

Painter (General)

NSQF LEVEL - 4

1st Year

TRADE THEORY

SECTOR : CONSTRUCTION

(As per revised syllabus July 2022 - 1200 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 : Construction

Duration : 2 - Years

Trades : Painter (General) - 1st Year - Trade Theory - NSQF Level - 4 (Revised 2022)

Developed & Published by



National Instructional Media Institute

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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, an autonomous body under the Directorate General of Training (DGT), Ministry of Skill Development & Entrepreneurship is entrusted with developing producing and disseminating Instructional Media Packages (IMPs) required for ITIs and other related institutions.

The institute has now come up with instructional material to suit the revised curriculum for **Painter (General)** - Trade Theory NSQF Level - 4 (Revised 2022) in **Construction** Sector under **Yearly Pattern**. The NSQF Level - 4 (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 - 4 (Revised 2022) trainees will also get the opportunities to promote life long learning and skill development. I have no doubt that with NSQF Level - 4 (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

Addl. Secretary/Director General (Training)
Ministry of Skill Development & Entrepreneurship,
Government of India.

New Delhi - 110 001

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 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

ACKNOWLEDGEMENT

National Instructional Media Institute (NIMI) sincerely acknowledges with thanks for the co-operation and contribution extended by the following Media Developers and their sponsoring organisation to bring out this IMP **(Trade Theory)** for the trade of **Painter (General) - NSQF Level - 4 (Revised 2022)** under the **Construction** Sector for ITIs.

MEDIA DEVELOPMENT COMMITTEE MEMBERS

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Shri. Harish	-	Patron & past president IPCAC (Indian paints & Coating association)

NIMI - COORDINATORS

Shri. Nirmalya Nath	-	Deputy Director, NIMI, Chennai - 32.
Shri. V. Gopalakrishnan	-	Manager NIMI, Chennai - 32.

NIMI records its appreciation of 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 staff who have contributed for the development of this Instructional Material.

NIMI is grateful to all others who have directly or indirectly helped in developing this IMP.

INTRODUCTION

TRADE PRACTICAL

The trade practical manual is intended 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 **Painter (General)** 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 - 4 (Revised 2022) syllabus are covered.

The manual is divided into Nine modules.

	Module Name
Module 1	- Safety Workshop Practice
Module 2	- Free Hand Sketch Lines and Strokes
Module 3	- Colours and Colour Knowledge
Module 4	- Drawing and Painting instruments
Module 5	- Lettering Types
Module 6	- Basic Carpenter and Plumbing Work
Module 7	- Basic Sheet Metal Work
Module 8	- Basic Computer Operations
Module 9	- Stencils, Signboard and Screen Printing

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 **Painter (General)** Trade Theory NSQF Level - 4 (Revised 2022) in **Construction**. The contents are sequenced according to the practical exercise contained in NSQF Level - 4 (Revised 2022) syllabus on Trade Theory 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 perceptual 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 indicating about the corresponding practical exercise 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 the purpose of self learning and should be considered as supplementary to class room instruction.

CONTENTS

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	Module 9: Stencils, Signboard and Screen Printing		
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1.9.103 - 111	Screen printing		229

LEARNING / ASSESSABLE OUTCOME

On completion of this book you shall be able to

S.No.	Learning Outcome	Ref. Ex.No.
1	Make different types of sketching viz., free Hand sketching of different objects, designing of different shapes, size, geometrical shapes of different objects following safety precaution.	1.1.01 - 1.2.20
2	Able draw the free Hand sketching of Human figures, Shading, Use graph & figure enlargement.	1.2.21 - 1.2.24
3	Identify the type of papers, colour schemes and compose different types of colour shade in 2D design.	1.3.25 - 1.3.35
4	Create different types of realistic objects viz., bird, animals, realistic human figure with application of colour shades.	1.4.36 - 1.4.46
5	Demonstrate with colour shades on different types of letters (Devanagari, roman, gothic, Text writing/ lettering.)	1.5.47 - 1.5.52
6	Plan & organize the work to make a job as per specification and applying different types of basic operation. [Basic fitting operation – marking, Chiseling, Filing, Drilling, Pipe fitting]	1.6.53 - 1.6.67
7	Manufacturing simple sheet metal items as per drawing and join them by riveting. (like- Screen frame, sign board, & hanging Paintings frame)	1.7.68 - 1.7.77
8	Execute different types of Operating System and explore the working on DTP, Corel Draw, Photo shop etc.	1.8.78 - 1.8.96
9	Produce stencils involving different shapes in ornamental design, text, symbols and operations for different medium like papers, cards, tin, foam board, observing procedure and check for accuracy.	1.9.97 - 1.9.98
10	Produce the Sign board, Name plate. Name plate back ground painting, screen printing, Observe finishing, lettering proportion & evenness	1.9.99 - 1.9.111

SYLLABUS

Duration	Reference Learning Outcome	Professional Skills (Trade Practical) with Indicative hours	Professional Knowledge (Trade Theory)
Professional Skill 126 Hrs; Professional Knowledge 27 Hrs	Make different types of sketching viz., free Hand sketching of different objects, designing of different shapes, size, geometrical shapes of different objects following safety precaution. PCS/N9431	1 Introduction of trade skills and work application. (02 hrs.)	Introduction of the Institution; rules and management (work) Process of an Institution. Knowledge about the facilities; leaves and rules and subjects an syllabus. Introduction of vocational trade, The importance of trade in the industrial Development of the nation Care in Vocational trade. (09hrs)
		2 Safety attitude development of the trainee by educating them to use personal protective equipment (PPE) and Material safety data sheet (MSDS). (05 hrs.)	
		3 First-aid method and basic training. (02 hrs.)	
		4 Safe disposal of waste materials like- cotton waste, waste paint and waste paint material etc.(02 hrs.)	
		5 Hazard and non hazard identification and avoidance. (02 hrs.)	
		6 Use of firefighting equipment, likeextinguishers, sand bucket, water etc. (10 hrs.)	
		7 Identification of safety signs, like-Danger, warning, caution and personnel safety .(01 hr)	
		8 Importance of trade training. (02 hrs.)	
		9 Understand precautions to be followed while working in the painting jobs. (02 hrs.)	
		10 Motivational talk by experts. (05 hrs.)	
		11 5S training. (02 hrs.)	
		12 Draw different sketches and hand writing practice. (11 hrs.)	
		13 Introduction and identification of tools and equipments different for cleaning and painting. (10 hrs.)	Accident and First-Aid: Cost of Accidents; Causes and effects of an accident; First-Aid in case of internal injuries; fracture; wound and electric shock. (05 hrs)
		14 Identification and there assembly and function of trade machineries. (10 hrs.)	
		15 Free hands sketching practice of different lines and strokes. (12 hrs.)	Lines- Different types of lines; its uses and specialty. Pencil-Origin of pencil and its introduction. Different types of pencils; uses and its specialty. (09 hrs)
		16 Free hands sketching practice of nature forms like- flowers, leaves, trees. (12 hrs.)	
		17 Free hands sketching practice of birds and animals. (16 hrs.)	
		18 Draw geometrical shapes and construct for design. (10 hrs.)	Colours for drawing and painting: charcoals, oil and dry pestles, water; poster; acrylic; oil colours and reducer medium. (04 hrs)
		19 Draw free hand geometrical forms in perspective. (5 hrs.)	
		20 Draw free hand different types of perspective. (5 hrs.)	
Professional Skill 42Hrs;	Ability to synthesizeof free Hand sketching of Human figures,	21Free hands sketching practice of human figures. (10hrs.)	Definition and Need of Sketching-Introduction to sketching; its benefits and

Professional Knowledge 10 Hrs	Shading, Use graph & figure enlargement. PCS/N9432	22 Black & white/ colour pencil shading of human figures (Male, female & children). (12 hrs.) 23 Graph and figure enlargement with pencil shading. (10 hrs.) 24 Draw with shading different tools and equipments of trade. (10 hrs.)	importance in our culture and traditions as well to the trainees. Human organs and their proper place; Body structures of Male and Female. (10 hrs)
Professional Skill 84 Hrs; Professional Knowledge 18 Hrs	Identify of paper, colour schemes and compose different types of colour shade Expertise in 2D design. PCS/N9433	25 Marking & Cutting different Drawing Paper as per given size. (04hrs.) 26 Draw colour wheel with poster colour. (8 hrs.) 27 Draw & Colour Design in primary, Secondary & Tertiary colours. (8hrs.) 28 Marking & Out line Drawing 2D Design. (05 hrs.) 29 Coloring 2D design in Warm & Cool Colors. (08 hrs.) 30 Make 2D design & Colour in Contrasts colours. (08 hrs.) Make colour shades: 31 Make gray scale in pencil shading (5hrs.) 32 Make gray scale in poster colour (5hrs.) 33 Make different colour scale in poster colour (09 hrs.) 34 Make 2D Design in different Composition paint in High key, middle key & low key by poster colour. (19 hrs.) 35 Colour mixing & matching Touch up on Damage posters & photographs. (5 hrs.)	Colours & colour knowledge: Definition of colour; colour blindness; tone, colour shade primary, secondary, tertiary. (07 hrs) Colour wheel, colours & Different types of colour schemes & colour harmony. (04 hrs) Brush: Different types of Brushes with shapes & sizes. Use & Care of Brushes. (07 hrs)
Professional Skill 126 Hrs; Professional Knowledge 27 Hrs	Create different types of realistic objects viz., bird, animals, realistic human figure with application of colour shades. PCS/N9434	36 Draw & colour realistic drawing of Birds. (20 hrs.) 37 Draw & colour realistic drawing of Animals. (20 hrs.) 38 Draw & colour realistic drawing of Human figure. (20hrs.) 39 Mounting & Decorate Painted Pictures. (05hrs.) 40 Draw Landscape. (05hrs.) 41 Colouring Landscape in water/poster colour. (10 hrs.) 42 Use graph on portrait picture & Enlarge outline drawing on drawing paper. (05 hrs.) 43 Water or poster colouring on enlarged drawing (10 hrs.) 44 Draw & Colour Safety or Related Trade Poster. (10 hrs.) 45 Enlarge & Sketching Cinema Posters. (05 hrs.) 46 Colouring enlarged Cinema Poster. (16 hrs.)	Drawing instruments- Drawing board; T-square; steel and wooden scale; set square; compass; Colour dish. (10 hrs) Brush- Different types of brushes with shapes and sizes. Uses and care of brush. (07hrs) Drawing paper- Types of drawing papers; its uses and care. (10hrs) Knife-Uses; different types of Putty knife; Scraper knife; hacking knife; Diamond-glazier; Gilder knife; Shave hook knife; Stencil knife; Chisel knife. (06hrs)
Professional Skill 42 Hrs;	Demonstrate with colour shades different types	47 Sketching & coloring gothic letters in English. (08 hrs.)	

Professional Knowledge 10 Hrs	L e t t e r s (Devanagari, roman, gothic, Text writing/lettering.) and apply them in appropriate place. PCS/N9435	48 Sketching & coloring gothic letters in Mother Language. (08 hrs.) 49 Sketching & coloring Roman letters. (08hrs.) 50 Do free hand boru Strokes Devnagri. (08hrs.) 51 Sketching & colouring Devnagri letters. (05hrs.) 52 Sketching & colouring Text or Italic letters. (05 hrs.)	Lettering- Description; uses of devnagri, Roman, Gothic; Italic and Text writing. Spacing - Mechanic and Optical spacing. (10hrs)
Professional Skill 84 Hrs; Professional Knowledge 18 Hrs	Plan and organize the work to make job as per specification applying different types of basic operation. [Basic fitting operation – marking, Chiselling, Filing, Drilling, Pipe fitting] PCS/N9436	<p>CARPENTER WORK:</p> <p>53 Marking Practice on wood. (06hrs.) 54 Holding & Sawing Practice different size of wood. (07 hrs.) 55 Teeth setting & sharpening of different saw. (06hrs.) 56 Tennifer Half cut on wooden border. (05 hrs.) 57 Setting of planers & sharpening on plane blade. (05 hrs.) 58 Plane on different wooden surfaces. (06hrs.) 59 Chiselling slots on thick wood. (05 hrs.) 60 Drilling on wood with different drilling tools (Gimlet, Hand Drill, Portable electrical drilling machine. (05 hrs.) 61 Identify & check different types of pipe. (05 hrs.) 62 Do pipe cutting & threading (07 hrs.) 63 Apply different types of pipe joint/ fitting of different materials & different diameter. (Use PVC pipe) (06 hrs.)</p> <p>64 Make a simple lap joint. (05 hrs.) 65 Make a simple mitred half lap joint. (05 hrs.) 66 Make a simple Dovetail joint. (05 hrs.) 67 Joint fitting with nails, screw, glue etc. (06 hrs.)</p>	Carpenter - safety precaution description, Use hand tools, carpenter tools, types of wood their description & use common defects in timber & their effects. Plumber: Instruction to the trade safety precautions and elementary first aid. Plumber hand tools description on rain water & pipe system including installation of water supply fitting. Description of different types of pipes & their use such as galvanized pipes, PVC pipes. Pipe line leakage & Maintenance. (10 hrs)
Professional Skill 84 Hrs; Professional Knowledge 18 Hrs	Manufacture simple sheet metal items as per drawing and join them by riveting. (like-Screen frame, sign board, & hanging Paintings frame) PCS/N9437	<p>SHEET METAL WORK</p> <p>68 Marking of straight lines, circles, profiles and various Geometrical shapes and cutting the sheets with snips. (10 hrs.) 69 Marking out of simple development (05 hrs.) 70 Marking out for flaps for joints (05 hrs.)</p>	Safety precautions to be observed in a sheet metal workshop, sheet and sizes, Shearing machine description, parts and uses.(05 hrs)
		<p>Make various joints</p> <p>71 Hemming, form locked, grooved and knocked up single hem straight and curved edges form double hemming. (15 hrs.)</p>	Marking and measuring tools, wing compass, Prick punch, square tools, snips, types and uses. hammers and mallets type-sheet metal tools, Soldering iron, Trammel, Stakes. (05 hrs)

		<p>72 Make cylindrical objects with joints. (10 hrs.)</p> <p>73 Make simple Square table tray with folding edge and fix handle with riveting. (12 hrs.)</p> <p>74 Make simple triangular tray with folding edge and fix handle with riveting. (08 hrs.)</p> <p>75 Make joint/ fitting for rain water (Use PVC pipe). (07 hrs.)</p> <p>76 Make joint/ fitting for water pipe line (Use GI pipe). (07 hrs.)</p> <p>77 Make joint/ fitting for water pipe line (Use PVC pipe). (05 hrs.)</p>	<p>Marking and measuring tools, wing compass, Prick punch, square tools, snips, types and uses. hammers and mallets type-sheet metal tools, Soldering iron, Trammel, Stakes. (08 hrs)</p>
<p>Professional Skill 105 Hrs; Professional Knowledge 23 Hrs</p>	<p>Execute different types of Operating System and explore the working on DTP, Corel Draw, Photo shop etc. PCS/N9438</p>	<p>78 Operate & familiarise with computer operating system. (05 hrs.)</p> <p>79 Operate paint software & draw freehand sketch & use like as colour bucket, eraser, pencil & all tools.(05 hrs.)</p> <p>80 Draw scenery like realistic in paint software (05 hrs.)</p> <p>Photoshop:</p> <p>81 Tool handling in photo shop. (05 hrs.)</p> <p>82. Familiarise with all hand. (05 hrs.)</p> <p>83 Make a different layer & create background, artistic text, design, images. (05 hrs.)</p> <p>84 Import photo image from file & scanner, edit photo image. (05hrs.)</p> <p>85 Edit Image adjustment effects. & layer style effects. (05 hrs.)</p> <p>86 Edit special effect on different layer, colours, textures, filter effects. (05 hrs.)</p> <p>87 Edit & Save image in PSD, JPEG & other format. (05 hrs.)</p> <p>88 Create a colour advertise design for festival offer. (10 hrs.)</p> <p>89 Export Design, image, photograph from Photoshop to other different format for different software's. & make a print & print file for different printers. (05 hrs.)</p>	<p>Standard pipe threads, nominal diameter, wall thickness, schedule number, die & diestock, tubing. (13 hrs)</p>

		<p>Corel Draw :</p> <p>90 Apply select /move /copy /objects, retire skew, size Objects. (05 hrs.)</p> <p>91 Apply Combine, Shape, weld, trim, Align, Group / Ungroup objects. (05 hrs.)</p> <p>92 Add text & Format text, create different heading & Sub-heading. (05 hrs.)</p> <p>93 Draw dimensionally objects, creating special effects for backgrounds & related objects. (10 hrs.)</p> <p>94 Do graphical effects to text. (05 hrs.)</p> <p>95 Creating symbols, logo, special effects. (10 hrs.)</p> <p>96 Make a flex design for marketing offers. Convert & Save to CD/DVD/ PD for final printing. (05 hrs.)</p>	<p>Drawing simple geometric objects using Corel Draw Transforming objects, Organizing objects, Working with text, Dimensioning objects Creating special effects. (10 hrs)</p>
<p>Professional Skill 21Hrs; Professional Knowledge 05 Hrs</p>	<p>Produce stencils involving different shapes in ornamental design, text, symbols etc. operations for different medium like papers, cards, tin, foam board, observing procedure and check for accuracy.</p> <p>PCS/N9439</p>	<p>97 Create ornamental designs for stencils, cut it & make a print. (10 hrs.)</p> <p>98 Draw simple sentence in different lettering, stencil cutting & stencilling. (11 hrs.)</p>	<p>Stencil -Definition and types of stencils. Uses; Care and cleaning of different types of stencils. Instruments and equipments for stencil. (05 hrs)</p>
<p>Professional Skill 126 Hrs; Professional Knowledge 26 Hrs</p>	<p>Produce Sign board, Name plate. prepare background painting, screen printing, Observe finishing, lettering proportion & evenness</p> <p>PCS/N5016 (PCS/Q5006</p>	<p>99 Make sign board with background painting. (10 hrs.)</p> <p>100 Make Figure Enlargement for sign board. (10 hrs.)</p> <p>101 Draw and painting letters & design or logo on Sign Board. (10hrs.)</p> <p>102 Paint a name plate on different material (wood/ tin/ acrylic). (10 hrs.)</p> <p>103 Make a wooden frame with bolting cloth. (10hrs.)</p> <p>104 Create Art work on tracing for screen exposing. (10 hrs.)</p>	<p>Advertisement-Sign Board, Banner, Posters, Hoardings, Wall painting, Name plate, Logo, Symbol, Monogram, Digital Flex Board.</p> <p>Graph Making & Enlargement, Need of graph for Enlargement. (08 hrs)</p> <p>Screen Printing - Types, definition and explanation. Origin and development of screen painting.</p>

		<p>105. Coating solution & expose screen with ready art work, Develop exposed screen with cold water, touch up pin holes and nonprinting area, taping around inside. (16hrs.)</p> <p>106. Use cromoline film & expose screen with ready art work, Develop exposed screen with cold water, touch up pin holes and nonprinting area, taping around inside. (15hrs.)</p>	<p>Selection of cloth, instruments, chemicals, cloth fitting, exposing.(09 hrs)</p>
		<p>107. Prepare & registration Pining work on printing table. (05 hrs.)</p> <p>108. Testing of registration with squeezing ink. (02 hrs.)</p> <p>109. Do single colour printing on selected cards/sheets. (10 hrs.)</p> <p>110. Do multi colour printing on selected cards/sheets. (20 hrs.)</p> <p>111. Decorating used screen with bleach powder or decorating solution, wash & clean. (03 hrs.)</p>	<p>Screen developing; printing and de-exposing /washing. Types of ink. (09 hrs)</p>

Organisation structure of the industrial training institute

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

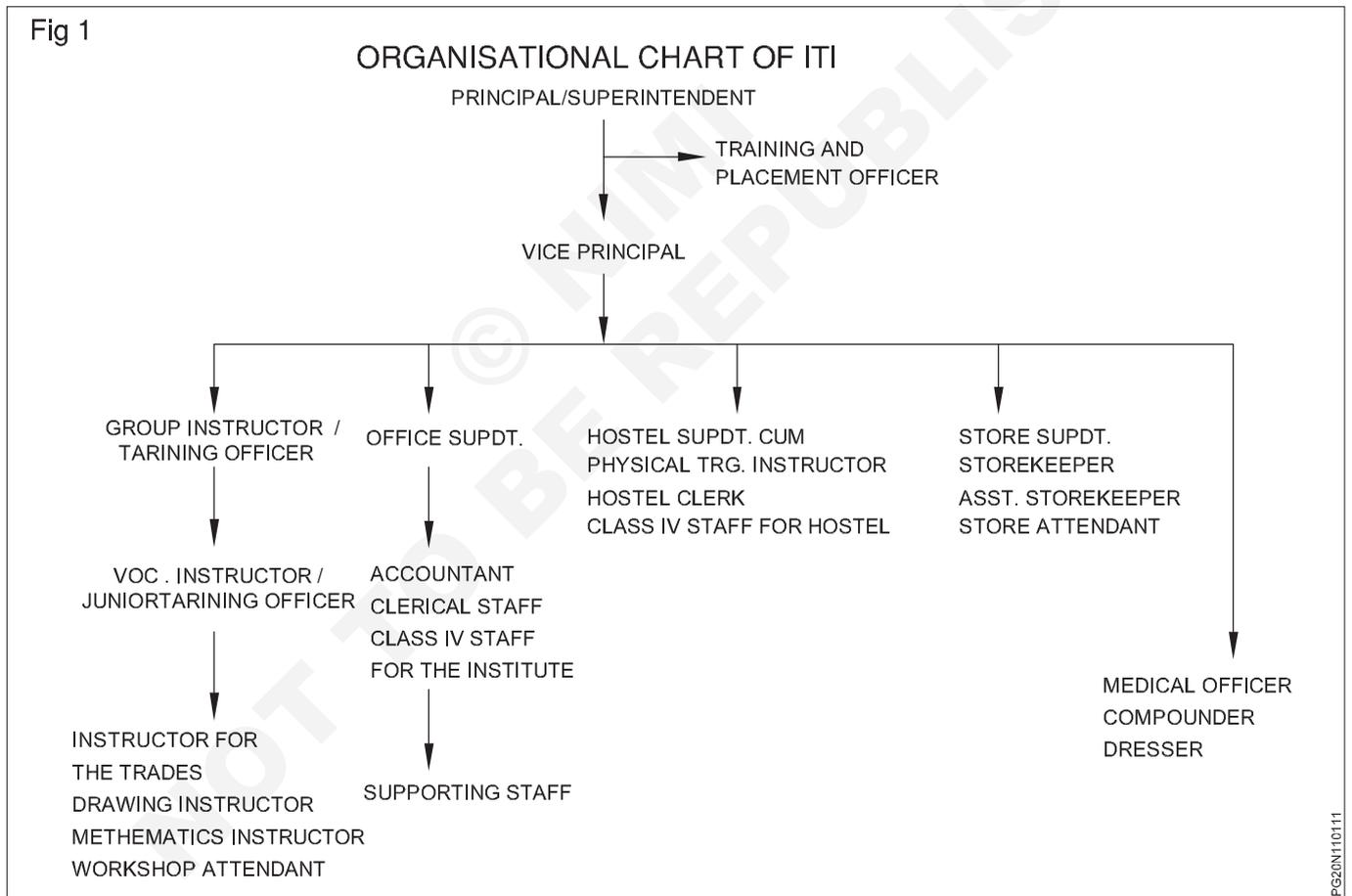
- state the organisational structure of the I.T.I.

Organisation structure of industrial training institute (ITI): Industrial training institute plays a vital role in economy of our country and in terms of providing skilled manpower for the global needs.

The directorate of training comes under ministry of skill development and entrepreneurship (MSME) offers a range of vocational training trades in different sectors based on economy / labour market. The vocational training programmes are delivered under the aegis of national council of vocational training. They are given training in various trades including engineering and non

engineering trades. The training duration is as 6 month, 1 year, 2 year. The minimum eligibility for admission in I.T.I 8th, 10th, 12th and above with respect to the trades and admission process will be held in every year in July.

The head of the industrial training institute is the principal under whom there is one vice principle accounts officer and other technical and non technical staffs are working in the organisation. The structure of organisation is as follows. (Fig 1)



Scope of the painter (General) and knowledge about the facilities in the I.T.I

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

- state the importance and scope of the painter general trade
- state the facilities in the I.T.I.

Scope of the painter (General) training

Painter (General) trade craftsman training scheme (CTS) is one of the most popular trade delivered nation wide through the network of I.T.I. This trade duration is two years.

Carrier of painter general trainees: Painter (general) trainees can join the apprenticeship training in different types of industries on completion of training DGT conduct the examination and issue the national apprenticeship certification (NAC).

Painter (general) trainees on completion of I.T.I and NAC can join with craftman instructor training scheme (CTI) to become an instructor in I.T.Is.

Job opportunities:

- Painter can join in central and state government establishments
- Employment opportunities in overseas

Self employment opportunities:

- Service centre in rural and urban areas
- General maintenance contractor
- Auto body painting shop
- Advertisement board writing and drawing
- Screen printing work
- Building wall painting work
- Paint dealership

General discipline in the institute: Always be polite, courteous while in institute

Do not arguments with others, on matters of related to your training or with the office while seeking clarifications.

Do not bring bad name to your institute by your improper habit.

Do not waste your precious time in gossips with your friends and on activities other than training.

Do not be late to the theory practical and other classes.

Do not interfere in others activities.

Attentive and listen to the lecture carefully during the theory class and practical demonstration given by the instructor.

Give respect to your trainer and all other staffs and co-trainees in your institute.

Be interested in all the training activities.

Do not make noise and play while undergoing training.

Keep the institute premises neat and clean avoid polluting the environment.

Do not take away any material from the institute which does not belongs to you.

Always attend the institute well dressed and good physical appearance.

Be regular to attend the training without fail and avoid absent from the theory or practical classes for simple reasons.

Prepare well before writing a test/examination.

Avoid any malpractice during the test/examination.

Write your theory and practical records regularly and submit them for correction

Take care of your safety as well as others safety while doing the practicals.

Time-table

Practical and theory class hours are scheduled in advance and working hours generally 8 hrs.

I.T.I working hours as per I.T.I administration timing schedule.

Facilities in I.T.I: Hostel, First aid kit, Visiting doctor canteen, sports, libraries and industrial visit, inplant training and campus interview provided by the institute.

Course content in the syllabus:

- Safety precautions
- Free hand sketching of different objects
- Designing of different shapes, sizes and different objects
- Free hand sketching of human figures, shading use graph & figure enlargement
- Compose different types of colour shade in 2D, 3D design
- Create a different types of letters and colour shading.
- Manufacture simple sheet metal and wood items
- Working with DTP, Coral draw and photo shop
- Produce sign board, Name plate, Screen printing

Safety practice

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

- state the causes for accidents in general terms
- state the safe attitudes
- list out the four basic categories of safety signs.

Causes for accidents: Normally accidents do not just happen. They are caused.

Causes for accidents are many. Some of the important causes are listed below.

- Unawareness of danger
- Disregard for safety
- Negligence
- Lack of understanding of proper safety procedures
- Untidy condition of workplace
- Inadequate light and ventilation
- Improper use of tools
- Unsafe conditions

Safe attitudes: People's attitudes govern what they do or fail to do. In most cases where someone is working with unsafe equipment or in an unsafe situation, somebody has allowed that state of affairs to come about by something they have done or failed to do.

Most accidents don't just happen; they are caused by people who (for example) damage equipment or see it is faulty but don't report it, or leave tools and equipment lying about for other people to trip over.

Responsibilities: Safety doesn't just happen - it has to be organised and achieved like the work-process of which it forms a part. The law states that both an employer and his employees have a responsibility in this behalf.

Employer's responsibilities: The effort a firm puts into planning and organising work, training the workers engaging skilled and competent workers, maintaining plant and equipment, checking, inspecting and keeping records- all of this contributes to the safety in the workplace.

The employer will be responsible for equipment provide in the working conditions and the training given on nature of work to their employees.

Employee's responsibilities: Employer will be responsible for the equipment to use as per training and follow the general attitude to safety.

A great deal is done by employers and other people to make your working life safer; but always remember you are responsible for your own actions and the effect they have on others. You must not take that responsibility lightly.

Rules and procedures at work: What you must do, by law, is often included in the various rules and procedures laid down by your employer. They may be written down, but more often than not, are just the way a firm does things - you will learn these from other workers, when you do your job. Follow the rules for issue and use of tools,

protective clothing and equipment, reporting procedures, emergency drills, access to restricted areas, and many other matters. Such rules are essential for they contribute the efficiency and safety of the job.

Safety signs: As you go about your work on a construction site you will see a variety of signs and notices. Some of these will be familiar to you - a 'no smoking' sign for example; others you may not have seen before. It is up to you to learn what they mean - and to take notice of them. They warn of the possible danger, and must not be ignored.

Safety signs fall into four separate categories. These can be recognised by their shape and colour. Sometimes they may be just a symbol; other signs may include letters or figures and provide extra information such as the clearance height of an obstacle or the safe working load of a crane.

The four basic categories of signs are as follows. (Fig.1)

- prohibition signs
- mandatory signs
- warning signs
- Information signs

Prohibition signs (Fig 1)

- Shape** - Circular.
Colour - Red border and cross bar.
Black symbol on white background.
Meaning - Shows it must not be
Example - done.
No smoking.



Mandatory signs

- Shape** - Circular.
Colour - White symbol on blue background.
Meaning - Shows what must be
Example - done.
Wear hand protection.



Warning signs

- Shape** - Triangular.
Colour - Yellow background with black border and symbol.
Meaning - Warns of hazard or
Example - danger.
Caution, risk of electric shock.



Information signs



- Shape** - Square or oblong.
Colour - White symbols on green background.
Meaning - Indicates or gives information of safety provision.
Example - First aid point.

Prohibition signs (Fig 2)



Mandatory signs (Fig 3)



Warning signs (Fig 4)

Your safety work management

Know the general safety rules that cover your place of work.

Familiar with the safety laws that cover your particular job.

Know how to do your work without causing danger to yourself, your workmates and public.

Ensure the plant, machinery and tools that are safe. and use them safely and keep them in a safe condition

Wear all the right protective clothing, and necessary safety equipment

Know all the necessary safety information about the materials used by you.

Take necessary training and instruction to do your job safely



Know who is responsible for safety at your place of work

Know the appointed 'Safety Representatives'.

- Stop the machine before changing the speed.
- Disengage the automatic feeds before switching off.
- Check the oil level before starting the machine.
- Before starting the machine, move the ram by hand to ensure that the ram or tool-handler does not strike the workpiece or table.
- Never start a machine unless all the safety guards are in position.
- Take measurements only after stopping the machine.
- Use wooden planks over the bed while loading and unloading heavy jobs.
- Do not stop the machine before the finish of the cutting stroke.

Safety is a concept, understand it.

Safety is a habit, cultivate it.

Knowledge of personal safety and general precautions observed in the shop

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

- state the personal protective equipment and its purpose
- name the two categories of personal protective equipment
- list the most common type of personal protective equipment.

Personal Protective Equipment (PPE)

Devices, equipment, clothing are used by the employees, as a last resort, to protect against hazards in the workplace. The primary approach in any safety effort is that the hazard to the workmen should be eliminated or controlled by engineering methods rather than protecting the workmen through the use of personal protective equipment (PPE). Engineering methods could include design change, substitution, ventilation, mechanical handling, automation, etc.

The Factories Act, 1948 and several other labour legislations 1996 have provisions for effective use of appropriate types of PPE.

Ways to ensure workplace safety and use personal protective equipment (PPE) effectively.

- Workers to get up-to-date safety information from the regulatory agencies that workplace safety in their specific area.
- Use all available text resources that may be in work area and for applicable safety information on how to use PPE best.
- When it comes to the most common types of personal protective equipment, like goggles, gloves or bodysuits, these items are much less effective if they are not worn at all times, or whenever a specific danger exists in a work process. Using PPE consistent will help to avoid some common kinds of industrial accidents.
- Personal protective gear is not always enough to protect workers against workplace dangers. Knowing more about the overall context of your work activity can help to fully protect from anything that might threaten health and safety on the job.

- Inspection of gear thoroughly to make sure that it has the standard of quality and adequately protect the user should be continuously carried out.

Categories of PPEs

Depending upon the nature of hazard, the PPE is broadly divided into the following two categories:

- 1 Non-respiratory: Those used for protection against injury from outside the body, i.e. for protecting the head, eye, face, hand, arm, foot, leg and other body parts
- 2 Respiratory: Those used for protection from harm due to inhalation of contaminated air.

They are to meet the applicable BIS (Bureau of Indian Standards) standards for different types of PPE.

The guidelines on 'Personal Protective Equipment' is issued to facilitate the plant management in maintaining an effective programme with respect to protection of persons against hazards, which cannot be eliminated or controlled by engineering methods listed in table 1.

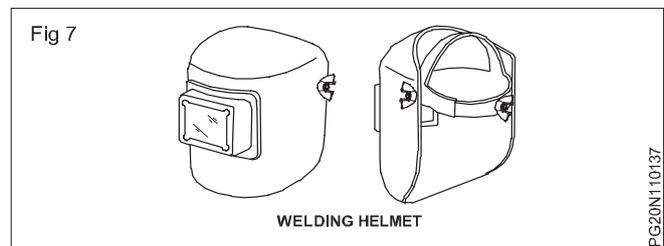
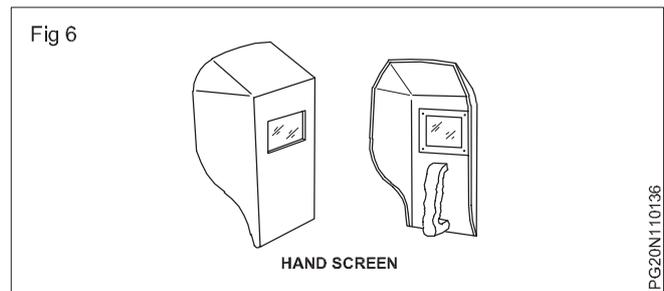
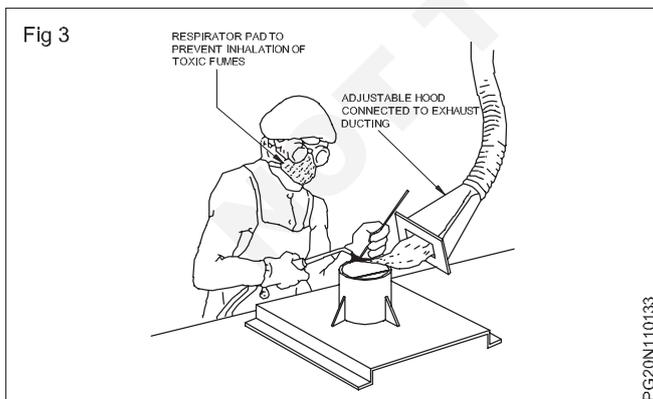
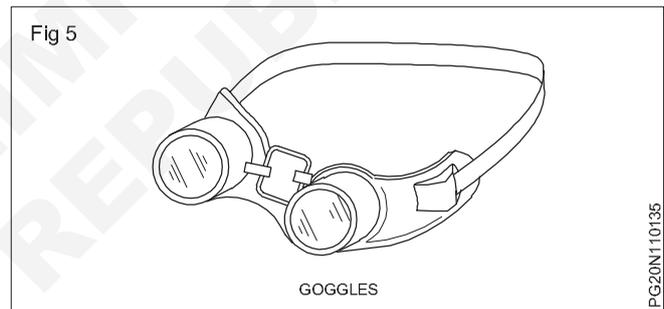
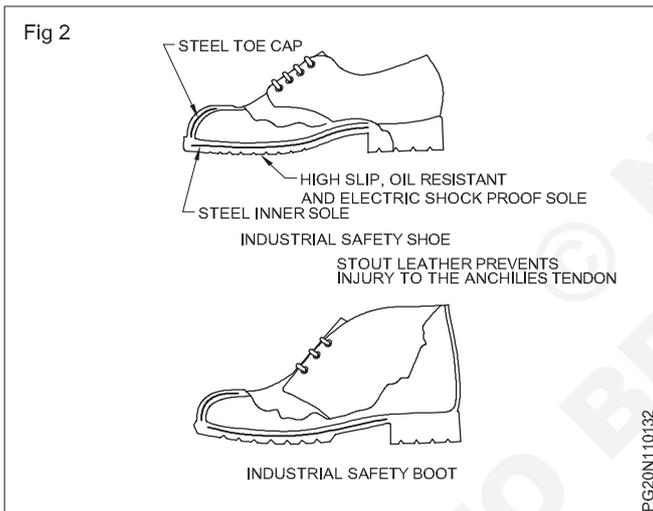
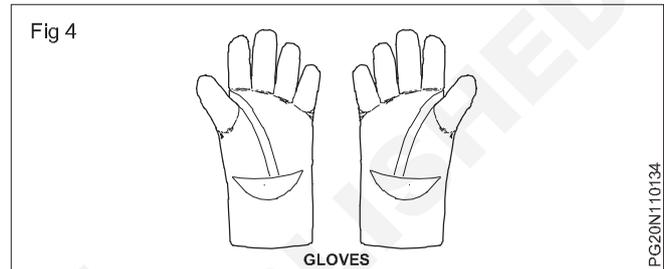
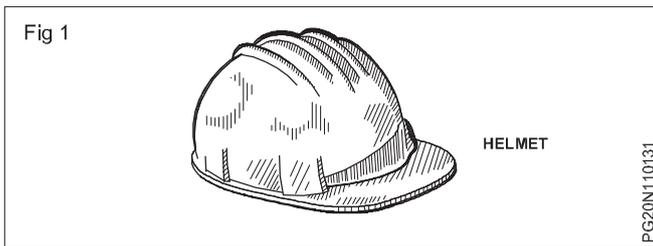
Table 1

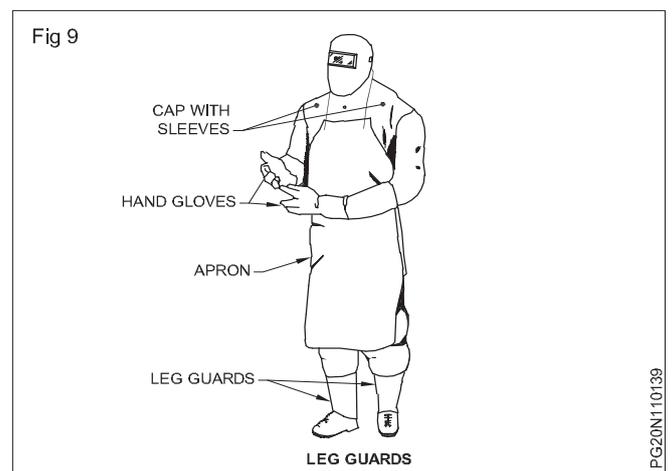
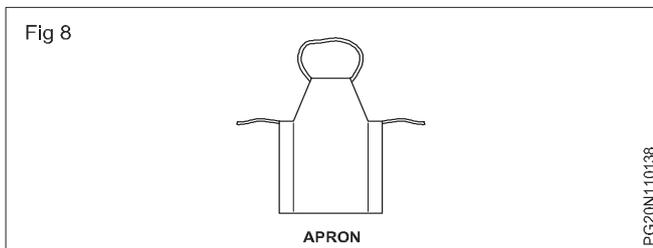
No.	Title
PPE 1	Helmet
PPE 2	Safety footwear
PPE 3	Respiratory protective equipment
PPE 4	Arms and hands protection
PPE 5	Eyes and face protection
PPE 6	Protective clothing and overall
PPE 7	Ears protection
PPE 8	Safety belt and harnesses

Common type of personal protective equipments and their uses and hazards are as follows

Types of protection	Hazards	PPE to be used
Head protection (Fig 1)	<ol style="list-style-type: none"> 1. Falling objects 2. Striking against objects 3. Spatter 	Helmets
Foot protection (Fig 2)	<ol style="list-style-type: none"> 1. Hot spatter 2. Falling objects 3. Working wet area 	Leather leg guards Safety shoes Gum boots
Nose (Fig 3)	<ol style="list-style-type: none"> 1. Dust particles 2. Fumes/ gases/ vapours 	Nose mask
Hand protection (Fig 4)	<ol style="list-style-type: none"> 1. Heat burn due to direct contact 2. Blows sparks moderate heat 3. Electric shock 	Hand gloves

Eye protection (Figs 5 & 6)	<ol style="list-style-type: none"> 1. Flying dust particles 2. UV rays, IR rays heat and High amount of visible radiation 	<p>Goggles Face shield Hand shield Head shield</p>
Face Protection (Figs 6 & 7)	<ol style="list-style-type: none"> 1. Spark generated during Welding, grinding 2. Welding spatter striking 3. Face protection from UV rays 	<p>Face shield Head shield with or without ear muff</p> <p>Helmets with welders screen for welders</p>
Ear protection	<ol style="list-style-type: none"> 1. High noise level 	<p>Ear plug Ear muff</p>
Body protection (Figs 8 & 9)	<ol style="list-style-type: none"> 1. Hot particles 	<p>Leather aprons</p>





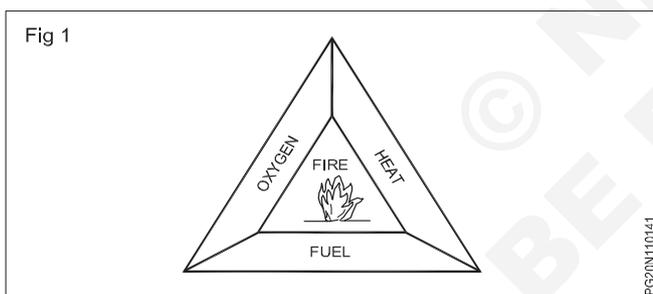
Safety practice - fire extinguishers

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

- state the effects of a fire break out
- state the causes for fire in a workshop
- state the conditions required for combustion relevant to fire prevention
- state the general precautionary measures to be taken for prevention of fire.

Fire is the burning of combustible material. It might injure people, and sometimes cause loss of life as well. Hence, every effort must be made to prevent fire.

The following are the three factors that must be present in combination for a fire to continue to burn. (Fig 1)



Fuel: Any substance, liquid, solid or gas will burn, if there is oxygen and high enough temperatures.

Heat: Every fuel will begin to burn at a certain temperature. It varies and depends on the fuel. Solids and liquids give off vapour when heated, and it is this vapour which ignites. Some liquids do not have to be heated as they give off vapour at normal room temperature say 15°C, eg. petrol.

Oxygen: Usually exists in sufficient quantity in air to keep a fire burning.

Extinguishing of fire: Isolating or removing any of these factors from the combination will extinguish the fire. There are three basic ways of achieving this.

- Starving the fire of fuel removes this element.
- Smothering - ie. isolate the fire from the supply of oxygen by blanketing it with foam, sand etc.
- Cooling - use water to lower the temperature.

Removing any one of these factors will extinguish the fire.

Preventing fires: The majority of fires begin with small outbreaks which burn unnoticed until they have a secure hold. Most fires could be prevented with more care and by following some simple common sense rules.

Accumulation of combustible refuse (cotton waste soaked with oil, scrap wood, paper, etc.) in odd corners are a fire risk. Refuse should be removed to collection points.

The cause of fire in electrical equipment is misuse or neglect. Loose connections, wrongly rated fuses, over loaded circuits cause overheating which may in turn lead to a fire. Damage to insulation between conductors in cables causes fire.

Clothing and anything else which might catch fire should be kept well away from heaters. Make sure that the heater is shut off at the end of the working day.

Highly flammable liquids and petroleum mixtures (thinner, adhesive solutions, solvents, kerosene, spirit, LPG gas etc.) should be stored in the flammable material storage area.

Blowlamps and torches must not be left burning when they are not in use.

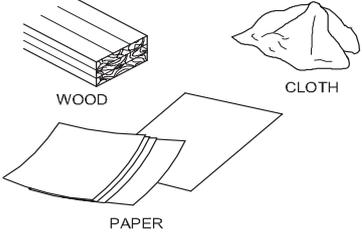
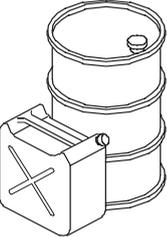
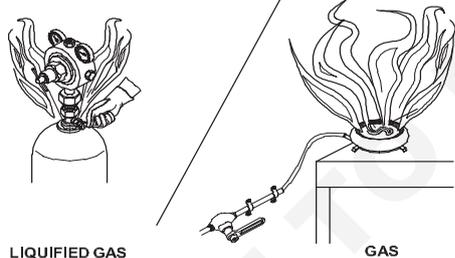
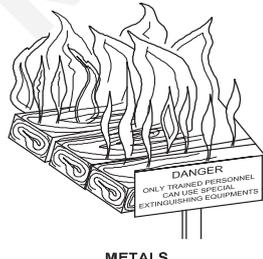
Extinguishing fires: Fires are classified into four types in terms of the nature of fuel. (Figs 2,3,4 & 5)

Different types of fire have to be dealt with in different ways and with different extinguishing agents.

An extinguishing agent is the material or substance used to put out the fire, and is usually (but not always) contained in a fire extinguisher with a release mechanism for spraying into the fire.

It is important to know the right type of agent for extinguishing a particular type of fire; using a wrong agent can make things worse. There is no classification

for 'electrical fires' as such, since these are only fires in materials where electricity is present.

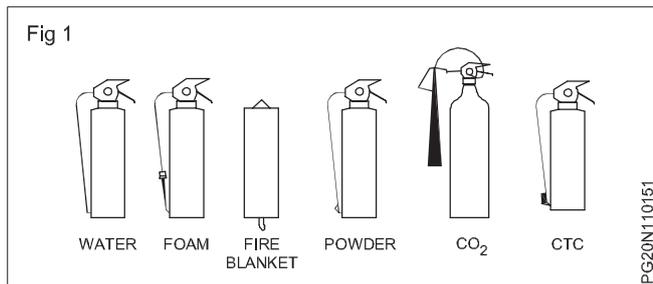
Fuel	Extinguishing
<p>Fig 2</p> <p>CLASS 'A' FIRE</p>  <p>WOOD CLOTH PAPER</p> <p>PG20N110142</p>	<p>Most effective ie. cooling with water. Jets of water should be sprayed on the base of the fire and then gradually upwards.</p>
<p>Fig 3</p> <p>CLASS 'B' FIRE</p>  <p>FLAMMABLE LIQUIDS AND LIQUIFIABLE SOLIDS</p> <p>PG20N110143</p>	<p>Should be smothered. The aim is to cover the entire surface of the burning liquid. This has the effect of cutting off the supply of oxygen to the fire.</p> <p>Water should never be used on burning liquids.</p> <p>Foam, dry powder or CO2 may be used on this type of fire.</p>
<p>Fig 4</p> <p>CLASS 'C' FIRE</p>  <p>LIQUIFIED GAS GAS</p> <p>PG20N110144</p>	<p>Extreme caution is necessary in dealing with liquefied gases. There is a risk of explosion and sudden outbreak of fire in the entire vicinity. If an appliance fed from a cylinder catches fire - shut off the supply of gas. The safest course is to raise an alarm and leave the fire to be dealt with by trained personnel.</p> <p>Dry powder extinguishers are used on this type of fire.</p> <p>Special powders have now been developed which are capable of controlling and/or extinguishing this type of fire.</p>
<p>Fig 5</p> <p>CLASS 'D' FIRE</p>  <p>METALS</p> <p>PG20N110145</p>	<p>The standard range of fire extinguishing agents is inadequate or dangerous when dealing with metal fires.</p> <p>Fire on electrical equipment.</p> <p>Halon, Carbon dioxide, dry powder and vapourising liquid (CTC) extinguishers can be used to deal with fires in electrical equipment.</p> <p>Foam or liquid (eg. water) extinguishers must not be used on electrical equipment under any circumstances.</p>

Types of fire extinguishers

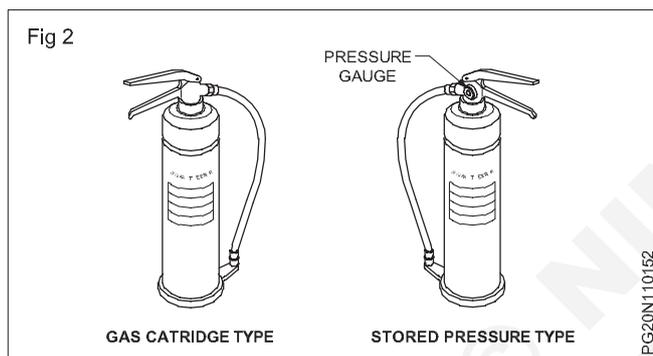
Objectives: At the end of this lesson you shall be able to

- distinguish different types of fire extinguishers
- determine the correct type of fire extinguisher to be used based on the class of fire
- describe the general procedure to be adopted in the event of a fire.

Many types of fire extinguishers are available with different extinguishing 'agents' to deal with different classes of fires. (Fig 1)



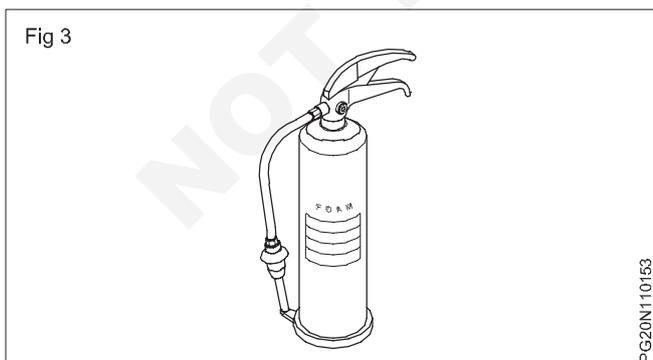
Water-filled extinguishers: There are two methods of operation. (Fig 2)



- Gas cartridge type
- Stored pressure type

With both methods of operation the discharge can be interrupted as required, conserving the contents and preventing unnecessary water damage.

Foam extinguishers (Fig 3): These may be of stored pressure or gas cartridge types. Always check the operating instructions on the extinguisher before use.



Most suitable for

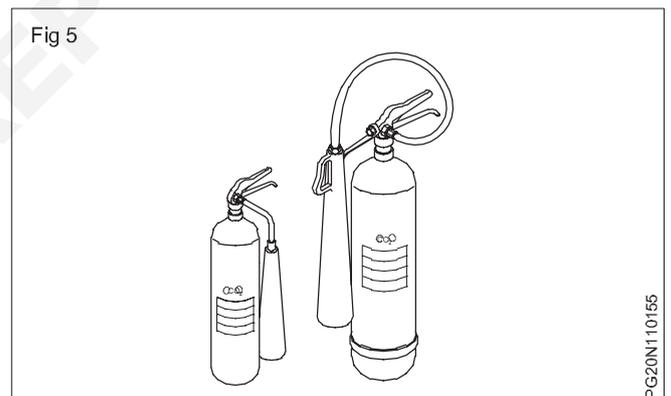
- flammable liquid fires
- running liquid fires.

Must not be used on fires where electrical equipment is involved.

Dry powder extinguishers (Fig 4): Extinguishers fitted with dry powder may be of the gas cartridge or stored pressure type. Appearance and method of operation is the same as that of the water-filled one. The main distinguishing feature is the fork shaped nozzle. Powders have been developed to deal with class D fires.



Carbon dioxide (CO₂): This type is easily distinguished by the distinctively shaped discharge horn. (Fig 5).



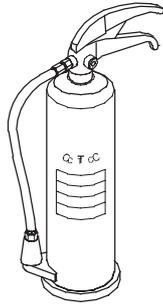
Suitable for Class B fires. Best suited where contamination by deposits must be avoided. Not generally effective in open air.

Always check the operating instructions on the container before use. Available with different gadgets of operation such as - plunger, lever, trigger etc.

Halon extinguishers (Fig 6): These extinguishers may be filled with carbon-tetrachloride and Bromochlorodifluoro methane (BCF). They may be either gas cartridge or stored pressure type.

They are more effective in extinguishing small fires involving pouring liquids. These extinguishers are particularly suitable and safe to use on electrical equipment as the chemicals are electrically non-conductive.

Fig 6



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The fumes given off by these extinguishers are dangerous, especially in confined space.

The general procedure in the event of a fire

- Raise an alarm.
- Turn off all machinery and power (gas and electricity).
- Close the doors and windows, but do not lock or bolt them. This will limit the oxygen fed to the fire and prevent its spreading.
- Try to deal with the fire if you can do so safely. Do not risk getting trapped.
- Anybody not involved in fighting the fire should leave calmly using the emergency exits and go to the designated assembly point. Failure to do this may mean that some person being unaccounted for and others may have to put themselves to the trouble of searching for him or her at risk to themselves.

Elementary first-aid

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

- define first aid
- list out the first aid key points
- describe the ABC of first aid.
- determine the responsiveness.

First aid is defined as the immediate care and support given to an acutely injured or ill person, primarily to save life,

First aid procedure often consists of simple and basic life saving techniques that an individual performs with proper training and knowledge.

The key aims of first aid can be summarized in three key points:

- **Preserve life:** If the patient was breathing, a first aider would normally place them in the recovery position, with the patient learnt over on their side, which also has the effect of clearing the tongue from the pharynx. The first aider will be taught to deal with this through a combination of 'back slaps' and 'abdominal thrusts'. Once the airway has been opened, the first aider would assess to see if the patient is breathing.
- **Prevent further harm:** Also sometimes called prevent the condition from worsening, or danger of further injury, this covers both external factors, such as moving a patient away from any cause of harm, and applying first aid techniques to prevent worsening of the condition, such as applying pressure to stop a bleed becoming dangerous.
- **Promote recovery:** First aid also involves trying to start the recovery process from the illness or injury, and in some cases might involve completing a treatment, such as in the case of applying a plaster to a small wound.

ABC of first aid

ABC stands for airway, breathing and circulation.

- **Airway:** Attention must first be brought to the airway to ensure it is clear. Obstruction (choking) is a life-threatening emergency.

- **Breathing:** Breathing if stops, the victim may die soon. Hence means of providing support for breathing is an important next steps. There are several methods practiced in first aid.

- **Circulation:** Blood circulation is vital to keep person alive. The first aiders now trained to go straight to chest compressions through CPR methods.

When providing first aid one needs to follow some rule. There are certain basic norms in teaching and training students in the approach and administration of first aid to sick and injured.

Important guideline for first aiders

Evaluate the situation

Are there things that might put the first aider at risk. When faced with accidents like fire, toxic smoke, gasses, an unstable building, live electrical wires or other dangerous scenario, the first aider should be very careful not to rush into a situation, which may prove to be fatal.

Avoid moving the victim

Avoid moving the victim unless they are immediate danger. Moving a victim will often make injuries worse, especially in the case of spinal cord injuries.

Call emergency services

Call for help or tell someone else to call for help as soon as possible. If alone at the accident scene, try to establish breathing before calling for help, and do not leave the victim alone unattended.

Determine responsiveness

If a person is unconscious, try to rouse them by gently shaking and speaking to them.

If the person remains unresponsive, carefully roll them on the side (recovery position) and open his airway.

- Keep head and neck aligned.
- Carefully roll them onto their back while holding his head.

First aid

- Call EMERGENCY number.
- Check the person's airway, breathing, and pulse frequently. If necessary, begin rescue breathing and CPR.
- If the person is breathing and lying on the back and after ruling out spinal injury, carefully roll the person onto the side, preferably left side. Bend the top leg so both hip and knee are at right angles. Gently tilt the head back to keep the airway open. If breathing or pulse stops at any time, roll the person on to his back and begin CPR.

- If there is a spinal injury, the victim's position may have to be carefully assessed. If the person vomits, roll the entire body at one time to the side. Support the neck and back to keep the head and body in the same position while you roll.
- Keep the person warm until medical help arrives.
- If you see a person fainting, try to prevent a fall, lay the person flat on the floor and raise the level of feet above and support.
- If fainting is likely due to low blood sugar, give the person something sweet to eat or drink when they become conscious.

Do not

- Do not give an unconscious person any food or drink.
- Do not leave the person alone.
- Do not place a pillow under the head of an unconscious person.
- Do not slap an unconscious person's face or splash water on the face to try to revive him.

Electrical safety tips

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

- rescue a person who is in contact with a live wire
- treat a person for electric shock/injury.

The severity of an electric shock will depend on the level of current which passes through the body and the length of time of contact. Do not delay, act at once. Make sure that the electric current has been disconnected.

If the casualty is still in contact with the supply - break the contact either by switching off the power, removing the plug or wrenching the cable free. If not, stand on some insulating material such as dry wood, rubber or plastic, or using whatever is at hand to insulate yourself and break the contact by pushing or pulling the person free. (Figs 1 & 2)

In bare foot, do not touch the victim with your bare hands until the circuit is made dead or moved away from the equipment.

If the victim is aloft, measures must be taken to prevent him from falling or at least make him fall safe.

Electric burns on the victim may not cover a big area but may be deep seated. All you can do is to cover the area with a clean, sterile dressing and treat for shock. Get expert help as quickly as possible.

If the victim is unconscious but is breathing, loosen the clothing about the neck, chest and waist and place the casualty in the recovery position. (Fig 3)

Keep a constant check on the breathing and pulse rate.

Keep the casualty warm and comfortable. (Fig 4)

Send for help.

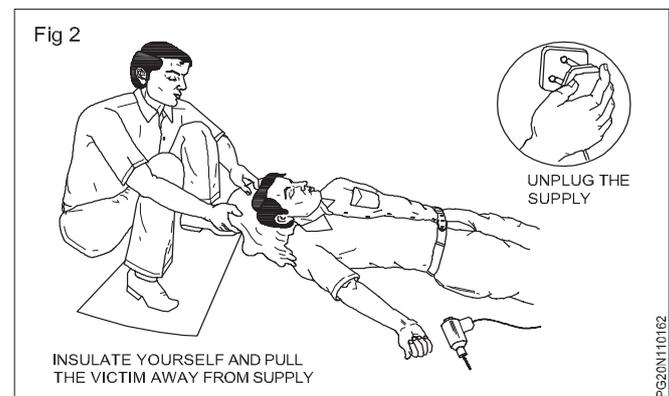


Fig 4



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Do not give an unconscious person anything by mouth.

Do not leave an unconscious person unattended

If the casualty is not breathing - Act at once - don't waste time!

Safety practice first - aid

Electric shock: The severity of an electric shock will depend on the level of the current which passes through the body and the length of time of the contact.

Other factors that contribute to the severity of shock are:

- Age of the person
- Not wearing insulating footwear or wearing wet foot wear
- Weather condition
- Floor is wet or dry
- Mains voltage etc.

Effects of electric shock: The effect of current at very low levels may only be an unpleasant tingling sensation, but this in itself may be sufficient to cause one to lose his balance and fall.

At higher levels of current, the person receiving the shock may be thrown off his feet and will experience severe pain, and possibly minor burns at the point of contact.

At an excessive level of current flow, the muscles may contract and the person unable to release his grip on the conductor. He becomes conscious and the muscles of the heart may contract spasmodically (fibrillation). This may be fatal.

Electric shock can also cause burning of the skin at the point of contact.

Treatment of electric shock

Prompt treatment is essential.

If assistance is close at hand, send for medical aid, then carry on with emergency treatment.

If you are alone, proceed with treatment at once.

Switch off the current, if this can be done without undue delay. Otherwise, remove the victim from contact with the live conductor, using dry non-conducting materials such as a wooden bar, rope, a scarf, the victim's coat-tails,

any dry article of clothing, a belt, rolled-up newspaper, non-metallic hose, PVC tubing, bakelised paper, tube etc. (Fig 5)

Fig 5



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Avoid direct contact with the victim. Wrap your hands in dry material if rubber gloves are not available.

Electrical burns: A person receiving an electric shock may also sustain burns when the current passes through his body. Do not waste time by applying first aid to the burns until breathing has been restored and the patient can breathe normally - unaided.

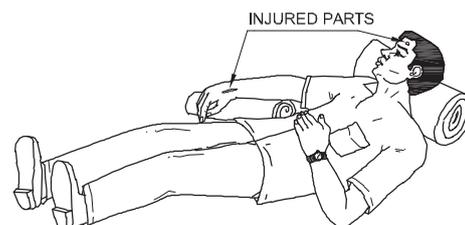
Burns and scalds: Burns are very painful. If a large area of the body is burnt, give no treatment, except to exclude the air, eg. by covering with water, clean paper, or a clean shirt. This relieves the pain.

Severe bleeding: Any wound which is bleeding profusely, especially in the wrist, hand or fingers must be considered serious and must receive professional attention. As an immediate first aid measure, pressure on the wound itself is the best means of stopping the bleeding and avoiding infection.

Immediate action: Always in cases of severe bleeding

- Make the patient lie down and rest
- If possible, raise the injured part above the level of the body (Fig 6)

Fig 6

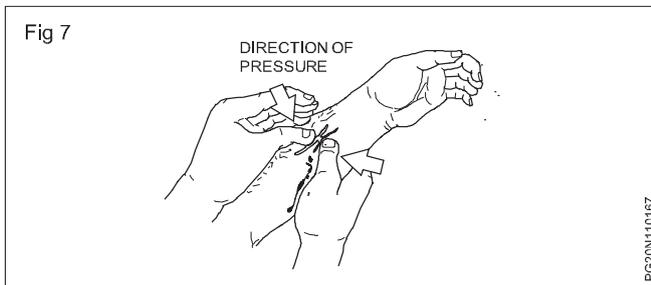


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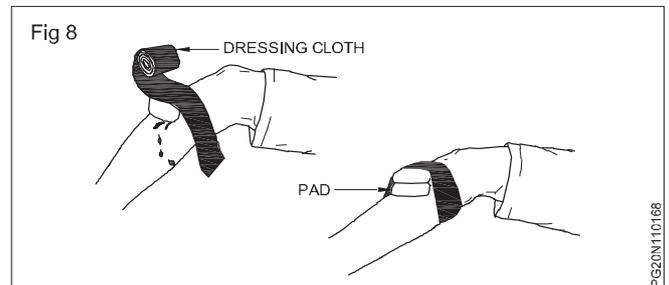
- Apply pressure to the wound
- Summon assistance.

To control severe bleeding: Squeeze together the sides of the wound. Apply pressure as long as it is necessary to stop the bleeding. When the bleeding has stopped, put a dressing over the wound, and cover it with a pad of soft material. (Fig 7)

For an abdominal stab wound, such as may be caused by falling on a sharp tool, keep the patient bending over the wound to stop internal bleeding.



Large wound: Apply a clean pad (preferably an individual dressing) and bandage firmly in place. If bleeding is very severe apply more than one dressing. (Fig 8)



Follow the right methods of artificial respiration.

Safe disposal of toxic dust

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

- list the waste material in paint shop
- explain the methods of disposal of waste material.

Introduction: The paint shop produces paint fumes containing air fog gasses which are harmful to human health. Hence a systematic and scientifically designed methods are adopted for safe disposal of such toxic dust.

Dust from paint removing and cleaning to be flown into the air since dust floating in the air for many hours may cause harm to people who breath unknowingly when used compressed air jet to clean the paint dust confirming the PPE to safety regulation & policies. This includes over-all coat, face mask, safety goggles for ayes, ear plug for ear protection, rubber gloves of barrier cream for hand and valved respirator for breathing.

Don't use compressed air to clean dust from various paint removed component of sign boards. Solvent used for cleaning can also form a toxic waste wash work cloths separately from other cloths so that toxic dust does not get transfer to other cloth paint shop waste water must be caught in a sledge pit and not into the storm water drain. Vacuum cleaner is a best device control toxic waste. Providing high speed exhaust ventilation can solve toxic dust used paint can not re-used and stored in a separate container and stored with unique identification waste cotton and paints stored in separate container, labled on container.

Concept of house keeping & 5 'S' method

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

- elements of house keeping and cleanliness at work place
- state the concept of 5'S' techniques.

Concept of house keeping: House keeping is the systematic process of making home/work place neat and clean. House keeper is responsible for systematic administration of activities that provide segregation, storage, transfer, processing treatment and disposal of solid waste (which is collected during cleaning)

Scope of house keeping maintenance: The scope of work hieghly depend on where the house keeping activity is performed in general, maintains cleanliness and orderliness, Furnishes the room, office, workplace, house keeping supervisor assisted by an assistant house keeper.

- Eye appeal
- Safety
- Maintenance

Elements of housekeeping and cleanliness at workplace: The major elements which are normally included in the housekeeping and cleanliness practices at the workplace are described below.

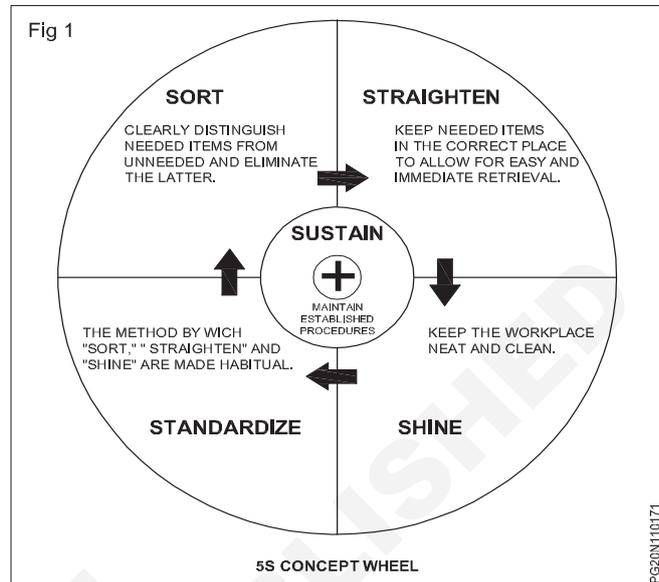
- **Dust and dirt removal:** Working in dusty and dirty area is unhygienic as well as unhealthy for the employees, regular sweeping the workplace for the removal of dust and dirt is an essential housekeeping and cleanliness practice. Further, compressed air is not to be used for removing dust or dirt off employees or equipment. Compressed air can caused dirt and dust particles to be embedded under the skin or in the eye.
- **Employees facilities:** Adequate employees facilities such as drinking water, wash rooms, toilet blocks, and rest rooms are to be provided for the employees at the workplace so that employees can use them when there is a need. Cleanliness at the place of these facilities is an important aspect of the facilities.
- **Flooring:** Floors are to be cleaned regularly and immediately if liquids or other materials are spilled. Poor floor conditions are a leading cause of accidents in the workplace. It is also important to replace worn, ripped or damaged flooring that poses a trip hazard.

- **Lighting:** Adequate lighting reduces the potential for accidents. It is to be ensured that inoperative light fixtures are repaired and dirty light fixtures are cleaned regularly so that the light intensity levels are maintained at the workplace.
- **Aisles and stairways:** Aisles and stairways are to be kept clear and not to be used for storage. It is also important to maintain adequate lighting in stairways. Further stairways need to have railings preferably round railings for adequate grip.
- **Spill control:** The best method to control spills is to prevent them from happening. Regular cleaning and maintenance on machines and equipment is an essential practice. When cleaning a spill, it is required to use the proper cleaning agents or absorbent materials. It is also to be ensured that the waste products are disposed of properly.
- **Waste disposal:** The regular collection of the waste materials contribute to good housekeeping and cleanliness practices. Placing containers for wastes near the place where the waste is produced encourages orderly waste disposal and makes collection easier. All recyclable wastes after their collection are to be transferred to their designated places so that the waste materials can be dispatched to the point of use or sold.
- **Tools and equipment:** Tools and equipment are required to be inspected prior to their use. Damaged or worn tools are to be taken out of service immediately. Tools are to be cleaned and returned to their storage place after use.
- **Maintenance:** One of the most important elements of good housekeeping and cleanliness practices is the maintenance of the equipment and the buildings housing them. This means keeping buildings, equipment and machinery in safe and efficient working condition. When a workplace looks neglected means there are broken windows, defective plumbing, broken floor surfaces and dirty walls etc. These conditions can cause accidents and affect work practices.
- **Storage:** Proper storage of materials is essential in a good housekeeping and cleanliness practice. All storage areas need to be clearly marked. Also it is important that all containers be labeled properly. If materials are being stored correctly, then the incidents of strain injuries, chemical exposures and fires get reduced drastically.
- **Clutter control:** Cluttered workplaces typically happen because of poor housekeeping practices. This type of workplace can lead to a number of issues which include ergonomic as well as injuries. It is important to develop practices where items like tools, chemicals, cords, and containers are returned to their appropriate storage location when not in use.
- **Individual workspace:** Individual workspace need to be kept neat, cleared of everything not needed for

work. It is necessary to make a checklist which is to be used by the employees to evaluate their workspace.

It can be said that a clean work area demonstrate the pride employees have with the job and the culture of safety at the workplace.

5 Steps (5s) - Concept (Fig 1)



5s is a people-oriented and practice-oriented approach. 5s expects every one to participate in it. It becomes a basic for continuous improvement in the organisation.

The terms (5s) 5 steps are

- Step 1:** SEIRI (Sorting out)
- Step 2:** SEITON (Systematic arrangement)
- Step 3:** SEISO (Shine cleanliness)
- Step 4:** SEIKTSU (Standardization)
- Step 5:** SHITSURE (Self discipline)

Fig 1 shows the 5s concept wheel.

The list describes how to organize a work space for efficiency and effectiveness by identifying and storing the items used, maintaining the area and items and sustaining the new order.

Benefits of 5s

- Work place becomes clear and better organised.
- Working in workplace becomes easier.
- Reduction in cost.
- People tend to be more disciplined.
- Delay is avoided.
- Less absenteeism.
- Better use of floor space.
- Less accidents.
- High productivity with quality etc.

Lines and stroke

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

- state the about various types of lines
- state the different kinds of lines
- state the lines and its symbolic meanings
- make a list of the lines
- describe the various types of strokes.

Lines: Line is the most important and basic part of painting line is defined as when many number of points meet and form an object. These lines represent the two dimensional and three dimensional objects, sculpture and architecture and these lines find an important place to form and definite object.

The lines can be drawn by using pencil, brush and have a form, beauty and each lines creates a different meaning or emotion during the primeval period the people created language using the lines and in the their caves made pictures of human beings, animals and explained their thought through line of art and we can see them in Ajanta caves which are arched and rhythmical.

When we of paintings of the ajunta, rushal and rajput style we understand the importance of lines in indian painting and creativity of artist language in line.

Lines are different types horizontal lines, emission lines, angular lines, flame phate lines, dual type lines, periodic lines, dashed lines, terminal lines, spot lines, chart lines, circular lines etc.

A line connects two points. It is also made by moving point. Lines can be thick or thin. They can be long or short. They can be vertical, horozontal, or diagonal. They can be solid or dotted or dashed. Lines can be curved or straight of combinations of both lines can be literal or implied. Draw a series of 3,4,5 points.

Each line represented and gives it unique characteristics. Thick lines convey a different meaning than thin lines. A curved lines send a different massage than a sharp straight line.

Elements of lines

Length: Before you start drawing and objects, you have to determine the length of the lines, depending on the one objects you want to draw and the message you wish to convey. For instance, a long line is used to reptall, strong, or distant object while a short line depicts small, cute and close.

Width: The width of lines determines the type of message convey with painting. Normally, the two main types of width: thin and thick. A thin line indecates a delicate, slim, and light weight object, thick line represents the strength, weight, and power of the object.

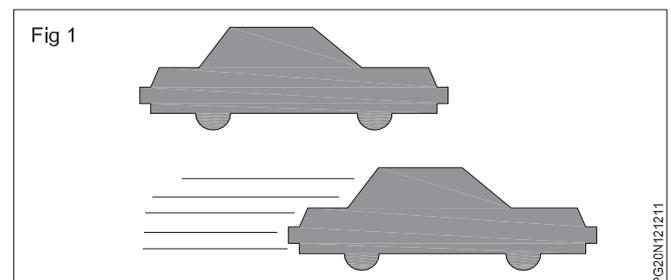
Weight: In art, the weight of a line means the continuous change of width. When an object is in front of another.

Texture: The texture of a line is meant to define its smoothness or roughness. To vary the texture of your lines simply change your working medium. For instance, if you are using a marker, replace it with charcoal, also vary a line's texture by changing your digital brushes.

Style: The most common styles of lines in the art include continuous, dashed, dotted, and implied lines. Colour and implied lines help to direct the eyes of the viewer to what you want them to see in the painting dotted and dashed lines are good for patterns, calling for attention and energy.

Types of lines: There are several types of lines defined by their use.

- **Contour lines** are used to define edges. They create boundaries around or inside an object. Most lines you encounter are contour lines. In web design these could be the borders you add around an object or group of objects.
- **Dividing lines** can also define edges, but what distinguishes them from contour lines is they divide space. The lines between columns of text are dividing lines as are the lines separating menu items.
- **Decoration lines** are used to embellish an object. Cross-hatching is an example of using decoration lines to add shading and form to an object. The line beneath liked text is a decorative lines as are the lines used to create a floral background image.
- **Gesture lines** are quick and rough continuous lines used to capture form and movement. They are generally used when studying the shape and motion of the human form. You likely won't use gesture lines (based on the technical definition) in a web design, but you could certainly create patterns of lines to signify motion or build up a form. (Fig 1)



The meaning of different kinds of lines: As mentioned above there are a lot of different ways to describe a given line and each gives a line unique characteristics.

Thin lines are fragile. They appear easy to break or knock over. They suggest frailty and convey an elegant quality. They are delicate and give off an ephemeral air.

Thick lines on the other hand appear difficult to break. They suggest strength and give emphasis to nearby elements. Thick lines are bold and make a statement.

Horizontal lines are parallel to the horizon (hence the name). They look like they're lying down at rest, asleep. They suggest calm and quiet, a relaxed comfort.

Horizontal lines can't fall over. They accentuate width. They're stable and secure. They convey an absence of conflict, a restful peace. Horizontal lines by their connection to the horizon are associated with earthbound things and ideas. (Fig 2)

Vertical lines are perpendicular to the horizon. They are filled with potential energy that could be released if they were to fall over. Vertical lines are strong and rigid. They can suggest stability, especially when thicker. Vertical lines accentuate height and convey a lack of movement, which is usually seen as horizontal. (Fig 2)

They stretch from the earth to the heavens and are often connected with religious feelings. Their tallness and formality may give the impression of dignity.

Diagonal lines are unbalanced. They are filled with restless and uncontrolled energy. They can appear to be either rising or falling and convey action and motion. Their kinetic energy and apparent movement create tension and excitement. Diagonal lines are more dramatic than either horizontal or vertical lines. (Fig 2)

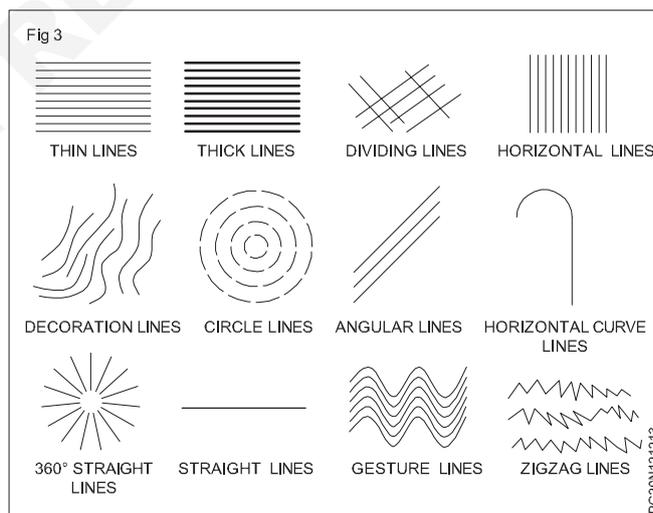
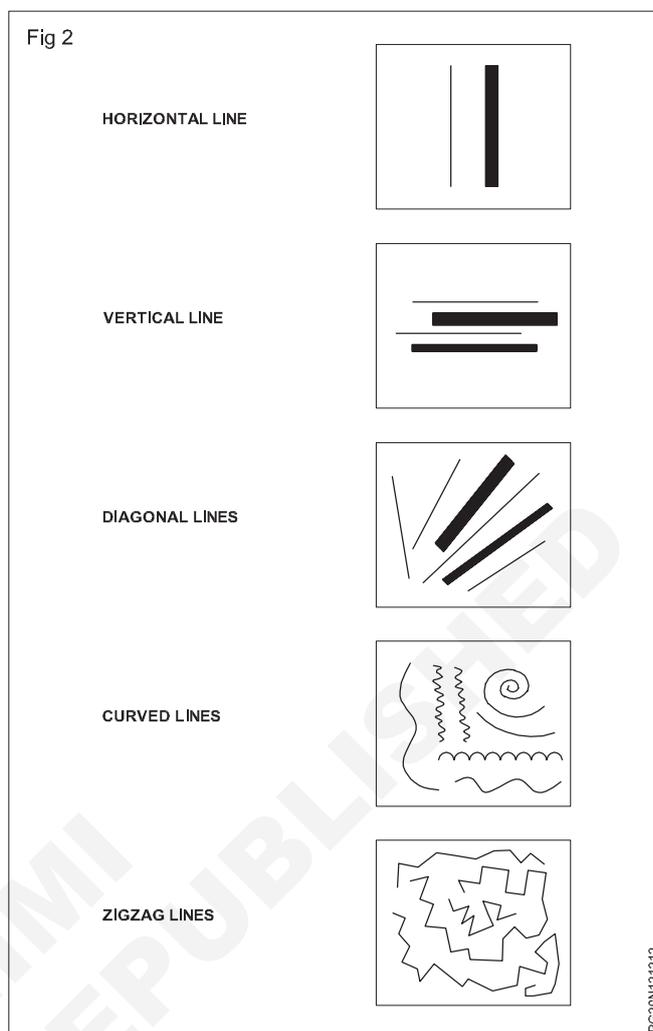
Diagonal lines can also appear solid and unmoving if they are holding something up or at rest against a vertical line or plane. (Fig 2)

Curved lines are softer than straight lines. They sweep and turn gracefully between end points. They are less definite and predictable than straight lines. They bend, they change direction. Curved lines express fluid movement. They can be more dynamic depending on how much they curve. The less active the curve the calmer the feeling. (Fig 2)

Zigzag lines are a combination of diagonal lines that connect at points. They take on the dynamic and high energy characteristics of diagonal lines. They create excitement and intense movement. They convey confusion and nervousness as they change direction quickly and frequently. They can imply danger and destruction as they break down. (Fig 2)

Types of line (Fig 3)

Line of Art: Sketching line diagram is drawn by pencil or by different coloured lines. It is normally done by single colour.



Contours: Shade and texture are included in it. Apart from lines colouring materials and dots are used in line art realistic.

Before the invention of photography and halftones, line art was the only format available to illustrate in print publications. This type of illustration used black ink on white paper. It also included stippling hatching, and at times shades of gray could be replicated. Even today, a line is one of the most fundamental elements of art.

A line has many functions in art but the most important one is the indication of the edges of 2-dimensional

shape or 3-dimensional form. A 2-dimensional shape is normally shown by way of an outline while dimensional is shown through contour lines.

But although this type of art is usually monochromatic, nothing stops you from having lines of different colours. Line art focuses on form and drawings of several constant widths (technical illustrations), caricature, cartoon, and ideograph.

As an artist, it is important to know how to use different lines in your work because everything begins with a dot and then develops into different lines.

Line variation: The artist used the free hand and geometrical lines to express different emotions like, sadness, happiness, anger, fierceness, tenderness, nobility, speed, struggle, explode, peace, fear, war, youth, enthusiasm etc.

Each line has got its importance and admiration in art. Developing a visual grammar use of different types of lines in art and when to use them.

Length in lines can be long (far) or short (small, cute, close).

Width in lines goes from thin (delicate, slim, lightweight) to thick (strength, weight, power).

Weight in lines means the continuous change of width. By varying the weight, one can capture energy, movement, and even suggest when one object is in front of the other.

Texture in lines defines how smooth or rough it is. Varying it can simply mean changing your working medium (for example, going from marker to charcoal or changing your digital brush).

Style of lines refers to continuous, dotted, dashed, or implied lines. Continuous or implied lines are great for leading the eye of the viewer in the direction you want them to go. Dashed or dotted lines are great for patterns, energy, and calling for attention.

Painting strokes: The configuration given to paint by contact with the bristles of a brush, also the paint left on the surface by a single application of a brush or palette knife, often used figuratively to describe the quality especially of a narrative or description, a story told in broad brush strokes. There are five strokes in art.

- Gradient blending, wet into wet, optical mixing, stumbling and smudging.

Paint strokes:

- Glazing strokes - Smooth strokes
- Flowing strokes - Parallel strokes
- Scumbling strokes - Vertical strokes
- Semicircular strokes

Brush strokes: The basic brush strokes used by writers.

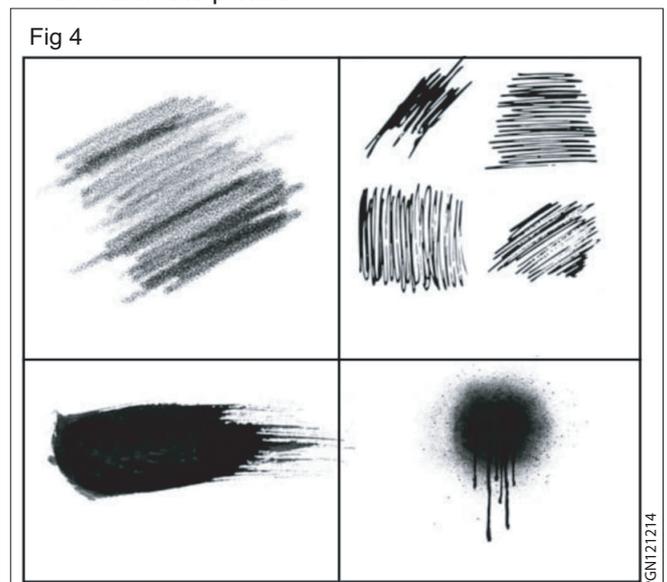
- 1 The appositive
- 2 The participle,

- 3 The absolute
- 4 Adjective shifted out of order
- 5 Action verbs
 - 1 Horizontal line - mode, peace, calmness
 - 2 Vertical line - steady, piagnity
 - 3 Slant line - stir, speed, composition, enthosiasim
 - 4 Rhythme line - enthusiasm, lazy
 - 5 Rhythmic curved line - happiness, mouth, pentiness
 - 6 Intersecting lines- enthusiasm, toxic
 - 7 Penetrating line - war, struggle reject
 - 8 Thin lines - tenderness, wear
 - 9 Thick lines - energy, equilibrium
 - 10 Circle lines - improve, enthusiasm
 - 11 Emission lines - solidarity, scope
 - 12 Analem line - learness, importance, wrong, deviot etc.
 - 13 Flame type lines - ambition
 - 14 Dual type line - grow, impulsiveness, idealists
 - 15 Terminal line - anxiety
 - 16 Dotted lines - incomplete, functions
 - 17 Straw lines - cohabitation
 - 18 Circular line - Wonderful, beautiful lines and its names

Following are the types of strokes (Fig 4)

- | | |
|----------------------|---------------------|
| Pencil stroke | Pen stroke |
| Brush stroke | Spary stroke |

Stroke: The action of rapidly applying colour on a paper or any surface in painting by using pencil, pen, boru, chalk or brush is known as stroke. A good stroke can be made with practice. There is a sense of movement in the original painting. A pencil stroke brings life to an inanimate picture.



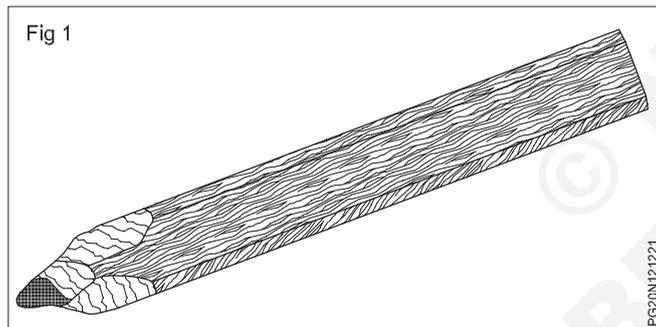
Pencil & Their types

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

- state the history of the pencil
- state the types of pencil
- explain the importance of pencil in the painting field
- state the parts of a pencil
- describe the function of a pencil.

History of the pencil: The addition of a woodeen casing surrounding the graphite stick was first developed by an italian couple, lyndiana and simonio bernacotti, as early as the 1560s. Their design featured a hollowed out juniper stick into which the graphite would be placed to produce a flat carpenter's pencil. The oldest example of a carpenter's pencil is dated from the 17th century and was found in the roof of a german house, built during this peroid. (Fig 1)

In time, the manufacturing process evolved to use a wooden casing, sawn into two halves and then carved out for the graphite stick. The two halves would then be glued together. This technique proved so successful that it has changed little in the last four centuries. Each pencil capable of 35 miles of earthing , which equals to approximately 45,000 words. The uniqueness of the pencil as a writing instruments cannot be under estimated.



Pencils are used for writing and draw a drawing, in this narrow pigment is fitted inside a cylindered wooden piece. It is used for writing on a piece of paper and make sketches or drawing. This is a simple device by which you can make sketches drawn quickly and it is also used to drawing and painting and also to make different inventions and textures. For making various types of lines like sharp, thin, thick and other lines, separate pencils are used. By giving lines and more pressures pencils are being used. By giving lines and more pressures on pencils different stroke variations can be given.

Different types of pencils: All the drawing and writing mediums, needs different types of pencils for a complete drawing set. (Fig 2)

Initially, graphite sticks were properly wrapped in strings, and later, these graphite sticks were presented in wood-cases, giving birth to the very first wood-cased pencil. Basically, the graphite was inserted in wooden sticks that were hollowed out. So it looked like sticks

of graphite were being enclosed within similar-shaped wood cases or coverings, enough, companies like faber-castell and steadtler came into existence, forming an active global pencil industry that continued to develop century industrial revolution.

The following 14 main categories of pencils that are still being used

Table of contents

B Pencils (Bold pencils)	H Pencils (Hard pencils)
1 8B	10 2H
2 7B	11 3H
3 6B	12 4H
4 5B	13 5H
5 4B	14 6H
6 3B	
7 2B	
8 HB	
9 F	

Types of pencils chart

B Pencils: May use them for note-taking purpose, they are excellent for doodling and sketching, purpose.

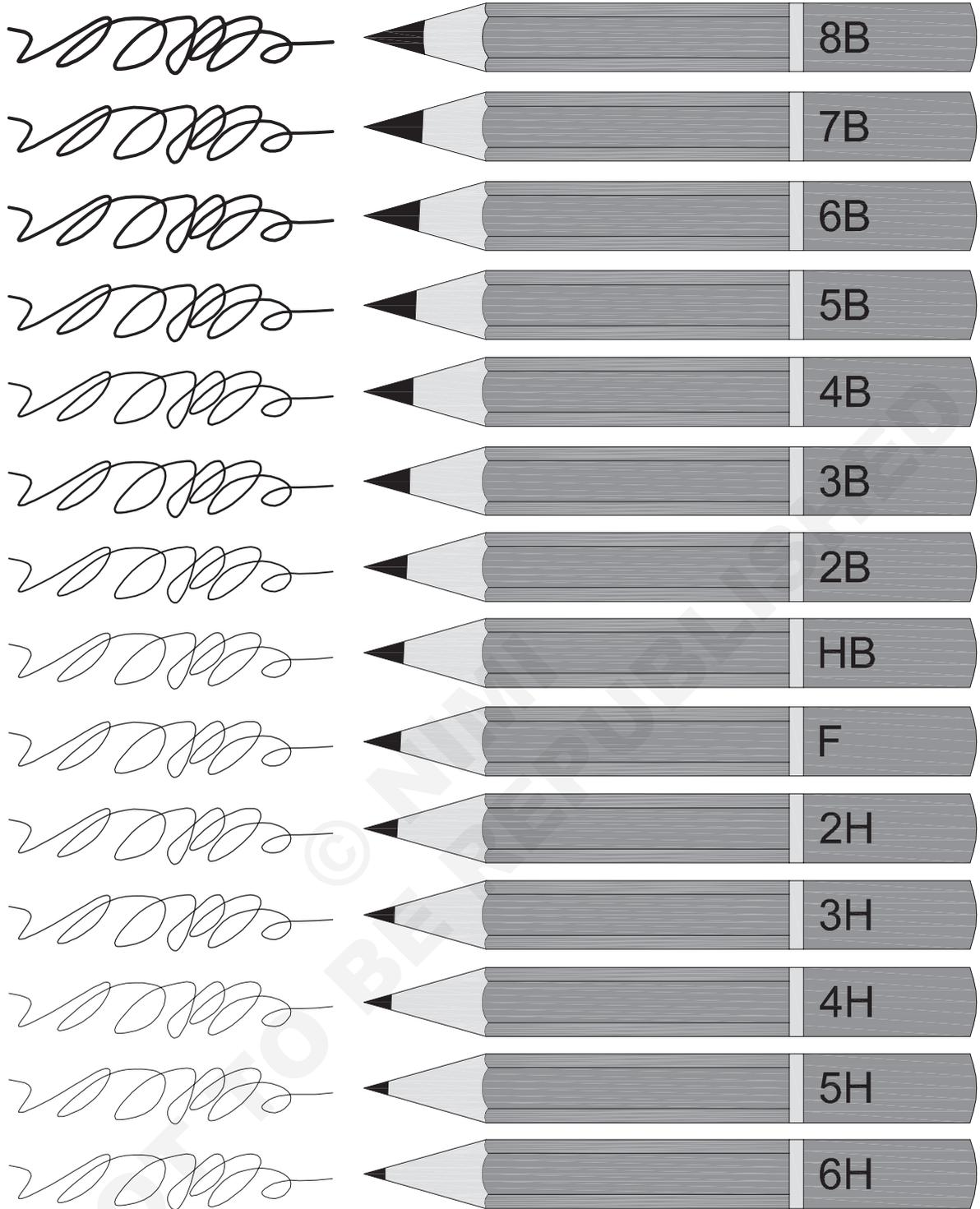
8B pencil: This type of pencil is extremely dark and comes out as the darkest of grays on paper. It is best used for drawing and sketching purposes since it takes very dark and prominent marks that end up sticking out on the paper (Fig 3)

7B pencil: Almost similar to 8B, this type of pencil is also great for art-related purposes. It gives off a very dark gray shade that sticks to the paper and makes drawings look great on paper. (Fig 4)

6B Pencils: This pencil is best for those who like to draw, and it is particularly meant for adding dark values to your drawing pieces. This is also a great option for creating portraits where you would want to achieve realistic textures like skin, fur or fabric. (Fig 5)

5B Pencils: This pencil produces a darker mark than the ones after it and is quite softer than a 2B pencil for example. This is because the higher number of B that a pencil is, the softer the pencil will be. (Fig 6)

Fig 2



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Fig 3



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Fig 5



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Fig 4



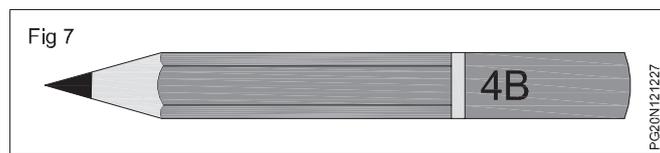
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Fig 6

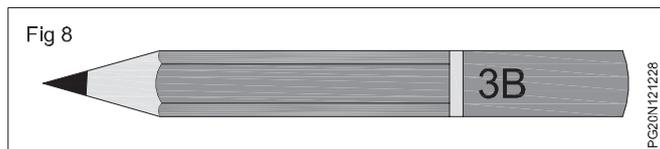


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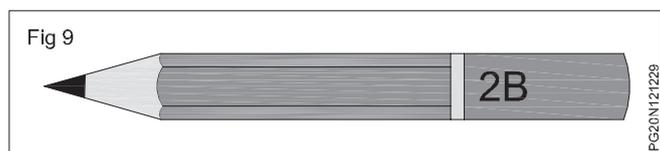
4B Pencils: The 4B pencil is slightly lighter than the ones before it and is also an excellent choice for sketching and drawing purposes. Anyone with an aptitude for art and drawing will definitely enjoy using this pencil. (Fig 7)



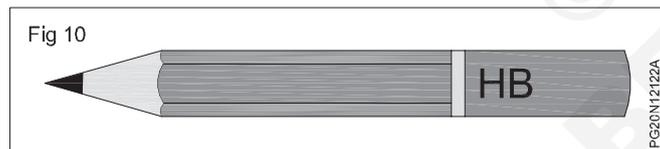
3B Pencils: This pencil is more like a mix of dark and light but is more towards a lighter gray. It is an ideal option for those who like their drawings to contain light values with slight shades of dark gray. (Fig 8)



2B Pencils: This 2B pencil is best for medium to dark shading and provides a good range of tone or value from light to a dark shade. It is commonly used shading and sketching. (Fig 9)

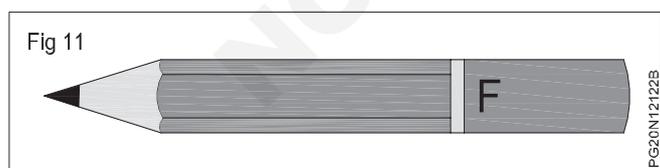


This pencil falls in the exact middle of the pencil lead scale. HB is a significantly hard pencil, making it a reasonably hard pencil even for drawing purposes. (Fig 10)



The 'H' refers to the hardness of the pencil, and the letter 'B' is used to denote the blackness of the particular pencil's mark.

F: 'F' stands for fine point. This pencil, compared to the others is slightly harder. While it is certainly easier than a few to keep sharp, it is way too dark for general and everyday drawing. (Fig 11)

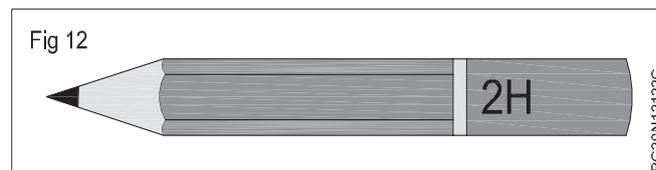


H Pencils: In this case, 'H' refers to the hardness of the pencil. This is to say that the higher the value of H a pencil has, the harder its lead will be. And the harder the lead is, the lightest the pencil will be.

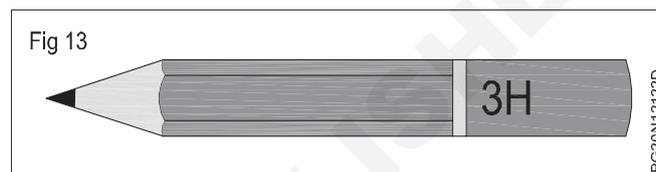
The 'H' pencils are generally very hard, and they are able to hold a tip in place, ensuring extreme precision. They also make light lines that can be erased with great

ease and convenience so one can easily use these pencils to design products or write things on paper.

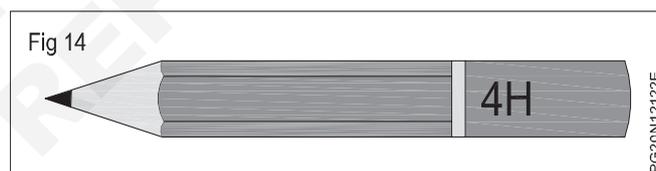
This pencil type is great for any technical work that involves making lines that are easily erasable. This is particularly because 2H contains a very light amount of lead. It is also a great option for those who just begun to draw and wish to add very light shades to their drawing. (Fig 12)



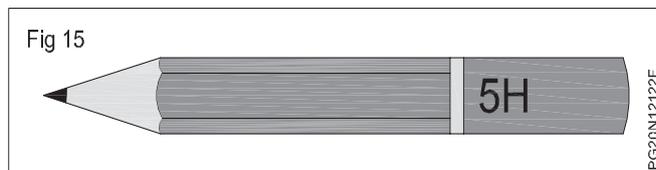
3H Pencil: 3H is an extremely light shade of gray that leaves a very light imprint on paper. It can be a great choice for sketches where you need to add light shades or slightly fill in the empty spaces with a pencil. (Fig 13)



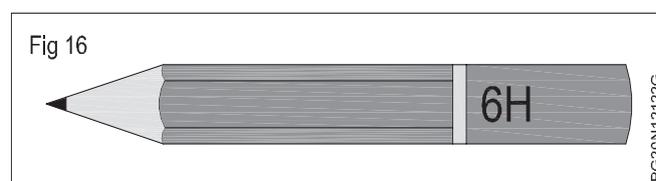
4H Pencil: This is an excellent choice of pencil for light, fine and even shading. It is more towards the gray side and less shiny because of the amount of clay it contains. It is also easier to keep sharp so can be easily used for shading and sketching. (Fig 14)



5H Pencil: This type of pencil helps create the darkest and the thinnest of lines, given its hardness levels. This happens because it falls towards the end of the 'H' or hardness scale, hence, giving a hard touch. It is a great option particularly for those who are into drawing and sketching and wish to draw dark and thinnest lines. (Fig 15)



6H Pencil: This is a top-quality graphite pencil that is primarily designed for the purpose of sketching, writing, and drawing. It is an ideal pencil for artistic and technical applications. (Fig 16)

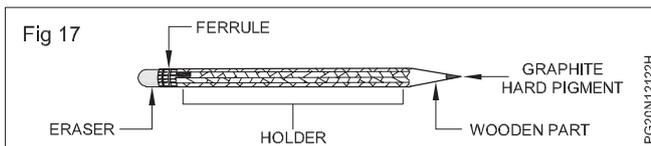


Keeping in mind the hardness rule, it gives maximum hardness with the darkest and thinnest look on paper.

By pencil shading on the paper surface triangular effect can be given, various textures like stant, straight, crones lines which crones each others at a print can be made by pencil shading. These sketches are permanent erases have to be water erase the lines.

Parts of a pencil: (Fig 17)

- 1 Hard pigments
- 2 Wooded part
- 3 Coloured part
- 4 Ferrule
- 5 Eraser



Graphite pencil: Ordinary pencils are made from graphite powder and clay blinder paste. These are grey and blanch in colour and also called lead pencils. These are ordinary pencils is used for art. Engineering and writing and called drawing pencils.

In mark the graphite drwing pencils are available from HB, H to 9H and B to 9B. HB is ordinary pencils. Other H for stands hard, B for Black.

H-2H, 4H, 6H, 9H pencils are there popularity 2H pencils are hard and faded. 9H is more hard and faded in engineering drawing all types of H pencils.

The light lines made from charcoal after shading come out easily and the paper does not get applied. That's why it is a good medium, to practice sketching. that's why after sketching complete, so as to stitch on the paper a

fixative spray is strayed on it. Charcoal is applied light and slowly with the help of brush. For sketching large pictures it is a suitable medium and its success depends on control on our hands while drawing the sketches and lines.

Colour pencil: This is the medium of drawing. These are called crayons which are made by a coloured paste on cylindrical wood. This is different from graphite and charcoal pencil. War and oil are the basic components of a colour pencil and these are manufactured with the help of the pollution of pigment. Binder and additive and wed for shading paper. These colour are available in various shades, bonds and sizes by which many types for pencil shading paper. These colour are available in various shades, bonds and sizes by which many types of pencil shading can be do.

Glass marking pencil: Wax based coloured pigment is used in this pencil you can write on smooth glass like surface with this pencil and can also be written not only on glass and pipe, but also on metal plastic, pottery, china clay vessel, leather stove, painted articles, bright and smooth surface. It can enaved on paper by also which is written on the sooth surface can be removed by wiping. These surfaces cannot be marked by ordinary pencils, but only by this pencil for cutting. Because of its oily character the with this it can be used for marking on glass. It is more useful for industrialist, cooker carpenter and also available in scatted colours.

Water colour pencil: Water colour pencil is a beautiful medium art count creation cannot be done through any other medium, because its base is pencil. After sketching with water colour on paper, then with the help of water brush painting is done. The sketch done by pencil lines with the water and appears as water colour on the paper.

Types of colour

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

- state the names of different colours
- describe the methods of painting
- state the importance of colour.

Types of colours: There are many types of colors are used in art and painting work. Colour types are as follows.

- Water Colour
- Poster Colour
- Acrylic Colour
- Oil Colour

Water Colour: Water colours are recognized for their transparency, gentle wash and ability to develop complete colours by creating varying levels of colour. To make a plain wash, small particles of colours spread evenly on the paper, which the colour of the lower surface is visible in every particle. Its medium is water and these colours are transparent and bright. Its medium is water.

In India this colour is being used to make picture in landscape in handmade paper for brightness the top of the white paper portion is left and light transparent colour of bright to deep textures is applied and white and colour is not being used by the transparency of the water colour, beautiful art work is done, to use this you should have enough knowledge about water colour applications. The painter should have in depth knowledge of shadow, light colour dyes.

Where this water colour is applied it becomes permanent, That's why, while applying it should be applied confidently and thoughtfully because there is no scope for improvement the picture should be complete in a small time that's why there should be control on the paint brush and water colour while painting.

The characteristics of this method are brightness, freshness, flow and encouragement and the strokes allied by brush with self confidence, density brings the picture becomes attractive and alive.

In market we can get water colors in tube and cake form use a short brush to apply water colour brush is a made of sable hair or soft round synthetic bristles with this style and daily practice you can master over it.

In central asia this painting is known as brush painting or stroke painting.

Poster colour: Poster paint is a distemper paint that usually uses starch, cornstarch, cellulose, gum water, or another glue size as its binder. It either comes in large bottles or jars or in powdered form. It is normally a cheap paint used in for practice in art classes.

Poster colour is a water soluble paint, this paint consisting of a colour mixed with a binder such as glue or gum to

give it a dull finish. Many poster colours are available, it is one of the most eye catching media. This poster colour is used to create colour signs and banner. It is perfect for lettering and creates much thicker lines than a typical marker.

For advertisement, poster 2D design, resolution picture, nature picture, portrait painting, greetings, design etc. Poster colour is being used. These colours oscillate, but when some of them are mixed up it becomes clay coloured or cloudy. This colour is used on drawing paper, mount board, paper and on walls surface. This colour is temporary gets dissolved in water. It is available in various shading in tubes and bottles and are applied by brushed and spray method.

Acrylic colour: Quick drying paint made from suspended dyes in acrylic polymer emulsion is called acrylic colour. These are soluble in water.

By using water you can make this acrylic colour paint into a liquid form. but when it gets dried up it becomes water resistant. After painting with acrylic colour it looks like water colour, poster colour and oil painting. It doesn't depend on any harmful solvent and it can be applied on a large surface and with the help of a brush, roller, and corner box brush it can be painted on canvas, paper, plywood, wall etc. After drying it becomes permanent and the surface becomes strong.

Working with acrylics: Most paints are made by mixing dry paint pigment together with a wet binder. The difference between the type of paints you see in the art store, for example, oil paint, acrylic paint or watercolour, is simply due to the different type of binder used.

Acrylic paints use an acrylic polymer emulsion binder, which means they are water-soluble when wet but become water-resistant when dry.

This allows you to build a painting in layers, without disturbing the layer underneath (also perfect for hiding any mistakes)

Acrylics dry by evaporation and tend to dry quite quickly.

Artists refer to this as having a short 'working time', however, this can vary depending on several different factors, the main ones are:

How thick or thin you apply or layout the paint (on the palette and canvas)

Absorbency of the surface you're working on

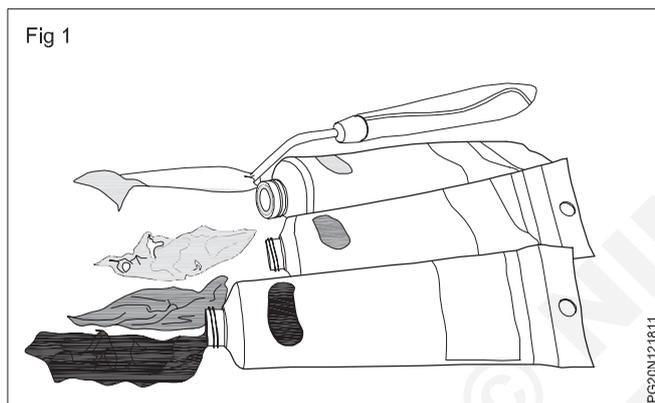
What you dilute the paint with, either water or a specialist medium

The heat and humidity of the environment you are painting in evaporation can be controlled by

Using a stay-wet palette that has been designed specifically to keep acrylic paints wet and workable for longer. It will stop the air getting to your paints, the longer they are out in the atmosphere the quicker they dry off. The staywet palette will keep the paints wet for a good few days, in comparison to if they were just left out in the open air where small mixes can dry off in a few minutes

There are specialist acrylic polymer mediums you can add into your paint mixes to dilute and keep them wetter for longer or extend their 'working time'. They can change the consistency of acrylic paint and allow you more flexibility and creative freedom than any other type of paint. The trick is to use the right ones for the right situation

Using OPEN or Interactive Acrylics specially designed to stay wet or open for longer (Fig 1)

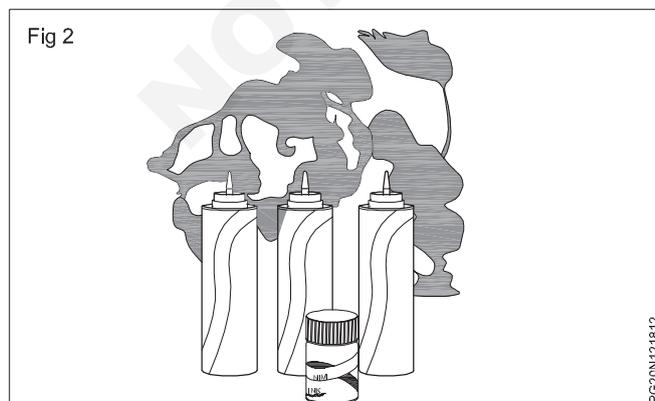


Misting the paints with water.

Opaque colours cover other paints easily and are great for making solid, flat areas of colour and covering up any mistakes you've made.

Transparent colours are used for luminous glazing and subtle tinting usually at the later stages of a painting.

They are often labelled on a paint tube to guide you, for example, Winsor & Newton use the following abbreviations: (Fig 2)



- T for transparent colours
- ST for semi-transparent colours
- SO semi-opaque colours
- O opaque colours

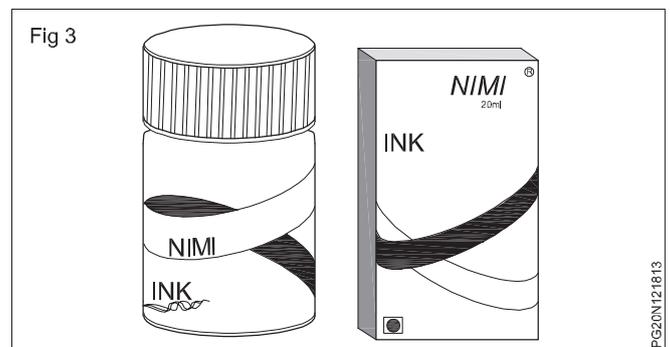
Oil colours: It is most durable colour and preferred in canvas paints landscape, skill picture, abstract image and portrait are beautifully painted with oil paint. It is applied with hog hair and shaper hair brush and in painting field oil paint is considered as the long last paint.

Oil painting, painting in oil colours, a medium consisting of pigments suspended in drying oils. The outstanding facility with which fusion of tones or colour is achieved makes it unique among fluid painting mediums; at the same time, satisfactory linear treatment and crisp effects are easily obtained. Opaque, transparent, and translucent, and translucent painting all lie within its range, and it is unsurpassed for textural variation.

Artists' oil colours are made by mixing dry powder pigments with selected refined linseed oil to a stiff paste consistency and grinding it by strong friction in steel roller mills. The consistency of the colour is important. The standard is a smooth, buttery paste, not stringy or long or tracky. When a more flowing or mobile quality is required by the artist, a liquid painting medium such as pure gum turpentine must be mixed with it. In order to accelerate drying, a siccativ, or liquid drier, is sometimes used.

A coat of picture varnish is usually given to a finished oil painting to protect it from atmospheric attacks minor abrasions, and an injurious accumulation of dirt. This varnish film can be removed safely by experts using isopropyl alcohol and other common solvents. Varnishing also brings the surface to a uniform lustre and brings the tonal depth and colour intensity virtually to the levels originally created by the artist in wet paint. Some contemporary painters, especially those who do not favour deep, intense colouring, prefer a matte, or lustreless, finish in oil paintings.

Water proof ink: (Fig 3)



This is a special black and colourful ink. Which is used in a large extent in the printing and writing field. Now a days it is prudently used in painting and outline. Since it is a water proof ink it dries up quickly and water has no effect on it. In an art and lettering black ink is used and for comics book, printing, glass painting coloured ink is used. Water proof drawing ink black is suitable for all papers, cards and drawing papers, free flowing, safe for use in bow pens and croquills.

Printing Ink: In the liquid and paste form ink is called pigment. It is being used for drawing images, writing and marking design on the painting surface. This ink is used for paint with the help of pen, brush to write or draw sketch. In letter press, screen printing and lithograph printing. this dark ink is widely used in paste form.

Printing ink used turpentine or kerosene is used for liquid form.

It is a complete medium consisting of solvents, pigments, dyes, resins, greases, non-dissolving, particulate matter, fluorescent and other material.

Fluorescent colour: Fluorescent colour emit more light than the traditional ones and reflective. These colours are bright and attractive. These colours are in the form of paste and powder.

With the help of brush and spray medium is used for applied on the surface. It is widely used in designing and lettering purposes. These colours are prepared by mixing fevicol water and fluorescent powder.

Lettering on the wall is drawing in old days while painting the cinema posters, bright colours were made by mixing oil paint with in acid oil and fluorescent powder with the help of this cinema posters printed in a large scale, fluorescent colour ink was used for screen and off set printing. In various styles of painting and particularly in thermocol design fluorescent colour was applied with the help of them.

Sketching

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

- state the importance of sketching
- state of sketching medium
- state the benefits and importance of sketching.

Sketching: A sketch is rapidly free hand drawing, that is not usually intended as a finished work. A sketch may serve a number of purpose of painting. It might record something that the artist might record or develop an idea for later use on any surface or media.

In painting through any medium sketching can be done. The term is most often applied to graphic work executed in a dry manner such as pencil, charcoal or pastel is used to a long extent and apart from that good sketches drawn or drawing executed by ink pen, ball pen, nasher pen, water colour oil paint. Sketching usually refers to students of painting. Many things are studied clearly for a

Reducer medium: A reducer is a pure function that takes an action and the previous state of the application and returns the new state the action describes what happened and it is the reducer's job to return the new state based on that action it may seem simple but it does have to be a pure function with no side effects.

A reducer is a function that determines changes to an application's state it uses the action it receives to determine this change. Use tools like reduce, that help manage an application's state changes in a single store so that they behave consistently.

Charcoal: Artists charcoal is a form of a dry art medium made of finely ground organic materials that are held together by a gum or was binders by eliminating the oxygen inside the material during the production process.

Purpose: Suitable for drawing sketching or smudging a charcoal pencil offers a familiar feel and provides you with a lot of control over your marks. Even in this more structured form it can be manipulated to create an array of rich and dark tones as well as thin lines and bold ones.

Charcoal is traditionally made from thin peeled willow twigs which are heated without the presence of oxygen. This produces black crumbly sticks which leave microscopic particles in the paper or textile fibres producing a luse that is dense at the pressure point, but more diffuse or powdery at the edges.

Charcoal pencils are much more difficult to erase than a stick or bottom. When too much pressure is applied the charcoal pencil can create an indentation may completely ruin a drawing.

Dry pastel: Pastel dry drawing medium executed with fragile, finger-size sticks. These drawing crayons called pastels are made of powdered pigments combined with a minimum of non greasy binder usually gum tragacanth or from the mid 20th century, methyl cellulose.

Oil pastels: Oil pastels are similar to oil paints dry out or harden completely.

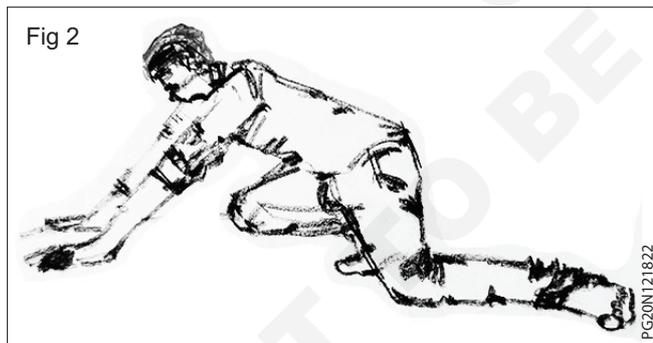
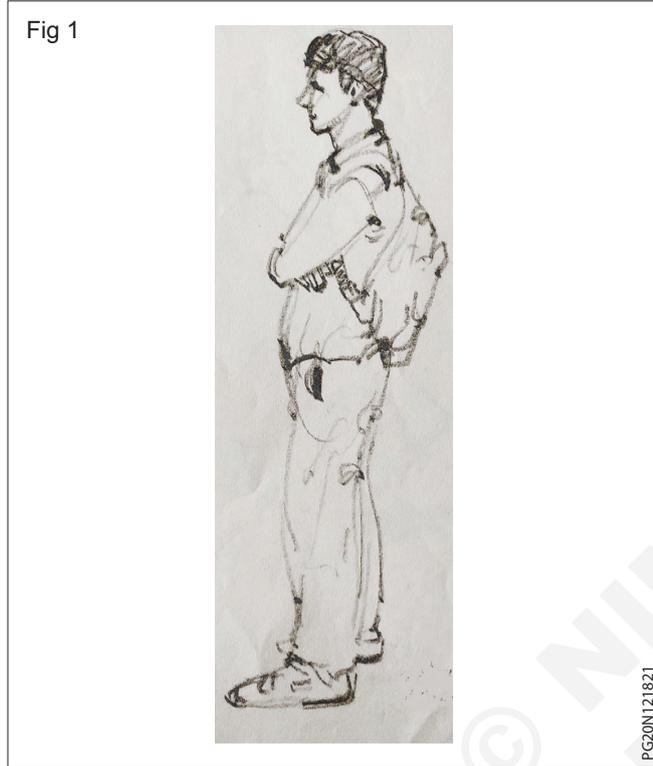
large design. Sketching is also a type of doodling in which ambition is taken into account. If there is any problem regarding design then the ideas related to its solution is well clarified through sketching. Also to draw complex design in tree style is difficult then sketching plays an important role in the development of design process.

Sketching is also a form of sketching and in the beginning of design house this was used to referent it. Due to these sketches intelligence, concentration and ability to concentrate develops. It has life and career this skill may from alliterate. While drawing no artist can draw in minute detail, but he concentrates only on its important part and points.

Bonds, babies and animals are not at one place, so these subjects are good for sketching. The sketch concept is very unique and personal. The artist is familiar with inner identity.

Mainly there are three types of sketches

- 1 Simple sketch (Fig 1)
- 2 Rough/Rapid sketch (Fig 2)
- 3 Finished sketch (Fig 3)



Pencil is used to show the detail or fineness of the picture. 2A-4A pencil is used to show the texture and shading. The lead of the black pencil soft white 9A lead is very dash and used for dark shading. For sketching 2A pencil and for shading 4A pencil is being used widely.

A guide to pencil sketching techniques

Pencil sketching has long been a popular art form and its no wonder why sketching with a pencil is versatile, portable and requires only a few basic supplies with just few tools can create an incredibly detailed and beautiful work of art sketching techniques can take pencil drawing to a whole new level, bringing greater depth and refinement to the artwork you create. There are different types of sketching techniques.



- 1 Hatching of cross hatching
- 2 Stippling
- 3 Scribing
- 4 Circling
- 5 Smooth shading of blending
- 6 Creating highlights
- 7 Rendering

Benefits of sketching

- 1 Sketching and drawing is a great way to improve your creative skills and start thinking in a different way. Art shows you that there is normally more than one way to solve a problem. Art encourages open minded thinking and creativity. These can be really helpful for personal development and solving problems. Skills you learn through sketching can be applied in a number of different areas.
- 2 Sketching help develop a number of different areas of human brain. Develop the ability to focus and pay attention, a skill that can be very useful throughout life and career. It also develops hand-eye coordination so that everyday tasks can become easier. But it also develops strategic thinking, a concept that can be useful to everyone.
- 3 Sketching can even improve holistic health. Build self esteem and confidence through art and sketches as become better. To get a sense of achievement and start feeling proud of your art which you will carry that confidence. Having confidence in work.
- 4 Sketching can also help to improve communication skills. Because there are no words in a drawing, well most of the time, the artist finds other ways to communicate with the practice. This can help to improve other communication skills by better understand of feelings and emotions and without the need for words to be spoken.

Sketching is great for a number of different reasons and they don't just apply to pencil and paper sketching. All of these advantages simply come from the act of drawing and taking time to sketch. The lifestyle benefits of this hobby are incredible and can really help improve the skills in a number of different areas of life, not just sketching.

Importance of sketching

There are six reasons for

- Sketching is fun
- Sketching brings out the best idea
- Clients love sketches
- Sketching in your inspiration
- Sketching is a time saver
- Sketching is for everyone

Great Health Benefits Of Painting And Drawing

1 Improved creativity: Painting and drawing would obviously make use of one's imagination. They would create vivid images of houses, people, and places. People can even choose to portray their emotions and produce abstract art. As these would entail the creation of personal works, one would have to use his artistic skills. These activities would then play a beneficial role in the development of one's brain.

For right-brained or artistic people, painting and drawing would be healthy ways of enhancing the creative skills that they already manifest. On the other hand, left-brained or analytical people can also stimulate their creativity and improve it.

Knowing these factors, drawing and painting is highly recommended for children. In fact, many children who are at the developing ages are encouraged to engage in painting and drawing. By promoting the development of their brains, they would be more prepared for academic work. Furthermore, they would have an easier time conveying their ideas to their peers.

2 Improved memory: On the other hand, the health benefits of painting and drawing are also enjoyed by those who experience illnesses such as Alzheimer's disease. Although they may have problems with their memory, enabling them to engage in painting and drawing can help boost their recalling skills. As they sharpen their minds through imagination and thinking, they may experience less complicated conditions of their illnesses. Thus, they may still enjoy a lot of activities in their lives in spite of their condition.

3 Improved communication skills: Another point in the long list of health benefits of painting and drawing would involve the opportunity to improve one's communication with other people.

As art involves expressing one's inner thoughts and feelings, he may project all these indescribable emotions through paintings and drawings. In using art to break free from personal limitations, individuals can surpass their weaknesses. These can include shyness, autism, and other disabilities.

Furthermore, as painting and drawing are continuous processes, these individuals would improve their flow of thought as they create such artworks. These can be very useful for their future endeavors.

4 Improved problem solving skills: Aside from these benefits, people may actually be surprised that painting and drawing can also instigate the development of critical thinking and problem solving. In fact, painting and drawing enables an individual to realize that there can be more than one solution to a single problem. As they discover the artworks they can produce from a blank sketch pad, they develop the technique of thinking outside the box.

Painting and drawing would widen their perspectives on various situations. In effect, they would be able to address various tasks in a creative and very effective way.

Emotional Restoration

5 Stress relief: Perhaps the major health benefits of painting and drawing involve the emotional aspects of individuals. For one, many people use art to release stress.

As the pressures of life can be very tiring, individuals have tried painting and drawing to relax from the demanding requirements of life. They are able to free themselves from the stress that has accumulated by releasing these in the form of color and drawing. As they temporarily exit the world of fears and worries, they enter the world of fun and excitement.

Releasing one's stress can be very beneficial to reduce their risk of other physiological illnesses.

6 More positive emotions: Additionally, creating these paintings and drawings would obviously lessen the negative emotions within an individual. This would be replaced by the positive thoughts and feelings as color and drawings would be exemplified. Of course, as one develops his skills in painting and drawing, these would produce very good results. Hence, this may make an individual feel good about his capabilities. These activities would boost his self-esteem and would inspire him to believe in what he can do.

Through these health benefits of painting and drawing, an individual may also develop optimism and feel happier through painting and drawing. With the body and mind becoming more relaxed, one can function better.

7 Release of hidden emotions: Furthermore, as one pours out his emotions through art, he concentrates on releasing all these hidden emotions. In fact, physical pain may even disappear as one is deeply involved in his paintings and drawings. Research has called this state the "Alpha"; this signifies that part of one's brain is consciously performing activities while the unconscious part is also expressed. Such a state can also be obtained from other activities such as prayer, music, and meditation. This state would release energy and would revitalize an individual. He would gain strength in this special form of recovery. In effect, the healing process can be faster and more effective.

Knowing these benefits, it isn't surprising to know that painting and drawing are highly recommended for an individual's recuperation from painful events such as war and abuse (e.g. rape). In fact, many therapists

include these activities in the schedules of their patients. They would encourage their patients to release their feelings.

As an individual is able to find a safe environment to convey his emotions, the health benefits of painting and drawing can be maximized to aid the recovery of this said individual. He would be immersed in a world of cleansing from all the bitter events that may have happened to him. His stress level and emotional anxiety would be soothed, thus enabling him to function better and return back to his regular work.

Through painting and drawing, many therapies have become successful. With the added support of family and loved ones, patients are able to achieve inner peace and find closure from their previous experiences.

8 Increase of emotional intelligence: Given these various health benefits of painting and drawing, it is clear that these activities can cause an increase in an individual's emotional intelligence. In enabling one's emotions to flow through art, one can create a better grasp of his varying feelings. One can experiment on feelings of joy, peace, love, and happiness while performing these tasks.

Through the improvements in one's personality and emotional stability, painting and drawing do not benefit a single individual but even the people around him. As the individual would be able to respond to the emotions felt by others, these people would also share the positive effects of art.

The individual who engages in doing such art can brighten other people's days and help them cope with whatever difficulties they may experience. As he has more control of his emotions, he would be an excellent companion for the people with whom he interacts.

Improving the Senses: As the health benefits of painting and drawing are evident in one's mental activities, these activities can also promote the improvement of the senses. Knowing the role of the brain in delivering messages

to instruct the actions to be performed by one's body, stimulating this integral organ is vital to improve the organs it controls. Thus, an individual who has engaged in painting and drawing would experience many positive changes in how he would respond to and perceive the world.

9 Better mobility: Art can enable a person to have better mobility. As the individual would need to use a brush or pencil to create artworks, develop more efficient hand movements. Through the improvement of one's brain activities, signals can be effectively sent from the brain to the motor neurons that would deliver the specific action that must be performed. As a result, fine motor skills would arise.

10 Observant of the details: To add to the list of health benefits of painting and drawing, these activities would enable one to become more observant of the details of his surroundings. As one is more exposed to light, darkness, color, shading, and many other properties of painting and drawing, he would be able to pay closer attention to finer details. Human eyes would be trained to look for intricate designs and forms that may have been ignored in the past. Thus, as the brain would let one's concentration improve, an individual may see and appreciate even the most miniscule details that can be viewed.

Given the various health benefits of painting and drawing, it is clear these activities can be very useful in promoting the welfare of an individual. Aside from improving mental and emotional capabilities, an individual may enjoy improved sensory and motor skills through constant painting and drawing.

Knowing the difficulties that are offered by life, it would be nice to occasionally take some time off, lift a paintbrush or pencil, and start painting or drawing.

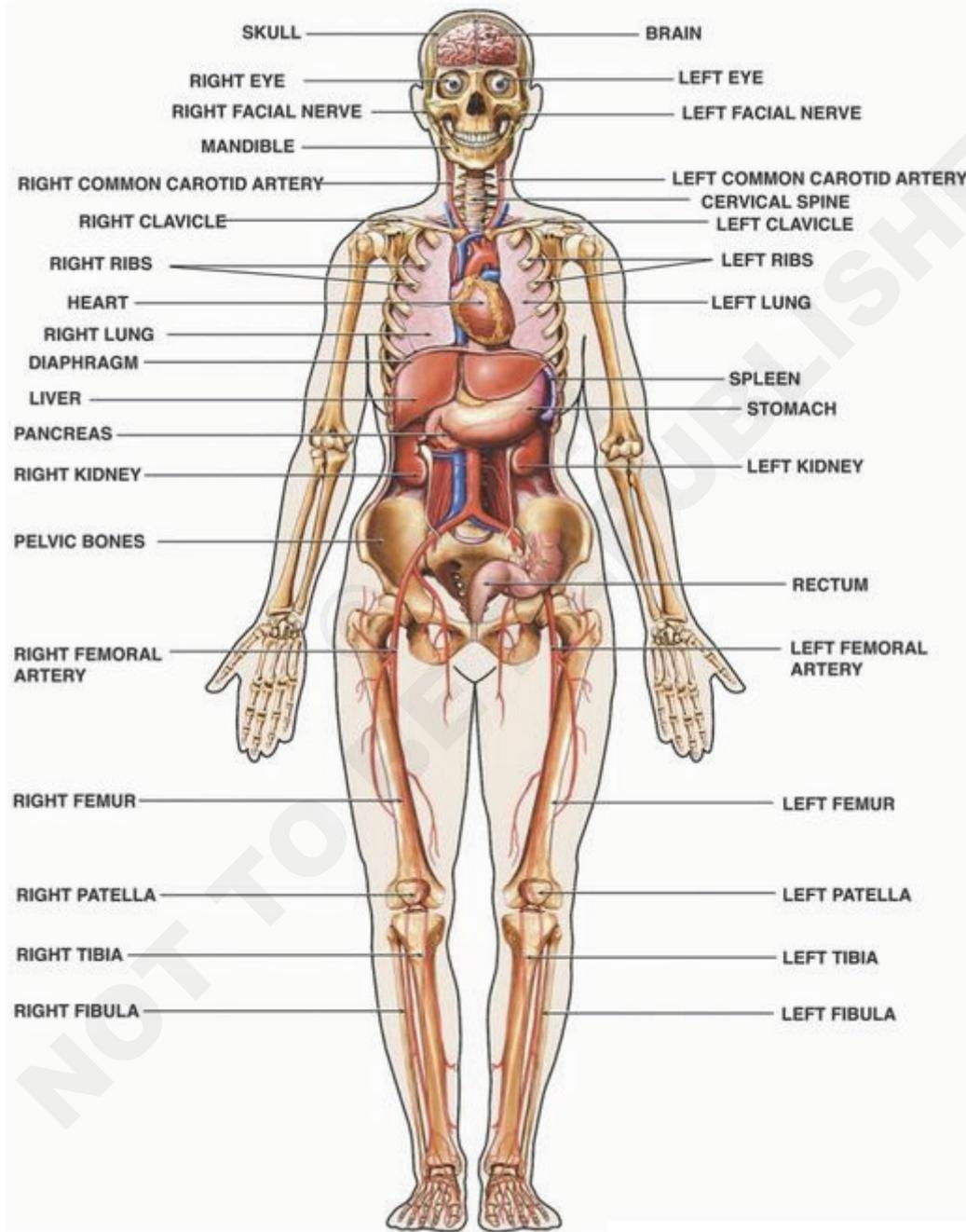
Human anatomy

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

- describe the size of the human anatomy.

Human organs and their places (Fig 1)

Fig 1



Anatomy:

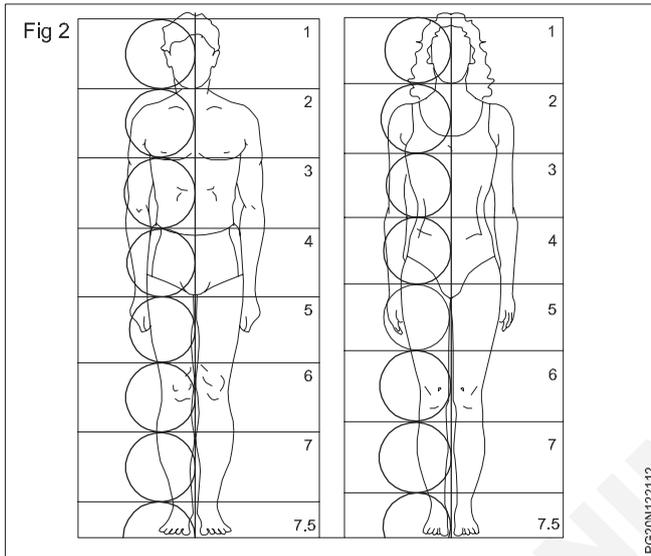
Study of anatomy is very important for painting art work. It is necessary to study the skeleton, muscles, skin symmetry and composition of the human body.

Despite having more than one standard and its measurements the layout of the functions of the parameters remains troubled. In the anatomy of the human body this height is driven lines of his face. There will be a change in the height because in human beings it will for a very tall

person it will be eight times of his face, for a short person it will be six and a half or seven times.

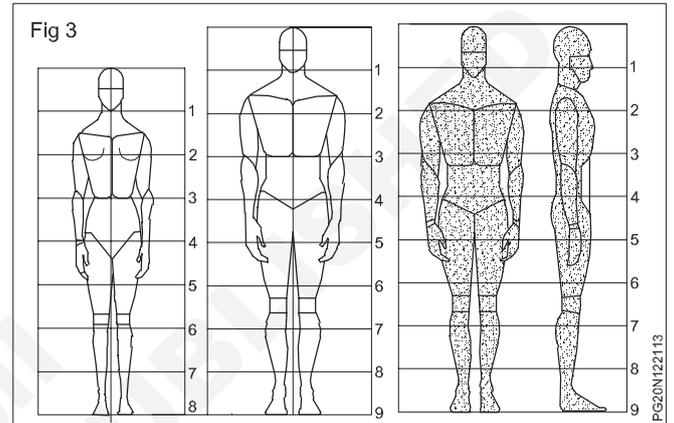
For normal man or woman the shoulder width is 2 times of his height of the head while for children the length of the body will be 5 to 6 times of its face. Their will be suitable changes according to the age. His palm measurement will be his face's measurement. The basic results of the human body, the composition of the bones and the muscles of the body must be consistent and realistic. Also it is necessary for the painter to be able to draw the figure. (Fig 1)

Body structures of male and female (Fig 2)



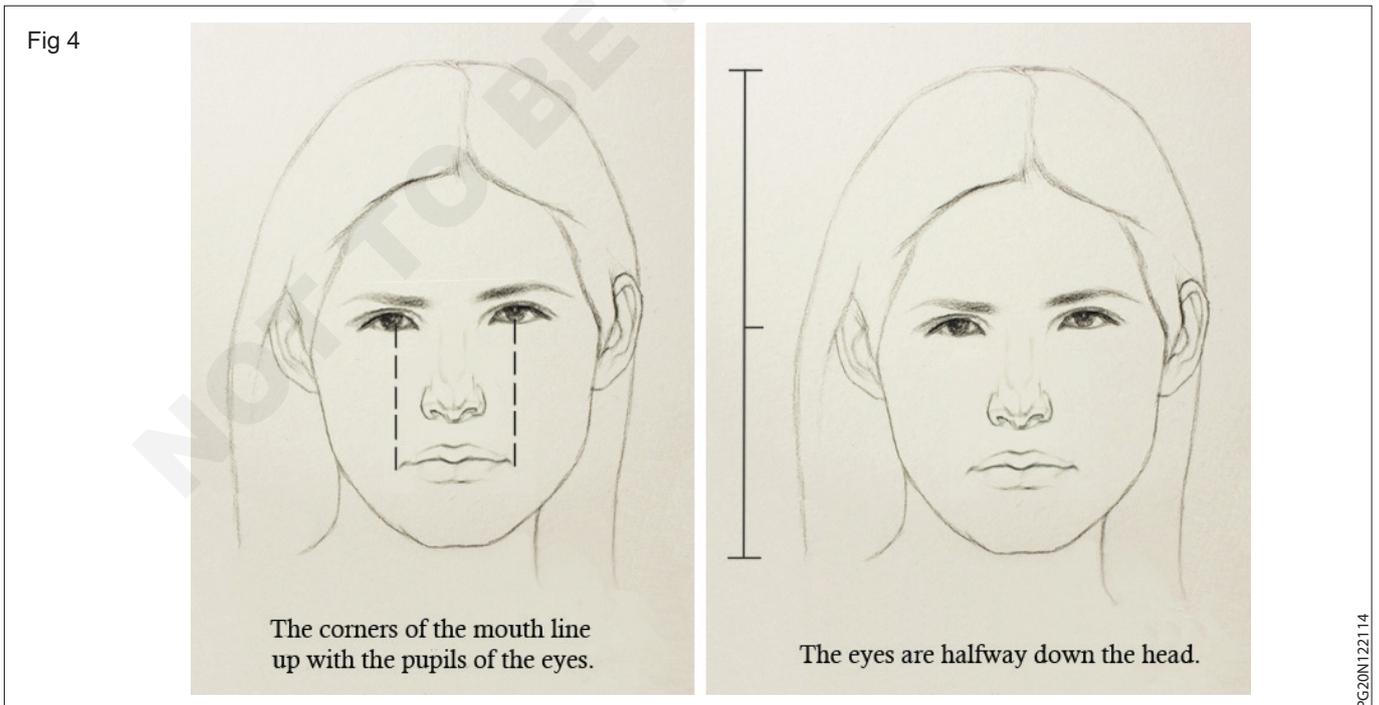
Measurement of seven and a half to head is an method by which heads form and length is used to measure the figures height and width. It is decided in this method of measuring head of a person usually for height it is seven and half and width to heads. This method is beneficial for the youth and those who have problems with shaping the phase in the proper result, human shape results must be graphically consistent realistic, artistic is why to know the basic moulds and is necessary to know about the confection of the bones, when we want to measure the human anatomy, it is dependent on basic human consequences and this is taken for training needs.

Ladies and mens outcomes differs in new born, young child outcomes. (Fig 3)



Different ages person heights will be vary and measuring the height based on head will be vary.

Men/women – from head seven and half to eight times (Fig 4)

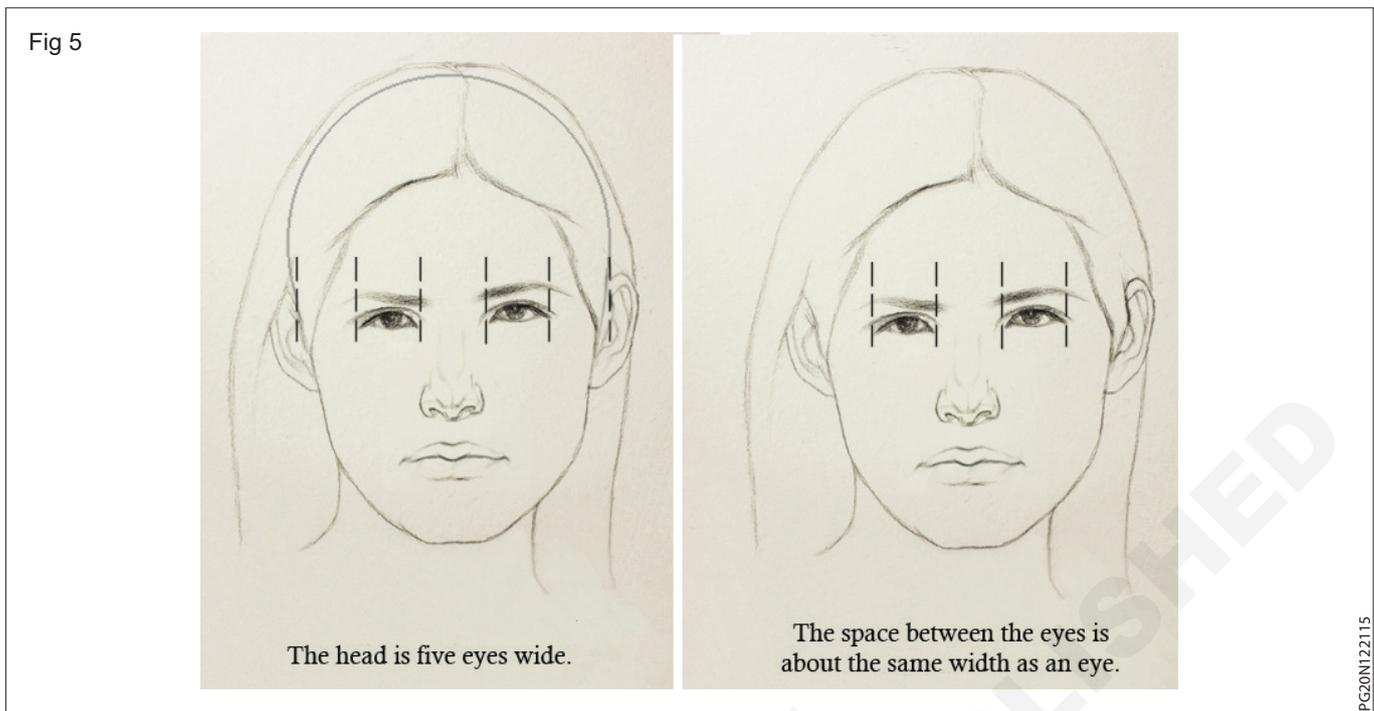


The corners of the mouth line up with the pupils of the eyes.

The eyes are halfway down the head.

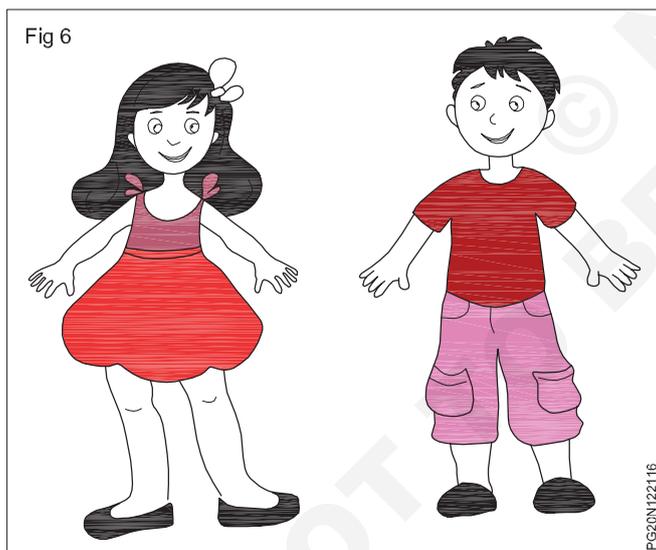
Teen – from head six to seven times

Boy – from head five and half to six times (Fig 5)



Child – from head to nose to five and a half times

Head is always measured from top to bottom. (Fig 6)



Graphic & Its perspective

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

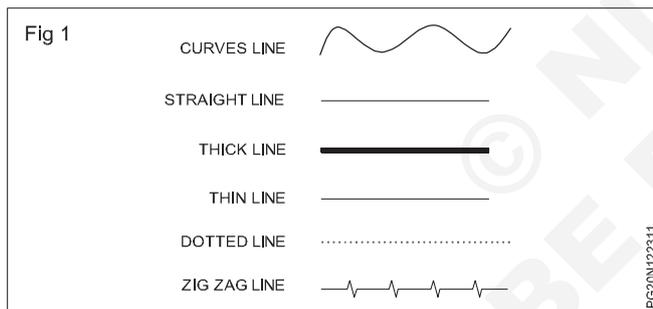
- state the importance of graphic design
- state the uses of LOGO Design
- state the perspective in painting
- describe the types of perspective.

Graphic design

Visual communication and problem solving is achieved through the use of topography, photography and illustration through graphic design. Graphic designer assembles ions, images and material to bring the ideas and images into visual representation. To create visual designs they employ to topography. Visual art, page layout technique. Graphic design consists of corporate design (LOGO and branding), editorial design (Monthly, paper & Books), environmental design, advertisement, web design, communication design, product – packaging, singing board.

Visual design is the basic units in parts of arts. One who create the design and concepts the visual message. Line graphic design is the most basic part.

Curved line, straight line, thick line, thin line etc are two and three dimensional are used in graphic. (Fig 1)



2 LOGO Designer (LOGO – Language of Graphics Orientation)

Logo of any company, trademark. Appreciation is representing is the graphic form. LOGO is made a visual sign to give the information about company product and services.

Before designing a company letter head, business card and choosing its colours, first they should have their LOGO. (Fig 2)



Perspective: Linear or part projection approach is two types one of graphical projection approach to the graphic arts second one is equal projection to the graphic arts.

Graphical approach means approximate representation of an idea.

Usually the plain surface line being with (line parts) Linear approach characteristic is that when the viewer view the object from distance increases it appears smaller.

That is the result of the visible line in a line are less visible by crossing the visible lines. All objects move from the side of the horizontal line, but above and below the horizontal line depending on the point of view used. Perspective is a technique of describing three dimensional sections spatial relationships in three dimension, in two dimensions from the point of view of the holder.

Human faces result from the front

Result 1: The eyes will be at a half way a of below the head. Fig 3A

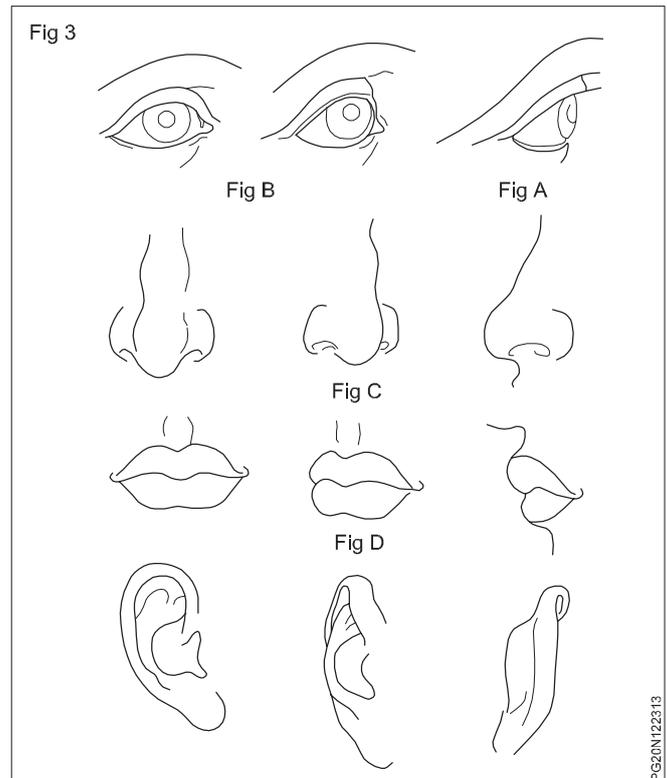
Result 2: In the vertical line of the tear duct on the side of the nose. Fig 3C

Result 3: The distance between the two eyes is width of one eye. Fig 3B

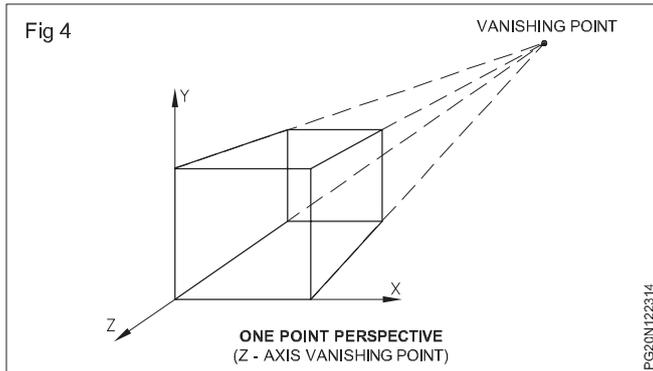
Result 4: The head is about the width of five eye width Fig 3b

Result 5: The corners of the mouth are in the perpendicular lines of the pupils of the eyes. Fig 3D

To make a portrait out of memory and thoughts a lines knowledge in necessary.



One point perspective: Sketch means there is only one invisible point in the line. Even if there is no requirement, then also when the viewer is seeing the object in straight line, even though it is in reverse direction, it is on horizontal line. In the writers method, a point approach is that whenever any visual object moves away it looks smaller and when it is situated in the horizontal line it moves towards the invisible line on the plain surface of a paper this is the only way to show an objection three dimensional and real. (Fig 4)

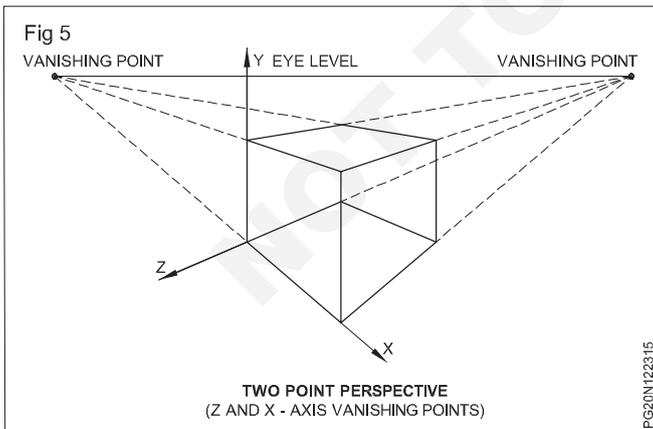


Two – point perspective: Line approach is that in which the parallel line passes through the breadth and depth of the object which is shown as a back at two different prints measured up to 90° difference of the horizontal by measure at the common mid-point of the projection.

When we are from our view point two invisible points are called two point perspective. This perspective is used in architecture drawing and also it is used for both exterior and interior objects.

Approach on a flat surface creates an implosion of depth and difference. In approach there are three basic types. Single point, two points and three points. When the impression of depth and place is created, the invisible points numbers are one, two, three,

When we are drawing a 2 dimensional plane is being used and when we try to bring reality into our drawings and to achieve, in this place feel of three dimensional is created. (Fig 5)



Ex: Men's sketching start 5 from top to 7.5 to 8 heads but when sketching about children it starts from top by 5 to 6 heads.

Men's results (Basic results) (Fig 6)

The male result is primarily used on the basis of many human forms.



Women's result: (Fig 7)

The result of a women and the result of a man are the same. But for the womans there was a separate characteristic. While creating woman certain factors were to be includes. Her neck should be narrow and long, shoulders wide, hands should be narrow and legs should be more ringe.



Pencil shading

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

- state the importance of pencil shading in painting
- describe about the various types of pencil shading
- state the characteristics of pencil shading
- describe the tools of shading
- state the shading techniques.

Pencil shading: Pencil shading is real art flags an important role. It is known as the art suitable for making a object drawing appear darker lines or lighter. Pencil shading is an art by which an object which in darker region to appear more darker, lines dense for light parts light shade.

It is used to bring on the paper the impression of the depth of the light and shadow areas.

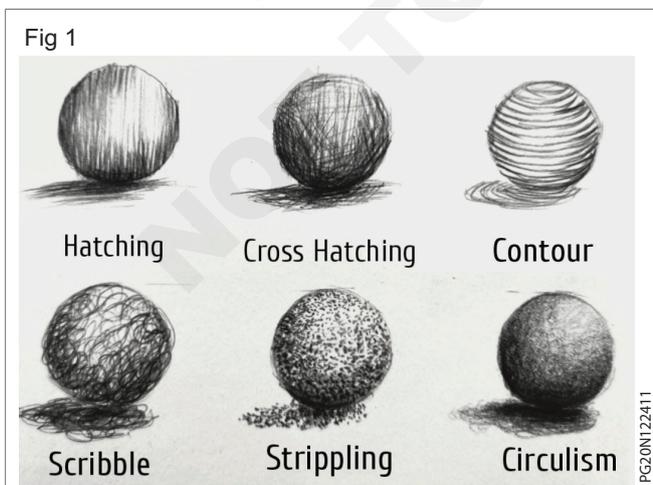
Shading means form, space and in the most important sketching it will bring the impression. It will increase the picture's value and is a very important powers. When shading is employed it makes a realistic picture and it is look like a three dimensional picture.

Shading in painting has a very important place and bring reality in it. It also creates the impression of the intensity of shading and also 3D.

To inhibit art it is a suitable medium and it is a technique for lines and sketching

Different types of pencil shading techniques (Fig 1)

- 1 Hatching
- 2 Cross hatching
- 3 Contour scabble hatching
- 4 Sleeping
- 5 Circulism / Blending



The creative shading will take your art to a higher level. Shading art makes all the difference between an amateur drawing and a piece of art, simply because shadows add depth to your subject. Shading is the part that makes a

drawing go from a flat contour drawing to a 3 dimensional illusion.

There are many types for shading and each type will change the style of your drawing.

Cross hatching (Fig 2): Cross hatching is where you overlap lines at various angles. It's great for drawing fabrics like burlap, textured (wrinkly) skin and whatever else you can think of that displays such a pattern. To shade light areas, lighten you lines and space them further apart. In shadowed areas, darken them and bring them.



If you like to start by the lightest area and then add layers of cross hatching until reach the darkest area of the drawing.

Hatching (with parallel lines) (Figs 3a & 3b): Hatching with parallel lines is the same as cross hatching, except you are making all the lines go in the same direction. It is a bit more time consuming than cross hatching but can lead to interesting results.

Contour shading (Fig 4): Contour shading is similar to hatching and cross hatching. The difference is that the lines are curved to follow the contours of the subject. So these lines can be drawn horizontally, vertically and even diagonally. (Fig 4)

Scribbles: A doodle is a drawing made while a person's attention is otherwise occupied. Doodles are simple drawings that can have concrete representational meaning or may just be composed of random and abstract lines, generally without ever lifting the drawing device from the paper, in which case it is usually called a "scribble".

Scribbling or scumbling is a fun way to shade a drawing and it goes fast. Scumbling or scribble drawing shading works particularly well for portraits and still life.

Fig 3

Fig a

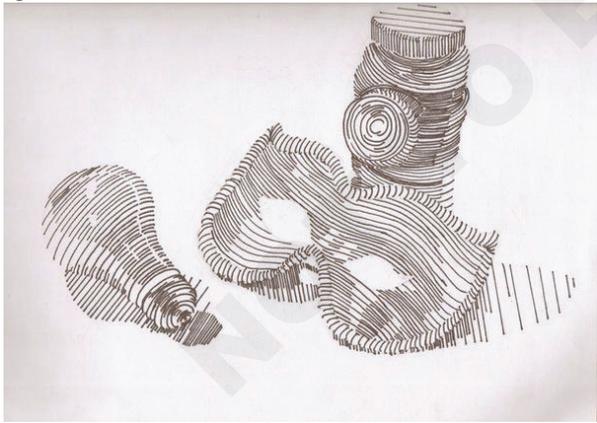


Fig b



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Fig 4



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Powder shading (Fig 5): This is the modern form of pencil shading. In this style, stumping powder and paper stumps are used to draw pictures. The stumping powder is smooth and does not have any shiny particle. The paper is to be used should have small grains so that the powder remains on the paper.

After finishing the drawing a fixative spray is applied so that the powder stick on too the paper. Powder shading

on pictures or painting should be covered with a butter trace paper or should be photo framed.

Fig 5



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In to the shading shadow light plays an important role. Due to this type of effect only in this type fast or drawing reality, dimension and 3D effect can be how and the shadow light to be used at different levels and varying shades have to be shown. The inter relationship of shadow light is called shadow discrimination.

Charcoal powder and graphite powders are used for drawing shading purpose.

Blending stump: A blending stump is a cylindrical drawing, tool, tapered at the end and usually made of rolled paper, used by artists to smudge or blend marks made with charcoal, connate crayon, pencil on other drawing stensils. Painter makes use these for charcoal or powder shading.

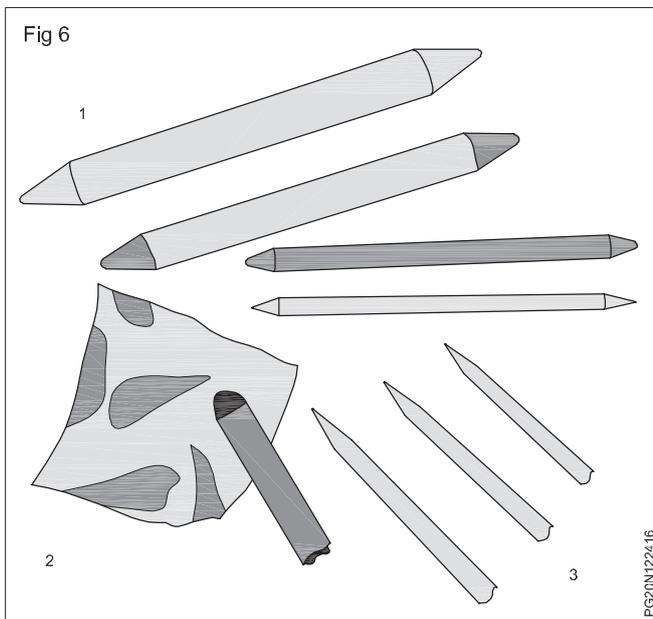
With the help of this paper stumps to remove colour strokes from graphite and coloured powder shading on picture. With the use of cotton duds, cotton cloth and fingers you can do powder shading on paper. When the blending tip stump gets spoiled it is sharpened by sand paper or sharpener. To make dark, medium and light shade in portrait different stumps are used.

Croonwell/Dippen: Adippen usually consist of a metal nib with capillary channels like those of a fountain pen nibs, mounted in a holder or handle, done metal and plastic. Generally dip pens have no ink reservoir must recharge the ink from an ink bowl or bottle to continue drawing on writing. Recharging can be done by dipped ink an ink well, with an eye dropper a spring or brush. (Fig 6)

Tools for drawing and shading (Fig 6)

Shading technique

- 1 Hold the pencil at approximately a 45° angle shading is done with the side of the pencil tip.
- 2 Move the pencil with your shoulder or wrist. Each produces different types of marks.
- 3 The harder you press during shading the darker the mark produced and the darker the shade.
- 4 Spark with a light pressure and increase pressure of application as you proceed in overlapping pencil strokes.



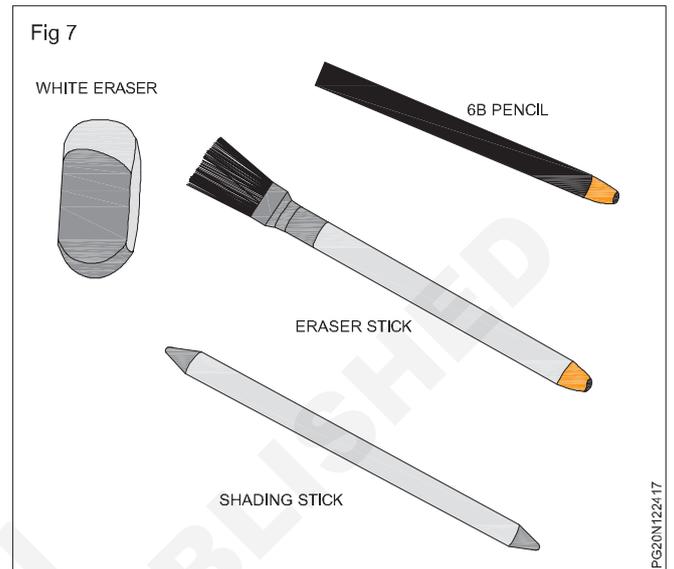
- Charcoal sticks artists pencils and care sticks
- Image by one light studio via shutter stick
- Graphite sticks.
- Inks, dip brushes, dip pens and pens
- Craft knife, erasers stumps and sharpeners
- Papers

5 Apply strokes in various overlapping of several different angles and directions the resulting shade will be move even with greater luminosity.

Tool for drawing and shading (Fig 7)

Arts more drawing pencil set – 12 piece sketching pencils, graphite pencils shading pencils for sketching art pencils for drawing and shading sketch pencils for drawing pencils for artists.

- Graphite pencils
- Colored and pastel pencils



Elements of arts

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

- name the elements of arts
- describe the importance and function of the elements of arts.

Elements of colour

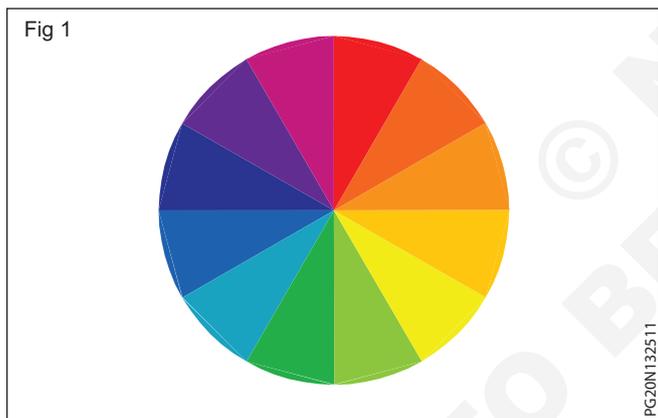
The intensity of colour depends on the amount of energy contained within the wavelength, colour has three virtues.

- 1 Hue
- 2 Chroma
- 3 Value

Hue: The actual colour - (The color it self)

Hue is simply the colour position around the colour wheel and the brightest, purest version of each colour. Hue is determined by the wavelength because each wavelength produces a definite colour on retina of the eye. The largest wavelength creating the red colour and the shortest wavelength creating violet colour. In the same way the intermediate wavelengths in between these two colours represent other colours. (Fig 1)

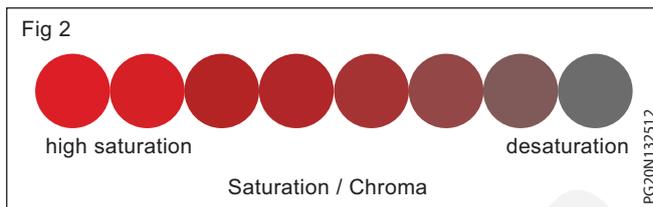
Saturation / Chroma - The brightness or dullness of a colour



Saturation or Chroma is also known as intensity. This tells how vibrant (lively) a colour is. A desaturated colour is greyed out and dull, while a saturated colour is vibrant and strong. If colour has more intensity it means the colour has more saturation. (Fig 2)

Chroma: Chroma is that one in which brilliance may be less or more. That brilliance depends on gray colour. Adding gray to any basic colour reduces the brightness of the original colour, changes it colour. The brightness of the black, white and gray colours can be reduced by making full use of right on bright colour it becomes attractive and it harms the fixture.

Saturation: The colorfulness of an object as compared to the light levels. For example, in a dark image a color may be saturated if it stands out as somewhat bright. In a bright image, a color has to appear brighter than the rest to be considered saturated.



Gray scale: Three dimensionality can be seen in a two dimensional picture with the help of a gray scale. It the place of high key, middle key on low key is changed in an image gives different results. By this changes are brought in space, intensity and depth. Due to the shadow key the form of full image is changed for this it becomes necessary to study the rotating scale of eleven parts. Top portion of the scale is white and bottom portion is black colour. The middle nine parts are divided by three shades of each.

- 1 High nay
- 2 Middle nay
- 3 Low nay

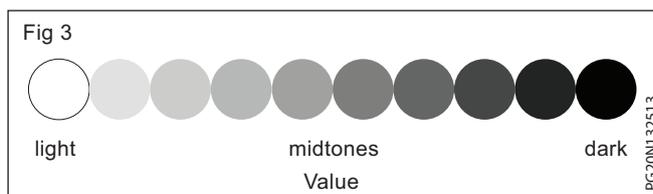
High nay: The part which is below the white colour on the grey scale is called high nay.

Middle nay: In gray scale middle nay is in 5 to 7 nos portion. The measure of white and black colour is almost equal. These three parts are high middle, middle and lower middle.

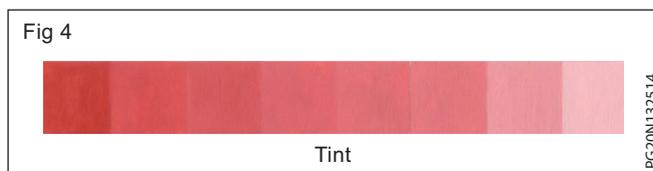
Low nay: The part which goes is above the three parts of the black colour is called low nay. It is called as high deep, middle deep and lower deep keys.

Value The lightness or darkness of a colour.

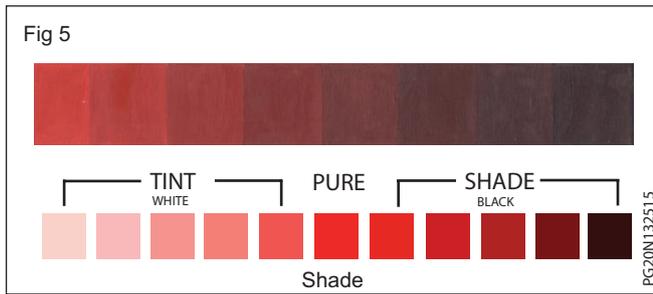
Value tells us how dark or light a colour is. When dealing with pure colour (hue) value can be affected by adding white or black to a colour. (Fig 3)



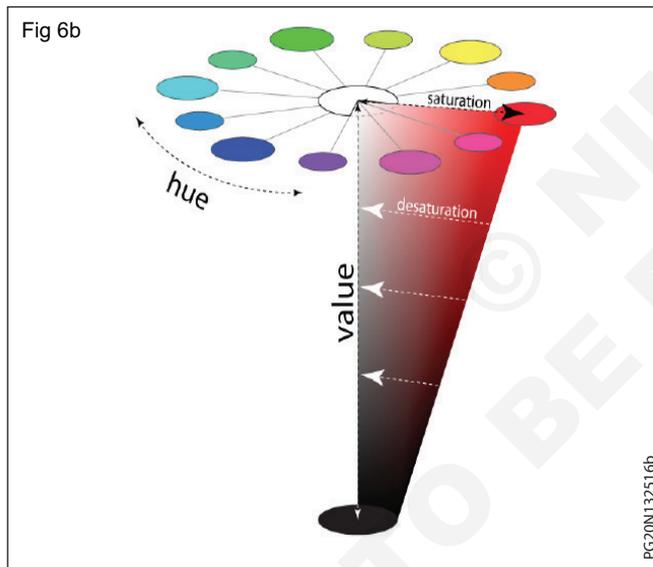
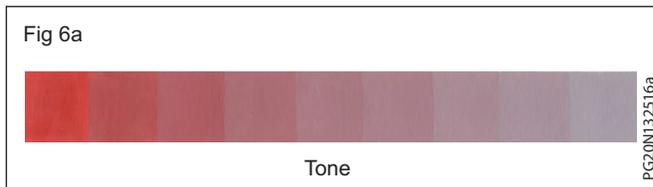
i **Tint:** A tint is created when you add white to a color and lighten it. It is also sometimes called a pastel color. (Fig 4)



ii Shade: A shade is created when you add black to a color and darken it. Just as with tints, you can add black to any of the twelve hues of the color wheel or to any combination of hues of the color wheel to create shades of that hue by adding various amounts of black. (Fig 5)



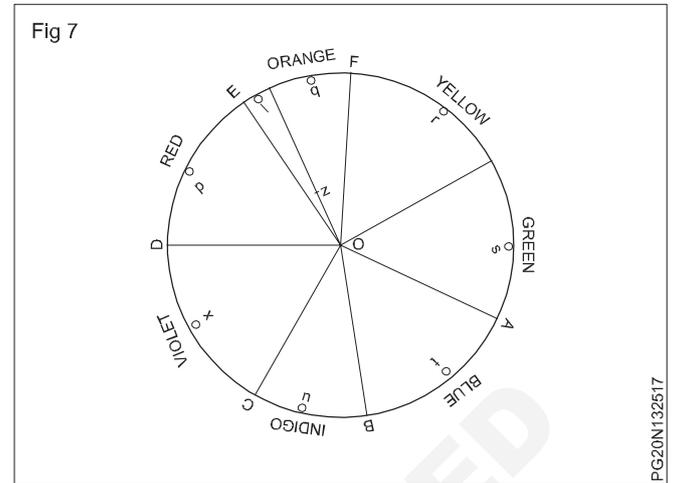
iii Tone: A tone is created when you add both white and black (which is grey), to a color and tone it down. (Fig 6a & 6b)



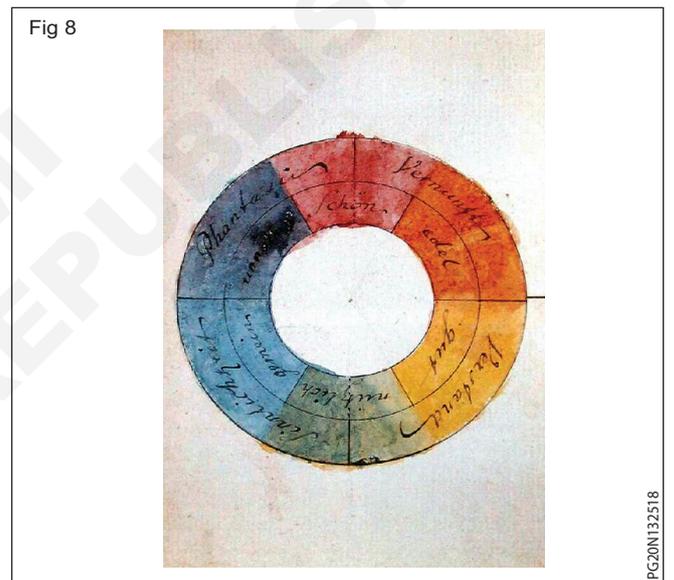
Colour Wheel: The color wheel or color circle is the basic tool for combining colors. It gives good understanding of colours. It consists of the colours of the rainbow arranged in circular fashion. This colour wheel can be used to explain the main relationships of colours. An understanding of these relationships is useful for choosing furnishings, coverings, paints and other colour materials.

A color wheel or color circle is an abstract illustrative organisation of color hues around circle, which shows the relationships between primary colors and tertiary colors etc. Most color wheels are based on three primary & secondary colors and fix international formed by mixing with secondary known as tertiary colors, for a total of 12 main divisions, some add more intermediates for 24 named colors. They make us of the trichromatic model of color. The different types of color wheels.

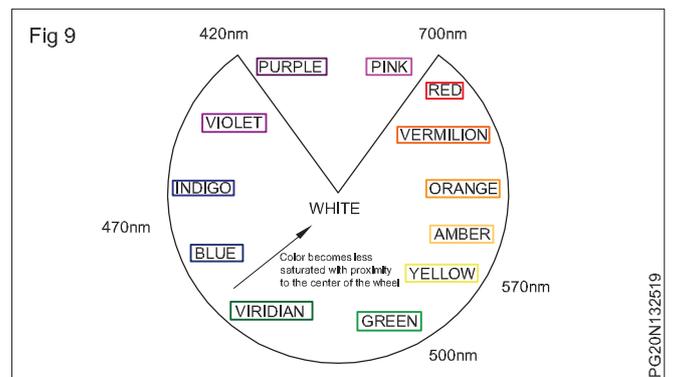
Newton's asymmetric color wheel based on musical intervals. Mixing "rays" in amounts given by the circles yields color "z" (1704) (Fig 7)



Goethe's symmetric color wheel with 'reciprocally evoked colours' (1810) (Fig 8)



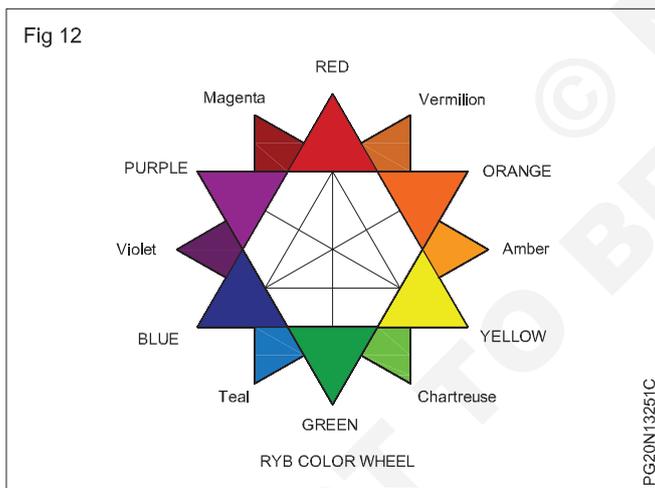
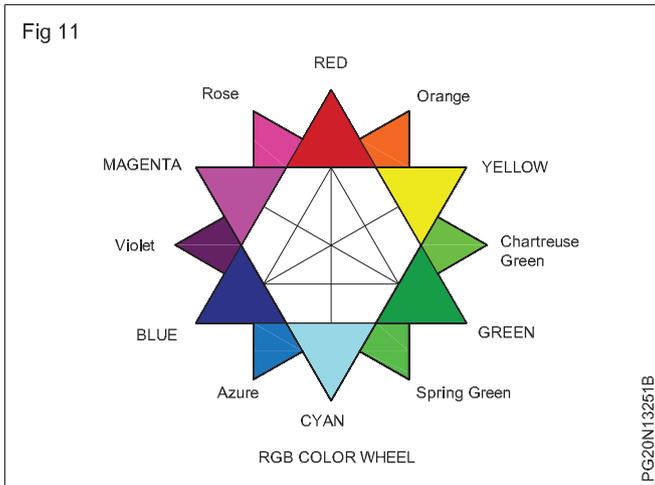
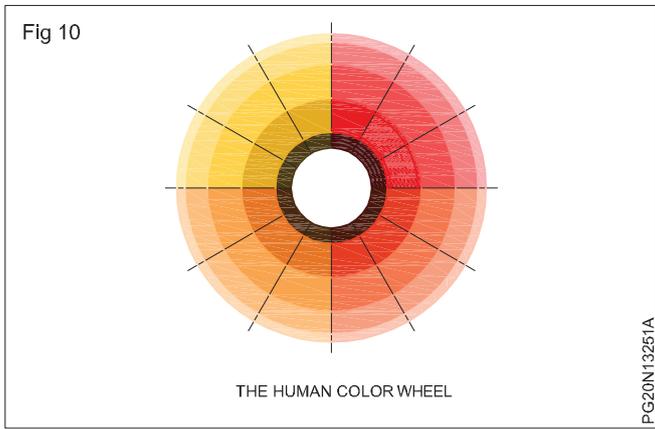
A color circle based on additive combinations of the light spectrum, after schiffman (1990) (Fig 9)



Human color wheel based on the hue and light detected on human skins, after Harbisson (2004-2009) (Fig 10)

RGB color wheel (Fig 11)

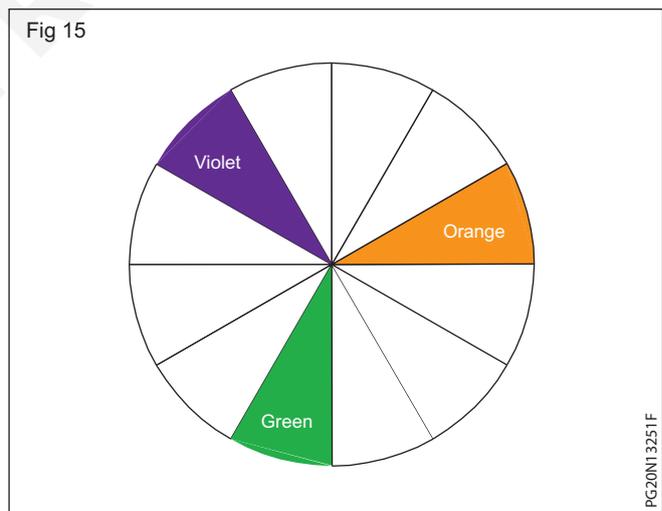
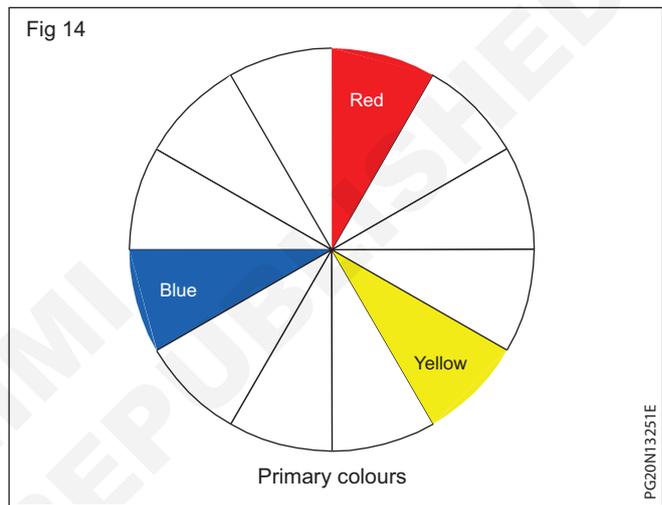
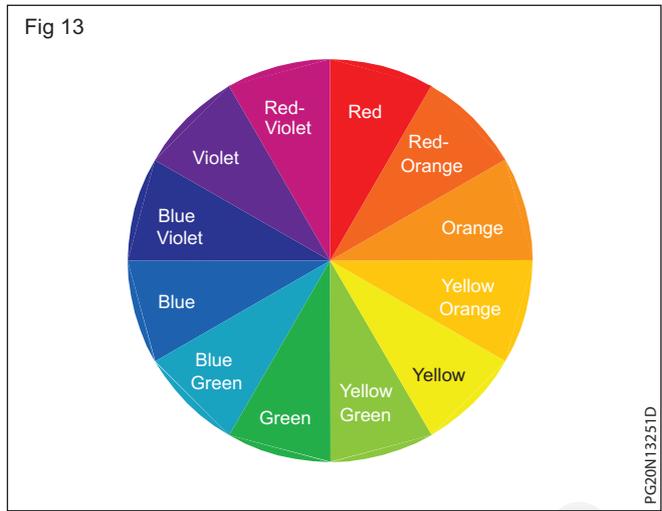
RYB color wheel (Fig 12)



The first colour wheel was presented by Sir Isaac Newton in the 17th century when he first discovered the visible spectrum of light. Around this time, colour was thought to be a product of the mixing of light and dark, with red being the “most light”, and blue the “most dark”. (Fig 13)

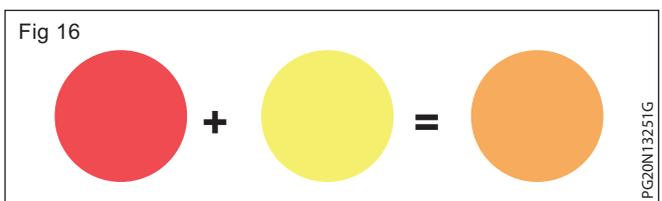
Primary Colours: Red, blue and yellow are known as primary colours because they cannot be obtained by mixing any other colours. (Fig 14)

Secondary Colours: Secondary colours are obtained by mixing two primary colour. They are orange (red + yellow), green (yellow + blue), and violet (blue + red). (Fig 15)

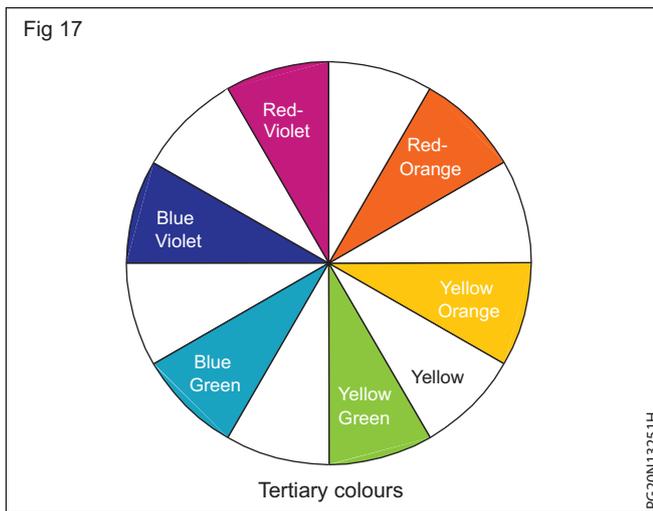


One Primary Colour + Another Primary Colour = 1 Secondary Colour

Example: Red + Yellow = Orange (Fig 16)



Tertiary colours: Tertiary colours are created by mixing equal parts of a primary colour and a secondary colour together. There are six tertiary colours - red - violet, red - orange, blue - green, yellow - green, blue - violet and yellow - orange. The proper way to refer tertiary colours is by listing the primary colour first and secondary colour, second. (Fig 17)



Red violet (magenta)

Red orange (vermillion)

Blue green (aqua)

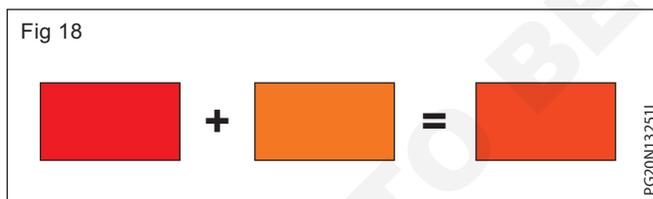
Yellow green (lime green)

Blue violet (purple)

Yellow orange (marigold)

One Primary + One Secondary = One Tertiary colour

Example: Red + Orange = redorange (Fig 18)



Quaternary colours: The colours formed after mixing the tertiary colour is called quaternary colours. This colour is very fuzzy, swiny, clay-like and black

- Raddish grey + yellowish grey = Orange grey
- Yellowish grey + bluish grey = greenish grey (sage)
- bluish grey + reddish grey = Purplish grey (plum)

Intermediate colours

The colour formed after the mixing of primary colour and secondary colour is intermediate colour:

- 1 Yellow + orange = Yellow orange
- 2 Red + orange = Red orange
- 3 Red + purple = Red purple
- 4 Blue + Purple = Blue purple

5 Blue + green = Blue green

6 Yellow + green = Yellow green

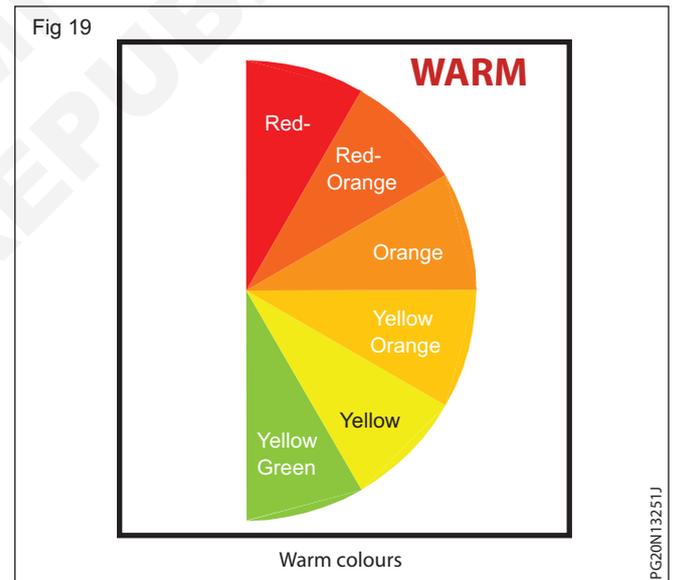
The colours formed by suitable colour mix is called intermediate colour.

Classification based on characteristics of colours

Colours can also be classified into various groups based on their characteristics.

1 Colour temperature: Colour temperature refers to the warmth or coolness of a color. A color's temperature affects the color of everything we see. The colour wheel can be split into two main groups warm colours and cool colours. But, individual colours can also change in temperature as we move around our colour wheel. For example, A warm red includes more yellow and a cool red includes more blue.

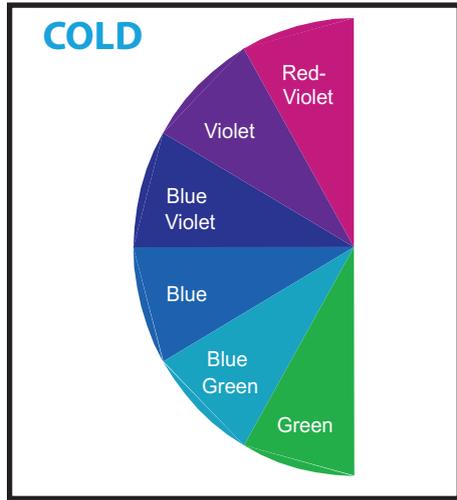
- i **Warm colours:** Warm colours are those colours which are bright, aggressive, attract attention and excite emotions. It also makes a colour schemes cheerful and rich. The hue from red to yellow colour including orange, pink and brown are on the maximum side warm colours. (Fig 19)



- ii **Cool colours:** Cool colours have opposite effects of warm colours. It cools down the metabolism of the body. Sometimes it appears gloomy and oppressive but cool shades of blue and green look clean and inviting for a nice change. The hues from green to violet including blue and all shades of grey are known as cool colours. (Fig 20)

2 Light colours: Light colours is the mixture of basic hues and white colour which reduces the intensity of colour. Light colour looks sof and sublimed and is preferred in interior decoration. Light colour scheme may look effective in its quiet way depending on environmental surroundings.

Fig 20



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3 Dark colours: Dark colours are the mixture of basic hues with black or warm colours with their actual hues which may or may not be mixed with black colour. These colours look heavy, dense, strong and solid and generally combined with lighter colours. Dark red, purple, green and blue are associated with royalty and dignity.

4 Dull colours: Dull colours are the mixture of basic colours and grey or in other words we can say diffusion of basic colour in grey. It creates a blurry impression but at the same it helps to reduce tension.

Brightness: Brightness is the degree to which a color appears to be radiating light. For example, changing the brightness of a flat screen display can have a significant influence on the perceived lightness and darkness of colors. This is one reason why items may look different in digital photographs than they do in person based on the screen you are using and its current brightness settings.

Spectral vs Non-Spectral: A spectral color is a pure wavelength of light. These are typically listed as red, orange, yellow, green, blue, indigo and violet. A non-spectral color is a color that results from mixing different wavelengths of light such as white, brown, grey and pink. It should be noted that most colors perceived as red, orange, yellow, green, blue and violet are mixes of non-spectral color. For example, RGB display technologies have no ability to display the spectral color violet but simulate this with combinations of blue and red.

Colour scheme: Color schemes are logical combinations of colors on the color wheel. The purpose of a color scheme is to create an aesthetic feeling of style and appeal.

Uses of colour scheme

Colour is responsible for so many factors

- i It makes the interior pleasing.
- ii The dimensions of an interior can be made to look smaller or bigger with the help of colours.

- iii It camouflages undersized elements in an interior
- iv It creates a certain mood in an interior - mood of relaxation or mood of activity etc.

Types of colour scheme

1 Monochromatic color schemes: “Mono” means “one”, “chroma” means “colour”. A monochromatic color scheme consists of using one colour in varying intensities. (Monochromatic color schemes are derived from a single base hue and extended using its shades, tones and tints. Tints are achieved by adding white and shades and tones are achieved by adding a darker color, grey or black).

This colour scheme helps to give a spacious feeling to an interior and provides unity for a composition and a quiet background for objects and people within it. (Fig 21)

Fig 21



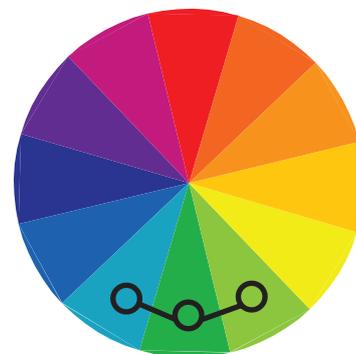
Monochromatic color schemes

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2 Analogous color scheme: Analogous color schemes use colors that are next to each other on the color wheel. They usually match well and create serene and comfortable designs. Analogous color schemes are often found in nature and are harmonious and pleasing to the eye.

This colours scheme is one of the simplest and most appealing colour harmonies and works best if you choose one dominant colour and use the other colours as accents. (Fig 22)

Fig 22

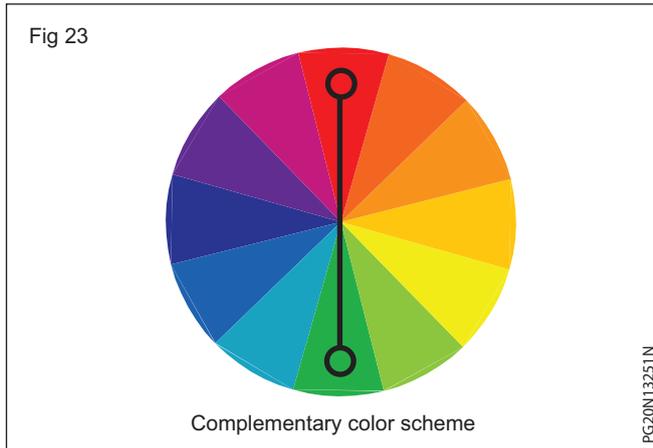


Analogous colour scheme

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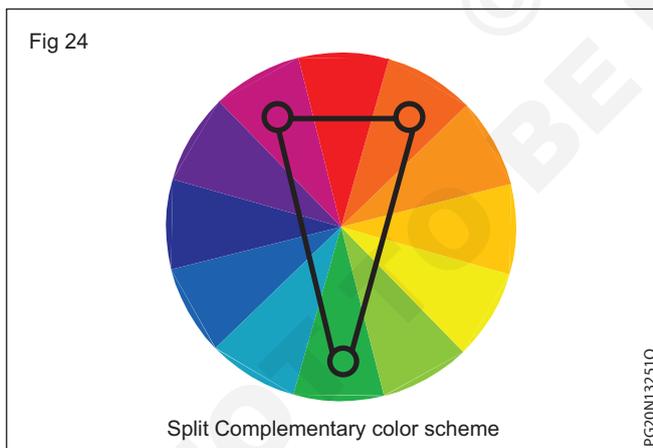
3 Complementary colour schemes: Complementary colours are directly opposite to each other on the colour wheel. These colours need not be used in their pure form. They can be used in many values or intensities. The high contrast of complementary colours creates a vibrant look especially when used at full saturation.

This type of colour scheme is great for creating strong contrast in your image. (Fig 23)



4 Split-Complementary color scheme: The split-complementary color scheme is a variation of the complementary color scheme. In addition to the base color, it uses the two colors adjacent to its complement.

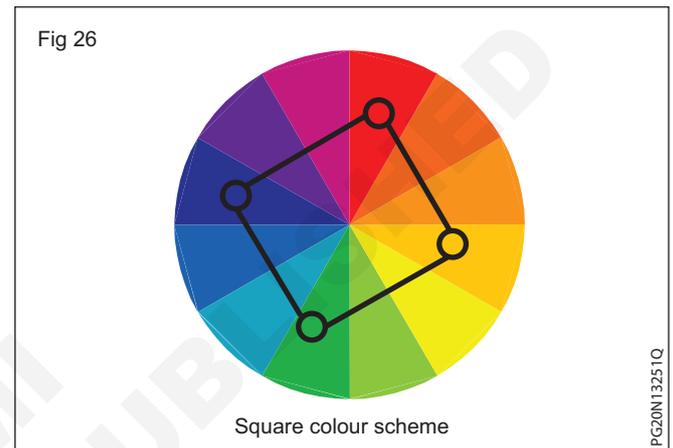
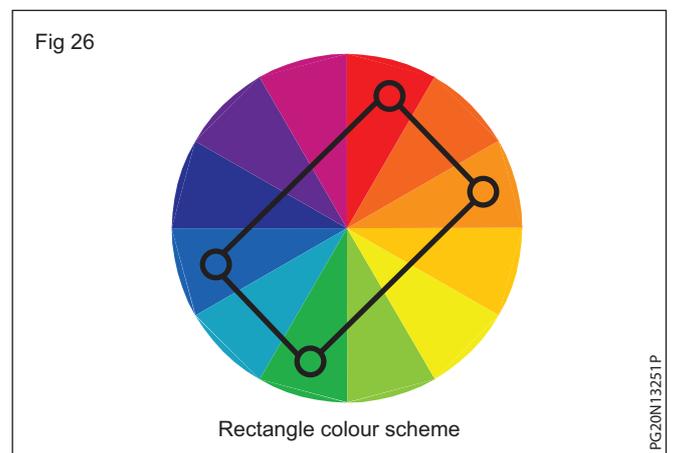
This color scheme has the same strong visual contrast as the complementary color scheme, but has less tension. (Fig 24)



5 Rectangle (tetradic) color scheme: The rectangle or tetradic color scheme uses four colors arranged into two complementary pairs. This rich color scheme offers plenty of possibilities for variation.

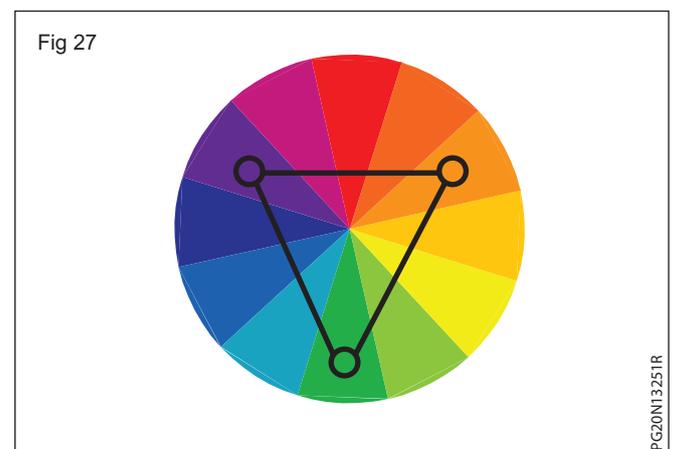
This colour scheme works best when you focus on one main colour and use the other colours as contrasting accents (subtle way). (Fig 25)

6 Square colour scheme: The square color scheme is similar to the rectangle, but with all four colors spaced evenly around the color circle. Square color schemes works best if you let one color be dominant. (Fig 26)

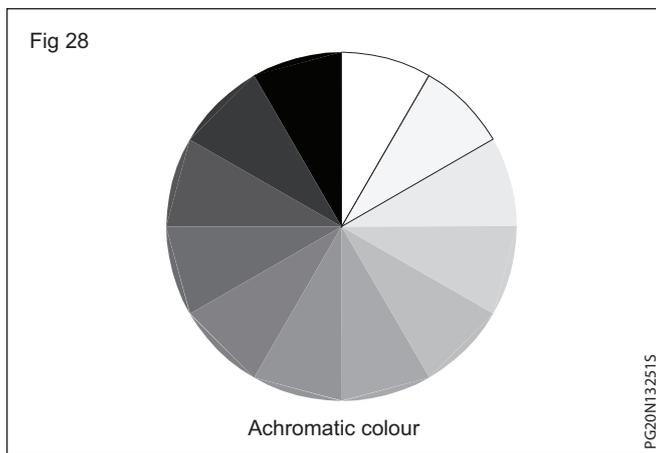


7 Triadic colour scheme: A triadic color scheme uses colors that are evenly spaced around the color wheel. Triadic color schemes tend to be quite vibrant, even if you use pale or unsaturated versions of your hues.

This colour scheme works best when you use one colour as dominant colour, and the other two in lesser quantity. These colour combinations are often bolder and more vibrant. (Fig 27)

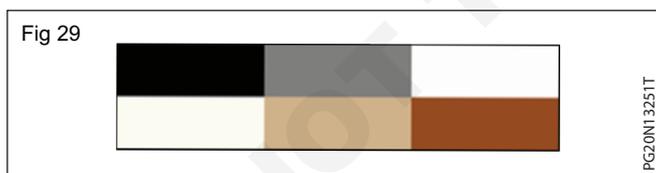


8 Achromatic colour: An achromatic color scheme is simply colorless scheme possessing no hue, using only black, white and grey. It has (White, grey and black) lightness but no hue or saturation. They can be created by mixing complementary colours together.” (Fig 28)



- 9 The following are associations with the color purple include royalty, imagination, power, luxury, wealth, extravagance, ambition, wisdom.
- 10 Some associations of the color blue include the sea, the sky, trust, honesty, loyalty, sincerity, peace, tranquility, intelligence.
- 11 Some associations of the color green include spring, growth, renewal of rebirth, balance, nature, grass of gardens, stability, possessiveness, jealousy, envy, fertility, safety, money, recycling.
- 12 Some associations of the color yellow include creativity, sunshine, happiness, energy, cowardice, deceit, warnings, instability, clarity, activity.
- 13 Orange color association of the color include risk taking, citrus, healthy food, halloween, target market and audience enthusiasm, happiness, autumn harvest, creativity, spontaneity. Orange color can be used to people talking or thinking.
- 14 Red color associations include the following energy, positivity, action, war, danger, strength, courage and all things intense and passionate, love, sex, passion and desire.

Natural colours (Fig 29): Colours which are not included in colour wheel are known as neutral colours eg: white, black, grey, brown and tans



Guidelines for good colour schemes

- a In all colour schemes one colour should dominate. This basic colour occupies 60 to 70 percent of the whole colour.
- b Definite colour schemes like harmonious, complementary or triad are recommended.
- c A safe colour scheme consists of tints and shades of one colour.
- d A colour scheme should be definitely dark or light.
- e Either warm or cool colours should dominate.

- f Every colour scheme must have a dominating colour and secondary colour.
- g A neutralised colour (grey) is best for large areas.
- h Rely on colours to brighten dark areas.

Psychological impact of colours

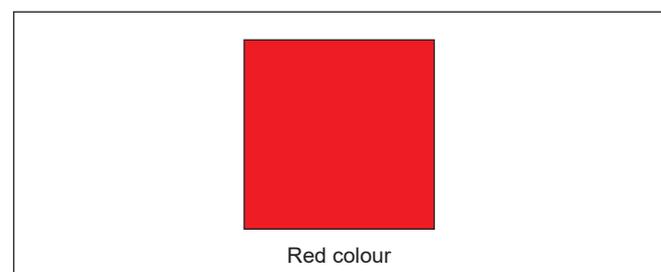
Introduction

Color psychology is the study of colors in relation to human behavior. Colors and emotions are always closely linked together. A Warm colour can evoke different emotion than a cool colour and a bright colour can create different feeling than a muted colour. It all depends on how the psychological effects of color are being used.

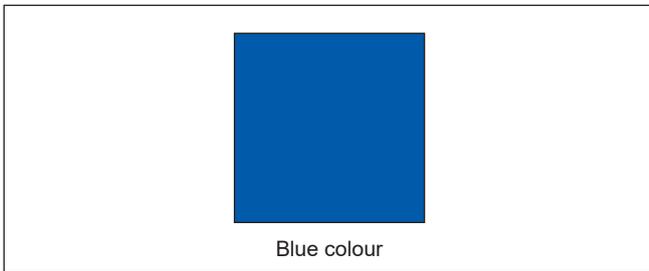
Colour psychology in interior design

Colour psychology is a powerful interior design tool that impacts the mood of a room more than any other factor. Different shades evoke certain emotions so, when choosing colours, it's important to consider the kind of atmosphere you wish to create and which colours will help you achieve this. It is important to note that each colour impacts on different people differently. Many factors can influence these including one's age, race, culture as well as life experiences. However, people will always respond to colour no matter what. In general, following colors create following psychological effects in interiors.

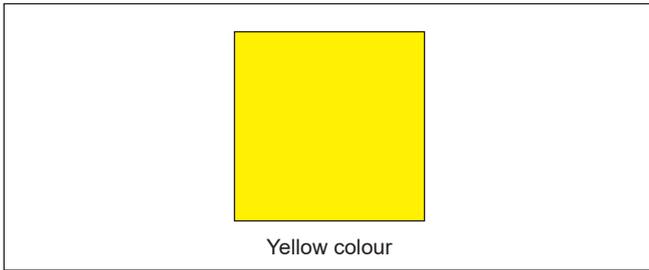
- 1 **Red colour:** Red colour is the bright colour in the whole spectrum. It has a dynamic character and denotes courage and aggressiveness. It affects the atmosphere and makes it hot and non tolerable. But it is a definite positive colour. It should be used in a room where the sun rays do not reach. The most intense colour, red raises a room's energy level and pumps the adrenaline. In the living or dining room, red draws people together and stimulates conversation. In an entrance hall, it creates a strong first impression.



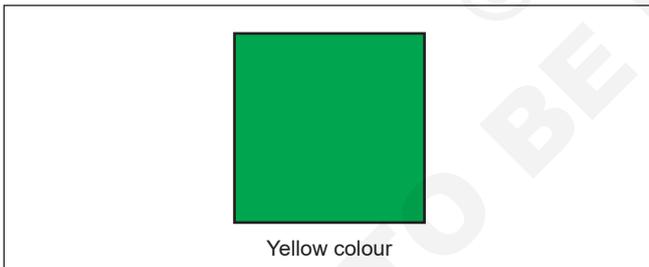
- 2 **Blue colour:** Blue is one of the strongest hues of the colour psychology spectrum, It is believed to bring down blood pressure and slow respiration and heart rate. It is a cool static colour which has the property on increasing the distance from which it is being reflected to the observer. It makes atmosphere calm and soothing. It promotes relaxation after a day of hard work, but at the same time too much of blue can be depressing. This colour is often recommended for bedrooms and bathrooms where you want to create a relaxing environment.



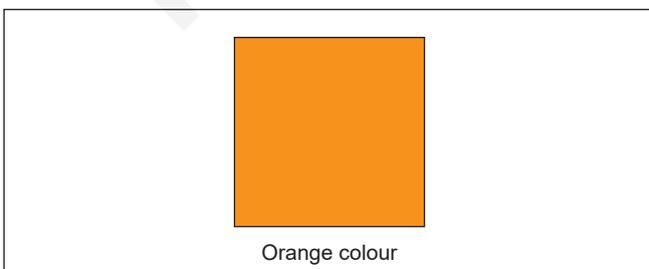
- 3 Yellow colour:** Yellow is the colour of intellectual nature. It captures the warmth of sunlight and evokes positivity. It's a great choice for kitchens, dining rooms and bathrooms, where it is energising and welcoming.



- 4 Green colour:** Green is psychologically the most soothing colour and it is largely found in nature. It is a combination of blue and yellow. It cools the environment and is a natural healing agent. It is a soothing and safe colour, even its excess use does not harm. Being a cool friendly color it mixes well with many other colors. It looks great with white and is suitable for almost any room in the house. It stimulates thoughts of balance, growth and restoration in colour psychology.



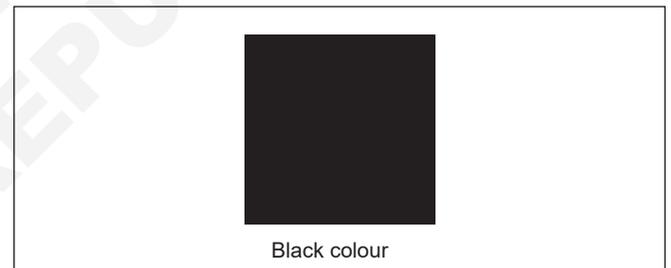
- 5 Orange colour:** Orange hues are bright, fun and energize. It is a combination of yellow and red. It brings brightness, cheer and happiness in the atmosphere. It gives the feeling of well being. It is suitable for lobby and children room.



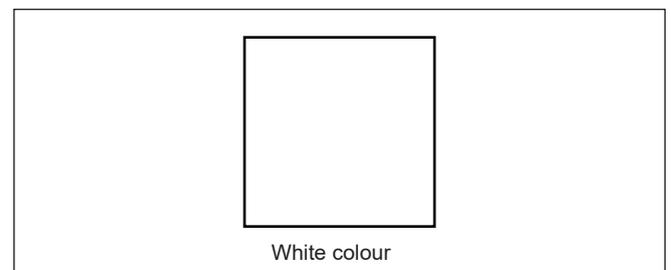
- 6 Purple colour:** Purple has long been the colour of royalty, and can inspire creativity and spirituality. It's a popular choice for kid's rooms. It is great in areas for study room, but should not be used in a busy or active room. Lavender can become grey looking in rooms that do not have much natural light. Using this colour in a dressing room creates the maximum effect, and you can also use it in your hallway to give a good impressive look.



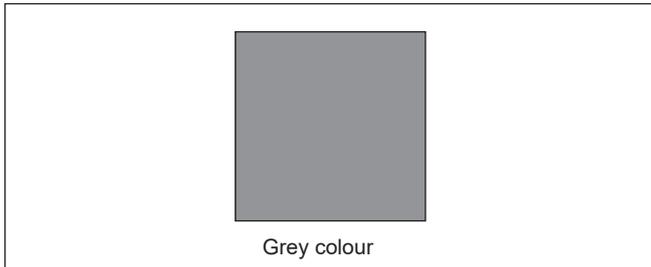
- 7 Black colour:** Black is always associated with sophistication, elegance and luxury. It's most often used as an accent in the home, as all - black interiors can become dreary and overwhelming very quickly. (It is always used in small amounts with contrasting, complementary colors. When used right, it can add depth and timeless elegance to a room. Avoid using black in large quantities as it can seem oppressive).



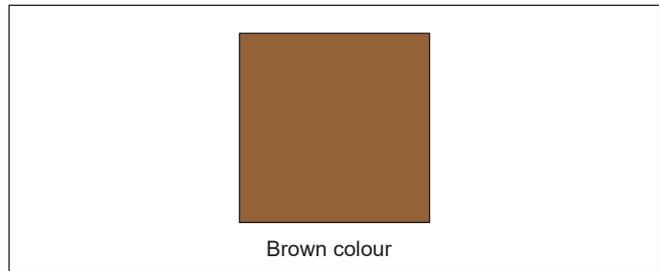
- 8 White colour:** White is the colour of purity and cleanliness, and often is regarded as blank palette. White can help smaller spaces appear large. It can also make rooms look livelier, fresher and crisper, but can also be very cold and barren without the proper accent pieces. Excess use of this colour can lead to feeling of emptiness.



9 Grey colour: Grey is a combination of white and black and therefore a mixture of qualities of both. The grey interior gives a formality that is subtle elegance without being too conservative. Its effect depends very much on the color shade that you will use. For example, if grey has a yellow tint it may be depressed, especially if you have things in the room in various shades of brown. But a beautiful shade of grey, in combination with not very bright white color, can create a clean and refreshing appearance. If you have too many grey areas will become predominant and create a boring environment.



10 Brown colour: Brown is a mixture of red, yellow and black. It represents tradition and conservation taste. It stimulates growth and achievement. It is said to be a rich colour as we get qualities of red, yellow and black. Brown is the best for furniture upholstery and wardrobes. Brown shades are turly versatily, and go with any design style and mood.



11 Beige colour: Beige is a mixture of light yellow and grey. It can be matched with all colours. It merge with surroundings. If you are not sure which colour is suitable for a room, try beige.



Drawing and painting instruments - Features and their uses

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

- name the contents of an instrument box
- state the features and uses of large compass and large divider
- state the features and uses of bow instruments, beam compass
- state the use of lengthening bar, screw driver, lead case and ruling pen
- state the grades of the pencils
- state the scales, drawing board, set square, eraser, protractor, pencil and sharpener
- state the templates.

The quality of a good drawing not only depends on the talent of the painter but also on the quality of instruments he uses.

Drawing and painting instruments are generally sold in sets in boxes, but they are also available separately. The main parts of high grade instruments are generally made of Nickel or Brass. They must be rust proof. Tool steel is used for making the blades of the inking pen, bow instruments.

An instrument box contains the following: (Fig 1a to h)

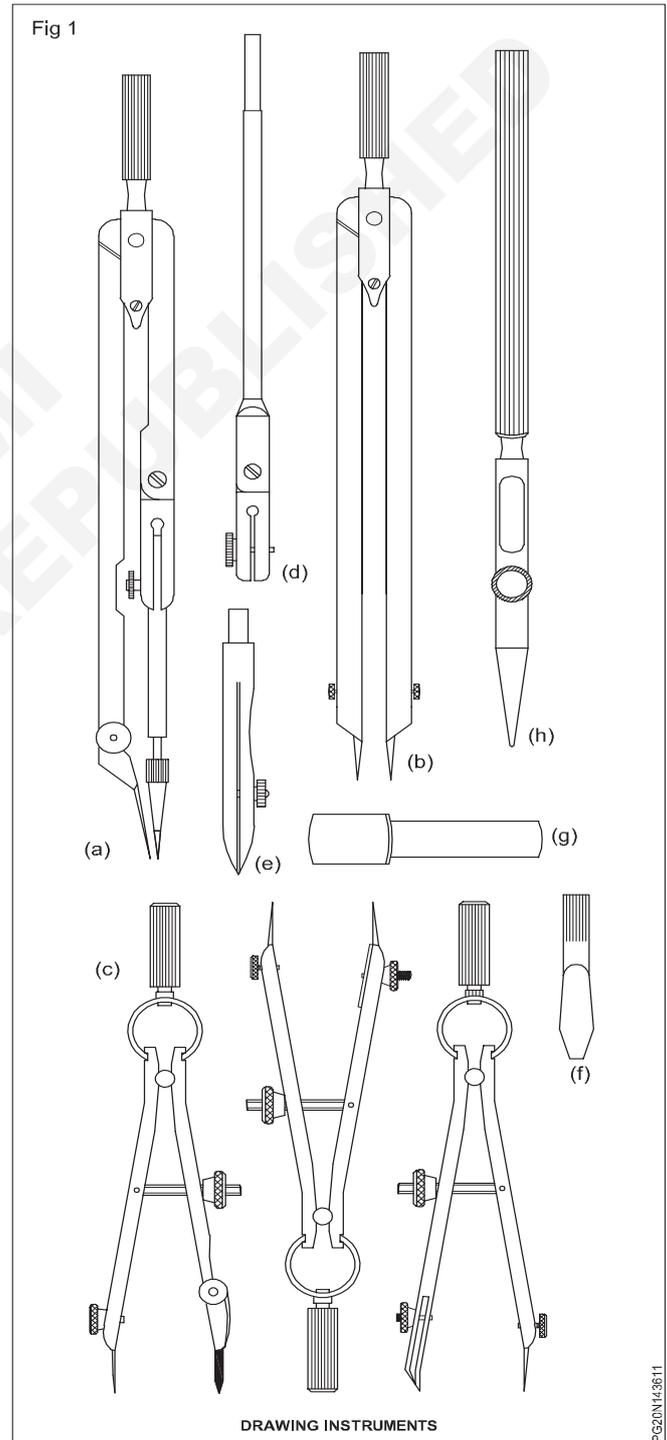
- Large compass (with attachment facility) (a)
- large divider (b)
- Bow compasses, bow divider (c)
- Lengthening bar (d)
- Pen point for attachment (e)
- Screw driver (f)
- Lead case (g)
- Liner (h)

Large compass (Fig 2): It has a knee joint in one leg that permits the insertion of pen or pencil point or attaching lengthening bar with pen or pencil point attached to it. It is used for drawing large circles / arcs also for taking large measurements. The pin on the other leg can be swiveled to vertical position when drawing large circles, while drawing the circles of arcs it should be held in such a way that the needle point leg and pencil point leg should be bent so as to make perpendicular to the paper.

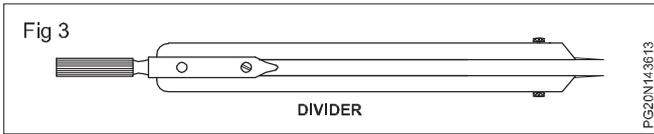
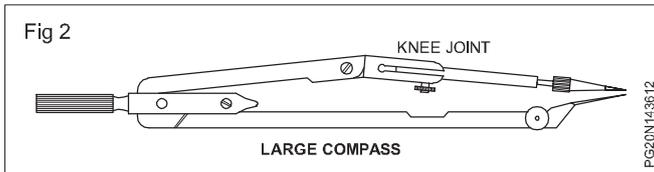
As a rule while drawing concentric circles, small circles should be drawn first before the centre point gets worn

Large divider: It is used to transfer dimensions and dividing lines into a number of equal parts. Divider with adjustable joints is preferable rather than plain legs. (Fig 3)

Bow instruments: Bow pencil and bow pen compass are used for drawing circles of approximately 25 mm radius. Bow divider is used for marking or dividing smaller spaces. There are two types (i) Integral legs with spring action (4e) (ii) two legs held with a curved spring on top with handle on it.

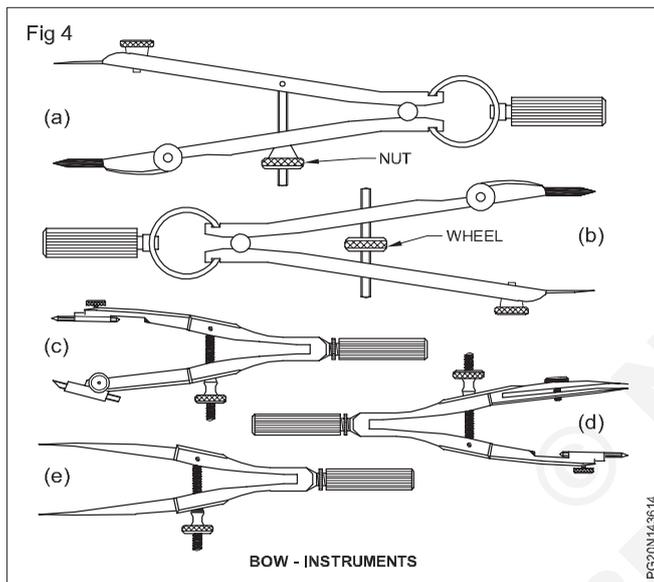


DRAWING INSTRUMENTS



Bow instruments may have adjusting wheel and nut. To draw circles, it is better to mark the required distance separately and set the instruments and check. Then only the circles or arcs should be drawn on the drawing.

Fig 4 shows different types of bow instruments. Adjustment should be made with the thumb and middle finger. The instrument is manipulated by twisting the knurled head between the thumb and finger.

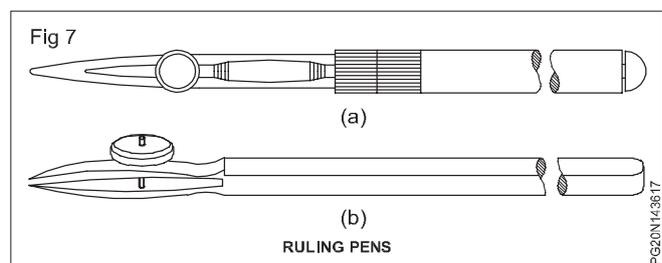
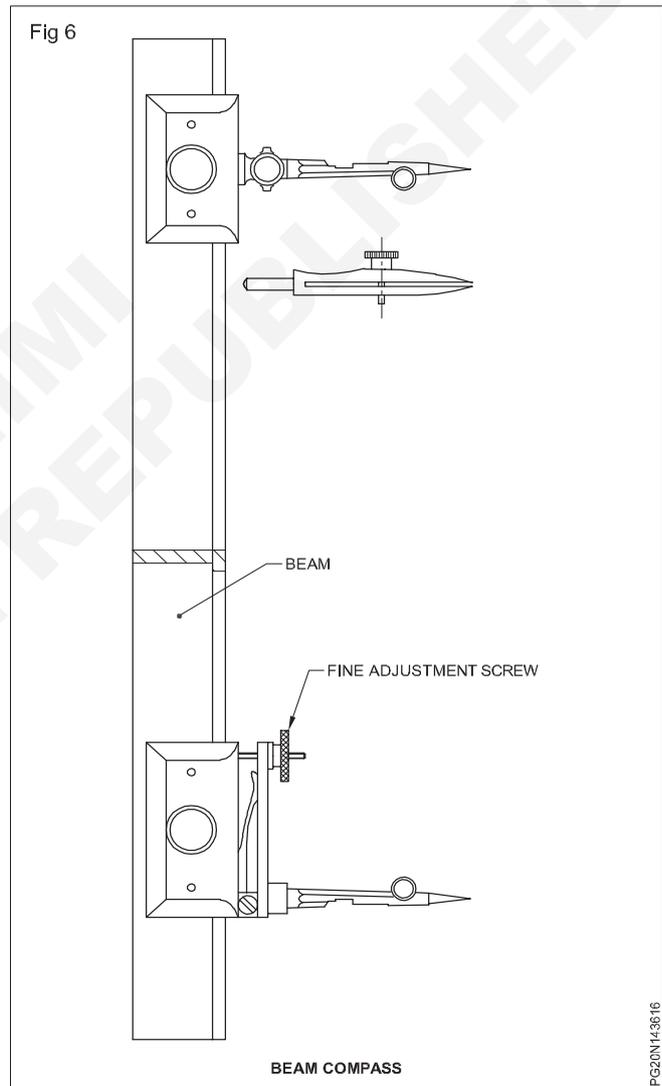
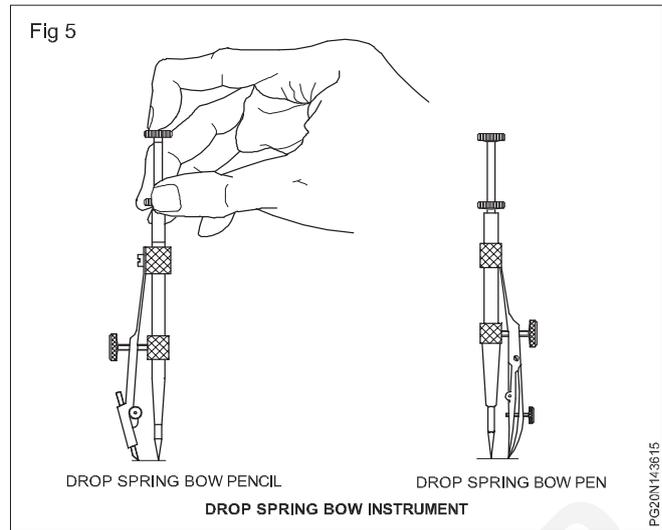


Drop spring bow pencil and pen (Fig 5): Drop spring bow pencil and pen are designed for drawing multiple identical small circles. example rivet holes drilled / reamed holes.

The central pin is made to move freely up and down through the tube attached to the pen or pencil unit. It is used by holding the knurled head of the tube between thumb and middle finger while the index finger is placed on the top of the pin. The pin point is placed on the centre point of the circle to be drawn (Fig 5) and pencil or pen is lowered until it touches paper. The instrument is turned clockwise and the circle is drawn.

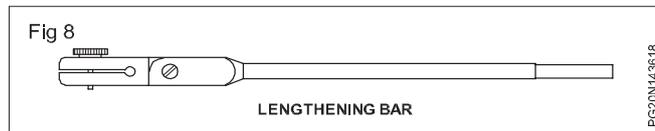
Beam compass (Fig 6): It consists of a beam made of steel rod or wood. The steel point is used as centre, and by adjusting the compass point (Pencil / Pen), very big circles and arcs are drawn. The divider point and the pencil point are replaceable to the adjustable holders. These pens have provision for varying the thickness of lines.

Inking pen or liner or ruling pen (Fig 7): It is used to ink the straight lines drawn with the instruments but never for free hand lines or lettering.

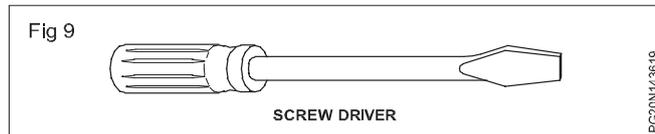


Lengthening bar (Fig 8): To draw larger circles, it is fitted to the compass. The pencil point or pen point is inserted to its end.

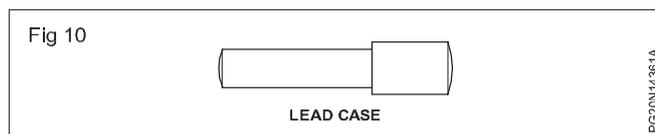
Pencil, pen and needle points are replaceable spares attachable to compass.



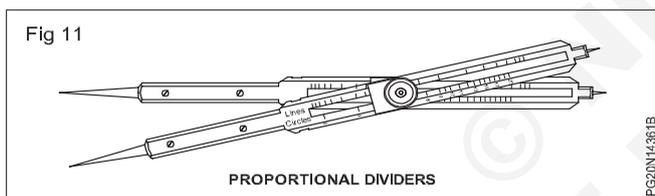
Screw driver (Fig 9): Used for adjusting the screws of the instruments.



Lead case (Fig 10): Lead case is the box for holding the pencil leads.



Proportional divider: For enlarging or reducing drawing, dividing a line into a number of equal parts, proportional divider is used. It is best suitable for percentage reduction with the help of graduation marked on the instrument. (Fig 11)



Pencils (Fig 12): Soft lead pencils are used to draw a perfect outline of picture. This will allow to fill the paint in correctly, within the borders of drawing.

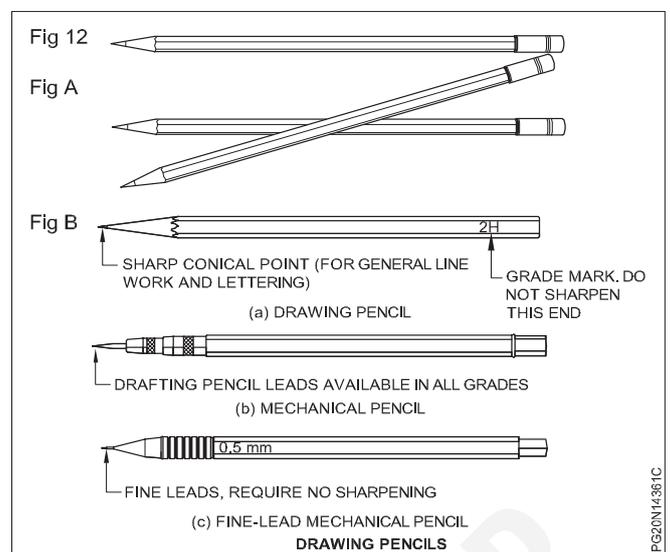
Use coloured pencils to create interesting textures and add details to drawings. In drawing office, standard pencils (lead encased in wood) and semi-automatic pencils are made for use. Pencil leads are made of graphite with kaoline (clay) of varying proportion to get the desired grades. More kaoline higher the hardness of pencil leads.

Grades of pencils: Pencils are graded according to the hardness or softness of the lead.

Hardest pencil is 9H grade and softest pencil is 7B grade. Selection of grade of pencils depends on the type of line work required and paper on which it is used.

Softer lead pencils are used to produce thicker and darker line work, but they wearout quickly. Medium grade of H, 2H are used for general line work as well as for lettering. HB pencil is an ordinary pencil. It means hard and B. bold or black.

Harder grade leads produce lighter and thinner lines. Most construction line work is done with 4H, 5H and 6H pencil leads, producing thin but also sufficiently dark by



exerting pressure. Depending upon the individuals touch and the style of writing, right pencil may be selected.

For any drawing on drawing paper or tracing paper, lines should be black, particularly drawings which are to be reproduced. For this purpose, the pencil chosen must be soft enough to produce jet black lines as well hard enough not to smudge easily. The point should not crumble under normal working pressure.

The pencils should not be hard and cut grooves on the paper while drawing with normal pressure, Pencils H, 2H or 3H depending upon the paper (quality) and weather conditions are selected.

In summer the pencil leads become softer due to rise in temperature, so slightly harder pencils can be made use of softer grade pencils are used on smooth surfaces for lettering and arrow head.

During rainy season or when humidity is more, the drawing paper expands and wrinkleless form, pencil leads become harder. So softer pencils are to be used. Whatever may be grade of pencil you use, always prefer quality pencils/ leads viz., Venus, Kohinoor, Apsara etc.

For better line work, i.e., dense black lines, prefer paper which is not having too much teeth (roughness).

Selection of pencils: Pencil grades vary from one brand to another brand. Select the grades of the pencil depending upon the type of line work. For construction lines, you can choose 2H or 3H, for lettering and object lines grade H pencils. In general H, HB and 2H are used.

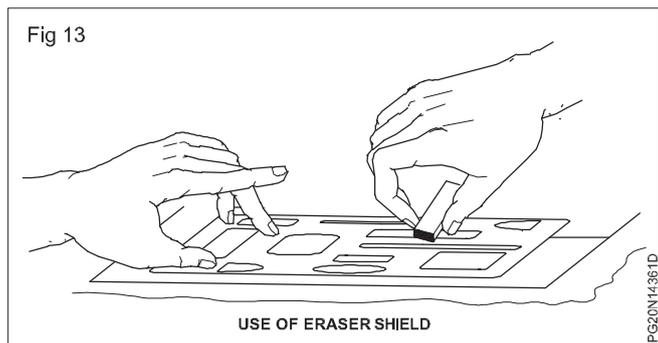
H medium hard
HB medium soft
2H hard

Pencils used for drawing are always hexagonal in cross sections as they do not roll easily even when they are placed on slope surfaces. Its cross section helps in rotating the pencil, while drawing lines, to give uniform line thickness.

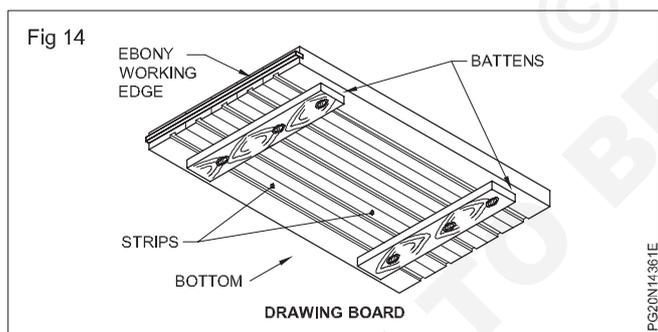
Now-a-days automatic (Mechanical) pencils or clutch pencils are available in different sizes (lead dia 0.3, 0.5, 0.7 or 0.9 mm). They are easy to handle as there is no

reduction of holding length pencil leads can be replaced, as per required grade of hardness. They produce lines of uniform width without sharpening.

Erasing shield: When, on a drawing, if a part of a line or some lines among many other lines need to be erased or modified, in normal way of erasing will damage the other nearby lines. In such a situation an erasing shield is effectively useful. It is a thin metallic sheet having small openings of different sizes and shapes. A suitable opening is aligned to the line to be erased and the line is removed by the eraser. (Fig 13)



Drawing board (Fig 14): Drawing board is one of the main equipment painting artists. It is used for supporting the drawing paper/tracing paper for making drawings. It is made of well seasoned wood strips of about 25 mm thick or masonite, free from knots and warping. It should be softer enough to allow insertion and removal of drawing pins. Two battens are fastened to the board by screws, in slotted joints. They prevent warping and at the same time permit expansion and contraction of the strips due to the change of moisture in the atmosphere.



One of the shorter edges of the drawing board, is provided with an "ebony edge" (hard wood) fitted perfectly straight.

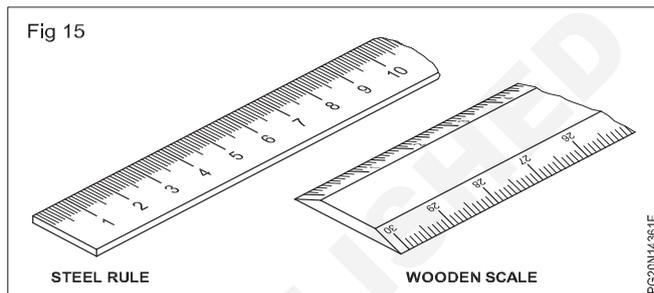
Standard drawing boards are designated as follows as per IS:1444-1989.

Sl. No.	Designation	Size (mm)
1	D ₀	1500 x 1000 x 25
2	D ₁	1000 x 700 x 25
3	D ₂	700 x 500 x 15
4	D ₃	500 x 350 x 15

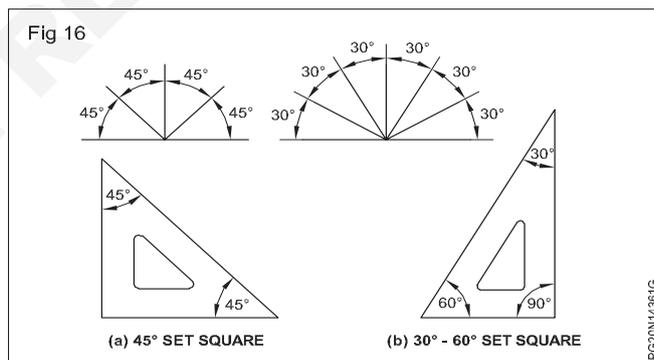
The working edge (ebony) must be straight.

Now-a-days the drawing boards are available with laminated surfaces. The flatness can be checked by placing a straight edge on its surface. If no light passes between them, the surface is perfectly flat.

Scales: Scales are used to transfer and or to measure the dimensions. They are made of wood, steel, ivory, celluloid or plastic, stainless steel scales are more durable. different types of scales are used. They are either flat, bevel edged or triangular cross-section. Scales of 15 cm long, 2 cm wide or 30 cm long 3.5 cm wide flat scales are in general use. Thin section or bevel edged scales are preferred over thick flat scales. Parallax error will be nil or least while using thin / tapered edge scales. (Fig 15)



Set square (IS:1361-1988): Transparent celluloid /Plastic setsquares are preferred and are commonly used rather ebonite ones. They are two in number, each having one corner with 90°. The setsquare with 60°-30° of 250 mm long and 45° of 200mm long is convenient for use. Setsquares sometimes loose their accuracy due to internal strains. So they should be tested periodically. (Fig 16)

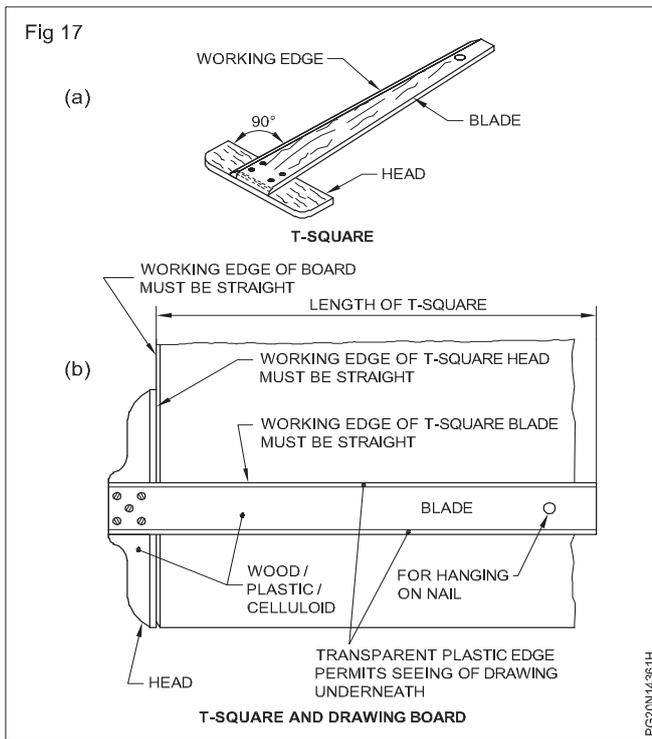


Sometimes set squares have french curves. Set squares are used to draw all straight lines except horizontal lines. It is convenient to draw horizontal lines using Mini drafter.

With the help of Mini drafter and manipulating the 45°, 30°-60° setsquares, angular lines in the multiples of 15°; Parallel lines to a given inclined line and perpendicular to can be drawn.

Set squares with graduated, bevel edge and french curve openings are preferable. They are also used to draw smooth curves. Setsquare should never be used as guide for trimming papers.

'T' Square (Fig 17): T square is a technical drawing instrument and it is used as a guide to draw the horizon line on draftsman drafting table. It guides the set square



to draw a vertical line. Its name is obtained from the English letter 'T'. Its length is 18', 24', 30', 36' & 42 inches. Its measurements depend on the length of the drawing

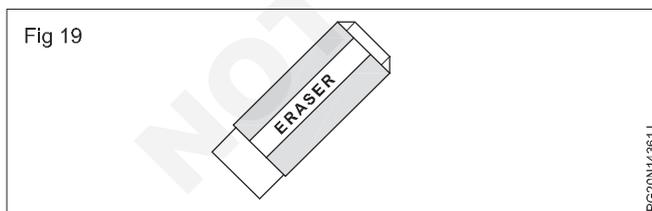
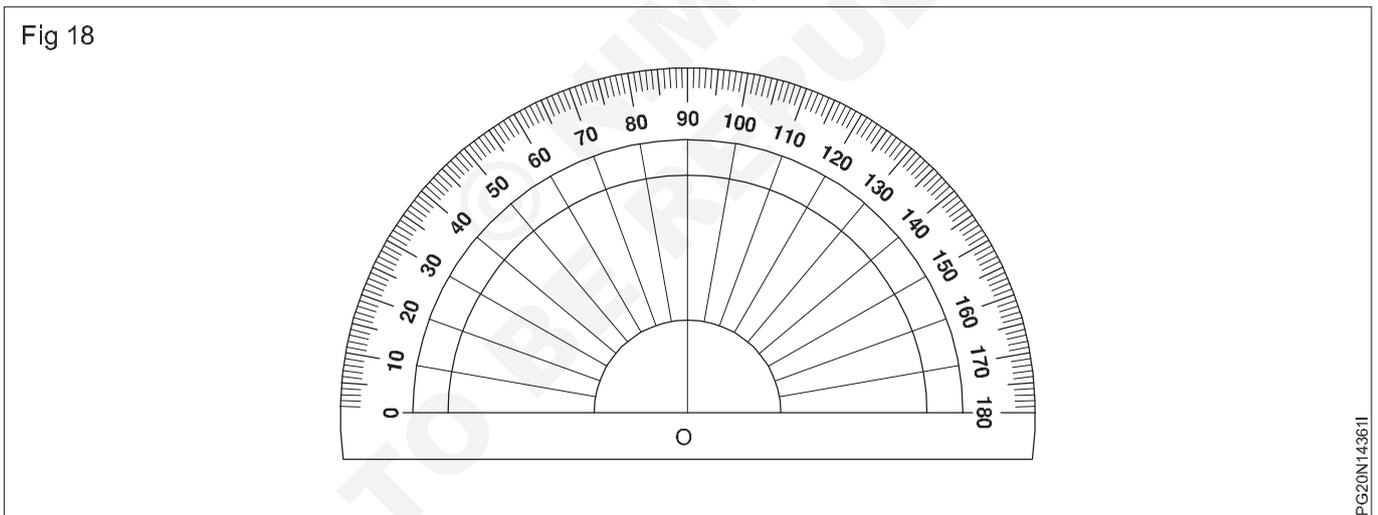
board. It is used to draw vertical and parallel lines. It is used to support the set square.

Protractor (Fig 18): A protractor is a measuring instrument, typically made of transparent plastic or glass, for measuring angles. Its dia is 100mm and it has an angle measurement upto 1degree most protractor measure angles in degrees, while radium scale protractors measure angle in radians. Most protractors are divided into 180 equal parts. Its figures or readings can be read either in clockwise or anticlockwise direction.

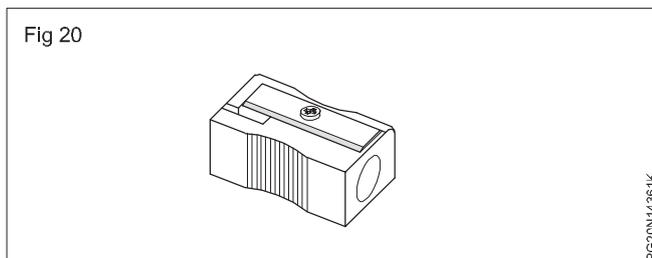
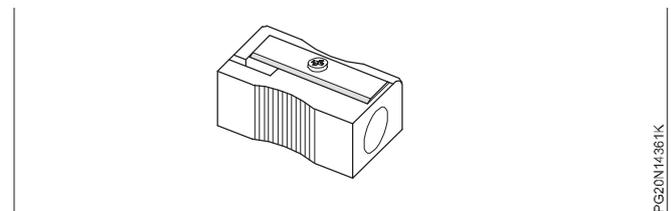
Eraser / Rubber (Fig 19): It is a piece of rubber or other material and it is used to erase the written material by a pencil. It is available in different colours and shapes.

The modern eraser is usually a mixture of an abrasive such as synthetic rubber and other ingredient.

Pencil sharpener (Fig 20): A pencil sharpener also referred to as pencil pointer. It is a tool for sharpening a pencil's writing point by shaving a way its worn surface. The block shaped sharpener consists of a combined point-shaping cone that is aligned to the cylindrical pencil alignment guide hole, into which the pencil is inserted. A sharp blade is mounted on the top so that its sharp edge just enters the shading cone tangentially with the use of the pencil become sharp to write.



Template (Fig 21)



Stencils cut on flat plastic with different shapes, designs or letters are called drafting templates. It is used to repeat the outline of a shape, design or letter with a pencil or pen. Many graphing templates have different architecture scales, which are used for different tasks of painting works.

Art tool & equipments

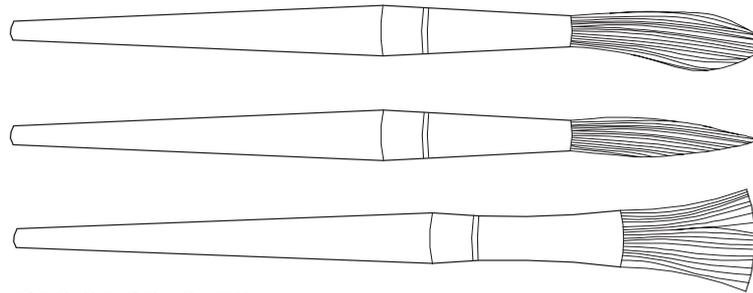
Objectives: At the end of this lesson you shall be able to

- state the paint brush, painting palette, painting knife, eraser.

1 Paint brush (Fig 1): A paint brush is also used for applying colour and sometimes ink. A paint brush is usually made by clamping the bristles to a handle with ferrule. They are available in various sizes, shapes and materials. To apply paint on a large surface. Thick brush is used to apply paint finely or with precision the thin brush is used for painting and decoration. Different

brushes give different types of results depending on their characteristics. The paint brush is a magic tool for creating works of art. There are a wide selection of paint brushes of varying shapes and sizes that produce different results. Below the detailed information of brushes are given.

Fig 1



TYPES OF BRUSHES



ROUND BRUSH NO 2



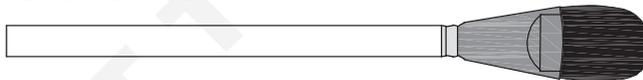
ROUND BRUSH NO 4



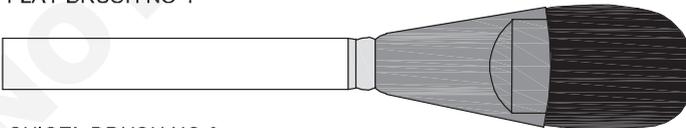
ROUND BRUSH NO 6



FLAT BRUSH NO 2



FLAT BRUSH NO 4



CHISEL BRUSH NO 6

The round brush No.2 will give you fine detailed strokes.

The round brush No.4 will give you moderate strokes.

The round brush No.6 will allow you to fill larger areas with contour.

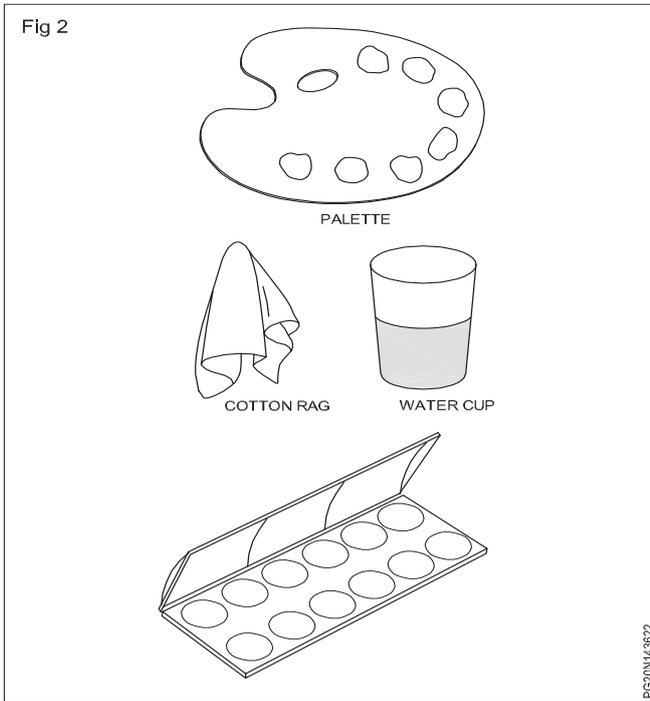
The flat brush No.2 will help you to fill small flat spaces.

The flat brush No.4 will allow you to fill larger spaces.

Chisel brush No.6 will help you to produce slant strokes.

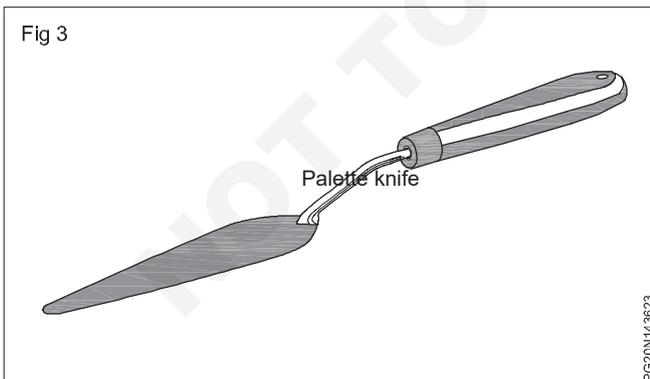
2 Painting Palette: The most commonly known type of painters palette is made of a thin wood board designed to be held in the artists hand and rest on the artists while painting, the paint or colour is taken on the

palette and it is mixed as needed and applied on the canvas, varnish and netting solution is applied to the palette so that the colour does not absorb, painting palettes are available in the market in different shapes and materials. (Fig 2)

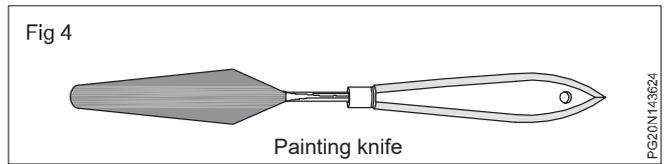


Palette made from wood, plastic, acrylic, metal used for oil colour the palette made from wood or acrylic material is used for water and poster colour palette made from plastic and china clay is used for common purpose while painting you should always keep a cup of water near you to keep washing a painting brush and also keep a cotton rag clean and wipe your art material.

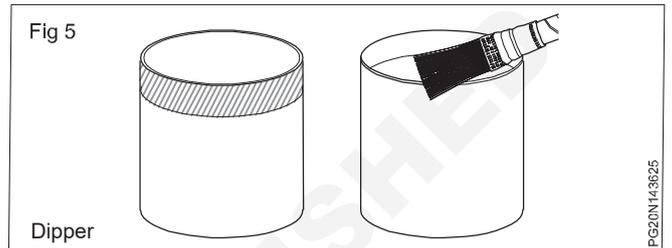
3 Palette knife: This knife is made from stainless steel and the blade length is 3 to 6 inches and it is flexible. It is used to remove paint from the palette and for mixing different paints or colours. It is used in fine art painting. (Fig 3)



4 Painting knife: This knife is made from high quality stainless steel. It is similar to palette knife and its blade is shorter. It is used to paint on canvas / paper by taking oil and acrylic colour from palette. Painting done through this knife is called knife painting. (Fig 4)

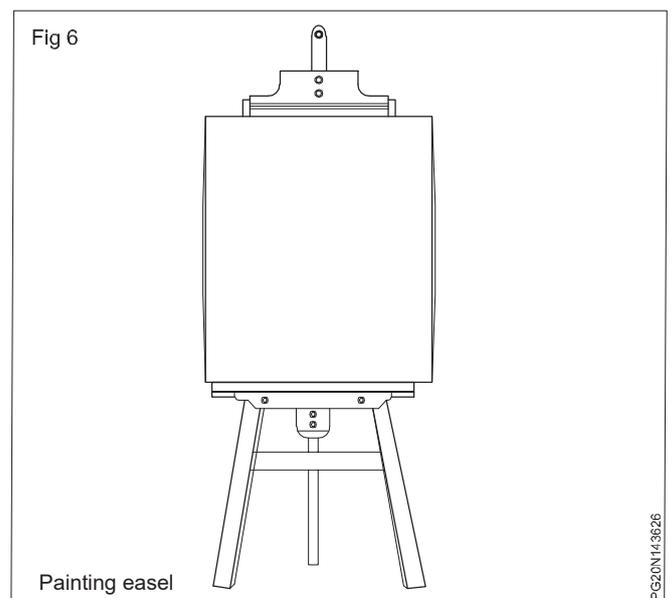


5 Dipper (Container): Dipper is made from thick plate of steel on high plastic. An oil dipper is used to hold a supply of turpentine oil, or painting medium. Fastened to the painters palette. Dipper is used to hold the palette from either side while doing sign board painting or portrait artist painting. If there is a clip on either side of dipper then the palette can be fixed on any side. It is very light and small bowls are provided in it to keep turpentine and linseed oil. (Fig 5)



6 Painting easel: An easel is an up right support on stand used for displaying or fixing something resting upon it at an angle of about 20° to the vertical. In particular, easels are traditionally used by painters to support a painting while they work out. As it is made of light material it is a portable one. (Fig 6)

Artists easels are still typically made of wood, in functional designs that they have changed little for centuries, or even millennia, though new materials and design are available easels are typically made from wood, aluminum or steel and with the old design.



7 Wooden scale: Wooden scales are used to draw lines on paper, wall and boards. Measurements can be taken upto a limited range. It is used to maintain the

balance of the hand while doing signboard painting. In it millimeters, centimeter and inch graduations are there wooden scales lengths are 12', 18' and 24 inches and its one end is tapered.

Mount Board & Frames

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

- state the mount boards and frames.

Mount boards: Mount board is also called foam core. It is made by pressing light foam piece in between two paper. It is a solid board. It has a thickness of upto 1.4mm, 1.25mm & 1.65mm mount board serves to protect a framed photography or piece of artwork by providing a rigid, sturdy batching to keep photographs and art work from moving on warping in the fame. The thick cartoon cutting fame placed inside to hold the frame firmly is called mounting.

The following are the measurement standards of full mount board in modern India.

Plain mount board – 20" x 28" and its thickness range from 1.50mm to 2.50mm. The mount board adds depth to the picture and the artwork looks beautiful. It is mostly used to make posters related to different topics from poster colour. It is also used in the architectural field to make house or building model with different colours of mount board. Mount boards are available in different colours texture and sizes. It is very important to frame the mounting under the glass of an artwork with water colour, sketching, charwal and pastel. Mounting has to be done keeping in mind some basic elements regarding double mounting. In double mounting fame it brings a dash shade to the picture. Golden coloured wooden slip with painting inside the frame makes the frame work strong and beautiful.

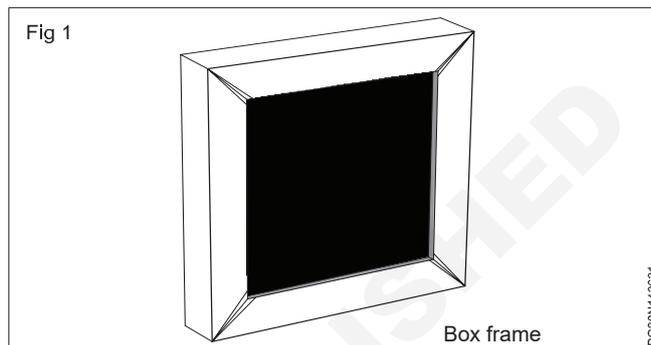
Frame: Frame around an artwork is called framing which is the last stop of its beauty. After framing only painting gets its fullness. By this artwork looks alternative and it is safe also. The frames are made of different materials. For this plaster, wood, fiber, paper, glass and metal are used. Normally wooden frames are used widely. Teak wooden frames appear beautiful and is long lasting. The importance of photo on artwork increases by framing and we get more attracted towards artwork. Frames are mainly two types, plain and moulding. The different types of frames is as given below.

- 1 Box frame
- 2 Standard frame
- 3 Floating frame
- 4 Deep edge frame
- 5 Plaster frame

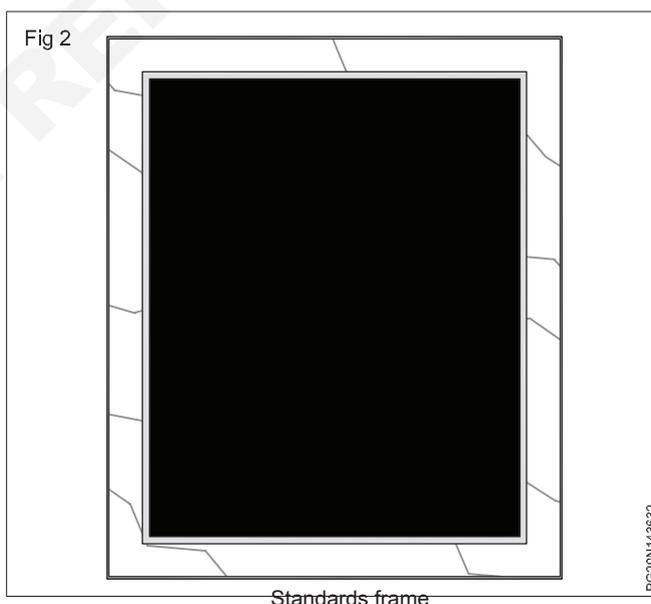
Different types of frames

1 Box frame: The depth of this frame is more than that of other frames and photograph attractive artwork can be easily displayed. Which type of artwork we want to inhibit, it depends on the selection of the frame for it. These frames can be done for uplifting artifacts like sports memory, handicraft, uplifting craft while

framing in the box frame there should be a nominal gab between the glass and the artwork otherwise the glass will break. This frame is being used to show the depth of artwork. (Fig 1)



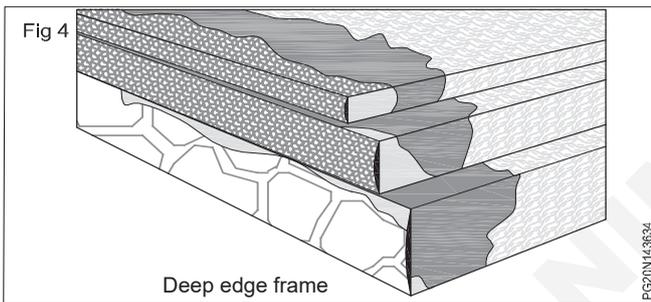
2 Standard frame: Standard frames are used in house and offices. It is usually normal and permanent in colour. This frame keeps the eyes fixed on the picture. These frames are available in different shapes. These frames are available in black, brown and bright colour. (Fig 2)



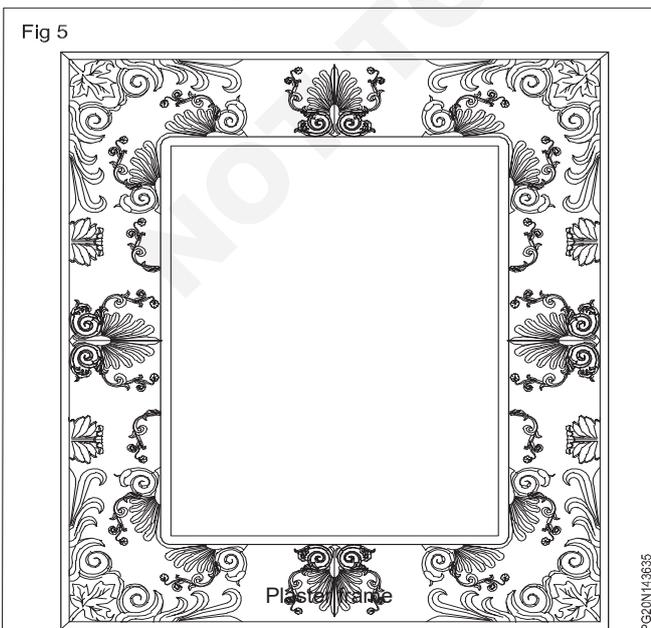
3 Floating frame: In this type of frame wooden, fiber and any other metallic door frames are not being used. To make it visible on the wall on any surface, two inch pushing are fixed on the tour corner of the glass and the walls with the help of the screws. If creates a impression that glass in hanging before the wall. This is called floating frame. Photo or picture is left in between thick glass pictures and this creates a impression that photo is inside a frame. (Fig 3)



4 Deep edge frame: The deep edge frame is a wooden frames side width it will be one inch or more on this structure canvas is used on the front and side width. The painting is done on the front side of the canvas the same painting is extended to its width of one inch or more on its side. We see a portion of the painting due to the above reason and no framing is required. (Fig 4)

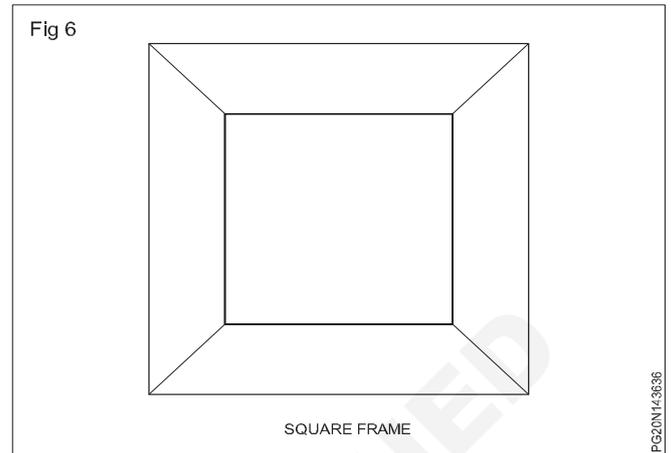


5 Plaster frame: This frames are being widely used for old pictures, the frame is made by carving the wall around the picture in a certain mould and applying sticky clay or cement plaster to it. In the olden times plaster frames were very strong but now a days there decorative frames are made from plaster of parts and fiber and bright colours are applied to it. Golden colour is widely used. At present its prevail once has decreased to a great extent. (Fig 5)

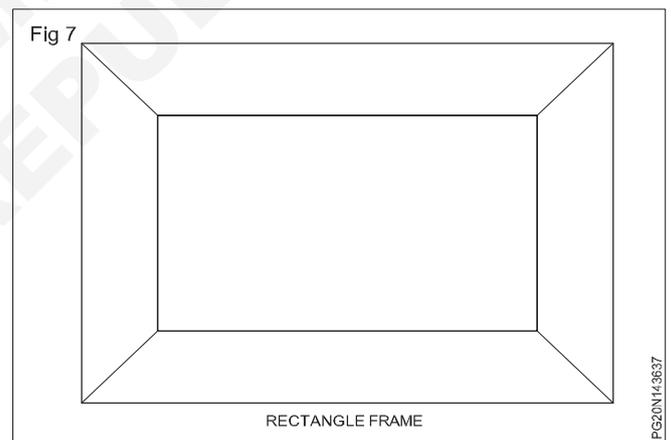


Different shapes of frames

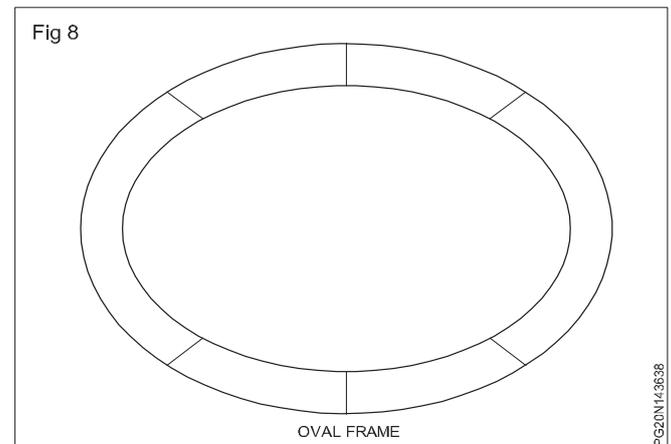
1 Square/Square size frame: When the picture is not normal then choose square size picture frame The square frame around which focuses the eye of the beholder in the picture. (Fig 6)

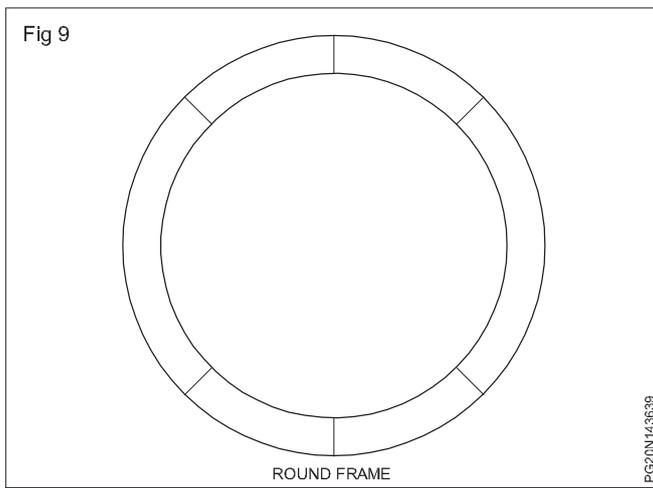


2 Rectangular frame: (Rectangle): This frame is commonly used for picture framing. This frame can be easily flitted and to fit the picture need not be cut. That size being common for photography and painting, frames of this size can be easily found in different places. (Fig 7)



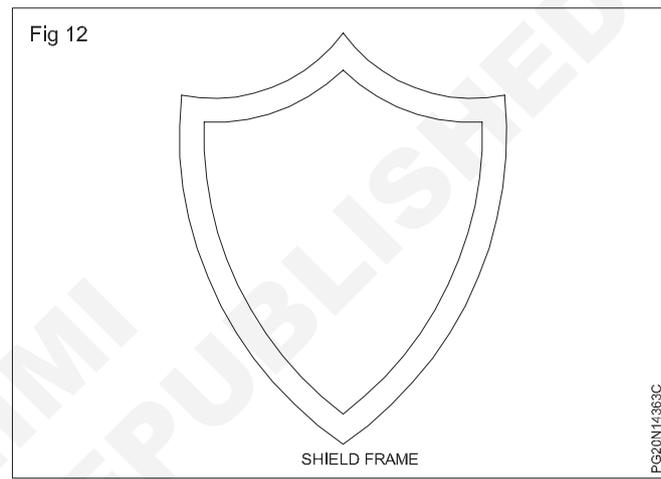
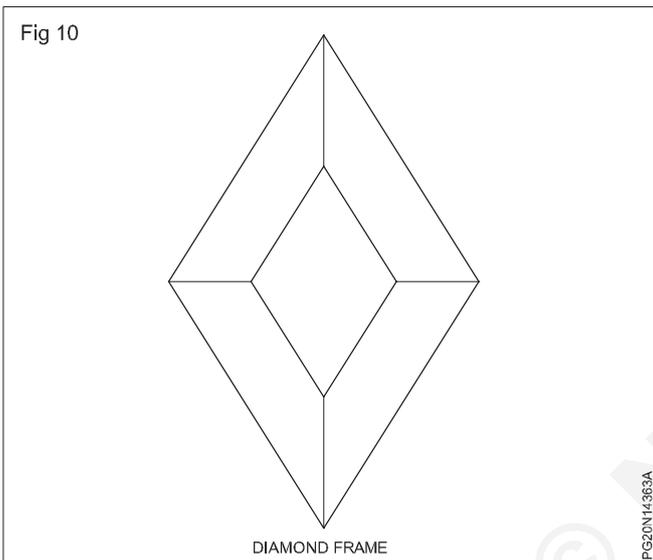
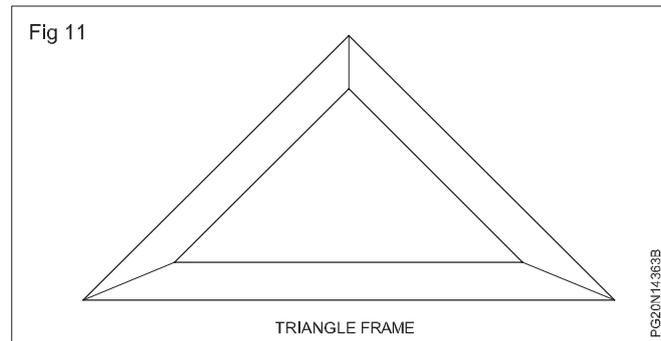
3 Oval/Round frame: This type of frame is rare use in artwork the high-end frame draws attention. In comparison to other frames these are fancy framer. (Figs 8 & 9)





3 Diamond & triangle shield frame (Figs 10, 11 & 12)

This type of frame is comparison rarely used to ask frame work



Brush and their types

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

- state the different types of brushes .

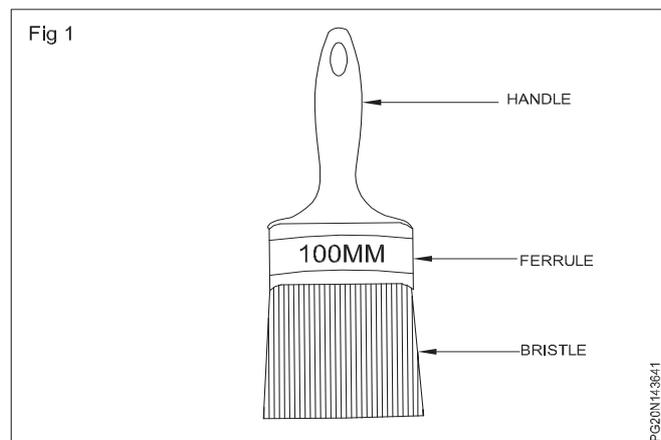
Brushes: Brushes are made from animal hairs. It is made from pig, goat, bear, bull, sable animals tail, feather of squirrel and other animals birds hair. (Fig 1)

It is medium various shapes. It is used for different colour painting work. Brush has three part

- Bristles
- Ferrule
- Handle

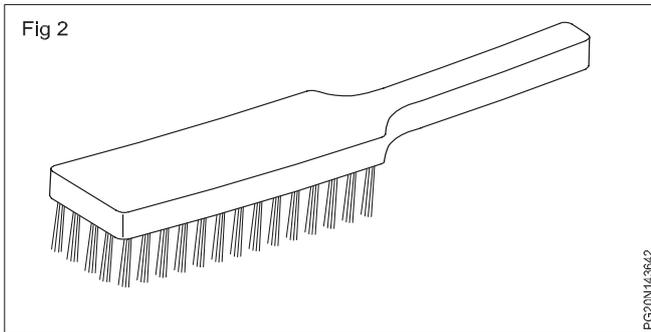
The animals hair are bundled and by applying special cement it is fitted into a metal ferrule. Resin is the cement used to make distemper and varnishing brush. Vulcanized rubber is used for varnish brush distention made from glue or thread is not be used for varnish & oil paint.

Due to this material being flexible, there is as possibility of sticking out of the bristles on back side of the brush. In the industrial field this brush is used to remove the dust, trash, iron chips from the machines. After dipping in water the brush becomes soft and the brush gets spoiled.

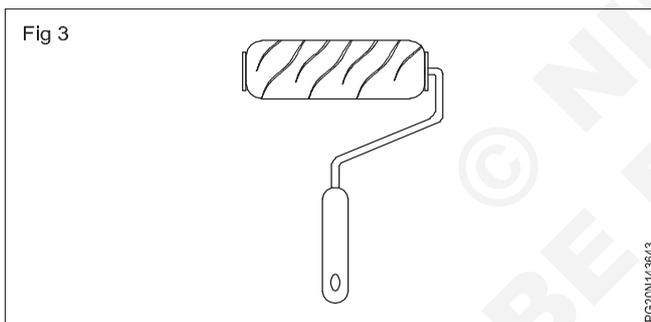


For different types of works different types of brushes are being used. For small and decorative works small brush with soft bristles are used. For big works, 25mm to 100mm brushes with hard bristles are used. There are different types of brushes according to the work.

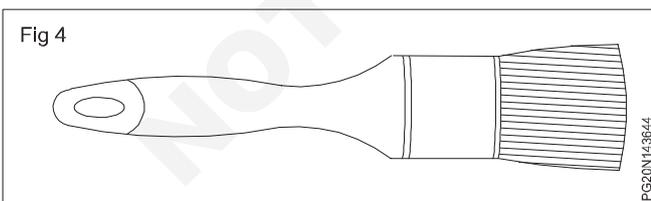
Dusting brush: It is used to clean dust, trash from the surfaces. Some brushes are wrapped with wire and then a specific type of wire has been used by dipping it in gum. Its width is 34' and length 44' and thickness 112'. The bristles are black and brown in colour and it has a short life. (Fig 2)



Roller brush/Round brush: It is used to painting a large surfaces. It's bristles length is four to five inches. Before dipping it in the paint the bristles have to be tied with good quality of thread. Some brushes are made from rich rubber on vulcanized rubber. The brushes made by this method has long life and its shape is oval and round. These brushes are used for large colors wash. It has to be held at 60° angle and then painted to get good results. It is convenient to do painting by varnish and enamel paint by this brush. (Fig 3)

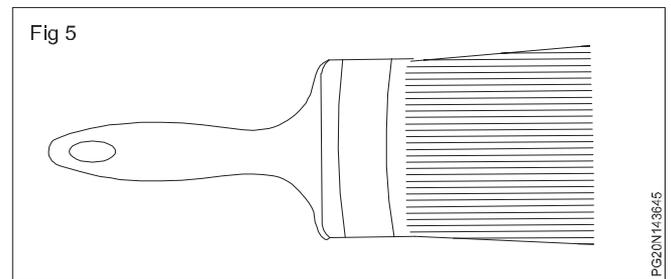


Sash tool brush: These brushes are round and sharp. The brush number is determined as per the bristles length. When these brushes are manufactured. Resin cement is applied on it, while some brushes bristles are tied by a thread. (Fig 4)

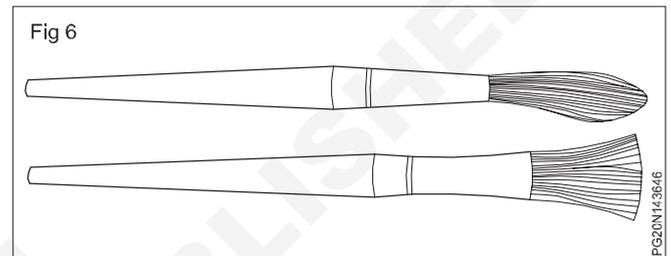


The bristles of these brushes are soft and black in colour and also they are flat and round. As the brush handle is long, with this grill painting is carried out. These brushes are used for rubber setting work.

Wall brush: It is called as ground brush. It is used for wall surface painting. This brush bristable width is 100 mm. (Fig 5)



Flat brush: These brushes are made with various shapes of handles. Generally these brushes bristles width are 1' to 4 inches only. The hair of this brush is dipped in the chemical of good quality and tied with rubber or thread and applied in a good quality ferrule. By this, the brush becomes stronger for distemper and oil paint. Flat brush is being used this brush is available in three types. (Fig 6)



- a Thick
- b Doodle thick
- c Extra thick

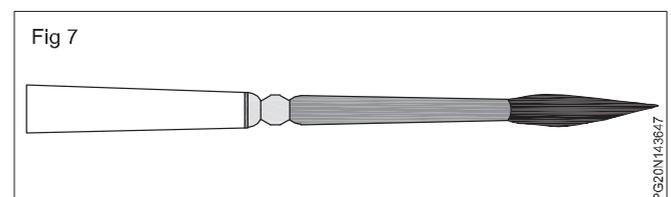
As thick brushes have less hair or bristles the ability to spread colours is less. Extra thick brushes are suitable for this and in large painting works flat brushes are being used. Ex: Building, painting, handling

Decorating brush

Decorating brushes are as follows

- a Sample hair brush / synthetic brush
- b Hog hair brush
- c Stencil brush
- d Fan brush
- e Filbert brush

a Sample hair brush (Fig 7): This brush is used to do decorative works in the painting work. This brush is made from the hairs of sable animal, squirrel. It is available in two shapes flat and round and it is mainly used for water colour, poster colour and also for signboard painting. In market it is available of from 0 to 18 numbers. If the usage of these two types of hair brush is restricted then nylon or synthetic brushes usage.



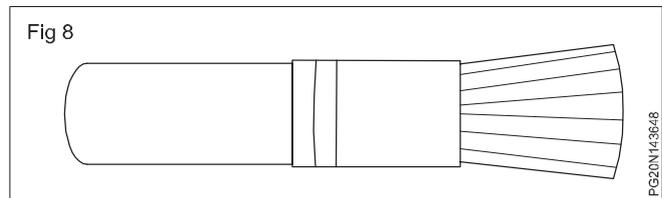
b Hog hair brushes: Hog bristle brushes are an excellent option for both oil and acrylic painting. The thick coarse nature of hog hair is best suited for medium to thick bodies paints and therefore will not be effective for water colour applications. Hog bristles come in a wide variety of quality.

Hog hair brushes have long been used for paint brushes and art brushes because such animal fibres are flexible and resilient and display an excellent capacity for holding paint brushes No. as 2, 4, 6, 8, 10, 12.....etc.,

c Stencil brush: Its hair on bristles are thick and round in stencil brush because of its less bristles a hair good stenciling can be carried out easily hog hair must be used many times for stencil brush.

d Fun brush: It is a thin brush with the spread out in a semi-circle, like a hand-held paper fan. The metal ferrule holds the hairs in this shape. Even when wet, the hairs stay spread out, won't come together to form a point. Its hairs are a bit rough. This brush is used for oil painting in canvas and also used for finishing work.

e Filbert brush: The filbert paint brush is used in artwork. It has a thick ferrule and hairs that are on average, medium to long hairs in the shape of an oval filberts are particularly effective in portrait, landscape realism painting and blending work. (Fig 8)



Maintenance of a brush

- 1 When this brush is dipped in an acid solution the hair falls off, so don't use the acid to clean the brush.
- 2 The paint brush used for oil painting has to be cleaned with kerosene, thinner and turpentine.
- 3 Do not mix the paint in paint box with a brush.
- 4 Do not leave the brush dipped in varnish open for a long time.
- 5 Don't apply the painting rear portion of the brush.
- 6 After washing the brush should be kept in a right to fit.

Drawing materials

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

- identify the man-made and machine-made papers
- state the relationship between the sides of standard size sheets
- designate and state the length and breadth of standard drawing sheet sizes
- interpret the sizes of elongated series in the table
- state the method used in arriving at the standard sizes
- state the sizes elongated series of sheet sizes.

Drawing paper: These are two types

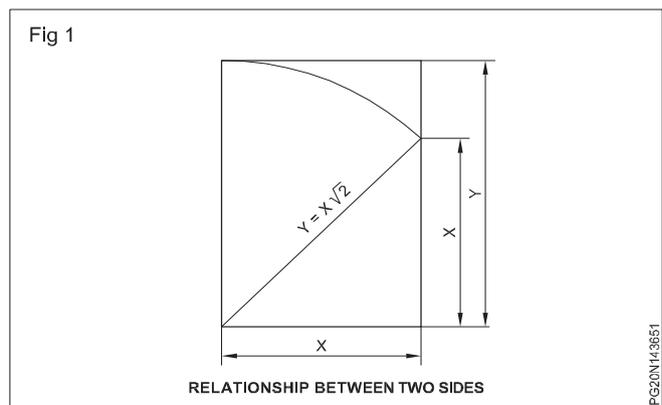
- Hand-made paper
- Mill-made paper

Hand-made papers have rough surfaces, pale in colour and not used for regular work, but meant for charts.

Mill-made papers are most commonly used for regular work, and are available in different sizes and rolls. They are specified by their weight in kg per ream or density in grams per square meter.(GSM)

Size of drawing sheets (in mm): While working or handling, the papers are liable to tear on the edges. So slightly large size (untrimmed) sheets are preferred. They are trimmed afterwards. IS:10811:1983 lays down such a designation of preferred trimmed and untrimmed sizes.

The basic principle involved in arriving at the sizes of the drawing paper is as under. The area of the biggest size (A_n) is 1m^2 and its length and breadth are in the ratio $1:\sqrt{2}$. Let x and y be the sides of the paper. The surface area of A_0 is 1m^2 , then the sides are $x = 0.841\text{m}$ and $y = 1.189\text{m}$. (Fig 1)



Two series of successive sizes are obtained by either halving or doubling along the length. The area of the successive sizes are in the ratio of 1:2.

Designation of sheets: The drawing sheets are designated by symbols such as A_0, A_1, A_2, A_3, A_4 and A_5 . A_0 being the largest. Table 1 below gives the length and breadth of the above sizes of sheets. (Trimmed and untrimmed)

The relationship between two sides is same as that of a side of a square and its diagonal.

TABLE 1

Designation	Trimmed size	Untrimmed size
A ₀	841 x 1189	880 x 1230
A ₁	594 x 841	625 x 880
A ₂	420 x 594	450 x 625
A ₃	297 x 420	330 x 450
A ₄	210 x 297	240 x 330
A ₅	148 x 210	165 x 240

For drawings which cannot be accommodated in above sheets, elongated series are used. Elongated series are designated by symbols A₁ x 3; A₂ x 4 etc.

Special elongated series increasing its widths, double, treble etc. are designated as follows A₃ x 3, A₃ x 4, A₄ x 3, A₄ x 4, A₄ x 5. Please refer Table 2

TABLE 2

Special elongated series

Designation	Size
A ₃ x 3	420 x 891
A ₃ x 4	420 x 1189
A ₄ x 3	297 x 630
A ₄ x 4	297 x 841
A ₄ x 5	297 x 1051

Exceptional elongated series

Designation	Size
A ₀ x 2	1189 x 1682
A ₀ x 3	1189 x 2523
A ₁ x 3	841 x 1783
A ₁ x 4	841 x 2378
A ₂ x 3	594 x 1261
A ₂ x 4	594 x 1682
A ₂ x 5	594 x 2102
A ₃ x 5	420 x 1486
A ₃ x 6	420 x 1783
A ₃ x 7	420 x 2080
A ₄ x 6	297 x 1261
A ₄ x 7	297 x 1471
A ₄ x 8	297 x 1682
A ₄ x 9	297 x 1892

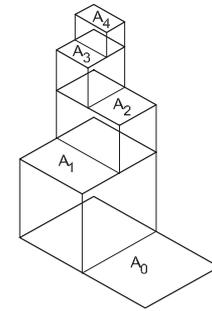
A₄ x 3 means the length of A₄ size is retained and the other side is 3 times the width of A₄.

A₄ x 3 = 297 x 630 (210 x 3)

Figs 2 & 3 shows how the sheet sizes are formed by halving/doubling and similarity of format.

White drawing papers which do not become yellow on exposure to atmosphere are used for finished drawings, maps, charts and drawings for photographic reproductions.

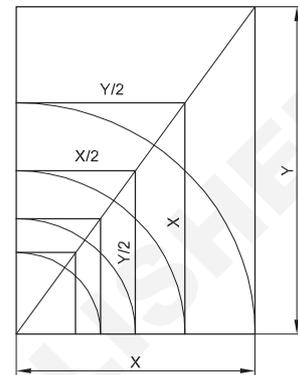
Fig 2



HALVING AND DOUBLING

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Fig 3



SIMILARITY OF FORMATIONS

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For pencil layouts and working drawings, cream colour papers are best suited.

Quality drawing paper: The drawing papers should have sufficient teeth or grain to take the pencil lines and withstand repeated erasing.

A backing paper is to be placed on the drawing board before fixing drawing / tracing paper, to get uniform lines. Before starting the drawing, the layout should be drawn. (Ref: IS:10711)

Drawing paper types and its uses

In art work for drawing and painting separate type of papers are used. They are as following types

- 1 Norway drawing paper
- 2 Snow white paper
- 3 Handmade paper
- 4 Mount board
- 5 Tinted paper
- 6 Oil paper
- 7 Art paper
- 8 Crepe paper
- 9 Acid free paper
- 10 Acrylic paper
- 11 Bristol paper
- 12 Canvas paper
- 13 Cellulose fiber paper
- 14 Charcoal paper

- 15 Cotton fiber paper
- 16 Drawing paper
- 17 Hot press paper
- 18 Layout bond paper
- 19 marker paper
- 20 Mixed media paper
- 21 News print paper
- 22 Oil painting paper
- 23 Palette paper
- 24 Pastel paper
- 25 Print making paper
- 26 Sand paper
- 27 Sketching paper
- 28 Tracing paper
- 29 Toned paper
- 30 Unfinished paper
- 31 Vellum paper
- 32 Water color paper

Drawing paper is normally painted with pencil, charcoal. Paster, water colour and poster colour. These paper are available in different size.

Sizes from 224 x 284 to 304 are available. When drawing with pencil on a drawing paper, it is be erased by an eraser.

Commercial painting, advertisement, poster designs are done through different colours on paper. Sometimes pastels, cryons, carbon pencils, paper used for powder shading. The powder shading used except an oil paper.

Paper and its uses: Different papers are being used for painting according to the importance of paper it is being used.

Norway paper: This paper is not fully white, but it is bale yellow and rough also. Pencil shading is done well on this paper. By envoy the written material by pencil, its top layer gets spoiled and minimize the usage of rubber.

Snow white paper: This paper is fully white and smooth. This is used for pencil shading and poster colour pictures. This is mostly used for drawing engineering drawings.

Handmade paper

These are of two types

- 1 Rough handmade
- 2 Matte handmade

Rough handmade paper is rough and on matte handmade paper just like canvas it has got small pares. Hand made paper is prominently used for water colour, portrait and landscape painting before painting on drawing this paper is

made full wet – by dipping it in water and then panoramic it on the board by gum. Even on dry hand made paper water colour painting can be done.

Mount boards: Mount board is also called foam core. It is made by pressing light foam piece in between two papers. It is a solid board. It has a thickness range up to 1.4 mm, 1.25 mm & 1.65 mm, 1.65 mm board is believed type of museum quality mount board services to protect a framed photograph on piece of artwork by providing a rigid, sturdy backing to keep photography and artwork form moving or washing in the frame. The thick cartoon cutting frame placed inside to hold the frame firmly is called mounting Mount board – 20 x 28 and its thickness range from 1.5 mm to 3.0 mm. It is mostly used to make posters related to different topics from poster colour. As the paper is thick then it is used to mount the four sides of the drawing or painting with water colour painting is done on the mount board.

Tinted paper: This paper is available in different colours in the market. This paper is used to make poster colours, water colour and pastel illustrator keeping the base colour of the tinted paper as it is and using shade & light draw the drawing or painting.

Oil paper: To draw drawing with oil colour on oil paint this paper is being used. Due to the specific coating on the paper, the oil cannot absorb the paint, and it retains its shine.

Art paper: Art paper is a special coating and hence the need for precise sketching. Art drawing paper is a heavier and better sketching and finished work. The ideal mediums used with drawing paper are graphic, charcoal, dry monochroms soft pastel, oil pastel markers pen and ink. This paper is relatively new surface in the world of paper. Art paper with stand many media techniques commonly used by artists today.

Newsprint: Uses this paper for rough sketching on pen work in kalakshetra. This is the most cheaper paper than all others. It is thin and thick white.

Tracing: Make any picture, or design as same line that you have to use trace paper. This paper is transparent and the same design repeats it self. It is mostly and widely used in draftsman trade.

Craft paper: In the field of painting trace paper is used in handicrafts and jewellery field. This paper is very thin, ensued texture and available in many colour.

Acid free paper: Acid free paper may have been trated to make it acid free. Acid free paper does not have acid in it. It is the opposite of acid paper. The treatment includes buffing with calcium carbonate to neutralize the acid in the paper. This acid is absorbed through the age or as the paper ages. Eventually this treatment will wear off and the paper will begin to deteriorate. When the paper is not acid free, it will become yellow.

Acrylic paper: Acrylic paper is both delicate line and textured paper that is an ideal size for use with acrylic graphite pencil and acrylic are ideal mediums for this paper.

Bristol paper: Bristol paper is a cotton fiber type of paper. It is usually multiply but can be found in one plug and three plug. One plug is ideal for tracing. Bristol is versatile and durable. It is a high standard for drawing paper.

Canvas textured paper: Canvas textured paper is ideal for oil and acrylic because it is sized so that oil does not seep to the sides of the paper. This paper is ideal for practicing techniques for using paint. This type of paper is often used in school to help while teaching techniques. Coloured pencils, oils, acrylic, graphite and painting mediums are ideal for this paper.

Cellulose fiber paper: Cellulose fiber paper is made from wood pulp and the most common paper you will find. This paper is acidic but can handle different writing implements and erasing.

Charcoal paper: Charcoal paper is 100 percent cotton with a finish that is unique. Charcoal paper is considered a laid paper. It gives you precise control over your medium for shading purposes. The best mediums include monochromes, pastel, graphite, charcoal, and drawing chalks.

There are artists who have used light washes of ink, watercolor, and gouache. It would be best if you kept in mind that this paper is lightweight and cannot accept much water.

Cold press paper: Cold press paper has been smoothed a little from a cold finish, cold press paper does not have much texture and has weaker tooth than paper that is considered rough paper. However many artists consider the texture of this paper to be just right for them.

Cotton fiber paper: Cotton fiber paper is the most durable paper. It is highest quality and handles the most erasing.

Hot press paper: Hot press paper undergoes a process that is similar to ironing clothes to smooth the paper. The hot press allows to have the most details on art paper. This type of paper is ideal for drafting, etching, printmaking, or polished sketching.

Mixed media paper: Mixed media paper is a newer type of paper in the art world. This paper was intended to do exactly as its name suggests, which is to withstand many different types of media.

Many feel this paper has qualities of water color, but the drawing surface is like vellum. The best mediums for this

paper are just about anyone from acrylic to watercolor to gel pens and anymore.

Pastel paper: Pastel paper is unique because it is smooth on one side and rougher on the other side. Pastel paper is best for pastels. You can use the charcoal and drawing chalk.

Print making paper: Print making paper is a versatile and heavy weight paper. It is the perfect size for a large number of printing inks it is used for many drawing styles such as woodblock, lithography, fine drawing and aquatint. It is ideal mediums for print making papers are water color, drawing chalks, graphite.

Sand paper: Sand paper can be used for drawing. This light sand paper. This light sand paper is intended for heavy application of media while remaining rough. When you use sandpaper for a drawing, it has a smoky look to it because the paper is often visible in areas. The best medium for sandpaper is a pastel pencil or a coloured pencil.

Sketch paper: Sketch paper is most often used for practice, experimenting with new media, and a quick mark up of what will be completed on a heavier paper. Sketch paper is lighter than drawing paper. Many artists have a sketch book with this type of paper when they keep items to use for reference later. Colored pencils, graphite, monochrome chalk, oil pencils, and charcoal drawing chalk are the best medium for this paper.

Toned paper: Toned paper comes in shades: blue, gray, and tan. The tone of this paper gives the ability to sketch and draw on mid-range colored paper to give it a different look. In addition, it allows you to use light and dark values to make it easier for highlights and shadows.

Vellum paper: Vellum is a paper that is translucent and has a variety of uses, especially for arts and crafts. It is used as tracing paper but also can cover art or be used as decoration. Graphite markers, chalk, pastels, markers, and coloured pencil are the perfect medium.

Water color paper: Water color paper is the largest category of paper. It comes in a wide variety of weights and textures. Typical weights include 90lb, 140lb, and 300lb. The higher the weight means, the stiffer the paper is. Often, artists will stretch 90 and 140lb paper to prevent it from moving while painting.

Painting knives

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

- state the different types of Knives.

Painting knife: The terms painting knife and palette knife are often used interchangeably when describing the technique of applying paint to a surface with the blade of an artist's knife. Both tools are made of either plastic or of wood and metal. Both are available in a variety of blade shapes and sizes. A palette knife handle is generally

straight, having at most a slight bend. The purpose of the palette knife is to mix colours or clean the surface of the palette. On the other hand, a painting knife has a deep bend in the handle that keeps the artist's knuckles out of the paint. As its name indicates, a painting knife is used for actual painting.

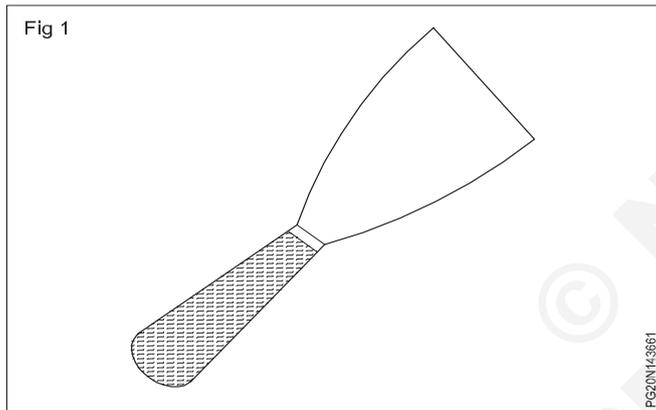
Apply paint with knife is to achieve the desired thickness and swirls of paint. The knife as a conductor would hold a bar on and change the angle of the knife to the board to achieve the desired effects. A clean palette knife is essential for changing the art colors. To remove paint from the blade, simply wipe it with a clean cloth or paper towel. Carefully inspect the painting knife after each stroke once paint has begun to accumulate on the board.

Choosing the painting knife size: Smooth relatively flat areas can be painted with a large blade, So the larger painting knife is used for laying in large areas of paint. water or sky.

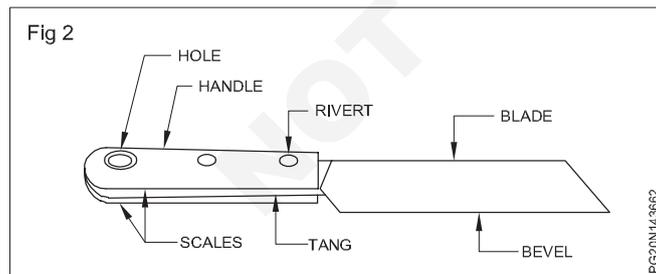
Knives: Knife has got an importance in the painting field. The following works are carried out by knife paper cutting, stenciling, removing old putty scraping of colours, putting fill up and glass cutting work.

Functions of knife

Scraper knife: It is made of high quality steel and flat and whose front is sharp and taper. It is made up of wood, plastic on metal and its handle is riveted to the scraper. It is used to remove the old paint by scraping and removing the heat – softened wall paper. (Fig 1)



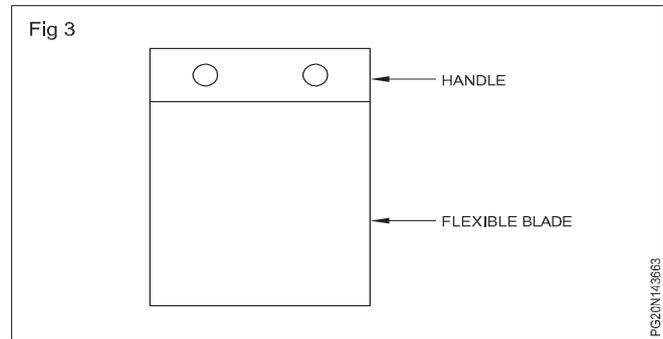
Hacking knife: With this knives sharp can scrape the old putty and remove it. Its handle is made of wood and fitted by rivet. Its blade is of high quality steel and tapered. It is used to scrape the dried putty from windows for glass pane from the windows frame the hardened putty can be removed with a hammer by its thick blade. (Fig 2)



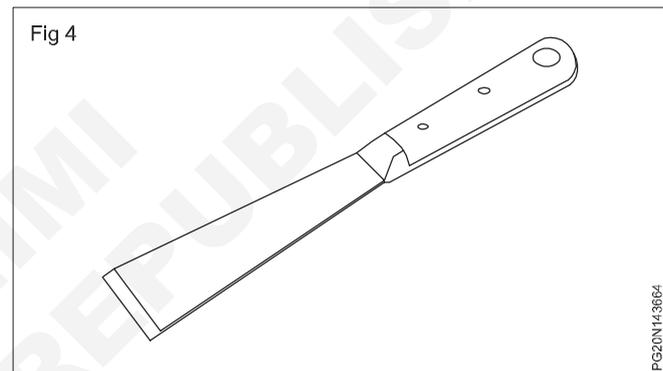
Putty knife: In spray painting and building painting used to fill the putty on the surface holes and to remove the excess putty on the painting surface sharpen and its blade are made of thin spring steel. For removing spray painting from 1 to 4 mm With 2 to 8 mm putty knife on walls and large surfaces the putty can be applied putty for painting. As per the given shape putty knife are of two types.

A Rectangular thin piece of spring steel sheet.

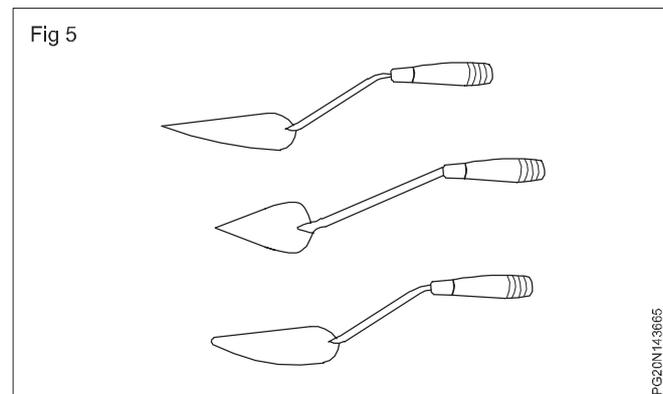
The knife should be cleaned after the putty is filled. If the old putty gets stitched to knife then this putty cannot be filled again with this knife. (Fig 3)



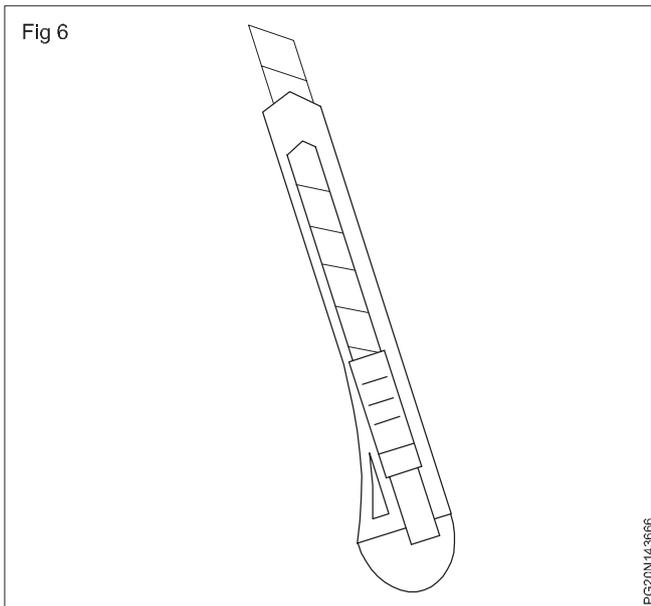
Palette knife: A palette knife is a blunt tool used for mixing & applying paint, with a flexible steel blade. Its length is three to six inches and the blade sits in the handle. Its handle is made of wood or plastic. It is used to remove paint or to mix oil colour in a palette. (Fig 4)



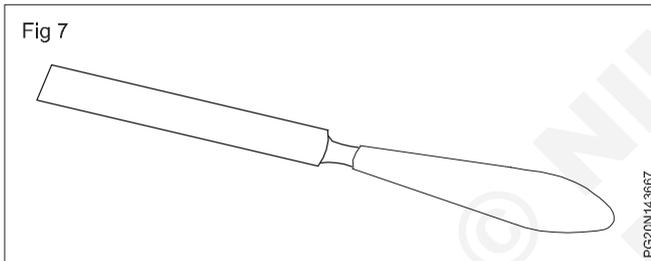
Painting knife: It is made of stainless steel. It is similar to palette knife and its blade is small and that is why it is not flexible painting knife is used to take oil colour or acrylic colour from palette and carry on the painting. The painting done by this knife is called painting knife. (Fig 5)



Stencil knife: This is made from good quality steel. Its blades are sharp. It is to be used carefully with this knife stencils can be cut or sharply with this you can out stencils on to drawing paper, oil paper and cartoon while stenciling you have to keep glass underneath the paper. (Fig 6)



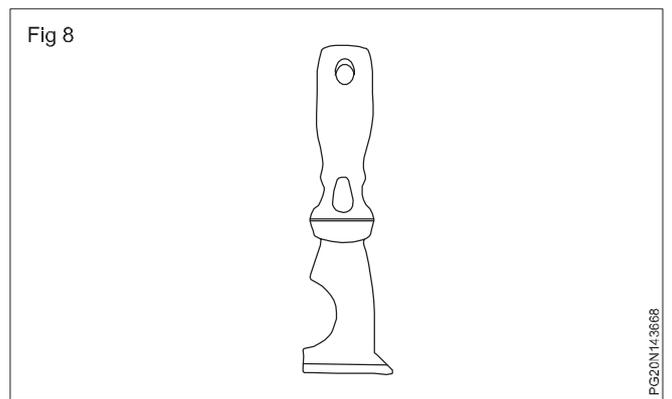
Glazier putty knife: It is made of good steel and metal. In this wooden handle is there and is fitted by riveting. On the steel frame of windows glass pane putty can be filled by fingers and then with glazier knife it is made plain. As the knives sides are sharp the struck putty on the window pane can be removed easily. (Fig 7)



Diamond glazier knife (Fig 8)

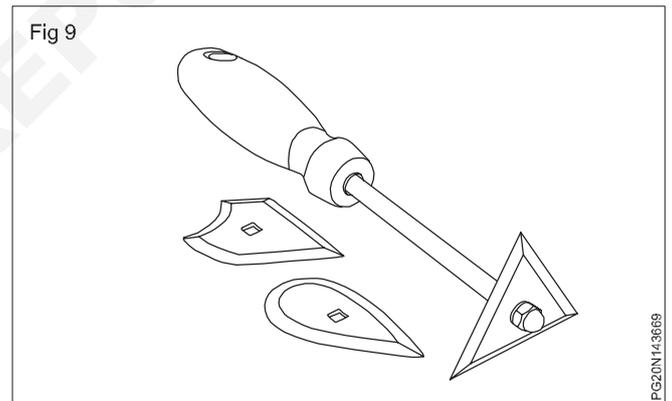
This knife is divided into three parts

- a Head
- b BGDT
- c Handle



Diamond is fit end on the tip of its head, which is being used to cut the glass. It is also called as glass cutter. In this knife there are holes according to the thicknesses of glass and the glass is separated by drawing a line and holding it in the hole. If the glass is not cut properly and it has to be done in 90° triangle line, then with the help of cutting, an attempt is made to cut the glass little by little. Glazier knife is made of thick and fine steel.

Shave – hoot knife: Shave hoot knife tighten the blade to the front of the rod six to eight inches and the rod is fitted into the wooden handle. To clean the moulding this tool is being used. Its blades are sharp, square and triangular in shape. It is used to cut the wall cracks. It have three types of blades and it can be easily remove and refit it on the handle. (Fig 9)



Painter (General) - Lettering Types

Lettering and their types

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

- recognise different lettering types
- decide standard proportion for height, width and spacing of letters
- state the devanagari letters history
- state the hand lettering tools and instruments
- state the lettering calligraphy tools & design.

Apart from graphical elements (lines, arcs, circles etc) technical drawings and art will also contain written informations. These written informations are referred as "lettering".

Styles of lettering: Many styles of lettering are in use to day. However, a few styles which are commonly used are shown in Fig 1.

Fig 1

<p>ABCDEFGHIH abcdefgh</p> <p>ABCDEFGHIH abcdefgh</p> <p><i>ABCDEFGHIH</i> <i>abcdefgh</i></p> <p>ȦḂĊḊĖḞĠḢ ȧḃċḋėḟġḣ</p>	<p>GOthic ALL LETTERS HAVING THE ELEMENTARY STROKES OF EVEN WIDTH ARE CLASSIFIED AS GOthic</p> <p>ROMAN ALL LETTERS HAVING THE ELEMENTARY STROKES "ACCENTED" OR CONSISTING OF HEAVY AND LIGHT LINES ARE CLASSIFIED AS ROMAN</p> <p>ITALIC ALL SLANTING LETTERS ARE CLASSIFIED AS ITALIC. THESE MAY BE FURTHER DESIGNATED AS ROMAN-ITALICS, GOthic-ITALICS, TEXT-ITALICS</p> <p>TEXT THIS TERM INCLUDES ALL STYLES OF OLD ENGLISH, GERMAN TEXT, BRADLEY TEXT OF OTHERS OF VARIOUS TRADE NAMES. TEXT STYLES ARE TOO ILLEGIBLE FOR COMMERCIAL PURPOSES</p>
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Lettering: Letter writing is a type of art. In which each letter of the sentence serves as an illustration. Every letter is made with the utmost care and it plays an important role in that creation. Syllables usually root doesn't get translated into letters because that particular word is made with that in mind.

Lettering includes comic book (story book), decoration, sign board painting and graphics design. Eg., Posters, letter heads, logos, advertisements etc.,

There are five types of lettering.

- 1 Block lettering
- 2 Roman lettering
- 3 Italic lettering
- 4 Ornamental text lettering
- 5 Devanagari (Balbodh) lettering

1 **Block lettering:** The letters which are composed of the same thick components on all sides are called Block lettering. (Fig 2)

- 1 Mechanical spacing (Fig 2a)
- 2 Optical spacing (Fig 2b)

Fig 2

Mechanical spacing 2a

Optical spacing 2b

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2 **Roam lettering:** The English letters which are arranged in the composition of thin and thick components of the same size are called Roman lettering. (Fig 3)

Fig 3

PG20N154713

3 **Italic lettering:** Letters of any type drawn diagonally are called Italic lettering. (Fig 4)

Fig 4

PG20N154714

4 **Ornamental text lettering:** The letters which are made in beautiful, ornament form are called text, ornamental or modern lettering. (Figs 5 & 6)

Fig 5

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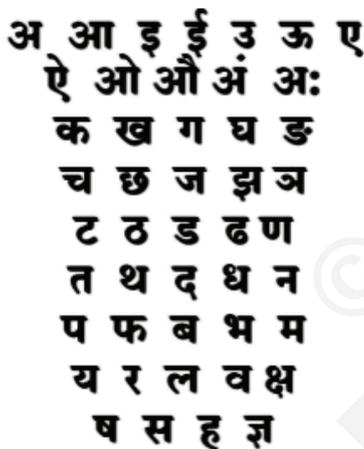
Fig 6



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5 Devanagari (Balbodh) lettering: The letters which are placed at a specific place in the composition of thin and thick components are called Devanagari/Balbodh lettering. Devanagari lettering is used in all regional languages in India, hence it is considered as popular lettering. (Fig 7)

Fig 7



PG20NI54717

6 Correct lettering spacing: 'Correct letter spacing' means the correct spacing between two letters. Instead of taking out beautiful letters, one should try to keep the spacing between the letters uniform, this is very important. Because new students find it troublesome how to keep the spacing. This means it is very important to know how to keep spacing in them instead of extracting beautiful characters. While learning the composition of letters, considering its composition, one should be uniform and beautiful, just as the pages of the book are in a similar tone. There appears to be incompleteness in some of the proofs. That is, keeping the correct spacing of letters with the help of eye sight is called 'optical equalized spacing'. This is called correct spacing. Keeping this simple thing in mind from the beginning soon makes sense. There are two type of letter spacing.

1 Different letters under the composition and the space they take cannot be used in the same proof.

- 2 Spacing instead of using letters, the letters can be read by keeping the spacing slightly less than half its spacing.
- 3 For convenience three divisions of letters are made.
 - a Regular E F H N U
 - b Irregular AIJKLMTVWXYZ
 - c Circular-BCDGOPQRS
- 4 While writing the circular letter, fill in the remaining letters in the space against the evidence against it.
- 5 If the spelling is reduced in these regular and circular shaped letters those letters can be read.

It is essential to practice writing alphabets in Roman script, in Devanagari script or other scripts Writing letters correctly and well is a part of painting. Whose lettering is good, that painter needs beautiful letter writing for sign boards, function boards for exhibition, wall pictures, advertisements, book covers, greeting cards. Roman script is used for English and Devanagari script is used for all languages. The basic composition of this script is decided according to the rules. In the method of writing letters with Boru, the upper line is shorter and the lower line becomes thick, in this way Boru is caught. In the Devanagari script, the right end of the thickness of the boru is held up and the left end of the boru is held down in this way.

- 1 It is also necessary to think about the letters for which it is going to be used, if the letters are to be made for the poster, then they should be clearly visible even from a distance. Delight and good consistency are essential in the lettering of the greeting card. The main purpose of the letter is to make the subject effective for which letters are being used.
- 2 The letters should be big enough that the board or paper on which they are written looks attractive. Must be of proper size and in the right place.
- 3 All letters must be the same. If all the letters are diagonal, they will look the same. It works even if the shape changes, but the artistry should not be harmed in any way.
- 4 Use bright colours to paint the letter so that it looks attractive on the colour of the background.
- 5 Always keep the surface clean while doing lettering work. Take care that the surface is not damaged. Give importance to the outline of the lettering rather than painting the letter.

Painting (Fig 8): There are two main type of letters in English.

- 1 Upper case or Capital letters
- 2 Lower case or Small letters

When capital and small letters are arranged together, the letters are divided vertically into four parts.

Top line Middle line
Base line Drop line

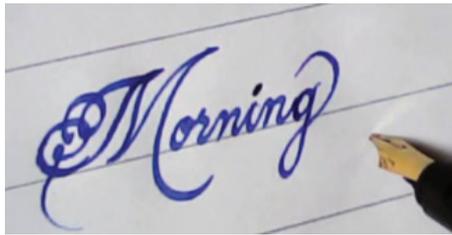
Fig 8

Painting

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Calligraphy: It is a visual art related to writing. Making ornate compositions of letters with the help of writing instruments such as boru, pen, brush, cut nib, marker is called calligraphy. At present calligraphy has become a part of inscription art work in fine art. Pen and brush are the main tools of calligraphy. The pen of calligraphy is flat, circular or pointed. According to the decoration. Cut nib, Mult nib are used. Apart from this, calligraphy work can also be done excellently with felt-tip and ball point pen. The calligraphy pen should be held vertically at the top of the page for straight downward strokes. If you want to apply curved strokes, then the pen should be held in 45 degrees as shown in the Fig 9.

Fig 9



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Boru (Bamboo pen) (Fig 10): Boru is made from thin bamboo. The front part of the bamboo is chamfered. Due to this, after immersing in the Boru ink, the ink remains in its hollow part and that ink comes out while writing by pressing on the paper. Every time Boru has to dip in ink. Devanagari and English calligraphy characters can be written well by Boru. While writing with Boru, a thin line is formed where the letters are twisted, while a thick line is formed in the horizontal and vertical place. With the practice of Boru, it becomes easier to make letters with a brush. This allows the hand to gain momentum and practice writing Devanagari and cursive calligraphy letters. It also practices letter strokes.

Fig 10



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Cut nib (Fig 11): Cut nib & dip pen, is a type of fountain pen, which is written using ink. Nibs are made from a variety of materials and in different sizes and types. The tip of a cut nib is cut, so it is called a cut nib. Thick letters can be made from this nib due to the excessive amount of ink coming out. Due to the flattening of the nib, where the letter or design is bent (curve), a thin line is formed while the straight and vertical lines become thick. Devanagari alphabets, English Roman and cursive calligraphy can

be made exquisitely with cut nibs. The cut nib is used for writing greeting or certificate.

Fig 11



PG20N15471B

The pen should be held in 45 degrees while writing with cut nib.

Marker pen: The marker pen is filled with ink. It has a tip to release the ink. The types of markers are decided according to its size. These are as follows

a Round marker

b Flat marker (also called chisel marker pen)

a Round marker: Since the tip of the round marker is round, it is used to write letters of equal thickness. (Fig 12)

Fig 12



PG20N15471C

b Flat marker: Its tip is flat and slanted from one side, hence it is called Flat marker or Chisel type marker. This marker is used to write Devanagari or Roman letters. Markers are used more for calligraphy works. Both the above mentioned markers are available in the market in different tip sizes. There are two types of marker ink. (Fig 13)

Fig 13



PG20N15471D

a Regular ink marker

b Permanent ink marker

Regular ink is written on paper with a marker. Its ink is wiped off when writing on other things. Permanent markers can be written on paper, cloth, glass, aluminium or plastic and cannot be erased. Its ink is made from toluene and xylene in solvents, both of which are harmful and have a strong colour.

Flat lettering brush: Devanagari, Roman letters and calligraphy can be done in the best way with Boru. Cut Nib or chisel marker pen. But with these means one or one and a half inches high or smaller lettering or calligraphy can be done. For lettering larger than this, a flat brush is used. Since this brush is flat, it can be used to do direct Devanagari or Roman lettering instead of sketching. The thickness of the brush. Small letters can be written with a small brush and capital letters with a big brush. When this brush is flat, when lettering on the surface, the curved side (curved part) is written thin and the horizontal or vertical side is thick. Flat lettering brush hairs are slightly longer and soft fitted into fine ferrules. These days synthetic flat lettering brushes are available in the market. (Fig 14)



Fig 14

PG20N15471E

Even more suitable lettering works can be done. The colour comes in the brush made from animal hair and these brushed become hard after being in water or colour. Lettering can be done better with a sable brush than with a synthetic or nylon brush. To do lettering with a flat brush, it is very important to have control over the hands and this is possible only with constant practice. Lettering and engraving can be done well with this brush. This brush is used for sign boards.

Hand lettering tools and instruments

- Tombow dual brush pen marker (set of 10)
- Tombow hard-tip brush pen marker (set of 10)
- staedtler lead holder
- Tombow for ink of pencil mono sand eraser
- Rhodia graph black note pad
- Strathmore 9"x12" Tracing pad
- Bristol 9"x12" pad
- Staedtler mars technico
- Felt pens
- Brush pens
- Nib pen - The tool of the calligrapher
- Flat pen

Lettering and calligrapher tools (Fig 15)

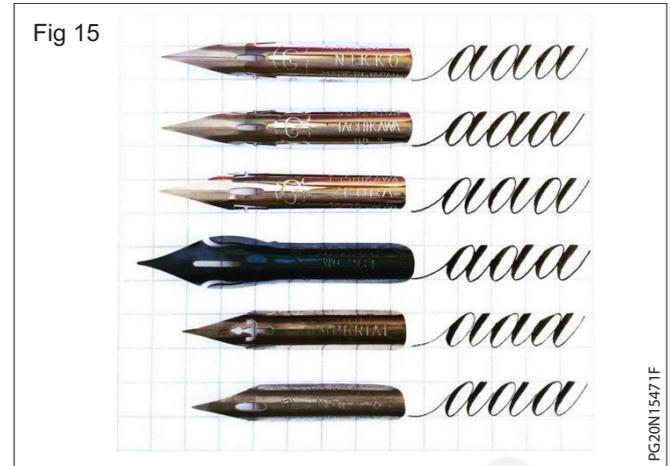


Fig 15

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- Light table
- Tracing paper
- Tombow mono zero eraser
- Kneaded eraser
- Rolling ruler
- Composition ruler
- Microphone stand
- Video light
- Scanner
- Art supplies storage box
- Eye dropper
- Flat brushes
- Gouache

Calligraphy is a visual art associated with writing art of Calligraphy script reference chart is given below will help you to draw fine art. (Fig 16)

Fig 16
Script Reference Chart

	A	B	C	D	E	F	G	H	I	K	L	M	N	O
ROMAN & LATE ROMAN SCRIPTS	Λ	β	ϸ	Ϲ	Ϻ	ϻ	ϼ	Ͻ	Ͼ	Ͽ	Ͽ	Ͽ	Ͽ	Ͽ
	α	β	γ	δ	ε	Ϻ	ϻ	ϼ	Ͻ	Ͽ	Ͽ	Ͽ	Ͽ	Ͽ
	A	B	C	D	E	F	G	H	I	K	L	M	N	O
	α	β	γ	δ	ε	Ϻ	ϻ	ϼ	Ͻ	Ͽ	Ͽ	Ͽ	Ͽ	Ͽ
INSULAR & NATIONAL SCRIPTS	α	β	γ	δ	ε	Ϻ	ϻ	ϼ	Ͻ	Ͽ	Ͽ	Ͽ	Ͽ	Ͽ
	a	b	c	d	e	f	g	h	i	k	l	m	n	o
CAROLINGE & EARLY GOTHIC SCRIPTS	α	β	γ	δ	ε	Ϻ	ϻ	ϼ	Ͻ	Ͽ	Ͽ	Ͽ	Ͽ	Ͽ
	a	b	c	d	e	f	g	h	i	k	l	m	n	o
	a	b	c	d	e	f	g	h	i	j	k	l	m	n
	a	b	c	d	e	f	g	h	i	j	k	l	m	n
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
GOthic SCRIPTS	Α	Β	Γ	Δ	Ε	Ϻ	ϻ	ϼ	Ͻ	Ͽ	Ͽ	Ͽ	Ͽ	Ͽ
	a	b	c	d	e	f	g	h	i	j	k	l	m	n
	α	β	γ	δ	ε	Ϻ	ϻ	ϼ	Ͻ	Ͽ	Ͽ	Ͽ	Ͽ	Ͽ
	α	β	γ	δ	ε	Ϻ	ϻ	ϼ	Ͻ	Ͽ	Ͽ	Ͽ	Ͽ	Ͽ
	a	b	c	d	e	f	g	h	i	j	k	l	m	n
ITALIAN & HUMANIST SCRIPTS	Α	Β	Γ	Δ	Ε	Ϻ	ϻ	ϼ	Ͻ	Ͽ	Ͽ	Ͽ	Ͽ	Ͽ
	a	b	c	d	e	f	g	h	i	j	k	l	m	n
	a	b	c	d	e	f	g	h	i	j	k	l	m	n
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
POST-RUMANIAN SCRIPTS	a	b	c	d	e	f	g	h	i	j	k	l	m	n
	A	B	C	D	E	F	G	H	I	J	K	L	M	N

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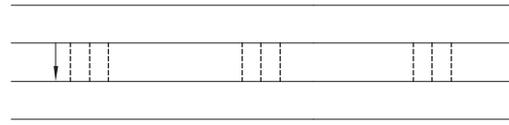
Method of draw letters line: Various methods of line drawing used for writing alphabets. They are as follows (Fig 17)

- 1 Standing lines
- 2 Slanting lines (Right)
- 3 Sleeping line
- 4 Slanting line (left)
- 5 Zig Zag line
- 6 Curves
- 7 Bumps
- 8 Circle

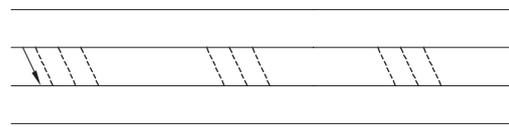
Script reference chart (Fig 17)

Fig 17

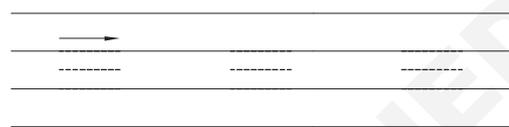
STANDING LINES



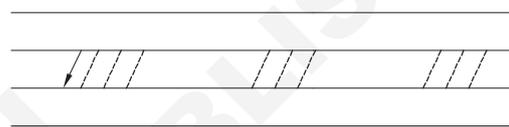
SLANTING LINES (R)



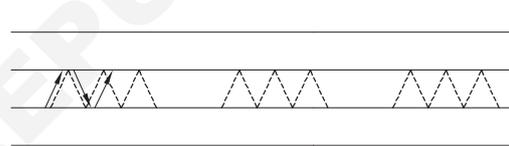
SLEEPING LINES



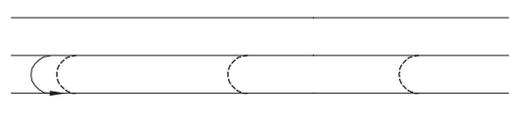
SLANTING LINES (L)



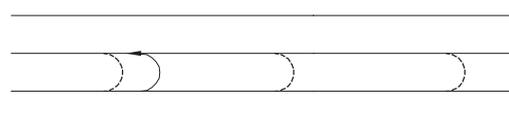
ZIGZAG LINES



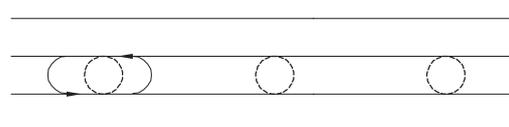
CURVES



BUMPS



CIRCLE



Hand writing

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

- identify the different type of letters
- state the method of draw a different sketches.

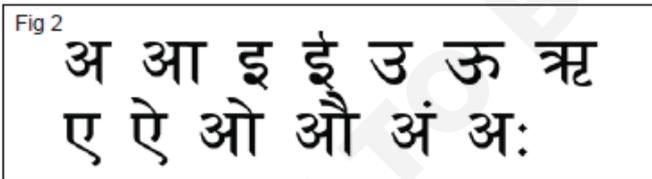
Introduction on hand writing: In our country people's are used to communicate their message from one person to another person by oral language, body language and written language.

Every language have their own style of letters to write and communicate their message by writing.

Letters are draw by art of lines as follows. Tamil letters design (Fig 1)



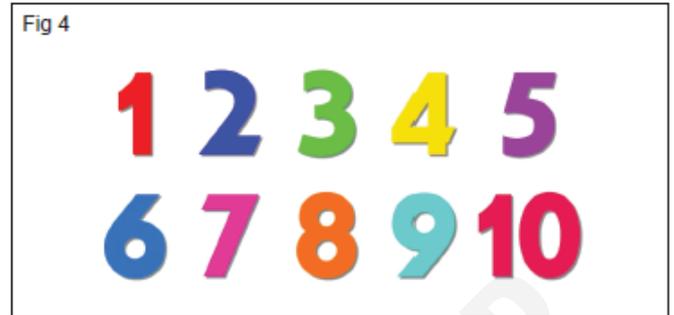
Hindi letter design (Fig 2)



Example of English writing text letter (Fig 3)



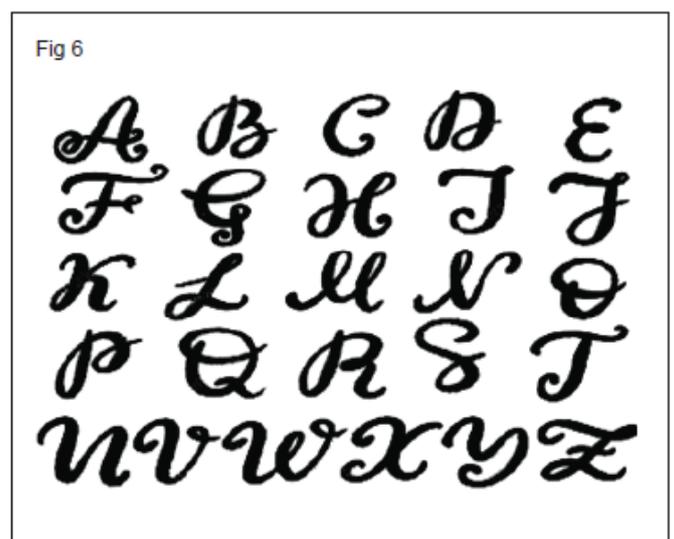
Numerical letters graphic design sample (Fig 4)



Example of English writing style (Fig 5)



English letters graphic design sample (Fig 6)



Carpenter work safety and carpenter tools

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

- state the safety precaution on carpenter work
 - state the use of carpenter hand tools
 - state the types of wood and common defects in timber.
-

Introduction of carpenter work

Carpentry is working of wood cutting, shaping polishing, assembling and installing of assembled materials on their location marked to fix the assembled part.

Carpenter makes, assemblies alters and repairs wooden structures and articles. Study the wooden structure sample structures and articles. Study the wooden structure sample drawing before start the wood work and select the timber to suit the requirements. Repair the damaged wooden parts.

Safety precaution on carpenter work:

Safety precaution is most important to wood work craftsman for protect him/her self from any accident happen during work. The following safety precautions to be follow while on wood work.

- Select the proper tools and avoid wear loose clothing.
- Ensure the tool condition is in good condition
- Select the suitable wood for structure or articles in similar manner.
- Marks them to size by using square scribe and other tools
- Saws chisels and planes wooden pieces to required sizes.

- Check parts frequently with square, foot rule measuring tape and ensure corrections.]
- Assembling the parts and secures them in position by screwing, nailing or drawing.
- Ensure the assembled structure is match with drawing or sample.
- Glue the parts together
- Smoothen and finish the surface with sand paper and article made by you.
- Sharpen the tools as required condition.
- When you finish work with a tool, clean and keep it in shape place.

Note: Accidents donot happen they are caused, most accidents are avoidable. A good craftsman should be having a knowledge of various safety precautions.

The shop floor should always be kept clean and free from debris, otherwise it may cause us to slip over and fall on it.

Introduction of carpentry hand tools

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

- introduction of carpentry hand tools.

Carpentry hand tools are listed as per the following:

1 Marking and testing tools

(e.g) scribe, spirit level, try squares, marking gauge etc.,

2 Holding and supporting tools

(e.g) mitre box, work table, clamps etc.,

3 Measuring tools

(e.g) Foot rule, tape rule, caliper etc.,

4 Cutting tools

(e.g) saws, chisels etc.,

5 Planing tools

(e.g) Planes, spoke shave etc.

6 Boring tools

(e.g) Hand drill, auger, bits, twist bit, etc.,

7 Striking tools

(e.g), Hammers, mallet etc.,

8 Driving tools

(e.g), Screw driver, spanner's etc.,

9 Miscellaneous tools

(e.g) Punches, Pincer etc.,

10 Abrasion tools

(e.g), File, oil stone etc.,

Classification and uses of marking tools

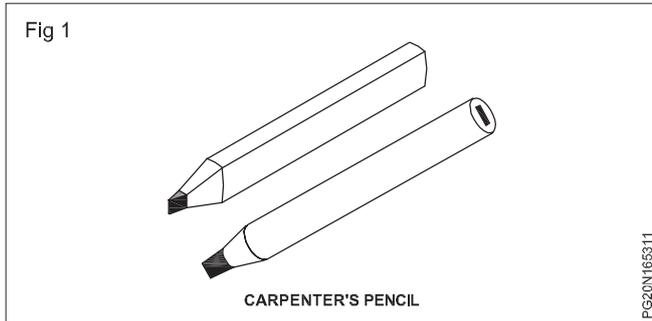
Objectives: At the end of this lesson you shall be able to

- state the different type of marking tools
- explain the use of marking tools
- brief constructional features of marking tools.

Marking off or layout is carried out to indicate the location of operation to be done and provide guidance during sequence of operations.

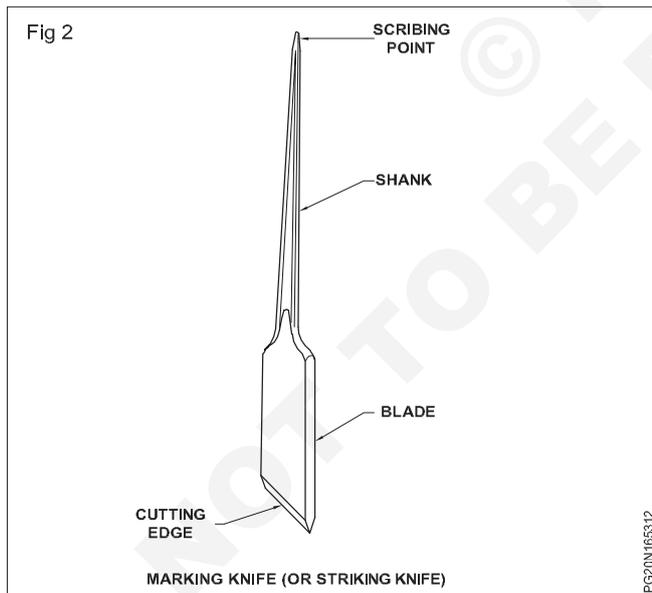
- Marking out is done with pencil or scriber etc.,

Carpenter's pencil (Fig 1)



- Carpenter's pencil usually is an oval cross-section.
- It is sharpened with a chisel.
- The pencil is not used for an accurate work.
- Suitable pencil hardness for marking out on 'HB', 'H' and 'F'

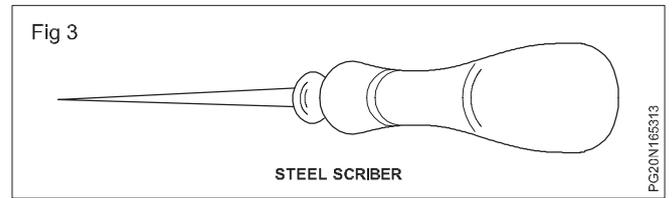
Marking knife (Fig 2)



It is made of steel fashioned to a point at one end and a sharp blade at the other end to form a cutting edge. The blade or knife is used for marking cut lines where a vertical shoulder is to be cut with a saw or chisel. The point is used for marking distances and scribing lines.

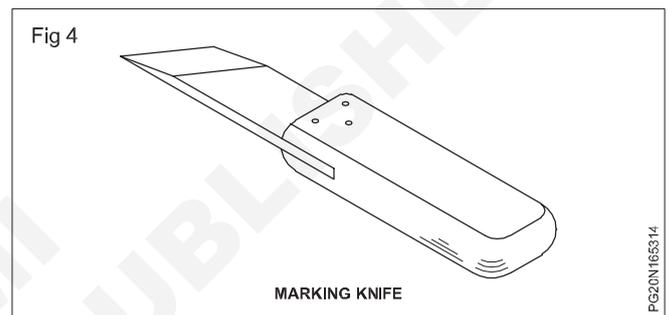
Steel scriber (Fig 3)

A steel scriber should be sharp at its point. It is used for scribing lines on which a chisel cut or a saw cut is made.

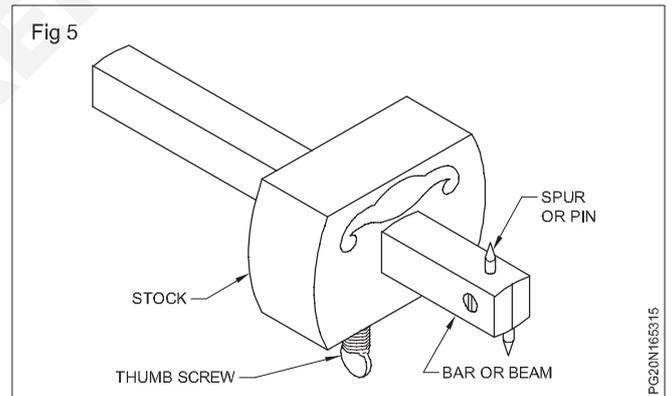


The scriber should not be used as an awl. Do not strike the handle with a hammer.

Marking knife is also used for marking and scribing. It is a steel blade fixed in a wooden handle. It serves the same purpose as that of scriber. (Fig 4)



Marking gauge (Fig 5)



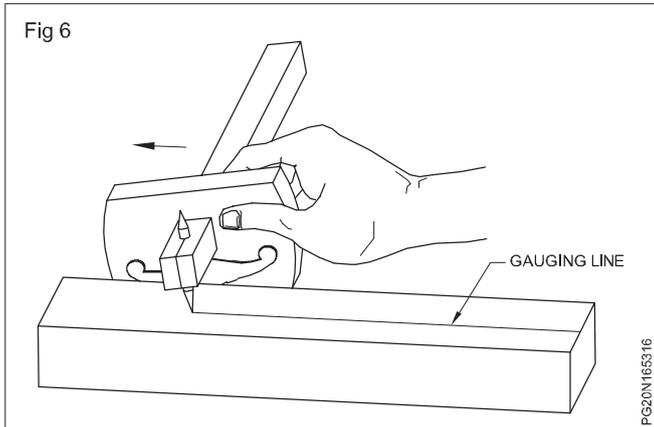
Marking gauge is used for marking lines parallel to a face and edge (e.g) gauging width and thickness.

The marking gauge can be made of wood or steel. The gauge consists of square, wooden bar or beam on which wooden block or stock is sliding. This block can be fastened at any required measurement by use of a thumb screw.

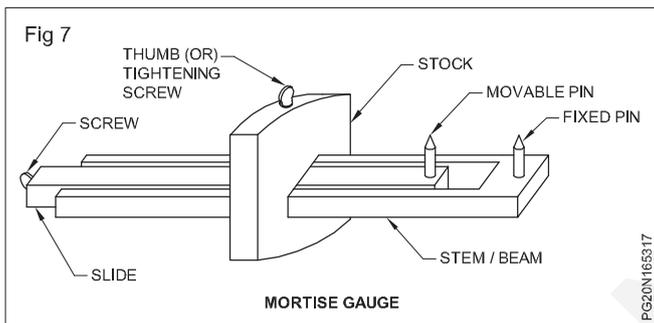
In better form of gauges the stock is protected from wear by a piece of brass set flush with surface. The bar is graduated in millimeter and provided with a spur or steel point at the end. It is always advisable to measure the distance from the spur to the face of the block, with an 'ordinary rule'.

The gauge is set by loosening the screw and the stock is shifted to the distance required from the spur. Measurement are taken from a rule.

After setting the screw is tightened while gauging the stock is firmly held against the wood and pushed in forward direction. (Fig 6)



Mortise gauge (Fig 7)



A mortise gauge is a marking gauge with two spurs. The two spurs can be spaced at different distances and mark two parallel lines at a time.

This is made of hard wood and has an adjusting screw in the end of the beam.

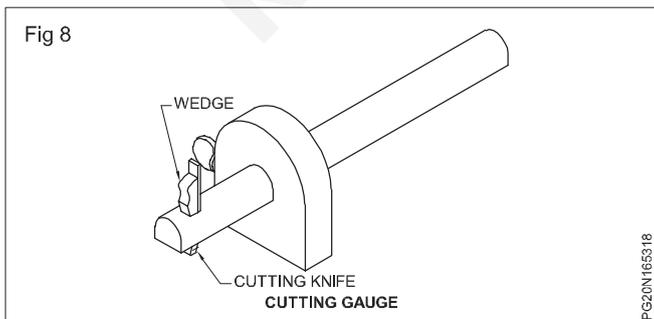
The screw moves one of the spurs up and down as desired. The other side of the beam is fitted with a single point as in the ordinary marking gauge.

The gauge is used for marking mortises and tendons, and similar joints using parallel lines.

Stem/beam and stock made of beech wood. Thumb screw made of box wood. Pin or spur made of steel.

Cutting gauge (Fig 8)

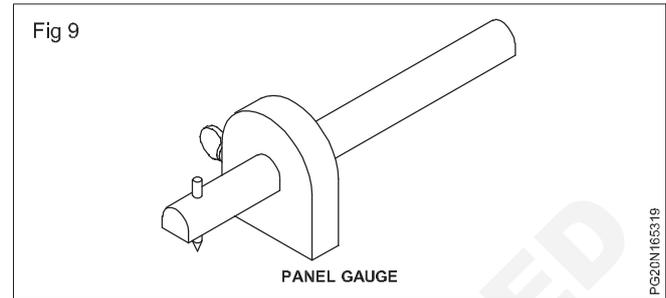
This is just the construction of a marking gauge.



At the end of the stem scribing knife is fixed with aid of one wedge. By loosening the wedge, the length of knife may be increased or decreased. In broad planks scribing marks can be marked with this gauge.

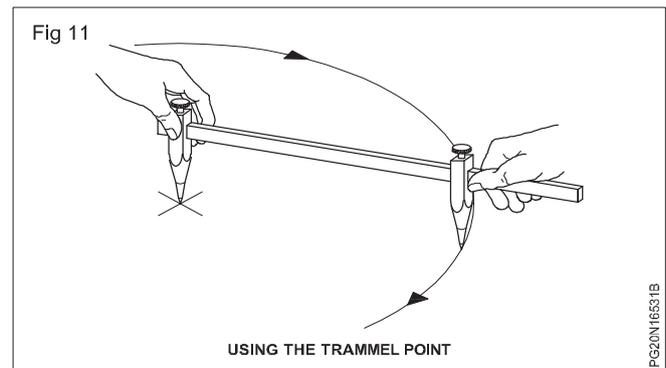
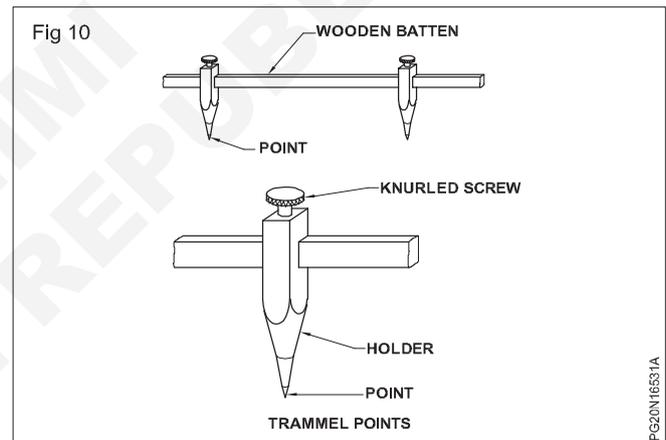
Deep marks can be scribed with this cutting gauge for making grooves, rebates and dovetails. It is possible to cut thin strips of timber and plywood upto 3mm thick.

Panel gauge (Fig 9)



This is just like single marking gauge but the stem and stock are long. The length of stem is 450mm. In planks longer than 150mm scribing marks are made with the panel gauge.

Trammel points (Fig 10 & 11)



Trammel points are used for laying out larger circles and arcs.

Two sliding points are fastened to a wooden batten or a steel rod at any distance required from each other by turning the knurled screw. The point is fastened to the batten or steel rod.

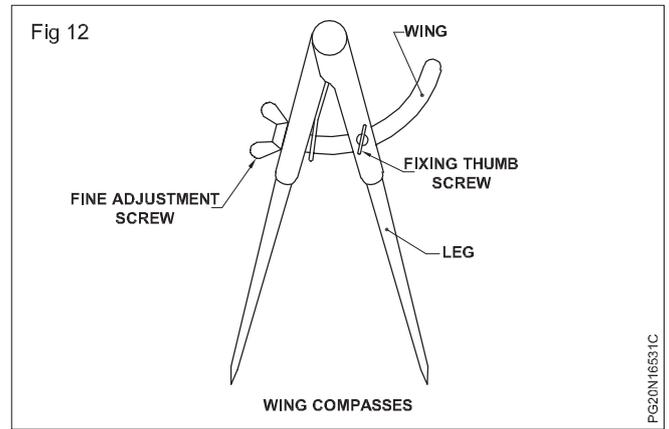
Wing compass; It consists of a pair of dividers (legs) made of steel.

The legs are sharpened to points and at the top they are riveted or screwed.

They are fixed at the required radius by means of a set screw. (Fig 12)

Uses

- 1 For setting out arcs of circles.
- 2 To transfer the measurement from the steel rule to the job.
- 3 To mark curves.

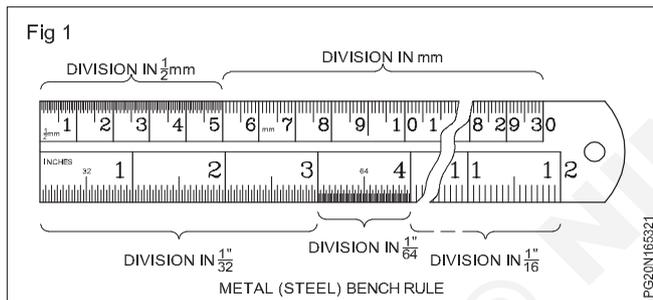


Measuring and testing tools

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

- state the different types of measuring and testing tools
- explain the use of measuring and testing tools
- brief the constructional and features of measuring and testing tools.

The Rule (Steel) (Fig 1)

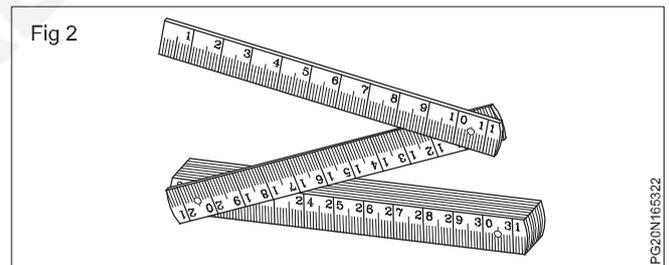


- In the workshop wooden or steel rules are used
- The division in cm is 30cm long and sub divided in mm (2) and half mm (3).
- The division in inches is 12 inches (12") long twelve inches equals one English foot 12" = 1'
- The Sub division is accurate in 1/16" (4) in 1/32" (5) and In 1/64" (6).
- For the conversion of parts of an Inch in to the metric system (with units: m, cm, mm) a conversion table might be useful.

1/16"	=		=	1.6 mm
2/16"	=	1/8"	=	3.2 mm
3/16"	=		=	4.8 mm
4/16"	=	1/4"	=	6.35mm
5/16"	=		=	8.0mm
6/16"	=	3/8"	=	9.5mm
7/16"	=		=	11.1mm
8/16"	=	1/2"	=	12.7mm
9/16"	=		=	14.3mm
10/16"	=	5/8"	=	15.9mm

11/16"	=		=	17.5mm
12/16"	=	3/4"	=	19.05mm
13/16"	=		=	20.6mm
14/16"	=	7/8"	=	22.2mm
15/16"	=		=	23.8mm
16/16"	=	1"	=	25.4mm

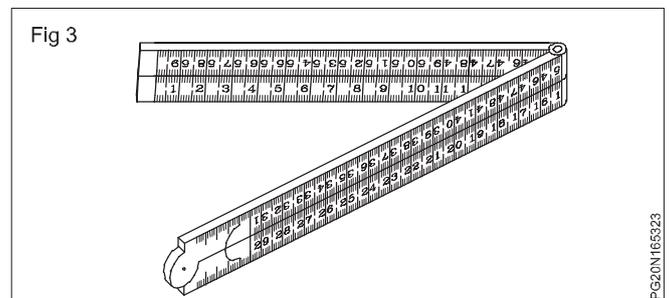
Collapsible Carpenter's rule (Zig-Zag) (Fig 2)



It is also called Zig-Zag rule. It consists of 10 pieces each loosely riveted to one another. Each piece is 10cm long and total length is 1 metre.

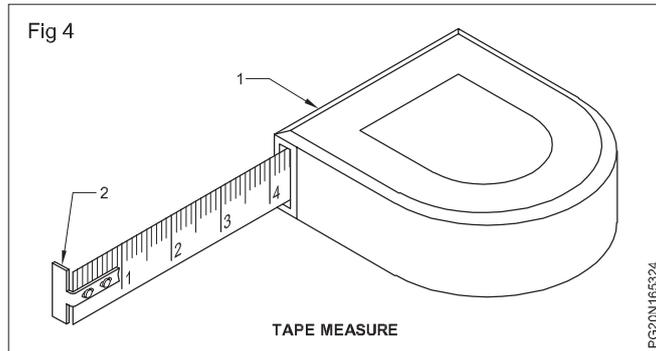
Longer distances can be measured with this rule. Some times it contains British system measurements on the other side.

Folding Rule (Foot rule) (Fig 3)



It is also called foot rule. It has four folds each of which is 6 inches or 150mm long. It is joined in a plastic metallic hinge. After taking measurement, keep the scale folded and free from dust. It is easily carried in packets. Metal clip is provide at the end of this rule to avoid wear and tear.

Tape measurement Rule (Fig 4)



Tape measures are used for longer measurements. The tape is made of steel and is durable and accurate. When not in use, the tape should be kept in the box. Division are made in centimeters or in inches.

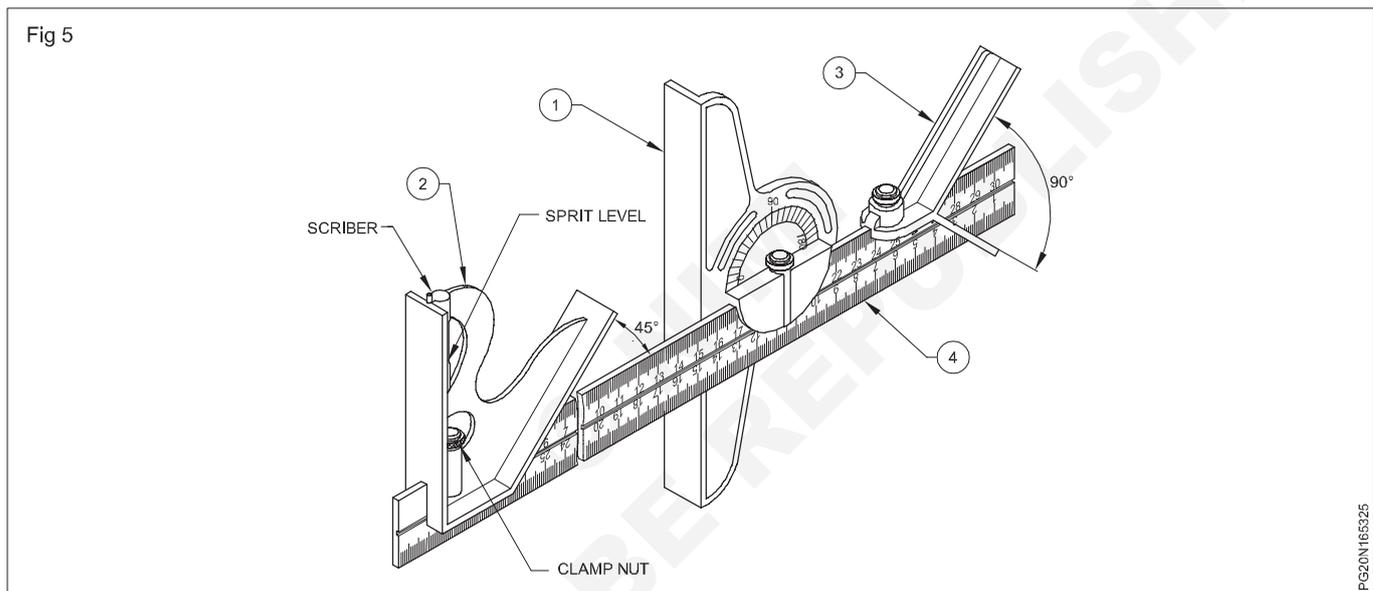
Tape measure has a sliding end piece for inside and outside measurement.

Combination set

Combination sets can be used for different types of work, like layout work, measurement and checking of angles.

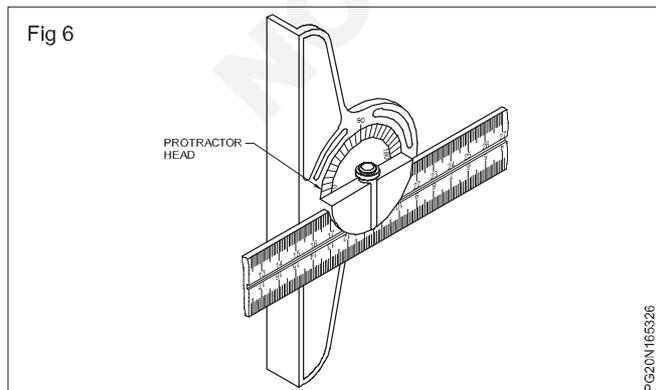
The combination set has a (Fig 5)

- Protractor head (1)
- Square head (2)
- Centre head (3)
- Rule (4)



Protractor Head: The protractor head can be rotated and set to any required angle.

The protractor head is used for marking and measuring angles within an accuracy of 1°. The spirit level attached to this is useful for setting jobs in a horizontal plane. (Fig 6)



Square head: The square head has one measuring face at 90° and another at 45° to the rule.

It is used to mark and check 90° and 45° angles. It can also be used to set workpieces on the machines and measure the depth of slots. (Figs 7a,b & c).

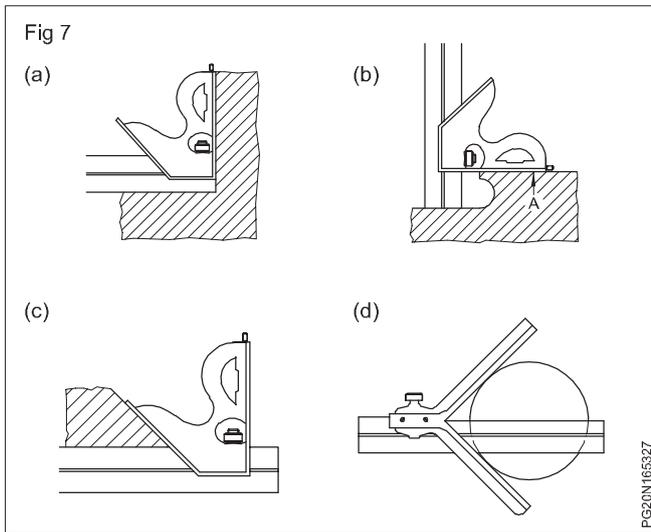
Centre Head: This along with the rule is used for locating the centre of cylindrical jobs. (Fig 7d)

For ensuring accurate results, the combination set should be cleaned well after use and should not be mixed with cutting tools, either while using or storing.

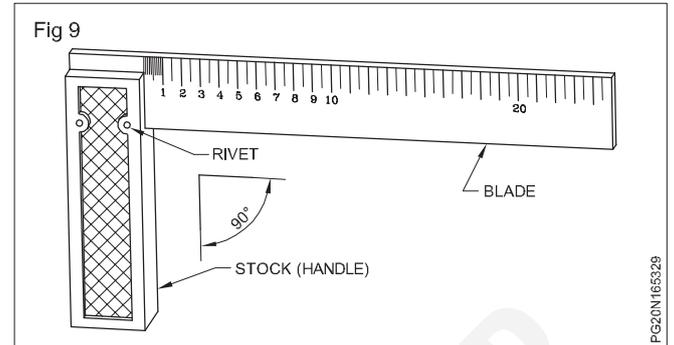
Calipers: Calipers are simple measuring instruments used to transfer measurements from a steel rule to objects, and vice versa.

Calipers are of different types depending on the type of the joint and the shape of the leg.

Types of Joints: The commonly used calipers are firm joint calipers and spring joint calipers.



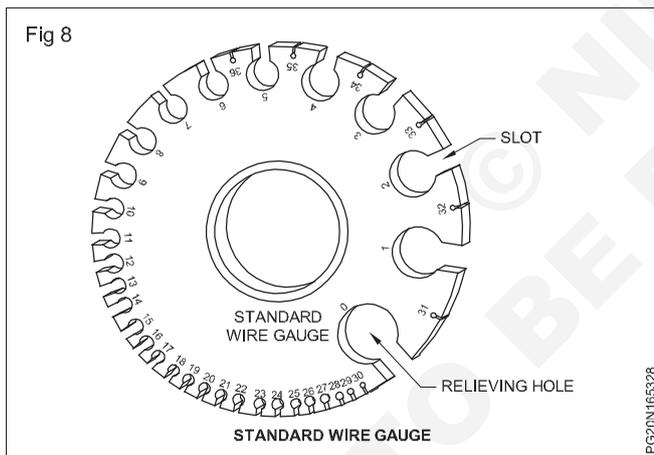
- The accuracy of measurements by a try square about 0.002mm per 100mm length.
- Which is accurate enough for most work shop purposes.
- The blade is fixed to the stock at 90°. (Fig 9)



Standard wire gauge (Fig 8)

The job drawing indicate only gauge or thickness of the sheet to be used. Before starting the work identify the correct thickness of the sheet. The thickness of the sheet is measured with the help of the standard wire gauge.

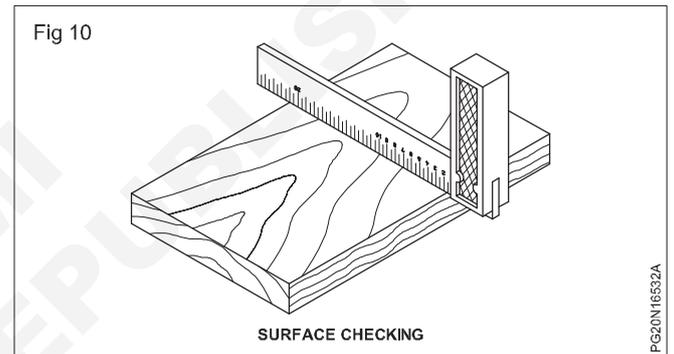
The gauge consist of a disc shape smoothed steel metal piece with numerous slots around the outside edge. These slots are of various width and correspond to certain gauge number.



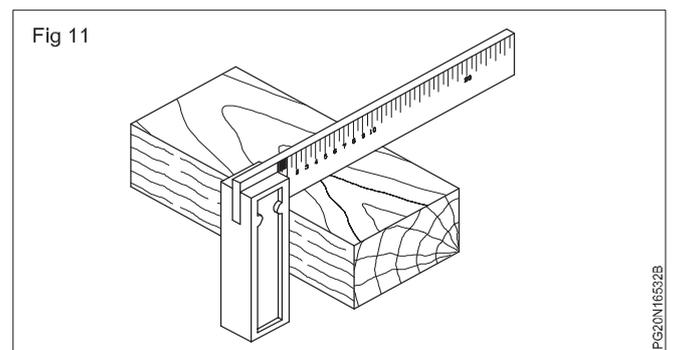
Uses

The try square is used

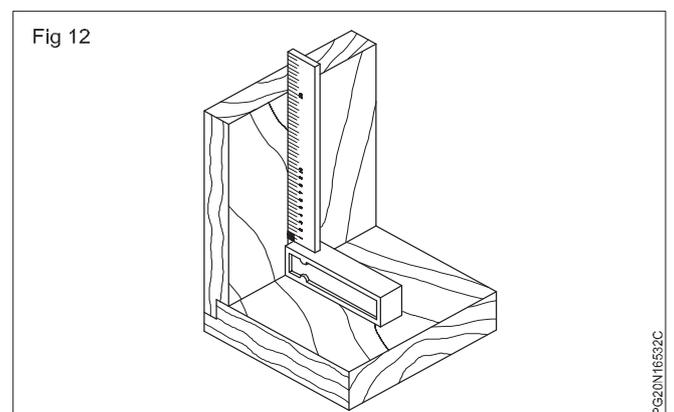
- To check the flatness of the surface.(Fig 10)



- To check the squareness of edge. (Fig 11)



- To check the inside squareness. (Fig 12)



Gauge number is stamped on one side of each slot and on the other side, the decimal part of an inch is stamped to show the thickness of the sheet and diameter of the wire.

Thickness of the sheet is checked by inserting the edge of sheet in the appropriate slot of the standard wire gauge.

Wire diameter is checked by inserting the wire only in the slot, and not in the circle.

Higher the SWG gauge number, lesser the thickness of the sheet.

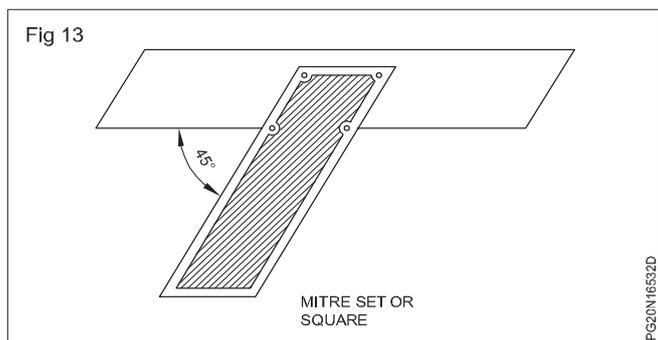
Try square

The try square is a precision instrument.

- Which is used to check squareness of a surface.

- The blade of try squares are made of hardened steel.
- The stock is made of seasoned hard wood or cast iron, mild steel and aluminum.
- If it is made of wood it must be well seasoned timber.
- To prevent the wooden stock from wearing a brass plate is fixed to the inside edge.
- The try squares are specified according to their blade lengths.
- Try square blade lengths are available in 100,150,200,250mm and 300mm.

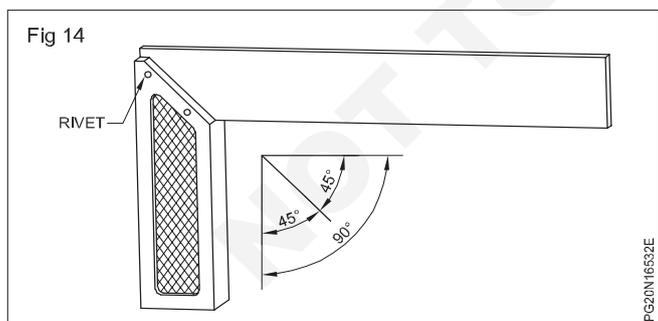
Mitre square (Fig 13)



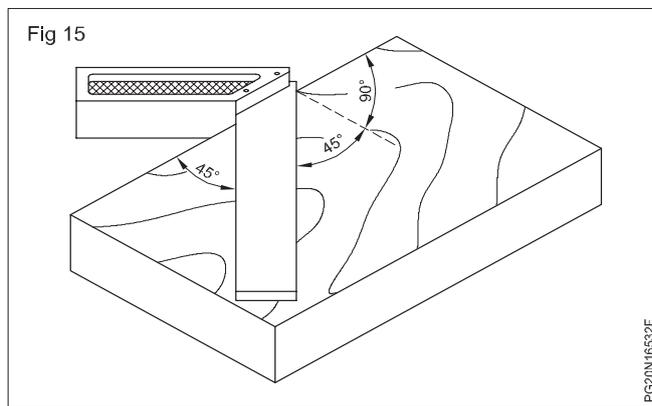
- To mark 45° and to test 45° by mitre square is used at the end of its stock and at the cutting of the blade.
- It is fixed permanently by rivets, the length of its blade is 200mm to 350mm. There are graduations on its blade.
- The only difference between try square and mitre square is that the blade and stock are fixed at 90° in the try square and 45° in the mitre square.

Try and Mitre square

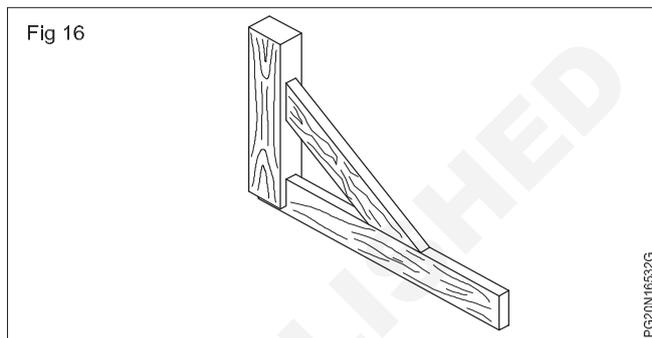
- The try square and mitre square is also useful for angle 45°,90° and 135°. (Fig 14)



- The try and mitre square is useful for setting out mitres at 45 testing chamfers and other work 45° or 135°. (Fig 15)
- The blade is permanently fixed so the stock is at the length of the blade which is 200mm to 350mm.



Wooden try square (Fig 16)



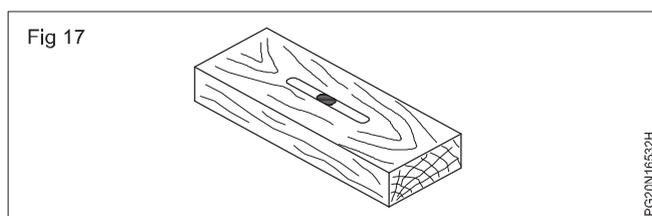
The try square is fully made of wood. Its handle is slightly heavier than blade. The length of blade is 600mm (24") and width is 50mm (2"). The length of the handle is 400mm some times up to the length of 450mm.

Without changing the angle 90° the handle and the blade are diagonally attached, by a brace. angle of wooden try square is 90°.

Uses

This is used for carpentry works and for building construction works. Large and wide planks are used to scribe the works.

Spirit level (Fig 17)

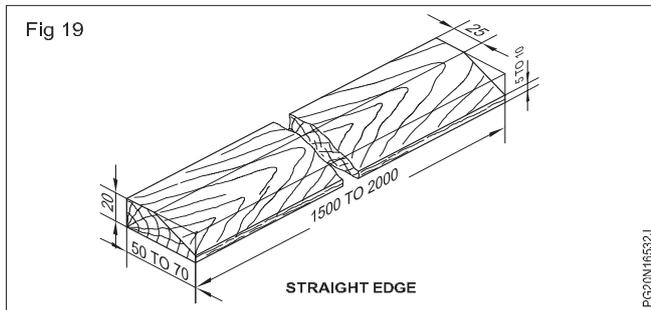


A spirit level is used principally by the carpenter. It consists of a piece of wood (common wood for spirit level is Teak wood) or aluminum into which a spirit level glass is fastened horizontally and vertically. As the glass tube is not filled, a bubble always remains, when the bubble is in the centre of glass indicated by lines marked on it, the structure on which the level rests is absolutely horizontal or vertical.

In some spirit level there will be two glass tubes perpendicular to the horizontal glass tube. This will be called as plumb glass and is used to test the perpendicularity of walls and windows. (Fig 18)



Straight edge (Fig 19)



Straight edge made of steel or wood with perfectly straight parallel edges, although some times has only one straight edge.

Uses: For testing the straightness of surface and edges.

Its length is 1500mm to 2000mm breadth 50mm to 70mm and thickness 20mm.

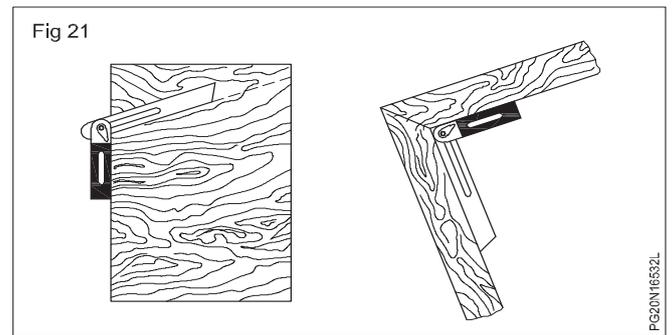
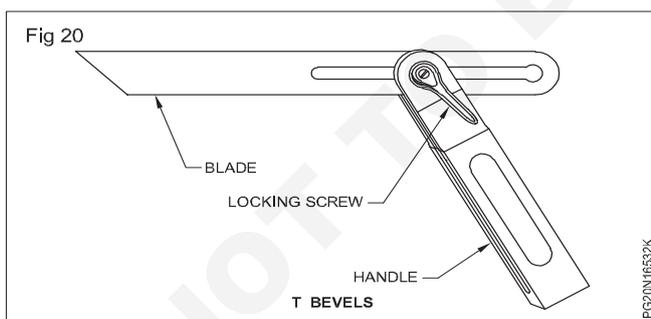
'T' bevel or bevel square

The T-bevel is used to test and transfer angles other than right angles. The bevel is called sliding bevel because it has an adjustable sliding blade. The blade may be locked by a wing nut or set screw.

The required angle is set from a straight edge and the degrees are measured against a protractor.

Uses

The sliding bevel is used for laying out dovetails, side rails for chairs, chamfers, bevels and for transferring angles from the drawing to the work piece. The Parts of the bevel square. (Figs 20 & 21)



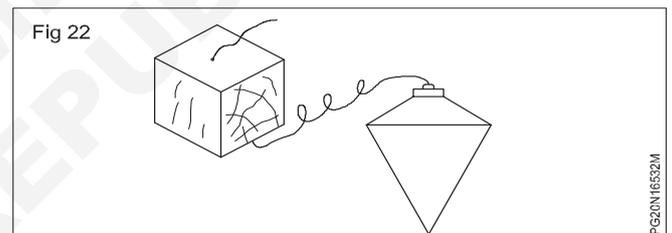
Handle: Handle is made of hard wood, cast iron and aluminum. The top edge is half rounded and there is a slot to fix the bevel square.

Blade: One edge of the blade is half rounded and their other edge is cut at 45°. There is a longitudinal slot. The handle is fitted with the wing nut in the slot or with a machine screw. The slotted blade passes through a slot in the stock.

On loosening the wing nut the blade can be shifted to any angle. And also the blade can be extended for further length if necessary.

Locking nut: This may be a wing nut or a set screw used for loosening or tightening the blade.

Plumb bob (Fig 22)



This tool consists of a solid brass or metal cylinder with a pointed end which is attached to a suspending line so that its tip always pointing vertically down. Its upper part is small wooden block with a hole drilled in its centre so that the line with the cylinder on it can be pulled up on lowered down through the hole.

The diameter of the wooden block is slightly greater than the diameter of cylinder so that the cylinder can move freely up and down without touching the work piece.

The main use of the plumb bob is a more accurate replacement for the vertical spirit level and also to transfer points down vertically in marking.

Common India timbers

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

- state the types of common India timbers
- explain the properties of India timbers
- brief the uses of India timbers
- state the advantages of India timbers.

Teak

It is very valuable timber. It is a large tree with light coloured leaves.

The wood is straight grained and of rich brown yellow color.

Sap wood is pale yellowish and heart wood is golden brown. In India it is found in Madhya Pradesh, Maharashtra, Andhra Pradesh, Kerala and Gujarat, maximum of teak output is from Madhya Pradesh. It is hard and heavy and weighting about 650 kg/m³ at 12% moisture content suitable for any work, ship building furniture and cabinet making etc.,

Deodar: It has straight tall trunk having short branches and pointed leaves. It is found in altitudes of 1200 to 3000m. The tree has lofty straight trunk with small branches. It is found in Arunachal Pradesh, Punjab, Himalayas, Kashmir and U.P.

The sap wood is white and heart wood is light yellowish brown. The wood is hard and heavy with average weight 545 kg/m³ at 12% moisture content. It has a medium fine and even texture deodar is a non-porous wood.

Uses: Construction purposes, furniture, packing cases, railways sleepers, carriages etc.,

Chir: It is similar to deodar but is inferior in quality. The sap wood is white and heart wood is light yellowish brown.

It is hard and heavy with an average weight of 575 kg/m³. It is medium and uneven textured with straight to spiral or twisted grain.

Uses

Construction purposes, furniture, height packing and cabinet making.

Kail: It is an ever-green tree.

Kail is similar structure to chir. It is found in foot hills of Himalayas Kashmir, Punjab, and Uttar Pradesh. The sap wood is white and heart wood is light and pinkish red.

It is closely grained hard and durable.

It has resinous colour when freshly cut.

It is soft and light with average weight 515 kg/m³

Uses: Cabinet making, furniture, packing cases, drawing boards and railways sleepers etc.,

Shisham (sissoo): It is a tree having short trunk and large branches.

It is found in Assam, Orissa, U.P. Punjab, Himachal Pradesh, Bihar etc.,

Sap of sissoo is pale yellowish and heart wood is golden or dark brown. It generally grows along the road side.

It is hard and heavy with an average weight of 780 kg/m³

It has medium coarse texture with fairly straight inter locked grains.

Sal: It is a straight growing up right tree.

It is found in Assam UP, Orissa, Maharashtra, Andhra Pradesh, Tripura, Madhya Pradesh etc.,

The sap wood is pale yellowish and heart wood is brown or reddish brown.

The wood is hard and heavy with an average of 855 kg/m³

It is coarse textured with inter locked grains.

Uses

It is a valuable timber and recommended for all.

Construction purposes and railways sleepers.

Babul: It has small leaves and the not available in large shapes.

It is available in abundance all over India. The wood is closed grained and tough colour of wood is pale red and weighing about 785 kg/m³. It is not available in large sizes.

Uses

Tool handles, wheels and bodies of carts, ploughs and other structural works.

Mango: Mango is found all over India. The wood is of inferior quality, coarse and open grained and weighting about 690 kg/m³ colour of wood is yellowish gray. It contains large amount of moisture and sap.

Uses

Inferior quality doors and windows, packing case etc.,

Bamboo: This tree is found practically all the parts of India. It is a flexible and strong material.

Bamboo grows naturally on soils which are neither too acidic nor too alkaline. The greater concentration of Bamboo is however found in Assam Region.

It is used for making the poor man's hut all over the country.

Uses

Walls, portions, flooring, ceiling, roofing ladder, basket making mats, walking sticks, umbrella handle, toys and paper pulp.

Advantages of timber

- 1 It can be easily converted to any size and shape.
- 2 It has a high resale and salvage value.
- 3 Timber construction is light in weight.
- 4 Timber has better insulating properties.
- 5 Timber can be used for loading and loading elements.
- 6 Timber connections are easy to make.
- 7 In terms of specific strength timber is better to many other building materials.
- 8 Durability of timbers is very high, if properly seasoned and pressed.

Defects in timber

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

- identify the defects in timber
- explain the knots, shakes and grains
- state the causes for defects in timber.

Defects in timber

Natural defects occurs in all kind of timber depending upon the soil upon which they grow and climatic conditions to which they are subjected while growing.

A defect in any irregularities occurring in or on the timber

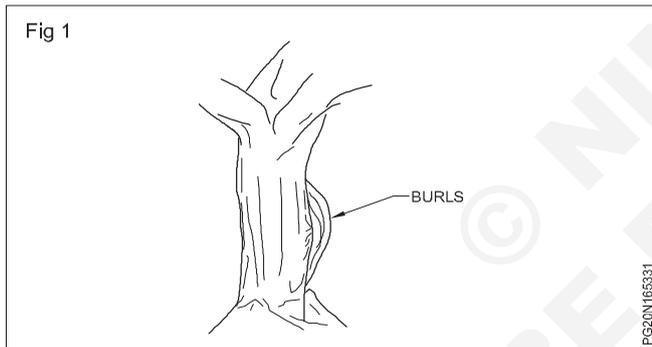
Defects reduces strength durability or utility value of the timber.

Causes: Lighting, strong winds, fires, diseases, parasite (insects, fungi etc),

Carelessness while felling, seasoning, Conversion, fungi and insects.

Common defects

Burls: Burls are abnormal growths on the side of the tree caused by some injury or irritation of the trunk. (Fig 1)

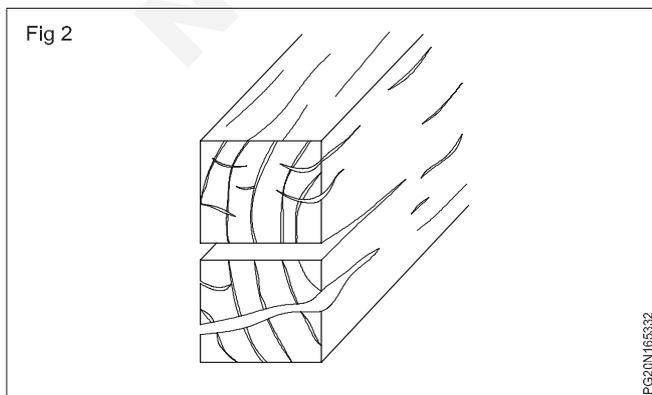


Case hardening: Is a condition of the outer layer of timber is abnormally hard.

Caused by in complete seasoning and this outer layers are dried too quickly.

Check: Check is the separation of the wood extending for a few (inches) centimeter along the grain and formed while drying.

End check: Occurring on the end of the piece of timber. (Fig 2)

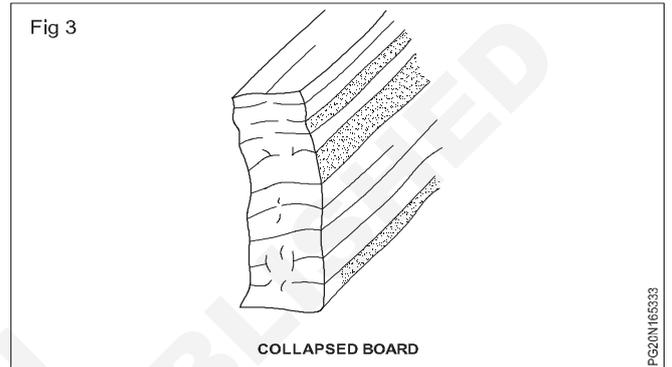


Internal check: Occurring in the interior of the piece

Surface check: Occurring on the surface of the piece.

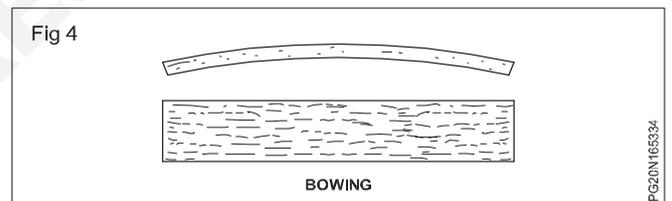
Through check: On which extends through the piece from one surface to the other.

Collapse: A flatter of the cells may be due to excessive or uneven drying. (Fig 3)



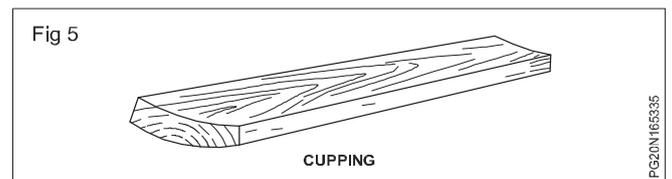
This may be prevented if drying in low temperature.

Bowing: A curvature from plane along the wide surface of the board. Caused by uneven shrinkage and uneven drying during seasoning.(Fig 4)



Board not being out parallel to the growth rings.

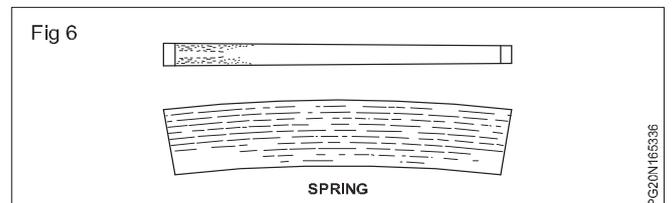
Cupping: A simple curvature across the width of board due to greater shrinkage on the concave side. (Fig 5)



It is more pronounced in back sawn boards.

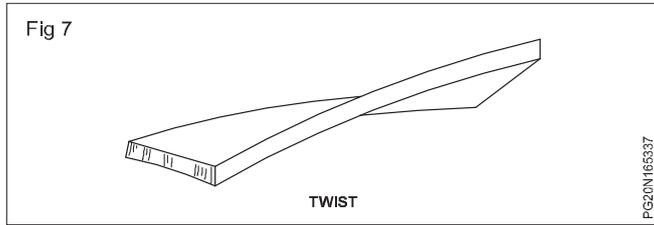
The curvature is usually away from the heart

Spring: A curvature along the edge of the board. (Fig 6)



Not affecting the face, the face remaining flat caused by uneven shrinkage and poor drying of the timber.

Twisted fibres (Fig 7)



This defect is due to the tree being twisted constantly in one direction by the force of prevalent wood.

A spiral distortion along the length of the piece of timber.

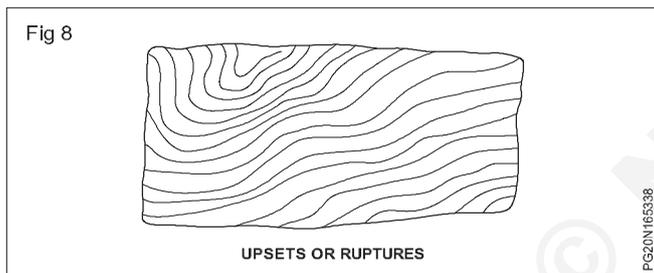
This may be caused by uneven shrinkage due to uneven drying.

Warp

Any variation from a true flat surface (not perfectly flat).

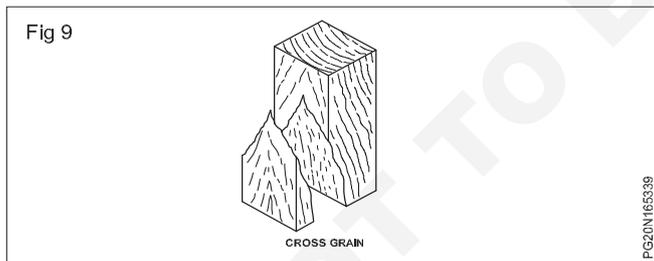
Upsets

This is the fracture of the fibre across the grain and may be the result of injury in felling. (Fig 8)



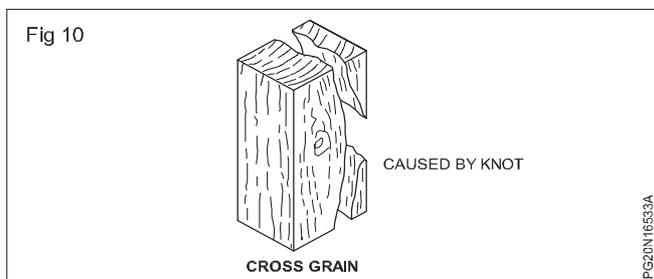
Grain

Refers to the direction of the cells and vessels of the wood. (Fig 9)



Cross grain

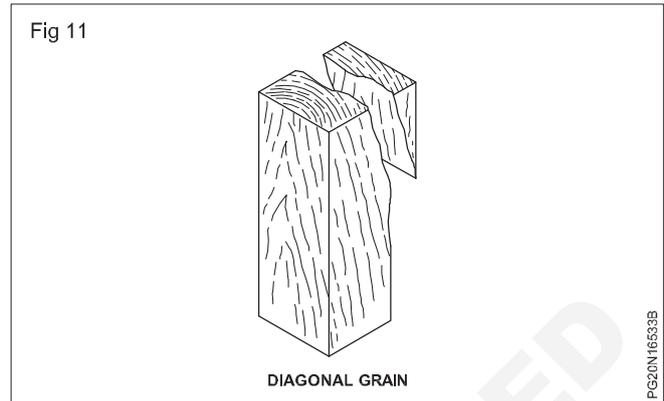
When have a varying inclinations to the axis of the piece due to cutting from timber in which the straightness of the grain is imperfect. (Fig 10)



Diagonal grain

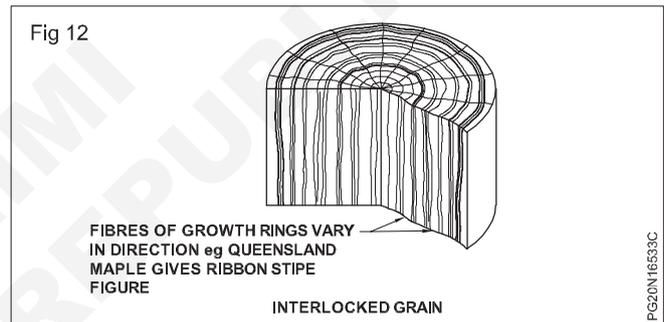
When the fibers do not run parallel to the axis of the piece, although cut from straight grained timber.

This is caused by cutting parallel to the axis of the log instead of parallel to the bark. (Fig 11)



Inter lock grain

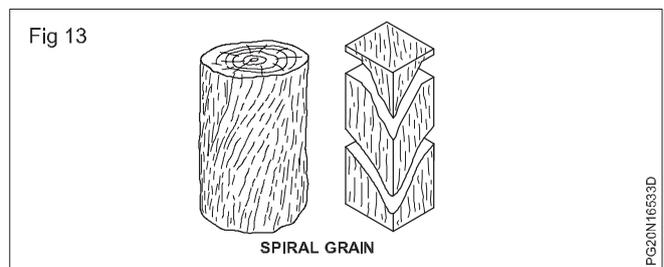
Caused by the fibers of adjacent layers of wood being spirally inclined in opposite directions. This grained surface is difficult to plane. (Fig 12)



Spiral grain

Occurs when the fibers have taken a spiral course in the tree trunk as if the tree have been twisted.

The cause is not definitely known. (Fig 13)



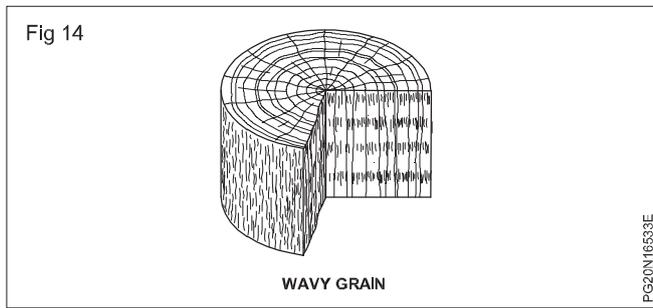
Wavy grain

A wavy arrangement of the fibers, also known as curly or fiddle back grain.

This grained surface is difficult to plane and work. (Fig 14)

Waney edge

This defect lies in the sap wood which accompanies wane due to economical conversion of logs.



Rind galls

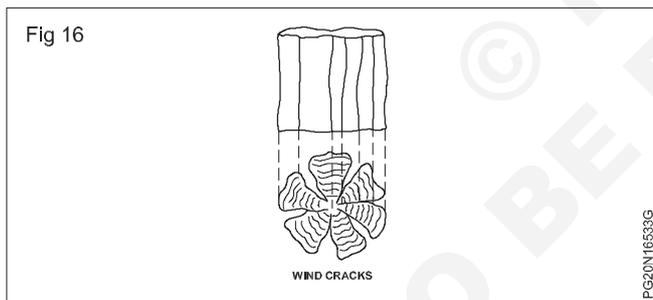
These peculiar curved swelling found on living on dead tree.

Generally caused by the growing of the layer over the "Wounds" left after the branches have been imperfectly cut off or removed. (Fig 15)



Wind cracks

These are shakes or splits on the sides of a bark of timber due to the shrinkage of the exterior surface exposed at atmospheric agencies like sun and wind etc. (Fig 16)



Knots

Caused by a branch or limb being cut through during the process of sawing up the log.

They may live or dead but break the continuity of fibres.

Generally these are distinct defect either in appearance or weakening the wood. (Fig 17)

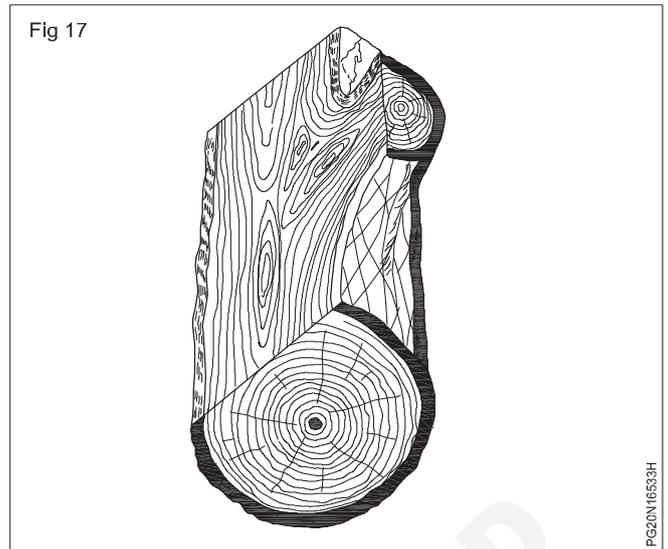
Loose or dead knot

Left by branches that have been cut off or broken before felling.

It is loose in position on the surface of the piece.

It cannot be relied on to remain in position in the piece.

(Fig 18)



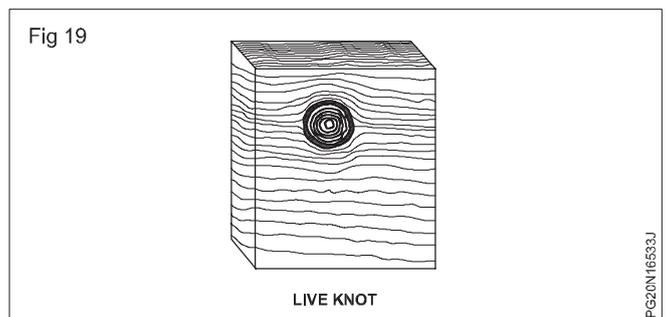
Live or sound knot

It is left by a branch when the tree is felled.

It is solid across its face and hard as the timber surrounding it.

It is free from decay

Knots are considered to add beauty and effect in the final appearance. (Fig 19)



Shakes

Is the partial or complete separation between adjoining layers of wood.

Due to the relief of growth stresses present in the stem at the time of felling.

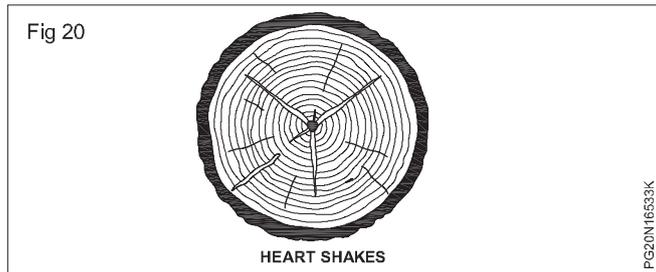
To impact of the tree with the ground.

Heart shake

These are the cracks or splits in the centre.

Starting from the pith and extending in the direction of the medullary rays in one or opposite directions towards sap wood.

Such defects are found in over matured trees, but some times they may be caused by quick drying of central part of the tree. (Fig 20)



If a tree nearing maturity is felled and left unbreakable for a long time.

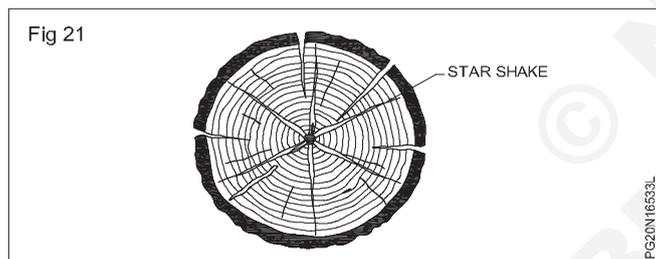
This defect is caused due to shrink of heart wood.

Star shake

These are crack or split which extend from bark towards sap wood.

This defect is caused when the tree is subjected to serve heat or frost during its growth.

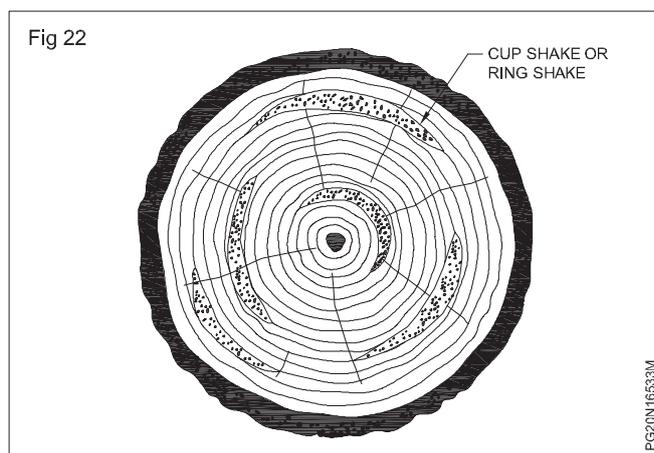
The width of these cracks or shake is more at the outer ends and reduces when they extend towards centre. (Fig 21)



Cup shake or ring shake

These are formed by the rupture of tissue in a circular direction across the cross section of a log.

It forms usually along the annual rings. (Fig 22)

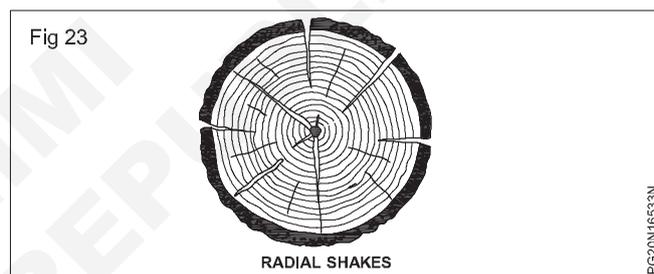


Radial shake

These are similar to star shake, but it occur due to exposure to sun when felled timber is placed for seasoning.

These cracks are fine, irregular and numerous.

Many cracks or split run for a short distance from bark towards centre than follow the course of an annual ring and lastly go towards the centre radially. (Fig 23)



When the rupture extends only a part round, it is called cup shake.

When the whole way round or almost so it is called ring shake.

This defect is caused either due to unequal growth or due to sudden contraction for timber under atmospheric changes assisted by twisting action due to wind.

Diseases in timber and decay of timber

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

- state the decay that occur in timber
- explain the effects caused by the diseases in timber.

Decay

When timber is confined to a place where it is liable to be subjected to alternate dry and wet conditions or when used in dark unventilated position it gives birth to two common diseases.

- 1 Dry rot
- 2 Wet rot

Dry rot

The disease in timber is caused due to lack of ventilation. Due to improper ventilation there is growth of fungus which eats away the fibres of timber and reduces them to powder. The growth of fungus accelerates the process of dry rot, but the origin of the disease is due to the decomposition of sap in the timber. This

decomposition supplies food for the growth of fungi. The disease is highly infectious and causes tremendous destruction of the timber. This disease may develop in seasoned timber, timber or unseasoned timber treated with preservatives. This disease is common in warm cellars, unventilated wooden floors basements ends of timbers built into walls.

This disease can be detected by tapping at one end of timber post or log and hearing the sound on the other end. If distinct sound is heard then it indicates a sound timber and if a dull sound is heard then it is a sign of decayed or diseased timber.

The following method can be adopted to prevent or eradicate this disease.

- 1 By allowing free circulation of free air.
- 2 Portion of wood attacked by dry rot should be cut off and the remaining portion painted with copper sulphate.
- 3 By exposing the infected portion to sunlight and sweeping of fungus.

Wet rot

This disease is the result of decomposition of timber caused by damp and moisture. This disease is further induced by alternate wet and dry conditions. The portion of the timber attacked by wet reduces to greyish brown powder. In this disease the timber is just decomposed while wet and then it scales off when it dries.

This disease can develop in a timber whether dead or alive. All types of timber used in uncovered situations is likely to be exposed to rain and hence subjected to wet rot.

This wet rot disease can be avoided by removing sap from timber through seasoning first and then treating it with preservatives.

Diseases

Timber is said to be decayed when it is deteriorated to the extent it loses its value as an engineering material. Timber deteriorates in strength when it is subjected to excessive defects, diseases or attacked by insects. These insects damage the appearance and reduce their strength. Following insects generally attack the timber.

a Pinhole borers

They attack the standing tree or recently felled timber.

b Powder post beetles

They attack timber while it is stacked for seasoning sale or awaiting use for years.

Termite or white ants

They attack timber used for structural purposes in buildings bridges, poles, sleepers fence posts etc. The following are various causes of decay.

- 1 Alternate dry and wet conditions .
- 2 Improper stacking storage of timber.
- 3 Improper seasoning or unseasoned timber.
- 4 Use of unseasoned timber treated with preservatives.
- 5 Use of seasoned timber without treating with preservatives.
- 6 Presence of moisture sap and different types of insects.
- 7 Development of defects during growth conversion improper use etc.
- 8 Improper position of structural member of timber.
- 9 Development of timber disease.
- 10 Effect of natural agencies.

Introduction to plumbing work

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

- state the safety precaution of plumbing work
- state the use of plumbing hand tool
- state the rain water and pipe system installation method
- state the pipe line leakage and maintenance.

Safety precaution of plumbing work:

- Study the nature of plumbing work and estimate the cost of work.
- Select the materials for particular job
- Select the tools for the job
- Study the job drawing carefully
- Wear the proper dress while working
- Fix the pipes properly without any leakage
- Use the sealing compound for pipe fitting
- Use the solutions to fix the PVC and UPVC pipes
- Use the proper tools for plumbing work
- Use the hack saw blade to cut the pipes
- Use the first aid kit while unexpected accidents happened during plumbing work.

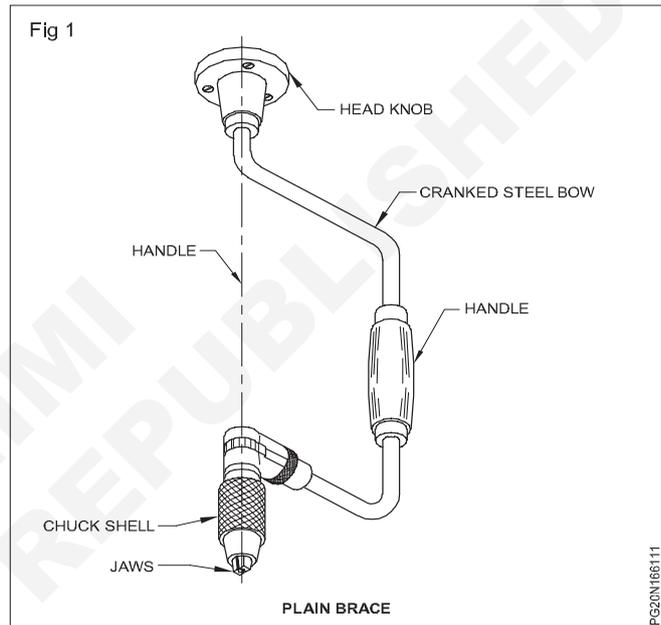
Plumber hand tools: Different types plumber hand tools are used to measure, cut, fix, threading the metal and PVC pipes. The hand tools are as follows

- Plain brace
- Ratchet brace
- Die stock and dies
- Single end spanner
- Double end spanner
- Adjustable spanner
- Ratchet type die set
- Pipe wrenches
- Chain pipe wrenches
- Open end spanner
- Ring spanner
- Combined spanner
- Tubular spanner
- Socket spanner
- Offset spanner

The brace (plain & Ratchet)

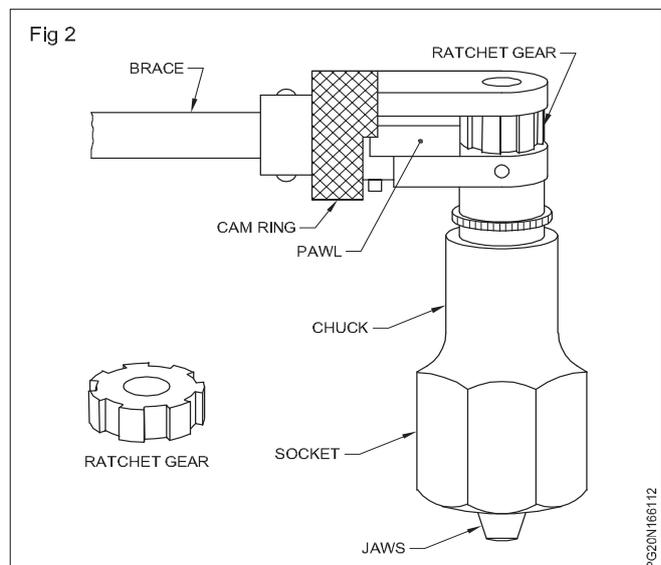
Circular holes are drilled or bored in wood by means of drill. To penetrate into the wooden piece it is necessary to use the drill to cut a hole.

The brace is a cranked tool for holding a bit while boring a hole. The brace is used to give a rotating movement. The head, knob and the handle can rotate freely. (Fig 1)



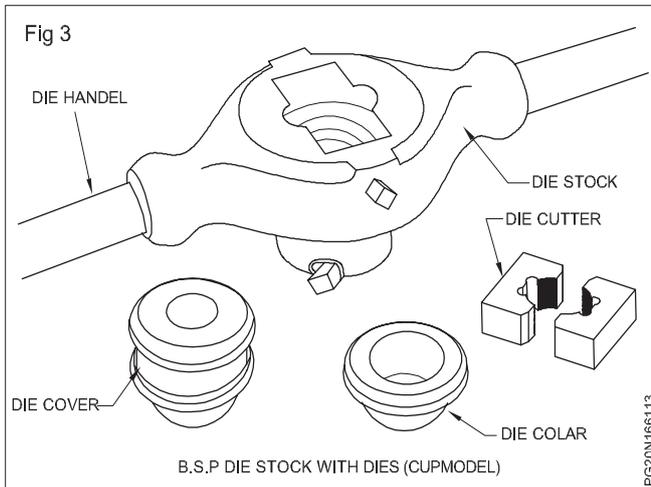
The chuck consists of a metal screwed chuck shell in which the jaws are enclosed. When the shell is loosened the jaws will be open to receive the bit.

The ratchet brace (Fig 2)



The ratchet brace is provided with a ratchet mechanism. The ratchet permits the brace to be rotated to and fro while the chuck rotates in only one direction. The cam ring can be set in positions for clock - wise and anti - clockwise rotation.

Die stock and dies (Fig 3)



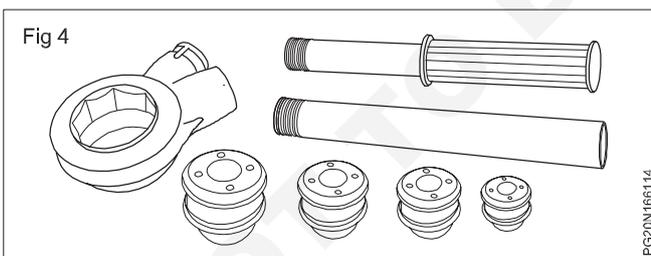
This B.S.P die set is used for making external threads on pipes used for plumbing work 1/2" (15mm) 3/4" (20mm) 1" (25mm) cutters and collars are changed and can be used to cut the threads using same die - stock and die - cover cutter are split into two pieces. One end of the cutters are chamfered which makes easy to assemble before threading.

Parts

Die - stock	Die - Cover	Die - Collar
Die - Cutter	Die - Handle	Adjustable screw

Use lubrication oil frequently as this will make threading easy and prevent the damage of teeth in the die cutter.

Ratchet type dieset (Fig 4)



This type die set are now a days used to cut threads up to 32 mm f G.I pipes another type is from 1/2" (15mm) to 2" (50mm)

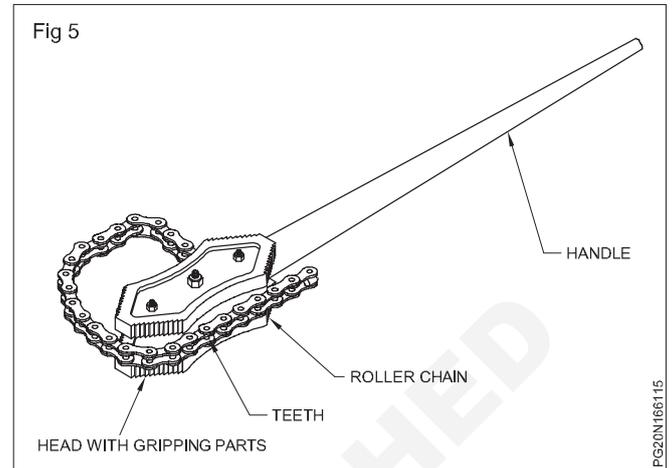
If the pipe is loose it must be hold securely in either a pipe stand or pipe vice or a bench mounted vice.

To fit the die head to the ratchet head select the size die according to the size of the pipe push it into the left side of the ratchet head.

Die stock with the die located over the pipe place a small quantity of cutting oil.

Avoid long cut as this will increase the heat and teeth in the dies will be damaged.

Chain pipe wrench (Fig 5)

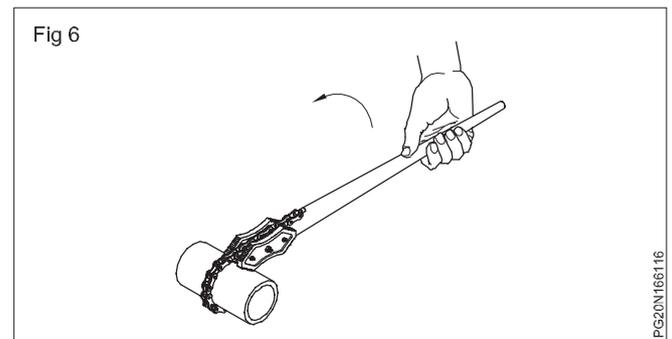


Chain pipe wrenches are used for pipes with diameters of 50mm to 150mm. They may be used for gripping cylindrical or irregular objects.

Application of chain pipe wrench

To use a chain pipe wrench, the head is placed on the pipe and the chain pulled round the circumference of the pipe. The chain is then engaged with the large teeth in the centre of the head.

The movement of the lever in the direction indicated by the arrow in the figure caused the serrated edges of the head to wedge firmly against the pipe giving a firm grip. (Fig 6)



The chain pipe wrench is a heavy gripping tool and should not be used for pipes with less than 50mm diameter.

Spanners and their Uses

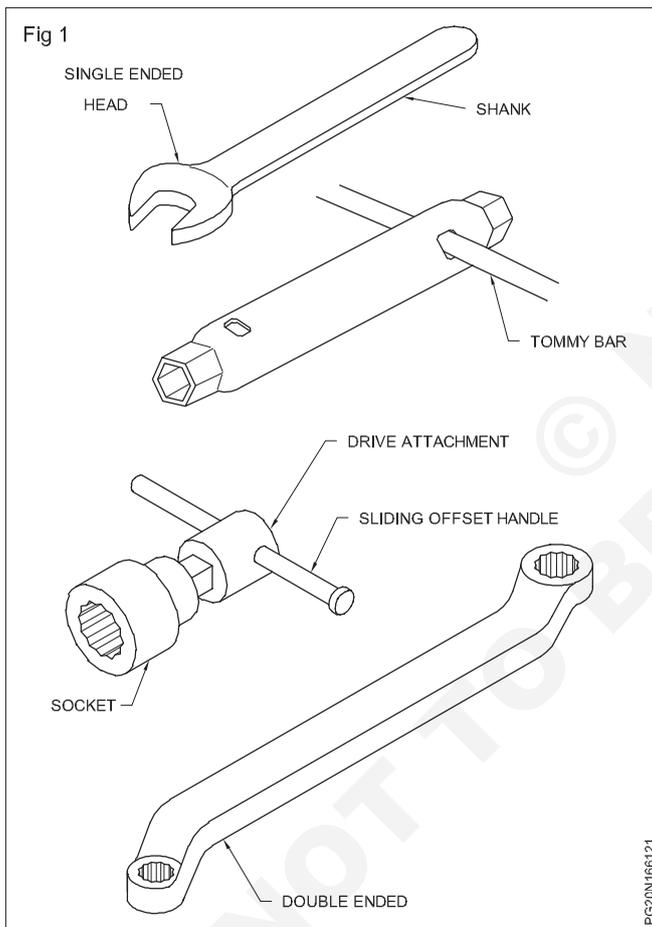
Objectives: At the end of this lesson you shall be able to

- state the necessity of spanners
- identify the different types of spanners
- specify the spanners
- list out the parts of adjustable spanners
- state the features of 'C' spanners and their uses.

Necessity of Spanners: are used for operating threaded fasteners, bolts and nuts. They are made with jaws or opening that fit square on hexagonal nuts and bolts and screw heads. They are made of high tensile or alloy steel. They are drop-forged and heat-treated for strength. Finally they are given a smooth surface finish for ease of gripping.

Spanners vary considerably in shape to provide ease of operation under different conditions.

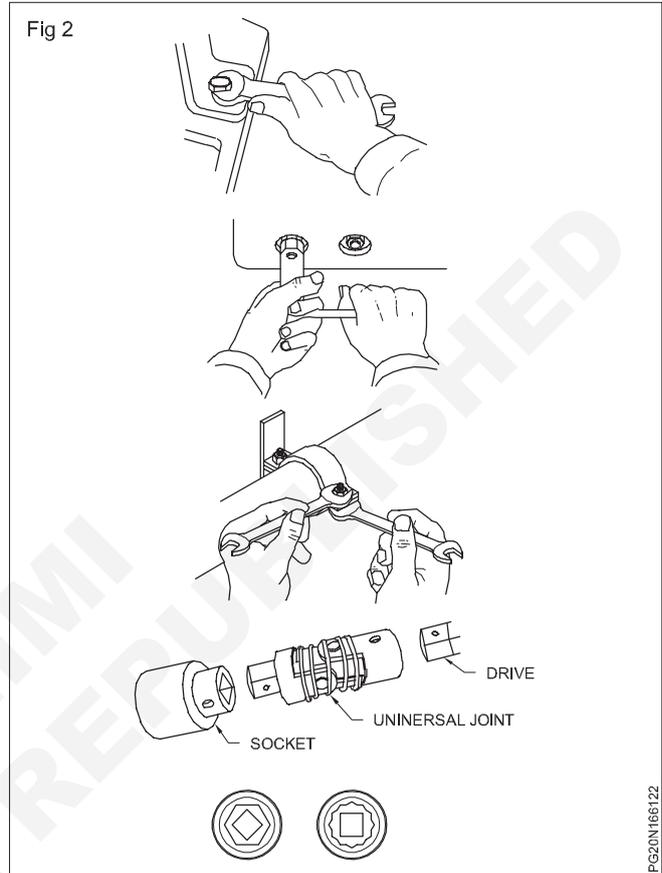
The basic types of spanners are: (Fig 1)



- Open end spanners (1)
- Tube or tubular box spanners (2)
- Socket spanners (3)
- Ring spanners (4)

The correct spanner to use is the one that fits exactly and allows room for use. They should also permit the job to be done in a shorter time.

The following are the points to be noted for using spanners in a safe way. (Fig 2)



Use open end and ring spanners by pulling on the shank. It is safest to pull as there is less chance of hitting your knuckles if the spanner or nut slips suddenly. If you are forced to push the spanner, use the base of your hand and keep your hand open.

Use both hands for large spanners.

Keep yourself balanced and firm to avoid slipping yourself, if the spanner slips suddenly. Hold on to some support, if there is any chance of falling.

Use both hands as shown in the figure, when using tubular box spanners. (Fig 2)

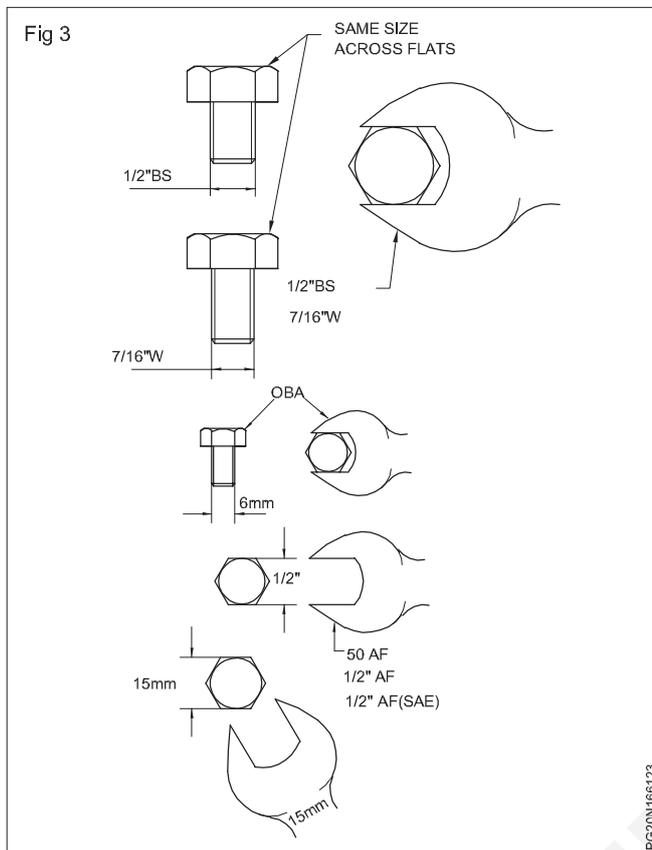
Use two spanners as shown in the figure to stop the head of the bolt rotating as the nut is operated. (Fig 2)

Socket spanners may be turned by accessories which have square driving ends. (Fig 2)

Size and identification of spanners

The size of a spanner is determined by the nut or bolt it fits. The distance across the flats of a nut or bolt varies both with the size and the thread system.

In the British system the nominal size of the bolt is used to identify the spanner. (Fig 3)



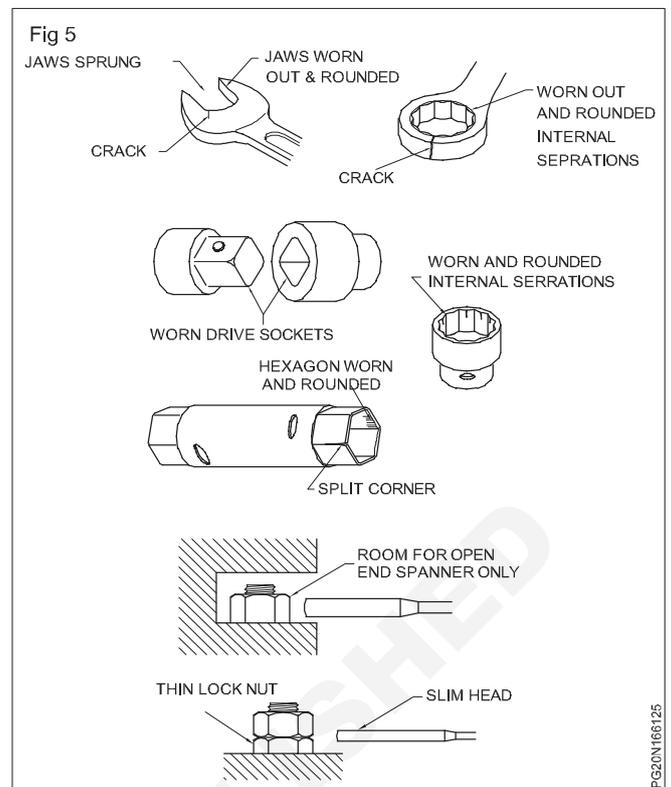
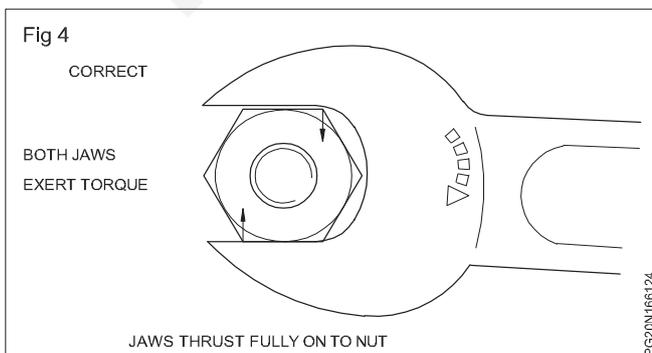
In the unified standard system (Fig 3), the spanners are marked with a number based on the decimal equivalent of the nominal fractional size across the flats of the hexagon, following the sign A/F or with the fractional size across the flats following the sign A/F. In the metric system, spanners are marked with the size across the jaw opening followed by the abbreviation 'mm'.

To fit exactly, a spanner must be :

- of the correct size
- placed correctly on the nut
- in good condition.

Spanners have their jaws slightly wider than the width of the nut so that they can be placed into position easily. Any excess more than a few hundredths of a millimeter clearance could cause the spanner to slip under pressure.

Place the spanner so that its jaws bear fully on the flats of the nut. (Figs 4 & 5)



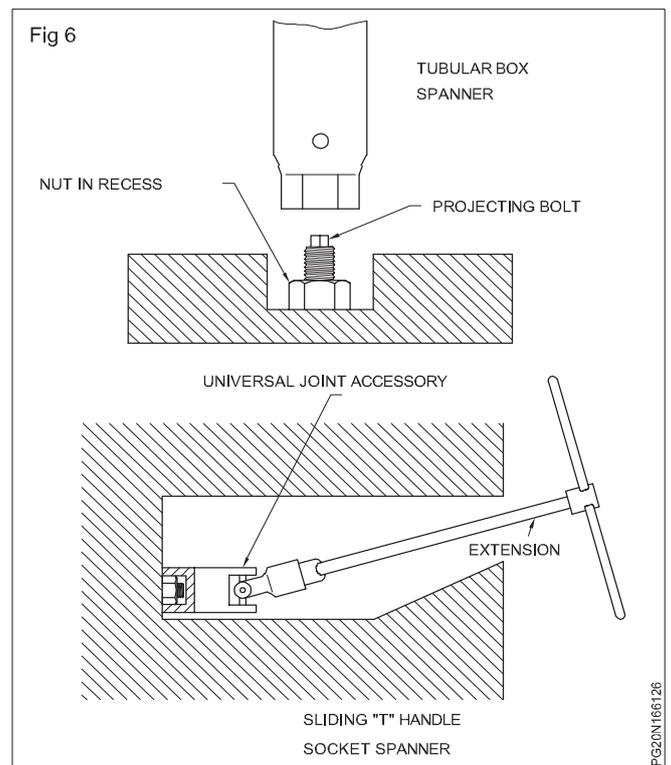
Incorrect use damages the spanners & the nuts too.

Discard any defective spanners. The spanners illustrated here are dangerous for use.

Choose spanners that allow room for use.

Nuts in inaccessible positions may be reached with socket spanners, with special drawing accessories.

Length of spanners (Fig 6)



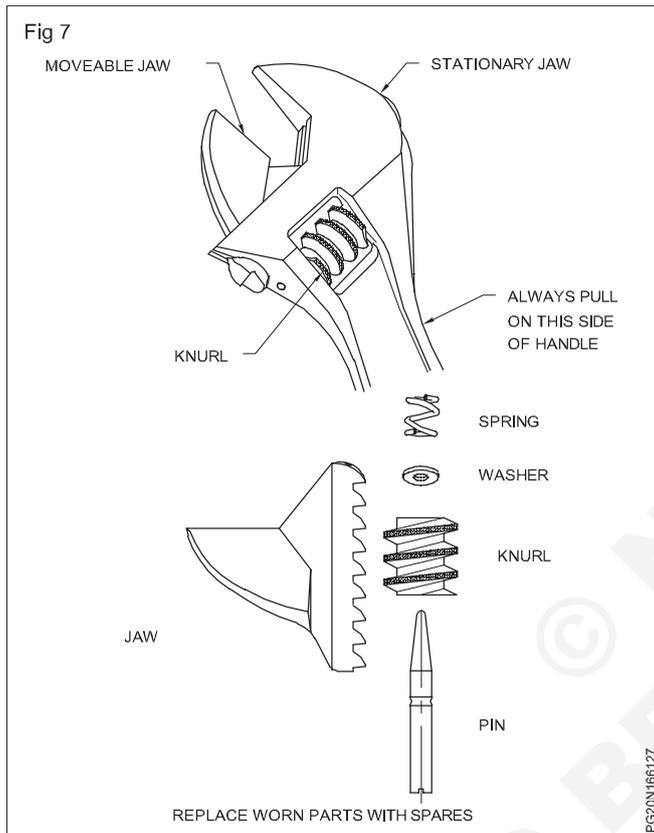
Normally spanners have a length that is about ten times the width of the jaw opening.

Never exert excessive pull on a spanner, particularly by using a pipe to extend the length of a spanner.

Excess turning effect of the spanner could result in:

- Striping the thread
- Shearing the bolt
- straining the jaws of the spanner
- making the spanner slip and cause an accident.

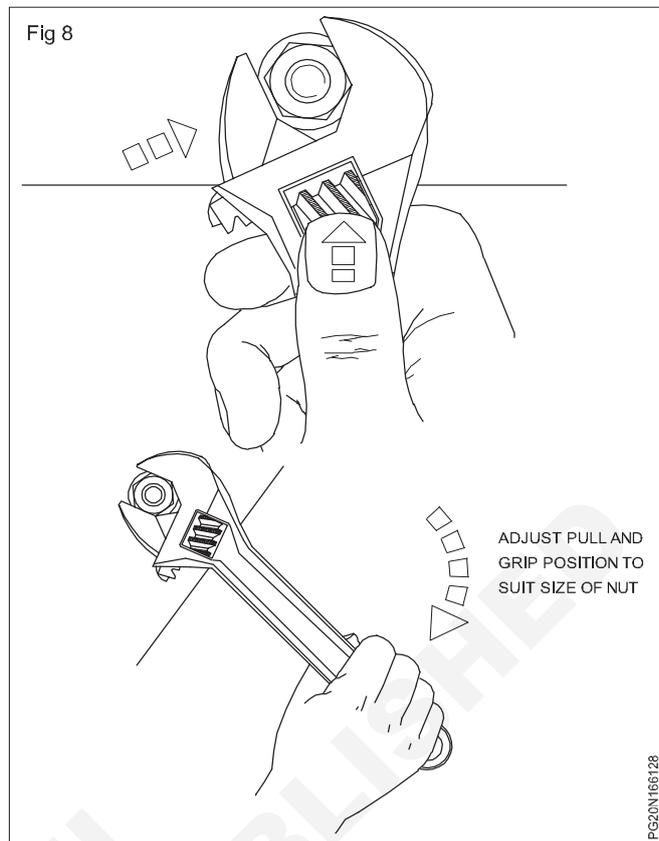
Adjustable spanners (Figs 7 & 8)



Most common types of adjustable spanners are similar to open end spanners, but they have one movable jaw. The opening between the jaws of a typical 250 mm spanner can be adjusted from zero to 28.5 mm. Adjustable spanners may range in length from 100 mm to 760 mm. The type illustrated has its jaws set at an angle of 22 1/2° to the handle. Adjustable spanners are convenient for use where a full kit of spanners cannot be carried about. They are not intended to replace fixed spanners which are more suitable for heavy service. If the movable jaw or knurled screw is cracked or worn out, replace them with spare ones.

When using the adjustable spanner follow the steps given below.

Place it on the nut so that the jaw opening points in the same general direction the handle is to be pulled. In this position the spanners are less liable to slip and the required turning force can be exerted without damage to the moving jaw and knurl.

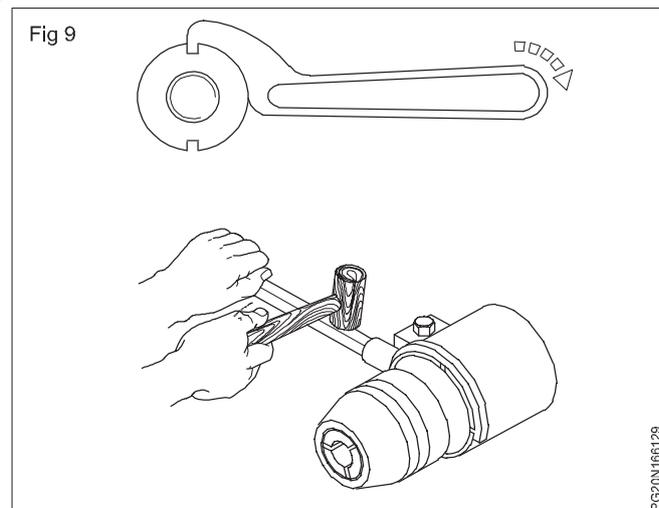


Push the jaws into full contact with the nut.

Use the thumb to tighten the adjusting knurl so that the jaws fit the nut strongly.

Pull continuously. The length of the handle is designed to suit the maximum opening of the jaws. With small nuts, a very small pull on the handle will produce the required torque.

'C' spanners (Hook spanners) (Fig 9)

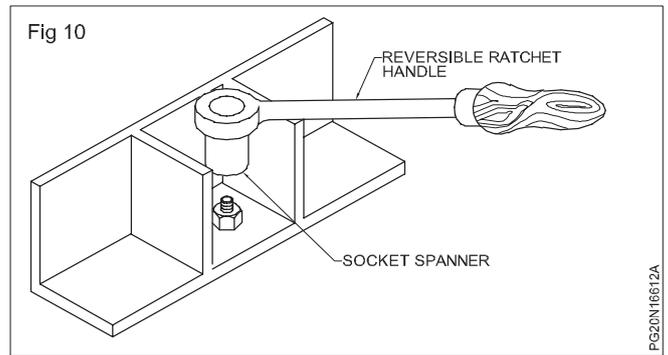


It has a lug that fits in a notch, cut in the outer edge of a round nut. The 'C' section is placed around the nut in the direction in which it is to be turned. In adjustable hook wrenches, part of the 'C' section pivots to fit nuts with a range of diameters. A set of three spanners is needed to cover diameters from 19 mm to 120 mm.

The applications of 'C' spanners are shown in the figure.

C' Spanners are also used for zero - setting of micrometer.

With socket spanners (Fig 10), use the reversible ratchet handle for doing fast work, where turning space is restricted.



Wrenches

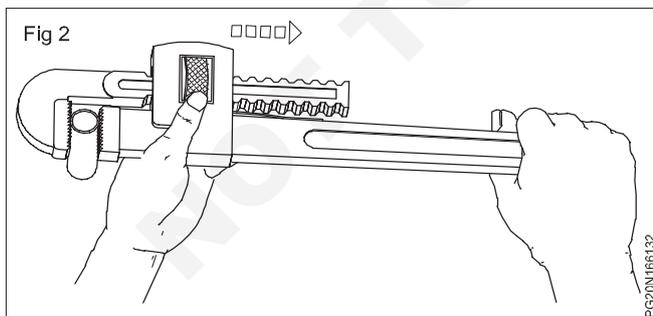
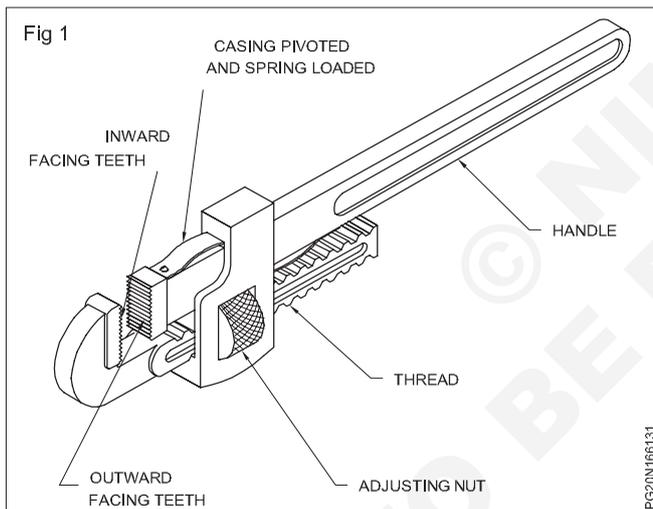
Objectives: At the end of this lesson you shall be able to

- state the different types of wrenches
- state the features of each type of wrenches.

Types of wrenches

- Still son pipe wrench
- Footprint pipe wrench
- Tension wrench
- Hexagon socket wrench

Stillson pipe wrenches (Figs 1 & 2)



These are used for gripping and turning pipes of a wide range of diameters.

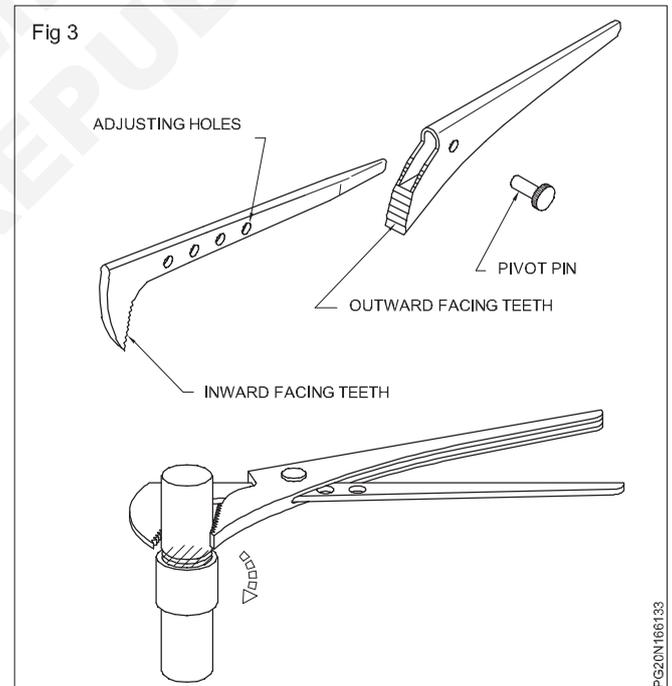
The parts and their names are shown in the figure.

A jaw is fixed to the handle with outward facing teeth. Attached to the handle by a pivot pin is a spring-loaded casing that carries a knurled adjusting nut. This engages with a thread on the adjustable arm of a jaw with inward facing teeth.

Once the jaws are adjusted, the spring loading keeps them in contact with the work, and the toggle action causes the hardened serrations to bite into the work.

The jaws will mark the work. File off any burrs. Never use them on polished or plated surfaces. Never grip hardened materials with this type of wrench as this will damage the serrations.

Footprint pipe wrenches (Fig 3)

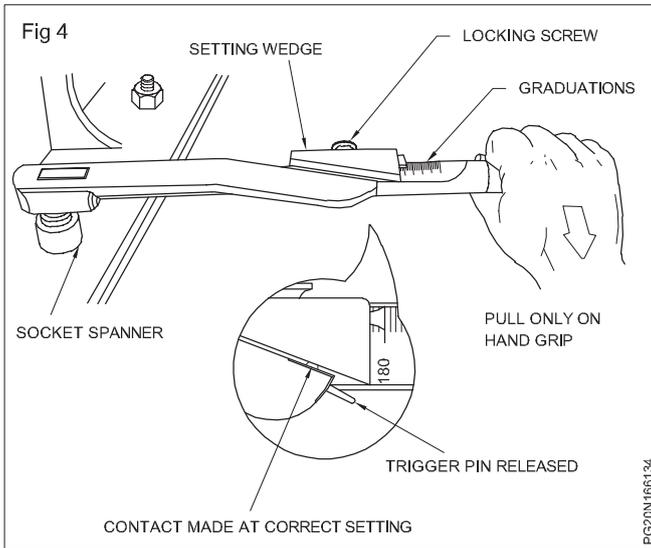


These are used for gripping and turning pipes and round stock, particularly in confined spaces.

Adjust the size by fitting the removable pin in the hole that allows the pipe to be gripped, with the handles a comfortable distance apart. Thrust the jaws fully on to the pipe. Squeeze the handles firmly. Pull on the folded steel handle to turn the pipe. Stop squeezing and slide the jaws back round the pipe, squeeze and pull again.

File off any burrs raised by the jaws on the pipe.

Tension wrenches (Fig 4)



A tension wrench acts as a torque limiting device for turning (rotating) nuts to a predetermined degree of tightness. This avoids breaking the fasteners. It is also essential to avoid warping or springing components held by multiple fasteners that could be unevenly or excessively tightened, cylinder heads of engines, for example.

Some tension wrenches have direct reading indicators that you must watch as you pull the handle to the desired extent. With others, you preset to the desired graduation and pull until you detect a signal which may be an audible click, the release of a trigger pin or an automatic release within the wrench mechanism.

To apply the correct torque with a tension wrench :

- check that the threads of the nut and the bolt are clean and well formed.
- pull slowly with evenly increasing effort on the hand grip of the handle.

Different type of pipes (G.I, C.I, D.I PVC, CPVC, PPR, AC and HDPE etc)

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

- state various type of pipes used for various purposes
- state the advantages and disadvantages of A C pipe
- state the various uses of cast iron pipe
- state the uses of P.V.C C.P.V.C and P.P.R
- state the uses of HDPE pipes.

Pipes and pipe fittings

Various types of pipes and tubes are used for the following purposes.

- Domestic hot and cold water supplies.
- Waste water outlets.
- High pressure steam supplies.
- Hydraulic oil supplies.
- Lubricating oil supplies.
- Special fluid and gases for industrial processes.
- Pneumatic systems.
- Refrigeration systems.
- Fuel oil supplies.

The common types of pipes classified according to material are:

- Galvanized iron pipes
- Mild steel pipes
- Cast iron pipes
- C.I. soil pipes
- Copper pipes
- Aluminium pipes
- Brass pipes
- Lead pipes
- P.V.C. pipes

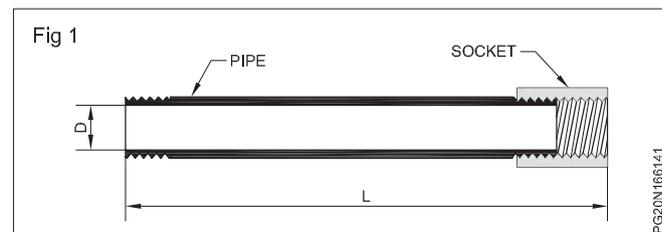
- Rubber pipes
- Plastic pipes
- Stoneware pipes

Standard pipe fitting: 'Pipe fittings' are those fittings that may be attached to pipes in order to:

- Change the direction of the pipe
- Connect a branch with a main water supply pipe
- Connect two or more pipes of different sizes

Close the pipe ends.

G.I. pipe: The hollow long open ended object of circular cross section is a pipe. (Fig 1)



Mild steel pipe after galvanisation are called galvanised iron pipes. It may be of hot finished seam less, electric resistance welded, high frequency induction welded, hot finished welded or cold finished seam less.

All screwed pipes and sockets shall have threads as per I.S.554. Dimensions and nominal mass of G.I. medium pipes are as per Table 2/I.S1239.

Tolerance on thickness and mass of G.I.pipes shall be as per P2/I.S.1239.

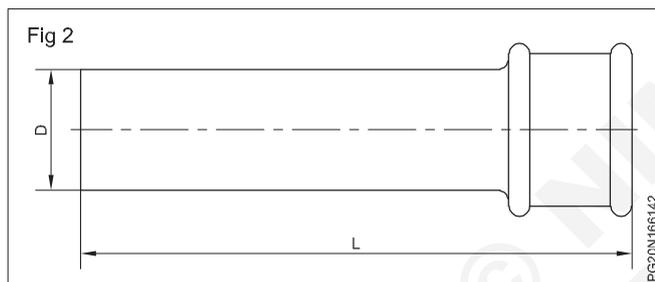
G.I.pipes available in market are of 6m lengths. Measurements are taken including one socket. It will have threads on both ends. One end will have socket and another end has PVC bush to protect thread. Pipes used for water distribution are of 50 to 150mmf. Pipes used in house connection are of 15 to 32mmf.

Grades: There are 3 grades of G.I. pipe i.e. high, medium and low. They are marked with paint band of red, blue and yellow respectively. Medium grade pipes are used for water supply.

The diameter of pipe is specified by its nominal bore. The socket are designated by the respective nominal bore of pipe for which they are intended.

AC pipes:

General: AC pipes are manufactured from pure asbestos fibre, portland cement and silica under high pressure in machines and are available from 5cm to 100cm in diameter and 2m to 3m in length. The pipes have socket at one end of the pipe for joining. AC pipes are used for carrying waste water or rain water. (Fig 2)



C.I.pipe: C.I.pipes are manufactured using good quality grey cast iron. These pipes are manufactured in two different methods. i.e. sand casting or centrifugal casting (Fig 3).

Sand cast pipes are manufactured by pouring molten pig iron in the sand moulds. The centrifugal cast pipes (spun pipes) are manufactured by using metal moulds and rotating mould by means of machine. Due to the centrifugal force the molten metal spreads uniformly. These pipes are generally free from Blister, sand holes, or air blocks.

Inside and outside are coated with Bitumenous solution.

- Cast iron pipes shall have the following qualities.
- It should be able to cut, drill, chipping and fitting.
- There should not be any crack.
- There should be no visible blister, air block, sand holes.
- There should be bell sound on hammering with a small hammer.

C.I.pipes are classified into 5 types based on its use and physical properties.

- C.I water supply pipes

- C.I drain and sewer pipes
- C.I soil pipes
- C.I waste pipes
- C.I rain water pipes

Spun iron pipes used in water supply shall conform to IS1536. These are available from 80mm to 750mm. There are three class of pipes like Class LA, Class A and Class B. The specials used in these pipe shall conform to IS 1538- specials used in these pipe shall conform to IS 1538- specials like bends, collar, offset, reducer, tee, Y junction etc. are available. These pipes are joined with use of pig lead or lead wool.

Sand cast CI pipes used for soil pipes shall conform to IS. 1729. Spun iron CI pipes used for soil pipes shall conform to IS. 3989

Types of PVC pipes

Polyvinyl Chloride (PVC)

- Polyvinyl chloride (PVC) is manufacture from ethylene or acetylene.
- It is essentially consists of polymerisation of vinyl chloride.
- PVC has to be mixed besides plasticizers, with release agents, stabilizers etc. to make it easily processable.

Uses

- Non plasticized grades are widely used for the manufacture of pipes and conduits.
- It is used as cable coating because of its high Electrical Resistance.
- Blow moulded components are used for replacement of glass for its high transparency.
- Non-toxic products are used for packing foods.
- Manufacture of Toys, dolls, paper coating, lampshade, etc.
- PVC is used for temperature below about 1400F.

Poly propylene Random Co-polymer (PPR)

- Latest and advanced Technology using raw material PP co-polymer.
- It is used for cold and hot water system, water purifying, chemical flow, etc.
- Three key parameters for polyfusion welding are
 - Temperature
 - Pressure
 - Time
- Temperature around $2600 \pm 50C$ to ensure proper plastification of the joint.

ii Pressure

- Weld components need to be inserted into the weld at even pressure and length.

iii Time

- i Warming up time
- ii Adoption time
- iii Connection time

i Warming up time

Warming up time starts when both components are simultaneously pressed.

ii Adoption time

Adoption time starts when components are removed from welder.

iii Connection time

Connection time is the components being pushed with each other with lateral pressure.

iv Weld hardening time

Hardening time is the joint to get cooled and free from physical stresses.

Table for PPR Welding

Diameter mm	Melting length mm	T1	T2	T3	T4 (Seconds)
		20	12	5	3
40	16	12	6	12	4
75	26	30	8	30	6
125	41	60	10	60	8

Co-polymer vinyl chloride (CPVC)

- CPC and CPVC are made of the same basic elements.
- CPVC is altered by a free radical chlorination reaction that effectively increases the chlorine content of the material
- CPVC to be used temperatures upto 1900F.
- CPVC pipe is an off-white or yellowish colour.
- CPVC pipe is more suitable for hot water and potable water system

No damage to PE pipe lines by termites has ever been occurred PE and PP are not a nutrient medium for bacteria fungi and spores. Resistant to all forms of microbial attack as well as to both sulphurous acid and sulphates. The standard lengths of 6m reduced the amount of joints branches can be manufactured and delivered in every type and form triangle can be adapted individually from 30° to 90°.

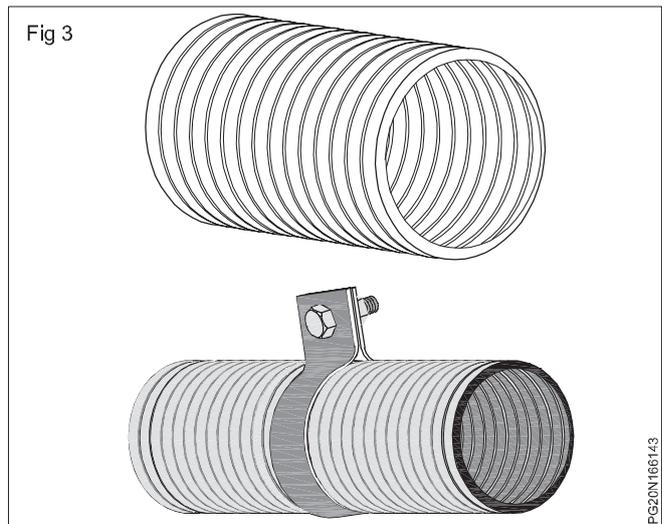
HDPE pipe (Fig 3)

HDPE pipes and fittings

HDPE pipe was established in 2002. HDPE pipes and fittings ranges from 300 to 400 mm so far tests have shown that the pressure pipes made of HDPE have a life time of over 100 years.

Ensures a trouble free service of the pipe and of course the compete piping system. Pipes made of polyethylene (PE) and polypropylene (PP) are thermoplastics with excellent properties for the application of water and sewer These are resistant to many chemicals and very suitable for conveying and storing various liquids.

It can be welded, can be reused continuously. The whole pipe line is a homogenous systems and absolutely safe. This has good chemical resistance The smooth round surface of plastic pipes does not give the teeth of rodents sufficient hold to cause damage.



Different types of pipe fittings for various purpose in pipelines

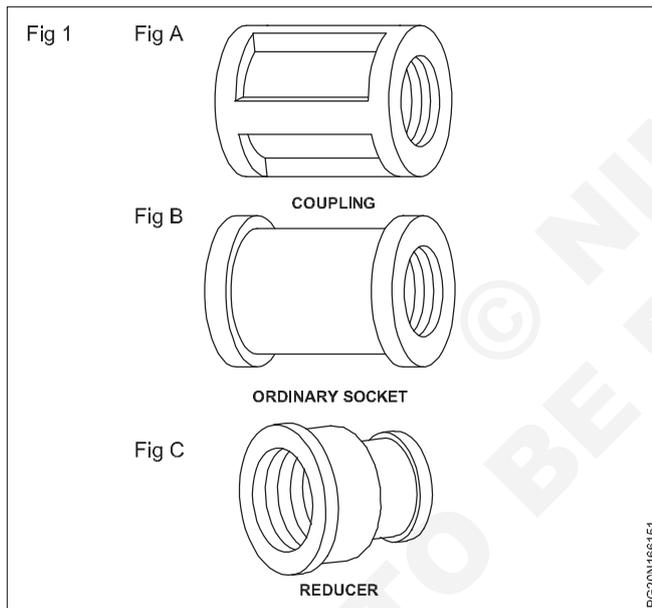
Objectives: At the end of this lesson you shall be able to

- state the standard pipe fittings of various types and sizes
- state the types of elbows, unions, plugs and special fittings
- state the materials from which they are made
- state the symbols used for the pipe
- state the uses of HDPE pipes.

Standard pipe fittings

Coupling: An ordinary coupling shown in (Fig 1a), usually comes with the pipe, one coupling to each length. The couplings are made of cast iron metal or of brass. They are regularly threaded with right hand thread R and L coupling have projecting bars or rings to distinguish them from standard coupling. Another form of coupling called an extension piece is shown in (Fig 1b) It differs from the standard coupling in that it has a male thread at one end there are numerous other type is known as reducers.

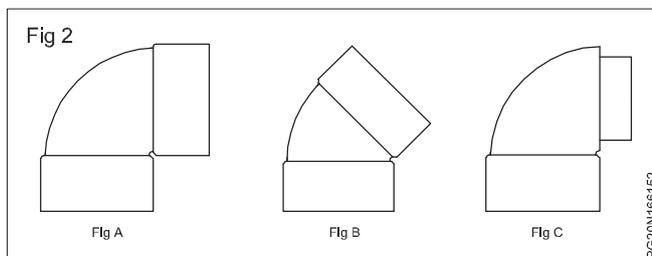
Reducer (Fig 1c): A reducer coupling is used to connect two pipes with different diameters.



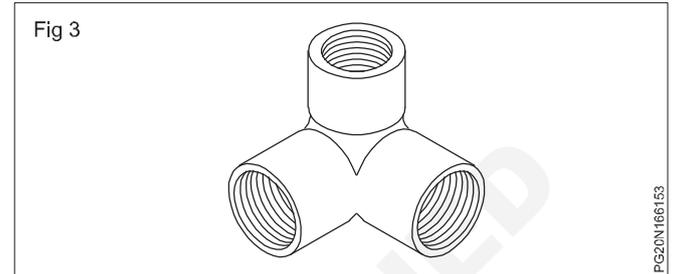
Elbows (Fig 2a): Elbows and bends provide deviations of 90° and 45° in pipe work systems.

The 45° elbows allow pipe deviation of 450 (Fig 2b).

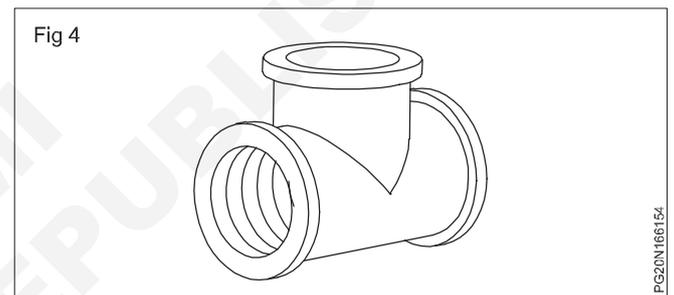
Reducer elbow (Fig 2C): The reducer elbow is used to connect two different dia pipes in deviation of 90° in pipe line work systems.



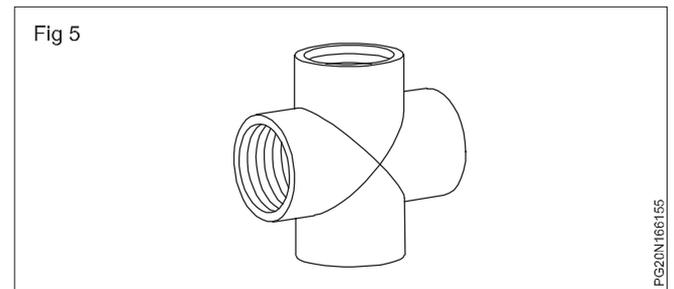
Three way elbow: Three way elbow is used to connect three pipes at deviations of 90°. (Fig 3)



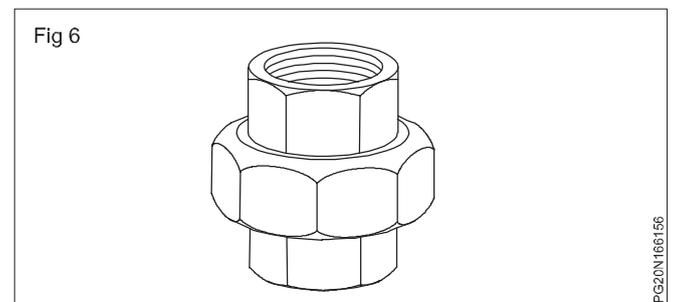
Tee (or) Three way: A tee is used to take a branch line at deviation of 90°. (Fig 4)



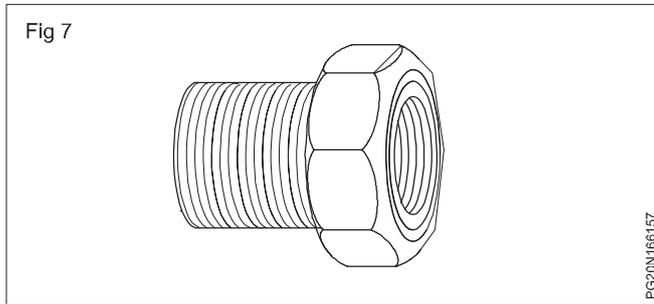
Four way: A fourway is used to connect four bits from straight line two opposite 90° are joined. (Fig 5)



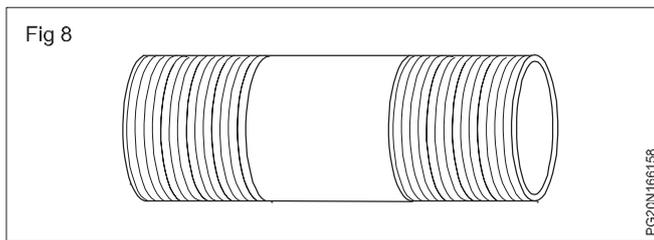
Union: A device used to connect pipes when unions are used in pipe lines it is easy to dismantle and repair. (Fig 6)



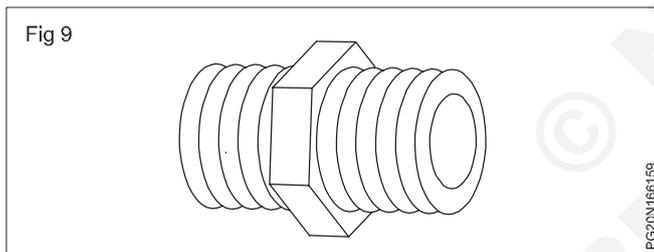
(Fig 7) This is special fittings used to connect two different diameter pipes one side is internal threaded used for joining small diameter pipe other type is external threaded used for joining bigger diameter pipe.



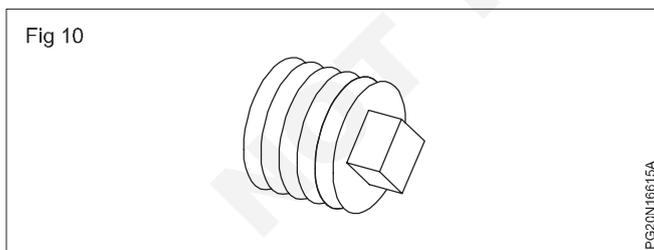
Pipe nipples (Fig 8): A nipple is a piece of pipe less than 30 CM length thread on both end.



Hexagonal nipple (Fig 9): This nipple is used where fittings or valve are to be very close to each other. Both sides are external threaded and a hexagonal steps at the middle for gripping. (Fig 9)

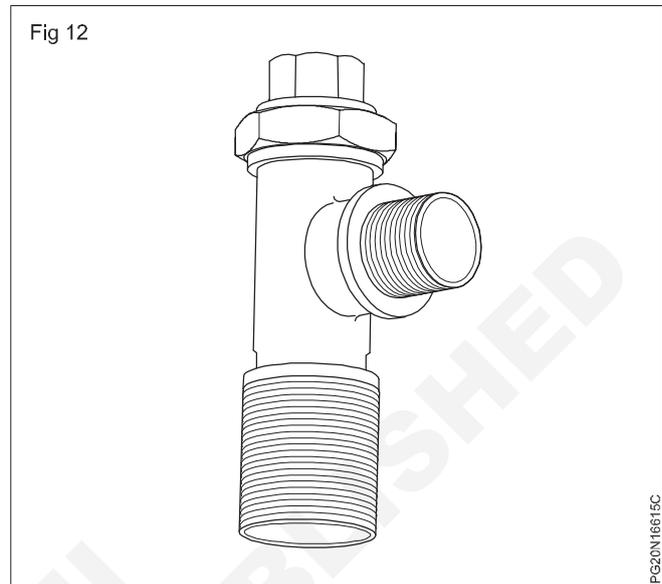
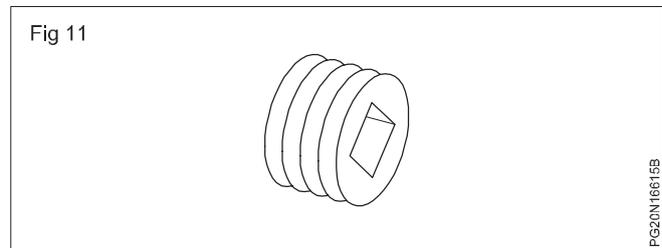


Plug (Fig 10): A plug is used for closing the end of a pipe or a fitting having a female thread square head is provided at the top to grip. Plugs are made on sizes ranging from 6 mm to 300 mm. It is made of castiron, malleable iron and brass.

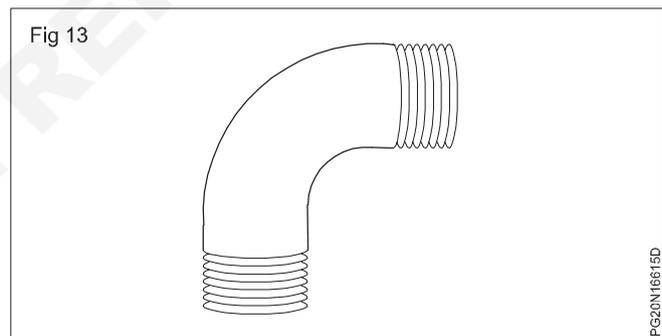


CAP (Fig 11): A cap is female threaded and is used for closing the end of a pipe or fitting having a male thread cap are made of castiron malleable iron and brass They are regularly made in sizes from 6mm to 150mm.

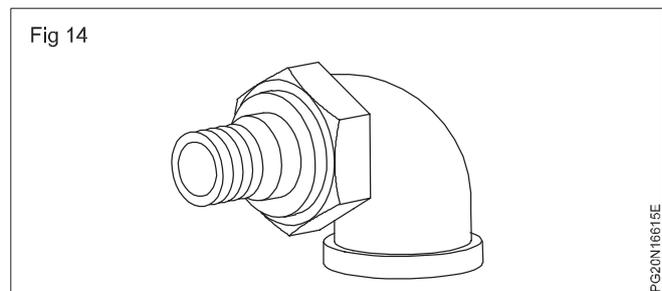
Ferrule (Fig 12): This ferrule is made of gun metal and is used to take service connection from water supply main line. It is fitted in the C.I pipes and P.V.C supply main line. It is fitted in the C.I pipes and P.V.C saddle.



BEND (Fig 13): This bend is made of G.I pipe having external thread on both end It is used to join with the male threaded pipes using couplings or flanges join directly to the female threaded fittings.



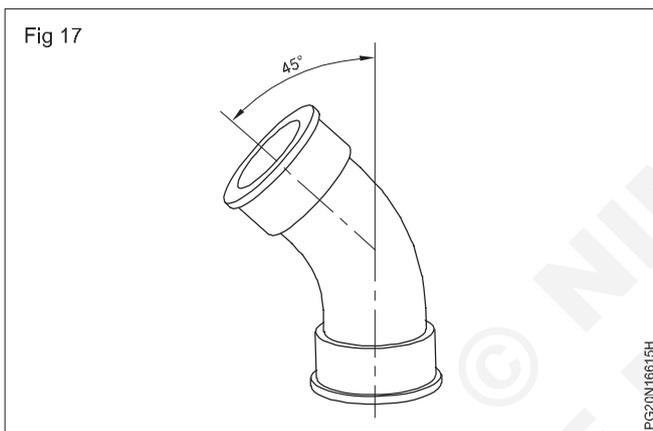
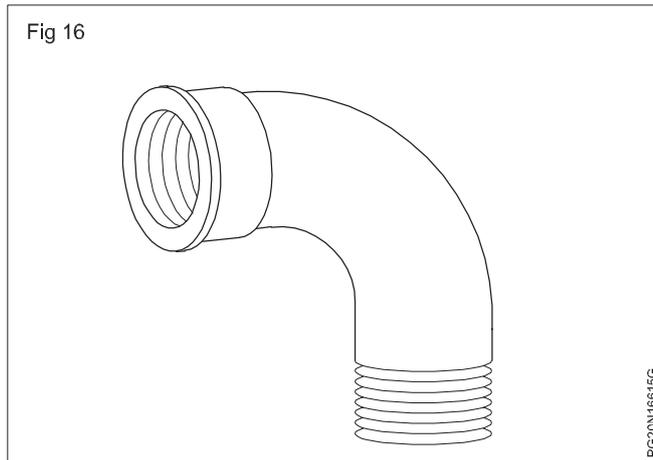
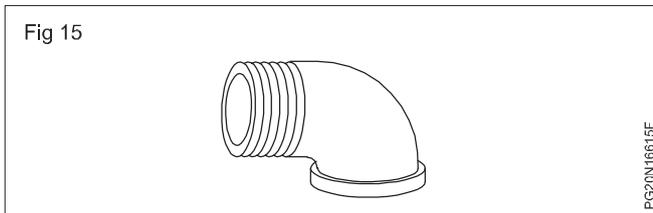
Union elbow (Fig 14): A pipe fitting with a male union at one end.



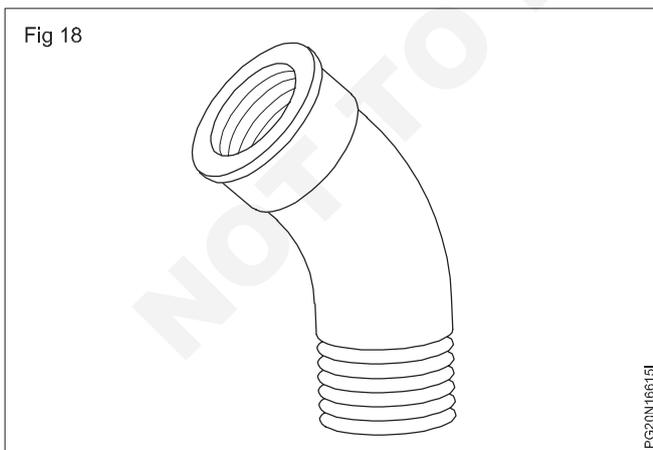
Elbow M+F: A pipe fitting as above only one internal threads and other one external thread. (Fig 15)

Bend (M+F): A fitting as before but with an external thread and internal thread.(Fig 16)

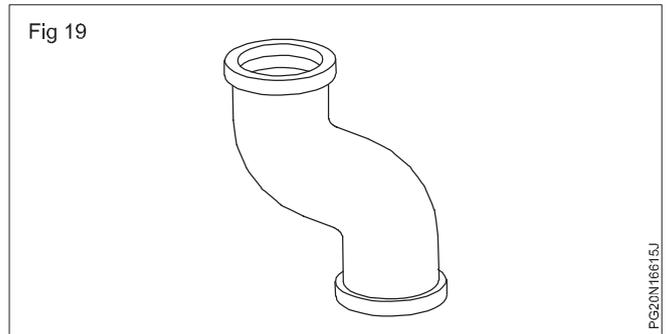
Bend 45° (F+F): A fitting as before. Both ends have internal threads. (Fig 17)



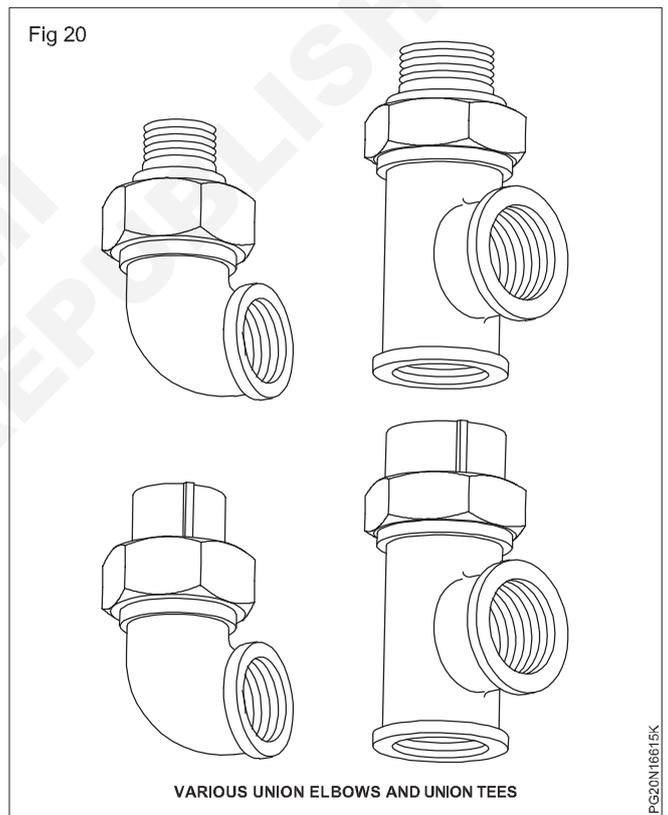
Bend 45° (M+F): A pipe fitting as before only one end has an external (Male) thread and the other end has internal (female) thread. (Fig 18).



Offsets: In piping, part of the pipe line must sometimes be in a position, parallel to but not in alignment with the balance of the pipe. An experienced pipe fitter can offset the line by bending the pipe, but ordinarily when the offset or distance between the axes of the two pipes is of standard dimension, a fitting called an offset, can be used more conveniently. (Fig 19)



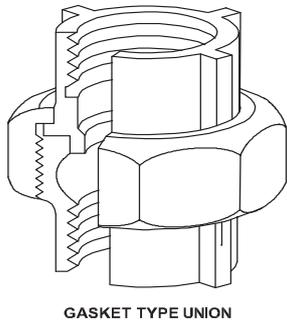
Special union elbow and tee: The frequent use of union in pipe lines is desirable for convenience in case of repair. When the union is combined with a fitting, the advantage of a union is obtained with only one threaded joint instead of two as in the case of a separate union. A disadvantage of union fittings is that they are not usually as easily obtainable as ordinary fitting as shown in (Fig 20). Various union elbows and union tees of the female and of the male and female types.



Unions: There are various kinds of unions available in the market. The two pipes are to be joined by the union must be in approximate alignment to secure a tight joint because of the flat surfaces which must press against the gasket. Various union having spherical seat and ground joints have been devised. These consist of a composition ring bearing against iron or with both contact surface of composition. (Figs 21,22 & 23) shows the construction of a ground joint unions. Unions are also made entirely of brass with ground joints.

On working drawings or sketches plumbing pipe fittings are shown by symbols.

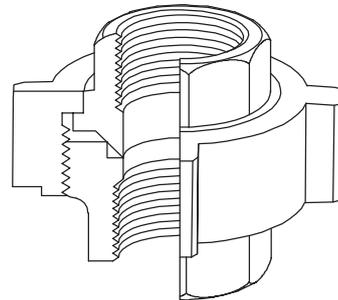
Fig 21



GASKET TYPE UNION

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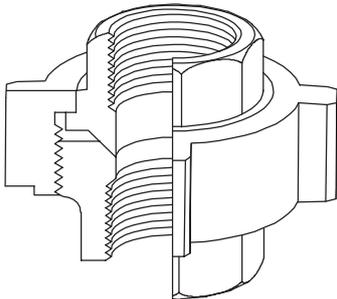
Fig 23



GROUND JOINT TYPE UNION

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Fig 22



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Piping symbols are used by architects and plumbing engineers on blueprints or working drawings. They represent the various plumbing fixtures and piping systems as well as the pipe fittings and valves used to construct these systems.

Plumbers must recognize these symbols in order to locate water supply systems on drawings or sketches.

Standard symbols for plumbing, piping and valves

Plumbing

Corner Bathtub		Standard kitchen sink		Water closet (Flush valve, floor outlet).	
Recessed Bathtub		Kitchen sink, R & L Drain Board		Water closet (Flush valve, wall-Hung).	
Sitz Bath		Kitchen sink, LH Drain Board		Urinal (Wall-Hung)	
Bidet		Combination sink & Dishwasher		Urinal (Seal)	
Shower stal		Combination sink & Laundry Tray		Urinal (Trough-Type)	
Shower head		Service sink		Drinking Fountain (Recessed)	
Overhead gang shower		Wash sink (Wall-Type)		Drinking Fountain (Semi-Recessed)	
Pedestal lavatory		Wash sink			
Wall Lavatory		Laundry Tray (single)			
Corner lavatory		Laundry Tray (Double)			
Handicapped lavatory		Water closet (Tank Type)			
Dental lavatory		Water closet (Integran Tank)			

Plumbing (continued)		Drinking water	Lateral				
Drinking Fountain (Projecting type)		Return					
Hot water Tank		Vacuum cleaning					
Water heater		Compressed air		Valves			
Meter		Pipe fittings			Valve	Screwed	Solidward
Hose Rack		Fitting	Screwed	Solidward	Gate valve		
Hose Bibb		Joint			Globe valve		
Gas outlet		Elbow-90°			Angle globe valve		
Vacuum outlet		Elbow-45°			angle gate valve		
Drain		Elbow-Turned up			Check valve		
Grease separator		Elbow-Turned down			Angle check valve		
Oil separator		Pipe fittings (continued)			Stop cock		
Cleanout		Fitting	Screwed	Solidward	Safety valve		
Garage drain		Elbow-long radius			Quick-opening valve		
Floor drain with backwater valve		Side outlet elbow-outlet down			Float valve		
Roof sump		Side outlet elbow outlet up			Motor-Operated Gate valve		
Piping		Base elbow					
Soil and waste, above grade		Double branch elbow					
Soil and waste, Below grade		Single sweep tee					
Vent		Double sweep tee					
Cold water		Reducing elbow					
Hot water		Tee					
Hot water return		Tee-outlet up					
Fire line		Tee-outlet down					
Gas line		Side outlet tee outlet up					
Acid waste		Side outlet tee outlet down					
Drinking water supply		Cross					
		Concentric reducer					
		Eccentric reducer					

Types of fittings for different joints in different pipes

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

- state the different type of fittings used for different pipe joints and their uses
- state the method adopted for flange joint, socket joint with lead
- state the method of detachable joint stone ware socket and spigot cement mortar joint
- state the method of ductile iron pipe joint.

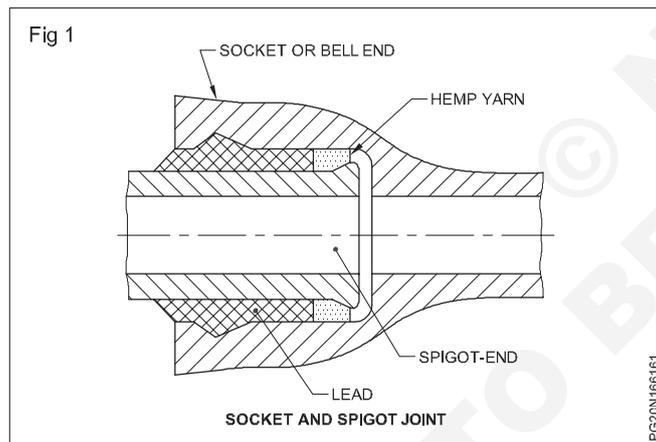
Rain water is a source for the soil and stored in a tank pipes are used for handling & transporting the water in position.

Pipes are manufacturing in small length of 2 to 6 meters. These small pieces of pipes are then joined together after placing in position, to make a continuous length of pipe line.

The pipe joints are classified as follows

- 1 Spigot and socket joint
- 2 Expansion joint
- 3 Flanged joint
- 4 Screwed joint
- 5 Collar joint
- 6 A.C pipe joint
- 7 Solvent cement joint

1 Socket and spigot joint (Fig 1)

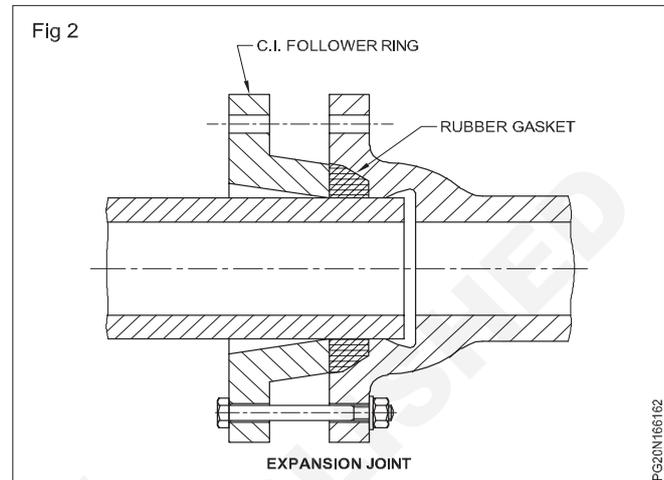


This type of joints are mostly used for cast iron pipes. Sometimes wet clay is used to make light contact between the runner and pipe so that hot lead may not run out of the joints space. The molten lead is then poured into the "V" shaped opening left in the top by the clamped joint runner. The space between the hemp yarn and the clamp runner is filled with molten lead. When the lead has hardened, the runner is removed the lead which shrinks while cooling is again tightened by means of caulking tool and hammer.

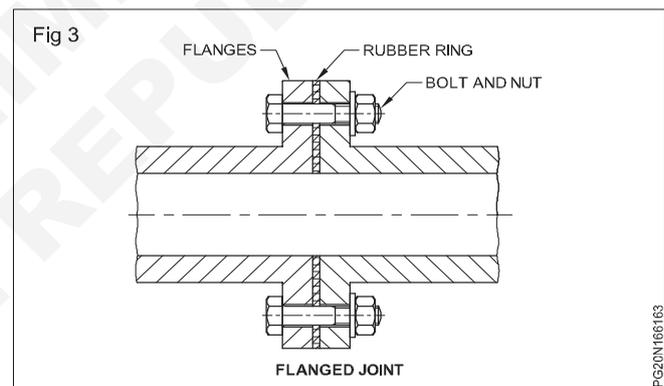
2 Expansion joint (Fig 2)

This joint is used at such places where pipes contract due to change in atmospheric temperature and thus checks the setting of thermal stresses in the pipe. In this joint the socket end is flanged with cast iron follower ring, which can freely slide on the spigot end or plane and of other pipe. An elastic rubber gasket is tightly

pressed between the annular space of socket and spigot by means of bolts as shown in the (Fig 2).



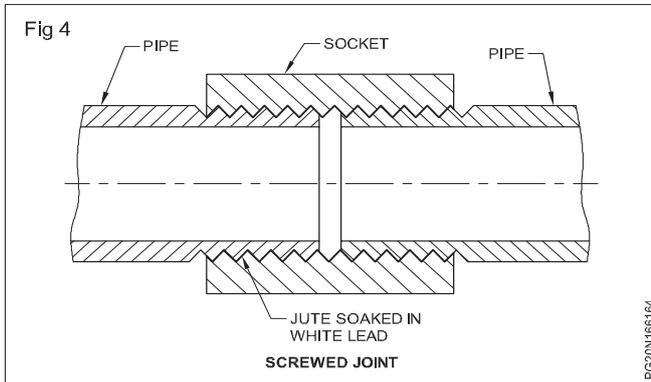
3 Flanged joint (Fig 3)



This joint is mostly used for temporary pipe lines, because the pipe line can be dismantled and again assembled at other place. The pipe in this case has flanges on its both end welded or screwed with pipe. The two end of the pipes which are to be joined together are brought in perfect level near one another and after placing one hard rubber washer between flanges are bolted. Placing of washer or gasket of rubber, canvas, copper or lead between the two ends of flanges is very necessary for securing a perfect water tight joint. This joint cannot be used at such places where it has to bear vibration or deflection of pipes. (Fig 3)

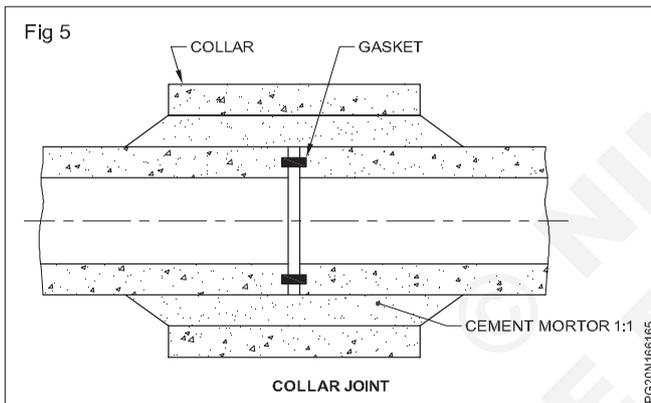
These joints are commonly used for joining pumping station, filter plants, hydraulic laboratory boiler, house etc. where it may be necessary occasionally to dismantle and reassemble the pipe line. If the steel pipes are to be jointed by these joints, it is better to screw the separately cast flanges on the pipe and then they are joined.

4 Screwed joint (Fig 4)



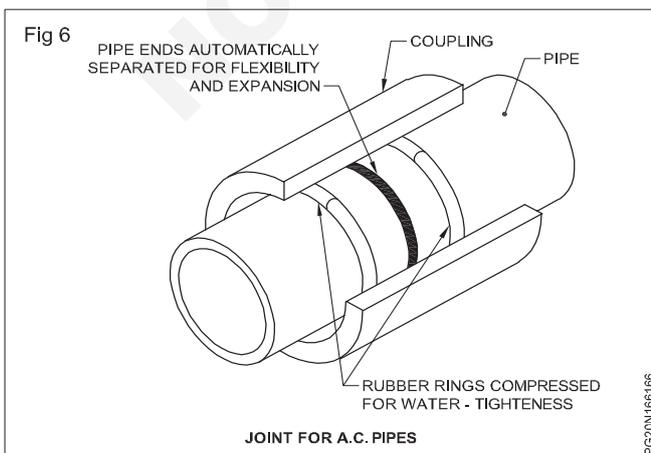
This joint is mostly used for connecting small dia. cast iron, wrought iron and galvanised pipes. The ends of the pipe have threads on outside while socket or coupling has threads on the inner side. The same socket is screwed on both the end of the pipe to join them, for making water tight joint zinc paint or hemp yarn should be placed in the threads of the pipe before screwing socket over it. (Fig 4)

5 Collar joint (Fig 5)



This type of joints are mostly used for joining big diameter concrete and asbestos cement pipes. The end of the pipes are brought in one level before each other. The rubber gasket between steel rings and jute-rope soaked in cement is kept on the groove and the collar is placed at the joint so that it should have the same lap on both the pipes. Now 1:1 cement mortar is filled in the space between the pipes and the collar as shown in (Fig 5).

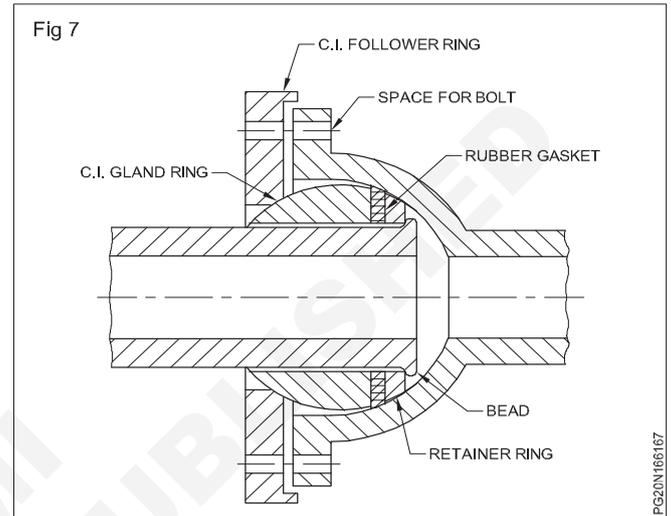
6 AC pipe Joint (Fig 6)



For joining small diameter AC pipe the two ends of pipes are butted against each other then two rubber ring will be slipped over the pipes and the coupling will be pushed over the rings as shown in (Fig 6).

7 Flexible joint

Sometimes the joint is also called bolt and socket or universal joint. This joint is used at such places where settlement is likely to occur after the laying of the pipe. This joints can also be used for laying pipe on curves, because at the joints, the pipe can be laid at angle. This is a special type of joint. (Fig 7)



8 Solvent cement joint

Clean the contacting surface of joint with a clean cloth- Abrace these area with emery paper and again clean it. Apply an even coat of solvent adhesive with a clean dry brush having sufficient width for quick application. Immediately after applying solvent cement, insert the pipe in the socket to its full depth and turn it through 90° angle. Leave joint undisturbed till the joint sets.

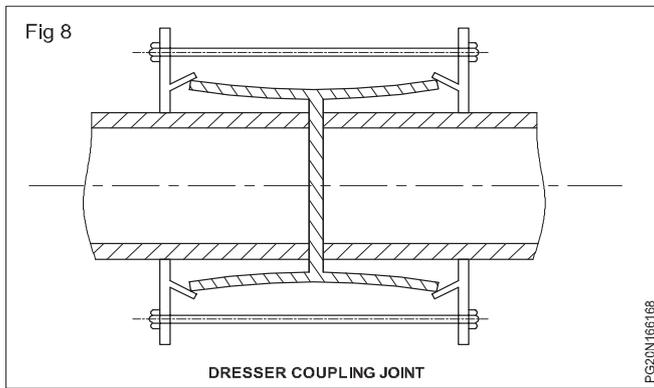
For small breakage of pipe i.e. less than 300mm \varnothing a piece of pipe bigger than damaged portion can be cut vertically into unequal half. After applying thin coat of PVC solvent cement around the damaged portion and inside the bigger half cut pipe piece, stick it over the damaged portion.

9 Mechanical Joints

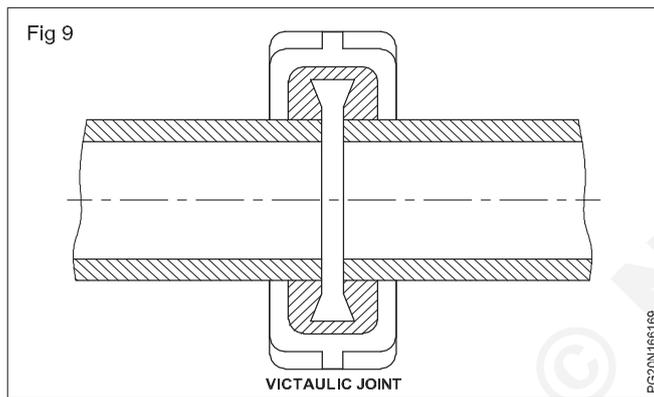
This type of joint is used for jointing cast iron, steel or wrought iron pipes, when both the ends of the pipes are plain or spigot. There are two types of mechanical joints.

a Dresser-coupling: It essentially consists of one middle ring, two follower rings and two rubber gaskets. The two follower rings are connected together by bolts, and when they are tightened they press both the gaskets tightly below the ends of the middle ring. In this way the joint remains watertight.

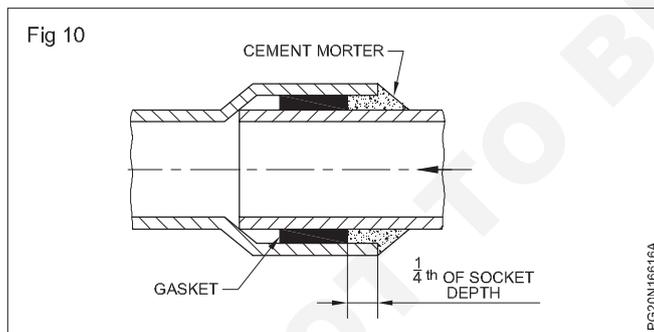
These joints are very strong and rigid, and can withstand vibration and shocks upto certain limit. These joints are most suitable for carrying water lines over bridges, where it has to bear vibrations. (Fig 8)



b **Victaulic-Joint:** In this type of joint a gasket or leak proof ring is slipped over both the ends of the pipes as shown in the Fig 9. This gasket is pressed from all sides on both the pipes by means of half iron coupling by bolts. The ends of pipes are kept sufficient apart to allow for free expansion, contraction and deflection. This joints can bear shocks, vibrations etc. and is used for cast-iron, steel or wrought iron pipes line in expose places. (Fig 9)



Stone ware pipe joint (Fig 10)



This type of joint is called socket and spigot joint. For this joint spigot end is inserted to the socket end and hemyarn (or) gasket soaked in thick cement sulrry is placed in the gaps. This hemyarn is caulked tightly by the spunyarn caulking chisel.

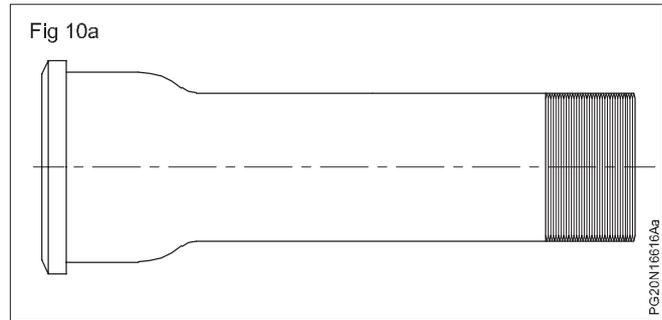
Cement mortar of ratio 1:1 is filled in the socket for the 45° angle this is mostly used for under ground drainage.

Tests to be conducted on SW pipe are

- Hydraulic test
- Acid resistance test

- Alkali resistance test
- Crushing strength test

Details refer IS 651 (Fig 10a)



Permissible tolerance on internal diameter of pipe are as under.

0	Permissible tolerance
100	3 mm
150	5 mm
200 - 230	6 mm
250 - 350	8 mm
400 - 450	10 mm
500 - 600	12 mm-

Plumber should check the following

- Pipes are straight
- Pipes are circular throughout
- Pipes has got required glazing.
- Pipes sounds riging on knocking.
- There are no obstructions inside pipe.

Ductile iron pipe (D.I pipe): Ductile iron pipe is sized according to a dimensionless tem known as the pipe size or nominal diameter.

Individual lengths of ductile iron pipe are joined either by flanges, coupling

Flanged joints: Flanges are flat rings around the end of pipes which mate with an equivalent flange from another pipe the two being held together by bolts usually paned through holes drilled through the flanges.

A deformable gasket, usually elastomeric, placed between raised faces on the mating flanges provides the seal.

Flanges are designed to a large number of specifications that differ because of dimensional variations in pipes sizes and pressure requirements and because of independent standards development.

A flanged joint is rigid and can bear both tension and compression as well as a limited degree of shear and bending.

It also can be dismantled after assembly. Due to the rigid nature of the joint and the risk of excessive bending moment being imposed it is advised that flanged pipe work is not buried.

Spigot and socket joint: Spigot and sockets involve a normal pipe end the spigot being inserted into the socket or bell of another pipe or fitting with a seal being made between the two with in the socket.

A large number of different socket and seals exist. The most modern is the push joint (or) slip joint

Where by the socket and rubber seal is designed to allow the pipe spigot to be after lubrication, simply pushed into the socket. Push joints remain proprietary designs.

Also available are locking gasket systems these locking gasket systems allow the pipe to be pushed together but do not allow the joint to come apart without using a special tool or torch on the gasket

In the late 1950's ductile iron pipe was introduced to the market place featuring higher strength and similar corrosion resistance compare to cast iron.

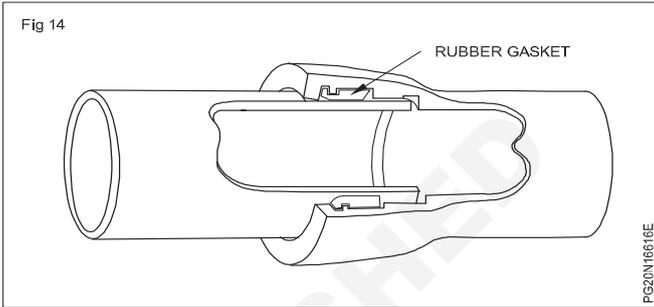
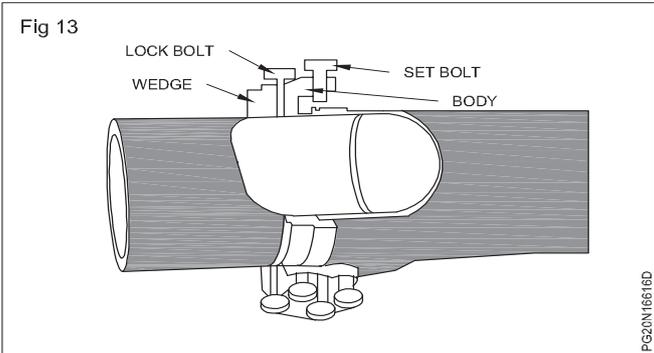
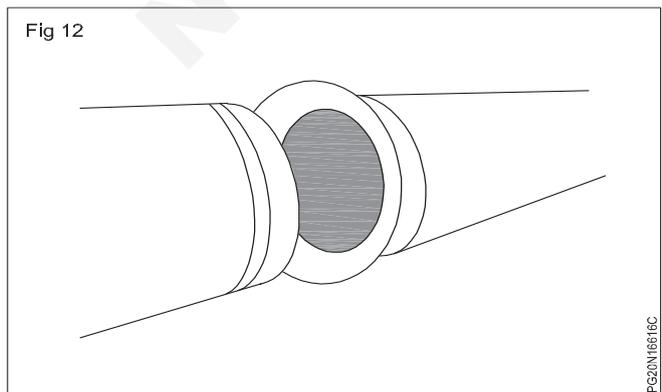
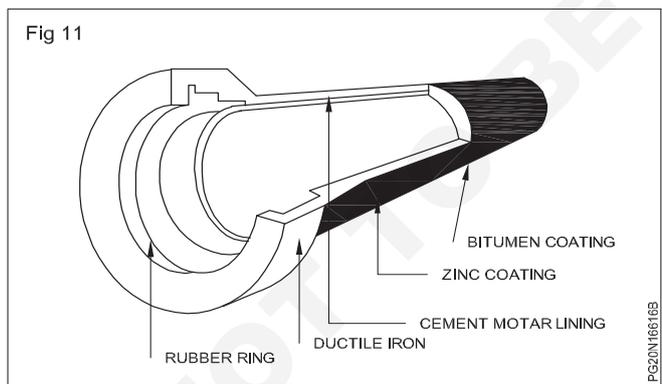
An expected life span of 100 years, using evolved laying practices had an estimated life up to 110 years. Like most ferrous materials ductile iron is susceptible to corrosion can occur in two ways in ductile iron pipes.

Graphitization and corrosion pitting unprotected pipes in highly corrosive soil tend to have shorter life spans.

Use of polyethylene sleeaking can reduce corrosion by controlling the effect of corrosive soil on piping.

Ductile iron pipe is some what resistant to internal corrosion in potable water cement mortar lining is by for the most common port land cement is used the cement mortar in the ratio 1:2 and 1:3:5 There are two types of jointing method.

Ductile iron (DI) Pipe Joints (Figs 11,12,13 &14)



Sand cast iron pipes: Sand cast iron spigot as socket soil and waste and ventilating pipes, fittings and accessories should confirm is 1729. Centrifugally cast (spun) iron spigot and socket soil, waste and ventilating pipes fittings and accessories should confirm IS3989. These pipes can be recognised by looking at the socket shape. The fittings shall confirm to the respective I.S. Specifications to which the pipe itself confirm to which they are connected. There should not be any visible cracks, taps and pinholes and it should ring clearly when struck with light hand hammer. These pipes are available at 1.5, 1.75, 2, 2.5 and 3m lengths. (Figs 15, 16, 17 & 18).

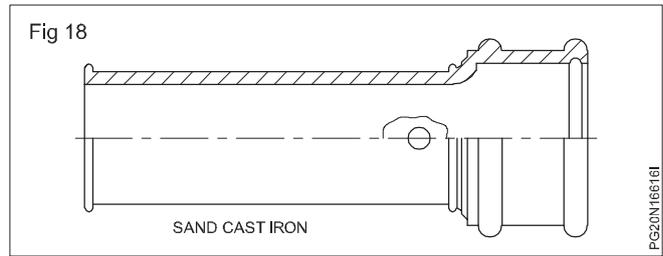
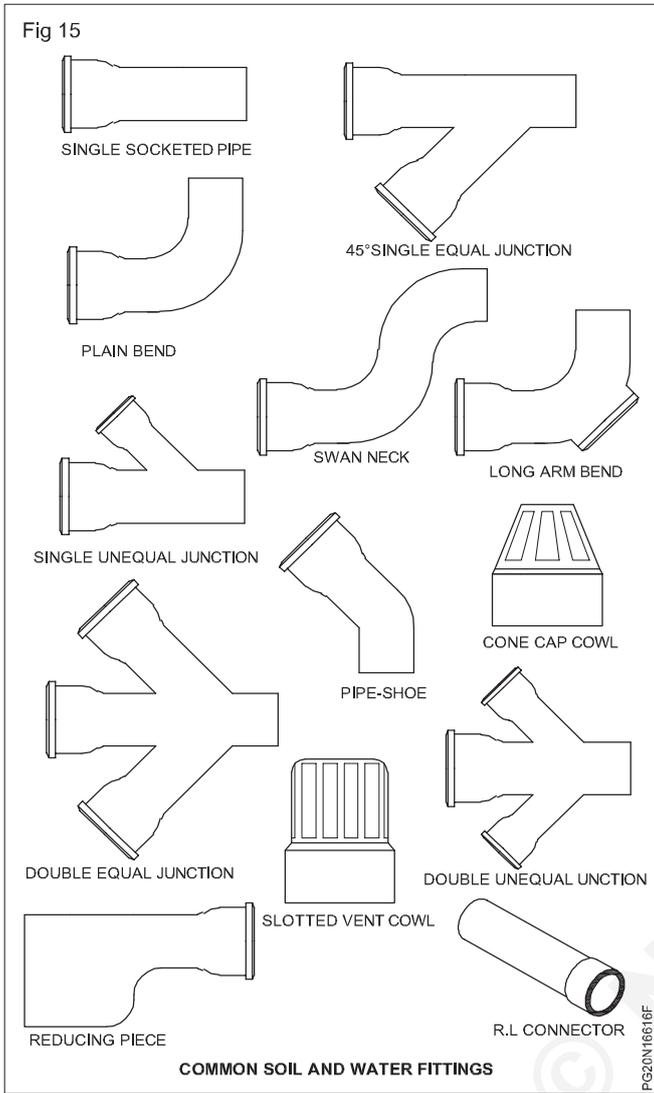
The pipes and fittings should be without ears. The pipes and fittings are coated internally and externally with same material at factory.

The access door fittings should be designed so as to avoid dead spaces in which filth may accumulate. Door are provided with 3mm rubber insertion packing and when closed and bolted, the joints should be water tight.

The standard weight and the accuracy of pipes and their tolerance should be as under.

Sand cast iron pipes

Nominal dia of bore mm	Thickness mm	Overall weight of pipe in Kg excluding ear for effective length		
		1.5m	1.8m	2.00m
50	5	9.56	11.41	12.65
75	5	13.83	16.52	18.37
100	5	18.14	21.67	24.15
150	5	26.70	31.92	35.66



Cast iron (Spun pipes)

Nominal ϕ	Thick ness	Overall weight in kg for effective length in meter for				
		3m	2.5m	2m	1.8m	1.5m
50	3.5	13.4	11.3	9.2	8.4	7.1
75	3.5	20.0	16.8	13.8	12.5	10.6
100	4.0	30.0	25.2	21.0	18.8	16.0
150	5.0	56.0	47.0	38.5	34.9	29.5

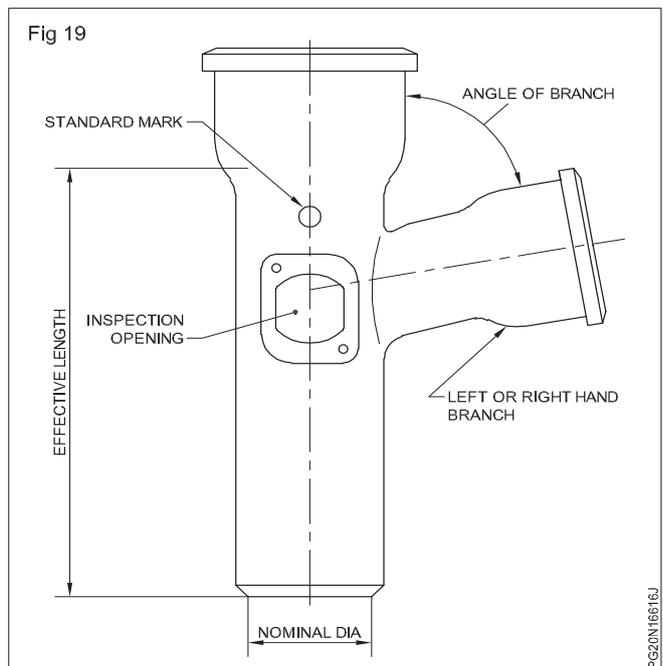
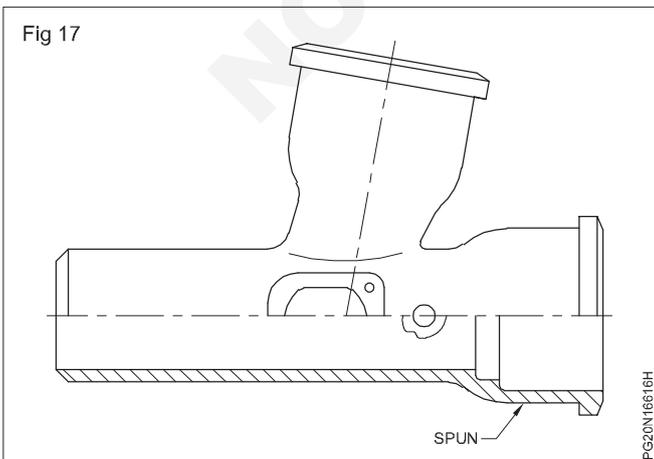
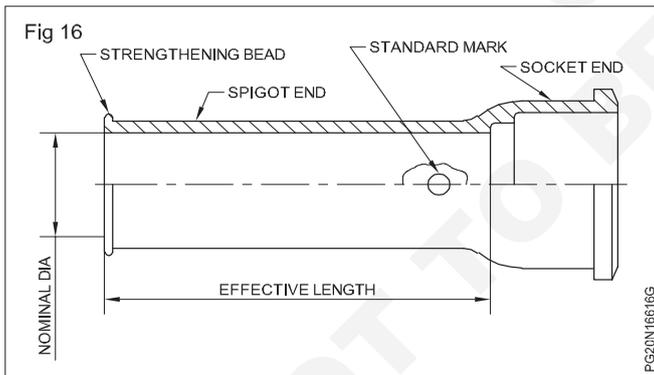
Table 1

Dimension in mm	Nominal ϕ in mm	Tolerance mm
External ϕ of barrel	50,75	± 3
	100	± 3.5
	150	± 4.0
Internal ϕ socket	All diameter	± 3.00
Depth of socket	All diameter	± 10.00

- Inspection opening

Pipe fittings

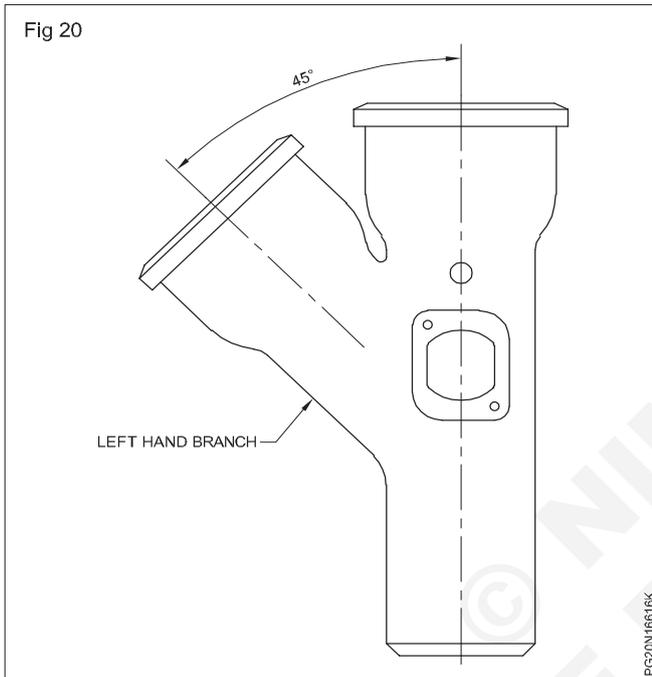
Very extensive range of cast iron fittings is available. (Refer manufacturer's catalogues). Care must be taken specifying and selecting the fittings. Always check the following points. (Fig 19)



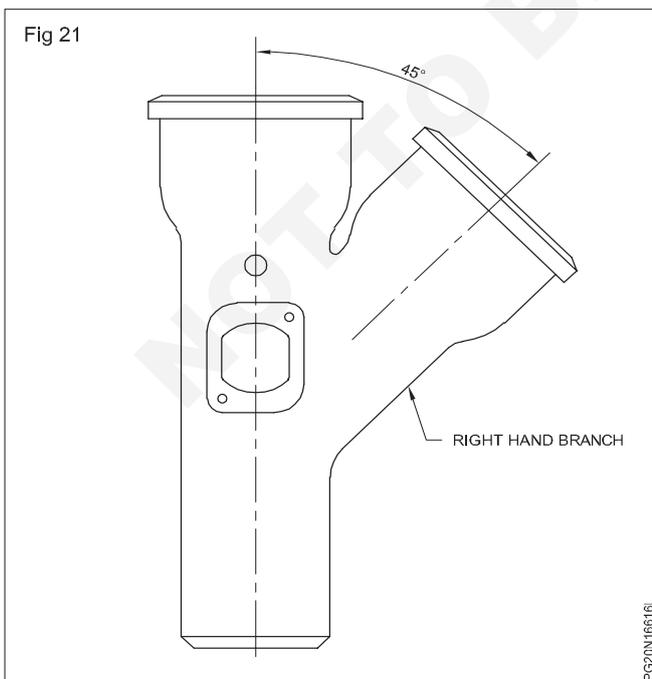
- Nominal diameter
- Standard mark
- Inspection opening
- Left or right hand branch
- Angle of branch
- Effective length

Specification branches can be handed either left or right. A branch can be used in either position. The hand of the is determined by its position when the branch is from the front.

- Shows a left hand branch. (Fig 20)



- Shows a right hand branch (Fig 21).



Some countries, a “branch” may be called a “junction”.

Anches can be of equal or unequal diameters and are to receive the discharge from a waste pipe or for a connection to an anti - syphon vent pipe.

The angles of branches in common use are

- 45°
- 70°
- 80°

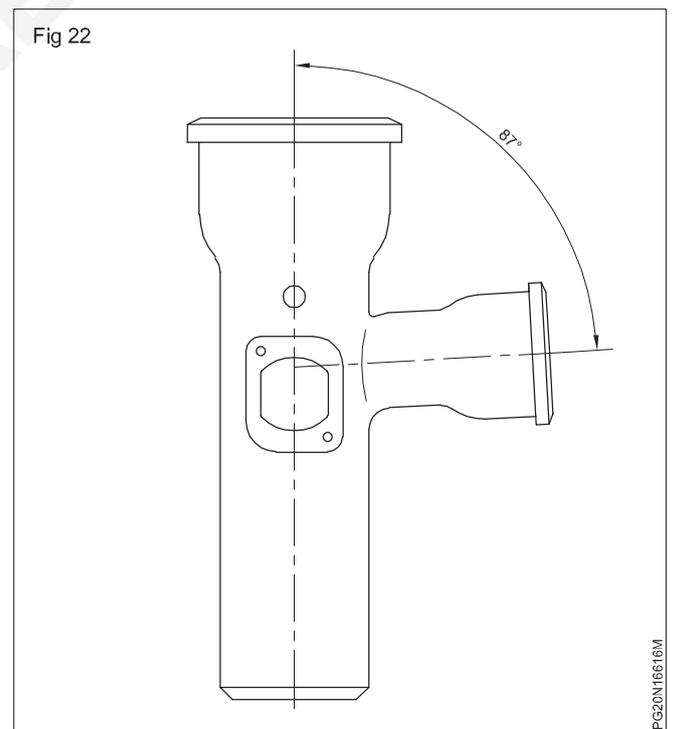
Branches may be equal and unequal.

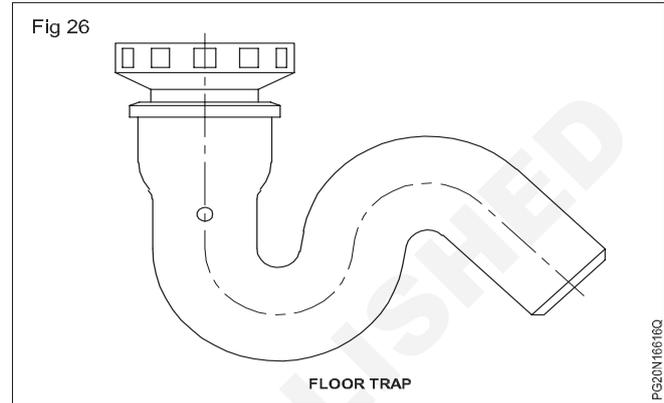
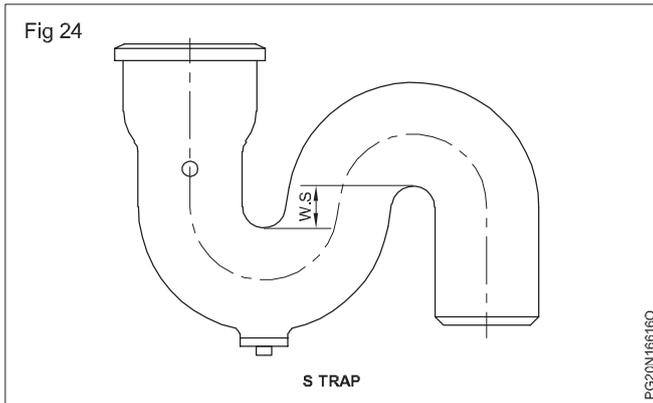
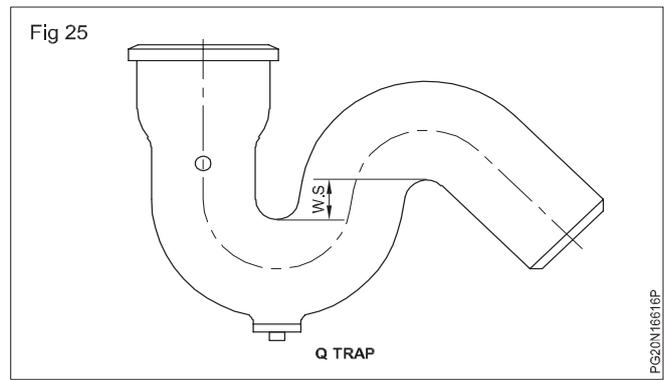
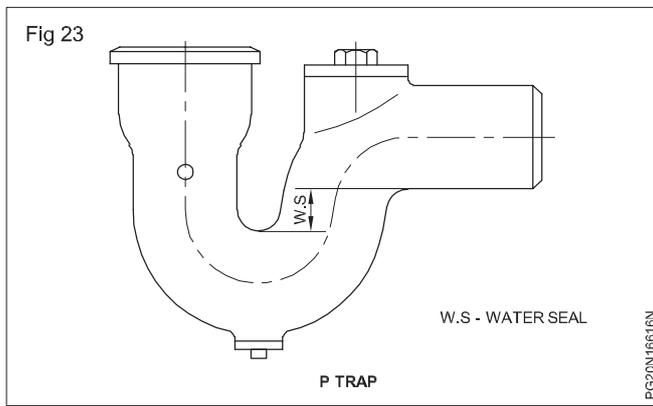
E.g equal x 50mm

Unequal 75 x 50 mm

Double branches of equal and unequal f with 45°, 70° and 87°, “Y” branches, (Fig 21) invert branches, long arm sanitary branches, bends both large and short radius are used to change the direction of flow. They are available as plain fittings or with inspection openings. The angle of the bend vary from 15°, 30°, 45°, 60°, 70°, 80°, and 87°. By using a combination of bends as 2 x 45° bends a large radius 90° bend can be obtained and it will help for easy flow rather than using 87° bend. (Fig 22) offsets, reducers and tapering pieces are available. C. I traps are fitted in an installation to prevent foul air passing into the building. Three common types of traps are P trap, S trap and Q trap. (Figs 23, 24 & 25)

Floor outlets are fitted areas such as kitchen, bathrooms and corridors. Surface cleaning water is discharged into outlet through a trap as shown in (Fig 26).





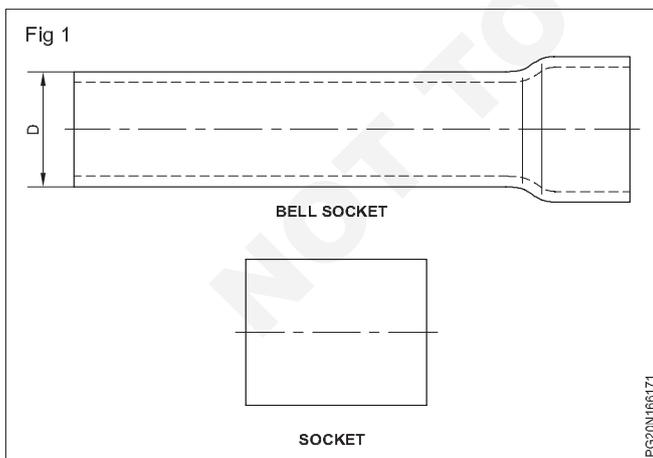
PVC and CPVC pipe

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

- state the different type of PVC fittings used for different purposes
- state the different type of CPVC pipe and HDPE fittings.

PVC pipes

General: PVC pipes are manufactured using poly vinyl chloride and additives. PVC pipes are available in 6 metres length and the pipe is specified by the outer diameter of the pipe. PVC pipes are available with bell or socket end. (Fig 1)



Advantages

- PVC pipes are light weight.
- They are corrosion free.
- Cost of PVC pipe is cheaper than G.I./C.I./A.C pipes.

Disadvantages

- PVC pipes could not be used for carrying hot water.

Types of PVC pipes

- Low density polyethylene pipes.
- High density polyethylene pipes.
- Polyethylene pipes are normally available in black colour.
- Rigid (unplasticized).

Uses: PVC pipes are used for carrying drinking, waste and rain water.

PVC pipe fitting

Unplasticized polyvinyl chloride (UPVC) pipe: There are two types of pipes as detailed under

Type A is used in ventilation pipe work and rain water application.

Type B: is used in soil and waste discharge system. these pipes should confirm IS13592. The material from which the pipes are produced consists of Polyvinyl Chloride, additives and stabilizer.

Pipes are available in length of 2,3,4 & 6M either plain or with sliding/grooved sockets. A tolerance of +10mm on specified lengths are permitted. The pipes are

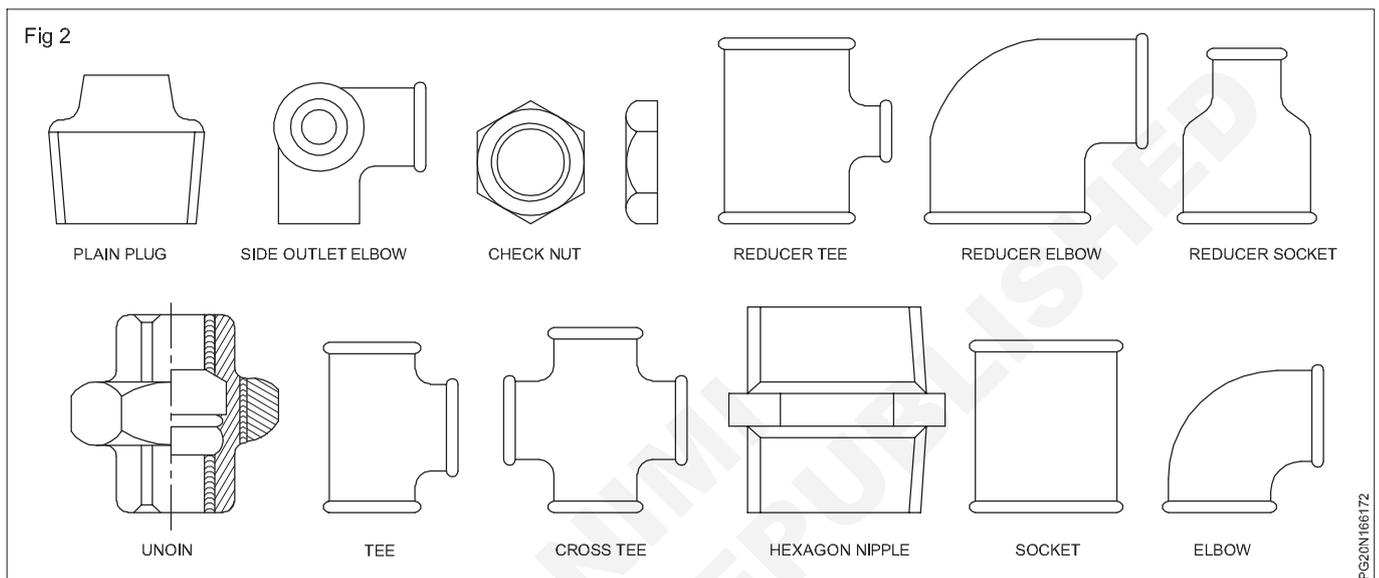
designated by its outside diameter. The mean outside f, outside f at any point wall thickness for Type A and B are at Table1.

Size of pipe mm	Support distance in meter	
	Vertical	Horizontal
40	1.2	0.5
50	1.2	0.7
75	1.8	0.9
110	1.8	0.9
160	1.8	1.0

Fittings used should confirm to IS14735 and rubber ring to IS5382. The pipes and fittings are provided with square groove and special shaped rubber rings. The single socketted pipes cover with plain end duly chamfered at the end. When required lengths are cut from pipe the plain end to be chamfered. The plain end of all fittings are chamfered at the end. The pipes should be supported on the walls with PVC pipe clip and it should be fixed below the socket of pipe or fitting (not on the socket). Maximum spacing of clips shall be as under.

Types of PVC joints and their uses

Union (Fig 2)



It is a fitting used to connect two pipes.

It is used

At the beginning of a pipe system inside a room.

For all appliances

Mid way between long pipe line.

Union enables repairs/replacement of the pipe line system, without disturbing the other parts of the system.

Socket

These fittings are used to connect one length to another, for continuation of the pipe line.

Elbow

It connects two pipes at 90° has a short curvature

Bend

Bend connects two pipes at any required angle.

It cannot be used in walls because of a layer curvature.

Tee

Tee is a fitting with a side outlet at 90° to the run of the pipe.

Cross Tee

Croste is a fitting with four branches arranged in pairs each at right angles to the other.

Reducer

This fitting is larger at one end than the other.

It is used to connect pipes of two different diameters by

- Reducer Tee
- Reducer elbow
- Reducer bend
- Reducer socket

Barrel nipple

It is a piece of pipe threaded at both ends and can be used for short extension of the plumbing line.

Double nipple

It is used to connect two fittings within a short distance. It has threads on both sides of the central piece.

Plug

Plug has an exterior pipe thread end and a projecting head for fitting in the socket.

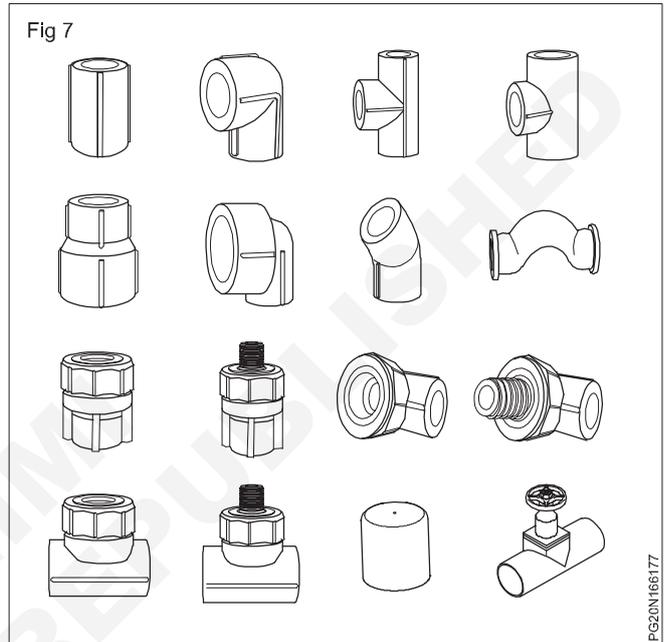
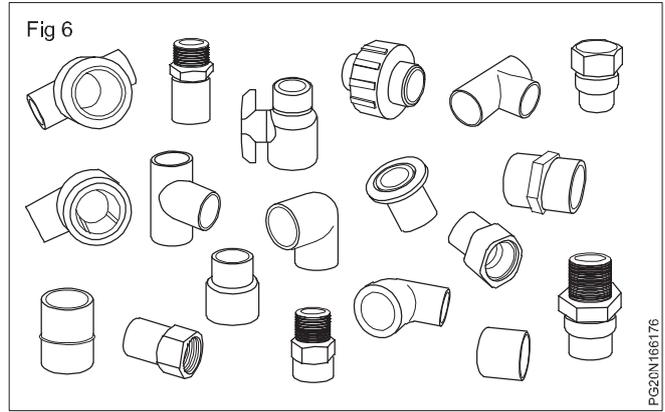
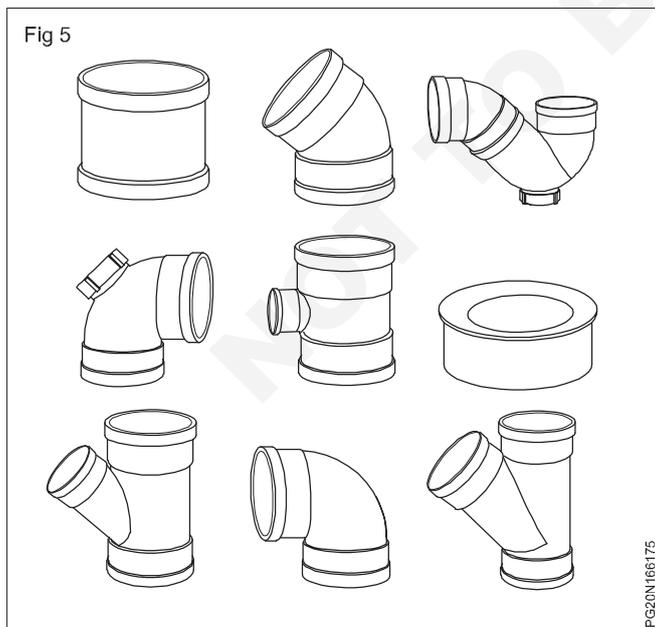
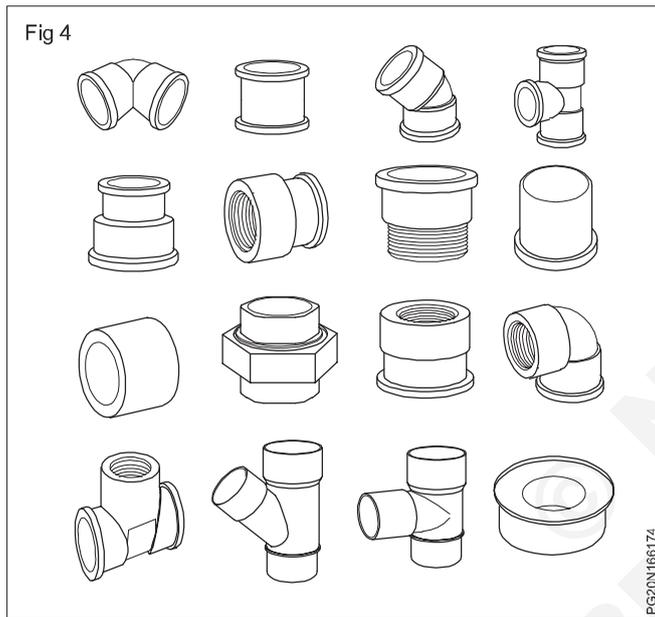
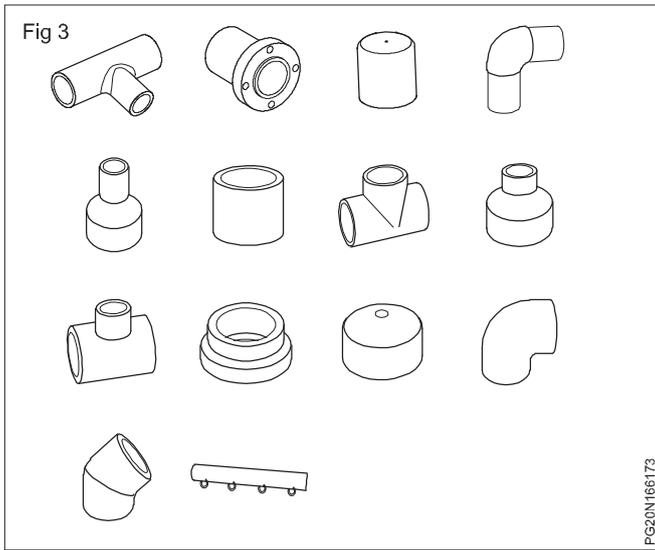
HDPE pipe fittings (Fig 3)

PVC pipe fittings (Fig 4)

UPVC pipe fittings (Fig 5)

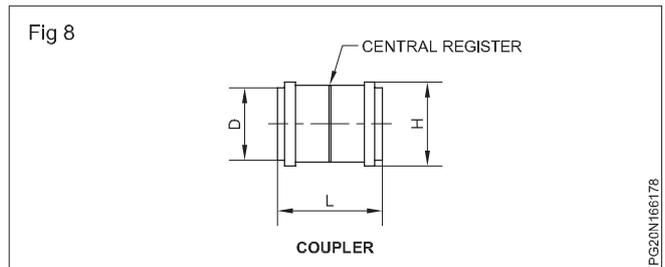
CPVC pipe fittings (Fig 6)

PPR pipe fittings (Fig 7)

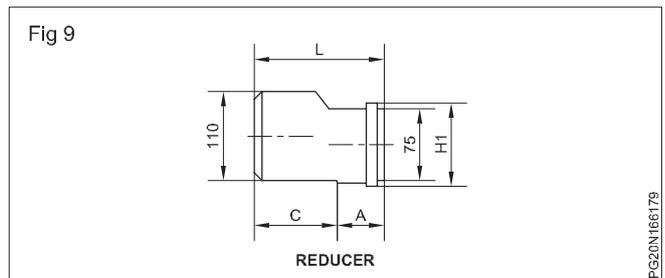


P.V.C Sanitary Fitting for Soil waste and Rain water pipes

Coupler (Fig 8)



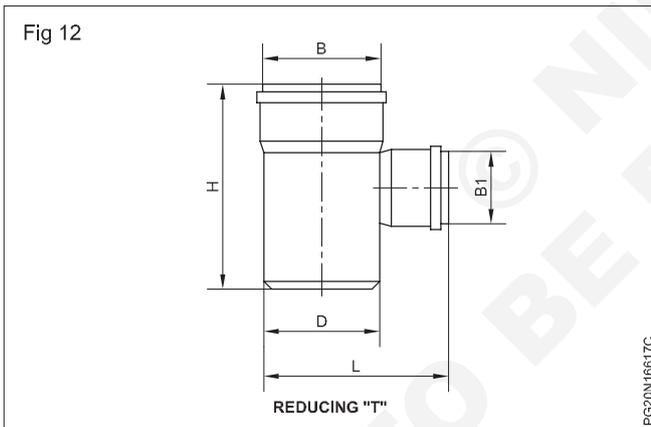
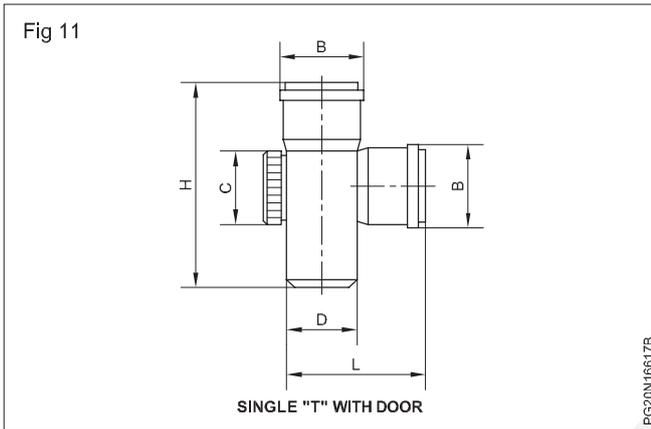
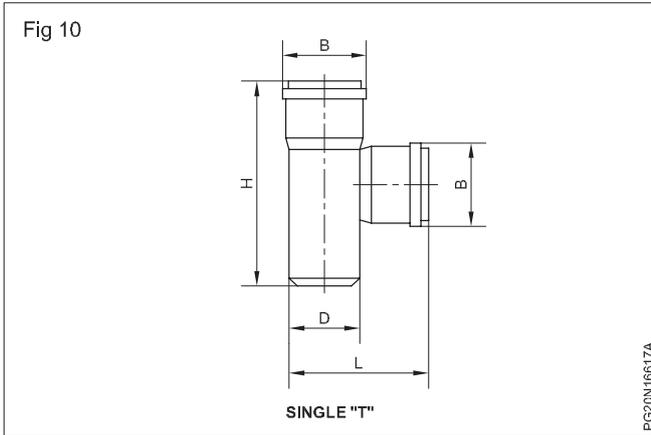
Reducer (Fig 9)



Single "T" (Fig 10)

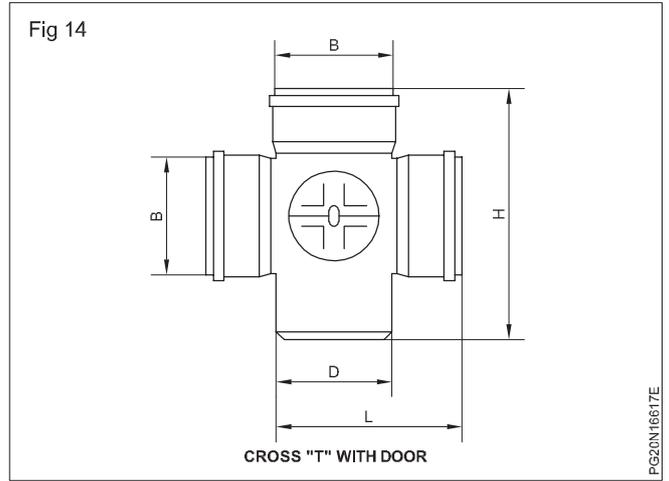
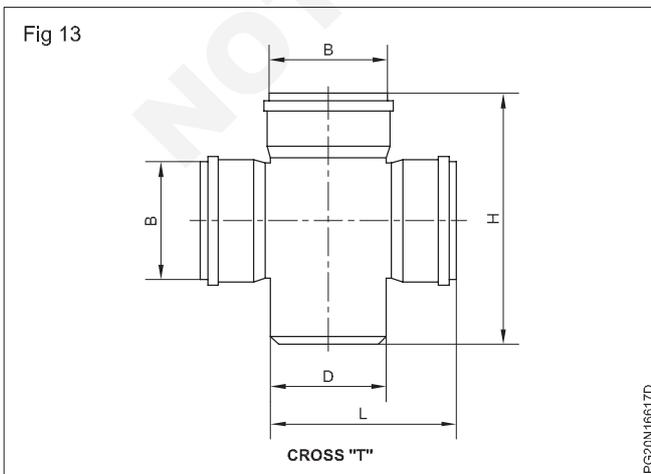
Single "T" with door (Fig 11)

Reducing "T" (Fig 12)

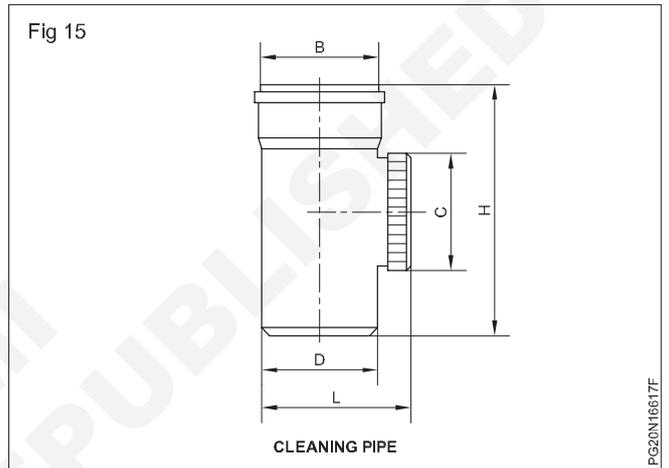


Cross "T" (Fig 13)

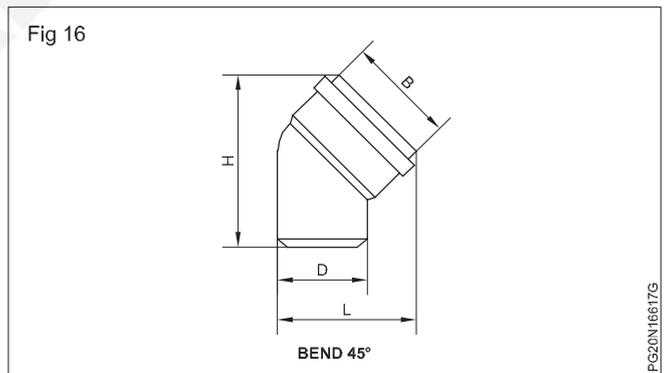
Cross "T" with door (Fig 14)



Cleaning pipe (Fig 15)



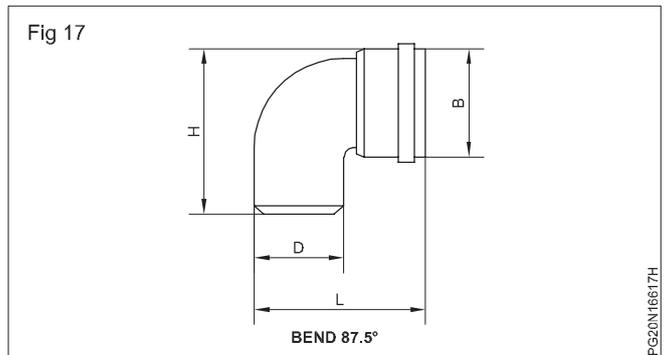
Bend 45° (Fig 16)

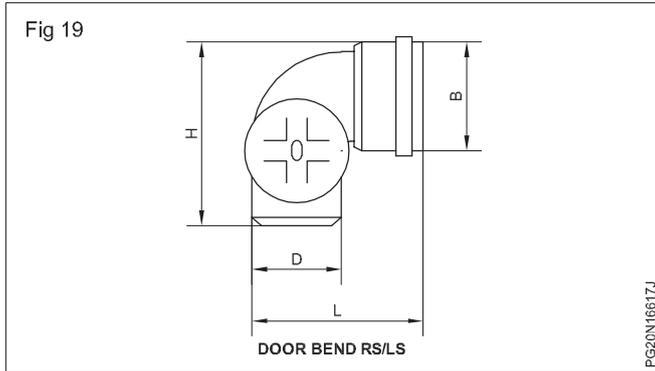
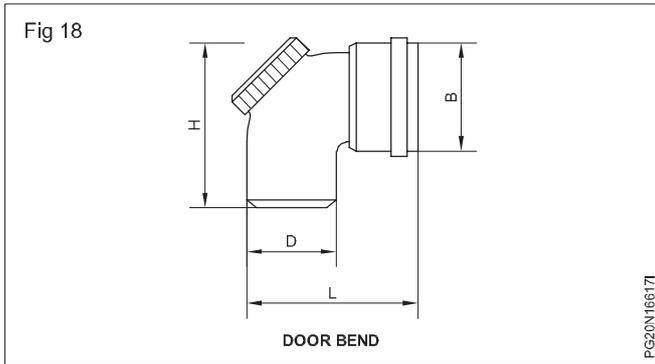


Bend 87.5° (Fig 17)

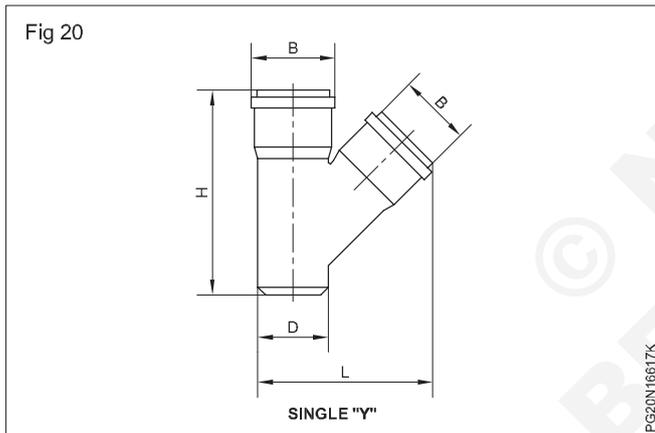
Door bend (Fig 18)

Door bend RS/LS (Fig 19)

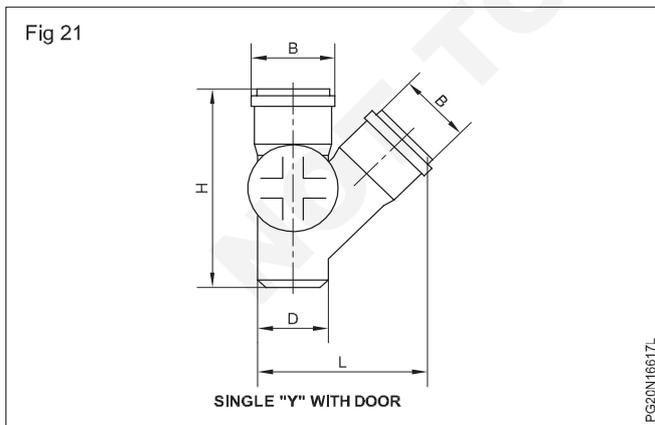




Single "Y" (Fig 20)



Single "Y" with door (Fig 21)

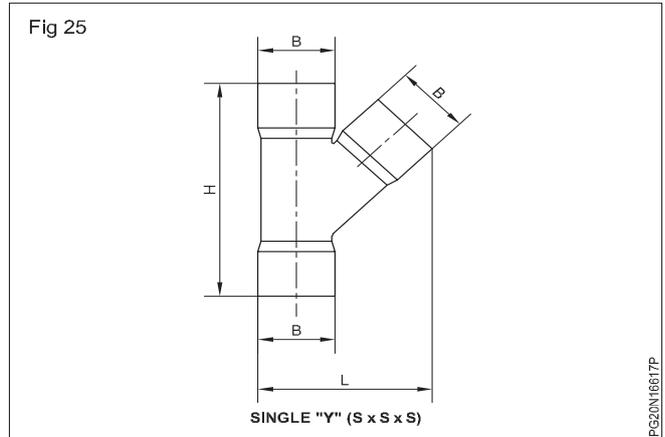
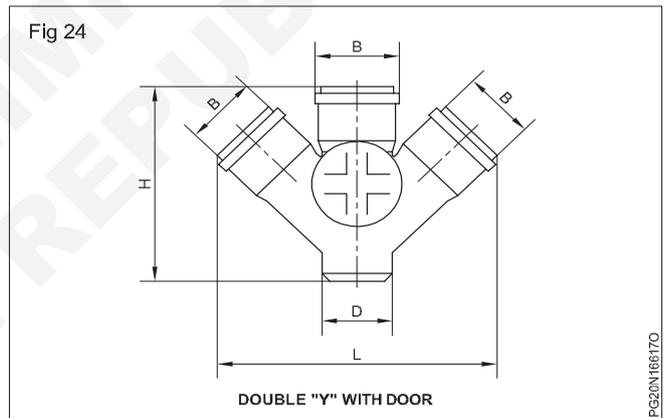
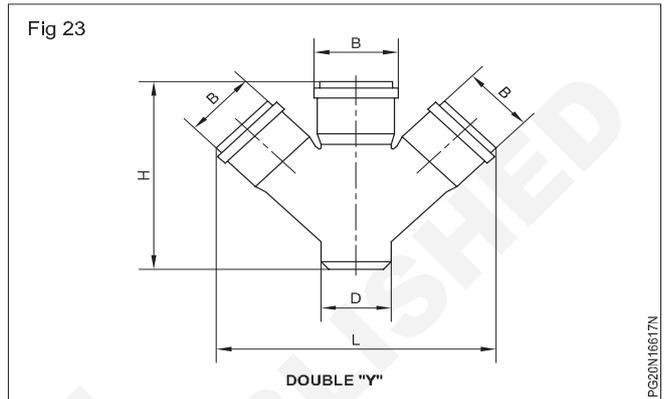
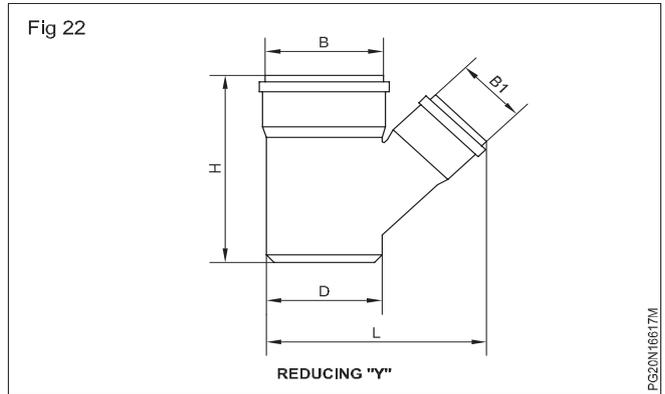


Reducing "Y" (Fig 22)

Double "Y" (Fig 23)

Double "Y" with door (Fig 24)

Single "Y" (S x S x S) (Fig 25)

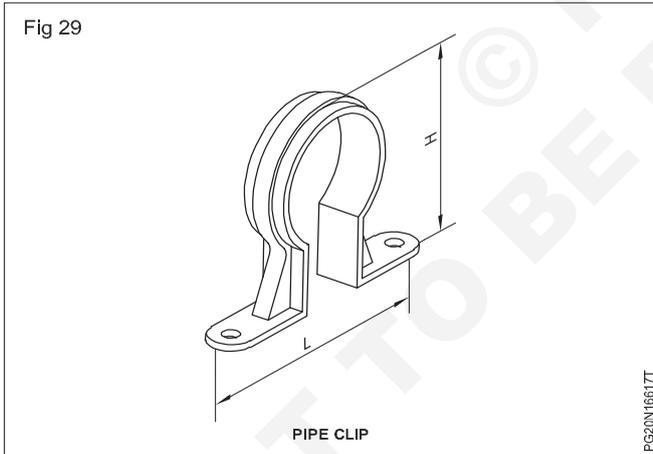
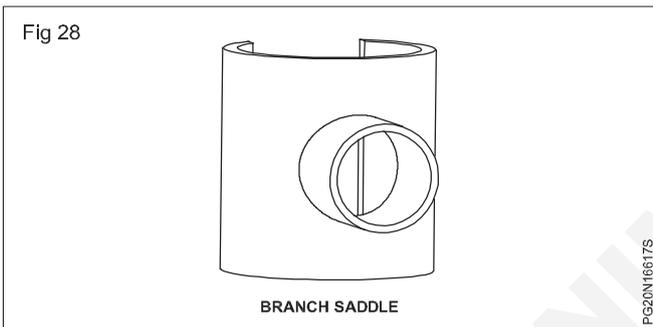
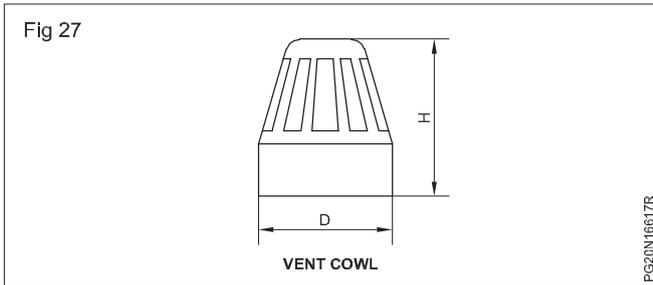
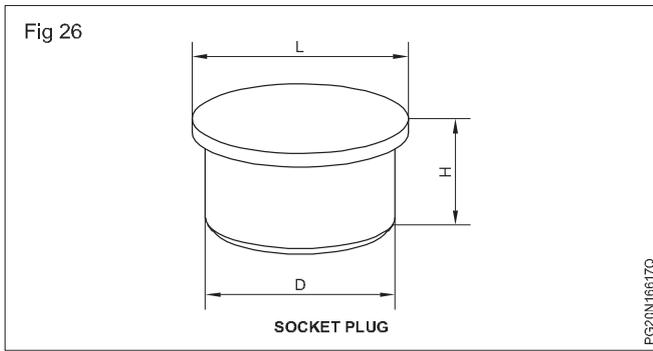


Socket plug (Fig 26)

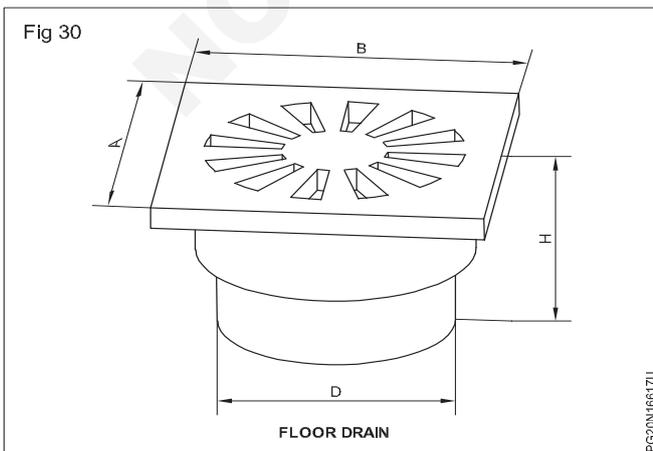
Vent cowl (Fig 27)

Branch saddle (Fig 28)

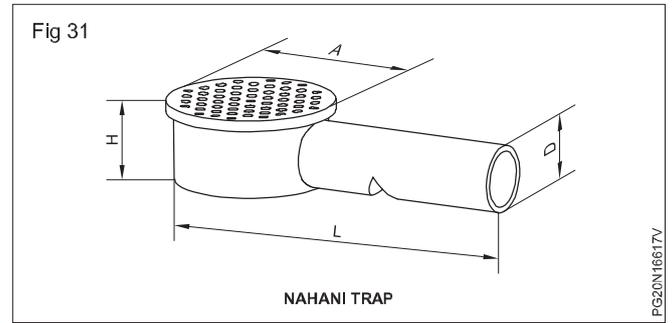
Pipe clip (Fig 29)



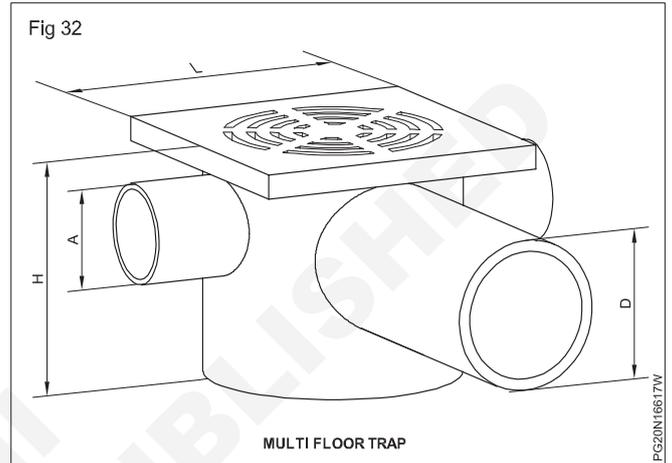
Floor drain (Fig 30)



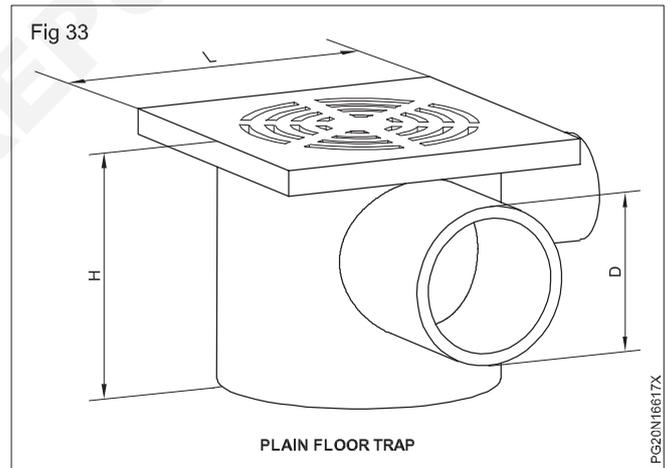
Nahan trap (Fig 31)



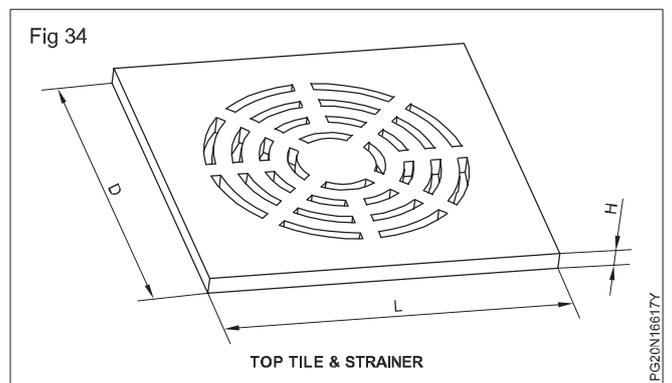
Multi floor trap (Fig 32)



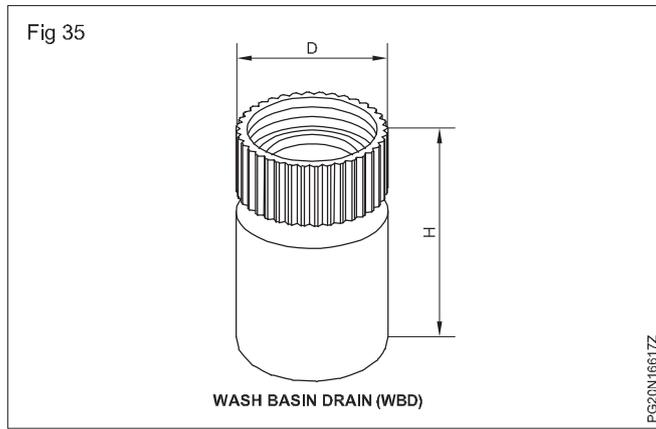
Plain floor trap (Fig 33)



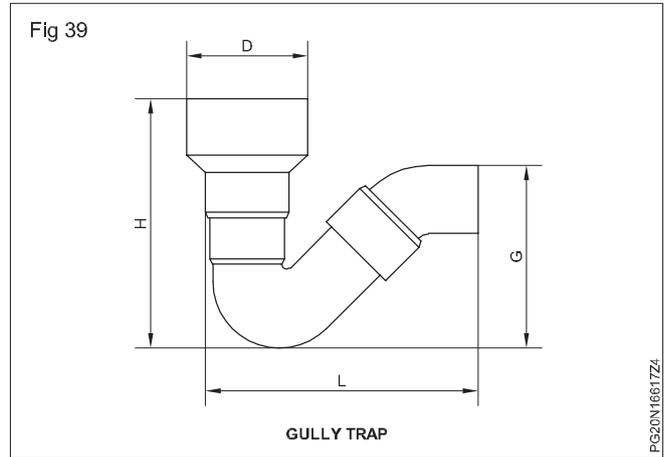
Top tile & strainer (Fig 34)



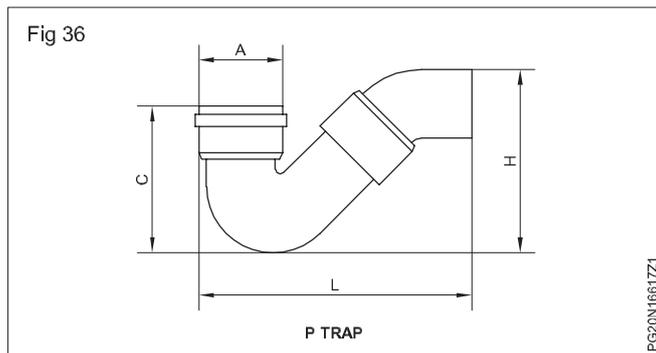
Wash basin drain (WBD) (Fig 35)



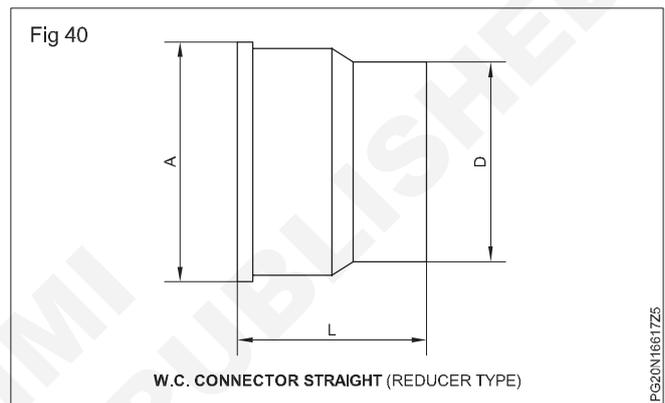
Gully trap (Fig 39)



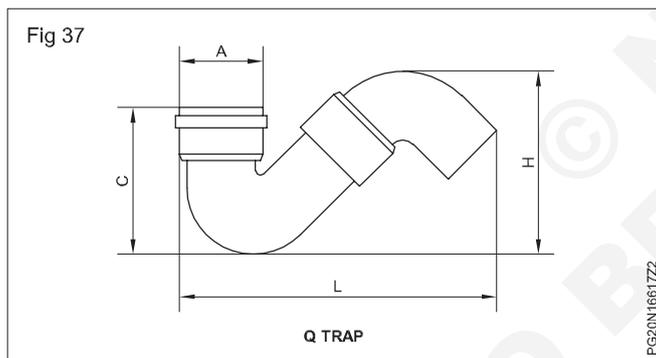
P trap (Fig 36)



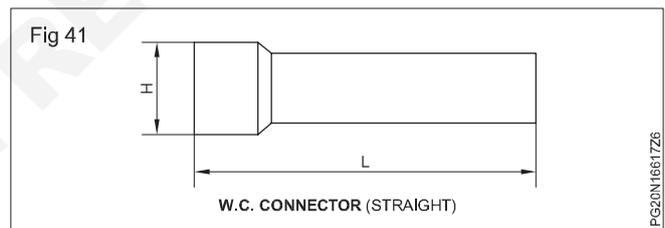
W.C. Connector straight (Reducer type) (Fig 40)



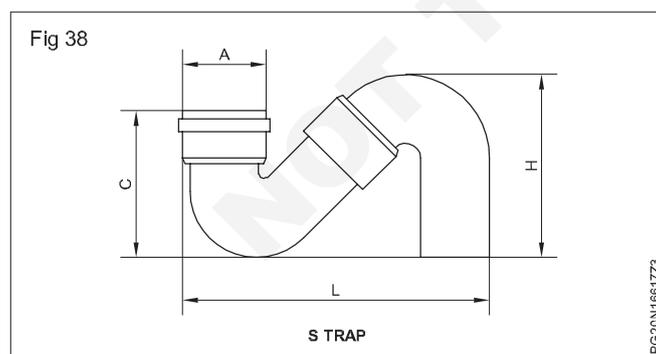
Q trap (Fig 37)



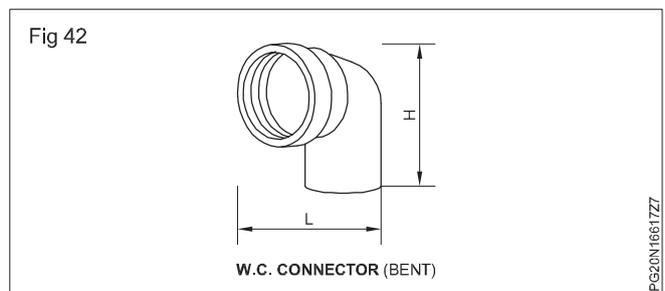
W.C. Connector (Straight) (Fig 41)



S trap (Fig 38)



W.C. Connector (Bend) (Fig 42)



General layout of water pipe connection to mains

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

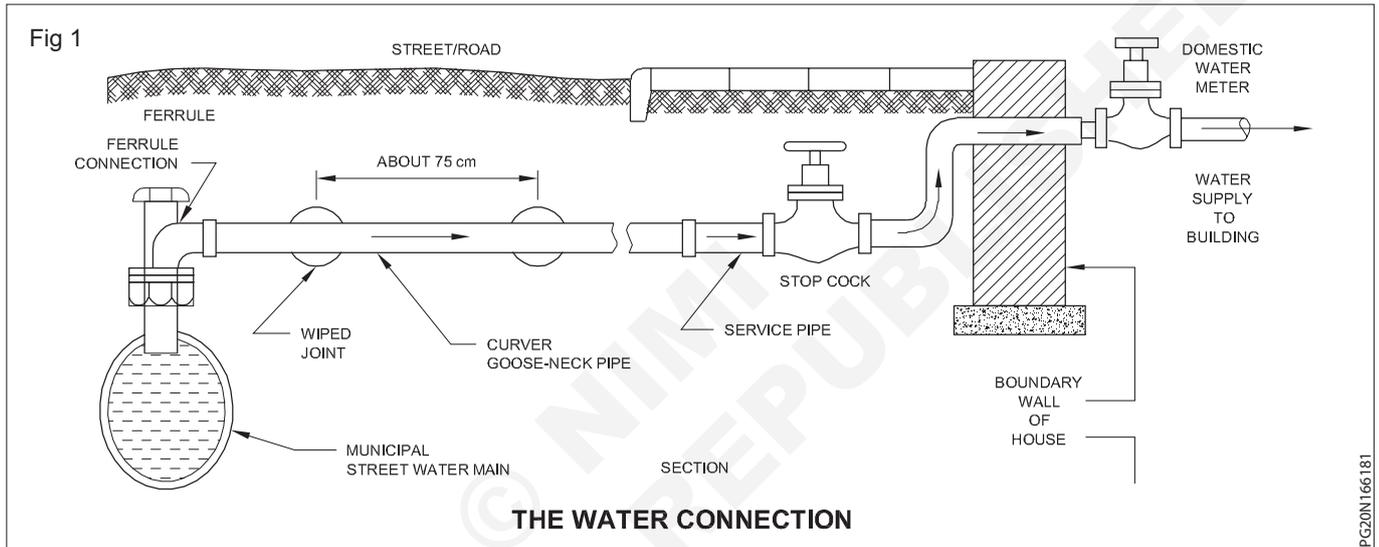
- state house water connection.
- state goose neck, service pipe, stop cock
- state water meter and stop cocks.

The house water connection

An installing a 'water supply plumbing system' in a building is, to obtain a 'water connection' from the municipal water main, because the water supply to a house or a building can start only from this point. A typical water connection, connecting the service pipe with the municipal water main, is shown in Fig 1. As is evident, the water connection consists of : (i) a ferrule; (ii) a goose neck; (iii) a service pipe; (iv) a stop cock; and (v) a water meter, as described below:

Ferrule

A ferrule is a right angled sleeve made of brass or gun metal, and it is joined to a hole drilled in the water main, and it is screwed down with a plug. Its size usually varies between 10 to 50 mm dia. For all other connections of more than 50 mm dia, a tee branch connection, off the water main, is used.



Goose neck

Goose neck is small sized curved pipe made of a flexible material (usually lead) and is about 75cm in length forming a flexible connection between the water service pipe.

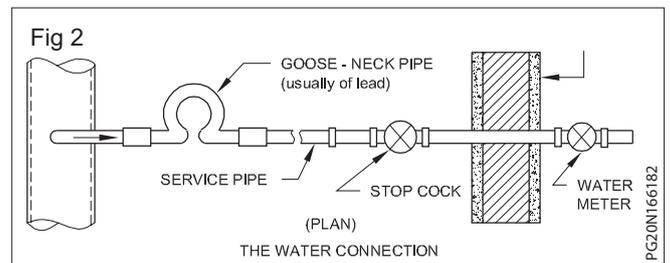
Service pipe

Service pipe is galvanized iron pipe of size less than 50 mm dia. It should be laid underground in a trench in which no sewer or drainage pipe is laid. The service pipe which supplies water to the building through the municipal main is thus connected to the main through the goose neck and ferrule.

Stop cock

The stop cock is provided before the water enters the water meter in the house. It is housed in a suitable masonry chamber with a removable cover, and is fixed in the street close to the boundary wall in an accessible position. Sometimes, it is provided just before the water meter inside the house, keeping both of them in one chamber. The details of stop cocks are given in the next article.

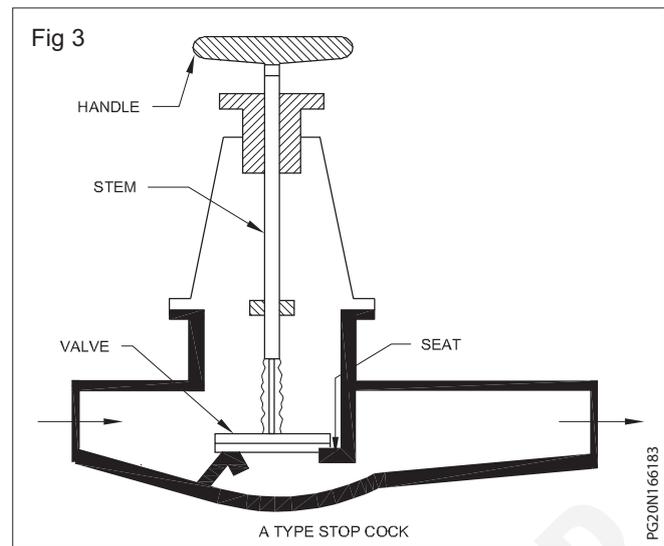
Water meter (Fig 2)



Water meter measures and records the quantity of water consumed in the house. The domestic type water meter generally employed for houses is fitted into the service pipe with unions, which enables the meter to be changed where necessary. The water meter is generally fixed in an iron box fitted in an opening or cavity made in the boundary wall of the house, and is covered with a movable iron cover.

Stop cocks (Fig 3)

A stop cock is a screw down type of sluice valve which is used in smaller sized pipes in service connections for stopping or opening the supply. They are generally provided at the water entrance of each building and also within the building. When provided just prior to the water meter in each house connection, they should be enclosed in a proper cast iron box having a hinged cover.



Erecting of rain water pipe system

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

- state the installation of rain water pipe from roof to ground
- fix the rain water gutter with rain water pipe.

Installation of rain water pipe from roof to ground:

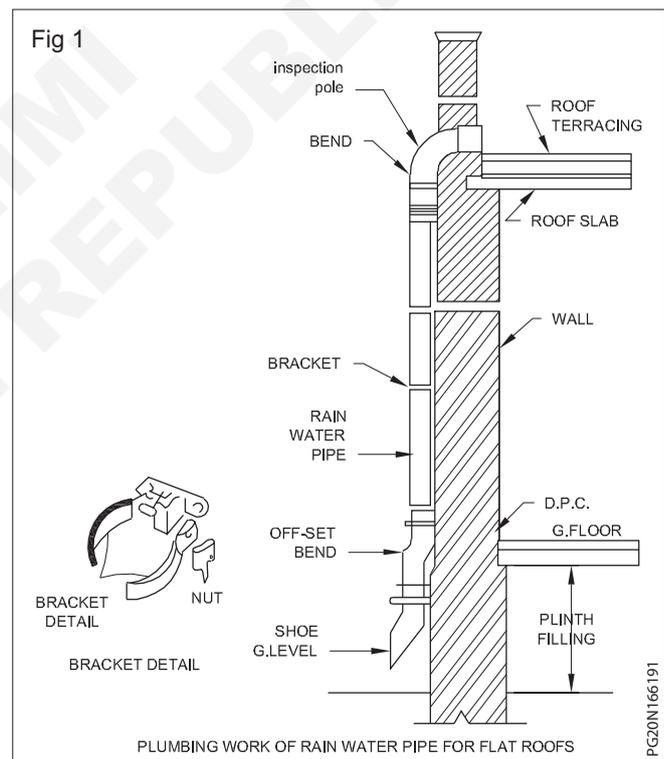
The pipe laid to collect the rain water from the roofs is known as rain water pipe. The water from the flat as well as sloppy roofs is to be connected and brought on the ground level, from where it is allowed to flow in open drains.

Rain water pipes for drainage of roofs (Fig 1). The roofs of a building shall be constructed or framed as to permit effectual drainage of the rain water there from by means of a sufficient number of rain water pipes of adequate size so arranged, jointed and fixed as to ensure that the rain water is carried away from the building without causing dampness in any part of the walls or foundations of the building or those of an adjacent building.

The rain water pipes shall be fixed to the outside of the external walls of the building or in recesses or chase cut or framed in such external walls or in such other manner as may be approved by the administrative authority.

(A rain water pipe conveying rain water shall discharge directly or by means of a channel into or over an inlet to a surface drain or shall discharge freely in a compound, drained to surface drain or shall discharge freely in a compound, drained to surface drain but in no case shall it discharge directly into any closed drain.

Whenever it is not possible to discharge a rain water pipe into or over an inlet to a surface drain or in a compound, drain to surface drain or in a street drain within 30m from the boundary of the premises, such rain water pipe shall discharge into a gulley trap which shall be connected with the street drain. Such a gulley trap shall have a screen and a silt catcher incorporated in its design.



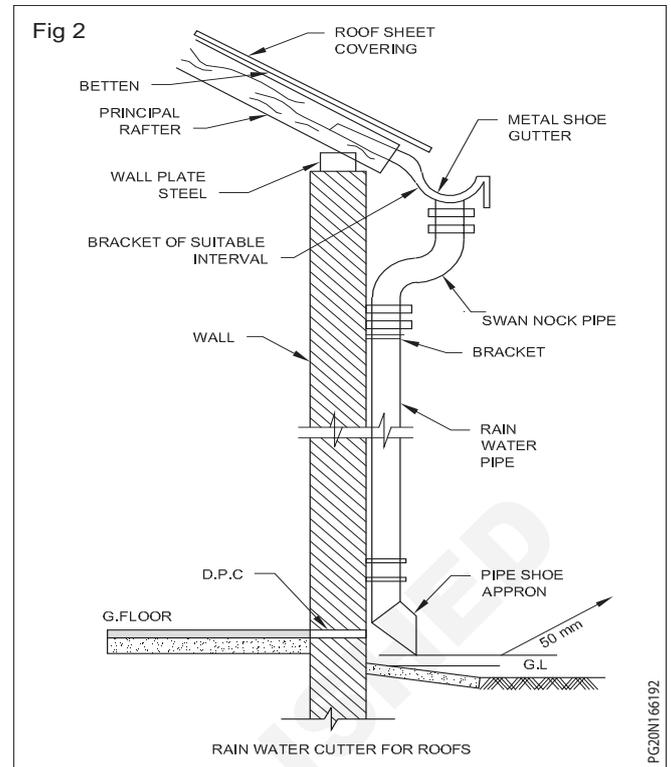
Rain water pipes shall be constructed of cast iron, asbestos cement, galvanized sheet or other equally suitable material and shall be securely fixed. The latest practice, however it is not to use the pipes made from galvanized sheets for rain water services. Cast iron rain water pipes and fittings shall conform to IS: 1230 -1979. Asbestos cement building pipes and gutters and fittings (Fig 2) (spigot and socket type) shall conform to IS: 1626 (Part 1) 1980, IS 1626 (Part 2) 1980 and IS: 1626 (Part 3) 1981. Sizing of rain water pipes for roof drainage: Rain water pipes shall be normally sized on the basis of roof

areas according to Table as under. A bell mouth inlet at the roof surface is found to give better drainage effect, provided proper slopes are given to the roof surface.

The spacing of pipes depends on the position of the windows and arc openings but 6m apart is a convenient distance. The strainer fixed to the bell mouth inlet shall have an area 1½ to 2 times the area of pipe which it connects.

Laying of rainwater pipe

- 1 Correct threading, the same which is on the specials should be done on the pipes.
- 2 All the joints should be made water-tight by wrapping jute thread and white lead paint in the threads, while screwing.
- 3 Over-screwing should not be done in any case, otherwise it may split or crack the parts of the fittings, socket, elbow, tee or cross etc.
- 4 While measuring the length of pipes for cutting, due to allowance for the space of fittings should be made, otherwise the length of the pipes may be more or less.



Sl. No.	Dia. of pipe mm	Average rate of rainfall in mm					
		50	75	100	125	150	200
		Roof area in square metres					
1	50	13.4	8.9	6.6	5.3	4.4	3.3
2	65	24.4	16.0	12.0	9.6	8.0	6.0
3	75	40.8	27.0	20.4	16.3	13.6	10.2
4	100	85.4	57.0	42.7	34.2	28.5	21.3
5	125			80.5	64.3	53.5	40.0
6	150					83.6	62.7

- 5 All the pegs should be fixed with their border end inside the wall and smaller size in face of the wall.
- 6 Only the required size whole should be made in the wall for fixing of pegs, brackets etc. de-shape the pipe and make it oval in section.
- 7 While bending the pipes on the bending machines, care should be taken otherwise it may also press the pipe and give more bend than desired.
- 8 The cutting of the pipes should be done properly, it should be at right angle to the axis of the pipe.
- 9 The pipes should be fixed with pipe-hooks at proper place. These hooks should be driven in the masonry joints.
- 10 In case of accidents first-aid facilities should be available.

Tracing of leakage in water supply system by sound test

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

- state the losses from water supply system
 - explain benefits of leak detection and repair
 - state the types of leakages
 - explain the leak detection and repair strategies.
-

Losses from Water Supply System

Detecting and repairing leaks is one of the main components of water conservation. This guidance document will address the strategies to reduce water loss due to leaks, and acknowledges the concepts developed by organizations such as the International Water Association

Old or poorly constructed pipelines, inadequate corrosion protection, poorly maintained valves and mechanical damage are some of the factors contributing to leakage. Leak detection has historically assumed that all, if not most, leaks rise to the surface and are visible. In fact, many leaks continue below the surface for long periods of time and remain undetected.

With an aggressive leak detection program, water systems can search for and reduce previously undetected leaks. Water lost after treatment and pressurization, but before delivered for the intended use, is water, money and energy wasted. Accurate location and repair of leaking water pipes in a supply system greatly reduces these losses. Once a leak is detected, the water utility must take corrective action to minimize water losses in the water distribution system.

Benefits of Leak Detection and Repair

Minimizing leakage in water systems has many benefits for water customers (and their suppliers). These benefits include:

- Improved operational efficiency.
- Lowered water system operational costs.
- Reduced potential for contamination.
- Extended life of facilities.
- Reduced potential property damage and water system liability.
- Reduced water outage events.
- Improved public relations.

Some added benefits of leak detection and repair that are difficult to quantify include:

- Increased knowledge about the distribution system, which can be used to respond more quickly to emergencies and set priorities for replacement or rehabilitation programs;
- More efficient use of existing supplies and delayed capacity expansion;
- Increased firefighting capability.

Leak detection and repair programs can lead other important water system activities, such as:

- Inspecting hydrants and valves in a distribution system;
- Updating distribution system maps;

- Using remote sensor and telemetry technologies for ongoing monitoring and analysis of source, transmission, and distribution facilities. Remote sensors and monitoring software can alert operators to leaks, fluctuations in pressure, problems with equipment integrity, and other concerns; and
- Inspecting pipes, cleaning, lining, and other maintenance efforts to improve the distribution system and prevent leaks and ruptures from occurring. Systems might also consider methods for minimizing water used in routine water system maintenance.

Types of Leaks

There are different types of leaks, including service line leaks, and valve leaks, but in most cases, the largest portion of unaccounted-for water is lost through leaks in supply lines. There are many possible causes of leaks, and often a combination of factors leads to their occurrence. The material, composition, age, and joining methods of the distribution system components can influence leak occurrence.

Another related factor is the quality of the initial installation of distribution system components. Water conditions are also a factor, including temperature, velocity, and pressure. External conditions, such as stray electric current; contact with other structures; and stress from traffic vibrations, frost loads, and freezing soil around a pipe can also contribute to leaks.

Underground Leaks

The underground piping on either side of a water meter should be maintained. Leaks in underground plumbing can be caused by many different factors, including rusting through from age or from stray electric currents from other underground utilities that can prematurely rust metallic piping, driving over piping with heavy trucks or equipment, poor initial installation, freezing and thawing of a pipeline, leaking joints or valves, or transient high pressure events such as opening and closing valves or starting and stopping pumps quickly.

Signs of underground leaks include:

- Unusually wet spots in landscaped areas and/or water pooling on the ground surface.
- An area that is green, moldy, soft, or mossy surrounded by drier conditions.
- A notable drop in water pressure/flow volume.
- A sudden problem with rusty water or dirt or air in the water supply (there are other causes for this besides a leak).
- A portion of an irrigated area is suddenly brown/dead/dying when it used to be thriving (water pressure is too low to enable distant heads to pop up properly).

- Heaving or cracking of paved areas. Sink holes or potholes.
- Uneven floor grade or leaning of a structure.
- Unexplained sudden increase in water use, consistently high water use, or water use that has been climbing at a fairly steady rate for several billing cycles.

Leak Detection and Repair Strategies

There are various methods for detecting water distribution system leaks. These methods usually involve using sonic leak-detection equipment, which identifies the sound of water escaping a pipe. These devices can include pinpoint listening devices that make contact with valves and hydrants, and geophones that listen directly on the ground. In addition, correlator devices can listen at two points simultaneously to pinpoint the exact location of a leak.

Large leaks do not necessarily constitute the greatest volume of lost water, particularly if water reaches the surface where they are usually found quickly, isolated,

and repaired. However, undetected leaks, even small ones, can lead to large quantities of lost water since these leaks might exist for a long time. Ironically, many small leaks are easier to detect because they are noisier and easier to hear using hydrophones. The most difficult leaks to detect and repair are usually those under stream crossings. Leak detection efforts should focus on that portion of the distribution system.

Checking for Leaks

Identifying leaks can be difficult; however, at minimum the following should be performed:

- Inspect irrigation systems for obvious above ground leaks. Extremely wet areas above an underground pipe can be an indication of a broken pipe or joint.
- Examine equipment routinely and look at exposed pipes to see if you can visually see any leaking water.

If you suspect a leak at your facility, take steps to get the leak fixed.

Inspection and testing of water supply system

Objective: At the end of the lesson you shall be able to

- state the soundness of the pipe line system.

Testing of the pipe lines

After a pipe line has been laid, fitted with all appurtenances and accessories, painted both from inside as well as outside by means of protective paints, etc., the pipe line will be tested for the soundness in its construction. The soundness of the construction is examined by performing the pressure test on the pipe line. The set by step procedure adopted for performing this test is described below:

The pipe line is tested from section to section. Thus, at a time, only one particular section lying between two sluice valves is taken up for testing.

The downstream sluice valve is closed, and water is admitted into the pipe through the upstream sluice valve. The air valves will be properly operated during filling up of the pipe.

The upstream valve, through which water was admitted, is closed, so as to completely isolate the pipe section from the rest of the pipe.

Pressure gauges are then fitted along the length of the pipe section at suitable intervals (say 1 km or so) on the crown, through holes left for this purpose.

The pressure in the pipe line is low raised by means of a small hand force pump or a hydraulic pressure pump, till the test pressure (to be measured on the pressure gauge fixed on the pipe) is nearly 25-50% above the highest working pressure.

The pipe and the joints are then visualized for water tightness. The applied test pressure should also maintain itself without any appreciable loss during the observation period, which may be at least 4 hours.

When the field test pressure is less than the works test pressure, then the observation period should be increased to at least 24 hours.

The pipe is finally evaluated through drain valves, and them observed defects (in the test) are rectified, so as to make the line fit for use. The pipe is again tested by repeating the and ensure proper rectification of defects is carried out.

After the satisfactory completion of the pressure test, a leakage test at a pressure to be specified by the authority for a duration of 2 hours may also be performed. Leakage is defined as the quantity of water that is required to be supplied for maintaining the specified leakage test pressure after the pipe has been filled with water and the air is expelled.

In a newly laid pipe line, there should generally be no leakage. Moreover, the allowable leakage during the maintenance stage of pipes carefully laid and well tested during construction, should also not exceed the value given by equation below:

$$q_L = N \cdot D \sqrt{P}$$

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where

q = Allow leakage in cm /hr

N = Number of joints in the length of the pipe line

D = Diameter of pipe in mm

P = The average test pressure during the leakage test in kg/cm² (i.e. 10 m of water head)

Pressure testing of pipeline with pressure testing machine

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

- state the application of pressure testing machine
- explain the pressure test conducting.

Application

- Boilers, Pressure Vessels, C.I. Mains, Casting parts
- Gas Cylinder, Pipes & Tubes parts
- Subject to Hydro Test Pressure

Special Features

- Portable hand operated system can be easily handled by one man
- Pump unit is mounted on fabricated M.S. water tank which stores liquid for testing

- Pump done not required any foundation
- Provides self base for testing

Standard Accessories

- Pressure release cock made from brass metal.
- Discharge pressure hose with attachment of 1/2 : BSP Length 2 Mtrs.
- Stainless Steel Glycerin filled pressure gauge with 4" inch dial
- Suction & discharge valve (NRV) made form Stainless Steel material

Performance table

Discharge size BSP MM	Max. Pressure Kg/cm2 P.S.I	Output CC/Stroke	Plunger Size in mm	Water Tank Size in ltrs
1/2" 12.5	35 500	15.70	19	9

Conducting the Pressure Test

To conduct a pressure test of building services piping systems in all Station buildings, complete the following steps:

1. Identify the maximum test pressure to be used, as determined by the Project Engineer of Field Engineer.
2. Identify the type of pipe system to be tested. The maximum aggregate length of pipe to be tested at one time is 40 feet.
3. Examine all connections prior to the test t ensure proper tightness
4. Determine the pressure rating for all connected fittings and devices to ensure they are rated for the maximum test pressure.
5. Isolate any equipment that may be damaged by the test and indicate this isolation on the test form.
6. Secure a blind flange or cap suitable for the system's rated pressure on all openings that are not closed off by valves.
7. Plug all test, drain, and vent ports that are not required for the test.
8. If the section of pipe being tested is isolated from other sections by in-line valves, ensure the portion not being tested is open to the atmosphere.

For Pneumatic Testing follow steps 9 through 15:

- 9 Apply a preliminary test pressure of 25 psi.

This pressure should be held for a minimum of 10 minutes to allow for the location of any major leaks. If leaks are detected during this step, or at any time during the test, relieve the pressure and take appropriate action to correct the leak. If necessary, consult the Project Engineer for instruction.

- 10 Apply the test pressure in increments of 25 psi, until the maximum test pressure is reached. Hold pressure for 5 minutes at each 25 psi increment and inspect for leaks before adding more pressure.
- 11 Hold this pressure for 25 hours.
- 12 Obtain confirmation of successful by the operator after the 24 hour time period.
- 13 Remove the pressure with caution to avoid escaping air stream, debris and high decibel noise level.

After completing these steps, pressure testing is completed once the test is successfully completed, then piping system is ready for service.

Safety precautions in sheet metal work shop

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

- state various safety precautions while working in a SMW shop
- state the general workshop rules.

Safety Precautions

Whenever a work is done in a shop the following aspects may create an injury to the workman/trainee or to others working nearby.

- 1 Way of handling the materials, tools and machine.
- 2 Cleaning of the work area/shop floor.
- 3 Damaged/faulty tools, machines and safety appliances.
- 4 Carelessness and negligence of the workman/trainee.
- 5 Ignorance of general safety rules.

To avoid the accident/injuries taking place, while working it is very important to follow certain safety precautions. They are:

- Do not bend your whole body while lifting heavy loads. Instead use your thigh muscles for lifting.
- Use gloves while handling thin sheets.
- Use chipping screen during chiseling operation.
- Avoid using a mushroom head chisel.
- Arrange the tools properly over the work table so that the tools are not allowed to fall from the table on your foot.
- Wear proper size safety shoes.
- Remove burrs by filing from a plate or sheet after cutting them by chisel or hacksaw.
- Do not use a hammer with a broken or damaged handle.
- Fix the hammer head with the handle securely using a wedge.
- Do not wear loose garments/dress.
- Wear plain goggles/face shield while grinding.
- Do not grind materials which are 3mm or less in thickness and non-ferrous metals.
- Adjust the gap between the work rest and the grinding wheel to 1-2 mm.
- Select and use the right kind of tool for the right job.
- Keep the floor on the work area neat and clean without any cut pieces of material, oil, etc.

- Keep a separate bin/basket for throwing cotton waste, metal chips etc.
- Always keep fire fighting equipment and the First Aid Box ready for use in case of any emergency.
- After completion of work keep the tools in the tool box.
- Wear helmet if anybody is working above your work place, either to repair at the roof or on a overhead crane.
- Use tongs while handling hot objects.
- Do not try to check the sharpness of any tool with bare fingers.
- Switch off the mains of a machine while leaving the machine after completion of work.
- Do not try to rectify any electrical fault by yourself. Call an electrician for doing any electrical repair work.
- Wherever and whenever possible avoid polluting the environment.
- If any other person is affected by electric shock, immediately switch off the mains or separate the person from the electrical contact using a wooden rod or any other insulating material.
- Always fix the job at a convenient height on the vice.
- Use sufficient leverage while tightening or loosening a nut or bolt.

General workshop rules

- 1 Safety glasses must be worn
- 2 Safety footwear must be worn when working in the workshop.
- 3 Ask workshop instructor before using equipment.
- 4 Visitors must remain within marked walkways.
- 5 Long hair must be tied back
- 6 Clean, equipments & machines after use
- 7 Take care when using compressed air.
- 8 Hearing protection should be worn when using machinery.
- 9 Working alone after hours is not permitted.

Importance of sheet metal work in industries

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

- state the importance of sheet metal work.

Introduction

Many engineering products are made out of sheet metal. The person who works on metal sheets is called sheet metal worker. The skilled sheet metal worker make and install various kind of sheet metal products. (Fig 1)

- Roofings
- Ductings
- Vehicles body buildings like 3 wheelers, 4 wheelers, ships, air crafts etc.
- Furnitures
- House hold articles
- Railway equipment

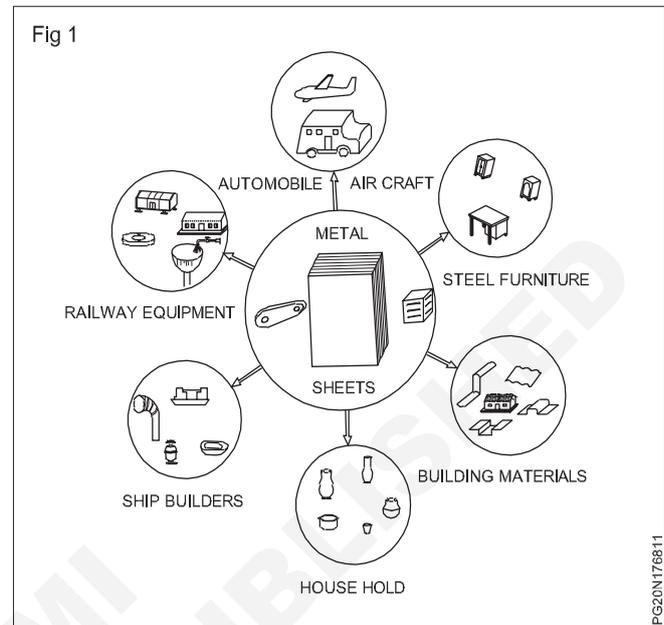
Also repairing of the above items.

To carry out these works, the sheet metal worker has to plan, layout and determine the size and the type of the sheet metal to be used.

The sheet metal worker carries out the operations such as cutting, folding, forming, fastening and assembling manually and by means of power machines.

The above requirements needs proper training and to know the basic principles of operation and process. All the advance technologies are developed from basic

principles only. The advance technologies facilitates for mass production, consistence in accuracy of product and the volume of needs.



Metals and non-metals

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

- state the different metals and their alloys
- state the different types of ferrous and non-ferrous metals
- state the difference between the metals and the non-metals
- state the different non-metals.

Metals are desirable materials for product manufacturing because of their many outstanding properties. For example, they are good conductors of heat and electricity, they are opaque, shiny, tough, ductile and they are easily machined.

Alloy metal is a mixture of two or more metals. Usually it consists of a base metal and a smaller amount of other metals. Metals are divided into two groups. The ferrous metals which have large percentage of iron and the non-ferrous metals which have little or no iron.

- 1 Cast iron is used for the heavy parts of many machines and to make castings. It contains 2 to 4 percent of carbon. The basic kinds of cast iron are white, grey, and malleable iron. They are very brittle. Cast irons are difficult to weld.
- 2 Wrought iron is almost pure iron. It contains only less amount of carbon. Wrought iron forges well, can easily be bent hot or cold and can be welded.

- 3 Carbon steels are classified by the amount of carbon, they contain.
 - a Low carbon steel, often called mild steel or soft steel contains 0.1 to 0.3 percent carbon. It is not suitable for heat treatment. This type of steel is available as black iron sheet, band iron, bars and rods, because it is easily welded, machined and formed.
 - b Medium carbon steel has 0.3 to 0.6 percent carbon. It is used for many standard machine parts.
 - c High carbon steel contains 0.6 to 1.7 percent carbon. It is used for making cutting tools, such as chisels, files, scribers, axe etc.
- 4 Alloy steels have special properties, which are determined by the mixture and the amount of other elements, particularly the metals added.

- a Nickel is added to increase the strength, toughness and resist corrosion.
- b Chromium adds hardness, toughness and resistance to wear. Gears and axles for example are often made of chromium nickel steel because of its strength.
- c Manganese is used in steel to produce a clean metal and adds strength to steel.
- d Silicon is often used to increase the resistance of steel for making springs.
- e Tungsten is used with chromium, vanadium, molybdenum or manganese to produce high speed steel, used in cutting tools.
- f Molybdenum acts tougher and adds strength to steel. It is used in making high speed steels.
- g Vanadium improves the grain of the steel. It is used with chromium to make Chrome-Vanadium steel from which transmission parts and gears are manufactured. This type of steel is very strong and has excellent shock resistance.

Methods of Identification of steel

Steels are identified by the number system, colour code and the spark test.

Non-Ferrous metals and Alloys

Aluminium

Bluish white metal, very light in weight with a specific gravity of 2.7 and a melting point of 658°C malleable and ductile at 100°C to 150°C. Good conductor of heat and electricity. Resists corrosion forms.

Uses

It is used in making utensils, electrical wires, engines and aeroplane bodies, Railway carriages, bus bodies, ship building etc. Nowadays aluminium sections are used in making partitions, sliding windows and doors.

Copper: It is reddish brown in colour. Soft, malleable and ductile metal with a specific gravity of 8.2 and a melting point of 1083°C. Good conductor of heat and electricity. Highly resistance to corrosion by liquids. Forms important alloys like bronze and gun metal. It can be cast forged or rolled.

Uses

It is used in making electric wires and cables, parts of electrical machinery, coins and house hold utensils like boilers, oil tubes etc.

Lead

Soft bluish grey metal with a specific gravity of 11.36 and a melting point of 326°C, malleable and ductile.

Uses

It is used for water pipes and sanitary fittings and to prepare soft solders and coating material for chemical containers.

Zinc

Bluish white grey in colour. It is a crystalline metal. Brittle at ordinary temperature but malleable and ductile between 100°C to 150°C. Good conductor of heat and electricity. Specific gravity 7.0 and melting point 420°C.

Uses

Used for galvanizing on iron sheets. Making dry cells cover and for making zinc points, forms a number of alloys like brass silver spelter, silver.

Tin

Silver white in colour, malleable and ductile metal. Specific gravity 7.8 and melting point 230°C.

Uses

It is used as protective covering for iron and steel sheets and pulleys.

It is used in ship building work. In ice rooms internal linings to protect from atmospheric effects and also for preparing alloys.

Brass

It is yellowish colour metal. Zinc varying from about 60% to 70%. Hardness of the alloy depends upon the amount of zinc percent in it. Malleable and ductile; resists corrosion.

Uses

It is extensively used for making household utensils. Water pumps and certain machine parts and for light metal casting.

Bronze

It is an alloy of 90% copper and 10% tin easily machined and cast. Resists corrosion and takes a fine polish. It is also tough. It has good electrical and thermal conductivity.

Uses

It is used in the manufacture of household utensils and coins. It is used for bearings especially where corrosion resistance is required. Used in making engineering parts like worm wheel, basement of machine tools.

Gun metal

Copper 88%, Tin 10%, Zinc 2%. It is tough, strong and hard, high corrosion resistance. Bearing and wearing qualities are high. Zinc promotes fluidity and so it is suitable for castings.

Uses

It is used for making minor accessories, bearings, glands, steam pipes, fittings and gears.

Muntz metal: Muntz metal consists of 60% copper and 40% zinc. Muntz metal primarily is hot working alloy is used where cold working is not required. This

metal possess good mechanical properties, combining strength with ductility, corrosion resistance is very good. This brass is having pleasing colour. This yellow brass is invented by George F. Mumtaz in 1832.

White metal: White metal is an alloy of lead, antimony, tin, and copper employed for machine bearings, packings and linings to the low melting point alloys. It is used for toys, ornaments and fusible metals and to the type metal. White metal consists of 85% copper, 5% antimony, and 10% tin.

Phosphorous bronze: Tin 10% to 14% phosphorous 0.3 to 1% remaining copper. It is having good tensile strength. Very high corrosion resistance and excellent bearing quality.

Uses: It is used for bearing, gears, worm wheels, slide valves, springs etc.

Silver: A white metal symbol (Ag) specific gravity is 10.7 and the melting point is 964°C. Sterling silver is applied only to the specific silver-copper alloy.

Uses: It is used to prepare spelters for silver solder. It is also used for making ornaments and jewellery.

Gold: It is a royal metal, bright yellow in colour, very malleable and ductile. It is very soft in its purest form hence it is alloyed with copper to make it hard and ductile to make it suitable for ornamental works. Pure gold is having 24 carats. Melting point of gold is the best conductor of electricity.

Uses: It is commonly used in making ornaments and jewellery and it is also used for electrical contacts in radars, rockets as special applications.

Copper and its alloys: Metals without iron are called non-ferrous metals. Eg. Copper, Aluminium, Zinc, Lead and Tin.

Copper: This is extracted from its ores 'MALACHITE' which contains about 55% copper and 'PYRITES' which contains about 32% copper.

Properties: Reddish in colour. Copper is easily distinguishable because of its colour.

The structure when fractured is granular, but when forged or rolled is fibrous.

It is very malleable and ductile and can be made into sheets or wires.

It is a good conductor of electricity. Copper is extensively used as electrical cables and parts of electrical apparatus which conduct electric current.

Copper is a good conductor of heat and also highly resistant to corrosion. For this reason it is used for boiler fire boxes, water heating apparatus, water pipes and vessels in brewery and chemical plants. Also used for making soldering iron.

The melting temperature of copper is 1083°C.

The tensile strength of copper can be increased by hammering or rolling.

Copper alloys

Brass: It is an alloy of copper and zinc. For certain types of brass small quantities of tin or lead are added. The colour of the brass depends on the percentage of the alloying elements. The colour is yellow or light yellow, or nearly white. It can be easily machined. Brass is also corrosion-resistant.

Brass is widely used for making motor car radiator core and water taps etc. It is also used in gas welding for hard soldering/brazing. The melting point of brass ranges from 880 to 930°C.

Brasses of different composition are made for various applications.

Bronze: Bronze is basically an alloy of copper and tin. Sometimes zinc is also added for achieving certain special properties. Its colour ranges from red to yellow. The melting point of bronze is about 1005°C. It is harder than brass. It can be easily machined with sharp tools. The chip produced is granular. Special bronze alloys are used as brazing rods.

Bronze of different compositions are available for various applications.

Lead and its alloys: Lead is a very commonly used non-ferrous metal and has a variety of industrial applications.

Lead is produced from its ore 'GALENA'. Lead is a heavy metal that is silvery in colour when molten. It is soft and malleable and has good resistance to corrosion. It is a good insulator against nuclear radiation. Lead is resistant to many acids like sulphuric acid and hydrochloric acid.

It is used in car batteries, in the preparation of solders etc. It is also used in the preparation of paints.

Lead alloys

Babbitt metal: Babbitt metal is an alloy of lead, tin, copper and antimony. It is a soft, anti-friction alloy, often used as bearings.

An alloy of lead and tin is used as 'soft solder'.

Zinc and its alloys: Zinc is a commonly used metal for coating on steel to prevent corrosion. Examples are steel buckets, galvanized roofing sheets, etc.

Zinc is obtained from the ore-calamine or blende.

Its melting point is 420°C.

It is brittle and softens on heating; it is also corrosion-resistant. It is due to this reason it is used for battery containers and is coated on roofing sheets etc.

Galvanized iron sheets are coated with zinc.

Tin and Tin alloys

Tin: Tin is produced from cassiterite or tinstone. It is silvery white in appearance, and the melting point is 231°C. It is soft and highly corrosion-resistant.

It is mainly used as a coating on steel sheets for the production of food containers. It is also used with other metals, to form alloys.

Eg. Tin with copper to form bronze. Tin with lead to form solder. Tin with copper, lead and antimony to form Babbit metal.

Aluminium: Aluminium is a non-ferrous metal which is extracted from 'Bauxite'. Aluminium is white or whitish grey in colour. It has a melting point of 660°C. Aluminium has high electrical and thermal conductivity. It is soft

and ductile, and has low tensile strength. Aluminium is very widely used in aircraft industry and fabrication work because of its lightness. Its application in the electrical industry is also on the increase. It is also very much in use in household heating appliances.

Non-Metals: Materials that are non-conductors of electricity are called non-metals.

Wood, Rubber, PVC, Porcelain, Mica, glass, fiber glass, graphite etc are examples of non-metals.

Physical and mechanical properties of metals

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

- state the different physical properties of metals
- state the mechanical properties of metals.

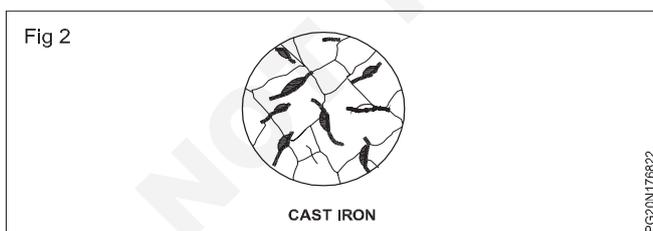
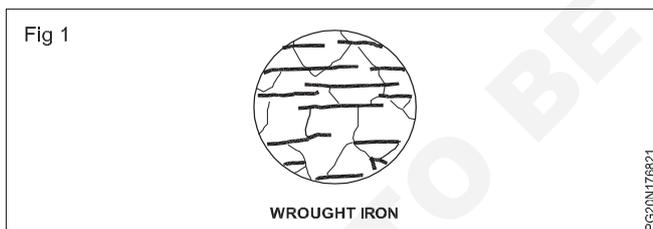
Properties of metals: Metals have different properties. Depending on the type of application, different metals are selected.

Physical properties of metals

Colour: Different metals have different colours. For example, copper is of a distinctive red colour. Mild steel is of a blue/black colour.

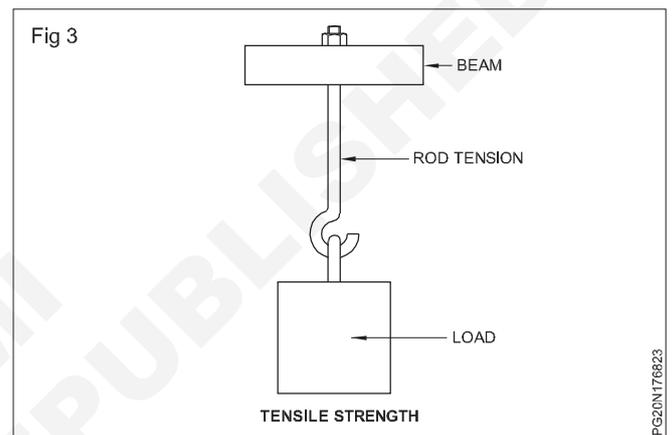
Weight: Metals have different weights. A metal, like aluminium is lighter (specific gravity 2.8) than many others and a metal like lead, is heavy (specific gravity 9)

Structure (Figs 1 & 2): Generally metals can also be differentiated by their internal micro structure. Metals like wrought iron and aluminium have a fibrous structure, and metals like cast iron and bronze have a granular structure.

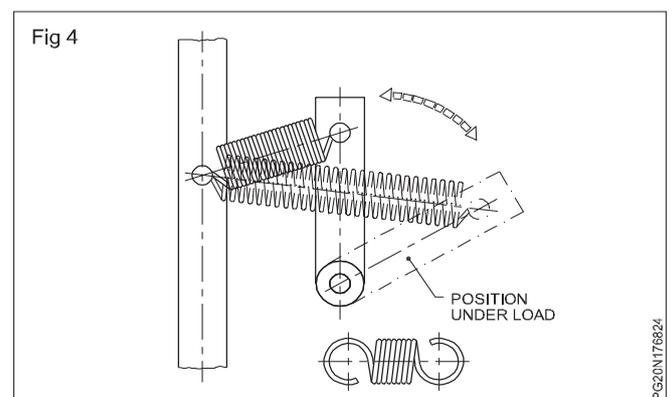


Conductivity: Thermal conductivity and electrical conductivity are the measure of the ability of a material to conduct heat and electricity. Conductivity will vary from metal to metal. Copper and aluminium are good conductors of both heat and electricity. Copper is used for soldering irons and electrical conductors.

Tenacity (Fig 3): Tenacity of a metal is its ability to resist the effect of the tensile forces without rupture. Mild steel, wrought iron and steel are examples of tenacious metals.



Elasticity (Fig 4): Elasticity of a metal is the property of returning to its original shape after the applied force is released. Properly heat treated spring is a good example of elasticity.



Machinability: Metal which can be easily machined and gives a longer tool life, better surface finish, at maximum cutting speed is said to be a good machineable metal.

Example: Aluminium is a good machineable metal in comparison with cast iron. Cast iron is a good machineable metal in comparison with cast steel.

Technical terms in sheet metal work

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

- state the meaning of various terms used in sheet metal work.
-

- 1 Beading:** The process of raising a strip of metal around the end of a round pipe.
- 2 Bench machines:** Machines clamped to a bench and operated by turning a crank. Used by the sheet metal worker to turn edges on circles and round pipes.
- 3 Bench stakes:** Steel anvils of various specialized shapes that the sheet metal worker uses to form and seam sheet metal objects.
- 4 Black iron:** Iron and steel sheets covered with an oxidized coating only.
- 5 Braising:** The process of stretching a piece of metal by hitting it with a round head hammer, as in forming a bowl.
- 6 Brake:** A machine that the sheet metal worker uses for bending and folding edges on metal.
- 7 Burring:** The process of turning an edge on a circular piece of metal.
- 8 Clips:** Special strips of sheet metal bent in a manner to connect two pieces of sheet metal duct.
- 9 Crimping:** The process of corrugating the end of a round pipe to make it smaller so it will fit into the end of another pipe.
- 10 Cut acid:** Zinc chloride, made by putting strips of zinc in hydrochloric acid.
- 11 Edges:** Bends on the edges of sheet metal to eliminate sharp edges and provide stiffening.
- 12 Embossing:** A stamping process that produces a shallow relief design on sheet metal.
- 13 Flux:** Chemical used to clean metal and remove the oxides from the metal surface prior to soldering.
- 14 Forming:** The process of rolling sheet metal into pipe or making bends to form objects.
- 15 Gage:** The system of classifying the thickness in which sheet metal is produced. Also a tool used for measuring and determining the thickness of a metal sheet.
- 16 Hem:** A folded edge on a sheet metal object.
- 17 Layout work:** The process of developing the pattern for a sheet metal object.
- 18 Longitudinal seam:** A seam running the long length of a pipe.
- 19 Miter:** The joining of two pieces at an evenly divided angle.
- 20 Nibble:** Nibble to piece metal along or on its edge.
- 21 Oxides of metal:** A chemical formed by a combination of the oxygen in the air with the metal. Iron rust is iron oxide.
- 22 Parallel line development:** A method of pattern drafting employing parallel lines.
- 23 Pattern:** The shape of an object to be made out of sheet metal as it appears when marked out on the flat sheet. Also, the exact size and shape that a piece of sheet metal must be in order to be formed into the object desired.
- 24 Pickle:** To clean dirt and oxide from metal by immersing it in an acid bath.
- 25 Pictorial drawings:** A drawing of an object in three dimensions as it actually appears after being formed into shape.
- 26 Pierce:** To cut out interior waste stock from a metal part with a die.
- 27 Planish:** To make a metal surface smooth by hammering it over a stake or block.
- 28 Press brake:** A power machine used by the sheet metal worker to form sheet metal.
- 29 Press forming:** Creating sheet metal products using dies to cut and shape the metal and presses to power the dies. Also called stamping.
- 30 Primer:** A first coat of finish on a metal, it binds and adheres to the metal giving good base for later coats.
- 31 Punching:** The process of making holes in sheet metal by the use of dies.
- 32 PVC (polyvinyl/chloride):** A plastic often used for hoods and tanks that require high corrosion resistance.
- 33 Radial line development:** A method of pattern drafting using lines radiating from a center and using arcs.
- 34 Raw acid:** Hydrochloric acid (HCl)
- 35 Rivets:** Fasteners used to join two pieces of sheet metal together. The rivet is inserted in a hole and a head is formed by pounding the rivet with a hammer.
- 36 Seams:** Various types of bent and hooked edges used to join two pieces of sheet metal. For lighter sheet metal, mechanical joints are used. In medium and heavy gage metal, a riveted or welded seam is used.
- 37 Seam welding:** A kind of resistance welding in which rollers are used instead of electrodes.

38 Sheet metal: Any type of metal sheets that are 1/8" thick or less.

39 Sheet metal screws: Special screws used for joining sheet metal. Also called self-tapping because the screws tap their own threads in the drilled hole.

40 Overlapping parts: Resistance to electricity generates heat producing the weld.

41 Square-to-round: The name of a common sheet metal fitting that is square or rectangular on one end and round on the other end.

42 Stainless steel: A special steel containing other types of metals such as chromium, nickel and molybdenum. There are many types of stainless steel sheets. All of them vary in corrosion resistance.

43 Swage: A special forging tool used for smoothening and finishing.

44 Sweat soldering: The process of soldering two pieces of metal together by making the solder "sweat" completely through the seam.

45 Tinning: Covering an area of metal with molten solder.

46 Transition piece: A sheet metal fitting that changes size or shape from one end to the other.

47 Triangulation: A method of pattern drafting employing the use of triangles.

48 Wired edge: A sheet metal edge folded around a piece of wire for added strength.

Tools & equipments used in sheet metal worker

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

- know about measuring tools
- know about marking tools
- know about production tools
- know about machines & appliances.
- know about the draw the free and sketch.

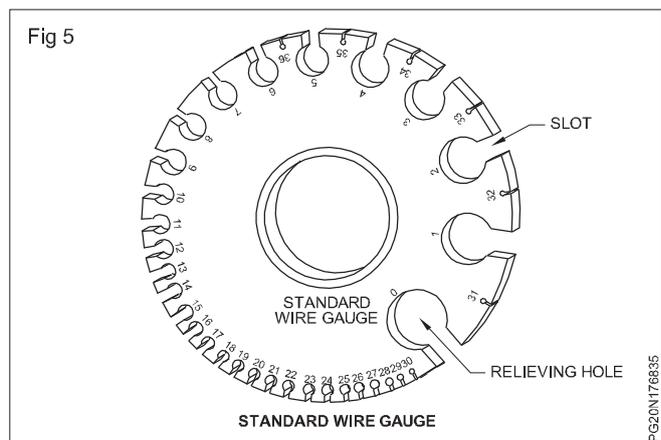
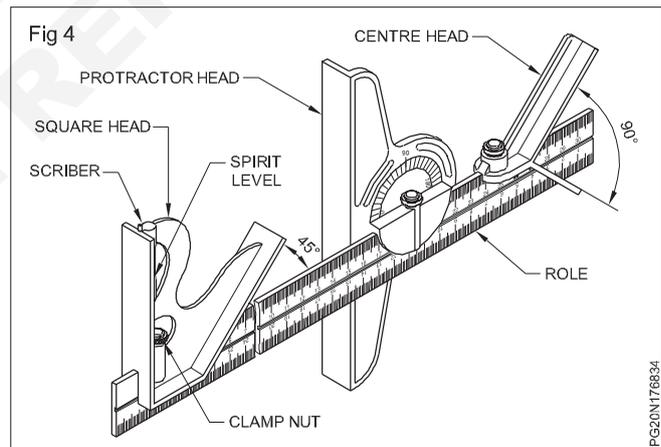
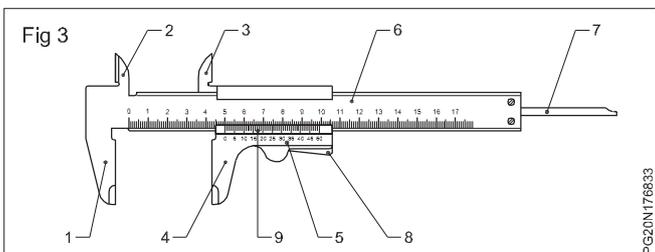
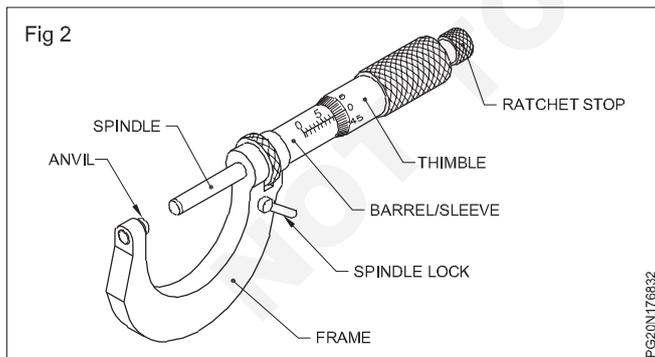
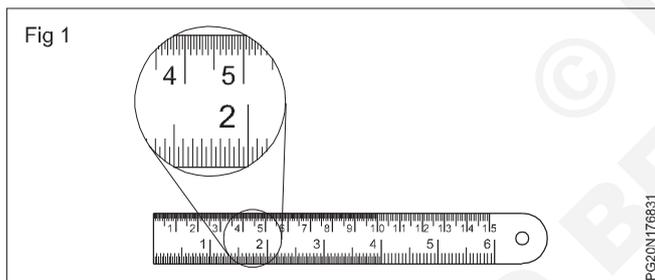
Measuring Tools	Marking Tools	Machines & Equipments
Steel Rule	Vernier IT gauge	Machines & Equipment
Micro meter	Straight Edge	Electric hand drill(light)
Vernier caliper	Try Square	Electric hand drill (heavy)
Combination set	Tinman's square	Phenmatic hand drill
Standard wire gauge	Straight Scriber	Soldering iron
Radius gauge	Bend Scriber	Gas heated soldering copper
Screw pitah gauge	Scratch AWL	St. soldering copper with handle
Com pass	Center punch	Adjustable soldering bit
Temmy caliper	Dot punch	Handy soldering copper bit
Templates	Prick punch	Electric copper soldering iron
Trammel		Lazy tong
Beam Trammel		Ratchet drilling m/c
Surface plate		Pedestal type spot weld
		Hand lever shear
		Breast drilling m/c
		Blow lamp

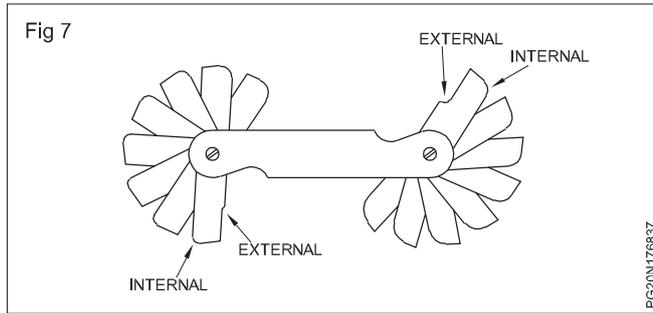
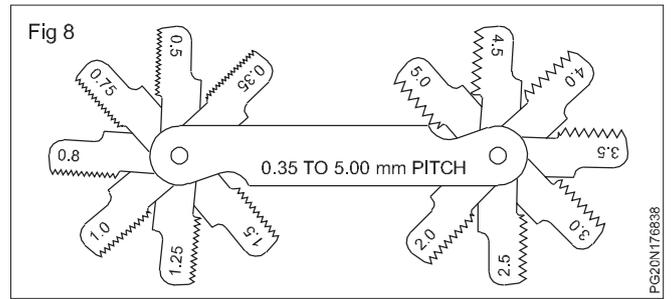
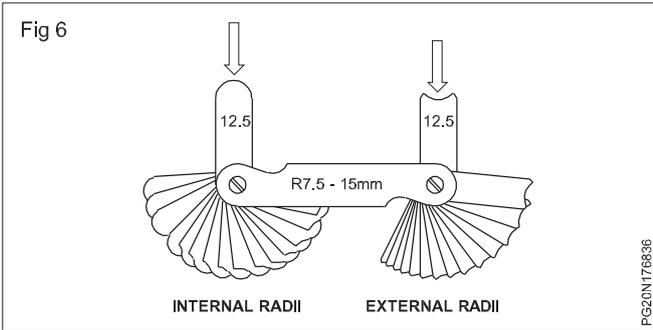
Production Tools

Wooden mallet	Peening hammer	Round bottom stake	Revolving bench plate
Proofing mallet	Tarmean's shear	Half moon stake	'C' clamp
End-patched mallet	Universal combination or Gillow shear	Funnel stake	Angle iron
Raw hide mallet	Pipe shear	Beak or Bick iron stake	Folding bars
Ball pein hammer	Scotch shear	Casting iron	Solid punch
Cross peen hammer	Block shear	Tinman's Hosse	Hollow Punch
Straight peen hammer	Roudes shear	Round bottom wead	Tinner's hand punch
Setting hammer	Straight scrips	Amil lead	Grow hand punch
Rivetting hammer	Bend scrips	Half moon head	Hand lever punch
Creasing hammer	Hauvk-billed shear	Round head	Hand Riveter
Stretching hammer	Aviation shear	Triman's Anvil	Pop Riveter
Hollowing hammer	Bench shear	Universal stake holder	Blويد rivetting equipment
Bullet hammer	Double cutting shear	Copper smith stake	File
Olanishing/Plateneming hammer	Electric portable shear	Hand leaver	Chisel
		Bar folder m/c	Hacksaw
		Bench plate	Groover

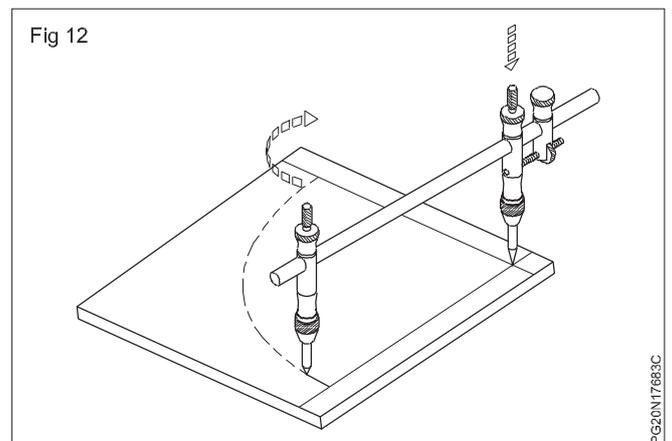
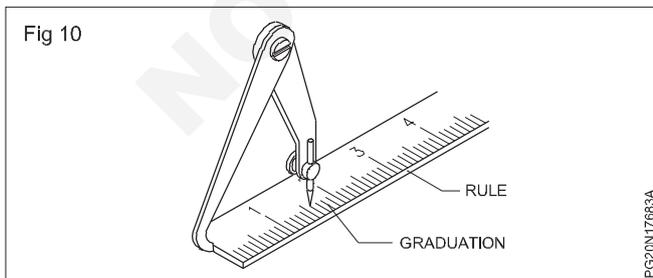
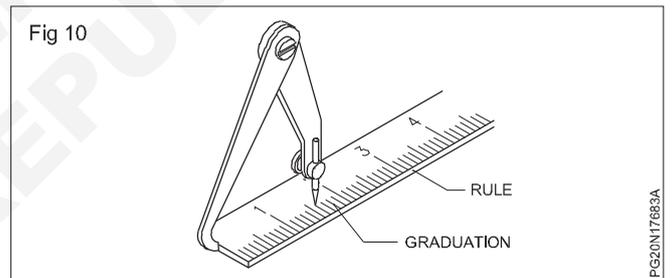
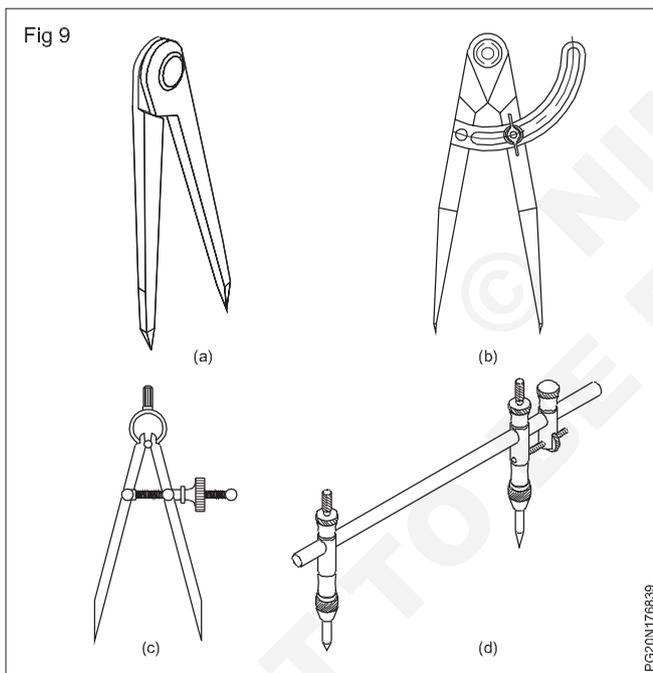
TOOLS & EQUIPMENT FOR SHEET METALWORKER

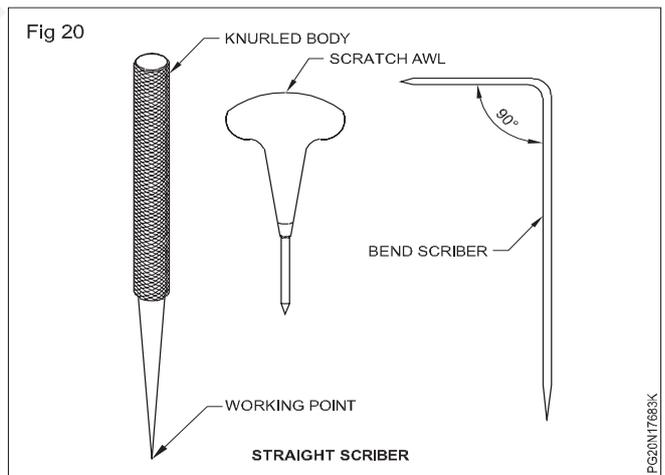
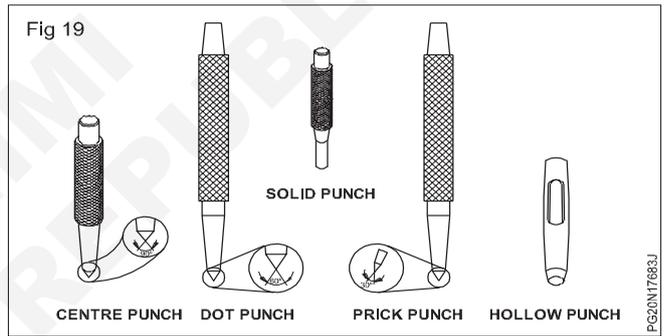
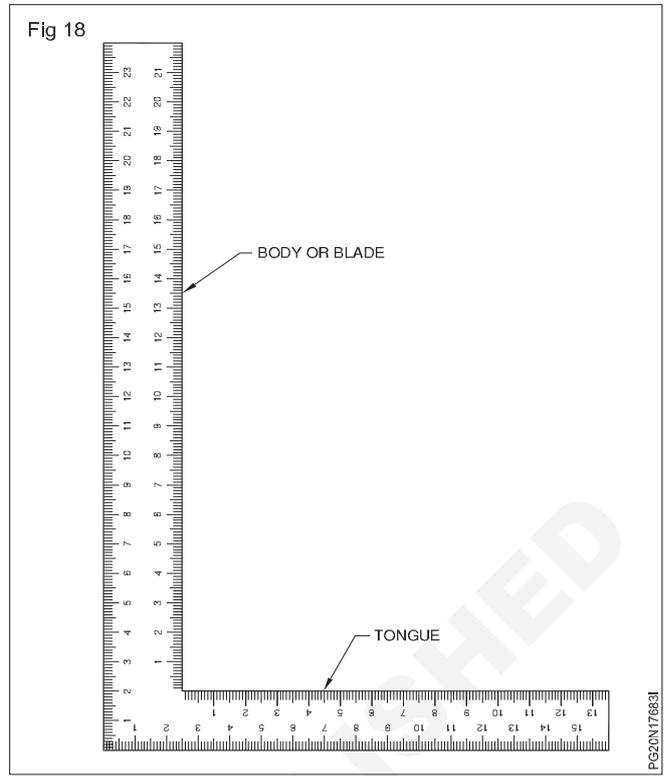
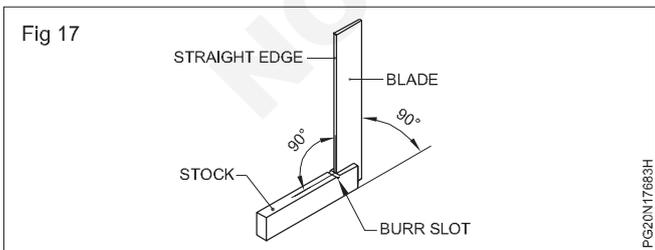
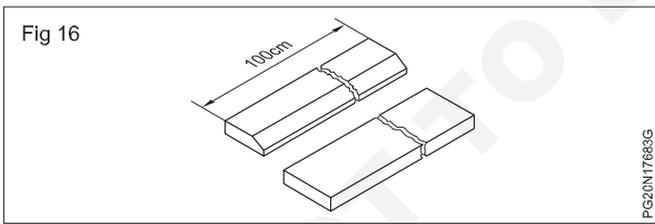
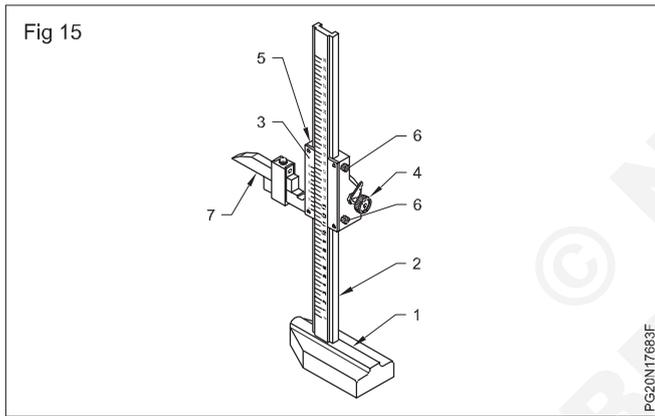
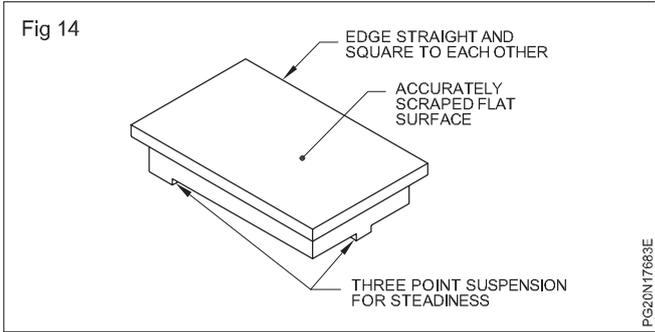
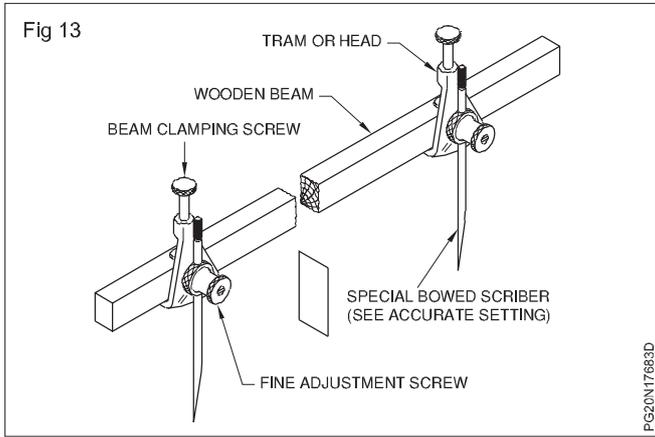
MEASURING TOOLS (Figs 1 to 8)



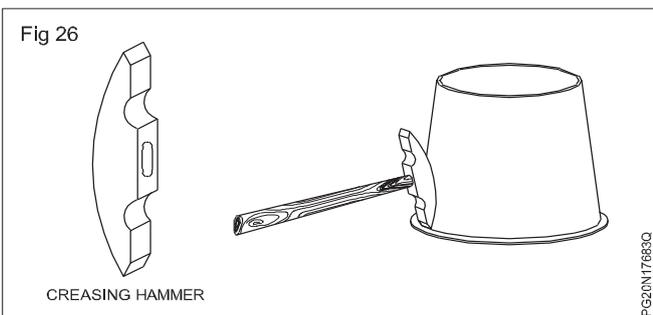
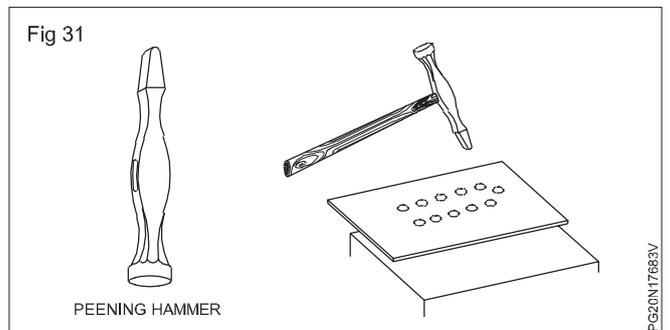
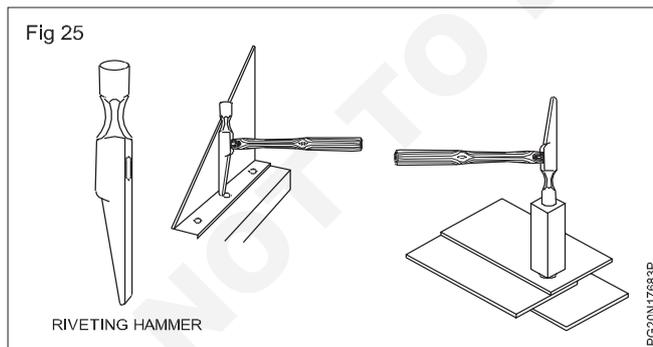
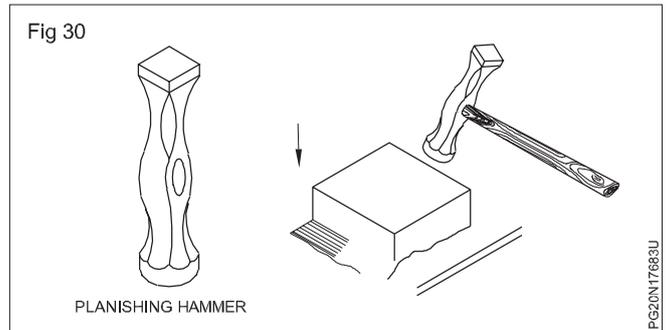
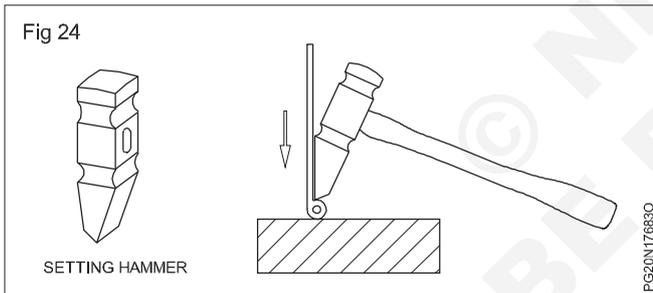
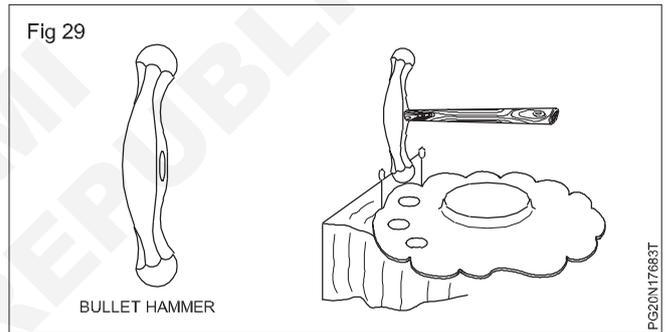
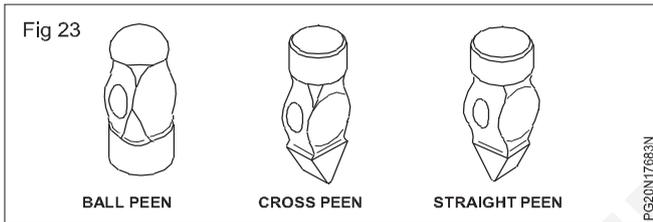
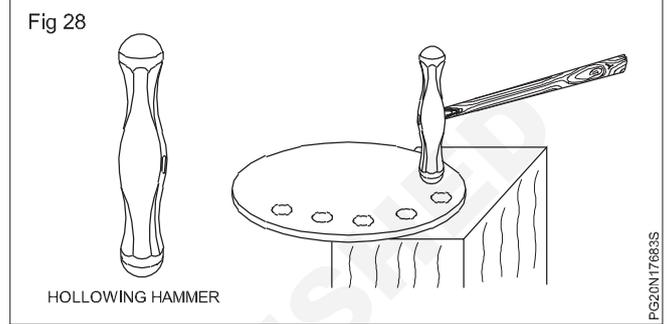
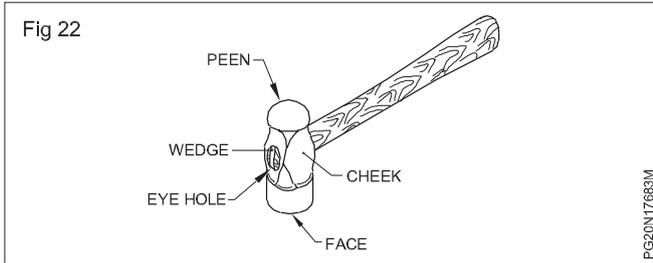
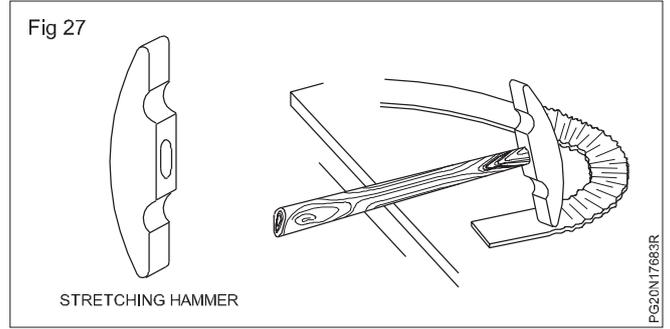
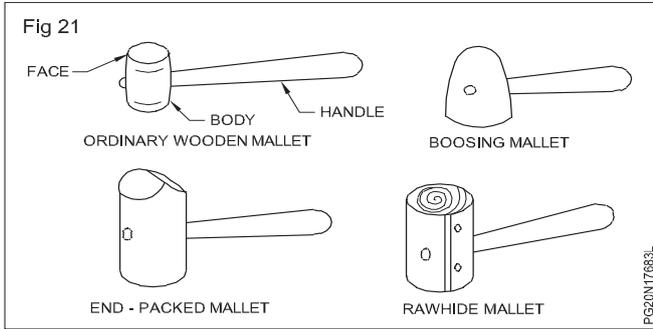


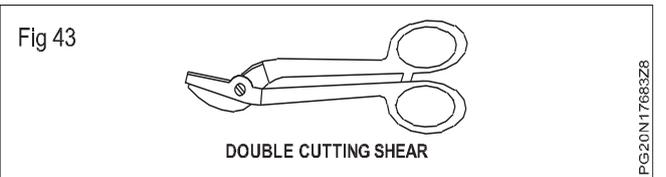
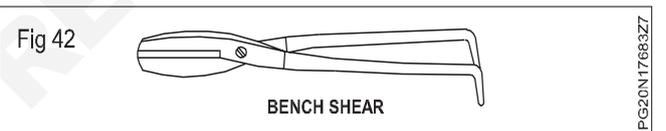
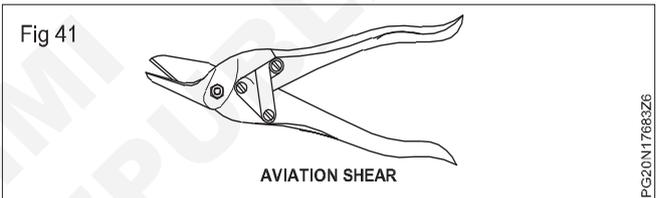
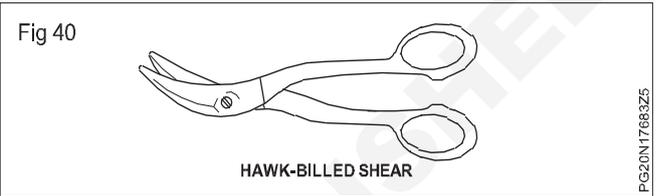
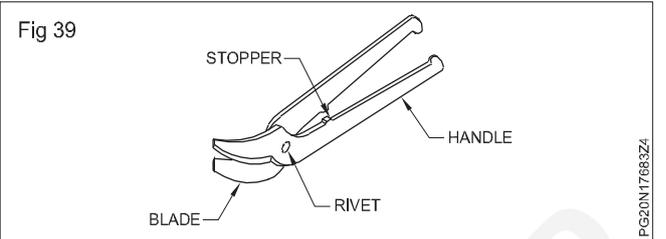
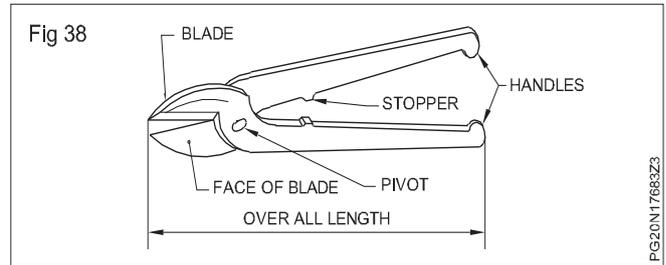
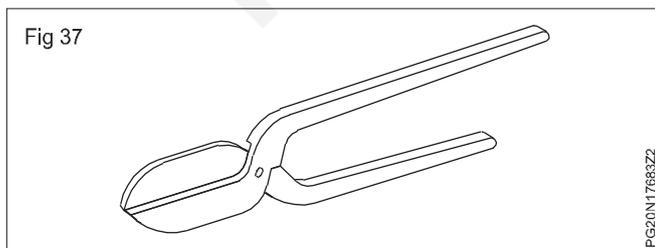
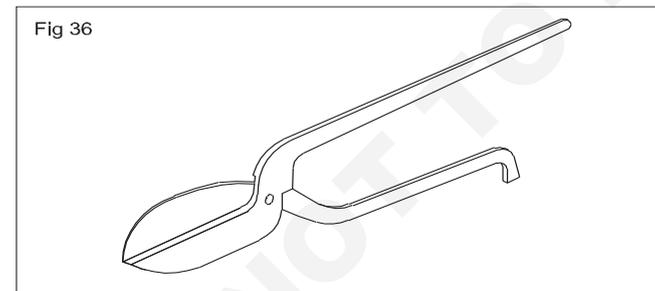
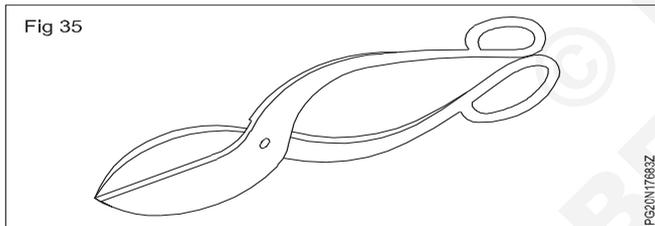
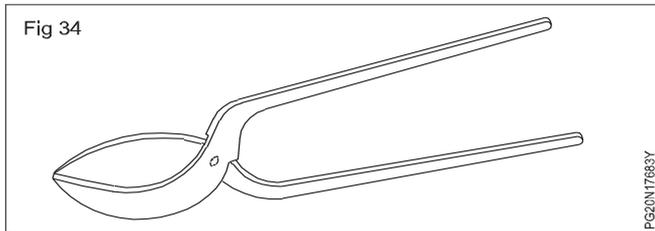
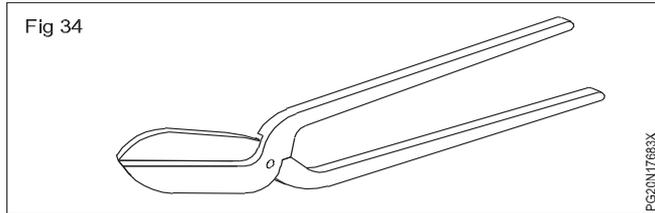
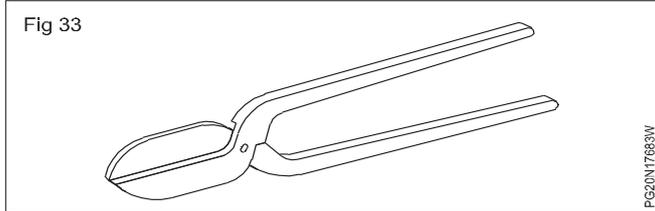
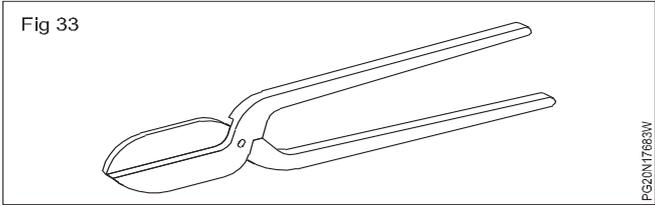
MARKING TOOLS (Figs 9 to 20)

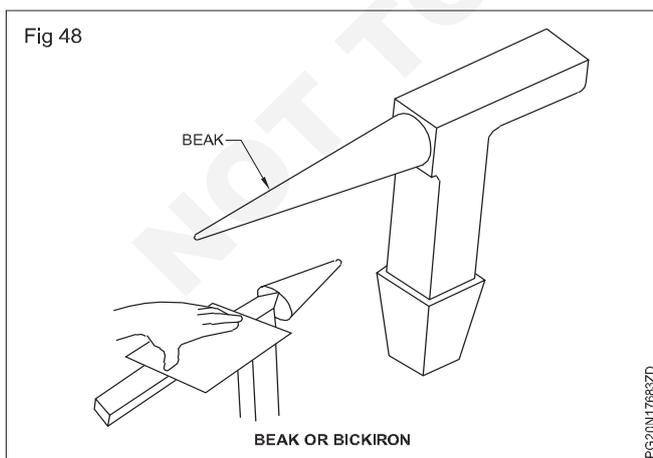
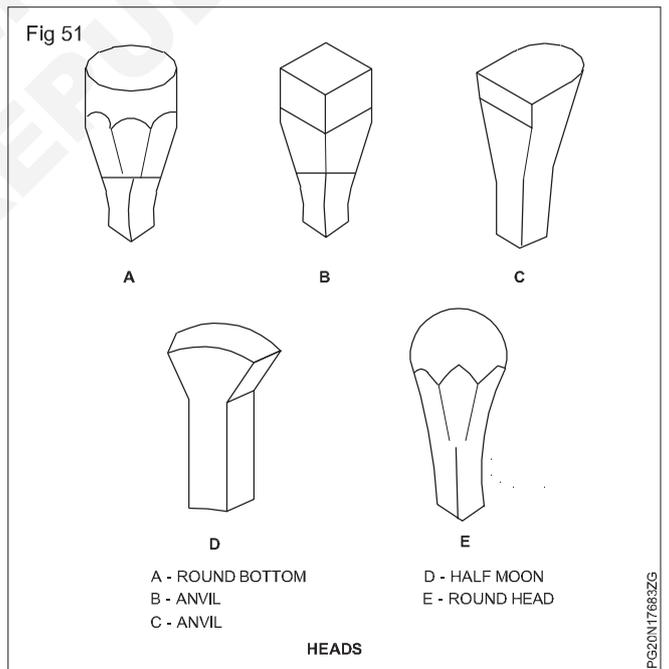
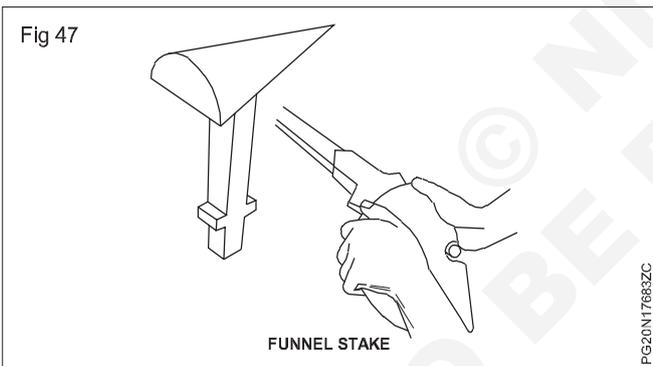
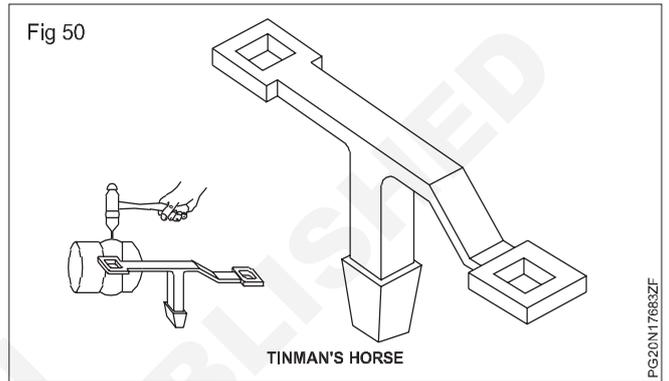
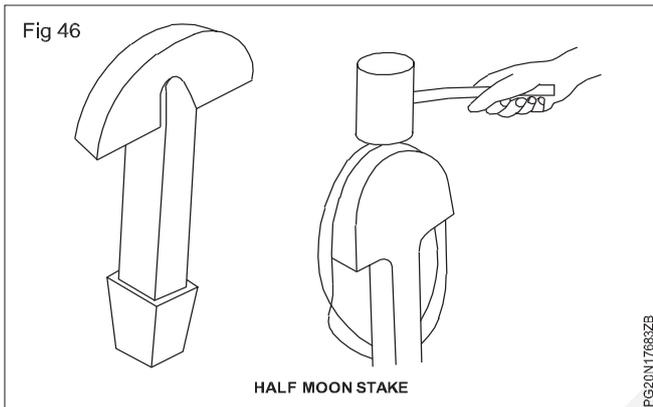
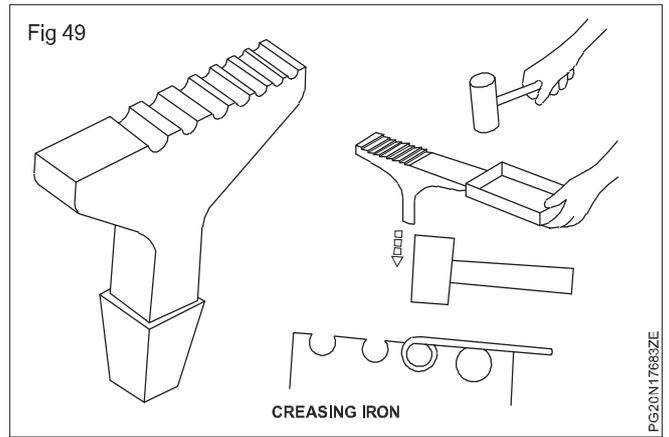
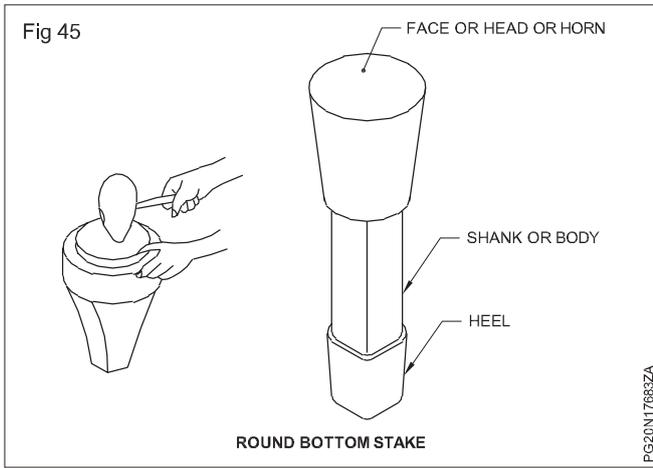


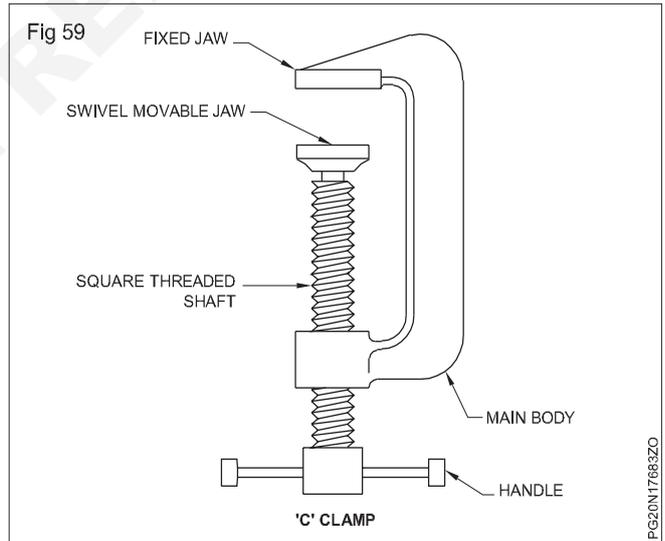
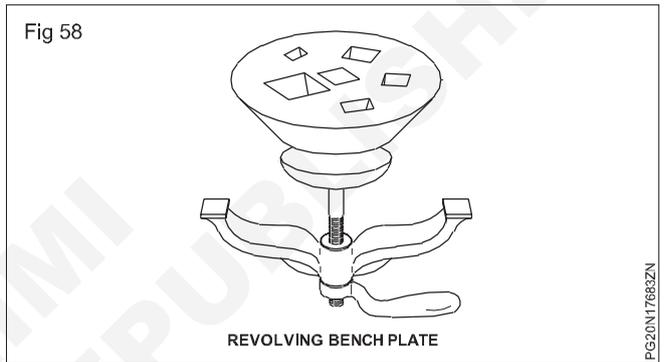
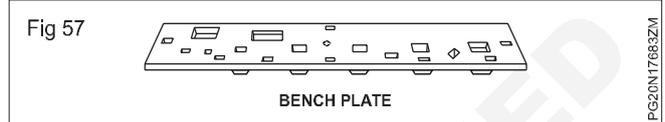
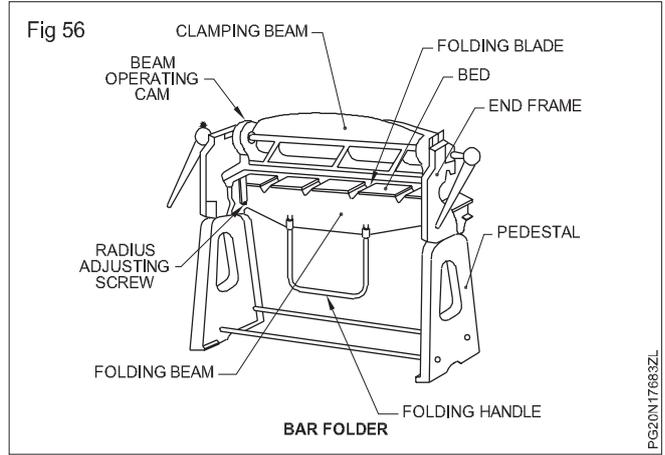
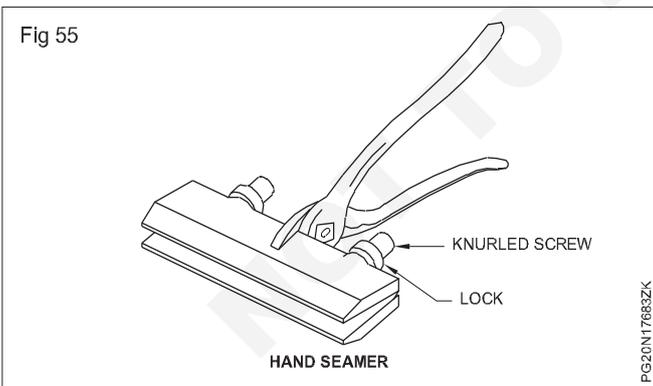
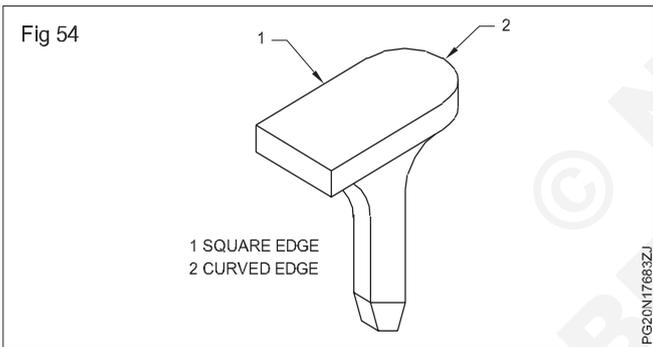
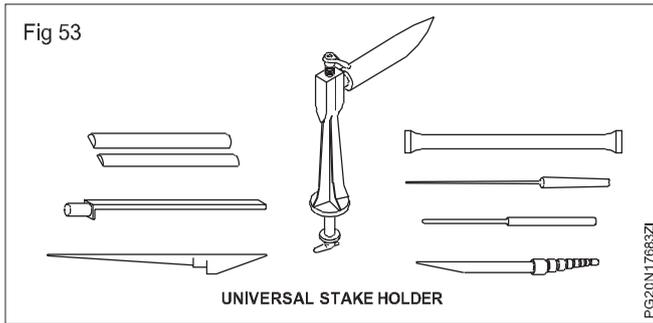
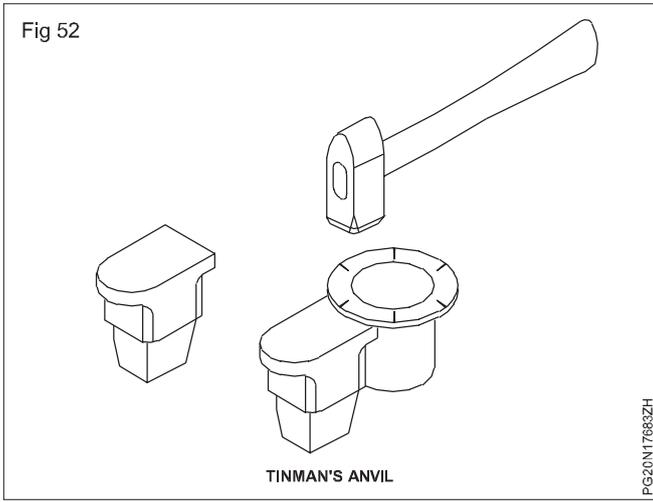


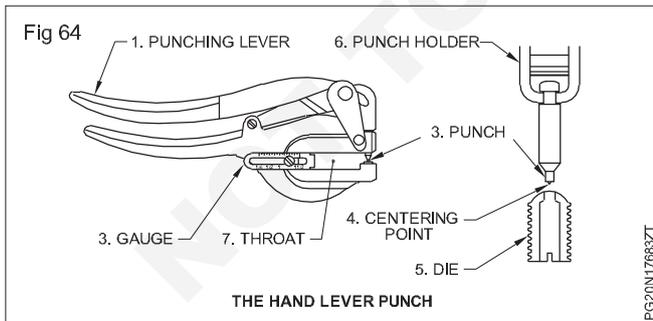
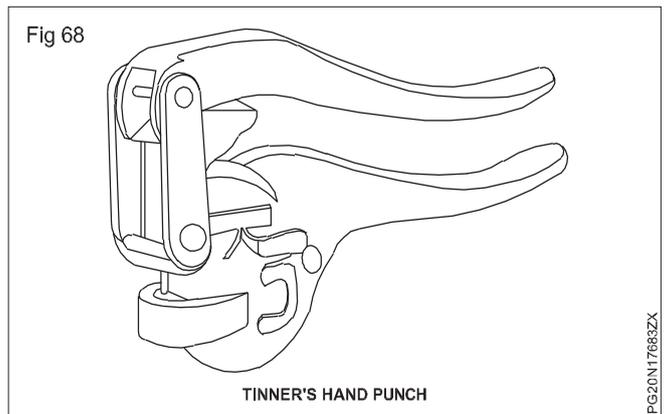
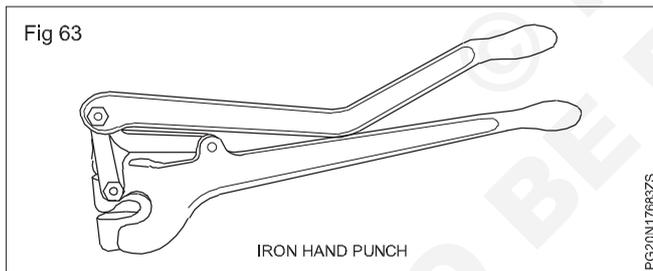
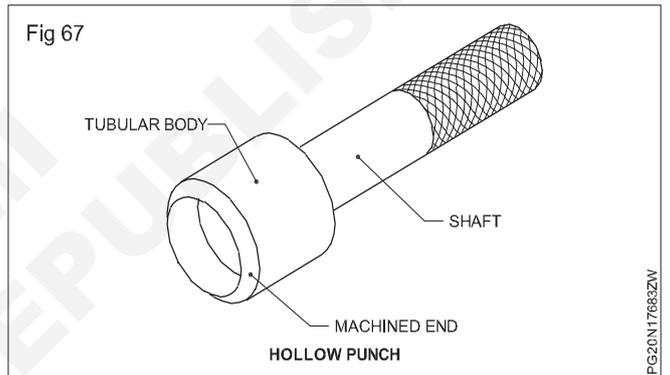
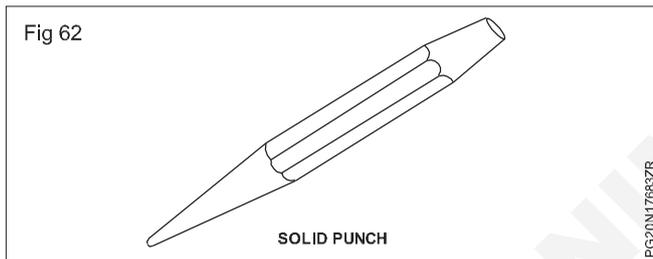
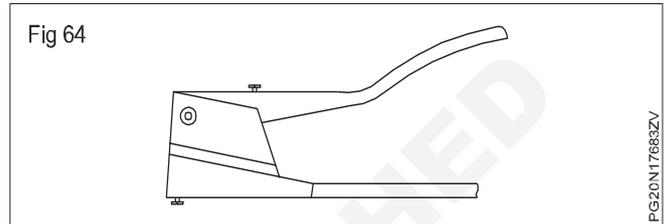
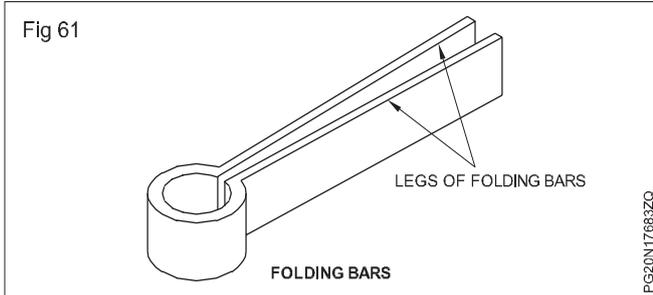
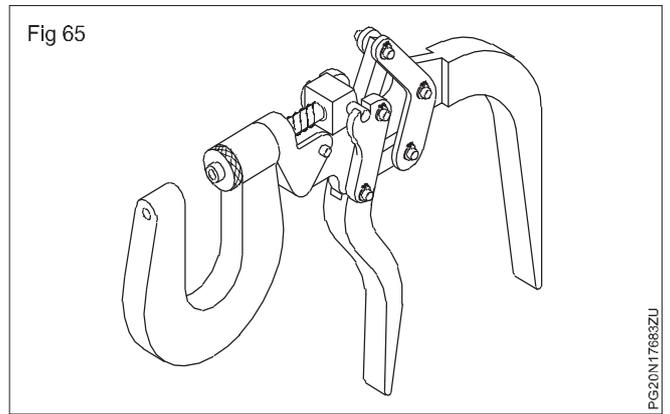
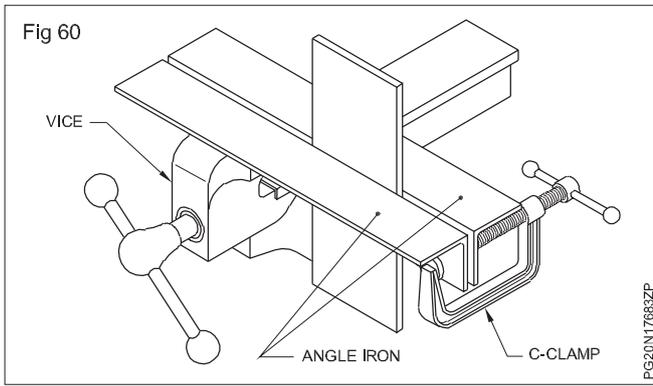
PRODUCTION TOOLS (Figs 21 to 73)

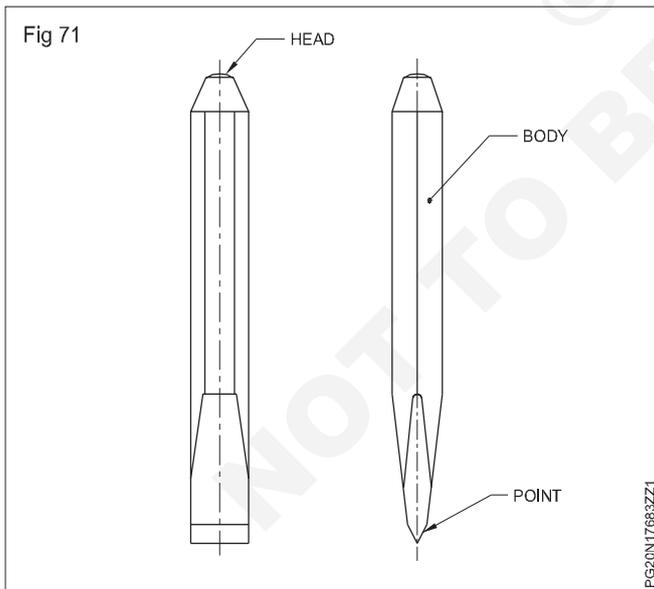
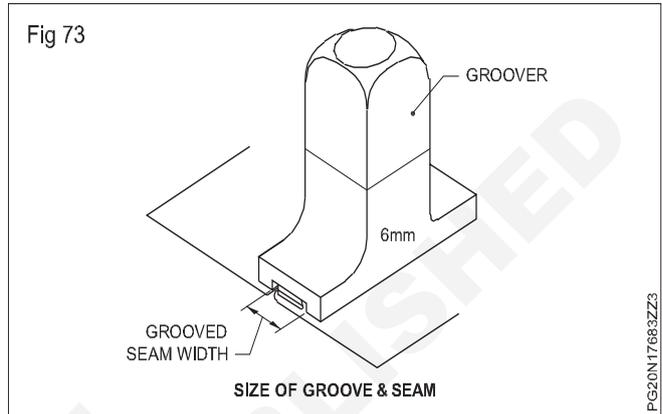
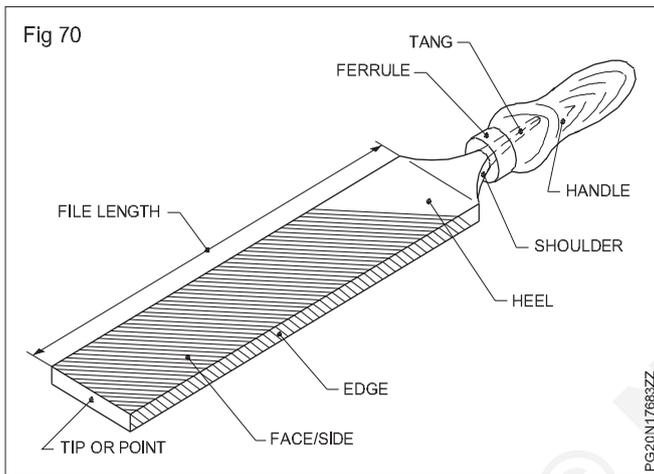
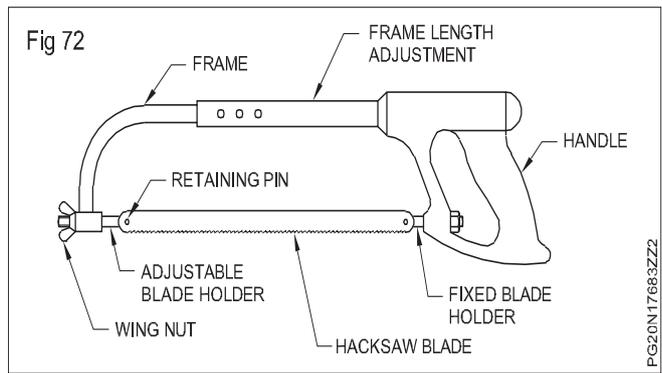
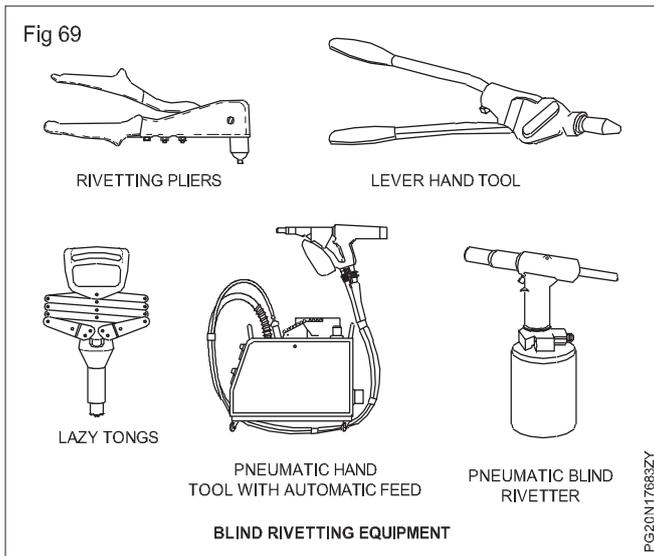












MACHINES AND APPLIANCES TOOLS (Figs 74 to 91)

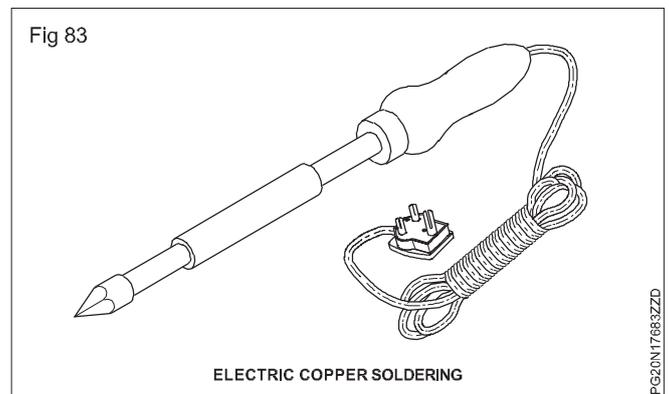
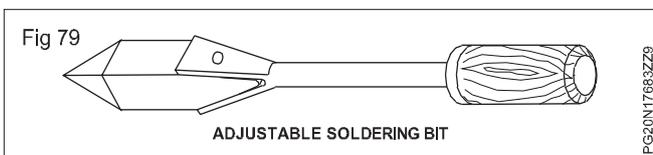
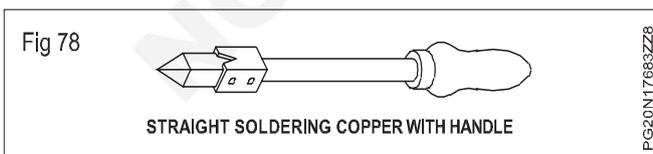
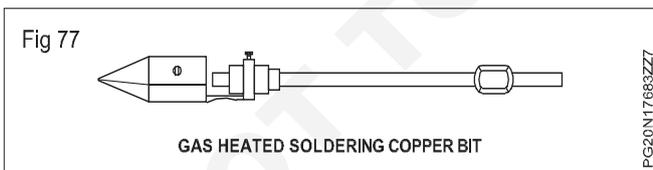
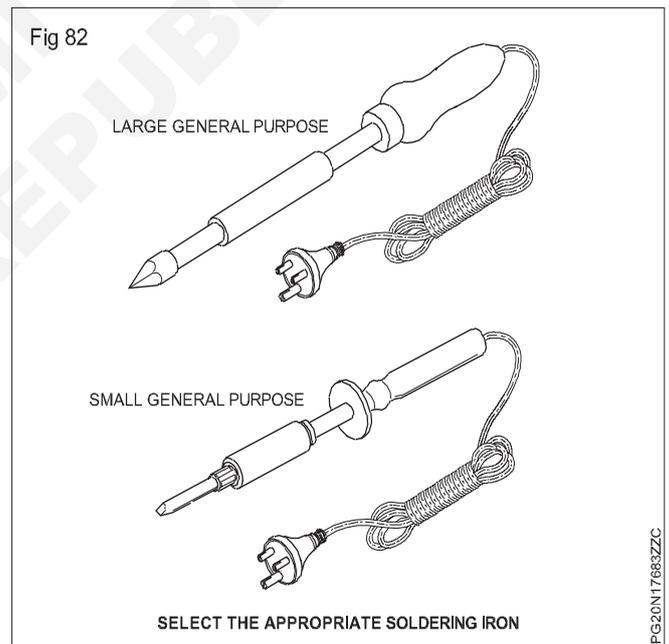
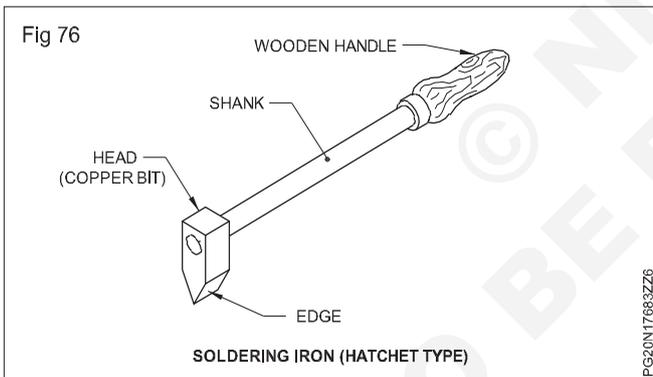
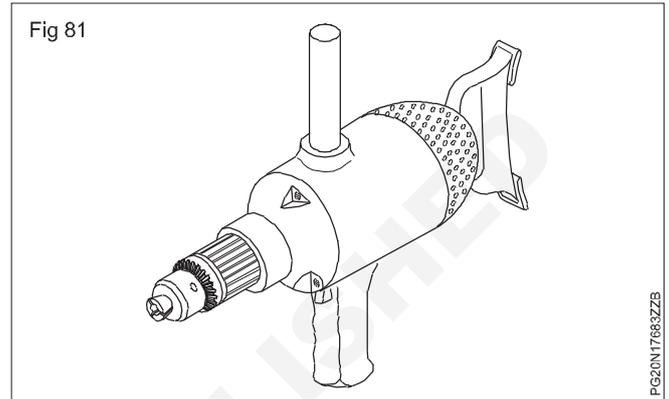
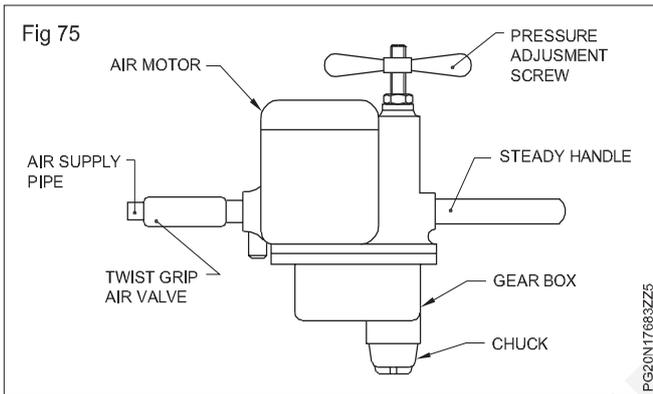
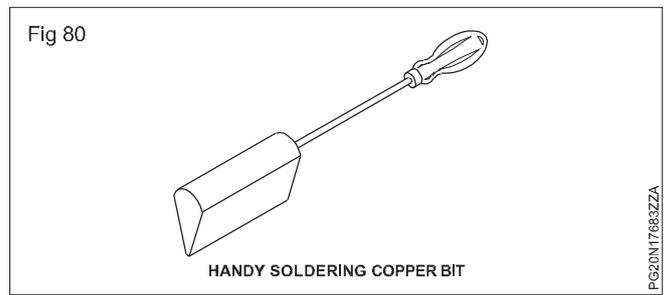
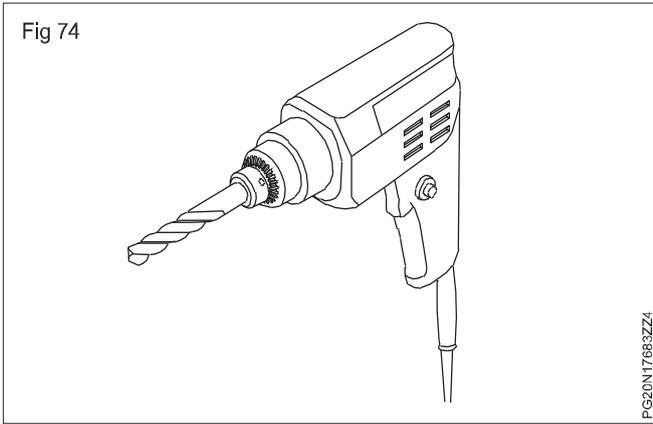
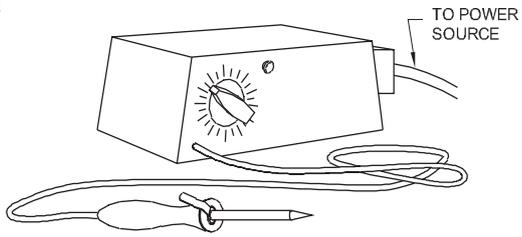


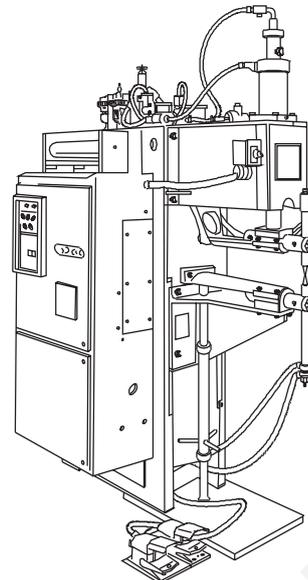
Fig 84



TRANSFORMER TYPE ELECTRIC SOLDERING IRON

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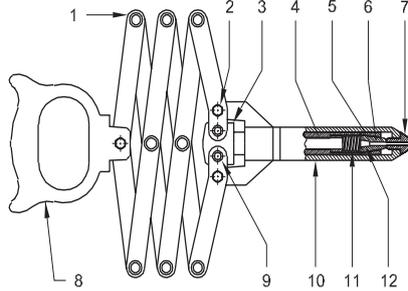
Fig 87



PEDESTAL TYPE SPOT WELDER

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Fig 85

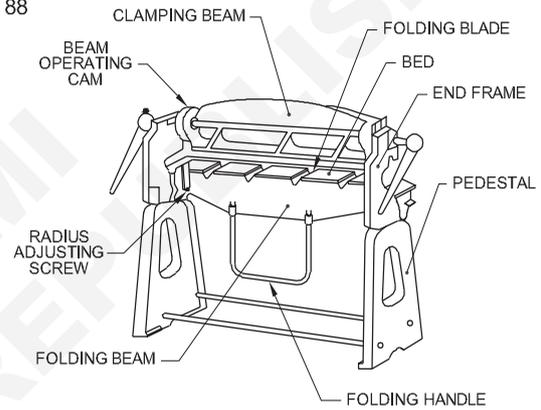


PARTS LIST OF LAZY TONG

NO.	DESCRIPTION	QTY.
1	LINKAGES	1 SET
2	LOCK NUT	2
3	YOKE	1
4	POWER COUPLING	1
5	JAW CASE	1
6	JAWS	1 SET
7	NOSE PIECE	1
8	HANDLE	1
9	FULCRUM PINS	2
10	BODY	1
11	JAW PUSHER SPRING	1
12	JAW PUSHER	1

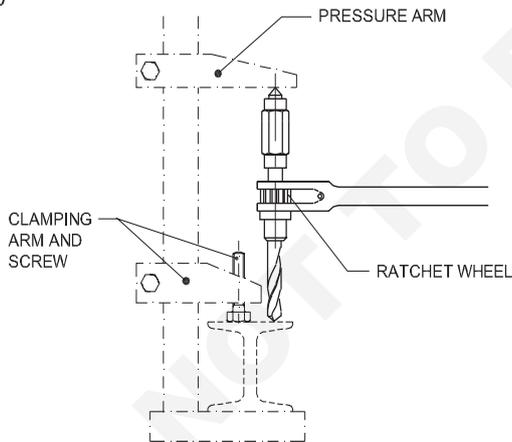
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Fig 88



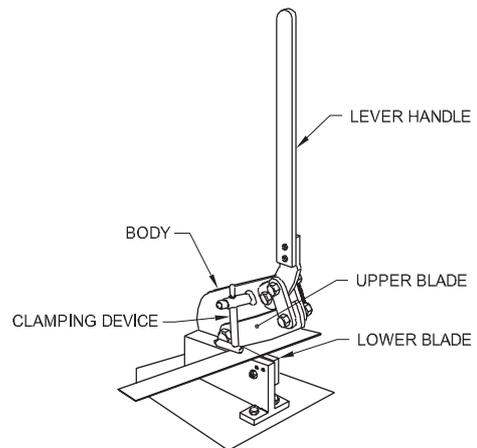
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Fig 86

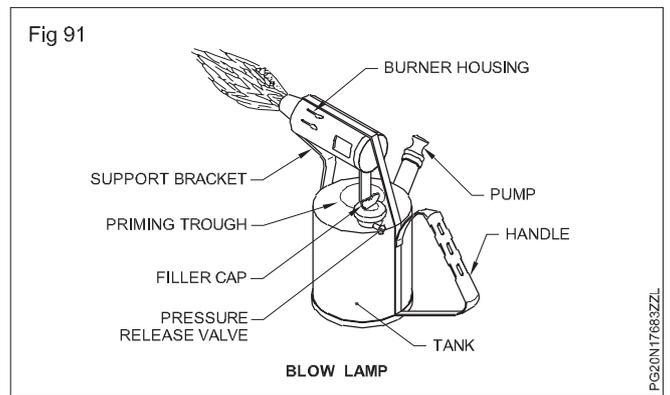
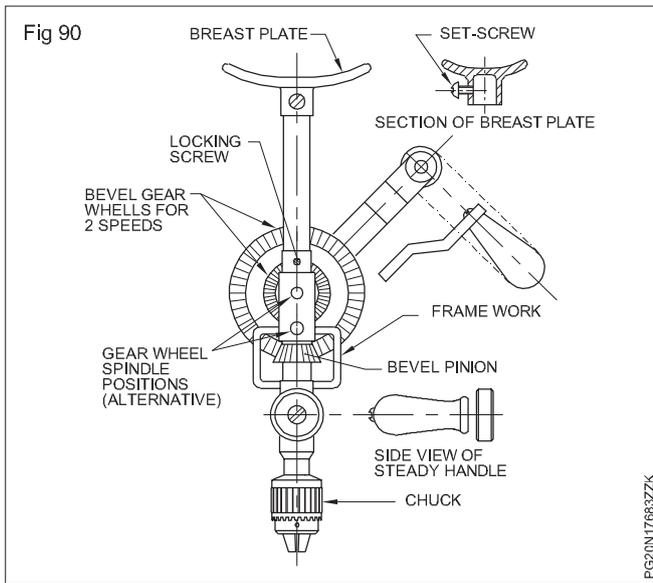


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Fig 89



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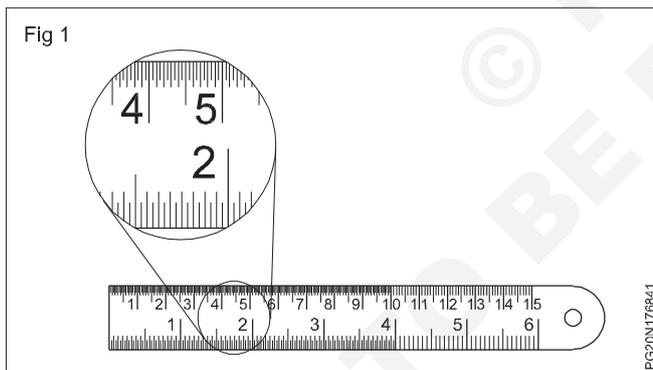


Measuring and marking tool

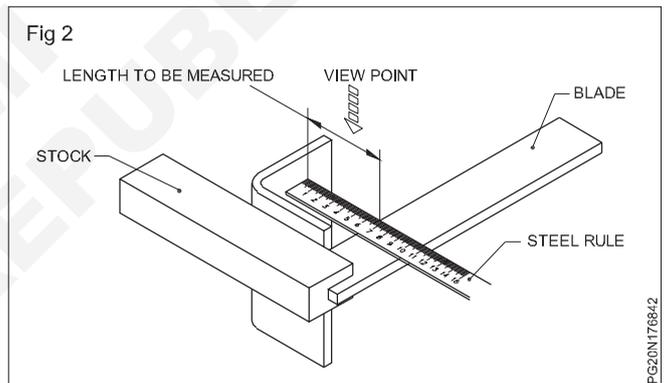
Objectives: At the end of this lesson you shall be able to

- state the purpose of a steel rule
- state the precautions to be followed while using a steel rule.

Engineer's steel rules (Fig 1) are used to measure the linear dimensions of workpieces. Steel rules are made of spring steel or stainless steel. These rules are available in lengths of 150 mm, 300 mm and 600 mm and 1000 mm. The reading accuracy of the steel rule is 0.5 mm.



For accurate reading it is necessary to read vertically to avoid errors arising out of parallax. (Fig 2)



For maintaining the accuracy of the steel rule, it is important to see to it that its edges and surfaces are protected from damage and rust.

Do not place a steel rule with other cutting tools.

Apply a thin film of oil when not in use.

Tinman's "L" square

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

- state the use of the Tinman's "L" square.

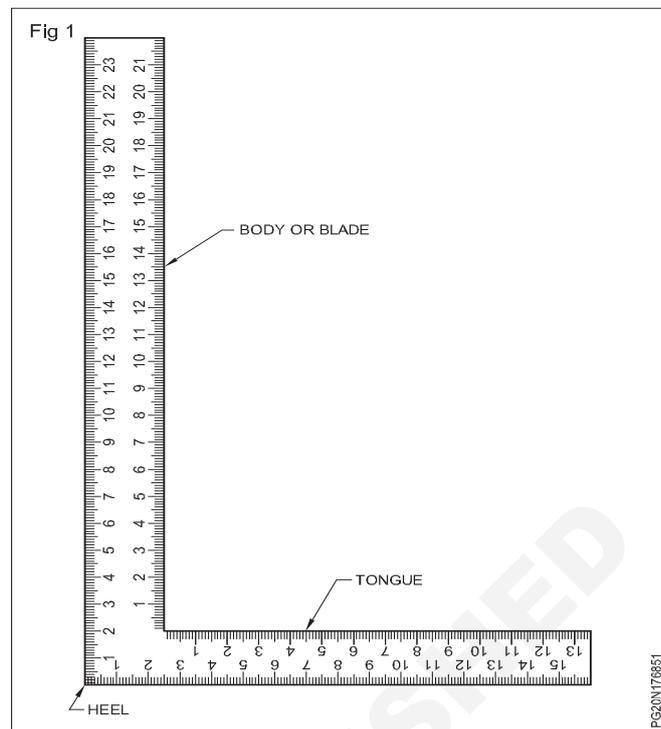
A Tinman's "L" square is an "L" shaped piece of hardened steel with graduation marks on the edges of the Tongue and Body or blade (Fig.1). It is used for marking in the

perpendicular direction to any base line and to check the perpendicularity.

The short arm of the “L” square is called the tongue and the long arm is called the body or blade and the corner is called the heel. The angle between the tongue and the body of the “L” square is 90°.

The size of the “L” square is specified by the length of the body and the tongue.

It is also called as Tinman’s square.



Straight edge

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

- state the use of straight edge
- list the types of straight edge.

Straight edge

Straight edge is a flat bar of steel.

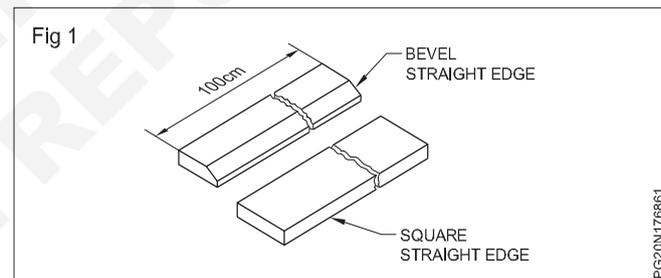
It is used to mark straight lines on a sheet metal surface.

Types (Fig 1)

Straight edges are available in two types.

- 1 Square straight edges
- 2 Bevel straight edge.

Straight edges are available in 600 mm, 1 to 3 mtrs in length. While marking with the help of a straight edge, place the straight edge on the sheet and hold it by your left hand.



Calipers

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

- state the commonly used calipers
- compare the features of firm joint and spring joint calipers
- state the advantage of spring joint calipers over firm joint calipers.

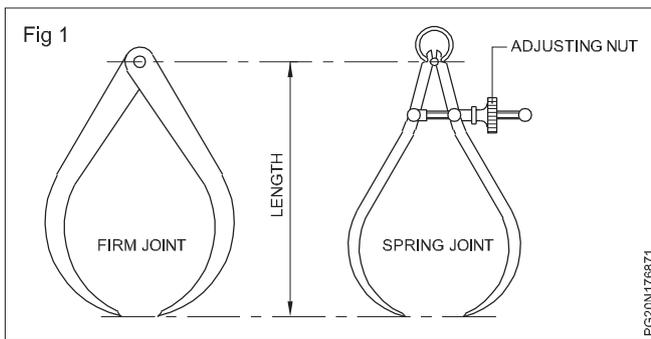
Calipers are simple indirect measuring instruments used to transfer measurements from steel rule to object and vice versa.

Calipers are of different types depending on the type of joint and the shape of leg.

Types of joints

- Firm joint calipers (Fig 1a)
- Spring joint calipers (Fig 1b)

Firm joint calipers: In the case of firm joint calipers, both legs are pivoted at one end. To take measurements of a workpiece, it is opened roughly to the required size. Fine setting is done by tapping the caliper lightly on a wooden surface.



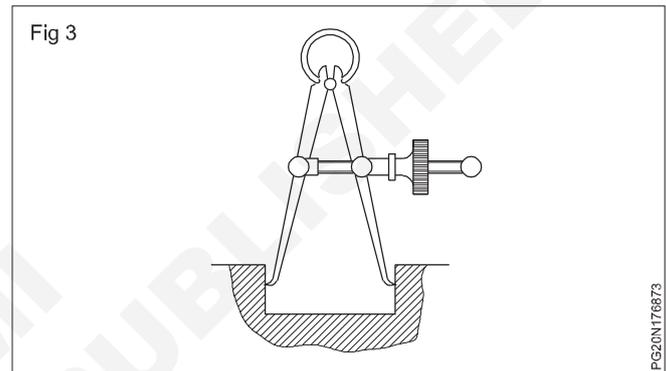
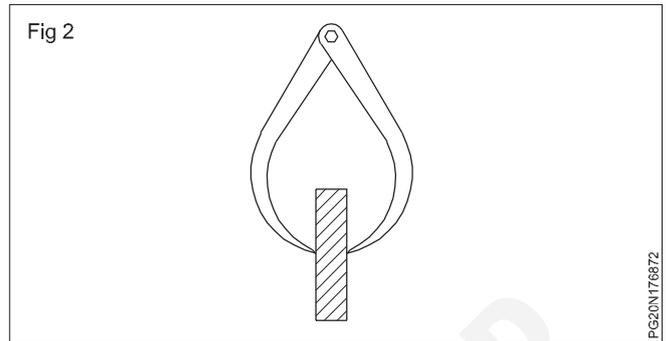
Spring joint calipers: For this type of calipers, the legs are assembled by means of a pivot loaded with a spring. For opening and closing the caliper legs a screw and nut are provided.

Spring joint calipers have the advantage of quick setting. The setting made will not change unless the nut is turned. The size of a caliper is specified by its length-which is the distance between the pivot centre and the tip of the leg.

The accuracy of the measurement taken depends very much on the sense of “feel or touch”. While measuring the job you should get the feel when the legs are just touching the surfaces.

Types of legs: Outside and inside calipers are differentiated by the shape of the legs.

Calipers used for outside measurements are known as outside calipers (Fig 2). The calipers used for internal measurements are known as inside calipers. (Fig 3). Calipers are used along with steel rules, and the accuracy is limited to 0.5 mm. The parallelism of jobs can also be checked using calipers.



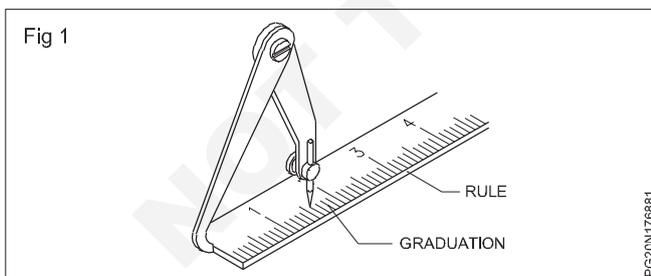
Jenny calipers

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

- identify a jenny caliper
- state the constructional features of a jenny caliper
- state the uses of a jenny caliper
- state safety, care and maintenance while using a jenny caliper.

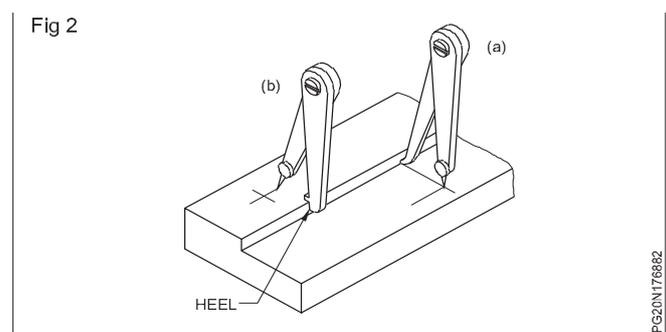
Jenny calipers are non-precision indirect marking tools.

They are also known as odd leg calipers, leg and point calipers and Herno prodite calipers. (Fig 1)



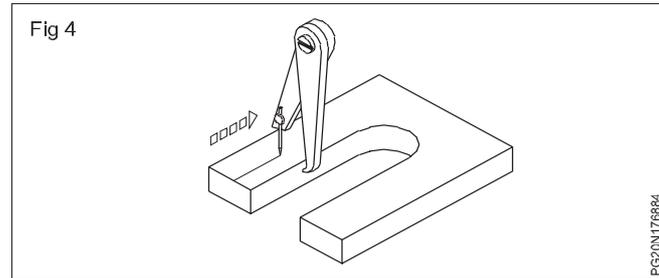
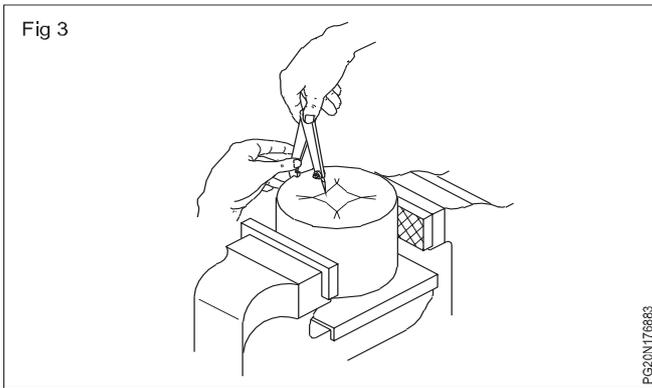
Constructions: These calipers are available with the usual bent leg or with a heel. (Fig 2)

These calipers have one leg bent and the other with an adjustable scribe point. In some calipers, other leg is fixed and pointed. These legs are joined together by means of a rivet to make the joint firm. These calipers are available in sizes of 150 mm, 200 mm, 250 mm and 300 mm.



Uses: These calipers are used for

- 1 Marking lines parallel to the inside and outside edges. (Fig 2)
- 2 Locating the centre of round bars. (Fig 3)
- 3 Scribing lines parallel to the curved edges. (Fig 4)



Safety, Care and Maintenance:

- 1 Do not open the legs beyond the capacity of the caliper.
- 2 Maintain the firmness of the joint.
- 3 Maintain the sharpness of the scribing point
- 4 Do not allow the caliper to rust. Apply a thin film of oil and keep it in its place.

While setting dimensions and scribing lines both the legs should be of equal length.

Specification of steel flats and strips

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

- designate the size of steel flats and sheets as per Indian standard specifications
- determine the weight of a particular size of flat and sheet.

Importance of specifying steel sections correctly

A fitter should be able to correctly specify steel sections and also interpret the specifications given in a drawing. This will help in selecting and ordering raw materials required for fabrication.

Steel flats

Hot rolled steel flats are designated by the width (mm) followed by the letters ISF. and the thickness (mm) as per IS 1730: 1989.

Example: 50ISF10

(Where the width and the thickness of the flat are 50 mm and 10 mm respectively)

Table 1 will assist in selecting the standard sizes of flats and also to determine the weight of the flats of different width and thickness.

What should be the weight of 50ISF 10 of ten meter

Answer

Flats and also to determine the weight of the flats of different width and thickness. (Fig 1)

What should be the weight of 50 ISF 10 of ten meter.

Answer

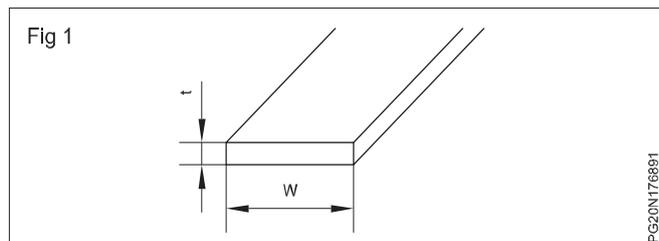


Table 1

Dimensions and Mass of Hot Rolled Steel Flats

Mass*, kg/m for Varying (mm) Thickness

Width mm	3	4	5	6	8	10	12	15	20	25	30	40	50
10	0.236	0.314	0.393	0.471	-	-	-	-	-	-	-	-	-
16	0.377	0.502	0.628	0.754	1.00	1.10	1.51	-	-	-	-	-	-
20	0.471	0.628	0.785	0.942	1.26	1.57	1.88	2.30	-	-	-	-	-
25	0.589	0.785	0.981	1.18	1.57	1.96	2.36	2.94	-	-	-	-	-
30	0.707	0.942	1.18	1.41	1.88	2.36	2.83	3.53	4.71	-	-	-	-
35	0.824	1.10	1.37	1.65	2.20	2.75	3.30	4.12	5.50	-	-	-	-
40	0.942	1.26	1.57	1.88	2.51	3.14	3.77	4.71	6.28	7.85	9.42	-	-
45	1.06	1.41	1.77	2.12	2.83	3.53	4.24	5.30	7.07	8.83	10.6	-	-
50	1.18	1.57	1.96	2.36	3.14	3.93	4.71	5.89	7.85	9.81	11.8	-	-
60	1.41	1.88	2.36	2.83	3.77	4.71	5.65	7.07	9.42	11.8	14.1	18.8	-
65	-	-	2.04	2.55	3.06	4.08	5.10	6.12	7.65	10.2	12.8	15.3	20.4
70	-	-	2.20	2.75	3.30	4.40	5.50	6.59	8.24	11.0	13.7	16.5	22.0
75	-	-	2.36	2.94	3.53	4.71	5.89	7.07	8.83	11.8	14.7	17.7	23.6
80	-	2.51	3.14	3.77	5.02	6.28	7.54	9.42	12.6	15.7	18.8	25.1	31.4
90	-	-	3.53	4.24	5.65	7.07	8.48	10.6	14.1	17.7	21.2	28.3	35.3
100	-	-	3.93	4.71	6.28	7.85	9.42	11.8	15.7	19.6	23.6	31.4	39.2
120	-	-	-	5.65	7.54	9.42	11.3	14.1	18.8	23.6	28.3	37.7	47.1
130	-	-	-	6.12	8.16	10.2	12.2	15.3	20.4	25.6	30.6	40.8	51.2
140	-	-	-	6.59	8.79	11.0	13.2	16.5	22.0	27.5	33.0	44.0	55.0
150	-	-	-	7.07	9.42	11.8	14.1	17.7	23.6	29.4	35.3	47.1	58.9
160	-	-	-	-	10.0	12.6	15.1	18.8	25.1	31.4	37.7	50.2	-
180	-	-	-	-	11.3	14.1	17.0	21.2	28.3	35.3	42.4	56.5	-
200	-	-	-	-	-	15.7	18.8	23.6	31.4	39.2	47.1	62.8	-
250	-	-	-	-	-	19.6	23.6	29.4	39.2	49.1	58.9	78.5	-
300	-	-	-	-	-	-	28.3	35.3	47.1	58.8	70.7	94.2	-
400	-	-	-	-	-	-	-	47.1	62.8	78.5	94.2	126	-

*Based on the density of steel =7.85 gm/cm³as per Indian Standard are designated as ISSH received by figures denoting length (mm) x width (mm) x thickness (mm) of the sheet as per IS 1730 : 1989.

Example

ISSH 3200 x 600 x 1.00

where

3200 is the length of the sheet (mm)

600 is the width of the sheet (mm)

1.00 is the thickness of the sheet (mm)

Table 2 gives the weight of steel sheets of different standard sizes.

EXERCISE

Calculate the weight of the steel sheet given below.

ISSH 1800x1200 x 1.40mm

Table 2
Standard Nominal Dimensions and Mass of Sheet

Size mmXmm	Nominal Surface Area in m ²	Standard													
		Standard Nominal Thickness in mm													
		0.40	0.50	0.63	0.80	0.90	1.00	1.12	1.25	1.40	1.60	1.80	1.90	2.00	
1800 x	600	1.08	3.39	4.24	5.34	6.78	7.65	8.47	9.50	10.6	11.9	13.6	5.3	16.1	17.0
	750	1.35	4.24	5.30	6.67	8.48	9.54	10.6	11.9	13.2	14.8	17.0	19.1	20.1	21.2
	900	1.62	5.09	6.35	8.01	10.2	11.4	12.7	14.2	15.9	17.8	20.3	22.9	24.2	25.4
	950	1.71	5.37	6.71	8.45	10.7	12.1	13.4	15.0	16.8	18.8	21.5	24.2	25.5	26.8
	1000	1.80	5.65	7.06	8.90	11.3	12.7	14.2	15.8	17.7	19.8	22.6	25.4	26.8	28.3
	1100	1.98	6.22	7.77	9.79	12.4	14.0	15.6	17.4	19.4	21.8	24.9	28.0	29.5	31.1
	1200	2.16	6.78	8.48	10.7	13.6	15.3	17.0	19.0	21.2	23.7	27.1	30.5	32.2	33.9
	1250	2.25	7.07	8.83	11.1	14.1	15.9	17.6	19.8	22.1	24.7	28.3	31.8	33.6	35.3
	1400	2.52	7.91	9.90	12.5	15.8	17.8	19.8	22.2	24.7	27.7	31.7	35.6	37.6	39.6
	1500	2.70	8.48	10.6	13.4	17.0	19.1	21.2	23.8	26.5	29.7	33.9	38.2	40.2	42.4
2000 x	600	1.20	3.77	4.71	5.93	7.53	8.47	9.42	10.6	11.8	13.2	15.1	17.0	17.9	18.8
	750	1.50	4.71	5.88	7.42	9.42	10.6	11.8	13.2	14.7	16.5	18.8	21.2	22.4	23.6
	900	1.80	5.65	7.06	8.90	11.3	12.7	14.1	15.8	17.7	19.8	22.6	25.4	26.8	28.3
	950	1.90	5.97	7.45	9.39	12.0	13.4	14.9	16.8	17.9	20.8	23.6	26.8	28.3	29.8
	1000	2.00	6.28	7.85	9.89	12.6	14.1	15.7	17.6	19.6	22.0	25.1	28.3	29.8	31.4
	1100	2.20	6.91	8.63	10.9	13.8	15.5	17.3	19.3	21.6	24.2	27.6	31.1	32.8	34.5
	1200	2.40	7.53	9.42	11.9	15.1	17.0	18.8	21.1	23.6	26.4	30.1	33.9	35.8	37.7
	1250	2.50	7.85	9.80	12.4	15.7	17.7	19.6	22.0	24.5	27.5	31.4	35.3	37.2	39.2
	1400	2.80	8.79	11.0	13.8	17.6	19.8	22.0	24.6	27.5	30.8	35.2	39.6	41.8	44.0
	2500	3.00	9.42	11.8	14.8	18.8	21.2	23.6	26.4	29.4	33.0	37.7	42.2	44.7	47.1
2200 x	600	1.32	4.14	5.18	6.52	8.28	9.32	10.4	11.6	13.0	14.5	16.6	18.7	19.7	20.7
	750	1.65	5.18	6.47	8.16	10.4	11.7	13.0	14.5	16.2	18.1	20.7	23.3	24.6	25.9
	900	1.98	6.22	7.77	9.78	12.4	14.0	15.5	17.4	19.4	21.8	24.9	28.0	29.5	31.1
	950	2.09	6.56	8.20	10.3	13.1	14.8	16.4	18.4	20.5	23.0	26.2	29.5	31.2	32.8
	1000	2.20	6.91	8.63	10.9	13.8	15.5	17.3	19.3	21.6	24.2	27.6	31.1	32.8	34.5
	1100	2.42	7.60	9.50	12.0	15.2	17.1	19.0	21.3	23.7	26.6	30.4	34.2	36.1	38.0
	1200	2.64	8.29	10.4	13.1	16.6	18.7	20.7	23.2	25.9	29.0	33.2	37.3	39.4	41.4
	1250	2.75	8.63	10.8	13.6	17.3	19.4	21.6	24.2	27.9	30.2	34.5	38.9	41.0	43.2
	1400	3.08	9.67	12.1	15.2	19.3	21.8	24.2	27.1	30.2	33.8	38.7	43.5	45.9	48.4
	1500	3.30	10.4	13.0	16.3	20.7	23.3	25.9	29.0	32.4	36.3	41.4	46.6	49.2	51.8
2500 x	600	1.50	4.71	5.88	7.42	9.42	10.6	11.8	13.2	14.7	16.5	18.8	21.2	22.4	23.6
	750	1.875	5.88	7.35	9.26	11.8	13.2	14.7	16.5	18.4	20.6	23.6	26.5	27.9	29.4
	900	2.25	7.07	8.83	11.1	14.1	15.9	17.7	19.8	22.1	24.7	28.3	31.8	33.6	35.3
	950	2.375	7.45	9.32	11.7	14.9	16.8	18.6	20.9	23.3	26.1	29.8	33.6	35.4	37.2
	1000	2.50	7.85	9.80	12.4	15.7	17.7	19.6	22.0	24.5	27.5	31.4	35.3	37.2	39.2
	1100	2.75	8.63	10.8	13.6	17.3	19.4	21.6	24.2	27.0	30.2	34.5	38.9	41.0	43.2
	1200	3.00	9.42	11.8	14.8	18.8	21.2	23.6	26.4	29.4	33.0	37.7	42.4	44.7	47.1
	1250	3.125	9.81	12.3	15.5	19.6	22.1	24.5	27.5	30.7	34.3	39.2	44.2	46.6	49.1
	1400	3.50	11.0	13.7	17.3	22.0	24.7	27.5	30.8	34.3	38.5	44.0	49.5	52.2	55.0
	1500	3.75	11.8	14.7	18.5	23.6	26.5	29.4	33.0	36.8	41.2	47.1	53.0	55.8	58.9

* Based on the density of steel = 7.85 g/cm²
For determining the mass of sheet above 2 mm thickness refer to IS1730:1989.

Indian Standard strips are designated as ISST followed by width (mm) x thickness (mm) of the strip as per IS 1730 - 1989.

Example

ISST 1050 x 3.15: Where 1050 mm is the width of the strip and 3.15mm is the thickness.

Table 3 gives the weight in kg of a particular strip per meter length.

EXERCISE

Calculate the weight of a ISST 500 x 4 of 2 metres

Answer

Table 3

Width in mm	Thickness in mm													
	1.60	1.80	2.00	2.24	2.50	2.80	3.15	3.55	4.00	4.50	5.0	6.0	8.0	10.0
	Mass * kg/m													
100	1.25	1.41	1.57	1.76	1.96	2.20	2.47	2.79	3.14	3.53	3.92	4.71	6.28	7.85
125	1.57	1.77	1.96	2.20	2.45	2.74	3.08	3.48	3.92	4.41	4.90	5.88	7.85	9.81
160	2.01	2.26	2.51	2.81	3.14	3.52	3.95	4.46	5.02	5.65	6.28	7.53	10.0	12.6
200	2.51	2.82	3.14	3.52	3.92	4.39	4.94	5.58	6.28	7.06	7.84	9.42	12.6	15.7
250	3.14	3.53	3.92	4.40	4.90	5.49	6.17	6.97	7.85	8.83	9.80	11.8	15.7	16.6
320	4.02	4.52	5.02	5.62	6.28	7.05	7.90	8.92	10.0	11.3	12.5	15.1	20.0	25.1
400	5.02	5.65	6.28	7.04	7.85	8.78	9.88	11.1	12.6	14.1	15.7	18.8	25.1	31.4
500	6.28	7.05	7.85	8.79	9.51	11.0	12.4	13.9	15.7	17.7	19.6	23.6	31.4	39.2
650	8.16	9.17	10.2	11.4	12.7	14.3	16.1	18.1	20.4	23.0	25.5	30.6	40.8	51.0
800	10.0	11.3	12.6	14.1	15.7	17.6	19.8	22.3	25.1	28.3	31.4	37.7	50.2	62.8
950	-	13.4	14.9	16.7	18.6	20.8	23.5	26.5	29.8	33.6	27.3	44.7	59.7	74.6
1000	-	-	15.7	17.6	19.6	22.0	24.7	27.9	31.4	35.3	39.2	47.1	62.8	78.5
1050	-	-	16.5	18.5	20.6	23.3	26.0	29.2	33.0	37.1	41.2	49.5	65.9	82.4
1150	-	-	-	20.2	22.6	25.2	28.4	32.0	36.1	40.6	45.1	54.2	72.2	90.3
1250	-	-	-	-	24.5	27.5	30.9	34.8	39.2	44.2	49.1	58.9	78.5	98.1
1300	-	-	-	-	-	28.6	32.1	36.2	40.8	45.9	51.0	61.2	81.6	102
1450	-	-	-	-	-	-	35.8	40.4	45.5	51.2	56.9	68.3	91.1	114
1550	-	-	-	-	-	-	38.3	43.2	48.7	54.7	60.8	73	93.3	122

Indian Standard steel plates are designated as ISPL followed by figures denoting length (mm) x width (mm) X thickness (mm) of the plates as per IS 1730 : 1989.

Example:

ISPL 2200 x 950 x 8

where 2200 is the length of the plate (mm)

950 is the width of the plate (mm)

8 is the thickness of the plate (mm)

EXERCISE

Calculate the weight of the following steel plate.

ISPL 5600 x 1400 x 5. (Refer Table 4)

Ans _____

Table 4													
Mass Per Metre of Plates													
Width in mm													
	900	950	1000	1100	1200	1250	1400	1500	1600	1800	2000	2200	2500
Thickness in mm	Mass * per metre, kg												
5	35.3	37.3	39.2	43.2	47.1	49.1	55.0	58.9	62.8	70.6	78.5	86.4	98.1
6	42.4	44.7	47.1	51.8	56.5	58.9	66.0	70.6	75.4	84.8	94.2	104	118
7	49.4	52.2	55.0	60.4	66.0	68.7	76.9	82.4	87.9	98.9	110	121	137
8	56.5	59.7	62.8	69.1	75.4	78.5	87.9	94.2	100	113	126	138	157
10	70.6	74.6	78.5	86.4	94.2	98.1	110	118	126	141	157	173	196
12	84.8	89.5	94.2	104	113	118	132	141	151	170	188	207	236
14	98.9	104	110	121	132	137	154	165	176	198	220	242	275
16	113	119	126	138	151	157	176	188	201	226	251	276	314
18	127	134	141	155	170	177	198	212	226	254	283	311	353
20	141	149	157	173	188	196	220	236	251	283	314	345	392
22	155	164	173	190	207	216	242	259	276	311	345	380	432
25	177	186	196	216	236	245	275	294	314	353	392	432	491
28	198	209	220	242	264	275	308	330	352	396	440	484	550
32	226	239	251	276	301	314	352	377	402	452	502	553	628
36	254	268	283	311	339	353	396	424	452	509	565	621	706
40	283	298	314	345	377	392	440	471	502	585	628	691	785
45	318	336	353	389	424	441	495	530	565	634	706	777	883
50	353	373	392	432	471	491	550	589	628	706	785	864	981
56	396	418	440	484	528	550	615	659	703	791	879	967	1079
63	445	470	495	544	593	618	692	742	791	890	989	1088	1239

* Based on the density of steel = 7.85 g/cm³

Specification of steel angles

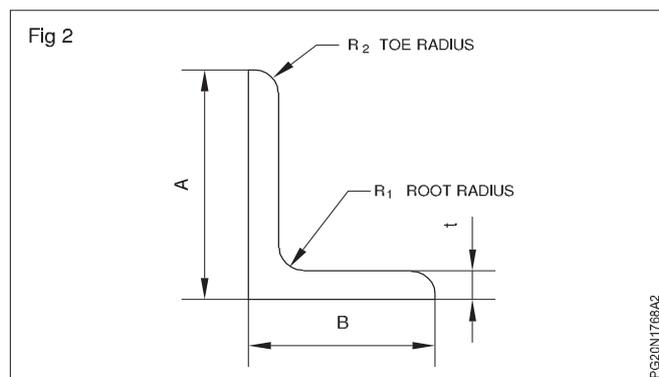
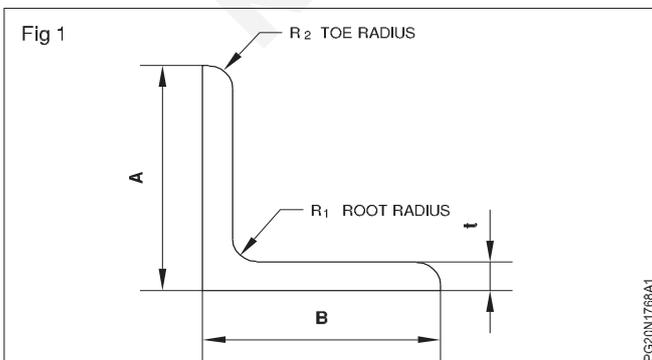
Objectives: At the end of this lesson you shall be able to

- specify the size of equal and unequal angles as per Indian Standard
- determine from the chart the weight of angles of different sizes.

Types of steel angles: Steel angles are widely used in engineering work. These angles are of two types. According to IS 808-1989, steel angles are classified as

Indian Standard equal leg angles ISA (Fig 1) and Indian standard unequal leg angles ISA (Fig 2).

Designation: Equal and unequal leg angles are designated by the abbreviated reference symbol () followed by the dimensions; i.e. length of legs (mm) x thickness (mm) as per IS 808:1989.



Example

200 100 x 10

Where,

is the abbreviated symbol, 200 is the length of one leg (mm)

100 is the length of the other leg and 10 is the thickness (mm)

The Table 5 gives the weight per meter length of angles of various thickness, sectional area of each size and radius of the root.

75 50 x 8

Answer

Exercise

Calculate the weight of 25 meters long unequal leg angle of the following specification

Size AxB mmxmm	Thickness (t) mm.	Sectional area cm ²	Weight per meter (W) Kgf/m	Radius at root (r1)	Size AxB mm X mm	Thickness (t) mm	Sectional area (a)	Weight per meter cm ²	Radius at root R1 (W) kgf/m
20 x 20	3.0	1.12	0.9	4.0	30 x 20	3.0	1.41	1.1	4.5
	4.0	1.45	1.1	4.0		4.0	1.84	1.4	4.5
25 x 25	3.0	1.41	1.1	4.5	40 x 25	5.0	2.25	1.8	4.5
	4.0	1.84	1.4	4.5		3.0	1.88	1.5	5.0
	5.0	2.25	1.8	4.5		4.0	2.46	1.9	5.0
30 x 30	3.0	1.73	1.4	5.0	45 x 30	5.0	3.02	2.4	5.0
	4.0	2.26	1.8	5.0		6.0	3.56	2.8	5.0
	5.0	2.77	2.2	5.0		3.0	2.18	1.7	5.0
35 x 35	3.0	2.03	1.6	5.0	50 x 30	4.0	2.86	2.2	5.0
	4.0	2.66	2.1	5.0		5.0	3.52	2.8	5.0
	5.0	3.27	2.6	5.0		6.0	4.16	3.3	5.0
	6.0	3.86	3.0	5.0		3.0	2.34	1.8	5.5
40 x 40	3.0	2.34	1.8	5.5	60 x 40	4.0	3.07	2.4	5.5
	4.0	3.07	2.4	5.5		5.0	3.78	3.0	5.5
	5.0	3.78	3.0	5.5		6.0	4.47	3.5	5.5
	6.0	4.47	3.5	5.5		5.0	4.76	3.7	6.0
45 x 45	3.0	2.64	2.1	5.5	65 x 45	6.0	5.65	4.4	6.0
	4.0	3.47	2.7	5.5		8.0	7.37	5.8	6.0
	5.0	4.28	3.4	5.5		5.0	5.26	4.1	6.0
	6.0	5.07	4.0	5.5		6.0	6.25	4.9	6.0
50 x 50	3.0	2.95	2.3	6.0	70 x 45	8.0	8.17	6.4	6.0
	4.0	3.88	3.0	6.0		5.0	5.52	4.3	6.5
	5.0	4.79	3.8	6.0		6.0	6.56	5.2	6.5
	6.0	5.68	4.5	6.0		8.0	8.58	6.7	6.5
55 x 55	5.0	5.27	4.1	6.5	75 x 50	10.0	10.50	8.3	6.5
	6.0	6.26	4.9	6.5		5.0	6.02	4.7	6.5
	8.0	8.18	6.4	6.5		6.0	7.16	5.6	6.5
	10.0	10.0	7.9	6.5		8.0	9.38	7.4	6.5
60 x 60	5.0	5.75	4.5	6.5	80 x 50	10.0	11.50	9.0	6.5
	6.0	6.84	5.4	6.5		5.0	6.27	4.9	7.0
	8.0	8.96	7.0	6.5		6.0	7.46	5.9	7.0
	10.0	11.0	8.6	6.5		8.0	9.78	7.7	7.0
						10.00	12.0	9.4	7.0

Specification of steel sections

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

- designate the size for round, square, hexagonal and octagonal sections as per Indian Standard
- determine the weight of different sections of steel having different lengths.

Steel rounds: Hot rolled steel rounds shall be designated by the symbol and diameter as per IS - 10720-1983. (Fig 1)

Example

Ø 30

30mm is the diameter of the round rod.

Steel squares: Square bars are designated by the symbol and followed by the side width (mm) as per IS 10720 1983. (Fig 1)

Example

□ 32

32 mm is the side width of the square in mm.

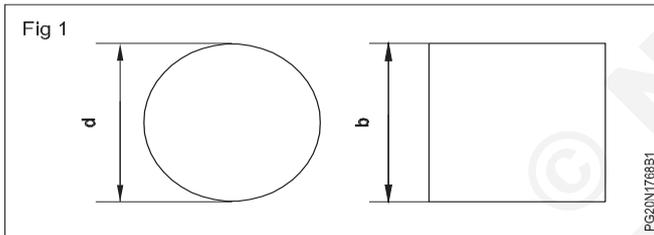
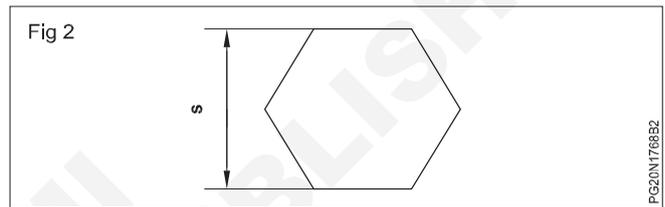
Steel hexagons and octagon sections: Hexagon and octagon steel rods are designated by the symbol and the width across flat as per IS 10720-1983. (Fig 2)

Regarding steel rounds, squares and hexagonal rods, weights of individual sizes are available in kg per metre length. See Table 1 & 2.

d or b	Weight kg/Meter	
	∅	□
5	0.154	0.196
6	0.222	0.283
8	0.395	0.502
10	0.617	0.785
12	0.888	1.13
14	1.21	-
16	1.58	2.01
18	2.00	-
20	2.47	3.14
22	2.98	-
25	3.85	4.91
28	4.83	-
32	6.31	8.04
36	7.99	-
40	9.85	12.6
45	12.5	15.9
50	15.4	19.6
56	19.3	-
63	24.5	31.2
71	31.1	-
80	39.5	50.2
90	49.9	-

TABLE - 2

Width across flat S	Weight kg/meter	Width across flat S	Weight kg/meter
5	0.170	20	2.72
6	0.245	22	3.29
7	0.333	24	3.96
8	0.435	25	4.25
9	0.551	27	4.96
10	0.680	30	6.12
11	0.824	32	6.96
12	0.979	36	8.81
13	1.149	40	10.88
14	1.33	41	11.4
15	1.53	46	14.4
16	1.74	50	17.0
17	1.96	55	20.6
18	2.20	60	24.5



Raw material information CRCA, HRCA.MS

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

- state the types of metals used in sheet metal work
- state the uses of the different types of metals.

In sheet metal work, different types of metal sheets are used. The sheets are specified by their standard gauge numbers.

It is very essential to know the different uses and applications of these metal sheets.

Black iron sheets: The cheapest sheet metal is the black iron, which is rolled to the desired thickness. The sheets are rolled in two conditions. When it is rolled in cold state, it is called cold rolled and when it is rolled in hot state, it is called hot rolled. Hot rolled sheets have a bluish black appearance, and are often referred to as uncoated sheets, since they are uncoated. They corrode rapidly.

Cold rolled sheets have plain silver whitish appearance and are uncoated. To decrease the work hardness, the cold ruled sheets are annealed in a closed atmosphere. These sheets are known as C.R.C.A (Cold roled close annealed) sheets.

The use of this metal is limited to making articles that are to be painted or enamelled such as tanks, pans, stoves, pipes etc.

Galvanised iron sheets: Zinc coated iron is known as 'galvanised iron'. This soft iron sheet is popularly known as G.I sheet. The zinc coating resist corrosion and improves the appearance of the metal and permit it to be soldered with greater ease. Because it is coated with zinc, galvanised iron sheet withstands contact with water and exposure to weather.

Articles such as pans, buckets, furnaces, heating ducts, cabinets, gutters etc. are made mainly from G.I sheets.

Stainless sheets: This is an alloy of steel with nickel, chromium and other metals. It has good corrosive resistance and can be welded easily. Stainless steel used in a sheet metal shop can be worked similar to galvanised iron sheets, but is tougher than G.I. sheets.

The cost of stainless steel is very high.

Stainless steel is used in dairies, food processing, chemical plants, kitchenware etc.

Copper sheets: Copper sheets are available either as cold rolled or hot rolled. They have a very good resistance to corrosion and can be worked easily. They are commonly used in sheet metal shops. Copper sheet has better appearance than other metals.

Gutters, expansion joints, roof flashings, hoods, utensils and boiler plates are some of the common examples where copper sheets are used.

Aluminium sheets: Aluminium cannot be used in its pure form, but is mixed with very small amount of copper, silicon, manganese and iron. Aluminium sheets are whitish in colour and light in weight. They are highly resistant to corrosion and abrasion.

Aluminium is now widely used in the manufacture of articles such as household appliances, refrigerator trays, lighting fixtures, windows and also in the construction of airplanes and in many electrical and transport industries.

Tinned plate: Tinned plate is sheet iron coated with tin, to protect it against rust. This is used for nearly all solder work, as it is the easiest metal to join by soldering.

This metal has a very bright silvery appearance and is used in making roofs, food containers, dairy equipment, furnace fittings, cans and pans etc.

Lead sheets: Lead is very soft and heavy in weight.

Lead sheets are used for making the highly corrosive acid tanks.

When lead is coated on black iron sheets, they are called Terne sheets. They are highly anti-corrosive and commonly used in preservation of chemicals.

Portable shearing and nibbling machines

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

- explain the constructional features of portable shearing of nibbling machines
- state the working of portable shearing and nibbling machine
- state the application of portable shearing and nibbling machine.

Portable shears and nibblers: Portable power cutting machines are either electrically or pneumatically operated and can be used for straight line cutting and for cutting irregular shape curves. These portable shears can be taken to the work place conveniently. The pneumatic machines are much safer for working on site, the power source being a compressor.

There are two types of portable shearing machines.

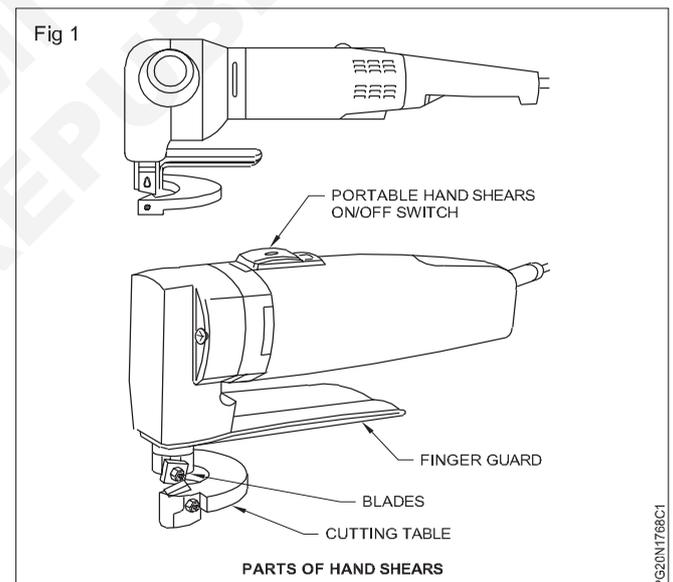
- Shear type nibbler
- Punch type nibbler

Shear type nibbler (Fig 1): This shear type nibbler portable power tool is used for rapid and accurate straight line or curve cutting of sheet material upto 1.6 mm or SWG thickness. It is short stroke power shear fitted with a rapidly reciprocating cutting blade. Each stroke makes a cut about 3 mm in length.

The shear type nibbler is fitted with a pair of very narrow flat blades, one of which is usually fixed and the other moving to and from the fixed blade at very high speeds. These blades have a very pronounced RAKE to permit piercing of the material for internal cutting and as the blades are so narrow, the sheet material can be easily turned during cutting.

The top blade is fixed to the moving member or ram and the bottom blade on a spiral extension. The top blade should be kept perpendicular to the metal being cut. This extension is shaped like the body of a throatless shear to part the material after cutting.

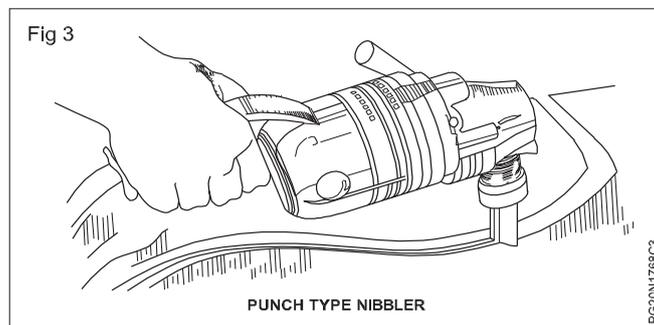
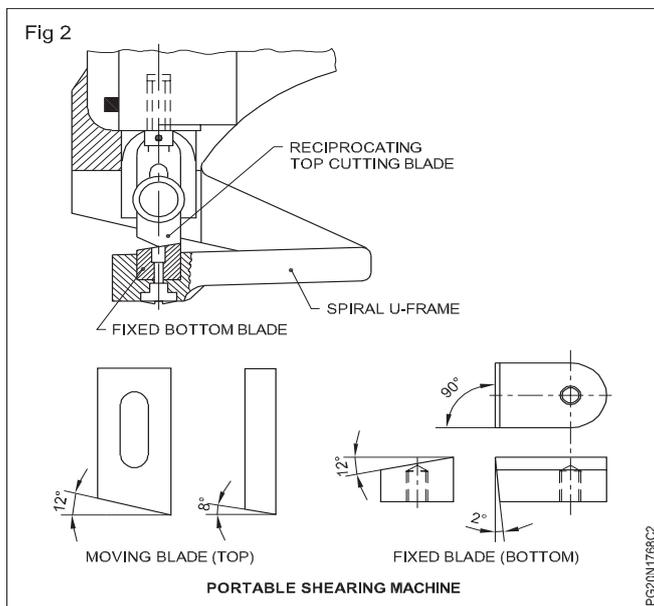
The lighter power machines have a minimum cutting radius of 10 mm and the heavier ones about 50 mm.



Generally, provision should be made for vertical adjustment to allow for resharpening of the blade by grinding, and an adjustment at the bottom blade to allow for getting the cutting clearance. Fig 2 shows details of the shear type nibbler.

The punch type nibbler (Fig 3): This is also called portable nibbler. This machine will not operate on the same principle as shear type nibbler. Instead of shearing blades, a punch and die is employed and the nibbling principle is a special application of punching.

The advantage of these nibbler machines is that they will effect certain operations, that cannot be done on other shearing machines. For example, they can be used to cut out apertures which could only be produced by means of punch and dies set up in a powerful press.



This portable power tools are used for rapid and accurate curved cutting or straight line cutting of material from 1.62 mm to 3.2 mm thickness approximately.

Like the shear type machine the top cutting tool (a punch) reciprocates a rapid short strokes. Punch type nibblers are available in many sizes and punch reciprocates at a rate of 350 to 1400 strokes per minute over a die, nibbling out by overlapping punching, and only a slight finishing is necessary to produce a smooth cut edge.

Nibbling machine

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

- state the working of nibbling machine
- state the uses of nibbling machine
- state the safety, care and maintenance when working in nibbling machine.

Nibbling machine: The nibbler is actually a fast acting machine that “nibbles” the sheet metal at every stroke. The strokes on a nibbler are very faster than the eye can follow. The nibbling machine can cut very heavy metal in any intricate form.

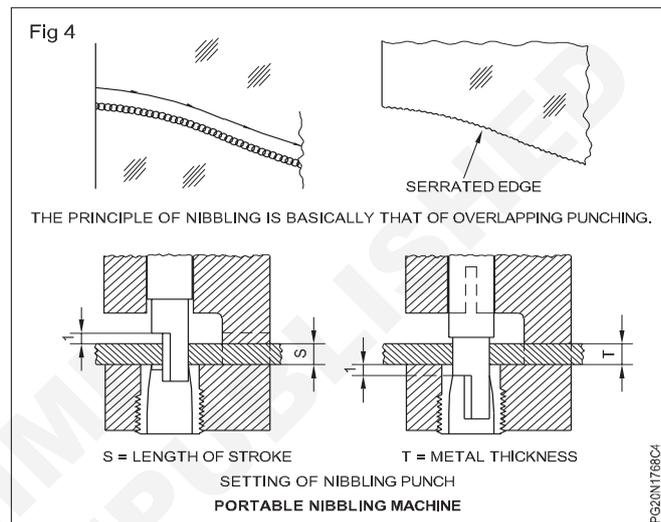
The nibbling machine shown in Fig 1 is a cutting machine having two small cutting edges, one of the edge is fixed to the bed of the machine, and the other (the upper cutting edge) is fixed to the Ram which moves up and down in a small and speedy pitch to cut sheet metal in a straight line, curved line and circle. The stroke of up

And there are heavy duty machines available for cutting steel upto 6.35 mm thickness.

Standard punches of 4.8,6,3.5 and 9.5 mm diameter are employed with machines of different sizes and the maximum linear cutting speed is approximately 1.8 meters per minute.

The main advantage of nibbling over shearing is that there is less distortion of the work.

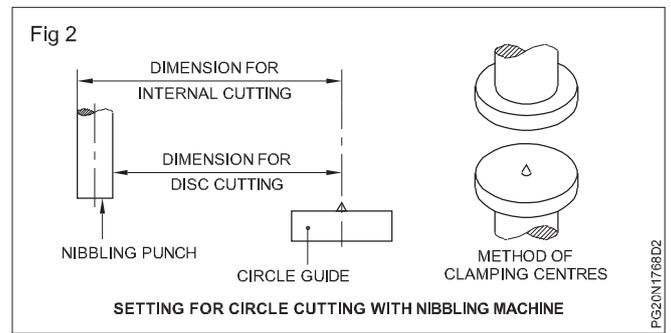
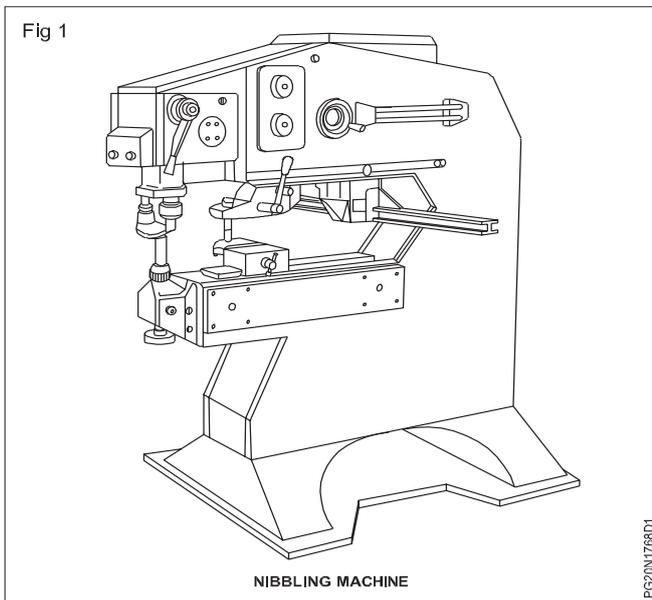
Fig 4 shows details of the punch type nibbler. Portable nibbling machines are also available with rectangular narrow punches. Rectangular punches make a cut without ragged edges similar to circular punch cutting operation.



Serrated edge: The principle of nibbling is basically that of overlapping punching. The width of the cut produced by nibbling machines is determined by the diameter of the punch in relationship with the thickness of the material to be cut. For example: Capacity of machine 2 mm Width of cut 8 mm Approximate cutting speed - 18 mm/min. Capacity of machine 3:2 mm Width of cut 9.5 mm Approximate cutting speed - 15 mm/min.

and down vibration of the cutting edge is 2 to 3 mm and frequency of vibration is 2800 to 3000 times per minute. The clearance between upper and lower cutting edges is about 1/20 of the thickness of sheet to be cut. The nibbling machine can also be used for forming work as joggling beading and embossing by changing the cutters of the nibbler and fixing suitable tools.

The speed of vibration can be adjusted as slow, medium and fast by the limit switches. Circular discs of different diameters can be cut by the adjustment provided on this machine as shown in Fig 2.

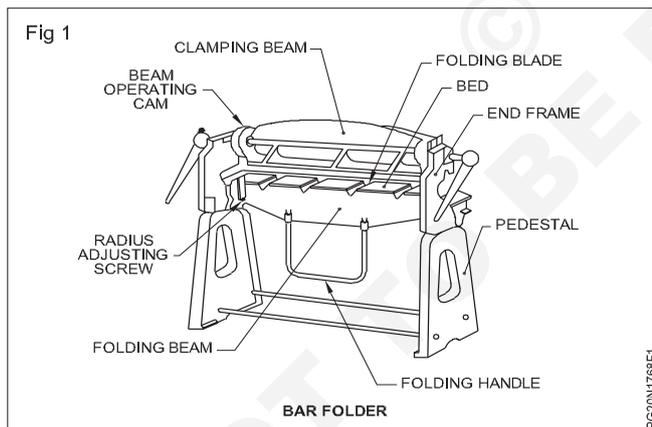


Bar folder/Bench folder

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

- state the mechanism of folding and clamping of a bar folder
- state the specifications and features of a bar folder
- state the use and application of a bar folder
- state the defects in bending on a bar folder, their causes.

Bar folder (Fig 1): Bar folder is a hand operated machine, used for folding sheet metal at different angles. When it is mounted on a pedestal, it is called bar folder and when it is mounted on bench, it is called bench folder.



bottom of the clamping beam. Workpiece is clamped in between the clamping blade and the bed by turning the beam operating lever.

In the folding mechanism, folding beam is pivoted at the end frames, below the bed. Folding blade is fixed on the folding beam at its upper end and the folding handle is attached to the bottom. Workpiece is clamped in between the clamping blade and the bed. Workpiece is folded by moving the folding beam radially upward towards the operators side, with the help of the folding handle.

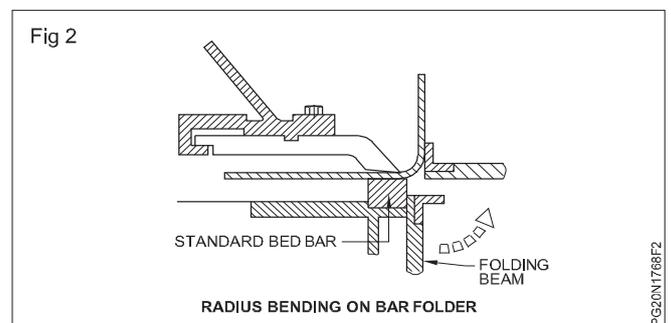
Bed is fixed on the end frames, Standard bed bar is fixed on the bed, on which the workpiece is placed in position. Radius adjusting screw (Fig 2) is provided at the end frame. With radius adjusting screw, the folding beam is moved forward. While turning the folding handle, the folding beam is moved forward and simultaneously radially upward, to fold the workpiece to the required radius. (Fig 2)

Folding is completed in four steps i.e.

- 1 Setting the workpiece
- 2 Clamping
- 3 Folding
- 4 Removal of workpiece

It comprises of a clamping mechanism, a folding mechanism and a bed.

In the clamping mechanism, clamping beam is attached to the end frames. Clamping beam moves up and down, by rotating the beam operating cam, with the help of the beam operating lever. Clamping blade is fixed at the



Specifications of the bar folder: Bar folder is specified by the maximum length of the bed and the thickness of the workpiece that can be bent. Thickness of the workpiece, that can be bent is determined by the lift of the clamping lever. The smallest width of the bend is usually 8 to 10 times of the metal thickness. The minimum inside corner radius of the bend is 1.5 times of the metal thickness. The variety of the bends and the

combination of the bends can be made on the bar folder using mandrels, special stepped bar, radius fingers etc.

Defects and Remedies: While working on a bar folder, some defects in bending may occur. Following is the chart showing the nature of defects, probable causes and remedies.

Hand lever bench shears

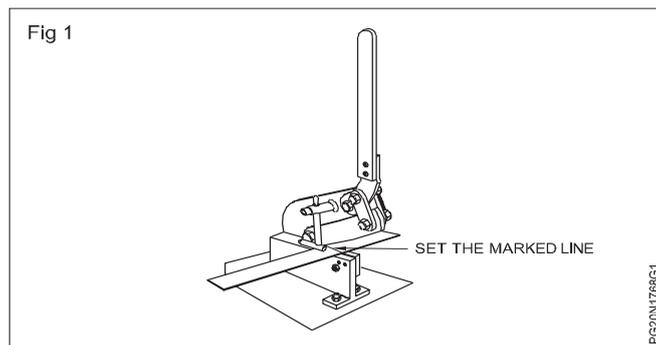
Objective: At the end of this lesson you shall be able to

- cut the sheet metal along the marked line safely using a hand lever bench shears.

Mark a line on a sheet metal to be cut using a scribe.

Hold the sheet metal to be cut in one hand and a lever in another hand.

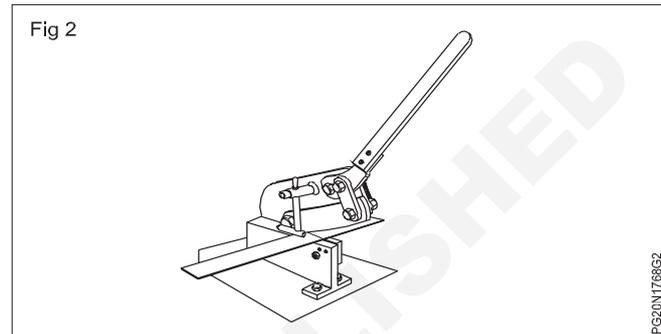
Set the marked line with the cutting edge of a lower blade. (Fig 1)



Be careful not too deviate from the marked line and set it at the innermost part of the cutting edge.

Pull the handle downward so that the upper blade moves downward from one end.

As the upper blade reaches the sheet metal, exert more pressure, pull the handle downward with more force. (Fig 2)



As the upper blade moves downward, the metal between the upper blade cutting edge and the lower blade cutting edge get sheared off and the metal is cut into two pieces.

While cutting, don't use the full length of the blade, otherwise that portion of the cut will get damaged. To avoid this, use approximately three fourth length of the blade, push the sheet metal inside and out the remaining portion accordingly.

While working on hand lever bench shears, do not place your fingers or part of your body near the blade, which may cause injury.

Notches in sheet metal

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

- state the purpose of notches
- name the types of notches
- distinguish the features of different notch forms.

Notches: Notches are the spaces provided for joining the edges when sheet metals are cut from the layout.

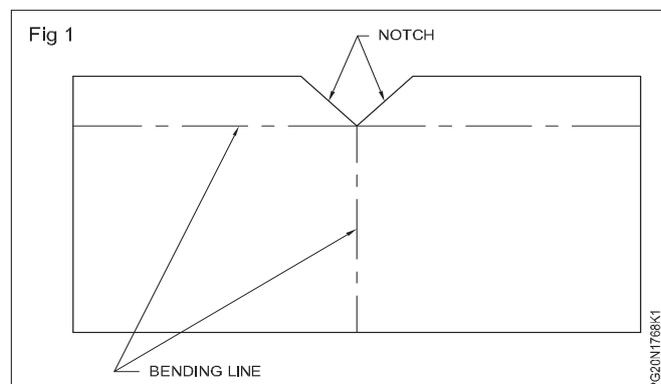
Purpose of notches

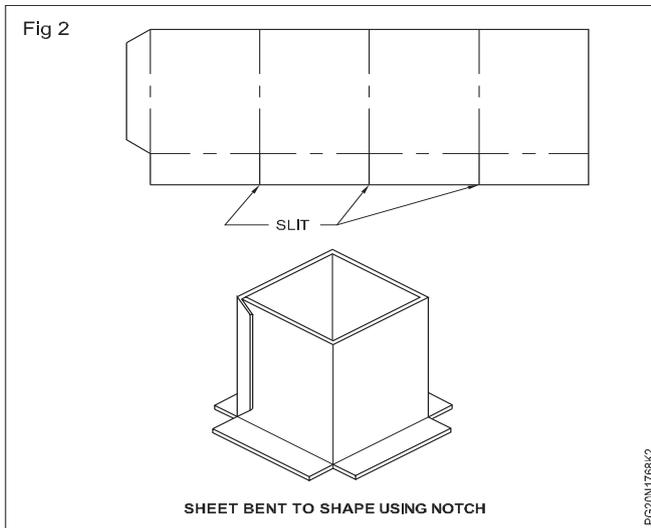
Notch helps:

- To prevent surplus material from overlapping and causing a bulge at the seam and edges.
- To allow the work to be formed to the required size and shape.
- To allow the work to assemble better.

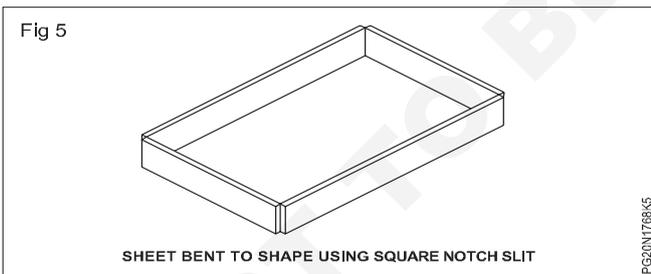
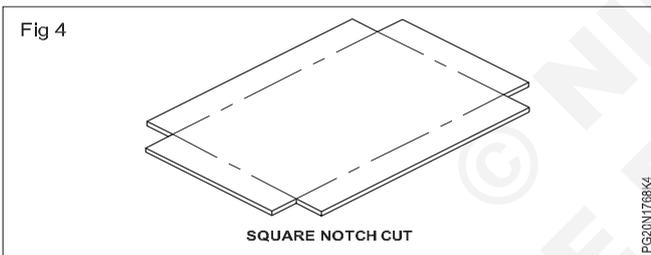
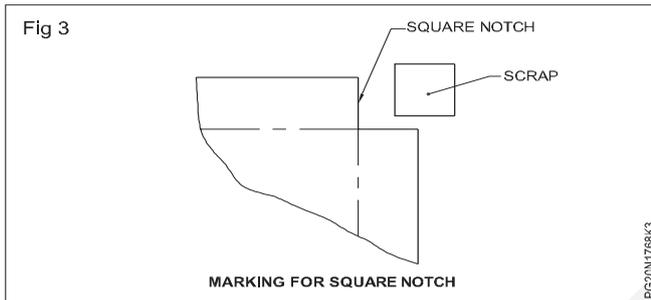
Types of notches

Straight notch or slit (Figs 1 & 2): Straight cuts made in the edge of the sheet where it is to be bent is known as a straight notch.



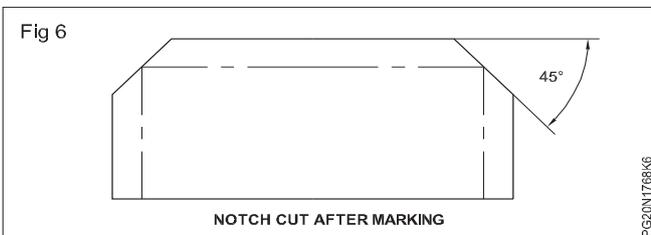


Square notch (Figs 3, 4 & 5)

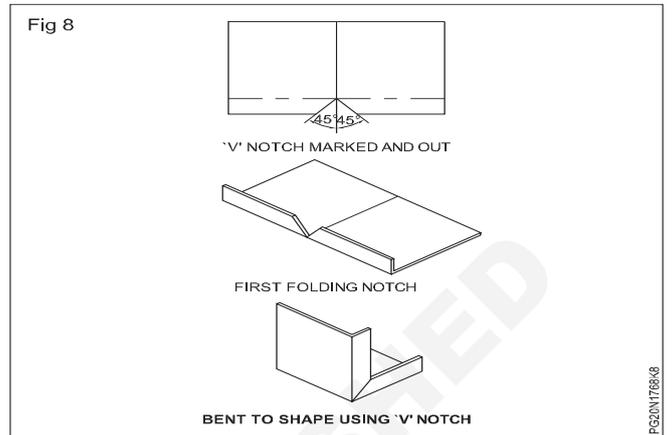
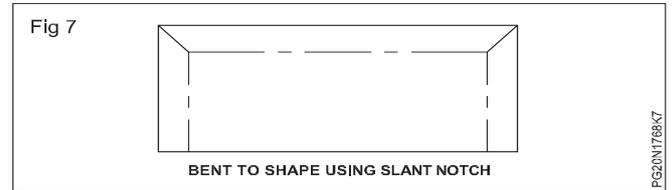


A square notch is used for forming a square or rectangular box.

Slant notch (Fig 6): This Notch is cut at an angle of 45° to the corner of the sheet. It is used when a single hem meets at right angles.



'V' Notch (Figs 7 & 8)

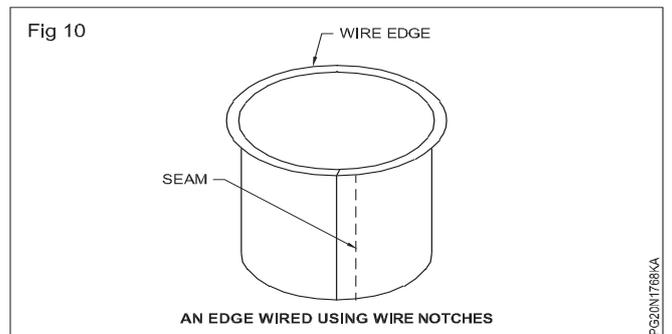
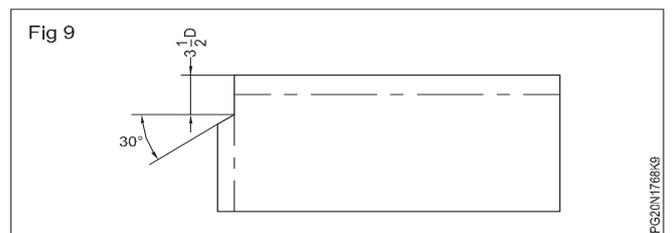


In this notch, both the sides are cut at a 45° angle to the edge of the sheet.

The sides of the notch meet at 90° . This notch is used when making a job with a 90° bend and an inside flange.

Wire notch (Figs 9 & 10): The angle of this notch is usually 30° and the distance from which the notch is started is 3 times the diameter of the wire.

Uses: The wire notch is used on a work which has wired edges. This notch must be provided to prevent the wired edge from overlapping at the seam.

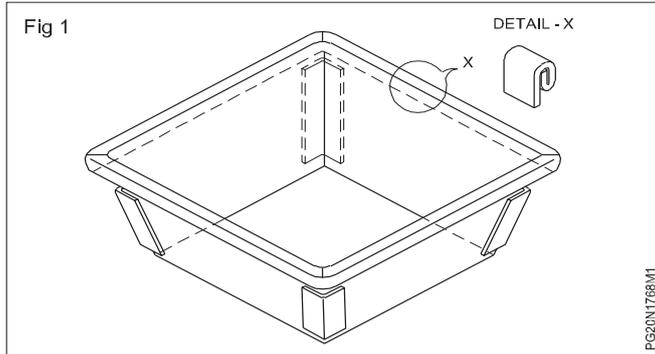


Edge stiffening

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

- state what is a hem
- state the types of hems
- state the uses of the different types of hems.

The edges of light gauge sheet metal articles (Fig 1) are very sharp and unsafe to handle. Safe edges are provided to strengthen the sheet metal and to enhance the appearance of the finished article.



What is a hem?

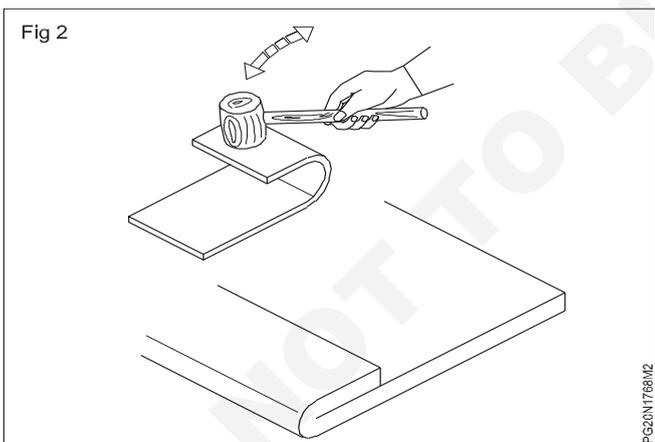
A hem is an edge or border made by folding.

It stiffens the sheet of the metal and avoids sharp edges.

Types of hems

- Single hem
- Double hem
- Wired edge

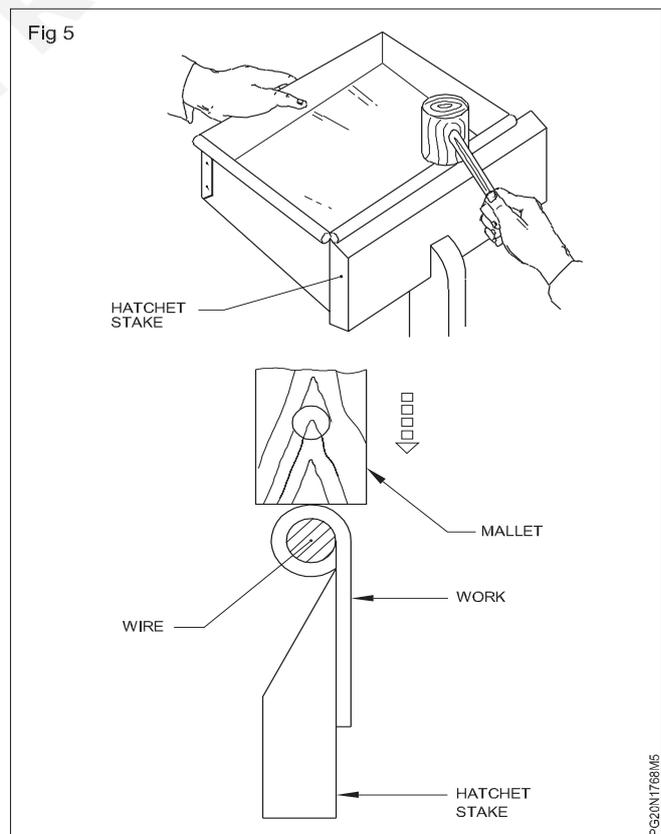
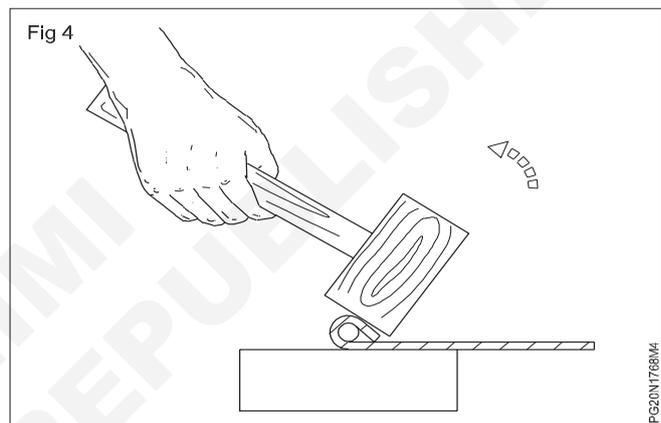
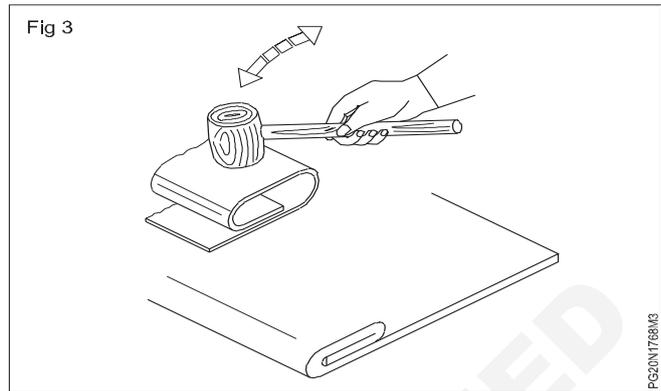
Single hem (Fig 2): A single hem is made by folding the edge of the sheet metal with a single folding.



It makes the edge smooth and stiff and is done while making small articles.

Double hem (Fig 3): A double hem is made by folding the edges over twice to make it smooth and this is done normally to strengthen the edges of lengthy articles.

Wired edge (Figs 4 & 5): The wired edge is done for round and lengthy articles to enhance the appearance and increase the strength. The wired edge is smooth and is very strong.



Sheet metal joints

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

- state what is a seam
- state the types of seams
- state the uses and application of the different types of seams.

Sheet metal working incorporates a wide variety of seams

What is a seam?

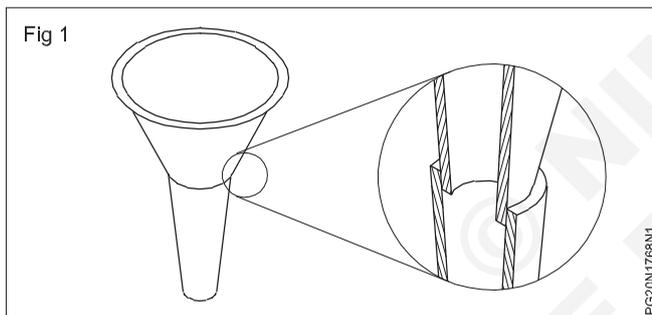
A seam is a joint made by the fastening of two edges of two pieces of metal together.

Types of seams

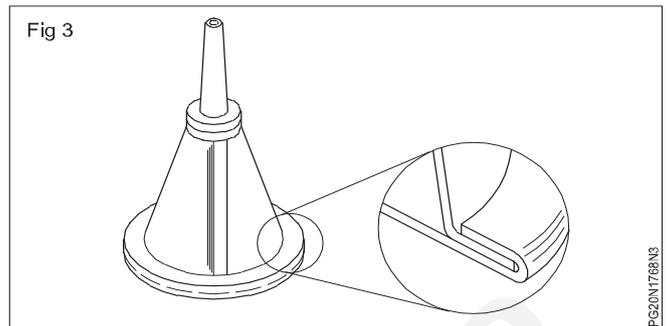
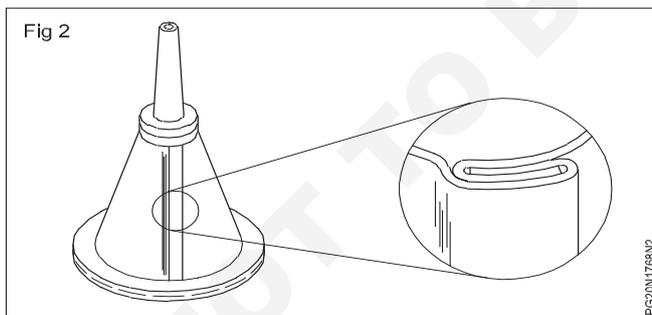
Lap seam: The lap seam is the simplest type of seam and can be prepared as a lap joint. This joint is also known as edged on joint. This joint is used to fit the top and bottom to cylindrical shapes. This joint is finally secured by soldering or brazing.

Grooved seam: A grooved seam is used to join two pieces of straight or curved metal of light gauge and then locking them by a groove.

Single seam (Fig 1): The single seam is used to join a bottom to vertical bodies of various shapes. This joint is called paned-down joint. This joint is also secured by soldering or brazing.

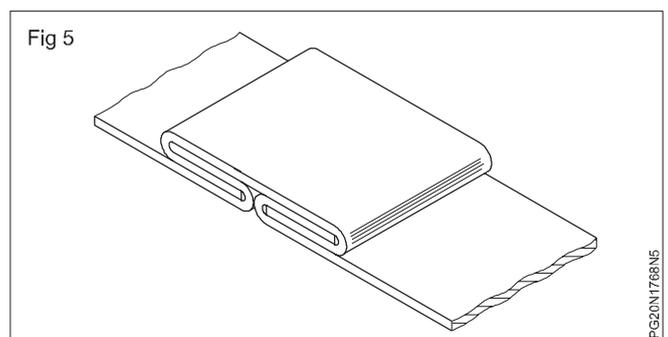
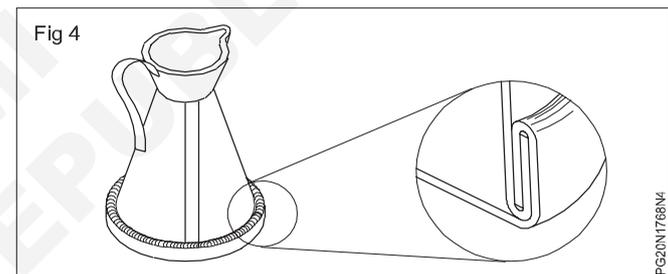


Double seam (Figs 2 & 3)



The double seam is similar to a single seam joint except that its forward edge is bent upward against the body. This joint fulfils the same function as the edged-on and paned-down joints, but it is the strongest of the three.

Double grooved seam (Figs 4 & 5): The double grooved seam is similar to the dovetail joint in carpentry and it is used for roofing and paneling joints.



Folding and joining allowances

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

- state the necessity for providing allowances in sheet metal operations.

When making self-secured joints or seams, it is necessary to make an allowance for the extra material to be added for the preparation of the edges and seams.

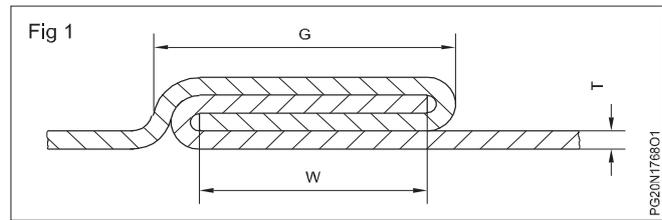
The allowance is necessary for maintaining the correct size of the finished product and for improving the strength at joints of all edges.

Allowance is also necessary for avoid cracking or warping, and for obtaining the required finish.

This allowance depends upon the width of the folded edge and the thickness of the metal.

Allowances: In the making of various types of hems and seams, no allowance is necessary for thinner sheets of 0.4 mm or less.

Allowance for grooved joints/seams (Fig 1): If we fold over the edges to width W and form the joint, the final completed width of the joint G will be greater than W . It can be seen that the final width of the groove will have a minimum value of $W + 3T$, where T represents the metal thickness.



Tubes and pipes

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

- state the uses of tubes and pipes in sheetmetal work.

Introduction: Metal tubes are used in different types of machines and installations. Tubes in hydraulic system rarely runs in a straight line. Tubes are curved, twisted for making structural frames and are bent by computerised numerical control (CNC) pipe bending machines.

Conduit pipes ranging from 16 mm to 65 mm diameter are used for electrical installations.

Pipes and tubes are made of metals and plastics and are used for transport, water, oil, gas and for domestic and industrial purposes. G.I.Pipe (galvanised iron) is commonly used for many purposes.

British standard pipe threads BSP, ISO, DIN. Standard threads are cut on pipes for joining purposes. Pipes are first cut to length with a hacksaw or pipe cutter and then a pipe reamer is used to remove the burr on the inside diameter of the pipe.

Generally the tube size is specified by the outer diameter, whereas the pipe size is specified by the internal diameter.

Pipe and Tubing: The sheet metal worker uses both black pipe and galvanized pipe as legs and stiffeners. In general the pipe work is done by plumber or pipe fitter.

Sheet metal worker may sometimes have to connect few small fittings to connect the equipment to the installed pipe.

Pipes can be obtained in various sizes. The pipes commonly used in the sheet metal trade are from 3/8 inch to 1 1/4 inch in diameter.

Split pipe: For a smooth, very stiff edge, the sheet metal worker uses split pipe. Split pipes are available in galvanized black and stainless steel pipes.

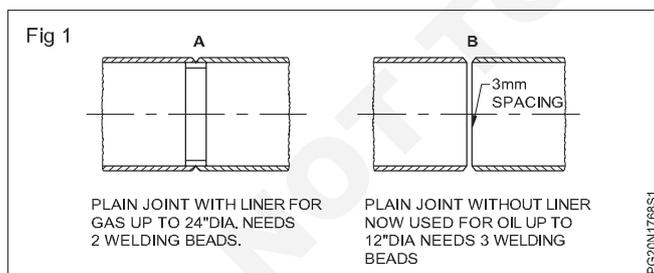
Various types of pipe joints

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

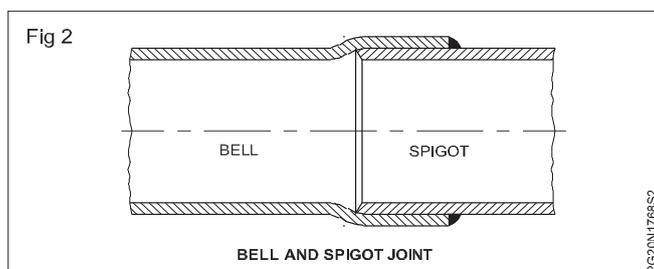
- explain the various types of pipe joints
- describe the factors to be considered for a pipe joint
- explain the method of cutting branch components (pipe development)

Various types of pipe joints

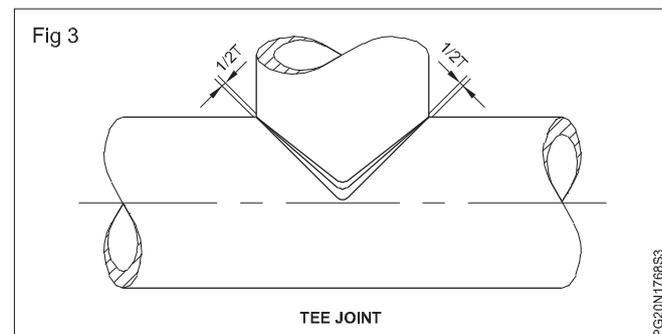
Square butt joint with liner and without liner. (Fig 1)



Bell and spigot joint. (Fig 2)



'Tee' joint. (Fig 3)



Branch joints. 450. (Fig 4)

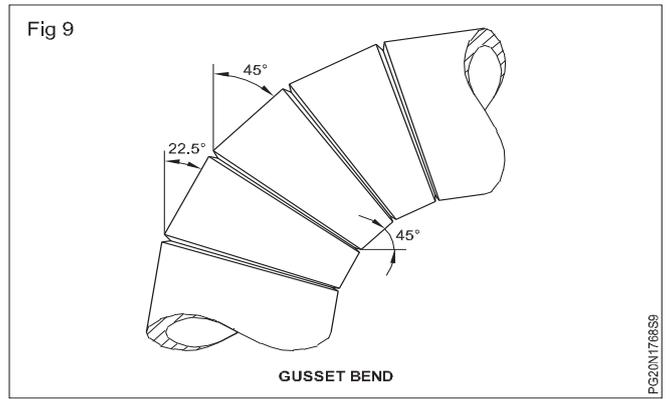
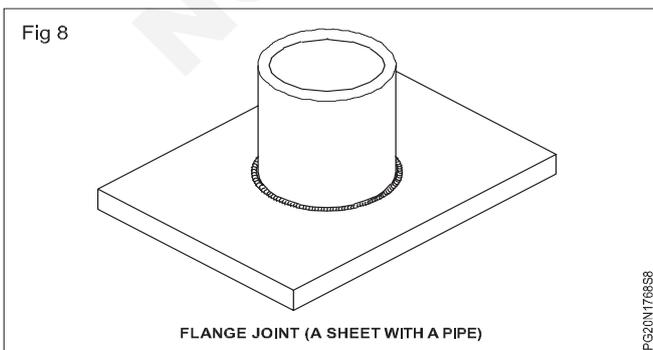
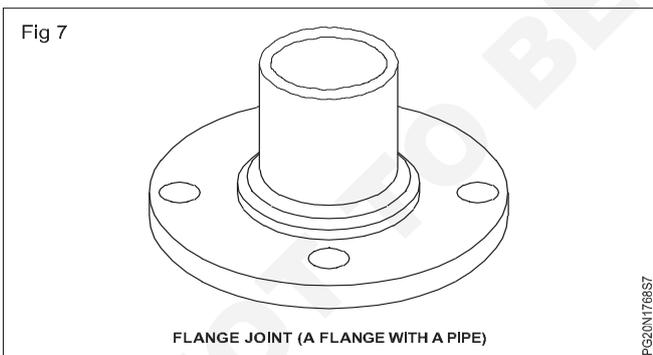
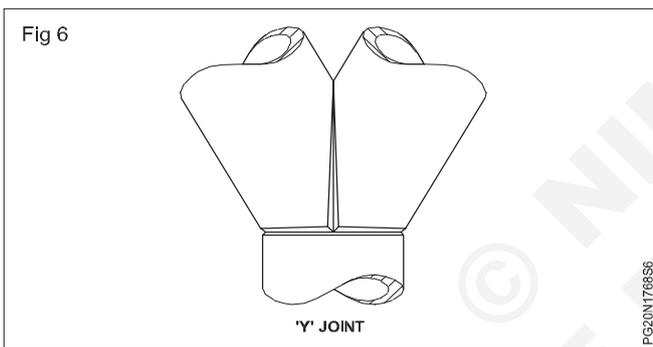
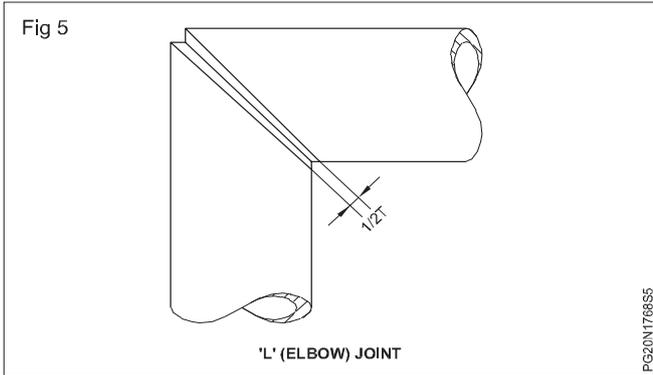
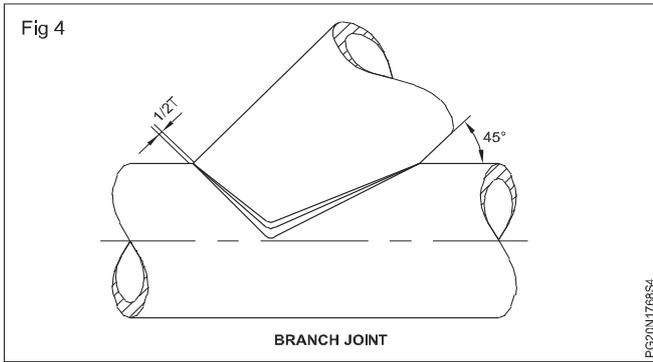
'L' elbow joint. (Fig 5)

'Y' joint. (Fig 6)

Flange joint (A flange with a pipe). (Fig 7)

Flange joint (A sheet with a pipe). (Fig 8)

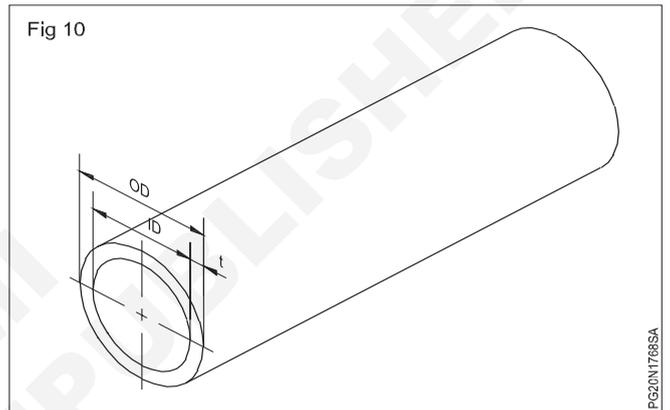
Gussel bend. (Fig 9)



The factors to be considered for a pipe joint

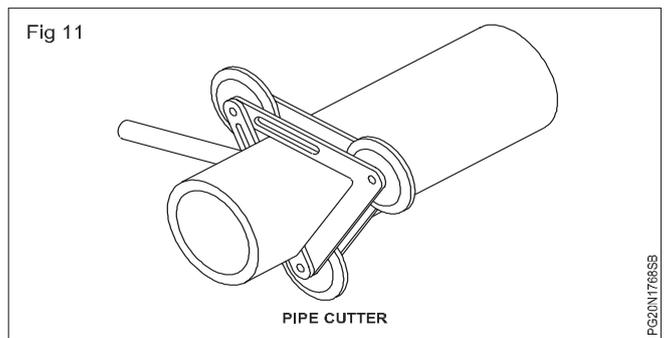
Check the pipes for:

- Specification of material and diameter (O.D/I.D) (Fig 10)

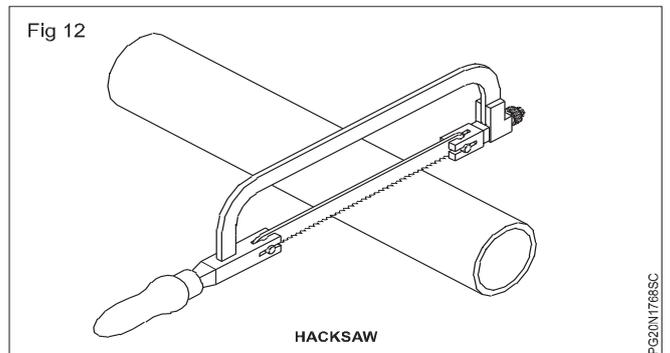


- Wall thickness
- End preparation required

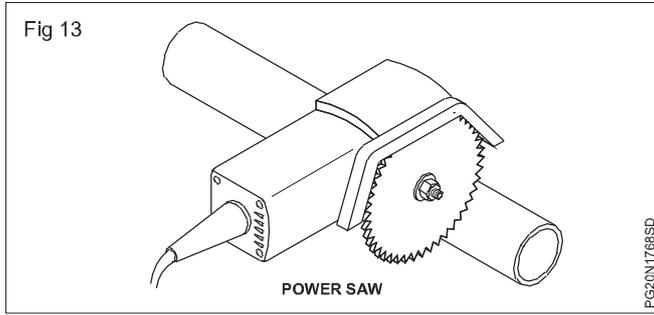
Method of edge preparation: For small diameter pipe end cutting may be done by a pipe cutter. (Fig 11)



- Hacksaw. (Fig 12)



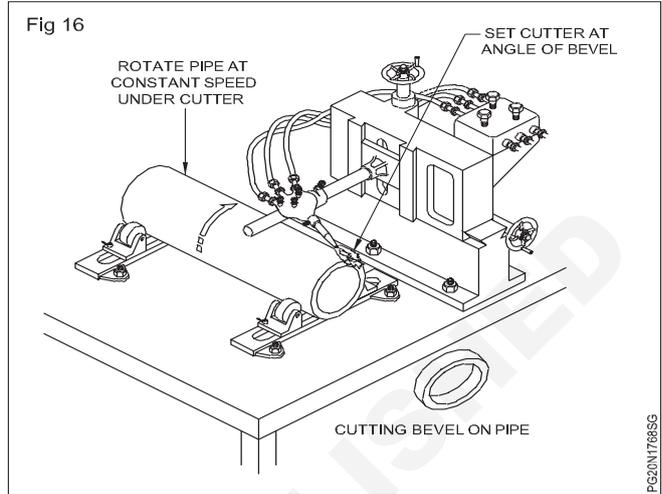
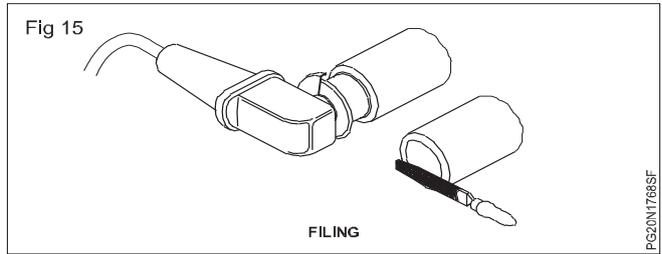
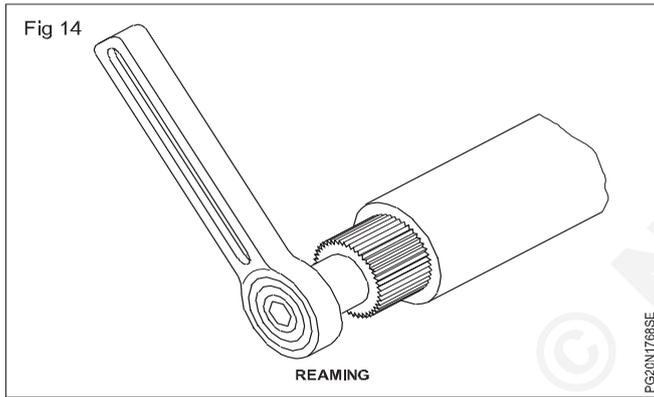
- Power saw (Fig 13)



After cutting to length, remove any burrs on the inside of the pipe by reaming or filing. (Figs 14 & 15)

For large diameters of pipe ends cutting may be done by a:

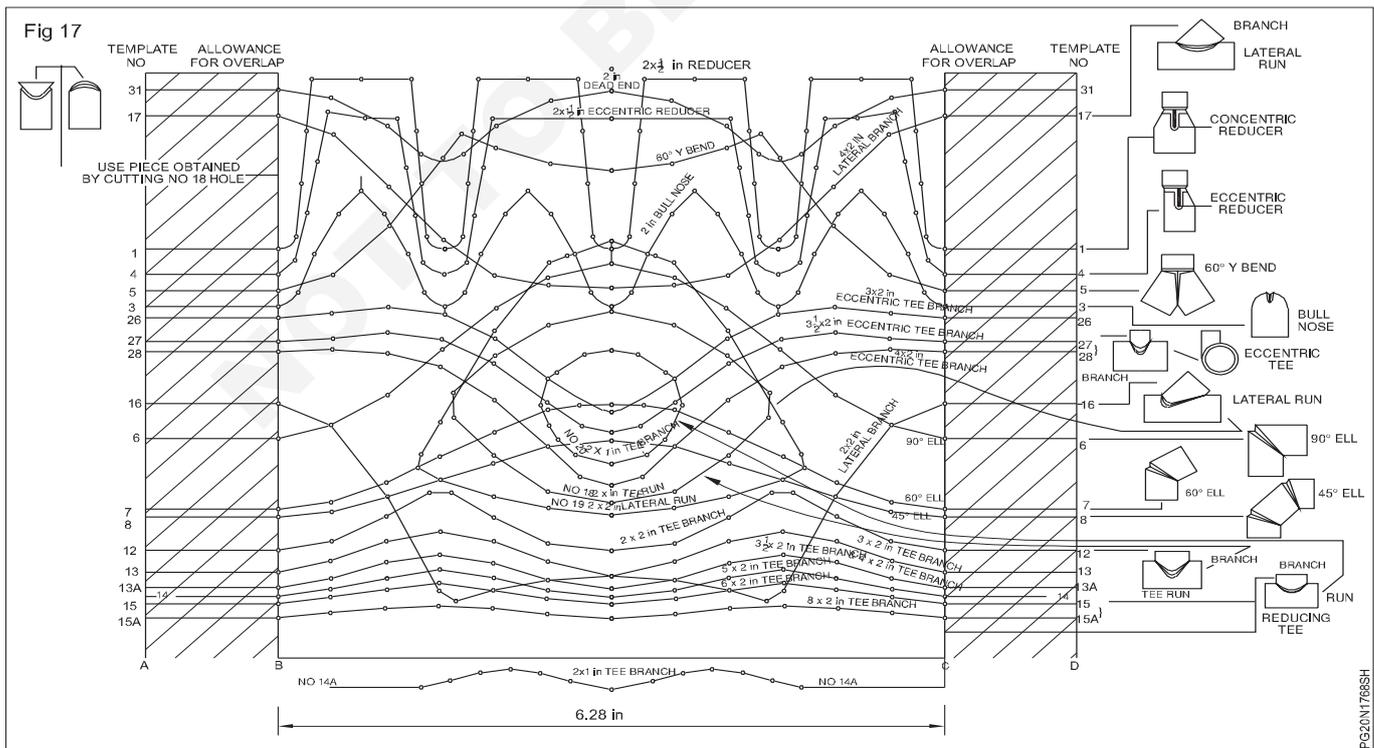
- Power hacksaw
- Portable oxy-fuel gas cutting machine, either mechanically or electrically driven (Fig 16)
- Oxy-fuel gas cutting machine
- Ending machine



Method of bevelling: To maintain a uniform root face take the following steps

- Grinding
- Machining
- Filing

Cutting of branch components: These may be done on a special oxy-fuel gas profiling machine. Where such equipment is not available, the branch pipes can be produced by (pipe development) marking the outline using a template and scribe, and then centre punched. (Fig 17)



The branch pipes can be cut by using oxy-fuel gas cutting equipment.

Branch holes may also be formed in the same manner. Various shapes of pipe development can be seen in the Fig 17.

Welding techniques adopted to weld pipe joints

Leftward welding: This technique can be used to make welded joints in all positions for pipes of lesser thickness and of different sizes.

It is a slow technique for positional work, and often requires more edge preparation and multi-runs than the rightward technique.

This method is generally used for thin wall pipes.

Rightward welding: This technique is mainly applied to the top sections of a pipe and the first run for vertical down welding.

A single pass weld in the horizontal/vertical position. (Butt weld in a vertical pipe)

All-position rightward welding: This technique is applied mainly to joints in the overhead and vertical positions.

This is a typical set of pipe-welding templates. Each line is a separate template for a cut in a pipe to produce a different pipe joint. This set of templates was originally drawn for 51 mm diameter pipe; therefore, the distance between the vertical lines B and C (where the left and right edge of the template meet when wrapped around the pipe) is the circumference of the pipe or $51 \text{ mm} \times 3.1416$ which equals 160 mm. The distances AB and CD are used for overlapping the template when it is wrapped around the pipe. You will be given a complete set of separate pipe-cutting templates to work with if you work in a pipe shop.

Standard pipe threads

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

- state the standard pipe threads
- state the types of pipe threads
- state the design of thread designs
- state the thread dimensions

Standard pipe threads: The Indian standard 150-7-1 pipe threads where pressure light joints are made on the threads dimensions, tolerance and designation issued by the ISO and these standards recommended for the engineering standard. Appropriate pipe jointing medium should be used on the thread to ensure-tight joints.

Types of pipe threads: There are two types of pipe threads.

- 1 Internal threads
- 2 External threads

That is used for pipe joint threads are classified as a complete thread, incomplete thread, washout thread, useful thread.

Fitting allowance: Length of useful thread beyond the gauge plane of an external thread required to provide for assembly with an internal thread at the upper limit of the tolerance.

Wrenching allowance: Length of useful thread, which is provided to accommodate the relative movement between the end of the externally threaded part and the internally threaded part required for wrenching beyond the position of hand tight engagement.

Pipe dimension: Pipe thread dimensions in millimeters are given table 1.

Designation: The designation of threads consists of the following elements in the sequence given below.

Description block shall be pipe thread: The international standard number block shall be I.S.O-7

The individual item block shall be composed of:

- a letter symbol(s) for type of pipe thread
- the letter R followed by the letter p for parallel internal threads;

- the letter R followed by the letter c for taper (conical) internal threads;
- the letter R for external threads;
- b the thread size, from column 1 of table 1.

Examples: The complete designation for a right-hand thread size 1 1/2:

	parallel	Pipe thread IS07 - Rp 1 1/2
Internal thread	taper	} Pipe thread ISO 7 - Rc 1 1/2
External thread	always taper	

For left-hand threads, the letters LH shall be added to the designation. Right-hand threads require no special designation.

Thread design

Thread forms

Parallel-thread: The basic form of the parallel pipe thread shall be as shown in figure 1. The angle between the flanks, measured in an axial plane section, is 55°. The thread profiles are rounded equally at crests and roots by circular arcs blending tangentially with the flanks. (Fig 1)

Taper thread: The basic form of the taper pipe thread shall be as shown in figure 2. The taper is 1 to 16, measured on the diameter. The angle between the flanks, measured in an axial plane section, is 55°, the flanks making equal angles with the axis.

The thread profiles are rounded off equally at crests and roots by circular arcs blending tangentially with the hanks in such a manner as to give the same thread height h as for parallel threads. (Fig 2)

Direction of thread helix: Unless otherwise specified, the ISO 7-1 thread shall be a right-hand thread.

Thread length

External thread

The terms relating to the external taper pipe thread. The terms relating to the external taper pipe thread are given in Fig 3.

Table 1 — Thread dimensions

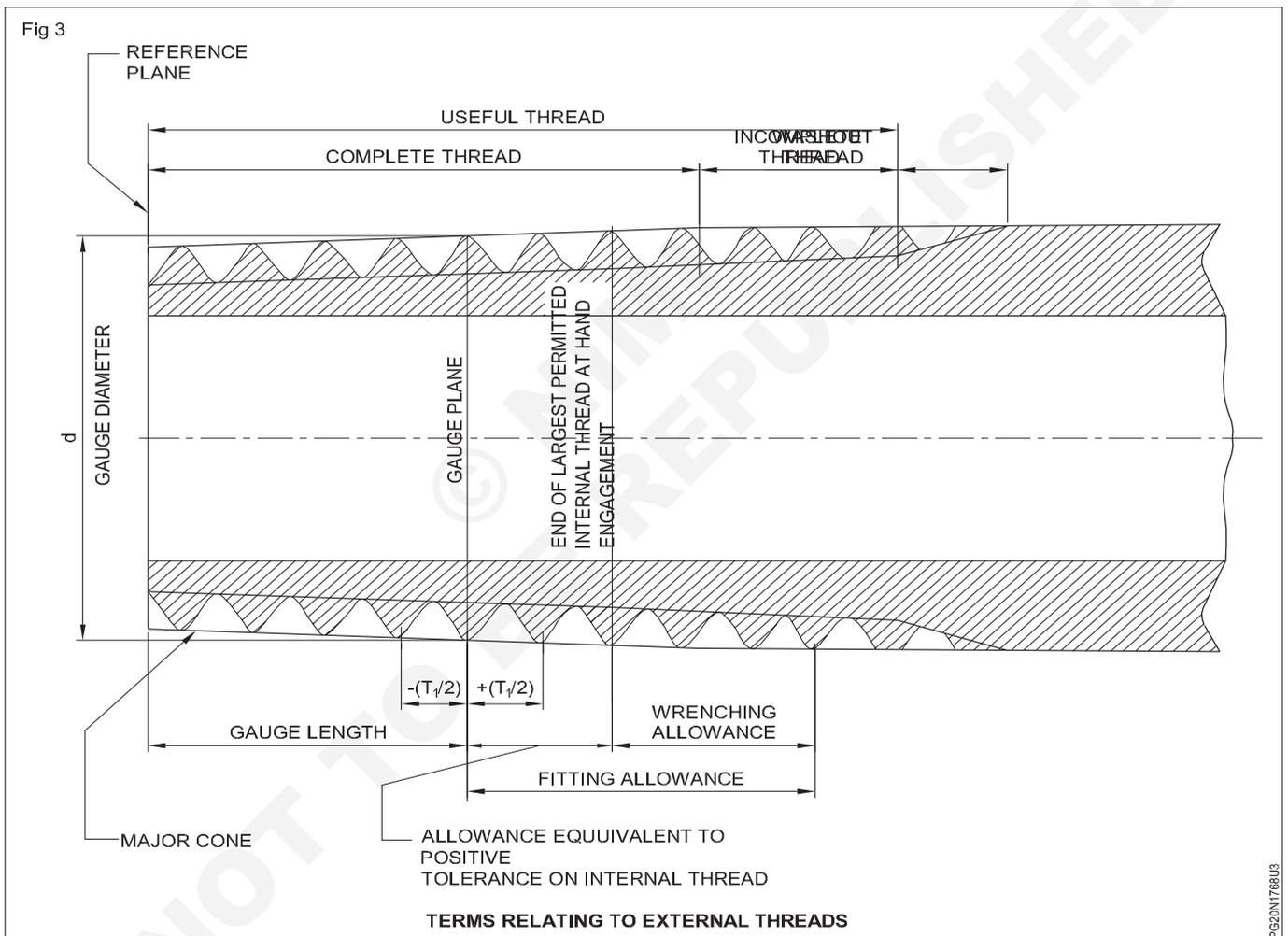
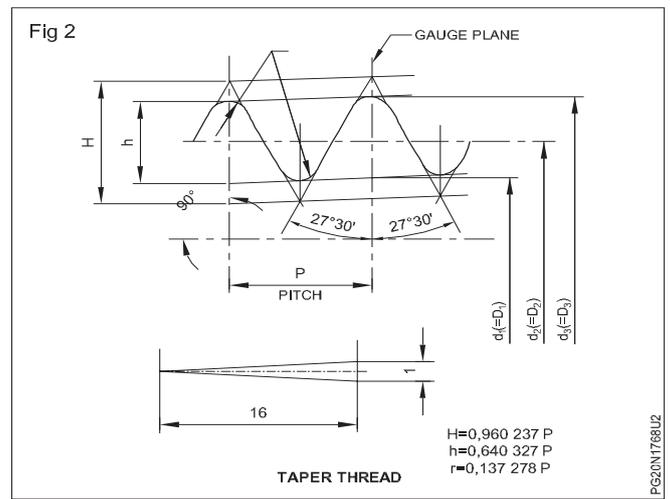
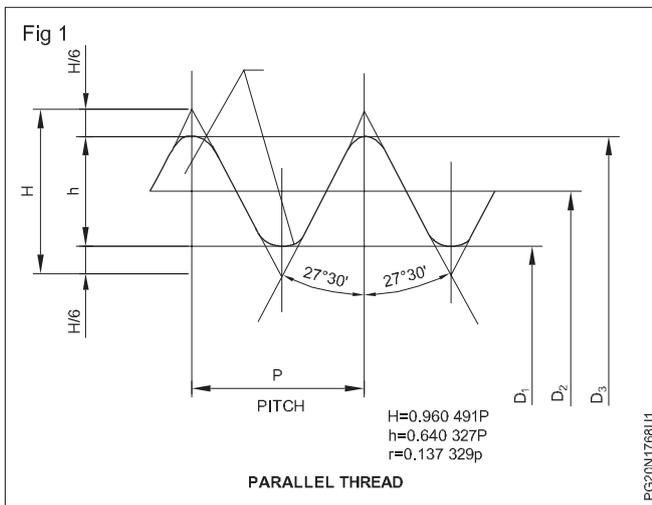
Dimensions in millimetres

1	2	3	4	5			6			7			8			9			10			11			12			13			14			15			16			17			18	19	20
				Designation of thread size	Number of threads in 25,4 mm	Pitch P	Height of thread h	Diameters at gauge plane			Gauge length (external thread)			Tolerance on position of gauge plane on internal thread	Length of useful external thread not less than			Fitting allowance	Diametral tolerance ¹⁾ on parallel internal threads																										
Major (gauge diameter) d	Pitch d_2	Minor d_1	Nominal					Tolerance $\pm T_1/2$	max.	min.	Tolerance $\pm T_1/2$	Turns of thread	For nominal gauge length		For maximum gauge length	For minimum gauge length	Tolerance $\pm T_1/2$			Turns of thread																									
1/16	28	0,907	0,581	7,723	7,142	6,561	4	0,9	1	4,9	3,1	1,1	11/4	6,5	7,4	5,6	2,5	23/4	± 0,071																										
1/8	28	0,907	0,581	9,728	9,147	8,566	4	0,9	1	4,9	3,1	1,1	11/4	6,5	7,4	5,6	2,5	23/4	± 0,071																										
1/4	19	1,337	0,856	13,157	12,301	11,445	6	1,3	1	7,3	4,7	1,7	11/4	9,7	11	8,4	3,7	23/4	± 0,104																										
3/8	19	1,337	0,856	16,662	15,806	14,950	6,4	1,3	1	7,7	5,1	1,7	11/4	10,1	11,4	8,8	3,7	23/4	± 0,104																										
1/2	14	1,814	1,162	20,965	19,793	18,631	8,2	1,8	1	10,0	6,4	2,3	11/4	13,2	15	11,4	5,0	23/4	± 0,142																										
3/4	14	1,814	1,162	26,441	25,279	24,117	9,5	1,8	1	11,3	7,7	2,3	11/4	14,5	16,3	12,7	5,0	23/4	± 0,142																										
1	11	2,309	1,479	33,249	31,770	30,291	10,4	2,3	1	12,7	8,1	2,9	11/4	16,8	19,1	14,5	6,4	23/4	± 0,180																										
1 1/4	11	2,309	1,479	41,910	40,431	38,952	12,7	2,3	1	15,0	10,4	2,9	11/4	19,1	21,4	16,8	6,4	23/4	± 0,180																										
1 1/2	11	2,309	1,479	47,803	46,324	44,845	12,7	2,3	1	15,0	10,4	2,9	11/4	19,1	21,4	16,8	6,4	23/4	± 0,180																										
2	11	2,309	1,479	59,614	58,135	56,656	15,9	2,3	1	18,2	13,6	2,9	11/4	23,4	25,7	21,1	7,5	31/4	± 0,180																										
2 1/2	11	2,309	1,479	75,184	73,705	72,226	17,5	3,5	11/2	21,0	14,0	3,5	11/2	26,7	30,2	23,2	9,2	4	± 0,216																										
3	11	2,309	1,479	87,884	86,405	84,926	20,6	3,5	11/2	24,1	17,1	3,5	11/2	29,8	33,3	26,3	9,2	4	± 0,216																										
4	11	2,309	1,479	113,030	111,551	110,072	25,4	3,5	11/2	28,9	21,9	3,5	11/2	35,8	39,3	32,3	10,4	4 1/2	± 0,216																										
5	11	2,309	1,479	136,430	135,472	134,514	28,6	3,5	11/2	32,1	25,1	3,5	11/2	40,1	43,6	36,6	11,5	5	± 0,216																										
6	11	2,309	1,479	163,830	162,351	160,872	28,6	3,5	11/2	32,1	25,1	3,5	11/2	40,1	43,6	36,6	11,5	5	± 0,216																										

NOTE — The main dimensions were converted into millimetres on the basis of 1 inch = 25,4 mm, beginning with the number of threads per inch, which determines the pitch P , the formula h (the height of thread) = $0,640327 P$ and the major diameter at the gauge plane. Pitch diameter and minor diameter were then compiled by subtracting once or twice respectively the height of thread h from the major diameter.

The nominal gauge length, the tolerances and the fitting allowance were directly computed. The remaining lengths given in table 1 were obtained by subtracting or adding the tolerances or fitting allowance respectively to the nominal gauge length. Tolerances and fitting allowance are expressed in millimetres and in number of turns of thread.

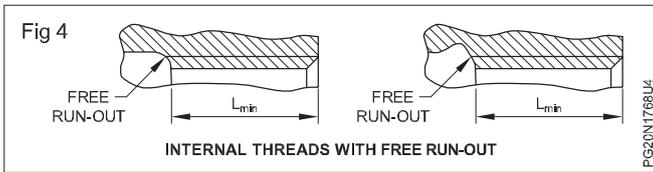
- 1) For parallel internally threaded parts the diametral tolerances are derived from the tolerances in column 14 by multiplying with the corresponding pitch in column 3 and with 1/16, the amount of taper.
- 2) Informative tolerances, in millimetres, are obtained from the mandatory values in turns of thread by multiplying with the corresponding pitch in column 3 and rounding to the nearest 0,1 mm.



The length of the useful thread, allowable in practice, is the sum of the lengths of the complete and incomplete threads, excluding the washout thread. The minimum length of the useful thread must be not less than the minimum gauge length plus the fitting allowance.

Internal thread: The design of internally threaded parts shall be such that they can receive external threads up to the lengths given in column 16 of table 1. The

minimum lengths &,, of useful thread in the case of internal threads with free run-out shall be not less than 80 % of the values given in column 17 of table 1. (Fig 4)



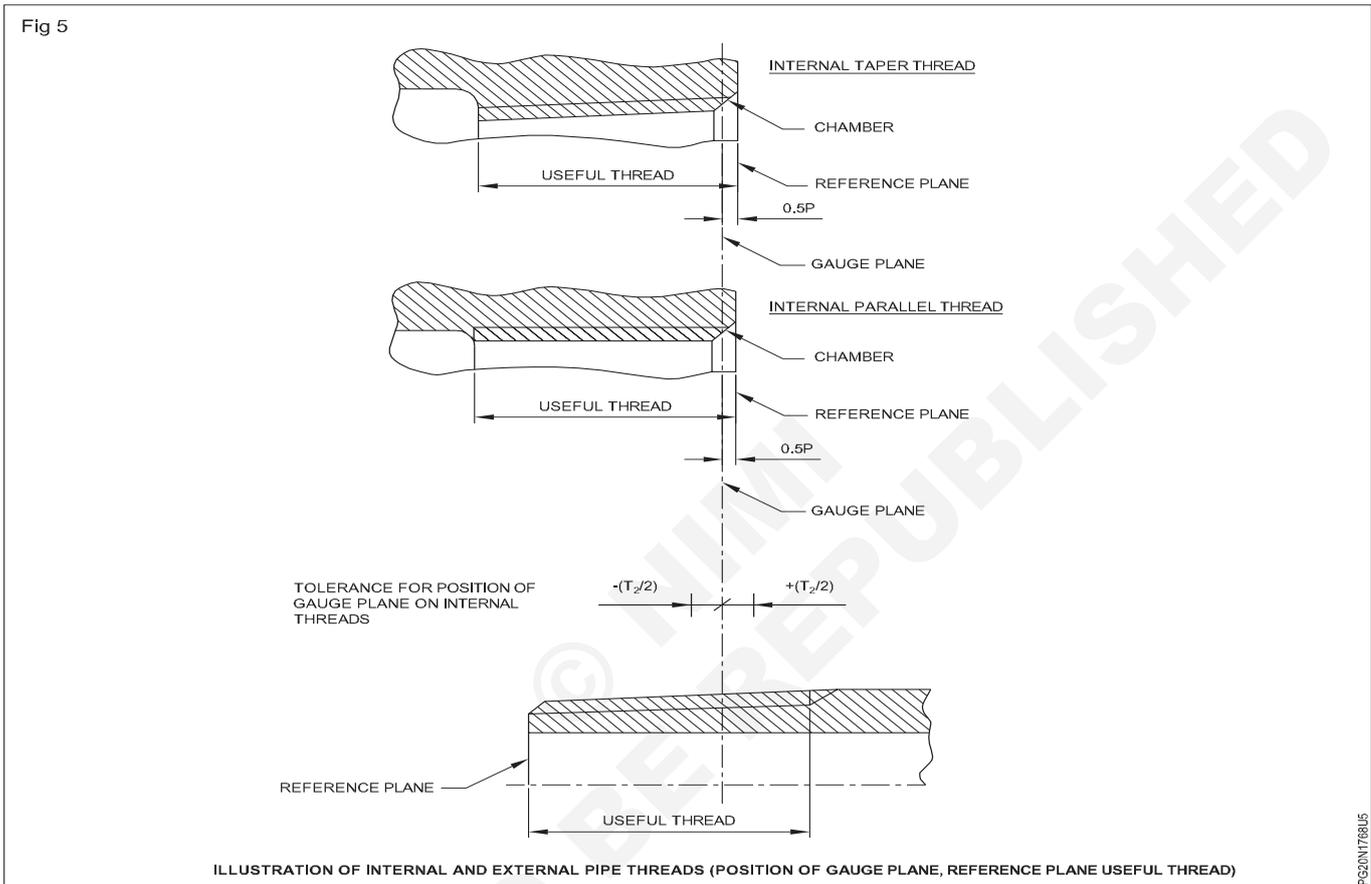
Gauging: For the verification of pipe threads, the plug and ring gauges used shall conform to ISO 7-2. The gauging always relates to a reference plane of the threaded part to be verified. (Fig 5)

Combination with fastening thread

The combination of an external parallel thread G to C, class A or B in accordance with ISO 228-1. with an internal parallel thread Rp in accordance with ISO 7-1 needs special consideration.

When it is necessary to have this combination, the positive or negative tolerance of the internal thread to ISO 7-1 shall be considered in the relevant product standards, where external parallel threads G are used.

Such a combination of threads may not necessarily achieve a leak-tight joint.



Die and die stock

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

- state the uses of dies
- state the type of dies
- state the procedure for use the die and die stock.

Dies and die stock

Uses of dies: Threading dies are used to cut external threads on cylindrical workpieces. (Fig 1)

Types of dies

The following are the different types of dies.

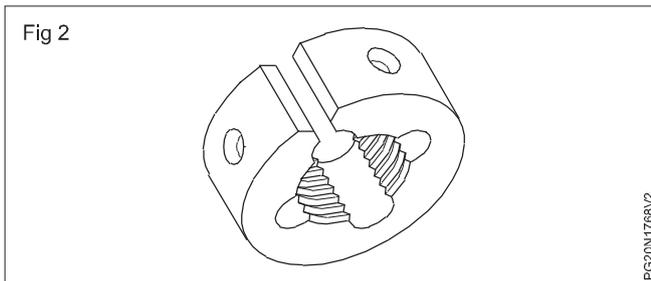
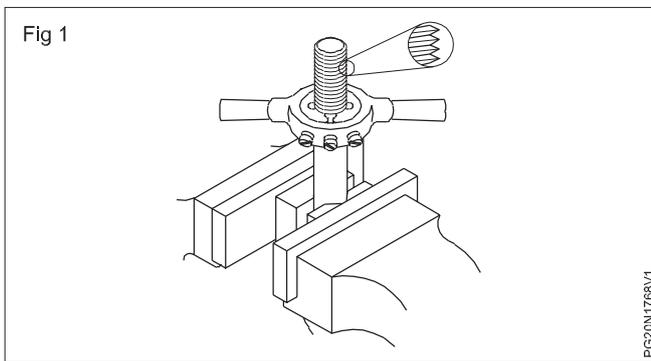
- Circular split die (Button die)

- Half die
- Adjustable screw plate die

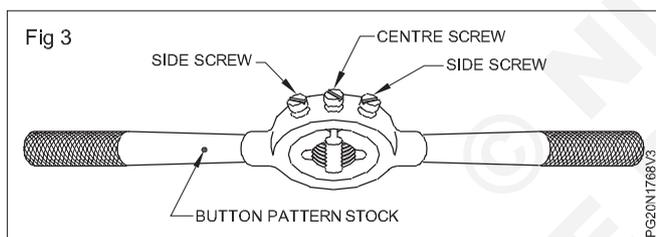
Circular split die/button die (Fig 2)

This has a slot cut to permit slight variation in size.

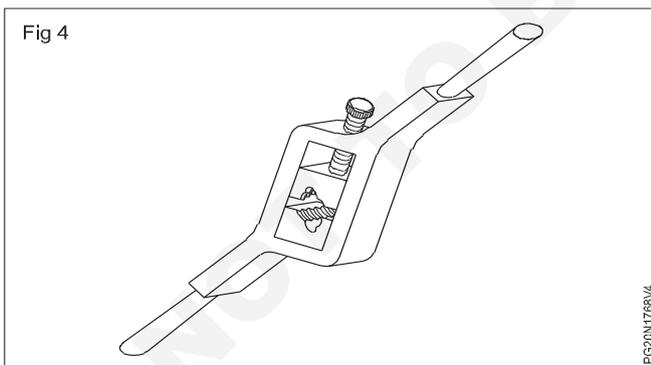
Dies are made of high speed steel.



When held in the die stock, variation in the size can be made by using the adjusting screws. This permits increasing or decreasing of the depth of cut. When the side screws are tightened the die will close slightly. (Fig 3) For adjusting the depth of the cut, the centre screw is advanced and locked in the groove. This type of die stock is called button pattern stock.



Half die (Fig 4)



Half dies are stronger in construction.

Adjustments can be made easily to increase or decrease the depth of cut.

These dies are available in matching pairs and should be used together.

By adjusting the screw of the die stock, the die pieces can be brought closer together or can be moved apart.

They need a special die holder.

Check blank size.

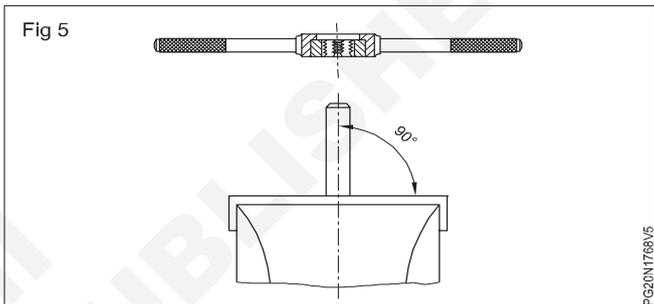
Blank size = Threads size - 0.1 > pitch of thread

Procedure: Fix the die in the die stock and place the leading side of the die opposite to the step of the die stock. (Fig 7)

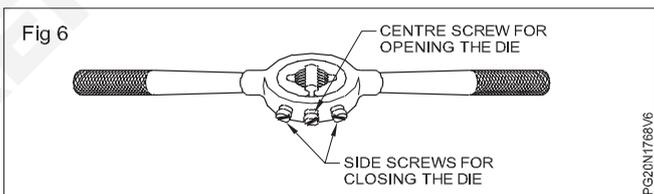
Use false jaws for ensuring a good grip in the vice.

Project the blank above the vice - just the required thread length only.

Place the leading side of the die on the chamfer of the work. (Fig 5)



Make sure that the die is fully open by tightening the centre screw of the die stock. (Fig 6)



Start the die, square to the bolt centre line. (Fig 7)

Apply pressure on the die stock evenly and turn clockwise direction to advance the die on the bolt blank. (Fig 8)

Cut slowly and reverse the die for a short distance in order to break the chips. (Fig 9)

Use a cutting lubricant.

Increase the depth of the cut gradually by adjusting the outer screws.

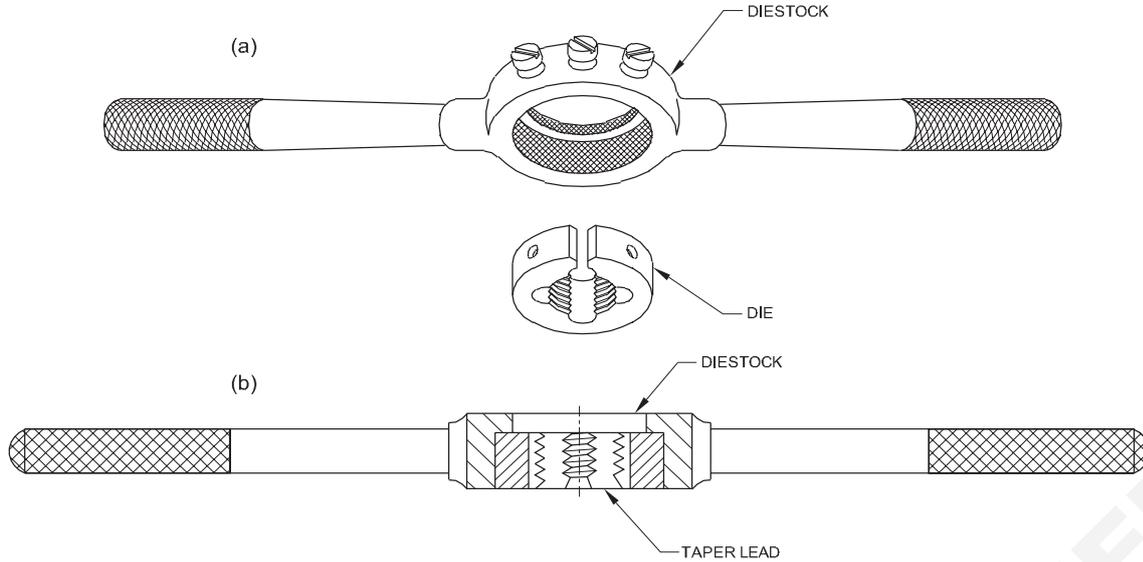
Check the thread with a matching nut.

Repeat the cutting until the nut matches.

Too much depth of cut at one time will spoil the threads. It can also spoil the die.

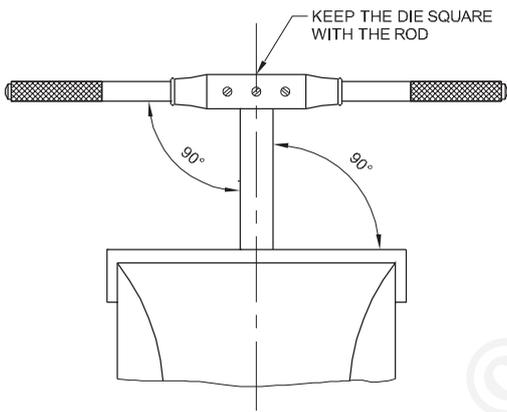
Clean the die frequently to prevent the chips from clogging and spoiling the thread.

Fig 7



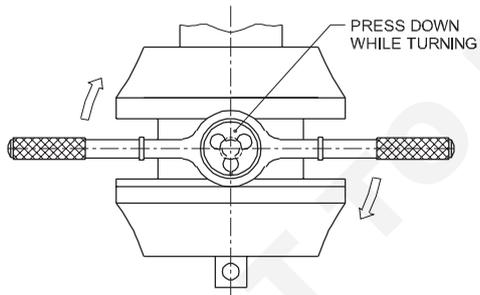
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Fig 8



PG20N1788V8

Fig 9

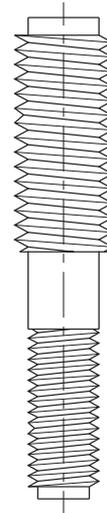


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Uses of studs (Fig 10): Studs are mainly used in assembling flange to the pump sets big size is inserted into the pump casting. Smaller size is used to connect flanges of suction pipe with ashers and nut.

It is also used for gland packing rope to tighten the gland cup.

Fig 10



OVERSIZE SPECIAL STUD TO SUIT THE TAPPED HOLE

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Introduction to computer

- Objectives:** At the end of this lesson you shall be to
- explain the organization of a computer and its units
 - explain the characteristics of computer
 - state the computer language and representation of data
 - list out the types of networks.

Computer - Definitions

A Computer is an electronic machine, operating under the control of instructions stored in its own memory that can accept data (input), manipulate the data according to specified rules (process), produce results (output), and store the results for future use.

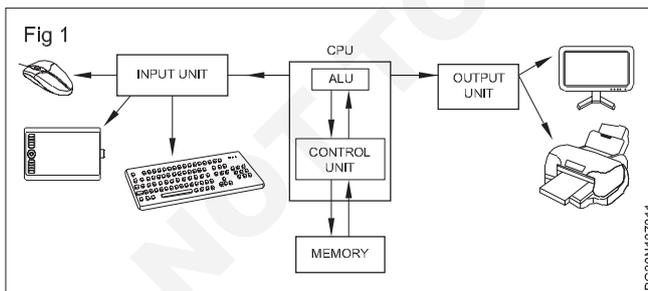
Technically, a computer is a programmable machine. This means it can execute a list of programmed instructions and respond to new instructions that it is given.

Data entered into a computer is called input. The processed results are called output. Thus a computer process input to create output. A Computer also can hold data and information for future use in an area called storage. This cycle of input, process, output and storage is called the information cycle.

All computers are made up of three basic units as shown in Fig 1. They are as follows:-

- 1 Input Unit
- 2 Central processing Unit (CPU)
 - a Arithmetic Logic Unit (ALU)
 - b Control Unit (CU)
- 3 Output Unit

Block Diagram of Computer (Fig 1)



Input Unit (Fig 2)

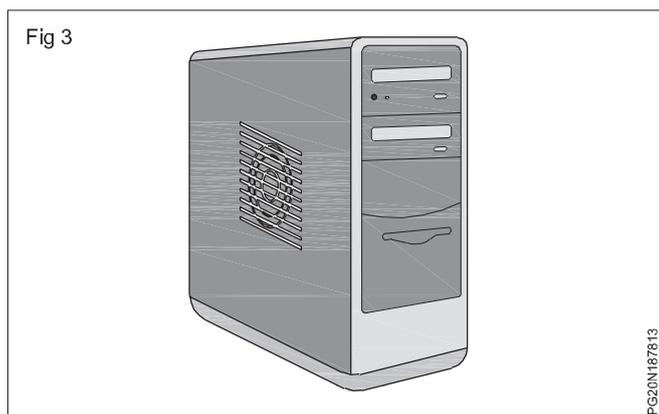


Computers need to receive data and instruction in order to solve any problem. Therefore we need to input the data and instructions into the computers. The input unit consists of one or more input devices. Keyboard is the one of the most commonly used input device.

Input devices perform the following functions

- Accept the data and instructions from the outside world.
- Convert it to a form that the computer can understand.
- Supply the converted data to the computer system for further processing.

Central Processing Unit (CPU) (Fig 3)



The central processing unit (CPU) is the electronic brain of the computer as on fig-3. The CPU in a personal computer is usually a single chip. It organizes and carries out instructions that come from either the user or from the software. The processor is made up of many components. CPU performs the following functions:

- It performs all calculations.
- It takes all decisions.
- It controls all units of the computer.

CPU Components

A lot of components go into building a modern computer processor and just what goes in changes with every generation as engineers and scientists find new, more efficient ways to do old tasks.

- Execution Core(s)
- Data Bus
- Address Bus
- Math Co-processor
- Instruction sets / Microcode
- Multimedia extensions
- Registers
- Flags
- Pipelining
- Memory Controller
- Cache Memory (L1, L2 and L3)

Two typical components of a CPU are the following

- The arithmetic logic unit (ALU), which performs arithmetic and logical operations.
- The control unit (CU), which extracts instructions from memory and decodes and executes them, calling on the ALU when necessary.

Arithmetic-Logic Unit (ALU)

The ALU is an electronic circuit used to carry out the arithmetic operations like addition, subtraction, multiplication and division. This unit carries out logical operations like greater than, less than, equal to etc.

It performs the operation on the data provided by the input devices. A comparison operation allows a program to make decisions based on its data input and results of the previous calculations.

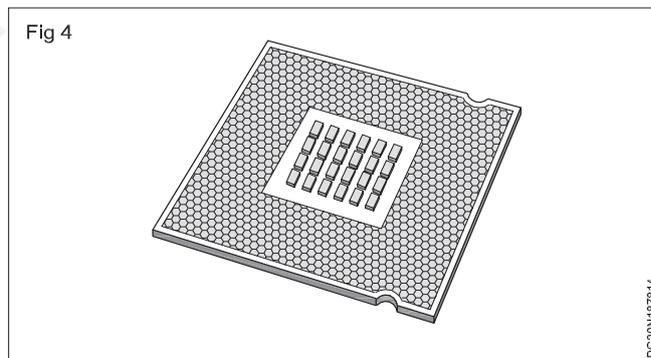
Logical operations can be used to determine whether particular statement is TRUE or FALSE. The ALU operates on the data available in the main memory and sends them back after processing again to main memory.

Control Unit

The control unit coordinates the activities of all the other units in the system... The control unit instructs the input unit, where to store the data after receiving it from the user.

It controls the flow of data and instructions from the storage unit to ALU. It also controls the flow of results from the ALU to the storage unit. The control unit is generally referred as the central nervous system of the computer that control and synchronizes it's working.

Processor (Fig 4)



The processor is plugged into the computer's motherboard. The motherboard is a rigid rectangular card containing the circuitry that connects the processor and all the other components that make up your personal computer.

In most personal computers, some of the components are attached directly to the motherboard and some are housed on their own small circuit boards that plug into the expansion slots built into the motherboard.

Processor Manufactures

- American Micro Devices (AMD)
- Intel

- IBM
- Motorola
- Cyrix
- Texas Instruments

Memory Devices (Storage Unit)

The storage unit of the computer holds data and instructions that are entered through the input unit, before they are processed. It preserves the intermediate and final results before these are sent to the output devices. It also saves the data for the later use. The various storage devices of a computer system are divided into two categories.

1 Primary Memory (Main Memory)

Random Access Memory (RAM)

RAM stands for Random Access Memory. As the name suggests data or instruction could be accessed quickly/ randomly from the RAM. It is a temporary/volatile memory i.e. whatever data or instruction is in RAM would be lost when the computer is switched off. Also when the program is been completely executed it is automatically removed from the RAM. The information stored in RAM could be read, written, modified or erased. RAM stores the user's data, instruction, intermediate and final result temporarily.

Read-only memory (ROM)

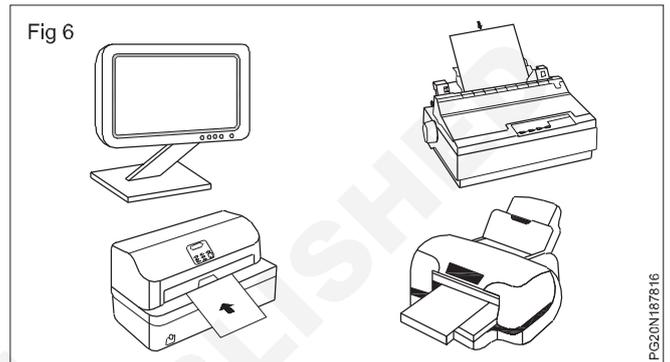
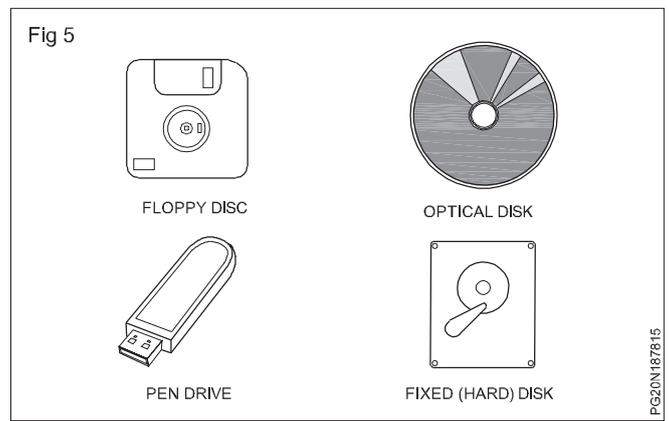
Read-only memory (usually known by its acronym, ROM) is a class of storage media used in computers and other electronic devices. Because data stored in ROM cannot be modified (at least not very quickly or easily), it is mainly used to distribute firmware (software that is very closely tied to specific hardware, and unlikely to require frequent updates). Modern semiconductor ROM chips are not immediately distinguishable from similar chips like RAM modules, except by the part numbers printed on the package.

Programs that you run on the computer are first transferred to the primary memory before it is actually run. Whenever the results are saved, again they get stored in the secondary memory. The secondary memory is slower and cheaper than the primary memory. Some of the commonly used secondary memory devices are Hard disk, CD, etc., are shown in Fig 5.

The size of the primary storage in a typical PC usually starts at 256MB, 512 MB, 1 GB, 2 GB, 4 GB, 8 GB memory are quite common.

Output Unit (Fig 6)

This is the process of producing results from the data for getting useful information. Similarly the output produced by the computer after processing must also be kept somewhere inside the computer before being given to you in human readable form. Again the output is also stored inside the computer for further processing.



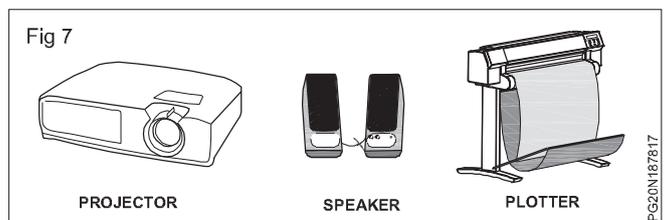
Computer Display (Monitors)

A computer display is also called a display screen or video display terminal (VDT). A monitor is a screen used to display the output. Images are represented on monitors by individual dots called pixels.

A pixel is the smallest unit on the screen that can be turned on and off or made different shades. The density of the dots determines the clarity of the images, the resolution.

Cathode Ray Tubes (CRT): A CRT is a vacuum tube used as a display screen for a computer output device. Although the CRT means only a tube, it usually refers to all monitors. Cathode Ray Tube monitors belong to the first generation monitor technology.

A Cathode Ray Tube consists of one or more electron guns, which discharge electrons into phosphorus pixels through a magnetic field. Three pixels colors, Red, Green and Blue are illuminated when hit by the ray of electrons. (Fig 7)



Monochrome Monitors

A monochrome monitor has two colors, one for foreground and the other for background. The colors can be white, amber or green on a dark (black) background. The monochrome monitors display both text and graphics modes.

The characteristics of a computer are described below:

Speed

Computers work at an incredible speed. A powerful computer is capable of performing about 3-4 million simple instructions per second.

Accuracy

In addition to being fast, computers are also accurate. Errors that may occur can almost always be attributed to human error (inaccurate data, poorly designed system or faulty instructions/programs written by the programmer)

Diligence

Unlike human beings, computers are highly consistent.

They do not suffer from human traits of boredom and tiredness resulting in lack of concentration. Computers, therefore, are better than human beings in performing voluminous and repetitive jobs.

Versatility

Computers are versatile machines and are capable of performing any task as long as it can be broken down into a series of logical steps. The presence of computers can be seen in almost every sphere - Railway/Air reservation, Banks, Hotels, Weather forecasting and many more. Storage Capacity

Today's computers can store large volumes of data. A piece of information once recorded (or stored) in the computer, can never be forgotten and can be retrieved almost instantaneously.

Power of Remembering

Computer has the power of storing any amount of information or data. Any information can be stored and recalled as long as you require it, for any numbers of years. It depends entirely upon you how much data you want to store in a computer and when to lose or retrieve these data.

No IQ: Computer is a dumb machine and it cannot do any work without instruction from the user. It performs the instructions at tremendous speed and with accuracy. It is you to decide what you want to do and in what sequence. So a computer cannot take its own decision as you can.

No Feeling: It does not have feelings or emotion, taste, knowledge and experience. Thus it does not get tired even after long hours of work. It does not distinguish between users.

Storage: The Computer has an in-built memory where it can store a large amount of data. You can also store data in secondary storage devices such as floppies, which can be kept outside your computer and can be carried to other computers.

2 Computing Power, Memory Capacity and cost

Computers are classified on the basis of size, speed and price as under:

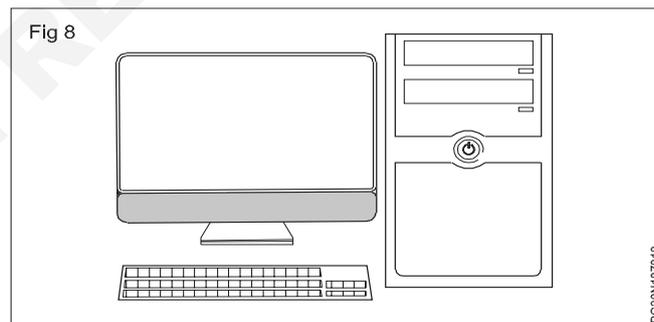
- 1 Microcomputer or Personal Computer.
- 2 Mini Computer.
- 3 Mainframe Computer.
- 4 Super Computer.

1 Micro Computers

Micro computer is also called personal computer. It was introduced in 1970. It contains input devices, output device, storage device, memory and processor. It is used by one person at a time. Examples of personal computers are PC and Apple Macintosh. The major types of personal computers are desktop computer and portable computer.

Desktop Computer

These computers can easily fit on a table or desktop, hence the name. These computers come in two models or casings. In Desktop model, the system unit is placed on the desktop or table. Monitor is placed on the system unit. In Tower model, both monitor and system unit are placed on the table as on Fig 8.



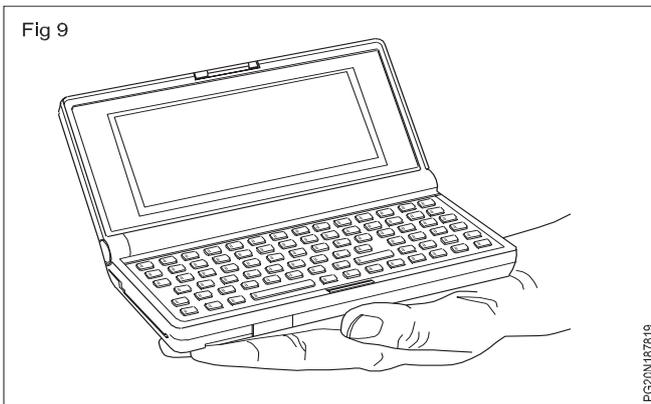
Tower Model computer Portable computer

Portable is a personal computer that can be carried from one place to other easily. Notebook computer (Fig-12) and handheld computer (smart phone) are examples of portable computers. Notebook computer is also called laptop computer. Laptop computers are very small in size and can be placed easily on lap.

Lap top computer or notebook computer: The Laptop computer or notebook computer will be as shown in Fig 9.

Palmtop Computer/Digital Diary /Notebook /PDAs

A handheld computer (like smart phone) is also portable. Hand held computer is known as palmtop computer. Palmtops have no keyboard but the screen serves both as an input and output device. It easily fits in the hand of the user.



Hardware and Software

A computer system consists of hardware (the electronic devices capable of computing and manipulating information), and software (a set of instructions) that carries out predefined tasks to complete a given job.

The sets of instructions, which control the sequence of operations, are known as programs, and these programs are collectively called software.

Software - Definitions

Software is a generic term for an organized collection of computer data and instructions. It is responsible for controlling, integrating and managing the hardware components of a computer system and for accomplishing specific tasks.

In other words, software instructs the computer what to do and how to do it. For example, software instructs the hardware what to be displayed on the user's screen, what kind of input to be taken from the user and what kind of output to be generated. Thus, software communicates with the hardware by organizing the control sequences, and the hardware carries out the instructions defined by the software.

As discussed earlier, a computer needs to be instructed to perform any task. These instructions are given in the form of computer programs, which are written in computer programming languages. A program controls the activity of the processor and the processor performs exactly what a program instructs. The moment the hardware (e.g. processor and memory) acts as per the instructions of a program, the program is said to be in the running or in the execution.

Relationship Between Software and Hardware

Software is a set of instructions that tells the hardware what to do and how to perform the requested actions. Thus, hardware and software share a special relationship. If hardware is the 'heart' of a computer system, software is its 'soul'. Both are complimentary to each other.

Software Categories

Software can be divided into two major categories:

- 1 System software: It provides the basic non-task-specific functions of the computer. System software is essential for a computer to function.

- 2 Application software: It is utilized by the users to accomplish specific tasks. It is the additional software that the users choose according to their needs.

1 System software a) Operating System Software:

An operating system is a collection of system programs that together controls the operation of a computer system. Operating system along with hardware, application and other system software, and users constitute a computer system. It is the most important part of any computer system. It acts as an intermediary between a user and the computer hardware.

Examples: DOS, Windows XP, Windows Vista, Unix/Linux, MAC/OS X etc.

b) Utility Software:

Utility software is system software designed to help analyze, configure, optimize or maintain a computer. A single piece of utility software is usually called a utility or tool.

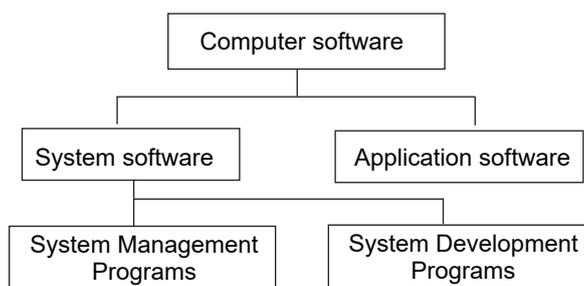
Utility software usually focuses on how the computer infrastructure (including the computer hardware, operating system, application software and data storage) operates

Examples: Windows Explorer (File/Folder Management), Windows Media Player, Anti-Virus Utilities, Disk Defragmentation, Disk Clean, Backup, WinZip, WinRAR etc...

2 Application software

The Application software includes enterprise, accounting software, office suites, graphics and media softwares.

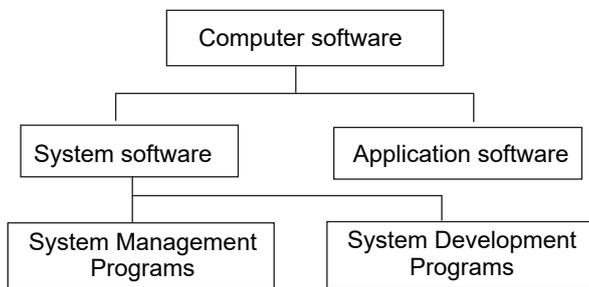
Apps may be bundled with the computer and its system software, or may be published separately. Some users are satisfied with the bundled apps and need never install one.



Some of the Package Softwares are MS Office 2003, MS Office 2007, Macromedia (Dreamweaver, Flash, and Freehand), Adobe (PageMaker, Photoshop), Corel draw, Autocad, etc...

Keyboard & Mouse

Keyboard Connectors are two types basically. All PCs have a Key board port connected directly to the motherboard. The oldest, but still quite common type, is a special DIN, and most PCs until recently retained this style connector.



The AT-style keyboard connector is quickly disappearing, being replaced by the smaller mini DIN PS/2-style keyboard connector. It can use an AT-style keyboard with a PS/2-style socket (or the other way around) by using a converter.

Although the AT connector is unique in PCs, the PS/2-style mini-DIN is also used in more modern PCs for the mouse. Fortunately, most PCs that use the mini-DIN for both the keyboard and mouse clearly mark each mini-DIN socket as to its correct use. Some keyboards have a USB connection, but these are fairly rare compared to the PS/2 connection keyboards.

USB (Universal Serial Bus)

USB is the General-purpose connection for PC. You can find USB versions of many different devices, such as mice, keyboards, scanners, cameras, and even printers. A USB connector's distinctive rectangular shape makes it easily recognizable.

USB has a number of features that makes it particularly popular on PCs. First, USB devices are hot swappable. It can insert or remove them without restarting your system.

Windows booting procedure

Every day we are using an operating system and most specifically a Windows operating system but most of us are not aware of the process or procedures involved in the starting of Windows.

Computer operating system

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

- explain operating system
- explain the functions of operating system
- state the types of operating system
- explain about windows XP operating system
- list out components of windows XP
- explain windows XP desktop components
- explain how to work multiple applications.

Operating system (OS)

An operating system is a collection of system programs that together controls the operation of a computer system. Operating system along with hardware, application and other system software, and users constitute a computer system. It is the most important part of any computer system. It acts as an intermediary between a user and the computer hardware.

Here we are going to learn the step by step processes involved in the booting procedure of a Windows operating system.

What is booting?

Before checking the booting procedures we should know the meaning of booting. Booting is just the process of starting or resetting the computer.

There are two types of booting: cold booting and warm booting. Cold booting is the booting process happening when we first turn on computer and warm booting is the processes happening when we reset the computer. During the booting process the computer loads the operating system to its memory and prepares it for use.

Serial Port

The serial port does not suffer the same problems of the parallel port. The behavior of the serial port has been standardized across computers so there are no surprises there.

The real problems are: bandwidth and limited ports. The serial port is the slowest of the group. If you have a host adaptor that claims to support 400 kbps, consider the fact that the serial port can only support 115 kbps. That just doesn't add up.

Parallel port

The Parallel port can be fast enough for most applications, but it suffers from many problems. The most significant issue is that the port is non-standard. Often times, users of the parallel port will run into OS issues or BIOS issues.

Most manufacturers have different implementations of the parallel port. On most computers there is usually only one parallel port available which can cause many headaches if that port needs to be shared with a printer or scanner.

The operating system has two objectives

- Managing the Computer's hardware
- Providing an Interface

Functions of Operating System

The main functions of a modern operating system are as follows:

- **Process Management:** As a process manager, the operating system handles the creation and deletion of processes, suspension and resumption of processes and scheduling and synchronization of processes.
- **Memory Management:** As a memory manager, the operating system handles the allocation and deallocation of memory space as required by various programs.
- **File Management:** The operating system is responsible for creation and deletion of files and directories. It also takes care of other file-related activities such as organizing, storing, retrieving, naming, and protecting the files.
- **Device Management:** Operating system provides input/output subsystem between process and device driver. It handles the device caches, buffers and interrupts. It also detects the device failures and notifies the same to the user.
- **Security Management:** The operating system protects system resources and information against destruction and unauthorized use.
- **User Interface:** Operating system provides the interface between the user and the hardware. The user interface is the layer that actually interacts with the computer operator. The interface consists of a set of commands or menus through which a user communicates with a program.
- **Multitasking Operating System:** In a multitasking system, more than one process (task) can be executed concurrently. The processor is switched rapidly between the processes. Hence, a user can have more than one process running at a time. For example, a user can have a word processor and an audio CD player running at the same time. The multitasking operating system allows the user to switch between the running applications and even transfer data between them. For example, a user can copy a picture from the Internet opened in the browser application and paste it into an image-editing application.
- **Real-time Operating System:** Real-time operating systems (RTOSs) are designed to respond to an event

Within predetermined time. This kind of operating system is primarily used in process control, telecommunications and so on. The operating system monitors various inputs, which affect the execution of processes, changing the computer model of the environment, thus affecting the output, within a guaranteed time period (usually less than 1 s). As the RTOSs respond quickly, they are often used in applications such as flight reservation system, railway reservation system and military applications.

- **Multiprocessor Operating System:** A multiprocessor operating system can incorporate more than one processor dedicated to the running processes. This technique of using more than one processor is often called parallel processing.
- **Embedded Operating System:** An embedded operating system refers to the operating system that is self-contained in the device and resident in the read-only memory (ROM). Since embedded systems are usually not general-purpose systems, they are lighter or less resource intensive as compared to general-purpose operating systems. Most of these operating systems also offer RTOS qualities. Typical systems that use embedded operating systems are household appliances, car management systems, traffic control systems and energy management systems.

Types of Operating System: The operating system has evolved immensely from its primitive days to the present digital era. From batch- processing systems to the latest embedded systems, the different types of operating systems can be classified into six broad categories:

- **Batch-Processing Operating System:** This type of operating system was one of the first to evolve. Batch- processing operating system allowed only one program to run at a time. These kinds of operating systems can still be found on some mainframe computers running batches of jobs. This system works on a series of programs that are held in a queue. The operating system is responsible for scheduling the jobs according to priority and the resources required. For example, this operating system would be best suited for a company wishing to automate their payrolls. List of employees will be entered, their monthly salaries will be calculated and corresponding pay slips would be printed. Batch processing is useful for this purpose since these procedures are to be repeated every month for each employee.
- **Time-sharing or Multiuser Operating System:** A multiuser operating system is used in computer networks, which allows different users to access the same data and application programs on the same network. It also allows the users to communicate with each other. The multiuser operating system builds a user database account, which defines the rights that the users have on a particular resource of the system.

Modern Operating Systems: Microsoft Windows is the most popular series of operating system in the past decade. Windows 95 revolutionized the personal computer operating system market. Then came Windows NT, Windows 98, Windows ME, Windows 2000, Windows XP, and Windows Vista and so on. Windows 7 & Windows 8 is one of the latest offering made by Microsoft and has already gained reputation among the business market. Let us discuss some features of Windows XP in futures.

Windows XP (Fig 1): Windows XP is an operating system introduced in 2001 by Microsoft. It was released in two versions: Windows XP Home and Windows XP Professional.

Windows XP Home Edition is designed for home use and small businesses, while Windows XP Professional is specifically designed for advanced home computing, businesses and larger organizations. Windows XP The name “XP” is short for “experience”, highlighting the enhanced user experience.

Fig 1



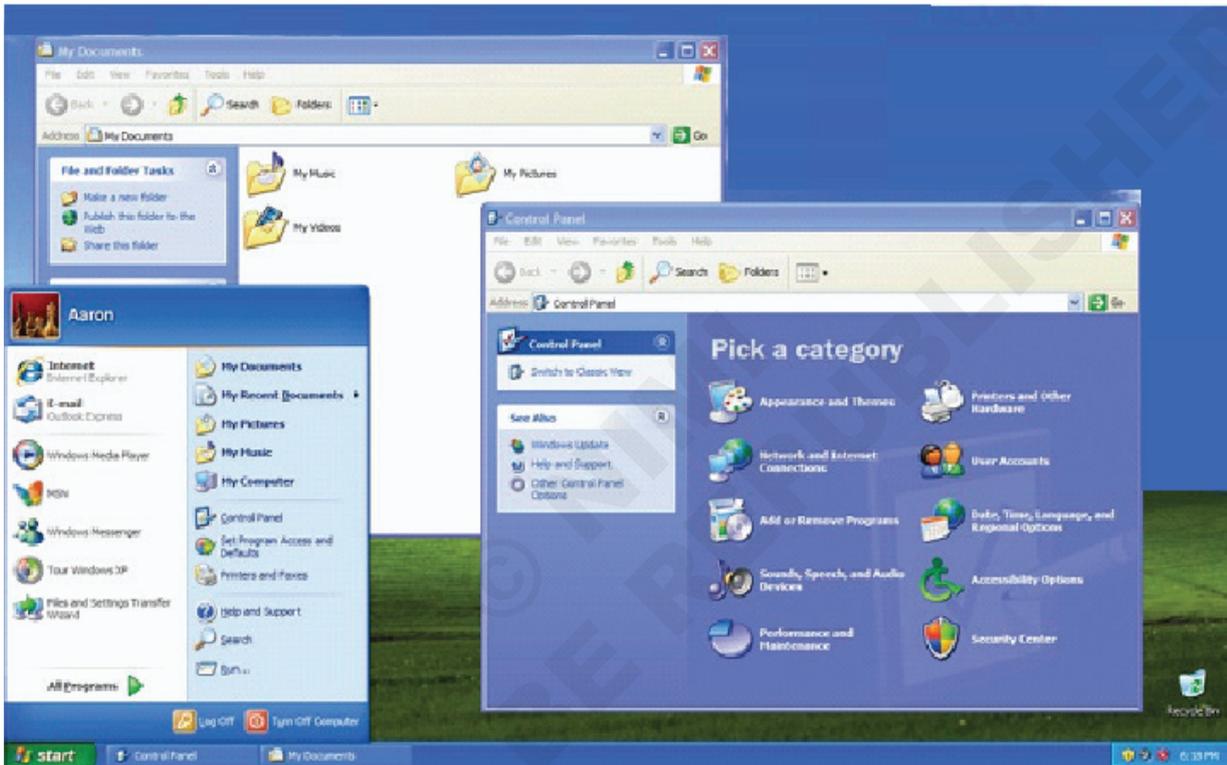
Windows XP, the successor to Windows 2000 and Windows Me, was the first consumer-oriented operating system produced by Microsoft to be built on the Windows NT kernel. Windows XP was released worldwide for retail sale on October 25, 2001, and over 400 million copies

were in use in January 2006. In Fig 1 shows logo of the windows XP, and Fig 2 shows windows XP themes

New and updated features Windows XP introduced several new features to the Windows line, including:

- Start Menu and Taskbar improvements (Fig 2)
- A number of new features in Windows Explorer including task panes, tiles and filmstrip views, improved sorting and grouping, searching by document categories, customizable info tips, built-in CD burning, AutoPlay, Simple File Sharing and WebDAV mini-redirector.

Fig 2



- Improved imaging features such as Windows Picture and Fax Viewer, improved image handling and thumbnail caching in Explorer
- A number of kernel enhancements and power management improvements
- Faster start-up, (due to improved Perfect functions) logon, logoff, hibernation and application launch sequences
- Hardware support improvements such as USB 2.0, FireWire 800, Windows Image Acquisition, Media Transfer Protocol, and Dual View for multi-monitors and audio improvements.
- Fast user switching, which allows a user to save the current state and open applications of their desktop and allow another user to log on without losing that information
- Remote Assistance and Remote Desktop features, which allow users to connect to a computer running

Windows XP from across a network or the Internet and access their applications, files, printers, and devices or request help.

- New security features such as Software Restriction Policies, Credential Manager, Encrypting File System improvements, improved certificate services, smart card and PKI support. Windows XP SP2 introduced Data Execution Prevention, Windows Security Center and Attachment Manager.
- Improved media features in Windows Media format runtime, Windows Media Player, Windows Movie Maker, TV/video capture and playback technologies, Windows Media Encoder and introduction of Windows Media Center, and so on...

Windows XP editions

The two major editions are Windows XP Home Edition, designed for home users, and Windows XP Professional, designed for business and power users. XP Professional

Screenshot of Windows XP	
Developer	
Microsoft corporation	
Website	Microsoft comwindows-xp
Releases	
Release date	October 25,2001: 10 years ago intel
Current version	5:1 (Build 2500, Service pack 3) April 21,2008: 4 years ago
Source model	Closed surface shared source
License	Proprietary commercial software

contains advanced features that the average home user would not use. However, these features are not necessarily missing from XP Home.

They are simply disabled, but are there and can become functional. These releases were made available at retail outlets that sell computer software, and were preinstalled on computers sold by major computer manufacturers.

Starting Windows XP

When a computer installed with Windows XP is switched on, after booting and running certain essential programs, (viz., config.sys, autoexec.bat etc.), a fairly big Microsoft Windows XP logo flashes on the screen and vanishes after few seconds.

Windows XP includes a new Start menu to provide quick access to frequently used programs and common system areas like My Computer, Control Panel, and Search. This article describes the function of the different areas of the new Start menu.

The left side of the Start menu contains the programs list, which is divided into two sections, the “pinned list” (at the top) and the Most Frequently Used (MFU) list. The two sections are separated by a line. The functions of these lists are as follows:

Pinnedlist

The pinned list allows users to place shortcuts to programs and other items in the Start menu. It will be pre-populated with the user’s default Web browser and e-mail program (these can be removed).

A program (.exe file) or a shortcut to a program can be “pinned” to the Start menu by right-clicking the item and clicking Pin to Start Menu. Any other item can be added to the pinned list by dragging and dropping it to the Start button or the Start menu.

An item can be removed from this list by right-clicking it and clicking Unpin from Start Menu or Remove from This List. The order of the items in this list can be arranged by dragging and dropping them to the preferred position.

If the program or shortcut that was pinned to the Start menu is moved or deleted, the links to it on the Start menu will no longer work.

MFUlist

The list of most frequently used programs (MFU list) appears below the Pinned list on the Start menu. This list keeps track of how often programs are used and displays them in order of most used (top) to least used (bottom). Programs can be removed from this list by right-clicking them and clicking Remove from This List.

The order of the items in this list cannot be manually arranged (they are arranged according to how often they are used). At the bottom of the MFU list is the All Programs menu, which displays other programs that are installed.

To configure the settings for the Programs list, follow these steps

- 1 Right-click an empty area in the Start menu and select Properties.
- 2 Click Customize.
- 3 Configuration options for the Programs list are on the General tab.

The right side of the Start menu displays links to special folders (My Documents, My Pictures, and My Music) and system areas (My Computer, Search, Control Panel).

To configure this area, follow these steps

- 1 Right-click an empty area in the Start menu and click Properties.
- 2 Click Customize.
- 3 Configuration options for the right side of the Start menu are on the Advanced tab.

The Windows XP Desktop: The Desktop gives you access to everything you need in Windows XP as shown in Fig 3. It occupies the entire screen and unlike a window, it can’t be reduced in size. The desktop consists of a coloured or patterned background, containing small pictures called Icons that represent programs or data stores. Double-clicking on an icon opens the corresponding program or file inside a window.

The icons that are visible on your desktop depend on choices made at installation. In the UCT labs, you will usually see icons for My Computer (the gateway to your computer’s drives, or data storage areas)

Recycle Bin (a temporary “trashcan” that holds files you want to delete)

Context menu: A context menu (also called contextual, shortcut, and popup or pop-up menu) is a menu in a graphical user interface (GUI) that appears upon user interaction, such as a right-click mouse operation as on Fig 4. A context menu offers a limited set of choices that are available in the current state, or context, of the operating system or application.

Fig 3

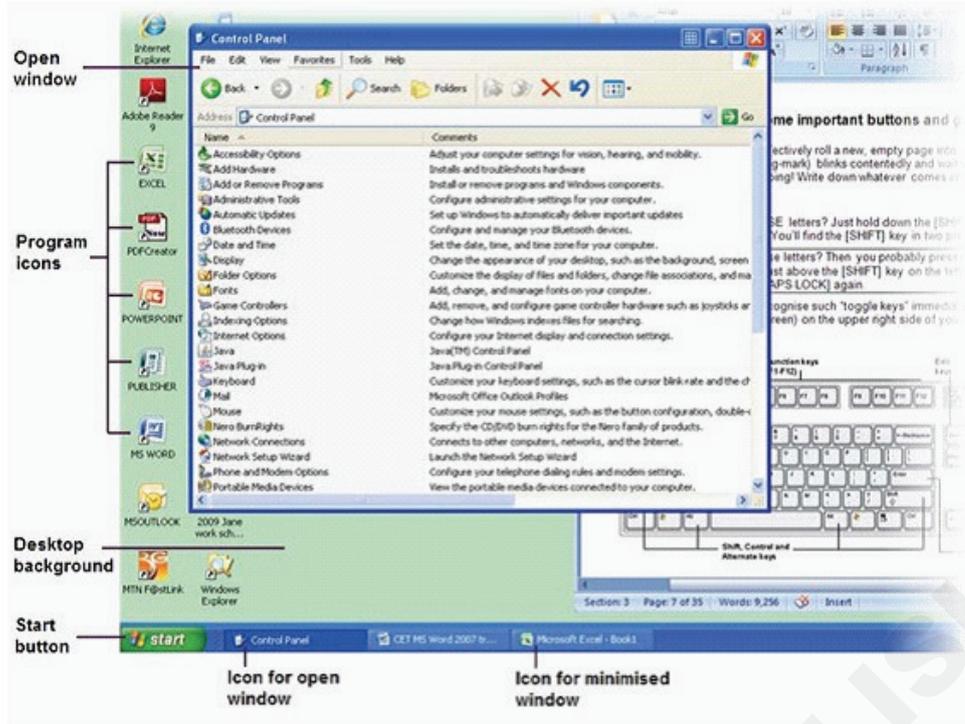
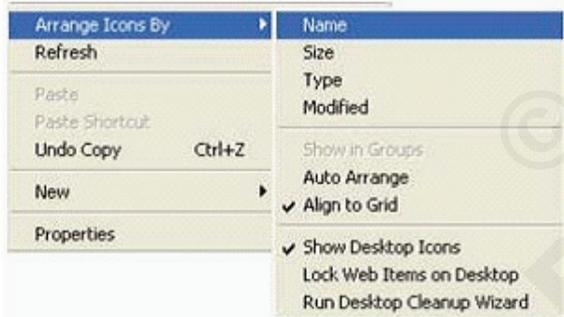


Fig 4



The Taskbar: The Taskbar lies across the bottom edge of your screen. The Start button on the left provides access to all the programs, data files, and other features available on the computer. When open a program or file, a corresponding rectangular icon will be displayed on the taskbar - even if the program has been minimised and is no longer visible on the screen. To access that program, just need to click its icon on the taskbar!

In Fig 5, two windows are open; the Control Panel window (which is slightly darker in color) is currently active.

Fig 5



The Start menu: When click on the Start button, a set of menu options is displayed. The contents will vary depending on the computer setup and most frequently

accessed programs. If click on the All Programs option, you'll see a list of all the programs installed on the computer - even those that don't have icons on the desktop as on Fig 6. Press the [ESC] (escape) key to close the menu.

Fig 6



If you need help

One of the menu options displayed when you click the Start button, is labeled Help and Support as on Fig 7. If select this option, a Help window will open.

To get help on a specific topic, type a word or phrase in the blank space at the top left of the window and then click the search arrow; alternatively, click to browse any of the Help topics listed in the window. Click the X in the top right corner to close the Help window.

Fig 7



Using mouse: The mouse is most useful tool when working with Windows! It allows you to quickly select and run programs by simply clicking a button.

It all clicks into place: You can use mouse in a number of different ways in Windows.

1 Pointing

Move the mouse so that the cursor points to an item on the screen.

2 Clicking

Hold the mouse still, and click the left mouse button once. Clicking usually selects an object (highlighting it) or opens a menu or window.

3 Double-clicking

Hold the mouse still and click the left mouse button twice in quick succession. Double-clicking is usually used to open a program or file, or to expand a folder so that you can see its contents.

4 Right-clicking

Hold the mouse still, and click the right mouse button once. Right clicking usually opens a context-sensitive menu that provides you with a set of relevant options.

5 Dragging

Position your mouse on an object; hold down the left mouse button, and drag the object before releasing the button.

Choosing or selecting?

Selecting an item on your desktop means that click on it once with the left mouse button, to highlight the object.

Choosing an item means that you double-click it with the left mouse button, so that it is not only selected but also opened. It can achieve the same result by selecting the item and then pressing [ENTER] on the keyboard.

Logging in and out

All the computers in the UCT labs are linked to a network. You must login before use a computer - this process identifies as a legitimate user. After you've logged in, you'll be able to access the files even if created them using a different computer.

To log in

The login window should be visible on the screen. If the screensaver is currently active, then just move the mouse slightly to return the login window to view as on Fig 8.

Fig 8



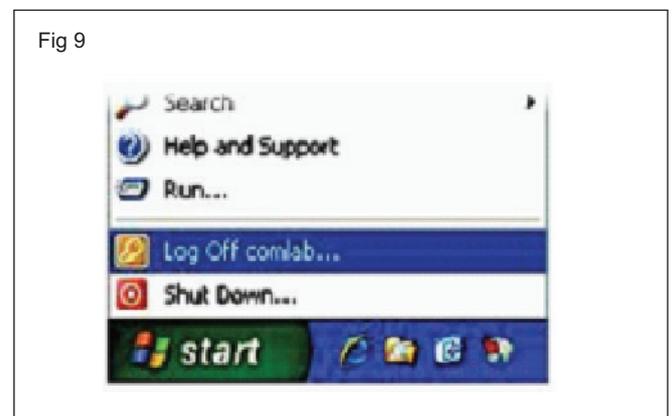
- 1 Type your login name (usually your student number) in the Username field of the dialog box.
- 2 Type your password on the Password field of the dialogue box.
- 3 Click on the OK button or else press [ENTER].
- 4 The Windows XP desktop will appear.

To log out

After finished working, must log out so that the next user of that computer won't be able to access the personal files and email, or use print credits.

- 1 Click on the Start button on the taskbar. You will see an option to Log Off, as well as an option to shut down (i.e. turn off) the computer.
- 2 Click on the Log Off button as on Fig 9. The system will ask to confirm that are logging off. The network login box will then appear for the next user to log in. (Note: Don't use the Shut Down option, or the next user will have to wait for the computer to start up again, which can take some time.)

Fig 9



Working with multiple windows

One of the most important features of Windows XP is its multitasking capability. This allows running more than one application at the same time. For example, you might have

both MSWord and MS Excel open at the same time, and within MS Word you might be working on two different document files, each in its own window.

Moving between applications

Each open window (even if it has been minimized) is represented by a rectangular icon on the taskbar at the bottom of your screen as on Fig 10. The icon for the currently active window usually appears darker, and looks as if it has been “pressed in”.

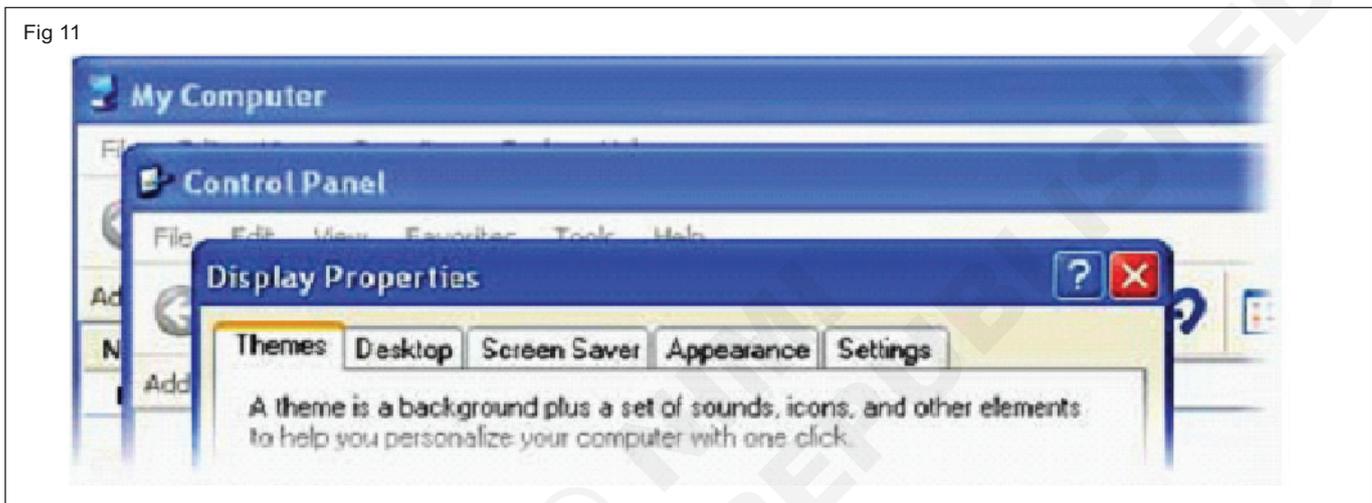


To switch between open applications, just click on the taskbar icon for the application that want to switch to, and Windows will display its window on top of anything else that may be on your screen.

Arranging windows: When multiple windows open, some of them may be hidden by others. Windows XP helps to arrange them so that all opened windows are visible as on Fig 11.

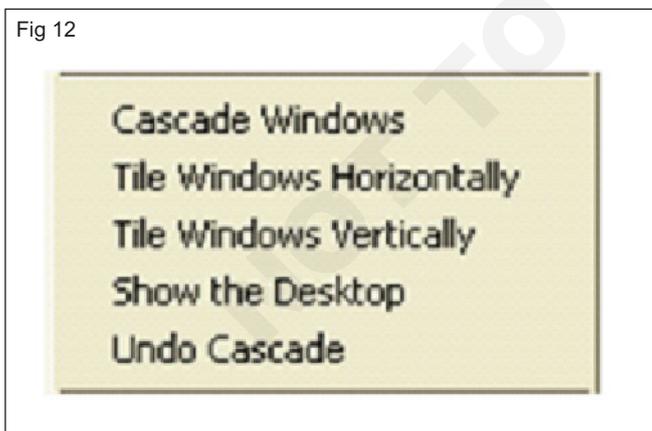
Cascade Open windows lie on top of each other, with the title bar of each one visible. To access a window that is not at the top of the cascade, just click its title bar.

Tile horizontally Windows are resized so that they fit one above the other on the screen.



Tile vertically Windows are resized so that they fit side by side on the screen.

To change the way your windows are arranged, right-click on a blank area of the taskbar and choose the option that you want as on Fig 12.



Backing up Data in Windows XP: A backup wizard is provided with the Windows package which is very helpful to create a backup copy of your important documents.

If you have Windows XP Professional, Backup utility is installed by default but in Windows XP Home it is not. However, Backup utility is provided with the CD.

Tips on taking Backup

One can actually just write all the files he wants to have a backup copy in a DVD or an external hard disk, but why use backup utility? That's because when you do it manually, every time you do a change in a file or folder you have to keep track of it and do the same changes in the backup copy. But when you use the backup utility, the Windows keeps track of it and does all the work for you. With its fully automated capability, it's the easiest thing around.

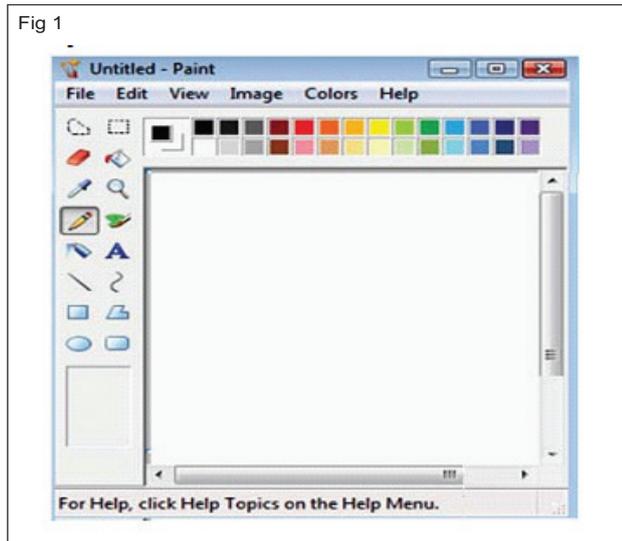
An ideal method of using backup utility will be to take the backup of documents using the backup utility and to copy the files such as Audio files, Video files and pictures in a DVD as the capacity of DVD is increasing day by day.

Familiarization of paint brush

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

- explain about paintbrush and features.

Paint (Software): Paint (formerly Paint brush for Windows) is a simple graphics painting program that has been included with all versions of Microsoft Windows. It is often referred to as MS Paint or Microsoft Paint as on Fig 1.



The program opens and saves files as Windows bitmap (24-bit, 256 color, 16 color, and monochrome, all with the .bmp extension), JPEG, GIF (without animation or transparency, although the Windows 98 version, a Windows 95 upgrade, and the Windows NT4 version did support the latter), PNG (without alpha channel), and TIFF (without multiple page support).

The program can be in color mode or two-color black-and-white, but there is no gray scale mode. For its simplicity, it rapidly became one of the most used applications in the early versions of Windows-introducing many to painting on a computer for the first time-and still has strong associations with the immediate usability of the old Windows workspace.

Initial Versions: The first version of Paint was introduced with the first version of Windows, Windows 1.0. It was a licensed version of ZSoft Corporation's PC Paintbrush. Paint was later renamed to Paintbrush in Windows 3.0, but the name was changed back to Paint in Windows 95 and later.

This version only supported the MSP and BMP file formats. The former is no longer supported by newer versions of Paint, along with PCX and RLE. Older versions cannot open or edit PNG files, and can only open GIF, JPEG, and TIFF files with a graphics filter for the specific file type.

Features: Recent versions of Paint allow the user to pick up to three colors at a time: the primary color (left mouse click), secondary color (right mouse click), and tertiary color (control key + any mouse click).

The program comes with the following options in its Tool Box (from left to right in image)

- Free-Form Select
- Select
- Eraser/Color Eraser
- Fill With Color
- Pick Color
- Magnifier
- Pencil
- Brush
- Airbrush
- Text
- Line
- Curve
- Rectangle
- Polygon
- Ellipse
- Rounded Rectangle

The Image menu offers the following options: Flip/Rotate, Stretch/Skew, Invert Colors, Image Attributes, Clear Image, and Draw Opaque. The "Colors" menu allows the user to Edit Colors (only menu option under Colors).

The Edit Colors dialog box shows the standard Windows color picker which includes a 48-color palette and 12 custom color slots that can be edited. Clicking "Define Custom Colors" displays a square version of the color wheel that can select a custom color either with a crosshair cursor (like a "+"), by Red/Green/Blue values.

There are 28 color wells in the workspace (different in Windows Vista). The default colors in the Color Box are the following: black, white, gray, silver, maroon, red, olive, yellow, dark green, green, teal, cyan, navy blue, blue, purple, magenta, old gold, lemon yellow, slate gray, Kelly green, dark Carolina blue, aquamarine, midnight blue, periwinkle, violet-blue, coral, brown, and pumpkin orange.

A color palette is also available, and pressing enter will replace the color chosen before going into the palette. A 10x magnification is available by clicking just below to 8x selector. The colors in the image can be inverted by pressing control key +I.

System settings using control panel

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

- explain about control panel
- list out the components and its system files of control panel.

Control Panel

The Control Panel is a part of the Microsoft Windows graphical user interface as on Fig 1. Which allows users to view and manipulate basic system settings, such as adding hardware, adding and removing software, controlling user accounts, and changing accessibility options.

The Control Panel has been an inherent part of the Microsoft Windows operating system since its first release (Windows 1.0).

Beginning with Windows 95, the Control Panel is implemented as a special folder, i.e. the folder does not physically exist, but only contains shortcuts to various applets such as Add or Remove Programs and Internet Options. Physically, these applets are stored as .cpl (Common Control Panel) files. For example, the Add or Remove Programs applet is stored under the nameappwiz.cpl in the SYSTEM32 folder.

Fig 1



More Information

Each tool in Control Panel is represented by a .cpl file in the Windows\System32 folder. The .cpl files in the Windows\System32 folder are loaded automatically when Control Panel start.

The .cpl files are used to access system properties such as Access.cpl - Accessibility properties, Appwiz.cpl - Add/Remove Programs Properties, etc.

Now we will go over the functions of the various Control Panel icons so you can get an idea of what they are for and how you can use them to improve your Windows experience.

Accessibility Options

Here it can change settings for keyboard, mouse, display and sound. Accessibility Options are covered in more detail here.

Add Hardware

This will open the Add Hardware Wizard which will search the computer for new hardware that have installed when Windows does not recognize it on its own.

Add or Remove Programs

If you need to install or uninstall any software on the computer. It should always uninstall software rather than delete it from hard drive. Add or Remove Programs is covered in more detail here.

Administrative Tools

This section of the Control Panel is used for administrative functions such as managing the computer, monitoring performance, editing the security policy and administering the computer's services. Administrative tools are covered in more detail here.

Automatic Updates

Here is where to tell Windows how and when to update itself. It can control whether or not it downloads updates automatically or at all and when want them installed or to ask before installing them.

Bluetooth Devices

If you are using any Bluetooth devices on computer here is where it can add, remove and manage them.

Date and Time

This one explains itself. It can set the computer's date, time and regional settings here.

Display

The display settings allow changing the way things appear on the screen. It can adjust items like the screen resolution and color depth. Here is where it can select the background wallpaper and setup the screensaver.

Folder Options

This is where you can adjust the way to view the files and folders from within My Computer or Windows Explorer. Folder Options are covered in more detail here.

Fonts

The Fonts applet allows you to add, remove and manage fonts on your computer. It will show what fonts are installed in the system.

Game Controllers

If uses a joystick, steering wheel or any other types of game controller it can use this section to add, remove and trouble shoot the devices.

Internet Options

If use Internet Explorer for web browser it will go here to change settings such for history, connections and security among other things. Internet Options are covered in more detail here.

Keyboard

Here it can adjust settings such as how fast the keyboard will repeat a character when a key is held down and the cursor blink rate.

Mail

The Mail applet lets you adjust your properties for your Outlook or Exchange email settings.

Mouse

Here it can adjust the mouse setting for features such as double click speed, button assignment and scrolling. It can also change the mouse pointers and effects as well as view details about mouse.

Network Connections

This item is where check and adjust the network connection settings. It will take to the same place as if you were to right click My Network Places and choose properties. It

will show all of the active network, dialup and wireless connections. There is also a New Connection Wizard to help setup a new connection.

Phone and Modem Options

It has a modem installed on the system and uses it for dialup connections or faxing can change the settings here. The dialling Rules tab allows changing settings for things such as dialling a number to get an outside line and setting up carrier codes for long distance and using calling cards. The Modems tab allows to add, remove and changed the properties for installed modems. The Advanced tab is for setting up telephony providers.

Power Options

Here is where to adjust the power settings of the computer. Windows has built in power schemes for different settings such as when to turn off the monitor or hard drives and when to go into standby mode. It can even create own schemes and save them. The advanced tab allows to assign a password to bring the computer out of standby and tell the computer what to do when the power or sleep buttons are pressed. If want to enable hibernation or configure an attached UPS then you can do it here as well. This area can also be accessed from the display properties settings under the Screensaver tab.

Printers and Faxes

This area is where the printers are installed and where you would go to manage their settings. It's the same area that is off of the Start menu. There is an add printer wizard which makes it easy to install new printers. To manage a printer would simply right click it and select properties.

Regional and Language Options

If need to have multiple languages or formats for currency, date and time you can manage them here.

Scanners and Cameras

Windows provides a central place to manage the attached scanners and camera and adjust their settings. There is even a wizard to add new devices to make the process of installing a scanner or camera easier.

Scheduled Tasks

This item provides the ability for schedule certain programs to run at certain times of the day. It can also have it run a program at any scheduled interval you choose. There is a handy wizard to help you through the process.

Security Center

The Windows Security Center checks the status of the computer for the stats of your firewall, virus protection and automatic updates. A firewall helps protect your computer by preventing unauthorized users from gaining access to it through a network or the Internet. Antivirus software can help protect the computer against viruses and other security threats. With Automatic

Updates, Windows can routinely check for the latest important updates for your computer and install them automatically.

Sounds and Devices

Here is where it can adjust the sound and speaker settings. The Volume tab has settings to mute the system, have a volume icon placed in the taskbar and tell the computer what type of speakers are using such as a 5.1 system. The sounds tab lets adjust what sounds occur for what windows events. If you need to change what device is used for playback and recording can do it under the Audio tab. Voice playback and recording settings are under the Voice tab. To troubleshoot the sound device you can use the Hardware tab. This is where you can get information about your particular sound device.

Speech Properties

Windows has a feature for text to speech translation where the computer will read text from documents using a computer voice that can hear through your speakers. The type of voice and speed of the speech can be adjusted here.

System

If you have ever right clicked My Computer and selected Properties then have used the System feature of Control Panel. This area gives you information about the computer's configuration, name and network status.

It can click on the Hardware tab to view details about hardware profiles and driver signing as well as get to Device Manager. The Advanced tab lets change settings for virtual memory (page files) and other performance settings. There is also an area to change startup and recovery settings if needed. If want to enable remote access to the computer for Remote Desktop or Remote Assistance you can enable it here.

Taskbar and Start Menu

This is where change the setting for the taskbar and Start menu. These settings are described in detail here.

User Accounts

If need to manage the local computer users then here is where need to go. It can add remove users and change the account types for users who log into the system. This feature is described in more detail here.

Windows Firewall

This is the same firewall setting described in the Windows Security Center section.

Wireless Network Setup Wizard

This wizard is used to help setup a security enabled wireless network in which all of the computer and devices connect through a wireless access point.

Photoshop

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

- state the Adobe Photoshop CS6
- learning about creating, opening and importing images in adobe photoshop
- identifying workspace and tools.

Introduction

Photoshop can be described as a digital editing application for digital-copy of raster images. Besides the standard colour and lighting correction tools along with filtering,

painting, masking, and layering options, it provides additional functionality to work with 3D objects, digital animations, and video editing. (Fig 1)

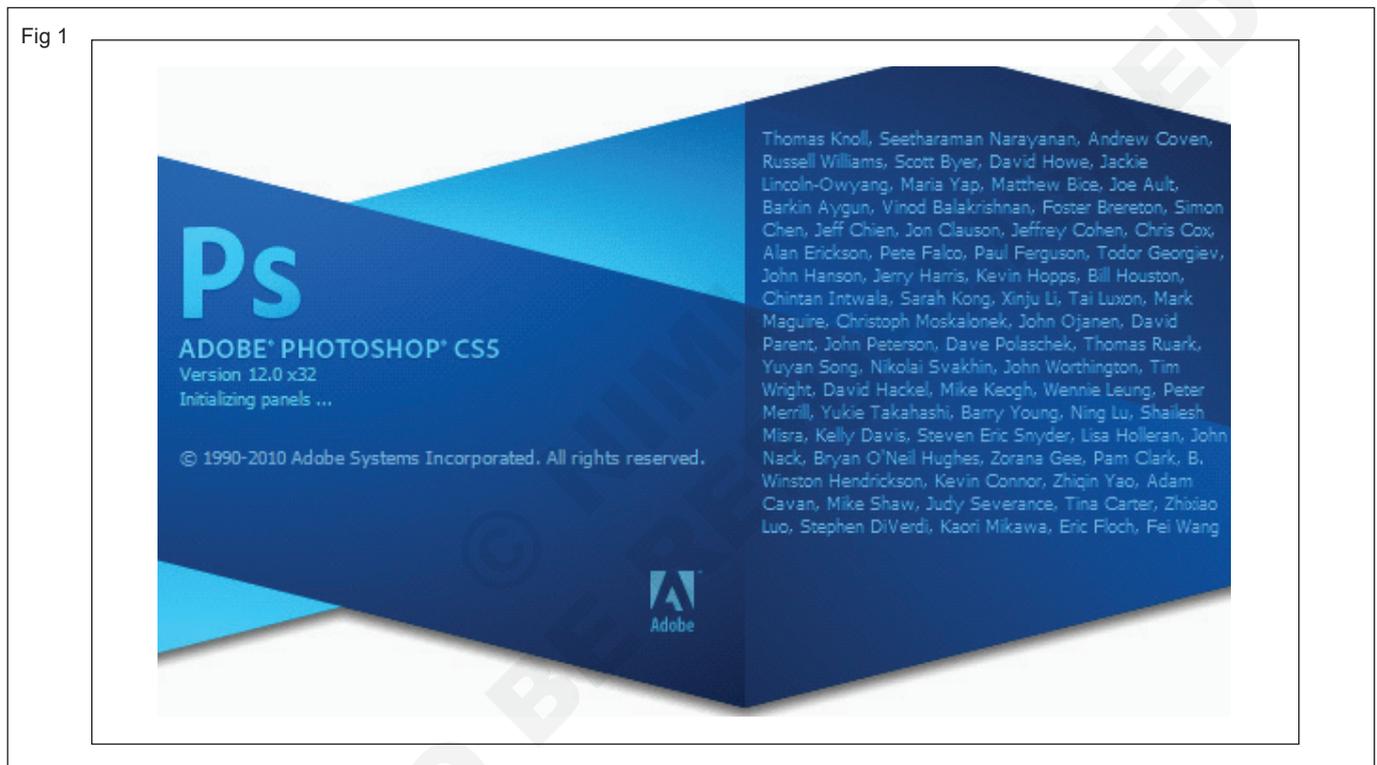


Photo Corrections: Photoshop's strength lies in the ability to correct digital images to restore original color and lighting as well as to correct problems introduced in images by camera lenses.

Photo composition: Image editing may be used to combine multiple images into one single image or composition. Multiple images taken from different horizontal angles from the same spot can be merged into a single panoramic image.

Artistic effects: Photoshop provides the ability to use different filters and warping tools to apply artistic effect to images. The combination of numerous tools and filters in Photoshop can create unexpected results.

Painting: Photoshop is one of the best applications available for creating digital paintings. The addition of wet brush capability in Photoshop CS5 makes it the first choice for digital painting. Many of the powerful features,

such as the layering and masking, are available for use with the painting tools. The paint-brushes are integrated into many of the other tools in Photoshop.

Creating vector artwork: Photoshop also is an excellent application to use for creating vector artworks. The path tool quickly creates/manipulates vector artwork created on a separate masked layer upon any raster image. You also can add vector artwork (including vector text) to raster images.

Adding text to images: Photoshop provides various type tools used to add text upon images. The text can be resized, warped, and adjusted to add special visual effects to the image(s).

Creating Web images

Another area where Photoshop excels is preparing images for the web. Photoshop provides utilities to quickly format images with the appropriate size, file format and

colors for use in web pages. Photoshop also provides tools for slicing of an image into clickable sections and provides the required HTML code for use of the slices in Web pages.

Print preparation

Photoshop is often used to convert the images from one colour format to another making it ready for being printed. Usually RGB colour mode is changed to CMYK for four-colour printing. Spot colors are added separately and color separations are also created.

Creating 3D objects

Photoshop has the capability to create and manipulate 3D objects. Although it is not the best utility for creating 3D objects, it is very good at manipulating them and then applying them to 2D images.

Adding textures to 3D objects

Photoshop has a big advantage over other 3D applications at applying textures to 3D objects. With Photoshop's filter and painting capabilities, edit the textures of your 3D objects in ways that you may not have thought possible.

Video corrections

Just as with 3D modeling, Photoshop should not be your choice for creating video projects; however, using Photoshop's color, lighting, and filter effects, quickly apply corrections to video and even add some artistic effects.

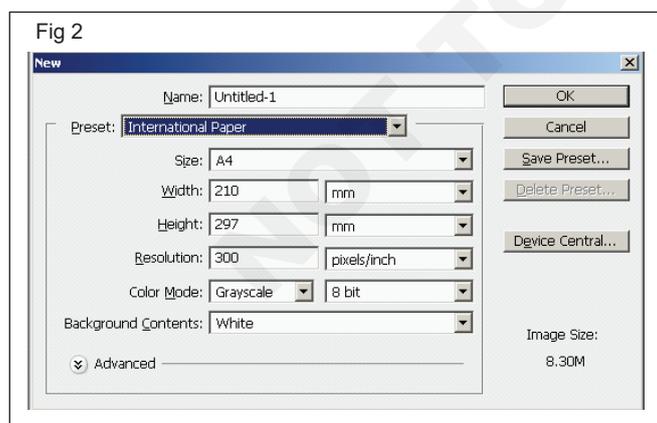
Animating images

Another fun feature of Photoshop is the ability to add animation to your images. Animated images can give life to web pages and allow you to create short animated movies.

New Photoshop document

New

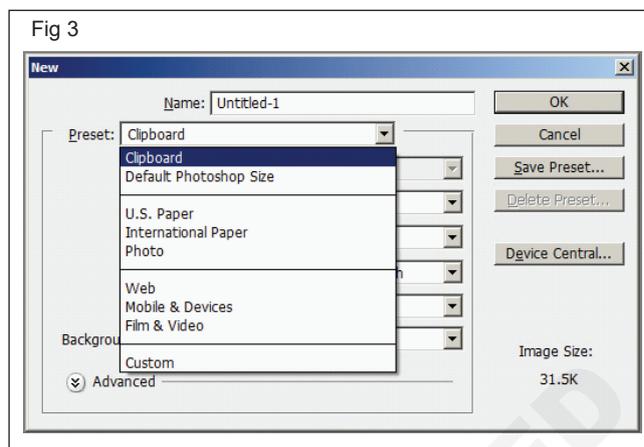
Go to File Menu @ Choose the Option New from file menu. The New Dialogue box opens. (Fig 2)



Name: These settings specify the name of the document which is used to locate the document in the file system later.

Preset: This option includes a drop down list as shown below.

Size: This settings to select drop down list based on the preset setting selected standard photo sizes and paper sizes or custom sizes available on the clip board. (Fig 3)



Width

This setting specifies the size of the document width area available on the size. The available units are inches, mm, cm, picas, point, pixels and columns the available in the preset.

Height

This setting specifies the size of the document height area available on the size. The available units are inches, mm, cm, picas, point, pixels and columns the available in the preset.

Resolution

This settings specify the resolution and the units to set the resolution of the new document. The available units are pixels/inch and pixels/cm

Color mode

This settings specify the Colour mode and number of channels to use the creating document. Colour mode (Bitmap, RGB colour, CMYK colour, Gray scale, Lab Colour and bit level (1bit, 8 bit, 16 bit, 32 bit) available on the new document

Background Contents

This setting specifies the contents of the background of the new document. This options are white, background color and transparent. background Colour is selected the Colour is selected the Colour of the back ground Photoshop toolbox is used as the background for the document.

Introduction to Adobe Photoshop CS6

Adobe® Photoshop® CS6, the benchmark for digital imaging excellence, provides strong performance, powerful image-editing features, and an intuitive interface. Adobe Camera Raw, included with Photoshop CS6, offers flexibility and control as you work with raw images as well as TIFF and JPEG images. Photoshop CS6 pushes the boundaries of digital image editing and helps you turn your dreams into designs more easily than ever before.

Installing adobe Photoshop

Before you begin using Adobe Photoshop CS6, make sure that your system is set up correctly and that you've installed the required software and hardware. You must purchase the Adobe Photoshop CS6 software separately. For system requirements and complete instructions on installing the software, see the Adobe Photoshop CS6 Read Me file on the application DVD or on the web at www.adobe.com/support. Note that some Photoshop CS6 Extended features, including all 3D features, require a video card that supports OpenGL 2.0. Photoshop and Bridge use the same installer. You must install these applications from the Adobe Photoshop CS6 application DVD (you cannot run the programs from the disc), or from the installation files you downloaded from Adobe, onto your hard drive. Follow the onscreen instructions. Make sure that your serial number is accessible before installing the application.

Photoshop CS6 system requirements

Windows

- Intel® Pentium® 4 or AMD Athlon® 64 processor
- Microsoft® Windows® XP with Service Pack 3 or Microsoft Windows 7 with Service Pack 1. Adobe® Creative Suite® 5.5 and CS6 applications also support Windows 8 and Windows 8.1. See the CS6 FAQ for more information about Windows 8 support.*
- 1 GB of RAM
- 1 GB of available hard-disk space for installation; additional free space required during installation (cannot install on removable flash storage devices)
- 1024 x 768 display (1280 x 800 recommended) with 16-bit color and 512 MB (1 GB recommended) of VRAM
- OpenGL 2.0-capable system
- DVD-ROM drive
- This software doesn't operate without activation. Broadband Internet connection and registration are required for software activation, validation of subscriptions, and access to online services.

Starting to work in adobe Photoshop

The Adobe Photoshop work area includes menus, toolbars, and panels that give you quick access to a variety of tools and options for editing and adding elements to your image. You can also add commands and filters to the menus by installing third-party software known as plug-ins. Photoshop works with bitmapped, digitized images (that is, continuous-tone images that have been converted into a series of small squares, or picture elements, called pixels). You can also work with vector graphics, which are drawings made of smooth lines that retain their crispness when scaled. You can create original artwork in Photoshop, or you can import images from many sources, such as:

- Photographs from a digital camera
- Commercial CDs of digital images
- Scans of photographs, transparencies, negatives, graphics or other documents
- Captured video images
- Artwork created in drawing programs

Open files: You can open files using the Open command and Open Recent command. You can also open files into Photoshop from Adobe Bridge or Adobe® Photoshop® Lightroom™.

When opening certain files, such as camera raw and PDF, you specify settings and options in a dialog box before the files completely open in Photoshop.

In addition to still images, Photoshop® Extended users can open and edit 3D files, video and image sequence files.

Photoshop uses plug-in modules to open and import many file formats. If a file format does not appear in the Open dialog box or in the File > Import submenu, you may need to install the format's plug-in module.

Sometimes Photoshop may not be able to determine the correct format for a file. This can happen, for example, because the file has been transferred between two operating systems. Sometimes a transfer between Mac OS and Windows can cause the file format to be mislabeled. In such cases, you must specify the correct format in which to open the file.

You can retain (where possible) layers, masks, transparency, compound shapes, slices, image maps, and editable type when bringing your Illustrator art into Photoshop. In Illustrator, export the art in the Photoshop (PSD) file format. If your Illustrator art contains elements that Photoshop doesn't support, the appearance of the artwork is preserved, but the layers are merged and the artwork is rasterized.

Specify the file format in which to open a file: If a file was saved with an extension that doesn't match its true format (for example, a PSD file saved with a .gif extension), or has no extension, Photoshop may not be able to open the file. Selecting the correct format will allow Photoshop to recognize and open the file.

(Windows) Choose File > Open As, and select the file you want to open. Then choose the desired format from the Open As pop up menu, and click Open.

If the file does not open, then the chosen format may not match the file's true format, or the file may be damaged.

Open PDF files: Adobe Portable Document Format (PDF) is a versatile file format that can represent both vector and bitmap data. It has electronic document search and navigation features. PDF is the primary format for Adobe Illustrator and Adobe Acrobat.

Some PDF files contain a single image, and others contain multiple pages and images. When you open a PDF file in Photoshop, you can choose which pages or images to open and specify rasterization options.

You can also import PDF data using the Place command, the Paste command, and the drag-and-drop feature. The page or image is placed on a separate layer as a Smart Object.

The following procedure is only for opening generic PDF files in Photoshop. You don't need to specify options in the Import PDF dialog box, when opening Photoshop PDF files.

Open an EPS file: Encapsulated PostScript (EPS) can represent both vector and bitmap data and is supported by virtually all graphic, illustration, and page-layout programs. The Adobe application that primarily produces PostScript artwork is Adobe Illustrator. When you open an EPS file containing vector art, it is rasterized—the mathematically defined lines and curves of the vector artwork are converted into the pixels or bits of a bitmap image.

You can also bring PostScript artwork into Photoshop using the Place command, the Paste command, and the drag-and-drop feature.

Opening a file with Adobe Bridge: In this book, you'll work with different start files in each lesson. You may make copies of these files and save them under different names or locations, or you may work from the original start files and then copy them from the DVD again if you want a fresh start. This lesson includes three start files.

In the previous lesson, you used the Open command to open a file. Now you'll open another file using Adobe Bridge, a visual file browser that helps take the guesswork out of finding the image file that you need.

Acquiring digital images from cameras

You can copy images to your computer by connecting your camera or a media card reader to your computer.

- Use the Get Photos From Camera command in Adobe® Bridge® to download photos, and to organize, rename, and apply metadata to them.
- If your camera or the card reader appears as a drive on your computer, copy images directly to your hard disk or into Adobe Bridge.
- Use the software that came with your camera, Windows Image Acquisition (WIA), or Image Capture (Mac OS). For more information on using Windows Image Acquisition or Image Capture, see your computer documentation.

Import images from a digital camera using WIA (Windows only)

Certain digital cameras import images using Windows Image Acquisition (WIA) support. When you use WIA, Photoshop works with Windows and your digital camera or scanner software to import images directly into Photoshop.

Importing scanned images

To import scanned images, either open TIFF files saved from separate scanning software, or use a TWAIN or WIA interface directly in Photoshop. In either case, make sure to install the software necessary for your scanner. For installation instructions, see the documentation provided by the scanner manufacturer.

Scanner drivers are supported by the scanner manufacturer, not Adobe. If you have problems with scanning, make sure that you are using the latest version of the scanner driver and software.

Import images from a separate scanning application

Most scanners come with software you can run outside of Photoshop, providing identical scanning options and quality. This method avoids issues caused by outdated TWAIN drivers. It can also improve efficiency, letting you edit images in Photoshop while scanning continues in the background.

- 1 Start the scanning software, and set options as desired.
- 2 Save scanned images in TIFF format.
- 3 In Photoshop, open the saved TIFF files.

Workspace overview

You create and manipulate your documents and files using various elements, such as panels, bars, and windows. Any arrangement of these elements is called a workspace.

- The Application bar across the top contains a workspace switcher, menus (Windows only), and other application controls.
- The Tools panel contains tools for creating and editing images, artwork, page elements, and so on. Related tools are grouped.
- The Options bar Control panel displays options for the currently selected tool.
- The Document window displays the file you're working on. Document windows can be tabbed and, in certain cases, grouped and docked.
- Panels help you monitor and modify your work. For example, the Layers panel in Photoshop. Panels can be grouped, stacked, or docked.

Hide or show all panels

- To hide or show all panels, including the Tools panel and Control panel, press Tab.
- To hide or show all panels except the Tools panel and Control panel, press Shift+Tab.

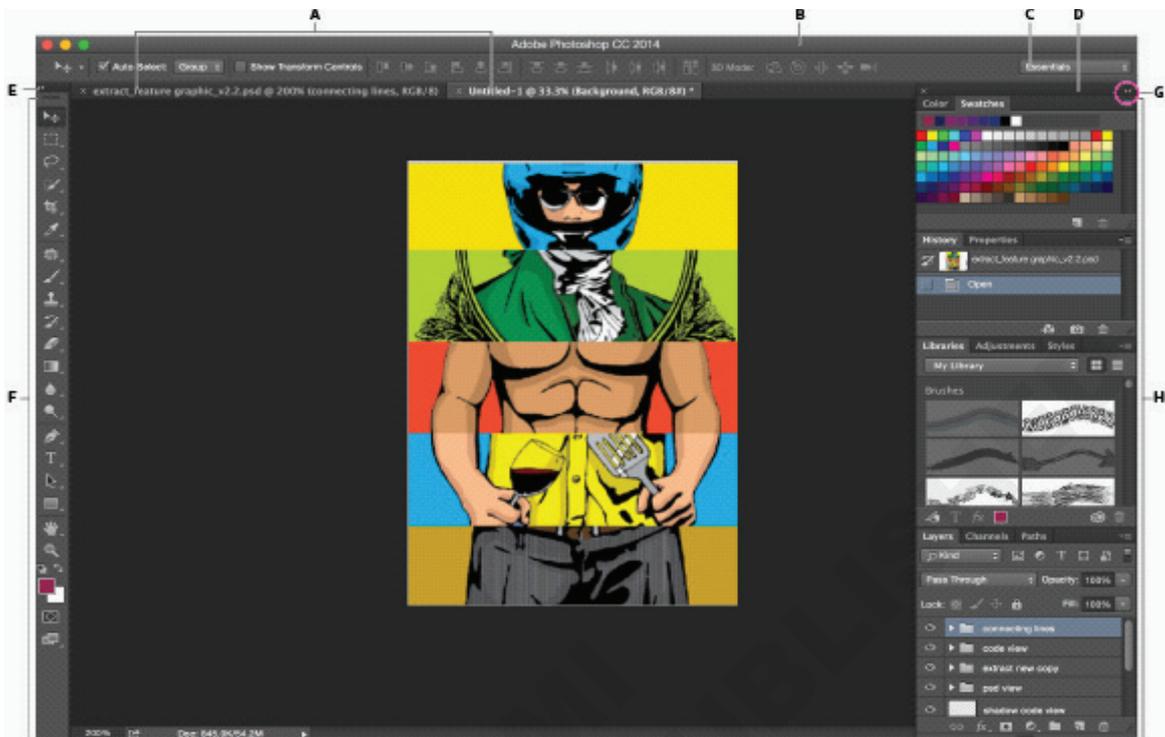
You can temporarily display hidden panels if Auto-Show Hidden Panels is selected in Interface preferences. Move the pointer to the edge of the application window (Windows®) or to the edge of the monitor (Mac OS®) and hover over the strip that appears.

Display panel options (Fig 4)

- Click the panel menu icon in the upper-right corner of the panel.

You can open a panel menu even when the panel is minimized.

Fig 4



Dock and undock panels: A dock is a collection of panels or panel groups displayed together, generally in a vertical orientation. You dock and undock panels by moving them into and out of a dock.

- To dock a panel, drag it by its tab into the dock, at the top, bottom, or in between other panels.
- To dock a panel group, drag it by its title bar (the solid empty bar above the tabs) into the dock.
- To remove a panel or panel group, drag it out of the dock by its tab or title bar. You can drag it into another dock or make it free-floating.

Add and remove panels: If you remove all panels from a dock, the dock disappears. You can create a dock by moving panels to the right edge of the workspace until a drop zone appears.

- To remove a panel, right-click (Windows) or Control-click (Mac) its tab and then select Close, or deselect it from the Window menu.
- To add a panel, select it from the Window menu and dock it wherever you want.

Save a custom workspace

- 1 With the workspace in the configuration you want to save, choose Window > Workspace > New Workspace.
- 2 Type a name for the workspace.
- 3 Under Capture, select one or more options:

Keyboard shortcuts: Saves the current set of keyboard shortcuts (Photoshop only).

Menus or Menu Customization

Saves the current set of menus.

Restore the default workspace

- 1 Select the Default or Essentials workspace from the workspace switcher in the application bar.
- 2 Select Window > Workspace > Reset [Workspace Name].
- 3 You can view information about any tool by positioning the pointer over it. The name of the tool appears in a tool tip below.

Photoshop CS5 tools: When you start Photoshop, the Tools panel appears at the left of the screen. Some tools in the Tools panel have options that appear in the context-sensitive options bar. You can expand some tools to show hidden tools beneath them. A small triangle at the lower right of the tool icon indicates the presence of hidden tools.

You can view information about any tool by positioning the pointer over it. The name of the tool appears in a tool tip below the pointer.

When you start Photoshop, the Tools panel appears at the left of the screen. Some tools in the Tools panel have options that appear in the context-sensitive options bar.

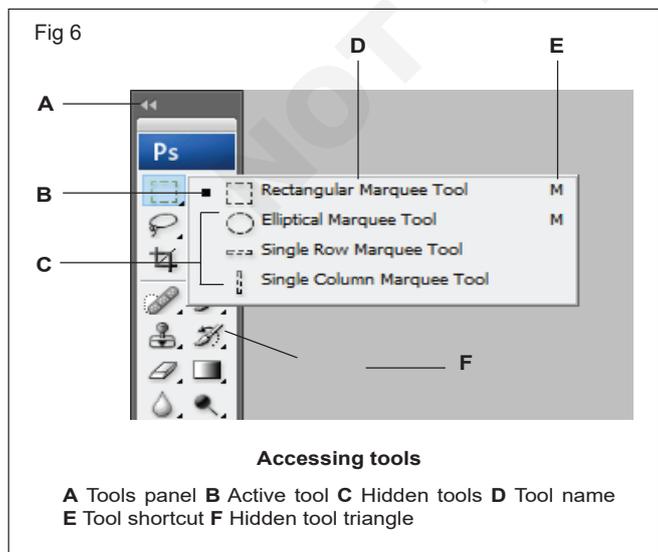
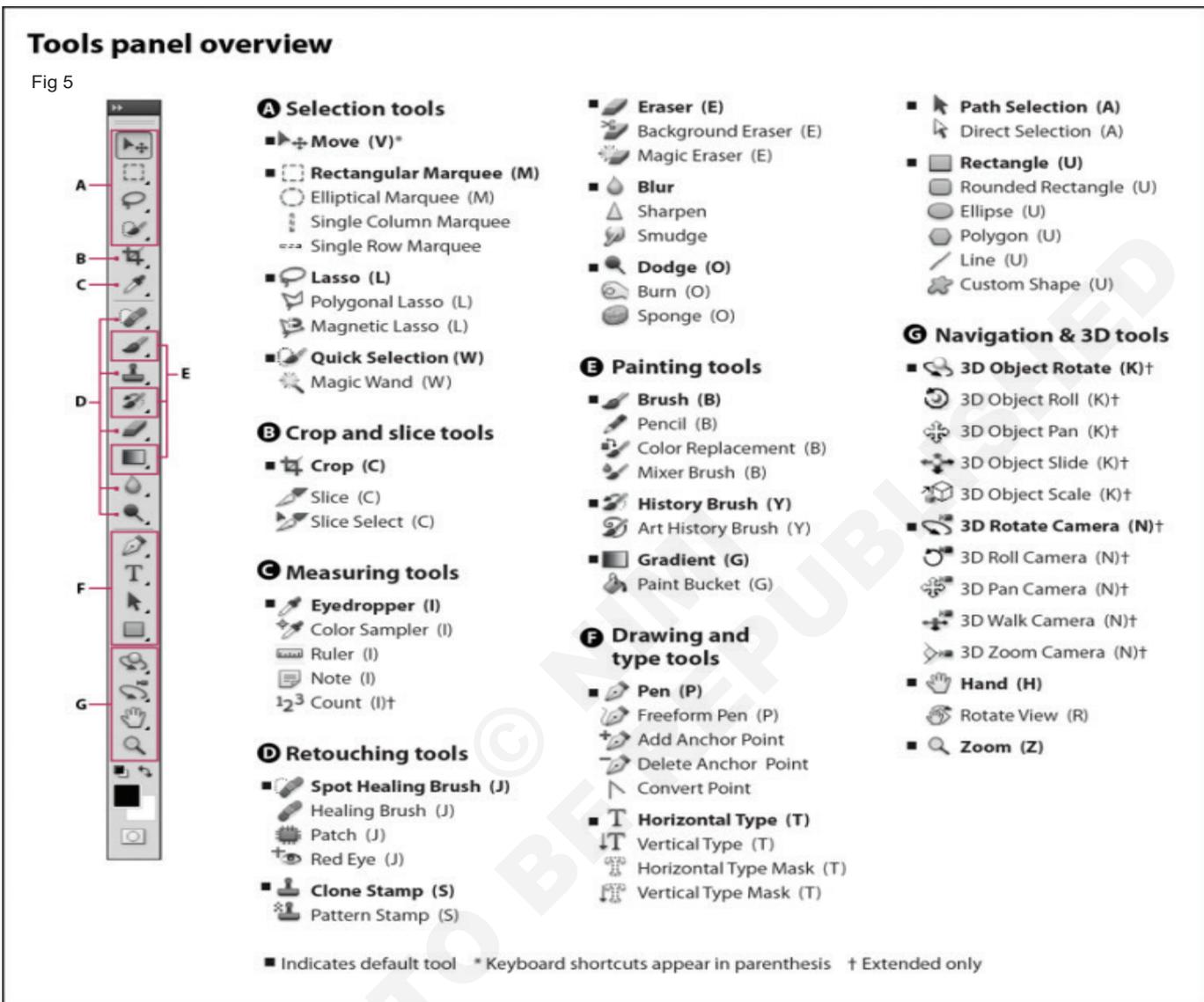
You can expand some tools to show hidden tools beneath them. A small triangle at the lower right of the tool icon signals the presence of hidden tools.

You can view information about any tool by positioning the pointer over it. The name of the tool appears in a tool tip below the pointer.

Selecting and displaying tools (Fig 5)

Select a tool (Fig 6)

- Click a tool in the Tools panel. If there is a small triangle at a tool's lower right corner, hold down the mouse button to view the hidden tools. Then click the tool you want to select.



- Press the tool's keyboard shortcut. The keyboard shortcut is displayed in its tool tip. For example, you can select the Move tool by pressing the V key.

Pressing and holding a keyboard shortcut key lets you temporarily switch to a tool. When you let go of the shortcut key, Photoshop returns to the tool you were using before the temporary switch.

Change tool pointers: Each default pointer has a different hotspot, where an effect or action in the image begins. With most tools, you can switch to precise cursors, which appear as cross hairs centered around the hotspot.

In most cases, the pointer for a tool is the same as the icon for that tool; you see that pointer when you select the tool. The default pointer for the marquee tools is the

cross-hair pointer ; for the text tool, the default pointer is the I beam ; and for the painting tools the default pointer is the Brush Size icon.

- 1 Choose Edit > Preferences > Cursors (Windows)
- 2 Choose tool pointer settings under Painting Cursors or Other Cursors:

Standard: Displays pointers as tool icons.

Precise: Displays pointers as cross hairs.

Normal Brush Tip: The pointer outline corresponds to approximately 50% of the area that the tool will affect. This option shows the pixels that would be most visibly affected.

Full Size Brush Tip: The pointer outline corresponds to nearly 100% of the area that the tool will affect, or nearly all the pixels that would be affected.

Show Crosshair In Brush Tip: Displays cross hairs in the center of the brush shape.

Show Only Crosshair While Painting: Improves performance with large brushes.

- 3 Click OK.

The Painting Cursors options control the pointers for the following tools:

Eraser, Pencil, Paintbrush, Healing Brush, Clone Stamp, Pattern Stamp, Quick Selection, Smudge, Blur, Sharpen, Dodge, Burn, and Sponge tools

The Other Cursors options control the pointers for the following tools:

Marquee, Lasso, Polygonal Lasso, Magic Wand, Crop, Slice, Patch, Eyedropper, Pen, Gradient, Line, Paint Bucket, Magnetic Lasso, Magnetic Pen, Freeform Pen, Measure, and Color Sampler tools

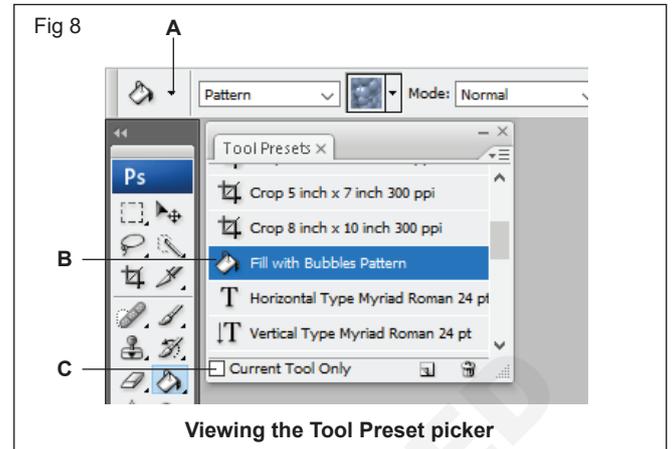
Using the options bar: The options bar appears below the menu bar at the top of the workspace. The options bar is context sensitive-it changes as you select different tools. Some settings in the options bar (such as painting modes and opacity) are common to several tools, and some are specific to one tool.

You can move the options bar in the workspace by using the gripper bar, and you can dock it at the top or bottom of the screen. Tool tips appear when you position the pointer over a tool. To show or hide the options bar, choose Window > Options. (Fig 7)



Tool presets: Tool presets let you save and reuse tool settings. You can load, edit, and create libraries of tool presets using the Tool Preset picker in the options bar, the Tool Presets panel, and the Preset Manager.

To choose a tool preset, click the Tool Preset picker in the options bar, and select a preset from the pop up panel. You can also choose Window > Tool Presets and select a preset in the Tools Presets panel. (Fig 8)

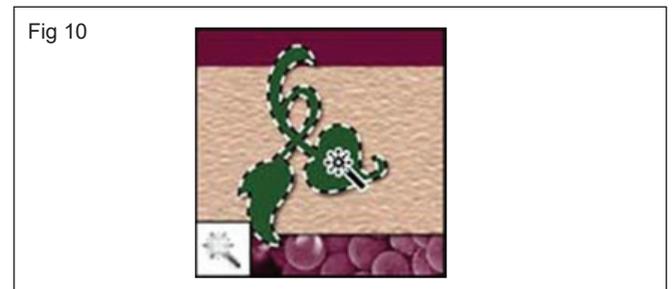


A. Click the Tool Preset picker in the options bar to show the Tool Preset pop up panel. B. Select a preset to change the tool's options to the preset, which applies each time you select the tool until you choose Reset Tool from the panel menu. C. Deselect to show all tool presets; select to show presets for only the tool selected in the toolbox.

The marquee tools make rectangular, elliptical, single row and single column selections. (Fig 9)



The Magic Wand tool selects similarly colored areas. (Fig 10)



The Move tool moves selections, layers and guides. (Fig 11 & 12)



Fig 12



The lasso tools make free hand, polygonal (straight- edged), and magnetic (snap-to) selections. (Fig 13)

Fig 13



The Quick Selection tool lets you quickly “paint” a selection using an adjustable round brush tip. (Fig14)

Fig 14



• **Crop and slice tools gallery (Fig 15)**

Fig 15



Crop tool trims images. (Fig 16)

Fig 16



The tool creates slices.

The Slice Select tool selects slices.

• **Retouching tools gallery**

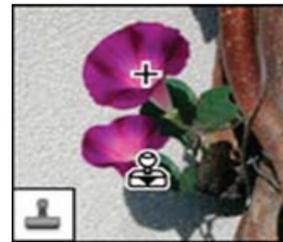
The Spot Healing Brush tool removes blemishes and objects (Fig 17)

Fig 17



The Clone Stamp tool paints with a sample of an image. (Fig 18)

Fig 18



The Magic Eraser tool erases solid-colored areas to transparency with a single click. (Fig 19)

Fig 19



The Dodge tool lightens areas in an image. (Fig 20)

Fig 20

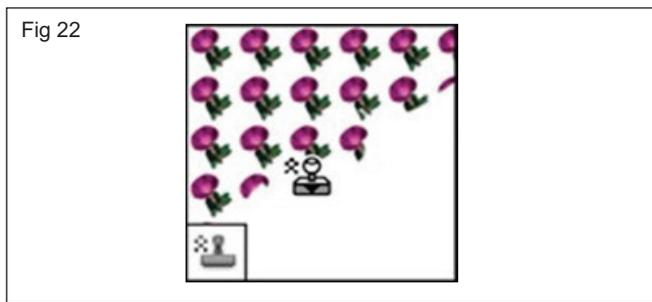


The Healing Brush tool paints with a sample or pattern to repair imperfections in a image. (Fig 21)

Fig 21



The Pattern Stamp tool paints with part of an image as a pattern.(Fig 22)



The Sharpen tool sharpens soft edges in an image. (Fig 27)



The Blur tool blurs hard edges in an image. (Fig 23)



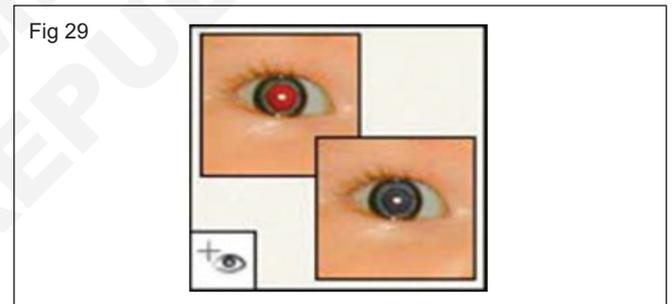
The Sponge tool changes the color saturation of an area. (Fig 28)



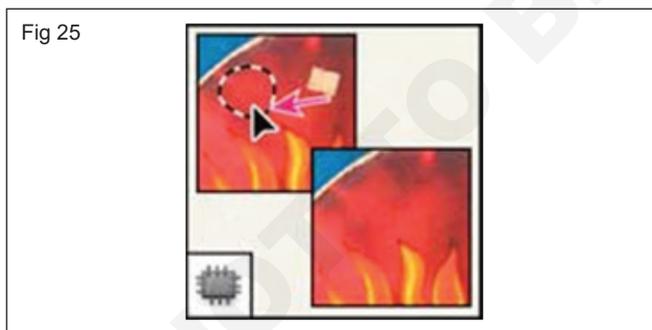
The Burn tool darkens are as in an image. (Fig 24)



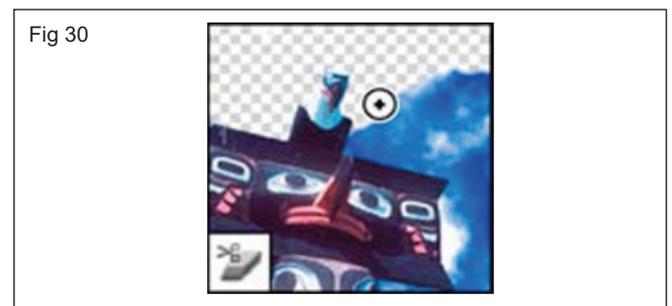
The Red Eye tool removes the red reflection caused by a flash. (Fig 29)



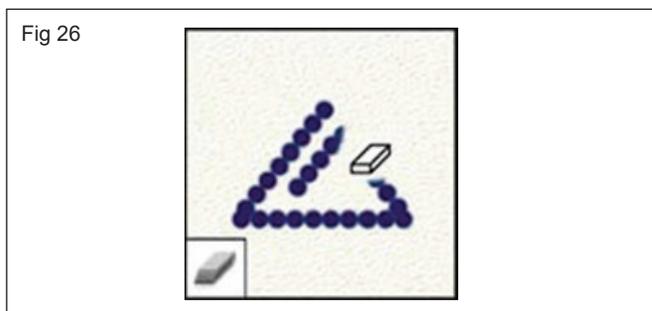
The Patch tool repairs imperfections in a selected area of an image using a sample pattern. (Fig 25)



The Background Eraser tool erases are as to transparency by dragging. (Fig 30)



The Eraser tool erase pixels and restores parts of an image to a previously saved state. (Fig 26)

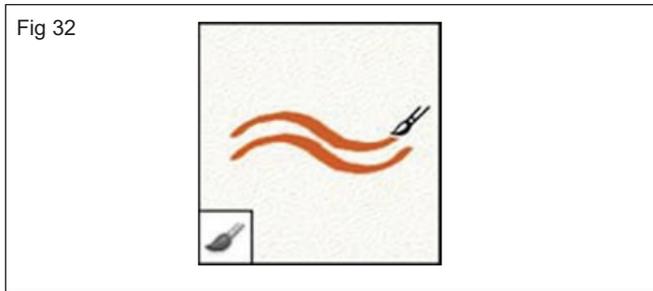


The Smudge tools muddges data in an image. (Fig 31)



- Painting tools gallery

The Brush tool paints brush strokes. (Fig 32)



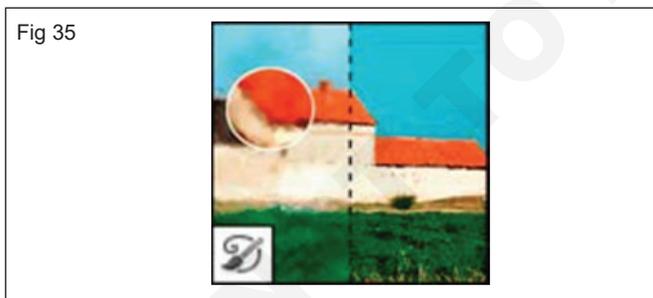
The History Brush tool paints a copy of the selected state or snaps hot into the current image window. (Fig 33)



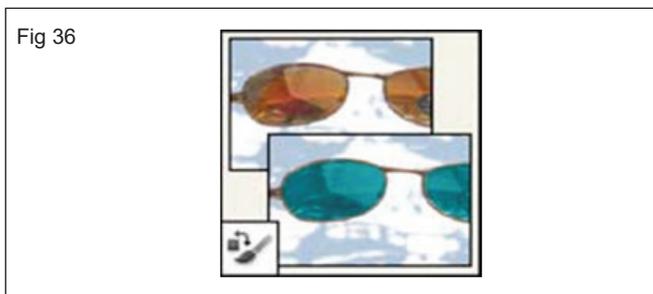
The Pencil tool paints hard-edged strokes. (Fig 34)



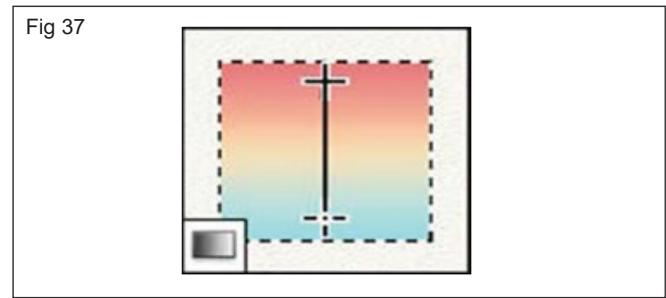
The Art History brush tool paints with stylized strokes that simulate the look of different paint styles, using a selected state or snapshot. (Fig 35)



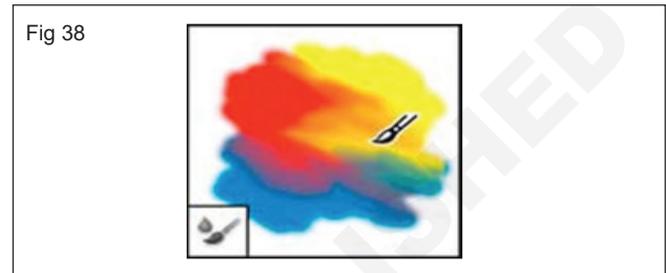
The Color Replacement tool replaces a selected color with a new color. (Fig 36)



The gradient tools create straight-line, radial, angle, reflected and diamond blends between colors. (Fig 37)



The Mixer Brush tool Simulates realistic painting techniques such as blending canvas colors and varying paint wetness. (Fig 38)

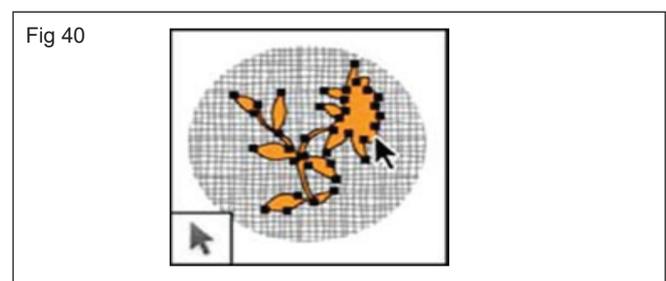


The Paint Bucket tool fills similarly colored areas with the fore ground color. (Fig 39)

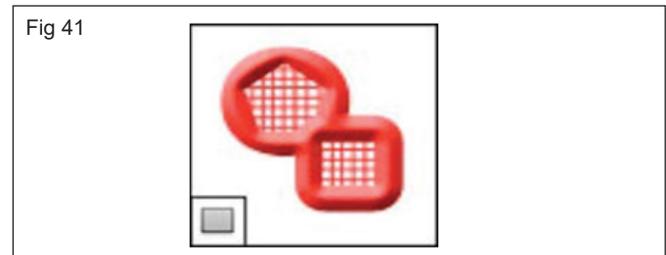


- Drawing and type tools gallery

The path selection tools make shape or segment selections showing anchor points, direction lines, and direction points. (Fig 40)



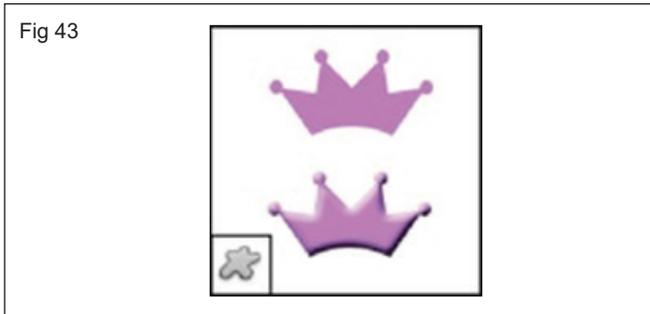
The shape tools and Line tool draw shapes and lines in a normal layer or a shape layer. (Fig 41)



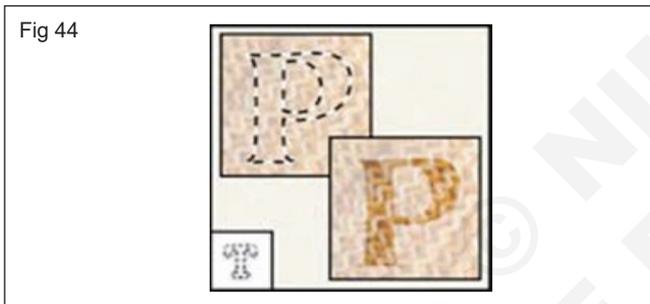
The type tools create type on an image. (Fig 42)



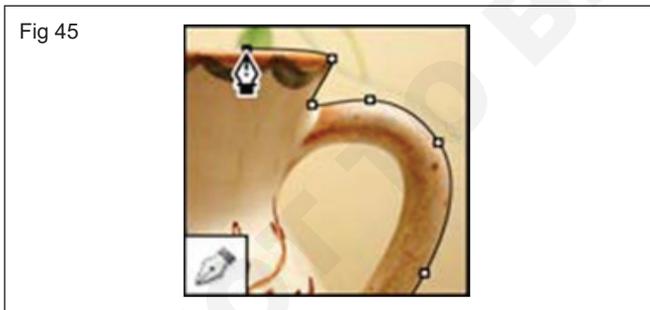
The Custom Shape tool makes customized shapes selected from a custom shape list. (Fig 43)



The type mask tools create a selection in the shape of type. (Fig 44)

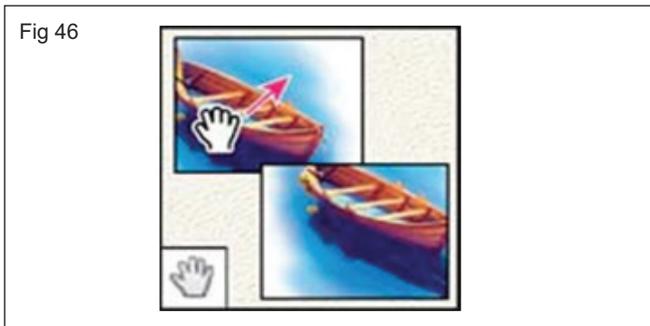


The pen tools let you draw smooth-edged paths. (Fig 45)



- Navigation, notes and measuring tools gallery

The Hand tool moves an image within its window. (Fig 46)



The Eye dropper tool samples colors in an image. (Fig47)



The Rotate View tool non-destructively rotates the canvas. (Fig 48)



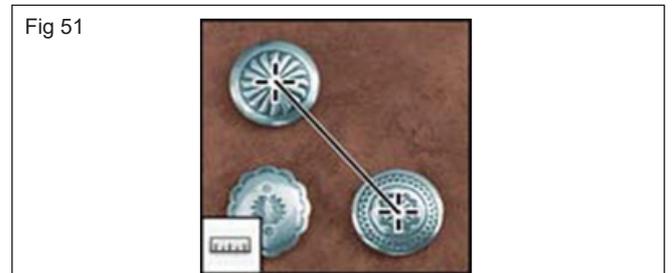
The Color Sampler tool displays color values for upto four areas. (Fig 49)



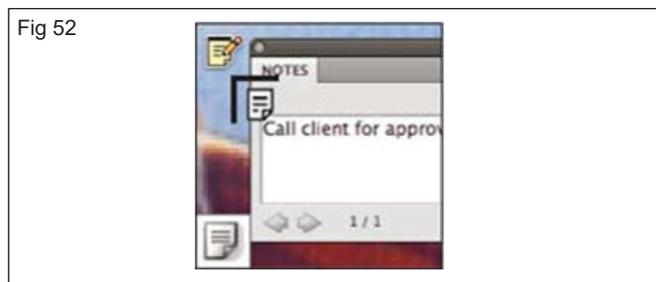
The Zoom tool magnifies and reduces the view of an image. (Fig 50)



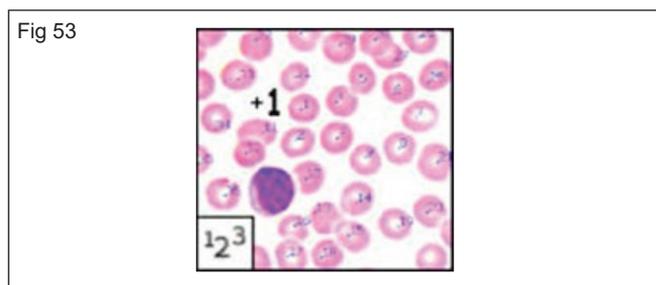
The Ruler tool measures distances, locations, and angles. (Fig 51)



The Note tool makes notes that can be attached to an image. (Fig 52)

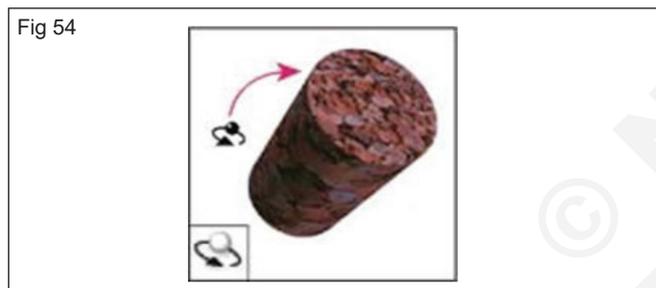


The Count tool counts objects in an image. (Photoshop Extended only) (Fig 53)

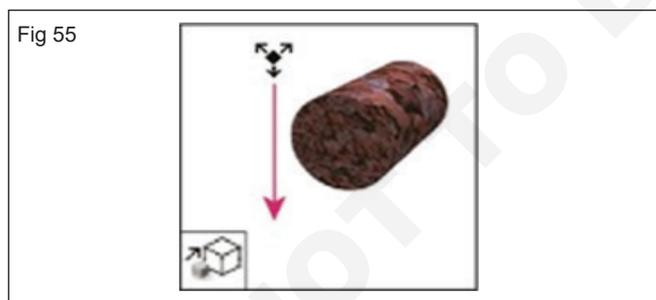


• 3D tools gallery

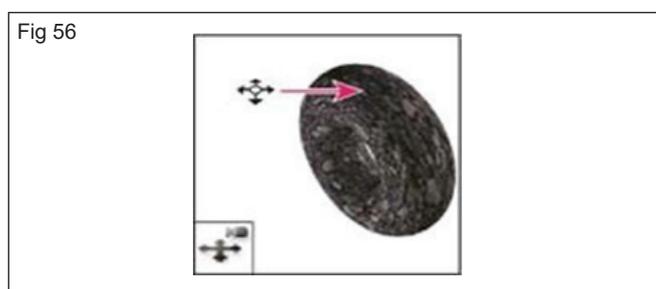
The 3D Object Rotate tool rotates the object around its x- axis. (Fig 54)



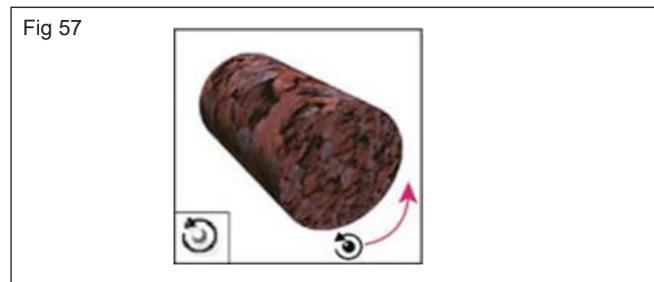
The 3D Object Scale tool scales the object larger or smaller. (Fig 55)



The 3D Walk Camera tool moves laterally when you drag horizontally, or forward and back when you drag vertically. (Fig 56)



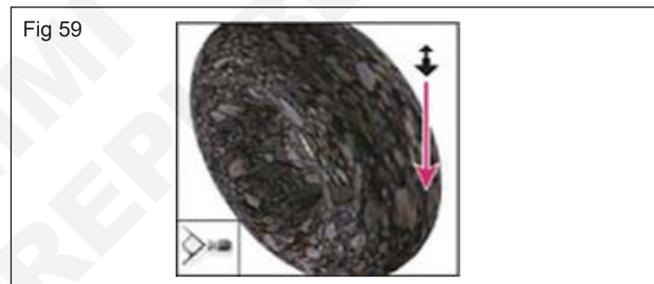
The 3D Object Roll tool rotates the object around its z- axis. (Fig 57)



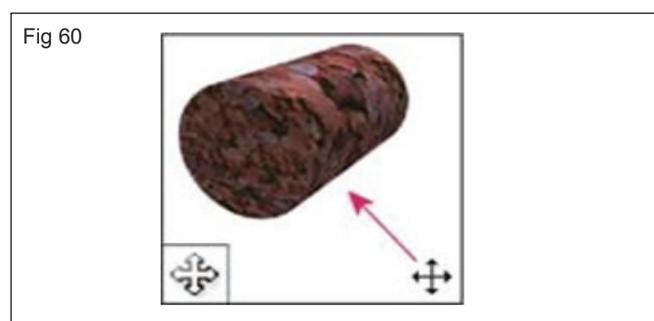
The 3D Rotate Camera tool orbits the camera in the x or y direction. (Fig 58)



The 3D Zoom Camera tool changes the field of view closer or farther away. (Fig 59)



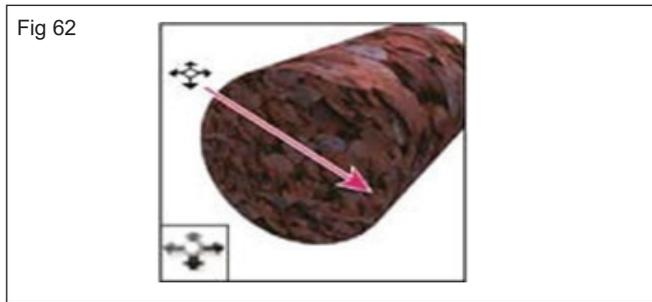
The 3D Object Pan tool pans the object in the x or y direction. (Fig 60)



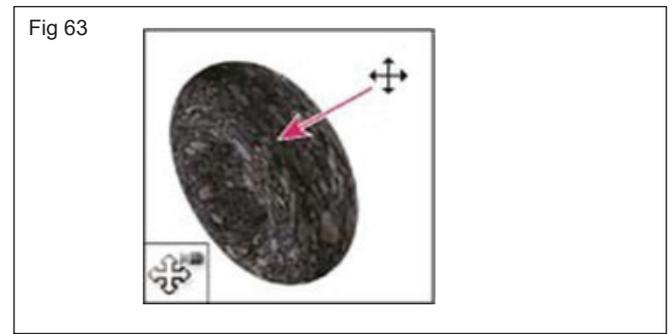
The 3D Roll Camera tool rotates the camera around the z-axis. (Fig 61)



The 3D Object Slide tool moves the object laterally when you drag horizontally, or forward and back when you drag vertically. (Fig 62)



The 3D Pan Camera tool pans the camera in the x or y direction. (Fig 63)



Drawing and painting

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

- understanding Shapes and Paths
- explain about drawing shapes
- painting Tools
- managing Paths
- editing paths.

Understanding shapes and paths: Drawing in Adobe Photoshop involves creating vector shapes and paths. In Photoshop, you can draw with any of the shape tools, the Pen tool, or the Freeform Pen tool. Options for each tool are available in the options bar.

Before you begin drawing in Photoshop, you must choose a drawing mode from the options bar. The mode you choose to draw in determines whether you create a vector shape on its own layer, a work path on an existing layer, or a rasterized shape on an existing layer.

Vector shapes are lines and curves you draw using the shape or pen tools. Vector shapes are resolution-independent—they maintain crisp edges when resized, printed to a PostScript printer, saved in a PDF file, or imported into a vector-based graphics application. You can create libraries of custom shapes and edit a shape's outline (called a path) and attributes (such as stroke, fill color, and style).

Paths are outlines that you can turn into selections, or fill and stroke with color. You can easily change the shape of a path by editing its anchor points.

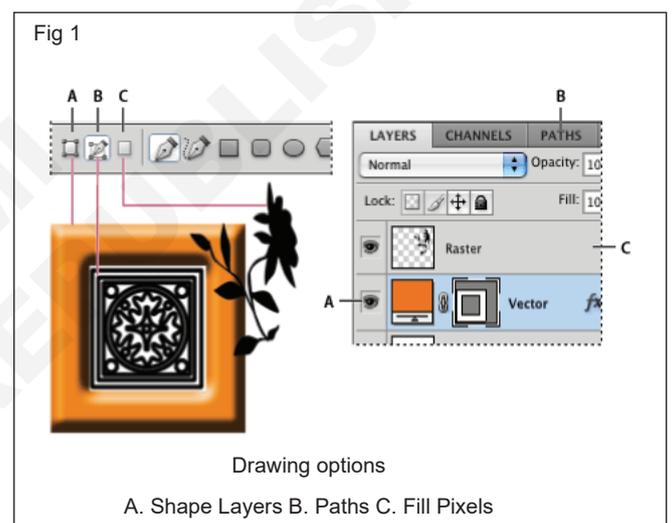
A work path is a temporary path that appears in the Paths panel and defines the outline of a shape.

You can use paths in several ways:

- Use a path as a vector mask to hide areas of a layer.
- Convert a path to a selection.
- Fill or stroke a path with color.

Designate a saved path as a clipping path to make part of an image transparent when exporting the image to a page-layout or vector-editing application.

Drawing modes: When you work with the shape or pen tools, you can draw in three different modes. You choose a mode by selecting an icon in the options bar when you have a shape or pen tool selected. (Fig 1)



Shape Layers: Creates a shape on a separate layer. You can use either the shape tools or the pen tools to create shape layers. Because they are easily moved, resized, aligned, and distributed, shape layers are ideal for making graphics for web pages. You can choose to draw multiple shapes on a layer. A shape layer consists of a fill layer that defines the shape color and a linked vector mask that defines the shape outline. The outline of a shape is a path, which appears in the Paths panel.

Paths: Draws a work path on the current layer that you can then use to make a selection, create a vector mask, or fill and stroke with color to create raster graphics (much as you would using a painting tool). A work path is temporary unless you save it. Paths appear in the Paths panel.

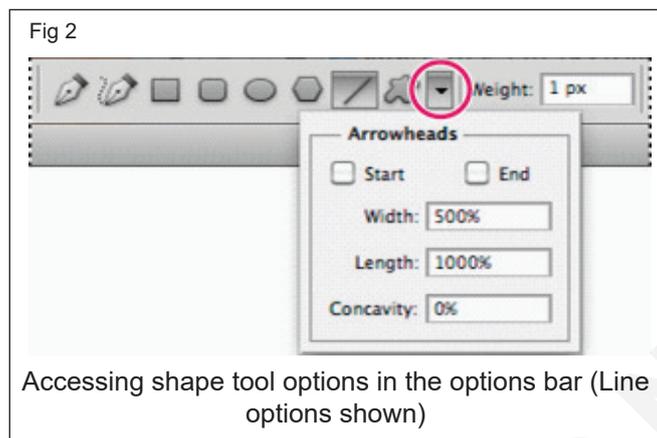
Fill Pixels: Paints directly on a layer—much as a painting tool does. When you work in this mode, you're creating raster images—not vector graphics. You work with the shapes you paint just as you do with any raster image. Only the shape tools work in this mode.

Draw a wheel shape: You cut out a shape within an existing shape so that the layers underneath show through. This procedure shows you how to create a doughnut shape, but you can use this technique with any combination of the shape tools, including custom shapes.

Draw a custom shape: You can draw custom shapes by using shapes from the Custom Shape pop-up panel, or save a shape or path to use as a custom shape.

Create a rasterized shape : When you create a rasterized shape, you're drawing and rasterizing a shape and filling it with the foreground color. You cannot edit a rasterized shape as a vector object. Raster shapes are created using the current foreground color.

Shape tool options: Each shape tool provides a unique subset of the options below. To access these options, click the arrow to the right of the row of shape buttons in the options bar. (Fig 2)



Arrowheads Start And End: Adds arrowheads to a line. Select the Line tool and then select Start to add an arrow to the beginning of the line; select End to add an arrow to the end of the line. Select both options to add arrows to both ends. The shape options appear in the pop-up dialog box. Enter values for Width and Length to specify the proportions of the arrowhead as a percentage of the line width (10% to 1000% for Width, and 10% to 5000% for Length). Enter a value for the concavity of the arrowhead (from -50% to +50%). The concavity value defines the amount of curvature on the widest part of the arrowhead, where the arrowhead meets the line.

You can also edit an arrowhead directly using the vector selection and drawing tools.

Circle: Constrains an ellipse to a circle.

Defined Proportions: Renders a custom shape based on the proportions with which it was created.

Defined Size: Renders a custom shape based on the size at which it was created.

Fixed Size: Renders a rectangle, rounded rectangle, ellipse, or custom shape as a fixed shape based on the values you enter in the Width and Height text boxes.

From Center: Renders a rectangle, rounded rectangle, ellipse, or custom shape from the center.

Indent Sides By: Renders a polygon as a star. Enter a percentage in the text box to specify the portion of the star's radius taken up by the points. A 50% setting creates points that are half the total radius of the star; a larger value creates sharper, thinner points; a smaller value creates fuller points.

Proportional: Renders a rectangle, rounded rectangle, or ellipse as a proportional shape based on the values you enter in the Width and Height text boxes.

Radius: For rounded rectangles, specifies the corner radius. For polygons, specifies the distance from the center of a polygon to the outer points.

Sides

Specifies the number of sides in a polygon.

Smooth Corners or Smooth Indents

Renders a polygon with smooth corners or indents.

Snap To Pixels

Snaps edges of a rectangle or rounded rectangle to the pixel boundaries.

Square

Constrains a rectangle or rounded rectangle to a square.

Unconstrained: Lets you set the width and height of a rectangle, rounded rectangle, ellipse, or custom shape by dragging.

Weight

Determines width, in pixels, for the Line tool.

Edit shapes: A shape is a fill layer linked to a vector mask. You can easily change the fill to a different color, a gradient, or a pattern by editing the shape's fill layer. You can also edit the shape's vector mask to modify the shape outline, and apply a style to the layer.

- To change the color of a shape, double-click the shape layer's thumbnail in the Layers panel, and choose a different color using the Color Picker.
- To fill a shape with a pattern or gradient, select the shape layer in the Layers panel and choose Layer > Layer Style > Gradient Overlay.
- To change stroke width, select the shape layer in the Layers panel, and choose Layer > Layer Style > Stroke.
- To modify the outline of a shape, click the shape layer's vector mask thumbnail in the Layers panel or Paths panel. Then change the shape using the Direct Selection and pen tools.
- To move a shape without changing its size or proportions, use the Move tool.

About painting tools, presets, and options: Adobe Photoshop provides several tools for painting and editing image color. The Brush tool and the Pencil tool

work like a traditional drawing tool applying color with brush strokes. Tools like the Eraser tool, Blur tool, and Smudge tool modify the existing colors in the image. In the options bar for each of these painting tools, you can set how color is applied to an image and choose from preset brush tips.

Brush and tool presets: You can save a set of brush options as a preset so you can quickly access brush characteristics you use frequently. Photoshop includes several sample brush presets. You can start with these presets and modify them to produce new effects. Many original brush presets are available for download on the web.

You can quickly choose presets from the Brush Preset picker in the options bar, which lets you temporarily modify the size and hardness of a brush preset.

Save tool presets when you want to store customized brush tip characteristics along with settings from the options bar such as opacity, flow, and color.

Brush tip options: Along with settings in the options bar, brush tip options control how color is applied. You can apply color gradually, with soft edges, with large brush strokes, with various brush dynamics, with different blending properties, and with brushes of different shapes. You can apply a texture with your brush strokes to simulate painting on canvas or art papers. You can also simulate spraying paint with an airbrush. You use the Brush panel to set brush tip options.

If you work with a drawing tablet, you can control how color is applied using pen pressure, angle, rotation, or a stylus wheel. You set options for drawing tablets in the Brush panel and options bar.

Paint with the Brush tool or Pencil tool : The Brush tool and the Pencil tool paint the current foreground color on an image. The Brush tool creates soft strokes of color. The Pencil tool creates hard-edged lines.

The Rotation tool rotates the canvas, which can facilitate easier painting.

Paint tool options

Set the following in the options bar. Options available vary with each tool.

Mode: Sets the method for blending the color you paint with the underlying existing pixels. Available modes change with the currently selected tool. Paint modes are similar to layer blending modes.

Opacity

Sets the transparency of color you apply. As you paint over an area, the opacity does not exceed the set level no matter how many times you move the pointer over the area, until you release the mouse button. If you stroke over the area again, you apply additional color, equivalent to the set opacity. Opacity of 100 percent is opaque.

Flow: Sets the rate at which color is applied as you move the pointer over an area. As you paint over an area, keeping the mouse button down, the amount of color builds up based on the flow rate, up to the opacity setting. For example, if you set the opacity to 33% and the flow to 33%, each time you move over an area, its color moves 33% toward the brush color. The total will not exceed 33% opacity unless you release the mouse button and stroke over the area again.

Press a single number key to set a tool's opacity in multiples of 10% (pressing 1 sets it to 10%; pressing 0 sets it to 100%). Press two number keys to set a specific opacity. To set Flow, press Shift and number keys.

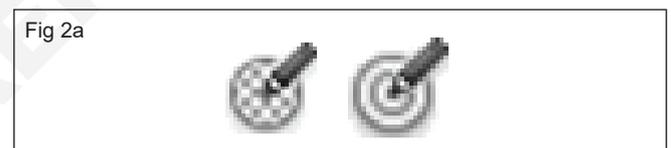
Air brush (Fig 2a)



Simulates painting with an airbrush. As you move the pointer over an area, paint builds up as you hold down the mouse button. Brush hardness, opacity, and flow options control how fast and how much the paint is applied. Click the button to turn on or off this option.

Auto erase: (Pencil tool only) Paints the background color over areas containing the foreground color. Select the foreground color you want to erase and the background color you want to change to.

Tablet pressure buttons (Fig 2b)



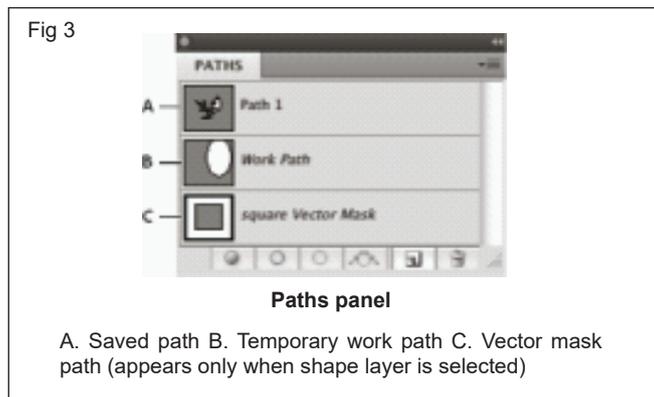
Use stylus pressure to override opacity and size settings in the Brush panel.

The Pen tools

Photoshop provides multiple Pen tools. The standard Pen tool draws with the greatest precision; the Freeform Pen tool draws paths as if you were drawing with pencil on paper, and the magnetic pen option lets you draw a path that snaps to the edges of defined areas in your image. You can use the pen tools in conjunction with the shape tools to create complex shapes. When you use the standard Pen tool, the following options are available in the options bar:

- Auto Add/Delete, which lets you add an anchor point when you click a line segment or delete an anchor point when you click it.
- Rubber Band, which lets you preview path segments as you move the pointer between clicks. (To access this option, click the pop-up menu to the right of the Custom Shape icon.)

Paths panel overview: The Paths panel (Window > Paths) lists the name and a thumbnail image of each saved path, the current work path, and the current vector mask. Turning thumbnails off can improve performance. To view a path, you must first select it in the Paths panel. (Fig 3)



Select a path

- Click the path name in the Paths panel. Only one path can be selected at a time.

Deselect a path

- Click in a blank area of the Paths panel or press Esc.

Change the size of path thumb nails: Choose Panel Options from the Paths panel menu, and select a size, or select None to turn off the display of thumbnails.

Change a path's stacking order

- Select the path in the Paths panel, and drag the path up or down. When the heavy black line appears in the desired location, release the mouse button.

You cannot change the order of vector masks or working paths in the Paths panel.

Create a new path in the Paths panel

- To create a path without naming it, click the Create New Path button at the bottom of the Paths panel.
- To create and name a path, make sure no work path is selected. Choose New Path from the Paths panel menu, or Alt-click (Windows) the New Path button at the bottom of the panel. Enter a name for the path in the New Path dialog box, and click OK.

Create a new work path

- 1 Select a shape tool or a pen tool, and click the Paths button in the options bar.
- 2 Set tool-specific options, and draw the path.
- 3 Draw additional path components if desired. You can easily switch between drawing tools by clicking a tool button in the options bar. Choose a path area option to determine how overlapping path components intersect:

Add To Path Area: Adds the new area to overlapping path areas.

Subtract From Path Area

Removes the new area from the overlapping path area.

Intersect Path Areas: Restricts the path to the intersection of the new area and the existing area.

Exclude Overlapping Path Areas

Excludes the overlap area in the consolidated path.

Manage paths: When you use a pen or shape tool to create a work path, the new path appears as the work path in the Paths panel. The work path is temporary; you must save it to avoid losing its contents. If you deselect the work path without saving it and start drawing again, a new path will replace the existing one.

When you use a pen or shape tool to create a new shape layer, the new path appears as a vector mask in the Paths panel. Vector masks are linked to their parent layer; you must select the parent layer in the Layers panel in order to list the Vector mask in the Paths panel. You can remove a Vector mask from a layer and convert a Vector mask to a rasterized mask.

Paths saved with an image appear when you open it again. In Windows, JPEG, JPEG 2000, DCS, EPS, PDF, and TIFF formats support paths in Photoshop. In Mac OS, all available file formats support paths.

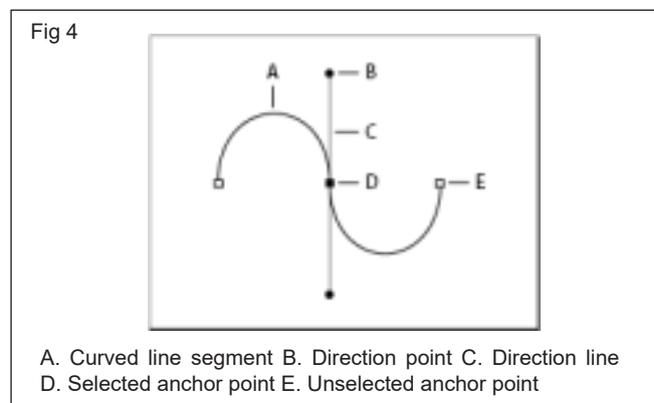
Save a work path

- To save without renaming, drag the work path name to the New Path button at the bottom of the Paths panel.
- To save and rename, choose Save Path from the Paths panel menu, enter a new path name in the Save Path dialog box, and click OK.

Rename a saved path

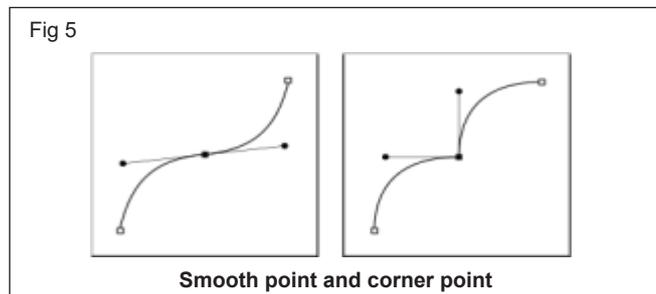
- Double-click the path name in the Paths panel, type a new name, and press Enter (Windows)

Path segments, components, and points: A path consists of one or more straight or curved segments. Anchor points mark the end points of the path segments. On curved segments, each selected anchor point displays one or two direction lines, ending in direction points. The positions of direction lines and points determine the size and shape of a curved segment. Moving these elements reshapes the curves in a path. (Fig 4)

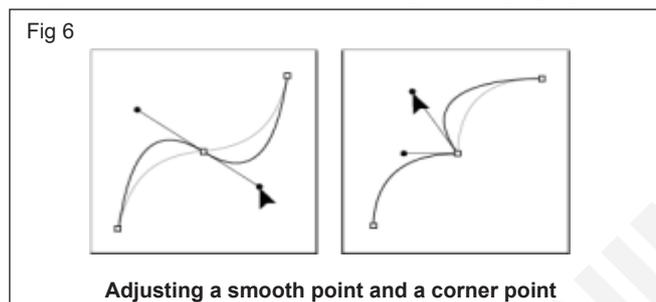


A path can be closed, with no beginning or end (for example, a circle) or open, with distinct end points (for example, a wavy line).

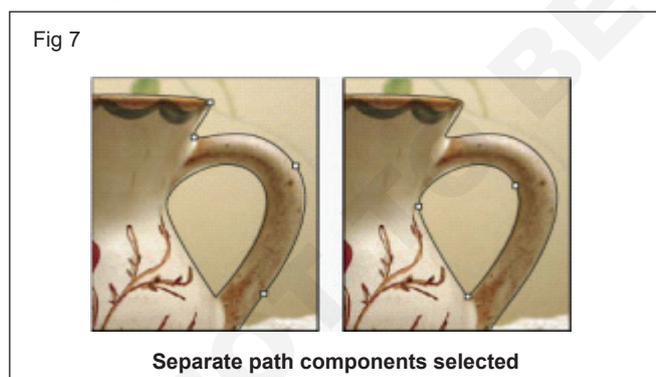
Smooth curves are connected by anchor points called smooth points. Sharply curved paths are connected by corner points. (Fig 5)



When you move a direction line on a smooth point, the curved segments on both sides of the point are adjusted simultaneously. By comparison, when you move a direction line on a corner point, only the curve on the same side of the point as the direction line is adjusted. (Fig 6)



A path does not have to be one connected series of segments. It can contain more than one distinct and separate path components. Each shape in a shape layer is a path component, as described by the layer's clipping path. (Fig 7)



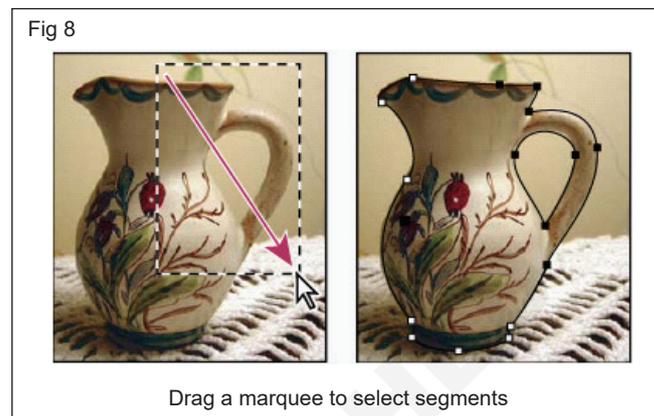
Select a path: Selecting a path component or path segment displays all of the anchor points on the selected portion, including any direction lines and direction points if the selected segment is curved. Direction handles appear as filled circles, selected anchor points as filled squares, and unselected anchor points as hollow squares.

1 Do one of the following:

To select a path component (including a shape in a shape layer), select the Path Selection tool, and click anywhere inside the path component. If a path consists of several path components, only the path component under the pointer is selected.

To select a path segment, select the Direct Selection tool and click one of the segment's anchor points, or drag a marquee over part of the segment.

2 To select additional path components or segments, select the Path Selection tool or the Direct Selection tool, and then hold down Shift while selecting additional paths or segments. (Fig 8)



Adjust path segments

You can edit a path segment at any time, but editing existing segments is slightly different from drawing them. Keep the following tips in mind when editing segments:

- If an anchor point connects two segments, moving that anchor point always changes both segments.
- When drawing with the Pen tool, you can temporarily activate the Direct Selection tool so that you can adjust segments you've already drawn; press Ctrl (Windows) or Command (Mac OS) while drawing.
- When you initially draw a smooth point with the Pen tool, dragging the direction point changes the length of the direction line on both sides of the point. However, when you edit an existing smooth point with the Direct Selection tool, you change the length of the direction line only on the side you're dragging.

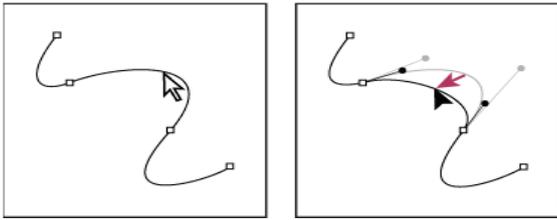
Adjust the length or angle of straight segments

- 1 With the Direct Selection tool, select an anchor point on the segment you want to adjust.
- 2 Drag the anchor point to the desired position. Shift-drag to constrain the adjustment to multiples of 45°.

Adjust the position or shape of curved segments

- 1 With the Direct Selection tool, select a curved segment, or an anchor point on either end of the curved segment. Direction lines appear, if any are present. (Some curved segments use just one direction line) (Fig 9)
- 2 Do any of the following:
 - To adjust the position of the segment, drag the segment. Shift-drag to constrain the adjustment to multiples of 45°.

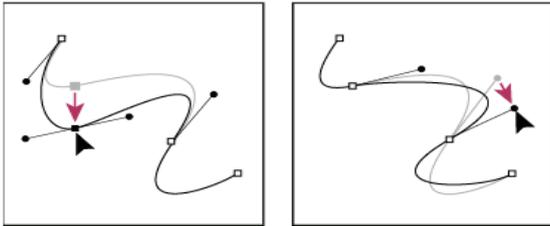
Fig 9



Click to select the curve segment. Then drag to adjust

- To adjust the shape of the segment on either side of a selected anchor point, drag the anchor point or the direction point. Shift-drag to constrain movement to multiples of 45°. (Fig 10)

Fig 10



Drag the anchor point, or drag the direction point

In Photoshop CC and CS6, adjusting a path segment also adjusts the related segments, letting you intuitively transform path shapes. To only edit segments between the selected anchor points, similar to earlier Photoshop versions, select **Constrain Path Dragging** in the options bar.

You can also apply a transformation, such as scaling or rotating, to a segment or anchor point.

Delete a segment

- (Optional) If you're creating an opening in a closed path, select the Add Anchor Point tool, and add two points where you want the cut to occur.
- Select the Direct Selection tool, and select the segment you want to delete.
- Press Backspace (Windows) or Delete (Mac OS) to delete the selected segment. Pressing Backspace or Delete again erases the rest of the path.

Delete the direction line of an anchor point

- Using the Convert Anchor Point Tool, click the anchor point of the direction line.

Add or delete anchor points: Adding anchor points can give you more control over a path or it can extend an open path. However, it's a good idea not to add more points than necessary. A path with fewer points is easier to edit, display, and print. You can reduce the complexity of a path by deleting unnecessary points.

The toolbox contains three tools for adding or deleting points: the Pen tool, the Add Anchor Point tool, and the Delete Anchor Point tool.

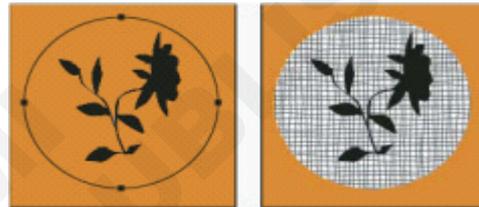
By default, the Pen tool changes to the Add Anchor Point tool as you position it over a selected path, or to the Delete Anchor Point tool as you position it over an anchor point. You must select Auto Add/Delete in the options bar to enable the Pen tool to automatically change to the Add Anchor Point or Delete Anchor Point tool.

You can select and edit multiple paths simultaneously. You can also reshape a path while adding anchor points by clicking and dragging as you add.

Don't use the Delete or Backspace keys or the Edit > Cut or Edit > Clear commands to delete anchor points. These keys and commands delete the point and line segments that connect to that point.

Fill paths with color: A path created with the Pen tool does not become an image element until you stroke or fill it. The Fill Path command fills a path with pixels using a specified color, a state of the image, a pattern or a fill layer. (Fig 11)

Fig 11



Path selected (left) and filled (right)

When you fill a path, the color values appear on the active layer. Make sure that a standard or background layer is active before completing the steps below. (You cannot fill a path when a mask, text, fill, adjustment, or Smart Object layer is active)

Stroke paths with color: The Stroke Path command paints the border of a path. The Stroke Path command allows you to create a paint stroke (using the current settings for your painting tools) that follows any path. This command is completely different from the Stroke layer effect, which doesn't mimic the effect of any of the painting tools. (Fig 12)

When you stroke a path, the color values appear on the active layer. Make sure that a standard or background layer is active before completing the steps below. (You cannot stroke a path when a mask, text, fill, adjustment, or Smart Object layer is active)

Fig 12



Path selected (left) and stroked (right)

Usage of guides and drawing tools in CorelDraw

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

- state the corel draw and corel draw tools
- explain the Guideline, Grid and uses
- state the Freehand tool and Polyline tool
- uses of Bézier Tool and the Pen Tool
- explain the 2-point tool and Artistic media tool
- use of B-spline tool.

Introduction to corel draw

Corel DRAW is an intuitive graphics design application that gives designers an enjoyable work experience. The program is built to meet the demands of today's graphics professionals. Whether you work in advertising, printing, publishing, sign making, engraving, or manufacturing, Corel DRAW offers the tools you need to create accurate and creative vector illustrations and professional-looking page layouts.

System requirements

The following list includes the minimum system requirements. Note that for optimum performance, you need more RAM and hard disc space than indicated in the list.

- Operating system with latest service pack: Window 8 (312-bit or 64-bit Editions) or Windows 7(32-bit or 64-bit Editions)
- Inte Core 2 Duo or AMD Athlon 64
- 2 GB RAM
- 1 GB hard disk space
- Electronic software downloads (ESD) require more space to allow for the download, the uncompressed setup files, and the actual installation, which includes copies the source files as well.
- Mouse or tablet
- 1280x768 screen resolution or greater
- DVD drive

- Microsoft internet explorer 8 or later

Installation requirements

To install CorelDRAW Graphics Suite applications

- 1 Close all applications, including all virus detection programs.
- 2 Insert the DVD in the DVD drive.
(Windows 7 and windows 8) If the installation wizard does not start automatically, browse to the root of the DVD, you must locate setup.exe on the DVD, and double-click the file. Be sure to navigate to the folder that corresponds to the version of your operating system: 64-Bit or 32-Bit.
- 3 Scroll down to read the license agreement, and then click I accept.
- 4 Click Next
- 5 Type your name in the User name text box.
- 6 Type your serial number in the serial number text box.
- 7 Click next.
- 8 Follow the instructions for installing the software.
After installing the corel draw you can open and use.

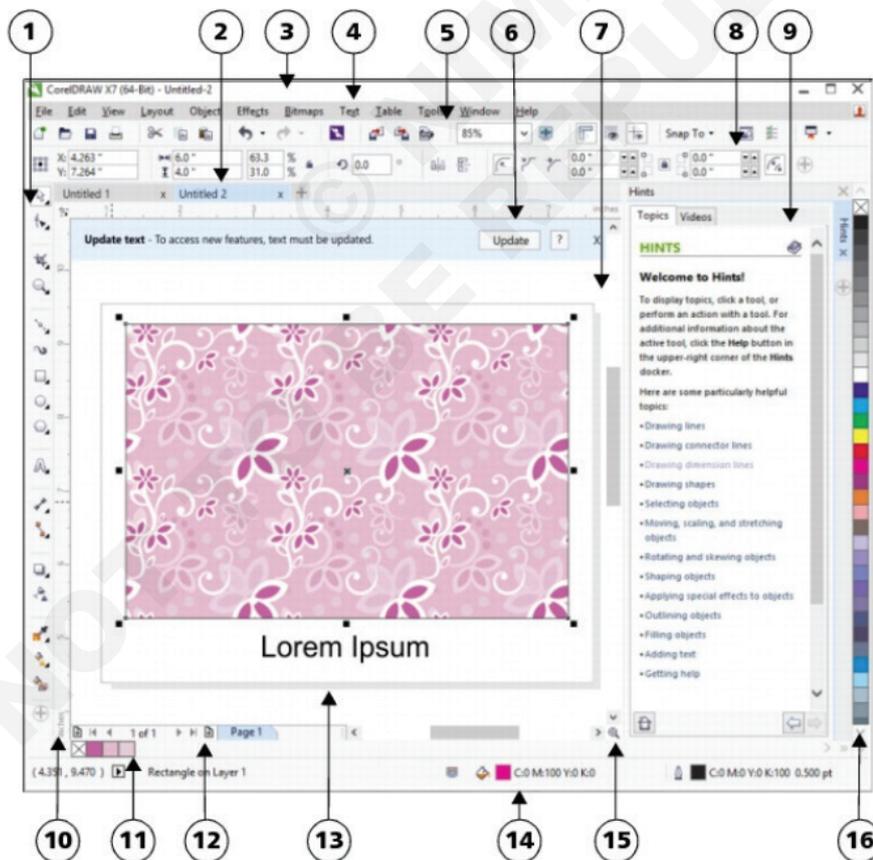
Interface of the Corel draw (Fig 1)

This is how the interface of the corel draw looks like, major options are similar but there will be slight different in other versions. Let us see about them in detail.

Sl.No	Part	Description
1	Toolbox	A docked bar with tools for creating, filling, and modifying objects in the drawing
2	Document tab	A tab displays for each open document to allow you to quickly move between documents
3	Title bar	The area displaying the title of the currently selected drawing
4	Menu bar	The area containing pull-down menu options
5	Toolbar	A detachable bar that contains shortcuts to menu and other
6	Update text toolbar	A temporary toolbar that allows you to update documents created in CorelDRAW X5 (or earlier) in order to edit the text

7	Drawing window	The area outside the drawing page bordered by the scroll bars and application controls
8	Property bar	A detachable bar with commands that relate to the active tool or object. For example, when the ext tool is active, the text property bar displays commands that create and edit text.
9	Docker	A window containing available commands and settings relevant to a specific tool or task
10	Rulers	Horizontal and vertical borders that are used to determine the size and position of objects in a drawing
11	Document palette	A dockable bar that contains color swatches for the current document
12	Document navigator	The area at the bottom left of the application window that contains controls for moving between pages and adding pages
13	Drawing page	The rectangular area inside the drawing window. It is the printable area of your work area
14	Status bar	An area at the bottom of the application window that contains information about object properties such as type, size, color, fill, and resolution. The status bar also shows the current cursor position.
15	Navigator	A button at the lower-right corner that open a smaller display to help you move around a drawing
16	Color palette	A dockable bar that contains color swatches

Fig 1



Circled numbers correspond to the numbers in the following table, which describes the main components of the application window.

Tools of the corel draw

New features and enhancements in the following areas will boost your productivity by helping you complete many

tasks more easily and in less time. The standard toolbar, which appears by default, contains buttons and controls that are shortcuts to many of the menu commands.

Standard toolbar

Click this button



To
Start a new drawing
Open a drawing

Click this button



To
Save a drawing
Print a drawing
Cut selected objects to the clipboard
Copy selected objects to the clipboard
Paste the clipboard contents into a drawing
Undo an action
Restore an action that was undone
Display the connect dock and search for content such as clipart, photos, fonts, and more
Import a drawing
Export a drawing
Publish to PDF
Set a zoom level
Display full-screen preview
Show or hide rulers
Show or hide grid

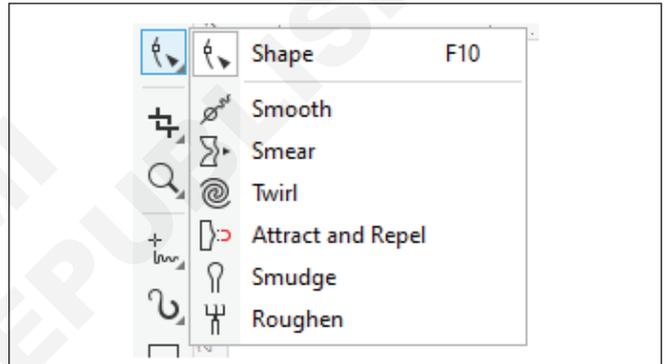


Show or hide guidelines
Enable or disable automatic alignment for the pixels, document grid, baseline grid, guidelines, objects, and page
Open the welcome screen
Open the options dialog box
Start Corel applications

Tool box

The toolbox contains a range of tools that you can use for specific drawing and editing tasks. Some tools let you draw shapes, and other tools let you apply colors, patterns, or other types of fills to objects.

Some tools belong to flyouts, which are groups of related tools. A small arrow in the lower right corner of a toolbox button indicates that the tool belongs to a flyout. The last-used tool in the flyout appears on the button. You can access the tools in a flyout by clicking the flyout arrow.



The following section summarizes the main categories of tools that are available in the toolbox. For more information about specific tools, see “Workspace tools” in the help

PICK tool



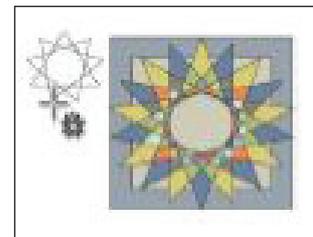
The pick tool and the freehand pick tool let you select, size, skew, and rotate objects.



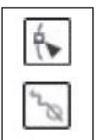
Shape tools



Shape tools let you draw many different shapes, including rectangles, ellipse, stars, polygons, and spirals. Additional tools in this category (not shown here) let you draw shapes such as smileys, arrows, banners, and flowcharts.



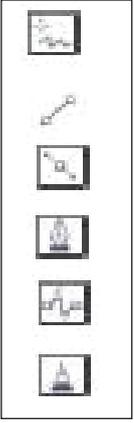
Shape editing tools



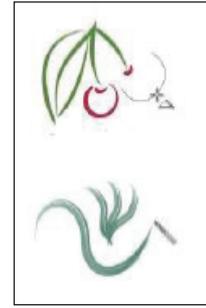
Shape editing tools let you change the shape of an existing object.



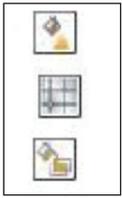
Curve tools



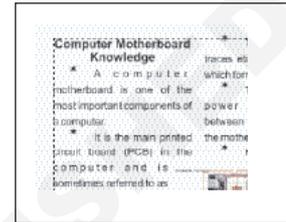
Curve tools let you draw lines and curves, such as freehand lines, straight lines, and Bezier curves. You can also use the Artistic media tool to spray images, draw calligraphic lines, or add brushstrokes.



Fill tools



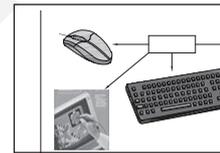
Fill tools let you apply various fills to objects, such as uniform, fountain, and mesh fills.



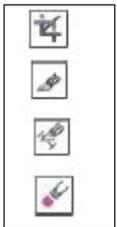
Interactive tools



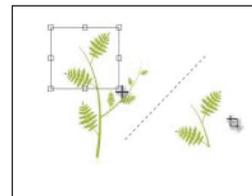
Interactive tools let you apply special effects to objects, such as blends, contours, drop shadows, extrusions and transparencies.



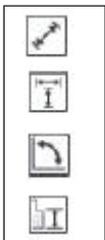
Cropping and erasing tools



Cropping and erasing tools let you remove parts of a document.



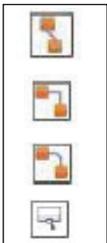
Dimension tools



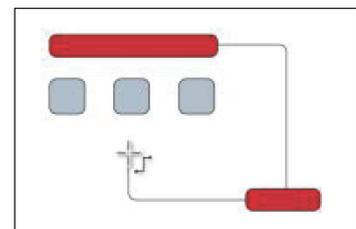
Dimension tools let you draw slanted, straight, and angular dimension lines to measure parts of objects in a document.



Connector tools



Connector tools let you draw lines that connect objects in diagrams and flowcharts.



Text tool



The Text tool lets you type words directly on-screen as artistic or paragraph text.

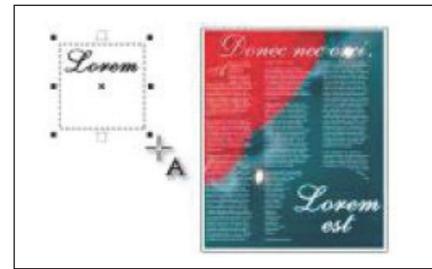
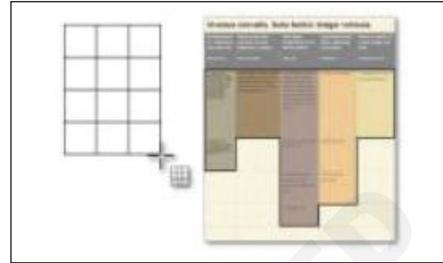


Table tool



The Table tool lets you draw and edit tables.



Zoom tool



The zoom tool lets you change the magnification level in the document window.



Explain the Guideline, Grid and uses

Guidelines

Guidelines are lines that can be placed anywhere in the drawing window to aid in object placement. In some applications, guidelines are known as guides.

There are three types of guidelines: horizontal, vertical, and slanted. By default, the application displays guidelines that you can add to the drawing window, but you can hide them at any time. You can also use objects as guides.

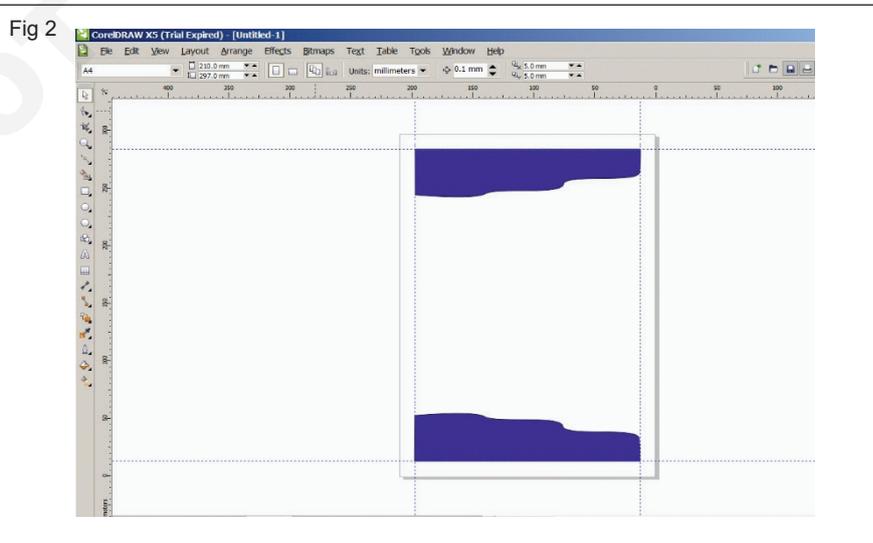
You can set guidelines for individual pages or you can set guidelines for the entire document. (Fig 2)

You can add a guideline wherever you need one; however, you can also choose to add preset guidelines. There

are two types of preset guidelines: Corel presets and user-defined presets. Examples of Corel presets include guidelines that appear at 1-inch margins and guidelines that appear at newsletter column borders. User-defined presets are guidelines whose location you specify. For example, you can add preset guidelines that display margins at a distance you specify or that define a column layout or grid. After you add a guideline, you can select it, move it, rotate it, lock it in place, or delete it.

You can have objects snap to the guidelines, so that when an object is moved near a guideline, it can only be centered on the guideline or lined up on either side of the guideline.

Guidelines use the unit of measure specified for rulers.



Guidelines can be placed in the drawing window to aid in object placement.

Grid

A series of evenly spaced horizontal and vertical dots that are used to help draw and arrange objects.

Setting up the grid

The grid is a series of non-printing intersecting lines that you can display in the drawing window. You can use the grid to precisely align and position objects.

You can customize the look of the grid by changing the grid display and grid spacing. The grid display allows you to view the grid as lines or as dots. The spacing allows you to set the distance between the grid lines. The spacing options are based on the unit of measure for the ruler. For example, if the ruler unit of measure is set to inches, the spacing options are based on inches.

If the ruler unit of measure is set to pixels, or if you enabled the Pixel preview, you can specify the color and opacity of the pixel grid.

You can also have objects snap to the grid or pixel grid so that when you move the objects, they jump between grid lines.

Curve Tools

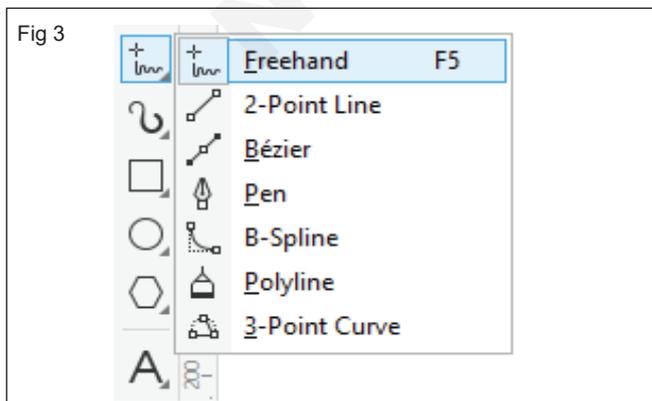
If you want to create a your own unique shapes, you can use one of the curve tools. Using these tools, you can draw an almost unlimited variety of shapes.

Drawing lines

A line is a path between two points. Lines can consist of multiple segments, and the line segments can be curved or straight. The line segments are connected by nodes, which are depicted as small squares. CoreIDRAW provides various drawing tools that let you draw curved and straight lines, and lines containing both curved and straight segments.

Freehand and Polyline Tools (Fig 3)

The Freehand and Polyline tools share a common function, giving you the freedom to draw as if you were sketching by freehand on a physical sketch pad, but the tools work in slightly different ways. Sketched lines can create a single open or closed vector path. Both tools are located in the Toolbox grouped with other line-creation tools, as shown here:



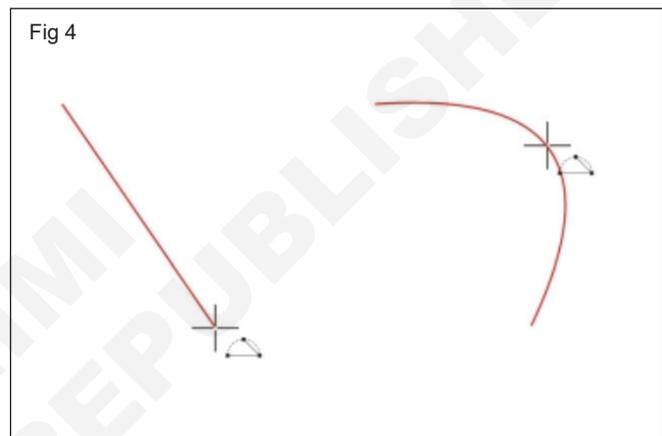
Freehand Tool and Polyline Tool

Using either of these tools, you have control over the smoothness of path shapes drawn using click-drag actions by adjusting the Freehand Smoothing option in the Property Bar before drawing your path. You can control smoothness after drawing a path by selecting nodes with the Shape Tool and then using the Reduce Nodes spin box. Reduce Nodes has a range between 0 and 100 percent; lower values apply less smoothing, and higher values apply more smoothing.

3-Point Curve Tool

The 3-Point Curve Tool is used to build perfectly smooth arcing line segments, with complete control over the direction and steepness of the curve between two points. (Fig 4)

You can draw a curved line by specifying its width (left), and then specifying its height and clicking the page (right).



Using the Bézier and Pen Tools

The Bézier Tool and the Pen Tool are variations on the same theme of drawing connected curves and straight segments (unlike the 3-Point Curve Tool), through the action of first clicking to set a path point, and then by either dragging to define a curve behind the click point or by clicking (not dragging) to define a straight path segment behind the click point.

One of the less obvious differences between the two tools is that the Pen Tool offers a “look ahead” point when you draw with it; before you click or click-drag a point, the proposed path between the point before you click and the previous (already defined) point on the path is shown in light blue. When you’re just beginning with CoreIDRAW, the choice between these tools should be based on the following:

The Pen Tool provides intuitive results when you want a path that has both straight segments and curves. The Bézier Tool excels at creating curved segments that are joined smoothly, and straight segments are not your design goal

2-point line tool

You can draw straight lines by using the 2-point line tool. This tool also allows you to create straight lines that are perpendicular or tangent to objects.

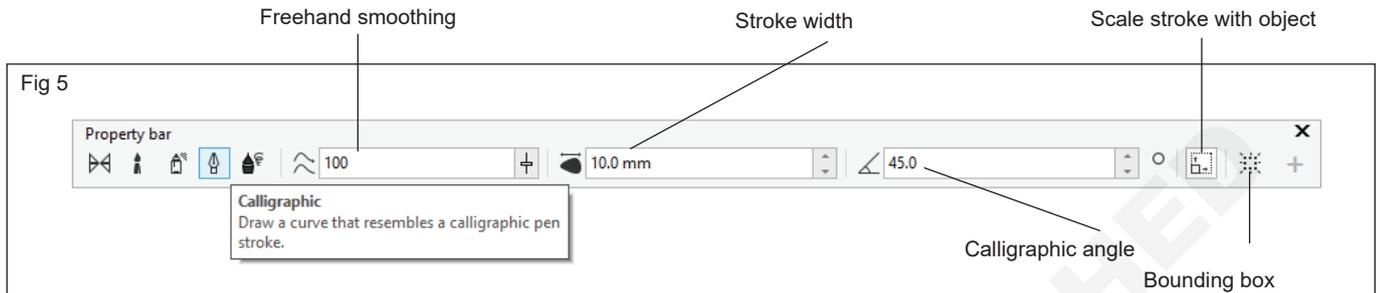
Artistic Media Tools

The Artistic Media tools in CorelDRAW lets you choose from a wide variety of new, sophisticated preset brush styles. You can draw vector shapes, brushstrokes, Sprayed images, calligraphic strokes and pressure sensitive strokes. For each stroke type that is available with the Artistic media tool, you can set preference for the level of smoothing, the stroke width and other properties.

Drawing calligraphic (Fig 5)

CorelDRAW lets you simulate the effect of a calligraphic

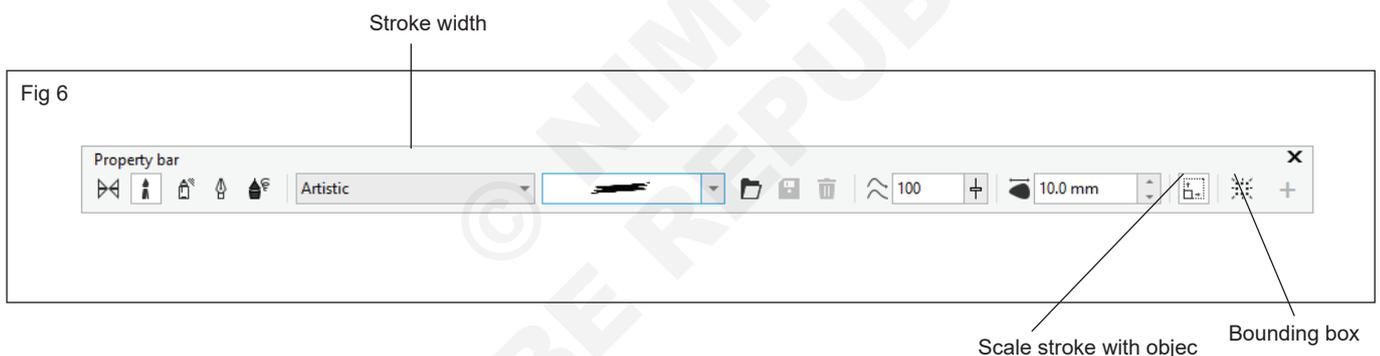
pen when you draw lines. Calligraphic lines vary in thickness according to the direction of the line and the angle of the pen nib. By default, calligraphic lines appear as closed shapes drawn with a pencil. You can control the thickness of a calligraphic line by changing the angle of the line you draw in relation to the calligraphic angle you choose. For example, when the line you draw is perpendicular to the calligraphic angle, the line is at the maximum thickness specified by the pen width. Lines drawn at the calligraphic angle, however, have little or no thickness.



Pressure-sensitive (Fig 6)

CorelDRAW lets you create pressure-sensitive lines which vary in thickness. You can create this effect using the mouse or a pressure-sensitive pen and graphics

tablet. Both methods result in lines with curved edges and varying widths along a path. For information about using a pressure-sensitive pen on a graphics tablet, see the manufacturer's instructions.

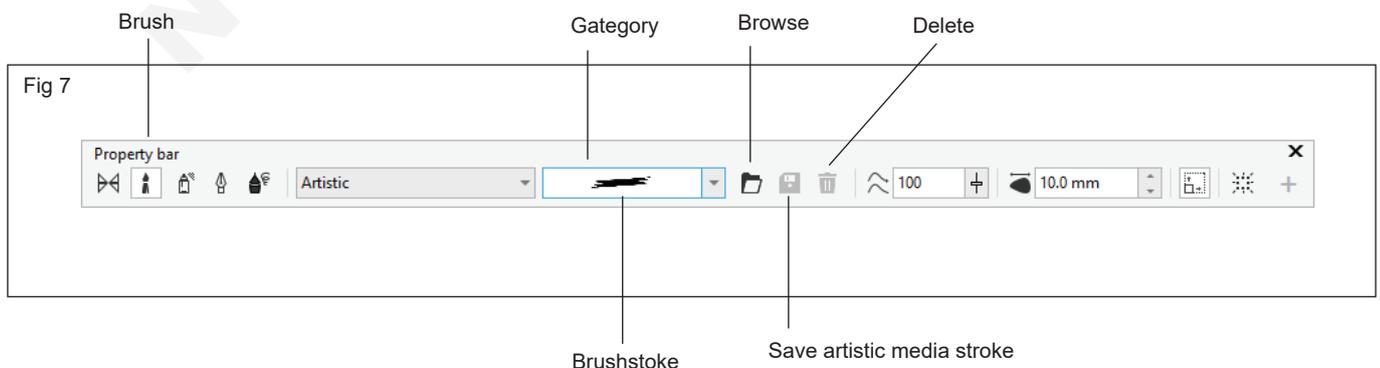


Preset lines (Fig 7)

CorelDRAW provides preset lines that let you create thick strokes in a variety of shapes. After you draw a calligraphic or preset line, you can apply a fill to it as you would to any other object.

Brushstrokes

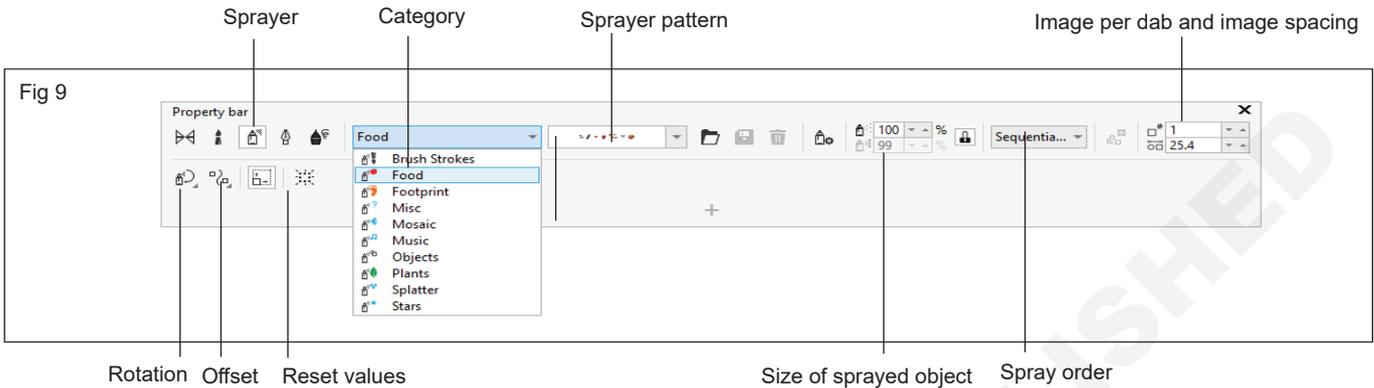
CorelDRAW lets you apply a variety of preset brushstrokes, ranging from strokes with arrowheads to ones that are filled with rainbow patterns. When you draw a preset brushstroke, you can specify some of its attributes. For example, you can change the width of a brushstroke and specify its smoothness.



You can also create custom brushstrokes by using an object or a group of vector objects. When you create a custom brushstroke, you can save it as a preset.

Spraying objects along a line. (Fig 8)

CorelDRAW lets you spray a series of objects in a line. Besides graphic and text objects, you can import bitmaps and symbols to spray along a line. (Fig 9)



You can control how a sprayed line appears by adjusting the spacing between objects, so they are closer or farther apart from each other. You can also vary the order of objects in the line. For example, if you are spraying a series of objects that includes a star, a triangle, and a square, you can change the spray order so that the square appears first, followed by the triangle and then the star. CorelDRAW also lets you shift the position of objects in a sprayed line by rotating them along the path or offsetting them in one of four different directions: alternating, left, random, or right. For example, you can choose a left offset direction to align the objects you spray to the left of the path. (Fig 10)

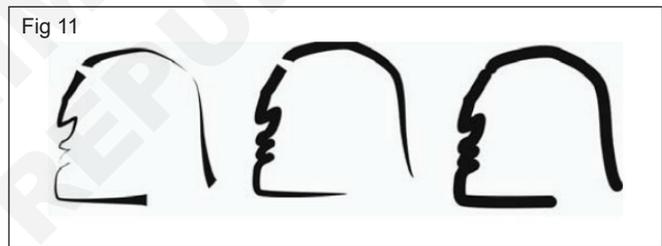


Objects sprayed along a curved line (left). The objects and line were edited after the objects were sprayed (right).

Preset mode

Using the preset mode of the Artistic media tool is perfect when you want to create a basic stroke that can be edited. Preset stroke vary in width and shape, and you can edit them by applying a different preset stroke shape, by

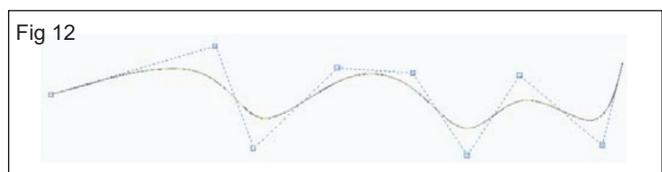
stretching and moving the stroke on the page, and by applying the outline and fill to the stroke. (Fig 11)



B-spline tool

By using control points, you can easily shape a curved line and draw B-splines, which are typically smooth, continuous curved lines. B-splines touch the first and last control points and are pulled by the points in between. However, unlike the nodes on Bézier curves, control points don't let you specify the points through which a curve passes when you want to align a curve with other drawing elements.

The control points that touch the line are referred to as "clamped". Clamped control points function as anchors. The control points that pull the line but do not touch it are referred to as "floating". The first and last control points are always clamped on open-ended B-splines. The points in between float by default, but you can clamp points if you want to create cusps or straight lines within the B-spline. You can edit completed B-splines by using the control points. (Fig 12)



Creating Ellipses, Circles, Rectangles and Squares

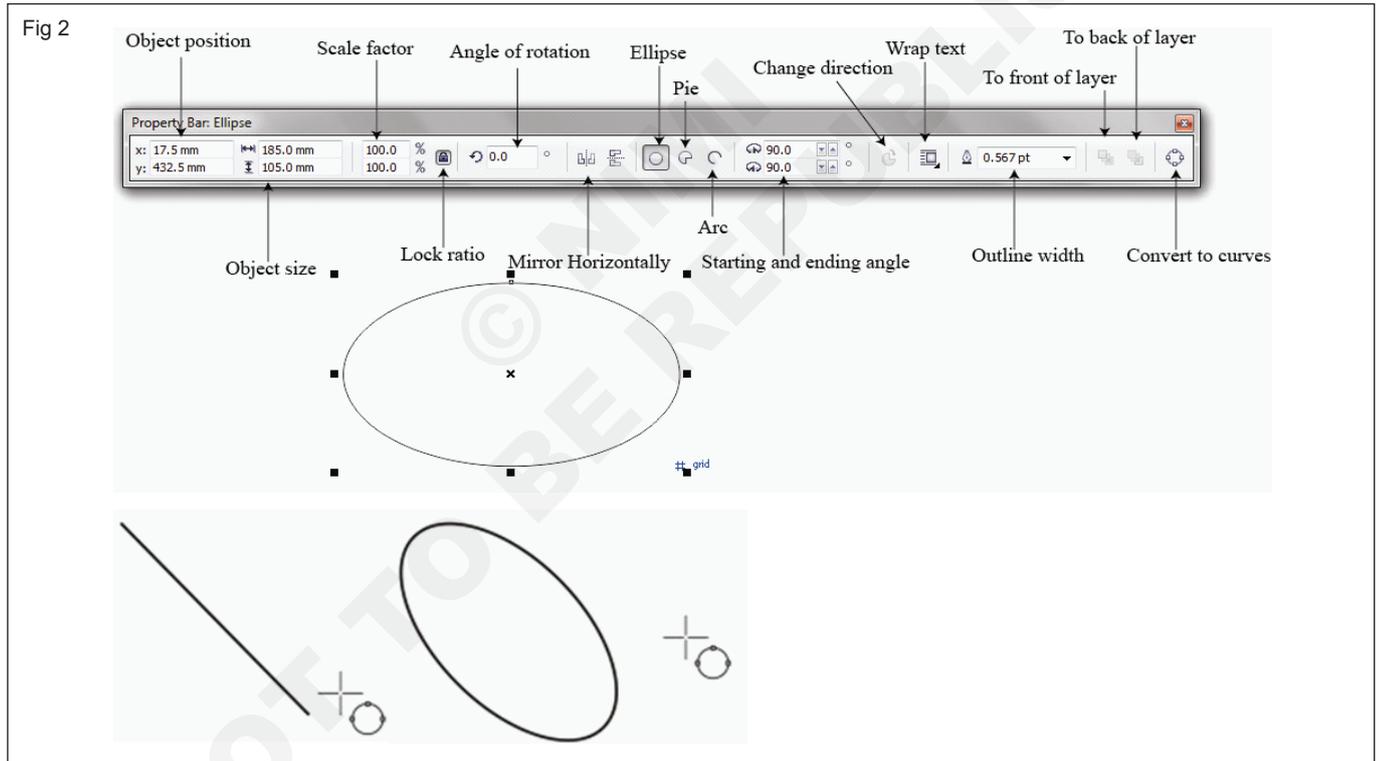
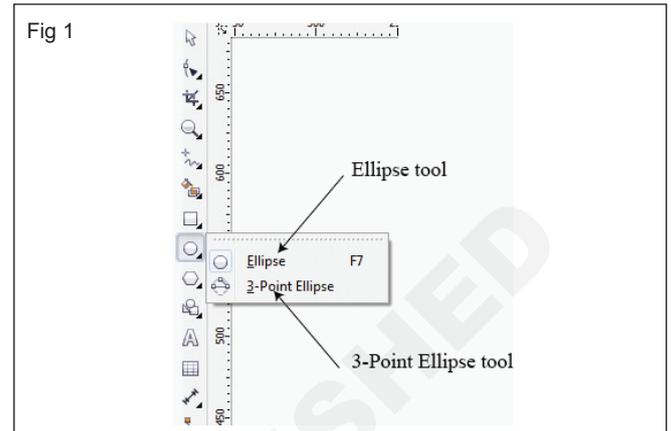
Objectives: At the end of this lesson you shall be to

- explain the ellipse, circle, rectangle and square tools
- polygon, star and complex star tools
- state the spiral and graph paper tools
- explain the shape edit tools.

Ellipses, circles, rectangle and square

Ellipse and circle

Draw an ellipse or circle by dragging diagonally with the Ellipse tool, or draw an ellipse by using the 3-point ellipse tool to specify its width and height. The 3-point ellipse tool quickly create an ellipse at an angle, eliminating the need to rotate the ellipse. (Fig 1)

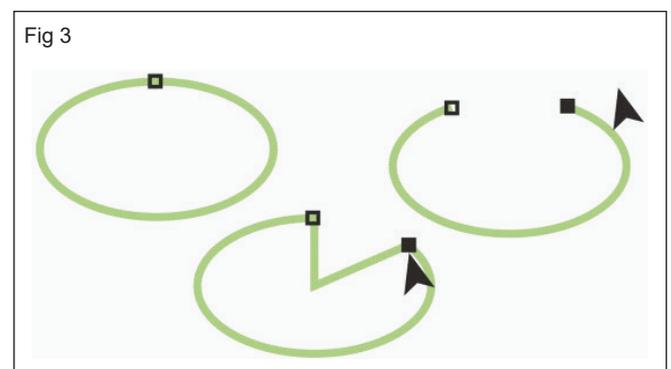


Using the 3-point ellipse tool, to draw an ellipse by first drawing its centerline and then drawing its height. This method to draw ellipses at an angle. (Fig 2)

To draw an ellipse or a circle from its center outward by holding down Shift as and drag.

Arcs, and Pie

Using the Ellipse tool, draw a new arc or pie shape, or draw an ellipse or circle and then change it to an arc or a pie shape. Change the default properties of new objects that are drawn with the Ellipse tool. For example, to set the default properties so that all new shapes to draw are arcs or pie shapes. (Fig 3)

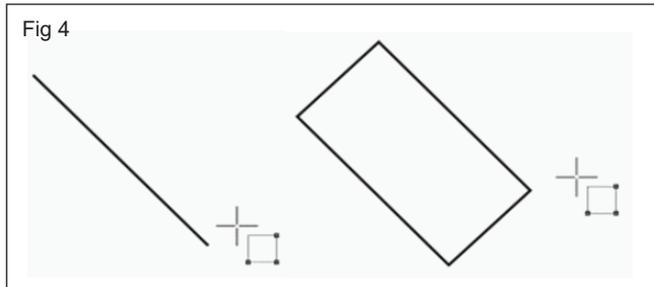


To use the Shape tool to create a pie shape, drag the node of the ellipse (left) to the inside of the ellipse (center). To create an arc, drag the node to the outside of the ellipse (right).

To draw an arc, the ellipse or circle must have an outline

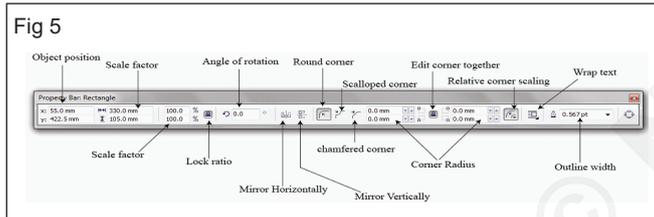
Rectangle and square shapes (Fig 4)

Draw a rectangle or square by dragging diagonally with the Rectangle tool or by specifying the width and height with the 3-point rectangle tool. The 3-point rectangle tool lets you quickly draw rectangles at an angle.



Create a 3-point rectangle by first drawing its baseline and then drawing its height. The resulting rectangle is angled.

Property bar of the Rectangle tool (Fig 5)



Draw a rectangle or square with rounded, scalloped or chamfered corners. To modify each corner individually or apply the changes to all corners. In addition, to specify that all corners scale relative to the object. To also specify the default corner size for drawing rectangles and squares.

Understanding rounded, scalloped, and chamfered corners

Rounding produces a curved corner, scalloping replaces the corner with an edge that has a curved notch, and chamfering replaces the corner with a straight edge, also known as a bevel. (Fig 6)

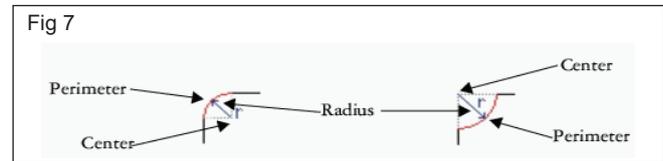


From left to right, to see standard corners with no changes, rounded corners, scalloped corners, and chamfered corners.

To draw rectangles or squares with rounded, scalloped, or chamfered corners, need to specify the corner size. For rounding or scalloping a corner, the corner size determines the corner radius. The radius is measured

from the curve's center to its perimeter. Higher corner size values produce more rounded corners or deep scalloped corners.

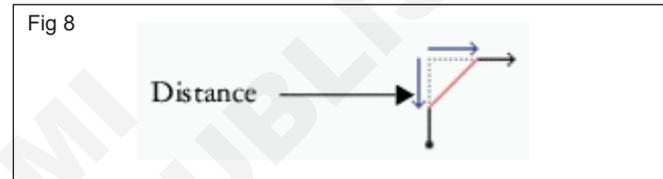
From left to right, to see the radius of a rounded corner and the radius of a scalloped corner. (Fig 7)



The size value for chamfering a corner represents the distance to set where the chamfer will begin in relation to the original corner. Higher corner size values produce a longer chamfered edge.

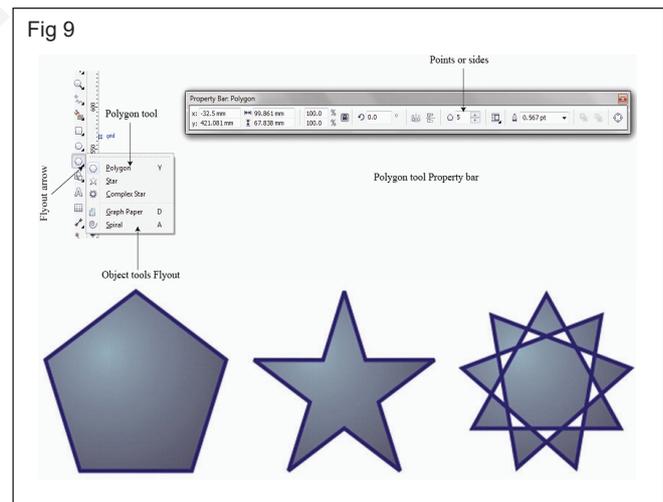
To draw a rectangle from its center outward by holding down Shift as you drag. Draw also a square from its center outward by holding down Shift + Ctrl as you drag.

Draw a rectangle that covers the drawing page by double-clicking the Rectangle tool. (Fig 8)



Polygon, star and complex star tools

Draw polygons and two types of stars: perfect and complex. Perfect stars are traditional-looking stars and can have a fill applied to the entire star shape. Complex stars have intersecting sides and produce original results with a fill applied. (Fig 9)



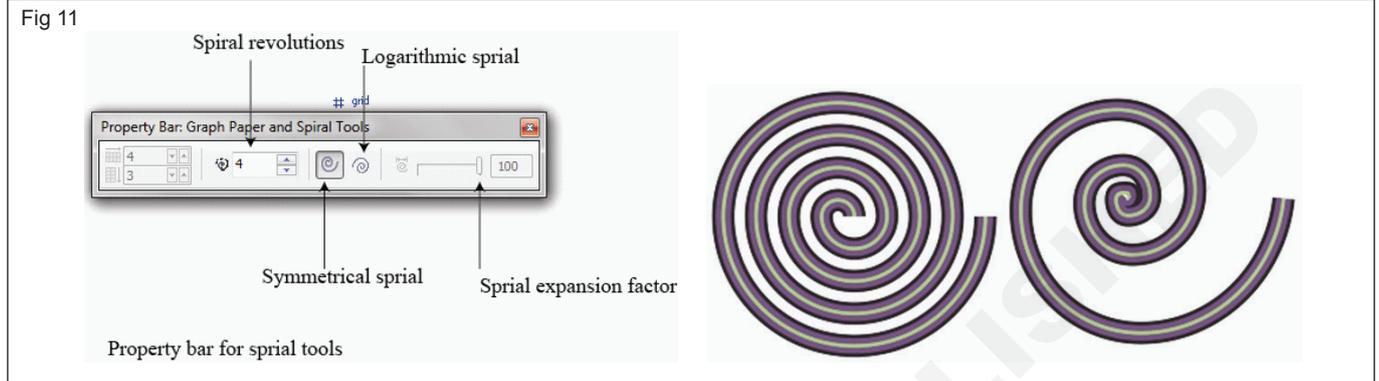
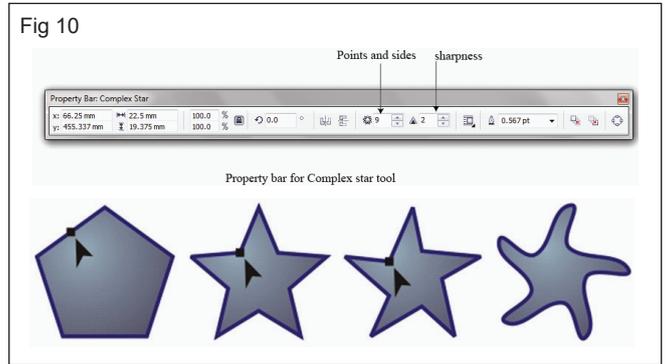
Left to right: Polygon, perfect star, and complex star, each with a fountain fill applied

To modify polygons and stars. For example, change the number of sides on a polygon or the number of points on a star, and sharpen the points of a star. Also to use the Shape tool to reshape polygons and complex stars, just as too with any other curve object. Perfect stars can also be reshaped, but with some restrictions.

Left to right: The Shape tool was used to change a polygon into a star that can be shaped as a curve object. The line segments of the star were then converted to curves and adjusted to produce the starfish shape. (Fig 10)

Spiral Tool

Draw two types of spirals: symmetrical and logarithmic. Symmetrical spirals expand evenly so that the distance between each revolution is equal. Logarithmic spirals expand with increasingly larger distances between revolutions. You can set the rate by which a logarithmic spiral expands outward. (Fig 11)



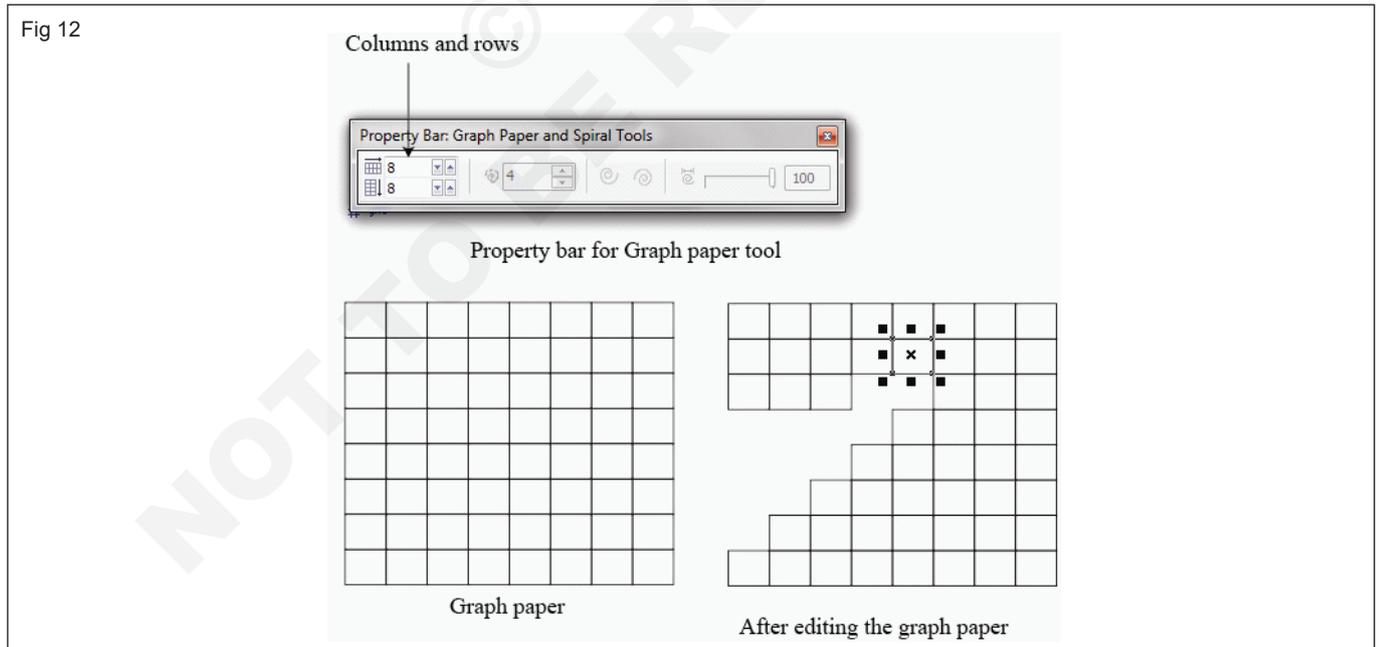
A symmetrical spiral (left) and a logarithmic spiral (right)

Also draw a spiral with even horizontal and vertical dimensions by holding down Ctrl as you drag.

Draw a spiral from its center outward by holding down Shift as you drag.

Graph paper tool

Draw a grid and set the number of rows and columns. A grid is a grouped set of rectangles that you can break apart. (Fig 12)



You can also break apart a grid by clicking the Ungroup button on the property bar

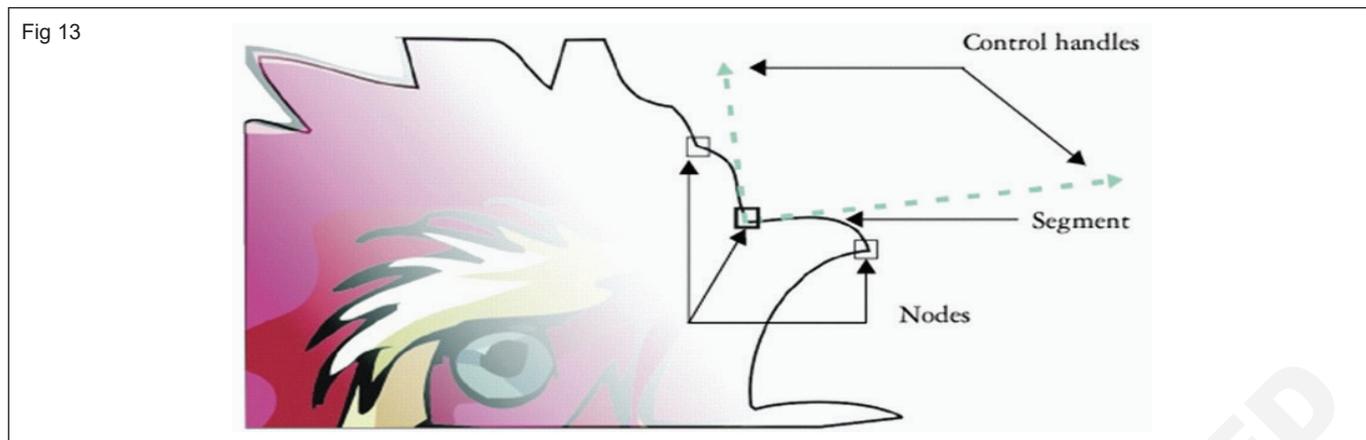
Curve objects

A curve object has nodes and control handles, which is use to change the object's shape. A curve object can be

any shape, including a straight or curved line. An object's nodes are the small squares that appear along the object's outline. The line between two nodes is called a segment. Segments can be curved or straight. Each node has a control handle for each curved segment connected to it. Control handles help to adjust the curve of a segment.

The components of a curve: control handles, segments, and nodes

Curve objects created in CorelDRAW follow a path that gives them their defining shape. A path can be open (for example, a line) or closed (for example, an ellipse) and can sometimes include subpaths. (Fig 13)



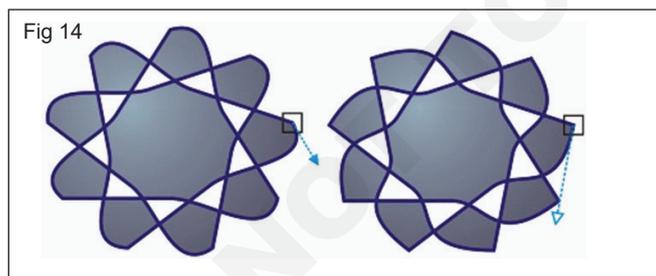
Most objects that are added to a drawing are not curve objects, with the exception of spirals, freehand lines, and Bézier lines. Therefore, if you want to customize the shape of an object or text object, it is recommended that you convert it to a curve object.

You can also convert an object to a curve object by selecting the object and clicking the Convert to curves button on the property bar.

Selecting and moving nodes (Fig 14)

Select individual, multiple, or all of the object's nodes. Selecting multiple nodes to shape different parts of an object simultaneously. The marquee select nodes by enclosing them with a rectangular marquee box, or by enclosing them with an irregularly shaped marquee box. Freehand marquee selection is useful when you want to select specific nodes in complex curves.

When a node is selected on curved segments, control handles are displayed. You can adjust the shape of the curved segments by moving the nodes and control handles.

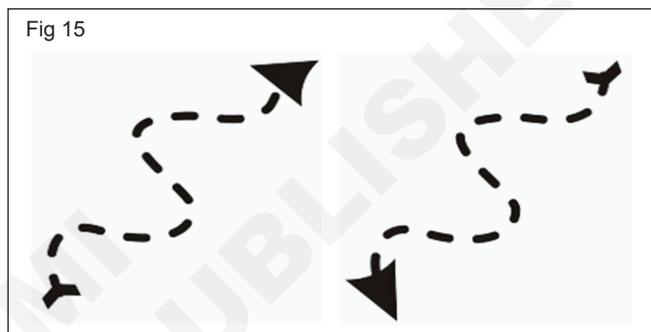


Usually, a control handle is displayed as a solid blue arrowhead (left). When a control handle overlaps with a node, it is displayed as an unfilled blue arrowhead beside the node (right).

The Shape tool is the standard tool for moving nodes. Also set an option to use the Pick and Bézier tools for selecting and moving nodes.

Manipulating segments (Fig 15)

To move curved segments to change an object's shape.



Also control the smoothness of curved segments.

To change the direction of a curve object by reversing the position of its start and end nodes. The effect is apparent only when the ends of a curve object are different. For example, when an arrowhead is applied to the end node of a curve object, changing the direction results in moving the arrowhead to the start node.

Changing the direction of a curve (Fig 16)

Adding, removing, joining, and aligning nodes

Add nodes, to increase the number of segments and, therefore, the amount of control you have over the shape of the object. To delete selected nodes to simplify an object's shape.

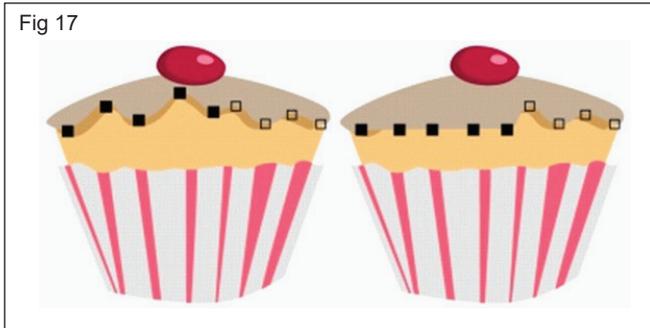
When curve objects contain many nodes, it is difficult to edit and output them to devices such as vinyl cutters, plotters, and rotary engravers. You can have the number of nodes in a curve object reduced automatically. Reducing the number of nodes removes overlapping nodes and can smooth a curve object. This feature is especially useful for reducing the number of nodes in objects imported from other applications.



Reducing the number of nodes to smooth a curve object

To join the start and end nodes of an open path such as a line to create a closed object. This feature is useful for filling an object with color because you can apply fills only to the inside of closed objects.

To align the nodes of a curve object horizontally or vertically. (Fig 17)



Using node types (Fig 18)

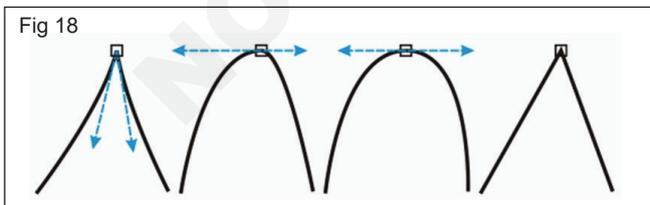
To change the nodes on a curve object to one of four types: cusp, smooth, symmetrical, or line. The control handles of each node type behave differently.

Cusp nodes to create sharp transitions, such as corners or sharp angles, in a curve object. To move the control handles in a cusp node independently of one another, changing only the line on one side of the node.

With smooth nodes, the lines passing through the node take on the shape of a curve, producing smooth transitions between line segments. The control handles of a smooth node are always directly opposite one another, but they may be at different distances from the node.

Symmetrical nodes are similar to smooth nodes. They create a smooth transition between line segments, but they also to give lines on both sides of a node the same curve appearance. The control handles of symmetrical nodes are directly opposite each other and at an equal distance from the node.

Line nodes to shape curve objects by changing the shape of their segments. To make a curved segment straight or a straight segment curved. Making a straight segment curved does not noticeably change the segment's appearance, but it displays control handles that to move to change the segment's shape.

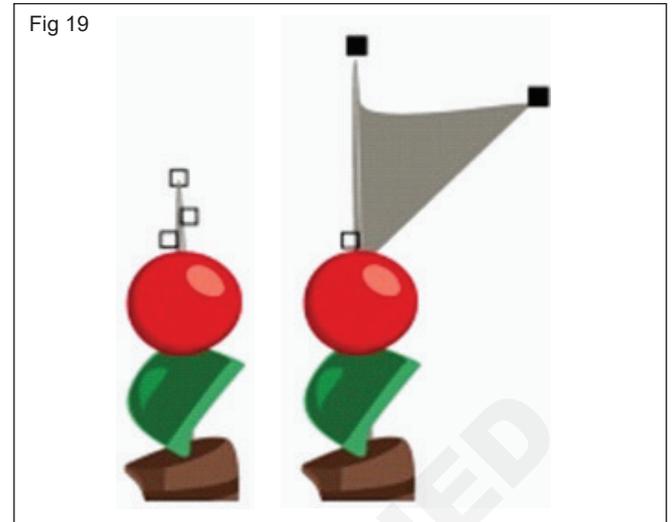


Left to right: Cusp, smooth, symmetrical, and line nodes

Transforming nodes

Shape objects by stretching, scaling, rotating, and skewing their nodes. For example, to scale the corner nodes of a curve object to enlarge the curve object proportionally.

Also, a curve object or parts of a curve object can be rotated in a counterclockwise or clockwise direction. (Fig 19)



Stretching nodes

Breaking the path of curve objects

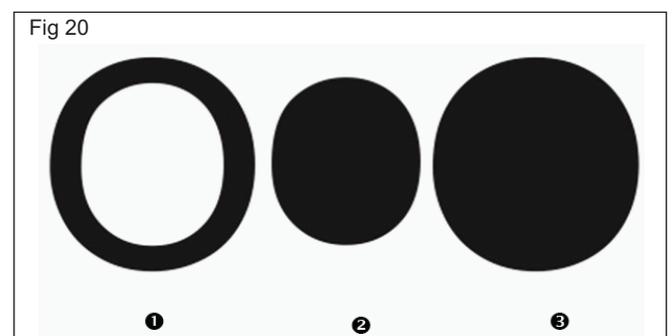
Paths

Paths outline an object's shape and are often visible as one or more line or curve segments. To disconnect line segments from one another to create subpaths. Even though they are not connected, subpaths are still part of the defining path of the original object; however, to extract a subpath to create two separate objects: the extracted subpath and the object it was extracted from.

Subpaths

Subpaths are the basic curves and shapes from which a single curve object is constructed. For example, a single curve object with subpaths is often created when text is converted to curves. The letter "O," for instance, is composed of two ellipses: the outside ellipse that defines the letter's shape and the inside ellipse that defines the "hole." The ellipses are subpaths that compose the single curve object, "O." One of the basic reasons for creating an object with subpaths is that can produce objects with holes in them. In the following example, to see objects underneath the center of the letter "O."

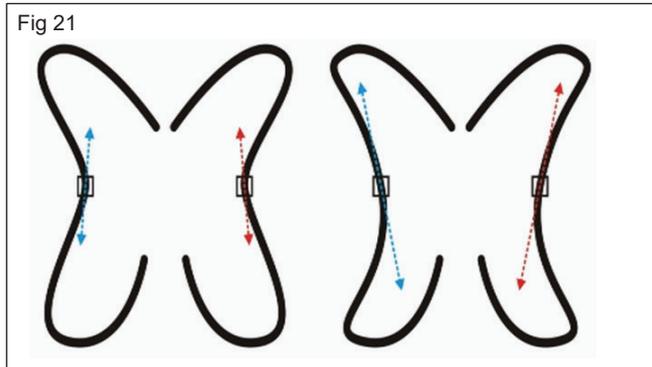
- 1) The letter "O" is converted to curves.
- 2) The resulting subpaths are the outside ellipse that defines the shape of the letter and the inside ellipse that defines the hole.
- 3) In comparison, the black ellipse consists of a single path and cannot contain a "hole." (Fig 20)



Mirroring changes in curve objects (Fig 21)

To change mirror in curve objects, to edit nodes and have the same edits take place in reverse on corresponding nodes. For example, to move a node to the right, and its corresponding node moves the same distance to the left.

To mirror changes, select two curve objects one of which was created by mirroring the other, or a symmetrical object. Next, need to choose whether to mirror changes horizontally (along a vertical line of symmetry) or vertically (along a horizontal line of symmetry). Finally, need to select the appropriate corresponding nodes so that editing changes are mirrored across the selected objects.



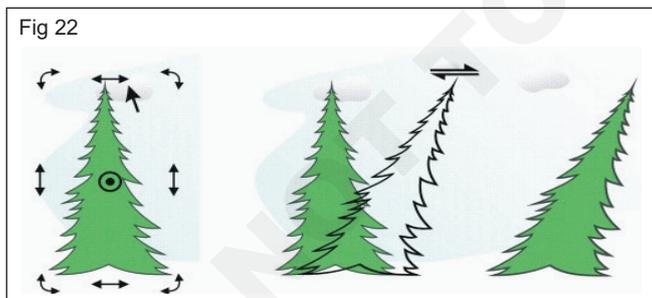
Left: Two corresponding nodes are selected in mirrored curve objects. **Right:** When the blue control handles are moved, the change is reflected in the corresponding control handles (in red).

Skewing and stretching objects (Fig 22)

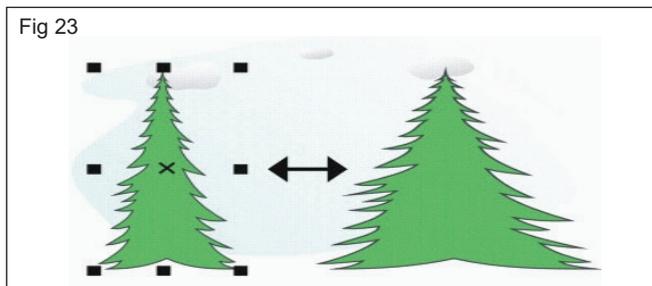
skew and stretch objects in CoreIDRAW. Change to skew an object, to specify the degree by which you want to slant the object. Stretching changes an object's vertical and horizontal dimensions non-proportionally.

CoreIDRAW also to change the skew and sizing anchor point of an object from its default center position.

Skewing an object horizontally

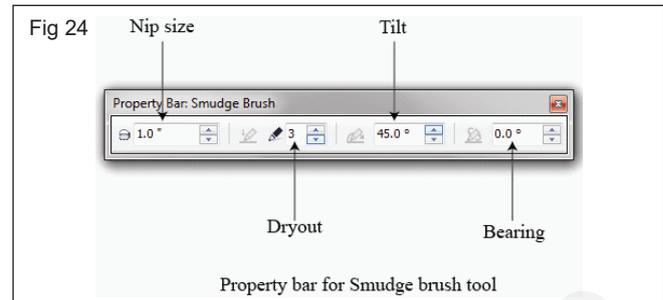


Stretching an object horizontally (Fig 23)



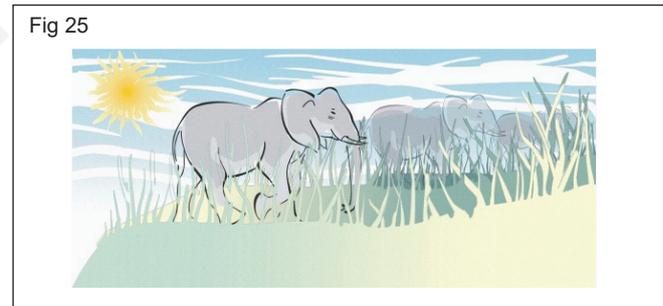
Smudging objects (Figs 24 & 25)

Smudging is to distort an object by dragging its outline. When applying smudging to an object, you can control the extent and shape of the distortion whether to activate the controls for the graphics tablet stylus or use the settings that apply to a mouse.



The smudging effect responds to both the angle of rotation - or bearing - and the tilt angle of a graphics tablet stylus. Rotating the stylus changes the angle of the smudging effect and tilting the stylus flattens the brush tip and changes the shape of the smudging. If using a mouse, you can simulate the bearing and tilt of the stylus by specifying values. Increasing the bearing angle from 0 - 359° changes the angle of the brushstroke. As to decrease the tilt angle from 90° - 15°, to change the smudging shape by flattening the brush tip.

Smudging can respond to the pressure of a stylus on a tablet where the smudging widens with more pressure and narrows with less. If using a mouse or want to override stylus pressure, enter real values to simulate the pressure of a stylus on a graphics tablet. Negative values to -10 create a narrowing distortion, 0 maintains an even stroke width, and positive values to 10 create an expanding distortion.



Objects placed in the foreground and background have been shaped by outside smudging (sun's rays and blades of grass) and inside smudging (clouds).

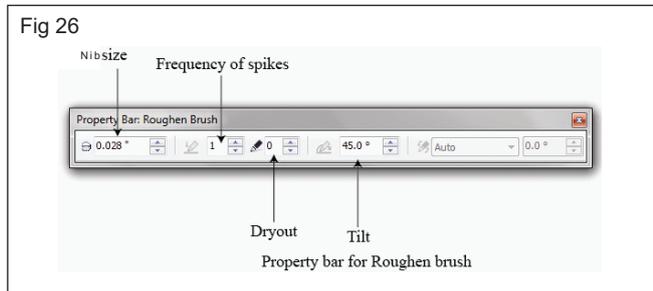
Whether to using a stylus or a mouse, must specify the nib size. The nib size determines the width of the smudging applied to an object.

To apply the smudging effect to the inside and outside of an object.

Smudging cannot apply to Internet or embedded objects, linked images, grids, masks, mesh-filled objects, or objects with blend and contour effects.

Roughening objects

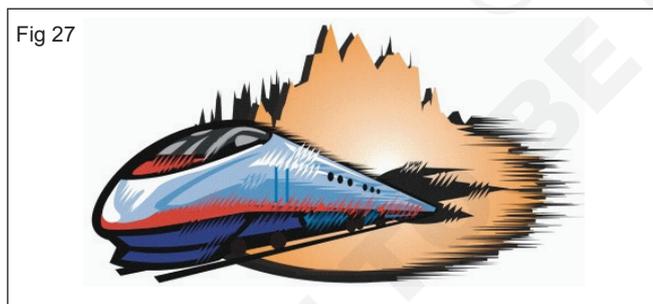
The roughening effect to apply a jagged or spiked edge to objects, including lines, curves, and text. To control the size, angle, direction, and number of the indentations whether you activate the graphics tablet stylus or apply settings to a mouse. (Fig 26)



The roughening effect is determined either by movements of a graphics tablet stylus, by fixed settings, or by automatically applying perpendicular spikes to the line. Tilting the stylus toward and away from the tablet's surface increases and decreases the size of the spikes. When using a mouse, to specify the tilt angle from 0 - 90°. Determine the direction of the spikes by changing the angle of rotation (or bearing) of the stylus as to apply the roughening effect to an object. When using a mouse, to set the bearing angle from 0 - 359°. Also increase or decrease the number of spikes that are applied as the drag.

The roughening effect also responds to the pressure of the stylus on the tablet. The more pressure to apply, the more spikes are created in the roughened area. Using a mouse, you can specify values to simulate the stylus pressure.

To change the brush nib size (Fig 27)



Roughening allows you to apply jags or spikes to part of an outline or path.

To make the tilt angle and bearing angle responsive to the graphics tablet stylus, right-click the roughened object, and select a command from the submenu.

To get the minimum and maximum values for the roughening controls, right-click the control on the property bar, and click Settings

Distortion effects

To apply three types of distortion effects to shape objects.

Distortion effect Description

Push and pull

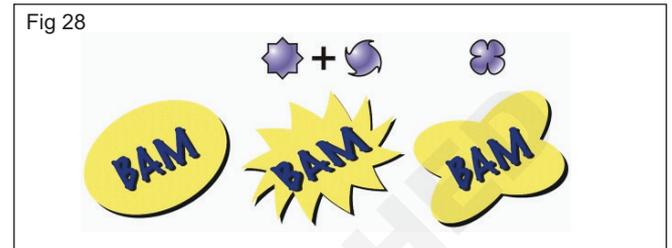
Drag to push the edges of an object in or pull the edges of an object out. (Fig 28)

Zipper

Apply to saw tooth effect to the edges of the object. To adjust the amplitude and frequency of the effect.

Twister

To rotate an object to create a swirl effect. Choose the direction of the swirl, as well as the origin, degree, and amount of rotation.



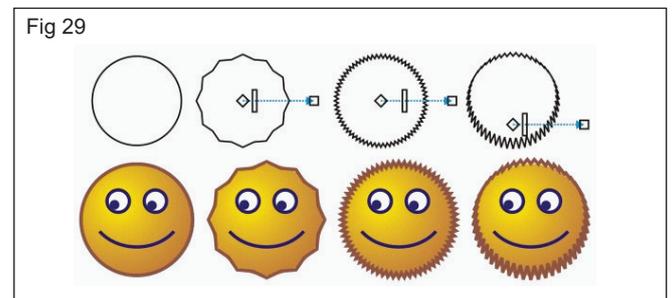
From left to right: Original image; Zipper and Twister distortions applied; Pull distortion applied

After apply distort an object, to change the effect by altering the center of distortion. This point is identified by a diamond-shaped handle, around which a distortion appears. It is similar to a mathematical compass, where the pencil moves around a stationary point. Place the center of distortion anywhere in the drawing window, or choose to center it in the middle of an object so that the distortion is distributed evenly and the shape of the object changes in relation to its center.

To create an even more dramatic effect by applying a new distortion to an already distorted object. Don't lose the effect of the original distortion if, for example, to apply a zipper distortion on top of a twister distortion. The CorelDRAW application also to remove and copy distortion effects.

Center a distortion by clicking the Center distortion button on the property bar.

Use the interactive vector controls to edit a distortion effect. Upper left: Zipper effect applied to circle. Upper right: Zipper effects with higher frequency (more spikes) applied. Bottom: Results of applying zipper effects. (Fig 29)



Shaping objects

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

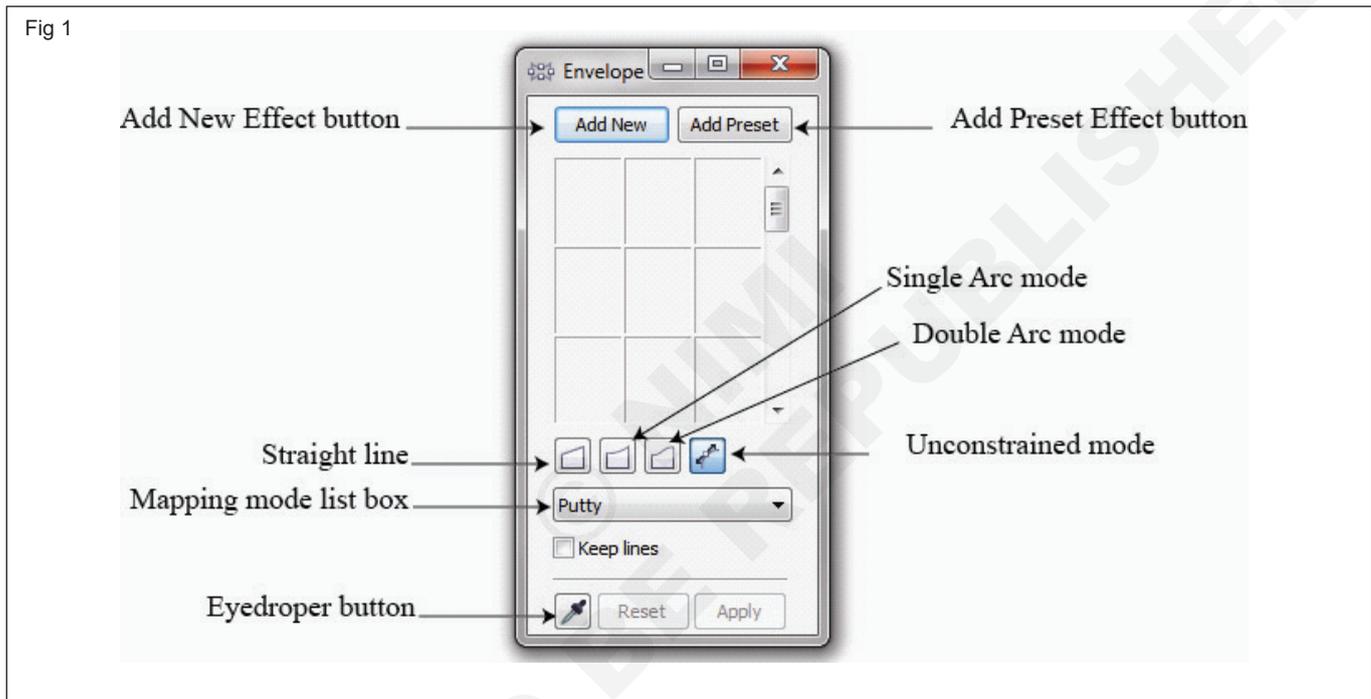
- state shaping object by use envelope effects
- explain the extrude and bevel effects
- state the Lens effects
- describe the blending and contour effects
- explain the perspective effects.

Shaping objects by use envelopes effects

CoreIDRAW apply to shape objects, including lines, artistic text, and paragraph text frames by applying envelopes to them. Envelopes are made of multiple nodes that you can move to shape the envelope and, as a result, change the shape of the object. To apply a basic envelope that conforms to the shape of an object, or to apply also a preset envelope. After you apply an envelope, to edit it

or add a new envelope to continue changing the object's shape. CoreIDRAW also to copy and remove envelopes.

Edit an envelope by adding and positioning its nodes. Adding nodes gives more control over the shape of the object contained in the envelope. CoreIDRAW also to delete nodes, move multiple nodes simultaneously, change nodes from one type to another, and change a segment of an envelope to a line or curve. (Fig 1)



To change the mapping mode of an envelope to specify how the object fits to the envelope. For example, stretch an object to fit the basic dimensions of the envelope, and then apply the horizontal mapping mode to compress it horizontally so that it fits the shape of the envelope.

Extrude effect

To make objects appear three-dimensional by creating extrusions. Create extrusions by projecting points from an object and joining them to create an illusion of three dimensions. CoreIDRAW also to apply a vector extrusion to an object in a group.

After to create an extrusion, copy or clone its attributes to a selected object. Cloning and copying transfer the extrusion attributes of an extruded object to another. However, the cloned extrusion settings cannot be edited independently from the master.

Change an extruded form by rotating it and rounding its corners.

CoreIDRAW also to remove a vector extrusion.

Bevels

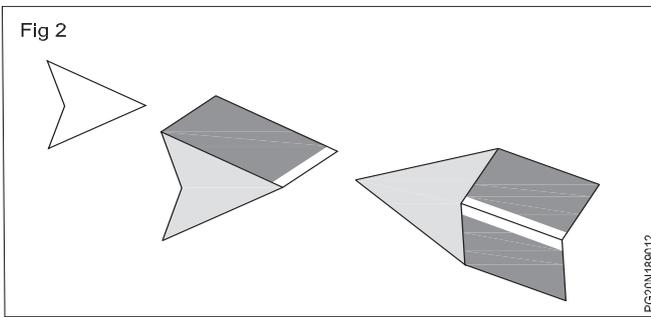
Another way in which give an object a three-dimensional appearance is by applying a beveled edge to an extrusion. A bevel creates the illusion that an object's extruded edges are cut on an angle. To specify the angle and depth values of the bevel to control the effect.

Create a bevel effect without extruding an object.

Extruded fills

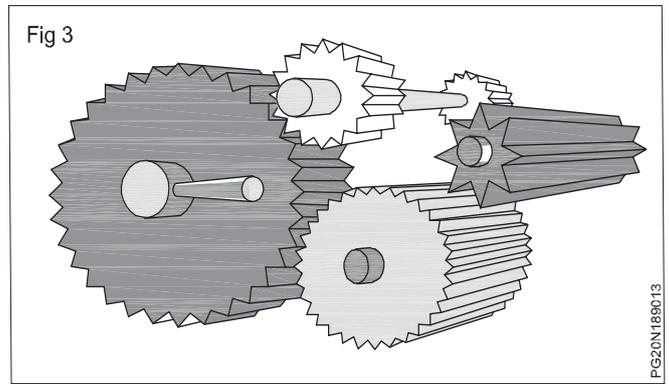
To apply fills to an entire extrusion or only to the extruded surfaces. Cover each surface individually with the fill, or drape the fill so that it blankets the entire object with no breaks to the pattern or texture. (Fig 2)

Left to right: A simple shape, the shape with an extruded fill of solid color, the shape with an extruded gradient fill and a rotation applied. (Fig 3)



Lighting

Enhance extrusions by applying light sources. Add up to three light sources to project toward the extruded object with varying intensity. No longer need light sources, you can remove them. (Fig 4)



Vanishing points: Create a vector extrusion in which the lines of the extrusion converge at a vanishing point. The vanishing point of a vector extrusion can be copied to another object so that both objects appear to recede toward the same point.

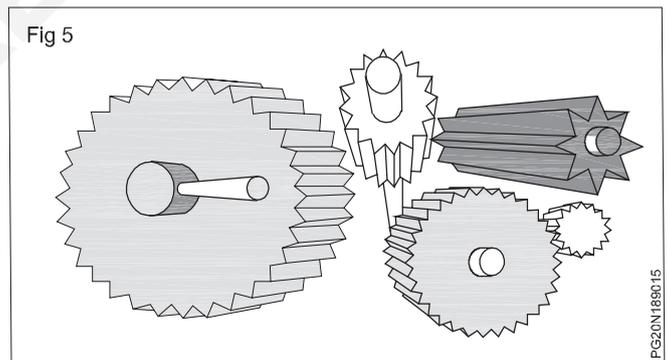
Extrusions with the same vanishing point

Also to give two extrusions different vanishing points.

Extrusions with different vanishing points. (Fig 5)

Lens effect : Lenses change how the object area beneath the lens appears, not the actual properties and attributes of the objects. To apply lenses to any vector object, such as a rectangle, ellipse, closed path, or polygon. You can also change the appearance of artistic text and bitmaps. When to apply a lens over a vector object, the lens itself becomes a vector image. Likewise, if the lens is placed over a bitmap, the lens also becomes a bitmap.

After you apply a lens, copy it and use it with another object



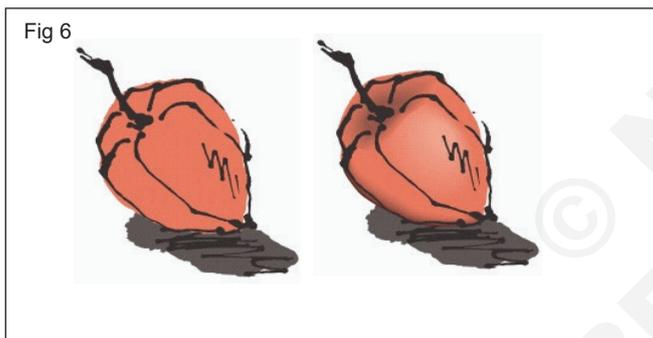
The lens types applied to the original (far left): (left to right) Heat map, Magnify, and a Custom color map

The following are the types of lenses apply to objects.

Lens	Description
Brighten	To brighten and darken object areas and set the rate of the brightness and darkness
Color add	Simulate an additive light model. The colors of the objects beneath the lens are added to the color of the lens as if you were mixing colors of light. Choose the color and the amount of color you want to add.
Color limit	To view an object area with only black and the lens color showing through. For example, if place a green color limit lens over a bitmap, all colors except green and black are filtered out in the lens area.

Custom color	Change all the colors of the object area beneath the lens to a color ranging between two colors you map specify. You can choose the range's start and end colors and the progression between the two colors. The progression can follow a direct, forward, or reverse route through the color spectrum.
Fish eye	To apply distort, magnify, or shrink the objects beneath the lens, according to the percentage value you specify
Heat map	Create the effect of an infrared image by mimicking the heat levels of colors in object areas beneath the lens
Invert	Change the colors beneath the lens to their complementary CMYK colors. Complementary colors are colors that are opposite one another on the color wheel.
Magnify	Magnify an area on an object by an amount that you specify. The magnify lens overrides the original object's fill, making the object look transparent.
Tinted grayscale	Change the colors of object areas beneath the lens to their grayscale equivalents. Tinted grayscale lenses are particularly effective for creating sepia-tone effects.
Transparency	To make an object look like a piece of tinted film or colored glass
Wireframe	To display the object area beneath the lens with the outline or fill color you choose. For example, set red for the outline and blue for the fill, all areas beneath the lens appear to have red outlines and blue fills.

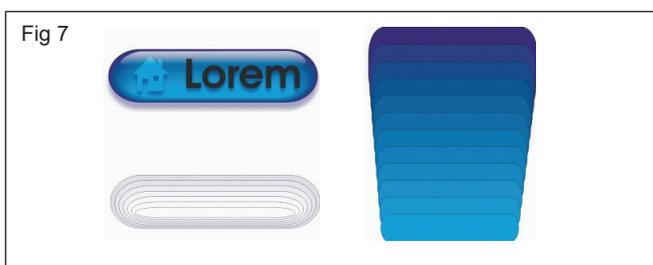
Blending objects: CorelDRAW lets to create blends, such as straight-line blends, blends along a path, and compound blends. Blends are often used for creating realistic shadows and highlights in objects. (Fig 6)



The highlights and shadows in the object on the right were created by using blends.

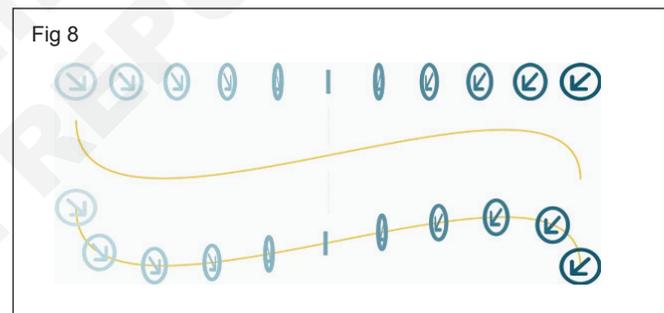
A straight-line blend shows a progression in shape and size from one object to another. The outline and fill colors of the intermediate objects progress along a straight-line path across the color spectrum. The outlines of intermediate objects show a gradual progression in thickness and shape.

After to create a blend, copy or clone its settings to other objects. Copy a blend, the object takes on all the blend-related settings, except for their outline and fill attributes. Clone a blend, changes to make to the original blend (also called the master) are applied to the clone. (Fig 7)



Straight-line blends can be used to create graphics with a glass-like appearance. The rollover button (left) contains a blend of tightly overlapped blended objects.

Can fit objects along part or all of a path's shape, and add one or more objects to a blend to create a compound blend.

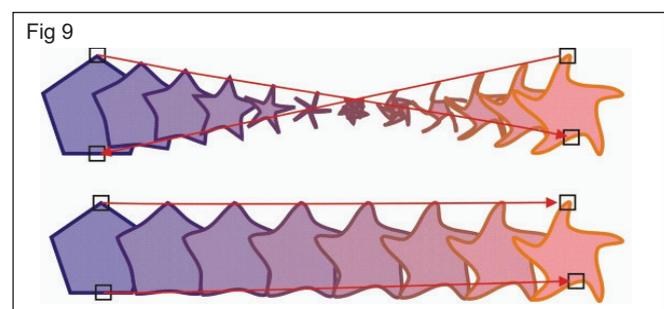


The straight-line blend (top) is fitted to a curved path (bottom).

Change the appearance of a blend by adjusting the number and spacing of its intermediate objects, the blend's color progression, the nodes the blends map to, the blend's path, and the start and end objects. Fuse the components of a split or compound blend to create a single object.

This compound blend consists of three blends.

To split and remove a blend (Fig 9)



By mapping nodes, control the appearance of a blend. Two nodes on the polygon are mapped to two nodes of a star shape, showing a more gradual transition (bottom).

To set object and color acceleration rates by clicking the Object and color acceleration button on the property bar and moving the corresponding slider.

Contour

An effect created by adding evenly spaced concentric shapes inside or outside the borders of an object. This effect can also be used for creating cuttable outlines for devices, such as plotters, engraving machines, and vinyl cutters

Contouring objects

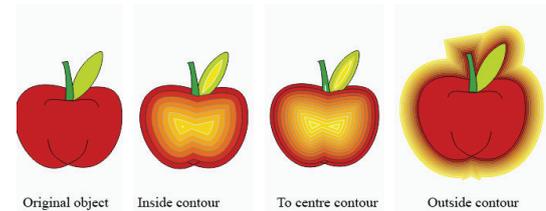
contour an object to create a series of concentric lines that progress to the inside or outside of the object. CorelDRAW also to set the number and distance of the contour lines.

In addition to creating interesting 3D effects, to use contours to create cuttable outlines for output to devices, such as plotters, engraving machines, and vinyl cutters.

After contouring an object, copy or clone its contour settings to another object. Change the colors of the fill between the contour lines and the contour outlines themselves. Set a color progression in the contour effect, where one color blends into another. The color progression can follow a straight, clockwise, or counterclockwise path through the color range of your choice. (Fig 10)

Separate an object from its contour lines.

Fig 10



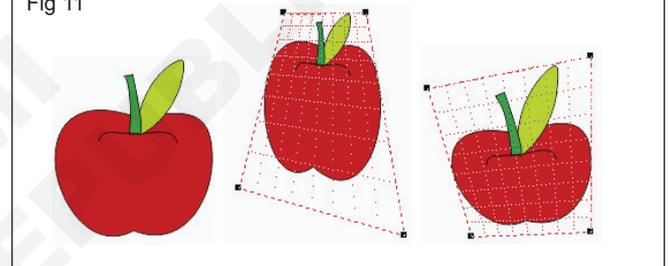
Perspective to objects

Create a perspective effect by shortening one or two sides of an object. This effect gives an object the appearance of receding in one or two directions, thereby creating a one-point perspective or a two-point perspective.

Perspective effects can be added to objects or grouped objects. Also to add a perspective effect to linked groups, such as contours, blends, extrusions, and objects created with the Artistic media tool. You can't add perspective effects to paragraph text, bitmaps, or symbols.

The original graphic (left) with one-point (middle) and two-point (right) perspective applied to it. (Fig 11)

Fig 11



Fills effects

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

- define colours, types of colour and features of colors
- sate Uniform fills and fountain fills
- explain the Pattern fills and Texture fills
- state the Postscript fills and mesh fills
- explain the area fills
- describe the colors.

Filling objects

To add colored, patterned, textured, and other fills to the inside of objects or other enclosed areas. Customize a fill and set it as a default, so that each object you draw has the same fill.

Uniform fills

Apply a uniform fill to objects. Uniform fills are solid colors that choose or create by using color models and color palettes.

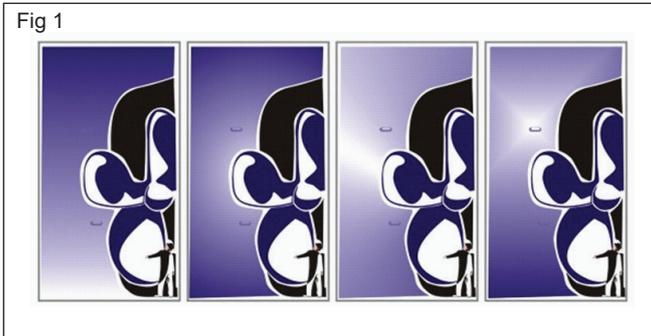
To apply a uniform fill by using the Uniform fill tool in the toolbox. Also apply a uniform fill by clicking the Interactive fill tool in the toolbox, and choosing Uniform fill from the Fill type list box on the property bar.

Fountain fills (Fig 1)

A fountain fill is a smooth progression of two or more colors that adds depth to an object. Fountain fills are also known as gradient fills.

There are four types of fountain fills: linear, radial, conical, and square. A linear fountain fill flows in a straight line across the object, a conical fountain fill creates the illusion of light hitting a cone, a radial fountain fill radiates from the center of the object, and a square fountain fill is dispersed in concentric squares from the center of the object.

There four types of fountain fills (left to right): linear, radial, conical, and square.



To apply preset fountain fills, two-color fountain fills, and custom fountain fills to objects. Custom fountain fills can contain two or more colors, which you can position anywhere in the fill's progression. After you create a custom fountain fill, save it as a preset.

When apply a fountain fill, to specify attributes for the fill type you choose; for example, the direction of a fill's color blend, the fill's angle, center point, midpoint, and edge pad. Adjust the print and display quality of the fountain fill by specifying the number of fountain steps. By default, the fountain step setting is locked so that the print quality of the fountain fill is determined by the value specified in the print settings and the display quality is determined by the default value you set. However, Unlock the fountain steps setting when you apply a fountain fill and specify a value that applies to both the print and view quality of the fill.

Pattern fills

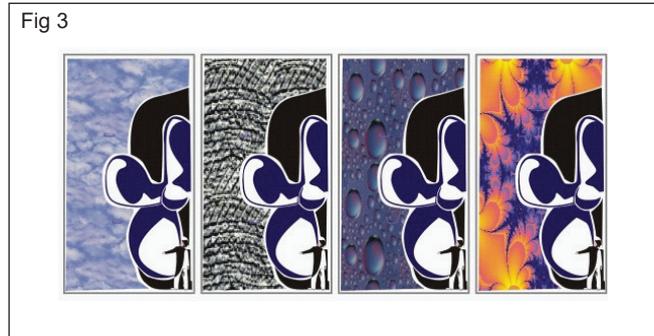
Fill objects with two-color, full-color, or bitmap pattern fills. (Fig 2)



To apply a pattern of two colors or many colors to an object.

Texture fills

A texture fill is a randomly generated fill that use to give objects a natural appearance. CoreIDRAW provides preset textures, and each texture has a set of options that change. Use colors from any color model or palette to customize texture fills. Texture fills can hold only RGB



Examples of bitmap pattern fills (Fig 3)

A two-color pattern fill is composed of only the two colors that you choose. A full-color pattern fill is a more complex vector graphic that can be composed of lines and fills. A bitmap pattern fill is a bitmap image whose complexity is determined by its size, image resolution, and bit depth.

CoreIDRAW provides preset pattern fills that to apply to objects; however, to create your own pattern fills. For example, create pattern fills from objects that you draw or images that you import.

Change the tile size of pattern fills. To specify exactly where these fills begin by setting the tile origin. CoreIDRAW also to set offset tiles in a fill. Adjusting the horizontal or vertical position of the first pattern, relative to the top of the object, affects the rest of the fill.

How the pattern fill appears by specifying whether to mirror the fill so that alternating tiles are the reflections of one another. If want a pattern fill to change according to actions you perform on the filled object, to specify that to want it to transform with the object. For example, if enlarge an object filled with a pattern that transforms, the pattern becomes larger while the number of tiles is not increased.

colors; however, other color models and palettes can be used as a reference to select colors.

Change the tile size of texture fills. Increasing the resolution of a texture tile increases the accuracy of the fill. To specify exactly where these fills begin by setting the tile origin. CoreIDRAW also offset tiles in a fill. Adjusting the horizontal or vertical position of the first tile, relative to the top of the object, affects the rest of the fill.

PostScript texture fills

To apply PostScript texture fills to objects. A PostScript texture fill is created in the PostScript language. Some textures are very complex, and large objects that contain PostScript texture fills may take time to print or to update on the screen. Depending on the view mode are using, the letters “PS” - rather than the fill - may appear.

To apply a PostScript texture fill, change several parameters, such as the size, line width, and the amount of gray that appears in the texture’s foreground and background.

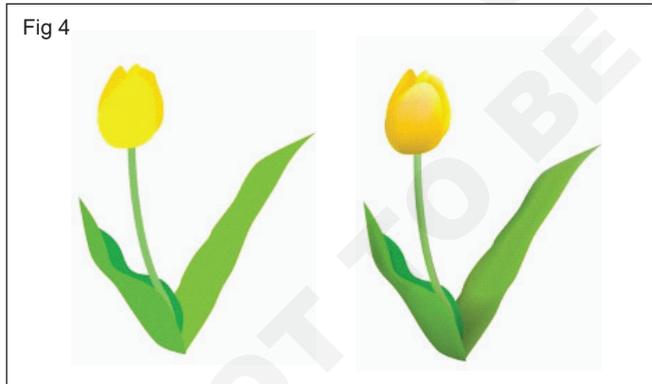
To rotate, skew, adjust the tile size, and change the center of the texture to create a custom fill.

If want a texture fill to change according to the actions perform on the filled object, to specify that to want the fill to transform with the object. For example, if enlarge an object filled with a texture that transforms, the texture becomes larger instead of increasing the number of tiles.

Texture fills are powerful features that can enhance a drawing. However, they also increase the size of a file and the time it takes to print, may want to use them in moderation.

Mesh fills

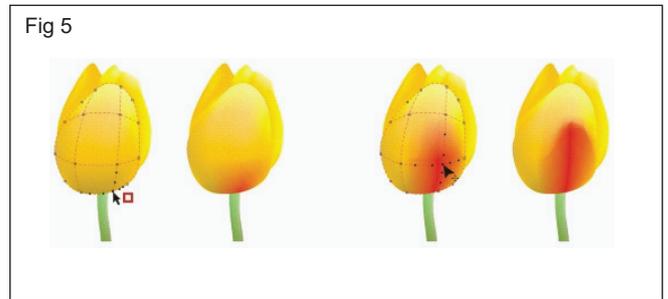
When fill an object with a mesh fill, create unique effects. For example, to create smooth color transitions in any direction without having to create blends or contours. Apply a mesh fill, to specify the number of columns and rows in the grid, and specify the grid’s intersecting points. After have created a mesh object, edit the mesh fill grid by adding and removing nodes or intersections. Also remove the mesh. (Fig 4)



Mesh fills were applied to the original drawing (left) to give it a realistic look (right).

A mesh fill can be applied only to closed objects or a single path. If want to apply a mesh fill to a complex object, first create a mesh-filled object and combine it with the complex object to form a PowerClip object.

To add color to a patch of a mesh fill and to the individual intersection nodes. To also choose to mix colors for a more blended appearance. (Fig 5)

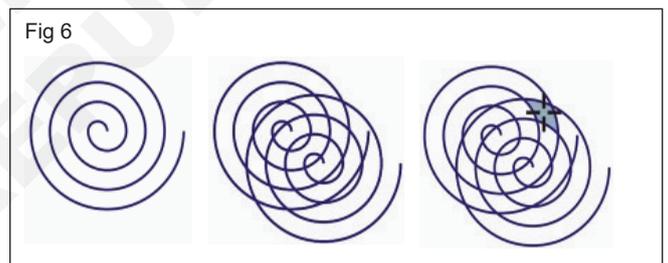


Left: Adding a color to a mesh fill. **Right:** Moving an intersection node in a mesh fill lets you adjust the progression of colors.

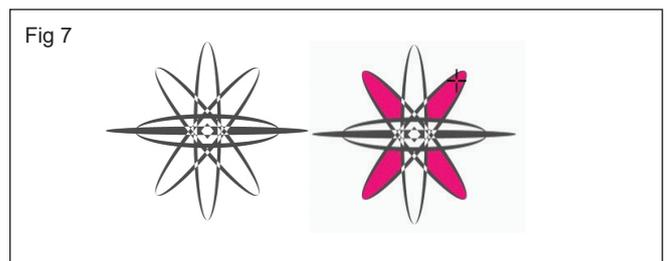
In addition, can smooth the color in a mesh fill to reduce the appearance of hard edges. Also reveal objects underneath a selected area by applying transparency to the mesh fill.

Fills to areas

To apply fills to any enclosed area by using the Smart fill tool. Unlike other fill tools, which fill only objects, the Smart fill tool detects the edges of an area and creates a closed path so that the area can be filled. For example, if draw a freehand line that crosses over itself to create loops, the Smart fill tool can detect the edges of the loops and fill them. As long as the paths of one or more objects completely enclose an area, it can be filled. (Fig 6)



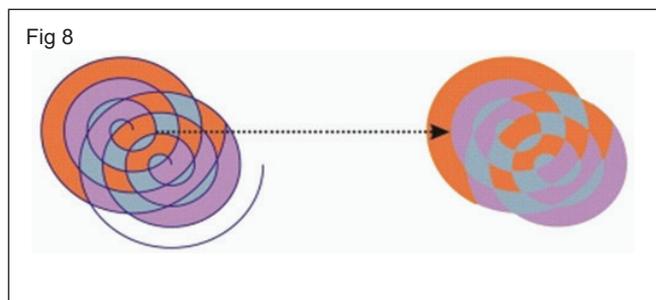
In the example above, the original spiral object is duplicated and offset, resulting in enclosed areas that can be filled by using the Smart fill tool. (Fig 7)



Using the Smart fill tool to fill enclosed areas

Because the Smart fill tool creates a path around the area, it essentially creates a new object that can be filled, moved, copied, or edited. This means the tool can be used in one of two ways: to fill an area or to create a new object from an area.

Although primarily used to fill areas, the Smart fill tool can also be used to create new objects. In the example above, the original objects - the two spirals (left) - are deleted (right), but the fill remains because each filled area is actually an object. (Fig 8)



Fills

There are a number of tasks that are common to all types of fills. You can choose a default fill color so that every object you add to a drawing has the same fill. To also remove any fill, copy it to another object, or use it to fill an area surrounded by an open curve

Understanding color management (Fig 9)

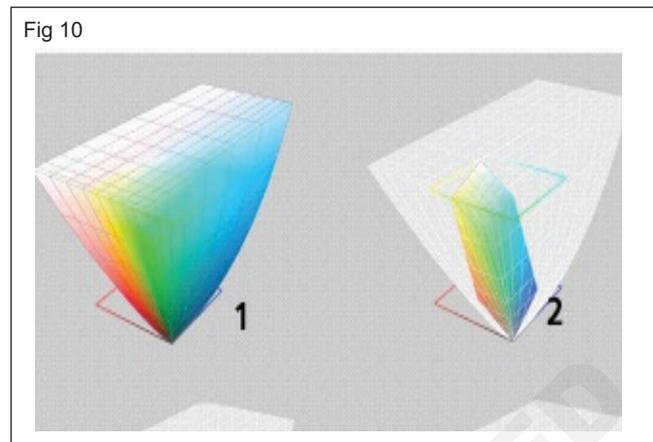
Different tools are used during the process of creating and sharing a document. For example, you may start with a file that was created in another application or import an image that was captured by a digital camera or scanner. After completing the document, you may print it or e-mail it to a colleague for review. Each of the tools that you use in your workflow has a different way of interpreting color. In addition, each tool has its own range of available colors, called a color space, which is a set of numbers that define how each color is represented.



Example of a document workflow

In other words, when defining and interpreting color, each tool speaks a unique language. Consider a color in the color space of your digital camera: a vivid blue RGB color with the values Red = 0, Green = 0, and Blue = 255. This color may appear as a different color in the color space of your monitor. In addition, the color space of the printer may not contain a match for this color. As a result, when a document moves through the workflow, this vivid blue color gets lost in the translation and is not accurately reproduced. A color management system is designed to improve the communication of color in the workflow so that the color of the output matches your intended color.

Colors are defined by their color space. 1. Lab color space. 2. sRGB color space, displayed against the Lab color space. 3. U.S. Web Coated (SWOP) v2 color space. 4. ProPhotoRGB color space. (Fig 10)



What is color management?

Color management is a process that to predict and control color reproduction, regardless of the source or destination of the document. It ensures a more accurate color representation when a document is viewed, modified, shared, exported to another format, or printed.

A color management system, also known as a color engine, uses color profiles to translate the color values from one source to another. For example, it translates the colors that are displayed on the monitor into the colors that a printer can reproduce. Color profiles define the color space of monitors, scanners, digital cameras, printers, and the applications that you use to create or edit documents.

Why do I need color management?

If the document requires accurate color representation, you want to learn more about color management. The complexity of your workflow and the ultimate destination of the documents are also important considerations. If the documents are destined only for online viewing, color management may not be as important. However, if you plan to open documents in another application or if you are creating documents for print or multiple types of output, then proper color management is essential.

Color management lets you do the following

- Reproduce colors consistently across your workflow, especially when opening documents that were created in other applications
- Reproduce colors consistently when sharing files with others
- Preview (or “soft-proof”) colors before they are sent to their final destination, such as a printing press, a desktop printer, or the Web
- Reduce the need to adjust and correct documents when sending them to different destinations

A color management system does not offer identical color matching, but it greatly improves color accuracy.

Aligning and arranging the objects

- Objectives:** At the end of this lesson you shall be to
- explain the copy, duplicate, and delete the objects
 - explain the align and distribute the object
 - state the combining and locking the object
 - describe finding and replacing the object
 - describe the barcode and symbols
 - preparation of graphic design and layout.

Copy, duplicate, and delete objects

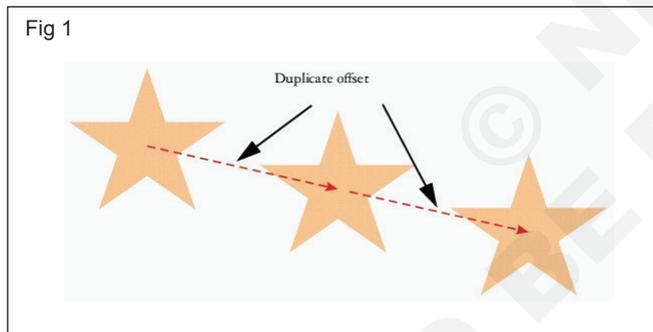
CorelDRAW provides you with several ways to copy objects. When you no longer need an object, you can delete it.

Cutting, copying, and pasting

To cut or copy an object to place it on the Clipboard and paste it into a drawing or another application. Cutting an object places it on the Clipboard and removes it from the drawing. Copying an object places it on the Clipboard but keeps the original in the drawing.

Duplicating

Duplicating an object places a copy directly in the drawing window and does not use the Clipboard. Duplicating is faster than copying and pasting. Also, when duplicating an object, to specify the distance between the duplicate and the original object along the x and y axis. This distance is known as the offset. (Fig 1)



To apply a transformation, such as rotating, sizing, or skewing, to the duplicate of an object while keeping the original object intact. If need decide that to keep the original object, to delete the duplicate.

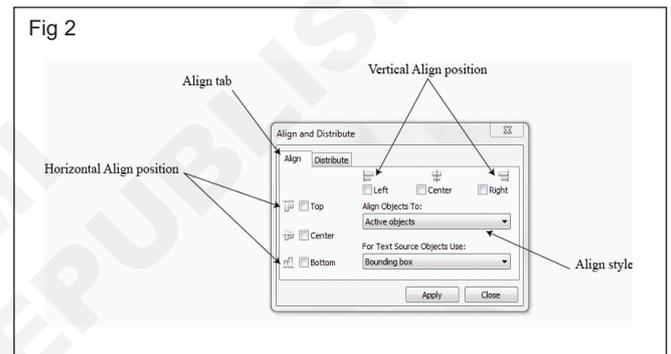
Copying objects at a specified position: To create multiple copies of objects simultaneously, while specifying their position, without using the Clipboard. For example, to distribute object copies horizontally, to the left or right of the original object; or you can distribute copies of objects vertically, below or above the original object. Specify the spacing between copies of objects, or you can specify the offset at which copies of objects are created in relation to each other.

Copying objects quickly: Use other methods to create copies of objects quickly, without using the Clipboard. To use the plus sign (+) on the numeric keypad to place a copy of an object on top of the original object, or create copies instantly by pressing the Spacebar or right-clicking while dragging an object.

Aligning and distributing objects

CorelDRAW lets you precisely align and distribute objects in a drawing. Align objects with each other and with parts of the drawing page, such as the center, edges, and grid. When align objects with objects, line them up by their centers or by their edges.

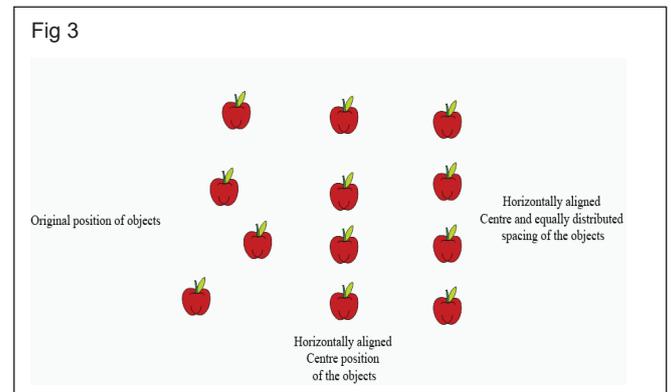
Align multiple objects horizontally or vertically with the center of the drawing page. Single or multiple objects can also be arranged along the edge of the page and to the nearest point on a grid. (Fig 2)



Distributing objects automatically adds spacing between them based on their width, height, and center points. Distribute objects so that their center points or selected edges (for example, top or right) appear at equal intervals. Also distribute objects so that there is equal space between them. To distribute objects over the extent of the bounding box surrounding them or over the entire drawing page.

Align an object with another object (Fig 3)

Select the objects one at a time, the last object selected is the reference point for aligning the other objects. If the marquee select the objects before you align them, the object that is positioned in the upper-left corner of the selection is used.



- To align objects along the vertical axis, enable the Left, Center, or Right check box.
- To align objects along the horizontal axis, enable the Top, Center, or Bottom check box.

Aligning text objects, choose one of the following from the For text source objects use list box:

- First line baseline - uses the baseline of the first line of text as a reference point
- Last line baseline - uses the baseline of the last line of text as a reference point
- Bounding box - uses the bounding box of a text object as a reference point

To align objects with another object quickly, without using the Align and distribute dialog box, by clicking Arrange Align and distribute and clicking any of the first six alignment commands. The letter next to a command name indicates the keyboard shortcut that you can use to align objects. For example, the letter L next to the Align left command shows that can press L to align objects with the leftmost point of the object that is used as a reference point.

Align objects by selecting them and clicking the Align and distribute button on the property bar.

Align an object with the page center

- Center to page - aligns all objects with the page center, both vertically and horizontally
- Center to page vertically - aligns objects with the page center along a vertical axis
- Center to page horizontally - aligns objects with the page center along a horizontal axis

Also align all objects with the page center, vertically and horizontally, by pressing P.

Align objects by selecting them and clicking the Align and distribute button on the property bar.

Align an object with the grid by choosing Grid from the Align objects to list box.

Distribute objects

To distribute the objects horizontally, enable one of the following options from the top-right row:

- Left - evenly spaces the left edges of the objects
- Center - evenly spaces the center points of the objects
- Spacing - places equal intervals between the selected objects
- Right - evenly spaces the right edges of the objects
- To distribute the objects vertically, enable one of the following options from the column on the left:

- Top - evenly spaces the top edges of the objects
- Center - evenly spaces the center points of the objects
- Spacing - places equal intervals between the selected objects
- Bottom - evenly spaces the bottom edges of the objects
- To indicate the area over which the objects are distributed, enable one of the following options:
- Extent of selection - distributes the objects over the area of the bounding box surrounding them
- Extent of page - distributes the objects over the drawing page

Combining objects

Combining two or more objects creates a single object with common fill and outline attributes. To combine rectangles, ellipses, polygons, stars, spirals, graphs, or text so that they are converted to a single curve object. If need to modify the attributes of an object that has been combined from separate objects, to break apart the combined object. Extract a subpath from a combined object to create two separate objects. Weld two or more objects to create a single object. (Fig 4)



The two objects (left) are combined to create a single object (right). The new object has the fill and outline properties of the last object selected.

The two objects (left) are combined to create a single object (right). The new object has the fill and outline properties of the last object selected.

Break apart a combined object that contains artistic text, the text breaks apart into lines first, and then into words. Paragraph text breaks into separate paragraphs.

Locking objects

Locking an object prevents from accidentally moving, sizing, transforming, filling, or otherwise changing it. Lock single, multiple, or grouped objects. To change a locked object, need to unlock it first. Unlock one object at a time, or all locked objects at the same time.

Cannot lock linked objects, such as blends, contours, or text inside an object. And also cannot lock objects within groups or linked groups

Finding and replacing objects

Using search criteria that you specify, the Find wizard guides you step-by-step when you need to find and select objects in a drawing. The search criteria can include object type and its related properties, fill and outline properties, vector effects applied to objects, or the name of an object or style. For example, can search for and select all rectangles with rounded corners and without fill, or all text on a path. Can also search for objects that contain the same properties as a selected object. Change the search criteria in the middle of a search. To also save search criteria for later use.

The Replace wizard guides to through the process of finding objects that contain the properties specify and then replacing those properties with others. For example, can replace all object fills of a certain color with fills of a different color. Also replace color models and palettes, outline properties, and text attributes, such as font and font size.

Also search for specific words and replace them with other words.

Inserting bar codes

The Barcode wizard in CorelDRAW lets to add bar codes to drawings. A bar code is a group of bars, spaces, and sometimes numbers that is designed to be scanned and read into computer memory. Bar codes are most commonly used to identify merchandise, inventory, and documents.

The Barcode wizard guides through the process of inserting a bar code.

symbol

A reusable object or group of objects. A symbol is defined once and can be referenced many times in a drawing.

symbols

The CorelDRAW application lets to create objects and save them as symbols. Symbols are defined once and can be referenced many times in a drawing. Each time to insert a symbol into a drawing, create an instance of the symbol. Symbol definitions, as well as information about instances, are stored in a symbol manager, which is part of the CorelDRAW (CDR) file. Using symbols for objects that appear many times in a drawing helps to reduce file size.

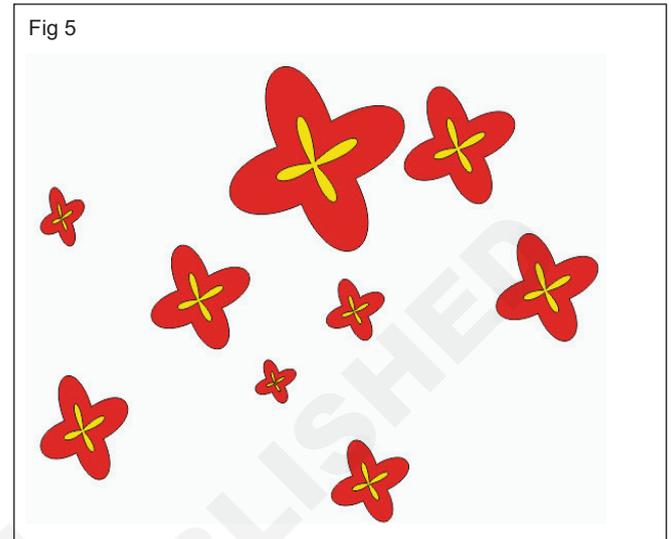
Creating, editing, and deleting symbols

Symbols are objects that are defined once and can be referenced many times in a drawing. Multiple instances of a symbol in a drawing with little impact on file size. Symbols make editing a drawing quicker and easier, as changes made to a symbol are automatically inherited by all instances.

Symbols are created from objects. When convert an object to a symbol, the new symbol is added to the Symbol manager, and the selected object becomes an instance. Create a symbol from multiple objects. To edit a symbol; any changes to make affect all instances in a

drawing. The selection handles for symbols differ from those for objects. Selection handles for symbols are blue; selection handles for objects are black. To delete a symbol instance and purge unused symbol definitions. Purging removes all symbol definitions that are not instanced in a drawing.

Using symbols for objects that appear many times helps to reduce file size. (Fig 5)



Using symbols in drawings

Insert a symbol into a drawing, which creates a symbol instance. To modify certain properties of a symbol instance, such as size and position, without affecting the symbol definition stored in the library. To revert a symbol instance to an object or objects while preserving its properties. To delete a symbol instance.

Managing collections and libraries

When create symbols, to store them in library files that are grouped into collections. To store symbols in a local library, so that they are only available in the current drawing, or export symbols to a network library that can be shared between drawings.

The Symbol manager docker always displays libraries and collections that are in the local Symbols folder. To add collections and libraries in the Symbols folder from elsewhere on the network. When insert a local or external symbol into a drawing, a copy of the symbol definition is added to the document, but it remains linked to the source symbol.

Sharing symbols between drawings

In CorelDRAW, each drawing has its own library of symbols, which is part of the CorelDRAW (CDR) file. Share symbols between drawings by copying and pasting. Copying symbols to the Clipboard leaves the originals in the library.

To copy and paste instances of a symbol to and from the Clipboard. Pasting a symbol instance places the symbol in the library and also places an instance of the symbol in the drawing. Subsequent pasting will place another instance of the symbol in the drawing without adding to

the library. If a modified symbol instance is pasted into a drawing, the new instance maintains the properties of the original instance, and the new symbol definition in

the library maintains the properties of the original symbol. Symbol instances are copied and pasted in the same way other objects are.

Adding and formatting text

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

- state the Anatomy of a Font
- explain the adding and formatting text
- state the fitting text to a path
- explain the formatting paragraph and wrapping the text
- embedding graphics and adding special characters.

The Anatomy of a Font (Fig 1)

When looking for a font that seems appropriate for a specific design, the shape of the individual characters might or might not work out the way you intend; you want the spacing between lines of text (called leading) to be extremely tight, but the ascender on certain characters is too high and juts into the preceding line of text. What's an ascender? The vertical strokes in characters have names typographers use and you should, too, when describing an ideal font or when seeking one.

Character height Used to describe the overall height, which includes not only the character but also the space above the character, this is usually coded in by the person designing the typeface. Character height determines how much interline spacing you'll need to make more than one line of text.

Cap height

This is the height of a capital letter in a typeface, which is usually not the same as character height, nor is it necessarily the height of all characters (which is called the ascender).

Ascender

This is the height of the tallest character in a font; usually it's the 'f', then 'h' or a swash if the font contains this embellishment.

Descender

This is the part of body of an alphabet which falls below the baseline. This is the lowest part of a character; usually a g or y, except when a font has swashes.

X-height

The measurement of a lowercase character, traditionally measured by the letter x in the font.

Baseline

An imaginary line where all the characters should rest. In other words, baseline is a hypothetical line connecting lower case English alphabets which do not have descender.

Artistic text

A type of text created with the Text tool. Use artistic text to add short lines of text, such as titles, or to apply graphic effects, such as fitting text to a path, creating extrusions and blends, and creating all other special effects. An artistic text object can contain up to 32,000 characters.

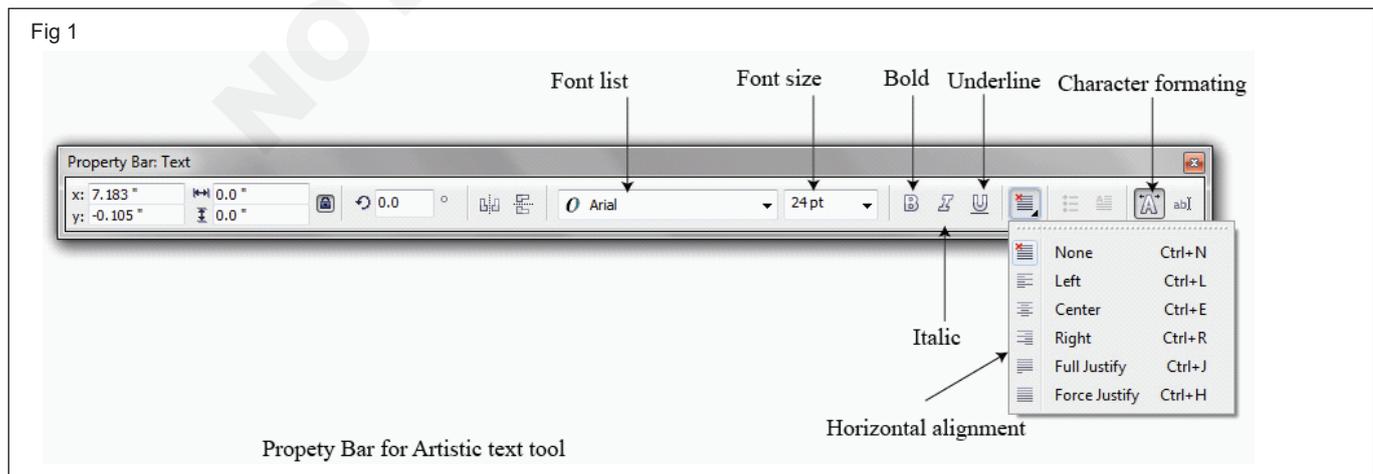
Adding paragraph text

A text type that allows you to apply formatting options and directly edit large blocks of text.

Adding text (Fig 2)

Add two types of text to drawings - artistic text and paragraph text. Add short lines of artistic text and then apply a wide range of effects, such as drop shadows or a contour, to the text. Paragraph text, also known as "block text," can be used for larger bodies of text that have greater formatting requirements. To add both paragraph and artistic text directly in the drawing window.

Add artistic text along an open or closed path. Also to fit existing artistic and paragraph text to a path.



When adding paragraph text, first create a text frame. By default, paragraph text frames remain the same size regardless of how much text to add them. Any text that continues past the lower-right border of the text frame is hidden and becomes red until either enlarge the text frame or link it to another text frame. Fit text to a text frame by automatically adjusting the point size so that the text fits perfectly.

Also can expand and shrink text frames automatically type, so that the text fits perfectly in the text frame.

To insert a paragraph text frame inside a graphic object. Use the object as a container for text and, and it increases the number of different shapes that use as text frames. Also to separate text from an object, so that each can be moved or modified independently and the text retains its shape.



Paragraph text placed inside an object. You can make the object invisible by removing its outline.

For example, change the font type and size, or change the text to bold or italic.

When import or paste text, to maintain formatting, maintain fonts and formatting, or discard fonts and formatting. Maintaining fonts ensures that imported or pasted text retains its original font type. Maintaining formatting preserves information such as bullets, columns, and bold or italic formatting. Preserve the text color or import black text as CMYK black. Choose to discard fonts and formatting, the properties of the selected text are applied to the imported or pasted text. If no text is selected, the default font and formatting properties are applied to the imported or pasted text.

Finding, editing, and converting text: Find text in a drawing and replace it automatically. Also find special characters, such as an em dash or optional hyphen. Edit text directly in the drawing window or in a dialog box.

Selecting text

To modify text, you must first select it. Choose to select either entire text objects or only specific characters.

Additional formatting options are available for paragraph text. Apply these formatting options to artistic text by first converting the text to paragraph text. Likewise, to apply special effects to paragraph text by converting the text to artistic text.

Encoding text

After opening or importing a drawing that contains text in a language different from the language of your operating system, to find that the text is not displayed correctly. To display text correctly, change the encoding. Encoding determines the character set of text.

Can also convert both paragraph and artistic text to curves. By transforming characters into single lines or curve objects, to add, delete, or move the nodes of individual characters to alter their shape.

Encoding settings do not affect the display of text outside the drawing window, such as keywords, filenames, and text entries in the Object manager and Object data manager dockers. For these types of text, use code page settings in the Open or Import dialog boxes to set the proper characters.

Convert text to curves, the appearance of the text is preserved, including font, style, character position and rotation, spacing, and any other text settings and effects. Any linked text objects are also converted to curves. If to convert paragraph text in a fixed-sized text frame to curves, any text that overflows the text frame is deleted.

Changing the basic properties of text: Enhance both artistic text and paragraph text by modifying the character properties. Change the default text style, so that the same properties are applied to all new artistic or paragraph text.

Change the text format to subscript or superscript, which is useful if a drawing contains scientific notation. Also add underlines, strikethrough lines, and overlines to text. In addition, change the thickness of these lines and change the distance between the lines and the text.

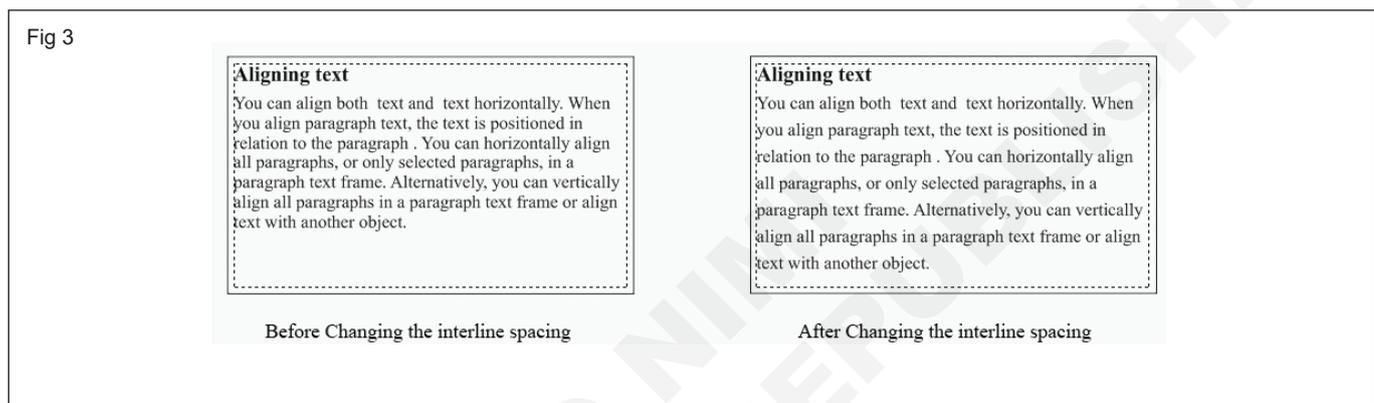
Change text to lowercase or uppercase without deleting or replacing letters. Also increase or decrease font size by a specified increment. By default, the unit of measure is points. Change this setting for the active drawing and all subsequent drawings that you create, so that the new unit of measure is used in all font settings.

If need to increase the redraw speed for text that is smaller than a specific font size, use lines to represent the text. This method, called “greeking” text, is useful for creating prototypes of documents or drawings. Make text readable again by reducing the greeking value or by zooming in on the text.

Aligning text (Fig 3)

To align both paragraph text and artistic text horizontally. Align paragraph text, the text is positioned in relation to the paragraph text frame. Horizontally align all paragraphs, or only selected paragraphs, in a paragraph text frame. Alternatively, vertically align all paragraphs in a paragraph text frame or align text with another object.

Artistic text can be aligned horizontally, but not vertically. Align artistic text, the entire text object is aligned in relation to the bounding box. If characters have not been shifted horizontally, applying no alignment produces the same result as applying left alignment.



To change character spacing and word spacing in selected paragraphs, or in an entire paragraph text frame or artistic text object. Changing the spacing between characters is also known as “tracking” or “letter spacing.” You can change the spacing between characters in an entire block of text or in a small group of characters. (Fig 4)



To change kern pairs of selected characters. Kerning refers to the repositioning of two characters to balance the optical space between them. For example, kerning is often used to decrease the space in character pairs such as AW, WA, VA, or TA. Such character pairs are known as “kerning pairs.” Kerning increases readability and makes letters appear balanced and proportional, especially at larger font sizes. (Fig 5)

If select the objects one at a time, the last object selected is the reference point for aligning the other objects. If marquee select the objects before you align them, the object that is positioned in the upper-left corner of the selection is used.

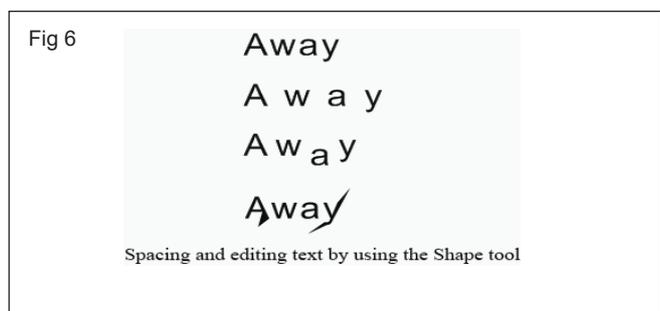
If have applied a linear transformation, such as rotation, to the text and are aligning objects with a baseline, the objects align with the baseline point of the starting edge of the text object.

Spacing text

The space between lines of text. This spacing is known as “leading” or “interline spacing.” Changing the leading for artistic text applies the spacing to lines of text that are separated by a hard return. For paragraph text, leading applies only to lines of text within the same paragraph. To change the spacing before and after paragraphs in paragraph text.

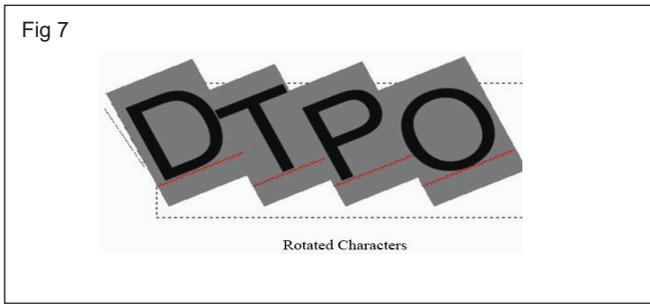


With CoreIDRAW, space text by using the Paragraph formatting and Character formatting dockers, or by using the Shape tool. (Fig 6)



Shifting and rotating text (Fig 7)

Artistic and paragraph text can be shifted vertically or horizontally, or rotated, to create interesting effects. Straighten text into its original position, and you can return vertically shifted characters to the baseline. Also to change mirror artistic and paragraph text.



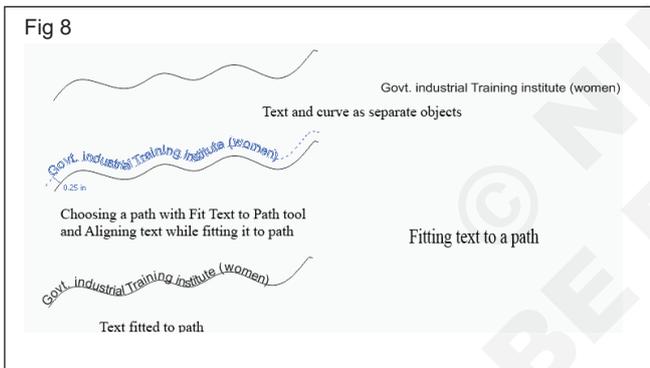
Fitting text to a path (Fig 8)

To add artistic text along the path of an open object (for example, a line) or a closed object (for example, a square). To also fit existing text to a path. Paragraph text can be fitted to open paths only.

After fit text to a path, to adjust the text position relative to that path. For example, an mirror the text horizontally, vertically, or both. Using tick spacing, you can specify an exact distance between the text and the path.

CoreIDRAW treats text fitted to a path as one object; however, separate the text from the object if you no longer want it to be part of the path. When the separate text from a curved or closed path, the text retains the shape of the object to which it was fitted.

The text reverts to its original appearance straighten it.



Formatting paragraph text

CoreIDRAW offers various formatting options for paragraph text. For example, add to fit text to a paragraph text frame. Fitting text to a text frame increases or decreases the point size of text so that it fits the text frame exactly. Use columns to lay out text-intensive projects, such as newsletters, magazines, and newspapers. You can create columns of equal or varying widths and gutters.

Applying drop caps to paragraphs enlarges the initial letter and insets it into the body of text. To customize a drop cap by changing its settings. For example, to change the distance between the drop cap and the body of text, or specify the number of lines of text that you want to appear next to the drop cap. You can remove the drop cap at any point, without deleting the letter.

Use bulleted lists to format information. text wrap around bullets, or offset a bullet from text to create a hanging indent. CoreIDRAW lets you customize bullets by changing their size, position, and distance from text. To change the spacing between items in a bulleted list.

After you add a bullet, you can remove it without deleting the text.

To add tab stops to indent paragraph text, remove tab stops, and change the alignment of tab stops. Also set tab stops with trailing leader characters, so that dots automatically precede the tab stops.

When adding drop caps, bullets, tab stops, and columns, save time by previewing all the changes make before committing to them. When preview the changes, they are temporarily applied directly to the text in the drawing window. Exactly how the new settings would affect your drawing if they were applied.

Indenting changes the space between a paragraph text frame and the text that it contains. To add and remove indents without deleting or retyping text. Indent an entire paragraph, the first line of a paragraph, or all lines of a paragraph except the first line (a hanging indent). To set indent from the right side of the text frame.

change the formatting of selected paragraph text frames, or of selected text frames plus the text frames with which they are currently linked.

Combining and linking paragraph text frames

To apply combine paragraph text frames. Also to break paragraph text frames apart into subcomponents- columns, paragraphs, bullets, lines, words, and characters. Every time to break apart a text frame, the subcomponents are placed into separate paragraph text frames.

Linking paragraph text frames directs the flow of text from one text frame to another if the amount of text exceeds the size of the first text frame. If shrink or enlarge a linked paragraph text frame, or change the size of the text, the amount of text in the next text frame is automatically adjusted. Link paragraph text frames before or after to type text.

To cannot link artistic text. However, link a paragraph text frame to an open or closed object. The link a paragraph text frame to an open object, such as a line, the text flows along the path of the line. Linking a text frame to a closed object, such as a rectangle, inserts a paragraph text frame and directs the flow of text inside the object. If text exceeds the open or closed path, to link the text to another text frame or object. And also link to paragraph text frames and objects across pages.

After linking paragraph text frames, to redirect the flow from one object or text frame to another. When to select the text frame or object, a blue arrow indicates the direction of the text flow.

Stenciling process

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

- state the stencil, advantage of stencil and uses of stencil
- state the types of stencil
- state the care and cleaning of stencil
- describe the instruments and equipments for stencil
- state the stenciling methods
- state the sign board and sign board materials
- state the poster, banner, Hoardings, Wall painting, Logo symbol, Name plate, Mono plate, Mono gram advertisement
- state the flex digital board
- state the graph making and enlargement.

Stencil

Stenciling produces an image or pattern by applying pigment to a surface under an intermediate object with designed gaps in it which create the pattern or image by only allowing the pigment to reach some parts of the surface. The stencil is both the resulting image or pattern and the intermediate object; the context in which stencil is used makes clear which meaning is intended. In practice, the (object) stencil is usually a thin sheet of material, such as paper, plastic, wood or metal with letters or a design cut from it is used to produce the letters or design on an underlying surface by applying pigment through the cut-out holes in the material.

Stenciling is usually done by drawing letters or designs on a sheet of thin paper. Plastic, wood or metal and the process of printing on that cut area using brush, spray, ink and paint is called stenciling. A design or lettering can be replicated using a stencil. In the beginning, most of the stencil work was done by hand, but due to the computer, this work has become easier. Now through computer, any design can be cut on paper or vinyl with a plotter cutter. It is many times sharper and clear than a hand cut stencil design.

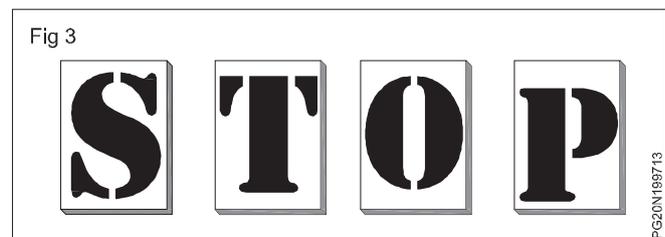
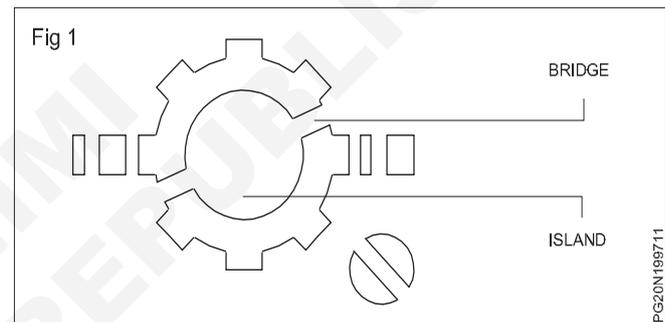
Advantage of stencil

The key advantage of a stencil is that it can be reused to repeatedly and rapidly produce the same letters or design. Although aerosol or painting stencils can be made for one-time use, typically they are made with the intention of being reused. To be reusable, they must remain intact after a design is produced and the stencil is removed from the work surface. With some designs, this is done by connecting stencil islands (sections of material that are inside cut-out "holes" in the stencil) to other parts of the stencil with bridges (narrow sections of material that are not cut out). (Figs 1, 2 & 3)

Uses of stencil: Stencils are frequently used by official organisations including the military, utility companies and governments to quickly and clearly label on the objects stencils for an official application can be customized as individual letters numbers and symbols. This allows the

user to arrange words, phrases and other labels from one set of template unique to the item being labeled. Template makes it easier to identify their affiliation or source.

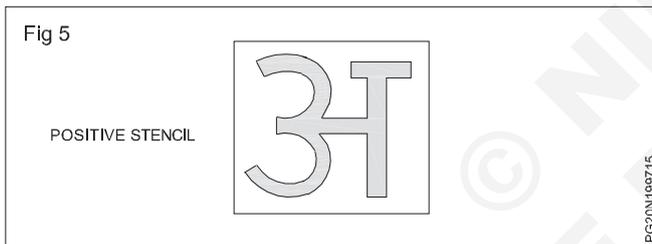
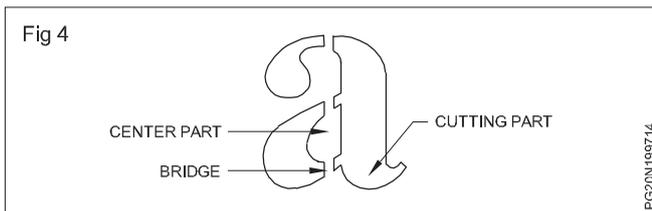
Types of stencil



- Positive stencil
- Negative stencil
- Craft/hobby stencil
- Interior wall stencil
- Ethnic stencil

- Geometric stencil
- Nature inspire stencil

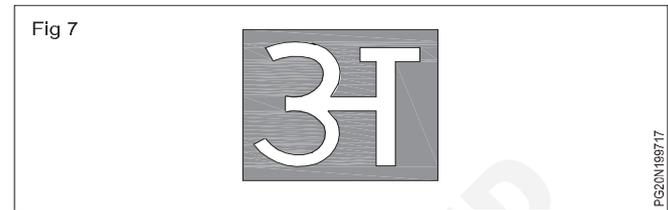
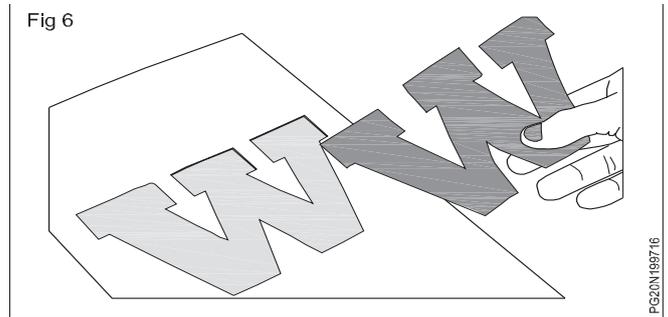
1 Positive stencil: In this, the inner part of the original letter or design has to be cut and the ties (bridge) of that surface have to be kept well. The middle of the letter or design is prevented from breaking due to ties or bridges. The tie/bridge acts as a bridge between the surface and the cut part hence the name 'bridge'. The cut part of the stencil is called the 'Cut hole' and the letter or design cut around it and the center is called the 'Island'. When making any stencil, atleast one or one and a half inches of space should be left around the design. Due to this, while stenciling, the color is applied only to the cut area instead of being applied elsewhere on the surface. The space around the stencil is called 'Border'. Positive stencils are used to temporarily create information and designs. This is not a finish work. It is used in Railways, Buses, Trucks, Container, Parcel Boxes and Industrial. (Figs 4 & 5)



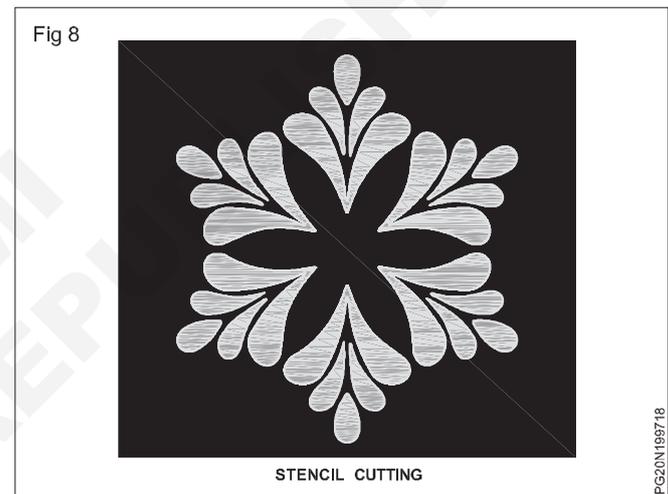
2 Negative stencil: In this, after cutting the unnecessary part on all sides of the design, keeping the same part as the design is and then use its print. (Figs 6 & 7)

This technique was used in primitive times to make paintings on the walls of the cave. At that time palmistry was used to draw human hands, pictures of animals and other objects. The primitive artist used hollow bones to spray paint. The color was sprayed on the bone by placing the hand on the surface and leaving the air through the mouth. Due to this hand prints were made on the surface, apart from this, hand prints were also made by applying hand paint. This is also a type of negative stencil.

The main function of the stencil is to repeat the design or lettering. The type of stencil that is required can be repeated. Stenciling saves time and money by getting the job done quickly.



The sample stencil cutting and stencil painting is shown in figs 8 & 9.



Materials needed for stenciling:

- 1 Various thick drawing paper, hardboard, cardboard, thin tin, thin plastic sheet, thick wax paper, etc.,
- 2 Stencil knife, blade or cutter is used to cut stencil.

The following tools and materials are needed for stenciling.

1 Waterman paper or Drawing paper: This paper is considered suitable for stenciling, but it is economical to take drawing paper because it is more expensive. A good type of stencil can be cut on it but this paper waterman paper is not that strong. After cutting the stencil on any paper, it should be applied a mixture of in the seed oil, turpentine oil, dyer. The paper stencil lasts longer after applying this mixture. Oil paper is used for oil paint work.

2 Stencil knife: A knife is needed to cut the stencil. This knife is available in the market.

Fabric paints for stenciling

- Spray painting
- Glass painting
- Wall painting
- Paper painting
- Canvas painting

Care and cleaning of stencil: Run the stencil under warm water and lightly scrub with a dish brush, mostly, pay attention to the paint around the edge of the graphic if the paint is caked on or the paint has fully dried, soak the stencil in warm soapy water or latest cleaning solution for an hour or overnight and then lightly scrubbed with dish brush and remove the paint.

Instructions for stencil cleaning

- Generously spray the front of the stencil with spray cleaner
- Place inside a plastic bag and close securely
- Wait a few hours or over night
- Remove stencil from the plastic bag and scrub lightly with dish brush
- Rinse with water
- Bolt the stencil with a paper towel and let it air dry completely
- Mineral sprits or turpentine are used to clean the stencil after using oil based paints.

Store the stencil: Always store stencil flat. A plastic under bed storage container works great-using paper between each stencil or use a clothing hanger. The multiple clip hangers are lovely and can hold quite few stencils per hanger hang in closet.

Instruments and equipments for stencil

- Roller pads
- Stencil set
- Fountain brush
- Fountain roller
- Stencils film
- Double trellis wall stencil
- Stencil cutter set

- Stencil brush
- Stewart utility brush set
- Clay embossing set
- Strippen brush
- Dry embossing kit
- Speed ball pop in brayer 4”
- Printing kit
- Clay embossing text kit
- Hot cutter - stencil film heat cutter
- Hobby knife set
- Sponge
- Straight strip or steel rule
- Squeegee

Stencil: The carrier of the printed information, the stencil is produced in different way production methods vary from extremely simply manual work to the high-tech methods of computer to screen.

Manual stencil production: The following method are primarily used in the hobby area.

Cutting: Films on base material are available for hand cut stencil making which are transferred from the base and stuck to the screen after the printing image areas have been cut away. There are films for moving on or catching/gluing with suitable solvent.

Masking: The stencil material is transferred to the screen in a similar manner to varnish with brush.

Washing off: Whereas with masking the information to the printed is applied as a negative image, in the washing off process the image information is applied to the screen using water-soluble varnish, after which the screen is completely coated with the actual stencil material a varnish based on a different solvent. The material applied initially is then washed off and the printing image areas become permeable for the ink. Coating and washing off can be alternately combined in such a way that two color printed graphics can be created from one screen.

Photo mechanical stencil production: Plate making for screen printing is currently the application of photomechanical stencil material based on diazo.

Direct stencil: The stencil material a UV cured varnish is applied to a screen that is more often that not set to a vertical/slightly inclined position with the help of coating channel, in a comparable way to manual application by squeegee. To achieve high stencil quality and ink film thickness during printing the screen can be coated repeatedly both from the stencil side and from the squeegee side with several intermediate drying operation for better print result, as the stencil has to lie evenly on the substrate during the printing process with no splits being produced into which ink might penetrate. The flat uniform positioning of the film is used for copying.

Direct/indirect stencils: The stencil material provided on the base film is first transferred to the screen and then exposed and developed like the direct stencil.

This type of stencil is used for extremely high precision applications. A scanning electron microscope exposure of stencil and screen.

Cutting on a cutting plotter: Stencils can be cut directly out of the appropriate films by means of graphics and CAD programs. The process used here is comparable to hand cut stencil production.

UV projection for oversize formats: Projectors that expose the photosensitive stencil material with UV light are used to save on film costs so that comparatively very large screens can still be exposed with manageable film formats.

Inject process: Ink jet systems that spray a UV impermeable ink on to a conventionally coated screen in accordance with the print image. The UV exposure cures the unmarked parts of the stencil. The ink jet produced film is removed in the subsequent development process and uncured areas are washed off.

Rotary screen production: The nickel based flat plates are stuck or welded or clamped to the appropriate and pieces to produce rotary screen plates.

Screen printing plates produced from electroformed: Electroformed screens made from nickel are primarily used for rotary screen printing.

Sign board: A sign board is a piece of any material, which has been painted with pictures or words and gives some information about a particular place product or event. There are four types of way finding signs. Identification, directional informational and regulatory. As stand alone signs, they serve a specific role, as part of the greater way finding system they uniform each other. Any design or sign board is used to convey a message.

The design or sign used to convey any message or to establish a certain type of communication through advertisement is called 'Sign Board'. Visual signs that are used to show any information to the viewer are called graphics. Sign boards are generally placed on the roadside or inside or outside the building. This includes banners, hoardings, neon signs acrylic boards, flex boards, road signs etc., Digital or electronic sign boards are also seen now. The main purpose of sign board is to establish communication with the help of the given Information about the supporting design is given through the sign board for anyone to take a decision. In this 'Advertisement' is a design through which the quality of any product or service is explained to the recipient. In the olden times sign boards were made by applying oil paint on a steel sheet. Presently such sign boards are rarely seen. In big cities, they are replaced by flex boards, acrylic boards, digital boards, neon sign boards, LEDs. (Light Emitting Diode) Electronic board has been taken. Since it is computerized, the characters on it are very dear. The letters or designs of the acrylic board are laser sharp-cutting with the help of a computer.

Following are the different types of sign boards.

1 MS Sheet Sign Board: This is the oldest method of sign board, in which iron (Mild Sheet) or zinc plated

(G.I) sheet is mounted on a wooden or iron frame. Red oxide primer is applied on this sheet so that it does not get spoiled by the external environment. After that the name of the shop, product and address are advertised on it by applying the required paint for the sign board.

2 Flex Board: Presently sheet sign board has been replaced by flex board. A light weight square pipe frame of iron is made for this. The advertisement is designed in the computer and printed on the flex printing machined. This flex print is pasted on the iron frame by stretching it from all sides with pasting solution, in flex printing. The name, subject photo or advertisement is printed very clearly. Flex boards are more attractive and clear than sign boards. Sheet sign board and oil paint applied on it lasts for a long time. But the flakes tear out quickly. Due to heat its ink becomes lighter and flakes become thin and exploded quickly. Flex board is a good choice for temporary used.

3 Sintra PVC Board: This board is completely row waterproof, it is a light weight material with a low sheen matte finish. It is not affected by the heat of the sun or changes in weather. It is used for shop front boards, outdoor advertising, home decoration, traffic signs, etc., This is the modern form of Flex Board, screen printing and computer printing can be printed on it.

4 Aluminium Composited Panel Board: Aluminium composite panel are a great choice for outdoor sign boards. Despite its low weight, it is strong and cheap. A few inches ahead of the wall an angled structural frame is made and aluminium composite panel board and mounted on it with the help of screws. If the board is large then the silent material is used to remove the gap between the two boards. After drying the silant becomes completely solid. After this radium or vinyl cutting letters are pasted on such aluminium panel board. Sign boards can be made better by applying acrylic or stainless steel letters instead of radium or vinyl.

5 Neon Sign: Neon sign tubes are more preferred for advertising. This tube of cold cathode discharge lamp current required high electrical pressure to start but has to be continued without discharging the meter unit afterwards. The neon tube is heated and placed in a sheet shaped box to ignite the tube. This required high electrical pressure. Such a tube is used to see from afar in the dark of night. Neon tubes are available in a variety of colours. They do not wear out quickly if they are used for a long time. It is used as a sign board in hotels, shopping malls, cinema theatres and large markets.

Sign materials

- Acrylic signs is often used for illuminated architectural trade show and paint - of - purchase sign. The letter design in acrylic board is done with help of laser sharp cutting.
- Aluminium signs is used outdoor signs and it is highly durable, weathering the elements without rusting

- Curved wood signs are used for classic look and excellent durability.
- Coroplast signs are ideally suited for a wide variety of indoor and short-term outdoor uses.
- Corrugated plastic sign used for visual communication solution and indoor and short term outdoor uses.
- Fabric sign use as wall graphic fine art print exhibit graphics, stage and photo backdrops, point of purchase displays, banner, flags, awning and to much more.
- Magnetic signs uses for fastening company name and logo mile after mile.
- Metal signs uses for outdoor advertisement and it is baked enamel finish gets the message out in an attraction and durable formate.
- Neon signs brings to light using bright colorful neon signs draw attention to message both day and night with wide variety of colourful styles.
- Plastic signs is a versatile, extruded twin-wall plastic sheet that comes in a variety of colors
- PVC signs (Polyvinyl chloride) is used for high quality professional image.
- Vinyl banners and signs are used for special events, grand opening and short events and business automations.

Sign board care and installation

- Find the location to install the sign board
- Find the method of sign board installation
- Fix the signboard on selected place by using proper method
- Ensure the signboard is properly fixed.

Poster advertisement: Poster is a printed paper announcement that is exhibited publicity. Whether promoting a product, an event or a sentiment, a poster must immediately catch the attention of the passer through that way main function of a poster is to capture a moving audience with a message of poster.

Hoardings: Advertising hoardings are the large boards erected around a construction site. Which can prominently feature printed graphics and designs boards are placed on the road side and bus stand and city roads. In this board products photo and frame is written in big attractive design letters to attract the audience passes through near the advertisement board.

Because of the larger image of the object, the les time it becomes understandable to the advertiser. Earlier, sign board painters used to do hoarding painting using scaffolding, but today the practice of putting digital flex printed advertisements on the boarding is more.

Acrylic sign board

Acrylic sign board is made from good quality plastic sheet. It is also known as flexi glass due to its excellent finishing. Acrylic board is a good choice if you want to

make high-tech and best quality sign boards. Acrylic letters or designs are given shapes in various fonts, styles, graphics and logo designs. Acrylic sign letters are safe and easy to set up due to their low weight.

Digital Acrylic Box Board: The digital acrylic box has tube lights on the inside to make it easier to read the board at night. The white acrylic box has a vinyl transparent print on the top. During the day it is clearly visible from outside and at night when the inside lights are switched on the letters and pictures on the vinyl look attractive and clear.

Wall painting advertisement: Wall painting advertisement is a conventional form of promoting products wall painting advertisements involve painting product information, product image the endorser's image products tagline, the dealer names where in the product in available. This advertisements are messages paid to the audience, it is the display type advertisement.

Name plate: A piece of metal, wood or plastic on which the name of a person, company name is printed or engraved or writing to indicate name to audience.

The name plate displays the identification of the name of a person or product. Name plates are usually in the shape of rectangles, but they are also made in other shapes. People often first choose to name their house and make name plated and put them outside the house. Name plates are typically made of plastic, acrylic, wood, stone, flooring, stainless steel, brass, aluminium, zinc and copper. When someone else walks into the home, the first thing they notice is the door or wall. The name goes on the plate itself. It tells a lot about your personality, so it is chosen carefully. Name plates are also popular for personal reasons. (Fig 10)



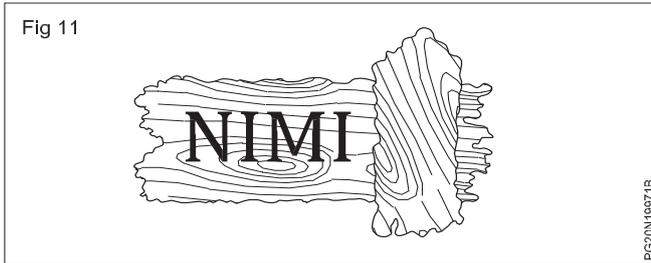
Following are the major types of name plates.

1 Office name plate

Name plates primarily serve an informational function, such as in an office environment, where name plates on doors or walls identify employees' spaces. Offices usually have one or two lines of text. The standard format for an office name plate displays a person's name on the first line and person's job title on the second line. (Fig 11)

It is rare for Office name plates to include three or more lines of text. Although there is a range in office name sizes, the most popular name plate size is 2 by 8 inches (5.08 cm x 20.32 cm). Office name plates are usually made of plastic. This is because plastic is a cheaper material relative to wood and metal. More expensive name plate for all employees. It helps to achieve a standard look.

Office name cards are not restricted to everyone. Many non profits and government agencies require name plates. For the names of plastics and wood, the name is molded into the material through a number of processes such a vinyl cutting, pasting, mechanical engraving, laser engraving or chipping



Personal name plate

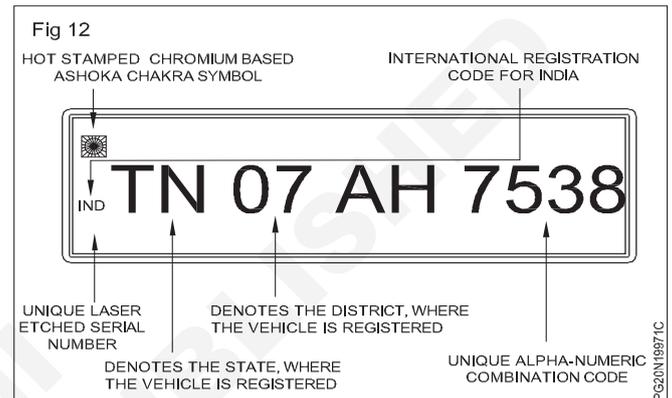
Personal name plates are traditionally made from wood. Personal name plates come in a variety of sizes. They are more colourful than office name plates. Personalized name plates also include graphics or art work, such as ball, bat, book, palette, that matches the interests of the identified individual. The graphics or art work reinforce the personality set by the name plate.

The size and shape of the name plate is according to the design and size of the door. The name plate can be selected according to the look of your house. If you want to keep the traditional look, you can choose the name plate made of wooden or slate. Otherwise, you can choose from acrylic, steel, aluminium, brass, ceramic, granite, etc., These days, different types of name plates are being seen in the market.

There is a growing trend to use name plates for hobby purposes. In these cases, the name plate is made of gold, silver or other metals and is worn as an ornament.

Logo: A logo is a graphic mark, emblem or symbol used to aid and promote public identification and recognition, it may be of an abstract or figurative design or include the text of the name. The purpose of a logo is to give your company an identity and capturing new clients with a logo that speaks to them and retain customers who trust the brand behind the logo.

Number plate (Fig 12): Under the Motor Vehicles Act 1988, the owner of any vehicle has to register the vehicle has to register the vehicle according to the number plate rule. It has been made mandatory to have number plates on the front and rear of the vehicle. Violation of the number plate rules or not wearing a registered number plate is considered a punishable offense.



This number plate is made by the people by the sign board painter and put on the vehicles. Therefore, it is very important for the sign board painter or computer designer to be aware of the dimensions colour, size, letters and numbers of the number plate according to the Motor Vehicle Rules. For example size of letters and numerals of the registration marks as shown in Table 1.

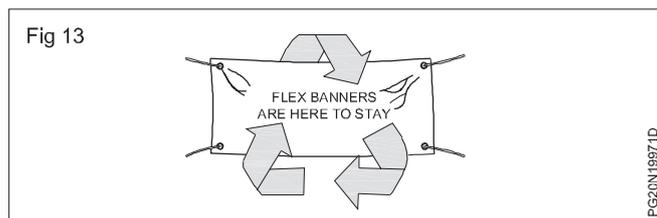
Table 1

Size of letters and numerals of the registration marks

Sl.No.	Class of Vehicle	Dimensions in MM			
		3	4	5	6
1	Motor cycles with engine capacity less than 40 CC	Front letters and numerals	15	2.5	2.5
2	All motor cycles and three wheeled invalid capacity	Rear letters	35	7	5
		Rear numerals	40	7	5
		Front letters numerals and letters	35	7	5
3	Three wheelers with engine capacity below 500 CC	Front and rear numerals and letters	35	7	5
4	Three wheelers with engine capacity above 500 CC	Front and rear numerals and letters	40	7	5
5	All other () vehicles	Front and rear numerals and letters	65	10	10

Monogram: A monogram is a note of made by overlapping two or more letters or other grapheme to form one symbol. Monograms are often made by combining the initials of an individual or company used as recognizable symbols or logos monogram logos are commonly used to represent the initials of person or business.

Banner: A banner ad also known as display ad is similar to a digital bill board in that it uses imagery to attract attention with goal of driving traffic to the advertiser's site. Banner ads are placed in high- traffic locations on web pages creating brand awareness and generating click through, purchases and leads. A great banner ad grabs the readers attention and invites them to learn more about the product. Banner ad is effective to target audiences, so you have some tricks to keep in while you are designing the banner. (Fig 13)



Digital flex board: Flex board is a material that is designed specifically to accept the flex material bonding. Flex board or digital flex board printing is the safest and most durable way to apply printed flex material to a banner or a sign rather than to clothing or other similar mediums. (Fig 14)



Graph making of enlargement: A graph is a diagram showing the relation between variable quantities, typically of two variable, each measured along one of a pair of axes at right angles. A graph is a structure mounting a set of objects in which some pairs of the objects are in some sense related. The objects correspond to mathematical abstractions called vertices and each of the related pairs of vertices is called an edge. The purpose of a graph is to present data that are too numerous or complicated to be described adequately in the text and in less space.

Need for graph enlargement: Many educators and communicators are used as effective tools for helping people visualize and comprehend large amounts of data. Bar graphs are easy to understand, it gives an advantage over other graphs.

Screen printing

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

- state the history and development of screen printing
 - state the types and definition of screen printing
 - state the selection method of screen cloth
 - state the screen printing instruments
 - state the screen printing chemicals
 - use the method of screen printing cloth fitting
 - state the procedure of exposing.
-

History and development of screen printing

Screen printing originated in china around AD 221 as a way of transferring designs onto fabrics following this Japanese begin using simple stenciling techniques as a way to create imaginery. At this time stencils were cut out of paper and the mesh was woven from human hair stiff brushes were used to force ink through the mesh onto fabric.

In 17th century silk screens were being used in France as a way of printing onto fabric stiff brushes were used to push ink through the mesh. The early part of the 20th century squeegees were introduced as a way of pulling ink through the screen mesh. In 1938 in Newyork a group of artists began experimenting with screen printing as an artistic medium on to paper.

In 1960's pop artists are used screen printing as an integral element to their practice. thus establishing and popularising it as a medium for creating contemporary art. The screen printing is stencil based paleographic process stencil based methods such as cut paper or photographic emulsion. A squeegees is then used to process ink through the unblocked area of the screen directly onto the paper or fabric. Now a days screen printing process is used in automatic semi automatic and manual process.

Screen printing

Screen printing is one of the most versatile processes for transferring ink and technical coatings. screen printing is a push through process a special type of stencil printing. During the printing process the ink passes through the screen and onto the substrate. The stencil is frastened onto the surface on which printing is to be done and the ink reaches the desired position through the stencil apertures. The ink can be painted on with a brush or a squeegee or sprayed on with spray gun or an air brush. The stencil is the carrier of the printed information. The printing plate is the combination of screen and stencil.

Types of screen printing: There are various types of screen printing used in practice as following types

- Plastisol screen printing without under base plastisol inks are used for mask standard prints.
- Plastisol screen printing without under base

- Gots certified screen printing
- Discharge screen printing
- Screen printed discharge under base
- Screen printed transfer method

Types of T-shirt screen printing

Spot color screen printing

Halftone printing

Gray scale printing

Duotone printing

CMYK printing

Simulated printing process

Common types of printings

Surface printing / Flat bed printing

Flexographic printing

Screen printing

Rotary screen printing

Gravure printing

Digital printing

The screen printing process steps

Screen printing is an effective technique for creating bold canvases, posters and art work but the method can also be used to print fabrics and textiles. so it is great for creating all sorts of custom clothing and products.

Step-1

Create a design

Create a design to start the printer takes the design to create on the finished product and prints it out onto a transparent acetate film. This will be used to create the stencil.

Step-2

Prepare the screen

The printer will choose a mesh screen to suit the complexity of the design and the texture of the fabric being printed.

The screen mesh is then coated with a layer of light reactive emulsion. which will be harden when developed under bright light.

Step-3

Emulsion is exposed

Acetate sheet featuring the design is then laid onto the emulsion coated screen and the whole thing is exposed to a very bright light. The light harden the emulsion.

Step-4

Washed off the emulsion

After the screen has been exposed for a set time the area of the screen not covered by the design will have turned hard. Any hardened emulsion is then carefully rinsed away. This leaves a clear imprint of the design on the screen for the ink to pass through once all the items have been printed and the stencil has served its purpose the emulsion is removed using a special washing fluid. So the mesh can be reused to create new stencils.

Step-5

Prepare the items for print

The screen is placed on the printing press the item being printed laid down flat onto the printing board underneath the screen automatic rotary carousel printer allows multicoloured prints and this type of printer can also be used to apply the separate colour layers in quick succession.

Step-6

Printing ink press through the screen onto the item

The screen is lowered down onto the printing board. Ink is added to the top end of the screen and a squeegee is used to pull the ink. If the final design includes more than one colour, then use a separate screen to apply each layer of ink. To create a multi-coloured product the printer must use separate designed stencil and line them up perfectly to ensure the final design.

Step-7

Check the finished products

Passes the printed products through a dryer, which cures the ink and creates a smooth colour fast finish. The final product will be checked and washed thoroughly to remove any residue, before being passed the product for marketing.

Selection of screen printing cloth: Natural fabrics are the ultimate choice for screen printing as they end to absorb the ink more readily than man-made fabrics do cotton and cotton blends are the most popular choice for most printers and customers as they are soft and permeable and organic cotton can be even softer again. Experience will help to determine which mesh count is used on individual projects.

- 20-40 mesh count screens are ideal for shimmer inks, as these inks contain particles that can not through finer mesh.

- 60 mesh count allows for a heavy ink deposit.
- 80 to 86 mesh count is often used when making heat transfers printing heavy under bases.
- 110 to 160 mesh count screens are most versatile and the most commonly used in screen printing.
- 180 to 200 mesh counts are perfect for printing images in light inks on dark fabrics
- 230 to 280 mesh count screen will deliver detailed prints with softer hand feel.
- Choose screen cloth for longer to allow the emulsion to properly set.
- Choose the screen mesh to use ultimately lies.

Basic material for screen printing: Fabric and paper are the most commonly screen printed surfaces, but with specialised inks, it is also possible to print onto wood metal, plastic and even glass. Polyester is a synthetic fiber, that is a common fabric for T-shirt polyester is the material you will need to make a custom print through dye sublimation, polyester has a look of great qualities.

Screen printing frame: There are various type of screen printing frames are used for fix the screen mesh metal frame, wooden frame, plastic frame, metal frame. A reliable stand by metal framed screens will hold their tension longer than screens on wooden frames. if you opt for aluminium screens as opposed to steel, they are also much lighter and easier on printing. Even though most of the screen printers are used wood frame only.

Chemicals for screen printing

- Crown laquer thinner
- Jacquard wrester screen printing color fixer
- Spray way anti skin spray
- Spray way fast track 384 super flash spray adhesive
- Spain remover, hand cleaner
- Spray way screen opener
- Mesh degreaser
- Emulsion remover
- Ulano stencil remover
- Ink degrader
- Ulanogel
- Adhesives
- Polyvinyl acetate
- Polyvinyl alcohol
- Solvent resistant polymer
- Green chemicals

Printing ink: The mask commonly used inks for silk screening are oil based plastisol ink, water based suede discharge and expanding ink. Printing can be a complex medium, composed of solvents, pigments, dyes, resins, lubricants particulate matter, fluorescents and other materials are used to prepre the printing ink.

Screen print ink knowledge is required for screen print on the objects without any effect. The following type of ink is used for screen printing process.

Types of Printing ink

- P.V.A. Solution (Polyvinyl alcohol)
- v Ammonium Dichromate (Sensation)

1 Polyvinyl alcohol

This is used for screen coating. The solution is available in a patch of ½ to 1kg. If the coating is to be done in a large scale preparing the solution yourself will be economical.

To prepare it bring polyclinic alcohol powder from industrial chemist. Then take two glasses of water in a vessel and add form spoons of powder to it. Who this mixture is well combined, take a vessel slightly larger than this vessel, the first vessel will be sub merged in it till half, heat this much water and place a small vessel in this big vessel. Keep lid on the large vessel and heat it. After the mixture kept on a small vessel become like a syrup, take it off from the stove. The filter this mixture.

After wards as required add colour to it and the measure of colour quantity should be less. In this solution pour photo sensitive.

2 Ammonia dichromate

This PVA solution is used to make photo sand card photo quality chemical is available in the shop in a pack of pebbles. Powder it and then take distilled water in a glass of water and add one spoon of ammonium dichromate powder and mix it well. After mixing the solution well and when holding it in hands you full the glass as will. It means the mixture is mixed well. Then keep the mixture in a dark coloured bottle in a dark place.

Ink and its uses

Due to the excellent embossing of screen printing in today's era, the dam and for printing is increasing even in mural area. This printing can be printed on any bag.

Matt Ink

This ink is available in all colours. This ink is being used in all commercial works like large patch print and in all types of work. In comparison to other inks this is very cheap. As oil base is in thin ink, kerosene, Thinner, Turpentine are being used.

The printing is done by this ink dries up in half or quarter of an hour with this ink printing can be done on paper card & wooden articles.

Gloss ink

This ink is available in various colours. It has a different brightness. The printing done by this print takes eight to nine hours for getting dried up. Visiting card, Envelope, Letter pads are made from this ink and also increases attractiveness. The PCB board used in the electronic field is used print with the help of this ink printing can be done on ball pen, backside of wood, resize, leathers resin side, Tin and glasses repair side. The printing done on Pen, Ball pen and glass the print can be removed by scratching with the nails of the hand but when rubbed with cloth it doesn't come out. For permanent print it is being processed Then only that work becomes permanent.

3 Fluorescent Ink

It doesn't have brightness like glass ink, but important fluorescent brightness is in it. This ink has its on brightness. On the white background, if any color patch is given and printing on this patch by this ink then a lusted comes out.

4 Polyvinyl chloride Ink

The main component in this ink is polyvinyl chloride. The ink is available in two forms glossy and battle. To take print out by using this ink, thinner is used. It has a strong smell P.V.C ink is generally used for printing on plastic. Another important use of this P.V.C ink is that it is used in screen printing. After drying it cannot be removed by kerosene and turpentine and also it doesn't melt. But P.V.C ink can be removed completely with the use of a thinner. This uses PVC ink to seal off part of the stencil in the printing wash of sill base, malt ink, gloss fluorescent ink with the help of a stencil, it is possible to print two or three colours on vaster.

By using the design and positive method, apply PVC ink to the inside of the appropriate mesh and writing it of using M.C. thinner Ex: If more letters are to be printed in the stencil, then and letters to be closed with PVC ink and first print it and then P.V.C ink portion to be wiped with thinner and keep the stencil open afterwards you close and letters to be closed by P.V.C ink and print and letters. If we have to do printing using P.V.C sticker to be printed with PVC ink then for each colour separate stencil to be made. If the colour printing is not required then that take the PVC solution in a brush and close that part to be closed permanently.

5 Gold and silver ink

To obtain special effect and printing wedding card this ink to be used. This ink taste is thin and base in P.V.C. In this gold end medium to be used.

Essential screen printing tools: To get a clean, sharp print a screen printer needs to have the right tools for the screen printing job.

- Film positives
- Screen mesh

- Squeegee
- Flash cure unit
- Belt dryer
- Screen printing press
- Exposure unit
- A computer with ink jet printer and vector software
- Pressure washer

Essential consumable items: ink jet film, emulsion, spray tack spray adhesive

- Scoop coater
- Press wash
- Emulsion remover
- Inject film
- Spray tack
- Spray bottles
- Cold running tap water

Screen printing: Screen printing is a printing method that uses a plate (screen mesh) that uses “screen mesh” which is woven with synthetic fibers such as polyester or metal fibers such as stainless steel. It is a type of stencil printing, which prints on target objects by passing ink through mesh of a screen mesh. Due to the many kinds of target objects on which it can print, it is even said that screen printing can be used on all materials other than water and air - in recent years in line with the advertisement of developments to enable the printing of extra fine line, its application to the electronic field which requires ultra fine processing has attracted attention.

The completed screen mesh is placed on top of the target object to be printed.

When the ink is spread across over the screen mesh, the portions of the mesh that are not blocked by photosensitive material are filled with ink.

The ink is pressed against the object with a squeegee from the edge of the screen mesh.

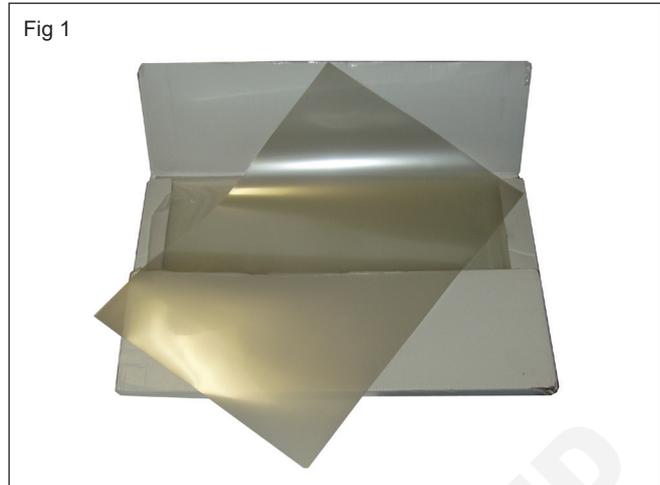
As a result of the plate that has been pressed by squeegee coming into contact being released from the object, the ink filled in the hole portions of the mesh is copied to the object. This completes the printing objects.

5 Essential screen printing tools are used in screen printing work

Film positives (Fig 1): After finalized the art work design needs to be separated into various of layers each with one color of the design, each layer is converted to black to create a film positive, which design is in black, on a clear film. These are placed on the mesh screens to create the stencil for each layer.

Mesh screens: Mesh screens are probably one of the most important tools in screen printing, it is called screen printing after all, place the film positive on the mesh screen and then degrease it and coat it with emulsion.

The emulsion is light sensitive so after it is exposed with euv light it creates the stencil.



Squeegee: Apply the ink on the press and screens. Then each layer of ink is pressed into the screen with a squeegee. The squeegee is pulled across the screen to make sure the ink is evenly distributed. While there are automatic machines that can do this many companies some people still use manual ink presses.

Flash cure unit: Screen printed designs are commonly flash dried between each layer of ink. A flash cure unit is an infrared heater that the printed object is placed under for a few moments before the text layer of ink is pressed onto the garment. This prevents bleeding with in the design and is especially important when working with dark garments.

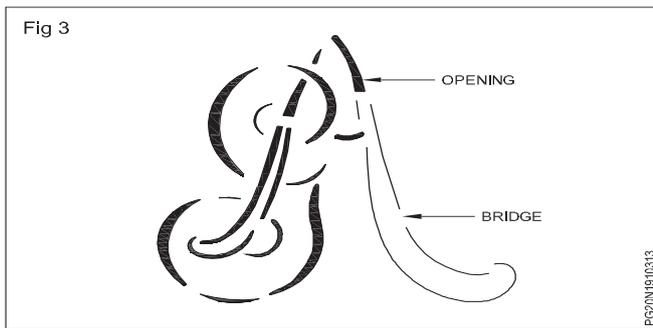
Belt dryer (Fig 2): The final stop in the screen printing T-shirt process is the belt dryer. They come in various sizes, but will all need to use the same temperature gauges to each tee. After a tee is flash cured, it rolls along a conveyer belt heated to 380 degrees to give the tee a final cure and will ensure the quality of design



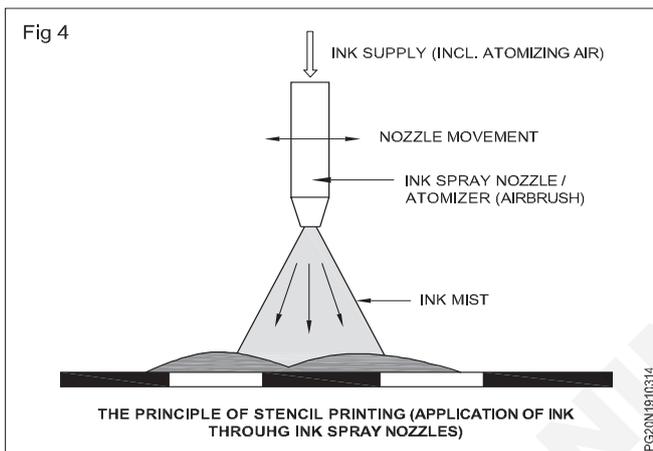
Screen washing station: The screens need to be washed to remove all traces of emulsion after use. so they can be reused again for future prints some larger print works may use large tubs of special cleaning fluid or acid to remove the emulsion. While other printers simply use a water through or sink and a power hose to clean their screens.

Screen printing equipment

Stencil for embroidered artwork (Fig 3)



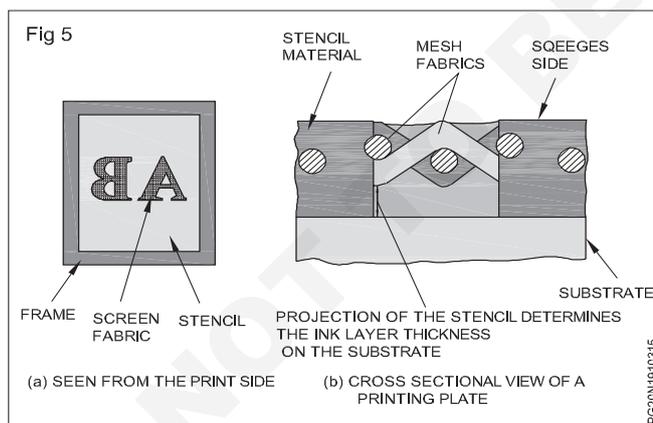
The principle of stencil printing (application of ink through ink spray nozzles) (Fig 4)



Printing plate: Screen with stencil.

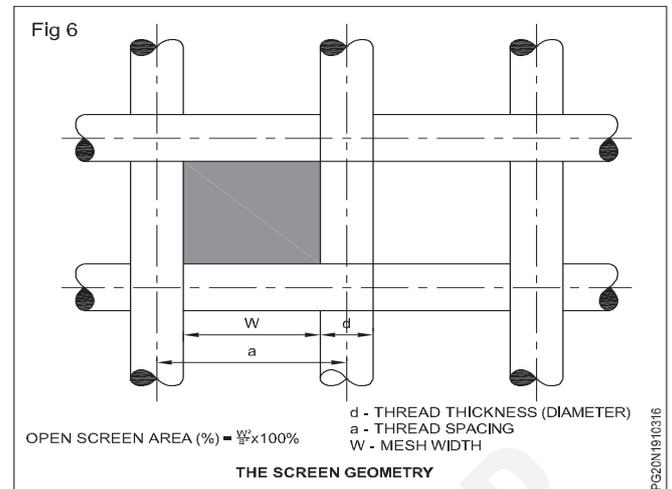
a Seen from the print side.

b Cross sectional view of a printing plate. (Fig 5)

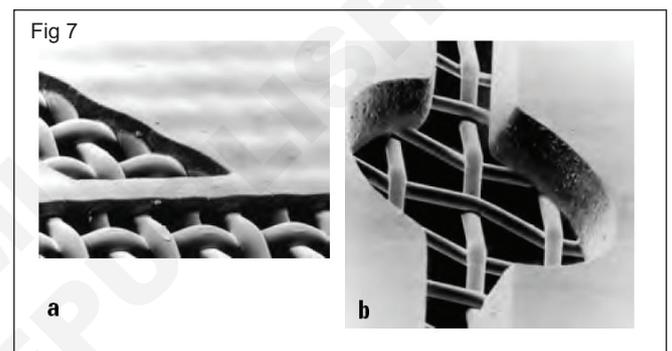


Note: The new technology applied for coating the screen with the stencil material, the stencil material is also applied to the squeegee side to protect and stabilize the fabric. The screen material is fully sheathed.

The screen geometry (Fig 6)



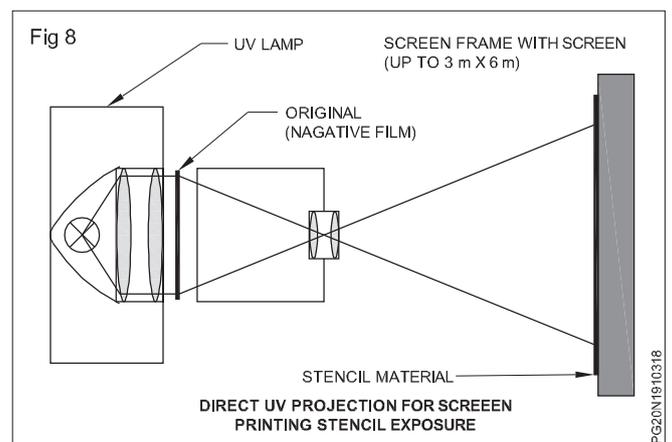
SEM exposure of a photo mechanically produced screen (view from the printing/substrate side) (Fig 7a and b)



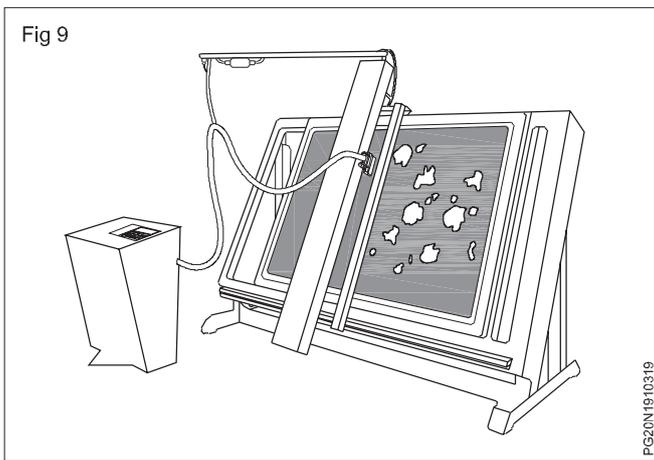
a Direct stencil

b Direct/indirect stencil (kissel + wolf)

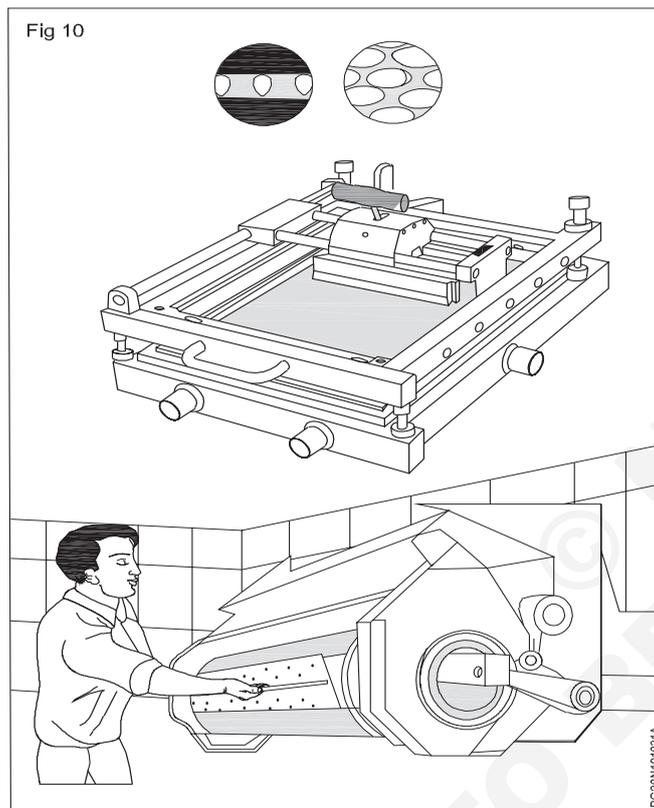
Direct UV projection for screen printing stencil exposure (Fig 8)



Imaging a screen printing plate (creating a mask) using the ink jet process, wax-pe ink. 1016 dpi resolution (Jet Screen, Loscher) Note: light yellow areas (wax emulsion) correspond to the print image, the wax emulsion is washed off with water after exposure) (Fig 9)



Electroformed nickel screen (Fig 10)



- a Structure of the openings (min. diameter up to 24 μm , up to 305 holes/inch, plate thickness 80 μm).
- b General view of the rotary screen press.
- c Fitting the flat printing plate on the cylinder (Rotaplate, stork,/theme).

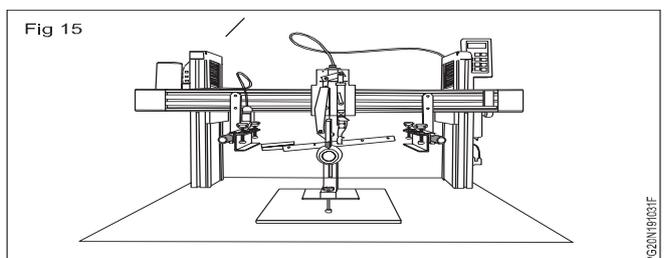
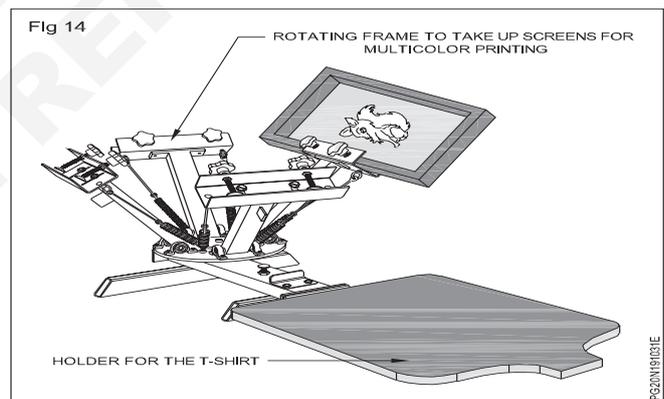
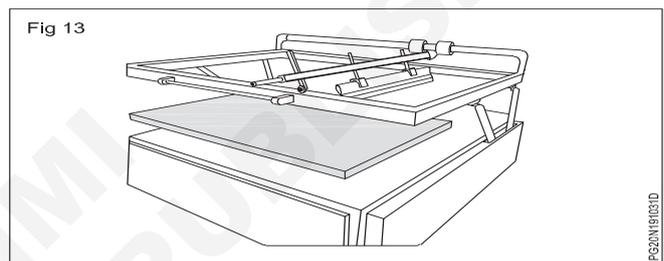
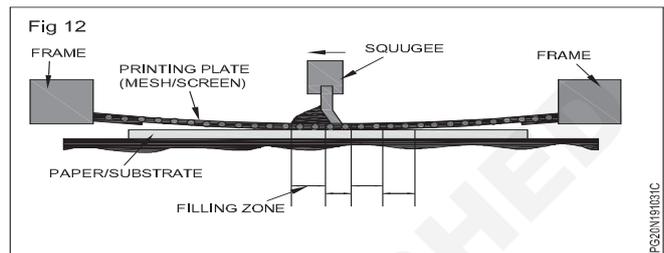
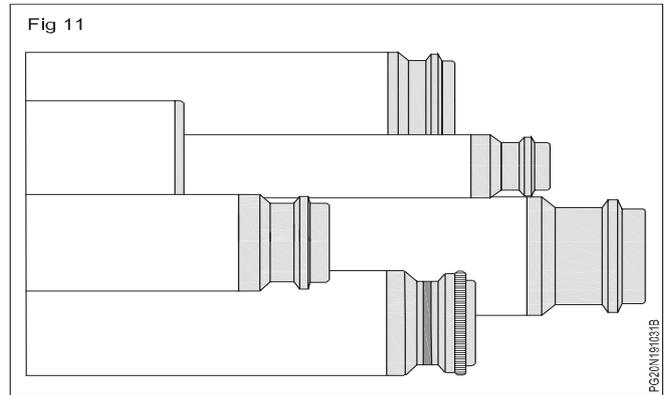
Rotary screen printing masters/cylinders (seamless) of varying diameters (Rotamesh, stork) (Fig 11)

Inking and printing process in screen printing (Fig 12)

Flat-bed screen printing equipment (Siri/steinmann) (Fig 13)

Screen printing equipment for multicolor printing of T-shirts (Siri/steinmann) (Fig 14)

Screen printing device for printing on curved objects/bodies (Rokuprint/steinmann) (Fig 15)

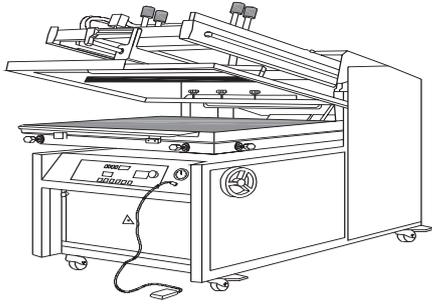


Semi-automatic screen printing machine for printing on flat substrates (Siri/bochonow) (Fig 16)

Multicolor automatic screen printing machine for printing on bottles, glasses, etc.

- a Automatic machine (EC/4F)

Fig 16



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- b Samples of printed products (ISIMAT) (Fig 17)
- Cylinder screen printing press (flat-round) (Fig 18)

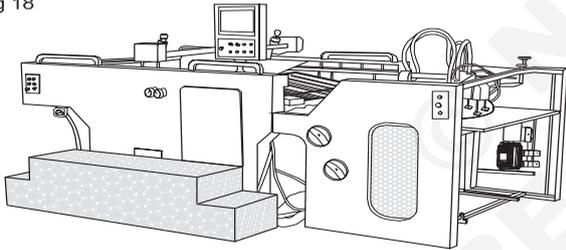
- a Printing system (model, maestro, sakurai)
- b The printing sequence

Screen printing unit in-line with a label printing system. (Fig 19a & b)

Fig 17

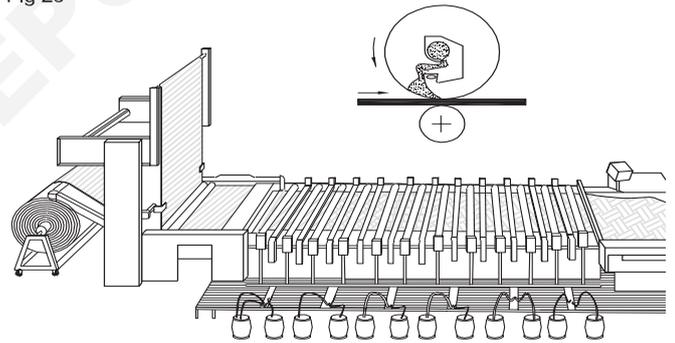


Fig 18



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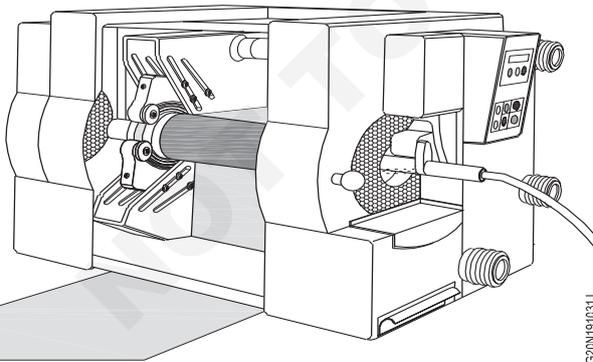
Fig 20



Stencil/screen printer for office applications,

- a Base material for producing the stencil.
- b Printing unit designed for change-over to a different color.
- c Fully automatic stencil/screen printer (Riso, see also Fig 21)

Fig 19



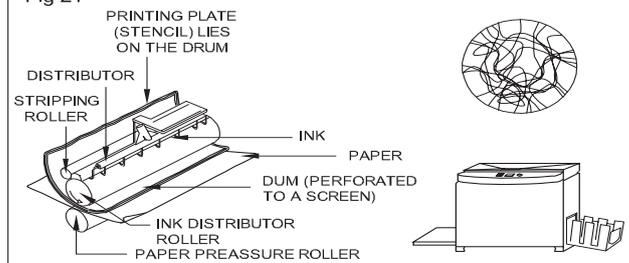
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a Hybrid machine (combination of letter press and screen printing) (Gallus R 200, Heidelberg/gallus),

b Screen printing unit with seamless rotary screen (stork)

Screen printing system for multicolor textile printing (Fig 20)

Fig 21



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