to
- **file surfaces flat within ± 0.5 mm**
- **file angular, concave and convex surfaces**
- **chamfer edges by filling**
- **drill through holes.**



1	65ISF12x85		Fe 310			
NO.OFF	STOCK SIZE	SEMI PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX.NO: 1.4.21
SCALE NTS	DRILLING AND FILING RADIUS				DEVIATIONS ±0.1	
					CODE NO. APN1421E1	

Requirements

Tools/Instruments/Material

- Tools kit - 1 No.
- Cotton waste - 1 No.

PROCEDURE

TASK 1: **File angular, concave and convex surface**

1 Check the raw material for its size.

2 File flat the top face first.

3 File the two adjacent sides flat and square to each other as well as with top surface.

4 Mark the dimension as per the drawing file and finish the block.

5 Mark horizontal, vertical angular curved lines as per the drawing using scriber block and dividers.

6 Fix the M.S plate in a vice.

7 File the radius and angle.

8 Locate the centres for holes to be drilled.

9 Drill ϕ 5mm and 10mm through holes as per drawing.

10 File with knife edge file to finish the surface.

Skill sequence

Drilling through hole

Objective : This shall help you to
- **drill through hole to the required size.**

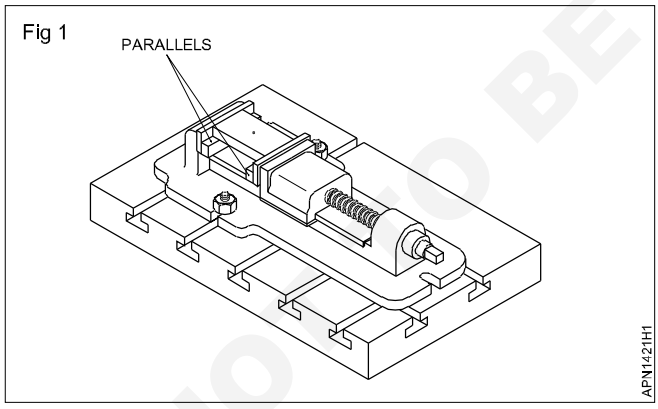
Method of Drilling

Check the given raw material for its size.

Mark and locate the centres for the hole to be drilled.

Mount the job in the machine vice on the parallels and clamp it securely to the drill-press-table (Fig 1).

Fig 1



Set the work table (Fig 2) in such a manner that a drill can be fixed and removed without disturbing the vice or the job.

Fix the centre drill on the drilling machine spindle and align with the centre mark on the job.

Spot the hole location with a centre drill.

Remove the centre drill and fix 8 mm drill for pilot hole.

Start the drilling machine.

Feed the drill and drill through hole. (Fig 3)

Fig 2

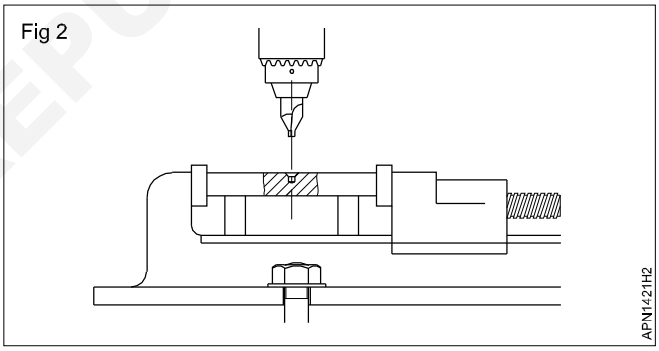
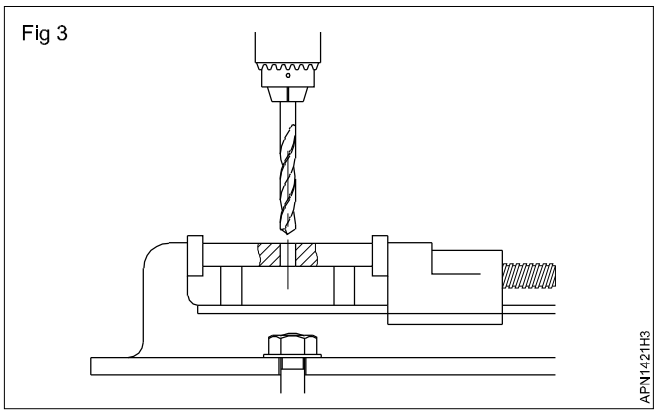


Fig 3



Set the spindle speed of the drilling machine to the nearest calculating r.p.m.

$$V = \frac{\pi d \times n}{1000}$$

Remove drill from the machine without disturbing the set up.

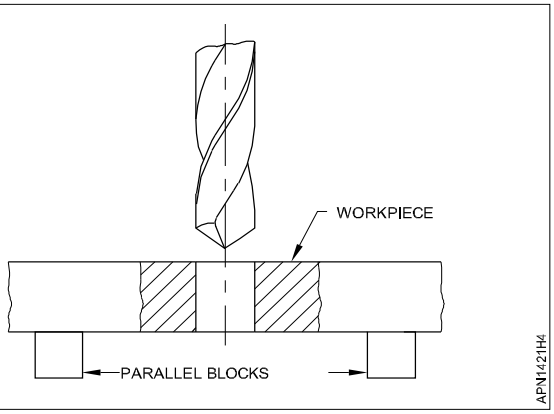
Fix 14.5 mm drill and drill through hole.

While drilling use cutting fluid.

Release the drill frequently from the hole for the chips to be flushed out by the cutting fluid.

Remove the drill and job from the machine. (Fig 4)

Fig 4



Drilling blind holes

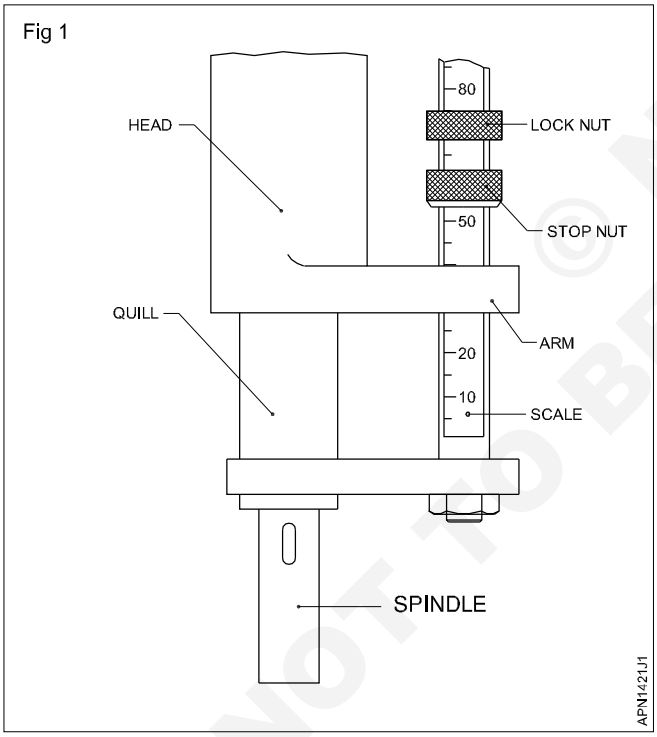
Objective : This shall help you to
- **drill blind holes to the required depth using the depth stops.**

Method of controlling depth of blind holes

While drilling blind holes, it is necessary to control the feed of the drill.

Most machines are provided with a depth stop arrangement by which the downward movement of the spindle can be controlled. (Fig 1)

Fig 1



Most depth stop arrangements will have graduations by which the advancement of the spindle can be observed.

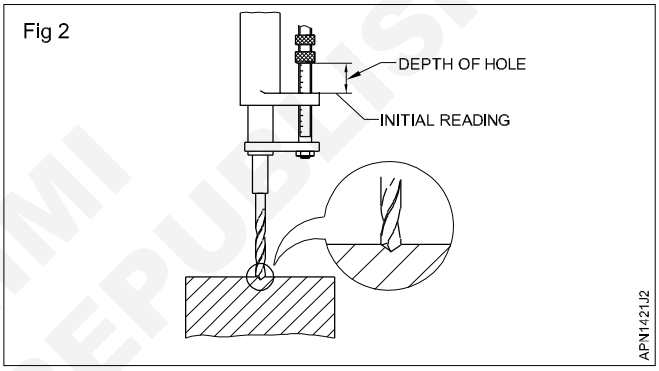
Generally the blind hole depth tolerances are given up to 0.5 mm accuracy.

Setting for drilling blind holes

For blind hole-depth setting, first the work is held on the machine and the hole is located correctly.

The drill is started, and it drills until the full diameter is formed. Note down the initial reading at this point (Fig 2)

Fig 2



Add the initial reading to the depth of the blind hole to be drilled.

Initial Reading + Depth of Hole = Setting

Adjust the stop next to the required setting, using the scale.

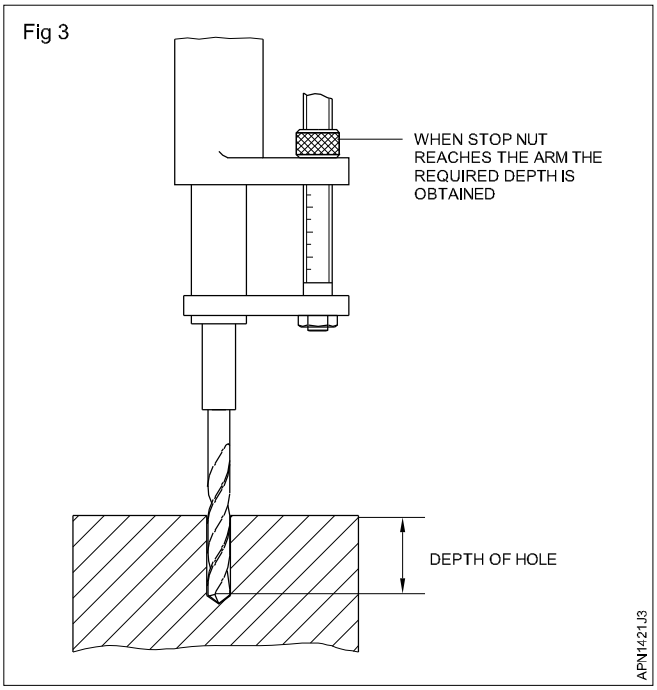
Tighten the lock nut to prevent the setting from being disturbed.

Start the machine and feed the drill. When the stop nut reaches the arm the blind hole is drilled to the required depth. (Fig 3)

While drilling, release the drill frequently from the hole for the chips to be flushed out by the cutting fluid.

Do not drill on a light component without clamping. If not clamped, the job will rotate along with drill.

Fig 3



Safety precautions while using drilling machine

Objectives: At the end of this exercise you shall be able to
- **follow personal, machine, job and drill bit safety.**

Requirements

Tools/Instruments/Material

• Tools kit	- 1 No.	• Brush	- 1 No.
• Cotton waste	- 1 No.	• Oil/grease	- as reqd.

PROCEDURE

TASK 1: **Follow the safety precautions while using the machine**

Wear a dress suitable for work. Ensure that the spindle head and table is locked properly.

The workpiece and the drill should be rigidly held. Switch off power when not in use.

Clean and oil the machine after use. Use a brush to clean the chips and swarf.

Select proper cutting speed according to material. Select proper cutting fluid according to material.

Remove the workpiece only after getting cooled or with a tong.

While fixing the drill in a socket or sleeve, the tang portion should align in the slot (Fig 1&2).

Fig 1

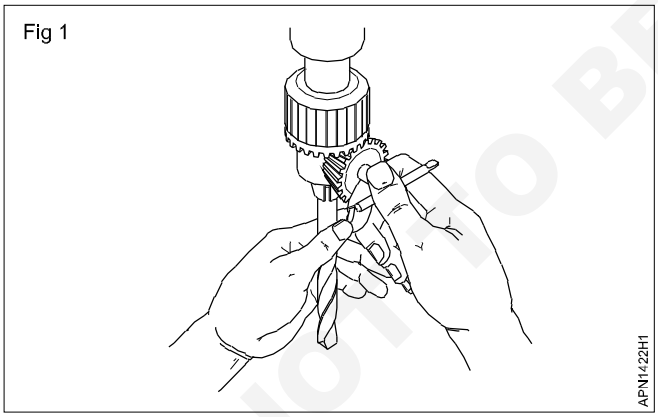
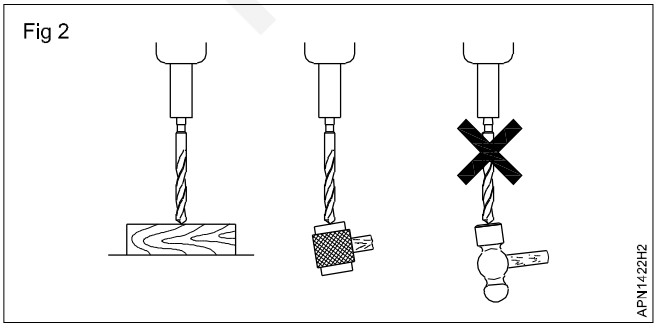


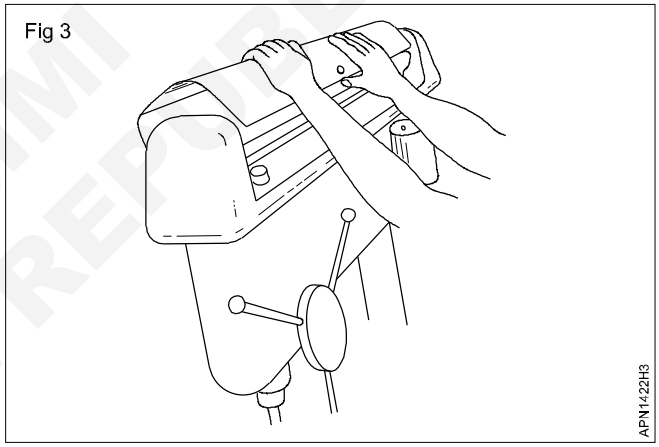
Fig 2



This will facilitate the removal of drill or sleeve from the machine spindle.

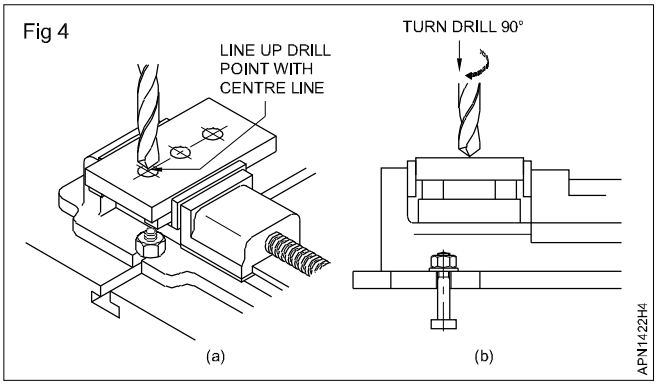
Ensure the belt safe guard properly placed before drilling (Fig 3).

Fig 3



Before Drilling ensure that Drill point tip properly sits on the punched marking of the job (Fig 4)

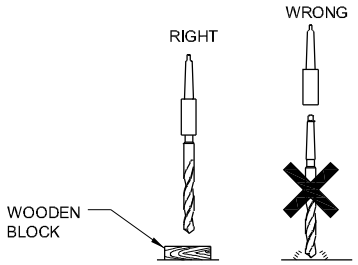
Fig 4



While removing the drill from the sockets/sleeves, don't allow it to fall on the table or jobs. (Fig 5)

Use a drift to remove drills and sockets from the machine spindle. (Fig 6)

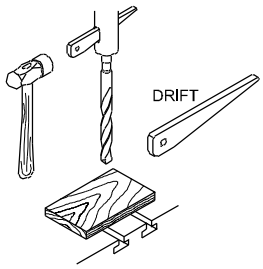
Fig 5



REMOVING A TAPER SHANK DRILL

APN1422H5

Fig 6

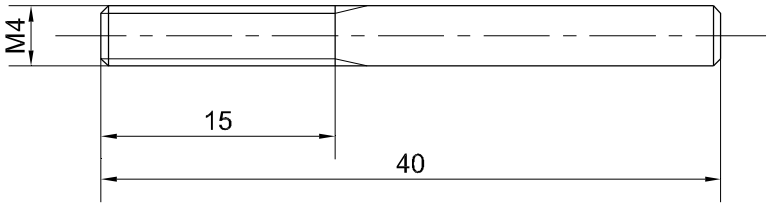


APN1422H6

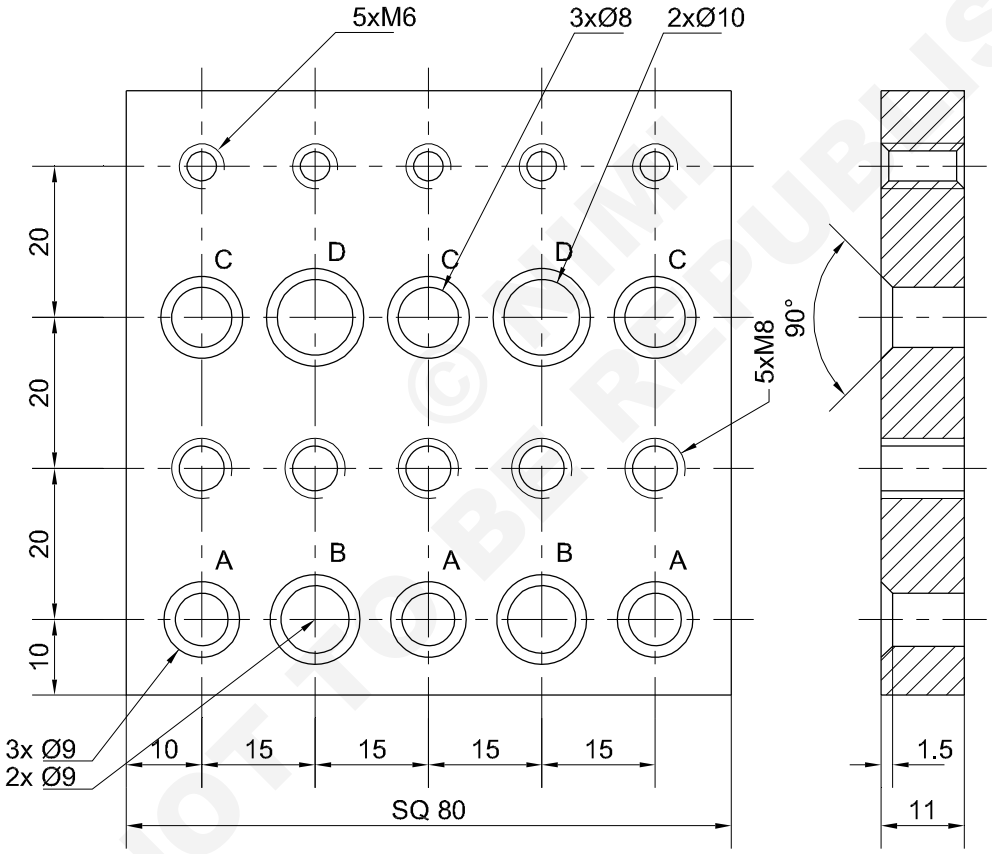
Practice on forming internal threads by tapping

Objectives: At the end of this exercise you shall be able to
- **internal threads using dies**
- **drill through holes.**

1



2



1	5x45		Fe310		1	1.4.23
1	90ISF12x85	-	Fe310		2	1.4.23
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	Ex.No.

SCALE 1:1	CUTTING INTERNAL THREADINGS	DEVIATIONS ±0.1	
		CODE NO. APN1423E1	

Requirements

Tools/Instruments

• Tools kit	- 1 No.	• Brush	- 1 No.
• Cotton waste	- 1 No.		

PROCEDURE

TASK 1: **Using dies for internal threads by tapping**

1 Check the raw material for its size.

2 File and finish the plate 80 x 11 x 80 within +0.2 mm.

3 Locate centres for holes to be drilled, tapped and countersunk.

4 Centre punch for the centres.

5 Drill five, ø5 mm tapping drill size holes for M6 tapping.

6 Drill five, ø6.8 mm tapping drill size holes for M8 tapping.

7 Drill four ø8 mm through holes as per drawing. Enlarge by drilling ø10 mm the 2nd and 4th hole of the second row.

8 Drill five ø7 mm through holes as per drawing.

9 Enlarge the 2nd and 4th holes by drilling ø9 mm on the 4th row

10 Countersink ø8 and ø10 holes with 90° countersink as per standard.

11 Countersink ø7 and ø9 mm holes with 120° countersink as per 5 standard.

12 Cut M6 internal thread in the four ø 5 mm drilled holes.

13 Countersink 120° all the four ø6.8 mm holes on both sides as per drawing.

14 Cut M8 internal threads in all the five ø6.8 mm drilled holes with M8 taps.

15 Check M6 and M8 tapped holes with the supplied M6 and M8 screws, respectively.

16 Hold cylindrical blank on vice.

17 Cut M4 external thread using M4 dies on part 2.

Skill sequence

Internal threading of through holes using hand taps

Objectives: This shall help you to
- **determine the tap drill sizes for internal threading**
- **cut internal threads using hand taps.**

Determining the tap drill size

For cutting internal threads, it is necessary to determine the size of the hole (tap drill size).

This can be calculated using a formula or can be chosen from the table of tap drill sizes.

Drill the hole to the required tap drill size.

Do not forget to give the chamfer required for aligning and starting the tap. (Fig 1)

Hold the work firmly and horizontally in the vice. The top surfaces should be slightly above the level of the vice jaws.

This will help in using a try square without any obstruction while aligning the tap. (Fig 2)

Use soft jaws while holding the finished surface on a vice.

Fix the first tap (Taper tap) in the wrench.

Too small a wrench will need a greater force to turn the tap. Very large and heavy tap wrenches will not give the feel required to turn the tap slowly as it cuts.

Fig 1

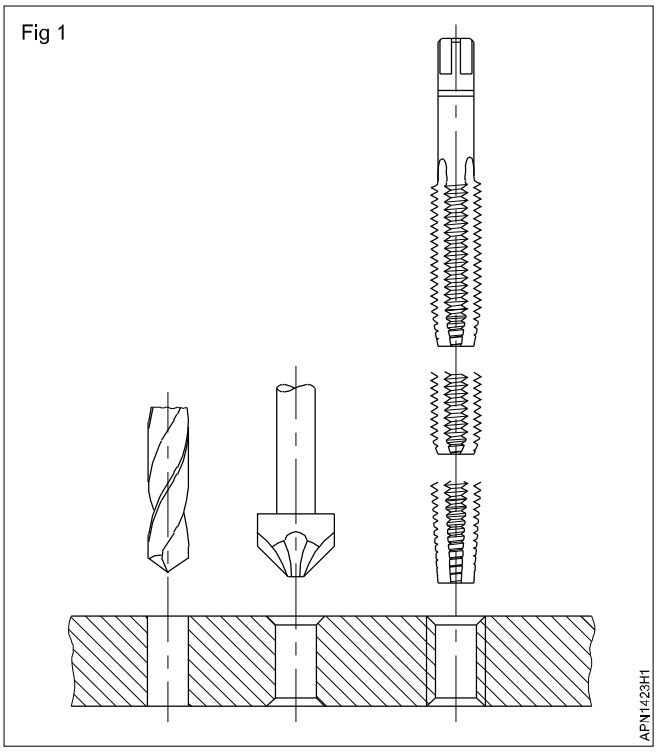
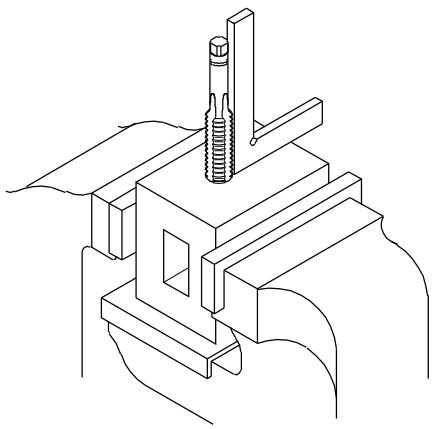


Fig 2



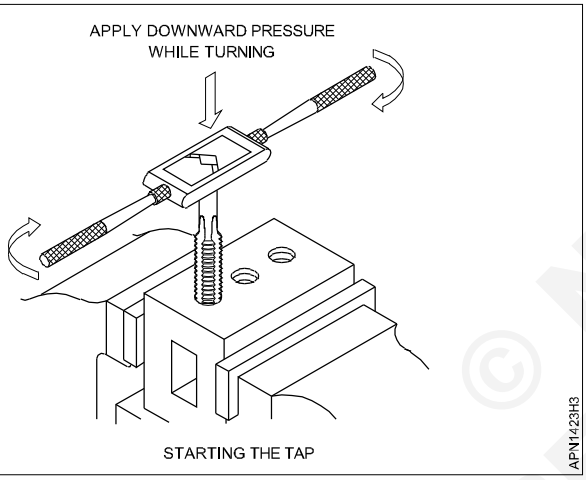
APN1423H2

Position the tap in the chamfered hole vertically by ensuring the wrench is in the horizontal plane.

Exert steady downward pressure and turn the tap wrench slowly in a clockwise direction to start the thread.

Hold the tap wrench close to the centre (Fig 3).

Fig 3



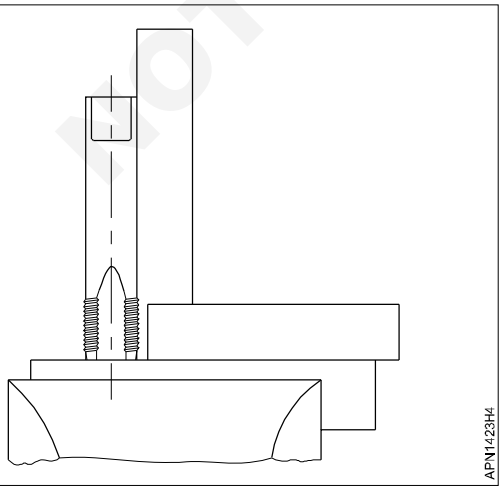
APN1423H3

When you are sure of starting of the thread, remove the tap wrench without disturbing the tap alignment.

Check and make sure the tap is vertical, use a small try square for help.

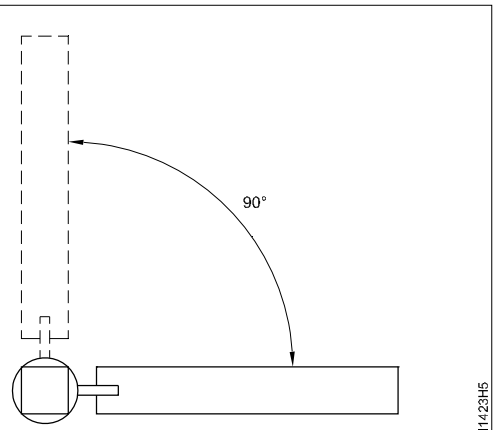
Place the try square in two positions, 90° to each other (Fig 4&5).

Fig 4



APN1423H4

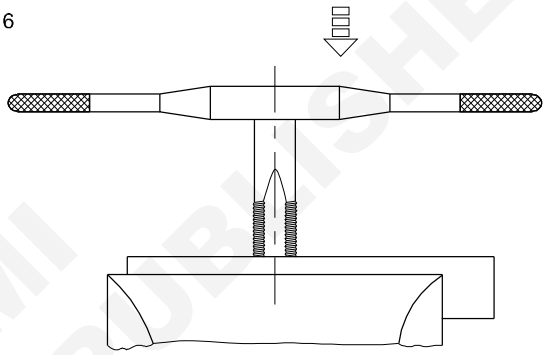
Fig 5



APN1423H5

Make corrections, if necessary. This is done by exerting slightly more pressure on the opposite side of the tap inclination (Fig 6).

Fig 6



APN1423H6

Never apply side pressure without giving a turning motion to the tap.

Check the tap alignment again with a try square.

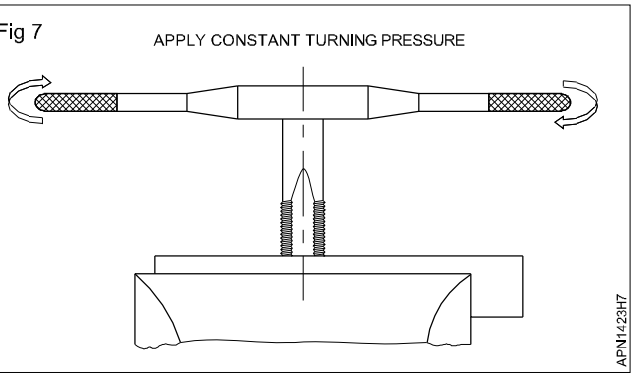
Fit the tap wrench, and tighten without disturbing the tap alignment.

Make one or two turns and check the alignment.

The tap alignment should be corrected within the first few turns.

After the tap is positioned vertically, turn the wrench lightly by holding the ends of the wrench handles without exerting any downward pressure. (Fig 7)

Fig 7



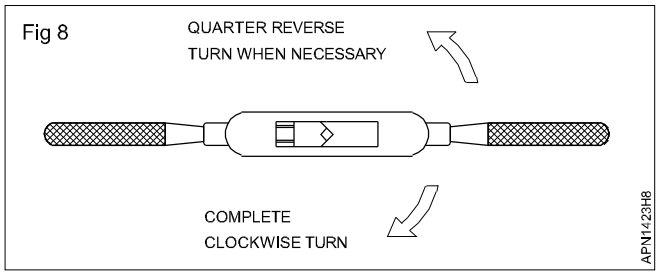
APN1423H7

While turning the wrench, the movement should be well balanced.

Any extra pressure on one side will spoil the tap alignment and can also cause breakage of the tap.

Continue cutting the thread. Turn backwards frequently, about quarter turn to break the chip.

Stop and turn backward also when some obstruction to movement is felt. (Fig 8)



Use a cutting fluid while cutting the thread.

Cut the thread until the tap is fully inside the hole being threaded.

Finish and clean up using intermediate and plug tap. The intermediate and plug tap will not cut any thread if the tap has entered the hole fully.

Remove chips from the work with a brush.

Check the threaded hole with a matching screw.

Clean the tap with a brush, and place it back on the stand.

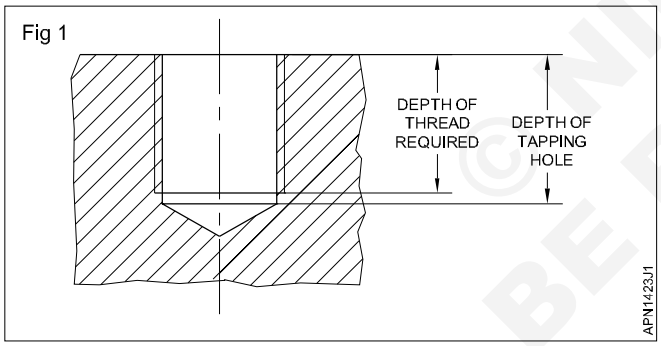
Internal threading blind holes using hand taps

Objective: This shall help you to
- **cut internal threads in blind holes.**

Drilling a blind hole

Determine the tapping drill size using the table for tapping drill sizes.

Drill a blind hole (Fig 1) using the depth stop arrangement.



The depth of the tapping hole should be slightly more than the depth of the required thread.

Procedure for threading

Remove metal chips, if any, from the blind hole by turning it upside down and slightly tapping it on a wooden surface.

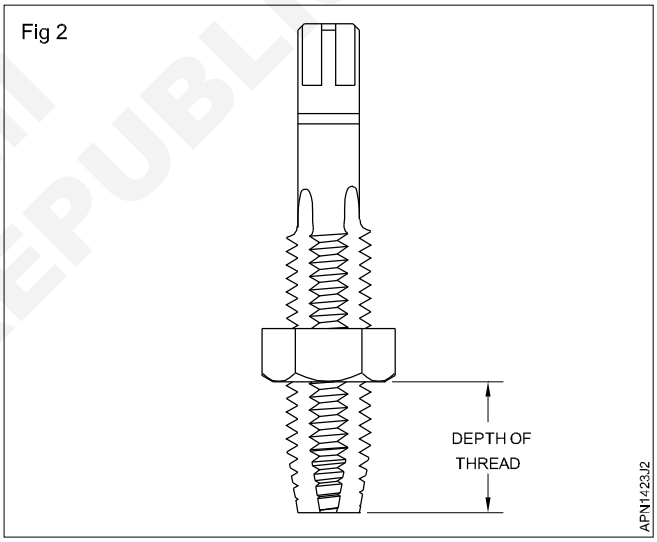
Do not clear chips by blowing as it can cause injury to your eyes.

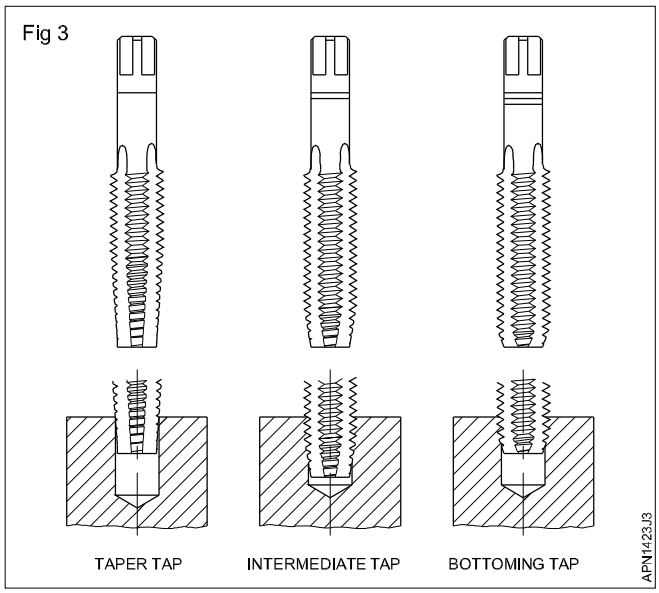
Screw a matching nut on the first tap to act as a depth stop (Fig 2).

Thread the blind hole until the nut touches the plate surface.

Remove the chips from the hole frequently, using a flattened and bent wire.

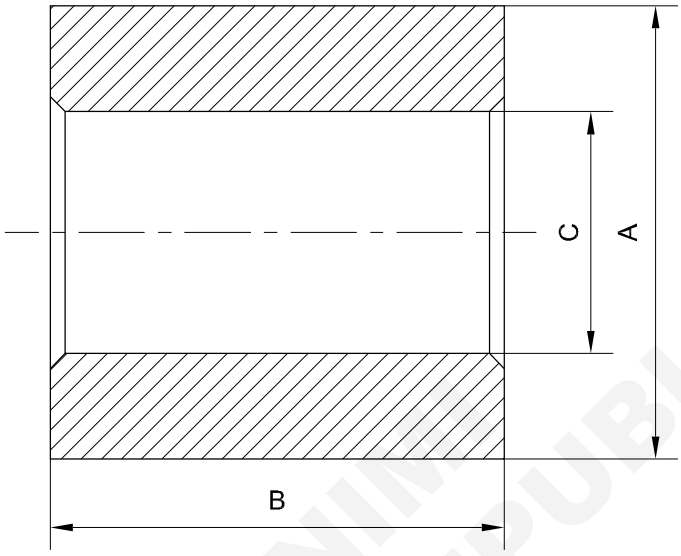
Finish tapping the hole with intermediate and bottoming tap. Set nut to control the depth of thread (Fig 3).





Practice on reaming a hole

Objectives: At the end of this exercise you shall be able to
- **ream through hole with a hand reamer**
- **check the reamed hole by using a plug gauge.**



A			
B			
C			

1	-	-	Fe310	-	-	1.4.26
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	Ex No.
SCALE 1:1	REAMING				DEVIATIONS ±0.1	
					CODE NO. APN1426E1	

Requirements	
Tools/Instruments	
• Tools kit	- 1 No.

PROCEDURE

TASK 1: **Ream through hole with a hand reamer**

1 Hold the job in a vice.

2 Select the correct type and size of reamer

3 Hold the reamer in tap wrench

4 Ream the hole by using sufficient coolant.

5 Give uniform hand feed while reaming.

6 Check the hole with a 'Go' and 'No-Go' plug gauge.

Skill sequence

Reaming drilled holes using hand reamers

Objective: This shall help you to
- **ream through holes within a limits and check reamed holes with cylindrical pins.**

Determining the drill size for reaming

Use the formula,

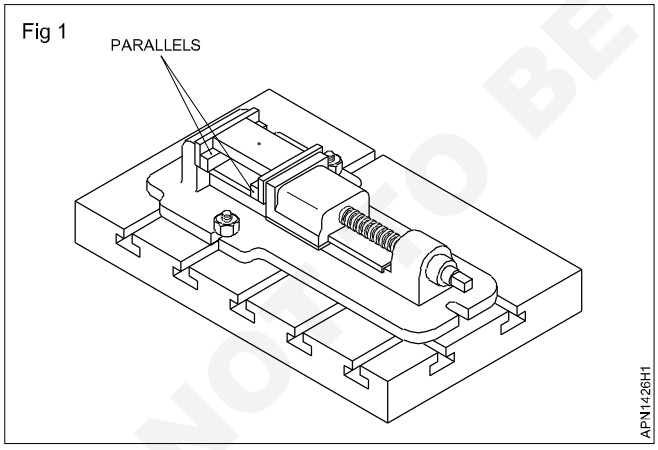
Drill diameter = reamed hole size. (undersize + oversize) [Refer to the table for the recommended undersizes in related theory on drill sizes for reaming. (See table 1.)]

Procedure for hand reaming

Drill holes for reaming as per the sizes determined.

Place the work on parallels while setting on the machine vice (Fig 1).

Fig 1



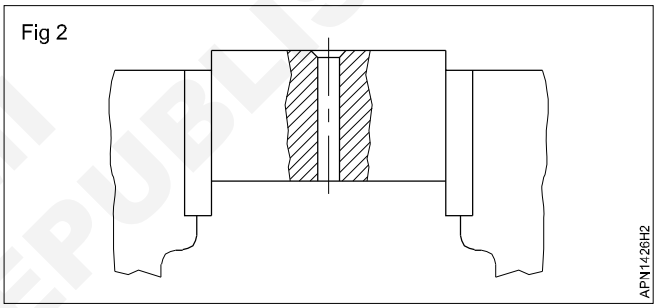
Chamfer the hole ends slightly. This removes burrs, and will also help to align the reamer vertically.

Fix the work in the bench vice. Use vice clamps to protect the finished surfaces. Ensure that the job is horizontal (Fig 2).

Fix the tap wrench on the square end and place the reamer vertically in the hole.

Check the alignment with a try square. Make corrections, if necessary.

Fig 2



Turn the tap wrench in a clockwise direction applying a slight downward pressure at the same time.

Apply pressure evenly at both ends of the tap wrench. Apply cutting fluid.

Turn the tap wrench steadily and slowly, maintaining the downward pressure (Fig 3).

Do not turn in the reverse direction for it will scratch the reamed hole (Fig 4).

Fig 3

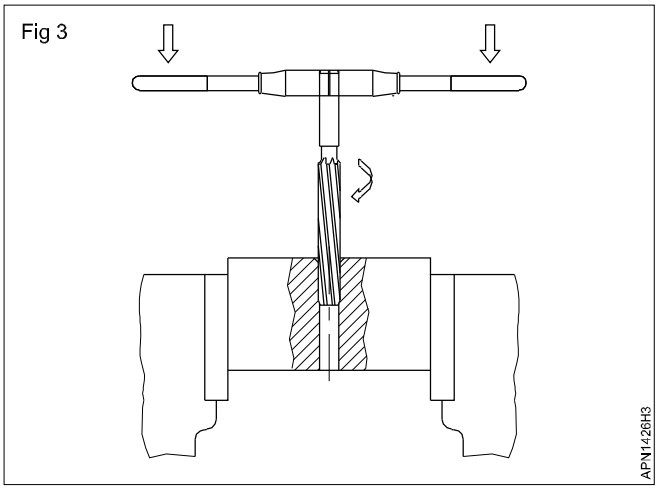
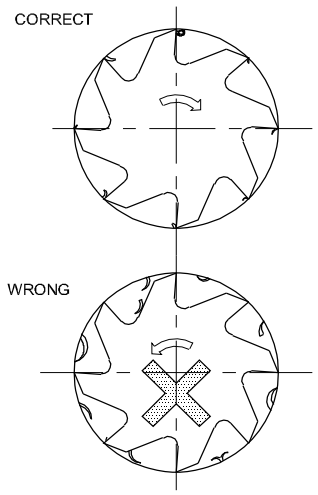


Fig 4



Ream the hole through. Ensure that the taper lead length of the reamer comes out well and clear from the bottom of the work.

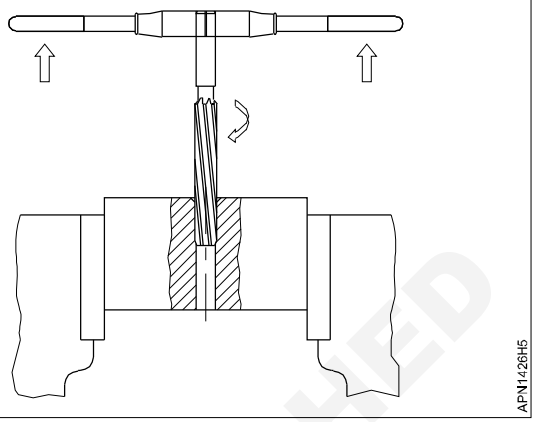
Do not allow the end of the reamer to the strike on the vice.

Remove the reamer with an upward pull until the reamer is clear of the hole. (Fig 5)

Remove the burrs from the bottom of the reamed hole.

Clean the hole. Check the accuracy with the cylindrical pins supplied.

Fig 5



Scraping curved surfaces

Objective : This shall help you to
- **scrape and test curved surfaces.**

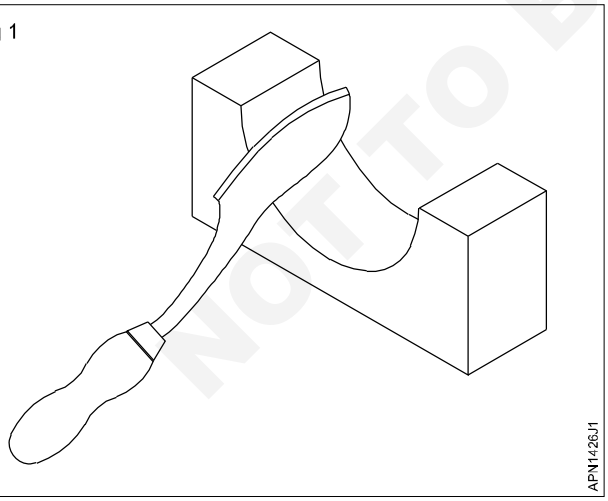
A half round scraper is the most suitable scraper for scraping curved surfaces.

This method of scraping differs from that of flat scraping.

Method

For scraping curved surfaces the handle is held by hand in such a way as to facilitate the movement of the scraper in the required direction (Fig 1).

Fig 1



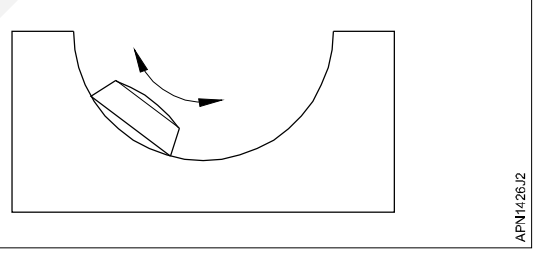
Pressure is exerted with the other hand on the shank for cutting.

Rough scraping will need excessive pressure with longer strokes.

For fine scraping, pressure is reduced and the stroke length also becomes shorter.

Cutting action takes place both on forward and return strokes (Fig 2).

Fig 2

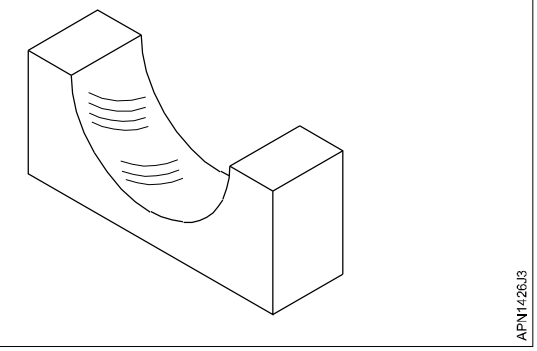


During the forward movement one cutting edge acts, and on the return stroke, the other cutting edge acts.

After each pass, change the direction of cutting. This ensures a uniform surface (Fig 3&4).

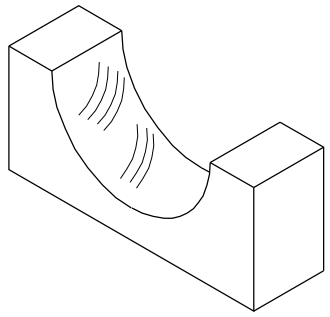
Use a master bar to check the correctness of the surface being scraped (Fig 5).

Fig 3



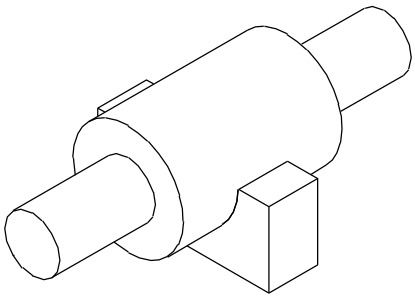
Apply a thin coating of Prussian blue on the master bar to locate the high spots.

Fig 4



APN1426J4

Fig 5



APN1426J5

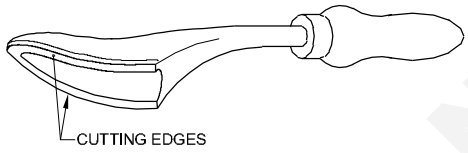
Sharpening scrapers

Objectives : This shall help you to
- **sharpen a half round scraper**
- **sharpen a three-square scraper.**

Sharpening half round scrapers

Locate the two cutting edges on the rounded back (Fig 1) for the half round scrapers.

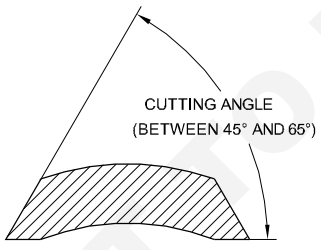
Fig 1



APN1426X1

Check the cutting edges are formed by the bottom surface, and the flat surfaces are ground on the rounded back of the scraper. (Fig 2)

Fig 2

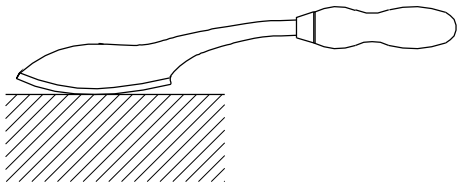


SECTION OF HALF - ROUND SCRAPER

APN1426X2

Grind the bottom surfaces with a slight curve. This helps the cutting edges to make point contact on the surfaces being scraped. (Fig 3)

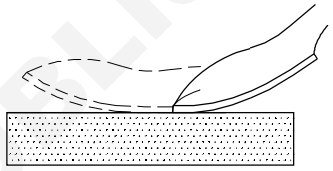
Fig 3



APN1426X3

Rub the bottom surface with a rocking motion on the oilstone for re-sharpening (Fig 4).

Fig 4



APN1426X4

Re-sharpened by grinding the bottom surface, when the cutting edge is blunt.

As far as possible avoid grinding of the edges. (Flat surface ground on the rounded back.)

These scrapers have triangular cross-section which tapers to a point. (Fig 5)

Fig 5

APN1426X5

The centre of each face is hollow and this makes sharpening easy. (Fig 6)

The angle of each cutting edge is 60°.

Re-sharpening is done on an oilstone and the method adopted is similar to that for the half round scraper.

While grinding, the movement should be such that it tapers to a point with a uniform movement.

The cutting edges of three-square scrapers are likely to be overheated quickly as they are very thin.

Apply only light pressure.

Maintain the cutting edge width to about 3 mm. (Fig 6)

A three-square scraper is very sharp instrument and has to be handled carefully.

Flatten the sharp tip for about 1 mm for safety while handling. (Fig 7)

Fig 6

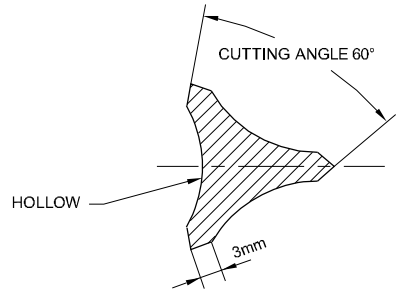
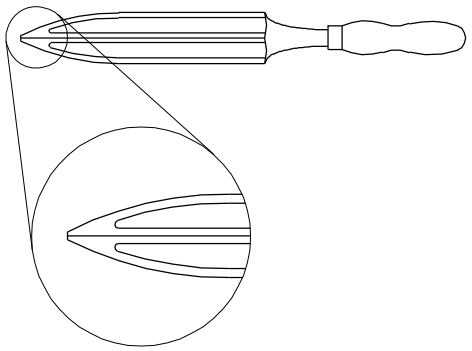


Fig 7



Practice on measuring electrical parameters in circuits

Objectives : At the end of this exercise you shall be able to
- **form DC series circuits and verify its characteristics (Current, voltage & resistance)**
- **form DC parallel circuits and verify its characteristics.**

Requirements

Tools/Instruments

• Trainee's tool kit	- 1 No.
• Ohmmeter/Multimeter	- 1 No.

Materials

• Wires 4mm	- as reqd.
• Insulation tape	- as reqd.

Equipments

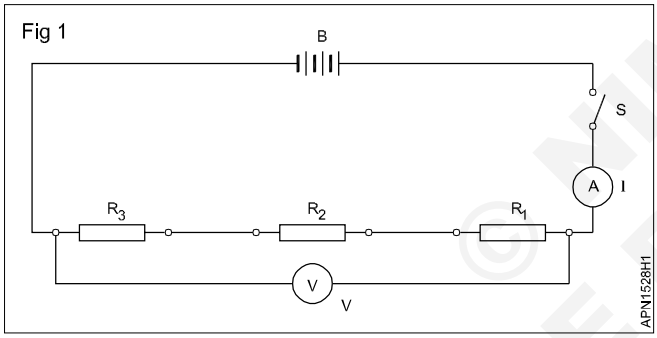
• Battery 12V, 6V	- 1 No.

PROCEDURE

TASK 1: **Connect DC series circuit (Fig 1) and Verify its characteristics**

1 Form a circuit as shown in the Fig 1.

Fig 1



2 Close the switch 'S', measure the current 'I' and voltage 'V'.

3 Enter the measured values in Table No.1.

4 Switch off the supply, connect the ammeter and voltmeter as shown in the Fig 2. Switch on the supply and measure voltage V_1 and current I_1, through R_1.

5 Switch off the supply, connect the ammeter and voltmeter as shown in the Fig 3. Switch on the supply and measure the voltage V_2 and the current I_2 in R_2.

6 Draw a circuit diagram showing the position of 'A' and 'V' in the circuit to measure the current I_3 and voltage V_3 across R_3.

7 Connect and measure I_3 and V_3 across R_3.

Fig 2

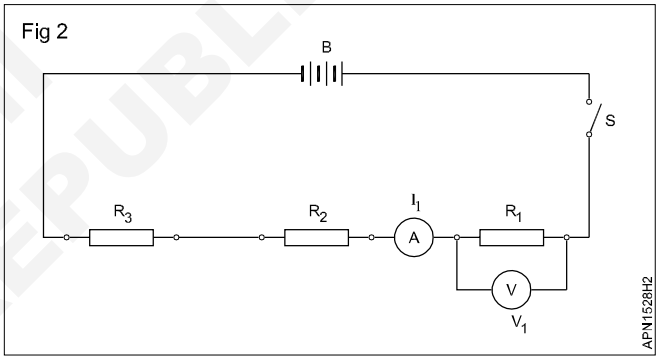
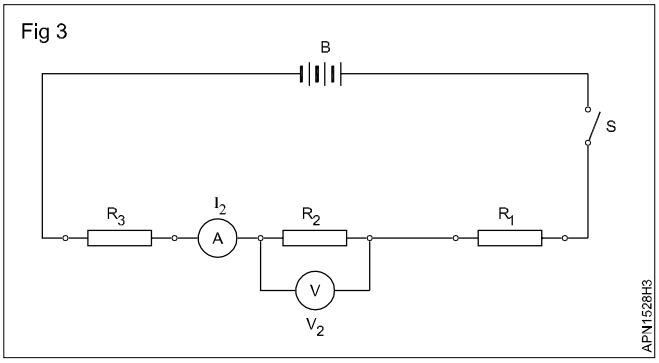


Fig 3



8 Enter the measured values in Table 1.

9 Verify the characteristics of current, voltage and total resistance.

Table 1

Values	Total circuit	R_1=10	R_2= 20	R_3= 10
Current	I =	I_1 =	I_2=	I_3=
Voltage	V =	V_1 =	V_2=	V_3=
Res. R=	R = _____ =	R_1=_____ =	R_2=_____ =	R_3=_____ =

— — — — — — — —

TASK 2 : **Connect DC parallel circuit (Fig 4) and verify its characteristics**

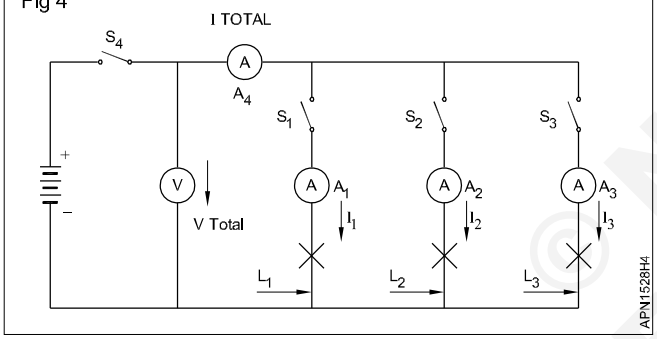
1 Form the branches 1, 2, 3 by connecting the torch lamps L1, L2, L3 (150 mA, 6v) with a holder, an ammeter A4 (500 mA) and switch 'S4' in series Fig 4.

2 Connect the lamp terminals of the three branches together.

3 Connect the leads of each branch together and also connect with the lead of the switch S4.

4 Form the circuit as shown in circuit diagrams with voltmeter (V), ammeter (A4), switch 'S4' and battery.

Fig 4



5 Close the switch 'S4' and switch 'S1' in branch 1.

6 Read the ammeters 'A4' and 'A1' and record the values in Table 2.

7 Close the switches 'S4' 'S1' and 'S2' in branch 2.

8 Read the ammeters 'A4' 'A1' and 'A2' and record the values in Table 2.

9 Close the switches 'S4' 'S1' and 'S2' in branch 3.

10 Read the ammeters 'A4' 'A1' 'A2' and 'A3' and record the values in Table 2.

11 Repeat the above steps after clamping the torch lamp in any one branch with 6v 300 mA lamp and record the results in Table 2.

12 Repeat the exercise by replacing all the three 'lamps with holder' by 'wire-wound resistors' (two numbers of 100 ohms and one of 150 ohms).

13 Verify the characteristics of current, voltage and resistance.

Table 2

Sl. No.	I_1	I_2	I_3	I_{Total}	Switches closed	Components in the branches
1					S_4, S_1	3 lamps of 150 mA.
2					S_4, S_1, S_2	,,
3					S_4, S_1, S_2, S_3	,,
4					S_4	,,
5					S_4, S_1	2 lamps of 150 m and one lamp 300 mA.
6					S_4, S_1, S_2	,,
7					S_4, S_1, S_2, S_3	,,
8						Resistors - two 100 ohms and one 50 ohms.
9					S_4, S_1, S_2	,,
10					S_4, S_1, S_2, S_3	,,

— — — — — — — —

Practice on continuity test

Objectives : At the end of this exercise you shall be able to
- **check the fuses of all the lighting units**
- **find out the open and short circuits in the lighting circuit**
- **use of jumper wire**
- **check the fusible links**
- **check the circuit breakers.**

Requirements

Tools/Instruments

• Trainee's tool kit	- 1 No.
• Multimeter	- 1 No.
• Wire cutter	- 1 No.

Equipments

• Battery 12V	- 1 No.
• Vehicle	- 1 No.

Materials

• Auto fuses	- as reqd.
• Test lamp	- 1 No.
• Cable/Wire	- as reqd.
• Fusible links	- as reqd.
• Circuit breaker	- as reqd.

PROCEDURE

TASK 1 : **Check the fuses of all the lighting units**

1 Check the battery for its charge.

2 Connect the test lamp clip to a good ground.

3 Touch the probe of the test lamp on either end of the fuse. If the test lamp lights, the fuse is in good condition.

If the test lamp lights only while touching one side that means the fuse is defective. If the test lamp does not light even on touching both the sides that means the power source is not on or the ground connection is bad.

4 Remove the fuse from its spring clip. Check whether it is blown or not.

If it is blown we can see through the glass tube.

If the fuse is blown due to short circuit the colour of glass tube becomes black (1) and the fuse wire melts like small balls (Fig 1).

If the fuse is blown (2) due to overload the fuse wire is simply cut off (Fig 2).

Fig 1

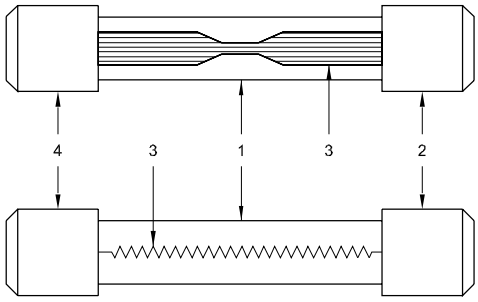
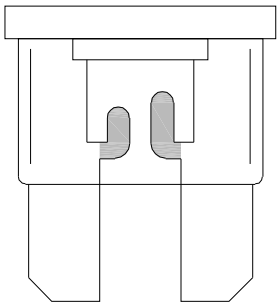


Fig 2



TASK 2 : **Find out open and short circuit in the lighting circuit**

1 Check the wiring for open circuit by connecting an ohmmeter between the two terminals.

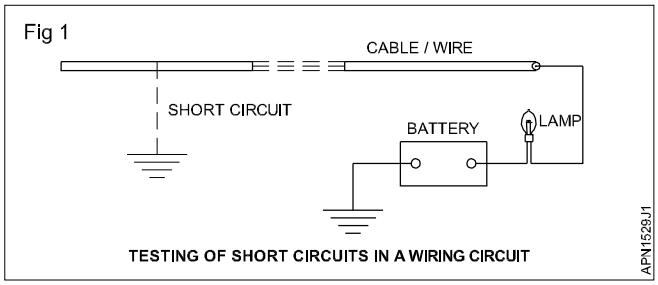
If there is an open circuit the ohmmeter reading will be more.

2 Trace the open circuit and rectify.

3 Check the wiring for short circuit with the test lamp. (Fig 1)

If there is a short circuit the test lamp will glow before the circuit is completed and also the fuse will be blown off.

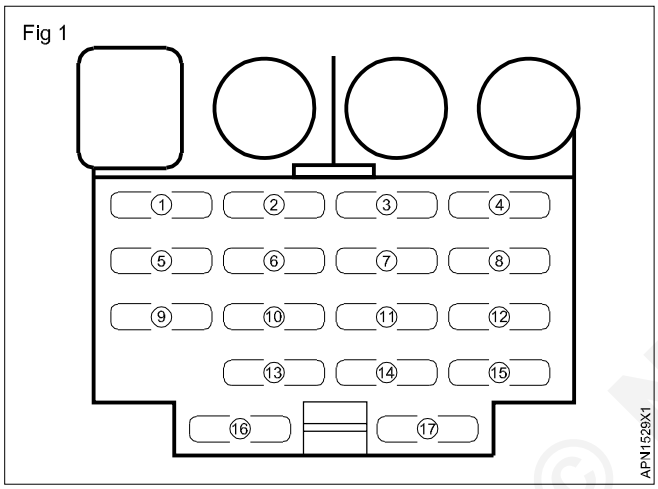
Fig 1



TESTING OF SHORT CIRCUITS IN A WIRING CIRCUIT

TASK 3 : **Identify the fuse unit in the panel board (Fig 1)**

Fig 1



1 **Engine 7.5 A :** Alternator voltage regulator (IG terminal), fuel cut solenoid, intake shutter, indicator light.

2 **Heater 20 A :** Heater blower motor, air conditioner.

3 **Tail 15 A :** Instrument panel lights, license plate lights, parking lights, tail lights.

4 **Head (RH) 15 A :** High beam indicator light, right hand headlights.

5 **Charge 7.5 A :** Alternator voltage regulator, (L terminal), discharge warning light.

6 **AC 20 A :** Air conditioner.

7 **HAZ-HORN 15 A :** Emergency flashers, emergency flasher indicator lights, horn, turn signal indicator lights, turn signal lights.

8 **Head (LH) 15 A** : High beam indicator light, left hand head lights.

9 **CIG 15 A :** Cigarette lighter, clock digital type.

10 **Wiper 15 A :** Windshield wipers and washer.

11 **Stop 15 A :** Stop light

12 **Radio 7.5 A :** Radio, stereo cassette tape player

13 **Gauge 7.5 A :** Back-up lights, engine temperature gauge, fuel gauge, warning lights, warning buzzers.

14 **Dome 7.5 A :** Clock (digital type), interior light.

15 **16 7.5 A and 15 A :** Spare fuses

16 Write the name of the parts in the Table 1.

Table 1

Sl. No.	Lable No.	Name of the control parts and its fuse rating
1	2	
2	5	
3	4	
4	1	
5	3	
6	11	
7	15	
8	12	
9	14	
10	6	
11	7	
12	9	
13	13	
14	16	
15	10	
16	8	

TASK 4 : **Jumper Wire**

1 Park the vehicle, on level ground and apply hand brake.

2 Open the bonnet and secure with the holding lever.

3 Place the fully charged battery adjacent to the vehicle discharge battery.

4 Connect the two battery terminal in parallel by using jumber wire cables as shown in Fig 1.

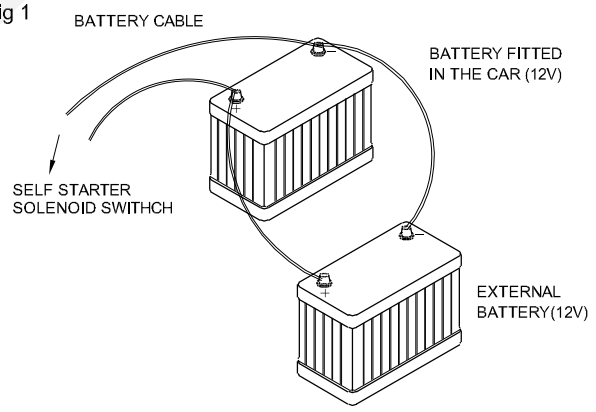
5 Start the vehicle run for some times.

6 Disconnect the jumber cables from the vehicle battery terminal.

7 Now the vehicle will run with its own battery.

8 Close the bonnet, securely.

Fig 1



JUMP STARTING OF AN ENGINE BY USING EXTERNAL BATTERY IN PARALLEL CONNECTION

TASK 5: **Checking of fusible link (Fig 1)**

1 Visually inspect the fusible link for burnout, disconnect, and damaged.

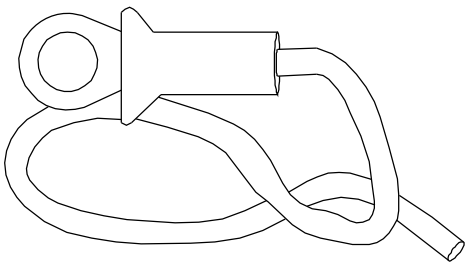
2 Check with the multimeter for continuity test.

3 Replace the fusible link if damaged, burnout or disconnected

Replacing fusible links (Fig 1) is little bit complex than simply pulling a fuse, since they are bolted in place and are sometimes difficult to reach.

Using the right tools and finding the blown fusible link location is important.

Fig 1



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It is also very important to use the correct replacement of fusible link's size and length.

Never replace fusible link with normal electrical wire.

Identify the different types of vehicle

Objective: At the end of this exercise you shall be able to
- **identify the different types of vehicle.**

PROCEDURE

1 Locate the type of vehicle name (Fig 1).
   a Car
   b Truck punjab body or straight truck
   c Truck half body
   d Truck Flat form type
   e Tractor
   f Tractor with articulated trailer
   g Tanker
   h delivery van
   i Dumper truck
   j Station wagon
   k Pick up
   l jeep

2 Write the name of the parts in Table 1.

Fig 1

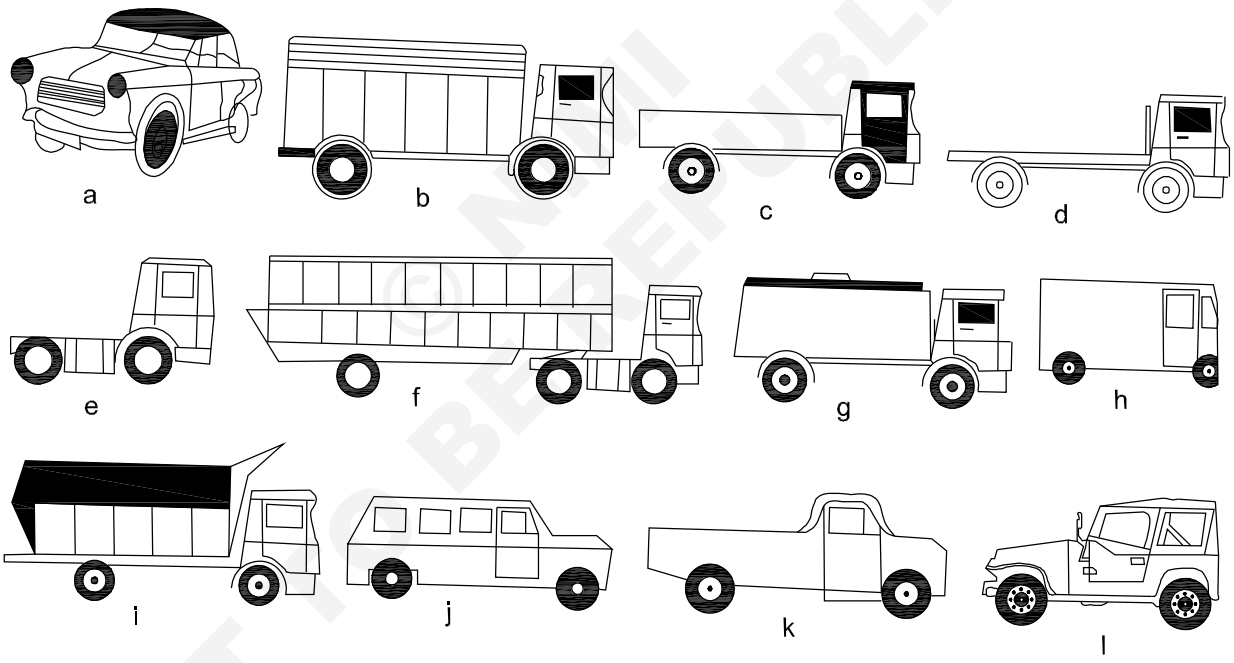


Table 1

Sl.No.	Match word	Vehicle name	Sl.No.	Match word	Vehicle name
1	b		7	h	
2	a		8	l	
3	e		9	k	
4	d		10	j	
5	c		11	i	
6	g		12	f	

Study the vehicle specification data

Objectives : At the end of this exercise you shall be able to
- **identify the parts of the vehicle**
- **check the specification of the parts as per vehicle specification data.**

Requirements

Tools/Instruments

- Trainee's tool kit - 1 No.
- Compression gauge - 1 No.
- Measuring tape - 1 No.
- Vacuum gauge - 1 No.
- Bore dial gauge - 1 No.
- Hydro meter - 1 No.
- Voltage tester - 1 No.

Equipment

- Vehicle - 1 No.

Materials

- Cotton waste - as reqd.
- Engine oil - as reqd.
- Hydraulic fluid - as reqd.

Note : Instructor demonstrate of vehicle specification

Mahindra Bolero GLX

Engine	XD-3PF IDiesel
Type	4-stroke oversquare, 4-cylinder, in line
Bore	94.0 mm
Stroke	90.0 mm
Cubic Capacity	2498 cc
Compression Ratio	23 : 1
Max. Gross Power	72.5 hp at 4000 R.P.M. (DIN 70020)
Max. Gross Torque	15.3 kg-m at 2000 R.P.M
Fuel Injection System	Distributor pump
Weight of Engine (dry)	200 kg with flywheel and starter
Cooling System	By Belt driven pump on cylinder head, thermostat controlled
Transmission	5-speed,All synchromesh
Ratios	1st Gear : 4.03 :1
	2nd Gear : 2.39 :1
	3rd Gear : 1.52 :1
	4th Gear : 1.00 :1
	5th Gear : 0.84 :1
	Reverse : 3.76 :1
Transfer Case	For 4WD only
Ratios	High - 1 : 1, Low - 2.48 :1
Suspension	
Front	2WD : Independent, Coil Spring, Double acting telescopic shock absorber and anti roll bar 4WD : Semi-elliptical leaf type,stabilizer bar at front
Rear	Semi-elliptical leaf type
Frame	Rectangular tubular section 5 intermediate cross members (6 for IFS). Rear bumper
Steering	Power steering - worm & roller type with universal joints.
Turning Radius	5.4 mts.

Clucth	Hydraulic, single dry plate 235mm (9.25” dia)
Brakes	
Type	Hydraulic with tandem master cylinder with vacuum assisted servo
Front	13 mm disc and calliper type
Rear	Drum : 27.4 x 50.8 mm (11” x 2”)
Parking	Internal expanding type on rear wheels.Hand lever and cable type.
Axle	
Front	IFS-2WD: Stub Axle 4WD : Full flating hypoid type
Capacity/Ratio	1000 kg / 4.88 : 1
Rear	Full floating hypoid type
Capacity/Ratio	1700 kg / 4.88 : 1

Electricals	
Battery	12 volts, negative earth
Capacity	70 amp. hr
Alternator	65 amp. with built-in regulator and vacuum pump
Drive	Belt drive
Wheels and Tyres	
Wheels	Rim size 6J x 15
Tyre	P215 / 75 R 15 radial
Fuel System	
Capacity	60 litres fitted with electrical float unit
Weights	
Kerb weight	1615 kg (2 WD) 1695 kg (4 WD)
G.V.W.	2200 kg (2 WD) 2280 kg (4 WD)

Identify the vehicle parts and check the specification of parts under guide line of instructor

— — — — — — —

Identify the Vehicle Identification Number (VIN)

Objectives : At the end of this exercise you shall be able to
- **identify the vehicle of identification number specification.**

Requirements

Tools/Instruments
- Measuring Tape - 1 No.

Equipments
- Car - 1 No.

Materials
- Cotton waste - as reqd.
- Paper - as reqd.
- Pencil - 1 No.
- Eraser - 1 No.

General information for VIN

Vehicle Identification Number (VIN) is composed of 17 digits and classified into three large groups such as WMI, VDS and VIS. Example:- MALBB5 IBC AMI 73752.

	Digt	Passenger Car	MPV	BUS
WMI	1	Geographic Zone		
	2	Manufacturer		
VDS	3	Vehicle Type		
	4	Series		
	5	Body Style and Version		
	6	Body Type		
	7	Restraint System	GVWR	Brake System
	8	Engine Type		
	9	Check Digit / Drive Side		
VIS	10	Model Year		
	11	Plant of product		
	12-17	Serial number		

- WMI: World Manufacturer Identifier
- VDS: Vehicle Descriptor Section
- VIS : Vehicle Indicator Section
- MPV: Multipurpose Passenger Vehicle (Ex: MPV,SUV,RV)
- GVWR : Gross Vehicle Weight Rating

Note: Vehicle code may be vary depend upon manufacture

Check the VIN number in your institute vehicle under guide line of instructor.

- Place a car in a plain ground
- Apply hand brake and chock the wheels
- Identify the location of VIN number in your vehicle
- Note the VIN Number of your vehicle on plain paper
- Decode the VIN Number details as per the manufactures general informations

Practice on garage service equipments

Objectives : At the end of this exercise you shall be able to
- **operate the air compressor and car washer**
- **operate the mechanical/hydraulic jack and jack stand**
- **operate a grease gun**
- **operate an oil spray gun,mechanical press and hydraulic press.**

Requirements

Tools/Instruments

- Trainee's tool kit - 1 No.
- Measuring Tape - 1 No.

Equipments

- Car - 1 No.
- Air compressor - 1 No.

Materials

- Cotton waste - as reqd.
- Soap oil - as reqd.

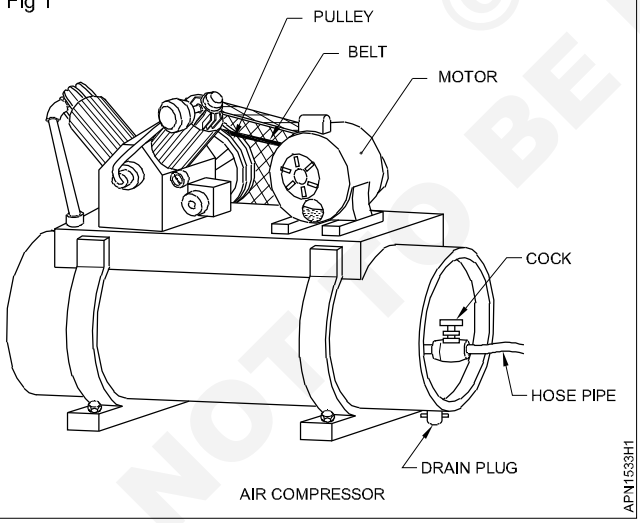
PROCEDURE

TASK 1: **Practice on using garage service equipment**

1 Air compressor (Fig 1)

- Check the oil level.
- Check the belt's (1) tension connecting the motor (2) and the compressor's pulley (3).

Fig 1



- Ensure that the belt guard is fixed in its position.
- Drain the water through the drain plug (4) and tighten the drain plug.
- Inspect the electrical connections visually for looseness, disconnections or cuts.
- Switch 'on' the compressor
- Observe the sound of the compressor. If any abnormal sound is found, stop the compressor immediately. (Consult your instructor)
- Switch 'off' the compressor.
- Hold the hose-pipe (5) and open the cock (6). Use compressed air wherever needed.
- Close the cock after using the compressed air.

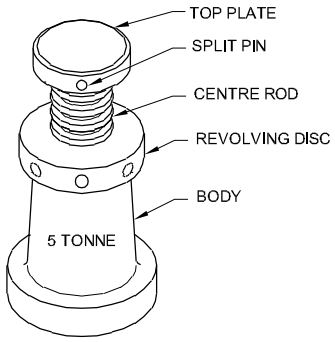
2 Car washer

- Check the oil level.
- Check the belt tension.
- Check the belt guard for its position.
- Inspect the electrical connection visually for looseness, disconnections or cuts.
- Open the water tank.
- Check the water level.
- Hold the gun before starting the car washer.
- Switch 'ON' the car waher and adjust the pressure gauge for the required pressure.
- Open the water gun.
- Check the water jet and adjust for force and spray at an angle to body panel.
- After completing the cleaning, stop the car washer.
- Close the water intake cock (water supply).

3 Mechanical jack (Fig 2)/Hydraulic jack (Fig 3)

- Park the vehicle on level ground.
- In case of jacking up the front axle, chock the rear wheels and vice versa.

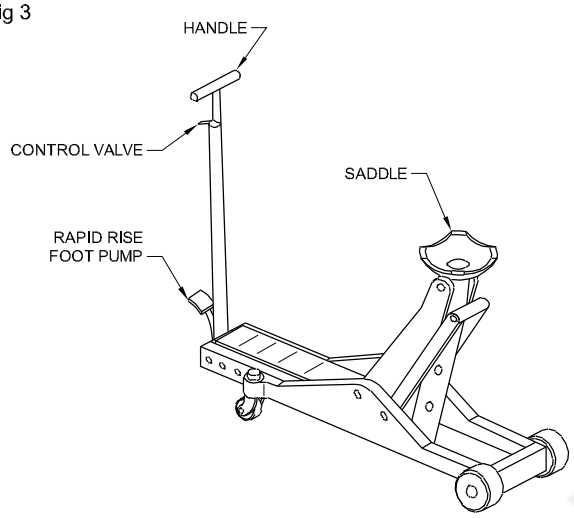
Fig 2



MECHANICAL JACK

APN1533H2

Fig 3



HYDRAULIC JACK

APN1533H3

- Check the free movements of threads in a mechanical jack by hand and in the hydraulic jack. Check the oil level and its operations.
- Place the jack under the vehicle in specified place.
- Rotate the screw gradually with the jack lever and lift the vehicle and in the case of hydraulic jack move the jack's lever slowly so that the axle jacks up without any jerk.
- Place the support/horses below the chassis frame/ axle.
- Lower down the jack and remove it.
- After completing the specific job jack up again.
- Remove the support/horses.
- Lower down the jack and remove it.

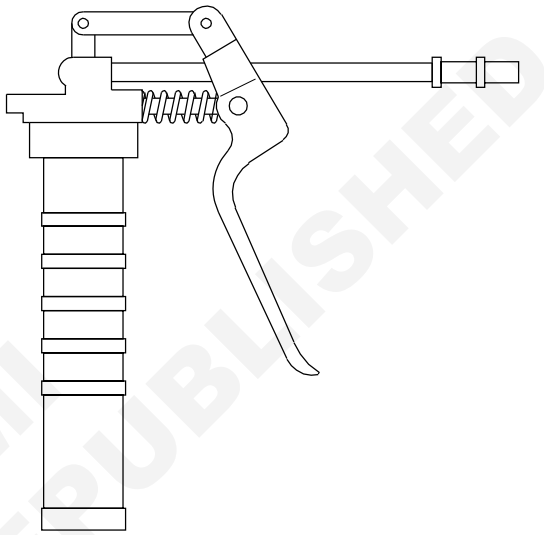
Safety

- **Never work under a vehicle supported only by a floor jack.**
- **Lift saddles must be properly located and in secured contact.**
- **Always check for equipments, parts or personnel beneath the car before lowering.**

4 Grease gun (Fig 4)

- Select the grease gun nipple according to the vehicle. (Consult your instructor)
- Check visually, the grease nipple holder for any damage.
- Fill up the gun with the specified grease.
- Close the grease gun and operate the lever till the grease comes out continuously from the nipple with pressure.
- Use the gun for the required purpose.

Fig 4



GREASE GUN

APN1533H4

5 Oil spray gun

- Check visually the oil spray gun nozzle, nozzle holder, operating lever, air hose for any damage.
- Fill the spray gun with SAE20W/40 and kerosene mixture in the ratio of 1:20.
- Connect the oil spray gun to the quick release coupler.
- Operate the oil spray gun.
- See that the oil is sprayed at pressure and spray over panel joints and moving part only.
- Close the air-hose connections and takeout the oil spray gun.

Arbor press (Fig 5)

- Check for easy movement of the operating lever (1) and rack if necessary lubricate.
- Select the plate (3) according to the work.
- Place the component on the plate.
- Press the work slowly and listen for abnormal noise.

Hydraulic press (Fig 6)

- Clean the press.
- Check the oil level (1) if necessary top up with hydraulic oil.

Fig 5

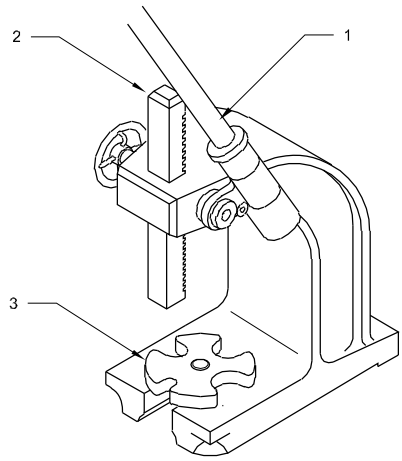
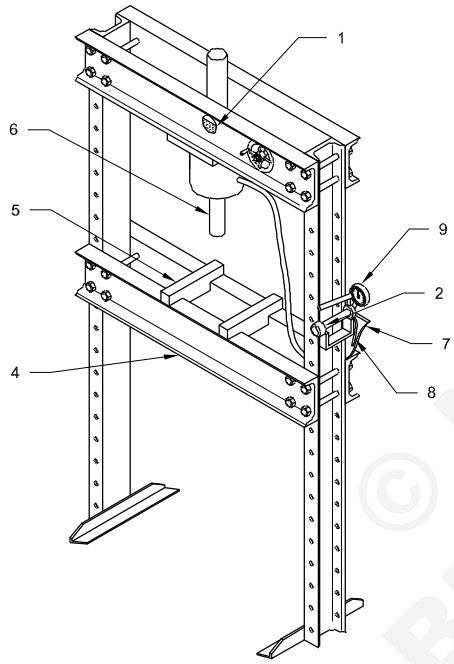


Fig 6



HYDRAULIC PRESS

- Check the hydraulic press for its free function and leakage
- Lock the cylinder plunger releasing knob (2).
- Adjust the bed(4) to the required height so that, after placing the job, there will be 100mm clearance between the plunger (6) and the bed (4).
- Align the anvil (5) according to the job.
- Place the job on the anvil (5).
- Select the distance piece in such a way that while pressing the shaft/bush, it does not touch the body (minimum 10mm gap to be given between the plunger (6) and the distance piece)
- Place the distance piece on the shaft/bush. Ensure that it does not touch the body.
- Operate the low pressure lever (7) and make the plunger (6) to have a contact on the job,
- Operate the heavy pressure lever (8), observe the load on the gauge (9) and the job simultaneously. Ensure the job comes out gradually.
- If the load exceeds more than the specified limit, stop the pressing.

Safety

- **Shield brittle parts such as bearings to protect against flying parts.**
- **After finishing the work loosen the plunger releasing knob (2).**
- **Remove the job and clean.**

Practice on vehicle hoists

Objectives: At the end of this exercise you shall be able to
- **operate the hydraulic car hoist**
- **operate the two post hoist and four post hoist**
- **operate the engine hoist**
- **operate the vehicle stand.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.

Equipments/ Machines

- Single post hoist - 1 No.
- Four post hoist - 1 No.
- Engine hoist - 1 No.
- Jack stand - 1 No.
- Air compressor - 1 No.

Materials

- Cotton waste - 1 No.
- Soap oil - 1 No.
- Hydraulic oil - 1 No.

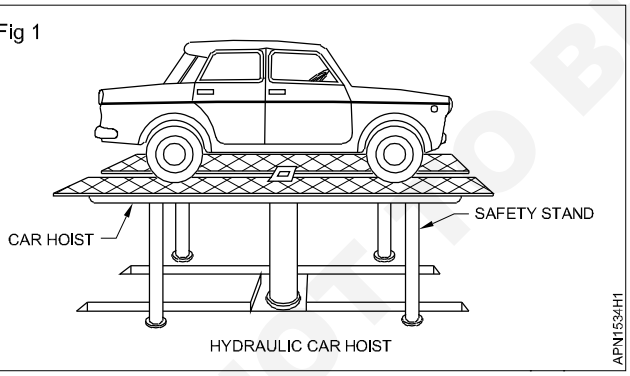
PROCEDURE

TASK 1: **Operate the vehicle hoist**

1 Hydraulic car hoist (Fig 1)

- Park the vehicle in the centre of the car.
- Clamp the front and rear axle or wheels.
- Open the air cock gradually and observe that the car hoist (1) is moving upwards.

Fig 1



- Close the cock when it reaches the required height.
- Provide safety stands (2) underneath the hoist. Open the outlet cock slowly so that the vehicle moves down without jerk. Ensure that the hoist side rail sits firmly on the stand.
- After finishing the required job, slightly open the inlet cock and raise the car hoist slightly up. Close the inlet cock.
- Remove the safety stands.
- Ensure that nobody is present underneath the vehicle.
- Open the outlet cock slowly so that the hoist comes down without disturbing the vehicle's position.
- Remove the clamps/chocks and remove the vehicle from the hoist.

2 Two post lift hoist

- Park the vehicle in the centre of the electro mechanical.
- Adjust and fix the telescopic two post lift lifting arm.
- Use the automatic arms locking and releasing device while lifting and lowering.
- Set safety mechanism to prevent uneven lifting.
- Use the extra safety nut.
- Check the chain drive and operate the lifting switch.
- Use the anchoring bolts for safety (Fig 2).

3 Four post lift (Fig 3)

- Drive the vehicle on the leveled ramp of the four post lift.
- Check the vehicle parked correctly are not on the romp & use wooden block as a stoper.
- Check the vehicle door & glasses are closed & pull up hand brake lever of vehicle.
- Drive the hydraulic cylinder in stable & lowering.
- Offering pull range mechanical protection by using safety block.

Fig 2

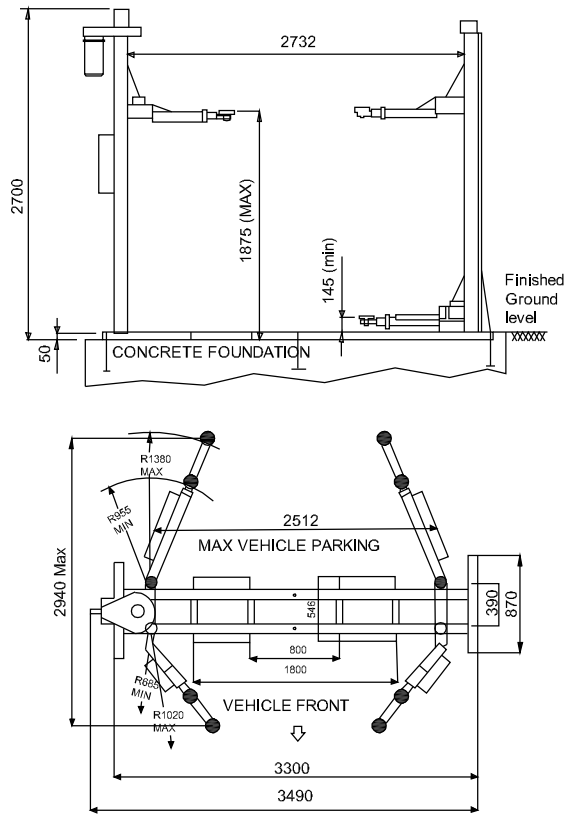


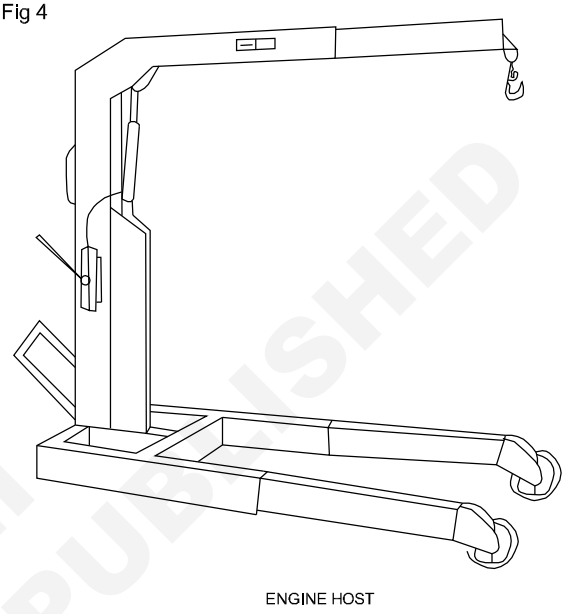
Fig 3

- Connected by using steel cables, Forced synchronized movement of the lift in order to effectively prevent the sloping of the vehicle
- Ton with extended run way length for LCV & Bigger vehicle.

4 Engine hoist

- Keep the vehicle on level ground.
- If level ground is not there, use big wooden block under the base of hoist.
- Pull up hand brake lever of vehicle.
- Place the hoist on plain ground & fix a rope to such part of engine.
- Lift the hoist slowly till free from the vehicle.
- Slowly role the wheel hoist and lake hoist to work shop. (Fig 4)

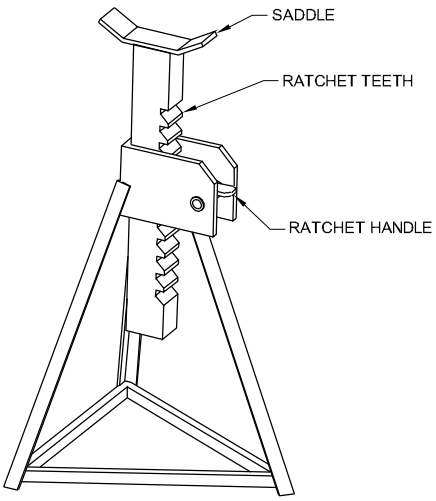
Fig 4



5 Jack stand (Fig 5)

- The height of the jack stand is adjusted by the ratchet adjustment.
- Stands must be place properly and securely.

Fig 5



Practice on wash the vehicle

Objectives: At the end of this exercise you shall be able to
- **clean and wash the dust of vehicle**
- **rub and polish the vehicle.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Scraper - 1 No.
- Brush - 1 No.

Equipments/ Machines

- Vehicle - 1 No.
- Air compressor - 1 No.
- Car washer - 1 No.

Materials

- Cotton waste - as reqd.
- Soap oil - as reqd.
- Banian cloth - as reqd.
- Emery sheet - as reqd.
- Wax - as reqd.
- Microfiber towel - as reqd.
- Vehicle liquid polish - as reqd.

PROCEDURE

TASK 1:**Dust off the vehicle**

1 Park the vehicle on the plain ground.

2 Remove the all tools and spares from the vehicle.

3 Remove the mates and seat cover of the vehicle.

4 Switch ON the air compressor and open the air from the air tank.

5 Apply air pressure inside of the vehicle to remove the dust inside of the vehicle.

6 Ensure complete dust is removed from inside of the vehicle.

7 Close all doors and apply air pressure on the vehicle outside surface of top remove the micro dusts.

— — — — — — —

TASK 2: **Wash the vehicle**

1 Park the vehicle on the washing ram.

2 Lock the front and rear wheels with help of locking plate.

3 Remove the battery terminals.

4 Apply mask on electrical parts.

5 Apply kerosene under chassis of the vehicle and allow it to stay for few minutes.

6 Apply water pressure to clean the vehicle body and under chassis.

7 Clean the wheels.

8 Apply soap oil mixed water on the vehicle body.

9 Clean the vehicle with compressed water pressure.

10 Ensure complete vehicle is cleaned away from dust and rust.

11 Bring down the vehicle from washing ram.

12 Allow the vehicle for dry from water.

13 Dry the vehicle with air pressure spray on the surface of the vehicle and electrical wire connections.

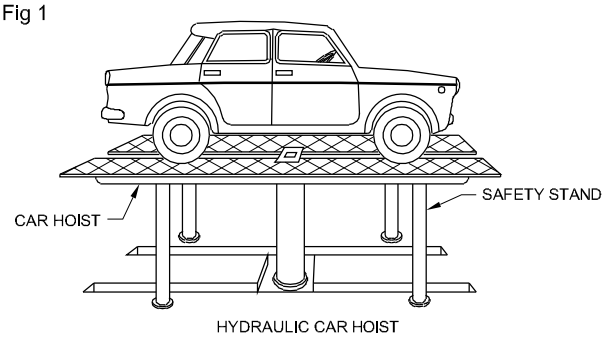
14 Dry the vehicle body with help of microfiber towels to prevent water spots and premature corrosion.

15 Apply wax or liquid polish on the vehicle body as per the vehicle manufactures recommendations. Polish should be applied springly, usually no more than once.

16 Remove the mask and dry the water spots with help of air pressure and correct the all items in interior and exteriors.

17 Compare the vehicle with before washing and after washing condition.

Fig 1



HYDRAULIC CAR HOIST

Identification of vehicle body, chassis and drive lines

Objectives: At the end of this exercise you shall be able to
- **identify the different type of vehicle body**
- **identify the different type of chassis**
- **identify the different type of drive line.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Different type of vehicle chart - 1 No.

Equipments/ Machines

- Different type of vehicle - 1 No.

Materials

- Cotton waste - as reqd.
- Soap oil - as reqd.

PROCEDURE

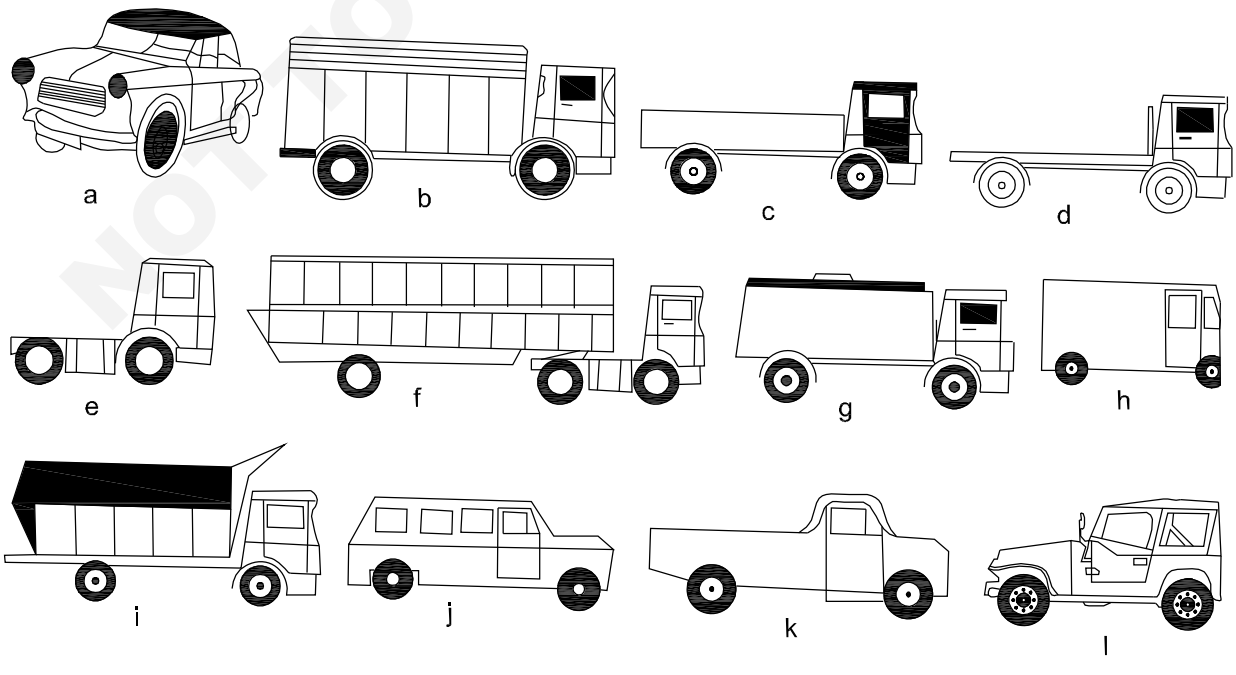
TASK 1: **Identify the different type of vehicle body**

1 Car body
2 Truck body
3 Truck helf body
4 Jeep body
5 Tractor body
6 Tanker body
7 Delivery van body
8 Pickup van body
9 Dumper truck body
10 Refrigerated truck body
11 Tank truck body

Write down the body type in the table 1.

S.No	Fig No	Body type	Remarks
1	a		
2	c		
3	d		
4	f		
5	g		
6	j		
7	k		

Fig 1



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TASK 2: **Identify the different type of chassis (Fig 2 to 5)**

1 general design frame
2 Box section frame
3 'X' - member type car frame
4 Commercial vehicle frame
5 Chassis cum body construction.

Write down the name of chassis frame in table 2.

S.No	Fig label No	Chassis type	Remarks
1	d		
2	c		
3	a		
4	e		
5	b		

Fig 2

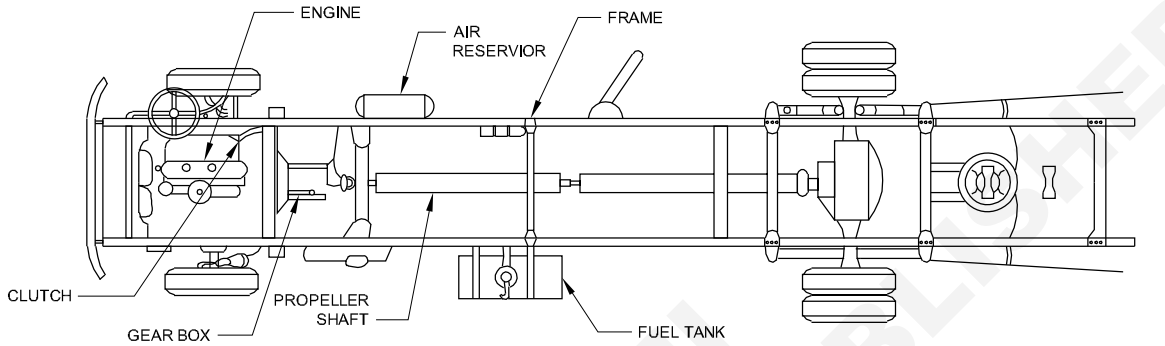
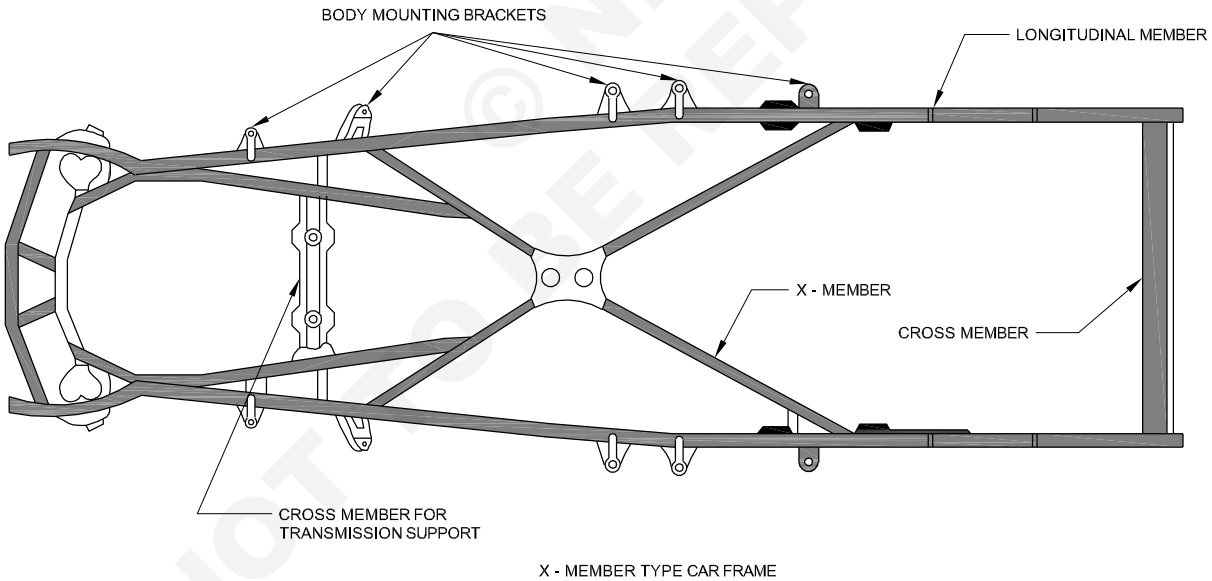
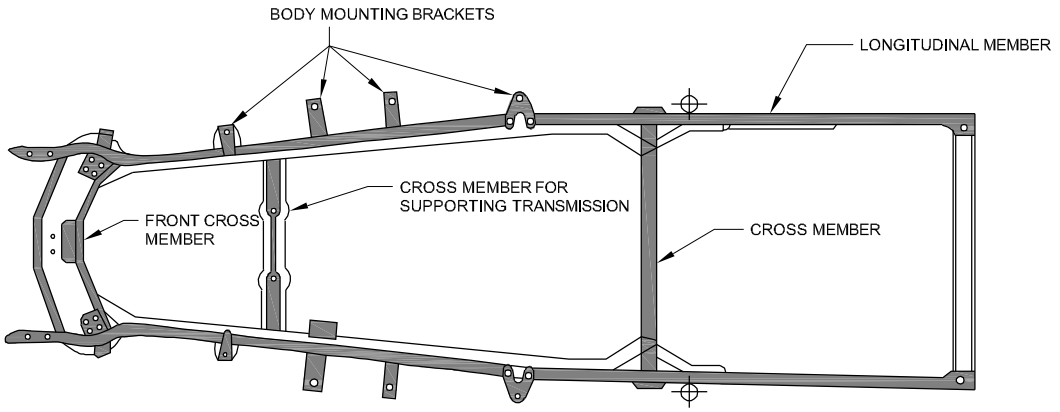


Fig 3



X - MEMBER TYPE CAR FRAME

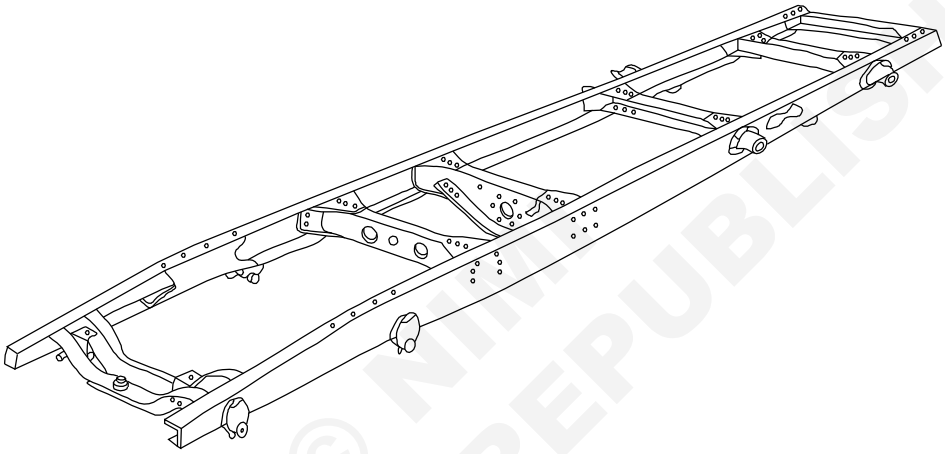
Fig 4

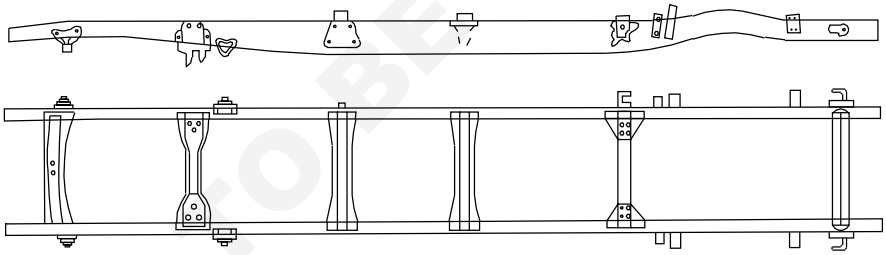


BOX SECTION CAR FRAME

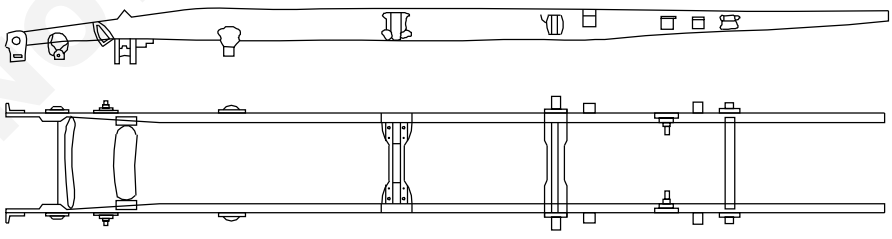
APN1536H4

Fig 5





(a) SERIES TJ



(b) SERIES TK

APN1536H5

TASK 3:**Identify the different type of vehicle drive line**

1 Front engine rear wheel drive (Fig 6).

2 Rear engine rear wheel drive (Fig 7).

3 Front engine front and rear drive (Fig 8).

4 Middle engine rear wheel drive.

Note: Match figure with your sections demo chassis body ram drive line.

Write down the name of vehicle drive line in table 3.

S.No	Fig label No	drive type	Remarks
1			
2			
3			
4			

Fig 6

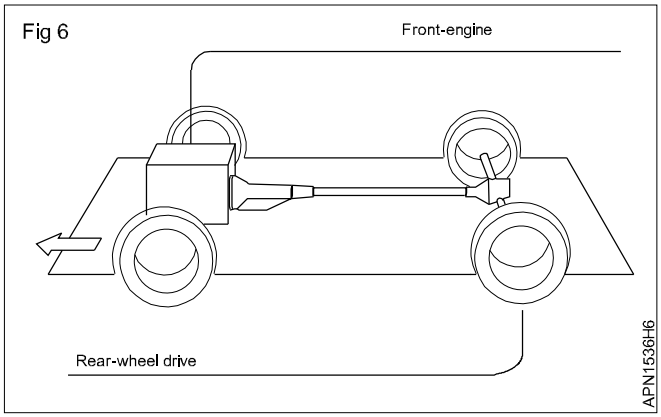


Fig 7

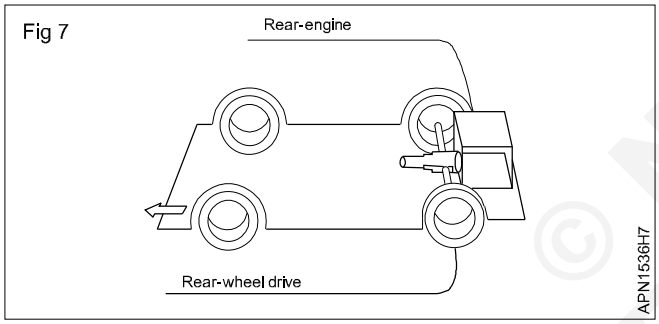


Fig 8

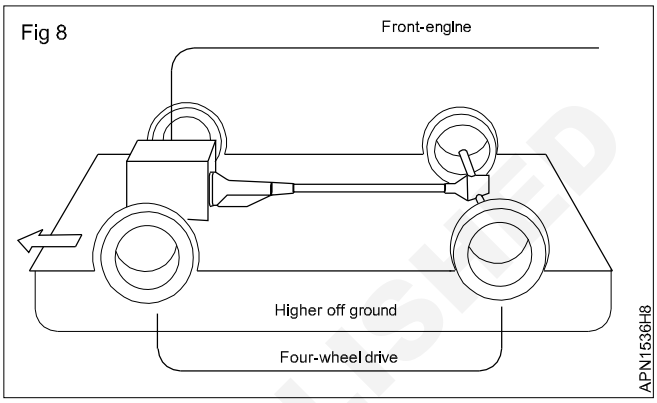
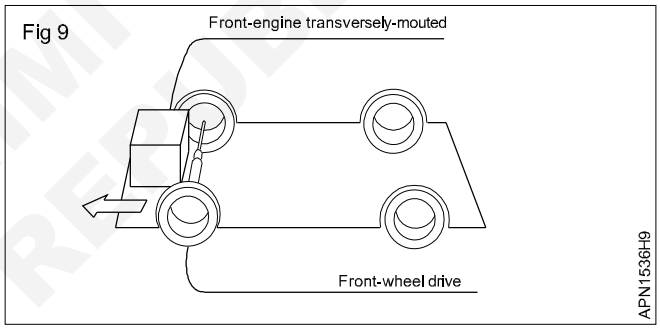


Fig 9



Practice to identify the location of vehicle parts and panels

Objectives: At the end of this exercise you shall be able to
- **identify the location of the vehicle parts and panels.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Vehicle chart - 1 No.

Equipments/ Machines

- Vehicle - 1 No.

Materials

- Cotton waste - as reqd.
- Soap oil - as reqd.

PROCEDURE

TASK 1:**Identify the location of vehicle parts (Fig 1)**

1 Identify the location of engine.

2 Identify the location of steering, battery, alternator.

3 Identify the head lights, air cleaner, carburetor, fuel tank, exhaust, pipe silencer and tail pipe.

4 Identify the front and rear axle, differential, gear lever, universal joint, hand breake lever and clutch.

5 Identify the track rod radiator, fan distributor, rear brake, wheel and tyres.

6 Write the parts name in Table - 1 and verify it with your instructor.

Fig 1

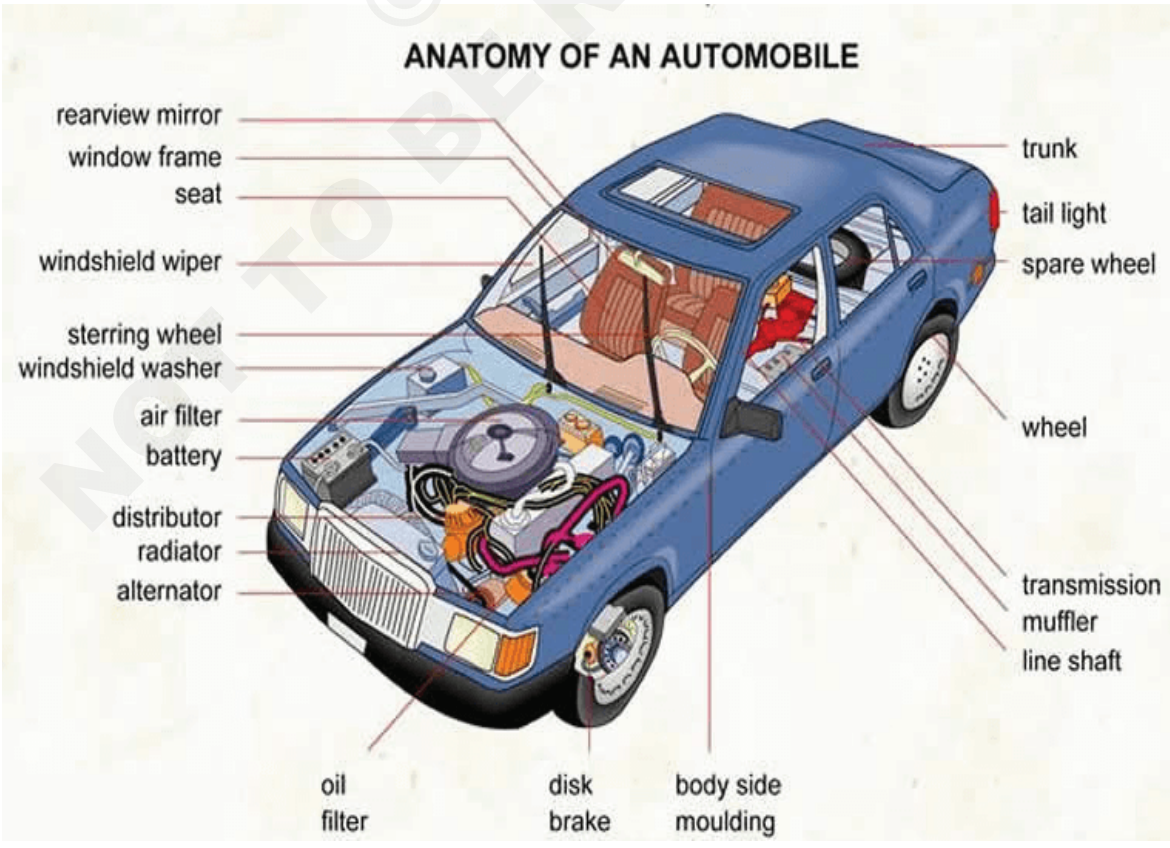


Table 1

S.No	Fig label No	Part name	Remarks
1	l		
2	a		
3	m		
4	z		
5	w		
6	g		

— — — — — — — —

TASK 2:**Identify the vehicle body panels (Fig 2)**

1 Identify the dash, bulk head, scuttle, sell, centre pillar

2 Identify the valance wheel arch, body quarter, body operators

3 Identify the rear bulk head, quarter panel, drip moulding “CANT” rail, roof panel and screen pillar.

4 Write the names of vehicle body panels in Table - 2 and verify it with your instructor.

Fig 2

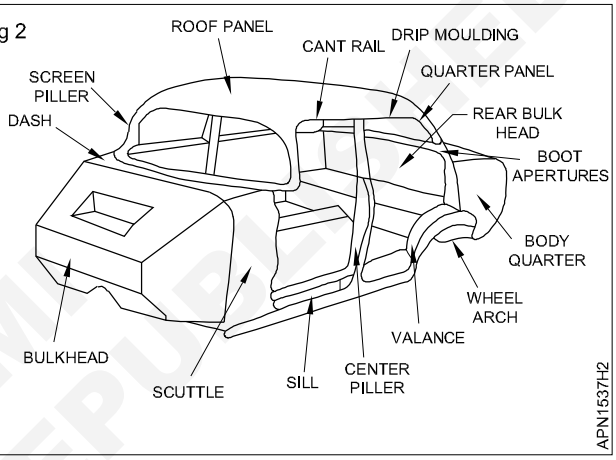


Table 2

S.No	Fig label No	Part name	Remarks
1	a		
2	c		
3	e		
4	g		
5	h		

— — — — — — — —

Practice on use of computer - based painting service informations

Objectives: At the end of this exercise you shall be able to
- **use the computer based service information and service manual**
- **use the refinishing guides**
- **use the vehicle dimention**
- **use the paint colour matching unit colour matching guide**
- **use the parts inter change guide with the help of computer based vehicle parts interchange guide.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.

Equipments/ Machines

- Computer with internet correction - 1 No.

Materials

- Cotton waste - as reqd.
- Baniyan cloth - as reqd.
- Soap oil - as reqd.
- Paper & pencil - as reqd.

PROCEDURE

TASK 1: **Refer the computer based service information of vehicle**

1 Open the computer with net connection.

2 Select the vehicle model and design of the manufacturer

3 Search the particular vehicle model service informtions from the computer software informations systems.

4 Collect the needed service informations from the system and note it on the paper.

5 If already uploaded particular vehicle service information software in the system, you can search the information without net connection.

— — — — — — — —

TASK 2: **Refer and use of service manuals**

1 Select the service vehicle.

2 Select and bring out the particular vehicle's service manuals.

3 Study the complete particulars of the service vehicle.

4 Refer the service manual for the systematic service of vehicle.

5 Refer the service manual for parts reference and sequence of dismantling and assembling parts.

6 Refer the manual for identify the correct part numbers.

7 Refer the manual for vehicle service duration.

Note: Before start the work refer the vehicle service manual for ready reference.

— — — — — — — —

TASK 3: **Refer the refinishing guides**

1 Refer the refinishing guide to paint calculation and estimation.

2 Refer the refinishing guide to examination and testing of the paint surface.

3 Refer the guide to surface preparation and conditioning.

4 Refer the guide to paint selection and preparation of the materials.

5 Refer the guide for the application of the painting procedure.

6 Refer the guide for the method of finishing paint touch.

7 Refer the guide for using film thickness gauge.

Note: Refer the refinishing guide and do practice as per the guide book with guideness of your instructor.

— — — — — — — —

TASK 4: **Refer the vehicle dimensions manual**

1 Refer the vehicle dimention manual for identify the type of body and chassis frame.

2 Refer the manual for identify the panels dimensions.

3 Refer the manual for length, width and height of the vehicle.

4 Refer the manual for the external dimension of vehicle by make.

5 Refer the manual for engine dimension.

6 Refer the manual for the vehicle parking space dimensions.

7 Refer the manual for all types of dimension of the vehicle.

— — — — — — — —

TASK 5: **Color matching guide**

1 Before damaged vehicle's body paint color matching, find the vehicle manufacturer, vehicle model, year, general color, paint color code, counting and paint type to be used.

2 Refer the vehicle paint color code with color matching guide.

3 Find the type of paint used in the vehicle.

4 Collect paint sample and match with paint color code book

5 Note the color code number and select the paint for the vehicle.

6 Mix the paint material and get the right color.

7 Match mixing paint color with color matching guide.

8 Keep the paint room temperature, paint will go thick in cold condition and will effect the application. Aerosols especially are not good when cold.

9 During paint, use a different air cap and fluid tip size as recommended by the paint manufacturer can cause the color to vary from their formula. Refer to the technical data sheet of the product you are using.

10 Always use the recommended thinner.

11 Setting the correct pressure at the spray gun. This is vary important as too high or low a pressure can cause the color to go darker or lighter.

12 Spraying to near or too far away from the panel can cause the color to vary. Make sure you maintain a consistant distance on all the panels you are spraying.

13 After paint the vehicle match the vehicle paint color with color code book.

14 Ensure paint color is matching with color code.

Note: Color analyser spectrophotometer let as closer matches speeding up and return cost of the process.

— — — — — — — —

TASK 6: **Parts interchange guide**

1 Find the vehicle manufacturer, model, year and vehicle brand.

2 Refer the particular vehicle manufacturer's vehicle parts inter chargable guide.

3 Study the parts list which part is suitable to intercharge to the particular vehicle.

4 Whenever you need to intercharge the parts refer the parts intercharge guide to right work for save time and parts cost.

— — — — — — — —

Identify the parts of stationary compressor

Objectives: At the end of this exercise you shall be able to
- **identify the parts of piston type compressor.**

Requirements

Tools/Instruments

• Trainees tool kit	- 1 No.
• Compressor manual guide	- 1 No.

Equipments/ Machines

• Stationary compressor (Cut section model)	- 1 No.

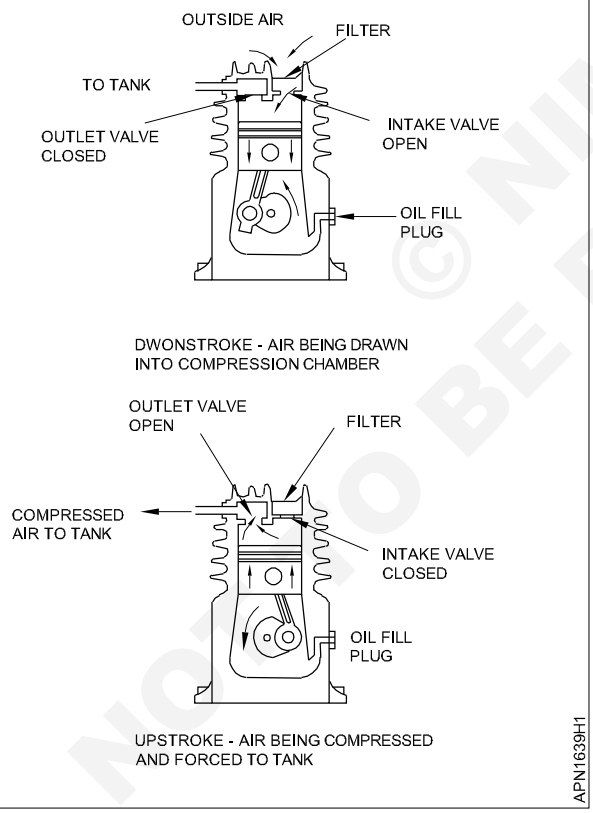
Materials

• Cotton waste	- as reqd.
• Soap oil	- as reqd.

PROCEDURE

TASK 1 : **Identify the parts of piston type compressor (Fig 1&2)**

Fig 1

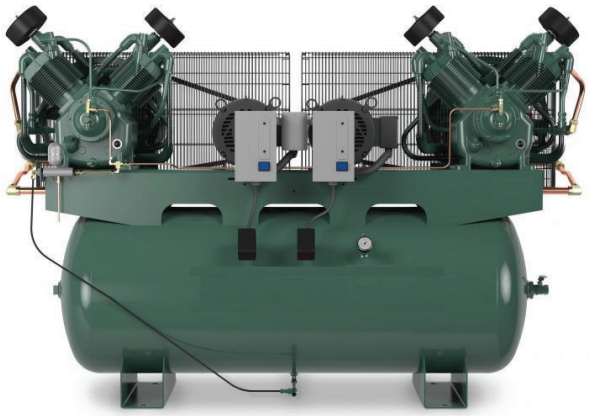


Note: The instructor may label the different of the piston type compressor and ask the trainees to identify it.

1 Identify the parts mentioned in the table.

2 Record and get it checked by your insert.

Fig 2



Table

S.No	Parts No	Lable No assigned by the Instructor
1	Single stage piston type compressor unit	
2	Air strainer	
3	Inlet valve	
4	Exhaust valve	
5	Piston	
6	Connecting rod	
7	Crank shaft	
8	Fly wheel	
9	Air compressor air tank	
10	Fan belt guard	
11	Drive belt and electricmotor.	
12	Compressor pump.	
13	Drain and discharge valve.	

— — — — — — — —

Overhauling of FRL unit

Objectives: At the end of this exercise you shall be able to
- **overhaul the FRL unit.**

Requirements

Tools/Instruments

• Trainees tool kit	- 1 No.
• Puller	- 1 No.
• Torque wrench	- 1 No.
• Box spanner set	- 1 No.
• Tray	- 1 No.

Equipments/ Machines

• Air compressor	- 1 No.
• Work bench	- 1 No.

Materials

• Cotton waste	- as reqd.
• Soap oil	- as reqd.
• SAE 40 oil	- as reqd.
• Piston	- as reqd.
• Piston ring	- as reqd.
• Valve	- as reqd.
• FRL	- as reqd.
• Kerosene	- as reqd.

PROCEDURE

TASK 1 : **Overhaul the air compressor unit**

1 Remove the filter regulator lubricator (FRL) unit

2 Dismount the filter

3 Clean the filter and oil with the unit

4 Replace the filter and oil

5 Clean the regulator (unit) valve.

6 Assembling and testing

7 Assemble the crankshaft in the crank case housing

8 Assemble the piston, piston pin, connecting rod

9 Assemble the connecting with crankshaft

10 Assemble the cylinder head for recommended torque.

11 Fit the air strainer.

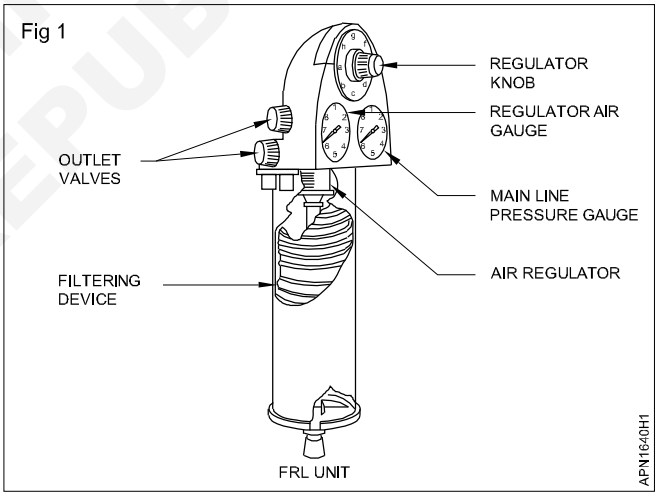
12 Fit and adjust the compressor drive belt

13 Connect the air horn to air tank and air tank to FRL unit

14 Mount fan guard and fill the recommended oil to the compressor

15 Ensure compressor unit is run smoothly.

Fig 1



Practice to drain the air receiver and moisture separator

Objectives: At the end of this exercise you shall be able to
- **drain the water from the air receiver or tank**
- **drain the air moisture water from the air transformer.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Tray - 1 No.

Equipments/ Machines

- Air compressor unit - 1 No.

Materials

- Cotton waste - as reqd.
- Soap oil - as reqd.
- Drain plug - as reqd.
- Air transformer - as reqd.

PROCEDURE

TASK 1 : **Drain the water from the air tank and air transformer**

1 Stop the air compressor operation.

2 Release the air pressure from the air tank.

3 Remove the air tank drain plug to drain the accumulated water in air tank

4 Allow to drain the complete water from the tank.

5 Fix the drain plug and tighten it as prescribed torque with suitable spanner.

6 Remove the air transformer drain plug.

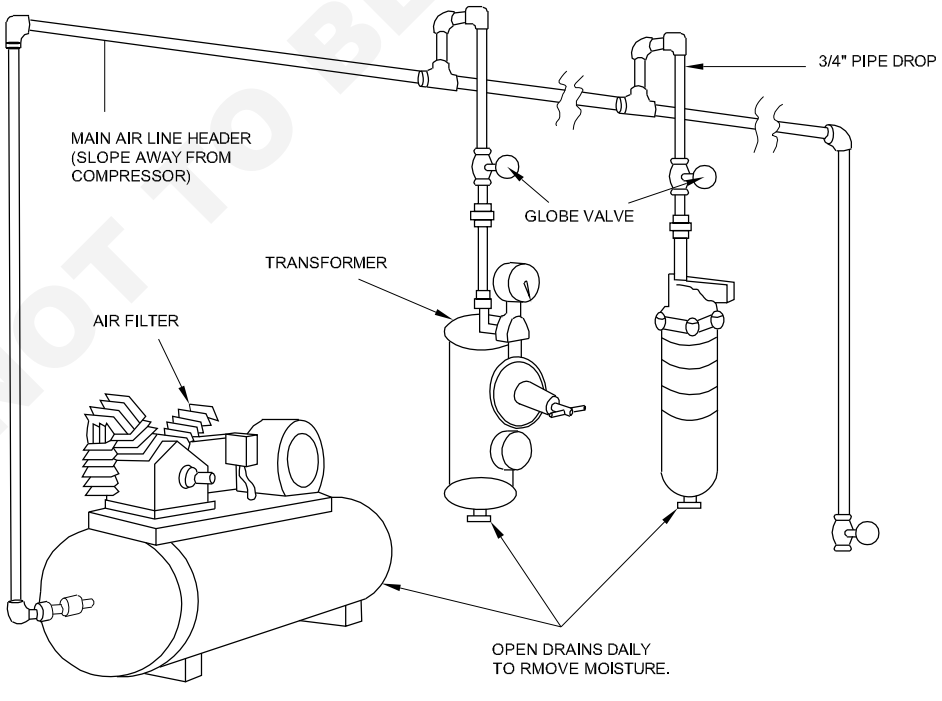
7 Allow to drain the water dust particals from the air transformer.

8 Ensure complete water is drained from the FRL unit.

9 Fix the air transformer drain plug.

10 Operate the compressor and ensure for fine or smooth operation and moisture free air delivery for painting work at low and high pressure.

Fig 1



Practice to check the air compressor crankcase oil level

Objectives: At the end of this exercise you shall be able to
- **check air compressor oil level and air filter.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.

Equipments/Machines

- Air compressor unit - 1 No.

Materials

- Cotton waste - as reqd.
- Soap oil - as reqd.
- SAE 40 oil - as reqd.
- Air filter - as reqd.

PROCEDURE

TASK 1: **Check the air compressor oil level**

1 Check the oil level of air compressor before start the compressor.

2 See the oil level in sight glass fitted with air compressor's crankcase.

3 Three oil level mark is marked on the oil level sight glass as max, medium and low.

4 Check the oil level is in the middle line touch, it means oil level is correct, if it is in lower line mark means oil level is low, if oil level is in upper line mark, it means oil level is high.

5 If oil level is high remove the oil from the crankcase upto level mark.

6 If oil level is low topup the oil in crankcase.

7 If oil level sight glass is not provided with compressor's crankcase, check the oil level through dipstick mark.

8 Check the oil viscosity if need change the oil.

9 Locate the air compressor oil dram plug.

10. Select the suitable spanner to open the drain plug

11 Place the tray under the air compressor and removal crankeasr oil drain plug.

12 Let it allow to drain the complete and crank case oil

13 Crank the air compressor with help of air compressor drim motor

14 Enforce the complete oil is drained from the air compressor crank case.

— — — — — — — —

— — — — — — — —

TASK 2: **Check the air filter of air compressor**

1 Remove the air filter from the air compressor

2 Dismount the filter from its bowel

3 Clean the filter with help of high air pressure

4 Clean the filter bowel with cleaning solvent.

5 Inspect the filter, if damaged, replace it.

6 Assemble the filter assembly and fit it on compressor.

7 Start the compressor and check function of air filter.

8 Ensure air compressor function is very smooth operation while it run.

— — — — — — — —

Practice to clean the cylinder head and inter cooler fins

Objectives: At the end of this exercise you shall be able to
- **clean the cylinder head fins**
- **clean the air inter cooler fins.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Wire brush - 1 No.

Equipments/ Machines

- Two stage air compressor - 1 No.

Materials

- Cotton waste - as reqd.
- Soap oil - as reqd.
- Cleaning solvent - as reqd.

PROCEDURE

TASK 1: **Clean the cylinder head fins**

1 Remove the air strainer filter

2 Disconnect the air out let hose

3 Loosen the cylinder head mounting.

4 Remove the cylinder head and inter cooler hose.

5 Use the strips of scotch brite pad and solvent to clean between fins.

6 Cut the strips “1” wide and “10” long and pull them front and back between the fins to clean dirt particals between the cylinder head fins.

7 If would not hurt, soak the whole cylinder overnight in a pail of solvent or gas lone before you go at it with the scotch brite.

8 Use the warm water with cleaning solvent to clean the cylinder fins.

9 Ensure compressor fins are cleaned.

— — — — — — — —

TASK 2: **Cleaning the air inter cooler fins**

1 Clean the inter cooler tube inside with cleaning solvent.

2 Clean the inter cooler fins with strips

3 If any damage in inter cooler pipe replace the pipe.

— — — — — — — —

TASK 3: **Assembling and testing the cylinder head and inter cooler**

1 Clean the dust of cylinder head by compressed air.

2 Fit the cylinder head on the cylinder bore.

3 Fix the cylinder head mounting bolt.

4 Fix the inter cooler tube.

5 Connect the air strainer filter.

6 Connect the air outlet hose with cylinder

7 Ensure all dismounted parts are mounted properly.

8 Ensure cylinder head fins and air inter cooler fins are cleaned and properly fitted on air compressor.

9 Start the air compressor to check air flow through fins and cooling effect of the compressor.

— — — — — — — —

Practice to change the oil filter and adjust the air pressure switch

Objectives: At the end of this exercise you shall be able to
- **replace the air line oil filter**
- **adjust the air pressure switch.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.

Equipments/Machines

- Air compressor unit - 1 No.

Materials

- Cotton waste - as reqd.
- Soap oil - as reqd.
- Air pressure switch - as reqd.
- Air line oil filter - as reqd.

PROCEDURE

TASK 1: **Replace the air line oil filter**

1 Identify the air compressor air line layout system with help of user manual.

2 Trace the location of filter regulator and lubricator (FRL) unit.

3 Close the air tank air outlet switch.

4 Loosen the FRL unit filter's mounting screw.

5 Remove air filter and air oil filter in the FRL unit.

6 Clean the both filter and bowels.

7 Inspect the filter service abillity.

8 If filter is damaged or unserviceable replace it.

9 Change the lubricator oil.

10 Place air filter in the bowel and fit it on the location

11 Fill the oil upto level in the lubricator bowel and fit it with filter on the correct location.

12 Ensure both bowel are seated properly in their location.

13 Fix the filter's mounting screw and tighten it upto recommended torque.

14 Open the air pressure to flow through FRL unit and check the function of FRL unit.

15 Ensure the difference in the function of FRL unit before and after servicing the FRL unit.

— — — — — — — —

TASK 2: **Adjust the pressure switch cut in and cut out**

1 Trace the location of pressure switch in the air line layout.

2 Identify the type of pressure switch, whether it is mechanical or electrical control.

3 Operate air compressor and check the function of air compressor cut in and cut out.

4 Adjust the air pressure through adjusting screw to increase or decrease the air pressure cut out.

5 To increase cut out air pressure loosen the adjusting screw.

6 To decrease the cut out air pressure tighten the adjusting screw.

7 After adjusting cut out air pressure, cut in and cut out air pressure is same, it means air pressure switch is defective.

8 If the air pressure switch is defective replace it.

9 Adjust the air pressure with new pressure switch.

10 Ensure the proper function of the air pressure switch air cut in and cut out as you desired.

— — — — — — — —

Practice to check the relief valve for exhausting of head pressure

Objectives: At the end of this exercise you shall be able to
- **identify the head pressure relief valve**
- **check the function of the head pressure relief valve.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.

Equipments/Machines

- Air compressor - 1 No.

Materials

- Cotton waste - as reqd.
- Soap oil - as reqd.
- Pressure relief valve - as reqd.

PROCEDURE

TASK 1: **Identify the compressor head pressure relief valve**

1 Trace the air compressor air out put pipe line and air receiver.

2 Identify the pressure relief valve.

3 Check the function of cylinder head pressure relief valve on compressor stop after run.

4 Normally it is filled near the pressure switch which is connected with small air pipe line connection it‘s function is connected with pressure switch. Some compressors pressure relief valve is filted near the air take air inlet.

— — — — — — — —

TASK 2: **Check the function of pressure relief valve**

1 Start the air compressor and ensure the air flow through air pressure switch.

2 Check the function of air pressure control switch.

3 Ensure the air pressure switch or unloaded valve is work properly at fixed certain air pressure in the tank when air compressor is automatically switch off/on check the function of cylinder head pressure relief valve make a... continue sound for release the air pressure between cylinder head to air tank pipe line.

4 If it is not release the air, it means pressure relief valve is defective, replace it.

5 Fit the new pressure relief valve and ensure proper function of the pressure relief valve.

— — — — — — — —

Practice to tighten the compressor drive belt

Objectives: At the end of this exercise you shall be able to
- **check the loosen or tighten the air compressor drive belt.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.

Equipments/ Machines

- Air compressor - 1 No.

Materials

- Cotton waste - as reqd.
- Soap oil - as reqd.
- Compressor drive belt - 1 No.

PROCEDURE

TASK 1 : **Loosen or tighten the air compressor drive belt**

1 Check the air compressor drive belt tension by tension gauge or pressing the belt by thumb.

2 If compressor drive belt tension is more or less, adjust belt tension for recommended by the manufacturer.

3 If the air compressor is operated by electric motor, make sure electric power is switch off or disconnected.

4 Loosen the four drive motor mounting bolts.

5 Looseen the drive motor base bolt.

6 Measure from the edge of the mounting plate to the edge of the drive motor base at both ends of the same side.

7 Align the compressor fly wheel pulley and drive motor pulley in one line.

8 Check the drive belt if it is damaged replace it

9 Fix the new drive ‘V’ belt.

10 Ensure the drive belt is seated properly on pulley grooves of both side.

11 Move the belt drive unit for tighten the drive belt.

12 Check the tightness of drive belt for proper tension.

13 Turn the belt adjustment belt clockwise to tighten the belt or counter clockwise to loosen belt. Until the belt has about in defection when pushed down with your thumb.

14 Tighten the drive motor’s base bolt without moving the motor. Remove the debris from the front area of the motor and compressor.

15 Tighten the electric drive motor mounting bolts.

16 Connect the electric motor power cable.

17 Start the air compressor and check for proper tension of drive beltand operation of the air compressor drive belt.

— — — — — — — —

Practice to check and align motor pulley and compressor fly wheel

Objectives: At the end of this exercise you shall be able to
- **check and align motor pulley and compressor fly wheel.**

Requirements

Tools/Instruments		Materials	
• Trainees tool kit	- 1 No.	• Cotton waste	- as reqd.
Equipments/ Machines		• Soap oil	- as reqd.
		• Nut bolt	- as reqd.
• Air compressor	- 1 No.	• Drive belt	- as reqd.

PROCEDURE

TASK 1 : **Check and align motor pulley and compressor fly wheel**

1 Run the air compressor

2 Check rotation of compressor wheel and motor pulley.

3 If misaligned the motor pulley and compressor fly wheel, align it inline.

4 Remove the compressor drive belt.

5 Check the motor pulley mounting, if found nut loose or pulley mounting key un service, remove the pulley and check motor shaft pulley holding key and mounting nut bolts.

6 If found any damage replace it and mount the pulley on the motor shaft.

7 Check the motor mounting bolt and base frame, if any damage repair or replace.

8 Check compressor fly wheel, if any looseness found and tight it.

9 Loosen motor mounting and base centre bolt move the motor for align the motor pulley with compressor fly wheel, ensure the alignment is inline.

10 Tighten the base centre and mount the drive belt and adjust for its tightness as per manufacturer recommendation.

11 Operate the air compressor and sure compressor fly wheel is aligned with electric drive motor pulley.

— — — — — — — —

Practice to check the air leaks in out fit piping system of air compressor

Objectives: At the end of this exercise you shall be able to
- **check air leaks in out fit piping system.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.

Equipments/ Machines

- Air compressor system layout - 1 No.

Materials

- Cotton waste - as reqd.
- Soap oil - as reqd.
- Pipe unions - as reqd.
- Air pipe - as reqd
- Pressure relief valve - 1 No.
- Pressure switch - 1 No.

PROCEDURE

TASK 1 : **Check air leaks in compressor air out fit piping system**

1 Identify and trace air line out fit piping layout.

2 Trace the pipe joints.

3 Check the tightness of pipe unions.

4 Check the pressure switch and pressure relief valve functions.

5 Start the air compressor and build the air pressure in air tank.

6 Open the air to the out fit piping system and check the air pressure to decrease or the same pressure is maintained on the pressure gauge.

7 If air pressure is decreased it means air pressure is leaks in the out fit piping system. (Fig 1)

8 Apply soap water on each pipe joints and metal pipes.

9 If any bubbles comes from the joints, it means air is leaking from there.

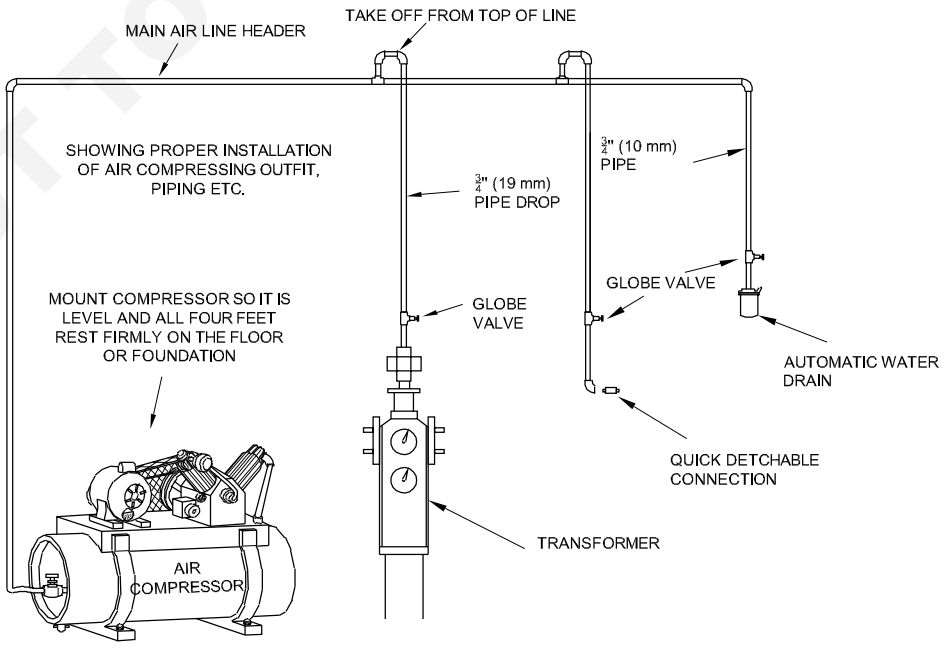
10 Tighten the joint to arrest the air leaks. If any damage pipe or pipe unions replace it.

11 Repeat the above procedure to check air leakage.

12 Operate the air compressor and allow to flow the air through out fit piping line.

13 Ensure there is no air leaks in compressor air out fit piping system.

Fig 1



Identify the different type of refinishing materials

Objectives: At the end of this exercise you shall be able to
- **identify the paint binders**
- **identify the paint solvent**
- **identify the paint additives.**

Requirements

Tools/Instruments

• Trainees tool kit	- 1 No.
• Paint guide book	- 1 No.

Equipments/ Machines

• Paint mixing machine	- 1 No.

Materials

• Thinner	- as reqd.
• Paint binders	- as reqd.
• Paint solvent	- as reqd.
• Pipe additives	- as reqd
• Cotton waste	- as reqd.
• Soap oil	- as reqd.

PROCEDURE

TASK 1 : **Identify the different type of refinishing materials (Fig 1)**

1 Identify the base coat binder.

2 Identify the automotive grade colour binder.

3 Identify the clear mixing base binder

4 Identify the base coat balancer binder

5 Identify the silver metalic paint binder

6 Identify the different colour paint binders

7 Identify the different type of hardeners

8 Identify water based paint binders

9 Identify the pure Acrylics binders

10 Identify the Emulsion binders

11 Identify the base coat binders

12 Identify the chemical binders

13 Identify the different type of solvents, like acetons, brake wash, lacquer thinner, methyl ethyl ketone (MEK), mineral sprits odorless mineral sprits, Toluene, VM of naphtha, xylene.

14 Identify the auto paint component, additives like, kaolin clay, hydrated aluminium silicate, magnesium silicate mineral, calcium carbonate.

Fig 1

Practice to select the repair materials for a particular job

Objectives: At the end of this exercise you shall be able to
- **select the suitable tools for a particular job.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint scraper - 1 No.
- Triangular load scraper - 1 No.
- Wire brush - 1 No.
- Putty knife - 1 No.
- Caulking gum - 1 No.
- Steel wool - 1 No.
- Sanding block - 1 No.

Equipments/Machines

- Vehicle - 1 No.
- Air compressor - 1 No.
- Paint spray gun - 1 No.

Materials

- Sand paper - as reqd.
- Cotton waste - as reqd.
- Baniyan cloth - as reqd.
- Abrasive material - as reqd
- Thinner - as reqd.
- Putty - as reqd.
- Body filter - as reqd.
- Paint - as reqd.

PROCEDURE

TASK 1 : **Select the suitable tools for a particular job**

1 Identify the job and study the job type and requirements.

2 Identify the materials required for the right job, size, shape and mass requirements.

3 Identify the material selection criteria.

4 Identify the candidate materials and list out the required material.

5 Evaluate the paint material cost.

6 Select the standard materials for the particular painting job.

7 Selected material should be suitable for the particular paint application.

8 Selected painting materials should be analyzed and tested to determine whether they do meet the criteria.

— — — — — — — —

Practice to select the right type of primer and paints

Objectives: At the end of this exercise you shall be able to
- **select the right type of primer**
- **select the right type of paint.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint colour code book - 1 No.

Equipments/Machines

- Paint colour mixing machine - 1 No.

Materials

- Cotton waste - as reqd.
- Soap oil - as reqd.

PROCEDURE

TASK 1 : **Selection method of primer and paint (Fig 1)**

1 Identify the primer application and type.

2 Calculate the primer required for the application.

3 Calculate value of selected primer.

4 Selected primer should be suitable for the particular (job) work.

5 Study the selected paint work.

6 Identify the paint whether it is Acrylic Enamel or Acrylic Lacquer.

7 Identify the paint type whether it is base coats, primer coat or clear coat.

8 Identify the paint whether it is water based or chemical based.

9 Identify the paint colour code and serial number of the paint chart.

Fig 1

— — — — — — — —

Identify the various type of mask materials

Objectives: At the end of this exercise you shall be able to
- **identify the mask materials available in the body shop.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.

Materials

- Cotton waste - as reqd.
- Soap oil - as reqd.
- Masking materials - as reqd.

PROCEDURE

TASK 1 : **Identify the different type of refinishing materials**

1 Identify the automotive masking papers.

2 Identify the automotive masking tape - 233.

3 Identify the automotive masking iconic green tape. Which is used for trim masking, jumb masking, multi colour striping and much more.

4 Identify the plastic sheeting.

5 Identify the fine line masking materials.

6 Identify the jamb masking tape.

7 Identify the trim masking tape.

8 Identify the precision poly tape.

9 Identify the rob tape, rob trim, rob film, rob plast, rob paper.

10 Identify the rob foam, rob tape fine, rob tape double

11 Identify the rob tape cloth.

12 Write down the use of following masking material in Table - 1.

Table 1

S.No	Masking materials	Use	Remarks
1	Masking tape		
2	Plastic sheeting		
3	Masking paper		
4	Rob stape cloth		

— — — — — — — —

Practice to identify the different type of body fillers

Objectives: At the end of this exercise you shall be able to
- **identify the body fillers.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint guide book - 1 No.

Equipments/Machines

- Vehicle - 1 No.

Materials

- Cotton waste - as reqd.
- Soap oil - as reqd.
- Body fillers - as reqd.
- Hardener - as reqd.

PROCEDURE

TASK 1 : **Identify the different types of body fillers (Fig 1)**

1 Identify bondo body fillers.

Fig 1

2 Identify the bondo professional body fillers

3 Identify the bondo fiber glass resin.

4 Identify the bondo fiber glass resin gelly.

5 Identify the glass and bondo hair fillers.

6 Identify the aluminium filler.

7 Identify the tight weight body fillers.

8 Identify the type of filler - table, line, diatomacedes earth or powered quartize.

9 Write down the usage of the body fillers in Table 1.

Table 1

S.No	Body filler name	Body filler usage	Remarks
1	Bondo body filler		
2	Fiber glass resin		
3	Fiber glass resin gelly		
4	Aluminium resin gelly		
5	Light weight body filler		

Practice to identify the various type of cream hardeners and fiberglass resin

Objectives: At the end of this exercise you shall be able to
- **identify the cream hardeners and fiber glass resin.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.

Equipments/ Machines

- Air compressor - 1 No.
- Vehicle - 1 No.

Materials

- Cotton waste - as reqd.
- Soap oil - as reqd.
- Hardener - as reqd.
- Resin - as reqd.

PROCEDURE

TASK 1 : **Identify the cream hardener and fiber glass resin**

Fiber glass resin is used for a shine glass finish. These resin used different conditions and climate depend upon work situation and place and work need.

The thinner one is good for application for mixing with pigments. Hardener is smooth and easy to mix with fillers putties and glazes.

The cream hardener and fiber glass resin

1 Identify the Polyster resin

2 Identify the Epoxy resin

3 Identify the Polyurethanes resin

4 Identify the Silicon resin.

5 Identify the Phenolic resins

6 Identify the Alkyd resin

7 Identify the Polyamide resins

8 Identify the bondo white cream hardner for all purpose

9 Identify the Bondo red cream hardner to colour change during mixing ensures.

10 Identify the Bondo 309 blue cream hardener tube.

— — — — — — — —

Practice to identify various type of grit ratings

Objectives: At the end of this exercise you shall be able to
- **identify the grit ratings and types of grit.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.

Equipments/ Machines

- Electric operated sanding wheel disc - 1 No.
- Hand operated sanding wheel disc - 1 No.
- Vehicle - 1 No.

Materials

- Cotton waste - as reqd.
- Soap oil - as reqd.
- Sanding paper - as reqd.
- Sanding wheel disc - as reqd.

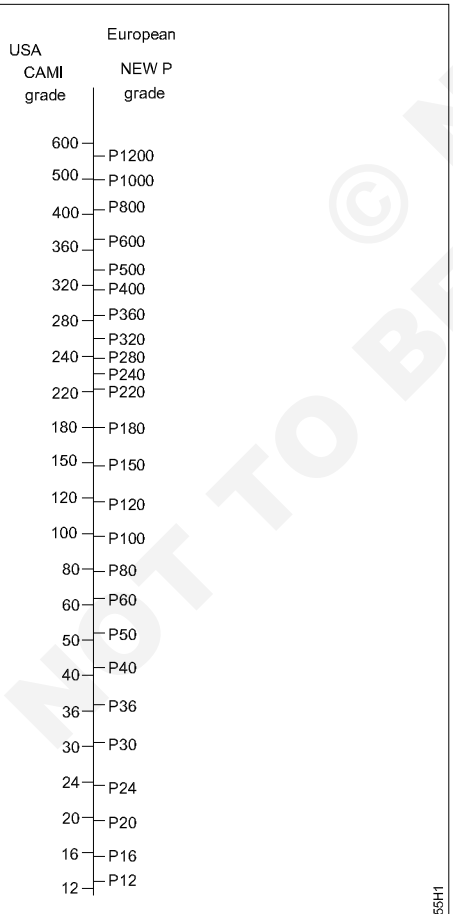
PROCEDURE

TASK 1 : **Identify the grit materials (Fig 1&2)**

1 Identify the sand paper.

2 Identify the ash and clinkers.

Fig 1



GRIT COMPARISION CHART

3 Identify the flap disc grit, coarse, fine medium and finer.

4 Identify the inert materials inorganic in nature.

5 Identify the composition of grit.

6 Identify the 24 grits/ 36 grits, 40 grits, 80 grits, 150 grits, 240 grits, 320 grits, 400, 600, 1500, 4000...

7 Identify the weather proof sanding sheets.

8 Identify the abrant sanding sheets.

9 Identify the gold flex sanding sheets.

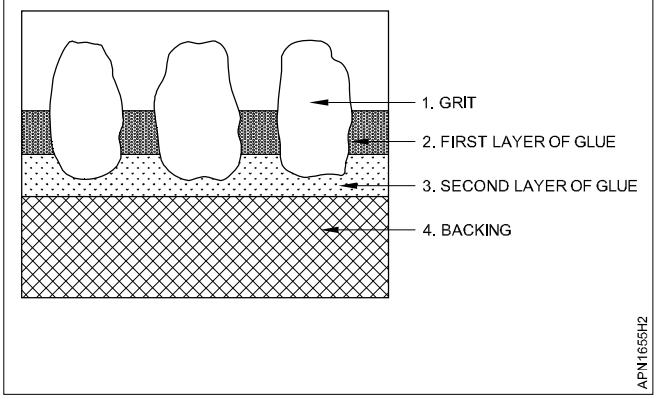
10 Identify the gold sanding sheet.

11 Identify the hand sanding wheel grit.

12 Identify the machine operated sanding wheel grit.

13 Identify the sanding materials made up of four components as shown in Fig 2.

Fig 2



Practice and identify the open and closed coat grit

Objectives: At the end of this exercise you shall be able to
- **identify the open and closed coat grit.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.

Materials

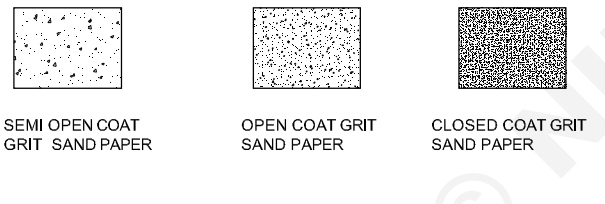
- Cotton waste - as reqd.
- Soap oil - as reqd.
- Sanding paper - as reqd.

PROCEDURE

TASK 1: **Identify the open and closed coat grit**

1 Identify the open coat grit about 50% coverage and less cutting power per grit designation.

Fig 1



2 Identify the semi open coat grit about 30% reduction in the amount of grain on the backing.

3 Identify the semi-open and open coat grit products which have gaps in their grain coverage.

4 Identify the closed coat grit, which is close to 100% of the backing on coated abrasive product is covered in abrasive grain closed coat grit provide the finest and mask aggressive.

Practice on Auto Body clean and ED coating of panel

Objectives: At the end of this exercise you shall be able to
- **clean the rust surface of the panel**
- **give pretreatment to panel surface**
- **check the panel surface condition**
- **ED coating on the surface of the panel.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.

Equipments/ Machines

- Electric operated sanding wheel disc - 1 No.
- Hand operated sanding wheel disc - 1 No.

Materials

- Sanding paper - as reqd.
- Sanding disc - as reqd.
- Cotton waste - as reqd.
- ED coating material - as reqd.
- Soap oil - as reqd.
- Primer - as reqd.

PROCEDURE

TASK 1: **Clean the rust surface of the panel**

1 Identify the rust surface of the panel
2 Mark the rusted surface on the panel
3 Use sand paper for rubbing on the rust spots and down to bare metal.
4 Enlarge sanded area
5 Switch to 120 grit sand paper to feather the edges of the repair area.
6 Complete the feathering with 220 grit.
7 Crack off any blistered paint with a scraper and use a tack rag to remove the particals from unmasked area.

— — — — — — — — —

TASK 2: **Pretreatment to panel surface**

1 Clean the panel with micro towel
2 Spray the filler primer in heavier coat to cover the entire repair area.
3 Move the can away from the surface slightly and bend it into the surrounding painted area.
4 Spray two to three medium coats with minimum 15 minutes gap.
5 Wait a full an hour for the epoxy to dry.

— — — — — — — — —

TASK 3: **Panel surface conditioning method**

1 Sand the epoxy primer with wet 1000 grit sand paper.
2 Wash with clear water and let it dry.
3 Wipe the dried epoxy primer with a lint-free cloth.
4 Apply two to three heavier coats of lacquer filler primer.
5 Allow to dry the filler primer.
6 Sand drips and sage with 320 grit sand paper.
7 Final sand the entire repair area.

— — — — — — — — —

TASK 4: **ED coating on the surface of the panel**

1 Apply ED colour base coat.
2 Start at bottom of the repair area.
3 Apply colour coat in left to right rows.
4 Over lapping each pass about one third.
5 Build the colour slowly in to the repair and surrounding area in two to three coats allowing about 10 to 15 minutes gap between coats.

6 Hold the spray gun about 12 inch away from the surface (Fig 1).

7 Slower you build the colour coat better.

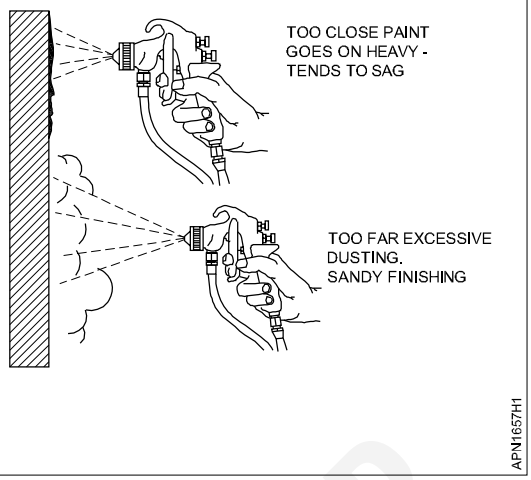
8 Allow the base coat to dry at least 60 minutes.

9 Apply several clear coats to achieve a smooth blend line..

10 Clean the painted area with tack rag. Then apply the first layer of clear coat, sit looks wet.

11 After 48 hours do buffing on the painted area.

Fig 1



Identify the different type of filler, hardeners and putties used in industry

Objectives: At the end of this exercise you shall be able to
- **identify the different type of body filler, hardener and putties.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint guide book - 1 No.

Equipments/ Machines

- Air compressor - 1 No.
- Paint mixing board - 1 No.
- Spray gun - 1 No.
- Vehicle - 1 No.

Materials

- Body filler - as reqd.
- Hardener - as reqd.
- Putties - as reqd.
- Thinner - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.

PROCEDURE

TASK 1: **Identify the different type of body filler**

1 Identify the all type of body fillers and layout it on the table.

2 Then identify the each type of body fillers separately.

3 Identify the best overall fillers - 3m Bondo 261.

4 Identify the best value car body filler - Ever coat - 156

5 Identify the best sanding body filler - Ever coat - 125

6 Identify the best professional use - 3m Bondo 233

7 Identify the premium - quality light weight filler - Ever coat - 112

8 Identify the complete body repair filler kit - 3m Bondo 312

9 Identify the powerful and fast - curing fiberglass filler - Bondo glass - 00272

10 Identify the versatile liquid metal filler - permatix - 25909

11 Identify the standard, mid range and premium fillers.

— — — — — — — —

TASK 2: **Identify the K3, K4, (UHS) hardener**

1 Identify the HS - C-35, CT, F, MX, P, Q700 type hardners.

2 Identify the repox hardener (Epoxy).

— — — — — — — —

TASK 3: **Identify the different type of putties**

1 Identify the lin seed oil based merchandise putty which is used to fill holes, miner cracks and destructions.

2 Identify the autobody restriction putties, which is used to achieve better result with less effort.

3 Identify the Polyester putties, which is used for filling very small creases, dents and auto body imperfections.

4 Identify the Polyester base is combined with a hardener putties, which cures quickly and makes it fast finishing.

— — — — — — — —

Practice to mix the body filler for apply on panel

Objectives: At the end of this exercise you shall be able to
- **mix the body filler on the mixing board for apply on panel.**

Requirements

Tools/Instruments

• Trainees tool kit	- 1 No.
• Body filler mixing board	- 1 No.

Equipments/ Machines

• Vehicle	- 1 No.

Materials

• Body filler	- as reqd.
• Hardener	- as reqd.
• Putties	- as reqd.
• Sand paper	- as reqd.
• Cotton waste	- as reqd.
• Baniyan cloth	- as reqd.
• Soap oil	- as reqd.

PROCEDURE

TASK 1: **Mix the body filler on the mixing board for apply on panel (Fig 1)**

1 Select the filler mixing board and place it on the surface.

2 Clean the surface of the mixing board.

3 Place auto body filler on the mixing board surface. It is important to mix filler on clean surface to keep it free of contamination.

4 Throughly mix the body filler for your satisfaction.

5 Don't allow to dry the body filler on mixing board incase dry the body filler on the mixing board it will damage the mixing board which removing the based body fillers.

6 After use the mixing board clean it with clean water.

7 Ensure mixing board surface is well cleaned before it is storage.

8 Hang the board on the wall with a hook.

9 Follow the safety measures during mix the body fillers.

Fig 1

Practice on preparation of damaged surface area of sheet metal

Objectives: At the end of this exercise you shall be able to
- **prepare the damaged surface area of sheet metal.**

Requirements

Tools/Instruments

• Trainees tool kit	- 1 No.
• Dent removing hammer	- 1 No.
• Scraper	- 1 No.
• Sanding tool	- 1 No.
• Sand paper holder	- 1 No.

Equipments/ Machines

• Vehicle	- 1 No.

Materials

• Sand papers	- as reqd.
• Primer	- as reqd.
• Cotton waste	- as reqd.
• Soap oil	- as reqd.

PROCEDURE

TASK 1: **Prepare the damaged surface area of sheet metal**

1 Inspect the damaged area of the sheet metal.

2 Mark the area to be prepared.

3 Clean the damaged area of sheet metal.

4 Wash the damaged area with clean water mixed with cleaning solvent.

5 Remove the paint burrs with help of scraper without scratches.

6 Remove the dent with help of dent removing tools.

7 Remove the rust and paint deposited on the surface of the damaged area.

8 Use the file, sand paper, sanding tool (power or hand tool) to remove the rust of paint.

9 After cleaning the paint and dust, inspect the damaged surface.

10 If sheet metal is more damaged or torn, cut the damaged sheet and weld with new piece.

11 Remove the weld burns deposited on welded place of sheet metal.

12 Ensure damaged position of sheet metal surface is restored as original.

Note: Use the mask and hand gloves, apron while sanding the damaged sheet metal surface.

Fig 1

Practice to apply the body filler on the damaged sheet metal area

Objectives: At the end of this exercise you shall be able to
- **apply the body filler on the damaged spot of sheet metal.**

Requirements

Tools/Instruments

• Trainees tool kit	- 1 No.
• Paint scraper	- 1 No.
• Steel wool	- 1 No.
• Bristle brush	- 1 No.
• Wire brush	- 1 No.
• Putty knife	- 1 No.
• Sanding block	- 1 No.
• Caulking gun	- 1 No.

Equipments/ Machines

• Vehicle	- 1 No.

Materials

• Body filler	- as reqd.
• Sand paper	- as reqd.
• Primer	- as reqd.
• Spacing paste	- as reqd.
• Baniyan cloth	- as reqd.
• Cotton waste	- as reqd.
• Thinner	- as reqd.
• Soap oil	- as reqd.

PROCEDURE

TASK 1: **Apply the body filler on a damaged sheet metal**

1 Clean the damaged sheet metal surface.

2 Inspect the damaged surface of sheet metal.

3 Identify the body filler which is suitable for damaged surface of sheet metal.

4 Select the body filler from the store.

5 Mix the body filler on the mixing board/ sheet.

6 Ensure body filler is well mixed and suitable to apply on the damaged surface of sheet metal (Fig 1).

7 Ensure primer is sprayed every on the damaged surface.

8 Apply the mixed body filler evenly on the surface of sheet metal in two directions for forming surface properly (forward and reverse direction).

9 Let allow to dry for few hours, there after sanding on the filler applied area to remove the projected filler.

Fig 1

Practice to using the hand block sanding to level the repair area

Objectives: At the end of this exercise you shall be able to
- **using the hand block sanding.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Hand block - 1 No.
- Face mask - 1 No.
- Hand gloves - 1 No.

Equipments/ Machines

- Vehicle - 1 No.
- Air compressor - 1 No.

Materials

- Sand paper - 40 grit - as reqd.
- Sand paper different grit - as reqd.
- Baniyan cloth - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.
- Body filler - as reqd.

PROCEDURE

TASK 1: **Using a hand block sanding to level a repair area (Fig 1)**

1 Clean the body filler metal surface.

2 Select the sand paper.

3 Fix the sand paper grit - 40 on the hand block.

4 Wear hand gloves and face mask for personal safety.

5 Position the hand block sander to rub on the body filler applied area.

6 Move the hand block sanding two directions to bring smooth surface.

7 Apply the compressed air on sanding area to clean the dust particals on metal surface.

8 Ensure the smoothness and level of a repair area properly.

Fig 1

Practice on repairing paint surface imperfections

Objectives: At the end of this exercise you shall be able to
- **repair the paint surface imperfections.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Hand block - 1 No.
- Power disc - 1 No.
- Face mask - 1 No.
- Hand gloves - 1 No.

Equipments/Machines

- Vehicle - 1 No.
- Air compressor - 1 No.
- Paint spray gun - 1 No.

Materials

- Sand paper - as reqd.
- Body filler - as reqd.
- Primer - as reqd.
- Paint - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.
- Baniyan cloth - as reqd.
- Thinner - as reqd.

PROCEDURE

TASK 1: **Method of repair the paint surface imperfections**

1 Clean the painted surface.

2 Check the surface of painting area.

3 Locate the imperfection of paint surface.

4 Mark the imperfection area on the painted part.

5 Wear the face mask and hand gloves.

6 Apply rubbing compound on the imperfection and paint damaged surfaces.

7 Rubbing compound should be used in the same way and with the same respect as a sand paper.

8 Never apply the compound on entire vehicle unless it is absolutely necessary for problem like.

9 Sever water spots or swirl mark, surface pitting from sand or road stone.

10 Before compounding you must protect all trim that you don't want compounded with masking tape.

11 Apply a small dab compound to the pad itself, and begin polishing a panel. Use moderate pressure and medium speed.

12 Compound no more than a 2' by 2' area at a time.

13 Aggressive compounds work fast so be careful.

14 Ensure to cut down a small amount of the paint surface to remove the imperfections and level the paint.

15 Use a finishing polish for the final step.

— — — — — — — —

Perform repairing of paint scratches, nicks and dings

Objectives: At the end of this exercise you shall be able to
- **repair the paint scratches, nicks and dings**
- **prepare surface for the rust free.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Artist brush - 1 No.
- Hand block sanding - 1 No.
- Buffing machine - 1 No.

Equipments/Machines

- Vehicle - 1 No.

Materials

- Wax and grease remover - as reqd.
- Paint - as reqd.
- Baniyan cloth - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.
- Thinner - as reqd.
- Rubbing compound - as reqd.

PROCEDURE

TASK 1: **Repair the auto body paint scratches, nicks and dings**

1 Clean the defect area.

2 Select the matching paint with painted earlier.

3 Apply a light coat of paint to the treated area by the use of artist brush.

4 Apply the several thin coats rather than a single thick paint coating.

5 Light sand on each coat with 600 grit sand paper, after it dries.

6 Follow the manufacturer's recommended drying time between each paint coats.

— — — — — — — —

TASK 2: **Preparing the metal panel surface for the rust free**

1 Use the mineral sprits to remove grease oil on the surface of the metal.

2 Clean the metal surface.

3 Remove the loose and peeling paint.

4 Remove the rust by using sand paper.

5 Repair small holes and dents, sanding the repair area until you reach bare metal and wipe with a degreaser mixed with mineral sprits for small holes and dents inject an approximate epoxy based composite directly into the hole or dent for longer holes apply epoxy filler to the edge of the hole.

6 Apply the fiber glass mash one inch larger than the hole and press into the filler.

7 Prime the metal surface, sanding on filler applied area.

8 Clean the sanding area with air pressure.

9 Ensure the metal surface is smooth and fine finishing.

10 Select the metal primer to apply on the surface of the panel.

11 Priming immediately after cleaning the surface is imperative to prevent dust or dirt accumulating and flash rust forming on the surface.

12 Apply the galvanized primer to prevent formation on the metal sheet.

— — — — — — — —

Practice on corrosion treatment of sheet metal

Objectives: At the end of this exercise you shall be able to
- **apply the corrosion treatment of sheet metal.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint spray gun - 1 No.
- Sand paper hand block - 1 No.
- Hand and power tool - 1 No.

Equipments/Machines

- Vehicle - 1 No.

Materials

- Cotton waste - as reqd.
- Thinner - as reqd.
- Machine primer - as reqd.
- Sand paper - as reqd.
- Soap oil - as reqd.
- Paint mixing stick - as reqd.

PROCEDURE

TASK 1: **Apply the corrosion treatment on interior and exterior surface**

1 Identify the rust formed metal surface

2 Remove the paint on the rust metal surface.

3 Remove the grease or oil on the metal surface or any other containments.

4 Clean the surface with chemical solution with approximate metal conditioner to remove corrosion and rust of the sheet metal.

5 If required application of the recommended conversion coating provide maximum adhesion.

6 Ensure anticorrosion treatment metal surface is clean from the dust and rust.

7 Select the metal conditioner.

8 Mix the metal conditioner in the proper ratio with water as per given directions on the label.

9 Use the plastic pail or mug to mix the metal conditioner.

10 Before applying the metal conditioner clean the surface with an abrassive pad, if rust present.

11 Corrosion coating area should be dry without any dust.

12 Apply the corrosion coating on the metal surface by rag or brush.

13 After 2 to 5 minutes rinsed off before it dries as per your instructor's direction.

14 Rinsed off again on the treated area of sheet metal surface.

15 Flashed with cold water along with rinsing on the surface by using rag or a sponge.

16 Wiped dry with clean cloth and allowed to air dry.

17 Wear the rubber or prone gloves to protect the skin from the metalic acid.

18 The bare metal must by primed as soon as possible to prevent a recurrence of rusting and oxidation.

19 The metal primer sprayed on the interior and exterior surface of sheet metal at a gun pressure of 40 to 45 psi of air pressure.

20 Primer sprayed from a distance of approximately 6 to 8 inch (152 to 200 mm) from the metal surface and primer spray gun.

21 Ensure the metal primer is sprayed on the interior and exterior of the vehicle properly.

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Practice to prepare the repair estimate

Objectives: At the end of this exercise you shall be able to
- **preparation of repair estimate by using estimate guide book.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint thickness gauge - 1 No.
- Estimate guide book - 1 No.
- Scan tool - 1 No.

Equipments/ Machines

- Vehicle - 1 No.
- Computer with printer - 1 No.

Materials

- Paper - as reqd.
- Pencil - as reqd.
- Eraser - as reqd.
- Cotton waste - as reqd.
- Baniyan cloth - as reqd.
- Soap oil - as reqd.

PROCEDURE

TASK 1: **Preparation of repair estimate by using estimate guide book**

1 Park the vehicle on the body repair shop.

2 Clean the vehicle by water and compressed air.

3 Inspect the vehicle and identify the repair/damaged parts to be repaired.

4 Study the autobody repair estimating guide to refer the parts price, labour work time and labour cost.

5 Better use the manual estimating use the computer based estimating guide, computer systems are set up with the same sequence as manual estimate formats.

6 Start the inspection from the front bumber and move towards back to the vehicle.

7 Note the all damaged parts in the estimate formate and refer the autobody repair estimating guide to right pricing.

8 Asses the material required for the repair or repainting the vehicle.

9 Fix the prices for material cost and labour coat and GST on the estimate format as per estimating guide.

10 Total the amount to be charged for the repair of vehicle.

11 Take print out the repair estimate with vehicle particulars.

12 Submit the estimate invoice to the vehicle owner to confirm the repair work. Sample estimate is given as below.

Sample estimate

Thangam **Estimate of repairs**

No. 002128

Collision Estimating Service

Name	Address	Phone Number	Date
Siva kumar	1143 Rail road st. Cressona, Pa.17929.	044-8596746	14-06-2020

Year	Make	Model	License No	Mileage	Serial/V.I. No
2006	Ford	PV	MAE 917	14864	IFTDFISYSGNA69994

Insurance company	Type of insurance	Adjuster	Phone	Car located at
Amerisure	Col			mF6. 4/07

Parts necessary and estimate of labour required	Paint cost Estimate		Parts cost Estimate		Labour cost Estimate	
1 Front face bar chrome No gds or pads			205	82		5
1 Front stone deflectror	1	0	40	50		5
1 Left head lamp door (with argent grill)			52	32		2
1 Left head lamp shield			3	20		
1 Left front fendek	3	1	133	00	1	6
1 Left front fendek apron			60	47	1	0
2 Wheels is 55.60			111	20		6
2 Stems and balance			2	50		5
2 Hub caps			43	46		
Repair radiator support					2	0
Align front end					1	5
1 Left door trim panel			73	40		
Stripe left front fender			15	00		5
Labour 23.0 Hrs @ 23.00			575	00		
(Note: May be front suspension damage)						
Paint mat			89	10		
Undercoat			15	00		

Total	**1419.97**
Grand total	**1419.97**
Tax	**85.20**
Total of estimate	**1505.17**

Practice and identify the information of part price and labour time in a estimate guide book

Objectives: At the end of this exercise you shall be able to
- **collect the part price, labour time and cost from the estimate guide.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint thickness gauge - 1 No.
- Estimate guide book - 1 No.
- scan tool - 1 No.

Equipments/ Machines

- Vehicle - 1 No.
- Computer with printer - 1 No.

Materials

- Paper - as reqd.
- Pencil - as reqd.
- Eraser - as reqd.
- Cotton waste - as reqd.
- Baniyan cloth - as reqd.
- Soap oil - as reqd.

PROCEDURE

TASK 1 : **Gathering the information of part price and labour price and cost from the estimate guide book**

1 Gathering the repair information of the vehicle by visual inspection and using scan tool.

2 Making the process as painless as possible for the customer.

3 Analyze damage to determine appropriate method for preparing the estimate include the following.
   - Estimating guide labour time.
   - Repair shop labour rates.
   - Labour categories - body, refinish, mech, structural work.
   - Judgement of labour time and refinishing material quality and it's cost.
   - Shop profit

4 Prepare the estimate invoice by using online updated autobody repair estimate guide information.

5 Select the parts price original part/ equalant part price.

6 Select the labour cost and time for each labour skilled and unskilled labours for mechanical work, structural work, refinishing work, estimater a shop profit.

7 The parts and labour cost are already fixed and programme in the computer system, it may be vary from manufacturer to manufacturer.

8 Add the each parts price in the estimate invoice.

9 Add the total labour cost for each type of work as per the labour estimate guide.

10 Add the total parts price + total labour cost + GST to complete the estimate invoice by using estimating guide.

— — — — — — — —

Practice on mix paints by paint mixing stick

Objectives: At the end of this exercise you shall be able to
- **mix the paints by paint mixing stick.**

Requirements

Tools/Instruments

• Trainees tool kit	- 1 No.
• Paint mixing cup	- 1 No.
• Paint mixing stick	- 1 No.

Equipments/Machines

• Vehicle	- 1 No.

Materials

• Paint	- as reqd.
• Thinner	- as reqd.
• Sand paper	- as reqd.
• Primer	- as reqd.
• Body filler	- as reqd.
• Cotton waste	- as reqd.
• Soap oil	- as reqd.

PROCEDURE

TASK 1 : **Paint mix by paint mix stick**

1 Select the suitable paint.

2 Open the paint tin which is packed.

3 Shocker the paint tin.

4 Pour the paint in a cup or mug.

5 There are many ways to mix the paint by manual and by machine with paint mixing stick (Fig 1).

6 Take a stick and insert the stick inside of paint cup/ mug.

7 Rotate the stick slowly to mix the paint well or fix the paint mixing stick on the drill machine and operate the machine slowly to rotate the stick inside the paint proper mix.

8 Ensure paint is properly mixed and ready to spray or paint viscosity test.

Fig 1

— — — — — — — —

Practice on use of paint viscosity cup

Objectives: At the end of this exercise you shall be able to
- **use the viscosity cup.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint viscosity test kit - 1 No.

Equipments/ Machines

- Vehicle - 1 No.
- Work bench - 1 No.

Materials

- Cotton waste - as reqd.
- Soap oil - as reqd.
- Thinner - as reqd.
- Paint - as reqd.
- Baniyan cloth - as reqd.

PROCEDURE

TASK 1 : **Use the viscosity cup**

1 Place the paint container to be viscosity tested.

2 Check the paint temperature.

3 Paint temperature should be at room temperature.

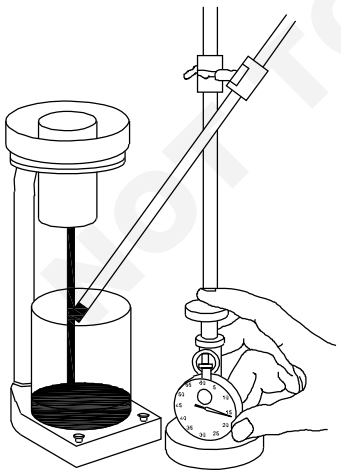
4 If vary the temperature allow to come down to room temperature before testing.

5 Place the paint viscosity test kit along with viscometer, stop watched bottom, paint storage cup on work bench.

6 Place the viscosity cone shaped 100cc cup with hole 4mm (or fire) at bottom.

7 Check the paint temperature, it should be approximately 70F (Fig 1&2)

Fig 1



USING THE VISCOSITY CUP

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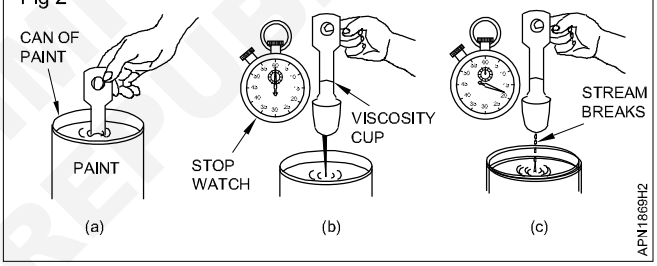
Fig 2



8 Read the instructions and directions of manufacturer for proper reduction. Add the reducer stirring untill the thinner and material are well mixed with paint mixing stick.

9 Place finger over the orifice in the bottom of the cup and fill with paint at hand. A stop watch is used to time, the number of seconds it takes the cup to empty or flow of paint to break.

10 Different types of material have different spraying viscosity.

11 For example lacquer will spray best and give good hiding and flow out at 18 to 22 seconds. Alkyd enamel will show its best qualities at 20 to 23 seconds. Acrylic enamel at 18 to 21 seconds and Polyurethane enamel at 18 to 22 seconds.

12 Use the different type of paints to check the viscosity of paint as per your instructor guideline with reference of paint guide book.

Practice on test the paint spray gun spray pattern

Objectives: At the end of this exercise you shall be able to
- **check the effect of spray on gun stroke**
- **check the gun speed and gun direction**
- **check the spray overlap**
- **check the gun handling problem - heeling and arcling.**

Requirements

Tools/Instruments

• Trainees tool kit	- 1 No.
• Paint spray gun	- 1 No.
• Gun cleaning kit	- 1 No.

Equipments/ Machines

• Vehicle	- 1 No.
• Air compressor	- 1 No.

Materials

• Paint	- as reqd.
• Thinner	- as reqd.
• Paint mixing stick	- 1 No.
• Cotton waste	- as reqd.
• Soap oil	- as reqd.
• Baniyan cloth	- as reqd.

PROCEDURE

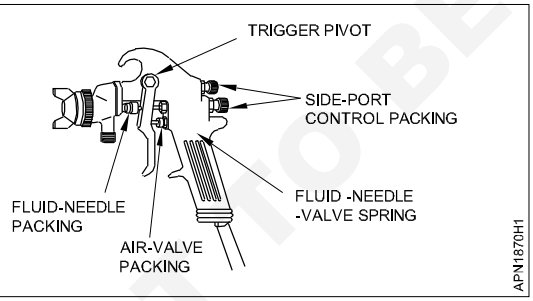
Task 1: **Adjust the paint spray gun knob**

1 Clean the spray gun

2 Air pressure regulator is locating at bottom of the paint spray gun.

3 Coming in the bottom of the gun, see there is knobe right next to the air inlet, this is a restrictor valve (Fig 1).

Fig 1



4 There are two knobs at the top of the handle of the gun.

5 One for fluid control and the other to spray pattern.

6 The fluid control (valve) knobe leads directly back from the paint nozzle where the paint comes out.

7 To adjust this knob back it almost all the way out. Just screw it back in and pull back and held the trigger handle of the gun. Slowly screw the knob in until it starts to push the trigger forwards. This is full fluid flow. Full fluid flow will give us the best control pattern and atomization.

8 The second knob is for the fan control. This knob could be above the fluid control knob or on the side of the handle.

9 First turn the nozzle or air horn 90 degrees. This is the part where the paint comes out. This will make your paint pattern lay on it's side rather than up and down.

10 Then turn the air horn back, so the pattern is vertical. Hold the gun about 6-8 inch from our metal panel. Set your pressure gauge at the gun is 30psi and pull the trigger fully back and release. This must be inlet pressure to the gun not air cap pressure.

11 Repeat in 5psi increments untill two identical patterns have been produced. The use lower of the two pressure of the identical patterns.

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TASK 2: **Check the effect of spray on gun stroke**

1 Select the paint spray gun and clean it.

2 Set the air pressure at the gun, turn the fan-adjustment screw fully open then the fluid adjustment screw fully open the thread of the screw should be suitable.

3 Hold the spray gun about 8 inches (200 mm) from a test panel. A quick way to measure the correct distance is to stretch your finger and touch the surface with your little finger and tip of the spray gun with your thumb. This puts the gun at the proper distance from the surface.

4 Full the trigger all the way back and quickly release it.

5 Now examine the size and shape of the spray pattern. The pattern should be round.

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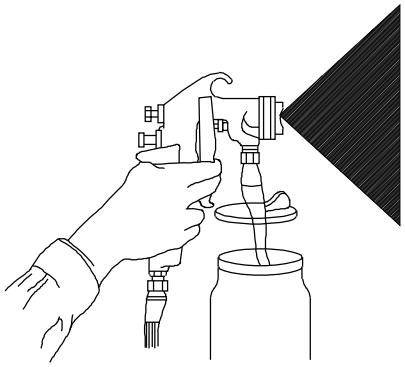
TASK 3: **Check the gun speed and gun direction**

1 Adjust the upper control knob proportional the air flow adjusting the spray pattern of the gun.

Fig 1



SPRAYING SOLVENT TO FLUSH ALL PAINT FROM THE GUN

APN1871H1

2 Adjust the lower knob which is turn controls the amount of or volume of paint being delivered through the gun.

3 Pull the trigger lever fully back move the gun across the proper and alternately adjusting between two knobs to obtain a spray fan of paint turning is on the lower or fluid knob reduce the amount of paint going through the gun.

4 Turning out increases the volume of paint. Turning out (to the left) on the upper or patter control knob widens the spray pattern. Turning is reduces it to a cone shape.

5 Once set the correct spray gun speed and direction next step is to following the correct spraying techniques for applying the coating on the sheet metal surface.

— — — — — — — —

TASK 4: **Check the paint spray overlap**

1 Start the practice by spraying the finish coat material or a flat. Horizontal panel, The spray pattern has been already adjusted by testing it on the surface.

2 Hold the gun 8-10 inches away from and perpendicular to the surface. Pull the trigger enough for air pass through the cap and start a pass with gun moving across the panel, as it reaches the point to start painting, squeeze the trigger fully back and continue moving the gun about one foot per second across the panel until the end is reached. Then release the trigger enough to stop the paint flow but not the air flow.

3 The constant air flow through the gun maintains a constant pressure rather than a build up of pressure each time that the trigger is released. This would be cause a build up of paint at the end of each pass causing runs and sags in the finish. Repeat the sequence of the application moving back in the opposite direction and overlapping the first pass by 50 percent overlapping passes.

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TASK 5: **Check the gun handling problem of heeling and arcing**

1 The spray gun should always be kept level and perpendicular to the surface being coated. Deviating from proper gun position can cause arcing of the spray pattern. Which can result in uneven film build characters. Arcing occurs when an applicator turns their wrist only. When arcing occurs the amount of coating in the middle of the spray pass is higher than the ends of spray pass. The proper technique is to stiffen the wrist move the arm/ shoulder keep the gun perpendicular and level and don't exceed 3 feet when using horizontal or vertical spray passes.

— — — — — — — —

Practice on clean and lubrication of paint spray gun

Objectives: At the end of this exercise you shall be able to
- **clean and lubricating of paint spray gun**
- **clean the pressure feed paint spray gun.**

Requirements

Tools/Instruments

• Trainees tool kit	- 1 No.
• Spray gun cleaning kit	- 1 No.
• Spray gun	- 1 No.

Equipments/Machines

• Vehicle	- 1 No.
• Air compressor	- 1 No.
• Paint test board	- 1 No.

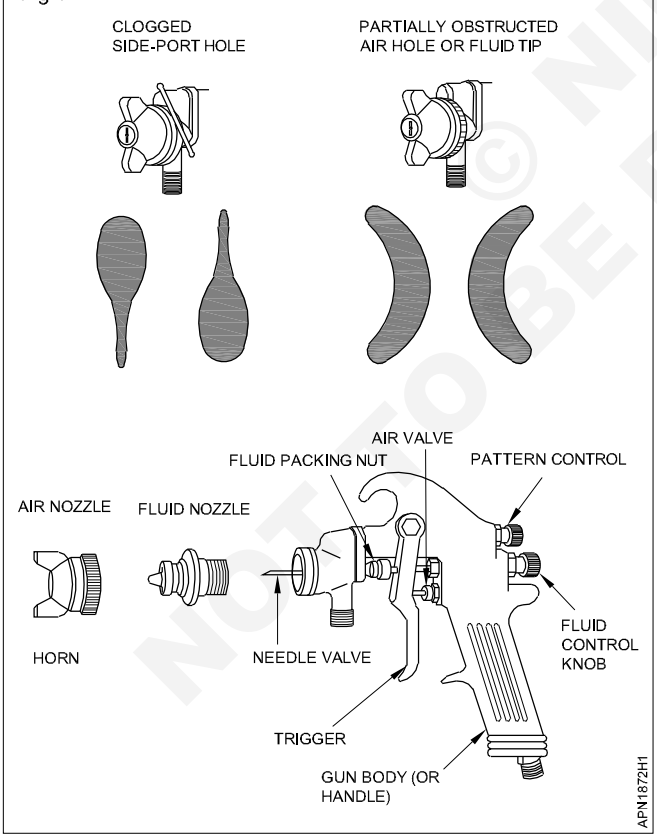
Materials

• Paint	- as reqd.
• Thinner	- as reqd.
• Baniyan cloth	- as reqd.
• Cotton waste	- as reqd.
• Soap oil	- as reqd.

PROCEDURE

TASK 1: **Clean and lubricating of paint spray gun (Fig 1)**

Fig 1



1 Disconnect the air hose from the paint spray gun.

2 Place the paint spray gun on the tray.

3 Dismantle the parts of spray gun.

4 Clean the dismantled parts with cleaning solvent.

5 Clean the parts with clean baniyan cloth.

6 Check air flow hole with air pressure.

7 Check the fluid adjusting screw and spraying and fluid flow hole.

8 Check the fan adjusting screw.

9 Check the fluid needle and fluid tip and air cap.

10 Check the trigger leaver and return spring.

11 If found any damaged parts replace it.

12 Assemble the parts and lubricate all moving parts with recommended oil.

13 Adjust the air screw, fluid flow screw, fan control screw as per learned in previous exercise No 70.

TASK 2: **Cleaning the pressure feed paint spray gun (Fig 2&3)**

1 Disconnect the air pressure hose.

2 Disconnect the fluid flow pipe.

3 Place the paint spray gun on the work bench tray.

4 Air pressure hose with the paint pressure tank.

5 Disconnect fluid line from the pressure tank.

6 Remove pressure tank top cover with pressure gauge.

7 Remove fluid inside of pressure tank.

8 Clean the tank with recommended cleaning solvent.

9 Clean the air pressure line and fluid pressure line if any leak or crack on the line repair or replace it.

10 Dismantle the spray gun and clean the all parts with cleaning solvent and dry it by spray air pressure and clean with baniyan cloth.

11 Viscosity inspect the all dismantle parts, if found any damaged parts replace the damaged parts before assembling the spray gun parts.

12 Assemble the all parts adjust the fan control screw, air flow control screw, and fluid flow control screw as per manufacturer recommendation, lubricate all moving parts.

13 Assemble the pressure tank top cover and air pressure line and fluid flow line.

14 Test the spray gun for it is performance.

Fig 2

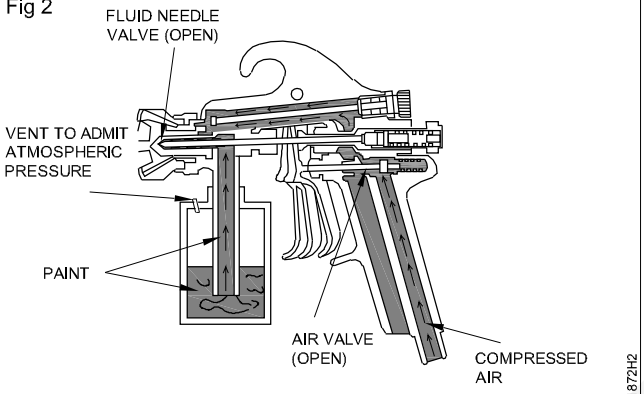
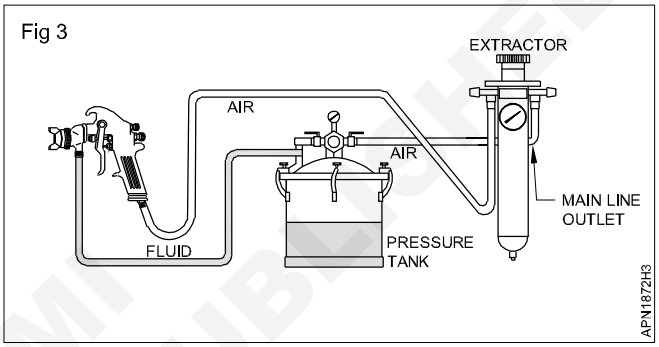


Fig 3



Practice on paint spray booth maintenance

Objectives: At the end of this exercise you shall be able to
- **maintenance the paint spray booth.**

Requirements

Tools/Instruments

• Trainees tool kit	- 1 No.
• Paint spray test kit	- 1 No.

Equipments/ Machines

• Paint spray booth	- 1 No.
• Air compressor	- 1 No.

Materials

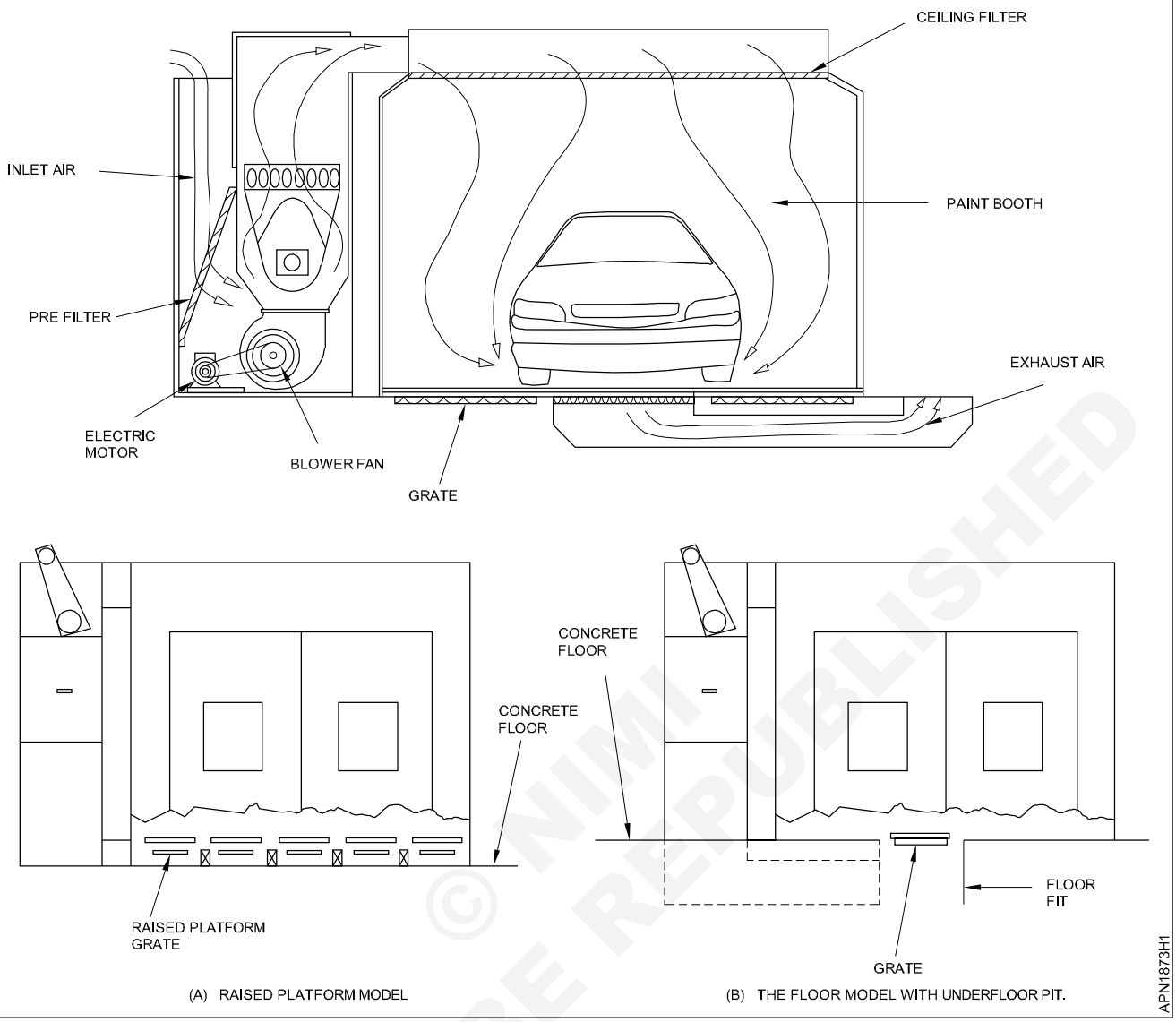
• Paint	- as reqd.
• Thinner	- as reqd.
• Baniyan cloth	- as reqd.
• Cotton waste	- as reqd.
• Soap oil	- as reqd.
• Cleaning solvent	- as reqd.

PROCEDURE

TASK 1 : **Maintenance the paint spray booth**

1 Five regular essential tips to paint booth maintenance
   a Prevent overspray
   b Service the fan
   c Maintain the air unit
   d Remove the contammiants
   e Clean the debris in the booth
2 Clean the paint debries by using the scrubbings brush with a solution of water and paint remover, to clean it or use the air with water pressure to clean the paint spray booth debries and contammiants.
3 Disconnect main power supply to the paint booth and make sure all areas are properly sealed.
4 Close the all vents and turn off all fan.
5 Remove the exhaust filter and clean it separately and keep them in working orderr.
6 Use safety wear, and gloves, face mask, before starting the maintenancce of paint booth.
7 Rinse with the water cleaning solvent, once you have sufficiently cleaned paint from the booth. Use a pressure washer to properlly clean it.
8 Regularly sweep and tidy up your paint booth to prevent debris from building up inside.
9 You should also change the air filter regular basis to ensure your booth continues to properly filter out the contammiants.
10 Clean the paint booth walls and floors and lights starts with keeping them protected from overspray.
11 3m06839 is a liquid that sprays on and dries to a clean film deposited on the wall use it with water.
12 Din control floor coat can be sprayed on paint booth every day the floor coat neutralizes the electrical charge of air particals so that upto 50% of contammiants fall to the floor and don't get stuck to whatever you are painting.
13 Ensure paint booth is well cleaned and dry.
14 Use a compressed air to dry the water spot on the paint booth wall or floors.
15 Connect air hose, fluid line and fan and filters.
16 Connect electric power to the booth and provide the suppression system.
17 Check the booth lights and exhaust benches if defective part is there replace it.
18 Check the paint mixing rooms and paint preparation station.
19 Ensure the paint booth connections are properly connected and properly functioning.

Fig 1



Practice on use of air supplied respirators

Objectives: At the end of this exercise you shall be able to
- **use the air supply respirators.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.

Equipments/ Machines

- Vehicle - 1 No.
- Paint booth - 1 No.
- Air compressor - 1 No.

Materials

- Respirators - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.
- Air hose - as reqd.
- Hose clamp - as reqd.
- Air filter - as reqd.
- Mask - as reqd.

PROCEDURE

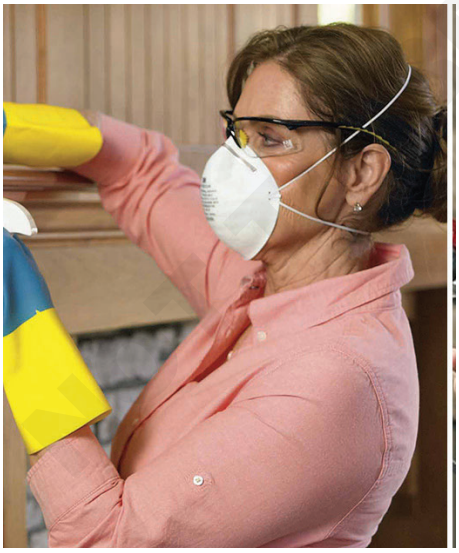
TASK 1: **Use the air supply respirators**

1 Identify the different type of respirators and practice to wear and remove it under guide line of your instructor.

2 Dust mask is used while sanding is done, it protect such as dust particals and solid particals from the air a person breaths.

3 This type mask/respirator covers the nose and mouth. (Fig 1)

Fig 1



DUST MASK

4 Use and throw - away type of respirator with a profiler is used in paint shops. (Fig 2)

5 This type respirator has been fitted on the painter's head by adjusting the stretchable elastic straps. (Fig 3)

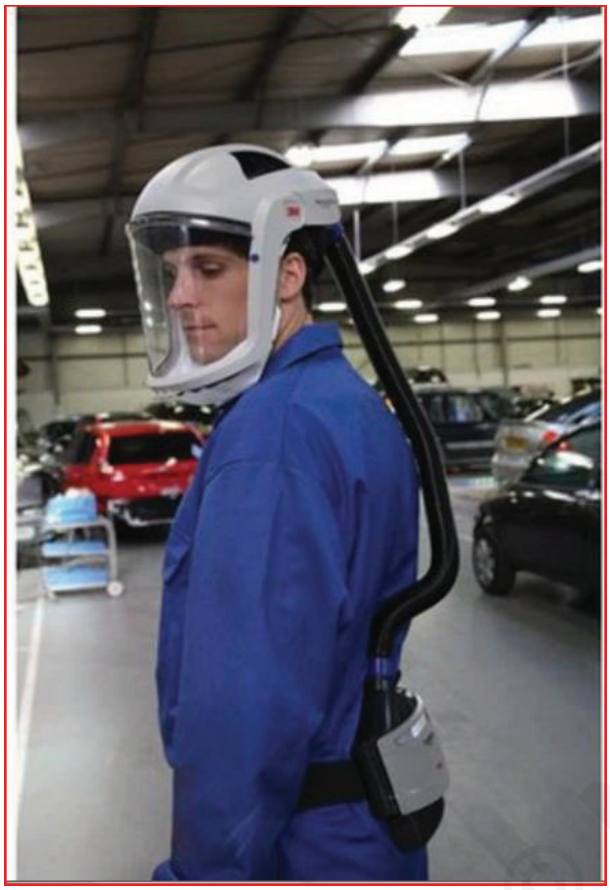
Fig 2

DISPOSABLE PAINT RESPIRATOR

Fig 3

6 Complete full face respirator is used in paint shop (Fig 4) for supply with clean air at all times in paint spraying area.

Fig 4



7 Half face respirator used in certain painting area to supply with clean air at all times in paint spraying area. (Fig 5)

Note: Which air line is used for paint spray gun cannot be use the same source as the respirator.

Fig 5

Practice to correct the paint air spray gun spray pattern

Objectives: At the end of this exercise you shall be able to
- **adjust the air spray gun according paint spray pattern.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint spray gun - 1 No.

Equipments/Machines

- Air compressor - 1 No.

Materials

- Paint - as reqd.
- Thinner - as reqd.
- Baniyan cloth - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.

PROCEDURE

TASK 1 : **Adjust the air spray gun according paint spray pattern**

1 A spray pattern test check the operation of the spray gun on a piece of paper, before attempting to paint the vehicle.

2 Identify the paint spreader control valve with paint spray gun. Which is controls amount of air allowed to the air horns.

3 Adjust the spreader control valve to change spray pattern as desired.

4 This air control valve is used to control the amount of air going through the horn holes of the air cap.

5 Air control valve controls height and width of the paint spray pattern.

6 Close the air spreader control valve completely clockwise to spray forms as small round pattern.

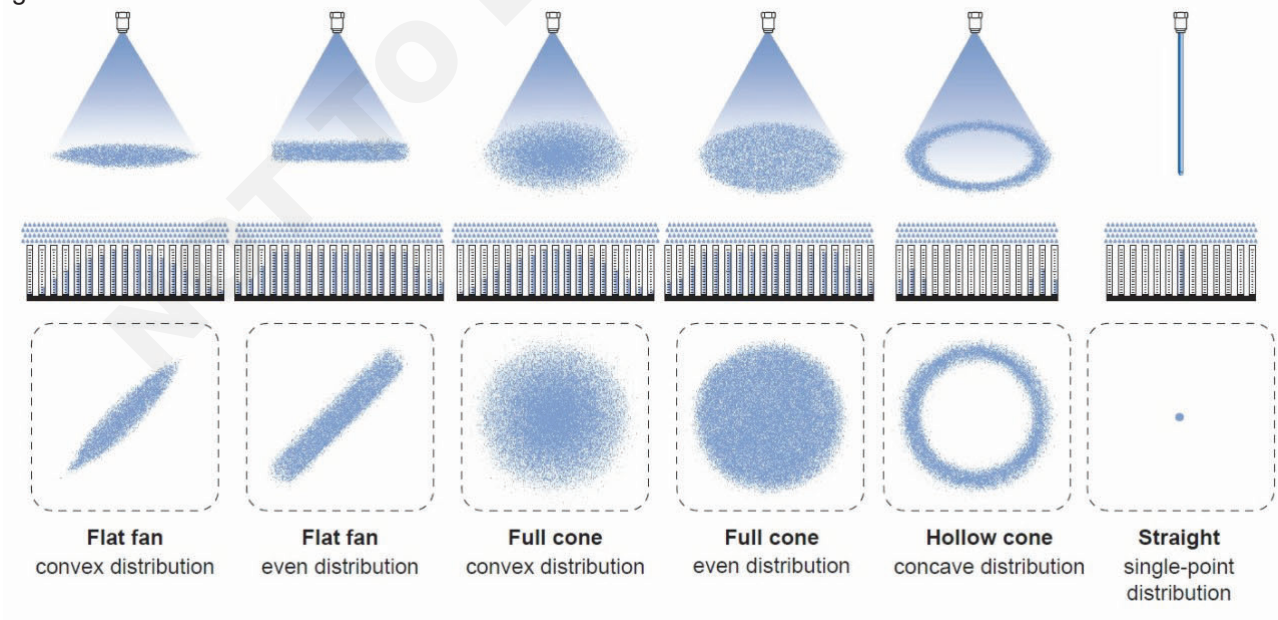
7 For spot repairing or medium sized spray pattern must be obtained by adjusting the spreader control valve.

8 For normal painting turn the spreader control valve to counter clockwise till the first thread shows.

9 Paint gun trigger is used to open both the fluid and air valve. The trigger operation desire the paint spray pattern.

10 To narrow the pattern, adjust the air valve inward. To widen the spray pattern turn the air valve outward.

Fig 1



11 Remember the following tips when evaluating a spray pattern test.

12 A pattern that is heavy in the middle indicates two little air flow.

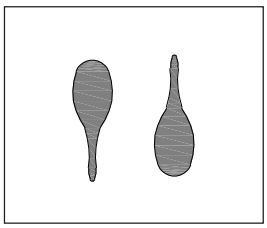
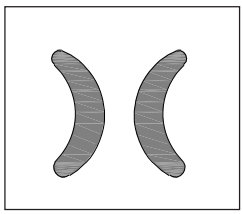
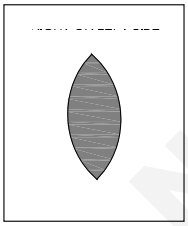
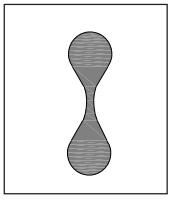
13 A pattern that is divided in the middle indicates two much air flow.

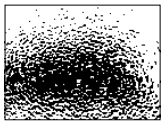
14 Two much paint at top or bottom may be caused by a restriction at the fluid needle or air cap horn.

15 A pattern that leans to one side could be the result of a restriction at the fluid needle or air cap horn.

16 If the pattern is heavy on one side or the top or bottom try turning the air cap 180°. If the pattern remains the same, clean or replace the fluid needle and fluid nozzle. If the pattern rotates 180° them the problem is in the cap horn.

Trouble shooting an air spray gun

Trouble	Possible cause	Suggested correction
Spray pattern top heavy or bottom heavy 	1 Horn holes partially plugged (external mix) 2 Fluid tip clogged, damaged, or not installed properly. 3 Dirt on air cap seat or fluid tip seat	1 Remove air cap and clean 2 Clean, replace, or reinstall fluid tip 3 Remove and clean seat.
Spray pattern heavy to right or to left 	1 Air cap dirty or orifice partially clogged 2 Air cap damages 3 Paint nozzle clogged or damaged 4 Too low a setting of the pattern control knob.	1 To determine where build up occurs, rotate cap 180° & test spray. If pattern, shape stays in same position, the condition is caused by fluid build up on fluid tip. If pattern changes with cap movement, the condition is in the air cap. Clean air cap, orifice and fluid tip accordingly. 2 Replace air cap 3 Clean or replace paint nozzle 4 Adjust setting.
Spray pattern heavy at center 	1 Atomizing pressure too low 2 Fluid of too great viscosity 3 Fluid pressure too high for air cap's normal capacity (pressure feed) 4 Caliber of paint nozzle enlarged due to wear. 5 Center hole enlarged	1 Increase pressure 2 Thin fluid with suitable thinner 3 Reduce fluid pressure 4 Replace paint nozzle 5 Replace air cap and paint nozzle
Spray pattern split 	1 Not enough fluid 2 Air cap or fluid tip dirty 3 Air pressure too high 4 Fluid viscosity too thin	1 Reduce air pressure or increase fluid flow. 2 Remove and clean 3 Low air pressure 4 Thicken fluid viscosity

Trouble	Possible cause	Suggested correction
Pinholes	1 Gun too close to surface 2 Fluid pressure to high 3 Fluid too heavy	1 Stroke 6 to 8 inches from surface. 2 Reduce pressure 3 Thin fluid with reducer
Blushing or a whitish coat	1 Absorption of moisture. 2 Too quick drying	1 Avoid spraying in damp, humid, or cool weather. 2 Correct by adding retarder. 3 Reduce booth temperature
Orange peel (surface looks like Orange peel) 	1 Too high or too low an atomization pressure 2 Gun too far or too close to work 3 Fluid not thinned 4 Improperly prepared surface 5 Gun stroke too rapid 6 Using wrong air cap 7 Overspray striking a previously sprayed surface. 8 Fluid not thoroughly dissolved. 9 Drafts (synthetics and lacquers) 10 Humidity too low (synthetics)	1 Correct as needed 2 Stroke 6 to 8 inches from surface. 3 Use proper reducing process 4 Surface must be prepared 5 Take deliberate, slow strokes 6 Select correct air cap for the fluid and feed. 7 Select proper spraying procedure 8 Mix fluid thoroughly 9 Eliminate excessive drafts. 10 Raise humidity of room

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Practice on trouble shoot excessive spray fog or over spray

Objectives: At the end of this exercise you shall be able to
- **rectify the over spray**
- **rectify the no control over size of pattern**
- **rectify the paint sags.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint spray gun - 1 No.

Equipments/Machines

- Air compressor - 1 No.

Materials

- Baniyan cloth - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.
- Paint - as reqd.
- Thinner - as reqd.

PROCEDURE

TASK 1: **Rectify the paint over spray**

Cause	Remedies
Improper head to target distance	Adjust the distance
Improper angles of application	Adjust the gun angle
Turbulent air flow	Adjust the air control valve
Insufficient levels of electrostatic force	Adjust for sufficient level of electrostatic force
Atomization air pressure is too high	Adjust the air pressure control valve

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TASK 2: **Rectify the no control over size of painting pattern**

Cause	Remedies
Air control valve defective	Replace
Air control valve improper adjustment	Adjust
Fluid control valve defective	Replace
Improper and adjustment of fluid control valve	Adjust
Fluid tip and cap improper fitting	Correct it

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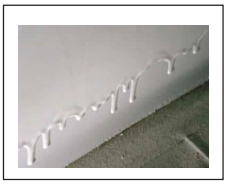
TASK 3: **Rectify the paint sags/ runs**

Cause	Remedies
Thick coat paint	Re-roll to re-distribute the exercise evenly
Painting at cold temperature	Follow the appropriate environment
Uneven application of paint	Prepare proper surface
Application over thinned paint	Use proper thickness of paint

Cause	Remedies
Painting over a glossy surface	Don't use over a glossy surface
Painting over a surface contaminant	Clean the surface
Hold the gun to close to the surface	Maintain the distance
Low air pressure	Increase the air pressure

Trouble	Possible cause	Suggested correction
Excessive spray fog or	1 Atomizing air pressure too high or fluid pressure too low.	1 Correct as needed.
	2 Spraying past surface of the product.	2 Release trigger when gun passes target.
	3 Wrong air cap or fluid tip.	3 Ascertain and use correct combination.
	4 Gun stroked too far from surface.	4 Strokes 6 to 8 inches from surface.
	5 Fluid thinned out too much.	5 Add correct amount of thinner.
No control over size of pattern	1 Air cap seal is damaged.	1 Check for damage; replace if necessary.
	2 Foreign particles are lodged under the seal	2 Make sure surface that this sets on is clean.
Sags or runs 	1 Dirty air cap and fluid tip	1 Clean cap and fluid up
	2 Gun manipulated too close to surface	2 Hold the gun 6 to 8 inches from surface.
	3 Not releasing trigger at end of stroke (when stroke does not go beyond object)	3 Release trigger after every stroke.
	4 Gun manipulated at wrong angle to surface.	4 Work gun at right angle to surface
	5 Fluid piled on too heavily.	5 Learn to calculate depth of wet film fluid.
	6 Fluid thinned out too much	6 Add correct amount of fluid by measure.
	7 Fluid pressure too high.	7 Reduce fluid pressure with fluid control knob.
	8 Operation too slow.	8 Speed up movement of gun across surface.
	9 Improper atomization	9 Check air and fluid flow; clean cap and fluid tip.

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Practice on trouble shoot streaks gun sputterns constantly and uneven spray pattern

Objectives: At the end of this exercise you shall be able to
- **trouble shoot of streaks gun sputters constantly**
- **trouble shoot uneven spray pattern**
- **trouble shoot fluid leaks from spray gun.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint gun - 1 No.

Equipments/Machines

- Vehicle - 1 No.
- Air compressor - 1 No.

Materials

- Cotton waste - as reqd.
- Soap oil - as reqd.
- Paint - as reqd.
- Thinner - as reqd.
- Baniyan cloth - as reqd.

PROCEDURE

TASK 1: **Causes for streaks**

Cause	Remedies
Gun moved too quickly across surface	Take dellibrate slow streaks
Air leaks around nozzle	Arrest the air leaks from air control valve or packing nut.
Loose packing nut.	Tighten the nut or replace.
Dirty fluid nozzle	Clean the fluid nozzle
Air pressure too high	Use least air pressure
Fluid pattern control screw not adjust properly	Adjust properly
Gun held wrong angle	Stroke 6 to 8 inches from surfaces.
Dirty or damaged air cap and/or fluid tip	Same as for sags
Not overlapping strokes correctly or sufficiently	Follow previous stroke accurately
Gun held too far from surface	Stroke 6 to 8 inches from surfaces.
Air pressure too high	Use least air pressure necessary
Split spray	Reduce air adjustment or change air cap and/or fluid up.

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TASK 2: **Causes for uneven spray pattern**

Cause	Remedies
Cap tip scat dirty	Clean
Horn holes plugged	Clean

Cause	Remedies
Obstruction on top of fluid tip	Clean
Fluid pressure too high	Balance the fluid of air pressure
Atomizing pressure is too low	Increase the air pressure
Material is too high	Thin to proper consistency
Fluid adjusting knob in turned too far	Back out counter clockwise to achieve proper pattern
Atomization air pressure too high	Reduce at air pressure
Spreader valve set adjusting to high	Adjust by turning clockwise

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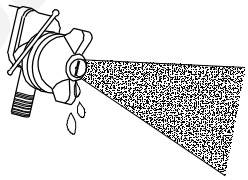
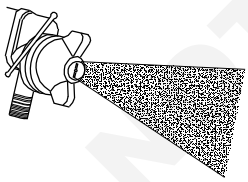
TASK 3: **Causes for fluid leaks from spray gun**

Cause	Remedies
Fluid tip improper fitting	Remove and refit properly
Air cap not properly fitted	Fit properly
Loose fluid connection	Tighten and lubricate
Fluid cup loose fitting	Remove and refit properly
Foreign particals blocking fluid tip	Clean the tip
Broken fluid needle spring	Replace
Wrong fluids needle spring	Replace
Fluid needle packing not too tight	Loosen not lubricate packing
Fluid needle packing dry.	Lubricate needle and packing frequently.
Damaged fluid tip or fluid needle	Replace both tip and needle.
Wrong fluid needle size.	Replace fluid needle with correct size for fluid tip being used.



Causes for gun sputters constantly

Trouble	Possible cause	Suggested correction
Gun sputters constantly	1 Connection, fittings and seals loose or missing.	1 Tighten and/or replace as per owner's manual.
	2 Leakly connection on fluid tube or fluid needle packing (suction gun)	2 Tighten connections; lubricate packing.
	3 Lack of sufficient fluid in container.	3 Refill container with fluid.
	4 Tipping container at an acute angle	4 If container must be tipped, change position of fluid tube and keep container of fluid.
	5 Obstructed fluid passageway.	5 Remove fluid tip, and fluid tube at clean.
	6 Fluid too heavy (suction feed)	6 Thin fluid
	7 Clogged air vent in canister top (suction feed)	7 Clean
	8 Dirty or damaged coupling nut on canister top (suction feed)	8 Clean or replace



Trouble	Possible cause	Suggested correction
	9 Fluid pipe not tightened to pressure tank lid or pressure cup cover.	9 Tighten; check for defective threads
	10 Strainer is clogged up.	10 Clean strainer.
	11 Packing nut is loose.	11 Make sure packing nut is tight.
	12 Fluid tip is loose.	12 Tighten fluid tip. Torque to manufacturer's specifications.
	13 O-ring on tip is worn or dirty	13 Replace O-ring it necessary.
	14 Fluid hose from paint tank loose	14 Tighten
	15 Jam nut gasket installed improperly or jump nut loose.	15 Inspect and correctly install or tighten nut.

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Practice to trouble shoot the fluid leaks from packing nut on trigger release

Objectives: At the end of this exercise you shall be able to
- **trouble shoot the fluid leaks from packing nut**
- **trouble shoot the fluid leaks through fluid tip.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint spray gun - 1 No.

Equipments/Machines

- Air compressor - 1 No.
- Paint test board - 1 No.

Materials

- Paint - as reqd.
- Thinner - as reqd.
- Baniyan cloth - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.

PROCEDURE

TASK 1: **Causes for fluid leaks from packing nut**

Cause	Remedies
Packing loose fitting	Tighten the nut
Loose packing nut	Maintain the recommended tightness
Fluid needle damaged	Replace
Fluid needle and nozzle improperly fitted and not lubricated	Lubricate and seat it properly
Dry packing	Lubricate

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TASK 2: **Causes for fluid leaks from fluid tip**

Cause	Remedies
Fluid tip hole packing block	Clean the tip hole or replace
Fluid nozzle and needle seat interrupt and not lubricated	Clean the needle and nozzle and lubricate
Low air pressure	Increase the air pressure.
Foreign particles lodged in the fluid tip.	Clean out tip and strain paint.
Fluid needle has paint stuck on it.	Remove all dried paint.
Fluid needle is damaged	Check for damage; replace if necessary
Fluid tip has been damaged	Check for nicks; replace if necessary
Spring left off fluid needle	Make sure spring is replaced on needle

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Practice to trouble shoot the excessive fluid come from spray gun

Objectives: At the end of this exercise you shall be able to
- **trouble shoot the excessive fluid from spray gun**
- **trouble shoot the fluid will not come from spray gun**
- **trouble shoot the fluid will not come from fluid tank.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint spray gun - 1 No.

Equipments/ Machines

- Air compressor - 1 No.
- Vehicle - 1 No.

Materials

- Paint - as reqd.
- Thinner - as reqd.
- Baniyan cloth - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.
- Emery sheet - as reqd.

PROCEDURE

TASK 1: **Causes for excessive fluid from spray gun**

Cause	Remedies
Over air pressure	Adjust the air pressure
Fluid needle damaged	Replace
Fluid needle seat damaged	Repair or Replace
Fluid flow adjusting screw improper adjustment	Adjust
Not triggering the gun at each stroke.	It should be a habit to release trigger after every stroke.
Gun at wrong angle to surface	Hold gun at right angles to surface.
Gun held too far from surface.	Stroke 6 to 8 inches from surface.
Wrong air cap or fluid tip.	Use correct combination.
Depositing fluid from of irregular thickness.	Learn to calculate depth of wet film of finish.
Air pressure too high	Reduce pressure
Fluid pressure too high	Use least amount of air necessary.
Fluid control knob not adjusted properly	Readjust

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TASK 2: **Causes for fluid will not come from spray gun**

Cause	Remedies
No air supply to the gun	Check air pressure
Air fan not work	Check and air screw
Fluid needle jammed in closed position	Lubricate
Fluid tip blocked	Clean
Spray gun trigger not work	Check and repair
No fluid in the fluid tank	Fill fluid

Cause	Remedies
Fluid tube disconnected	Connect the fluid tube
Internal mix cap using suction feed	Change cap or feed
Grit, dirt, paint stain and so on, blocking air gap, fluid tip, fluid needle or strainer.	Clean spray gun throughly and strain spray fluid, always strain fluid before using it.

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TASK 3: **Causes for fluid will not come from fluid tank**

Cause	Remedies
No fluid in fluid tank	Fill the fluid
Fluid flow tube disconnected	Connect
No air pressure in fluid flow line	Open or adjust flow control valve
Closed air vent hole	Clean
Loose coupling nut	Tighten
Leaking gasket on fluid cover	Replace with new gasket
Connections with regulator not correct	Correct the connection
Blocked fluid hose	Replace
Gum not converted correctly between canister and fluid tank	Connect correctly as per owners manual
Air intake opening inside fluid tank or canister clogged by dried up finish fluid.	Clean opening periodically

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Practice to trouble shoot the sprayed coat short of liquid material

Objectives: At the end of this exercise you shall be able to
- **trouble shoot the spotty**
- **trouble shoot the uneven pattern**
- **trouble shoot the slow to build**
- **trouble shoot the unable to get round spray**
- **trouble shoot the drippling from fluid tip.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint spray gun - 1 No.

Equipments/ Machines

- Air compressor - 1 No.

Materials

- Paint - as reqd.
- Thinner - as reqd.
- Baniyan cloth - as reqd.
- Paint gun repair kit - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.

PROCEDURE

TASK 1: **Causes for paint spotty**

Cause	Remedies
Dirty fluid nozzle	Clean or replace fluid nozzle
Fluid needles/horn/spring sits underneath the cap	Correct the fitting and setting
Low air pressure	Increase the air pressure
Fluid nozzle does not properly seat in the tip	Remove and refit the fluid nozzle
Gun motion too fast	Move at moderate pace

— — — — — — — —

TASK 2: **Causes for paint uneven pattern**

Cause	Remedies
Inadequate material flow	Adjust the fluid flow screws
Low suction and gravity feed	Increase air pressure and balance the spray gun
Gun motion too fast	Move at moderate pace

— — — — — — — —

TASK 3: **Causes for paint slow to build**

Cause	Remedies
Thick material	Provide proper thickness material
No air pressure	Adjust air pressure
Fluid flow needle seat blocked	clean the needle and needle seat

— — — — — — — —

TASK 4: **Causes for paint unable to get round spray**

Cause	Remedies
Fan adjustment screw not seating properly	Clean or replace
Air cap retaining ring loose	Tighten
Pattern control knob not seating properly	Clean or replace

— — — — — — — —

TASK 5: **Causes for paint drippling from fluid tip**

Cause	Remedies
Packing nut too tight	Adjust
Dry packing	Lubricate
Fluid tip damaged	Replace
Foreign matter's on tip	Clean
Fluid needle spring broken	Replace
Wrong size fluid tip	Replace
Spray head misaligned, causing needle to bend	Tap all around spray head with wood and rawhide mallet and retighten locking bolt.
	Lubricate

— — — — — — — —

Troubleshoot excessive overspary excessive fog, will not spray on pressure feed & suction feed

Objectives: At the end of this exercise you shall be able to
- **trouble shoot the excessive over spray**
- **trouble shoot the excessive fog**
- **trouble shoot the paint spray gun will not spray on pressure feed**
- **trouble shoot the paint spray gun will not spray on suction feed.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint spray gun - 1 No.

Equipments/ Machines

- Air compressor - 1 No.

Materials

- Paint - as reqd.
- Thinner - as reqd.
- Baniyan cloth - as reqd.
- Cotton waste - as reqd.
- Paint gun repair kit - as reqd.
- Soap oil - as reqd.

PROCEDURE

TASK 1: **Causes for the excessive over spray**

Cause	Remedies
Too much atomization air pressure	Reduce air pressure
Gun too fare from work surface	Adjust to proper distance
Improper stroking	Move parallel to work surface

— — — — — — — —

TASK 2: **Causes for the excessive fog**

Cause	Remedies
Too much or too fast drying thinner	Remix properly
Too much atomization air pressure	Reduce air pressure

— — — — — — — —

TASK 3: **Causes for the paint spray gun will not spray on pressure feed**

Cause	Remedies
No air pressure at gun	Check air supply
Internal mix air cap and tip used with suction feed	Change air cap and tip
Canister top gasket damaged	Replace
Fluid pressure to low with internal mix cap and pressure tank	Increase fluid pressure
Fluid needle adjusting screw not open enough	Open fluid needle adjusting screw
Fluid too heavy for suction	Change the pressure feed.
Closed strainer	Clean or replace

— — — — — — — —

TASK 4: **Causes for the paint spray gun will not spray on suction feed**

Cause	Remedies
No air pressure at gun	Adjust air pressure
No fluid in fluid tank	Fill fluid
Fluid suction tube damaged	Replace
Fluid is too thick	Remix the fluid
Fluid tank vent hole blocked	Clean the vent hole
Internal mix nozzle used	Use external mix nozzle used
Canister top gasket damaged	Replace
Clogged strainer	Clean or replace
Fluid control knob adjusted incorrectly	Correct the knob adjustment
Plugged or clogged strainer	Clean or replace strainer
Hole in canister cover clogged	Make sure this hole is open
Spray fluid has not been strained	Always strain before use

— — — — — — — —

Practice to trouble shoot the air continues to flow through gun

Objectives: At the end of this exercise you shall be able to
- **trouble shoot the air continues to flow through spray gun when trigger has been released.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint spray gun - 1 No.

Equipments/ Machines

- Air compressor - 1 No.

Materials

- Paint - as reqd.
- Thinner - as reqd.
- Baniyan cloth - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.
- Gun repair kit - as reqd.

PROCEDURE

TASK 1: **Causes for the excessive over spray**

Cause	Remedies
Air valve packing dry	Replace
Air control valve sticky in open position or spring broken	Replace
Trigger return spring broken	Replace
Air valve leaks	Clean, Replace if necessary
Piston is sticking	Clean piston, check 'O' ring or replace
Piston, nut too tight	Adjust packing nut
Needle is binding	Clean or straighten needle
Packing nut too tight	Adjust packing nuts
Control valve spring left out	Make sure to replace this spring

— — — — — — — —

Practice to trouble shoot the air leaks at canister gasket

Objectives: At the end of this exercise you shall be able to
- **trouble shoot the air leaks at canister gasket.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No
- Paint spray gun - 1 No

Equipments/ Machines

- Air compressor - 1 No

Materials

- Paint - as reqd.
- Thinner - as reqd.
- Baniyan cloth - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.
- Canister gasket - as reqd.

PROCEDURE

TASK 1 : **Causes for the air leaks at canister gasket**

Cause	Remedies
Canister gasket damaged	Replace
Canister top cover mounting loose	Tighten
Canister container cracked	Repair/ replace
Canister gasket improper fitting	Refit or replace
Canister not sealing on canister cover	Check gasket, clean threads and tighten canister

Practice to trouble shoot the leaks at set screw in canister top

Objectives: At the end of this exercise you shall be able to
- **trouble shoot the leaks at set screw in canister top cover**
- **trouble shoot the leaks between canister top and gun body.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No
- Paint spray gun - 1 No

Equipments/ Machines

- Air compressor - 1 No

Materials

- Paint - as reqd.
- Thinner - as reqd.
- Baniyan cloth - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.
- Canister gasket - as reqd.

PROCEDURE

TASK 1: **Causes for the leaks at set screw in canister top cover**

Cause	Remedies
Improper fitting of set screw	Fit properly
Screw not tighten	Clean threads and tighten screw
Defective set screw	Replace
Damaged threads on set screw	Inspect and replace if necessary
Improper air connection to set screw	Correct it

— — — — — — — —

TASK 2: **Causes for the air leaks between canister top and gun body**

Cause	Remedies
Canister top cover mounting screw loose	Tighten
Retainer nut is not light enough	Check nut to make sure it is tight
Canister top gasket damaged	Replace
Gasket seat damaged	Inspect and replace if necessary
Canister top cover cracked	Replace

— — — — — — — —

Practice on checking the paint thickness

Objectives: At the end of this exercise you shall be able to
- **check the paint thickness.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint thickness gauge - 1 No.

Equipments/ Machines

- Vehicle - 1 No.

Materials

- Sand paper - as reqd.
- Baniyan cloth - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.

PROCEDURE

TASK 1: **Checking the paint thickness**

1 Park the vehicle on the surface and clean the complete body by soft cloth.

2 Ensure there is no dust particals on the surface to be measured.

3 Use ultrasonic technique to measuring the thickness of paint over non-metal substrate surfaces such as plastic and fiber glass.

4 The probe of the instrument contains an ultrasonic transducer that sends a pluse through the paint coating.

5 Paint thickness range of 3 to 5 mils (75 - 125 μm)

6 Use the positector 200 B3 graphics capability thickness gauge to measure the paint thickness and upto 3 individual layer thickness in a multilayer system.

7 This gauge features a graphic read out for detailed analysis of the coating system.

8 This gauge large LED display is capable of showing both numerical and graphical representation of the measurement. The graphical display can be set to appear on the right hand side of the screw. It shows a graphical representation of the ultrasonic pulse as it passes through the coating system.

9 880/ FN digital coating thickness gauge also used to measure auto body paint.

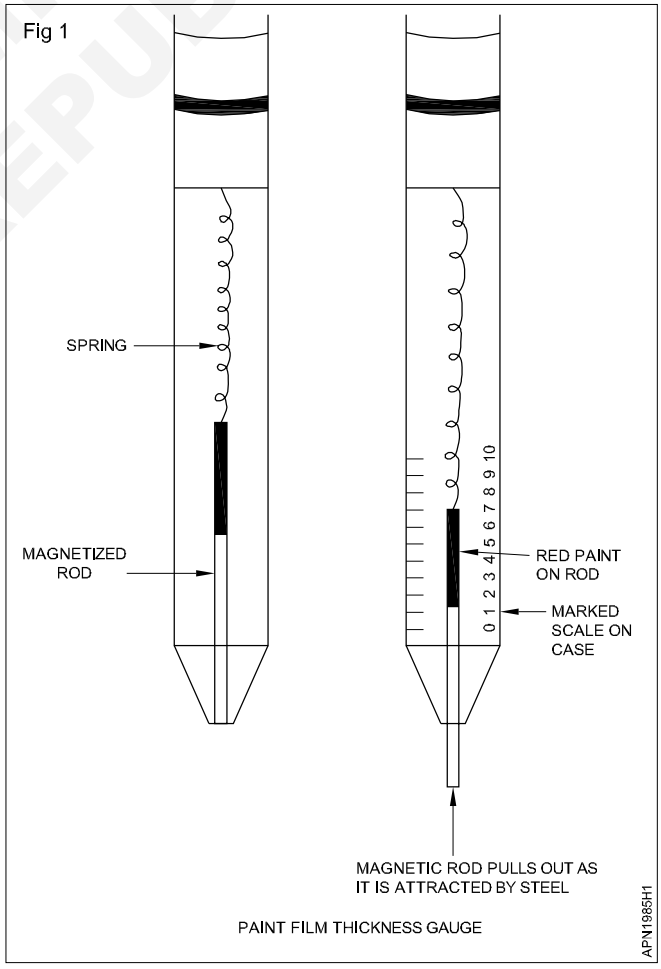
10 Paint depth gauges also used to measure the paint thickness of auto body paint. (Fig 1)

11 Place the paint depth gauge on vehicle panel paint surface and give light pressure on gauge to read the paint thickness.

12 Read out the paint thickness show on the gauge.

13 Check the paint thickness on different place of panel.

Fig 1



Practice on paint removal by using chemical stripping

Objectives: At the end of this exercise you shall be able to
- **remove the paint by using chemical stripping.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Scraper - 1 No.
- Power and hand sanding tool - 1 No.

Equipments/Machines

- Vehicle - 1 No.
- Air compressor - 1 No.

Materials

- Paint remover - as reqd.
- Sanding paper all grit - as reqd.
- Baniyan cloth - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.

PROCEDURE

TASK 1: **Paint removing by using chemical stripping**

1 Identify the paint removing area on the vehicle body by testing paint thickness.

2 Mark the area to be paint remove.

3 Mask the other areas to protect from damage by paint remover. Use masking tape or paper to masking the parts.

4 Masking will stop the paint remover from running into the joints, under the masking or along the edges of the panels.

5 Apply paint removing chemical stripping by paint brush in one direction only to eliminate breaking the film and trapping air in the remover.

6 Paint remover must be applied thick enough to remain wet while it performs its test.

7 Paint remover should be allowed to stand for at least 15 minutes depending on the temperature.

8 Paint stripper are fast acting water rinsable paint and varnish removers.

9 Paint remover chemical use only in well ventilated garage.

10 When the old paint surface is completely dissolved a rubber sequence or plastic spreader may be used to remove the chemical solvent applied.

11 If the residue is lacquer, wash it off with a dry thinner.

12 Other type of materials can be rinsed off with a strong stream of water.

Note: Before applying any type of paint remover can should be well shaken to mix all the ingredients. The hands should protected by hand gloves.

Paint remover should not be used on plastic, anolized aluminium fiber glass, rubber fabric, upholstery and plexiglass.

13 After paint removing the parts of the vehicle should be cleaned with a dewaxer and degreaser before sanding.

— — — — — — — —

Practice on media blasting and preparing bare metal using metal conditioners

Objectives: At the end of this exercise you shall be able to
- **use a media blasting to remove rust on the surface**
- **preparing bare metal using metal conditioners**
- **preparing hard chrome surfaces**
- **preparing metal replacement parts.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Sand blaster - 1 No

Equipments/ Machines

- Air compressor - 1 No
- Vehicle - 1 No

Materials

- Metal conditioner - as reqd.
- Sanding paper - as reqd.
- Baniyan cloth - as reqd.
- Thinner - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.

PROCEDURE

TASK 1: **Use of media blasting to remove dust and rust on the metal surface**

1 Select the sand blasting machine whether it is a suction feed or pressure feed.

2 Prepare the sand blasting machine to operate and fill the slica sand in the reservoir of sand blasting machine.

3 Connect the air hose with sand blasting machine (Fig 2).

4 The operator should be use a positive air supplied hood and cape.

5 Metal blasting operation should be done in an area where the dust can be removed safely.

6 Operate the sand blasting machine blast the sand on the metal surface to be removed the dust and rust deposited on it. (Fig 1)

Fig 1

7 Slica sand is sharp and removes rust quickly.

8 When sand blaster trigger is operated the greater pressure, the morturbulence and force that are created and sand levels the nozzle with great force. When sand strikes the surface, it cuts away the surface rust condition in front of it. The pressure usually between 50 and 80&450 of air pressure is used when sand blasting.

9 Clean the sand blast area after sand blasting.

10 Ensure complete rust is removed by sand blast operation.

Fig 2

TASK 2: **Preparing bare metal using metal conditioner and hard chrome surface**

1 After paint removing or repairing blown off to remove dirt and dust.

2 Mask the all parts where metal conditioner no need to apply.

3 Remove rust oil, grease and water from the surface that are to be spray painted.

4 Any carelessness in surface preparation will result in defective paint job.

5 Apply metal conditioner on the surface to be painted.

6 Allow enough time to react metal conditioner on the surface of the metal.

7 Clean the metal conditioner applied area with clean fresh water and dry.

8 When metal conditioner is used improperly such as with no reduction or insufficient reduction with water. This cause the film to be hard to reduce and clean off the surface.

9 When the metal has been conditioner, it should not be washed with cleaning solvent.

10 Metal conditioned surface should be primed as soon as possible. Zinc chromate is used on construction and overall priming of truck bodies it also prevents corrosion.

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TASK 3: **Preparing metal replacement parts**

1 Clean the surface, to properly prepare new metal surface use material sprits to remove grease and apply a rust - inhibitive primer before painting.

2 Remove loose and pealing paint.

3 Remove rust.

4 Repair small holes and dents.

5 Prime the surface of the metal parts.

— — — — — — — —

Practice on apply spot putty/ glazing putty

Objectives: At the end of this exercise you shall be able to
- **apply spot putty/glazing putty.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Filler gun - 1 No.
- Putty knife - 1 No.
- Putty surfacer - 1 No.

Equipments/ Machines

- Air compressor - 1 No.
- Vehicle - 1 No.

Materials

- Primer - as reqd.
- Putty - as reqd.
- Sand paper - as reqd.
- Baniyan cloth - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.
- Drop cloth - as reqd.
- Clean rags - as reqd.

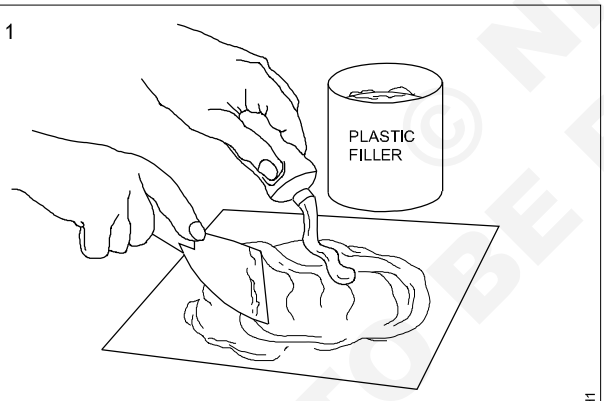
PROCEDURE

TASK 1: **Apply the spot putty on the metal surface**

1 Select the glazing putty compound.

2 Prepare the spot putty compound (Fig 1).

Fig 1



MIXING PLASTIC BODY FILLER AND HARDNER

3 Arrange sanding material and primer.

4 Prepare the surface by using 120 grit sand paper and a hand sander block.

5 Use cloth to wipe away the paint and metal dust.

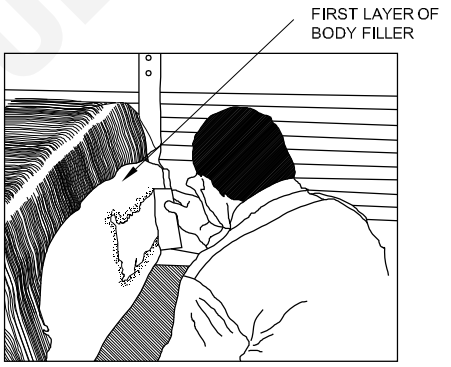
6 Rinse off the area with water and dry throughly.

7 Spray on two coats of primer and allow primer to dry.

8 Don't attempt use the spot/ glazing putty until the surface is completely dry.

9 Squeeze a small amount of the putty onto a putty knife and smooth into the area. Spread the putty through the dent or scrach or hole, smoothing the surface. (Fig 2)

Fig 2



APPLYING A SECOND COAT OF PLASTIC BODY FILLER OVER THE FIRST COAT

10 Allow the putty to dry, if you are using a two part putty their should not take longer than an hour, if you are using one part, it can take upto a day.

11 Using a fine grit sand paper (320 and up) for sanding the area. Taking care to keep the sand paper level and pressure apply equally.

12 Wipe the area with a damp cloth, when area is dirty, apply two coats of spray primer.

13 Use face mask and hand gloves while sanding surface.

Practice on final sanding by using the right grit and power sanding

Objectives: At the end of this exercise you shall be able to
- **selection of sand paper**
- **use the power sanding by using right grit**
- **use the hand sanding by using right grit**
- **use the dry sanding by using right grit**
- **use the wet sanding by using right grit.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Hand sander - 1 No.
- Power sander - 1 No.
- Water spray bottle - 1 No.

Equipments/ Machines

- Air compressor - 1 No.
- Vehicle - 1 No.

Materials

- Sand paper - as reqd.
- Baniyan cloth - as reqd.
- Cotton waste - as reqd.
- Clean rags - as reqd.
- Soap oil - as reqd.

PROCEDURE

TASK 1: **Selection of sand paper**

1 Select the work and identify the type of work and surface.

2 Select the suitable sand paper grit for the work.

3 Sanding is the most important part of a good paint job

4 Sand the old paint, and primer by using a dual action sander and 80 grit sand paper.

5 120 grit sand paper to sand down body filler used on the car.

6 380 grit sand paper to get smoothest finish before applying the paint.

7 Use the 220 grit sand paper to sand the primer coat after it has dried.

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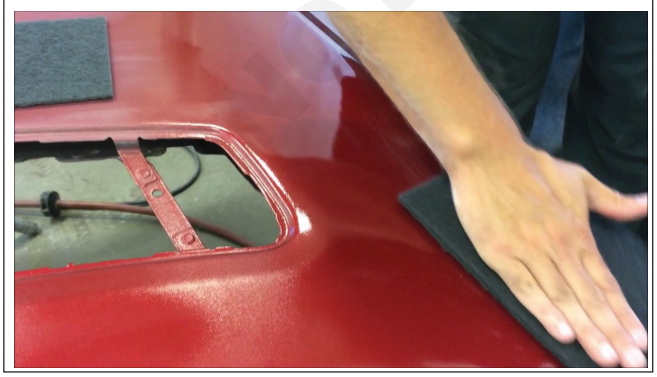
TASK 2: **Practice on hand sanding tool (Fig 1)**

1 Select the hand sanding tool.

Fig 1



2 Select the suitable sand grit for the job.

3 Fix the sand grit on the hand sanding block.

4 Wear hand gloves and face mask.

5 By sanding removes the top layer of paint using hand sanding abrasive materials.

6 Hand sander is used to remove light layer excess materials on the metal surface.

7 Apply even pressure on the hand sander block to remove old paint evenly.

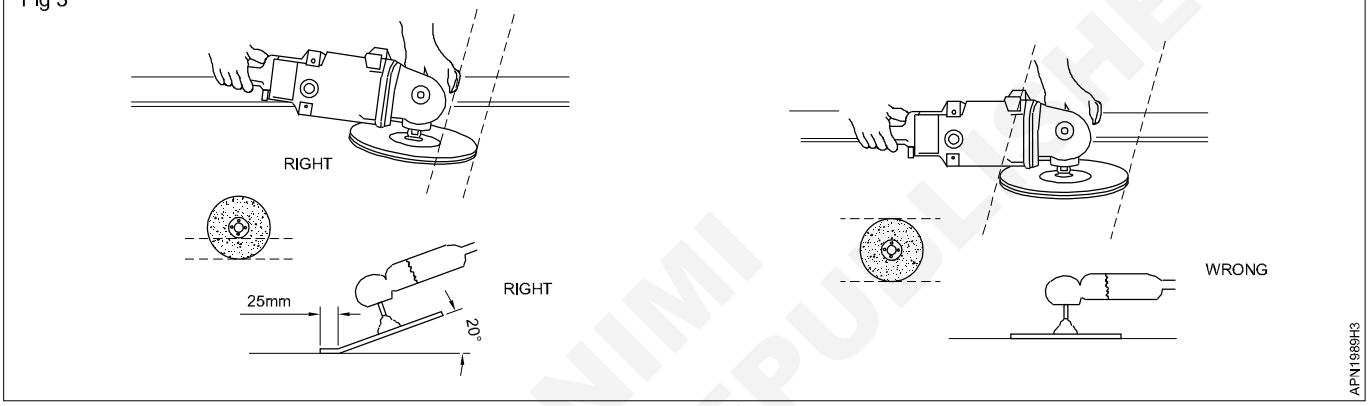
— — — — — — — —

TASK 3: **Practice on power sanding (Fig 2 & 3)**

Fig 2

1 Select the power sanding tool.
2 Select sanding disc according job required.
3 Fix sanding disc on the power sanding tool
4 Connect the power to the tool.
5 Apply power sanding to prepare the surface on the metal body.
6 Sanding the surface evenly if need replace the sanding disc.
7 Clean the surface with cleaning cloth.

Fig 3



TASK 4: **Practice on wet sanding**

1 Wet sanding is an amazing process that when done properly. Wet sanding is the process sanding a car with water.
2 Provide the spray bottle filled with water.
3 Clean the surface to be sanding.
4 Select the sanding paper 400 grits to knock down the little bumps.
5 Select the 600 grits sand paper for smooth surface.
6 Select the 800, 1000 grit sand paper for smoothness and shines the sanding surface.
7 Use spray water during sanding the surface. Water act as a lubrication. Water removes the sanding dust during sanding action.
8 Remember when sanding anything to take it slow let the sand paper work.
9 Don't apply to much hand pressure as this can cause grooves or uneven sanding.

TASK 5: **Practice on dry sanding**

1 Wear the safety equipment before starting the dry sanding.
2 Clean the repair area and remove all loose paint particals.
3 Apply dry guide coat and key the feathered.
4 Apply body filler.
5 Apply dry guide coat on to cured filler.
6 Filler sanding with the right hand block and dust extraction for a fast shaping of the filler area.
7 Reapply dry guide coat to high light fine scraches.
8 Reduce any scraches of 150+ by using 220+ to achieve optional flattered results use abrasive with hand block.
9 Final sanding before primer.
10 Blending area - interm protect any surrounding edges with a strip of masking tape, before you the blending area.

Practice on surface cleaning of vehicle body panel

Objectives: At the end of this exercise you shall be able to
- **carry out the panel surface cleaning.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.

Equipments/ Machines

- Air compressor - 1 No.
- Water sprayer - 1 No.
- Vehicle - 1 No.

Materials

- Cleaning solvent - as reqd.
- Baniyan cloth - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.
- Sand paper - as reqd.

PROCEDURE

TASK 1: **Carry out the surface cleaning**

1 Clean the surface using mineral sprits or soap oil.

2 Remove the loose paint or rust with a wire brush, sand paper or steel wool.

3 Sand glossy surface with fine grain sand paper and wipe with tack cloth.

4 Never wipe or dust the body with dry cloth.

5 Never wash a vehicle in the hot sun.

6 Be sure the windows and sun roof are closed before washing.

7 before you wash the car, hose it down to get rid of the surface dust.

8 Use the cold or luke warm water and a hose rather than a bucket of water to wet and rinse the car surface.

9 Use a sponge, soft rag or cotton wash mat.

10 Always wash the body of a vehicle from the top to down.

11 Wash one section of the vehicle at a time.

12 Towel-dry the car with terry towel, cotton dippers to get rid off water spotting on the surface.

13 At regular intervals apply a coat of wax or sealer.

14 Ensure vehicle body panel surface is well cleaned.

Practice to use a different masking techniques

Objectives: At the end of this exercise you shall be able to
- **use a different type of masking techniques to mask the vehicle parts.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.

Equipments/ Machines

- Air compressor - 1 No.
- Water sprayer - 1 No.
- Vehicle - 1 No.

Materials

- Masking paper - as reqd.
- Masking tape - as reqd.
- Masking cover - as reqd.
- Baniyan cloth - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.

PROCEDURE

TASK 1: **Different type of masking techniques**

1 A good masking provides the underpinings for a successful paint job a poor masking on the other hand result in the frustration of paint - refinishing problems.

2 The purpose of masking is to minimise flows, such as paper fibers solvent pnetration, paint over spray mist and paint flaking than can ruin in paint job.

3 To outline hoods, trucks and door areas prior to refinishing, use a high - quality, professional masking tape in connection with masking paper.

4 Plastic masking films also provide an excellent barrier against particle contaminants.

5 Over spray masking liquids are easy to apply to cleanup.

6 Masking jambs, gas caps and other pesky openings to prevent compound slings. These foam-like taps are labour saving ways to prevent contamination.

7 Before applying a foamy door - operator tape, always wipe clean the area to be taped with a solvent. Then apply the tape about 3/16 of an inch back from the area to be painted. Don't stretch the tape while applying it. Once tape is applied, firmly press it into place to ensure adhesion.

8 A soft paint edge can be obtained by back - tapping over the area, requiring protection with 2 inch masking tape.

9 Use high quality paper and masking tape to mask grills and bumbers.

10 Use two pieces of masking paper, over lapping the bottom masking - paper layer with the top layer on the window and wind shields, or use the wet over spray masking liquid to cover the glass.

11 Use canvas covers and newspaper or 2 inch, 4 inch plastic film to cover chrome moulding of wheel and tyres first wet the masking paper then drape it around the tire.

12 Outside mirrors can be masked 2" masking tape and hardware and are masked with inch masking paper and tape.

13 Use two inch wide strips of masking tape to protect head lights also protected with a coating of wet or dry over spray masking.

14 Letters, emblems can be masked with masking tape or with a fine line plastic tape.

15 Open areas used the masking paper and standard masking tape.

16 Masking paper and masking tape or masking film and tape are both suited for protecting engine components from over spray.

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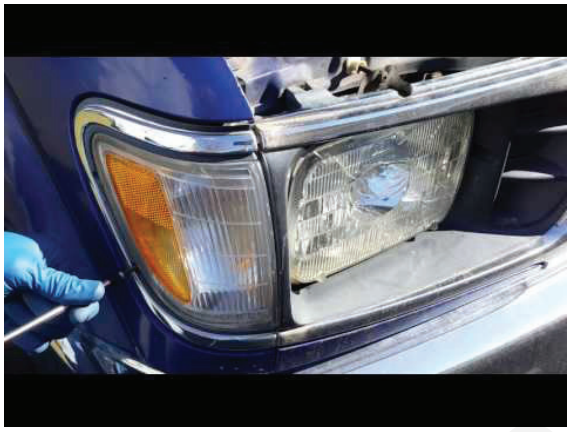
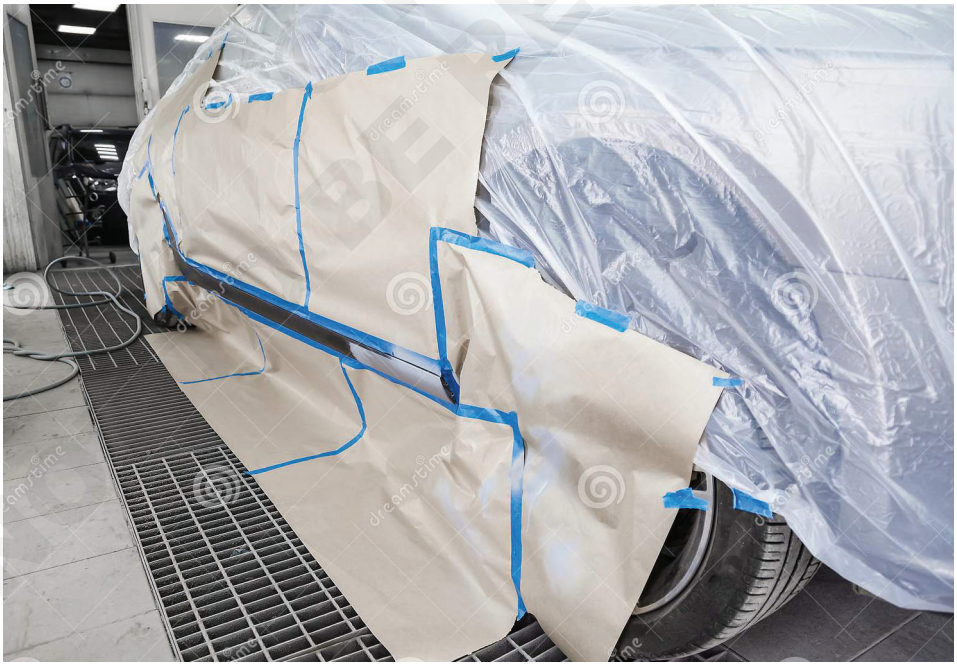
Fig 1





Identify the different type of paint used for top coat refinishing

Objectives: At the end of this exercise you shall be able to
- **identify the different type of top coat paint.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No
- Paint colour code book - 1 No
- Paint spray gun - 1 No

Equipments/ Machines

- Air compressor - 1 No
- Vehicle - 1 No

Materials

- Paint - as reqd.
- Thinner - as reqd.
- Baniyan cloth - as reqd.
- Clean rag - as reqd.
- Soap oil - as reqd.

PROCEDURE

TASK 1: **Identify the different type of top coat refinishing paints**

1 There are two types to top - coat refinishing.

2 The difference requires the paint technician to handle the top coat - refinishing.

3 Acrylic enamel and acrylic lacquer.

4 Paint colour and types are marked on the paint container.

5 These two paints are different in chemical composition. However their similarities are much greater than their difference.

6 The main difference between lacquer and enamel is the paint after sprayed on body surface with lacquer paint dries as the vehicle evaporates to form the final coat.

7 With enamel the paint also as the vehicle evaporates to form the coat. However the enamel builder having a different chemical composition, gradually, oxidizes over a period of weeks to produce the final hard finish.

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Practice on applying prime coats and refinishing plastic parts

Objectives: At the end of this exercise you shall be able to
- **apply prime coats on the parts**
- **refinishing plastic parts**
- **base coat and clear coat repairs.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint spray gun - 1 No.
- Hand sanding tool - 1 No.
- Bucket - 1 No.

Equipments/ Machines

- Air compressor - 1 No.
- Vehicle - 1 No.

Materials

- Primer - as reqd.
- Thinner - as reqd.
- Paint - as reqd.
- Sponge - as reqd.
- Baniyan cloth - as reqd.
- Cotton waste - as reqd.
- Clean rag - as reqd.
- Robbing compound - as reqd.
- Shoe polish - as reqd.
- Clean towel - as reqd.

PROCEDURE

TASK 1: **Prime coats apply on the parts**

Clean the surface to be under coats paint.

1 Primer is special type under coat material, it prevent the rusting and corrosion and also help bond the top coat to bare metal.

2 Select the suitable primer and prepare the primer to spray.

3 Apply primer on surface of under coated panel. Primer itself does not fill and cover sand scratches in the surface to be painted.

4 Apply primer surfacer, it is effect a primer to which has been added a surfacing material. This prepare the surface, so that paint will stick. Primer surfacer fills in small scratches, nicks and other minor surface imperfections.

5 Apply the primer sealer after the process of primer surfacer sprayed.

6 Primer sealer provides sealing film between the primer surfacer and the top coat.

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TASK 2: **Refinishing of plastic parts**

1 Clean first with scuff and clean a gray scuff pad. Rinse with water and dry.

2 Clean with (3835) plastic and leather preparation by using a clean lint free towel and wiping in one direction.

3 Use 77713XXX bumber stripper or 39913 urethane bumber stripper to remove the refinishing material.

4 Cut or grind away ragged edges, sand with 80 grit paper 2 - 3” around damaged area.

5 Apply low speed using a 24 grit disc gradually ‘V’ groove or disc out the damaged area, dispense repair material 2 - 3” beyond the repair area.

6 Use putty knife or spreader and press repair material firmly into the repair area to eleminate air pockets.

7 Fill the front side of repair area with repair material.

8 Allow repair material to cure for 15 - 20 minutes before sanding with 80 grit paper. Finish sanding with 180 grit paper.

9 Reapply a skin coat of repair material, resand with 180 grit sandpaper and clean with plastic and leather parts.

10 Apply refinishing primer and allow to dry it.

11 Dry sand with 320 - 400 grit paper blow off surfaces and tack clean with tack cloth.

12 After priming and sanding, apply the paint system of choice.

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TASK 3: **Base coat and clear coat repairs**

1 Clean the scratches area with warm water and mild soap into a bucket until form suds. Clean the area with sponge and dry with a clean towel.

2 Rub contrasting shoe polish into the scratches area with clean rag.

3 Fill a small bowl with cold water and two to three drops of mild soap it with help to lubricate the sand paper.

4 Wrap ultra fine, wet/ dry sand paper (2000 - 3000 grit) around the sanding block. Dip the sanding paper into the bowl and allow it to soak for two to three minutes until it is throughly soaked.

5 Sand in light strokes until you can see the contrasting colour disappearing.

6 Dry the area throughly with your clean towel for any signs of the scratches. Repeat the previous steps, if the scratch still appears, untill it is completely gone.

7 Buff the newly - repaired area with rubbing compound to restore the shine of the clear coat. Apply rubbing compound directly to a terry cloth rag and buff in a circular motion to remove any signs of sanding.

8 Rub the buffed area with a clean rag to remove any residual compound. Wash and dry the area again, if remove streaks if need.

9 When repair work is complete you may want apply wax to add even more shine to your finish, use a power buffer to buff the area.

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Practice on applying single stage paints and overall refinishing

Objectives: At the end of this exercise you shall be able to
- **apply the single stage paints**
- **repairs the panels**
- **overall refinishing.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No
- Paint spray gun - 1 No
- Putty knife - 1 No

Equipments/ Machines

- Air compressor - 1 No
- Vehicle - 1 No
- Respirator - 1 No

Materials

- Primer - as reqd.
- Paint - as reqd.
- Thinner - as reqd.
- Rubbing compound - as reqd.
- Sand paper - as reqd.
- Clean towel - as reqd.
- Baniyan cloth - as reqd.
- Clean rag - as reqd.
- Soap oil - as reqd.
- Masking tape & paper - as reqd.

PROCEDURE

TASK 1: **Apply the single stage paints**

1 Apply rust conditioner to rusty areas and also use a plastic putty knife to fill holes and dents with body filler. Feather the filler into the body with sand paper.

2 Mask off all areas not to be painted with tape and masking paper, make sure tape down the sheets of paper to prevent over spray from going underneath them.

3 Fill the cup of the spray gun with primer and turn on the compressor. Test the spray pattern, rotating the nozzle of the gun and air pressure from the compressor, until you get a vertical spray pattern about 8 inches wide from a distance of 6 inches.

4 Holding the gun 6 inches from the surface, begin spraying in a left - right motion from end to end, overlapping about half the width of the spray pattern. Move at a speed that will leave a shiny surface of paint without runs, drips or separation. When you are finished rotate the nozzle 90 degree and spray again in up - down pattern, let the primer dry for 2 hours.

5 Lightly sand the primer with 220 grit sand paper and tack the surface.

6 Fill the cup about three quarters full of urethane and mix in hardeners and reducer according to the manufacturer's specifications.

7 Spray the mixture on the surface in the same way as primer sprayed, let it dry for 12 to 24 hours and if a second coat is needed sand the surface with 400 grit sand paper, tack it and spray again.

8 Let the finish cure for 24 to 48 hours before buffing it out and wax or polish.

9 It is best to spray in a spray booth, but if you have to spray outside, the ideal conditions are cloudy, windless days when the temperature is between 70 - 80 degree Frenheat.

10 if paint runs or drips wait for it to dry before knocking down the drips with sand paper. When you spray again, try holding the gun a little farther away or moving it faster.

Warning: The solvent in Urethsne are harmful to breathe use a resipirator and make sure the spraying area is well ventilated.

TASK 2: **Auto body panel repairs**

1 Estimate the process area to be repaired.

2 Dismantle the damaged parts and other to new parts.

3 The repair process can not begin until the shop receives all of the structural parts.

4 Replace the damaged panels and aligned.

5 Clean the panels by sanding and clean with water air clean cloth.

6 Apply body filler to make up the scratches. Apply antirust solution on the panel and apply metal conditioning, then apply primer, primer surfacer, primer filler and under coat paint, top coat and clear coat paint and buffing the panel paint.

7 Ensure panels repair and painting is as it is original condition.

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TASK 3: **Overall refinishing the vehicle**

Safety precautions: Select and use the proper personal safety equipment for surface preparation, spray gun, and related equipment operation, paint mixing, matching and application paint defects, and detailing (gloves, suits, head, eye and ear protection)

Surface preparation

1 Inspect, remove, store and replace - exterior trim and moulding.

2 Soap and water wash entire vehicle, use appropriate cleaner to remove contamiants.

3 Inspect and identify substrate, type of finish and surface condition, develop a plan for refinishing using a total production system.

4 Remove paint finish and dry or wet sand areas to be refinished.

5 Feather edge broken areas to be reinforced.

6 Apply suitable metal treatment or primer.

7 Mask trim and protect other areas that will not be refinished.

8 Mix primer, primer surfacer or primer sealer.

9 Apply primer onto surface of repaired area.

10 Apply two - component finishing filler to mirror surface implications.

11 Dry or wet sand area to which primer surfacer has been applied.

12 Remove dust from area to be refinished including cracks or moulding of adjacent areas.

13 Clean area to be refinishing using a final cleaning solution.

14 Remove with a tack rag, any dust or lint particals from the area to be finished.

15 Apply suitable sealer to the area being refinished, when sealing is needed or desirable.

16 Scuff sand to remove nibs or imperfections from a sealer.

17 Check and adjust spray gun operation for HVLP or LVLP.

18 Select the paint and paint mixing, matching and applying.

19 Apply the selected product on test and let down panel in accordance with manufacturer's recommendation.

20 Apply base coat, clear coat for panel blending.

21 Apply base coat/clear coat for overall refinishing.

22 Derib, buff and polish refinishes where necessary.

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Practice to removal of masking materials

Objectives: At the end of this exercise you shall be able to
- **remove the masking materials.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No

Equipments/ Machines

- Air compressor - 1 No
- Vehicle - 1 No

Materials

- Masking paper - as reqd.
- Masking tape - as reqd.
- Masking cover - as reqd.
- Masking film - as reqd.
- Thinner - as reqd.
- Clean rag - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.

PROCEDURE

TASK 1: **Remove the masking materials**

1 Paper masking should be remove on completion paint, it is easy to remove.

2 Clean parts makes for easy and clean removal the masking tape.

3 before masking tape removal process, it is essential to flow the paint manufacturer's instruction to remove the masking material.

4 Slowly peeling the car paint tape back away from the paint job and over itself rather than upwards. Making sure that the surface is dry.

5 Lifting the tape at a 45 degree angle permits clean lines and cutting using a removals wheel and eraser, which should be complete at slow speed, to avoid burning the paint, so it is advised to wait for removal of masking tape 6 - 8 hours for one part enamels and one hour for two part enamels and basic lacquers if a newly painted vehicle is left outside, wind and sun will accelerate the drying process, sun exposure causes brittle tape.

6 Wet tape may harden and become difficult to remove, if tape get damp or wet, it is advised to remove it as soon as possible instead of letting it air dry.

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Practice on paint polishing

Objectives: At the end of this exercise you shall be able to
- **polishing the vehicle paint.**

Requirements

Tools/Instruments

• Trainees tool kit	- 1 No
• Buffing machine	- 1 No

Equipments/ Machines

• Air compressor	- 1 No
• Vehicle	- 1 No

Materials

• Rubbing compound	- as reqd.
• Buffing disc	- as reqd.
• Clean towel	- as reqd.
• Clean rag	- as reqd.
• Thinner	- as reqd.
• Wax polish	- as reqd.
• Soap oil	- as reqd.
• Baniyan cloth	- as reqd.

PROCEDURE

TASK 1: **Polishing the vehicle paint**

1 Apply wax on painted area for polishing.

2 Polishing bring back the original glossy surface.

3 It removes fine scratches

4 Remove the dullness of painted surface.

5 Revels the original colour beneath.

6 Clean the vehicle painted area with clean water and dry it with clean towel.

7 Apply liquid polish or wax on the surface of the painted area.

8 Let allow to spread for few minutes.

9 Use a buffing machine to polishing gently at low RPM.

10 The polishing will remove firmly bonded surface contaminants and surface paint defects.

11 Successfully polishing your car may requires a polishing wheel but it is possible to complete the polishing by hand.

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Practice on paint colour evaluation

Objectives: At the end of this exercise you shall be able to
- **evaluate the paint colour by using sunlight**
- **correct the paint colour by using light bulb.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint spray gun - 1 No.
- Electric buffing tool - 1 No.

Equipments/ Machines

- Vehicle - 1 No.
- Air compressor - 1 No.

Materials

- Paint - as reqd.
- Thinner - as reqd.
- Rubbing wax - as reqd.
- Polish - as reqd.
- Clean towel - as reqd.
- Clean rag - as reqd.
- Soap oil - as reqd.

PROCEDURE

TASK 1: **Evaluate the paint colour by using sunlight (Fig 1)**

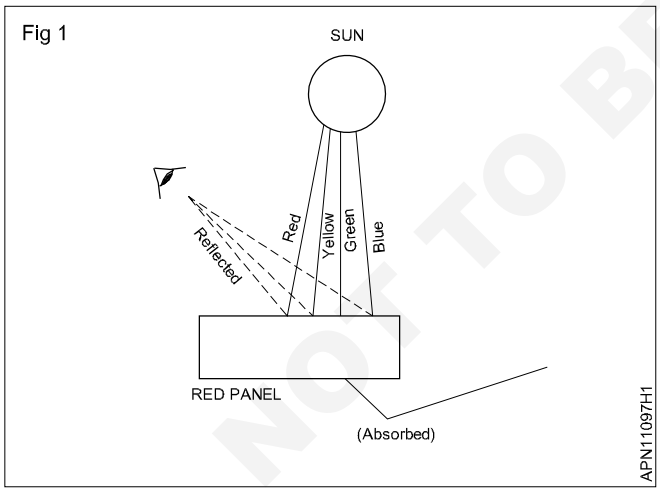
1 Colour - corrected light at the right temperature for colour matching and blending.

2 Light which falls in the range of 5000 - 6000 kelvin.

3 Park the vehicle in the shed where natural light spread over the painting surface.

4 Day light has the most even energy across the entire spectrum particularly in the blue wave lenghts.

Fig 1



5 D65 illumminant represents the colour temperature 6550k and it is used by automotive industries.

6 The spectra light source that best simulate illuminates like D50 and D65.

7 Paint colour evaluating by day light is achieved by the spectra light QC by using a filtered tungsten day light system.

8 Allow the day light spread over on the vehicle and match the painting colour with colour analyzing and matching with colour wheel.

9 Don't wear the tinted glasses or contact while testing the paint colour evaluation.

10 Don't assess the samples for more than 5 to 10 seconds before making pass/fail determination, because the human eyes sensitivity to colour differences decreases as time goes on.

11 Don't place the any other objects in the light booth other than the samples being assessed.

12 Check the paint colour and match with the paint colour matching guide, if found any defects carried as per learned in previous exercise.

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TASK 2: **Correcting the paint colour by using light bulb (Fig 2)**

1 Park the vehicle in paint booth.

2 Clean the vehicle for paint colour matching and correcting paint defects.

3 Start with over head garage lights. LED lights are really the way to go for mimicking day light. Anything higher than around 6500k may cause things to be appear to blue.

4 Colour matching lights can bring out imperfections in paint colour.

5 Base over head lighting can't expose swirls and scratches on painting surface.

6 Scan grip detailing lights is probably the most popular for colour matching paint correction.

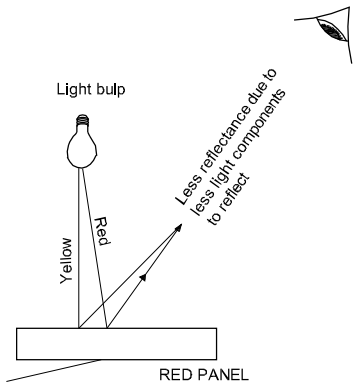
7 If scan grip detailing light is not available with paint shop you can use a couple of LED work lights on a tripod to help focus in on various panels of your car.

8 Focus the light on the surface of painted panel and visually check by eye focus at 45 degree angle.

9 If found any paint fault, mark the defective area and repair it as per learn previous exercises, by rubbing and polishing.

10 Even though fault not corrected, use once again clear coat spray.

Fig 2



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Practice on matching basic paint colours

Objectives: At the end of this exercise you shall be able to
- **matching basic paint colour with vehicle old paint.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint colour code sheet - 1 No.

Equipments/ Machines

- Vehicle - 1 No.

Materials

- Sand paper - as reqd.
- Clean towel - as reqd.
- Clean rag - as reqd.
- Baniyan cloth - as reqd.
- Thinner - as reqd.
- Soap oil - as reqd.

PROCEDURE

TASK 1: **Matching basic paint colour with vehicle old paint (Fig 1&2)**

1 Park the vehicle in the paint shop.

2 Clean the vehicle with water.

3 Allow it to dry by wiping wet and dry cloth.

Fig 1

4 Take the vehicle owner's manual and find the vehicle paint colour and paint colour code given by vehicle manufacturer.

5 Match the vehicle old paint colour with paint manufacturer colour code number and paint colour.

6 Paint colour code is a unique identification for a vehicle paint.

7 Ensure the new paint colour code and paint colour is same as the vehicle paint colour. Some times due to whether conditions the vehicle paint colour might be change or fade, due to this using a colour that is exact match to the colour code will probably seen to bright when compared to old paint.

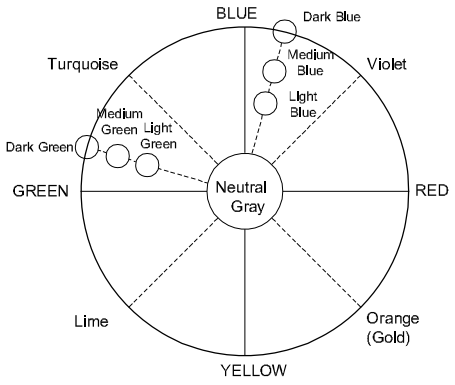
8 Paint manufacturer are programmed the paint code and colour in their paint colour mixing machine.

9 Paint colour code and computer program provide the correct, exact combination of paint hues to make a paint colour.

10 Compare the new paint colour in different lights is extremely important for a professional quality finish.

Note: The colour code is made up of a combination of letters and numbers and will be printed on a sticker some where in the vehicle.

Fig 2



Color wheel showing the chrome or saturation effect

Practice on spraying metallic colours and let down test panel

Objectives: At the end of this exercise you shall be able to
- **spray metallic colour paint on the panel**
- **let down test panel for a three stage finish.**

Requirements

Tools/Instruments

• Trainees tool kit	- 1 No.
• Paint spray gun	- 1 No.

Equipments/ Machines

• Air compressor	- 1 No.
• Vehicle	- 1 No.

Materials

• Metallic paint	- as reqd.
• Thinner	- as reqd.
• Primer	- as reqd.
• Clean towel	- as reqd.
• Masking paper	- as reqd.
• Masking tape	- as reqd.
• Clean rag	- as reqd.
• Soap oil	- as reqd.

PROCEDURE

TASK 1: **Metallic colour paint spray on the panel**

1 Clean the panel with clean soap water and allow to dry it or wipe the water by clean towel.

2 Prepare the metallic colour paint by adding thinner.

3 Adjust the paint spray gun and fill the metallic paint in the cup of spray gun.

4 Connect the air hose to paint spray gun and trigger to spray metallic paint on the panel evenly.

5 Once the previous coat has been left flash off, usually about 10 minutes depending on thinners.

6 Apply two or three lighter coats with the gun held a few inches further away from the panel, with very little flash - off time between.

7 These coats should give an even metallic surface whilst still being able to soak into previous layer giving smooth surface.

8 Some base coat metallic colours are applied as wet coats and try to give an even metallic finish without further attention.

9 The other type may require the application of one or two cross coats to produce an even surface.

10 Choosing the correct method for the material in use is vitally important, especially if colour matching adjacent panels.

— — — — — — — —

TASK 2: **Let down test panel for three stage finish**

1 Prepare the let down test panel with the same sealer being used on the vehicle.

2 After the sealer has flashed, apply the base coat colour using the same air pressure and spray pattern that will be used on the vehicle. Make sure you do not vary your paint spray procedure.

3 After the test panel has dried, mask it into flour equal sections with small pieces of masking paper and tape leave the top fourth of the test panel.

4 Apply one coat of semi - transparent mid - coat over the top quarter of the card.

5 After the mid coat has finished, remove the top layer of masking paper.

6 Apply another coat of mid - coat colour over the exposed top half of the test panel.

7 After this second coat has flashed, remove the masking paper to expose three quarters of the panel.

8 Apply another coat of mid-coat colour over the exposed three quarters of the panel.

9 Apply flashing remove the masking paper entirely.

10 Apply a fourth coat of mid-coat colour as always spray the coating in the same way as your plan to on the vehicle.

11 After the entire let-down test panel has dried, mask off half of the panel length wise.

12 Apply the manufacturer's recommended number of clear coat to the exposed half.

13 Compare the different shades on the let down test panel with the paint on the vehicle. Each layer of the intermediate or mid-coat will darken the appearance of the finish.

14 The let down test panel service as a hand made set of alternate paint colour chips.

15 You must find which area on the let down test panel best matches the colour of the vehicle.

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Practice on a repair with a multistage mica or pearl finish

Objectives: At the end of this exercise you shall be able to
- **repair with a multistage mica and pearl finish.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint spray gun - 1 No.

Equipments/Machines

- Vehicle - 1 No.
- Air compressor - 1 No.

Materials

- Paint - as reqd.
- Thinner - as reqd.
- Clean towel - as reqd.
- Clean rag - as reqd.
- Soap oil - as reqd.
- Baniyan cloth - as reqd.

PROCEDURE

TASK 1: **Repair with a multistage mica**

1 Clean the painting surface of the vehicle.

2 Inspect the painted area and identify the defect spot in multistage paint coats.

3 Mark the defect area on the surface.

4 Clean the minor repairs by wax and buffing operation.

5 Mask the surrounding area around the defect spot.

6 Before start the repair, technician should know the following;

Choice the solvents and colour matching

b Colour reduction and paint selection

c Air pressure limit for paint spray gun

d Wetness and dry sanding applications

e Spraying techniques

7 sanding and clean the defect paint spot, during sanding don't create deep scratches on the surface, apply primer surface and sealer on the surface.

8 Mix the paint and fill it spray gun cup.

9 Apply paint coating on the repair spot

10 Allow more spraying time when scheduling repair jobs with mica finishes.

There are number of factors keeping in mind when working with pearl luster paints repair.

1 Mica flakes are heavy keep the paint agitated to ensure even distribution.

2 Spray test panels before painting repair of vehicle.

3 Continually blend on spot repairs.

4 Do not rush, allow enough flash time between coats

5 Spray in a well - lit booth

6 Ultraviolet light can help in checking pearlecent effect.

7 Direct sunlight is the best source of light for evaluating repair touch-ups.

8 Check the paint match from three angles indirect sunlight straight on and standing on both sides of the repair area.

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Practice on use of spectrophotometer and computerized paint matching custom

Objectives: At the end of this exercise you shall be able to
- **use the spectrophotometer or electric colour analyzer**
- **use the computerized paint matching custom.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Spectrophotometer - 1 No.
- Electric colour analyzer - 1 No.
- Paint matching computer system - 1 No.

Equipments/ Machines

- Vehicle - 1 No.

Materials

- Baniyan cloth - as reqd.
- Clean rag - as reqd.
- Soap oil - as reqd.
- Cotton waste - as reqd.

PROCEDURE

TASK 1: **Use the spectrophotometer**

1 It is a device about the size of a shoe box that is hooked up to a computer. It measures paint colour electronically.

2 Port is provided in the system on one end of that shines light on the object. It takes a very sophisticated paint colour reading of each wavelength of light refelected off the object.

3 Park the vehicle on the surface to check the paint colour.

4 Switch on the Spectrophotometer.

5 Focus the Spectrophotometer shines beam of the light on your vehicle painting surface and takes a reading of each wavelength of light that is reflected off the object.

6 Then this reading is transformed into a colour formula so the paint store can mix paint.

7 Spectrophotometer are designed to measure colour in both reflective and transmittance mode.

8 When the light is refracted by a prism and causes a rainbow to be cast. A Spectrophotometer works in the same way breaking up the light into all the colours so that the system is as accurate as possible, when it analyze the colour.

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TASK 2: **Use of computerized paint matching custom**

1 A paint mica matches paint almost exactly to the colour.

2 Some mixers can only go by sample cards on display in the hardware store.

3 When the customer entered the paint colour code into computer system that signal sent to a Spectrophotometer and it deciphers the colour and picks the specific needed.

4 Inside the Spectrophotometer are interference filters. The colour sample is processed through the filter and colours that don't match are reflected off of them. This creates an accurate reading of the colour.

5 The colour then goes through the filters and it is collected in the fiber optics to be sent to the photodiode. The diode transfers the reading into a signal that is read by the computer, which processes the correct amount of tint to be added to the paint.

6 The numbers off tints depends on the brand and type of Spectrophotometer being used in their system.

7 The machine pushes the tints needed out of their cylinder and pours them out of the openings into the paint can waiting below.

8 After the tint is added, the lid is placed on the can, and the paint is placed in a mix. Metal clamps hold the can in place, and the machine shakes the extremely fast for several minutes. After ward the person on the paint counters open, the can and checks to make sure the paint is mixed throughly.

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Practice on removing foreign matter in wet paint

Objectives: At the end of this exercise you shall be able to
- **remove foreign matter in wet paint**
- **remove foreign matter in wet sanding between coats.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.

Equipments/Machines

- Air compressor - 1 No.
- Vehicle - 1 No.

Materials

- Paint - as reqd.
- Thinner - as reqd.
- Clean towel - as reqd.
- Clean rag - as reqd.
- Soap oil - as reqd.
- Cotton waste - as reqd.

PROCEDURE

TASK 1: **Removing foreign matter in wet paint**

1 Light defects can be removed by polishing.

2 Light foreign matter in wet painting surface can be removed by rubbing and polishing.

3 If it is not clear by rubbing and polish sand and refinish the effected area.

— — — — — — — —

TASK 2: **Removing foreign matter in wet sanding between coats**

1 Locate the defective surface.

2 Mask the area affected by foreign matter.

3 Mask the remain area to protect the paint.

4 Sanding until foreign matter removed and clean the surface if need apply sealer on the surface and paper for clear coat.

5 Apply top coat to match the painted area.

6 If painted colour is matching with previous paint sprayed on the surface make clear coat on the top coat paint.

— — — — — — — —

Practice to correcting the paint colour mismatch

Objectives: At the end of this exercise you shall be able to
- **correcting all type of colour mismatching problems.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint spray gun - 1 No.
- Hand and power sanding tool - 1 No.

Equipments/Machines

- Air compressor - 1 No.
- Vehicle - 1 No.

Materials

- Paint - as reqd.
- Thinner - as reqd.
- Primer - as reqd.
- Hardener - as reqd.
- Body filler - as reqd.
- Reducer - as reqd.
- Clean towel - as reqd.
- Clean rag - as reqd.
- Soap oil - as reqd.
- Cotton waste - as reqd.
- Sand paper - as reqd.

PROCEDURE

TASK 1: **Identify the colour mismatching on vehicle**

- Locate the defective surface
- Mark the area on vehicle
- Marking the remain area to protect the paint

Fig 1

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TASK 2: **Correcting paint colour mismatching problems**

- Check for the panels were painted with two different batches of top coat which were to different shades
- Check colour of the undercoat shows through on one panel
- In the case of metallic colour, check the adjarent panels were not sprayed with the same degree of wetness.
- Check whether it is wrongly colour. Streakes, flooding and blotchy is occured in any of the painted areas.

- Check whether it is wrongly colour. Streaked, flooding and blotchy is occured in any of the painted areas.
- If any of the alive problems are identified it is colour mismatch on vehicle body.
- To rectify use good spraying techniques. Keep the gunat constant distance from the work.
- Apply the required number of top coats insufficient hiding is almost always caused by films that are too thin
- To avoid spray on a cold surface or in a cold room.
- Spray a mist coat over metallic colours to detain colour uniformity
- If polishing and buffing does not correct the mismatch condition, the off colour area must be repainted

Note

Must use solvents that are compatible with your shops conditions. Use of a slow duying solvent where a regular flying solvent would call cause pigment particles to drift to uneven layers in the paint film.

Fig 2

Practice on removing paint runs chipped paint, panel detail sanding

Objectives: At the end of this exercise you shall be able to
- **repair the paint runs**
- **repair the chipped paint**
- **repair the panel detail sanding.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No
- Hand and power sanding tool - 1 No
- Paint spray gun - 1 No

Equipments/ Machines

- Air compressor - 1 No
- Vehicle - 1 No

Materials

- Paint - as reqd.
- Thinner - as reqd.
- Sand paper - as reqd.
- Primer - as reqd.
- Scaling compound - as reqd.
- Clean rag - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.
- Baniyan cloth - as reqd.

PROCEDURE

TASK 1: **Painting and trouble shooting**

Cause for paint runs

1 Causes

- Spraying over the surface contaminated with wax, oil grease or silicon.
- Solvent, Material, Surface or spray booth too cold.
- Using too much or to little solvent or solvent that dries too slowly.
- Pilling on coats by recoating before proceeding coats have flashed off.
- Using too low air pressure.
- Improper spray adjustment.
- Improper spray gun technique.

2 Prevention

- Throughly clean the surface to be painted, use wax and silicon remover before applying paint to a previously painted surface.
- Keep the surface, solvent and material at room temperature.
- Make sure the paint is properly reduced following the paint manufacturers recommendations. Runs can be caused by over reduction and use of a solvent. Which evaporates too slowly. Sags can be caused by under reduction. Which results in pilling on in heavy coats.
- Allow precoding coats to flash off before applying the next coat. Failure to do this can cause sags.
- Make sure sufficient air pressure is used. Low air pressure can cause sags because the paint will not properly atomize.
- Properly adjust the fluid and fan controls on the spray gun too narrow a fan with too much paint will cause sags.
- Keep the gun at the proper distance from the work. Holding the gun too close piles on the paint and invites sags also avoid using a jarkey spray strokes and moving the gun too slowly.

Repair the chipped paint

1 Cause

- The problem represents damage resulting from the impact of a sharp object. Which removes some of the finish.
- It may be caused from such things as road gravel. Misaligned door, dock lid, tail gate or hood edges, or a sharp tool striking a painted surface.
- If the impact is light only top coat will be removed and the red or gray primer will show. If the impact is severe, the entire finish will be removed, exposing bare metal and early rusting.

TASK 2: Repair the detailed panel sanding

Metal finishing marks are the result of poor surface preparation techniques. Cause of following;

1 Cause

- Improper metal - finishing techniques.
- Too their a coating of primer surfacer.
- Failure to allow primer - surfacer or putty to dry long enough before sanding.
- Failure to use putty when required.
- Cross sanding.
- Poor sanding techniques.
- Use of to coarse a sand paper.
- Use of poor top coat solvents.

2 Repair

- Metal - finishing marks and sand scrsatches found on original factory finishes can usually be repaired by a combination of sanding, polishing and buffing in some extreme cases, the surface may have to be repainted.
- The long cure time of refinishing enamels prevents polishing and buffing from being used on newly painted surfaces.
- Most cases of metal finishing marks or sand scratches found on refinished car panel will have to repair by repainted.

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Practice on visualising of painted surface in three different angles

Objectives: At the end of this exercise you shall be able to
- **visualising the painted surface in three angles.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.

Equipments/ Machines

- Air compressor - 1 No.
- Vehicle - 1 No.

Materials

- Paint - as reqd.
- Thinner - as reqd.
- Clean cotton rag - as reqd.
- Clean towel - as reqd.
- Cotton waste - as reqd.
- Soap oil - as reqd.

PROCEDURE

TASK 1: **Visualising the painted surface in three angles**

1 Clean the vehicle body to be visualising inspection.

2 Park the vehicle on the paint surface visualising inspection.

3 Set the visualising robot above the painted surface.

4 Each robot have one sensor.

5 Switch on the robot to visualising painted surface.

6 The robot systems inspects an entire painted surface of vehicle.

7 The robot sensors within the normal cycle time of 60 or less in stop and go or line tracking operation.

8 Defects can be visualised, marked or even automatically reworked by robot.

Paint defects

There are numerious way in which the paint finish on automotive panels can be inspected. Where it is projecting patterns/light onto the surface to direct fine texture variations such as orange peel or looking bigger defects like colour mismatches or scratches, get touch with your instructor to discuss potential defects that you would like to detect using machine vision system.

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Practice on identification of paint defects

Objectives: At the end of this exercise you shall be able to
- **identify the area wise defect ranking and tolerance.**

Requirements

Tools/Instruments

- Trainees tool kit - 1 No.
- Paint guide book - 1 No.

Equipments/Machines

- Air compressor - 1 No.
- Vehicle - 1 No.

Materials

- Cotton waste - as reqd.
- Soap oil - as reqd.
- Clean towel - as reqd.
- Paint - as reqd.
- Thinner - as reqd.

PROCEDURE

TASK 1: **Painting area wise defect ranking and tolerance**

1 Paint defects can have many causes, may be accident aggressive atmosphere condition, mistakes made during paint coating process, may be coat thickness was not right or paint drying time is too short, sometimes paint damage is due to body prepared substrates.

Refinishing defects identification on the vehicle body

1 Adhesion problems between base and clear coat.
2 Clouding.
3 Dirt and dust in base coat.
4 Dirt and dust in clear coat.
5 Edge mapping.
6 Lifting and wrinkling
7 Matting and gloss
8 Moisture blisters
9 Orange peel
10 Pin holes in polyester
11 Polyester bleeding
12 Poor adhesion - polyester stopper
13 Poor adhesion on plastic parts
14 Poor opacity
15 Runs
16 Salt or pepper effect
17 Sanding scratches
18 Silver hole effect
19 Solvent popping
20 Water spotting

Environmental defects identification

1 Acid rain
2 Bird droppings
3 car wash abrasions
4 Colour fade/change
5 Industrial fall out/rail out
6 Insect scratches
7 Line or cement dust
8 Stone chip metalic
9 Stone chip solid
10 Tar spots
11 Tree resin/ sap
12 Water spotting

Panel surface defects identification

1 Wrinkles, elivation and bulges, folds, depressions and dents.
2 Cracks, hole pattern, contraction, radius, spring back panel assembly - gap and flush.
3 Flush panel 1 - panel 2 - gap

Paint defects

1 Brush marks
2 Peeling
3 Chalking
4 Flaking
5 Sagging
6 Low coverage
7 Dry not proper
8 Efflorescene