TURNER

NSQF LEVEL - 4

1st Year

TRADE PRACTICAL

SECTOR: CAPITAL GOODS & MANUFACTURING

(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 : **Capital Goods & Manufacturing**

Duration : **2 Years**

Trade : **Turner - 1st Year - Trade Practical - NSQF Level - 4 (Revised 2022)**

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FOREWORD

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

The National Instructional Media Institute (NIMI), Chennai, has now come up with instructional material to suit the revised curriculum for **Turner - 1st Year - Trade Practical** - NSQF Level - 4 (Revised 2022) in **CG & M 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 Instructional Media Packages 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
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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 syllabus 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 Practical)** for the trade of **Turner - 1st Year- NSQF Level - 4 (Revised 2022)** under the **CG & M** Sector for ITIs.

MEDIA DEVELOPMENT COMMITTEE MEMBERS

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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 intented to be used in practical workshop. It consists of a series of practical exercises to be completed by the trainees during the course of the **Turner** 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.

This manual is divided into Eight modules. The Eight modules are given below.

Module 1	-	Occupational Safety
Module 2	-	Basic fitting
Module 3	-	Turning
Module 4	-	Taper turning
Module 5	-	Eccentric turning
Module 6	-	Thread cutting
Module 7	-	Other form thread
Module 8	-	Special jobs maintenance

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 **Turner -** Trade Theory NSQF Level - 4 (Revised 2022)in CG & M. The contents are sequenced according to the practical exercise contained in NSQF Level - 4 (Revised 2022) syllabus on TradeTheory attempt has been made to relate the theoretical aspects with the skill covered in each exercise to the extent possible. This correlation is maintained to help the trainees to develop the perceptional capabilities for performing the skills.

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

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

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

CONTENTS

LEARNING / ASSESSABLE OUTCOME

On completion of this book you shall be able to

S.No.	Learning Outcome	Ref.Ex.No
1	Plan and organize the work to make job as per specification applying different types of basic fitting operations & check for dimensional accuracy following safety precautions.[Basic Fitting Operation - Marking, Hack sawing, filing, drilling, tap ing etc.] **(NOS:CSC/N0304)**	1.1.01 - 1.2.21
2	Set different shaped jobs on different chuck and demonstrate conventional lathe machine operation observing standard operation practice. [Different chucks: - 3 jaws & 4 jaws, different shaped jobs: - round, hexagonal, square] **(NOS: CSC/N0110)**	1.3.22 - 1.3.26
3	Prepare different cutting tool to produce jobs to appropriate accuracy by performing different turning operations. [Different cutting tool - V tool, side cutting, parting, thread cutting (both LH & RH), Appropriate accuracy: - ±0.06mm, Different turning operation - Plain, facing, drilling, boring (counter & stepped), grooving, Parallel Turning, Step Turning, parting, chamfering, U -cut, Reaming, internal recess, knurling. **(NOS: CSC/N0110)**	1.3.27 - 1.3.45
4	Test the alignment of lathe by checking different parameters and adjust the tool post. [Different parameters - Axial slip of main spindle, true running of head stock, parallelism of main spindle, alignment of both the centres.] **(NOS: CSC/N0110)**	1.3.46 - 1.3.48
5	Set different components of machine & parameters to produce taper/ angular components and ensure proper assembly of the components. [Different component of machine: - Form tool, Compound slide, tail stock offset, taper turning attachment. Different machine parameters- Feed, speed, depth of cut.] **(NOS: CSC/N0110)**	1.4.49 - 1.4.54
6	Set the different machining parameter & tools to prepare job by performing different boring operations. [Different machine parameter- Feed, speed & depth of cut; Different boring operation - Plain, stepped & eccentric] **(NOS: CSC/N0110)**	1.5.55 - 1.5.59
7	Set the different machining parameters to produce different threaded components applying method/ technique and test for proper assembly of the components. [Different thread: - BSW, Metric, Square, ACME, Buttress.] **(NOS: CSC/N0110)**	1.6.60 - 1.6.81
8	Set the different Machining parameter & lathe accessories to produce components applying techniques and rules and check the accuracy. [Different machining parameters: - Speed, feed & depth of cut; Different lathe accessories: - Driving Plate, Steady rest, dog carrier and different centres.] **(NOS: CSC/N0110)**	1.7.82 - 1.7.83
9	Plan and perform basic maintenance of lathe & grinding machine and examine their functionality. **(NOS: CSC/N0110)**	1.8.84 - 1.8.86

SYLLABUS FOR TURNER

Duration	Reference Learning Outcome	Professional Skill (Trade Practical) (With inidcative hour)	Professional Knowledge (Trade Theory)
Professional Skill 145 Hrs.; Professional Knowledge 30 Hrs.	Plan and organize the work to make job as per specification applying different types of basic fitting operations & check for dimensional accuracy following safety precautions.[Basic Fitting Operation - Marking, Hack sawing, filing, drilling, taping etc.] **(NOS:CSC/N0304)**	1. Importance of trade training, List of tools & Machinery used in the trade. (1 hr.) 2. Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE). (5 hrs.) 3. First Aid Method and basic training. (2 hrs.) 4. Safe disposal of waste materials like cotton waste, metal chips/burrs etc. (2 hrs.) 5. Hazard identification and avoidance. (2 hrs.) 6. Safety signs for Danger, Warning, caution & personal safety message. (1 hr.) 7. Preventive measures for electrical accidents & steps to be taken in such accidents. (2 hrs.) 8. Use of Fire extinguishers. (5 hrs.) 9. Practice and understand precautions to be followed while working in fitting jobs. (2 hrs.) 10. Safe use of tools and equipments used in the trade. (1 hr.)	All necessary guidance to be provided to the newcomers to become familiar with the working of Industrial Training Institute system including stores procedures. Soft Skills: its importance and Job area after completion of training. Importance of safety and general precautions observed in the in the industry/shop floor. Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Response to emergencies e.g.; power failure, fire, and system failure. **Importance of housekeeping & good shop floor practices.** Introduction to 5S concept & its application. **Occupational Safety & Health:** Health, Safety and Environment guidelines, legislations & regulations as applicable. (02 Hrs.)
		11. Identification of tools &equipments as per desired specifications for marking & sawing (Hand tools, Fitting tools & Measuring tools) (2 hrs.) 12. Selection of material as per application Visual inspection of raw material for rusting, scaling, corrosion etc. (1 hr.) 13. Marking out lines, gripping suitably in vice jaws, hack sawing to given dimensions, sawing different types of metals of different sections. (10 hrs.) 14. Practice on hammering, marking out, chipping, chisel grinding. (6 hrs.)	Measurement, line standard and end standard, steel rule- different types, graduation and limitation. Hammer and chisel- materials, types and uses. Prick punch and scriber. (05 Hrs.)

		15. Filing practice on plain surfaces, right angle by filing. (45 hrs.) 16. Use of calipers and scale measurement. (3 hrs.)	Vice - types and uses, Files- different types of uses, cut, grade, shape, materials etc. Try square-different types, parts, material used etc. Calipers- types and uses (firm joint). (10 Hrs.)
		17. Filing at right angle, marking & hack sawing. (25 hrs.)	Vee - block, scribing block, straight edge and its uses. Hacksaw-their types & uses. (05 Hrs.)
		18. Marking operation on flat & round job. (8 hrs.) 19. Drilling operation: Drill on flat, square bar and round bar of different material (Sensitive drill machine). (10hrs.)	Center punch- materials, construction & material uses. Drill machine-different parts. Hacksaw blades- sizes, different Parts. Hacksaw blades-sizes, different pitch for different materials. Nomenclature of drill. (04 Hrs.)
		20. Different threading (BSW, BSP, BA, Metric, UNC, UNF) with the help of taps and dies both external & internal (including pipes) using collet chuck. (10 hrs.) 21. Extraction of broken tap. (2hrs.)	Surface plate its necessity and use. Tap - different types (Taper 2nd and bottoming) care while tapping. Dies different types and uses. Calculation involved to find Out drill size (Metric and Inch). (04 Hrs.)
Professional Skill 40 Hrs.; Professional Knowledge 08 Hrs.	Set different shaped jobs on different chuck and demonstrate conventional lathe machine operation observing standard operation practice. [Different chucks: -3 jaws & 4 jaws, different shaped jobs:- round, hexagonal, square] **(NOS: CSC/N0110)**	22. Identify & function of different parts of lathe. Practice on operation of lathe (dry/idle run). (15 hrs.) 23. Setting lathe on different speed and feed. (5 hrs.)	Getting to know the lathe with its main components, lever positions and various lubrication points as well. Definition of machine & machine tool and its classification. History and gradual development of lathe. (04 Hrs.)
		24. Mounting of chuck on machine spindle and unloading -3-jaw chuck & 4- jaw chuck. (10 hrs.) 25. Setting practice on round & square/ hexagonal bar. (3 hrs.) 26. Dismantling and assembling of 3 jaw and 4 jaw chucks. (7 hrs.)	Classification of lathe in Function and construction of different parts of Lathe. (04 Hrs.)
Professional Skill 210 Hrs.; Professional Knowledge 45 Hrs.	Prepare different cutting tool to produce jobs to appropriate accuracy by performing differentturning operations. [Different cutting tool - V tool, side cutting, parting, thread cutting (both LH & RH), Appropriate accuracy:-±0.06mm, Different turning operation - Plain, facing, drilling, boring (counter & stepped), grooving, Parallel Turning, Step Turning, parting, chamfering, U -cut, Reaming, internal recess, knurling. **(NOS: CSC/N0110)**	27. Turning of round stock and square/hexagonal as per availability on 4-jaw independent chuck. (15 hrs.) 28. Turning of round stock on 3-jaw self centering chuck. (10hrs.)	Types of lathe drivers, merit and demerit. Description in details-head stock-cone pulley type- all geared type-construction & function. Tumbler gear set. Reducing speed-necessary & uses. Back Gear Unit-its construction use. (05Hrs.)

		29. Grinding of R.H. and L.H., V-tool, side cutting tools, parting tool. (10 hrs.) 30. Checking of angles with angle gauge / bevel protractor. (1 hr.) 31. Grinding of "V" tools for threading of Metric 60- degree threads. (9 hrs.)	Lathe cutting tool-different types, shapes and different angles (clearances and rake), specification of lathe tools. (05 Hrs.)
		32. Facing operation to correct length (5 hrs.) 33. Centre drilling and drilling operation to required size. (05 hrs.) 34. Make square block by turning using 4-jaw chuck and perform drilling, boring and grooving operation. (10 hrs.)	Combination drill- appropriate selection of size from chart of combination drill. Drill, chuck- its uses. Lathe accessories, chuck independent, self-centering, collet, magnetic etc., its function, construction and uses. (05 Hrs.)
		35. Parallel turning, step turning, parting, grooving, chamfering practice. (38 hrs.) 36. Measurement with scale and outside caliper to ± 0.5 mm. accuracy. (2 hrs.)	Vernier caliper-its construction, principle graduation and reading, least count etc. Digital vernier caliper. Outside micrometer -different parts, principle, graduation, reading, construction. Digital micrometer. Cutting speed, feed depth of cut, calculation involved-speed feed R.P.M. etc. recommended for different materials. (10 Hrs.)
		37. Step turning within ± 0.06 mm with different shoulder, U/cut on outside diameter. (15 hrs.)	Different types of micrometer, Outside micrometer. Vernier scale graduation and reading. Sources of error with
		38. Drilling on Lathe-step drilling, drill grinding practice. (10 hrs.)	micrometer & how to avoid them. Use of digital measuring instruments. (05Hrs.)
		39. Boring practice-Plain. Counter& step, internal recessing. (20 hrs.) 40. Reaming in lathe using solid and adjustable reamer. (15 hrs.) 41. Make bore by trepanning (10 hrs.) 42. Drill grinding. (5 hrs.)	Drills-different parts, types, size etc., different cutting angles, cutting speed for different material. Boring tool. Counter - sinking and Counter boring. Letter and number drill, core drill etc. Reamers-types and uses. Lubricant and coolant-types, necessity, system of distribution, selection of coolant for different material: Handling and care. (07 Hrs.)
		43. Turning practice-between centres on mandrel (Gear blanks). (15 hrs.) 44. Fitting of dissimilar materials-M.S. in brass, aluminium, in cast iron etc. (10 hrs.) 45. Knurling practice in lathe (Diamond, straight, helical & square). (5hrs.)	Knurling meaning, necessity, types, grade, cutting speed for knurling. Lathe mandrel- different types and their uses. Concept of interchangeability, Limit, Fit and tolerance as per BIS: 919-unilateral and bilateral system of limit, Fits-different types, symbols for holes and shafts. Hole basis & shaft basis etc. Representation of Tolerance in drawing. (08 Hrs.)

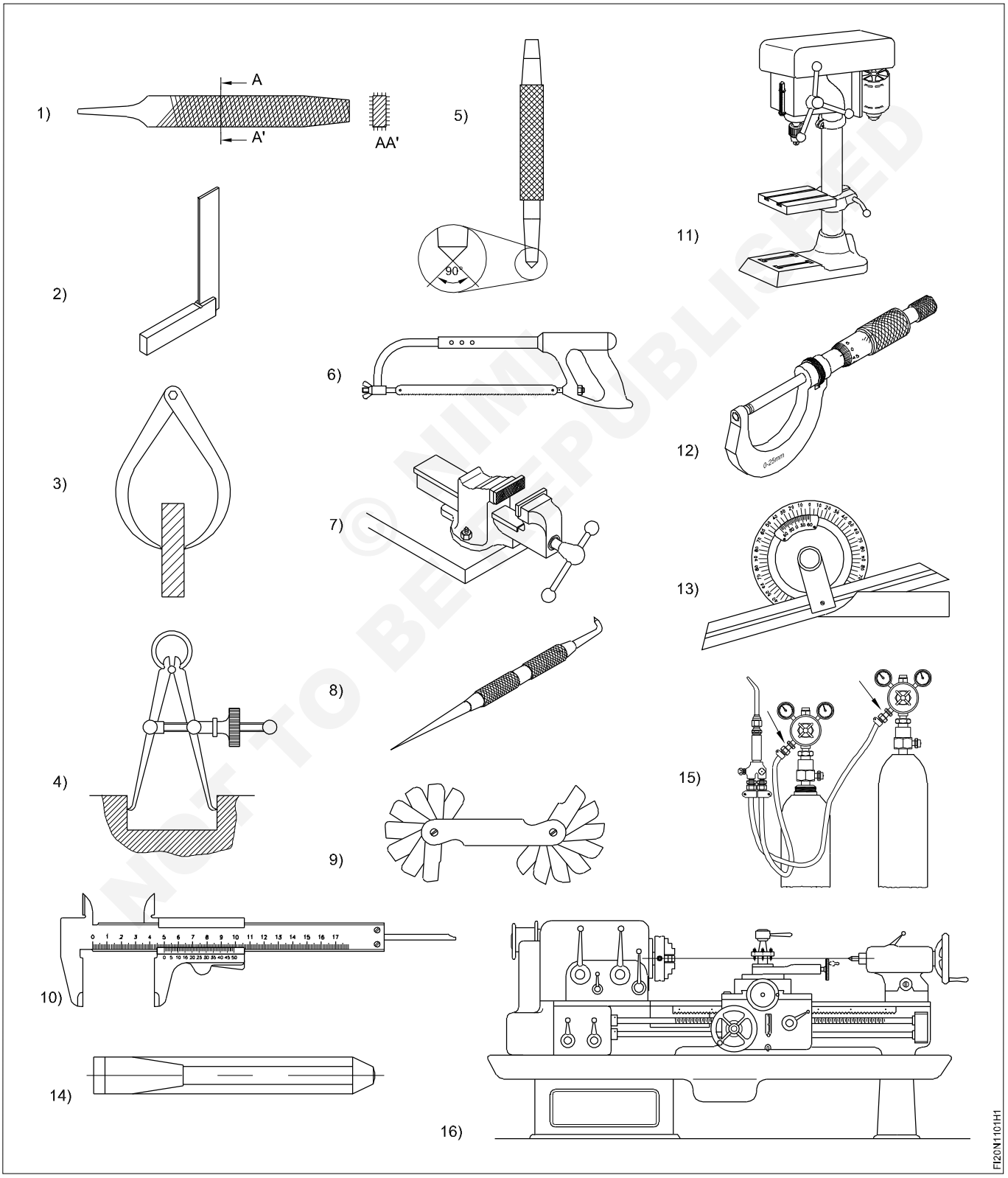
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	Test the alignment of lathe by checking different parameters and adjust the tool post.[Different parameters - Axial slip of main spindle, true running of head stock, parallelism of main spindle, alignment of both the centres.] **(NOS: CSC/N0110)**	46. Checking alignment of lathe centres such as Levelling, axial slip of main spindle, true running of head stock centre, parallelism of the main spindle to saddle movement, alignment both the centres. (20 hrs.) 47. Adjustment of tool post. (3 hrs.) 48. Mounting job in between centres. (2 hrs.)	Driving plate. Face plate & fixed & traveling steadies- construction and use. Transfer caliper-its construction and uses. Lathe centers-types and their uses. Lathe carrier-function types & uses. Mandrel - Different types and its use. Magnetic stand dial indicator, its used and care. (05 Hrs.)
Professional Skill 65 Hrs.; Professional Knowledge 10 Hrs.	Set different components of machine & parameters to produce taper/angular components and ensure proper assembly of the components. [Different component of machine:- Form tool, Compound slide, tail stock offset, taper turning attachment. Differentm achine parameters-Feed, speed, depth of cut.] **(NOS: CSC/N0110)**	49. Make taper turning by form tool and compound slide swivelling. (20 hrs.)	Taper - different methods of expressing tapers, different standard tapers. Method of taper turning, important dimensions of taper. Taper turning by swiveling compound slide, its calculation. (05 Hrs.)
		50. Male and female taper turning by taper turning attachment, offsetting tail stock. (22 hrs.) 51. Matching by Prussian Blue. (2 hrs.) 52. Checking taper by bevel protector and sine bar. (1 hr.) 53. Make MT3 lathe dead centre and check with female part. (Proof machining) (20 hrs.)	Bevel protector & Vernier bevel protractor-its function & reading. Method of taper angle measurement. Sine bar-types and use. Slip gauges-types, uses and selection. (5 Hrs.)
Professional Skill 65 Hrs.; Professional Knowledge 05 Hrs.	Set the different machining parameter & tools to prepare job by performing different boring operations. [Different machine parameter- Feed, speed & depth of cut; Different boring operation - Plain, stepped & eccentric] **(NOS: CSC/N0110)**	54. Turning and boring practice on CI (preferable) or steel. (22 hrs.)	Basic process of soldering, welding and brazing. (05 Hrs.)
		55. Eccentric marking practice. (2 hrs.) 56. Perform eccentric turning. (15 hrs.) 57. Use of Vernier height Gauge and V-block. (1 hr.) 58. Perform eccentric boring. (15 hrs.) 59. Make a simple eccentric with dia. of 22mm and throw/offset of 5mm. (10 hrs.)	Vernier height gauge, function, description & uses, templates- its function and construction. Screw thread-definition, purpose & its different elements. Driving plate and lathe carrier and their usage. Fundamentals of thread cutting on lathe. Combination set-square head. Center head, protractor head- its function construction and uses. (5 Hrs.)
Professional Skill 210 Hrs.; Professional Knowledge 40 Hrs.	**Set the different** machining parameters to produce different threaded components applying method/ technique and test for proper assembly of the components. [Different thread: - BSW, Metric, Square, ACME, Buttress.] (NOS: CSC/N0110)	60. Screw thread cutting (B.S.W) external (including angular approach method) R/H & L/H, checking of thread by using screw thread gauge and thread plug gauge. (14 hrs.) 61. Screw thread cutting (B.S.W) internal R/H & L/H, checking of thread by using screw thread gauge and thread ring gauge. (14 hrs.)	Different types of screw thread- their forms and elements. Application of each type of thread. Drive train. Chain gear formula calculation. Different methods of forming threads. Calculation involved in finding core dia., gear train (simple gearing) calculation. Calculations involving driver- driven, lead screw pitch and thread to be cut. (08 Hrs.)

		62. Fitting of male & female threaded components (BSW) (4hrs.) 63. Prepare stud with nut (standard size). (10hrs.)	
		64. Grinding of "V" tools for threading of Metric 60- degree threads and check with gauge. (3 hrs.) 65. Screw thread cutting (External) metric thread- tool grinding. (10 hrs.) 66. Screw thread (Internal) metric & threading tool grinding. (14 hrs.) 67. Fitting of male and female thread components (Metric) (2 hrs.) 68. Make hexagonal bolt and nut (metric) and assemble. (10 hrs.)	Thread chasing dial function, construction and use. Calculation involving pitch related to ISO profile. Conventional chart for different profiles, metric, B.A., With worth, pipe etc. Calculation involving gear ratios and gearing (Simple & compound gearing). Screw thread micrometer and its use. (08 Hrs.)
		69. Cutting metric threads on inch lead screw and inch threads on Metric Lead Screw. (20 hrs.)	Calculation involving gear ratios metric threads cutting on inch L/S Lathe and vice-versa. (03Hrs.)
		70. Cutting Square thread (External) (11 hrs.)	Tool life, negative top rake-its application and performance with respect to positive top rake (03 Hrs.)
		71. Cutting Square thread (Internal). (18 hrs.) 72. Cutting Square thread (Internal). (18 hrs.) 73. Fitting of male and female Square threaded components. (2 hrs.) 74. Tool grinding for Square thread (both External & Internal). (2 hrs.) 75. Make square thread for screw jack (standard) for minimum 100mm length bar. (12 hrs.)	Calculation involving tool Thickness, core dia., pitch proportion, depth of cut etc. of sq. thread. (08 Hrs.)
		76. Acme threads cutting (male & female) & tool grinding. (08 hrs.) 77. Fitting of male and female threaded components. (7 hrs.) 78. Cut Acme thread over 25 mm dia. rod and within length of 100mm. (10 hrs.)	Calculation involved - depth, core dia., pitch proportion etc. of Acme thread. Calculation involved depth, core dia., pitch proportion, use of buttress thread. (05 Hrs.)

Professional Skill 40 Hrs.; Professional Knowledge 08 Hrs.	Set the different Machining parameter & lathe accessories to produce components applying techniques and rules and check the accuracy. [Different machining parameters: - Speed, feed & depth of cut; Different lathe accessories: - Driving Plate, Steady rest, dog carrier and different centres.] **(NOS: CSC/N0110)**	79. Buttress threads cutting (male & female) & tool grinding. (11 hrs.) 80. Fitting of male & female threaded components. (2 hrs.) 81. Make carpentry vice lead screw. (5 hrs.)	Buttress thread cutting (male & female) & tool grinding(05 Hrs.)
Professional Skill 40 Hrs.; Professional Knowledge 9 Hrs.	Plan and perform basic maintenance of lathe & grinding machine and examine their functionality. **(NOS: CSC/N0110)**	82. Make job using different lathe accessories viz., driving plate, steady rest, dog carrier and different centres. (25hrs.) 83. Make test mandrel (L=200mm) and counter bore at the end. (15 hrs.)	Different lathe accessories, their use and care. (8 Hrs.)
		84. Balancing, mounting &dressing of grinding wheel (Pedestal). (10hrs.) 85. Periodical lubrication procedure on lathe. (10 hrs.) 86. Preventive maintenance of lathe. (20 hrs.)	Lubricant-function, types, sources of lubricant. Method of lubrication. Dial test indicator use for parallelism and concentricity etc. in respect of lathe work Grinding wheel abrasive, grit, grade, bond etc.(9 Hrs.)

Importance of trade training, list of tools & machinery used in the trade

Objectives: At the end of this exercise you shall be able to
- **identify the tools and equipments used in fitter section**
- **record the names of tools, do's and don't of each tool**
- **record the names of the industries where the turner are employed.**



Job Sequence

Instructor shall display all the tools and equipments in the section and brief their names, uses and the safety point to be observed for each tool and equipment.

- Trainees will note down all the displayed tools names, uses and the precaution to be observed while working with each tool.
- Record it in Table 1.
- Get it checked by the instructor.

Table 1

Sl. No	Name of tool/equipment	Uses	Precaution to be observed (Do's and Don't)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

Instructor shall brief the role of a turner in industries. Emphasis more on the assembly shop by providing the names of the private and public sector industries, where the turner are largely employed. Ask the trainees to note down the names of the industries.

Safety attitude development of the trainee by educating them to use personal protective equipment (PPE)

Objectives: At the end of this exercise, you shall be able to
- **identify personal protective devices**
- **interpret the different types of personal protective devices**
- **identify occupational hazards and the corresponding potential hazards.**

Fig 1

Job Sequence

- Read and interpret the visuals of personal protective equipment on real devices or from the charts.
- Identify and select personal protective equipment used for different types of protection.
- Write the name of the PPE and the corresponding type of protection and the hazards in table 1.

The instructor shall display the different types of personal protective equipments or charts and explain how to identify and select the PPE devices suitable for the work and ask the trainees to note down the hazards and type of protection in the Table 1.

TASK 1:

Table 1

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

Get it checked by your instructor.

— — — — — — — — —

TASK 2:

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

1 Identify the occupational hazard and the corresponding situation with the potential harm and record it in Table 2.

Table 2

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

Fill up and get it checked by your instructor.

First aid method and basic training

Objectives: At the end of this exercise, you shall be able to
- **provide first aid for chocking, wound, burn, bites and sting on human.**
- **take care a person with, eye injury, nose bleeding, diabetes, heat exhaustion by first aid treatment**
- **give first aid treatment to person with heat stroke.**

Job Sequence

TASK 1: **Chocking**

- Severe choking: back blows and abdominal thrusts explain in Fig 1.

Fig 1

CHOCKING

FI20N1103H1

- Stand behind them and slightly to one side. Support their chest with 1 hand. ...
- Give up to 5 sharp blows between their shoulder blades with the heel of your hand. ...
- Check if the blockage has cleared.
- If not, give up to 5 abdominal thrusts.

TASK 2: **Wound (Fig 2 to 3)**

- The first step in care of a wound is to stop the bleeding.
- Locate the source of the bleeding.
- Wash your hands and, when possible, wear gloves or use a barrier between you and the wound.
- Remove any loose debris.
- Apply direct pressure on wound (Fig 1)

Fig 1

- Dress the wound with cotton bandage (Fig 2)

Fig 2

TASK 3: **Burns (Fig 1, 2, 3)**

Fig 1

Fig 2

Fig 3

Treating minor burns

- Cool the burn.
- Remove rings or other tight items from the burned area.
- Don't break blisters.
- Apply lotion.
- Bandage the burn.
- If needed, take a nonprescription pain reliever, such as ibuprofen (Advil, Motrin IB, others), naproxen sodium (Aleve) or acetaminophen (Tylenol, others).

— — — — — — — — —

TASK 4: **Bites and Stings (Fig 1,2,3)**

Fig 1

Fig 2

Fig 3

- Stop the wound from bleeding by applying direct pressure with a clean, dry cloth.
- Wash the wound.
- Apply an antibacterial ointment to the wound.
- Put on a dry, sterile bandage.
- If the bite is on the neck, head, face, hand, fingers, or feet, call Doctor right away

— — — — — — — — —

TASK 5: **Eye Injury (Fig 1 & 2)**

Fig 1

- Ask patient to look up.
- Draw lower eyelid down. If object visible, remove with corner of moist cloth.
- If not visible, pull upper lid down.

Fig 2

- If unsuccessful, wash eye with sterile saline or clean water.
- If still unsuccessful, cover injured eye only and seek medical aid.

TASK 6: **Nose Bleedings (Fig 1 & 2)**

Fig 1

- Make a patient to sit straight and bend forward the head portion only(This will reduce blood pressure in the Veins of your nose)
- Ask the patient to breathe out from the nose.
- Pinch the nose to take out the blood in the nose.

Fig 2

- To prevent re-bleeding, don't pick or blow your nose and don't bend down for several hours.
- If re-bleeding occurs, go through these steps again.

TASK 7: **Diabetes (Low blood Sugar)(Fig 1 & 2)**

Fig 1

- Follow the Basic First Aid Plan to assess the casualty.
- Give high-energy foods or sugar.
- Only give food if the casualty is conscious.

Fig 2

- If medical aid is delayed give sugar every 15 minutes.
- The casualty will recover quickly if low blood sugar level is the cause.

TASK 8: **Heat Exhaustion (Fig 1 to 2)**

Fig 1

Fig 2

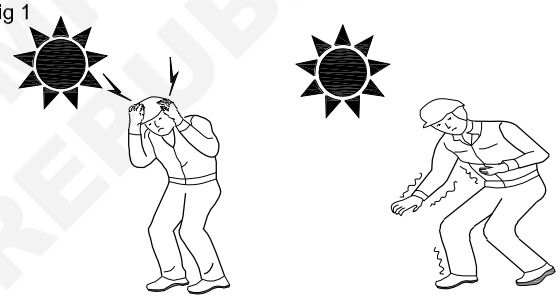
Heat Exhaustion

- Rest in a cool place. Getting into an air-conditioned building is best, but at the very least, find a shady spot or sit in front of a fan.
- Drink cool fluids. Stick to water or sports drinks.
- Try cooling measures.
- Loosen clothing.

TASK 9: **Heat Stroke (Fig 1)**

- Put the person in a cool tub of water or a cool shower.
- Spray the person with a garden hose.
- Sponge the person with cool water.
- Fan the person while misting with cool water.
- Place ice packs or cool wet towels on the neck, armpits and groin.
- Cover the person with cool damp sheets.

Fig 1



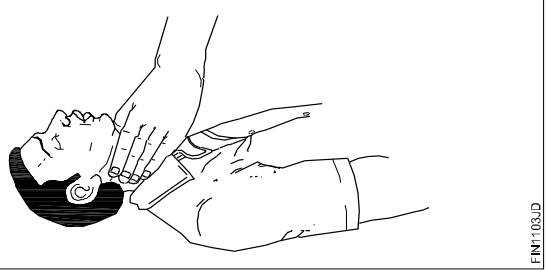
TASK 10: **Resuscitate a victim who is under cardiac arrest by (CPR) cardio pulmonary resuscitation**

In cases where the heart has stopped beating, you must act immediately.

- Check quickly whether the victim is under cardiac arrest.

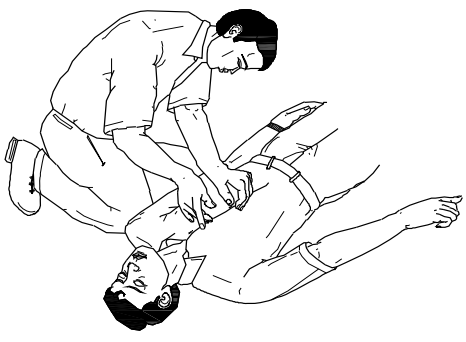
Cardiac arrest could be ascertained by the absence of the cardiac pulse in the neck (Fig 1), blue colour around lips and widely dilated pupil of the eyes.

Fig 1



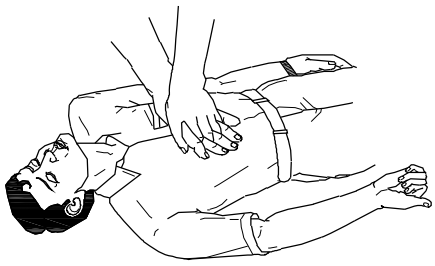
- Lay the victim on his back on a firm surface.
- Kneel alongside facing the chest and locate the lower part of the breastbone. (Fig 2)

Fig 2



- Place the palm of one hand on the centre of the lower part of the breastbone, keeping your fingers off the ribs. Cover the palm with your other hand and lock your fingers together as shown in Fig 3.

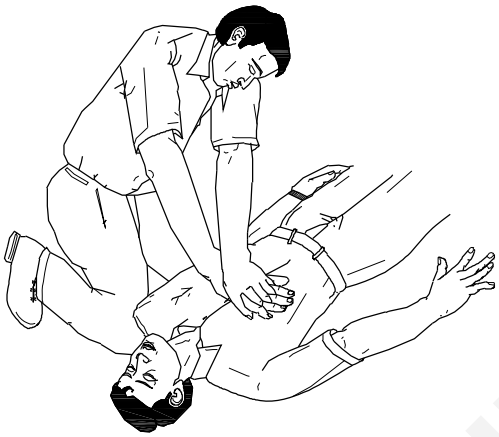
Fig 3



FIN1103JF

- Keeping your arms straight, press sharply down on the lower part of the breastbone; then release the pressure. (Fig 4)

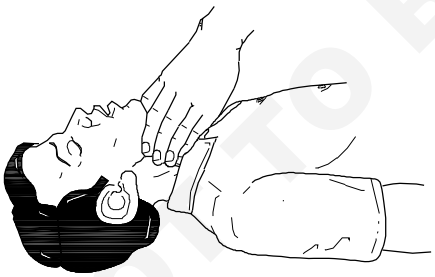
Fig 4



FIN1103JG

- Repeat step 5, fifteen times at the rate of at least once per second.
- Check the cardiac pulse. (Fig 5)

Fig 5



FIN1103JH

- Move back to the victim's mouth to give two breaths (mouth-to-mouth resuscitation). (Fig 6)

Fig 6

FIN1103JI

- Continue with another 15 compressions of the heart followed by a further two breaths of mouth-to-mouth resuscitation, and so on, check the pulse at frequent intervals.
- As soon as the heartbeat returns, stop the compressions immediately but continue with mouth-to-mouth resuscitation until natural breathing is fully restored.
- Place the victim in the recovery position as shown in Fig 7. Keep him warm and get medical help quickly.

Fig 7

FIN1103JJ

Other steps

- Send word for a doctor immediately.
- Keep the victim warm with a blanket, wrapped up with hot water bottles or warm bricks; stimulate circulation by stroking the insides of the arms and legs towards the heart.

Safe disposal of waste materials like cotton waste, metal chips / burrs etc.

Objectives: At the end of this exercise you shall be able to
- **identify and segregate the waste material in workshop**
- **arrange the waste material in different bins.**

Fig 1

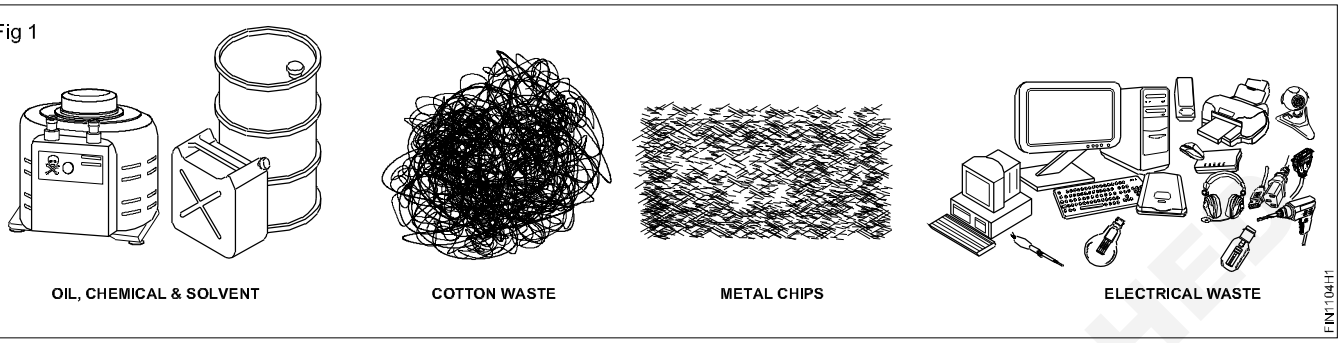
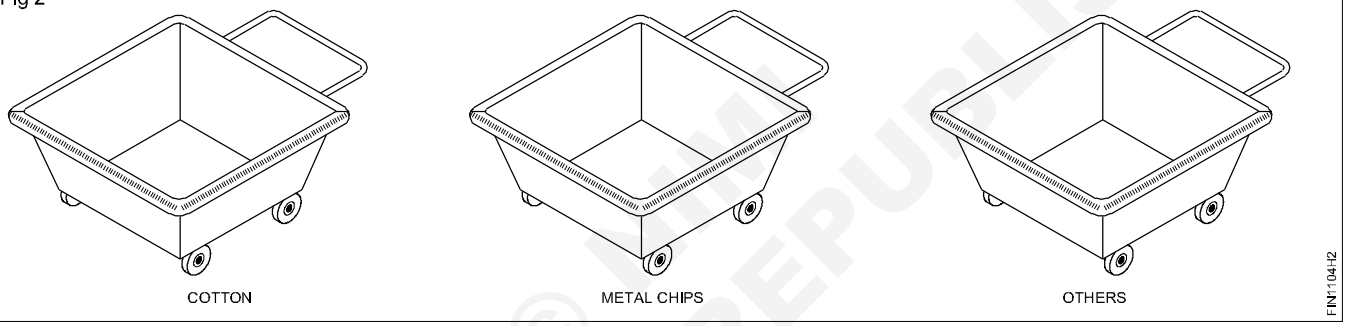


Fig 2



Job Sequence

- Separate the cotton waste.
- Collect the chips by hand shovel with the help of brush. (Fig.2).
- Clean the floor, if oil is spilled.

Do not handle the chip by bare hand

There may be different metal chips. So separate the chip according to metal.

- Separate the cotton waste material and store it in the bin provided to store the waste cotton material. (Fig.2)
- Similarly store the each category of metal chip in separate bins.

Each bin should have name of the material.

Identify the material given in fig 1 and fill in table 1

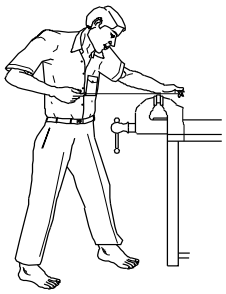
Table1

S. No.	Name of the material
1	
2	
3	
4	
5	

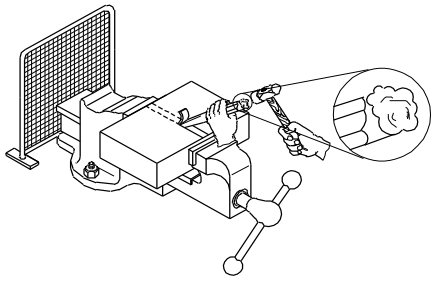
Hazard identification and avoidance

Objectives: At the end of this exercise you shall be able to
- **identify the occupational hazards**
- **suggest suitable methods to avoid occupational hazards.**

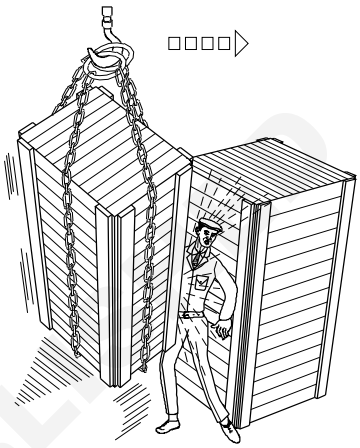
Fig 1



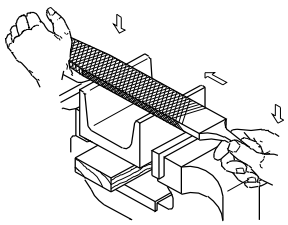
1 WORKING BARE FOOT IN SHOP FLOOR



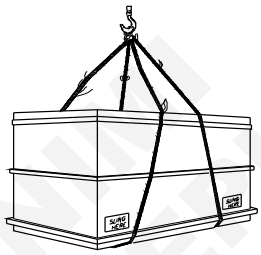
5 CHIPPING METAL SURFACE WITH MUSHROOM HEAD CHISEL



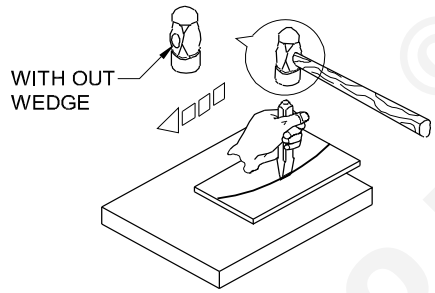
8 LIFTING A LOAD WHILE PEOPLE WORKING NEARBY



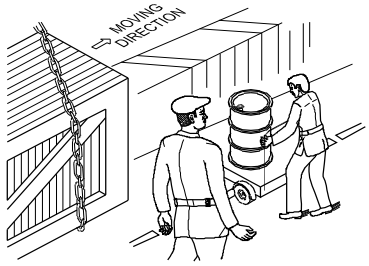
2 USING FILE WITHOUT HANDLE



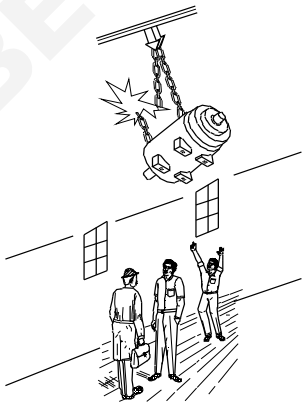
6 LIFTING LOAD WITH DAMAGED SLINGS



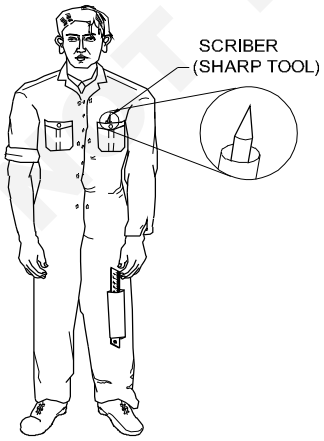
3 STRIKING ON CHISEL HEAD WITH BALL PEIN HAMMER WITHOUT WEDGE



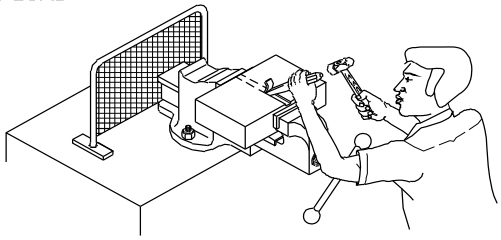
9 NO OBSTACLE WHILE MOVING THE LOAD



7 STANDING BELOW A SUSPENDED LOAD



4 KEEPING SCRIBER SHARP EDGE OPEN IN POCKET



10 CHIPPING ON METAL SURFACE WITHOUT SAFETY GOGGLES

FI20N1106H1

Job Sequence

The instructor shall emphasise the importance of hazard and avoidance to the students and insist them to follow properly.

- Study the drawing of industrial hazards.
- Identify the type of hazards.
- Name the hazards against their names.
- Record the hazards and avoidance in Table 1.

Table 1

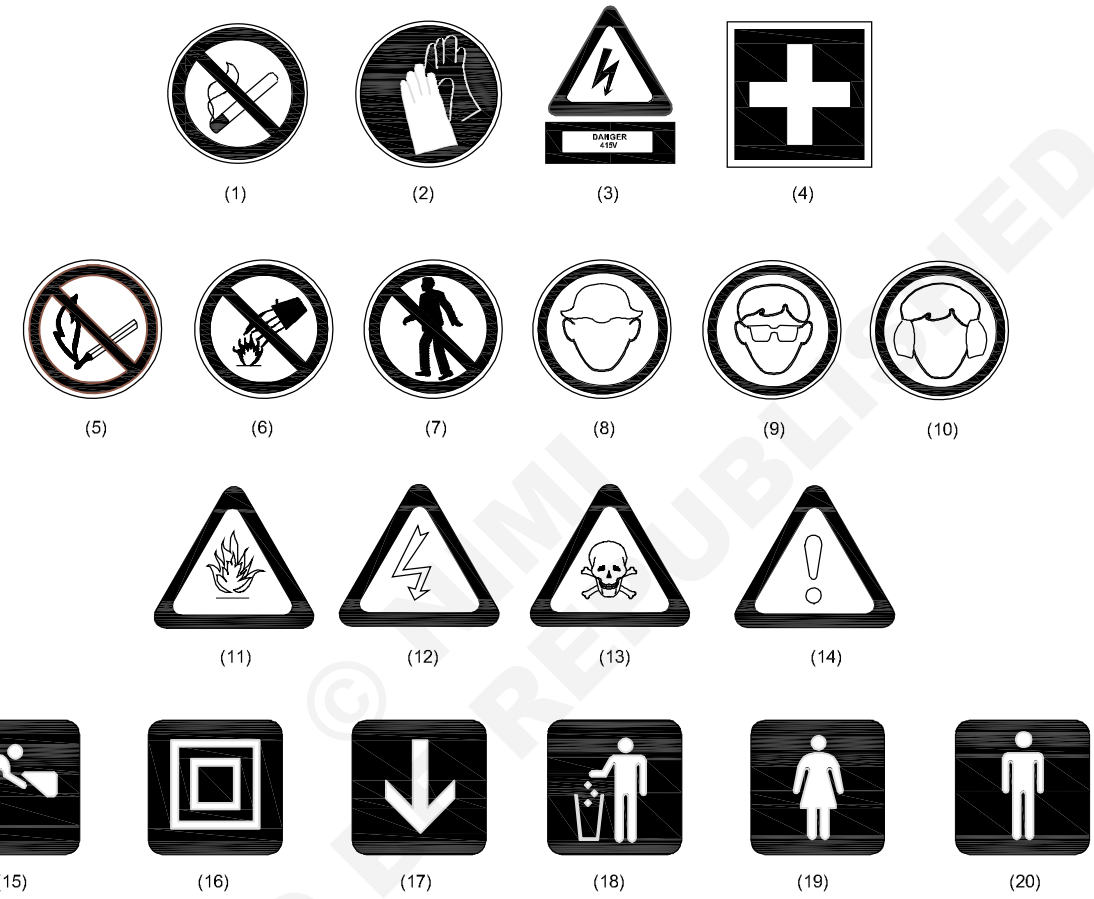
S. No.	Identification of hazards	Avoidance
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

- Get it checked by your instructor

Safety sign for danger, warning, caution and personal safety message

Objectives: At the end of this exercise you shall be able to
- **identify the basic categories of safety sign**
- **record the meaning of safety sign in the table given.**

Fig 1



Job Sequence

Instructor shall provide various safety signs, chart categories and explain their meaning, description. Ask the trainee to identify the sign and record in Table 1.

- Identify the safety sign from the chart.
- Record the name of the category in Table 1.
- Mention the meaning description of the safety sign in Table 1.

Table 1

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

- Get it checked by your instructor.

Preventive measures for electrical accidents and step to be taken in such accidents

Objectives: At the end of this exercise you shall be able to
- **adopt preventive measures to avoid electrical accidents**
- **take care of a person with electrical accident.**

Note: The instructor shall arrange suitable electrical Safety poster/chart/slogan appropriate to this exercise

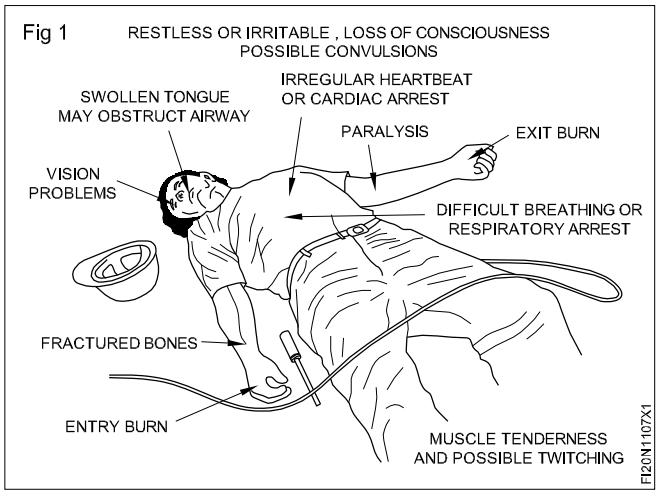
Job Sequence

Preventive measures for electrical accidents

- Never touch any electrical apparatus /machinery with wet hands or while standing in water.
- If you get a tingle or shock when touching any electrical item, a sink, tub, or other wet area, turn off the power at the main panel and immediately call an electrician.
- Don't use damaged or broken cords/ wires or plug in anything with a missing prong.
- When unplugging, don't pull the cord; pull it by the plug.
- Don't overload sockets; use a power extension board with a safety switch.
- Know the location and how to operate shut-off switches and/or circuit breaker panels. Use these devices to shut off equipment in the event of a fire or electrocution.
- Avoid for water or chemical spills on or near electrical equipment. Wear rubber shoes in wet areas.
- Cover unused outlets and keep metal objects away from outlets. you should always take extra care to ensure that you do not come into contact with the exposed live wires as this runs the risk of shock and burns.
- Put a notice nearby to the appliance to inform others of the danger and to ensure that it is protected until you are able to schedule repairs.
- Use safe work practices every time electrical equipment is used.
- All electrical installations regardless of whether at home or in the workplace, must be grounded, which is otherwise known as earthing to track down any excess electricity, the most effective route to return to the ground without posing any safety risks.
- It is safe to work on the electrical equipment that is plugged in with only dry hand and wear non-conductive gloves and insulated-soles shoes.
- Disconnect the device from the source in the period of service or maintenance of the device.
- Disconnect the power source before servicing or repairing electrical equipment.
- All electrical cords should have sufficient insulation to prevent direct contact with wires.
- In a laboratory/workshop it is particularly important to check all cords before each use, since corrosive chemicals or solvents may erode the insulation.
- Damaged cords should be repaired or taken out of service immediately, especially in wet environments such as cold rooms and near water baths.
- Keep away from the energized or loaded circuits Arcing, sparking, or smoking from the equipment
- If the device interacts with water or other liquid chemicals, equipment must be shut off power at the main switch or circuit breaker and unplugged.
- If any individual comes in contact with a live electric line, do not touch the individual or equipment / source/ cord; disconnect the power source from the circuit breaker or pull out the plug using a leather belt.
- always stay at least ten feet away from the overhead power lines, carry highest voltage, which means that should anyone come into contact with them, there is a significant risk of not only electrocution but also severe burns.

First Aid for Accidental Electric Shock Victims (Fig 1)

Fig 1



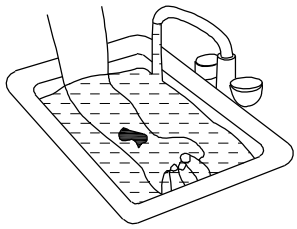
- Ensure that you are taking sufficient safety precaution to protect yourself before going to help the other person met with accidental electric shock.
- Talk to the person and ask loudly, "Are you OK?"; make him feel comfortable.
- Check for ventilation and airways; clear obstruction and provide fresh air flow.
- Check for signs of normal breathing; observe breathing.
- If not breathing normally, begin CPR
- Unplug the appliance or turn off the power at the control panel.
- If you can't turn off the power, use a dry wooden piece, like a broom handle, dry rope or dry clothing, to separate the victim from the electrical contact / power source.
- Do not try to move the victim touching a high voltage wire; Call for emergency help/immediate superior for assistance.
- Unconscious victims should be placed on their side to allow drainage of fluids; Keep the victim lying and observe for the symptoms shown in Fig 1
- Do not move the victim if there is a suspicion of neck or spine injuries call for the ambulance service.
- If the victim is not breathing, apply mouth-to-mouth resuscitation. If the victim has no pulse, begin cardiopulmonary resuscitation (CPR). Then cover the victim with a blanket to maintain body heat, keep the victim's head low and get medical attention.

First Aid for Accidental Electrical Burn Victims

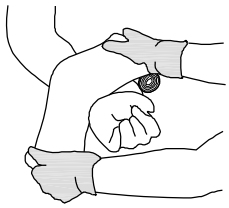
Electrical burns vary in severity depending upon the following conditions

- how long the victim is in contact with the electric current;
- the strength of the current flow;
- the type of current AC or DC; and
- the direction of the current takes through the body.
- Observe the person, if the person is conscious and there are no signs of shock (such as being cold, clammy, pale and having a rapid pulse)
- Do not apply grease or oil to the burn.
- Cover the burn with a dry, sterile dressing.
- There may be more than one area burned.
- If the person has electrical burn, check for shock and follow the outlined points shown in Fig 2

Fig 2



COOL WITH RUNNING WATER



COVER THE BURN

CALL EMERGENCY ASSISTANT

FI20N1107X2

- Keep the victim from getting chilled; Seek medical attention as soon as possible.

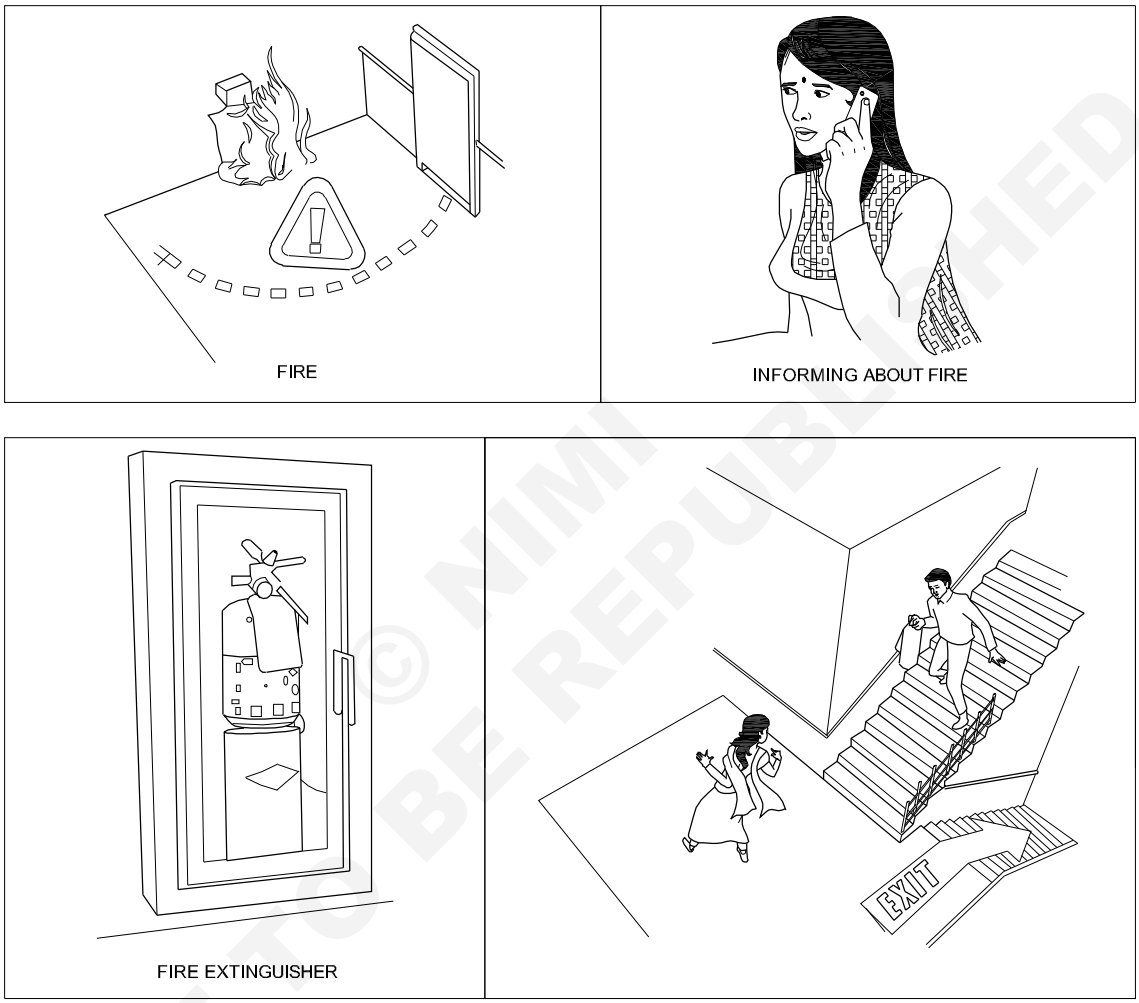
Accidental Electrical Fire

- Keep flammable materials away: Electrical appliances or outlets that come into contact with flammable materials that may trigger a fire.
- Inspect electrical wiring: Have your electric wiring checked to prevent electrical fires. Wiring does not last forever, so it is a good idea to have your wiring checked
- Be wary of certain appliances: If an appliance blows a fuse, trips a circuit, or sparks while being used, unplug the appliance immediately, and check to see if it needs to behave it repaired or replaced.
- Check Switches or outlets that are hot to touch and/or emit an acid odor; Inspect and repair outlets and switches.
- In case of electrical fire, use only CO2 type of Fire extinguisher.

Uses of fire extinguishers

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

Fig 1

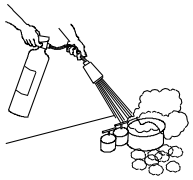
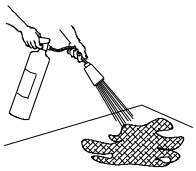
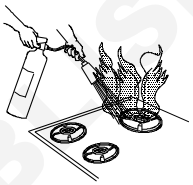


Job Sequence

- Alert people surrounding by shouting fire, fire, fire.
- Inform fire service or arrange to inform immediately.
- Open emergency exist and ask them to go away.
- Analyze and identify the type of fire. Refer Table1.

All fire extinguisher are labelled to indicate which class of fire they are designed to combat.

Table1

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

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

- Select CO_2 (carbon dioxide) fire extinguisher
- Locate and pick up CO_2 fire extinguisher. Check for its expiry date.
- Break the seal.

Stand back: Face the fire and keep your back to the exit stay between six and eight feet away from flame.

Operator: Object the fire extinguisher

Most of the fire extinguisher operator the same basic way stand six to eight feet away from the fire and remember to PASS - PULL - AIM - SEQUENCE - SWEEP.

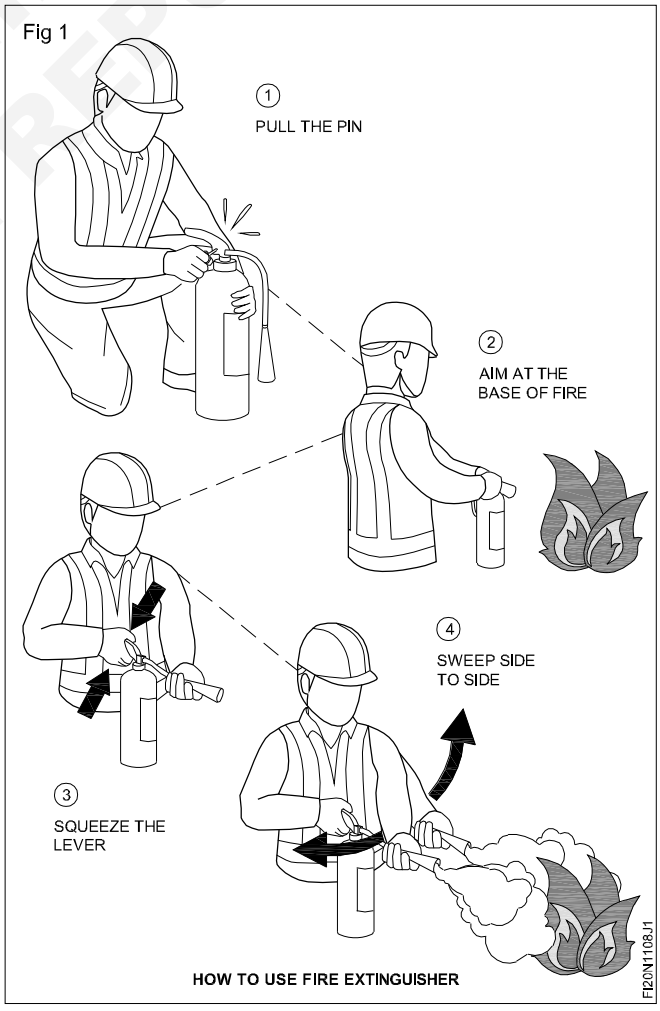
PULL the pin: This will allow you to discharge the extinguisher. (Fig 1-1)

AIM at the base of fire: If you aim at the flames (Which is frequently the temptation). The extinguishing agent will fly right through and do no good. (Fig 1-2)

Sequence the top handle or lever: This depresses a button that releases the pressured extinguishing agent in the extinguisher. (Fig 1-3)

Sweep from side to side until the fire is completion put off. Start using the extinguisher from distance away. Then move forward. Once the fire is put off keep on eye on the area incase reignite. (Fig 1-4)

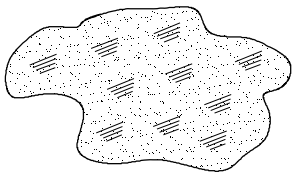
Fig 1



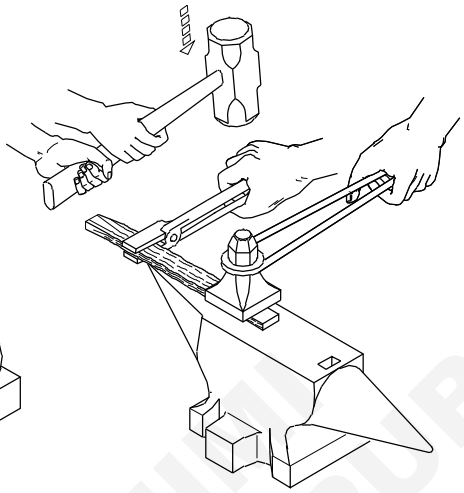
Practice and understand precautions to be followed while working in fitting jobs

Objective: At the end of this exercise, you shall be able to
- **record the precaution to be followed while working in fitting jobs.**

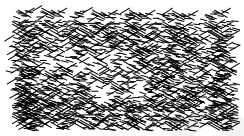
Fig 1



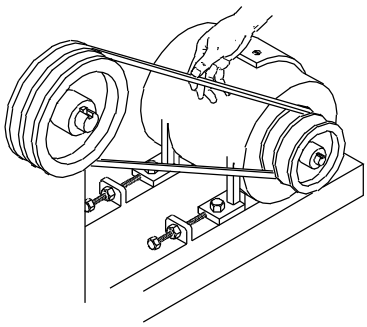
1 OIL SPILLS ON SHOP FLOOR AND WORK TABLE



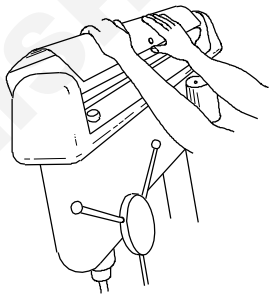
5 HANDLING HOT JOBS WITHOUT GLOVES



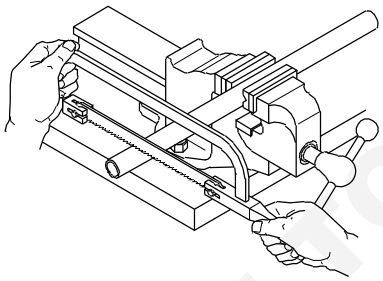
8 METAL CHIPS SPREAD ON SHOP FLOOR NEAR DRILLING MACHINE



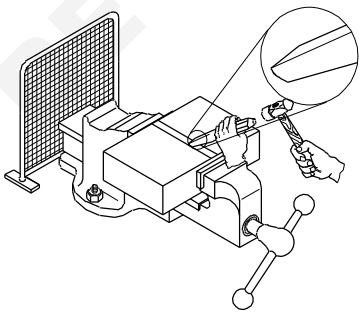
2 MACHINE RUNNING WITHOUT BELT GUARD



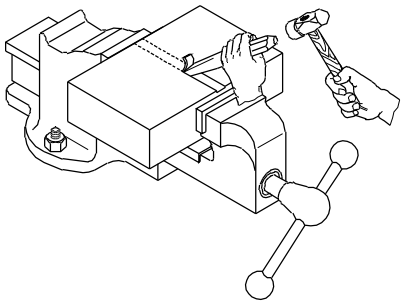
9 CHANGING THE BELT WHEN THE SPINDLE IS ROTATING



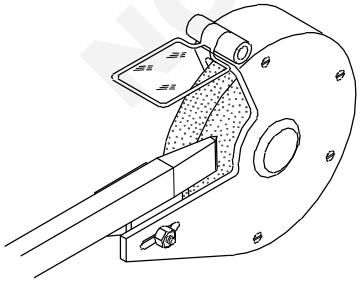
3 HACKSAWING WITHOUT HANDLE



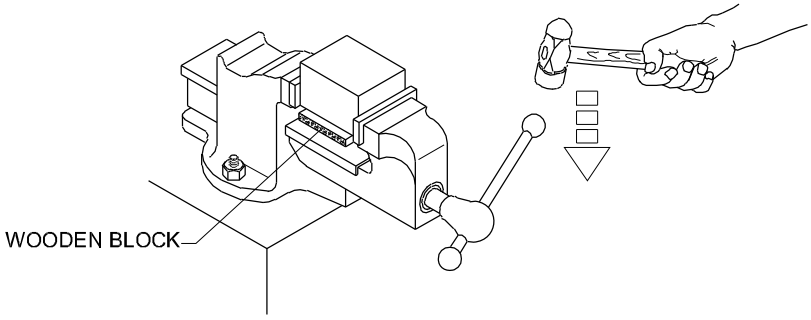
6 CHIPPING WITH BLUNT CHISEL ON METAL SURFACE



10 CHIPPING ON METAL WITHOUT CHIPPING SCREEN



4 GRINDING A FLAT CHISEL IN SIDE WAYS OF GRINDING WHEEL



7 STRIKING ON VICE HANDLE WITH HAMMER TO GRIP THE WORK PIECE

F120N1109H1

Job Sequence

The instructor shall guide and demonstrate the students to practice and understand precautions to be followed while working in fitting jobs.

- Record the precautions to be followed while working in fitting job in Table 1

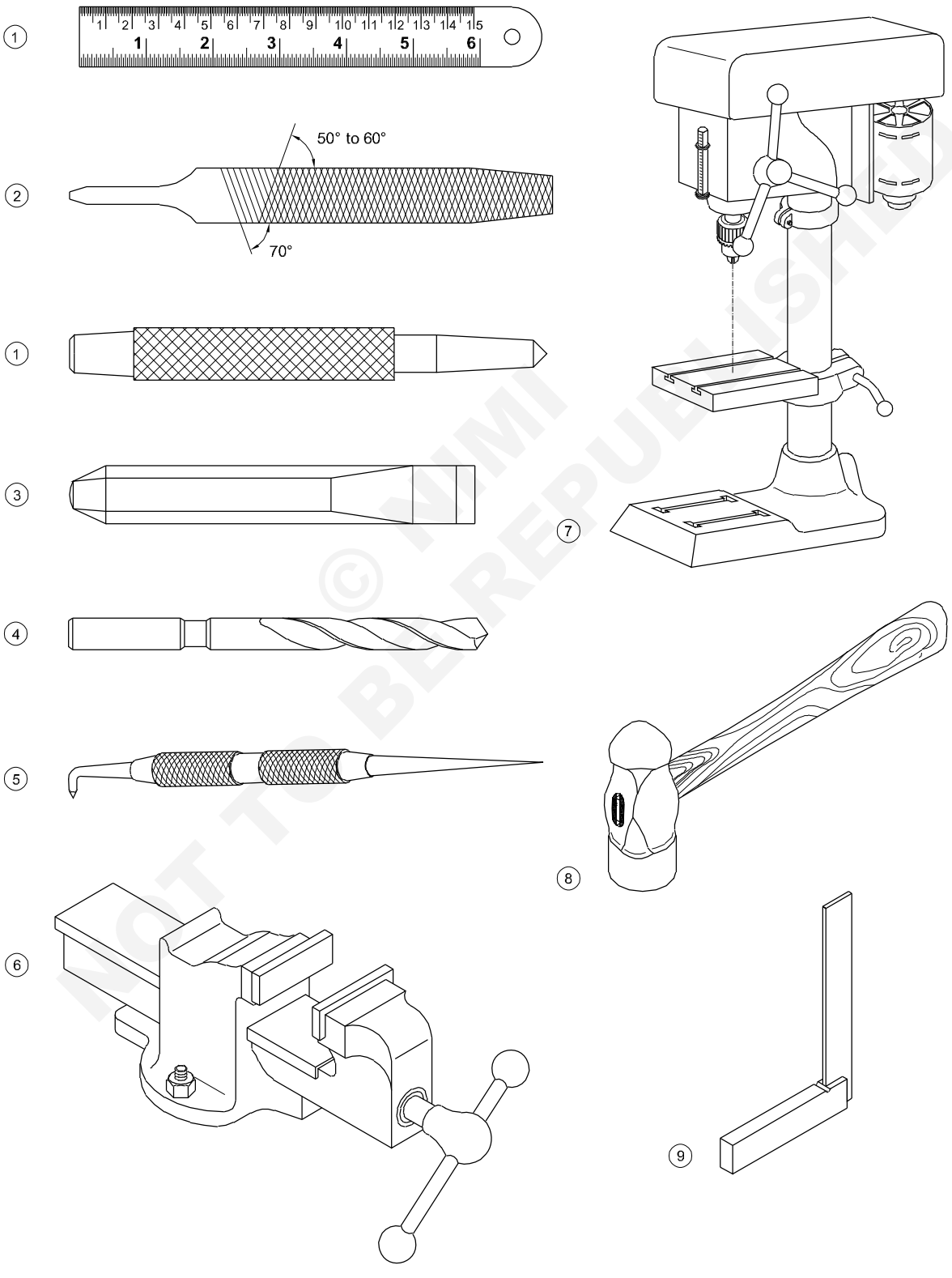
Table 1

Fig. No.	Description	Record precautions to be followed while working in fitting job
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

- Fill up and get it checked by your instructor.

Safe use of tools and equipments used in the trade

Objective: At the end of this exercise, you shall be able to
- **record the safety points while using the fitter trade tool and equipments.**



FI20N1110H1

Job Sequence

The instructor shall emphasise the students about the safe use of tools and equipments used in trade and guide them to record the safety points

- Record the precautions to be followed while working in fitting job in Table 1

Table 1

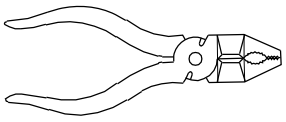
Fig. No.	Description	Record precautions to be followed while working in fitting job
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

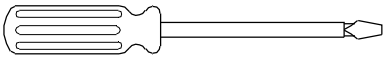
- Fill up and get it checked by your instructor.

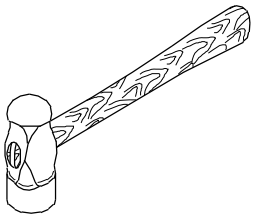
Identification of tools and equipments

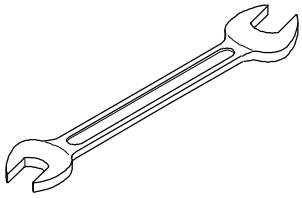
Objectives : At the end of this exercise you shall be able to
- **identify and name the hand tools**
- **identify and name the fitting tools**
- **identify and name the measuring tools.**

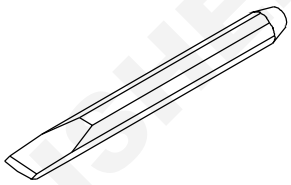
TASK : 1

(1) 

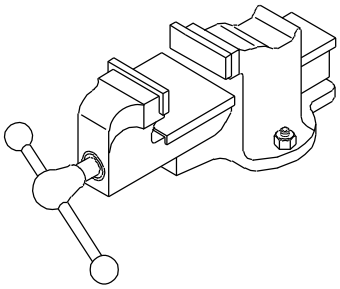
(2) 

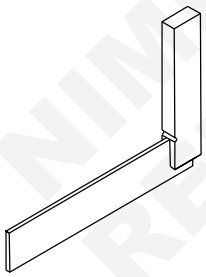
(3) 

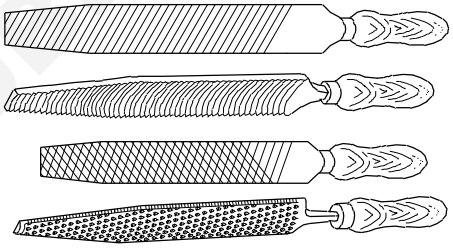
(4) 

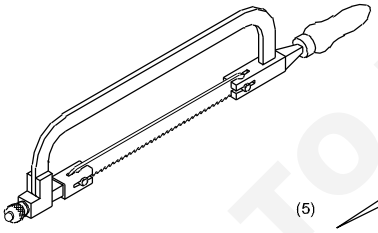
(5) 

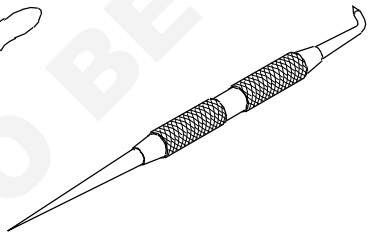
TASK : 2

(1) 

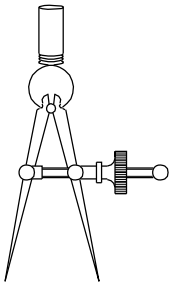
(2) 

(3) 

(4) 

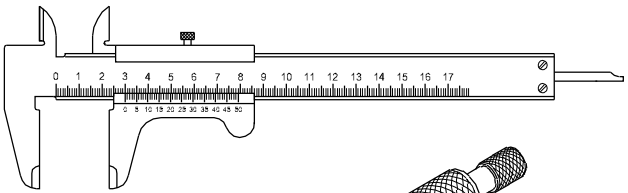
(5) 

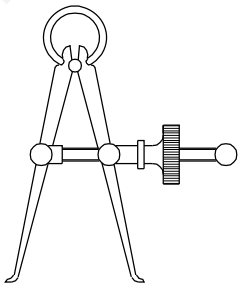
(6) 

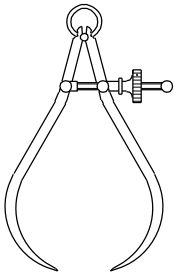
(7) 

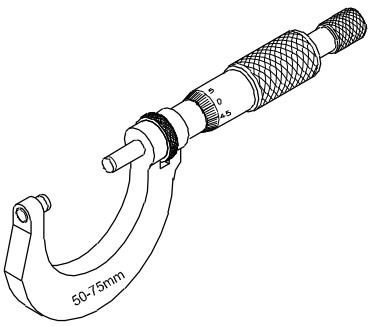
TASK : 3

(1) 

(2) 

(3) 

(4) 

(5) 

TU20N1211E1

Job Sequence

Instructor shall display all the tools and equipments in the section and brief their moves and marking condition of each tool and equipment

- Trainees will note down all the displayed tool names
- Record in Table 1.
- Get it checked by the instructor

Table 1

Sl.No.	Type of Tool	Name of the tool	Use of tool
TASK : 1 **Identification of hand tools**			
1			
2			
3			
4			
5			
TASK : 2 **Identification of fitting tools**			
1			
2			
3			
4			
5			
6			
7			
TASK : 3 **Identification of measuring tools**			
1			
2			
3			
4			
5			

Visual inspection of raw material for rusting, scaling, corrosion etc.

Objectives : At the end of this exercise you shall be able to
- **visual inspection of raw material for rusting**
- **identify scaling and corrosion parts.**

Fig 1 RUSTED COMPONENTS

Fig 2 CORRODED GEARS

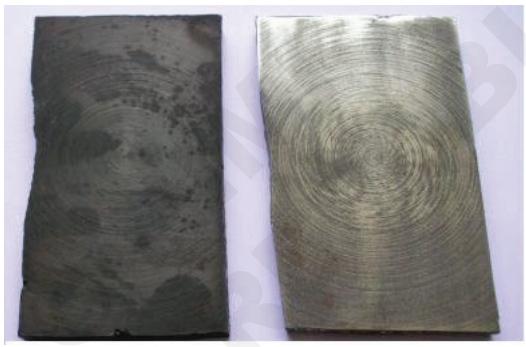


Fig 3 SCALED PART

Job sequence

Instructor shall arrange to display various section of raw material with rusting, scaling and corroded conditions.

- Observe the given raw material.
- Identify the formation of materials for rusting, corrosion and scaling.
- Record the appearance of the defects in Table1. Get it checked by the instructor.

Table 1

Sl. No	Defects on raw material	Brief the Appearance
1	Scaling	
2	Corrosion	
3	Rusted	

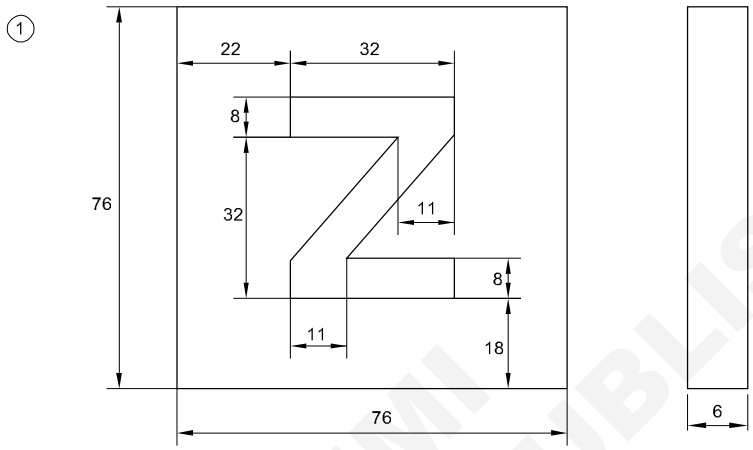
VISUAL INSPECTION OF RAW MATERIAL

Marking and sawing different materials and different sections

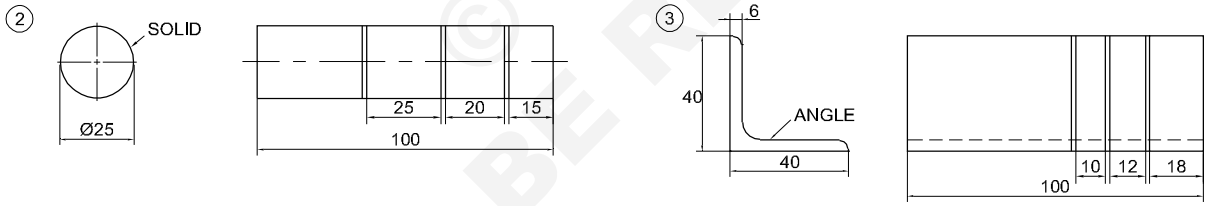
Objectives : At the end of this exercise you shall be able to

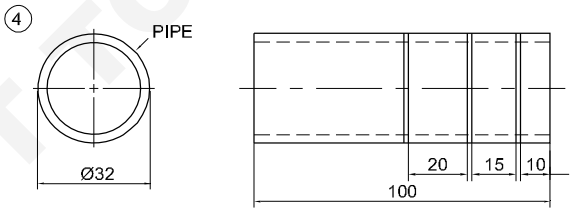
- **layout marking with steel rule and scriber**
- **punch the line using prick punch**
- **mark and cut piece on equal (angle section) round rod, L-angle and pipe.**
- **cut along the marked lines using hacksaw.**

TASK 1 :



TASK 2 :





1	②	Ø32 X 100		BRASS			
1	②	ISA 40 X 40 X 100		Fe 310			
1	②	Ø25 X 100		ALU-			
1	①	76 ISF 6X76	PRE-MACHINEST	Fe 310			1.2.13
NO.OFF	TASK	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1		**MARKING AND SAWING OF DIFFERENT MATERIAL**				DEVIATIONS ± 0.5	TIME
						CODE NO. TU20N1213E1	

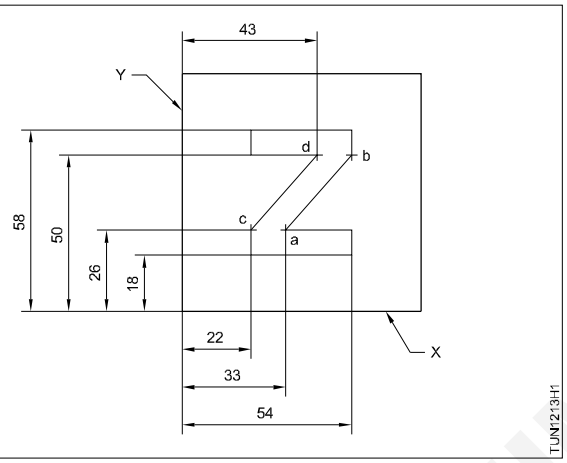
Job sequence

TASK 1 : **Layout marking**

Marking

- Check the raw material for its size and its squareness.
- Apply prussian blue on one side of the job end and allow it to dry.
- Scribe parallel lines to the edges 'x' and 'y' using a surface gauge.
- Draw the horizontal and vertical lines as per drawing. (Fig 1)

Fig 1



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

- Scribe two lines by joining points 'ab' and 'cd' using a steel rule and scriber. (Fig 2)
- Punch witness marks and complete 'Z'.
- Place the dot-punch in position; while doing so, rest your hand on the workpiece. (Fig 3)
- Set the dot-punch upright.
- The dot-punch is struck with the hammer; the blow must be delivered in the direction of the dot-punch axis. (Fig 4)

Fig 2

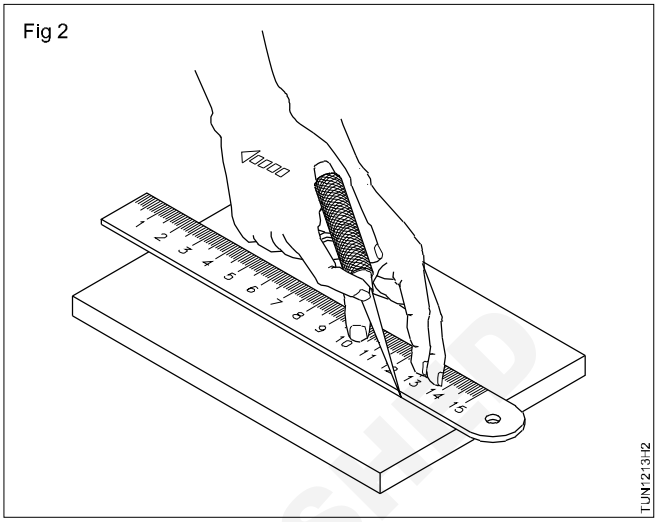


Fig 3

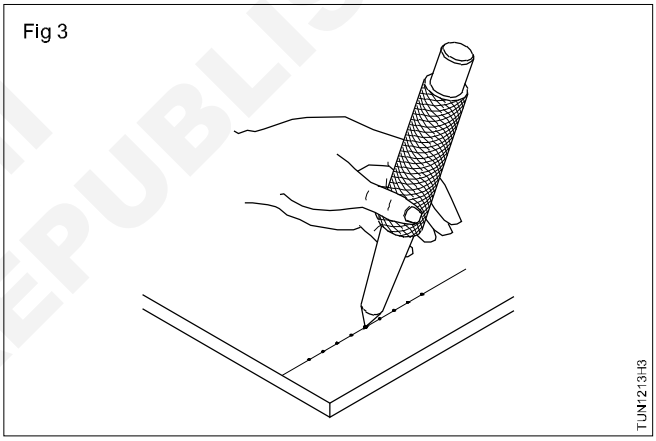
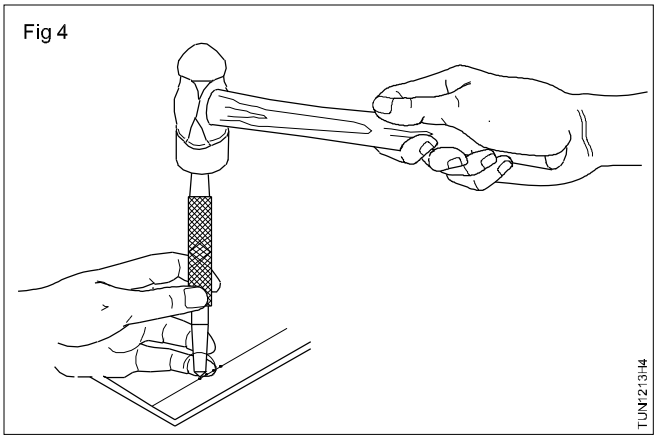


Fig 4



TASK 2 : **Hacksawing different material**

- Check the material to size.
- File and remove the burrs from the edges.
- Apply marking media only where marking is required.
- Mark the cutting line by a scribing block and a steel rule.
- Secure the job in the vice.
- Select the blade of correct pitch and fix the blade to the hacksaw frame.
- Select coarse pitch blade for solid metal and fine pitch blade for conduit tubes pipes and thin metal sections.

- Turn and change the position of pipe while sawing.

Caution : Avoid over tightening the pipe in the vice which may cause deformation.

Do not cut too fast.

Cut very slowly and reduce pressure while cutting through.

— — — — — — — —

Skill Sequence

Hack sawing (Holding-pitch selection)

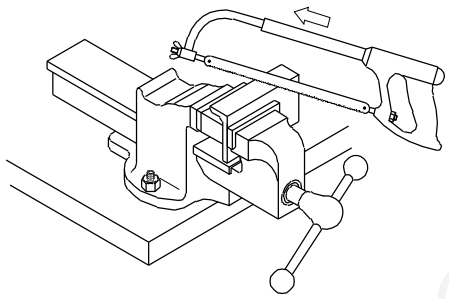
Objectives : This shall help you to
- **select blades for different metal sections**
- **hold different sections of workpieces for hacksawing.**

Holding the Workpiece

Position the metal to be cut according to the cross-section for hacksawing.

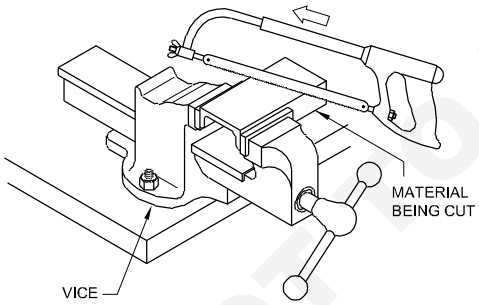
As far as possible the job is held so as to be cut on the flat side rather than the edge or the corner. This reduces the blades breakages. (Figs 1,2 and 3)

Fig 1



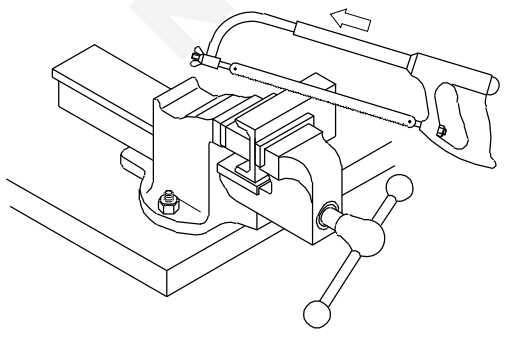
TUN1213J1

Fig 2



TUN1213J2

Fig 3



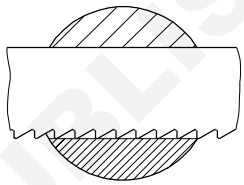
TUN1213J3

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

Pitch Selection

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

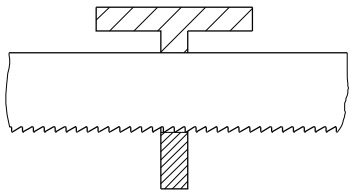
Fig 4



TUN1213J4

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

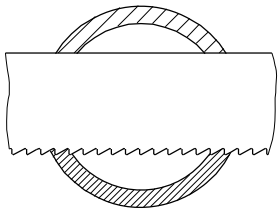
Fig 5



TUN1213J4

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

Fig 6



TUN1213J6

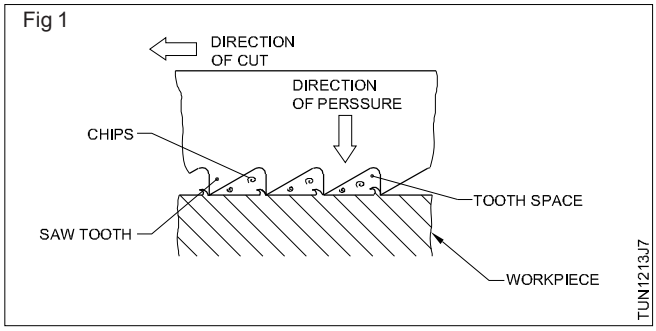
Fixing of Hacksaw

Objectives : This shall help you to
- **fix hacksaw blades maintaining correct tension and direction**
- **cut metal pieces with a hacksaw.**

Fixing of Hacksaw Blades

The teeth of the hacksaw blade should point in the direction of the cut and away from the handle. (Fig 1)

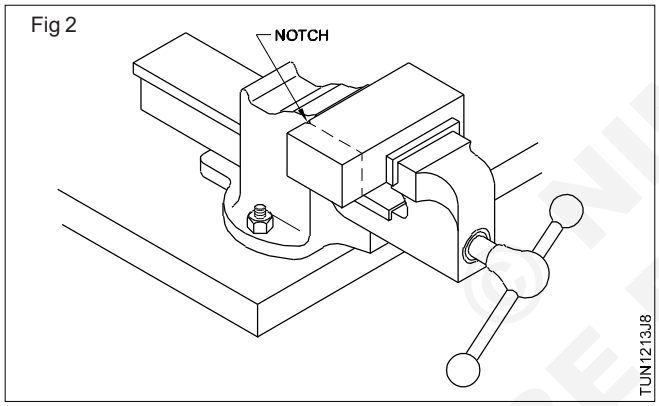
Fig 1



The blades should be held straight, and correctly tensioned before starting.

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

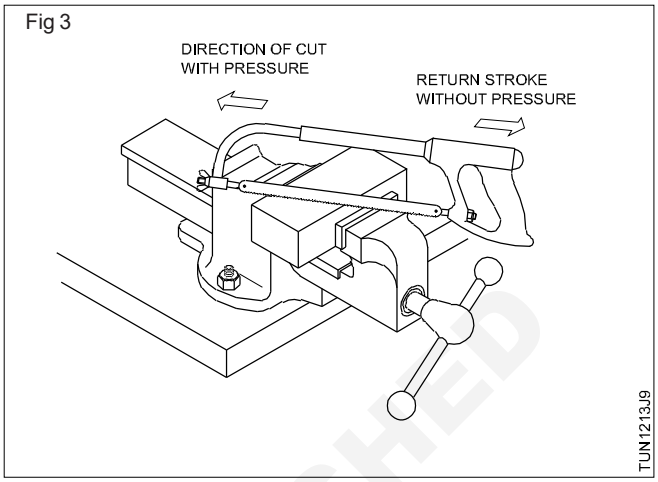
Fig 2



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

Apply pressure only during the forward stroke. (Fig 3)

Fig 3

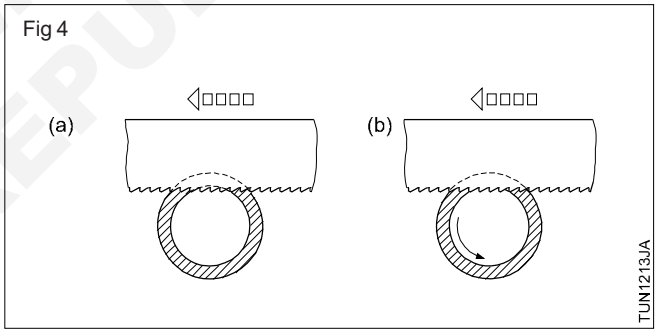


Atleast two to three teeth should be in contact with the work while cutting. Select a fine pitch blade for thin work. (Fig 4)

Turn and change the position of the pipe while hacksawing.

Normally, a coolant is not necessary while hacksawing.

Fig 4

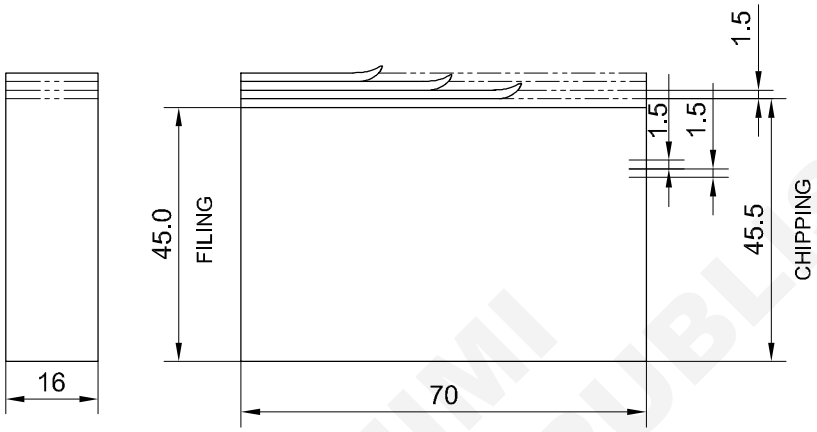


Do not move the blade too fast. While finishing a cut, slow down to avoid breakage of the blade and injury to yourself and others.

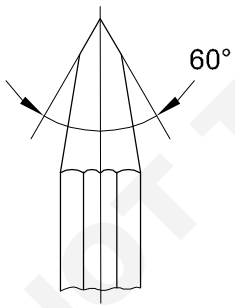
Practice on hammering, chipping and chisel grinding

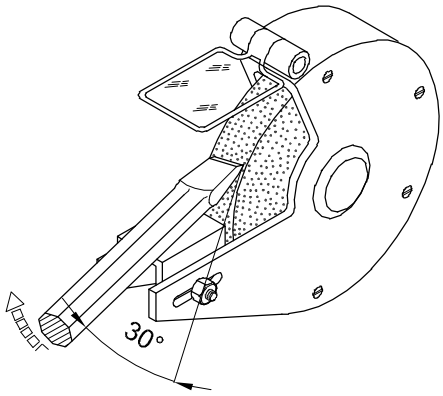
Objectives : At the end of this exercise you shall be able to
- **chip the surface evenly using a flat chisel with in ±1mm**
- **re-sharp the chisel when it becomes blunt.**

TASK-1



TASK-2





-		CHISEL	-	-	-	
-	50 ISF 16x70	-	-	-	-	1.2.14
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	**PRACTICE ON HAMMERING CHIPPING & CHISEL GRINDING**				DEVIATION :	TIME
					CODE NO. TU20N1214E1	

Job sequence

TASK 1: **Chipping practice**

- Apply marking media and mark the depth of metal to be removed by chipping. Punch the marked line with a dot punch.
- Hold the job firmly in the vice.
- Support with job with wooden block while chipping.

If necessary give a wooden support below the work piece so that the marked line should be above the vice jaw face.

- Select a flat chisel 20mm width with a proper cutting edge.
- Select a ball peen hammer with required weight.
- Hold chisel at approximately at 35° angle of inclination in chipping position.
- Hold the hammer at the end of the handle to get more leverage.

Caution : Chisel should be free of mushroom head.

Hammer handle should be securely fixed with eye hole with a wedge.

Use goggles while chipping.

Use a chipping guard behind the vice to arrest the flying chips.

— — — — — — —

TASK 2: **Chisel grinding**

- Check the grinding machine and check whether safety guards are properly fitted.
- Switch on the grinding machine.
- Rest the body of the chisel on the tool rest.

The body of the chisel must be at an angle of 30° in such a way as to get 60°.

- Give the minimum pressure to create the cutting point.
- Check angle with help of bevel protractor.

Ensure that there is enough coolant in the container.

— — — — — — —

Skill Sequence

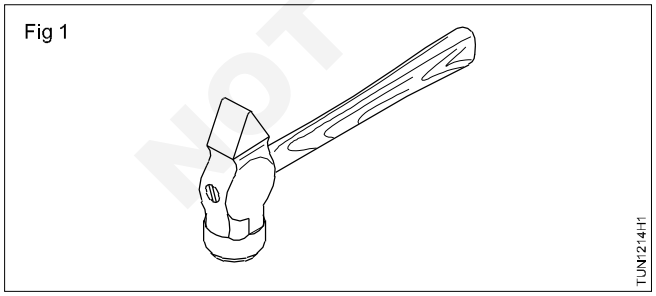
Hints on chipping

Objective : This shall help you to
- **observe safe practices while chipping.**

Before commencing the chipping operation we must ensure the following.

The hammer-head must be properly secured. (Fig 1)

Fig 1



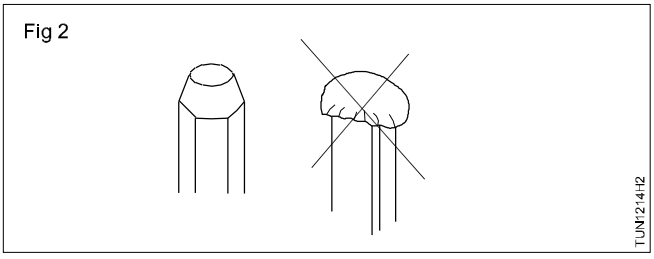
Wipe off oily substances, if any, from the face of the hammer.

The chisel head must be free from mushroom formation. (Fig 2)

Wear safety goggles.

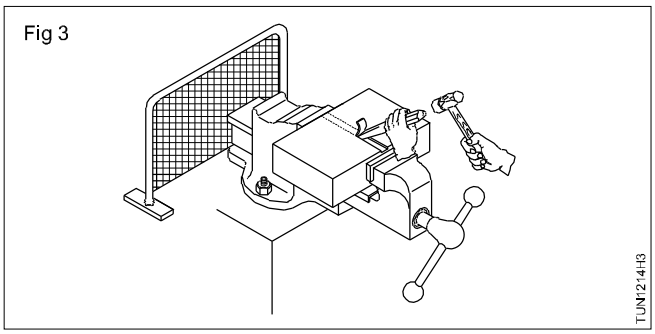
Remove bangles and wrist watches.

Fig 2



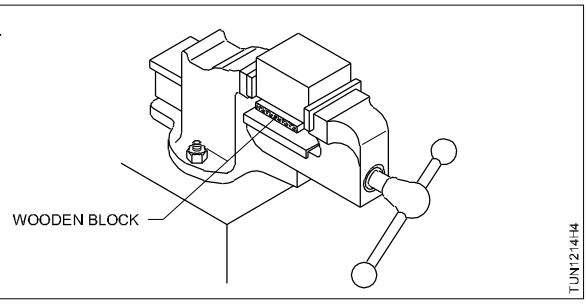
Install chip- guard against chips flying off. (Fig 3)

Fig 3



The work must be properly gripped in the vice. If necessary, support the work on the wooden block. (Fig 4)

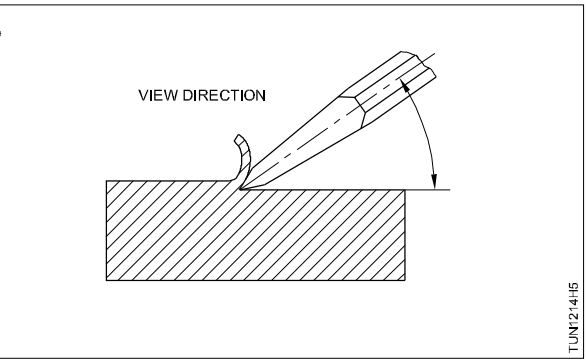
Fig 4



While chipping look at the cutting edge of the chisel, and not at the head of the chisel. (Fig 5)

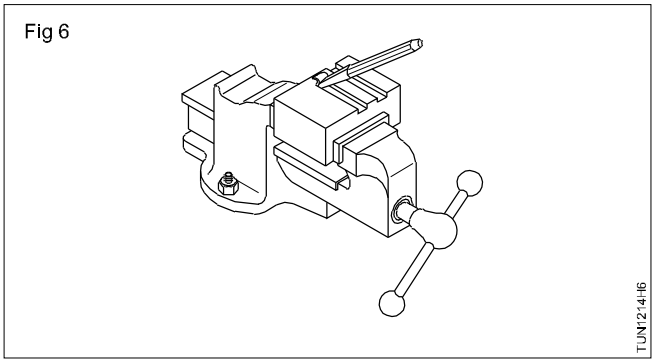
Position the chisel in such a way as to cut the metal in uniform thickness. (Fig 5)

Fig 5



Stop chipping before the end of the surface; otherwise, the edge of the job will break off. (Fig 6)

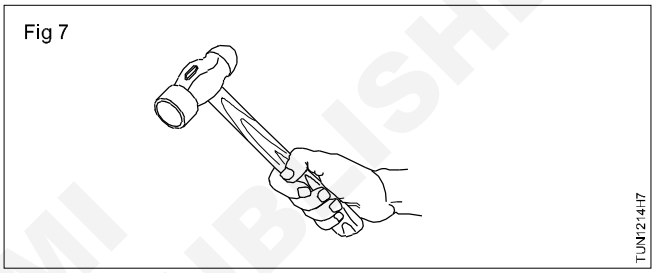
Fig 6



To prevent this, chip the end of the job from the opposite direction.

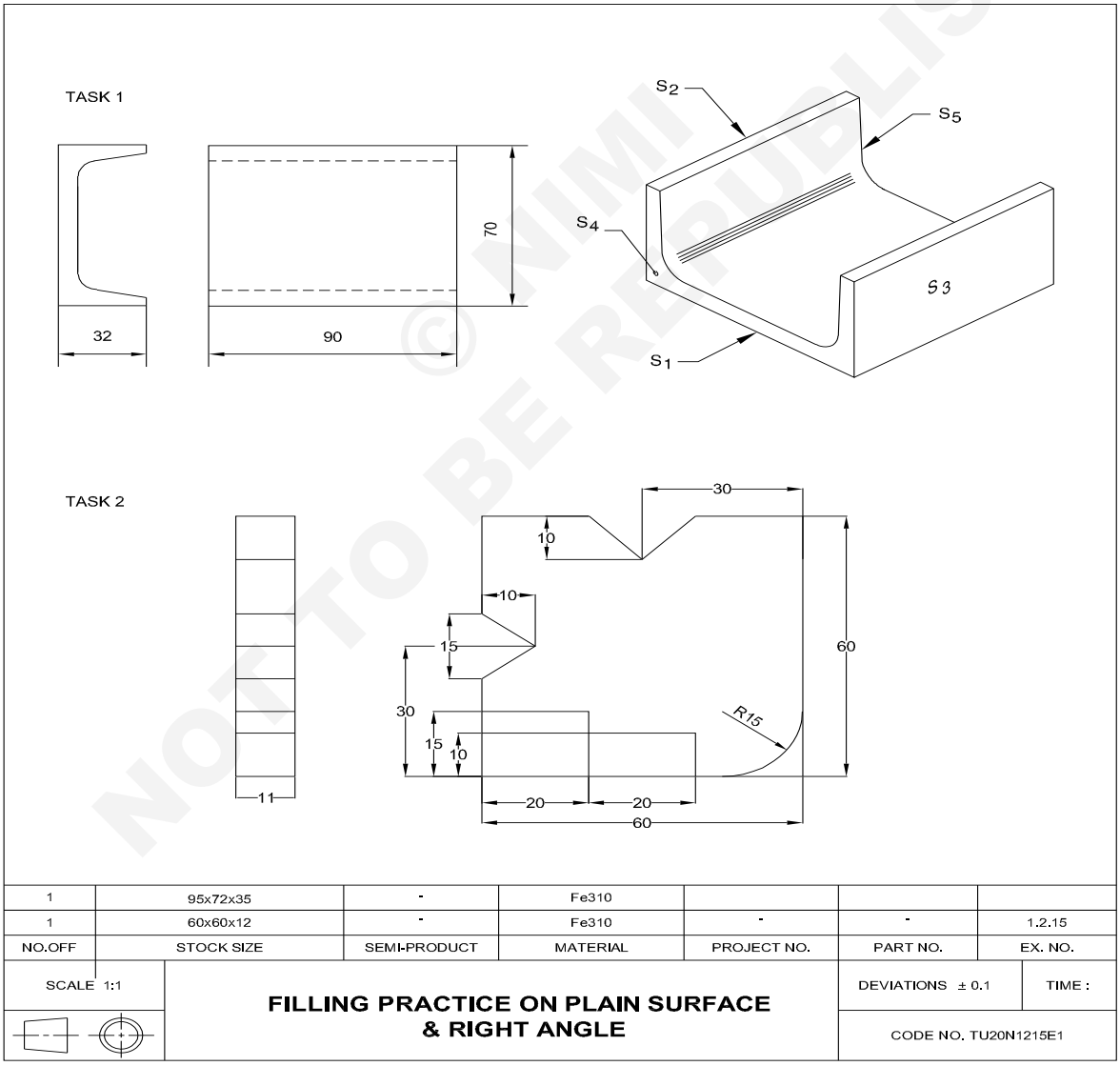
Hold the hammer at the end of the handle for maximum leverage. (Fig 7)

Fig 7



Filing practice on plain surface and at right angle

Objectives : At the end of this exercise you shall be able to
- **file flat surface**
- **file adjacent side at right angles**
- **check the flatness and squareness.**



1	95x72x35	-	Fe310			
1	60x60x12	-	Fe310	-	-	1.2.15
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	FILLING PRACTICE ON PLAIN SURFACE & RIGHT ANGLE				DEVIATIONS ± 0.1	TIME :
					CODE NO. TU20N1215E1	

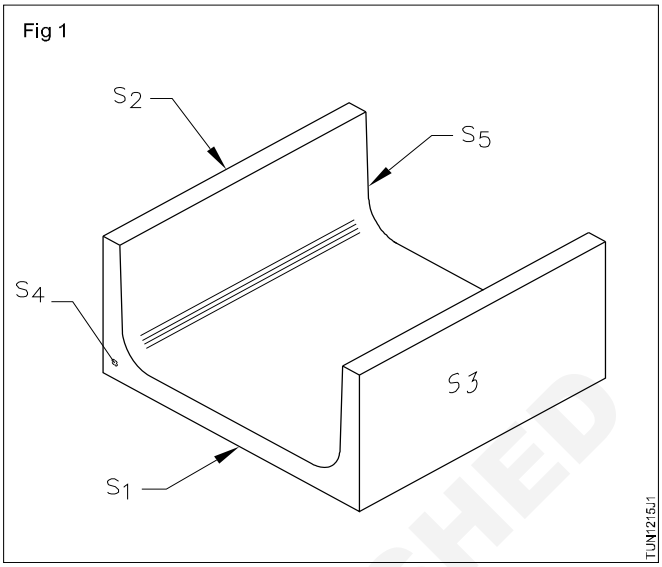
Job sequence

TASK : 1 **Filing practice - Channel section**

- Check the material size as per drawing.
- Remove the burrs if any
- Hold the job in the vice in such a way that the channel section does not get distorted.
- File the edges S4 square with the sides S1 and S3. (Fig1)

  Mark 90mm length keeping S4 as the base and punch the marked line.
- File the excess length by a rough file or a bastard file and finish it to the size (90mm given in the drawing).
- File the surface S2 square with the surface S1 and finish it to the given size. (90 x 72 x 35)
- Check the right angle in all corners.
- Check the raw material for its size as per drawing.
- Remove the burrs if any.

Fig 1



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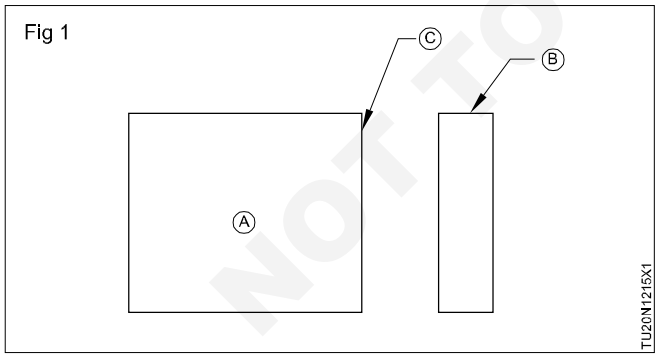
TASK : 2 **Filing practice**

- Check the raw material size using steel rule.
- Remove the scaling by flat rough file.
- File side (A) with flat bastard file (Fig 1)
- Check the flatness by blade of a try square.
- File side (B) and maintain the squareness with respect to side (A).

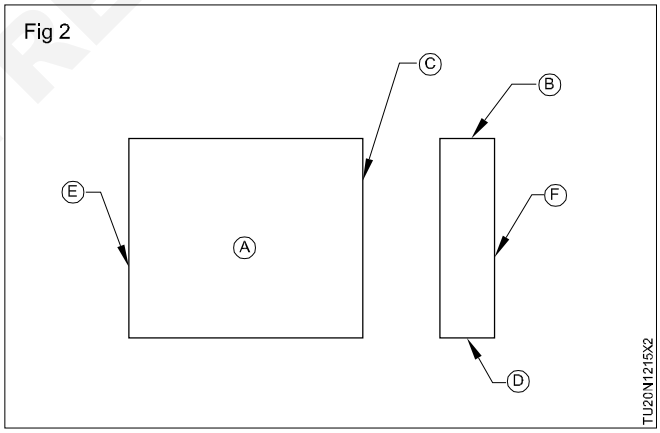
The sides A,B and C are mutually perpendicular to each other (Fig 1)

Fig 1



- Set jenny caliper to 74mm using steel rule.
- Draw parallel lines of 74mm to side (B) and (C).
- Punch the marked line using dot punch and ball peen hammer.
- Set and file sides (D) and (E) to 74mm and maintain squareness to all other sides.
- Maintain (D) and (E) parallel to side (B) and (C) (Fig 2)

Fig 2



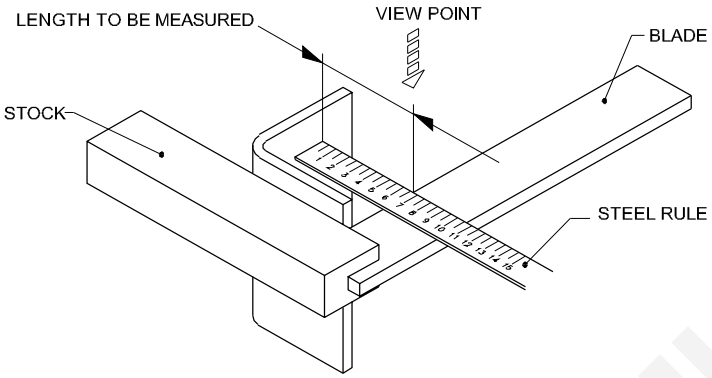
- Check the dimensions with a steel rule and squareness with a try square.
- File surface (F) and maintain the thickness of 9mm parallelism to side A.
- Remove sharp edges. Apply little amount of oil and preserve it foe evaluation.

— — — — — — —

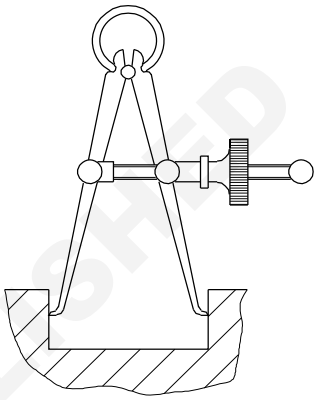
Use of calipers and scale measurement

Objectives: At the end of this exercise you shall be able to
- **check the dimension with a steel rule**
- **check the external dimensions with outside caliper**
- **check the inside dimensions with inside caliper**
- **check the depth of angle using try square and steel rule.**

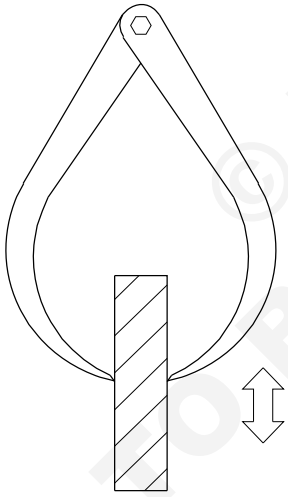
TASK 1



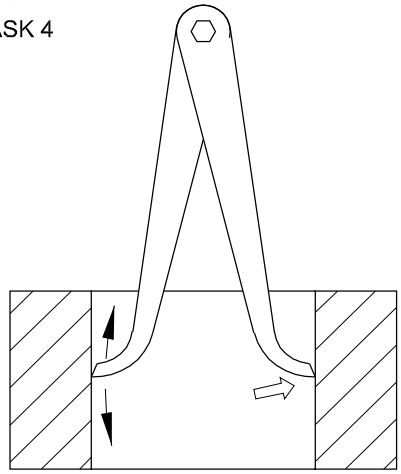
TASK 3



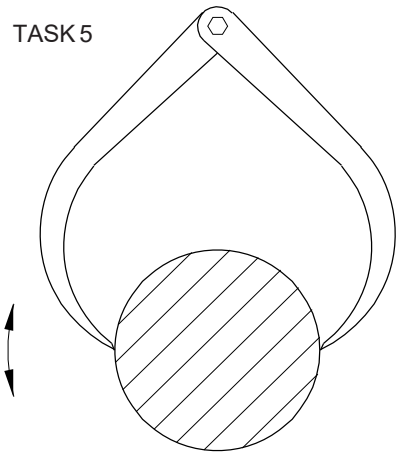
TASK 2



TASK 4



TASK 5



TU20N1216E1

Job sequence

TASK 1 : Measurement by steel rule

- Clean the work piece and the steel rule.
- Measure the sizes of given work pieces and record it.
- Get it verified by the trainer.

— — — — — — —

TASK 2 to 5 : Measurement by calipers

- Clean the work piece.
- Select the appropriate caliper clean and check the measuring points.
- Measure the give work piece and record it.
- Get it verified by the trainer.

— — — — — — —

Table -1

Sl. No	Measuring Instrument	Reading Area	Measurement
1	Steel rule	Length	
2	Outside calipers	Outer dia	
3	Inside calipers	Inner dia	

Skill sequence

Measuring with inside and outside calipers

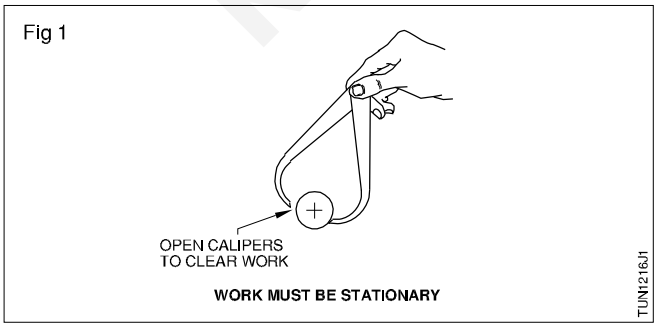
Objectives: This shall help to
- **select the right capacity caliper for measurement**
- **set the sizes both in firm joint and spring calipers**
- **read the sizes by transferring them to a steel rule or other precision measuring devices as the case may be.**

Outside calipers: Select a caliper based on the diameter to be measured.

A 150 mm capacity outside caliper is able to measure sizes from 0-150 mm.

Open out the jaws of the calipers until they pass clearly over the diameter to be measured. The work must be stationary when measuring the sizes. (Fig 1)

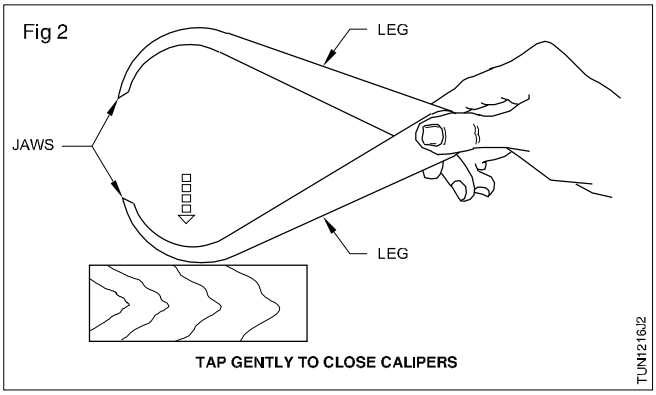
Fig 1



Place one point of the leg over the workpiece and get the sense of feel of the other point of the leg.

If there is clearance on the other point of the leg, gently tap the back of one leg of the firm joint calipers on a wooden piece until it just slips from the external diameter of the workpiece to give the right sense of 'feel'. (Fig 2)

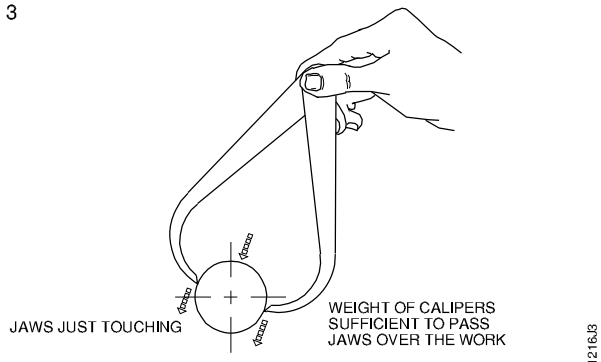
Fig 2



Because the accuracy of reading depends mainly upon the sense of feel of the user, high care should be exercised to get the correct `feel'.

In the case of spring outside calipers, adjust the screw nut so that the adjustment of the jaws just slips from the external diameter of the workpiece to give the right sense of feel. (Fig 3)

Fig 3

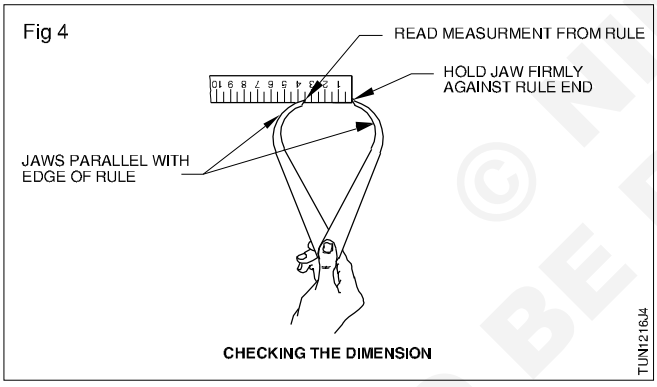


OBTAINING THE 'FEEL'

When you have adjusted the outside caliper for the correct 'feel' transfer the measurement to a steel rule or any other precision measuring instrument as the case may be.

Keep the graduated steel rule on a flat surface and hold the point of one jaw firmly against the rule end. (Fig 4)

Fig 4



CHECKING THE DIMENSION

The point of one jaw must be placed over the graduation so that the point of the other jaw is parallel with the edge of the steel rule.

Record the reading to an accuracy of ±0.5 mm.

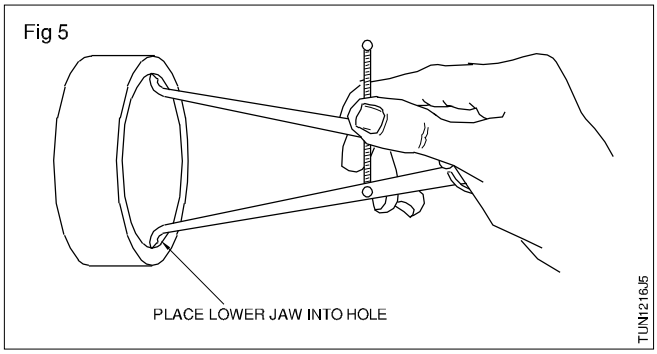
In the case of precision measurements, transfer the measurements over an inside micrometer or vernier caliper. This measurement will give an accuracy of ± 0.01 or ± 0.02 mm. Here, the sense of feel of the user is very important in deciding the reading.

Inside caliper: Open out the jaws slightly less than the size to be measured.

Hold the caliper lightly in one hand with your thumb and first finger on the adjusting screws.

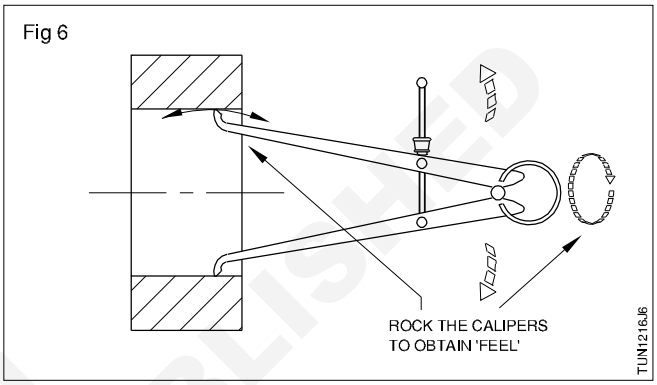
The point of one jaw should sit against the surface being measured. Support the weight of the caliper with the middle or third finger. (Fig 5)

Fig 5



Open out the other jaw and until you get the sense of 'feel' by rocking the other measurable surface. (Fig 6)

Fig 6



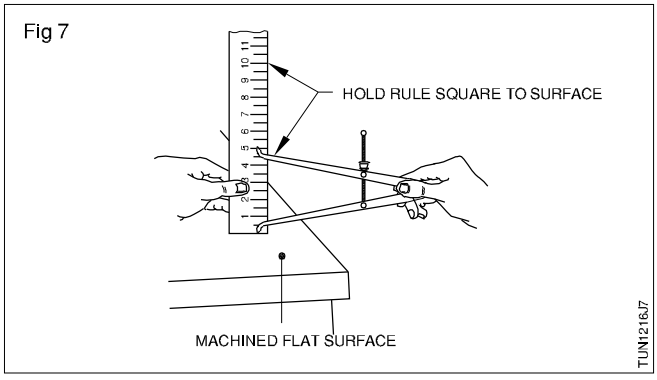
When a satisfactory sense of 'feel' is felt, transfer the measurement over a steel rule or precision measuring instrument as the case may be.

Hold the steel rule square on the machined flat surface.

Place one measuring jaw near the steel rule edge so that the point firmly touches the flat machined surface.

Keep the other measuring jaw parallel to the edge of the steel rule. (Fig 7)

Fig 7



Read the graduation to an accuracy of ± 0.5 mm.

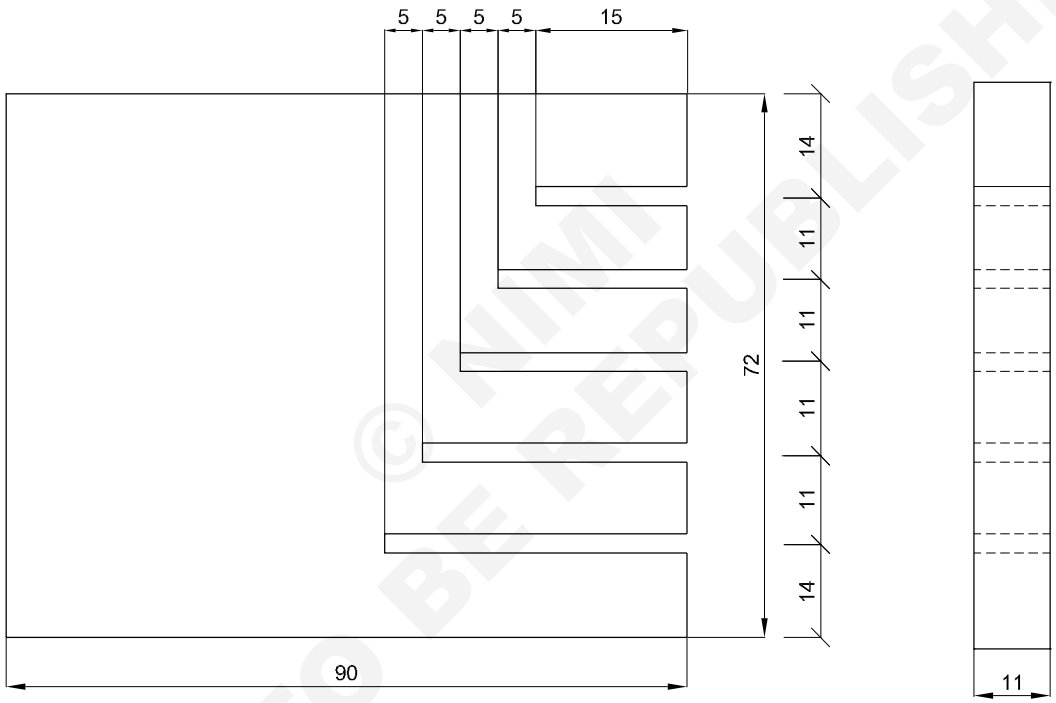
While transferring the measurement over to outside micrometer or universal vernier caliper, hold the caliper in the left hand, and the micrometer or the vernier caliper in the right hand.

Place one measuring jaw over the anvil surface and close the spindle over the other measuring jaw of the other leg.

Filing right angle, marking and hacksawing

Objectives : At the end of this exercise you shall be able to
- **file a true flat surface**
- **file a adjacent side at right angles**
- **mark and punch as per drawing**
- **hacksaw the punched metal.**

TASK -1



1	95x75x12	-	Fe310	-	-	1.2.17
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

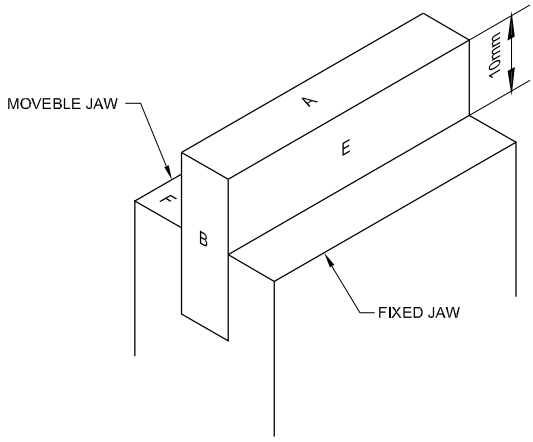
SCALE 1:1	FILING RIGHT ANGLE, MARKING & HACK SAWING	DEVIATIONS ± 0.1	TIME
		CODE NO. TU20N1217E1	

Job sequence

- Check the material size using steel rule. Hold the job firmly in the bench vice. The top surface (A) of the job should be approximately 10mm above the level of the vice jaws. (Fig 1)

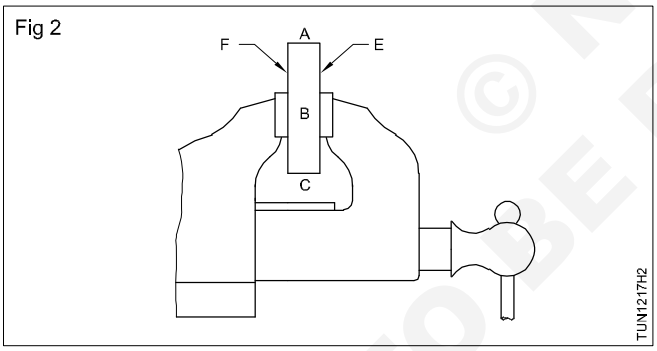
Select a bastard file for rough filing and a second cut file for finish filing.

Fig 1



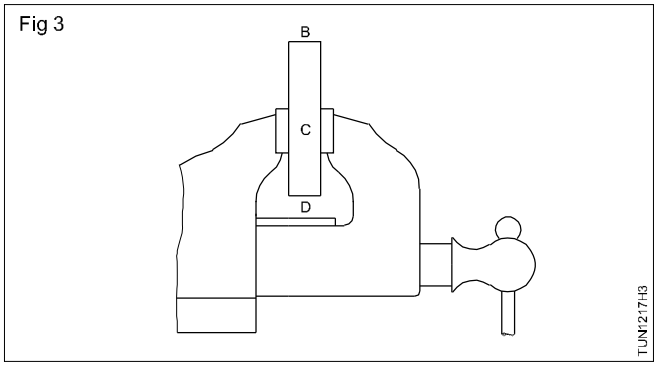
- For reference side 'A' by the use of a flat bastard and a second cut file. (Fig 2)

Fig 2



- Check the flatness and squareness with the help of try squares.
- File 'B' and 'C' sides with a bastard and a second cut file maintaining the dimension between A & C as 72mm. (Fig 3)

Fig 3



- Check the flatness and squareness with the help of try squares.
- File the side 'D' with the help of bastard and second cut file maintaining dimension as 90mm between 'B' and 'D' sides.

Do not over - tighten the work piece.

- File and finish the other two sides 'E' and 'F' to size and check the flatness and squareness with the try square.
- Check the dimensions using steel rule.

Use soft jaws and protect the finish filed surface while holding.

Working steps

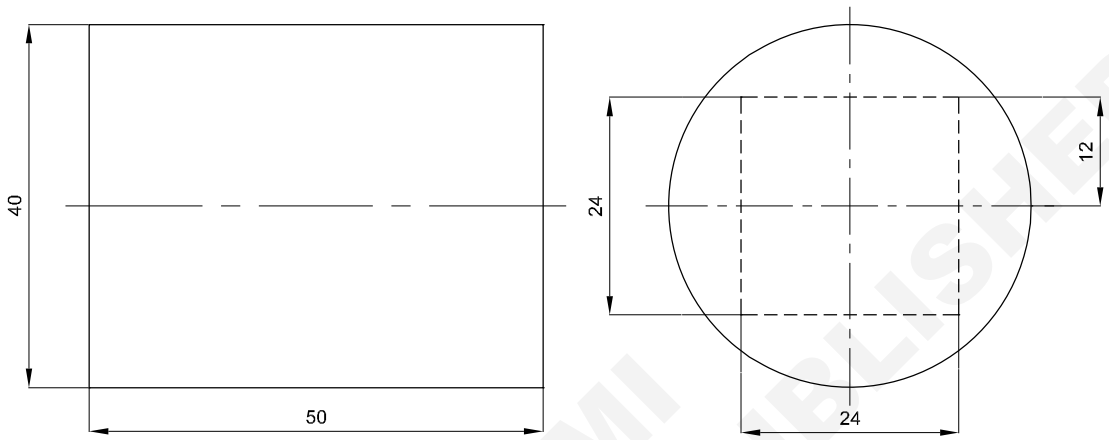
- Mark off lines for hacksawing using a scribing block.
- Fix hacksaw blade with frame.
- Select the correct pitch of blade.
- Fix job on the vice and make a notch on the line to start the cut.
- Hacksaw along line.
- Apply pressure only on the forward stroke.
- Reduce speed and pressure during completion stage of the cut, just before the pieces separate.
- Repeat the same procedure for the other cuts.
- Ensure the sawing is not getting staggered.
- Do not allow the saw to slip off to the side during commencement of the cut.

Marking on flat and round jobs

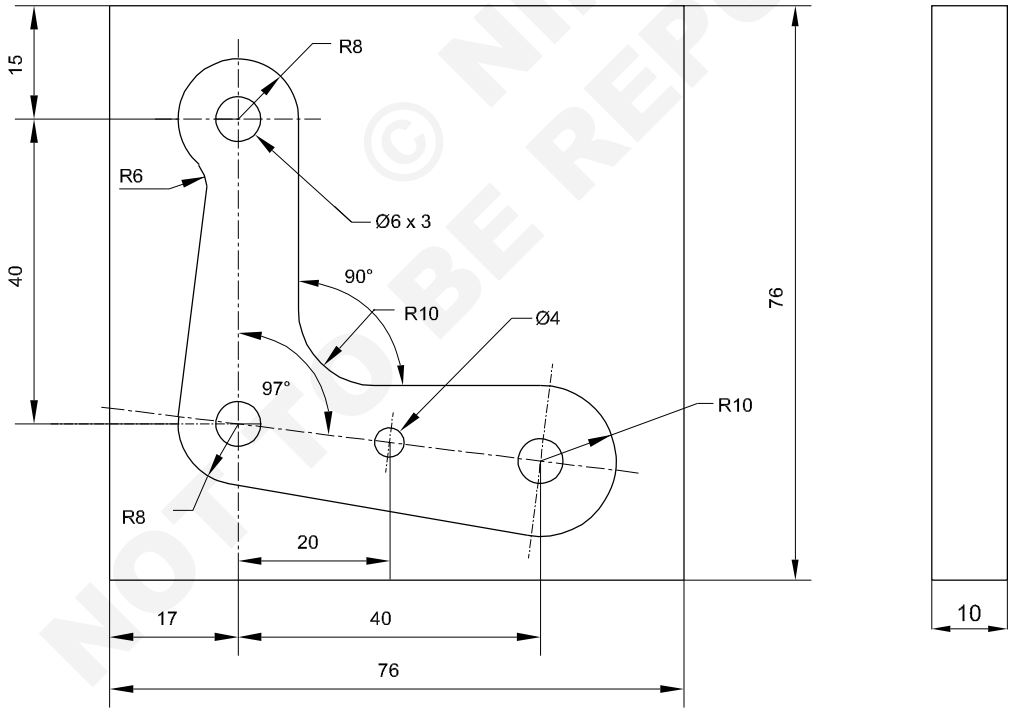
Objectives: At the end of this exercise you shall be able to

- **mark angles with a bevel protractor and scriber**
- **bisect the angles with a divider**
- **register the profile by dot punching**
- **punch the centre of the circle with a centre punch and ball - peen hammer**
- **re-sharpen a blunt centre punch/dot punch.**

TASK-1



TASK-2



1	Ø 40x50	PRE-MACHINED				
1	76 ISF 10x76	PRE-MACHINED	Fe310	-	-	1.2.18
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	**MARKING ON FLAT AND ROUND JOB**	DEVIATIONS ± 0.1	TIME :
		CODE NO. TU20N1218E1	

Job Sequence

TASK 1 : Marking I

- Check the raw material for its size.
- Apply marking media on one side of the job and allow it to dry.
- Place the round rod on 'V' block.
- Scribe the centre line of the round rod.
- Rotate the round rod and set to vertical position of scribing line with help of try square and mark centre point.
- Scribe the horizontal line away 12mm from centre point.
- In the same way to mark other three sides.
- Punch witness mark of four sides of marking line.

TASK 2: **Marking tangents & arcs**

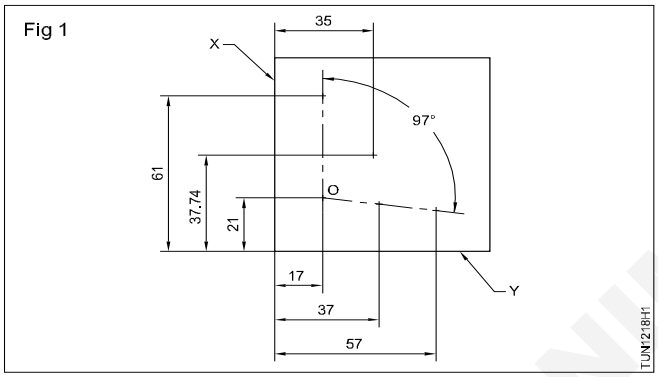
Step 1

- Check the material for its size and its squareness
- Apply marking media on one face of the job.

Step 2

- Draw parallel lines of 17,35,37 and 57 from side 'X' (Fig 1).

Fig 1



- Mark parallel lines of 23,39.74 and 63mm from side 'Y' (Fig 1).
- Set 97° on the bevel protractor
- Mark 97° line through point 'O' and set the centres of other two circle
- Punch centre marks on all four circles

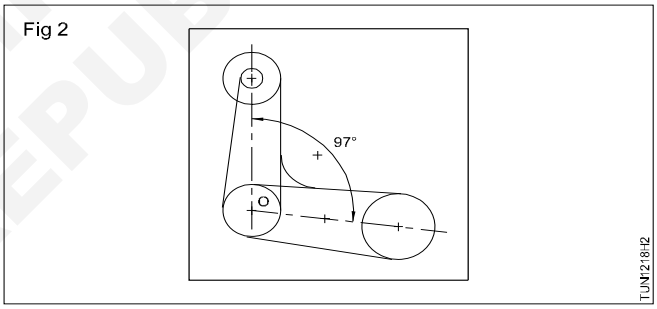
Step 3 (Fig 2)

- Draw Ø6 mm circle at 'a','o','c' and Ø4 mm circle at 'b'.

Step 4 (Fig 2)

- Draw an arc, R8 mm from the centre 'a' and 'o'
- Draw an arc, R10 mm from the centre 'c'.
- Draw tangent lines to join X,Y and Z as shown in Fig 2.
- Draw the tangent lines from the arc drawn, the inter section of the tangent (e) is the centre for joining the tangent with arc.
- Draw R10 mm arc from the centre at point 'f' as shown in Fig 2
- Similarly, draw R6 mm arc at point 'd'

Fig 2



Skill Sequence

Measuring angles with bevel protractors

Objective: This shall help you to
- **measure angles with a bevel protractor.**

How to use a vernier bevel protractor?

The bevel protractor setting depends on the type of angle to be measured. It can be set in different ways for measuring and checking angles.

Before measuring, check and ensure that the measured surfaces (the blade and the stock of the protractor)

Clean the measuring faces of the protractor and the workplace.Use a soft clean cloth.

While measuring, loosen the scale locking screw.

Loosen the blade locking screw, adjust the blade to suit the workpiece, tighten the blade screw and place the protractor on the work surface.

Adjust the protractor so that the inner surface of the blade and the base are in contact with the workpiece.

How to set a bevel protractor is properly on a workpiece?

Make sure that the protractor is perpendicular to the surface being measured.

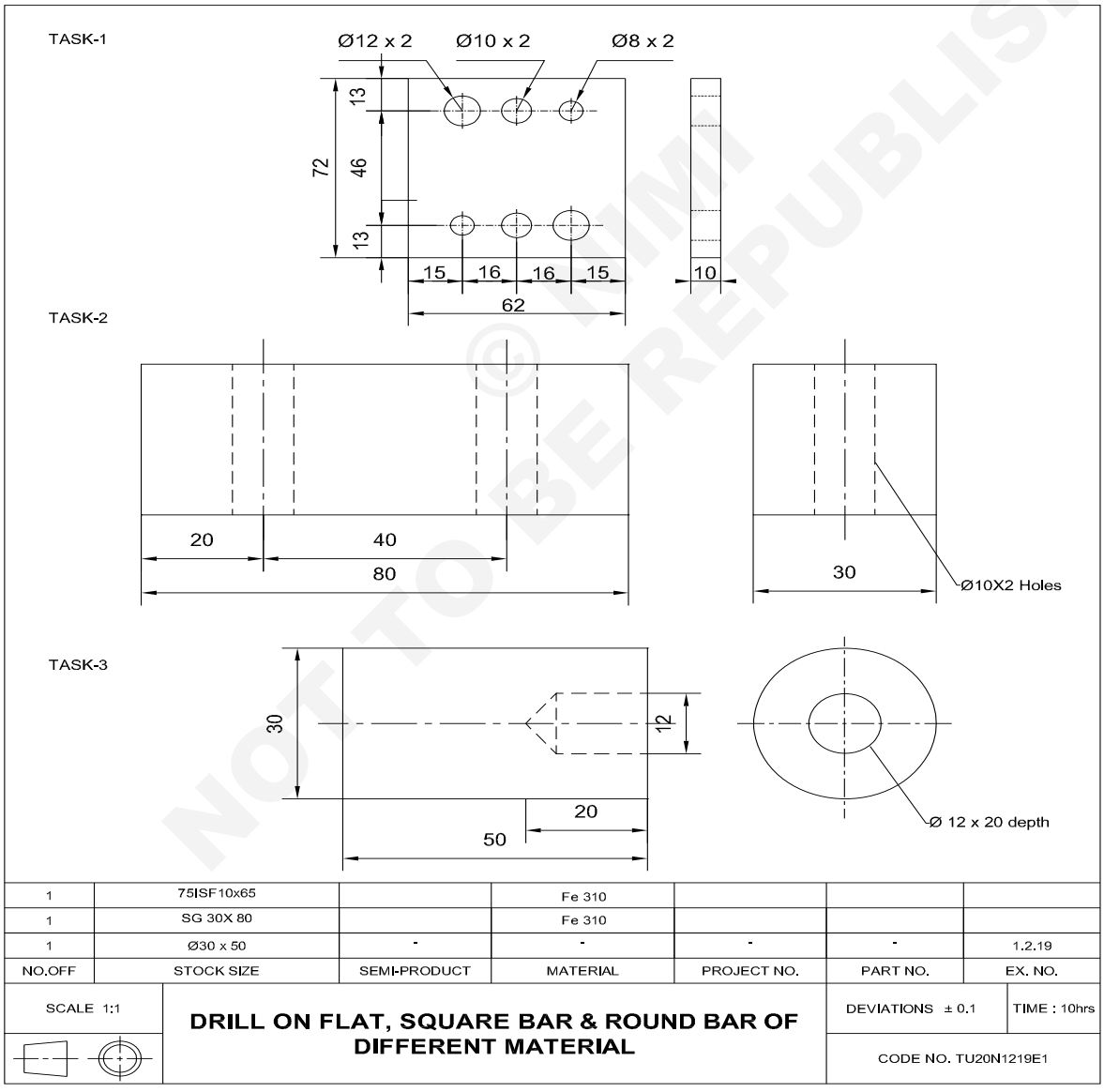
The protractor must be adjusted so that the blade and the base are in full contact with the surfaces being measured (There should be no gap between the blade, base and the workpiece surfaces).

When you have finished measuring, clean the protractor using a soft cloth, and put it back in its case.

Do not leave the protractor in a place from where it could fall, or, be otherwise damaged.

Drilling : Drill on flat, square bar and round bar of different material

Objectives : At the end of this exercise you shall be able to
- **mark the job as per drawing using surface gauge**
- **check the centre distance**
- **drill the different material.**



1	75ISF10x65		Fe 310			
1	SG 30X 80		Fe 310			
1	Ø30 x 50	-	-	-	-	1.2.19
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	DRILL ON FLAT, SQUARE BAR & ROUND BAR OF DIFFERENT MATERIAL	DEVIATIONS ± 0.1	TIME : 10hrs
		CODE NO. TU20N1219E1	

Job sequence

TASK 1

- Check the raw material size.
- File the job and finish the job as per dimension.
- Apply the chalk powder and allow it do dry.
- Mark and punch the holes centres with a centre punch and draw circles as per drawing.
- Fix the vice on the drilling machine table.
- Fix the job in the vice for drilling.
- Fix the drill chuck into the machine spindle.
- Fix centre drill in drill chuck
- Set spindle speed
- Make centre holes required locations
- Fix Ø8mm drill in the chuck rigidly.
- Set the spindle speed.
- Use a coolant and drill Ø8mm holes.
- In the same way continue drilling for the remaining holes.

Pilot hole drilling should be done for holes of Ø12 mm

- Deburr the edges of the holes with drills 3 to 5mm bigger in size than the hole sizes.

— — — — — — —

TASK 2

- Check the raw material size.
- File the job if any burr is there.
- Apply the chalk powder and allow it to dry.
- Mark and punch the hole centres with a centre punch and draw circles as per drawing.
- Fix the vice on the drilling machine table.
- Fi x the job in the vice for drilling.
- Fix the drill chuck into the machine spindle.
- Fix 10mm drill in the chuck rigidly.
- Set the spindle speed.
- Use a coolant and drill 10mm holes.
- In the same way continue drilling for the remaining holes.

Pilot hole drilling should be done for holes of Ø10 mm.

- Deburr the edges of the holes with drills 3 to 5mm bigger in size than the hole sizes.

— — — — — — —

TASK 3

- Check the raw material.
- File the job to correct length.
- Mark the centre line and the hole centre with surface gauge. (Figs 1 & 2)

Fig 1

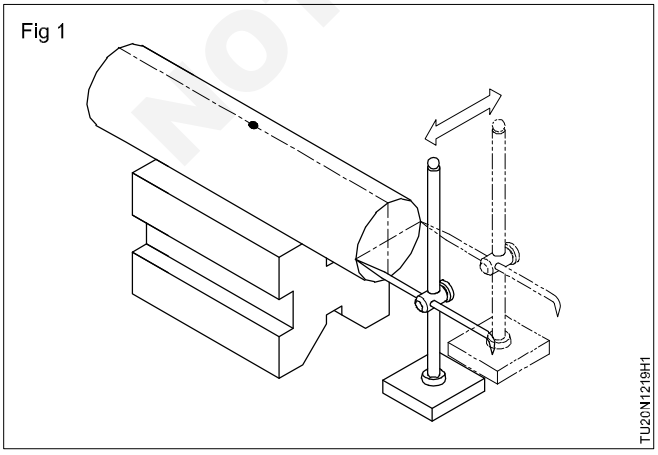
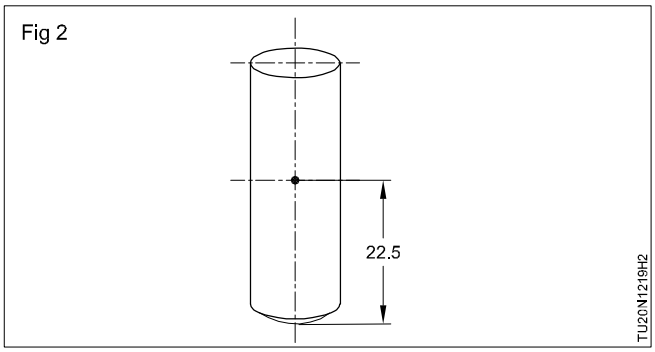
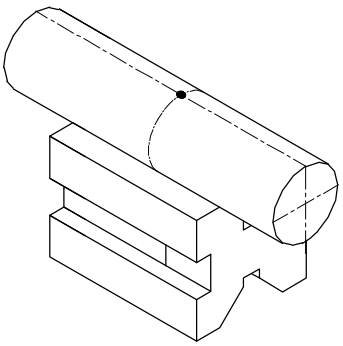


Fig 2



- Punch the centre point with centre punch.
- Hold the job in 'V' block and align the centre line. (Fig 3)
- Clamp the job on drilling machine.
- Align and centre drill the hole.

Fig 3



TU20N1219H3

- Drill Ø3mm at the centre through hole and drill Ø 5mm through hole.

take care the drill should hole drill the 'V' block

Skill sequence

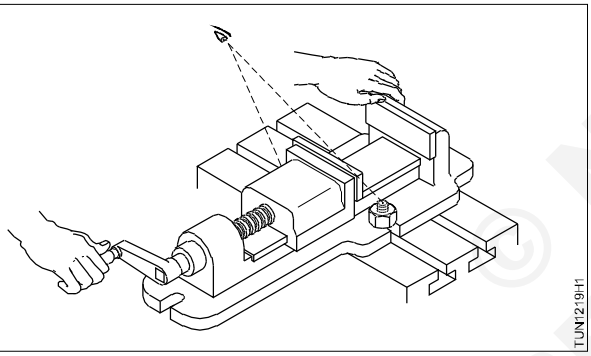
To set vice on the machine table in position

Objective: This shall help you to
- **align a machine vice on the table in position.**

Clean the vice base and the machine table top, free from dust for seating.

Place the vice at the middle of the table with maximum support to avoid falling off of the vice. (Fig.1)

Fig 1



TUN1219H1

Position the 'T' bolts into the 'T' slot. (Fig.1) while shifting the vice towards the slots ensure that there is 1mm to 2mm clearance between the 'T' bolt and the vice slot to allow for adjustment.

Tighten all the bolts by hand.

Locating hole accurately by drilling centre hole

Objective: This shall help you to
- **drill centre holes with a drilling machine.**

Drilling centre holes by combination drills is an accurate method of locating the position of the holes (i.e. within ±0.25mm). In drilling operations, this method will be specially helpful while drilling deeper holes and holes of fairly accurate locations. For doing centre drilling, proceed as follows.

Hold the combination centre drill in the drill chuck and check whether it 'runs true'. Adjust the spindle speed to suit the combination drill.

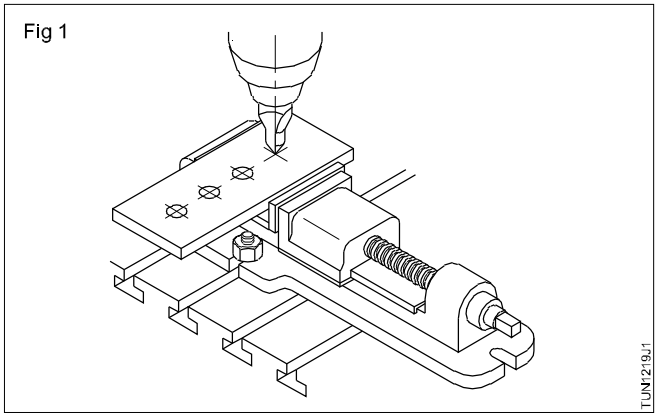
Adjust the job together with the vice and align with the centre punch mark.(Fig.1)

Drill a centre hole up to the depth of 3/4th of the counter sink. Do not apply undue pressure on the centre drill.

Apply sufficient quantity of cutting fluid.

Remove the centre drill, hold the twist drill of the required dia. check if it 'runs true'. start drilling the through hole.

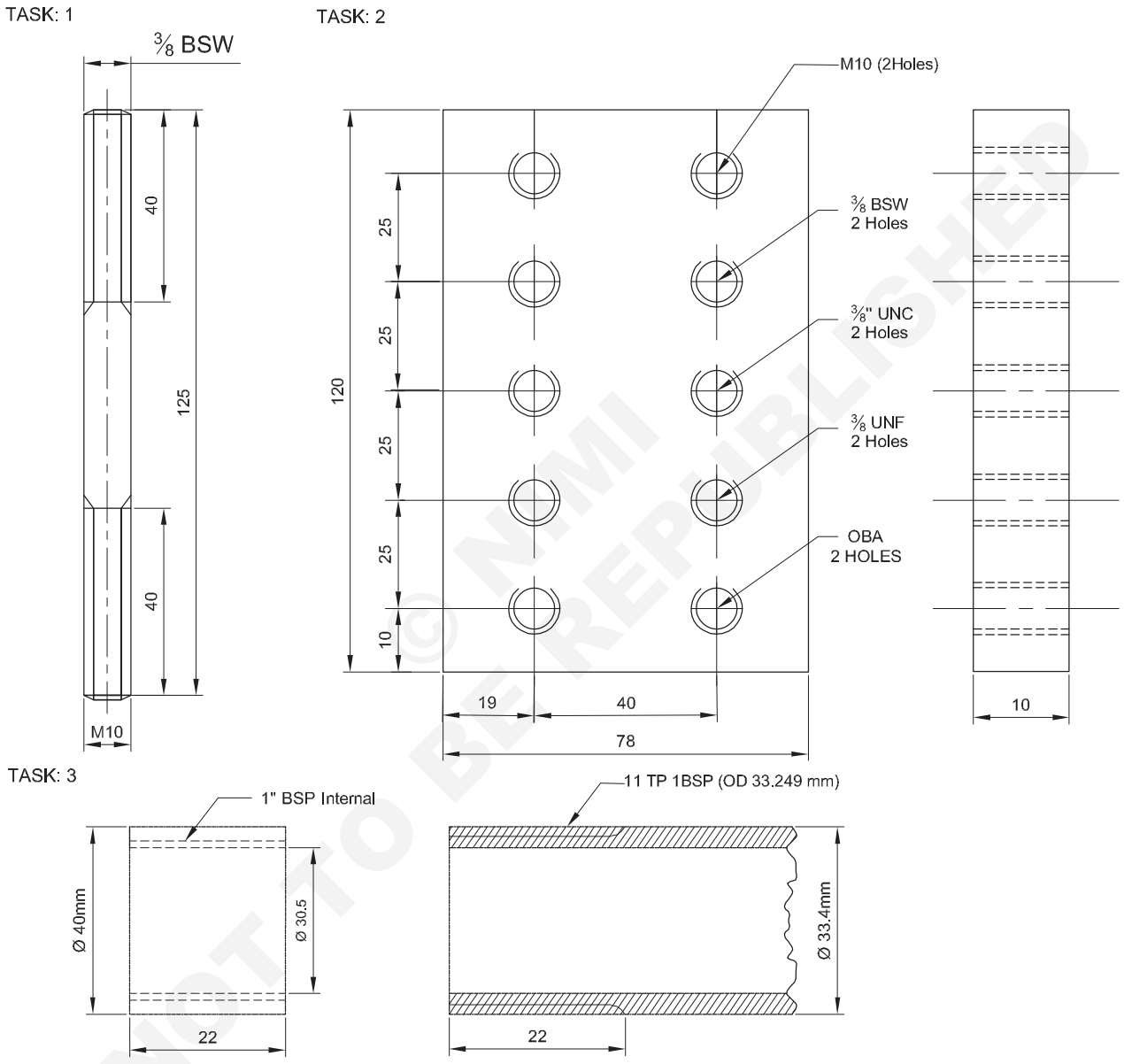
Fig 1



TUN1219J1

Different threading with taps and dies both internal and external

Objectives : At the end of this exercise you shall be able to
- **cut threads using Tap and Die**
- **cut external thread on pipe using etc.**



1	Ø 10-125	–	Fe 310	–		
1	80ISF 12-125	–	Fe 310	–		
2	Ø 34-60 , Ø40-22	–	GI Pipe	–		1.2.20
NO.OFF	STOCK SIZE	SEMI PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
	THREADING EXTERNAL AND INTERNAL BY TAP AND DIE					TIME :
					CODE NO. TU20N1220E1	

Job sequence

TASK 1: **Cutting external thread**

- Check the given raw material for its size.
- Select the 3/8 BSW Die, M10 Die and Diestock.
- Hold the workpiece in a bench vice with 'V' bolck.
- Cut external threads both ends using a hand die and match with M10 and 3/8 BSW thread nut.

— — — — — — — —

TASK 2 : **Cutting internal thread**

- Check the given raw material for its size.
- File and finish the given material to 78 x 10 x 120 mm size.
- Remove the sharp edges.
- mark and locate centre of drilling
- Drill tap drill size holes for M10, 3/8 BSW 3/8 UNC, 3/8 UNF and OBA threads and chamfer the ends.
- Cut threads with relevant tap sets.
- Deburr and complete the work.

Tap Drill Sizes

Thread	Tap drill size
M/1O	∅ 8.5m
3/8 BSW	∅ 8.2m
3/8 UNC/UNF	∅ 8.55mm
OBA	∅ 5.10mm

— — — — — — — —

TASK 3 : **Cutting pipe thread**

- Select 1" pipe of required length (1 Inch is bore dia of pipe).
- Standard size of pipe OD (or) 33.4mm and 11 TPI.
- Select the 11 TPI Die and Diestock.
- Hold the Die in a Diestock.
- Hold the pipe in a pipe vice with collect.
- Form the thread to a standard length of $\frac{7}{8}$" (or) 22.2mm
- Hold vertically thread coupling in a pipe vice.
- Select 1" BSP tap set and tap wrench.
- Form the thread 1" BSP using tap set.
- Check for its matching with 1" pipe.

— — — — — — —

Note

- **Make sure that the dia of the hole to be tapped is correct for the given size of tap.**
- **Turn backwards to break the chip after every quarter turn.**
- **Select the length of wrench suitable to the size of the over length of wrench may cause the breakage of tap.**
- **Use a cutting fluid while cutting the thread to minimise friction and heat**

Internal threading of through holes using hand taps

Objective: This shall help you to
- **cut internal threads using hand taps.**

Determining the tap drill size

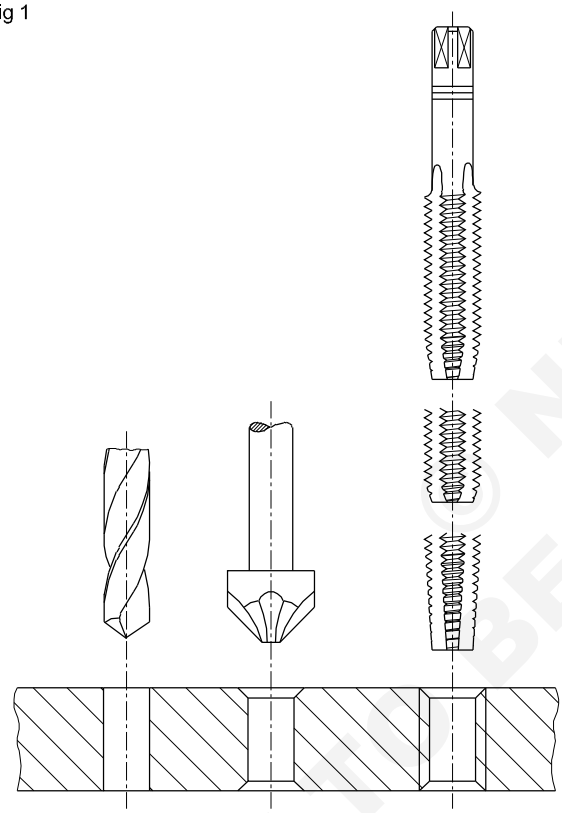
For cutting internal threads, it is necessary to determine the size of the hole (tap drill size). This can be calculated using the formula or can be chosen from the table of the tap drill sizes.

Procedure

Drill the hole to the required tap drill size.

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

Fig 1



Hold the work firmly and horizontally in the vice. The top surface should be slightly above the level of the vice jaws. This will help in using a try square without any obstruction while aligning the tap (Fig 2).

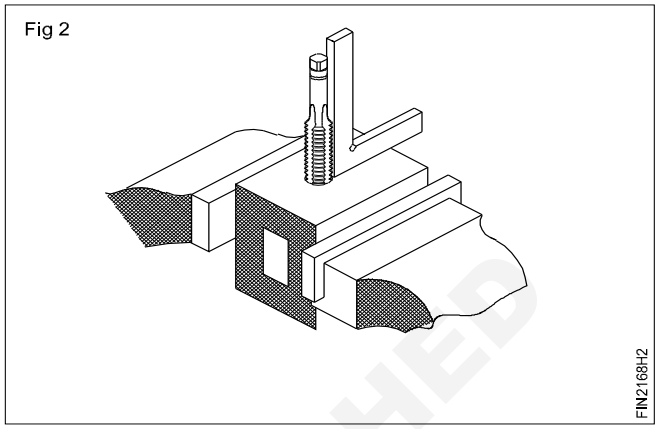
Use soft jaws while holding the finished surface on the vice.

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

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

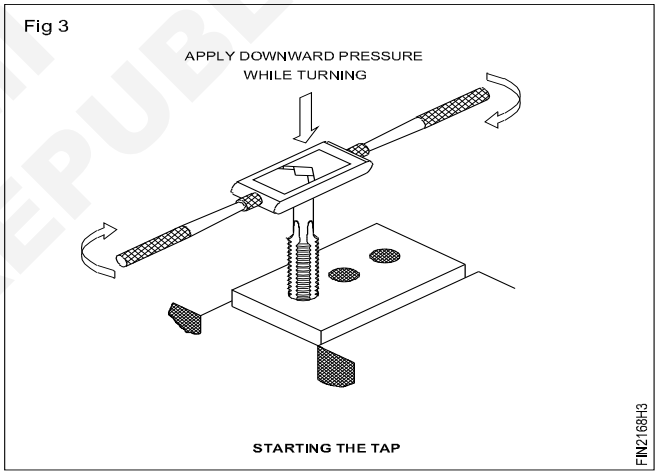
Position the tap in the chamfered hole vertically by ensuring the wrench in a horizontal plane.

Fig 2



Exert steady downward pressure and turn the tap wrench slowly in a clockwise direction to start the thread. Hold the tap wrench close to the centre. (Fig 3)

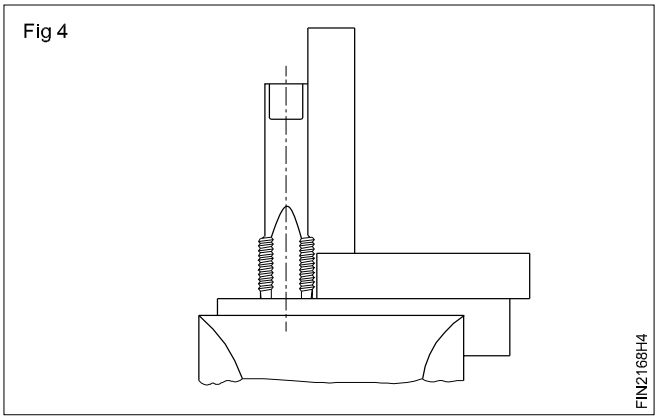
Fig 3



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

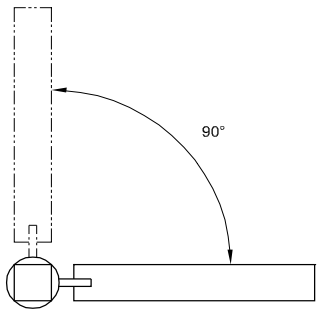
Check and make sure the tap is vertical. Use a small try square for help. (Fig 4)

Fig 4



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

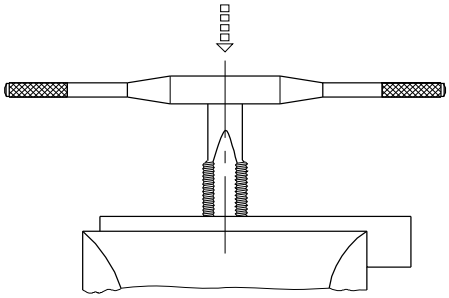
Fig 5



FIN2168H5

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

Fig 6



SQUARING UP THE TAP

FIN2168H6

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

Check the tap alignment again with a try square.

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

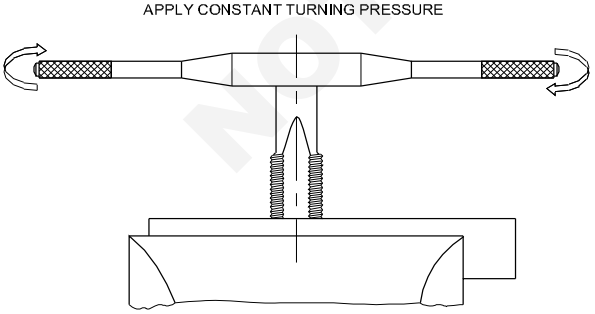
Make one or two turns and check the alignment.

The tap alignment should be corrected within the first few turns. Afterwards this cannot be done for the threads will break.

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

Fig 7

APPLY CONSTANT TURNING PRESSURE



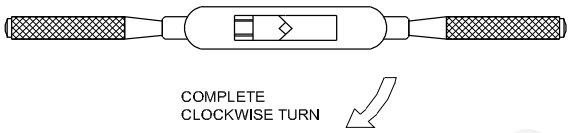
FIN2168H7

While turning the wrench, the movement should be well balanced. Any extra pressure on one side will spoil the tap alignment and can also cause breakage of the tap.

Continue cutting the thread. Turn backwards frequently, about quarter turn, to break the chip. (Fig 8) Stop and turn backwards also when some obstruction to movement is felt.

Fig 8

QUARTER REVERSE
TURN WHEN NECESSARY



COMPLETE
CLOCKWISE TURN

FIN2168H8

Use a cutting fluid while cutting the thread.

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

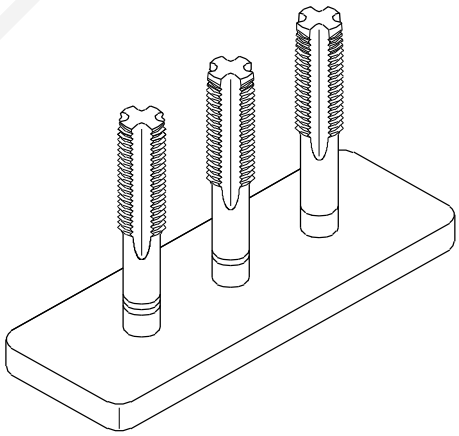
Finish and clean up using intermediate and plug tap. The intermediate and plug tap will not cut any thread if the tap has entered the hole fully.

Remove the chips from the work with a brush.

Check the threaded hole with a matching screw.

Clean the tap with a brush, and place it back on the stand (Fig 9)

Fig 9



FIN2168H9

Internal threading blind holes using hand taps

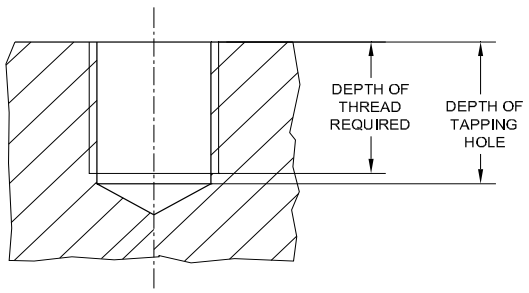
Objective: This shall help you to
- **cut internal threads using hand taps.**

Drilling a blind hole

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

Drill a blind hole using the depth stop arrangement. The depth of the tapping hole should be slightly more than the depth of the required thread. (Fig 1)

Fig 1

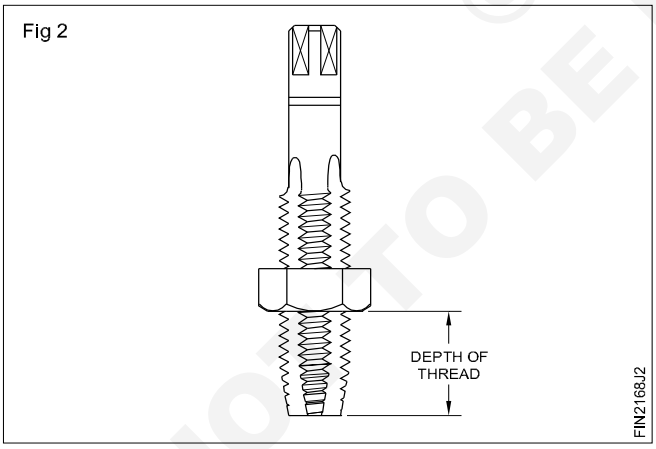


Procedure for threading: Remove metal chips, if any, from the blind hole by turning it upside down and slightly tapping it on a wooden surface.

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

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

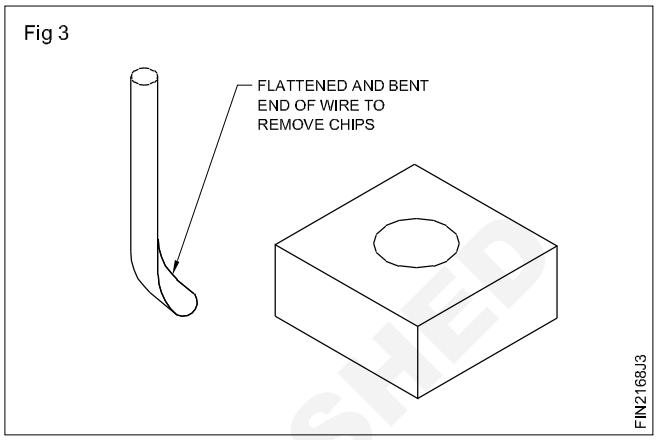
Fig 2



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

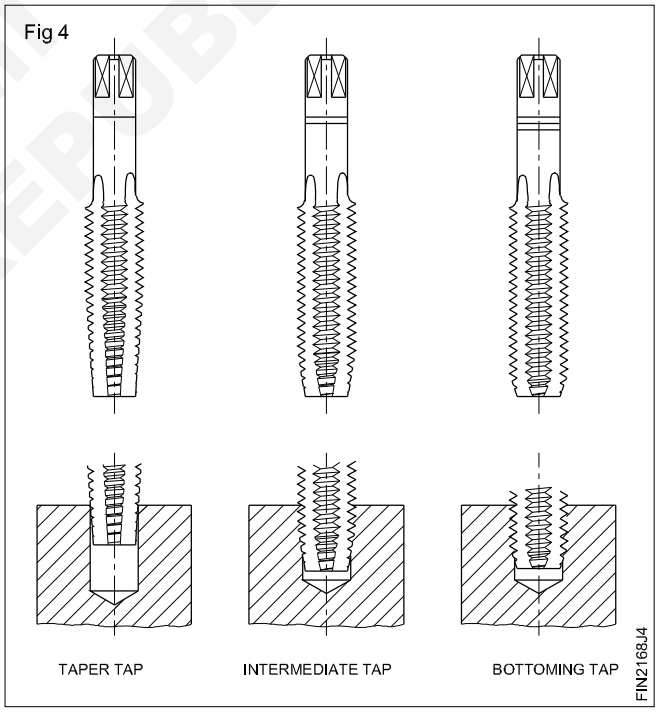
Remove the chips from the hole frequently, using a flattened and bend wire. (Fig 3)

Fig 3



Finish tapping the hole with intermediate and bottoming tap. Set the nut to control the depth of the thread. (Fig 4)

Fig 4



External threading using dies

Objective: This shall help you to
- **Cut external threads using dies.**

Check blank size.

Blank size = Thread size - 0.1 x pitch of thread

Fix the die in the diestock and place the leading side of the die opposite to the step of the diestock. (Fig 1 & 2)

Use vice clamp for ensuring a good grip in the vice.

Project the blank above the vice - just the required thread length only.

Fig 1

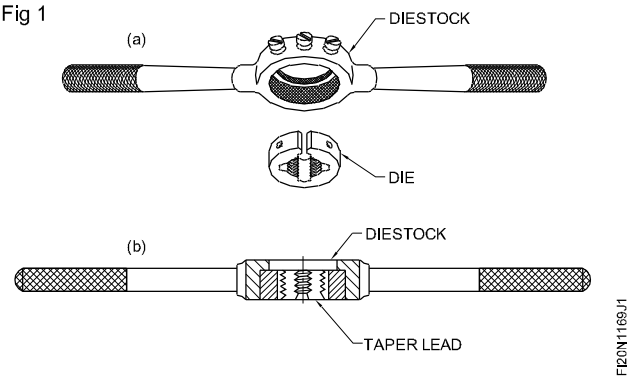
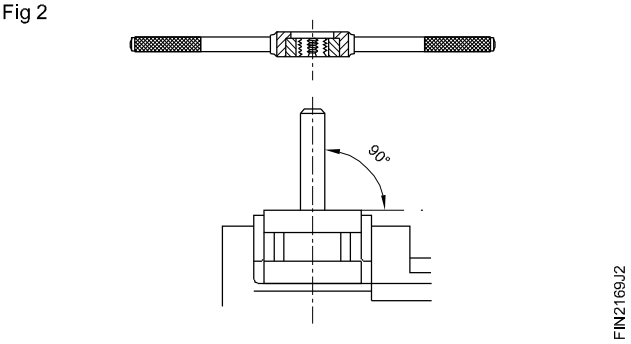
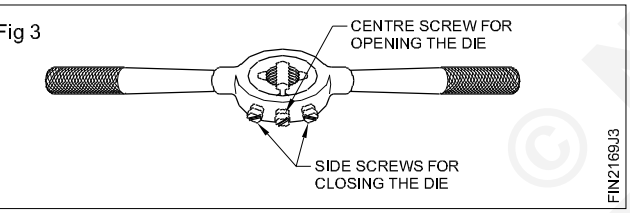


Fig 2



Place the leading side of the die on the chamfer of the work. (Fig 3)

Fig 3



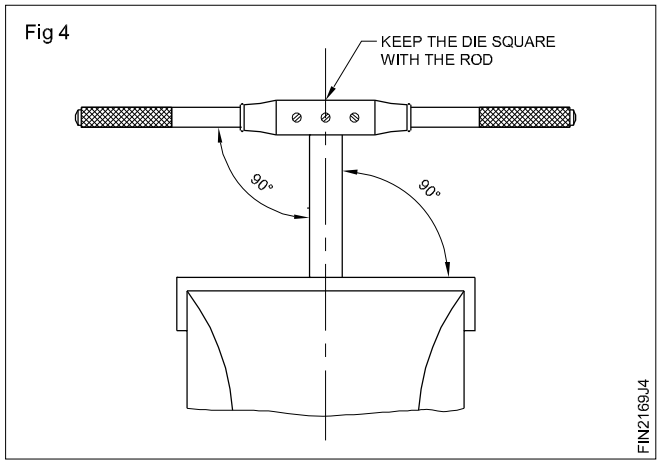
Make sure that the die is fully open by tightening the centre screw of the diestock. (Fig 4)

Start the die, square to the bolt centre line. (Fig 5)

Apply pressure on the diestock evenly and turn in a clockwise direction to advance the die on the bolt blank. (Fig 5)

Cut slowly and reverse the die for a short distance in order to break the chips.

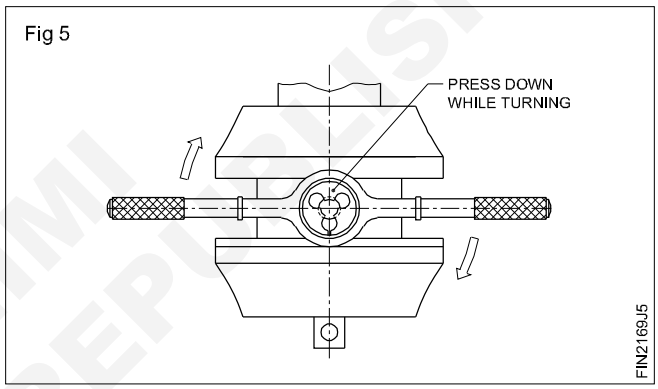
Fig 4



Use a cutting lubricant

Increase the depth of the cut gradually by adjusting the outer screws.

Fig 5



Check the thread with a matching nut.

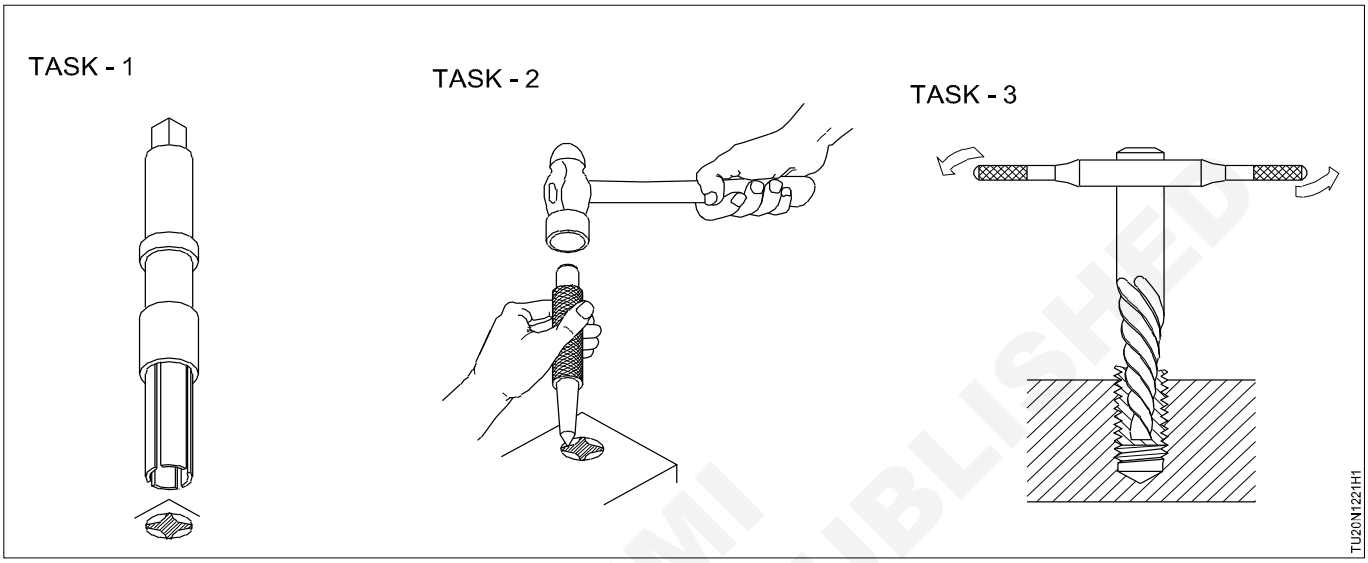
Repeat the cutting until the nut matches.

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.

Extraction of broken tap

Objectives : At the end of this exercise you shall be able to
- **removing broken tap by using tap extractor**
- **removing broken tap by using punch and hammer**
- **removing broken tap by screw extractor.**



Job Sequence

TASK 1 : **Tap extractor method**

- Note the condition/position of the broken tap.
- Study and try to insert the tap extractor leaves if possible. (don't try to bend the leaves.)
- After inserting to a possible depth in the flute gap, push down the collar downwards for gripping.
- Light blow over the extractor will release the tap from threaded body.
- By using tap wrench/wrench turn in anticlockwise direction.

Using excessive torque on wrench will cause leaves to twist while extracting the tap

- If required lubricate and twist to extract the tap.

— — — — — —

TASK 2 : **Punch and hammer method**

- Use centre punch over the flute gap.
- Light stroke on punch to turn the tap anticlockwise direction.
- Like wise use all the flute gap to punch and rotate tap in anticlockwise direction till it comes out to sufficient length to grip by plier/extractor.

While punching do not chip out the punch which will clog inside and the broken tap will jammed.

— — — — — —

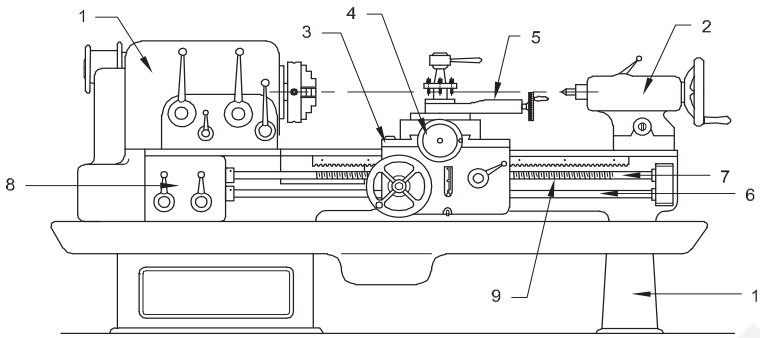
TASK 3 : **Screw extractor method**

- Heat the broken tap to red hot condition by blow lamp.
- Light stroke on punch to turn the tap anticlockwise in the red hot condition, if it is not possible to remove the broken tap, then cool down by annealing it.
- Check with a punch whether the tap has become soft.
- drill out tap portion to max drill dia. (for e.g. on M6 tap use 3.5 or 4 dia. drill).
- The rest of the portion to be removed either by drift or by extractor.

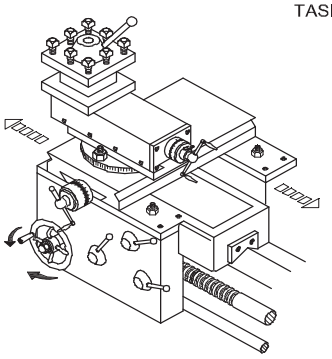
Identification and function of different parts of lathe and practice

Objectives : At the end of this exercise you shall be able to
- **identify the main parts of a lathe**
- **function of the parts**
- **identify the lubrication points in the lathe**
- **set the spindle speed and lever position in lathe.**

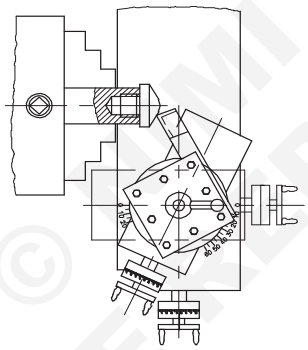
TASK: 1



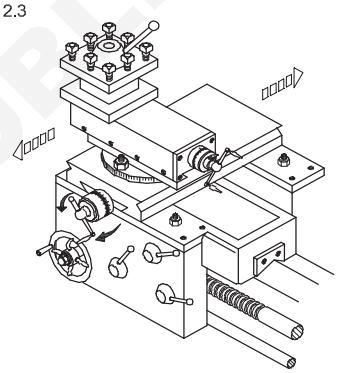
TASK: 2.1



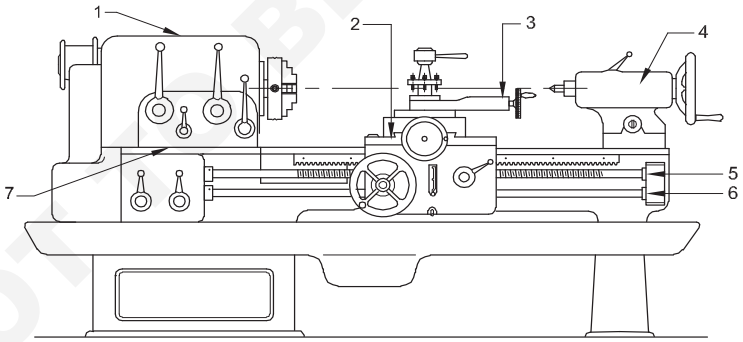
TASK: 2.2



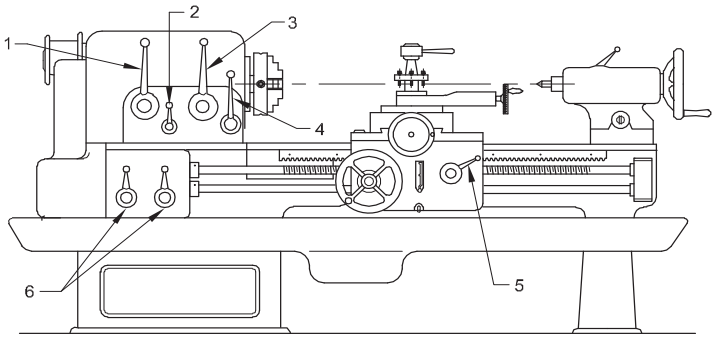
TASK: 2.3



TASK: 3



TASK: 4



TU20N1322E1

Job sequence

TASK 1 :

- Identify the main parts of the lathe marked 1 to 10.
- Record in Table 1.

Table 1

Sl. No.	Parts	Remarks
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

TASK 2 :

- Identify the part and functions 2.1, 2.2. 2.3 and record it in table 2, get it verified by your instructor

Table 2

Fig No.	Part name	Direction	Movement Direction
2.1		**ACW**	
2.1		**CW**	
2.2		**CW**	
2.2		**ACW**	
2.3		**ACW**	

TASK 3 :

Identify the lubrication points in the lathe and record it in table 3.

Table 3

Sl. No.	Lubricating Points and its name
1	
2	
3	
4	
5	
6	
7	

— — — — — — —

TASK 4 :

Set the Spindle Speed & Feed lever position in table 4

Table 4

Sl. No.	Speed & Feed Lever position
1	
2	
3	
4	
5	
6	

— — — — — — —

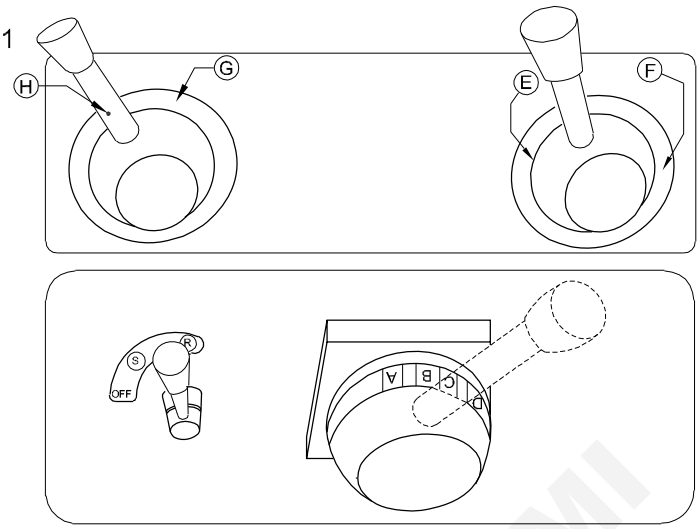
Note: Ask the trainees to practice

- **The movement of the carriage towards and away from the head stock**
- **Compound side movement**
- **Tail stock positioning and quill movement**
- **Set the different spindle speed and put ON and OFF the machine in idle condition**

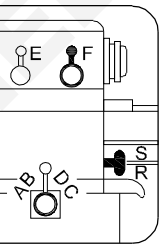
Setting lathe on different speed and feed

Objectives : At the end of this exercise you shall be able to
- **identify the speed chart on the lathe**
- **select the speed and feed**
- **tabulate the speed in the given table for the task 1.**

TASK. 1



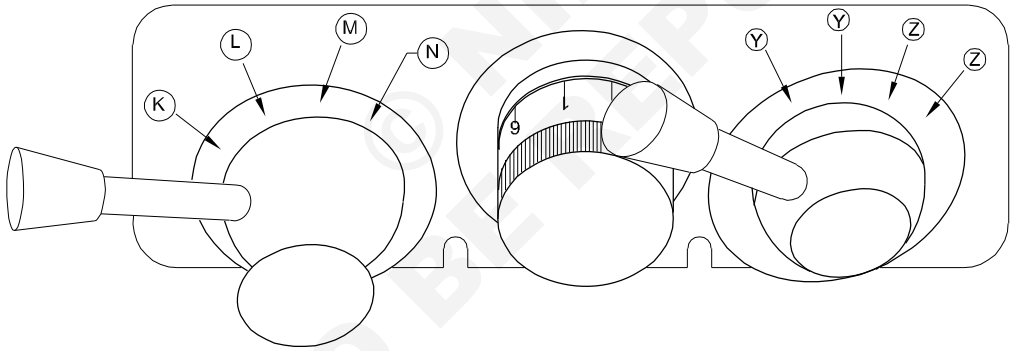
n/min		E	F
D	R	1600	250
C	R	1150	200
D	S	800	140
B	R	740	115
C	S	580	90
A	R	450	71
B	S	360	60
A	S	228	38



Note: G.H. lower for tumbler gear

Example shown for 1600 rpm selection, lever position is D,R,E

TASK. 2



			G			F		H
			K	L	M	K	L	M
36, 127, 90	Z	6	0.07	0.13	0.27	0.53	1.07	2.13
		2	0.08	0.16	0.32	0.64	1.27	2.54
		3	0.09	0.18	0.36	0.71	1.42	2.84
		5	0.11	0.23	0.46	0.91	1.82	3.66
		4	0.12	0.25	0.5	0.99	1.98	3.96
36, 90, 127	Z	6	0.05	0.1	0.2	0.4	0.8	1.6
		2	0.06	0.11	0.23	0.45	0.9	1.8
		3	0.07	0.13	0.25	0.5	1.0	2.0
		5	0.08	0.16	0.32	0.65	1.3	2.6
		4	0.09	0.18	0.35	0.7	1.4	2.8
1/2								

Note: Z,Z - Feed direction change lever
K,L,M and N - Feed, thread pitch/TPI) manufacturer selection lever
Y,Y - LH and RH thread cutting
1-6 - Feed thread pitch selection) design

TU20N1323H1

Job sequence

TASK 1 : **Selection of speed**

- Observe the speed chart in the machine.
- Change the right side lever in (E)
- After change the bottom side lever in (B)
- Then change the another bottom lever (D)
- Switch on the machine, the speed is 1600 rpm.
- Again and again change different lever at the chart method and take different speed.
- Identify speed change lever position A, B, C, D & E, F, S, R.
- Record in table 1.
- Get it verified by your instructor.

Note : According to the machines available in your institute prepare the speed chart for practice for the trainees.

Table 1

M/Min		E	F
A	S		38
B	S		
C	S	580	
D	S		
A	R		71
B	R		
C	R		
D	R	1600	

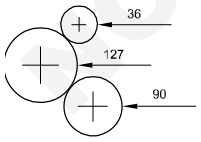
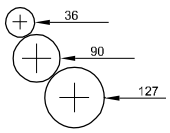
— — — — — — —

TASK 2 : **Selection of feed**

- Observe feed chart in the machine.
- Change the top left side lever (G)
- Change the bottom left side lever (K)
- Change the bottom right side lever (Z)
- After number change shaft rotate the number (6)
- Switch ON the machine and engage carriage feed lever and get feed rate 0.07mm/rev.
- Again and again change different lever on chart and take different feed.
- Identify the feed change lever position Y, G, H & K, L, M.
- Identify the feed in different set of change gears.
- Record in table 2.
- Get it verified by your instructor.

Note : According to machine avaiable in your institute prepare the feed chart for practice for the trainees.

Table 2

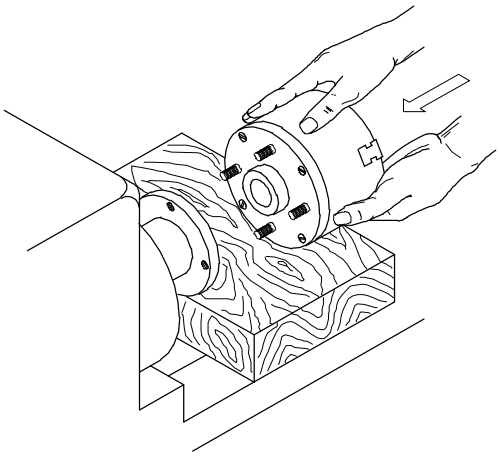
			G			F H		
			K	L	M	K	L	M
	Z	2		0.16				
		3				0.71		
		4						3.96
		5			0.46			
		6	0.07					
	Z	2		0.11				
		3				0.5		
		4	0.09					
		5					1.3	
		6			0.2			

— — — — — — — —

Mounting of chuck on machine spindle and unloading - 3-Jaw chuck and 4- Jaw chuck

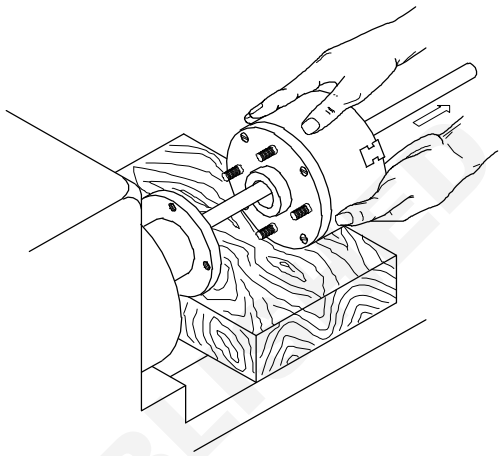
Objectives : At the end of this exercise you shall be able to
- **mount chucks on spindle noses**
- **dismount chuck from spindle nose.**

TASK-1



MOUNTING CHUCK TO BOLTED SPINDLE

TASK-2



DISMOUNTING CHUCK

TU20N1324E1

Job sequence

TASK 1: **Mounting chucks**

- Switch off the motor.
- Place the chuck on the wooden blank and slide it close to the spindle nose.
- Turn the spindle anticlockwise by hand and engage the chuck on the spindle.
- Set the speed change lever to the low rpm.
- Screw the chuck until it fits firmly on the spindle.
- The chuck should easily screw into the spindle.

— — — — — — —

TASK 2: **Dismounting chucks**

- Switch off the motor.
- Set the speed change lever to the lowest rpm.
- Place a wooden block between one of the chuck jaws and the rear of the lathe bed.
- The length of the wooden block should be slightly less than the bottom of the chuck of the lathe.
- Turn the lathe spindle clockwise by hand to loosen the chuck from the spindle nose.
- Unscrew the chuck from the spindle.
- Remove the wooden block.

Cam lock spindle

- Disengage the clutch to permit free rotation of the spindle.
- Insert the correct chuck key into a cam locking screw on the spindle.
- Turn each cam locking screw so that the registration line is vertical with the corresponding line on the spindle.
- Turn the spindle by hand until the clearance holes on the spindle align with the cam lock studs on the chuck.
- Set the speed change lever to the lowest rpm.
- Push the chuck on to the spindle.
- Tighten each cam lock screw in a clockwise direction.

Bolted spindle

- Remove the nuts and washer from the studs on the chuck.

- Disengage the clutch to permit free rotation of the spindle.
- Turn the spindle by hand until the key in the spindle lines up with the slot in the chuck.
- Set the speed change lever to the lowest rpm.
- Push the chuck on to the spindle.
- Fit washer and nuts to the studs.

Taper spindle

- Turn the spindle by hand until the key on the spindle nose lines up with the keyway in the chuck.
- Set the speed change lever to the lowest rpm.
- Push the chuck on to the spindle.
- Turn the locking ring anticlockwise.
- Engage the special 'C' spanner on the locking ring.
- The spanner should fit around the top of the locking ring with the handle pointing downwards
- Grip the end of the handle with one hand.
- Firmly strike the other end with the other hand in an anticlockwise direction.
- Securely tighten the locking ring.

— — — — — — —

Skill sequence

Mounting and dismounting of chucks

Objective: This shall help you to
- **mount and dismount chucks from spindle noses.**

To perform lathe operations on work materials, it may not be always possible to have only one type work-holding device fitted to the spindle. Hence it becomes an absolute necessity for dismounting the work-holding device already assembled to the spindle and mount the work-holding device which is needed for the work in hand.

For an easy understanding of different spindle noses and their applications, the mounting of different work-holding devices are illustrated.

When mounting a chuck on the headstock spindle, exercise care to prevent damage occurring to the chuck or spindle.

Damage may reduce the accuracy of the lathe. The points set out below are important and should be followed.

Before mounting

Before attempting to mount a chuck, ensure that it is the correct one for the lathe and for the job in hand.

Do not use power to mount a chuck on spindle noses

Clean all the mating parts of the chuck and spidle as, otherwise, the dirt on these surfaces could result in the following.

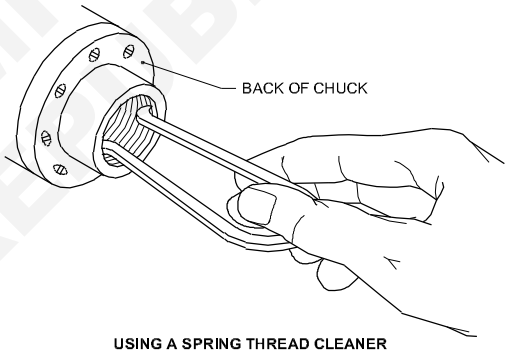
Damage the threads or taper on the spidle or chuck.(Fig 1)

To prevent such damage from occurring, take the following steps.

Place a wooden board on the lathe bed when mounting light chucks to prevent damage to the sideways. (Fig 2)

For large chucks place a wooden cradle between the chucks and the lathe bed. (Fig 3)

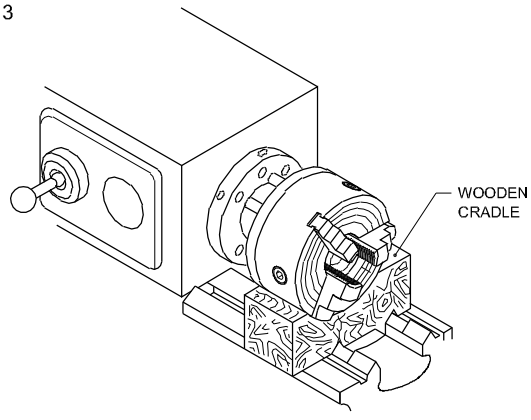
Fig 1



USING A SPRING THREAD CLEANER

TUN1324H1

Fig 3



CHUCK SUPPORTED ON WOODEN CRADLE

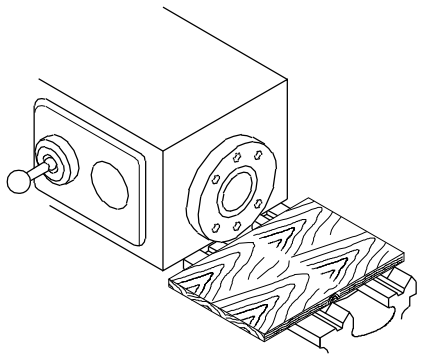
TUN1324H3

In addition to protecting the bed sideways it makes fitting the chuck easier and safer.

Always seek assistance when mounting large and heavy chucks.

Lubricate the mating surfaces with a light film of oil.

Fig 2



TUN1324H2

After mounting

Set the speed-change lever to the slowest speed.

Switch on the motor.

Engage the clutch lever.

The chuck would now begin revolving.

Check that the diameter and face of the chuck are running true by observing the surfaces.

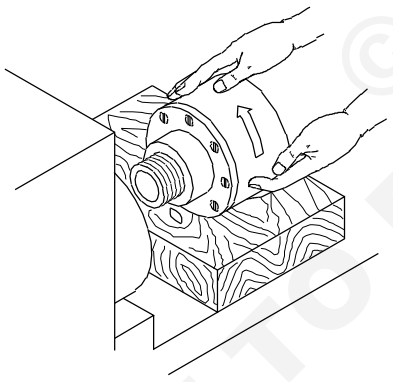
Mounting chuck on to the threaded spindle (Fig 4)

Switch off the motor.

Place the chuck on the wooden plank or cradle and slide it close to the spindle nose.

Turn the spindle anticlockwise by hand and engage the chuck on the spindle threads. (Fig 4)

Fig 4



MOUNTING THREADED CHUCK

TUN1324H4

Set the speed-change lever to the slowest speed. Screw the chuck in until it fits firmly on the spindle.

The chuck should easily screw into the spindle. If any resistance is felt, remove the chuck and check that the threads are clean and not damaged.

Mounting on tapered spindle (Fig 5)

Switch off the motor.

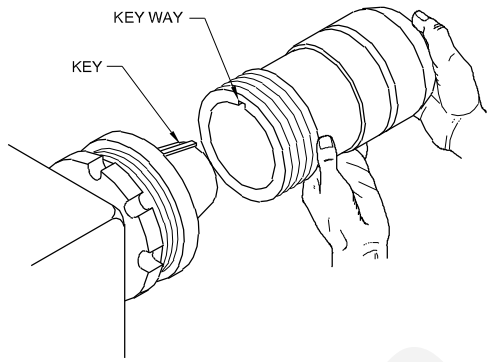
Hence the chuck on the wooden board or cradle and slide it close to the spindle nose.

Turn the spindle by hand until the key on the spindle nose lines up with the keyway in the chuck.

Set the speed-change lever to the slowest speed.

Push the chuck on to the spindle and turn the locking ring anticlockwise. (Fig 5)

Fig 5



MOUNTING THREADED CHUCK

TUN1324H5

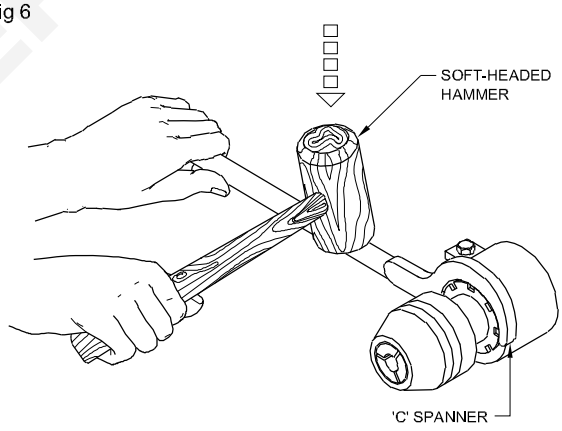
The figure given here illustrates a small chuck held with both hands and being mounted.

Engage the special 'C' spanner on the locking ring.

The spanner should fit around the top of the locking ring with the handle pointing downwards.

Grip the end of the handle with one hand and firmly strike the other end with the other hand in an anticlockwise direction. This would securely tighten the locking ring. (Fig 6)

Fig 6



LOCK CHUCK ON SPINDLE

TUN1324H6

Mounting on a cam-locking spindle (Fig 7)

Switch off the motor.

Place the chuck on a wooden board or cradle and slide it close to the spindle nose.

Disengage the clutch to permit free rotation of the spindle.

Insert the correct chuck key into a cam-locking screw on the spindle.

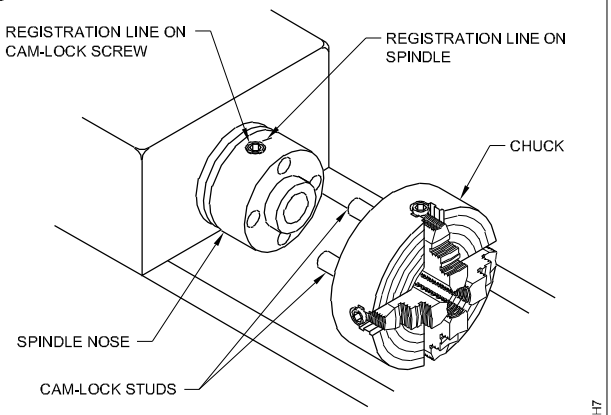
Turn each cam-locking screw so that the registration line is vertical or aligns with the corresponding line on the spindle.

Turn the spindle by hand until the clearance holes on the spindle align with the cam-lock studs on the chuck.

Set the speed-change lever to the slowest speed.

Push the chuck on to the spindle. Tighten each cam-lock screw in a clockwise direction.

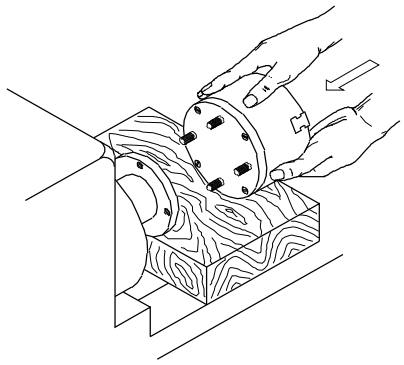
Fig 7



MOUNTING CHUCK ON CAM-LOCK SPINDLE

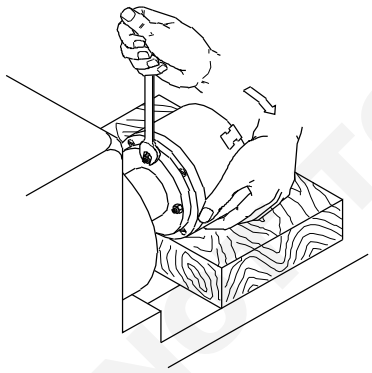
Mounting on to a bolted spindle (Figs 8 and 9)

Fig 8



MOUNTING CHUCK TO BOLTED SPINDLE

Fig 9



TIGHTEN NUTS FIRMLY

Switch off the motor.

Place the chuck on a wooden board or cradle.

Remove nuts and washers from the studs on the chuck.

Disengage the clutch to permit free rotation of the spindle.

Turn the spindle by hand until the key in the spindle lines up with the slot in the chuck.

Set the speed-change lever to the slowest speed.

Push the chuck on to the spindle.

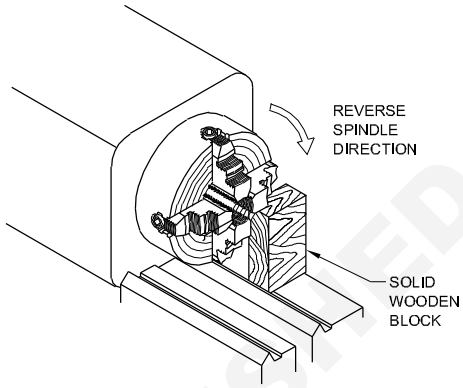
Fit washers and nuts to the studs.

Hold the chuck in position when fitting nuts.

Tighten the nuts in an anticlockwise direction using a spanner on the opposite nuts.

Dismounting chucks rom a threaded spindle (Fig 10)

Fig 10



REMOVING SCREWED CHUCK FROM SPINDLE

Switch off the motor.

Set the speed-change lever to the slowest speed.

Place a solid wooden block between one of the chuck jaws and the rear of the lathe-bed.

The length of the wooden block should be slightly less than the centre height of the lathe.

Turn the lathe spindle clockwise by hand to loosen the chuck from the spindle nose.

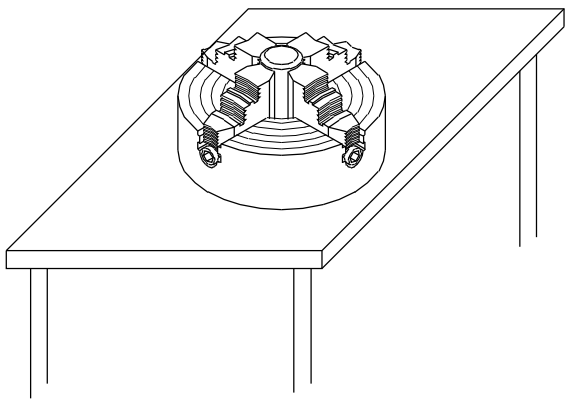
Remove the wooden block.

Place the wooden block or cradle on the lathe bed.

Unscrew the chuck from the spindle.

Clean and store the chuck (Fig 11)

Fig 11



STORE ALL CHUCKS CAREFULLY AFTER USE

Dismounting and mounting chucks

Objective: This shall help you to
- **dismount and mount chucks from a spindle nose.**

Depending upon nature and delicacy of operations, different work-holding devices are to be mounted and dismounted on to the lathe spindle nose.

Dismounting a chuck

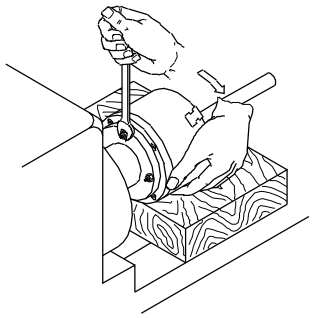
Hold Ø30x300mm iron piece projecting about 200mm more than the chuck to enable easy and safe lifting.

Set the spindle to the lowest speed.

Place a wooden block in the gap between the chuck body and the lathe bed. The thickness of the wooden block should be such that it can freely enter in the above gap.

Open the chuck from the spindle nose. (Fig 1)

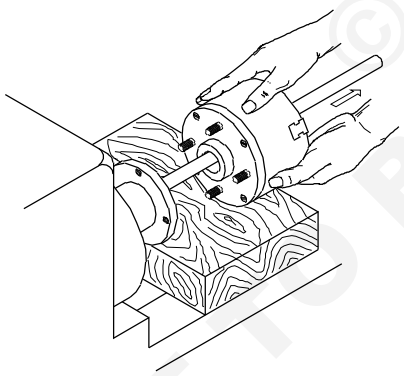
Fig 1



TUN1324HC

Slide and place the chuck on the wooden block. (Fig 2)

Fig 2



DISMOUNTING CHUCK

TUN1324HD

Clean and store the chuck.

Mounting a chuck

Depending upon the type of spindle nose and the type of back plate of the chuck, different methods of fastening the chuck are employed as follows.

1 Screwing the chuck directly to the lathe spindle nose.

2 Aligning the chuck taper with the spindle nose taper and fastening with a screw type flange.

3 Aligning the taper or both the chuck and the spindle nose and fastening with nuts/ bolts or with cams.

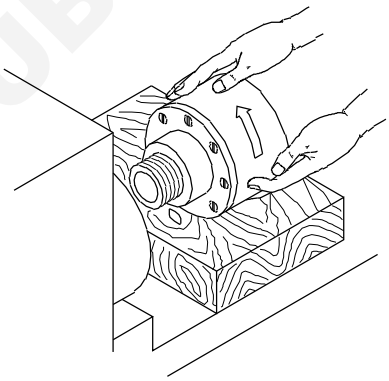
4 Place the wooden block which was used for dismounting the chuck on the bed near the spindle nose.

5 Place the chuck on the wooden block.

6 Set the spindle at the lowest rpm.

7 Slide, rotate and mount the chuck on the spindle nose. (Fig 3)

Fig 3



MOUNTING THREADED CHUCK

TUN1324HE

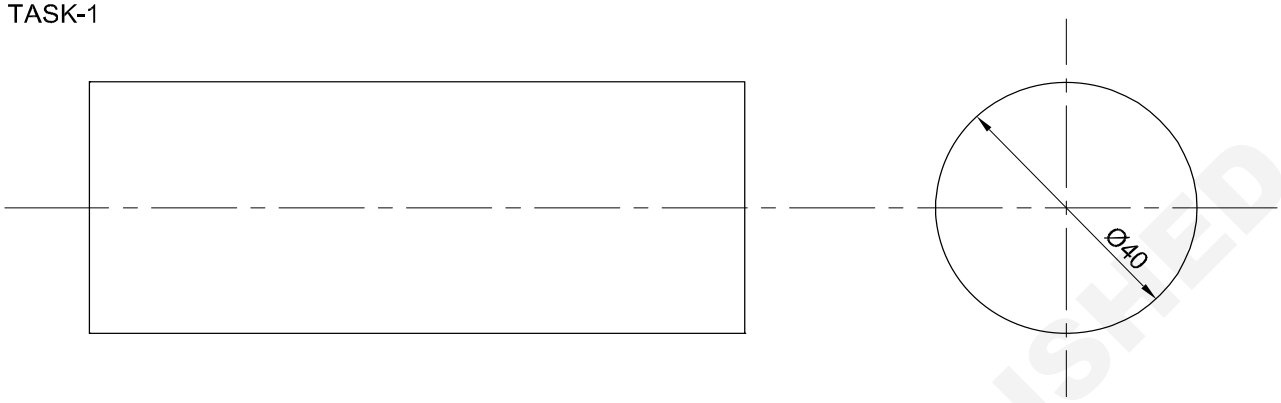
8 Fasten the chuck rigidly with the spindle using the appropriate wrench supplied with lathe.

Note : Follow the same procedure for the mounting and dismounting of driving plates.

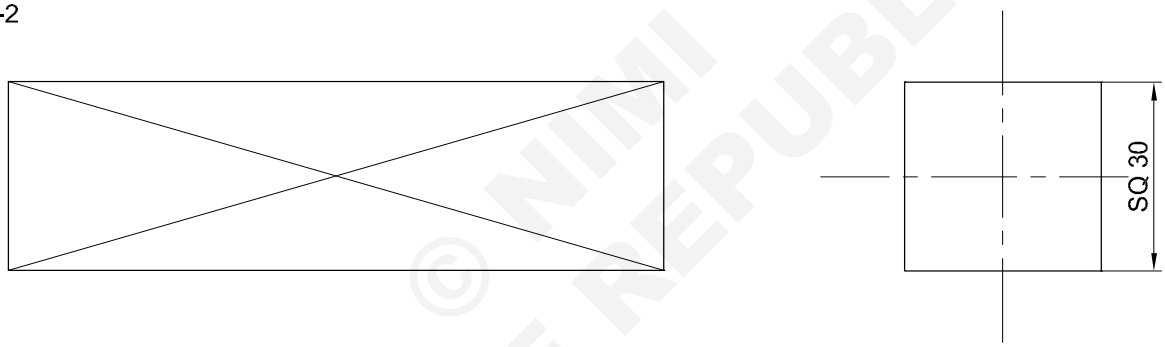
Setting practice on round, square and hexagonal bar

Objective : At the end of this exercise you shall be able to
- **true a round, square, hexagonal by using four jaw independent chuck.**

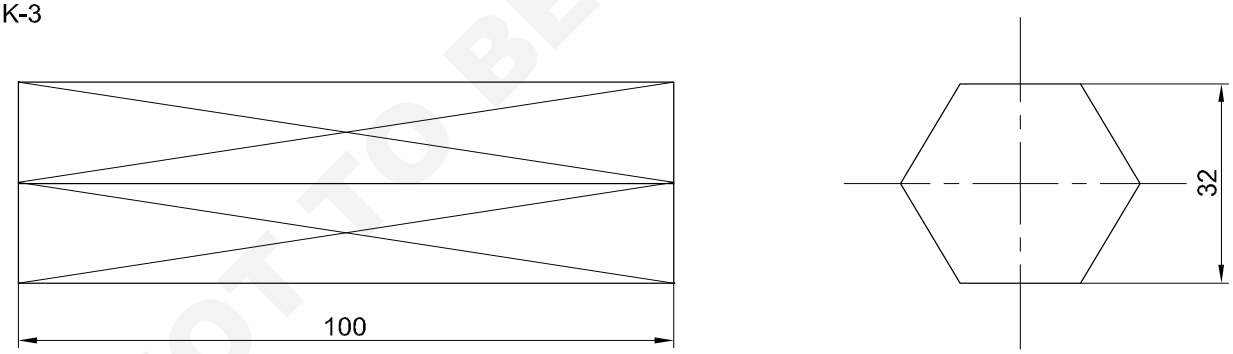
TASK-1



TASK-2



TASK-3



1	Ø 40-100	-	Fe 310	-	-	-
2	SQ 30-100	-	Fe 310	-	-	-
3	A/F 32-100	-	Fe 310	-	-	1.3.25
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	**SETTING PRACTICE ON FOUR JAW CHUCK**	DEVIATIONS	TIME
		CODE NO. TU20N1325E1	

Job sequence

TASK 1 : **Truing of round rod**

- Clean the machine and check before working.
- Position the four jaws of the independent chuck, equidistant from the centre to hold the work.
- Tighten the two adjacent jaws, enough to grip the work.
- Place the surface gauge on the bed ways close to the work.
- Adjust the pointer to make its tip move close to the top side portion of the work maximum gap.
- Rotate the chuck-by hand and observe the gap between the pointer and work surface for the position of the two opposite jaws.
- Open the jaw slightly when the gap is more and tighten the opposite jaw.
- Repeat until the gap is the same.
- Repeat the above sequence for other set of opposite jaws.
- Bring the pointer tip closer to the work.
- Rotate the chuck by hand and observe the gap.
- Engage the spindle lever at about 100 rpm and run the machine.
- Give slight pressure on the top of the tip to touch the work and feel.
- If the feel conducting the pointer tip is uniform it indicates that the work is trued.

— — — — — — —

TASK 2 and TASK 3: **Truing work in four jaw chuck square rod and hexagon rod**

- Clean the machine and check before working.
- Position the four jaw of the independent chuck equidistant from the centre.
- Open the adjacent jaws sufficiently enough to insert the work and place the work inside the chuck.
- Tighten the two adjacent jaw, enough to grip the work.
- Place the surface gauge on the bed ways close to the chuck.
- Adjust the pointer to make its tip move close to the top side corner of the square rod a maximum gap.
- Rotate the chuck by hand and observe the gap between the pointer and work corner for the position of the two opposite jaws.
- Open the two jaws slightly when the gap is more and tighten the opposite two jaws.
- Repeat until the gap is the same.
- Repeat the above sequence for the set of opposite jaws.
- Bring the pointer tip closer to the work corner.
- Rotate the chuck by hand and observe the gap.
- Engage the spindle lever at about 250 rpm and run the machine.
- Give slight pressure on the top of the tip to touch the work corner and feel.
- If the feel of conducting the pointer tip is uniform in each corner, it indicates that the work is trued.

— — — — — — —

Skill sequence

Truing work in a four jaw chuck with the help of a surface gauge

Objective: This shall help you to

• true a round, square and hexagonal in a four jaw independent chuck with the help of a surface gauge.

If truing is not done before turning, the following will be the results.

Uneven load on the cutting tool.

For the same depth more metal will be removed from the out of centre portion.

Surface turned may not be cylindrical.

Sequence during truing

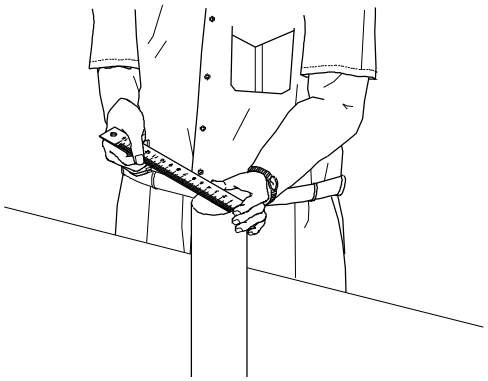
Keep the main spindle in a neutral position.

Measure the job size with an outside caliper or with a steel rule. (Fig 1)

Position the four jaws of the independent chuck, equidistant from the centre. The distance between the inner face of the opposite jaws is equal to the diameter of the work. (Fig 2)

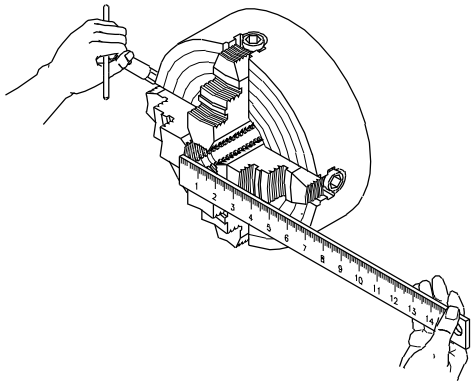
Open the adjacent jaws sufficiently enough to insert the work. (Fig 3)

Fig 1



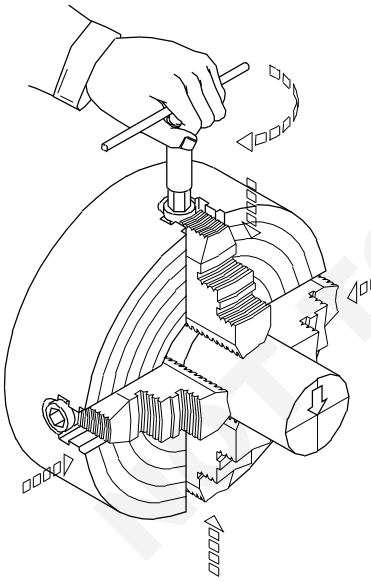
TUN1325J1

Fig 2



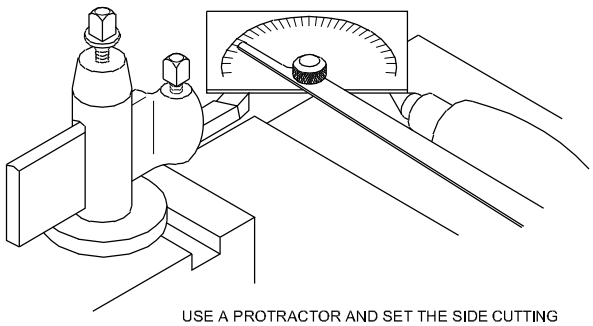
TUN1325J2

Fig 3



TUN1325J3

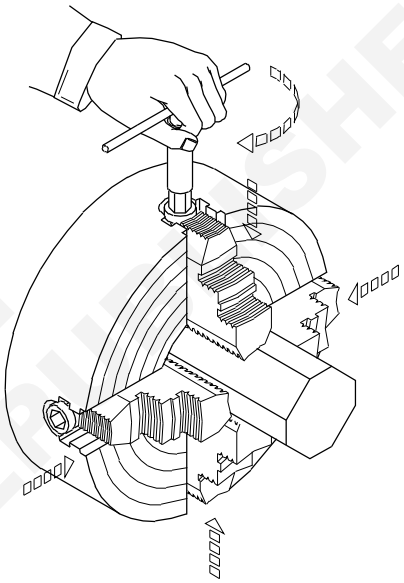
Fig 4



USE A PROTRACTOR AND SET THE SIDE CUTTING EDGE OF THE TOOL BIT TO THE DESIRED ANGLE

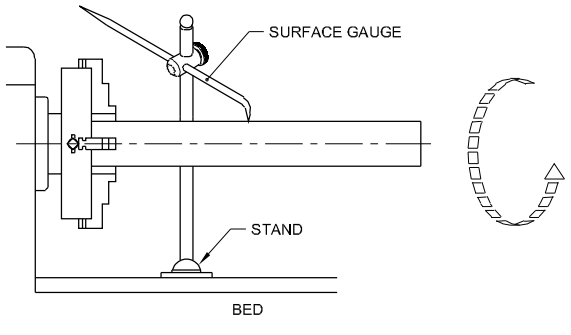
TUN1337H4

Fig 5



TUN1325J5

Fig 6



TUN1325J6

Place the work inside the chuck, keeping sufficient portion outside the chuck for turning and tighten the two adjacent jaws, enough to grip the work. (Fig 4)

Place the surface gauge on the bed-ways close to the chuck. (Fig 5)

Adjust the pointer to make its tip move close to the top or side portion of the work with a minimum gap. (Fig 6)

Rotate the chuck by hand and observe the gap between the pointer and work surface for the position of the two opposite jaws.

Open the jaw slightly where the gap is more, and tighten the opposite jaw. (Fig 7)

Repeat until the gap is the same. (Fig 8)

Repeat the above sequences for the other set of opposite jaws.

Fig 7

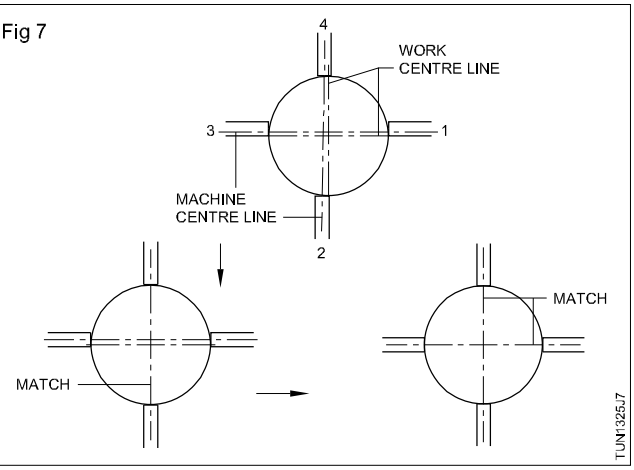
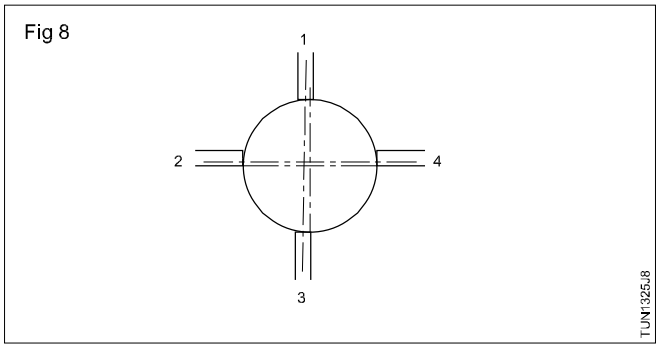


Fig 8



Bring the pointer tip closer to the work surface.

Rotate the chuck by hand and observe the gap.

Engage the spindle levers at about 250 rpm and run the machine.

Give slight pressure on the top of the pointer to make the tip to touch the work, and feel.

If the feel of contacting the pointer tip is uniform, it indicates that the work is trued.

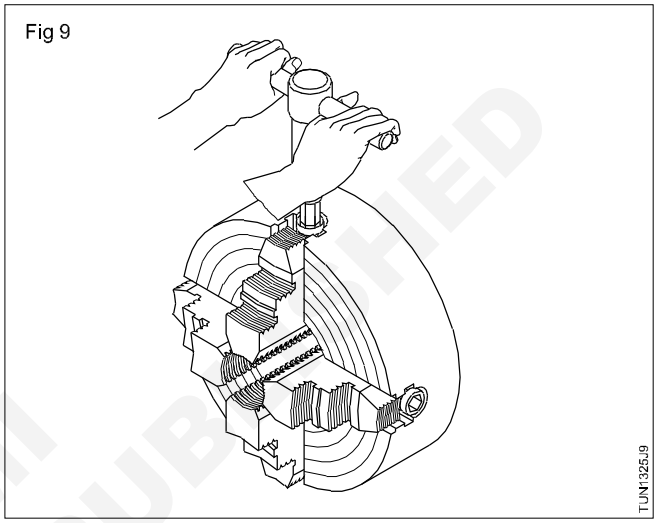
If the 'feel' is not uniform tighten the jaw where the feel is high.

Repeat till a uniform feel is felt.

Finally, tighten the opposite jaws with the same amount of pressure. (Fig 9)

Check once again for the true running of the work.

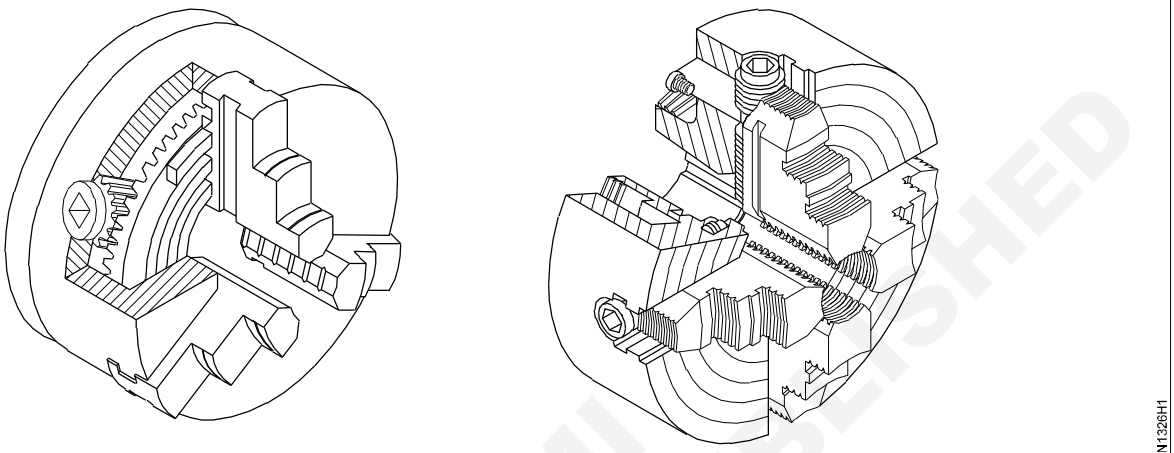
Fig 9



Dismantling and assembling of 3 jaw and 4 jaw chuck

Objectives : At the end of this exercise you shall be able to
- **dismantle 3 jaw self centring chuck of lathe**
- **dismantle 4 jaw independent chuck of lathe.**

Fig 1



Job sequence

Three jaw chucks

- Clean the chuck body with cotton waste.
- Rotate any one of the pinion in anticlockwise direction with the chuck key.
- Remove all the three jaws one after another by rotating.
- Remove the back plate by unscrewing the screws bolts.
- Separate the pinions by removing curved keys.
- Remove scroll disc from the chuck body.
- Clean all the parts with kerosene oil.
- Lubricate the sliding surfaces with grease.
- Reassemble all the parts in the reverse sequence.
- Mount the chuck on the machine spindle.
- Take a trial run of the chuck and check the function.

- **Four jaw chucks**
- Clean the chuck's body with cotton waste.
- Check the function of the chuck.
- Remove all the four jaws individually by rotating the screws in anticlockwise direction by a chuck key.
- Remove the fork pins by unscrewing the locking screws. Remove the driving screws.
- Repair or replace the worn out parts.
- Clean all the parts with kerosene oil.
- Lubricate all the moving surfaces with grease.
- Re-assemble all the parts in reverse sequence.
- Mount the chuck on the machine spindle.
- Take a trial run of the chuck and check its function.

Skill sequence

Dismantling and assembling of lathe chuck

Objectives: This shall help you to
- **dismantle a lathe chuck**
- **lubricate and re-assemble the lathe chuck.**

3 jaw self centering chuck

Clean the chucks body with cotton waste.

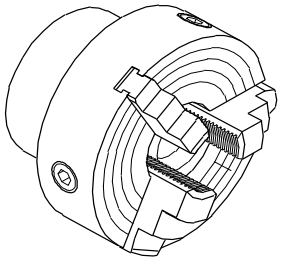
Inspect the function of the chuck.

Remove all the three jaws, one after another by rotating any one of the pinions in anticlockwise direction with the chuck key.

Remove the back plate by unscrewing the screws /bolts and separate the pinions by removing curved keys.

Remove scroll disc from the chuck body.

Fig 1



3 JAW SELF-CENTRING CHUCK

TUN1326H1

Use proper allen key, screwdriver, soft hammer, copper drift etc to avoid damage of the parts

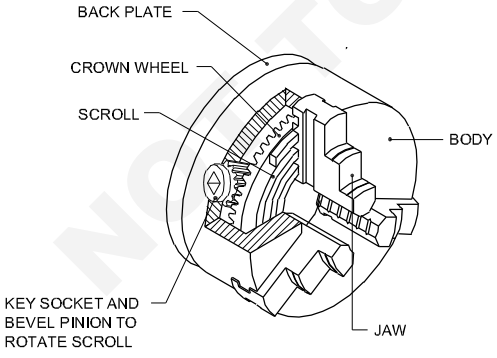
Repair or replace the broken / wornout parts, if any.

Clean all the parts with kerosene oil and wipe off with a banian cloth.

Lubricate the sliding /moving surfaces with servo gem No. 2 grease.

Reassemble all the part in the reverse sequence.

Fig 2



TUN1326H2

All the 3 jaws both forward set and reverse set are marked as 1,2,3 which must be fitted serially, one by one, into the slots provided for the particular jaws.

Take a trial run of the chuck and check its function.

4 jaw independent chuck

Clean the chuck's body with cotton waste.

Check the function of the chuck.

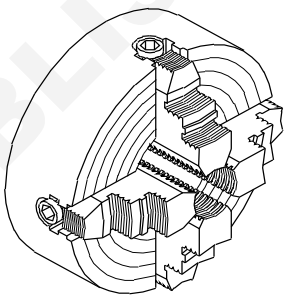
Remove all the four jaws individually by rotating the screws in anticlockwise direction by a chuck key.

Remove the fork pins (4 Nos) by unscrewing the locking screws.

Remove the driving screws. (4 Nos)

Use soft hammer, copper drift, proper allen keys/ spanners to avoid damage of the parts.

Fig 3



4 JAW INDEPENDENT CHUCK

TUN1326H3

Repair or replace the broken / worn out parts, if any.

Clean all the parts with kerosene oil.

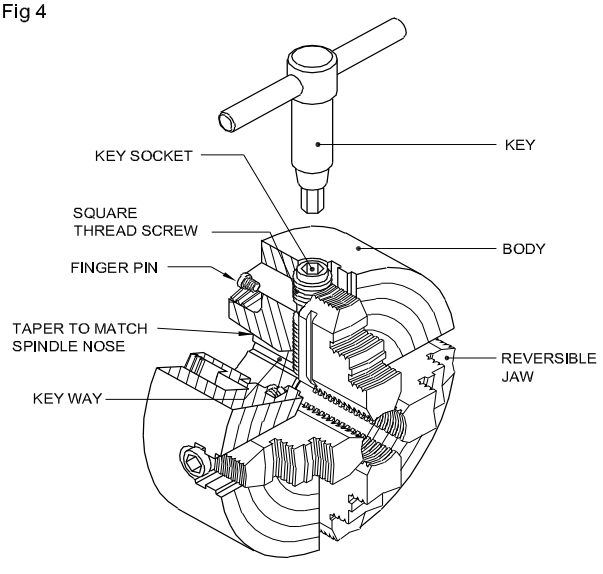
Wipe off all the parts with banian cloth.

Lubricate all the sliding/moving surfaces with servo gem No. 2 grease.

Re-assemble all the parts in reverse sequence.

Take a trial run of the chuck and check its function.

Fig 4

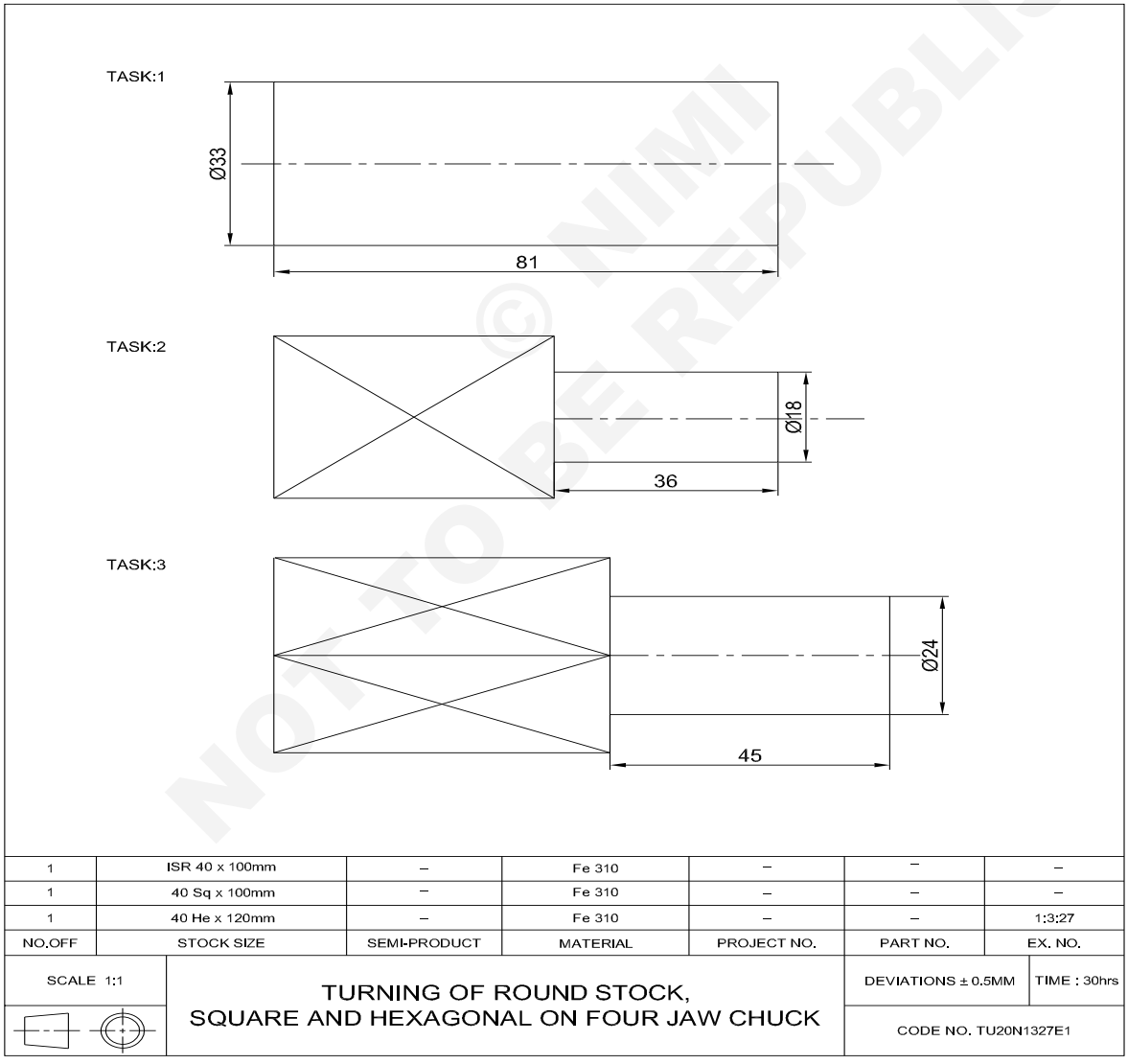


TUN1326H4

Turning of round stock, square and hexagonal on 4- Jaw independent chuck

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

- **true the workpiece on a 4 jaw chuck**
- **set the tool to the centre height**
- **turn to the required diameter and length**
- **measure the diameter and length using outside caliper and steel rule.**



NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
1	ISR 40 x 100mm	–	Fe 310	–	–	–
1	40 Sq x 100mm	–	Fe 310	–	–	–
1	40 He x 120mm	–	Fe 310	–	–	1:3:27

SCALE 1:1	TURNING OF ROUND STOCK, SQUARE AND HEXAGONAL ON FOUR JAW CHUCK	DEVIATIONS ± 0.5MM	TIME : 30hrs
		CODE NO. TU20N1327E1	

Job sequence

TASK 1 : **Turning round rod**

- Check the raw material.
- Hold the job in a four jaw chuck about 50mm outside and true it with help of surface gauge.
- Face one end.
- Turn Ø33mm to about 40mm length.
- Reverse the job and reset it holding Ø33mm.
- Face the other end to a total length 94 mm turn the outer diameter Ø33mm.
- Check the dimension with a steel rule and outside calipers.
- Deburr the workpiece.

— — — — — — —

TASK 2 : **Turning square rod**

- Check the raw material.
- Hold the job in a four jaw chuck about 50mm length outside and true it with help of surface gauge.
- Face and turn Ø18 to about 36mm length.
- Check the dimension with a steel rule and outside caliper.
- Face the other end to a total length 94 mm turn.
- Deburr the work piece.

— — — — — — —

TASK 3 : **Turning hexagonal rod**

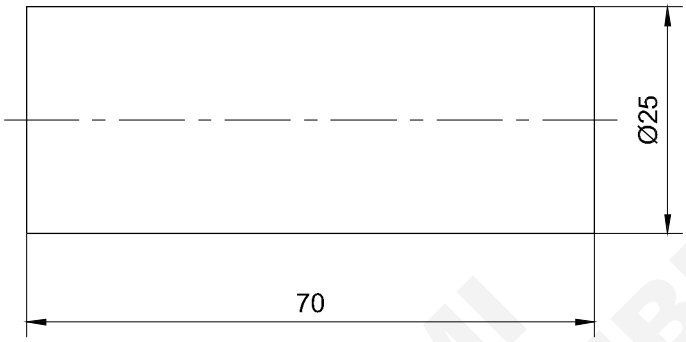
- Check the raw material.
- Hold the job in a four jaw chuck about 60mm length outside the chuck and true it with help of surface gauge.
- Face and turn Ø24mm about 45mm length.
- Check the dimension with a steel rule and out side caliper.
- Face the other end to a total length 94 mm turn.
- Deburr the workpiece.

— — — — — — — —

Turning of round stock on 3 jaw self centering chuck

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

- **hold the workpiece on a 3 jaw chuck**
- **set the tool to the centre height**
- **face the work piece to the required length. Turn the work piece to required diameter.**



Job sequence

- Check the raw material.
- Hold the job in a 3 jaw chuck about 50 mm outside and true it.
- Face one end.
- Turn Ø25 to about 40 mm length.
- Reverse the job and reset it, holding on ∅ 25 mm inside of the chuck.
- Face the other end to a total length of 70 mm and turn the outer diameter Ø25 mm.
- Check the dimension with a steel rule and calipers.
- Deburr the workpiece.

1	Ø30 - 75	–	Fe 310	–	–	1.3.28
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	TURNING OF ROUND STOCK ON 3 JAW CHUCK	DEVIATION ± 0.5	TIME 20h
		CODE NO. TU20N1328E1	

Skill Sequence

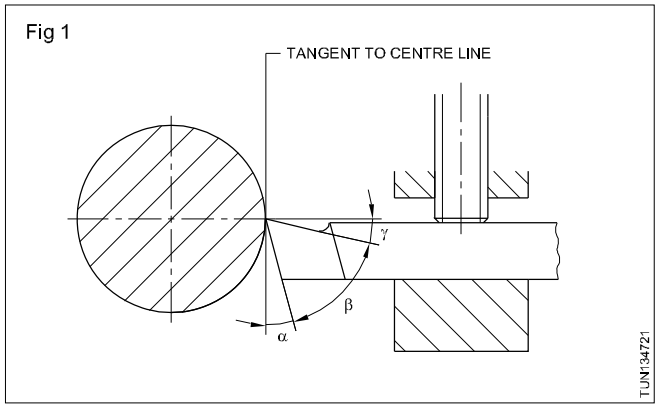
Tool setting

Objective : This shall help you to

- **set the tool in the tool post for performing the operation.**

For optimum cutting, the effective rake angle and clearance angle of the clamped tool must be equal to the ground angles of the tool. This requires clamping of the tool to have its axis perpendicular to the lathe axis, with the tool tip at the workpiece centre. (Fig 1)

Fig 1



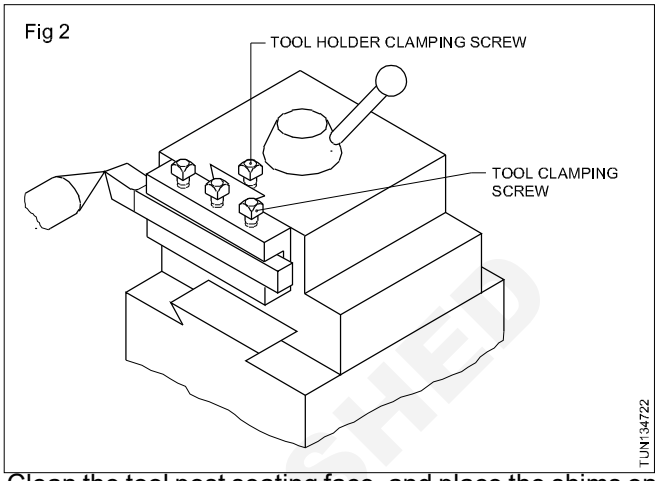
It is difficult to determine the effective angles of the tool when it is not set to the centre height.

The tool nose can be set to the work centre by means of a tool-holder with adjustable height. (Fig 1)

The tool nose can be set to the exact centre height by placing the tool in the tool post on the shims or packing strips. These packing strips should be preferably a little less in width than the width of the tool but should never be more. The length of these strips should be according to the shank length and the tool seating face of the tool post. (Fig 2)

The procedure to follow is given below.

Fig 2



Clean the tool post seating face, and place the shims on the seating face.

Use a minimum number of shims for height adjustment.

Shims must be flushed with the edge of the seating face.

Place the tool in the tool post on the shims, with the rear butting against the wall of the seating face. (Fig 3)

The unsupported length of the overhanging end of the turning tool should be kept to a minimum. As a rule, the overhanging length of tool is equal to the tool shank width x 1.5.

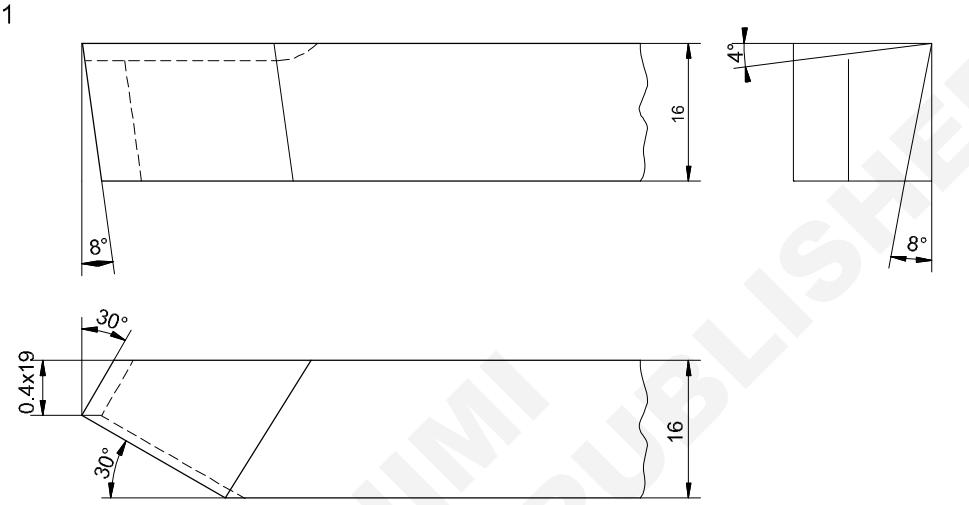
Tighten the tool with the centre screw of the tool post.

Grinding of R.H. and L.H., V-tool, side cutting tool and parting tool

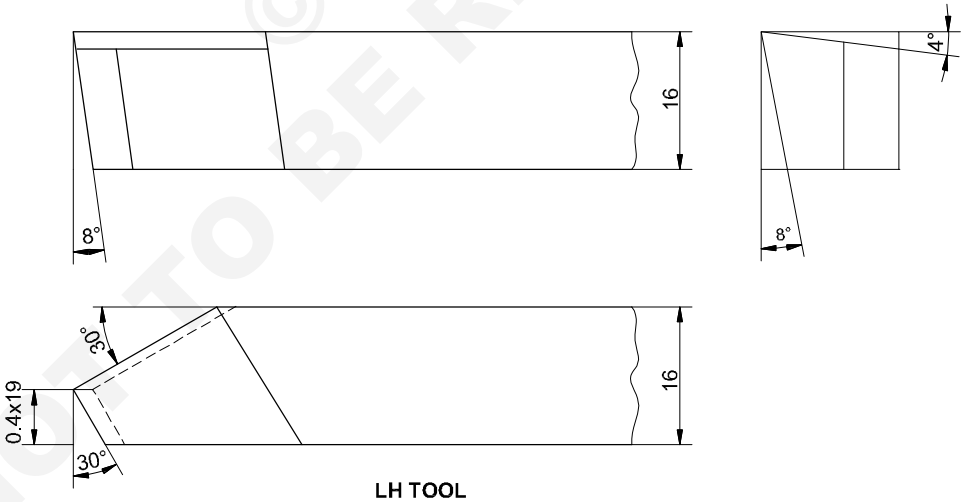
Objectives : At the end of this exercise you shall be able to

- **Grind R.H. and L.H. tool**
- **grind 'V' tool**
- **grind side cutting tool**
- **grind parting tool**
- **check the angles with a protractor.**

TASK-1



RH TOOL

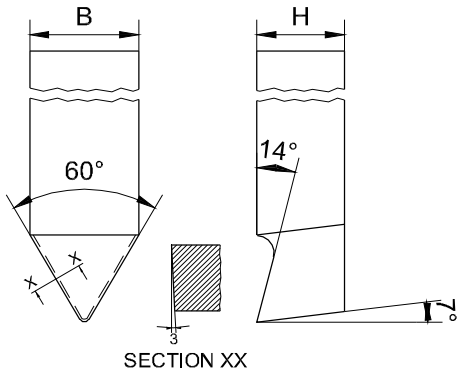


LH TOOL

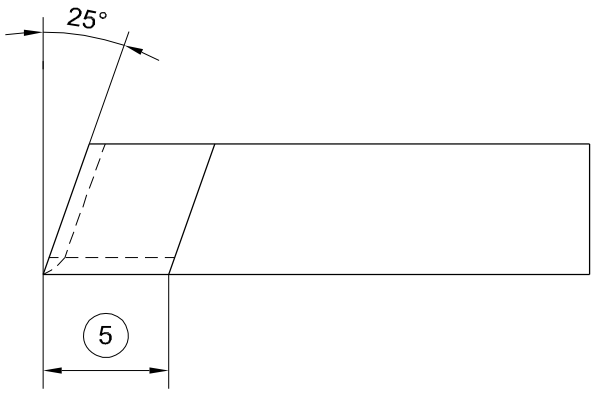
2	SQ 12-16	–	Fe 310	–		
1	SQ 16-110	–	Fe 310	–		
1	SQ 12-110	–	Fe 310	–		
1	20ISP-12-150	–	Fe 310	–		1.3.29
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX NO.

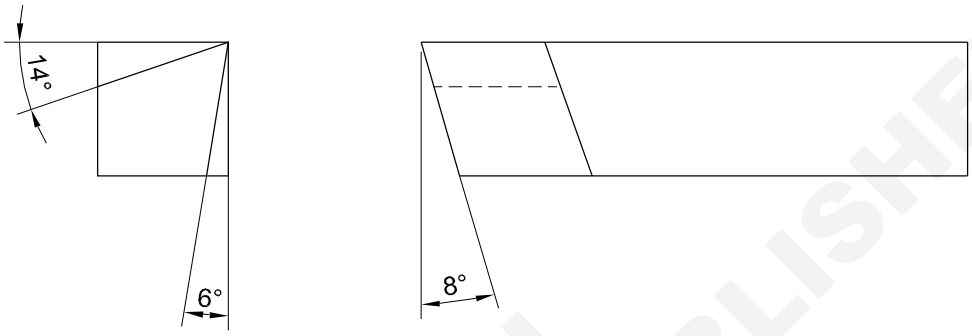
SCALE 1.1	**GRINDING OF R.H. AND L.H.TOOL**	DEVIATIONS ± 1°	TIME
		CODE NO. TU20N1329E1	

TASK:2

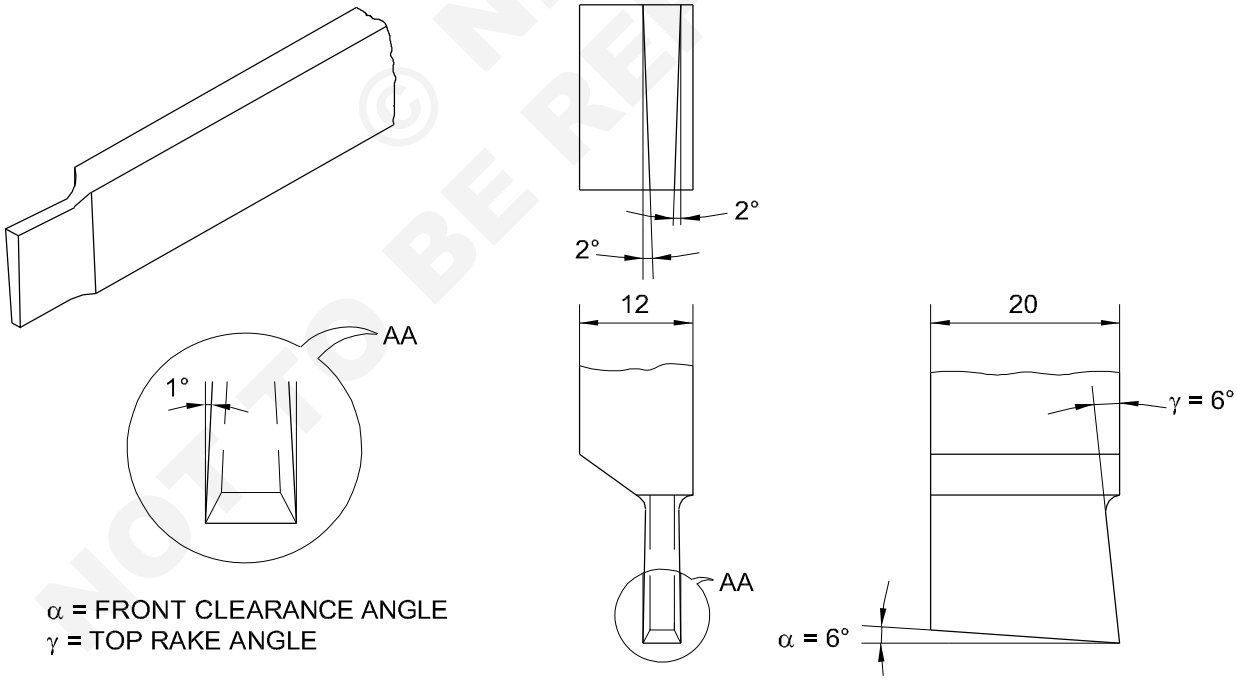


TASK:3





TASK:4



α = FRONT CLEARANCE ANGLE
γ = TOP RAKE ANGLE

–	–	–	–	–	–	1.3.29
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	**GRINDING 'V' TOOL, SIDE CUTTING TOOL AND PARTING TOOL**				DEVIATIONS ± 1°	TIME
					CODE NO. TUN1329E2	

Job sequence

TASK 1: **Grinding R.H and L.H tools**

- Rotate the wheel by hand and observe for free rotation.
- Check the grinding wheels for true running.
- Wear goggles.
- Dress the wheels by a wheel dresser.
- Adjust the tool-rest to maintain a minimum gap from the wheel face to a minimum of 2 to 3 mm.
- Hold and apply the side flank of the tool to the front face of the grinding wheel at 30° to horizontal.
- Move the tool left to right and vice versa to grind the side cutting edge angle to cover 2/3rd width of the tool.
- Grind a side clearance angle of 8°, the bottom of the edge touching the wheel first.
- Rough grind the end cutting edge angle of 30° and the front clearance angle of 4° simultaneously.
- Hold the top flank of the tool against the wheel face inclined at 14°, the rear side contacting the wheel first, and grind the side rake angle of 14°.
- Ensure that the ground portion is parallel to the side cutting edge.
- Finish grind all the faces on the finishing wheel.
- Grind a nose radius of approximately R. 0.4 mm.
- Check the angles with a tool angle gauge and template.
- Lap the cutting edge with an oilstone.
- The top rake (back rake) angle should be kept at 4°.
- To prepare L.H tool follow the same procedure.

— — — — — — — —

TASK 2 : **Grinding 'V' Threading tools (Metric)**

- Set the pedestal grinder for tool grinding and make sure it is safe to start.
- Remove excess material on right hand side of the tool to length equal to the thickness of tool and width.
- Adjust the tool test to maintain a minimum gap from the wheel face of 2 to 3 mm.
- Wear the goggles, start the wheel, hold the tool firm at an angle of approximately 60° to the face of the wheel, grind the left hand side of tool.
- Repeat the above procedure for right hand side to get the included angle of 60° .
- Grind the top rake angle, back rake angle of 14°
- Grind the front clearance angle of 7°, the bottom of the edge touching the wheel first.
- Lap the cutting edge with an oilstone.

Precautions:

- Wear goggle
- Avoid high temperature of tool by using suitable coolant.

— — — — — — —

TASK 3: **Grinding side cutting tool**

- Check the gap between the wheel and the tool rest, and maintain the gap 2 to 3 mm.

Damages or any corrections needed should be brought to the notice of instructor.

- Hold the blank against the wheel to grind the end cutting edge angle 20° to 25° and the front clearance angle between 6° to 8° - simultaneously.
- Grind the side of the tool - for giving 6° to 8° side clearance. The side length should be equal to the width of the tool blank.
- Grind the top of the tool for a side rake angle of 12° to 15°.
- Finish grind all angles and clearances - on a smooth wheel.
- Grind a nose radius of approximately R 0.5 mm.

The ground surfaces should be without steps and should have a uniform smooth finish.

— — — — — — —

TASK 4: Grinding parting tool

- Set the pedestal grinder for tool grinding.
- Remove excess of material on right hand side of the tool to length equal to the thickness of tool and width.
- Grind Half of the thickness of tool on rough grinding wheel.
- Grind 4° to 6° front clearance angle.

- Hold the tool at an angle of 55° to the face of the wheel.
- Grind $27\frac{1}{2}^{\circ}$ on left hand side of the tool.
- Repeat the above procedure on the right side of the tool to get an included angle of 55° on the tool.
- Grind 2° to 4° side clearance angle on each side of the tool.
- Finish all sides by using smooth grinding wheel. Check the tool by centre gauge; there should not be any light passing through gauge and cutting edges of the tool.
- Cutting point is carefully ground in a smooth wheel.
- Finally lap the tool by applying oil stone on cutting edges.

Remember

- Avoid high temperature of the tool.
- The cutting edge should be visible during grinding.

— — — — — — —

Skill sequence

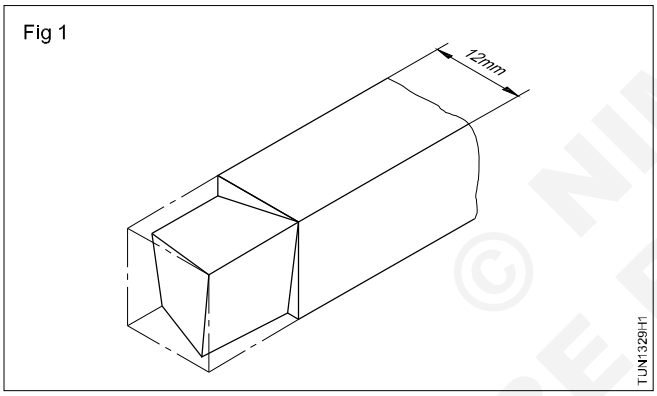
Grinding a side cutting tool for machining steel

Objective : This shall help you to

- **grind a right hand side cutting tool to machine steel.**

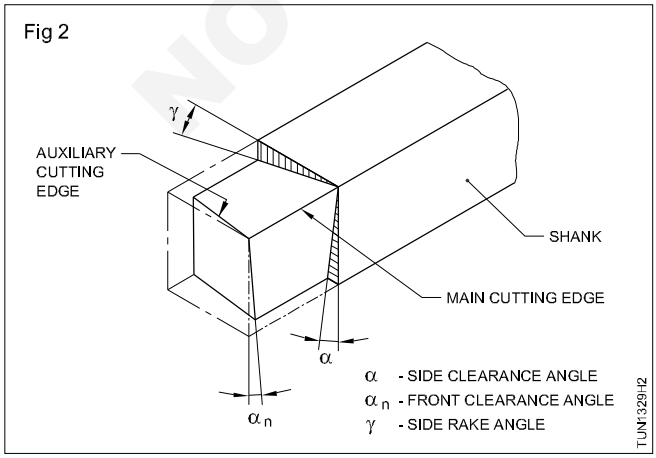
The side cutting tool to be used on steel is illustrated in Fig 1. The right hand portion illustrates the tool blank in dotted lines before grinding, and the ground tool by thick lines. (Fig 1)

Fig 1



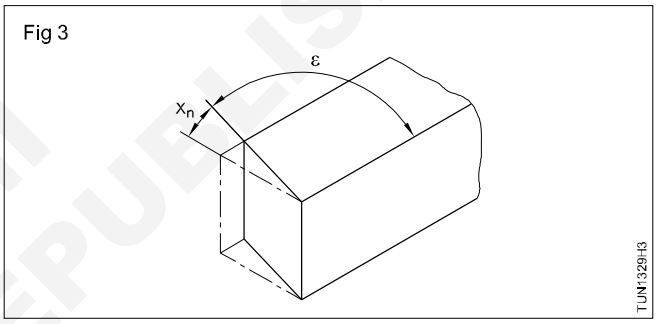
The side cutting edge is in line with the blank edge and the end cutting edge is inclined at an angle of 25°. The side rake angle is 14°. The front and side clearances are ground 6°. The length of the side cutting edge is maintained equal to the size of the square cross-section of the tool blank, i.e. 12 mm. Fig 2 shows the shaded portion to be removed by grinding the tool blank to get the ground tool. The procedure in sequence is as follows.

Fig 2



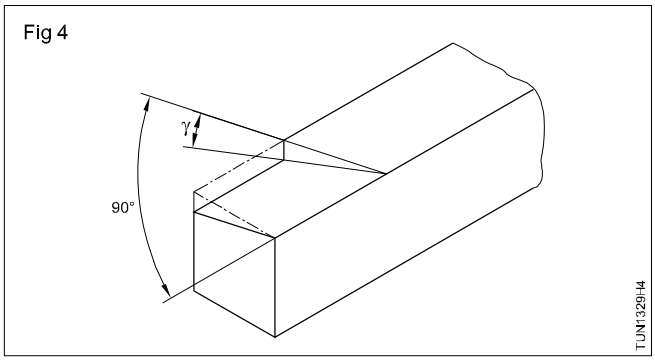
Grind the end cutting edge angle 25°. Angle 'x_n' (Fig 3)

Fig 3



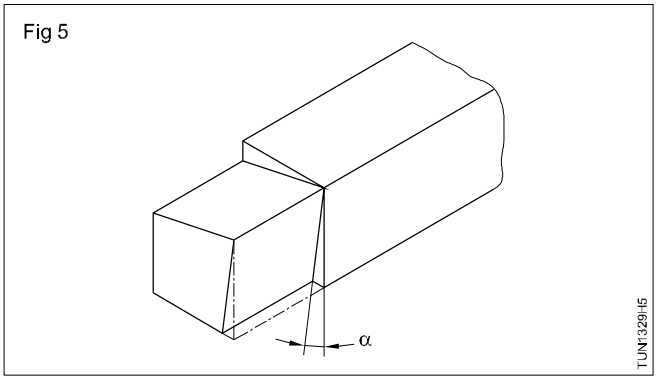
Grind the side rake angle of 14°. Angle γ. (Fig 4)

Fig 4



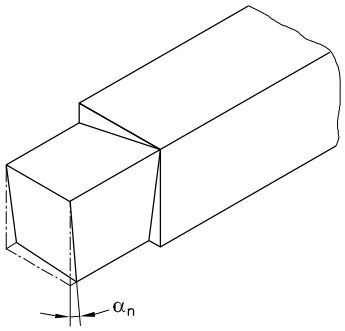
Grind the side clearance angle of 6°. Angle α (Fig 5)

Fig 5



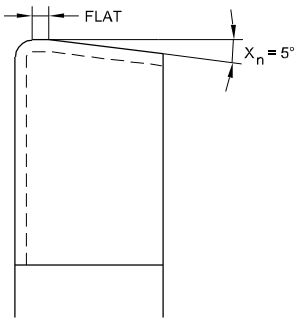
Grind the front clearance angle of 6°. Angle α_n (Fig 6)

Fig 6



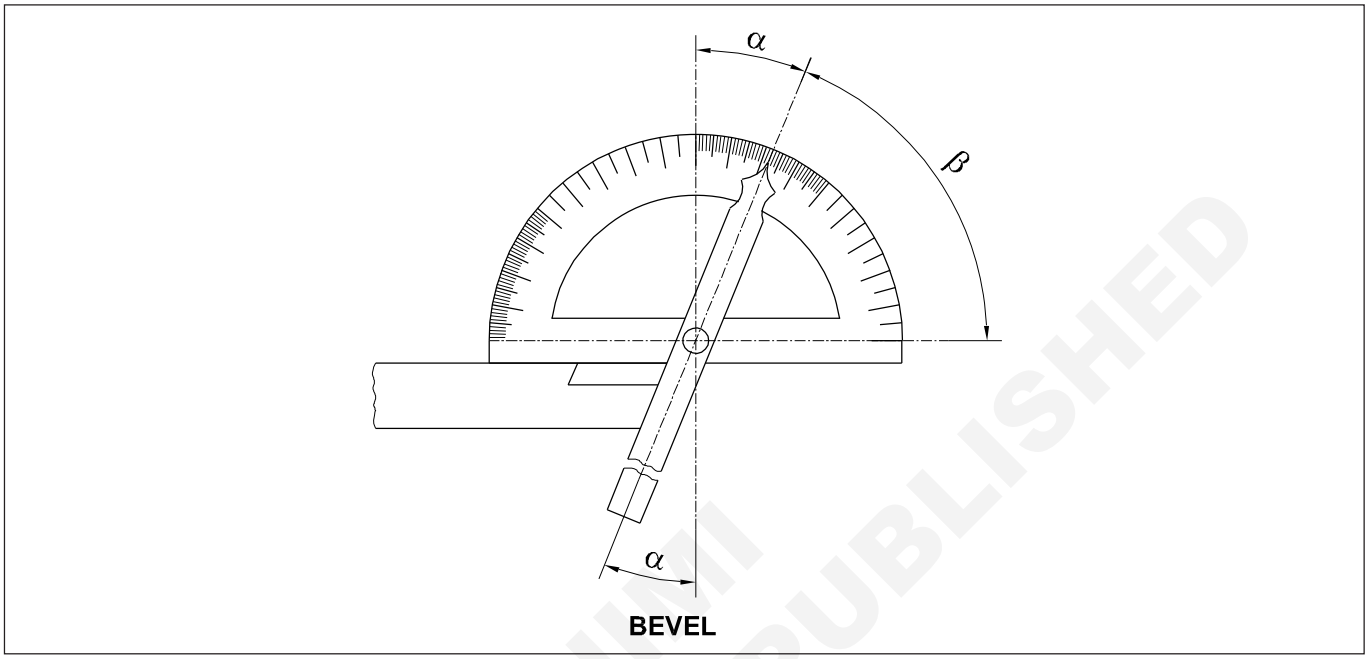
Grind and provide a nose radius of R 0.4 to R 0.6 mm at the point of tool. Grind a flat for a short length of 0.2 to 0.3 mm as shown in Fig 7. For the sake of clarity the figure is magnified.

Fig 7



Checking of angles with angle gauge and bevel protractor

Objectives : At the end of this exercise you shall be able to
- **build up different angle using angle gauge**
- **measure angle of a different components using bevel protractor.**



BEVEL

Job sequence

Instructor shall demonstrate on angle measurement using bevel protractor

- Trainees should be able to set different angle using bevel protractor.
- Trainees should measure the angle of work piece provided by the instructor and record it in table 1.

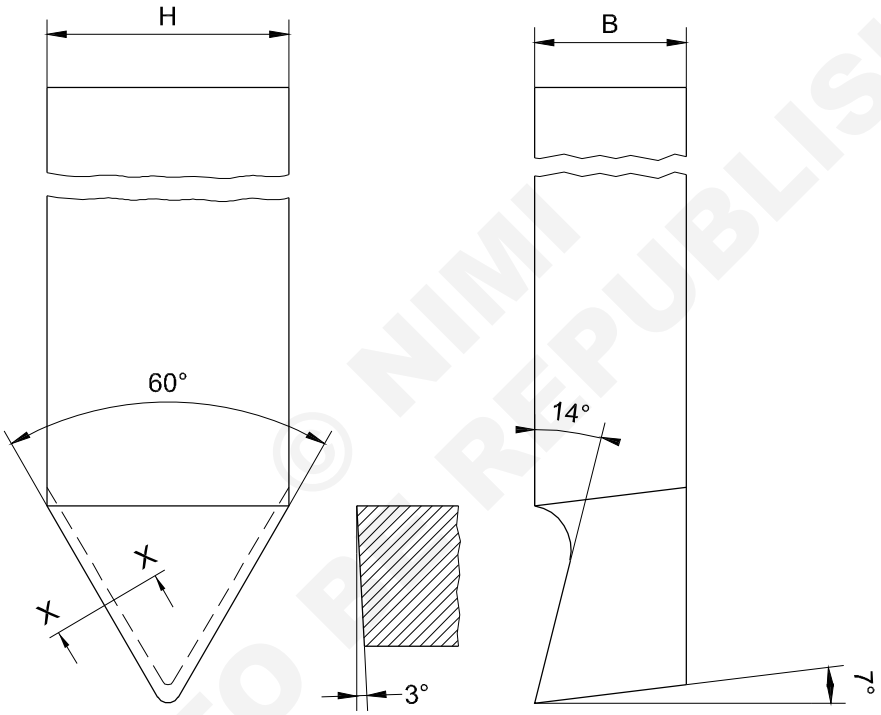
Note: The instructor may check the angle by angle gauge and evaluate

Table - 1

Component	Angle
1	
2	
3	
4	
5	

Grinding 'V' threading tool metric 60° degree threads

Objective : At the end of this exercise you shall be able to
- **grind 'V' threading tool (metric).**



SECTION XX

1	12 ISF 8 x 150	-	Fe 310	-	-	1.3.31
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	GRINDING 'V' THREADING TOOL METRIC				TOLERANCE	TIME 9hrs
					CODE NO. TUN1331E1	

Job sequence

- Remove the excess material on the right hand side to the required width and length by using a rough grinding wheel.
- Grind Half of the thickness of tool on rough grinding wheel.
- Grind 4° to 8° front clearance angle.
- Hold the tool at an angle 30° to the face of the wheel.
- Grind 30° on left hand side of the tool.
- Repeat the above procedure on the right side of the tool to get an included angle of 60° on the tool.
- Grind 3° to 5° side clearance angle on each side of the tool.
- Finish all sides by using smooth grinding wheel.
- Check the tool by centre gauge; there should not be any light passing through gauge and cutting edges of the tool.
- Cutting point is carefully ground in smooth wheel.
- Finally lap the tool by applying oilstone on cutting edges.

Remember

- Avoid burning of the tool.
- The cutting edge should be visible during grinding.

Skill Sequence

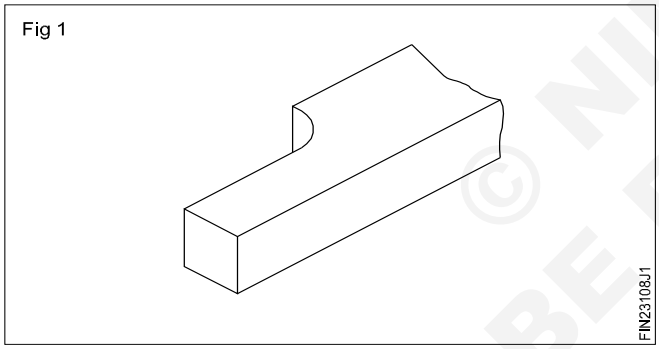
Grinding 60° threading tool

Objective : This shall help you to
- **grind 60° threading tool.**

Set the pedestal grinder for tool grinding.

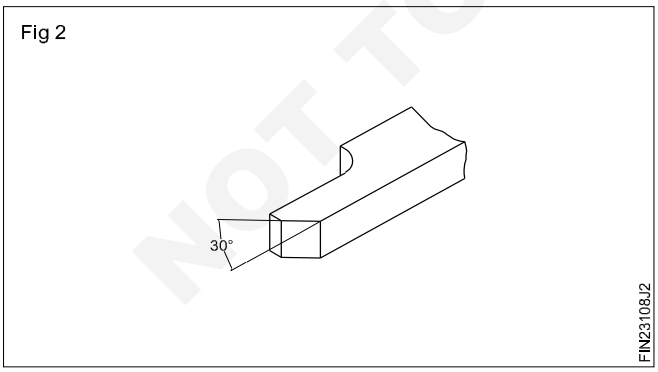
Remove excess material on right hand side of the tool to length equal to thickness of tool and width being half of the thickness of tool on rough grinding wheel. (Fig 1)

Fig 1



Hold the tool at an angle of 60° to the face of the wheel, grind 30° on left hand side of the tool. (Fig 2)

Fig 2



Repeat the above procedure on the right side of the tool to get an included angle of 60° on the tool. (Fig 3)

Finish all sides by using smooth grinding wheel.

Do not Grind Rake Angle

Check the tool by centre gauge, there light should not pass through gauge and cutting edge of the tool. (Fig4)

Fig 3

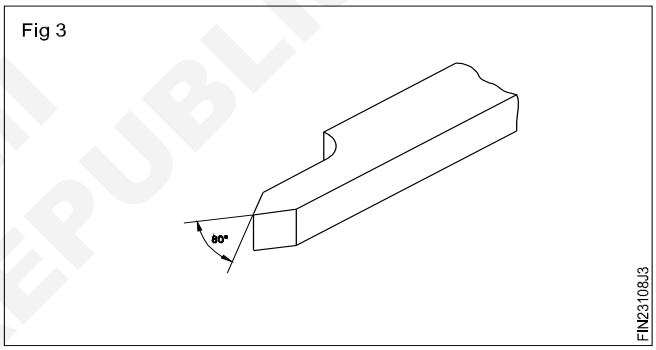
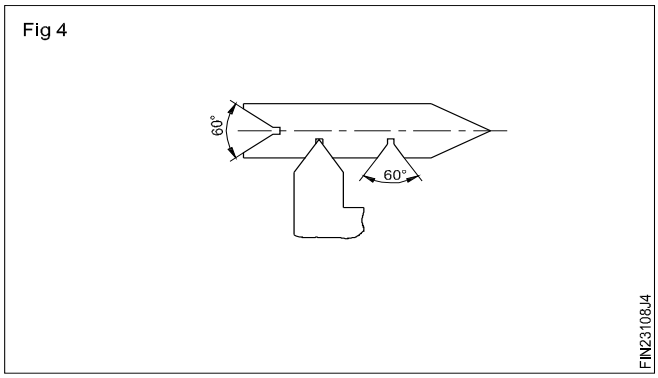


Fig 4



Cutting point is curved to 0.14 x pitch by carefully grinding in smooth wheel.

Finally Lap the tool by applying oil stone on cutting edges.

Safety precautions

Ensure grinding wheels are properly guarded.

Keep 2mm gap between tool rest and grinding wheel face.

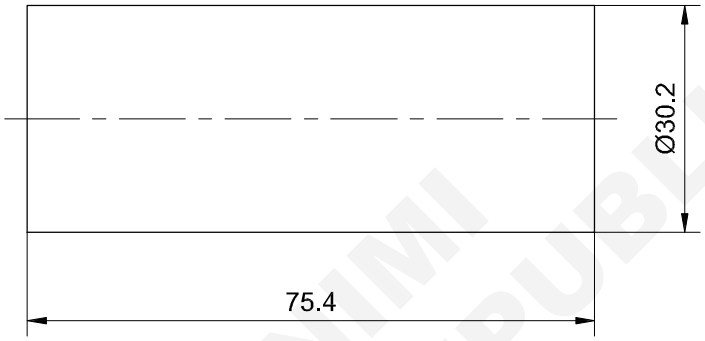
Ensure cutting edge is visible to the operator while grinding.

Do not give too much pressure on the wheel face.

Frequently cool the tool in coolant.

Facing operation to correct length

Objectives : At the end of this exercise you shall be able to
- **true the work piece on a 4 jaw chuck**
- **set the tool to the centre height**
- **face the work piece to an accuracy of ±0.1mm.**



Job sequence

- Check the raw material.
- Hold the job in a four jaw chuck about 60mm out side and true it.
- Face one end.
- Turn Ø30.2mm to about 50mm length.
- Reverse the job and reset it, holding on Ø 30.2mm.
- Face the other end to a total length 75.4mm turn the outer diameter Ø30.2mm.
- Check the dimension with a steel rule and out side caliper.
- Deburr the workpiece.

1	Ø36 - 80	-	Fe 310	-	-	1.3.32
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	FACING OPERATION TO CORRECT LENGTH	DEVIATIONS ± 0.1	TIME 5hrs
		CODE NO. TU20N1332E1	

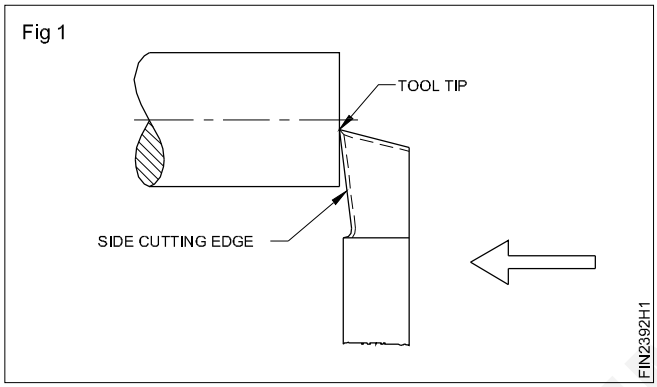
Skill Sequence

Finish-facing the work with a right hand facing tool

Objective: This shall help you to
- **finish-facing the work using a right hand facing tool.**

When more metal is to be removed on the face of work, we prefer to do rough facing by an L.H. facing tool or a L.H. roughing tool, feeding the tool from the periphery of the work towards the centre. Finish-facing is done to get a better surface finish on the face of the work by removing the rough facing. The normal R.H. facing tool, having its cutting edge straight, may be kept slightly inclined to the face of the work during facing. A tool, having its cutting edge itself ground at an angle, may be used. (Fig 1)

Fig 1



The procedure of the finish-facing the work with such a tool is given in sequence below.

Hold the tool in the tool post to the correct centre height with its axis at right angles to the axis of the work and with a minimum overhang.

Set the machine to about 500 rpm. (Calculate the spindle speed by choosing the recommended cutting speed for finish-facing and the mean diameter of the work).

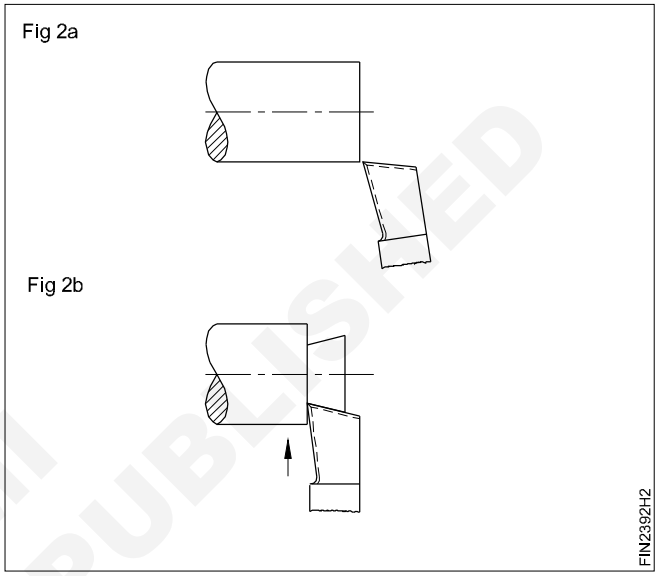
Start the machine and touch the tool point to the work-face by moving cross slide and carriage movement. Move the tool away from the work (Fig 2a) and set the top slide graduated collar to zero, eliminating backlash. Lock the carriage.

Feed the tool about 0.5 mm by the top slide.

Feed the tool towards the centre of the work by the cross-slide till the tool point crosses the centre. (Fig. 2b) Move back the tool to the starting position (Fig. 2a).

Fig 2a

Fig 2b



Advance the tool by a further 0.5 mm inside the work by the top slide.

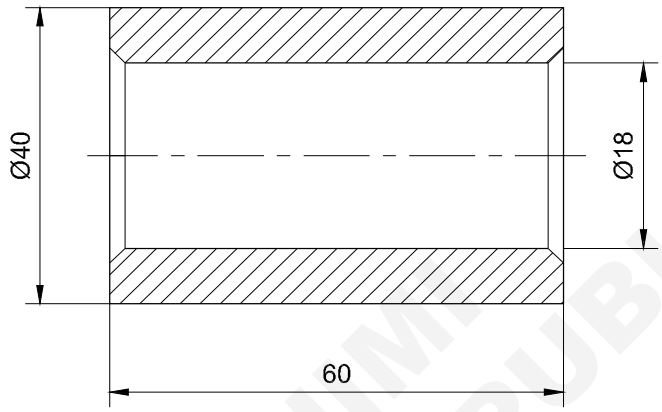
Engage the power feed (set at 0.05 mm/rev.) and allow the tool to travel towards the centre of the work, removing the metal.

Repeat the sequence until the required amount of material is removed.

Observe the finish obtained.

Centre drilling and drilling to a required size

Objectives : At the end of this exercise you shall be able to
- **set the job on a four jaw chuck**
- **set the tool to the centre height**
- **centre drill on a job**
- **drill through hole.**



Job sequence

- Check the raw material size.
- Hold the job in a four jaw independent chuck with 40mm overhang and true it.
- Set the right hand facing tool in the tool post.
- Face one end of the work.
- Fix the drill chuck in the tailstock spindle and fix the centre drill of size A2x6.3 IS : 2473.
- Centre drill the work.
- Turn the outerdia 40 mm to the length 35mm.
- Drill through hole in the job with Ø10mm drill bit after centre drilling.
- Drill through hole in the job with Ø18mm drill bit after drilling Ø10mm.
- Chamfer the drilled hole 1x45° .
- Reverse the job and reset it.
- Face the other end maintain to 60mm length.
- Turn the outer dia 40mm to length 25mm.
- Chamfer the hole 1x45°

1	Ø45 - 65	-	Fe 310	-	-	1.3.33
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	CENTRE DRILLING AND DRILLING	DEVIATIONS ± 0.1°	TIME 5hrs
		CODE NO. TU20N1333E1	

Skill sequence

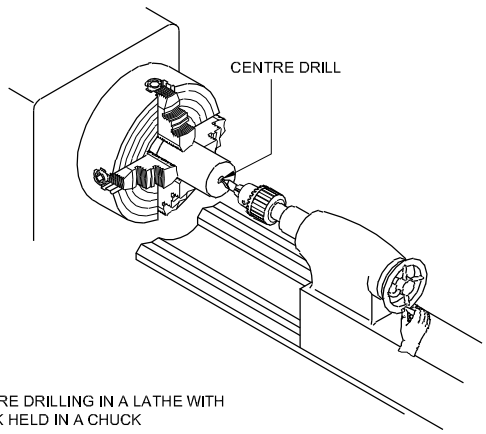
Centre drilling on lathe

Objective : This shall help you to
- **centre drill a work held in a chuck.**

Round workpieces can be quickly and accurately centre-drilled without the necessity of centre punch marks.

The procedure to centre drill a work held in a chuck is given below in sequence. (Fig 1)

Fig 1



CENTRE DRILLING IN A LATHE WITH WORK HELD IN A CHUCK

TUN1333J1

Hold the work in a four jaw chuck about 50 mm outside and true.

Finish face the work with a facing tool.

Ensure no 'pip' is left out in the centre and the face is at right angles to the axis.

Mount the drill chuck in the tailstock spindle.

Remove dirt on the taper shank of the chuck and the tailstock spindle taper bore.

Mount a suitable centre drill securely in the drill chuck.

Set the spindle speed about 1000 r.p.m.

Slide the tailstock over the bed until the centre drill is close to the work face.

Lock the tailstock in this position.

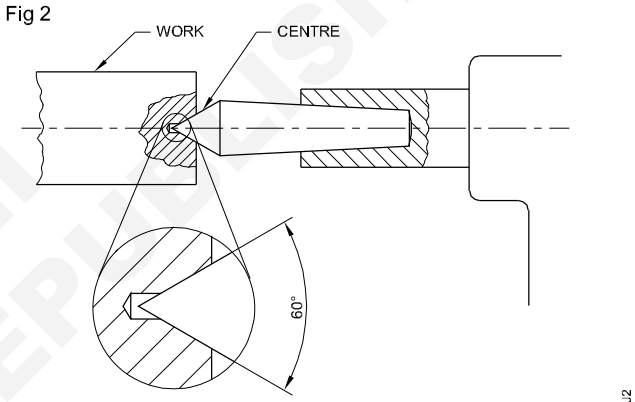
Start the machine and slowly feed the centre drill into the work by rotating the tailstock hand wheel.

Withdraw the drill frequently from the workpiece to clean the chips and to apply the cutting fluid.

Continue drilling until about three fourths of the tapered portion of the centre drill has entered the work. (Fig 2)

Ensure that uniform continuous pressure is applied during feeding and no extra force is given.

Fig 2



CORRECTLY DRILLED CENTRE HOLE

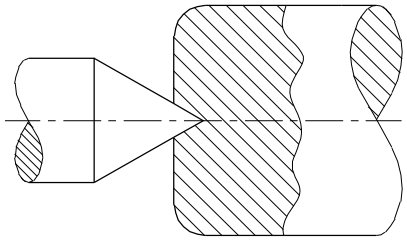
TUN1333J2

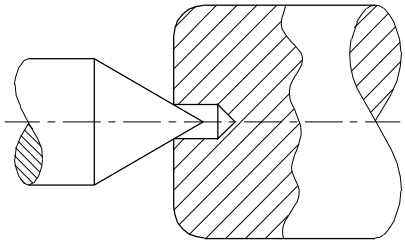
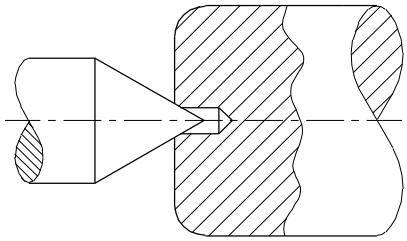
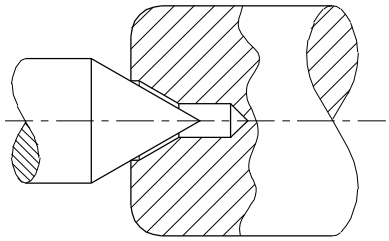
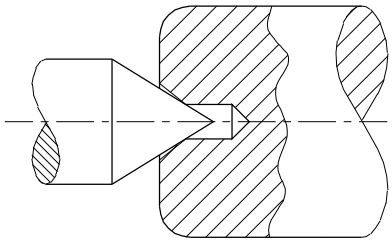
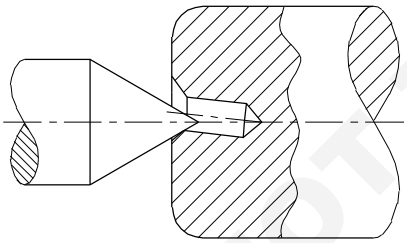
After drilling to the correct depth, withdraw the tailstock spindle.

Note

When the diameter of the work is more than 150 mm with the same amount outside the chuck, and when irregular work is held in the chuck, running the machine at 1000 r.p.m. for centre drilling will cause undue load to the spindle. Avoid this method of centre drilling.

Common errors in centre drilling

Condition of centre hole	Errors	How to avoid and correct the errors
	No clearance for point of centre. Centre hole incomplete. Insufficient bearing surface for lathe centre.	Drill pilot hole. Countersink pilot hole at 60°. Drill centre hole with a centre drill.

Condition of centre hole	Errors	How to avoid and correct the errors
	No bearing surface for lathe centre.	Countersink mouth of hole at 60°.
	Insufficient bearing surface for lathe centres.	Countersink deeper.
	Hole drilled too deep with centre drill. Poor bearing surface.	Face end if the job will allow it. Ream the mouth with a centre reamer.
	Poor bearing surface. Wrong angle.	Countersink hole with a 60° centre drill.
	Centre hole drilled at angle to the axis of work.	Align work squarely when drilling the centre hole. Face end and re-centre.

Rectifying a damaged centre-drilled hole

Objective : This shall help you to
- **correct a damaged centre hole previously centre- drilled.**

When components are disassembled for repairs, the centre-drilled holes in the shafts often get damaged due to many reasons. Unless the damaged centre holes are rectified, the shaft will not run true when held between centres or between chuck and centre.

Centre holes may be rectified by any of the following methods.

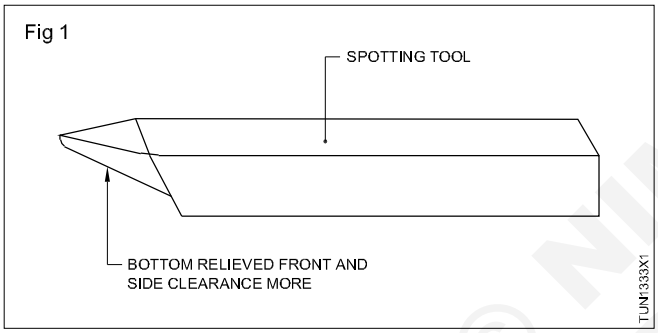
1. With a spotting tool.
2. With a boring tool held in top slide and swiveled at 30°.
3. With a special countersink.

With a spotting tool

Hold the shaft in a four jaw chuck and true by using a dial test indicator.

Grind a 60° spotting tool with sufficient side and front clearance to prevent it from rubbing in the centre hole.(Fig.1)

Fig 1



Fix and clamp the tool straight in the tool post or fix it in a tool-holder and c p the tool -holder in the tool post.

The tool tip must be on the centre line with the axis of the work.

Set the machine to the required r.p.m. depending upon the material and the diameter of the work.

Start the machine and slowly feed the tool bit into the centre hole with the carriage hand wheel.

With the cross-slide hand wheel, gradually feed the tool outwards to make contact with the damaged centre hole countersink portion. (Fig 2)

Continue feeding till the damaged centre hole runs true for its full length.

Finally finish the countersink portion of the centre hole using the 60° countersink drill held in the drill chuck mounted in tailstock.

With a special countersink

Better and quick results can be achieved by using a special countersink. This special countersink is nothing but a centre drill with a broken point but whose 60° angular portion is undamaged. A flat parallel with one cutting face is ground across the end of the centre drill so that only one lip or cutting edge remains. (Fig 3)

Fig 2

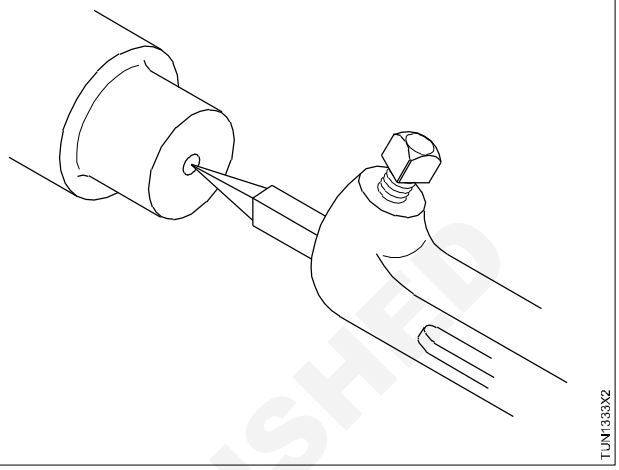
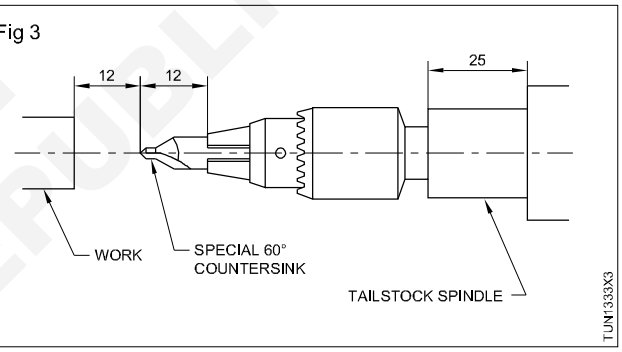


Fig 3



The sequence is as follows.

Mount the workpiece in a four jaw chuck and true it with the dial indicator.

Mount the drill chuck in the tailstock spindle.

Ensure that the tailstock spindle is aligned with the headstock spindle.

Insert the centering tool in the drill chuck with not more than 12 mm protruding.

Set and position the tailstock spindle with a minimum overhang.

Slide the tailstock towards the workpiece and lock the tailstock in position.

Start the lathe and allow the work to rotate.

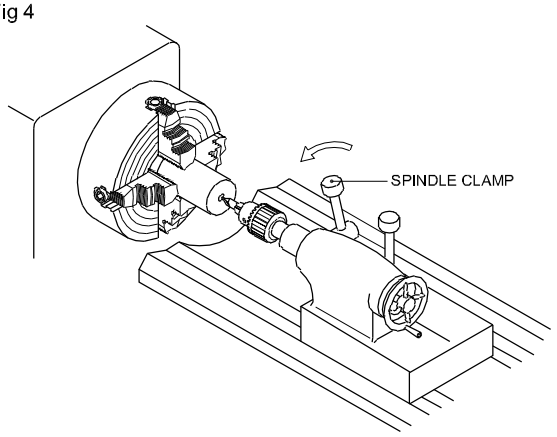
Tighten the tailstock spindle clamp until a slight drag is felt when turning the tailstock hand wheel. (Fig 4)

This prevents the tailstock spindle from deflecting.

Apply the cutting fluid, and slowly bring the centering tool into the damaged centre.

Continue feeding the centering tool until the centre hole runs true. (Fig 5)

Fig 4

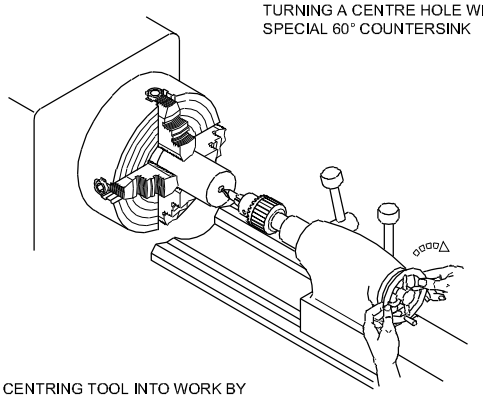


TIGHTEN TAILSTOCK SPINDLE CLAMP LIGHTLY

TUN1333X4

Fig 5

TURNING A CENTRE HOLE WITH A SPECIAL 60° COUNTERSINK



FEED CENTRING TOOL INTO WORK BY TURNING THE HARD WHEEL

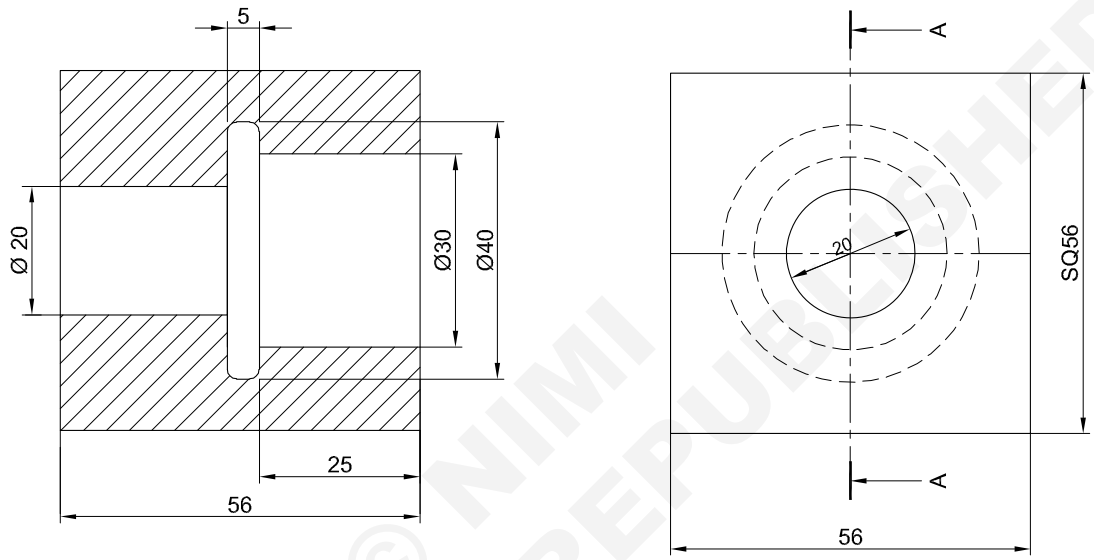
TUN1333X5

Exercise 1.3.34

Make square block by turning, using 4- Jaw chuck and perform and drilling, boring and grooving

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

- **face the work squareness to all the sides**
- **drill hole to required size**
- **select the recessing tool**
- **cut the recess**
- **bore a hole to an accuracy ±0.2mm.**



Job sequence

- Check the raw material.
- Hold the job in 4 jaw chuck and face the end.
- Calculate the maximum size of the square possible the in given round rod.
- Reset and face the other end and maintain total length of job to 56 mm and remove the job from chuck.
- Set the job in 'V' block and mark centre line of the job with help of vernier height gauge.
- Rotate the job to set vertical position of centre line with help of try square.
- Set vernier height gauge 28 mm above the centre line of the job.
- Scribe the horizontal line.
- Follow the same procedure for marking other sides.
- Punch the witness mark of the square.
- Hold the job in 4 jaw chuck in vertical position.
- Set witness mark to parallel of the chuck face and face the job.
- Follow the same procedure for other sides.
- Maintain the measurement side of the square is 56 mm.
- Make centre drill, pilot drill and 18 mm drill simultaneously.
- Enlarge the hole by boring to 20 mm and step bore ϕ 30 x 30 mm length.
- Cut groove as per drawing with help of grooving tool.
- Check the dimensions.

1	Ø80 - 60	–	Fe310	–	1	1.3.34
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	MAKE SQUARE BLOCK BY TURNING,USING-4 JAW CHUCK AND PERFORM DRILLING, BORING AND GROOVING				DEVIATIONS ± 0.1°	TIME : 10Hr
					CODE NO. TU20N1334E1	

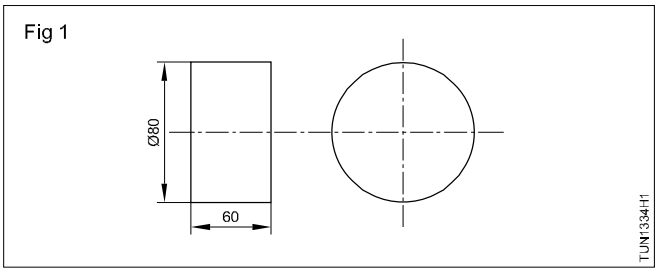
Skill sequence

Making square block from round bar in lathe.

Objective: This shall help you to
- **mark the square in round rod**
- **bore and recess.**

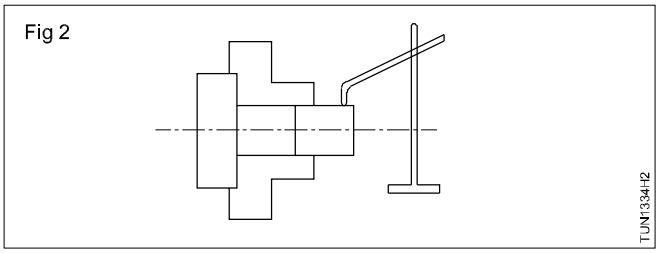
Check the raw material. (Fig 1)

Fig 1



Set the job. (Fig 2)

Fig 2



Face one end of the job. (Fig 3)

Face the other end and length is equal to side of the square (Fig 4).

Fig 3

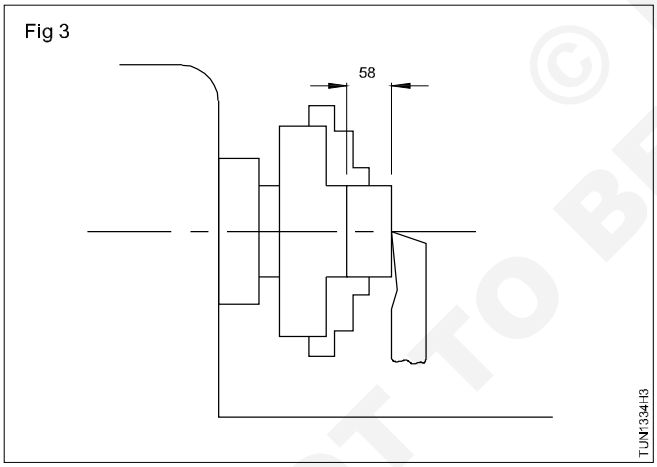
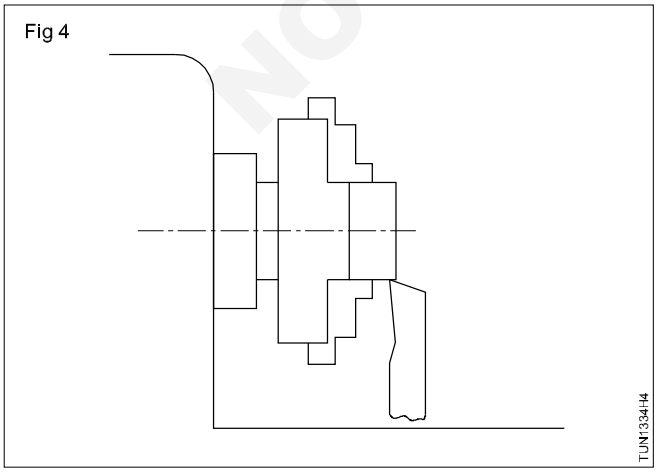
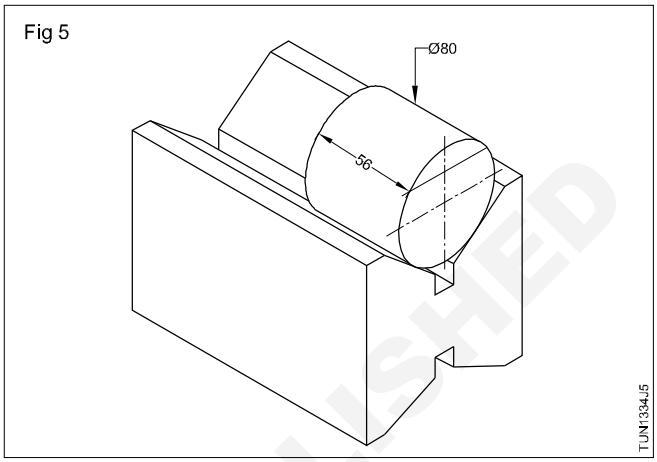


Fig 4



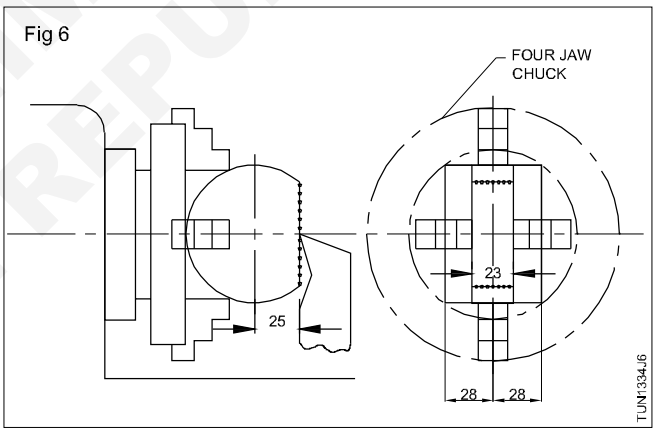
Apply the marking media and set 'V' block marking the side of square and punch witness marks. (Fig 5)

Fig 5



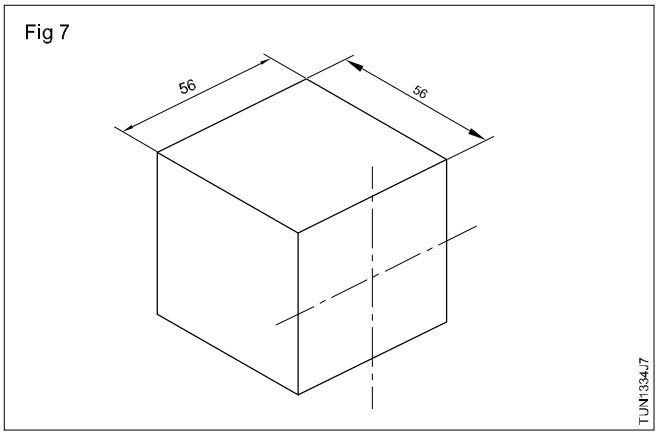
Set the work piece vertical position and set witness mark to parallel to the chucks face and face it. (Fig 6)

Fig 6



The same procedure to face other sides. (Fig 7)

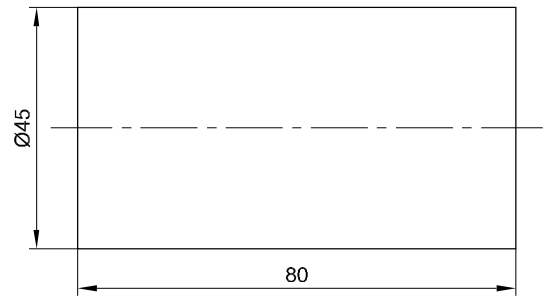
Fig 7



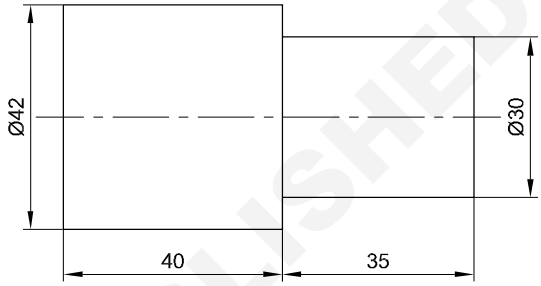
Parallel turning, step turning, grooving, chamfering and parting practice

- parallel turn the work by hand feed method with various depth of cuts
- turn step to the required diameter and length
- groove by the traverse feed method
- chamfer the edges and check with a protractor
- set the parting off tool in the machine to the correct centre height
- form a 'V' groove and match with the template.

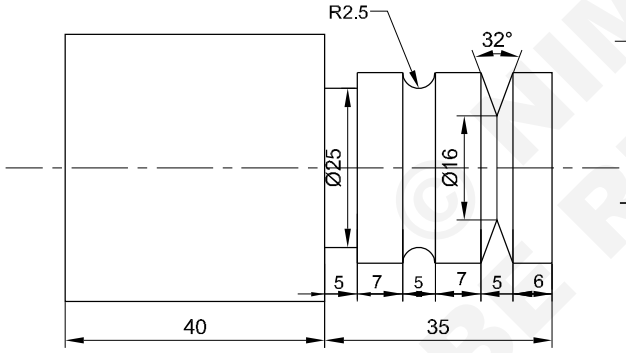
TASK : 1



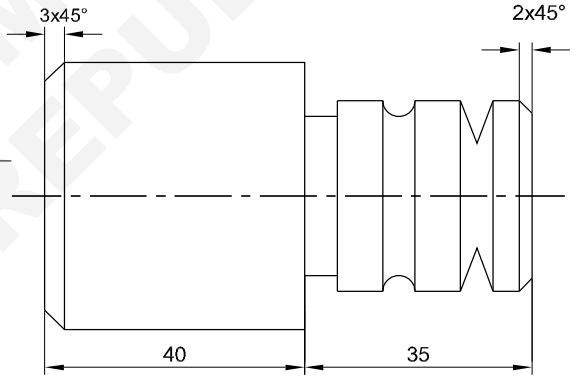
TASK : 2



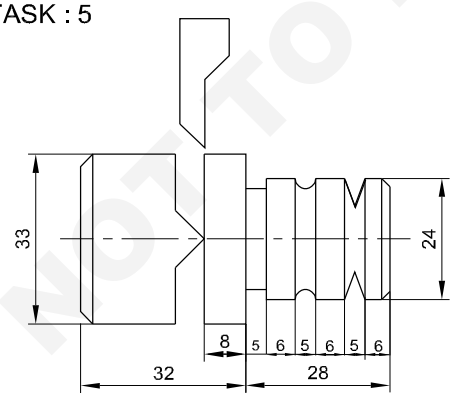
TASK : 3



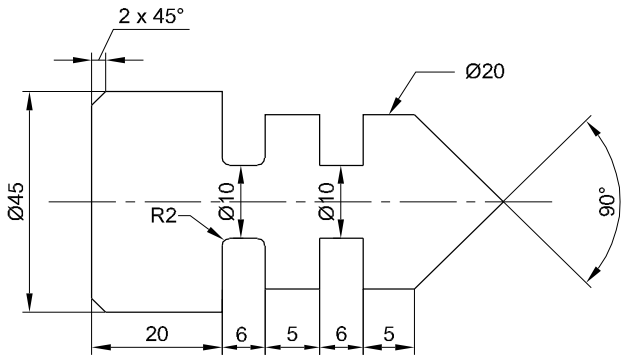
TASK : 4



TASK : 5



TASK : 6



2	Ø55 x 70	-	Fe310	-	TASK 1 - 6	
1	Ø55 x 90	-	Fe310	-	TASK 1 - 6	1.3.35
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	**PARALLEL TURNING STEP TURNING, GROOVING, CHAMFERING AND PARTING**	DEVIATIONS ± 0.1	TIME :
		CODE NO. TU20N1335E1	

Job sequence

TASK 1: Parallel turning

- Check the raw material size.
- Hold the job in a 4 jaw chuck and true it keeping about 50mm outside chuck.
- Set the tool to the correct centre height.
- Select and set the correct spindle rpm.
- Face one side first and turn the outer diameter to Ø45mm for the maximum possible length.
- Reverse and hold the job.
- Face the other end to a total length of 80mm.
- Turn Ø45mm to remaining length.
- Remove the sharp edge.

— — — — — — —

TASK 2: Step turning

- Hold the job in a 4 jaw chuck keeping about 45mm outside and true it.
- Face one end.
- Turn Ø30mm x 35mm length.
- Reverse the job and reset it.
- Face the other end to maintain a 75mm total length.
- Turn Ø42mm x 40mm length.
- Remove the sharp corners.

— — — — — — — —

TASK 3: Grooving

- Set the u/c tool, radius tool, 'V' groove tool to the correct centre height and hold it rigidly.
- form a square groove 2.5mm depth x 5mm width at 30mm from the end face.
- Form a radius groove 2.5mm depth x 5mm width at 18mm from the end face.
- Plunge the 'V' groove tool to form a 'V' groove 5mm width at 6mm from the end face.
- Remove the burrs.
- Check the dimensions.

— — — — — — —

TASK 4: Chamfering

- Set the chamfering tool correct centre height.
- Chamfer the Ø42 step to 3 x 45°.
- Reverse the job and reset it.
- Chamfer the Ø30 step to 2 x 45°.
- Remove the job and check the dimensions.

— — — — — — —

TASK 5: Parting

- Hold the job keeping Ø42 inside at 3 jaw chuck about 50mm outside and true the job.
- Set the 3mm width parting tool correct centre height.
- Select and set the correct spindle speed for parting operation.
- Part the job use plunge cut method at 45mm from the end face.

— — — — — — —

TASK 6: Groove turning

- Write the job sequence.
- Grind the required tool
- Turn the job as per drawing and maintain the dimension
- Part of the job after finishing all turning operations

— — — — — — —

Skill sequence

Parting off operation

Objectives: This shall help you to
- **set the parting off tool in the machine to the correct centre height**
- **follow the correct procedure while parting off**
- **observe certain precautions while parting off.**

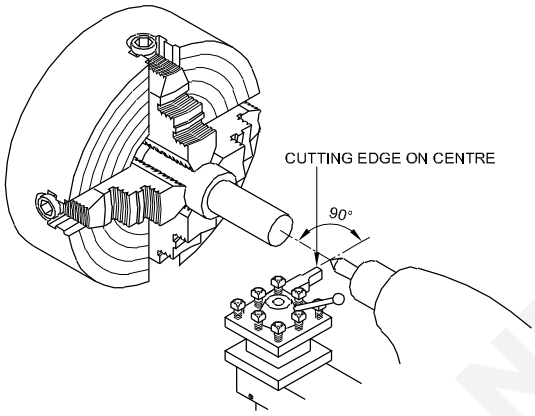
Parting off operation

Parting off or cutting off is the operation of severing a finished part from the rough or finished stock.

Setting of parting tool

Set the parting tool exactly on the centre with as little back-rake as possible. (Fig 1)

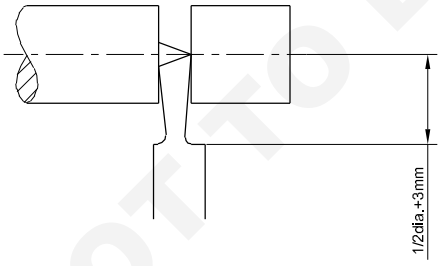
Fig 1



CORRECT CUTTING EDGE POSITION

Adjust the parting off tool so that it extends one half the diameter of the work plus about 3mm for clearance from the tool-holder (Fig 2)

Fig 2



If the cutting tool is too high, it will not cut through the workpiece. If it is too low, the work may be bent and the cutting tool may be damaged.

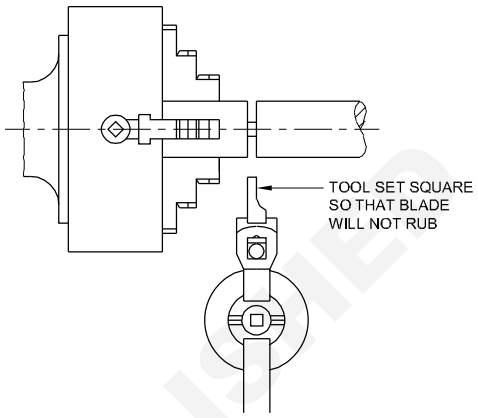
Procedure

Select the correct type of tool for a specified job.

Hold the work with the minimum overhang in a chuck.

Set the tool square with the work so that it does not rub against the sides of the groove, as it is fed into the work. (Fig 3)

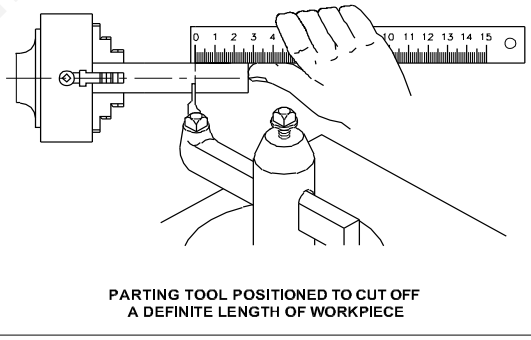
Fig 3



Set the spindle speed to half the speed for turning.

Move the carriage so that the right hand side of the blade is at the point where the work is to be cut off. (Fig 4)

Fig 4



PARTING TOOL POSITIONED TO CUT OFF
A DEFINITE LENGTH OF WORKPIECE

Start the lathe and feed the tool steadily into the work using the cross-slide handle.

Continue to feed the tool into the work until the part is severed.

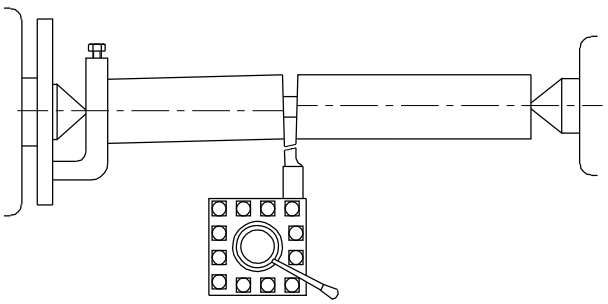
Precautions

The work should protrude from the chuck jaws, sufficiently enough to permit the cut to be made as close as possible to the chuck jaws.

The work must always be held securely in a chuck or a collet.

If the workpiece is held between centres, it may bend or break and fly out of the lathe during parting off. (Fig 5)

Fig 5

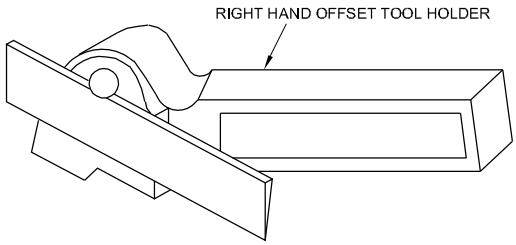


INCORRECT METHOD OF PARTING

TUN1335H5

Use a right hand offset tool-holder. (Fig 6)

Fig 6



INSERTED-BLADE TYPE PARTING TOOL

TUN1335H6

A work having more than one diameter should be gripped on the larger diameter while parting.

Intermittent feed tends to dull the tool's cutting edge.

Heavy feed causes jamming and tool breakage.

Use sufficient coolant on steel. Brass and cast iron should be cut off dry.

Make sure the saddle is locked during the entire operation.

Reduce the rate of feed, when the work is almost cut off.

While parting off long work, it should be supported with the tailstock centre.

If the machine is in good condition, the automatic cross feed may be used.

When the tool has penetrated to about the depth of its width, withdraw it and move it sideways with the compound slide and feed again.

The above operation should be repeated frequently to minimise the tendency of the tool to dig in and cause trouble.

When the parting off operation is almost completed, hold the workpiece by hand to prevent it from falling, so that damage can be avoided.

Chamfering on lathe

Objective : This shall help you to
- **chamfer the end to required size.**

Grind the tool to the given angle usually 45°

Mount the tool and set centre height properly.

Set the speed, lock the carriage.

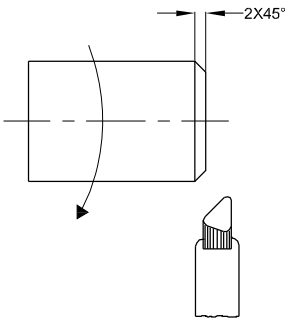
Move cross slide and plunge the tool to the reuired size.

Check the length of chamfer by vernier caliper.

If the protruding length is greater, support with centre.

Make sure the tool is perpendicular to the lathe axis.

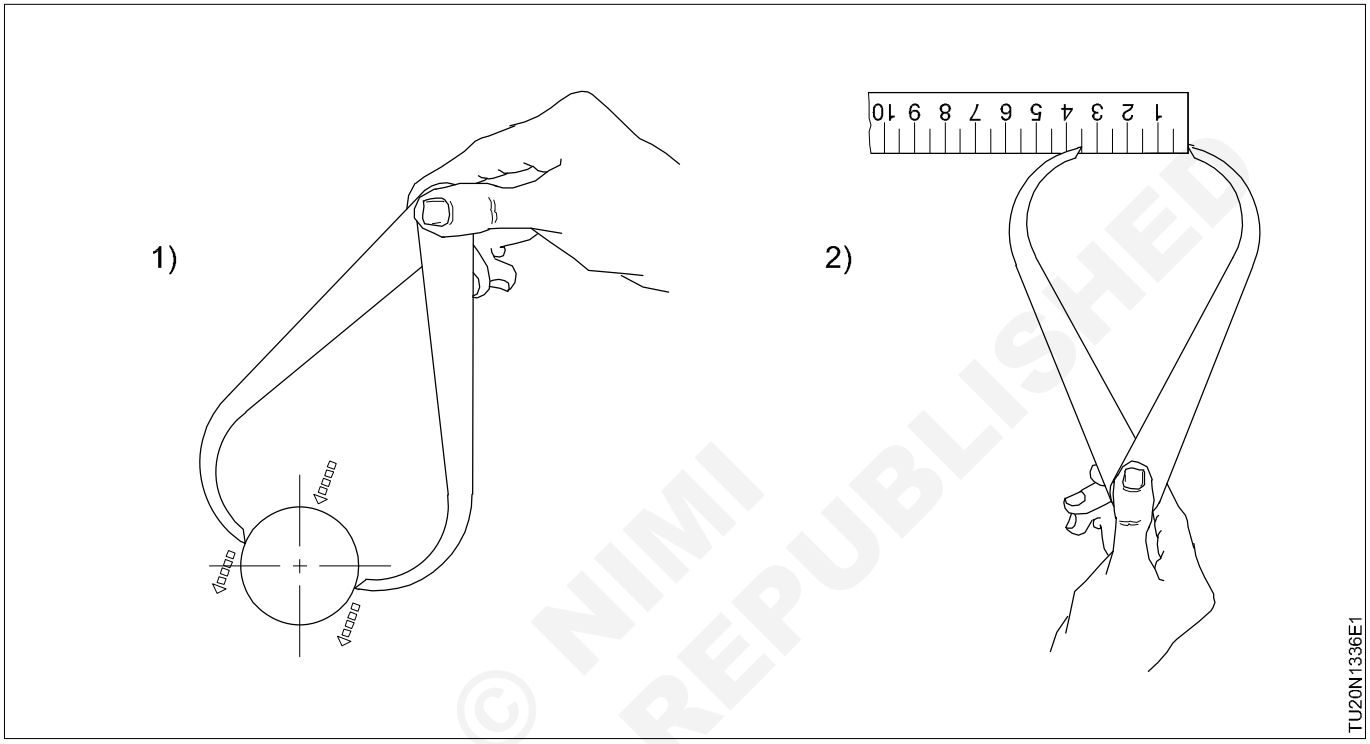
Fig 1



FIN23108H1

Measurement with scale and outside caliper to ± 0.5 mm

Objectives : At the end of this exercise you shall be able to
- **select the right capacity caliper for measurement**
- **set the size in caliper**
- **read the sizes by transferring them to a steel rule.**



Job sequence

- Measure the given jobs with help of outside caliper with steel rule.
- Record in Table 1.

Note
- Give different diameters for measurement.
- Trainees will measure and record Table 1.
- Get it verified by instructor.

Table 1

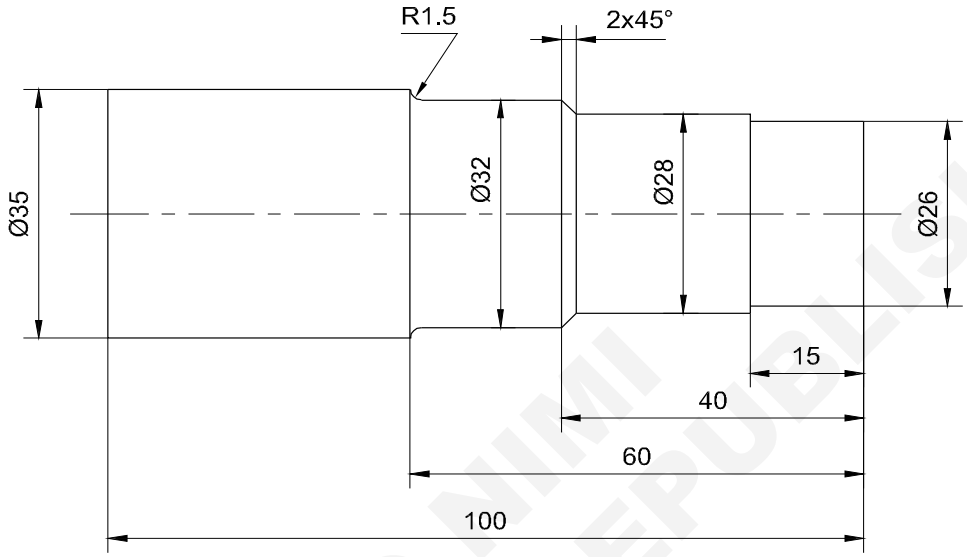
Sl.No.	Measurement job size		Remarks
	Dia	Length/Width	
1			
2			
3			
4			
5			

Step turning within ± 0.06 mm with different shoulder, undercut on outside diameter

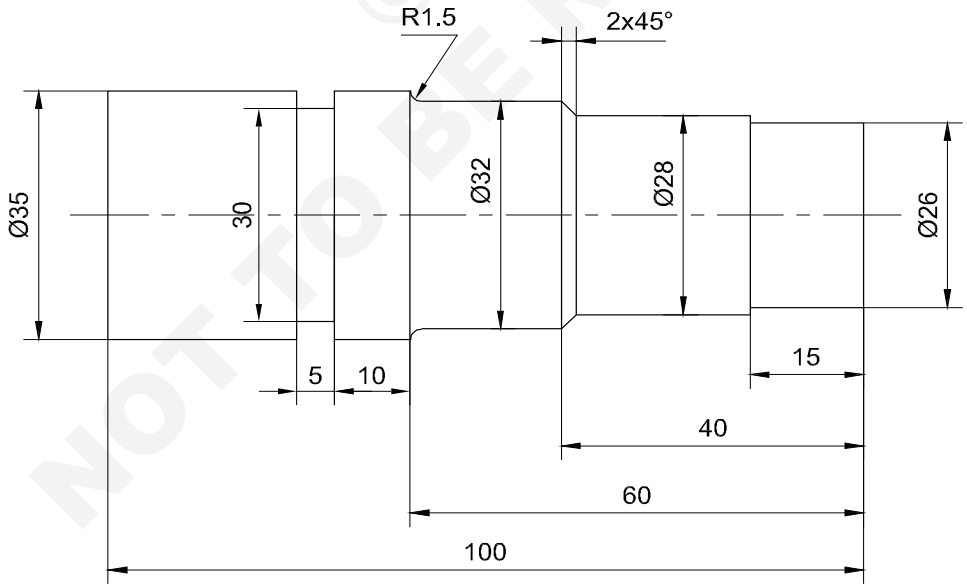
Objectives : At the end of this exercise you shall be able to

- **grind different shoulder turning tools**
- **form a different shoulder turning operations**
- **check squareness of a square shoulder**
- **measure chamfer of bevelled shoulder**
- **check the radius of a filleted shoulder with gauge.**

TASK : 1



TASK : 2



1	ISR Ø40 - 110	-	Fe 310	-	-	1.3.37
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	STEP TURNING WITH DIFFERENT SHOULDER UNDERCUT ON OUT SIDE DIAMETER	DEVIATIONS ± 0.1°	TIME 15h
		CODE NO. TUN1337E1	

Job sequence

TASK 1 : **Turning different shoulder**

- Hold the job in a four jaw chuck, true and face one side.
- Turn Ø 35mm to the maximum length.
- Reverse the job, true, face and maintain total length 100mm (Hold about 35mm inside the chuck.)
- Reduce the diameter to 32.5 mm up to a length of 55 mm.
- By using a 1.5mm R radius tool, remove 0.5 mm dia. and turn up to 60mm length as per drawing.
- By using a crank tool reduce the diameter to 28 mm to a length of 40mm, including shoulder 2 x 45° as per drawing.
- By using the side knife tool, maintain the diameter of 26 mm to a length of 15mm.

Points to remember

- Choose the r.p.m. depending upon the diameter.
- Set the tool properly.
- Make sure you are getting different shoulders as per drawing.
- Check the steps by using a steel rule. Use sufficient coolant.
- Remove burrs by filing.

TASK 2 : **Turning under cut**

- Hold the job in a four jaw chuck.
- Set the job with the help of surface gauge.
- Set the u/c tool on the tool post to correct centre height.
- Reduce the rpm by 1/3.
- After 70mm of length from the face, plunge the under cutting tool towards the job to make a width of 5mm groove maintaining diameter 30mm.
- Remove the sharp corners.
- Check the all dimensions.

Skill sequence

Lathe operation - Machining of different types of shoulders

Objectives : This shall help you to
- **machine a square shoulder**
- **machine a bevelled shoulder**
- **machine a filleted shoulder**
- **machine an undercut shoulder.**

Machining a square shoulder

Face the end of the work to provide a reference surface point from which to take measurements.

Lay out the position of the shoulder by one of the following methods.

Make a dot punch mark at the correct distance from the end of the workpiece. (Fig 1)

Cut a light groove with the point of a sharp tool bit around the circumference of the work to mark the required length. (Fig 2)

Rough and finish turn the diameter to within about 1 mm of the required length.

Mount a facing tool bit in the tool-holder and set it to lathe axis. (Fig 3)

Make sure that the tool bit is set up with the point close to the work, and with a slight space along the side cutting edge.

Apply chalk or layout dye to the small diameter, as close to the shoulder as possible.

Before starting the lathe, the tool bit should be brought fairly close to the diameter, by using a piece of paper or thin stock between the tool bit point and the work diameter.

Start the lathe and bring the facing tool in until it just removes the chalk.

Note the reading on the graduated collar of the cross-slide screw.

Bring the tool bit towards the shoulder with the carriage hand wheel until a cut is started.

Face the shoulder by turning the cross-slide handle anti-clockwise thus, cutting from the centre to the outside.

For successive cuts, return the cross-slide screw to the same graduated collar setting. Repeat the above procedure until the shoulder is machined to the correct length.

Fig 1

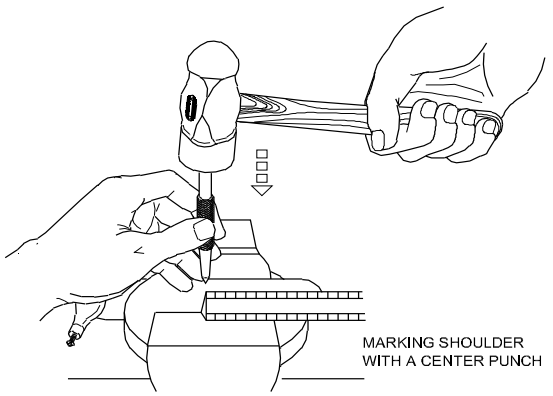


Fig 2

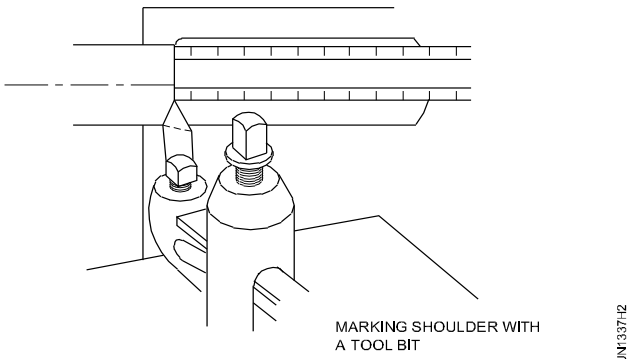
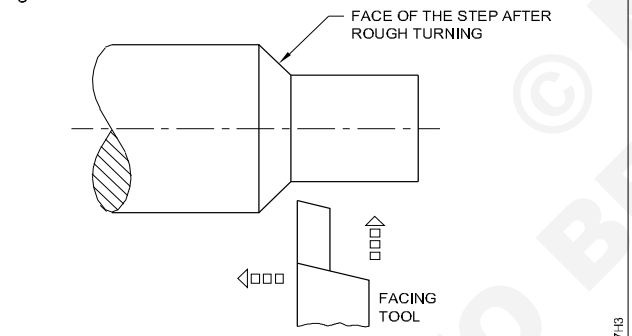
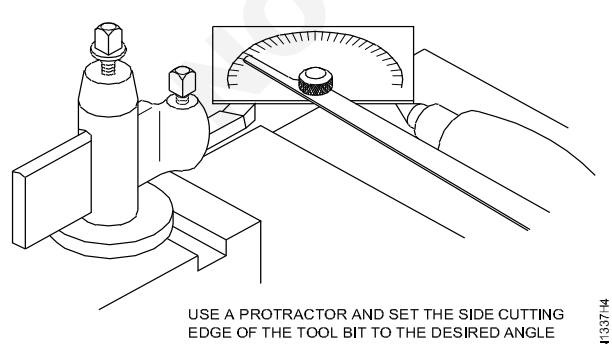


Fig 3



Machining a bevelled shoulder (Fig 4)

Fig 4



Lay out the position of the shoulder along the length of the workpiece.

Rough and finish turn the small diameter to size.

Mount a side cutting tool in the tool-holder and set it to centre.

Apply chalk or layout dye to the small diameter as close as possible to the shoulder location.

Bring the point of the tool bit in unit it just removes the chalk or layout dye.

Turn the carriage hand wheel by hand to feed the cutting tool slowly into the shoulder.

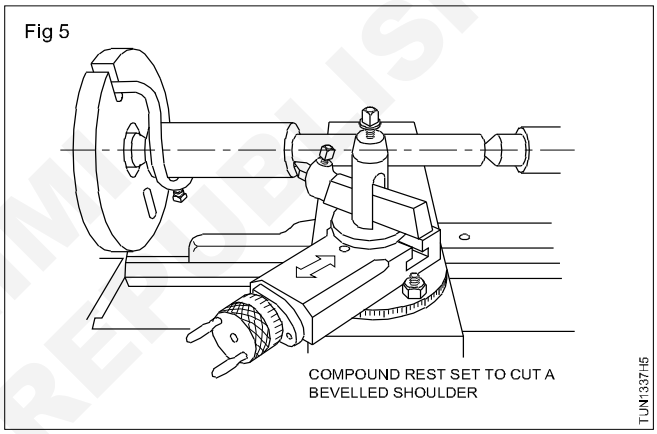
Apply a cutting fluid to assist the cutting action and to produce a good surface finish.

Machine the bevelled shoulder until it is to the required size.

If the size of the shoulder is large, and chatter occurs when cutting with the side of the tool bit, it may be necessary to cut the bevelled shoulder using the compound rest.

Se the compound rest to the desired angle. (Fig 5)

Fig 5



Adjust the tool bit so that only the point will cut.

Apply a cutting fluid to assist cutting action. Progressively machine the bevel. Always cut outwards and start each cut near the outermost edge of the face of the shoulder.

Be careful not to damage the small diameter when preparing to make each new cut. At the start of the final cut, bring the point of the tool bit in, until it just removes the chalk or layout dye at the innermost edge of the original shoulder face.

Machining a filleted shoulder

Lay out or mark the location of the shoulder on the workpiece.

When layout for a filleted shoulder make allowance for the radius to be cut. If a filleted shoulder has a 4 mm radius and 60 mm from the end of the workpiece, the layout should be 56 mm from the end. This would leave material for cutting the radius.

Rough and finish turn the small diameter to size.

Mount a radius tool in the holder and set it to centre. Check the tool bit with a radius gauge to be sure that it has the correct radius.

Apply a layout dye or chalk to the small diameter as close as possible to the shoulder location.

Set the lathe spindle speed to approximately one half of the turning speed.

Start the lathe and bring the tool bit in until it just removes the layout dye or chalk.

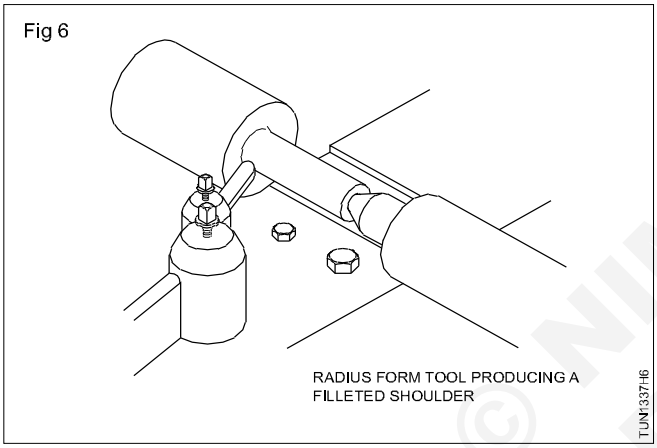
Note the reading on the graduated collar of the cross-slide screw.

Retract the cutting tool by turning the cross-slide handle anticlockwise one half turn.

Turn the cross-slide handle clockwise until it is within approximately 1 mm of the original collar setting. The point of the round nose tool bit should now be about 1 mm away from the work diameter. This prevents the cutting tool from undercutting while roughing out the filleted corner.

Turn the carriage hand wheel slowly to start the radius tool cutting the filleted shoulder. If chattering occurs while machining the filleted corner, reduce the lathe speed and apply a cutting fluid to improve the finish of the fillet. (Fig 6)

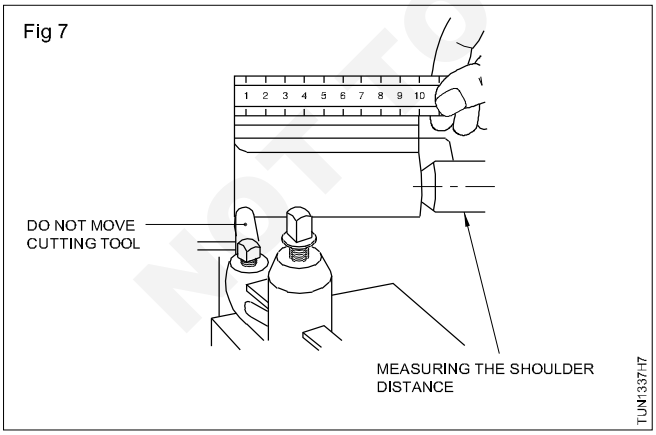
Fig 6



Continue turning the carriage hand wheel slowly and carefully until the length of the shoulder is correct.

When stopping the lathe to measure the shoulder distance, do not move the cutting tool setting by withdrawing it from the diameter. (Fig 7)

Fig 7



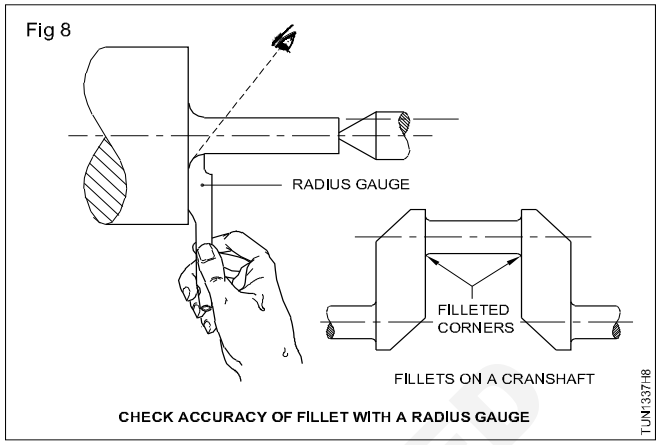
Turn the carriage hand wheel to move the cutting tool away from the shoulder slightly.

Turn the cross-slide handle anticlockwise about 1 mm back to the original collar setting.

Finish the filleted corner by carefully advancing the radius tool bit with the carriage hand wheel.

If the radius is too large for a form tool bit, or too much chattering occurs, cut the fillet in steps, using the largest radius tool that does not cause chattering. Check the accuracy of the fillet with a radius gauge. (Fig 8)

Fig 8



Machining an undercut shoulder

Lay out the position of the undercut shoulder along the length of the workpiece.

Rough and finish turn the small diameter to size.

Mount the undercut tool in the tool-holder and set it to the centre.

Apply chalk or layout dye to the small diameter as close as possible to the undercut shoulder location and also on the face of the larger diameter.

Set the lathe spindle to approximately one half of the turning speed.

Bring the point of the tool bit in until it just removes the chalk or layout dye on the face and set the top slide graduated collar to zero.

Apply a cutting fluid to assist the cutting action and produce a good surface finish.

Retract the cutting tool by turning the cross slide handle anticlockwise.

Repeat the above procedure until the undercut shoulder is machined to the correct depth.

Bring the tool tip clear off the large diameter face and advance the tool axially by 1 division of the top slide.

Feed the tool into the work from the edge of the larger diameter face, till it just removes the chalk mark applied on the small diameter.

Note the cross-slide graduated collar reading and advance the tool into the work to the number of divisions required according to the depth.

Ensure that the tool cutting edge is parallel to the work axis.

Ensure that the carriage is locked during the undercutting operation.

Apply a cutting fluid to assist the cutting action and to produce a good surface finish.

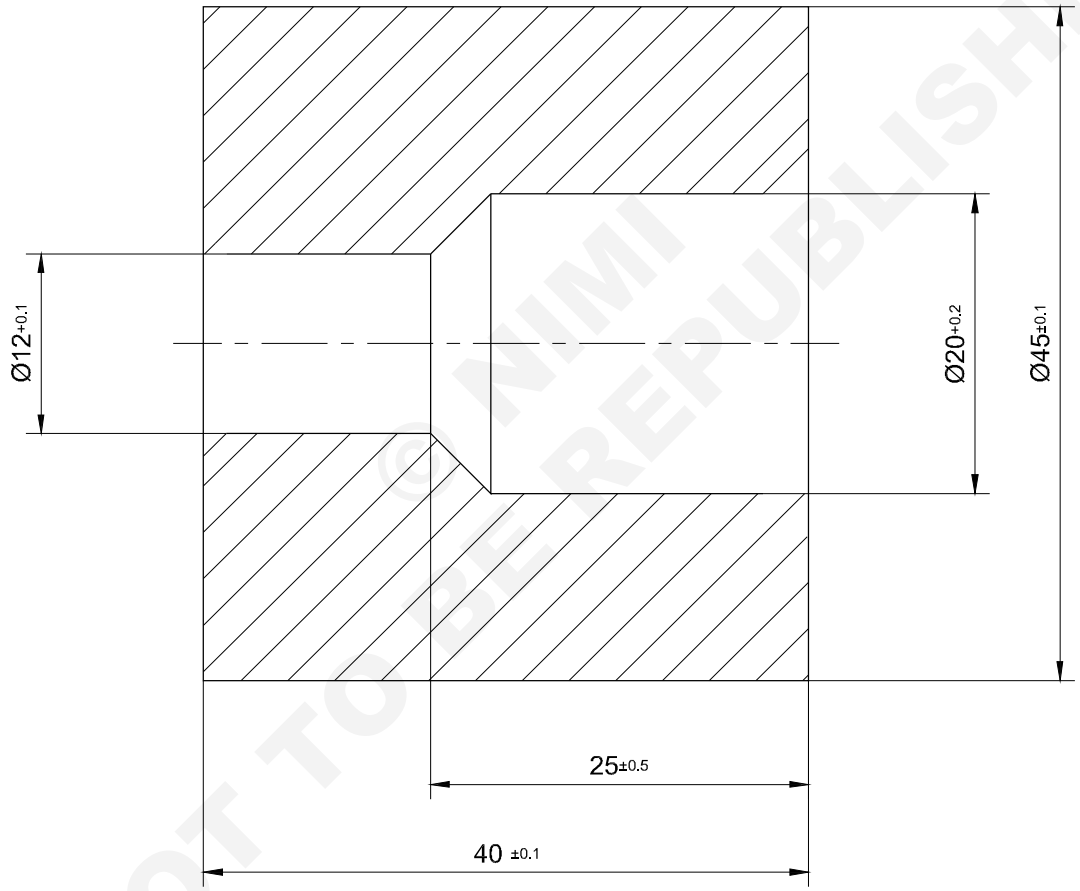
Retract the cutting tool by turning the cross-slide handle anticlockwise.

Repeat the above procedure until the undercut shoulder is machined to the correct depth.

Drilling on lathe, step drilling and drill grinding practice

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

- **turn an outside diameter to an accuracy of ±0.1 mm**
- **drill a hole to the required size by hand feed**
- **step drill the previously drilled through hole to correct depth**
- **drill grinding practice.**



1	Ø50 - 50	-	Fe 310	-	-	1.3.38
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 2:1	DRILLING AND STEP DRILLING	DEVIATIONS SPECIFIED	TIME 10h
		CODE NO. TUN1338E1	

Job sequence

- Hold the job in a 4 jaw chuck and true it.
- Face one end and centre drill the job.
- Drill the job with a Ø 12 mm drill bit throughout.

Clean the spindle of the tailstock shank and sleeve before use

- Fix a Ø20 mm drill in the tailstock spindle.
- Feed the Ø20 mm drill to 25 mm length with the help of the graduated collar of the tailstock.
- When feeding the drill bit for step drilling, first touch the drill to Ø12 mm hole and note down the reading on the graduated collar of the tailstock.

Be sure the graduated collar is set after the backlash is eliminated.

- Turn Ø45 mm to the maximum length.
- Reverse the job and reset it.
- Face the other end to maintain a 40 mm total length.
- Turn the remaining portion to Ø45 mm.
- Deburr the job and check the dimensions.

The instructor may give demo to the trainees to practice the drill grinding

Skill Sequence

Re-sharpening a twist drill

Objective : This shall help you to
- **re-sharpen a twist drill.**

A twist drill can be successfully sharpened on a bench or pedestal grinder by adopting the following procedure.

Check that the surface of each wheel is running true and that the wheels are dressed clean.

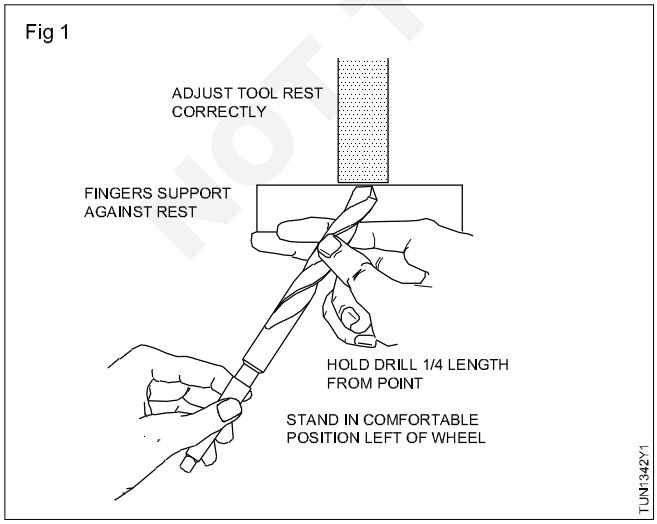
Ensure that the tool-rest are adjusted correctly and tightened

Wear safety goggles.

Stand in a comfortable position in front the machine.

Hold the drill at about one quarter of its length from the point, between the thumb and the first finger of the right hand. (Fig 1)

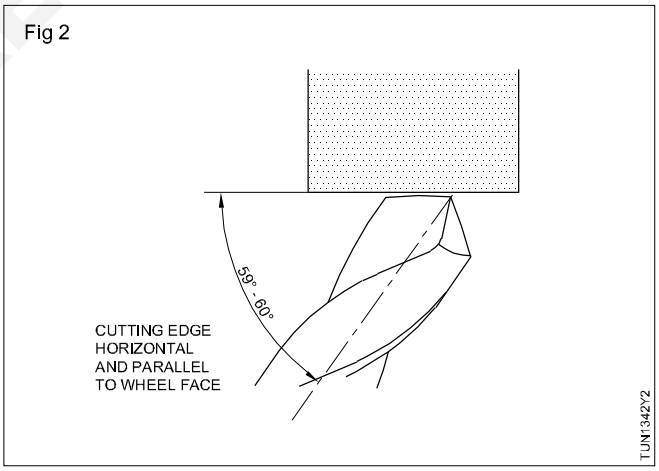
Fig 1



Keep both elbows against the side.

Position yourself in such a way that the drill makes an angle of 59° to 60° to the wheel face. (Fig 2)

Fig 2

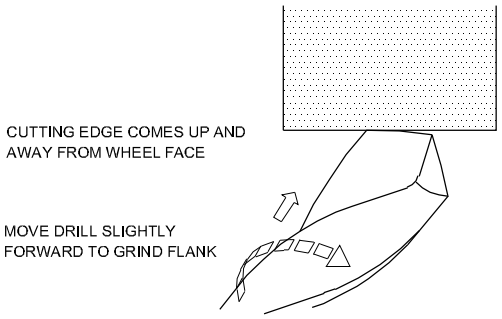


Hold the drill level. Twist it until one cutting edge is horizontal and parallel to the wheel face.

Swing the shank of the drill slightly downwards and to the left with the left hand. The right hand is on the tool-rest.

Watch the cutting edge against the wheel. Note that, as the shank, swings down, the cutting edge comes slightly upwards and away from the wheel face. (Fig 3)

Fig 3



Apply a slight foward motion to your hands

This will bring the flank of the point against the wheel to produce a lip clearance.

Coordinate the three movements of swinging down, twisting clockwise and forward movement. These movements should not be heavy movements. If they are performed correctly, they will produce a cutting edge that has the correct lip clearance and cutting angle

Practice these movements against a stationary wheel, using a new or correctly sharpened drill.

Notice how only a small movement is required to produce the required clearance.

Also note that, if the drill is twisted too far, the other cutting edge will swing down to contact the wheel face.

Proceed now to sharpen one edge, removing as little metal as possible.

Procedure to obtain equal angles

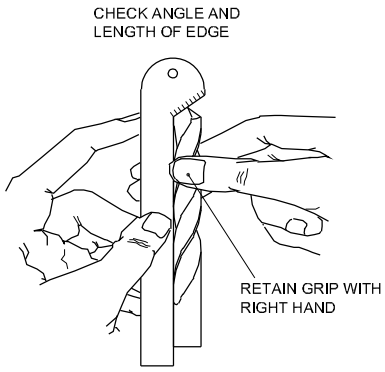
Move the drill back, clear of the Wheel face.

Turn the drill over without moving the position. This presents the second edge to the wheel face at the same angle as the first cutting edge.

Proceed to sharpen the second cutting edge, using the same amount of drill movement as before. When these actions are carried out carefully, the drill will be sharpened with equal cutting angles. The lip clearance will be correct and equal.

Use a drill angle gauge to check that the cutting angle is correct (118° for mild steel), the cutting edges are of equal length and the lip clearances are equal and correct (about 12°). (Fig 4)

Fig 4



CHECK CUTTING EDGE WITH DRILL GAUGE

Lift the drill off the wheel face. Retain the grip on the drill with the right hand.

Make such inspection or checks as are necessary. Move the right hand back on-the tool-rest in the same position as before.

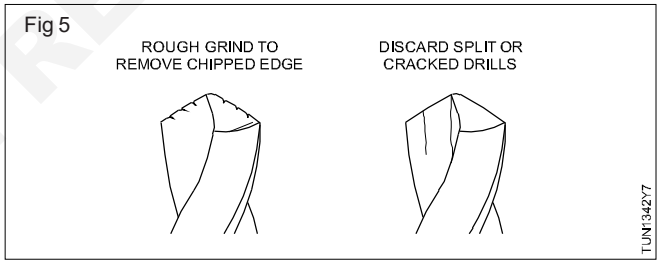
Hold the drill shank again in the left hand with the elbows against the side. The drill will swing back against the wheel face in the same position and at the same angle as before.

Points to be considered when sharpening drills

Grind as little as possible from the drill. Remove only enough to sharpen the cutting edges.

Rough down the drill point with a coarse grit wheel when the edges are badly chipped.(Fig 5)

Fig 5



Never re-sharpen a cracked or split drill.

Avoid overheating the drill.

Apply light pressure against the wheel face. Lift the edge clear of the wheel face frequently. This allows the air stream produced by the wheel to cool the drill point.

Cooling a drill rapidly by quenching in cold water may cause cracking of the cutting edge

Re-sharpening of very small drills requires great skill. They require proportionally less movement to produce the cutting angles.

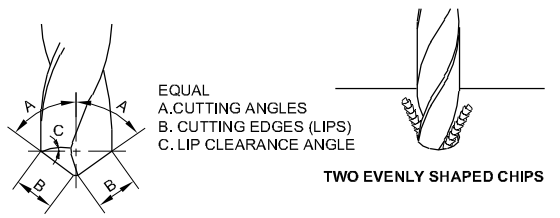
Testing a re-sharpened twist drill for its performance

Objective : This shall help you to
- **test the drill that has been re-sharpened by drilling a through hole.**

Set the spindle revolution of the drilling machine to.give a cutting speed of 25 to 30 meters per minute. A drill that has been re-sharpened correctly will:

- Produce two evenly curled chips from its cutting edges (Fig 1)

Fig 1

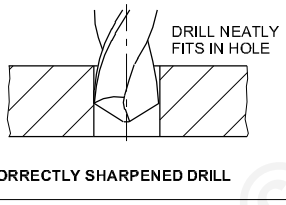


- Require only moderate pressure to feed it into the work.

When the hole has been drilled through, take the drill out of the machine and try it by inserting into the hole.

If the drill fits without any play it means that (Fig 2)

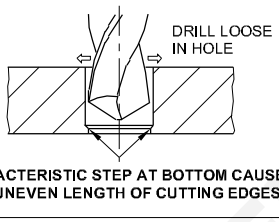
Fig 2



- the cutting edges and angles are equal
- the drill has produced a hole of the correct size.

Any looseness of the drill in the hole means (Fig 3):

Fig 3



- the cutting edges are of uneven length
- the drill has produced an oversized hole.

A drill that has been ground with uneven or too great a lip clearance will

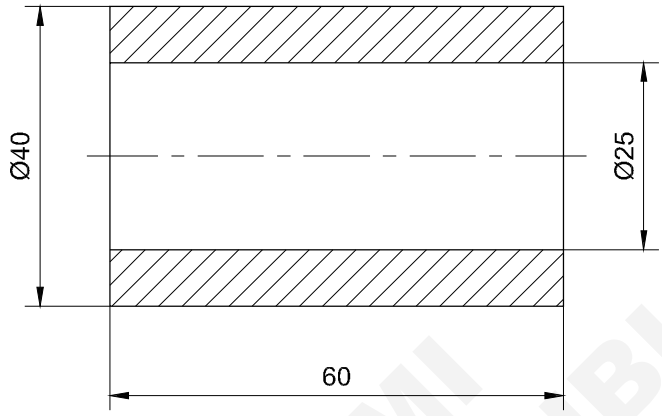
- tend to chatter during starting
- produce an out-of-round hole.

Boring, step boring and recessing

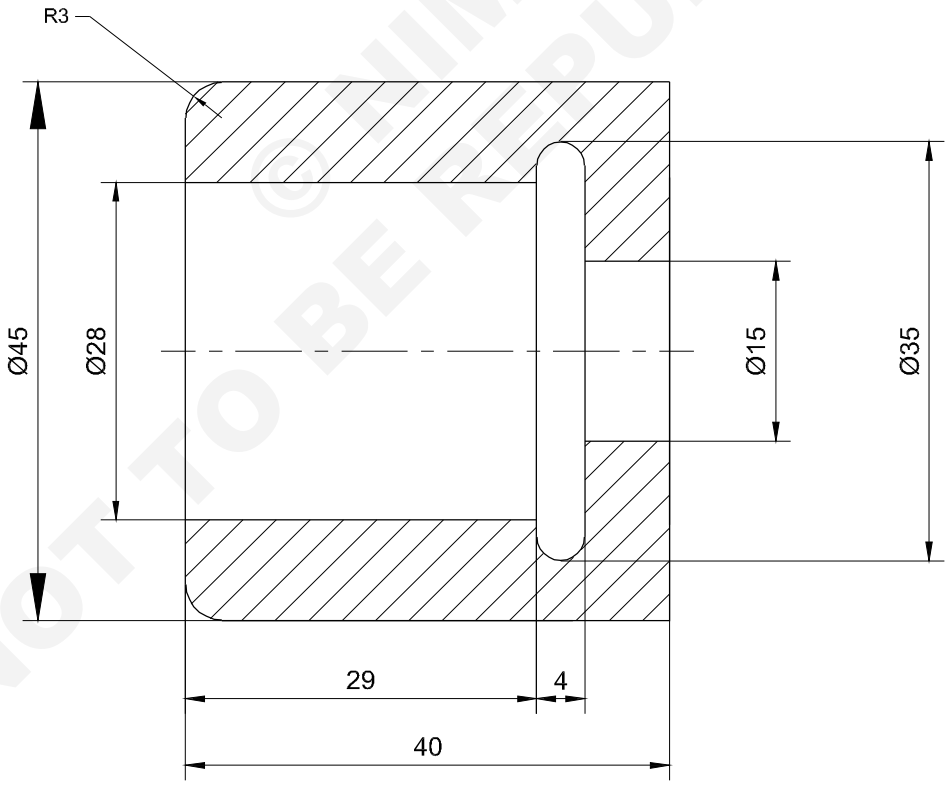
Objectives : At the end of this exercise you shall be able to

- **drill through hole**
- **bore a hole to an accuracy of ±0.2mm with a tool**
- **perform step boring**
- **form internal recess**
- **measure the bore and recessing with help of vernier caliper and inside caliper.**

TASK : 1



TASK : 2



1	Ø45 - 65	-	Fe 310	-	TASK-1	
1	Ø50 - 65	-	Fe 310	-	TASK-2	1.3.39
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	**BORING STEP BORING AND RECESSING**	DEVIATIONS	TIME 20h
		CODE NO. TUN1339E1	

Job sequence

TASK 1

- Check the raw material for its size.
- Hold the job in a 4 jaw chuck and true it, keeping about 45 mm outside the chuck.
- Set the facing tool to the correct centre height.
- Select and set the correct spindle speed, for facing.
- Face one side first, and turn the Ø 40 mm for the maximum possible length.
- Spot-face the job for drilling by centre drilling.
- Select the required size of drills including the pilot drill.
- Hold the drill in the tailstock spindle with the help of suitable sleeves after cleaning.
- Select the spindle speed for drilling the pilot hold of 12 mm dia.
- Move the tailstock to a convenient position for drilling, and lock the tailstock on the bed.
- Run the lathe and advance the drill so that it does the drilling operation on the job held in the chuck.
- Use a coolant while drilling and advance the drill slowly.
- After completion of drilling throughout the job, reverse, and true the job, face to the required length as per drawing, and turn Ø 40 mm.
- Enlarge Ø 12 mm hole to Ø 20 mm hole by drilling at a reduced spindle speed.
- Set the boring tool in the tool post to the centre height and bore the drilled hole to Ø 25 mm
- Check the bore size with a vernier caliper.

Safety precautions

- Select proper spindle speeds as per size and operations.
- Use pilot drill while drilling more than 20 mm drill size.
- Feed the drill slowly while drilling.
- Use a coolant while drilling.

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TASK 2

- Hold the job in a 4 jaw chuck and true.
- Face the end and centre drill.
- Drill Ø 10 mm hole through and enlarge to Ø 14 mm. by drilling.
- Bore through hole to Ø 15 mm.
- Finish turn the outer dia. to size Ø 45 mm for possible length.
- Reverse the job, hold on Ø 45 mm and true.
- Face to maintain the total length of 40 mm.
- Bore Ø 28 mm to length 33mm. Set the recessing tool.
- Form recess 4 mm width as per drawing and R2 Ø 35 mm.
- Perform R3 on a Ø 45 at one edge, with a 3R radius tool.
- Deburr all the sharp edges and check with the precision instruments.

Points to remember

- Hand feed should be uniform to obtain good surface finish; work with a round nose tool.
- Set the radius tool properly to avoid chattering marks.
- Limit the speed for internal recessing i.e., 1/3rd of the drilling r.p.m.
- Lock the carriage while recessing operation is done, to avoid vibration.
- Use a transfer caliper to measure Ø 35 mm.
- Check the radius with a radius gauge.

— — — — — — —

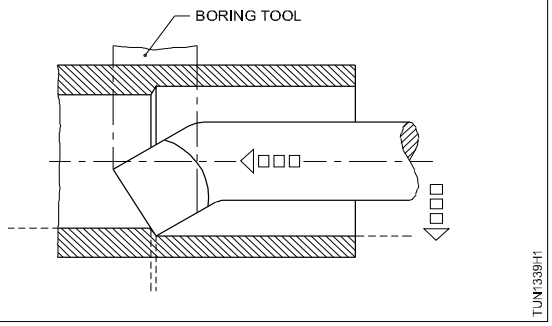
Skill sequence

Boring a drilled hole

Objectives : This shall help you to
- **set the boring tool in the tool post**
- **bore the drilled hole to the required size**
- **check the hole with the help of a vernier caliper.**

Boring is an internal operation of enlarging a hole with the help of a single point cutting tool. (Fig 1)

Fig 1



To bore the hole the following procedure is to be followed.

- Mount the workpiece in a four jaw chuck. True the face of the work and the outer diameter.
- Set the lathe to the proper spindle speed for boring.
- Mount the boring tool on the tool post of the compound rest.
- Fix the boring tool, level and parallel to the centre line of the lathe.

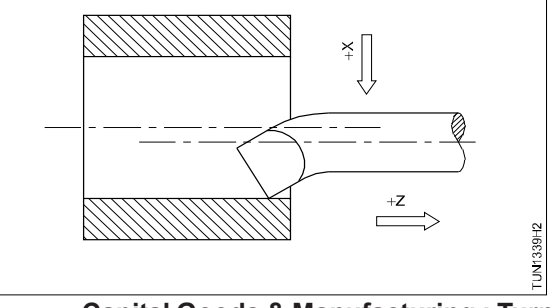
Grip the boring tools as short as possible to reduce chatter.

- Use the largest diameter boring tool which can be accommodated in the drilled hole. (Approximately 2/3 size of the bore)
- Set the cutting edge of the cutting tool just slightly above the centre line, since there is a tendency for the tool to spring downwards when cutting.
- Choose a proper feed for rough boring.

The speed for boring is the same as that for turning, and is calculated for the diameter of the bore.

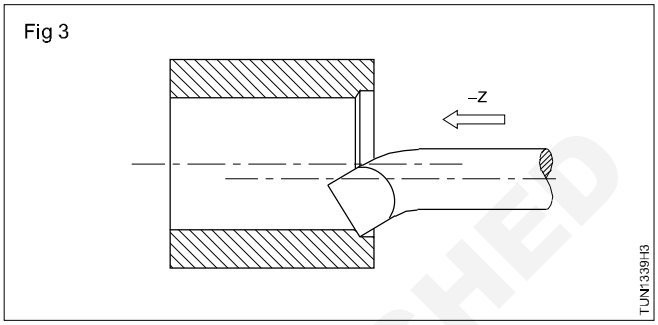
- Start the machine and turn the cross-slide handle anti-clockwise until the cutting tool touches the inside surface of the hole. (Fig 2)

Fig 2



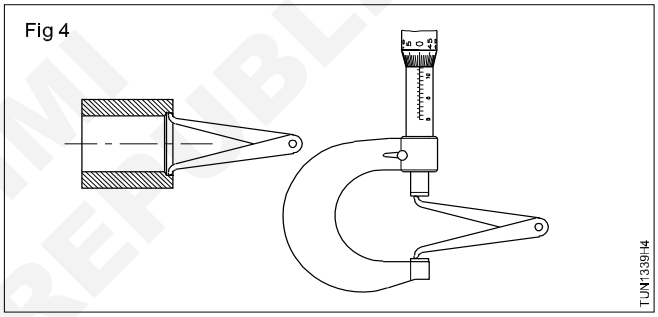
- Take a light trial cut about 0.2 mm deep and about 8 mm long at the right hand end of the work. (Fig 3)

Fig 3



- Stop the machine and measure the diameter using a telescopic gauge or inside caliper. (Fig 4)

Fig 4

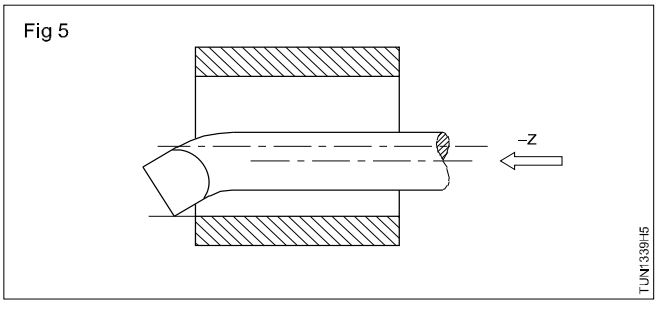


- Calculate the amount of material to be removed from the hole for the roughing cut.

Leave about 0.5 mm undersize for a finish cut.

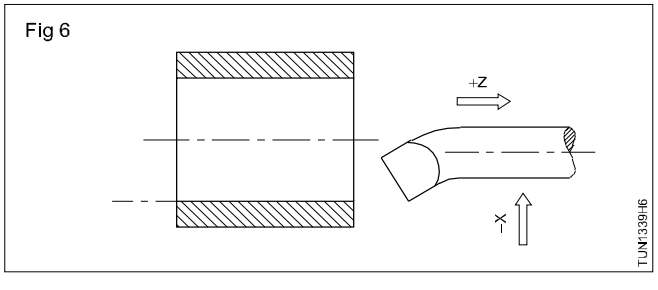
Take a roughing cut for the required length. (Fig 5)

Fig 5



Stop the machine and move the carriage to the right until the boring tool clear the hole. (Fig 6)

Fig 6



Set a fine feed of about 0.1 mm for the finish cut.

Set the cutting tool for the required depth to get the finished bore size.

Use the cross-slide graduated collar.

Finish the boring operation and measure with a vernier caliper.

To avoid bell mouth, repeat the same cut.

Several cuts taken without adjusting the depth of cut would correct bell mouthing.

Remove the sharp corners.

Inside caliper & Outside micrometer used for bore measurement

Objective : This shall help you to

- **take the measurement of a bored hole with an inside caliper, transfer it to an outside micrometer and read the measurement.**

Bores are checked for their dimensional accuracy by using

- inside micrometer
- universal vernier caliper
- inside caliper and outside micrometer (transfer measurement)
- telescopic gauges and outside micrometers (transfer measurement).

The first two methods give direct reading whereas the 3rd. and 4th are by transfer measurement.

For checking the bore diameters using inside caliper and out-side micrometer the following sequence is to be followed.

Select the inside caliper according to the size of the bore to be measured.

Select an outside micrometer of suitable range for the size of the hole.

Open the legs of the inside caliper approximately permitting its entrance into the hole.

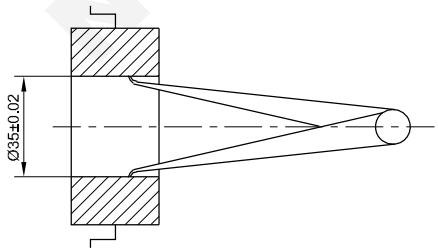
Position one leg in contact with the bottom of the bore.

Keeping this as the fulcrum, oscillate the other leg in the bore.

Adjust the distance between the legs by gentle tapping to increase or to decrease, so as to enable the leg to enter.

Rock the inside caliper with respect to the axis of the work so as to make the leg of the inside caliper contact the bore surface. (Fig 1)

Fig 1



If the 'feel' is hard, reduce the distance between the leg tips and if the feel is less or if there is not feel, increase the distance between the leg tips slightly.

Check once again and repeat till you get the correct feel.

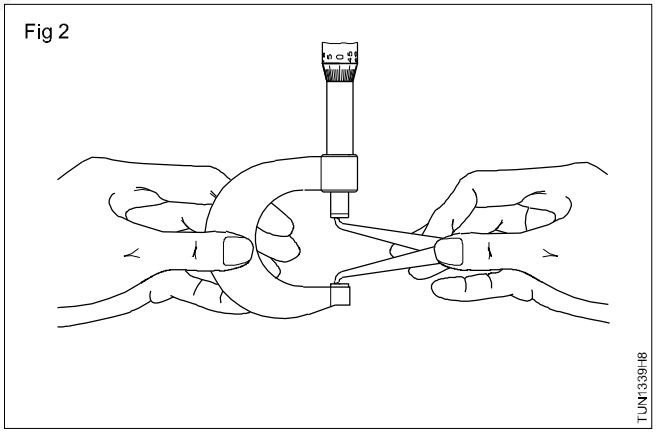
Ensure that the position of the legs is not disturbed, once the correct feel is obtained.

Hold the outside micrometer in one hand, and the spindle away from the anvil face, a little more than the distance between the two legs of the inside caliper.

Hold the inside caliper with the other hand, contacting the tip of one leg with the anvil face of the micrometer.

Oscillate the other leg and rotate the thimble of the outside micrometer to contact the tip of the oscillating leg of the inside caliper. (Fig 2)

Fig 2



Ensure you get the same 'feel' as before.

Note the readings on the barrel and thimble of the outside micrometer, and determine the size of the measurement.

Note : The accuracy depends on the skill. Practice to get the correct feel for the measurement.

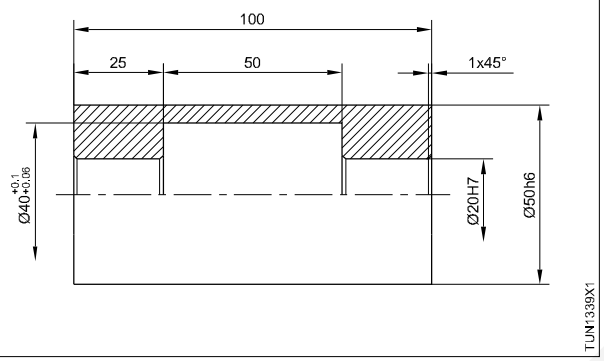
Internal recessing to a size broader than the width of the tool

Objectives : This shall help you to
- **grind an internal recessing tool maintaining a definite width of 4mm**
- **cut an internal recess of a given diameter for the required width.**

At times, it may be necessary to form the recess for sufficient length for the same diameter. This is necessary to

- reduce the weight of the bush
- have contact surfaces with the shaft only at both ends of the bush
- have parallelism in the bore diameter at both ends. (Fig 1)

Fig 1



A recessing tool is to be ground to a definite width 'w', say 4 mm. The relief given is 2° on both sides. The front clearance is about 12° and the front edge is ground to 45° of the secondary clearance, avoiding the bottom of the tool fouling with the bore diameter. The front cutting edge, 'with a primary clearance of 12°, is kept to about 1/5th of the height 'h' in order to have a maximum portion, ground to the secondary clearance. The cutting edge is ground parallel to the axis. A small back rake of about 6° is ground on top of the cutting edge.(Figs 2 and 3)

Fig 2

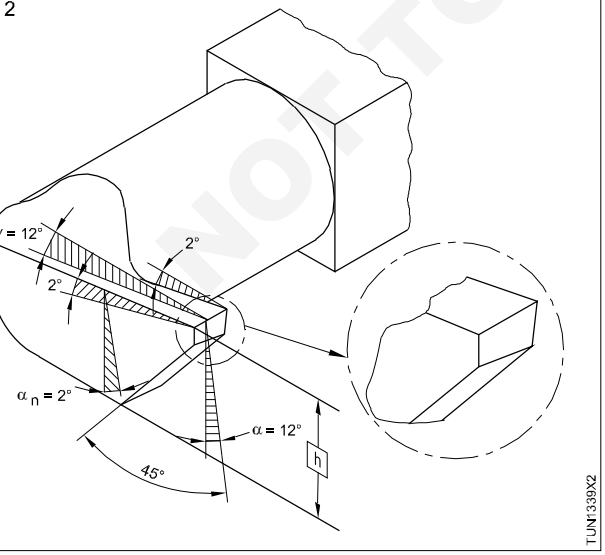
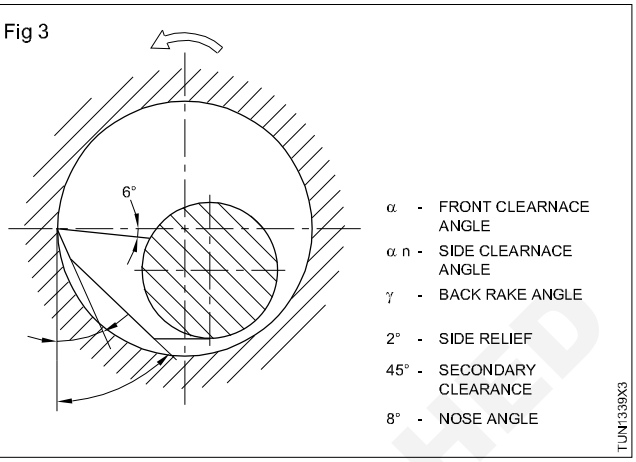


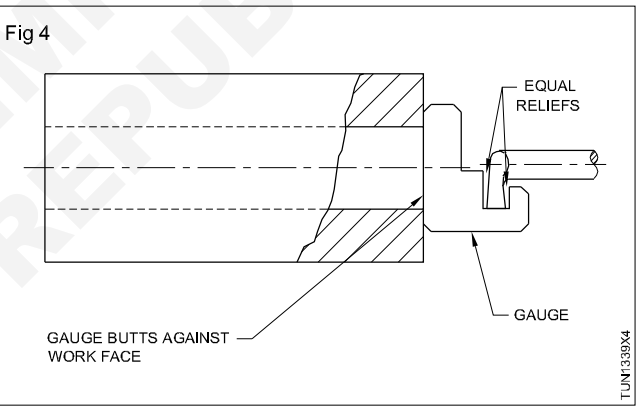
Fig 3



The procedure in sequence is as follows.

Hold and clamp the tool in the tool post to have the cutting edge to exact centre height and parallel to the axis of the work. Use the tool setting gauge as shown in Fig 4.

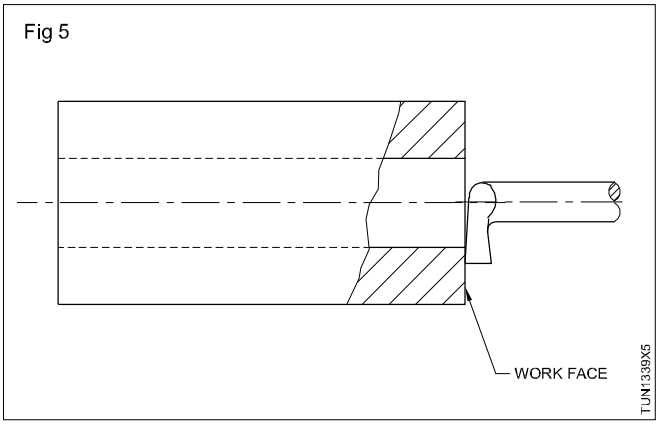
Fig 4



Keep a minimum overhang of the tool

Touch the leftside of the cutting edge so as to just contact the work face. (Fig 5)

Fig 5



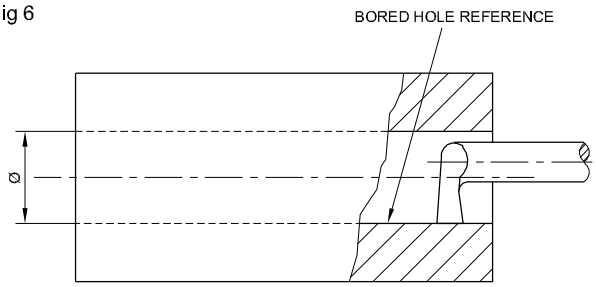
Set the top slide graduated collar to zero with the backlash eliminated.

Set the machine to about 250 r.p.m.

The spindle speed depends upon the material and diameter of the bush.

Lock the carriage and withdraw the tool from the face, and touch the bore diameter with the front cutting edge of the tool. (Fig 6)

Fig 6



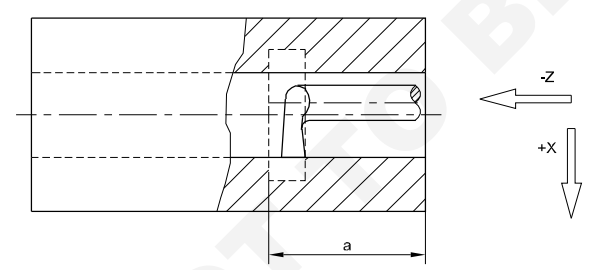
Set the cross-feed graduated collar to zero with the backlash eliminated.

Release the cutting edge from the bore diameter, and position the left side of the cutting edge of the tool at the start of the bore.

The top slide graduated collar reads the previously marked zero setting with the backlash eliminator.

Advance the tool inside the bore till the left side tip of the cutting edge is at a distance equal to the width of the cutting edge + the distance from the front face to the starting position of the recess. (Fig 7)

Fig 7



Example

In the example shown, it is equal to 4 mm +25 mm = 29mm. (Tool cutting edge width ground for 4 mm width)

Rotate the cross-slide hand wheel in the anticlockwise direction till the tool cutting edge touches the bore.

Ensure the graduated collar zero is in line with the fixed mark in this position.

Continue rotating the cross-slide hand wheel in the anticlockwise direction to make the tool advance deep,and form the recess.

Continuous, uniform, and slow feeding is necessary.

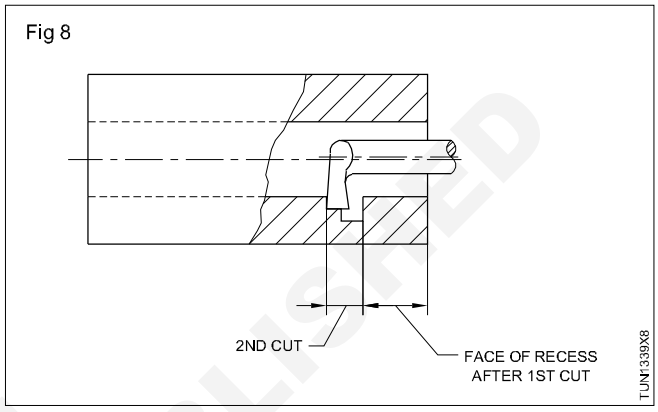
In the example given, the advancement of the tool is 10mm.

Note the cross-feed graduated collar reading in this position.

Rotate the cross-slide hand wheel in the clockwise direction till the tool cutting edge is released from the recess.

Advance the tool axially by the top slide movement for about 3/4th width of the tool. (Fig 8)

Fig 8



Rotate the cross-slide hand wheel till the tool tip reaches the same depth (10 mm in the example).

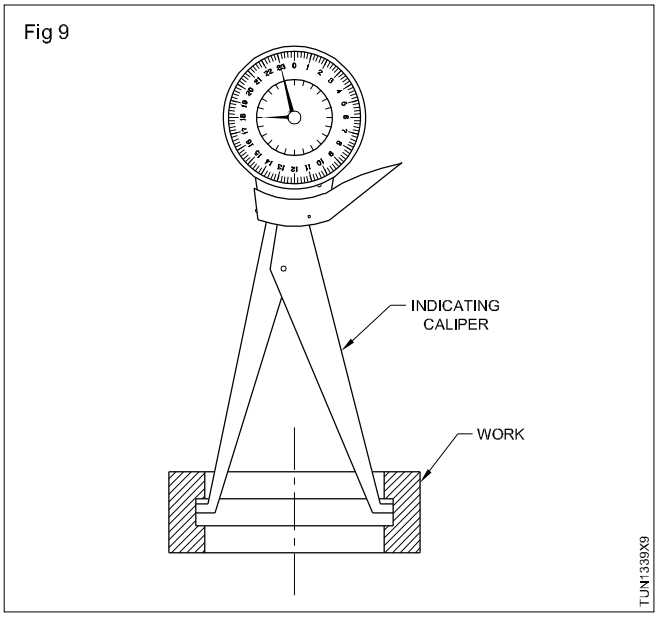
Repeat the steps till the required length of the recess (50mm) is reached.

Rotate the top slide graduated collar in the anticlockwise direction, continuously and uniformly to clean the recess till the right hand end of the cutting edge just touches the face at the start of the recess.

Withdraw the tool from the recess; and the bore.

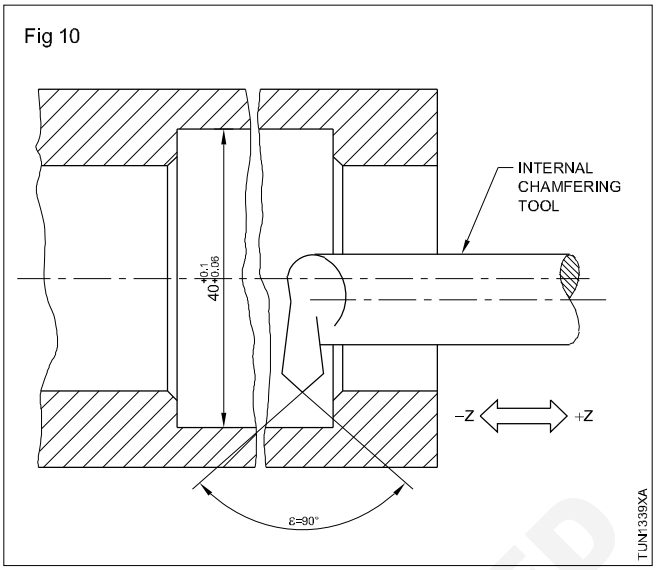
Check the diameter of the recess with the indicator caliper, (Fig 9)

Fig 9



Clamp the internal chamfering tool and chamfer the edges of the recess to remove the burrs. (Fig 10)

Fig 10



Form a recess

Objectives : This shall help you to

- **set the recessing tool in the tool post**
- **set the tool at the required position**
- **perform different types of recesses**
- **check the recess using an inside caliper.**

Recessing

Recessing is the process of cutting an annular channel inside the bored hole.

To perform recessing, the following procedure is to be followed.

Select an internal recessing tool of correct width.

Check that the tool and/or boring bar will clear the work of the bore.

Mount the tool on the tool post.

Align the face of the tool to the wall of the bore.

Calculate the distance from the face to the edge of the groove farthest from the end face.

Turn the top slide handle back to ensure that the slide can move the required distance.

Touch the tool edge to the face of the workpiece using the top slide handle.

The tool may be made to contact the feeler gauge held between the edge of the tool and the face of the workpiece.

Set the compound slide graduated collar to zero.

Turn the cross-slide handle so that the front of the tool just clears the wall of the bore.

Turn the top slide handle to position the tool at the calculated distance into the bore.

If a feeler gauge has been used in the above procedure, allow for the thickness of the gauge when calculating the distance to move the top slide.

Turn the cross-slide hand wheel in an anticlockwise direction to advance the tool and touch the bore.

Note the cross-feed graduated collar reading.

Rotate the cross-slide hand wheel in the same direction to make the tool remove the metal from the bore to form the recess.

Feed the tool slowly and continuously till the calculated division of the cross-slide reaches the zero mark.

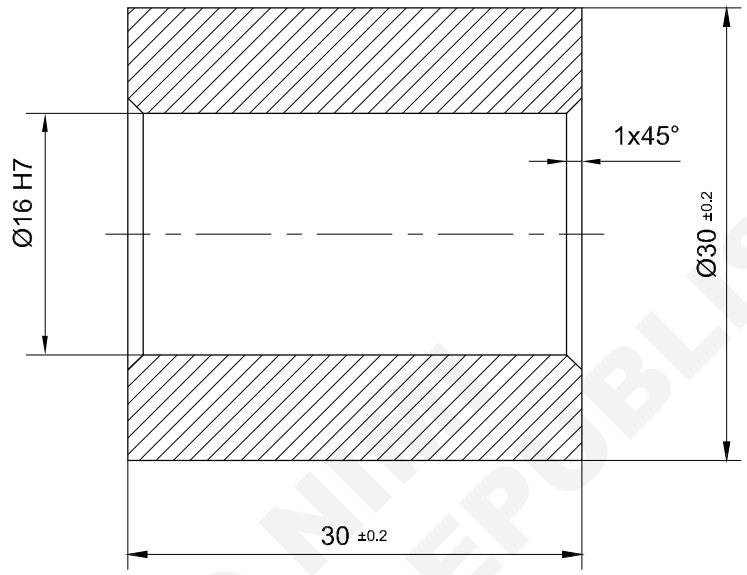
Reverse the direction of rotation of the cross-slide hand wheel and make the cutting edge clear the diameter of the bore.

Retract the tool by moving the saddle towards the tailstock.

Reaming in lathe using solid and adjustable reamer

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

- **drill a hole to size leaving allowance for reaming**
- **ream through hole with a hand reamer**
- **check the reamed hole by using a plug gauge**
- **enlarge the reamed hole by dia 0.1 mm using adjustable reamer.**



Job sequence

- Hold the job in a 4 jaw chuck and true it by holding it about 25mm outside the chuck.
- Face one end and turn Ø 30 ± 0.2 mm to the maximum length.
- Reverse the job and reset it.
- Face the other end to 30 ± 0.2 mm length.
- Turn the outside dia. 30 ± 0.2 mm to the remaining length.
- Hold the centre drill in a drill chuck mounted on to the tailstock barrel, and centre drill the work.
- Drill through hole in the job with Ø 15.75 mm drill bit after drilling a pilot hole of Ø10 mm.
- Chamfer the drilled hole 1 x 45°
- Fix the Ø 16H7 hand reamer in the tailstock, supporting with the dead centre.
- Ream the hole by using sufficient coolant.
- Give uniform hand feed while reaming.
- Check the hole with a 'Go' and 'No-Go' plug gauge.
- Enlarge the reamed hole using adjustable reamer to size of Ø 16.1 mm.
- Check the surface finish, comparing the roughness with the standard surface roughness set.

1	Ø32 - 35	–	Fe 310	–	–	1.3.40
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 2:1	REAMING IN LATHE	DEVIATIONS As specified	TIME 15hrs
		CODE NO. TUN1340E1	

Skill sequence

Reaming a hole by a hand reamer on the lathe

Objectives : This shall help you to
- **set the machine for hand reaming**
- **set the reamer on a lathe**
- **ream a hole accurately with a hand reamer.**

The procedure sequence of hand reaming on a lathe is as follows.

Check the drilled hole to ensure that it has the required reaming allowance.

Choose the correct type and size of reamer.

Remove the tool-holder and tool post.

Fix up the tap wrench to the square end of the reamer. The tap wrench must be short enough to clear the lathe bed.

Move the tailstock back so that there is sufficient space for the reamer between the dead centre and the workpiece.

Place the reamer into the pre-drilled hole slightly with the shank supported by the tailstock dead centre. (Fig 1)

Apply cutting fluid to the reamer during reaming.

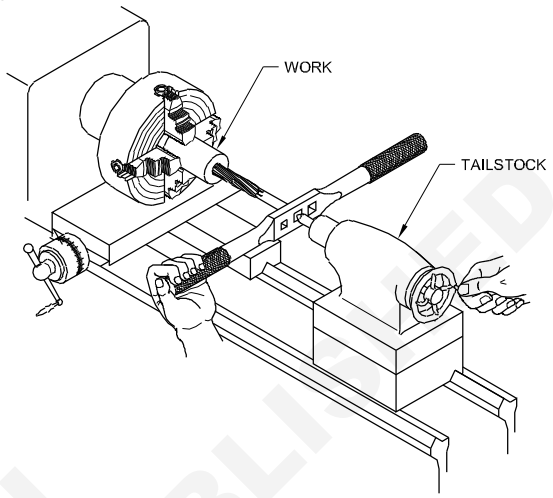
The job should not be rotated by power.

Now gently rotate the reamer clockwise with" the wrench as you turn the tailstock hand wheel to support and advance the reamer into the hole. (Fig 1)

An adjustable wrench can also be used to rotate the reamer instead of the tap wrench.

When the hole is fully reamed, continue to rotate the reamer clockwise as you- pull it out of the hole.

Fig 1



USING A HAND REAMER IN A LATHE

Remove the reamer occasionally by turning it clockwise to clear of the chips from the flutes.

Never use a hand reamer under power.

Never turn the lathe spindle or reamer backward. This will damage the reamer blunting the cutting teeth of the reamer, and will also result in developing scratches on the reamed surface of the hole.

Remove any burrs from the edge of the hole with a scraper.

Method of checking the bore with a plain cylindrical plug gauge

Objectives : This shall help you to
- **select the plug gauge according to the bore limits**
- **check the low limit of the bore with the 'GO' end of the gauge**
- **check the high limit of the bore with the 'NO-GO' end of the gauge.**

Select a plug gauge of the correct size and tolerance for the hole being checked.

Clean both the ends of the gauge and the hole of the workpiece with a clean dry cloth.

Check both the ends of the gauge and the workpiece and ensure they are free from burrs in the bore.

Position the 'Go' end of the gauge squarely to the axis of the hole at the front and apply light pressure axially. (Fig 1)

If the hole is within limit, the gauge will enter easily.

Allow the plug to enter for the full length of the bore.

Check for the play between the plug gauge and the bore diameter.

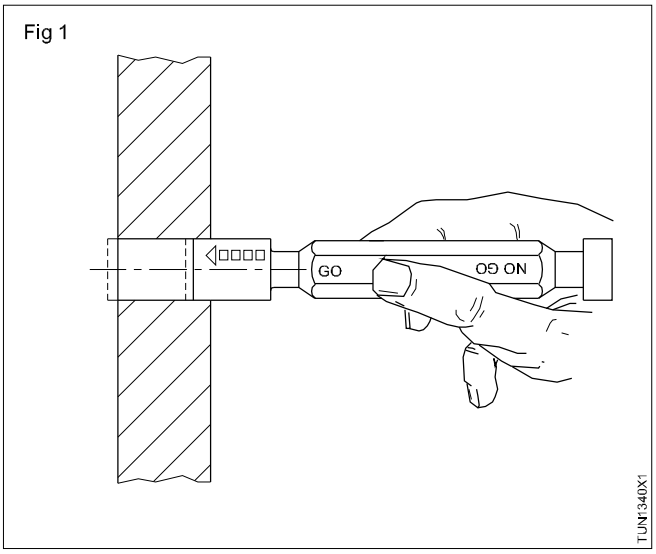
If the plug does not go throughout the bore, it indicates that the bore is tapered.

The plug should not forced inside unless the bore is rectified.

Excessive play or looseness in any one direction indicates that the hole is elliptical.

Check with the 'No-Go' end of the gauge also, using the same procedure.

Fig 1



An entry of a 'No-Go' gauge into a hole beyond the chamfered length indicates an oversized hole, bell mouthed or tapered hole.

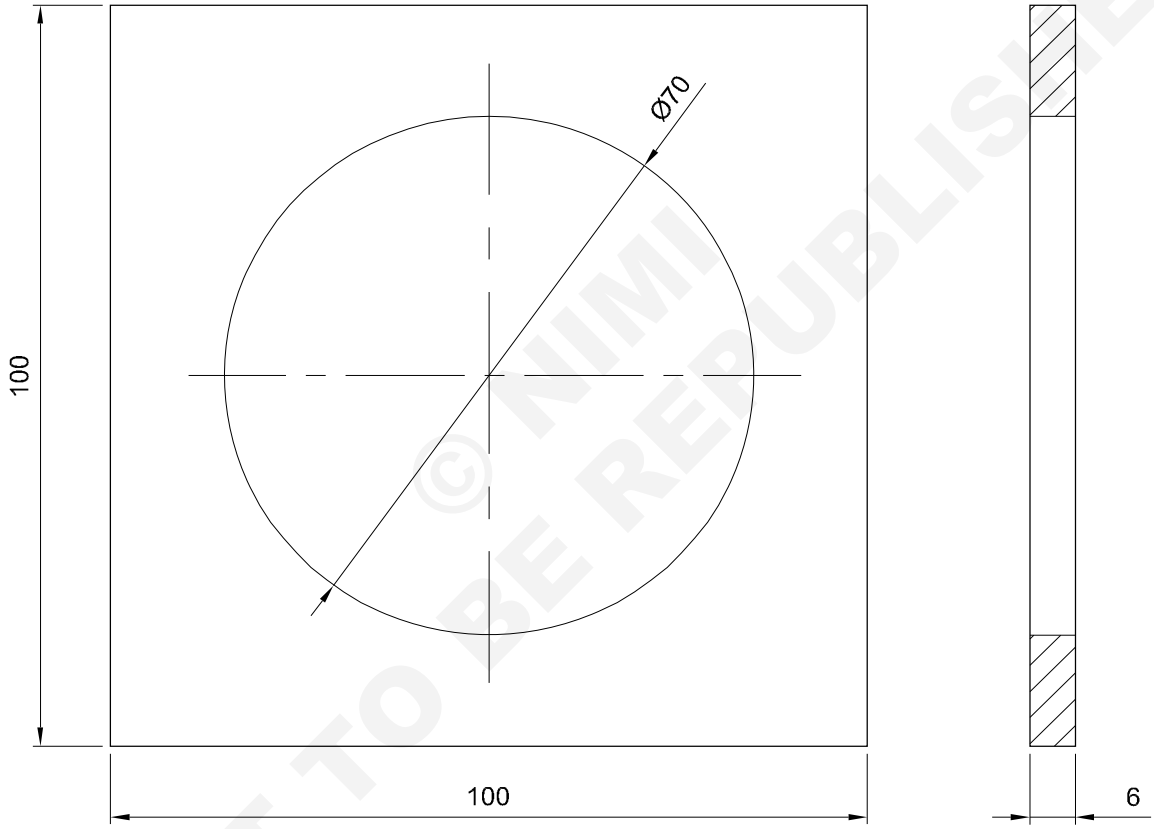
Do not force or twist a plug gauge in the hole. Forcing or twisting will cause excessive wear.

While checking, the plug gauge and workpiece must have the same temperature.

It is very important not to check the work which has warmed up during operation, with a cold plug gauge.

Make bore by trepanning

Objectives : At the end of this exercise you shall be able to
- **set the square plate on 4 jaw chuck**
- **to cut the 70mm dia with help of trepanning tool**
- **measure the diameter with help of vernier caliper.**



1	100 ISF 6 - 100	-	Fe310			1.3.41
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	MAKE BORE BY TREPANNING				DEVIATIONS ±0.1	TIME : 10Hrs
					CODE NO. TUN1341E1	

Job sequence

- Hold the square plate on 4 jaw chuck.
- Setting the job for 4 jaws adjust equal distance of reference concentric circle line.
- Mount the drill chuck to tail stock spindle.
- Hold the Ø10mm drill to drill chuck.
- Through the pilot hole 10mm.
- Set the trepanning tool make a bore size 70mm, tool adjust and set centre axis to tool cutting point 35mm.
- Clamp the tool holder in correct position and centre height.
- Select and set correct rpm.
- Locate the guide pin to guide hole if job and carriage locked rigidly.
- Move the compound slide giving gradual depth.
- Make a bore size Ø70mm in 6mm length.
- Stop the machine and remove inner piece.
- Trepanning tool is withdrawn carefully.
- Check the dimension

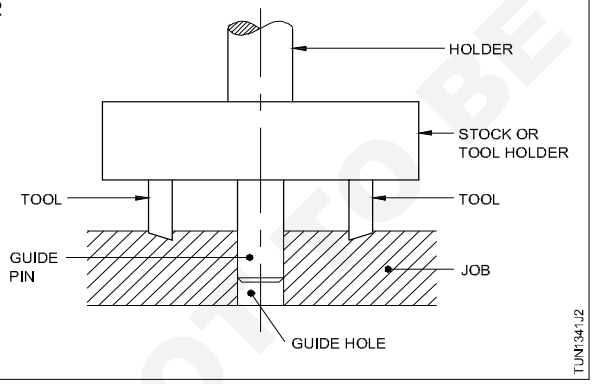
Skill sequence

Trepanning operation

Objective : At the end of this exercise you shall be able to
- **producing a hole on drilling machine by trepanning tool.**

Trepanning operation done on a Drilling machine: Trepanning is the operation of producing a hole by removing metal along the circumference of a hollow cutting tool. (Fig 1) The trepanning operation is performed for producing large holes. Fewer chips are removed and much of the material is saved while the hole is produced. The tool may be operated at higher speeds as the variation in diameter of the tool is limited by the narrow cutting edge. The tool resembles a hollow tube having cutting edges at one end and a solid shank at the other to fit into the drill spindle. this is one of the efficient methods of producing a bigger hole to a limited thickness.

Fig 2



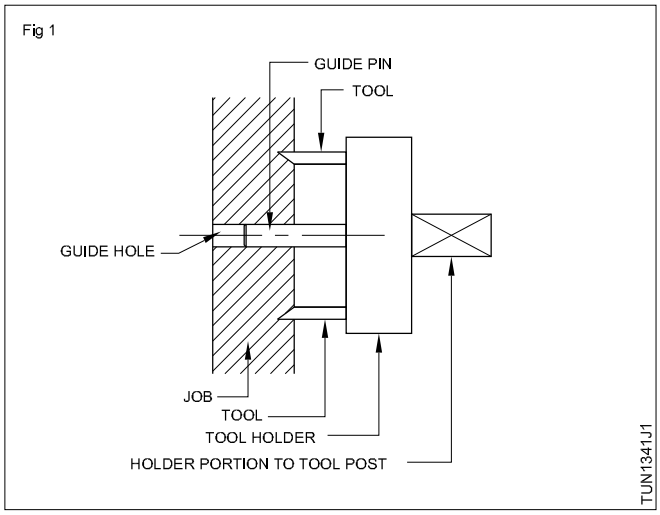
Trepanning operation done on a lathe: One of the special operations performed on a centre lathe is trepanning. The lathe should be rigid in construction to carry out this operation. The tool resembles that of a parting off tool with secondary front clearance. The tool is clamped in the tool post with its axis parallel to the lathe axis. Its cutting edge is positioned with the outer edge to contact the workface at a distance from the centre of the workpiece atleast about 0.1mm less than the radius of the hole required on the work. This is done with the help of the cross-slide hand wheel and graduated collar. The lathe is set to a spindle speed determined by taking 1/3 of the cutting speed recommended for boring.

The carriage is locked to the bed at the time of feeding the tool by the compound slide hand wheel. To avoid the curled chips getting clogged, it is better to clamp the tool with its cutting edge upside down, with the direction of rotation of the workpiece being reversed.

Trepanning on lathe is successfully done on very thin sheets which are cut to a definite size and to the same bore diameter. The inner discs that form as waste will be useful for some other applications. It is important to take the sheets together after properly aligning the edges so that when they are separated after the trepanning operation, the hole produced in each will be of uniform size and will be uniformly located from the edges.

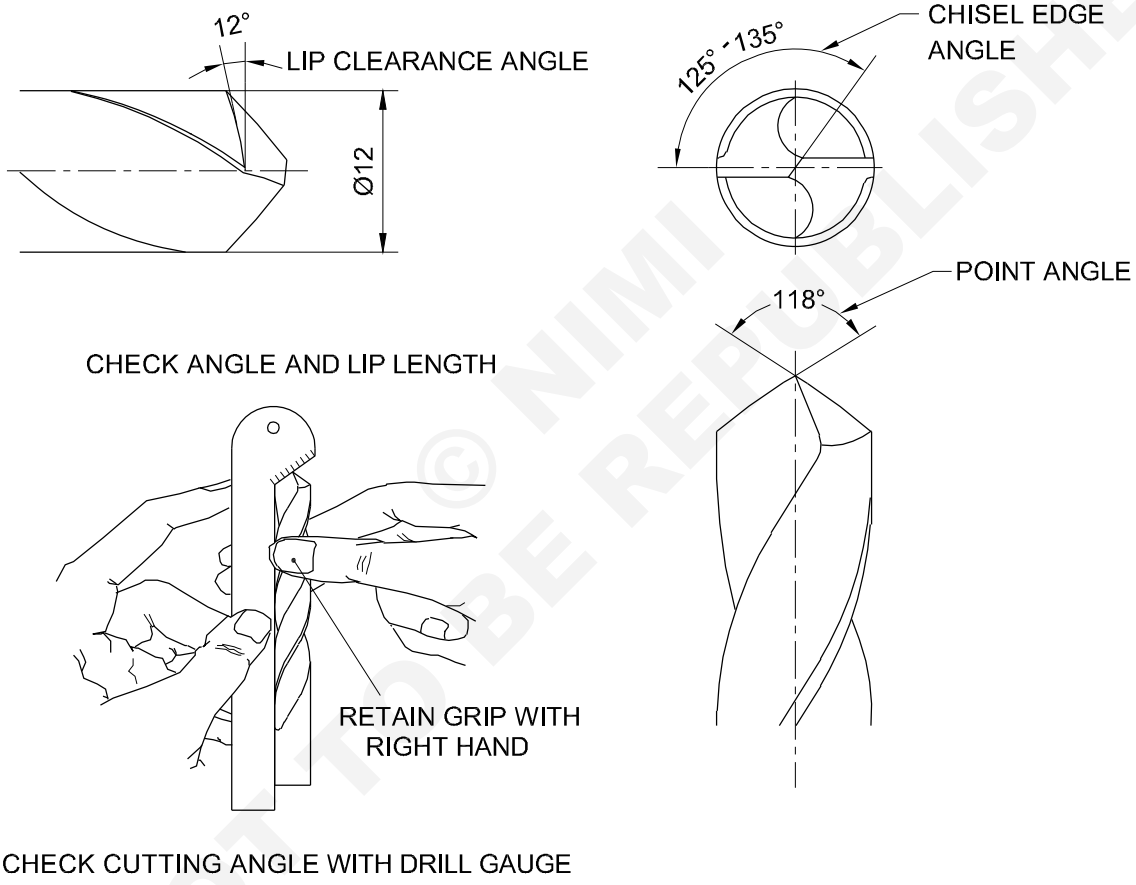
If the dimensional accuracy and surface finish of the hole thus produced are to be of the high degree, a light cut of about 0.1mm, with a fine feed rate of 0.05mm/rev may be given and the hole may be bored. The pieces are separated by the removal of tacking after the operation is completed. The shape of the trepanning tool, the individual component and the take pieces held in the chuck are illustrated in the Fig 2.

Fig 1



Drill grinding

Objectives: At the end of this exercise you shall be able to
- **grind the twist drill to the required cutting angle**
- **grind the lip clearance angle**
- **check the angle of a drill point with a drill angle gauge**
- **reduce the web thickness at the dead center**
- **inspect and mount a new grinding wheel**
- **dress and true a grinding wheel mounted on a pedestal grinder.**



1	–	–	HSS Worn out drill	–	–	1.3.42
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	DRILL GRINDING	DEVIATIONS	TIME 5 hrs
		CODE NO. TUN1342E1	

Job sequence

- Check the working condition of the grinding machine and its wheels.
- Dress the grinding wheel with a carborundum stick.
- The drill bit is held behind the point with the thumb and index finger of the left hand, shank with the thumb and index finger of the right hand.
- Lightly press the drill with an angle of 59° against the grinding wheel, and at the same time, the drill shank is moved up and down to get the lip clearance angle of 8° to 12°.
- Repeat the operation for the other lip.
- Dip the tool in a coolant frequently.
- Finish the clearance angle from 8° to 12° and check the angle with a drill gauge.
- Check the lip length and maintain both sides equal.
- Reduce the web thickness at dead centre.
- Deburr the cutting edge by an oilstone.

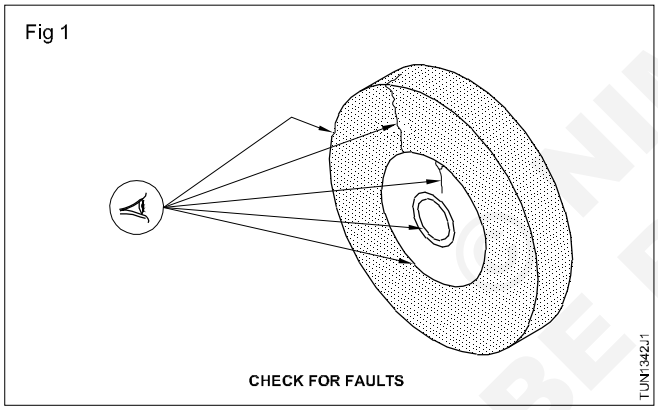
Skill sequence

Inspecting and mounting a new wheel

Objectives : This shall help you to
- **inspect the wheel selected for the job in hand**
- **mount the wheel on to the pedestal grinder.**

When a suitable wheel has been selected for the operation required, check it for visible flaws carefully. (Fig 1)

Fig 1



Look for :

1. broken and chipped edges
2. cracks
3. damaged mounting bushes
4. damaged compressible washers.

The wheel should also be dry and free from any loose material.

(Fig 2) illustrates the method of testing a small wheel for cracks.

A clear ringing sound indicates a wheel free from cracks.

A dull sound means a cracked wheel.

Discard any wheel that shows any sign of damage, and fails to produce a clear ringing sound.

Mark clearly with a tag indicating there is a possible fault. (Fig 3)

Fig 2

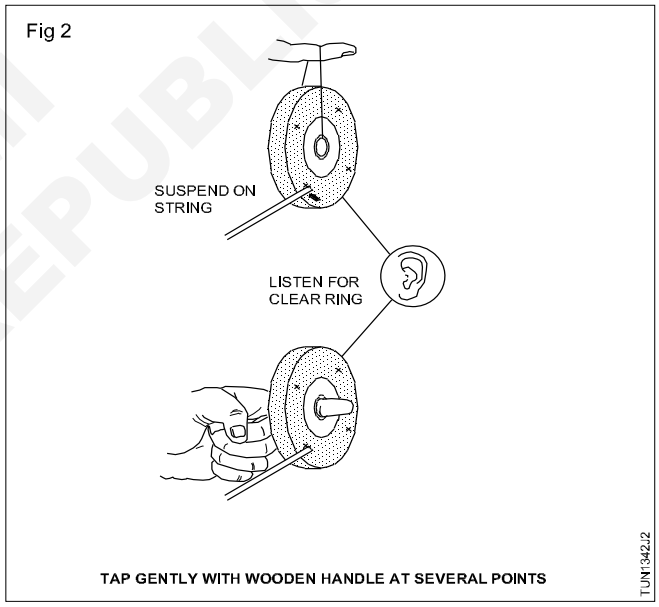
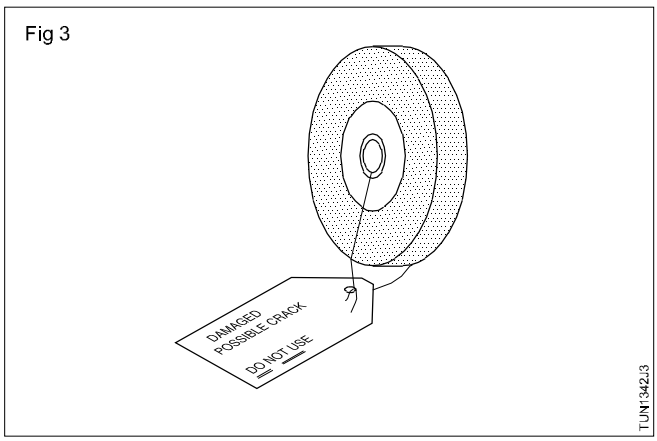


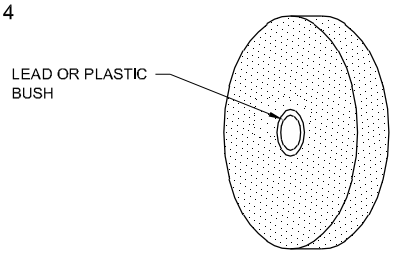
Fig 3



Mounting the wheel

Abrasive wheels used for off-hand grinding are fitted with a lead or plastic centre bush. (Fig 4) Make sure that this bush is in good condition.

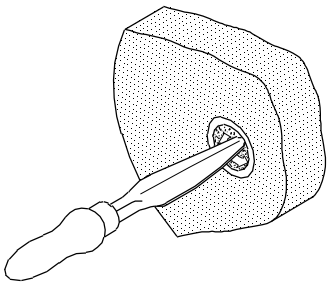
Fig 4



TUN1342J4

Remove any burrs in the bore with a half round scraper. (Fig 5)

Fig 5



REMOVE ANY BURRS OR TIGHT SPOTS WITH A SCRAPER

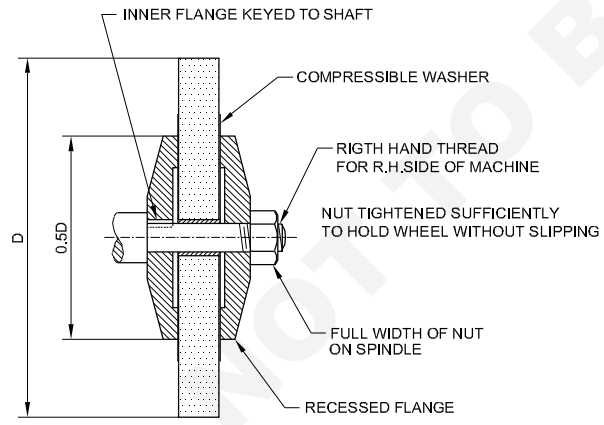
TUN1342J5

The hole should have a free sliding fit on the machine spindle.

Never force a wheel on to the spindle.

Abrasive wheels must be mounted on the spindle between steel flanges of equal size. They should be half the diameter of the wheel but never less than one third. The flanges are recessed on the side in contact with the wheel. The inner flange is firmly fixed to the spindle to give a positive drive. (Fig 6)

Fig 6



CORRECTLY MOUNTED WHEEL

TUN1342J6

Tighten the nut sufficiently to hold the wheel firmly without slipping.

Excessive tightening will cause damage to the wheel.

Fitting a new wheel on to a machine

Switch off the power supply to the machine at the isolator switch.

Brush down the machine to clear away any loose metal or abrasive particles.

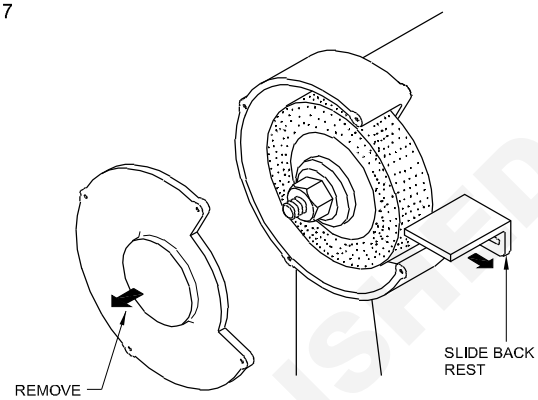
Remove any loose particles from and around the clamp and nut with a brush.

Loosen the work-rest clamp with the correct size spanner.

Slide the rest as far back from the wheel as possible. Remove it completely, if necessary. (Fig 7)

Undo the clamping screws and remove the outer plate of the wheel guard. (Fig 7)

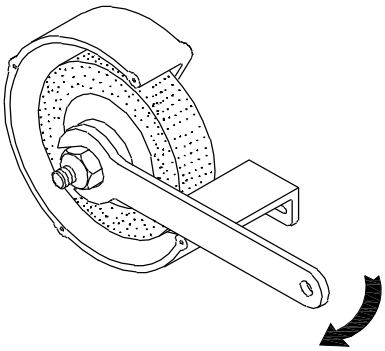
Fig 7



TUN1342J7

Loosen the nut using a spanner of the correct size. (Fig 8)

Fig 8



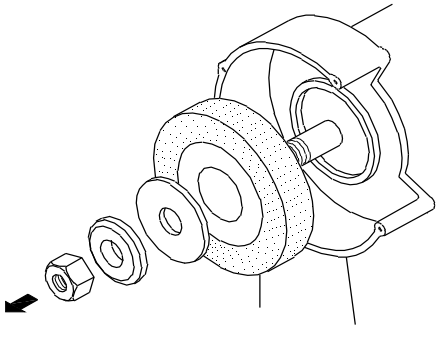
CHECK NUT DIRECTION BEFORE LOOSENING

TU20N1342J8

Check and ensure the direction in which the nut needs to be turned to loosen it.

Unscrew the nut from the spindle and remove the outer flange. (Fig 9)

Fig 9



REMOVE NUT AND FLANGE

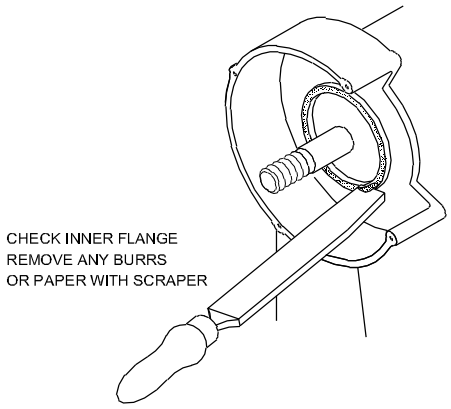
TUN1342J9

A light below with a soft head hammer may be needed to free it from the wheel.

Slide the worn out wheel off the spindle.

Remove any paper washer that has adhered to the flange. (Fig 10)

Fig 10



Brush down to flange, spindle and thread.

Clean out any abrasive particles that have collected inside the guard.

Insert the new wheel on the spindle and assemble. (Fig 11) Place the outer flange in position.

Screw up the clamping nut by hand, firmly enough to hold the wheel in position. (Figs 11 a)

Fig 11

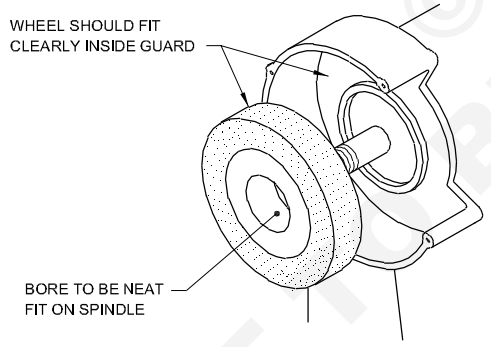
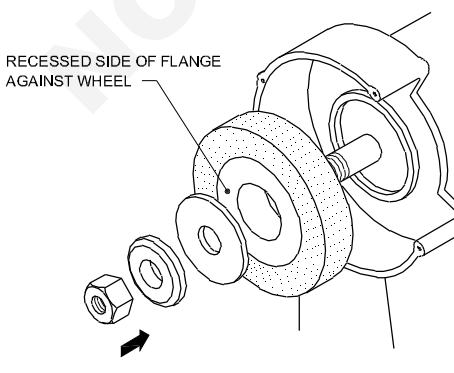


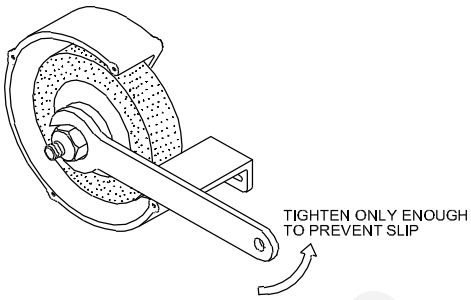
Fig 11a



Ensure that the wheel is running true and it is clear of the inner part of the guard.

Tighten the nut sufficiently to ensure that the flanges will drive the wheel without slipping. (Fig 12)

Fig 12

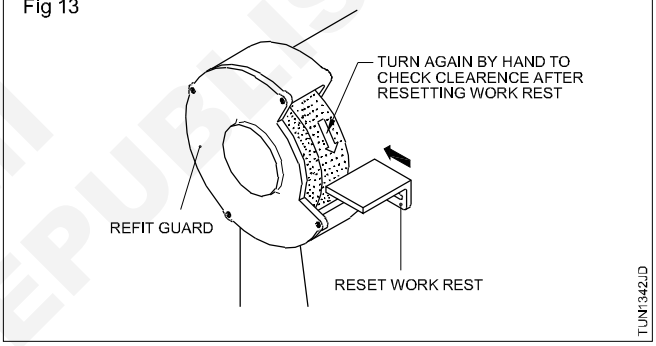


Refit the outer plate of the wheel-guard.

Reset the work-rest as close to the wheel face as possible.

Tighten the work-rest clamp firmly. (Fig 13)

Fig 13

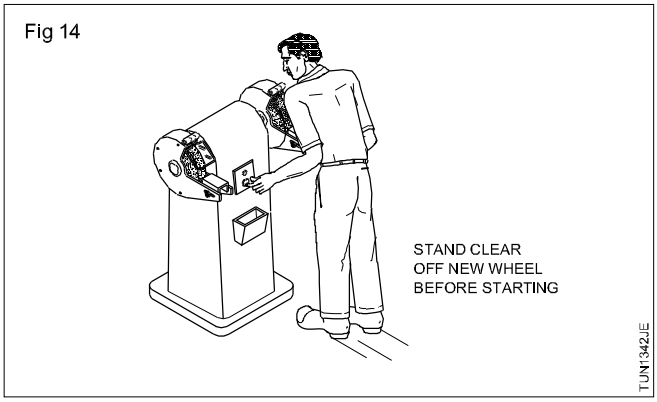


Rotate the wheel again by hand to ensure that it runs freely, and true.

Press the starting button and allow the wheel to operate for at least one minute at full operating speed. (Fig 14)

A correctly fitted new abrasive wheel should run true and it does not need dressing.

Fig 14



Dressing and truing the grinding wheel

Objective : This shall help you to
- **dress and true a grinding wheel of a pedestal grinder for tool grinding.**

Abrasive wheels that develop any of the conditions of loading, glazing, grooving and out-of-round must be dressed and trued.

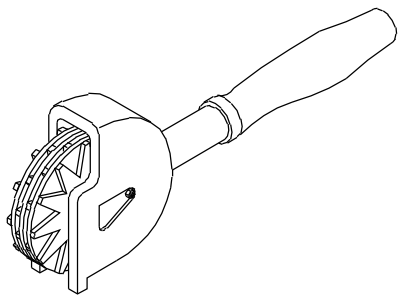
'Dressing' is the operation of cleaning or removing new abrasive particles on the cutting surface of the wheel.

'Truing' a wheel is the operation of removing material from the cutting face. This squares up the surface of the wheel and makes it to run concentrically with the axis.

Loading and glazing require 'dressing'. Grooved and out-of-round wheels require 'truing'.

The tool most commonly used to true or dress a grinding wheel consists of a revolving metal cutter or roller fitted with a long handle. (Fig 1)

Fig 1

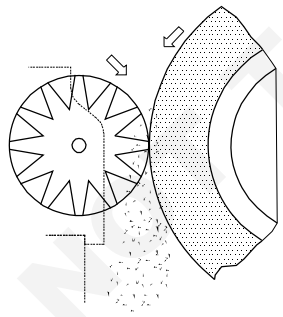


DISC TYPE OR STAR TYPE DRESSER

TUN1342X1

The revolving cutter is forced against the surface of the wheel being dressed. The action of the roller is to crush the surface of the wheel to free the abrasive particles. (Fig 2)

Fig 2



ROTATING DISCS CRUSH OUT PARTICLES

TUN1342X2

The following procedure is to be followed when dressing a grinding wheel with a disc type dresser. (Fig 3)

Select a suitable size dresser for the wheel face.

Check that the metal discs or stars revolve freely, and that they are not badly worn out.

Make sure that the spindle is fixed in position.

Add a few drops of lubricating oil to the spindle.

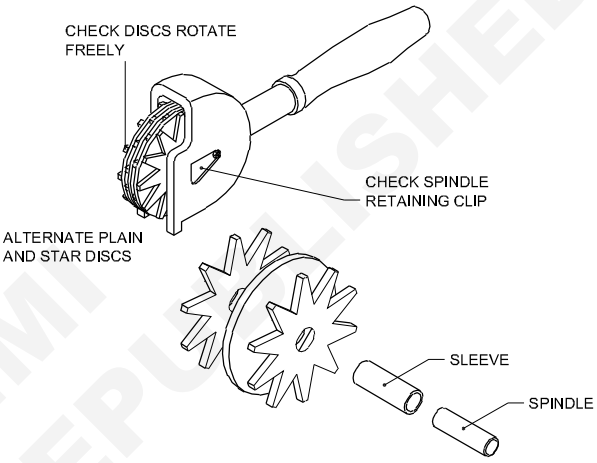
Switch off the power at the isolator switch.

Clean around the work-rest and the clamp, with a brush.

Loosen the clamp.

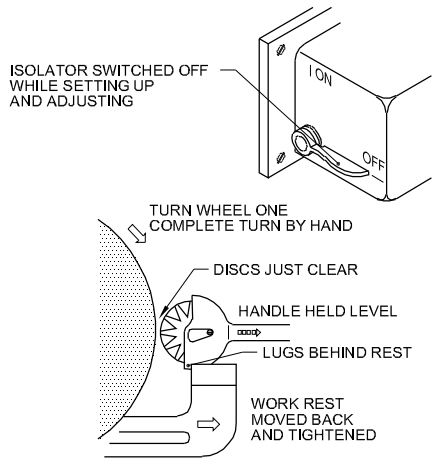
Slide the rest away from the wheel far enough for the lugs of the dresser to fit behind the rest. The discs should just clear the wheel face. (Fig 4)

Fig 3



TUN1342X3

Fig 4



TUN1342X4

Tighten the clamp.

Put on a pair of close-fitting safety goggles.

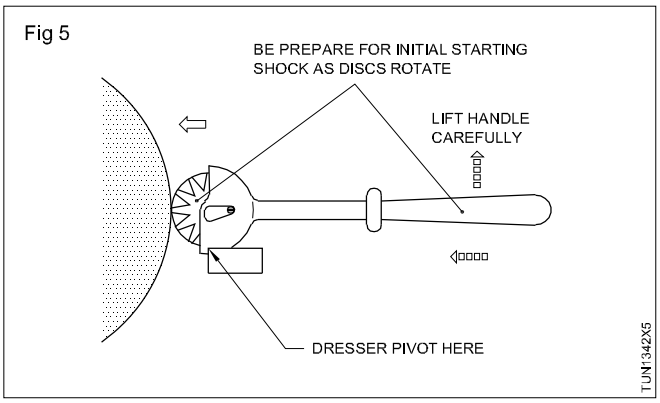
Turn the wheel a full revolution, by hand to check that all is clear.

Switch on the power at the isolator switch, and switch on the grinding machine.

Hold the handle of the dresser firmly with both hands.

Raise the end of the handle carefully to bring the discs in contact with the grinding wheel. (Fig 5)

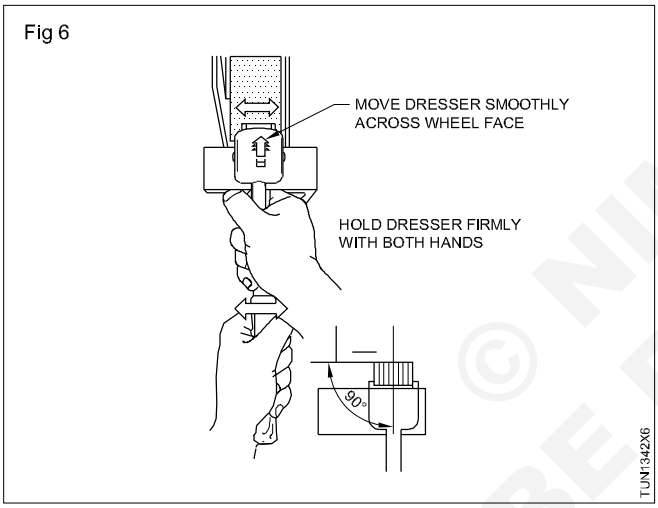
Fig 5



Counteract the movement of the sudden rise of the dresser handle because of the downward thrust of the wheel.

Move the dresser steadily across the face of the wheel. (Fig 6)

Fig 6



Apply enough pressure to cause the wheel to drive the discs positively.

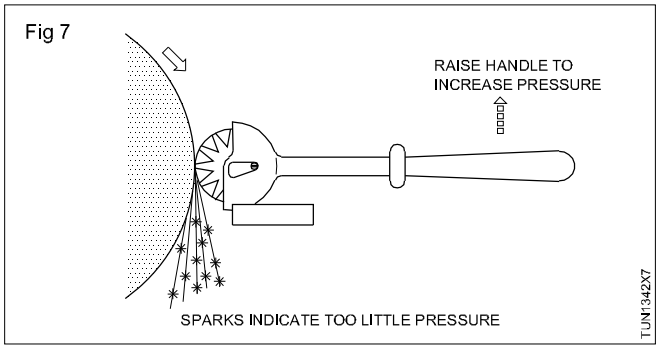
Sparks indicate that the wheel is grinding away the discs. More pressure against the wheel is required now. (Fig 7)

Relieve the pressure as you approach the edges of the wheel.

Retain atleast 1/2 length width of the discs on the wheel face at each pass to obtain a flat wheel face.

Dress the wheel face sufficient enough to remove the loaded or glazed surface or to produce a true face.

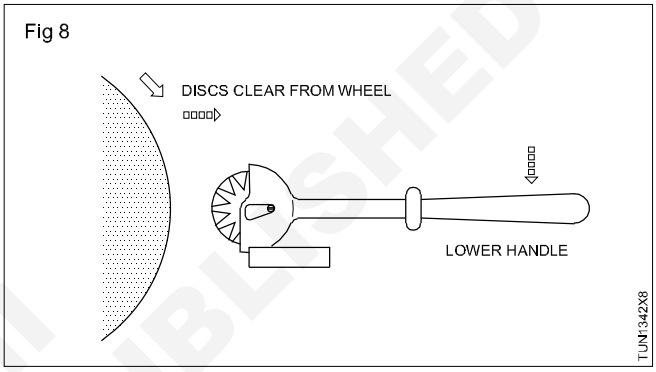
Fig 7



Reset the work-rest to obtain further movement of the dresser for dressing a badly out-of-round wheel.

When the wheel has been dressed, lower the handle to clear the dresser from the wheel face. (Fig 8)

Fig 8



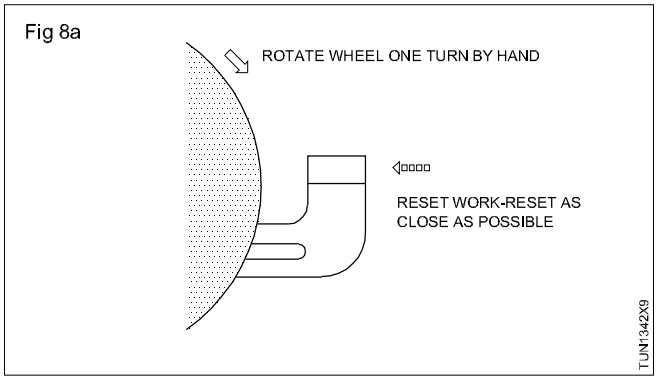
Switch off the machine and remove the dresser from the work-rest.

Switch off the power at the isolator switch.

Clean the machine after it has completely stopped.

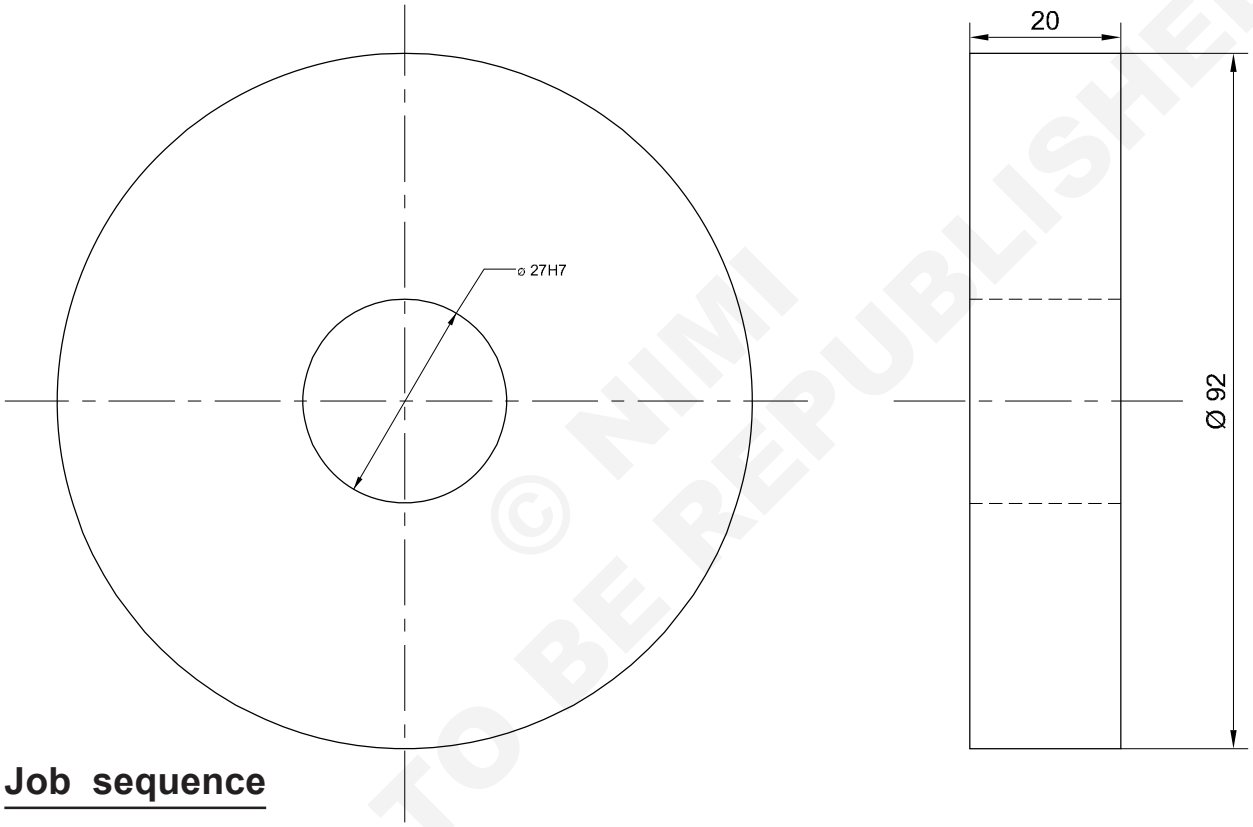
Reset the work-rest as close to the wheel face as possible, and tighten the work-rest clamp for grinding the tool. (Fig 8a)

Fig 8a



Turning between centres on mandrel (Gear blank)

Objectives : At the end of this exercise you shall be able to
- **mount the work on mandrel**
- **turn the gear blank.**



Job sequence

- Check the size of the raw material.
- Hold, true and face one end of the job.
- Drill and bore 26.98mm to fine finish.
- Ream the drilled hole to 27H7.
- Measure the bore size using an inside micrometer.
- Mark and punch the thickness to 20 mm.
- Reverse, refix and face up to the mark.
- Fix the job on the mandrel.
- Hold the mandrel on lathe (Between centre)
- Turn the job as 92mm
- Check the outside diameter by using outside micrometer 75-100mm range

1	IS - Ø100 x 25	-	Fe 310	-	-	1.3.43
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	TURNING BETWEEN CENTRES ON MANDREL (GEAR BLANK)				DEVIATIONS ±0.05 Unless otherwise stated	TIME 20h
					CODE NO. TUN1343E1	

Skill sequence

Turning work held on a plain mandrel

Objectives : This shall help you to
- **mount the work on a mandrel**
- **machine the work held on a mandrel.**

It may sometimes be necessary to machine external surfaces of a cylindrical work accurately in relation to a hole that has been previously bored in the centre of the work. In such cases the work is mounted on a mandrel and machined.

Work has to be mounted on a mandrel before holding on a lathe for machining. The following sequence is to be followed for mounting work on a mandrel.

Select the correct size of the mandrel to suit the hole of the workpiece.

Clean and apply a light film of oil or soft grease on the diameter of the mandrel.

Remove the burrs from the edge of the hole in the workpiece.

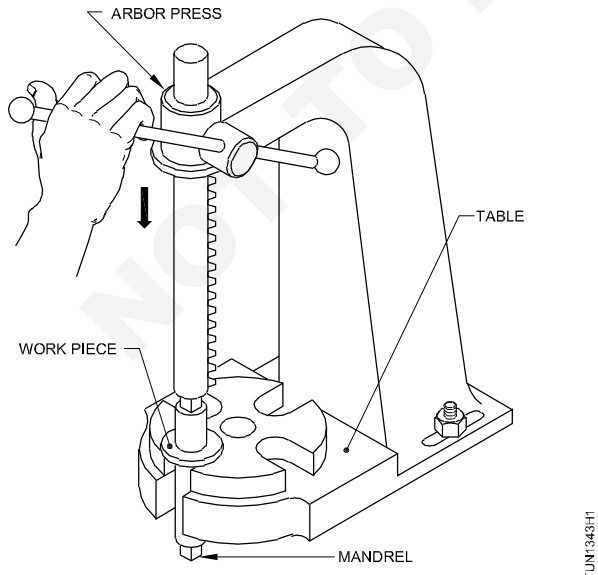
Clean and lubricate the hole in the workpiece to prevent seizing or scoring when the mandrel is pressed into or out of the work.

Insert the small end of the mandrel squarely into the hole by hand. It should enter the hole approximately about 25 mm and should square itself.

The larger end of the mandrel has the size stamped on it.

If an arbor press is available, place the work on the arbor press table, preferably with the machined surface downwards. (Fig 1)

Fig 1

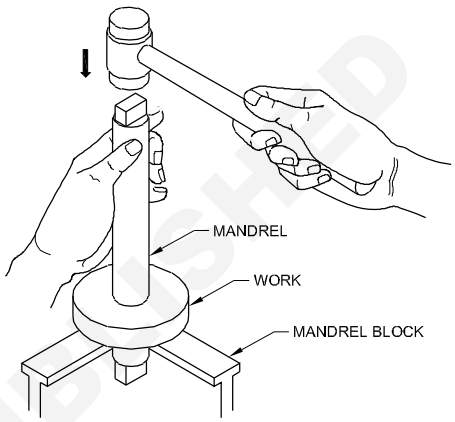


Press the mandrel firmly, but not too tightly, into the workpiece.

If the mandrel is forced into the work tightly, it may distort, damage the bore of the workpiece, and sometimes break the workpiece.

If an arbor press is not available, use a lead hammer to drive the mandrel into the hole by light hammering. (Fig 2)

Fig 2



USING A HAMMER TO MOUNT WORK ON A MANDREL

The workpiece is pressed on a solid plain mandrel, and is held in position approximately at the centre of the mandrel length only by friction. Take all cuts towards the large diameter end of the mandrel and avoid taking heavy cuts.

Mount a suitable lathe carrier on the large diameter end.

Check for the true running of the live centre.

Check the alignment of the live centre and the dead centre of the lathe with a test bar and dial indicator.

Clean the lathe centres and the centre holes of the mandrel thoroughly.

Mount a catch plate or driving plate to the spindle nose.

Mount the mandrel with the workpiece in between centres, and carefully adjust the force on the centres.

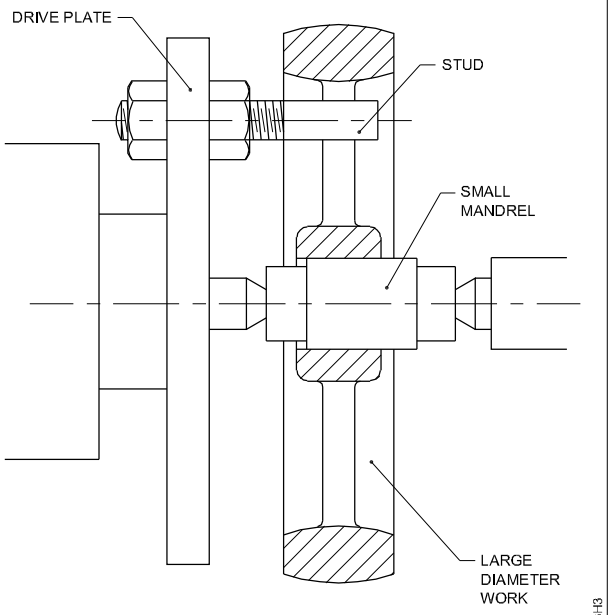
Avoid overhang of the tailstock spindle.

To prevent the work getting forced off from the mandrel, avoid taking cuts from the larger diameter end towards the smaller.

Very light cuts should only be taken on a work of a larger diameter mounted on a small mandrel.

If possible, drive the workpiece directly from the drive plate by means of a suitable stud. This will prevent the work from slipping. (Fig 3)

Fig 3



WORK DRIVEN DIRECTLY BY DRIVE PLATE

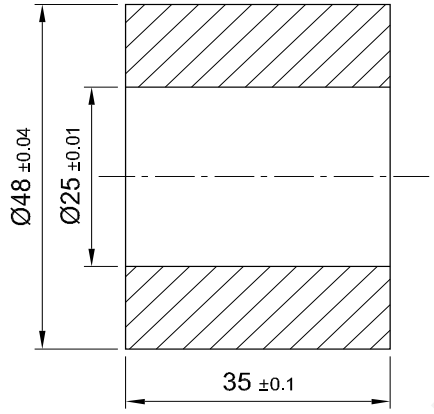
Exercise 1.3.44

Fitting of dissimilar materials

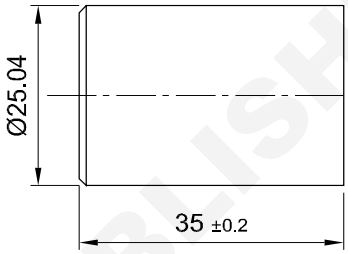
Objectives : At the end of this exercise you shall be able to

- **set the job on a four jaw chuck**
- **turn to the required diameter and length**
- **bore a hole to an accuracy of ±0.02mm with a tool**
- **fit the job part task 1 and 2.**

TASK : 1



TASK : 2



Job sequence

TASK 1**: Drill and boring**

- Check the raw material for its size.
- Set the 50mm dia job on a four jaw independent chuck with maximum possible projection.
- True it with help of surface gauge.
- Set the turning tool to the tool post with correct centre height.
- Select the correct rpm.
- Face one end and turn Ø48mm to a length 20mm.
- Put the centre drill and pilot drill Ø10mm and enlarge 16mm drill.
- Drill the job, up to dia 24mm through its full length 35mm.
- Set the boring tool on tool post to correct centre height.
- Boring upto dia 25mm full length.
- Reverse and hold the job in the chuck and true the job.
- Face the end and maintain the total length 35mm and turn Ø 48mm remaining length.

1	Ø50 - 40	-	Fe310		TASK-1	1.3.44
1	Ø32 - 100	-	BRASS		TASK-2	1.3.44
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

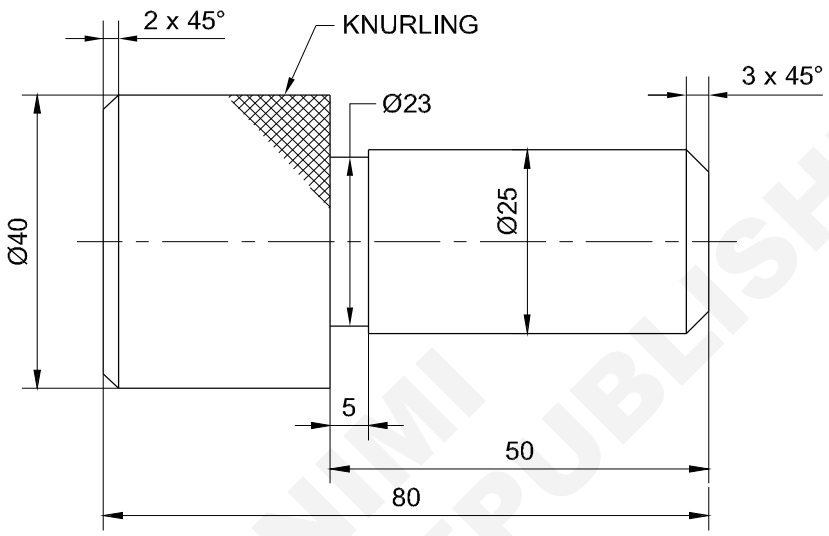
SCALE 1:1	FITTING OF DISSIMILAR MATERIALS	DEVIATIONS As specified	TIME 10h
		CODE NO. TU20N1344E1	

TASK 2**: Turning**

- Check the raw material size.
- Hold the job 32mm Ø in a four jaw chuck with maximum possible projection.
- True it with help of surface gauge.
- Set the tool to the tool post with correct centre height.
- Set the correct rpm for non ferrous metal.
- Face it one end.
- Turn the job upto dia 25.04mm length 39mm.
- Set the chamfering tool and chamfer the edge.
- Part the job upto length 40mm.
- Fit task 1 and task 2.
- Set the assemble job on four jaw chuck and true it with help of surface gauge.
- Face the other end up to 35mm length.

Knurling practice in lathe

Objectives : At the end of this exercise you shall be able to
- **mount a 4 jaw chuck**
- **true the job in the 4 jaw chuck with a surface gauge**
- **turn the component as per drawing and maintain the dimensions within ±0.2mm**
- **knurl the job as per drawing.**



Job sequence

- Check the raw material size.
- Hold the material secured in a 4 jaw chuck projecting 50 mm outside the chuck.
- True the job with a surface gauge and face the end.
- Turn the job to Ø40.00 - 0.2 for more than the required length for knurling.
- Hold the diamond knurling tool securely and set it to the centre height.
- Select the suitable speed for the knurling operation.
- Knurl the surface till a diamond shape is formed.
- Chamfer 2 x 45° at the end.
- Reverse and hold the job in the chuck and true the job.
- Face the end and maintain the length of 80 mm.
- Turn the job to Ø25 x 50 with a side knife tool. (Use a vernier caliper for measuring dimensions.)
- Chamfer to 3 x 45° at the end with a 45° chamfering tool.
- Undercut and maintain Ø23 and groove with a 5 mm width grooving tool.
- Deburr all sharp edges.

Remember
- Avoid overhanging of the tool.
- Use aluminium pieces for packing, to avoid marks on the knurled surface.

Safety precautions
- Never operate a lever when the machine is in motion.
- Do not keep any tools on the moving parts of the machine.
- Use a suitable coolant.

1	Ø45 - 85	-	Fe 310	-	-	1.3.45
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	STEP TURNING, KNURLING, UNDER CUTTING & CHAMFERING	TOLERANCE ± 0.2 on dia and length	TIME 5hrs
		CODE NO. TU20N1345E1	

Skill Sequence

Knurling on lathe

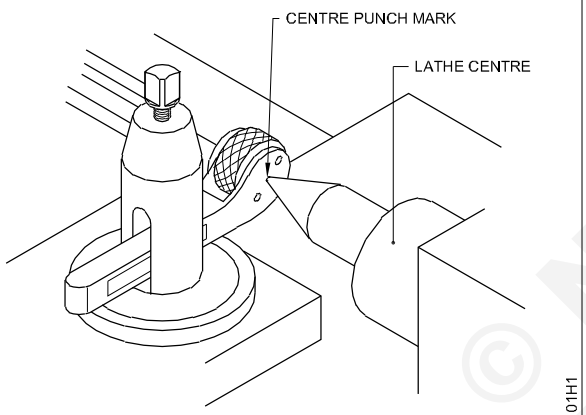
Objectives: This shall help to you
- **prepare the work for knurling**
- **set the speed for knurling**
- **set the knurling tool in the tool post**
- **knurl the job using the required grade of knurl.**

For better grip and for a good appearance on cylindrical surfaces, a portion of the component is knurled. The procedure of knurling, in sequence, is as follows.

Reduce the diameter of the portion to be knurled depending upon the grade of knurl and material of the job. Reduce 0.1 mm for fine knurling, 0.2 mm for medium knurling and 0.3 mm for coarse knurling approximately.

Set the knurling tool in the tool post and align with the centre or tail stock (Fig 1)

Fig 1



SETTING THE KNURLING TOOL ON CENTRE

Set the machine for a low speed, preferably 1/3 to 1/4 of the turning speed. Mark off the length to be knurled.

Adjust the knurling tool so that it is at right angles to the axis of the work; tighten it firmly. (Fig 2)

Feed the knurl and make the knurls to contact the work periphery by the cross-slide hand wheel.

Move the carriage until about the face of the knurling roll overlaps the end of the workpiece which helps to produce a true pattern.(Fig 3)

Start the lathe and feed the knurling tool into the work by the cross-slide.

Stop the lathe and reset the knurling tool, if necessary.

Feeding the knurl into the workpiece, before it is rotated, may damage the knurl.

Fig 2

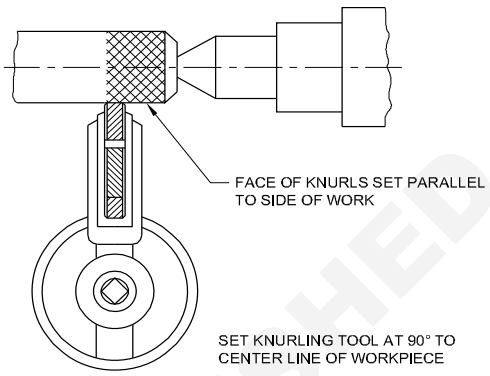
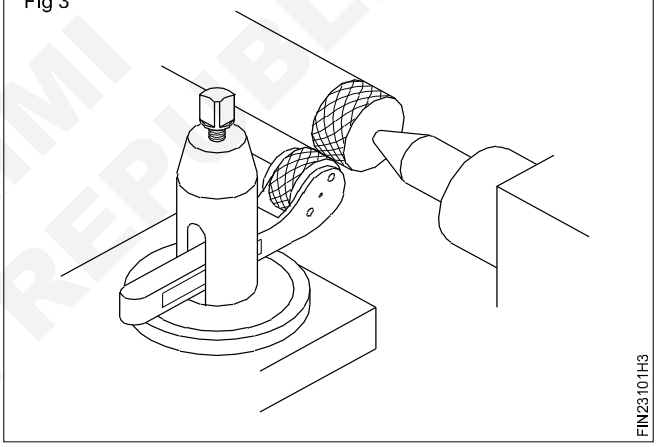


Fig 3



Move the knurling tool longitudinally with a uniform movement by the carriage hand wheel up to the required length of the work to be knurled.
Give the depth by the cross-slide without drawing the tool back. Feed the knurling tool to the other end.

Until the correct pattern is obtained, do not withdraw the knurling tool back.

Ample coolant is to be applied to the workpiece being knurled. This washes away any metal particles, and provides lubrication for the knurling rolls.

Use a fine feed for knurling hard metals and a coarse feed for knurling soft metals.

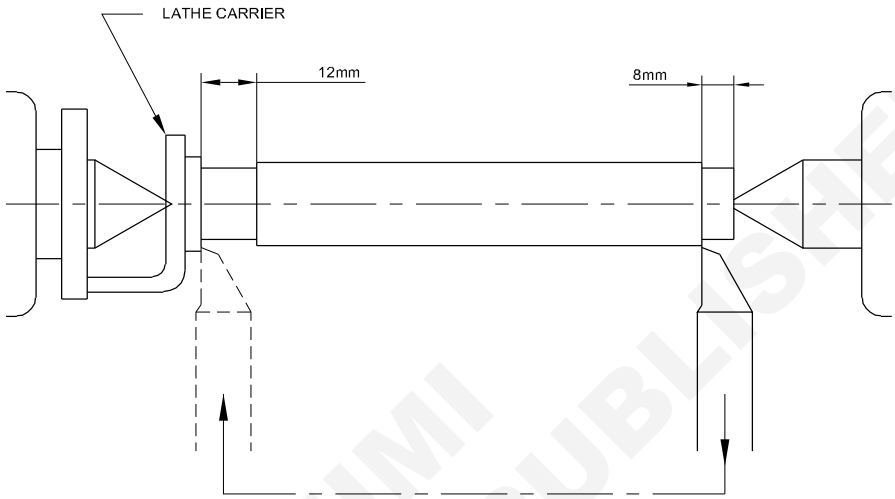
Clean the knurl with a brush for subsequent cuts.

Checking alignment of lathe centres

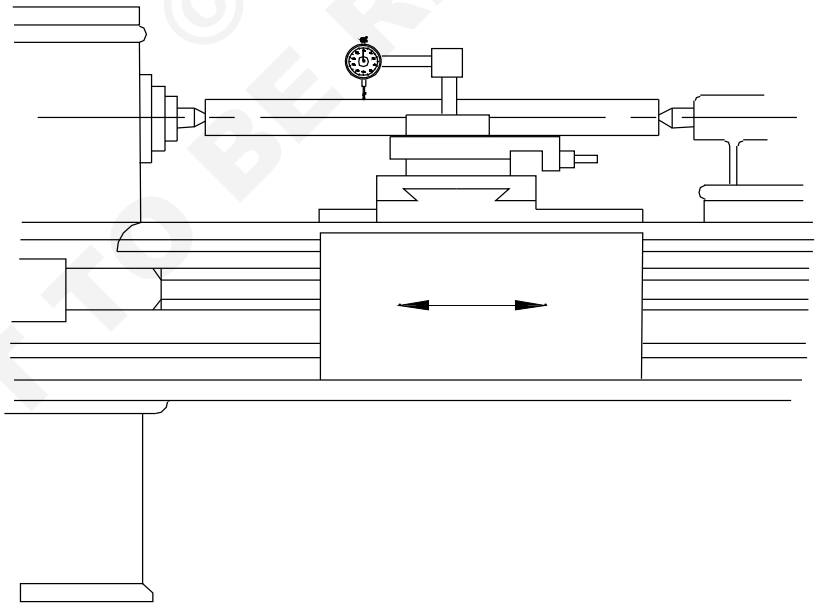
Objectives : At the end of this exercise you shall be able to

- **take trial cuts at each end of work and check the finished diameter with a micrometer and align lathe centres**
- **check the centre align use test bar with dial test indicator.**

TASK: 1



TASK: 2



1	-	-	TEST BAR	-	TASK-2	1.3.46
1	Ø 32-500	-	Fe 310	-	TASK-1	1.3.46
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	**CHECKING ALIGNMENT OF LATHE CENTRE**	TOLERANCE	TIME 20h
		CODE NO. TUN1346E1	

Job sequence

TASK 1 : Trial cut method

- Mount the workpiece between the centre of the lathe.
- Take a light cut at the tailstock end of the work deep enough to produce a true cylindrical surface.
- The cut should be about 8mm long.
- Stop the lathe and note the reading on the cross slide graduated collar.
- Back the cutting tool away from the work using the cross slide handle.
- Move the carriage until the cutting tool is about 25mm from the lathe carrier.
- Rotate the cross slide handle slowly until the graduated collar is at the same setting.
- Machine this end for a length of about 12mm.
- Stop the lathe and measure the diameter of both the turned surfaces with a micrometer.
- The lathe centres are in alignment, if the diameter of the two machined sections are the same.
- If these diameters are different, the tailstock must be adjusted by half of the difference.
- This can be done by using a feeler gauge of the correct thickness between the tool point and the workpiece.
- Adjust towards the cutting tool, if the diameter of the tailstock end is larger.
- Adjust away from the cutting tool, if the diameter of the tailstock is smaller.
- Take another light cut from the both machined diameters using the same graduated collar setting for each cut.
- Measure the diameters.
- Continue adjusting the tailstock.
- Taking light trail cut until both diameters are the same.

— — — — — —

TASK 2 : Using test bar and dial indicator

- Clean the centres of the lathe and the centres drilled holes in the test bar.
- Mount the test bar for required height between the centres and tighten the tailstock spindle clamp.
- Mount a dial indicator in the tool post or on the lathe carriage.
- The contact point should be on the centre of the bar and the indicator plunger should be in a vertical position.
- Adjust the cross slide so that the indicator needle registers about one half of a revolution on the dia at the tailstock end.
- Move the carriage to the left by hand until the indicator registers on the diameter at the headstock end.
- Note the indicator reading.
- If the readings are not the same.
- Move the carriage until the indicator again registers on the tailstock end diameters.
- Loosen the tailstock clamp nut. Using the tailstock adjusting screws.
- Move the tailstock in the proper direction.
- The amount of movement should equal the difference between the indicators readings.
- Tighten the adjusting screw to lock the upper part of the tailstock in place.
- Tighten the tailstock clamp nut and recheck to make sure that the test bar still fits snugly between centres.
- Repeat these steps until the indicator readings at the two ends are the same.

— — — — — —

Skill Sequence

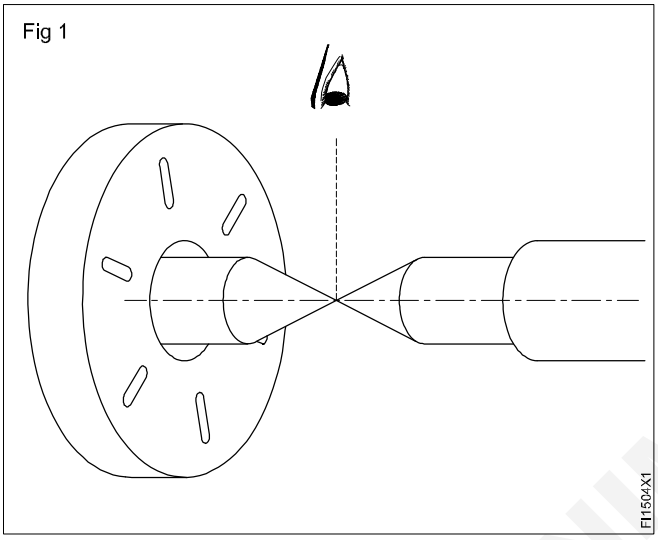
Checking alignment of lathe centres

Objective : At the end of this exercise you shall be able to
- **align lathe centres using the visual alignment method.**

Different methods are available for aligning lathe centres. Depending on the accuracy requirements the method is decided upon.

If the accuracy required is not very high, the method adopted is – visual alignment. (Fig 1)

Fig 1



Procedure

Loosen the tailstock clamp lever or nut.

Turn the tailstock hand wheel until the tailstock barrel extends about 25mm.

Slide the tailstock to the left until the dead approximately 10mm from the live centre.

Turn the tailstock hand wheel until the point centres are almost in contact.

Place a sheet of white paper on the lathe bed centres.

Look down on the top of the centres and alignment of the lathe centre points.

Adjust the tailstock by means of the two screws until the points of both centres are in

Tighten the loose adjusting screw to secure the part the tailstock.

Aligning lathe centres using tailstock graduation

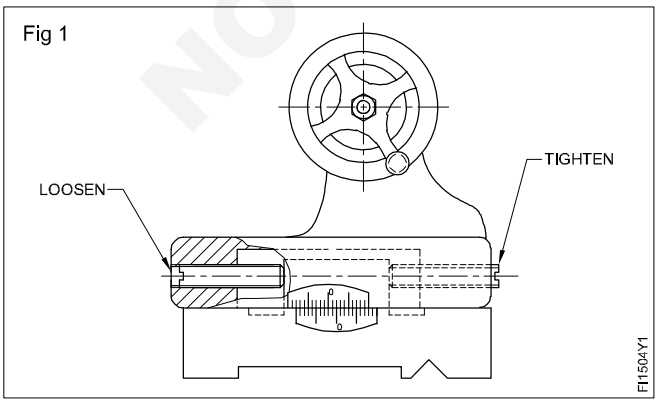
Objective : At the end of this exercise you shall be able to
- **align lathe centres using tailstock graduations.**

For producing components with a reasonable degree of accuracy, this method can be used.

The head-stock centre is always fixed and no changes can be made to this. Corrections are always made by adjusting the centre on the tailstock. For setting the centres, this method uses the graduation given on the base and the body of the tailstock.

Procedure (Fig 1)

Fig 1



Coinciding the zero of body and base

Observe the zero lines of graduations

Loosen the clamp holding the tailstock to the

Loosen one of the adjusting screws on the tails the side in which the body has to be shifted.

Tighten the other screw on the opposite side.

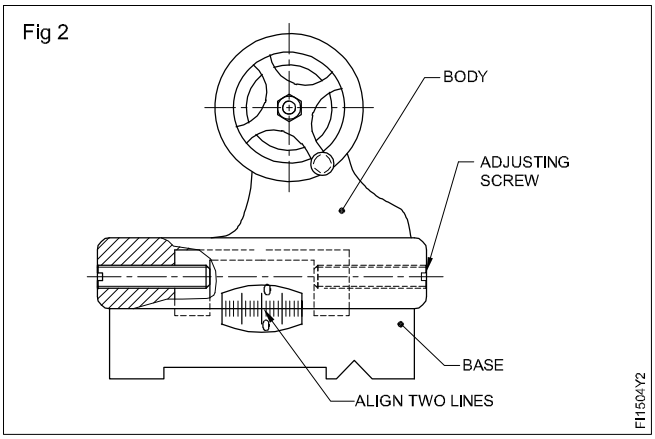
Observe the direction of movement of the stock centre. Continue adjusting the screws the line on the tailstock body coincides with line on the base plate. (Fig 2)

Tighten the adjusting screw to secure the upper part of the tailstock in this position.

While adjusting, loosening of one screw and tightening the opposite side screw should be carried out simultaneously.

Ensure the lines are coinciding.

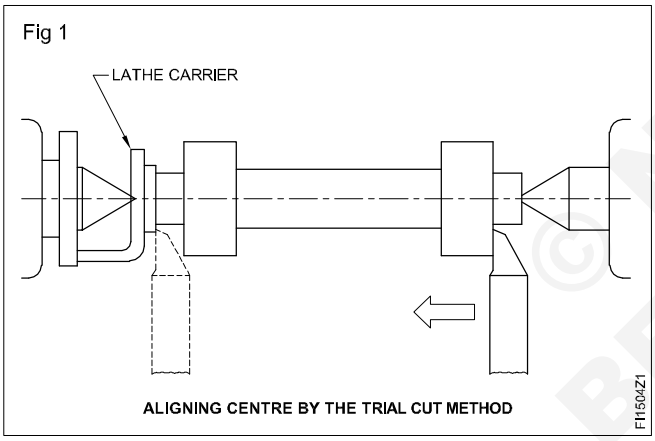
Check the center points of the live and dead centres ensure the correctness of alignment



Aligning lathe centres using trail cut method

Objective : At the end of this exercise you shall be able to
- **align lathe centres using trial cut method.**

Aligning the centres using the tailstock graduation may not be very accurate, because of the inaccuracies in setting and reading the lines. To overcome this, the method adopted to align the lathe centre is the trial cut method. (Fig 1)



Procedure

Mount the workpiece between the centres of the lathe.

A shaft with a collar on either end is preferred.

Take a light cut on the collar at the tailstock end. The depth of cut should be adequate to produce a cylindrical surface.

Move the carriage by hand until the tool reaches the other collar.

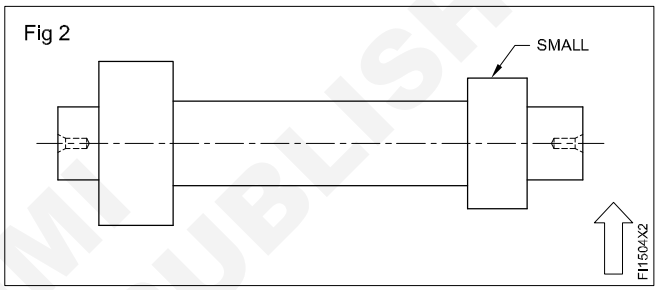
Ensure the cross-slide is not disturbed

Continue the same depth of cut.

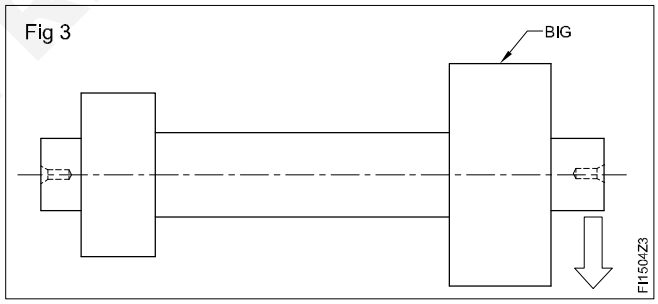
Measure the collar diameters.

If there is any difference in the size of the collars, the alignment is not true.

If the diameter of the collar is less at the tailstock end, move the tailstock body away from the operator. (Fig 2)



If the diameter of the collar at the tailstock end is bigger, move the tailstock body towards the operator - using the adjusting screws. (Fig 3)



Repeat the process until the shaft collar diameters are equal.

Aligning lather centres using test bard and dial indicator

Align lathe centres using a test bar and dial indicator.

This method is adopted when a very accurate alignment of lathe centres is needed.

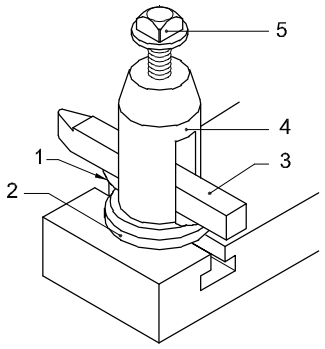
Procedure

Clean the centres of the lathe and the centre drilled holes of the test bar.

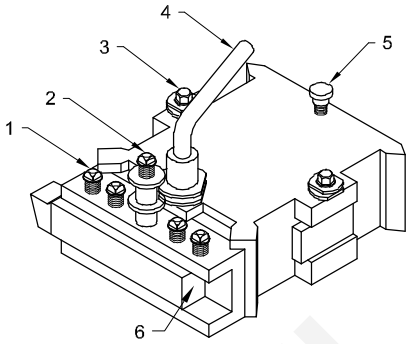
Adjustment of tool post

Objectives : At the end of this exercise you shall be able to
- **set correct centre height with help boat linear**
- **set correct centre height using packing piece**
- **set correct centre height with help of fine adjustment screw.**

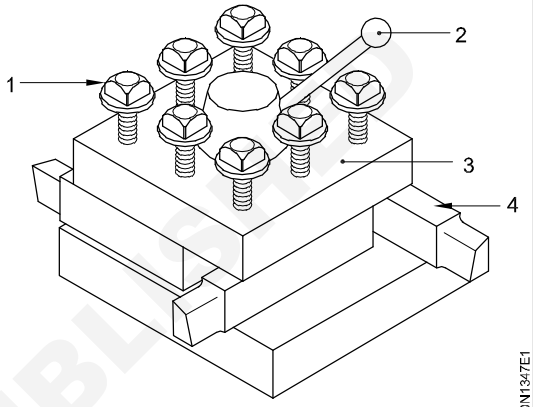
TASK: 1



TASK: 2

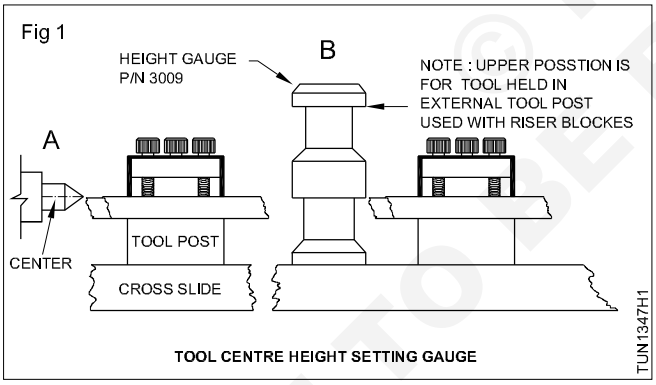


TASK: 3



Note : Refer to instructor.

Job sequence



TASK 1: Single way tool post

- Clean the tool post seating face.
- The tool is positioned on the boat piece and is clamped by the screw.
- The centre height of the tool tip can be adjusted with the help of the rocker arm and the ring base.
- Only one tool can be fixed in the tool post.
- The tool is clamped with only one screw.
- Check the centre height with a height setting gauge.
- Centre height is adjusted by boat piece.

TASK 2 : Quick change tool post

- Clean the tool post and tool holder.
- Tool is fixed on the tool holder and locate the tool post.
- Check the centre height with a height setting gauge.
- Centre height is adjusted by tool holder with help of fine adjust screw.
- Tool post has the best rigidity for holding the tool.
- Check the centre height with a height setting gauge.

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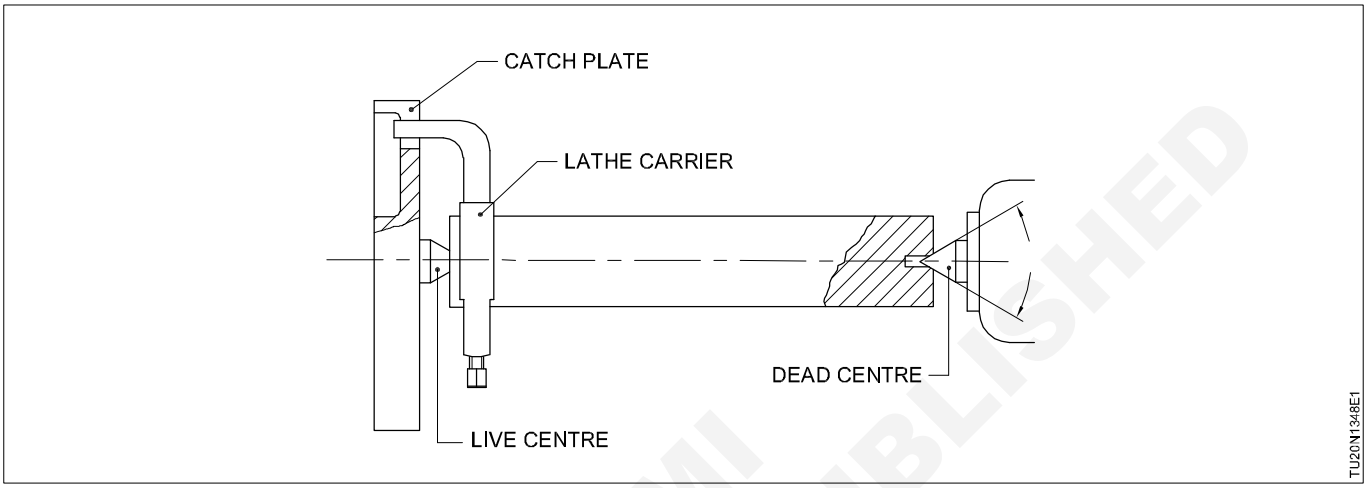
TASK 3 : Four way tool post

- Clean the tool post seating face and place the shims on the seating face.
- Use a minimum number of shims for height adjustment.
- Shims must flushed with the edge of the seating face.
- Place the tool in the tool post on the shims with the near butting against the wall of the seating face.
- Tighten the tool with the centre screw of the tool post.
- Check the centre height with a height setting gauge.
- Remove or add shims and check the height when the tool is tightened by the centre screw.
- Tighten the other two tool-holding screws alternately applying the same amount of pressure.
- When both the screws have a full gripping pressure tighten the centre carefully.
- Check once again with a tool height setting gauge.

— — — — — — —

Mounting job in between centres

Objectives : At the end of this exercise you shall be able to
- **set live and dead centre proper alignment**
- **mount the catch plate**
- **set the bent tail carrier**
- **support the job in between centre.**



Job sequence

- Dismount the chuck and clean spindle nose.
- Mount the catch plate and adaptor with MT centre.
- Mount the dead centre in tailstock spindle.
- Check live and dead centre alignment.
- Clamp the bent tail carrier in workpiece.
- Support the job in between centre.

Skill sequence

Preparing work for between centre turning

Objective: This shall help you to
- **prepare work for turning in-between centres.**

Turning work in-between centres avoids the need for truing the work. The work turned will be parallel throughout. But it requires great skill to perform operations especially like knurling, thread cutting, undercutting. It is limited to external operations only. The work needs the following preparations to be carried out before the actual operations are to be performed.

Face both sides of the work, and maintain the total length accurately within limits.

Choose the correct size and type of centre drill and do centre drilling at both ends.

Dismantle the chuck from the spindle nose and assemble the driving plate or catch plate.

Assemble the spindle sleeve to the spindle nose and fix live centre to the sleeve.

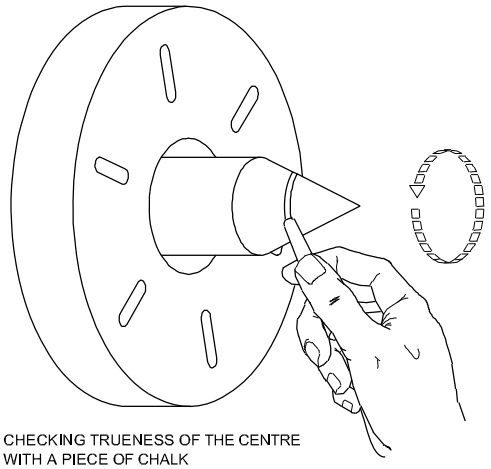
Ensure that the spindle sleeve and live centre are free from damages, burrs and are thoroughly cleaned before assembly.

Check for the true running of the live centre. (Fig 1)

Select a suitable lathe carrier according to the diameter of the work and fasten it on one end of the work with the bent tail pointing outwards. (Fig 2)

Work that has a finished surface should be protected by inserting a small sheet of copper or brass between the end of the screw in the carrier and the work. (Fig 3)

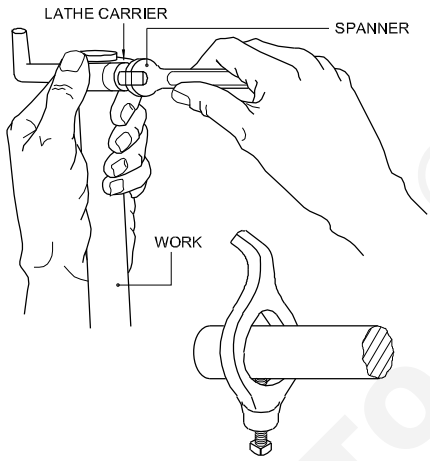
Fig 1



RESULT OF LIVE CENTRE BEING OUT OF TRUE

TUN1348H1

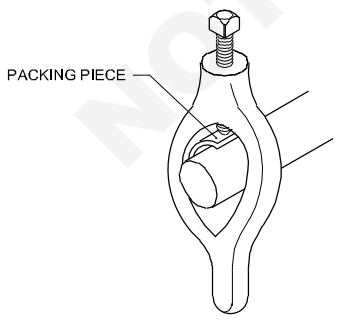
Fig 2



LATHE CARRIER FITTED TO WORK

TUN1348H2

Fig 3



TUN1348H3

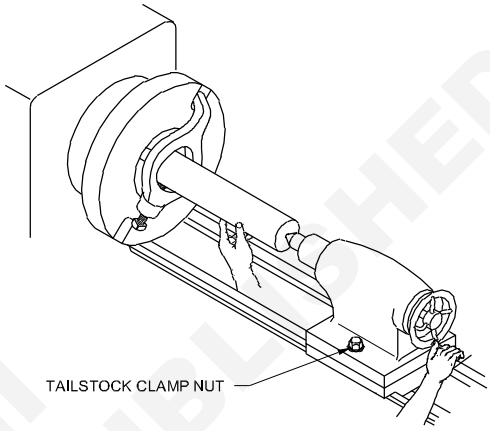
Apply a suitable lubricant (soft grease) to the centre hole of the workpiece to be engaged by the tailstock dead centre.

Move the tailstock to a position on the bed to suit the length of the workpiece. The tailstock spindle should extend approximately 60 to 100 mm, beyond the tailstock.

Ensure there is sufficient space for the saddle to operate before clamping the tailstock to the bed.

Clamp the tailstock in position by tightening the tailstock clamp nut. (Fig 4)

Fig 4

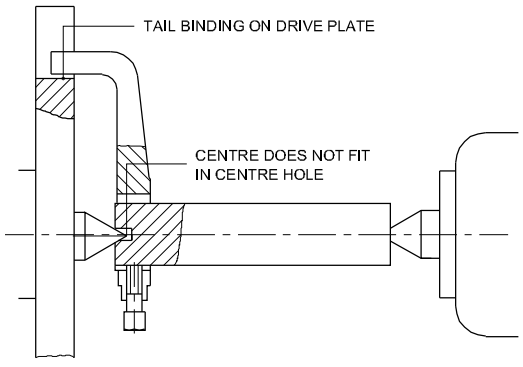


TUN1348H4

Engage the work centre hole with the point of live centre and with the tail of the lathe carrier in the slot in the catch plate. Hold the work in this position with hand.

Ensure that the tail of the lathe carrier does not rest on the bottom of the slot in the driving plate. This will not permit the centre entering the centre hole of the work for proper seating. (Fig 5)

Fig 6

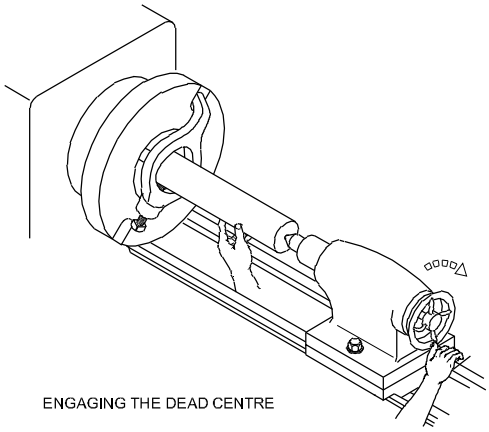


A LATHE CARRIER BINDING IN THE DRIVE PLATE CAUSES INACCURACIES SINCE THE WORK IS FORCED OFF THE LATHE CENTRE

TUN1348H6

Advance the tailstock spindle by the hand wheel rotation until the point of dead centre enters the centre-hole of the work with proper seating eliminating all endwise movement. (Fig 6)

Fig 5



ENGAGING THE DEAD CENTRE

TUN1348H5

Move the tail of the carrier back and forth. At the same time adjust the hand wheel until only a slight resistance is felt.

Tighten the tailstock spindle clamp at this position and check that the resistance does not change.

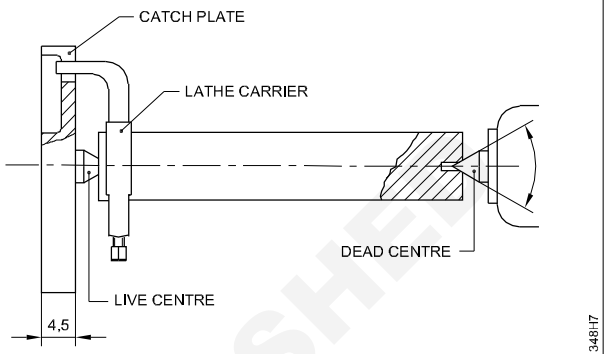
Set the machine for about 250 r.p.m. and allow the work to run for a few seconds.

Check once again for the resistance and adjust the tailstock spindle, if needed.

Work is now ready for operations. (Fig 7)

Before holding the work in between centres ensure that the centres are aligned.

Fig 7



WORK HELD BETWEEN CENTRES

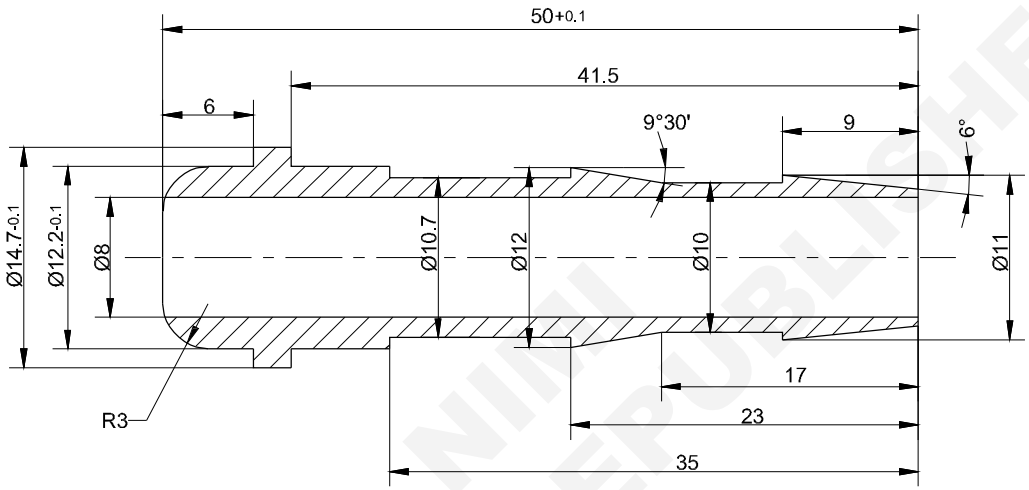
TUN1348H7

Make taper turning by form tool and compound slide swiveling

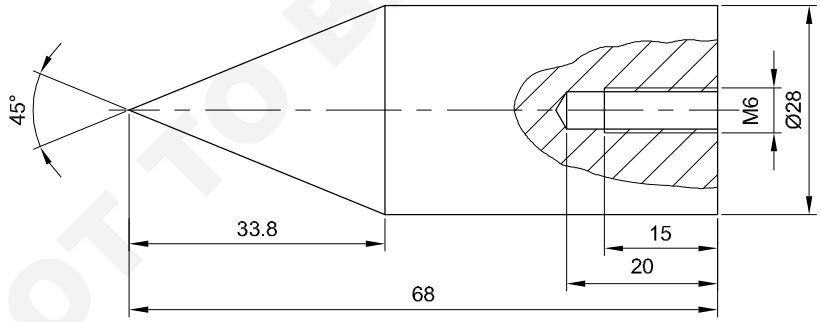
Objective: At the end of this exercise you shall be able to

- **grind form tool for taper turning**
- **turn taper using form tool**
- **turn taper by compound slide swivelling method**
- **select drill size for tapping**
- **drill blind hole to correct depth for tapping.**

TASK 1



TASK 2



1	Ø20 - 65mm	–	Fe310	–	TASK-1	
1	Ø32 - 75mm	–	Fe310	–	TASK-2	1.4.49
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO

SCALE 1 : 1	**TAPER TURNING BY FORM TOOL AND COMPOUND SLIDE SWIVELLING METHOD**	TOLERANCE Degree ±30 ±0.01 Unless otherwise stated	TIME
		CODE NO. TU20N1449E1	

Job Sequence

TASK 1: **Taper turning by form tool**

- Check the given material for the dimension.
- Hold the job 50mm projecting outside the chuck and true it.
- Face the one end and make centre drill.
- Drill ∅ 8mm through hole.
- Turn ∅14.7 mm for a length of 50mm.
- Turn the ∅12.2 mm for a length of 41.5mm from the face.
- Form a step of ∅ 10.7mm for 12mm width leaving a 23mm distance from the face to 35mm.
- Form an under cut to ∅ 10.7 for 8mm width leaving a distance of 9mm from the face to 17mm.
- Step turn ∅ 11mm for 9mm length from face.
- Grind with special form tools to the degree of 9°30' and 6°.
- Set from tool 9°30' perpendicular to the work axis to form taper by plunging.
- Set the machine to 1/3 of rpm for form turning.
- Feed the tool perpendicular to the axis of the work and form taper.

Ensure slow, steady and continuous feeding

- Set the form tool 6° perpendicular to the work.
- Form the 6°.
- Remove the job and hold the work on ∅12.2mm.
- Face the work and maintain the length.
- Turn ∅ 12.2 mm for a length 6mm.
- Form radius R3 at the end.
- Deburr and complete work.

— — — — — — — —

TASK 2: **Taper turning by compound slide swivelling**

- Check the raw material size for the job.
- Hold the job in the chuck, projecting more than 35 mm outside and true it.
- Hold the facing tool and face at one end.
- Make centre drill.
- Make 6 mm tap drill to the depth of 20 mm.
- Using M6 tap set and wrench tap the job for 15 mm depth.
- Remove the burrs on the tapped portion.
- Reverse and hold the job in the chuck by using soft packing pieces (Aluminium) under the jaws.
- Face the job and maintain the total length 68 mm.
- Set the angle in the compound rest for 45°.
- Turn the taper by feeding the tool with the help of the top slide.
- Deburr the job and do final checking.
- Use the tap in an orderly manner.
- Use cutting oil while tapping.
- Clear the chip by reversing tap frequently.

— — — — — — — —

Skill Sequence

Measuring with vernier bevel protractor

Objectives: This shall help you to
- **check the various angles of the machined parts up to an accuracy of ±5 minutes**
- **check the straightness of the machined surface with reference to the other vertical surface.**

The vernier scale is duplicated to read either side of the 'zero' graduation of the main scale. If you read the main scale in the clockwise direction, continue reading the vernier scale also in a clockwise direction. Always make sure that the vernier scale reading is added to the main scale.

Method of using clockwise reading

Set the angular surface of the workpiece between the blade and the face of the base and lock the blade and inner disc firmly with the locking device.

The position of the vernier scale with reference to the main scale is shown in Figure 1.

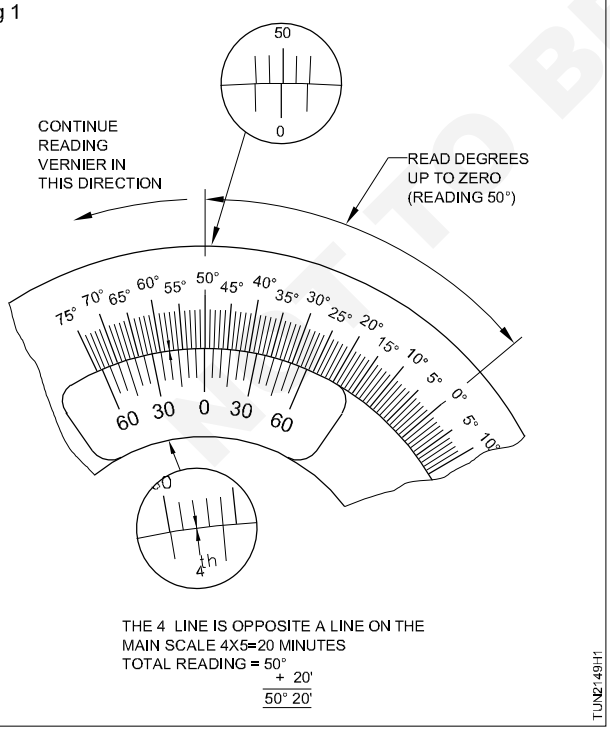
Read the degrees of the main scale up to the graduation '0' of the vernier scale i.e. 50°.

Continue reading on the appropriate vernier scale (towards the left hand side). Note the number of lines in the vernier scale the coincide with a division of the main scale. (i.e. 4th division of the vernier scale is coinciding with one of the main scale division line)

As the least count is 5' multiply this number by 5. (i.e 4 x 5' = 20')

Add this result to the main scale reading of 50° i.e. 50° + 20' = 50°, 20'.

Fig 1



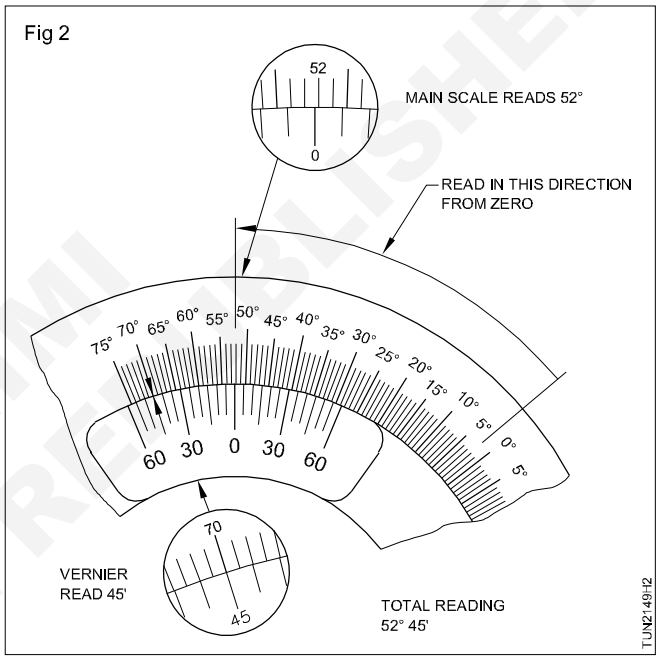
Similarly the reading for figure 2 may be obtained as 52°, 45'. (Fig 2)

Method of checking the straightness with reference to the vertical surface

Set the blade and base firmly on the machined surface.

Lock the blade and base in position with the help of the locking device.

Fig 2



Read the vernier scale with reference to the main scale.

If the '0' graduation of the vernier scale and 90° of the main scale coincide, the machined faces are at right angles, i.e. 90°.

If the '0' graduation of the vernier scale does not coincide, read the appropriate vernier scale and find the error in degrees and minutes.

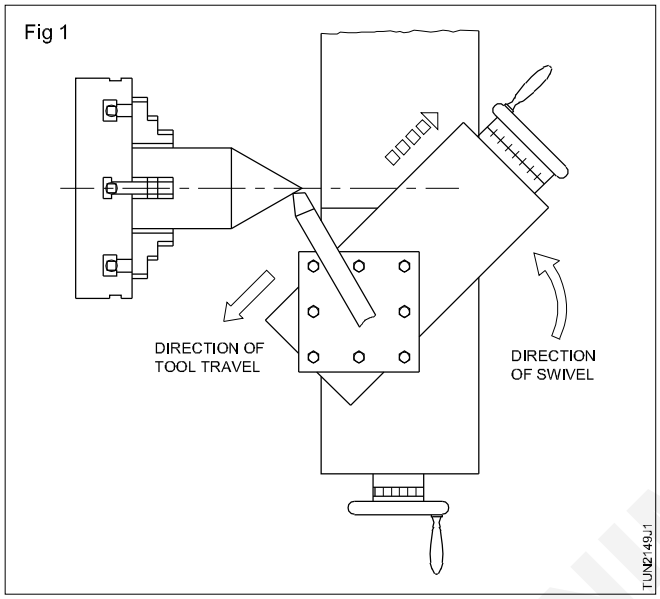
The error shows the deviation of surface from the straightness.

Turning taper by compound slide swivelling

Objectives: This shall help you to
- **set and swivel the top slide of the compound rest to the required taper angle**
- **set the tool in the tool post**
- **turn the taper**
- **check the taper with a vernier bevel protractor.**

One of the methods of turning taper is by swivelling the compound slide and feeding the tool at an angle to the axis of the work by hand feed. (Fig 1)

Fig 1



The procedure in sequence is as follows

Set and true the job turned to the bigger diameter of taper.

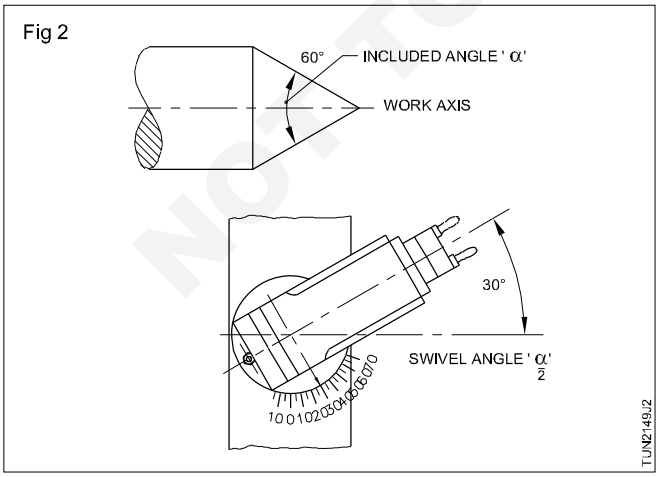
Set the machine to the required rpm.

Loosen the top slide clamping nuts.

Swivel the top slide to half the included angle of the taper away or towards the operator as required.

Tighten the clamping nuts firmly. (Fig 2)

Fig 2



Ensure that equal pressure is exerted by the spanner for both the nuts.

Fix the turning tool in the tool post to the correct centre height.

Keep a minimum overhang of the tool.

Position the top slide to cover the length of the taper turning.

As far as possible ensure that the top slide do not go beyond the edge of the base.

Lock the carriage in position.

Touch the tool to the work surface during running and set the cross - slide graduated collar to zero.

Bring the tool clear off the work by the top slide hand wheel movement.

Give a depth of cut by the cross - slide and feed the tool by the top slide hand wheel till the tool clears from the work.

Feeding by the top slide must be uniform and continuous.

Give successive cuts by the cross - slide, feeding by the top slide each time.

Check the angle of the turned job with a vernier bevel protractor.

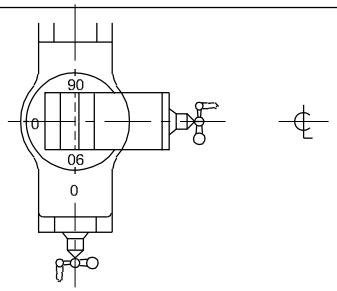
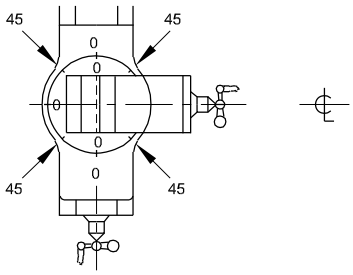
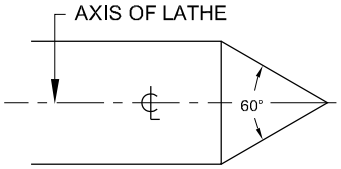
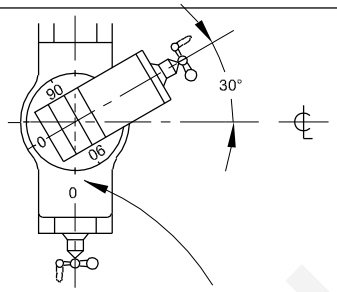
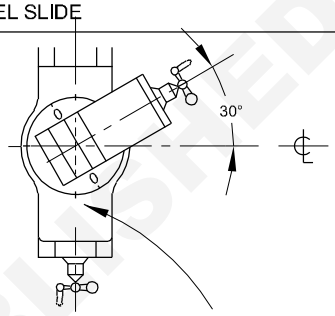
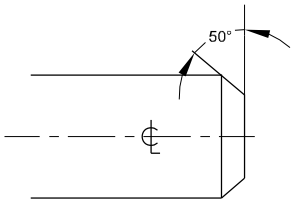
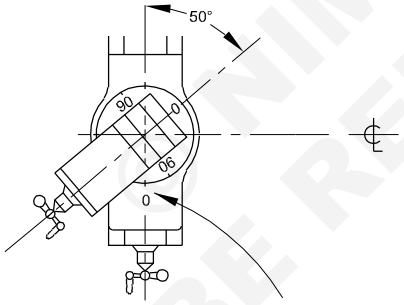
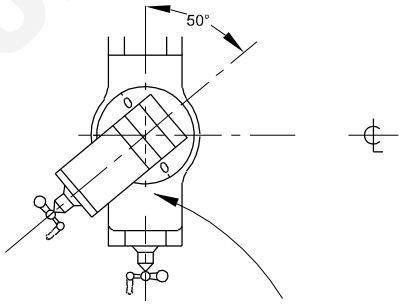
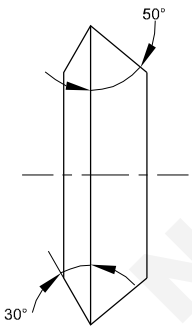
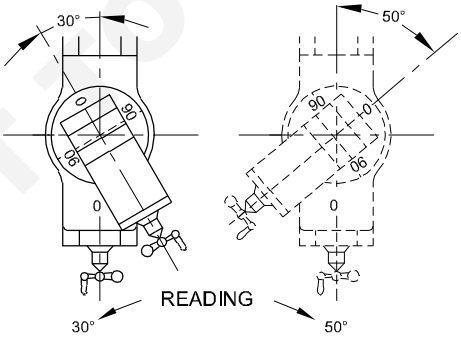
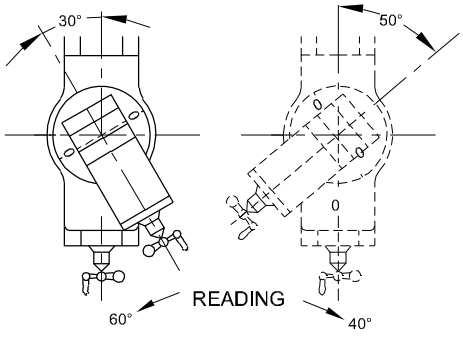
Adjust the swivel if there is any difference.

Continue the taper turning and finish the taper.

Compound rest setup for turning various angle is given in table 1.

Table 1

Compound rest setup for turning various angles

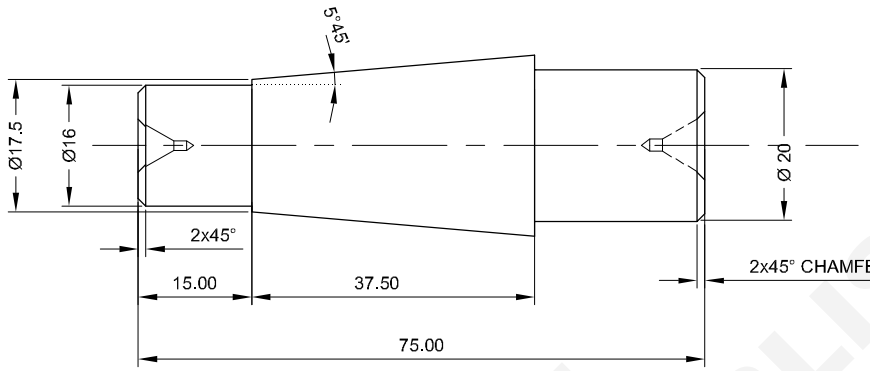
SPECIAL ANGULAR SETTING ON COMPOUND REST	ARRANGEMENT OF GRADUATIONS ON SWIVEL SLIDE	
	 GRADUATED FROM 90-0-90	 GRADUATED FROM 0-45-0
EXAMPLES	READINGS ON GRADUATED SWIVEL SLIDE	
 INCLUDED ANGLE MEASURED IN HORIZONTAL PLANE	 READING ON SCALE 60°	 READING ON SCALE 30°
 ANGLE GIVEN FROM A LINE AT 90° TO AXIS OF LATHE	 READING ON SCALE 50°	
	 READING	 READING

Male and Female taper turning by taper turning attachment and tail stock offset method

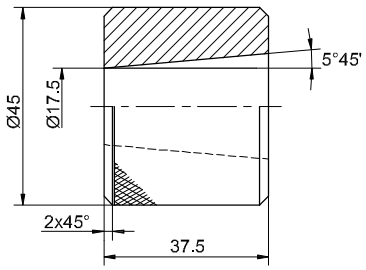
Objective: At the end of this exercise you shall be able to

- **produce taper (male and female) by taper turning attachment method**
- **knurl the surface**
- **turn the external taper by tail stock off set method.**

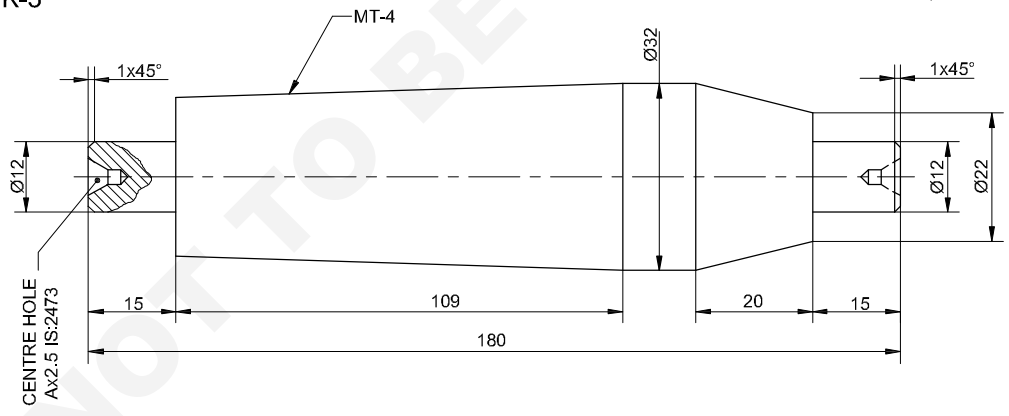
TASK-1



TASK-2



TASK-3



1	Ø30 -87L	–	Fe 310	–	TASK-1	
1	Ø50 - 60L	–	Fe 310	–	TASK-2	
1	Ø35 - 185L	–	Fe 310	–	TASK-3	1.4.50
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1 : 1	**MALE AND FEMALE TAPER TURNING (BY TAPER TURNING ATTCHMENT & TAIL STOCK OFFSET METHOD)**	Devietion ±0.02	TIME
		CODE NO. TU20N1450E1	

Job Sequence

TASK 1: **External taper by using taper turning attachment**

- Check the raw material size.
- Hold the material in 4 jaw chuck and true it.
- Face one end and make centre drill.
- Turn ∅ 20 to a length of 22.5 mm.
- Chamfer the end to 1 x 45°.
- Reverse the work & clamp in the jaw.
- Ensure that the total length remains 75 mm.
- Make a centre drill to hold the job between centres.
- Turn a step ∅ 16 mm to a length of 15 mm.
- Set the angle 5° 45" to turn external taper by taper turning attachment method.
- Turn the taper as per drawing.

Safety

- Remove the sharp corners
- Use coolant while centre drilling and taper turning

— — — — — — — —

TASK 2: **Internal taper by taper turning attachment**

- Hold the job in a 4 - jaw chuck and true it.
- Set the tool to correct centre height.
- Face one end of the job.
- Turn ∅ 44.75 mm to a length of 45 mm.
- Set the knurling tool (diamond cut) to correct centre height.
- Knurl the job to a length of 40 mm.
- Drill pilot hole ∅ 10 mm.
- Enlarge the hole to ∅ 16 mm by drilling.
- Chamfer 2 x 45°.
- Set the parting tool to centre height and cut off to a length of 40 mm.
- Hold the knurled job and face the ends to maintain a length of 37.5 mm.
- Chamfer the end to 2 x 45°.
- Set the taper turning attachment to the 5° 45' with the help of a vernier bevel protractor.
- Set the boring tool, to the correct centre height.
- Turn taper as per drawing.
- Match the taper with task - 1

Safety precautions

- Remove all sharp corners.
- Use slow speed while knurling.
- Use plenty of coolant while drilling, taper turning and knurling.

— — — — — — — —

TASK 3: **Taper turning by tail stock offset method**

- Check the raw material size.
- Hold the job in between centres.
- Turn the step ∅ 12 x 15 mm long at the taper end.

  Calculating the setting angle tail stock offset using formula.

$$= \frac{32 - 22}{2} \times \frac{180}{109}$$

$$= \frac{10}{2} \times \frac{180}{109} = \frac{1800}{218}$$

$$= 8.25\text{mm}$$

- Reverse and refix between centres.
- Turn the step ∅ 12 x 15 mm long from the other end of job.
- Calculate the setting angle of the compound rest using the formula.

$$\text{Tan } \theta = \frac{D - d}{2 \times L}$$

$$= \frac{32 - 22}{2 \times 20} = \frac{10}{40} = 0.250$$

Tan θ = 0.25

∴ θ = 14°2'10" (For trignometric tables)

- Swivel the compound rest slide to the above angle using a vernier bevel protractor.
- Turn the taper by using the top slide feed and maintain the major dia to 32 mm. minor dia to 22 mm and length to 20 mm.
- Check the size of the job with a vernier bevel protractor and vernier caliper.

— — — — — — — —

Skill Sequence

Lathe operation - Taper turning

Objectives: This shall help you to
- **state the principle of taper turning by the tailstock offset method**
- **identify the parts involved while taper turning by the tailstock offset method**
- **calculate the amount of offset according to the expression of taper.**

Principle of taper turning by the tailstock offset method

The job is held at an angle to the lathe axis, equal to half the included angle of the taper, and the tool is fed parallel to the axis.

As the job is held at an angle, it is possible to hold the work in between centres only as shown in the figure (1). The parts involved during turning, the taper by the offsetting tailstock are:

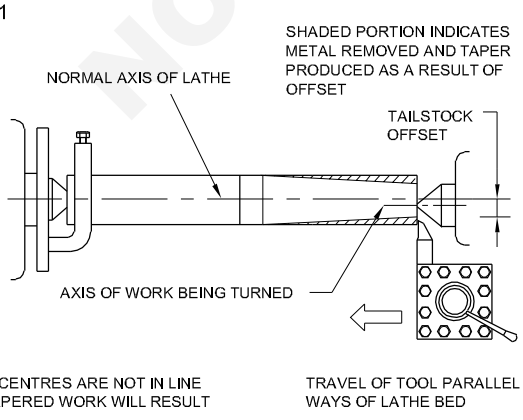
- Live centre and dead centre.
- Tailstock assembly of body and base.
- Driving plate/catch plate.
- Lathe carrier.

The centres used should preferably be ball centres to avoid distortion or damage to the centre - drilled holes of the job. To avoid more load and wear and tear on centres, the tailstock will not be usually offset more than 1/50th of the length of the workpiece.

Calculation of the amount of offset

If the taper is expressed by giving the big dia. (D) the small dia. (d) the length of taper (l), then

Fig 1



$$\text{offset} = \frac{(D-d)\times L}{2l}$$

where L = total length of job, l length of taper

Example

The big diameter of a tapered job (D) = 30 mm.

The small diameter of the tapered job (d) = 26 mm.

The length of taper portion (l) = 100 mm.

Total length of job (L) = 200 mm.

$$\text{offset} = \frac{(D-d)\times L}{2l}$$

$$= \frac{(30-26)\times 200}{2\times 100}$$

$$= \frac{4\times 200}{2\times 100}$$

= 4 mm

If the taper is expressed in TPF then the amount of offset

$$= \frac{TPF \times L}{2}$$

Where TPF is given in inches
L = total length of job.
If taper is expressed as a ratio then the amount of offset

$$= \frac{\text{ratio}\times L}{2}$$

If taper is expressed by included angle i.e. 2θ.

offset = L x tan θ

where L = total length

θ = 1/2 included angle in degrees.

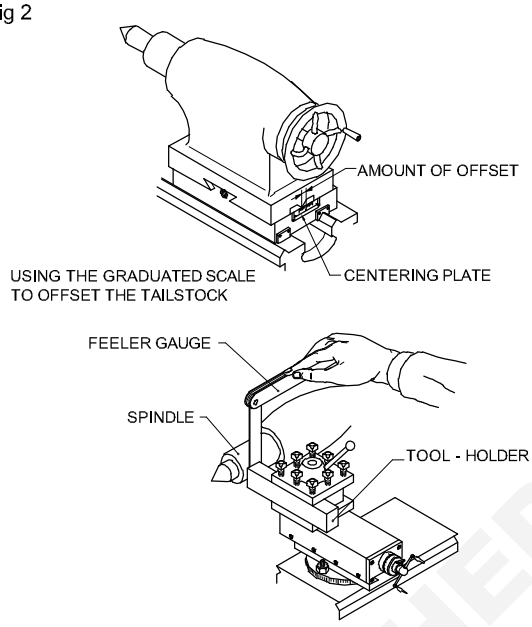
Different methods of offsetting the tailstock (Fig.2)

Setting offset with the help of the inside measuring jaws of a vernier caliper to the required mm, if directed graduation is not provided on the base of the tailstock.

Using a dial test indicator.

Using a cross - slide graduated collar and feeler gauge.

Fig 2



Aligning lathe centres using tailstock graduation

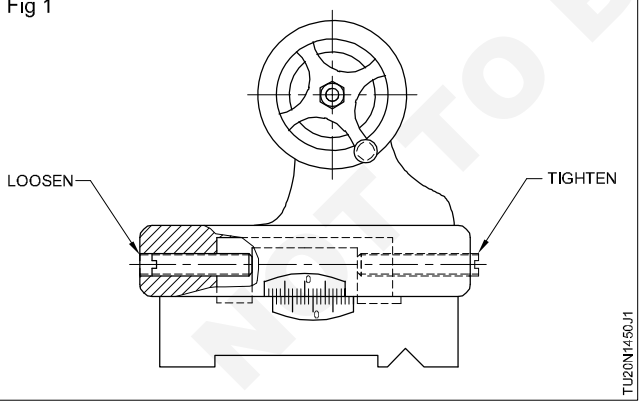
Objective: **At the end of this exercise you shall be able to**
- **align lathe centres using tailstock graduations.**

For producing components with a reasonable degree of accuracy, this method can be used.

The head-stock centre is always fixed and no changes can be made to this. Corrections are always made by adjusting the centre on the tailstock. For setting the centres, this method uses the graduation given on the base and the body of the tailstock.

Procedure (Fig 1)

Fig 1



Coinciding the zero of body and base

Observe the zero lines of graduations

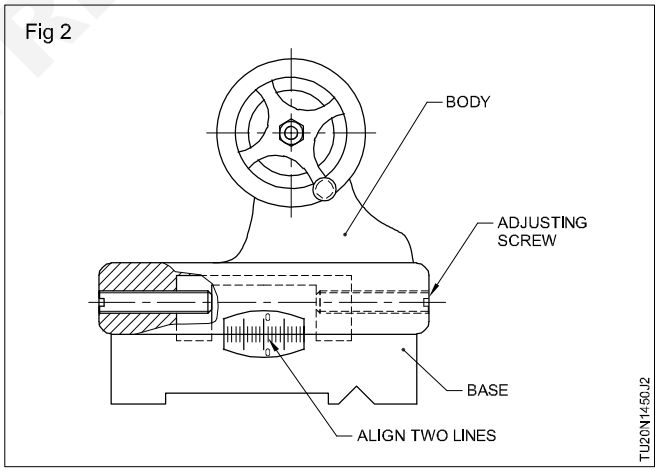
Loosen the clamp holding the tailstock to the

Loosen one of the adjusting screws on the tails the side in which the body has to be shifted.

Tighten the other screw on the opposite side.

Observe the direction of movement of the stock centre. Continue adjusting the screws the line on the tailstock body coincides with line on the base plate. (Fig 2)

Fig 2



Tighten the adjusting screw to secure the upper part of the tailstock in this position.

While adjusting, loosening of one screw and tightening the opposite side screw should be carried out simultaneously.

Ensure the lines are coinciding.

Check the center points of the live and dead centres ensure the correctness of alignment.

Matching by Prussian blue

Objective: At the end of this exercise you shall be able to
- **practice on applying prussian blue**
- **matching male and female taper.**

Job Sequence

- Clean both male and female part of Ex 1.4.50 Task 1 and Task 2.
- Apply thin layer of prussian blue on the male part. (Figs 1 & 2)
- Insert the male part into the female part.
- Slightly turn and remove the male part.
- Check if the prussian blue is rubbed in uniform.

Fig 1

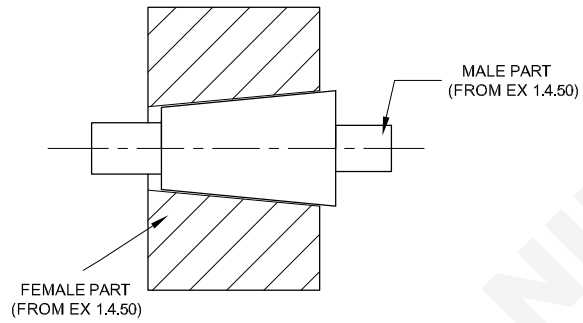
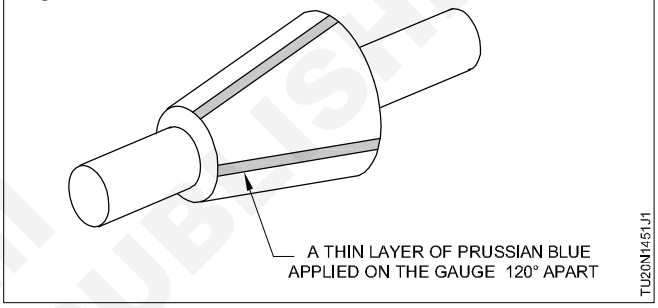
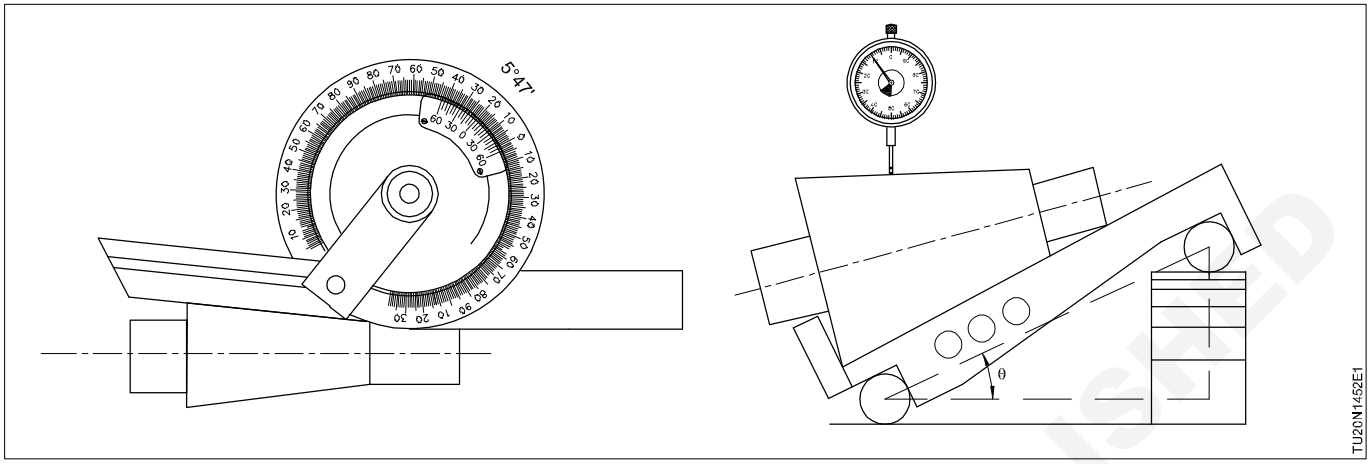


Fig 2



Checking taper by bevel protractor and sine bar

Objective: At the end of this exercise you shall be able to
- **check the angle of the machined parts upto an accuracy of ± 5 minutes.**



Job Sequence

TASK 1:

- Set the angular surface of the workpiece between the bevel protractor blade and the face of the base (Fig 1).
- Lock the blade and inner disc firmly with the locking device.
- Note the position of the vernier scale with reference to the main scale.
- Read the degrees of the main scale at the graduation '0' of the vernier scale.
- Note the number of lines in the vernier scale that coincides with a division of the main scale.
- Add this result to the main scale reading + least count 5' multiply number of division of the vernier scale coincidence.

— — — — — — — —

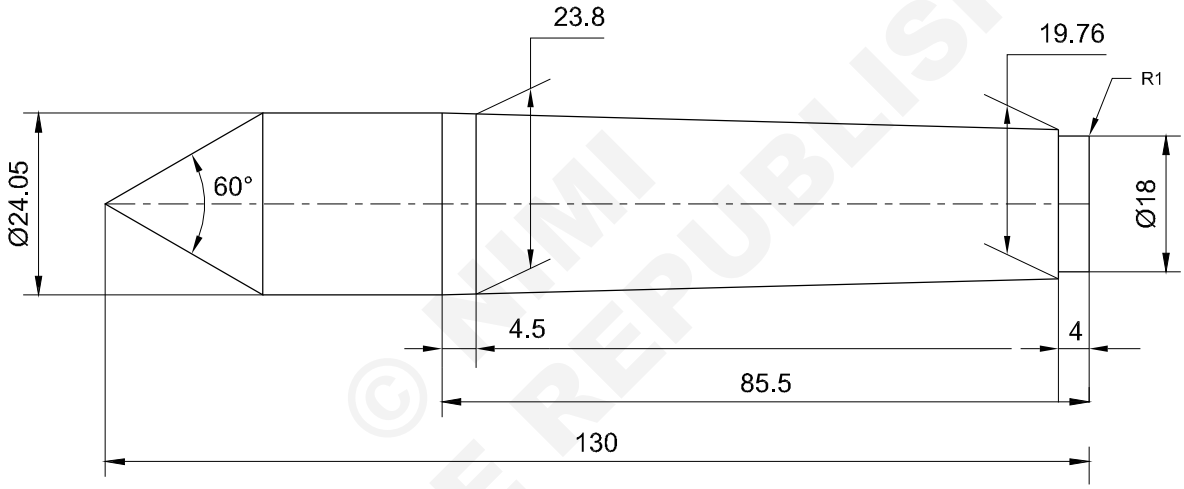
TASK 2:

- Set the sine bar on the surface plate.
- Mount the taper component on the sine bar after placing the selected slip gauge under one roller with the other roller resting on the datum surface.
- Mount the dial test indicator with a suitable stand or vernier height gauge.
- Set dial test indicator at one end and ensure the dial in zero position.
- Move the dial indicator to the other end of the component.
- If the dial indicator reads zero at both ends the setting is ok.
- If there is any difference than the angle set is incorrect. The height of slip gauge has to be adjusted till dial reads zero at both ends.

— — — — — — — —

Make MT3 lathe dead centre & check with female part

Objectives: At the end of this exercise you shall be able to
- **turn taper by using on taper turning attachment**
- **turn morse taper 3 and suit MT3 taper plug gauge.**



1	Ø25-140	-	C-45	-	TASK-1	53
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.1.4.53
SCALE 1:1	**MAKE MT3 LATHE DEAD CENTRE & CHECK WITH A SLEEVE (FEMALE)**				TOLERANCE	Time: 20 hrs
					CODE NO. TU20N1453E1	

Job Sequence

- Check the size of the raw material.
- Hold the job in a four jaw chuck and true it.
- Set the required tools in a four way tool post.
- Face one end.
- Reverse the job, face other end to maintain a total length of 130 mm and centre drill.
- Support the job on the tailstock keeping 115 mm from the chuck face and true.
- Turn the diameter 24.05 mm to the maximum posible length and check with a micrometer.
- Position the turning tool and turn step dia. to 18 mm x 4 mm long from face.
- Form radius R1 at the edge of ∅ 18mm.
- Set the taper turning attachment & turn a taper of 1°26'11".

Confirm the graduation on the bracket of the taper turning attachment whether for half included angle of the taper or full, and then set it.

- Taper turn, engaging the power feed for a short length and maintaining a smooth surface.
- Adjust the setting if needed, to get proper matching.
- Complete the taper turning to suit the gauge.
- Dismount the chuck from the spindle nose and fix the spindle sleeve to the nose bore.
- Insert the job in the sleeve and set the machine RPM.
- Swivel the compound slide to 30° away from you.
- Rough and finish turn taper to get a 60° included angle.

Clean both MT3 taper and the standard MT3 sleeve.

Apply a film of oil.

Check the taper by inserting on sleeve.

You can apply prussion Blue and check for the correctness of taper with Blue spots.

Producing taper by using taper attachment

- Check for backlash between guidebar & sliding block.
- Adjust if the backlash is in excess.
- Clean and oil the guide bar.
- Loosen the locking screws, then swivel the guide bar to the required angle and tighten locking screws.
- Adjust the base plate until the ends of guide bar, are equal distant from the cross - slide extension.
- Set up the tool exactly on to the centre of the job.

If tool is not set to exact center, an error in taper will be present.

- Mount the work piece on the chuck, & hold it between centres.
- Set the required speed.
- Feed the outing tool until it is about 6 mm for work surface.
- Move the carriage to the right until the cutting tool is about 12 mm away from RH end of workpiece.

This process removes any play in moving parts of taper attachment.

- Switch ON lathe and take a light cut.
- Set the exact depth and machine the work like plain turning.
- Check the taper after deburing.

Skill sequence

Producing taper by using taper turning attachment

Objectives: This shall help you to
- **set the taper turning attachment to the required angle**
- **produce taper by using a taper turning attachment.**

A taper turning attachment provides a quick and accurate means of turning tapers.

The following procedure is to be followed during turning taper using a taper turning attachment.

Check for backlash between the guide bar and the sliding block, and adjust, if necessary.

Clean and oil the guide bar.

Loosen the locking screws, then swivel the guide bar to the required angle.

Tighten the locking screws.

Adjust the base plate until the ends of the guide bar are equidistant from the cross-slide extension.

Set up the cutting tool on exact centre.

Any error will result in an incorrect taper

Mount the workpiece on the chuck or between centres.

Adjust the carriage until the cutting tool is approximately opposite to the centre of the tapered section.

Lock the clamping bracket to the lathe bed to secure the taper turning attachment in this position.

When using a plain taper turning attachment, follow the steps given below at this stage

Adjust the top slide so that it is parallel with the cross-slide, i.e at 90° to the work.

Set up the cutting tool for the correct position.

Wear safety goggles

Set the required r.p.m.

Feed the cutting tool in until it is about 6 mm from the work surface.

Remove the locking screws which connect the cross-slide and the cross-slide nut.

Use the binding lever to connect the cross-slide extension and sliding block.

Insert a suitable plug in the hole on the top of the cross-slide to protect the cross- slide screw from dirt and metal chips.

The compound slide must now be used to feed the cutting tool into the work.

Move the carriage to the right until the cutting tool is about 12 mm away from the right hand end of the workpiece.

This removes any play in the moving parts of the taper turning attachment

Switch on the lathe.

Take a light cut about 2 mm long and check the end of the taper for size.

Set the depth of the roughing cut.

Machine the work as with plain turning.

Remove the play by moving the cutting tool 12 mm beyond the right hand end of the work at the beginning of each cut.

Check the taper for fit.

Readjust the taper turning attachment, if necessary; take a light cut and recheck the taper.

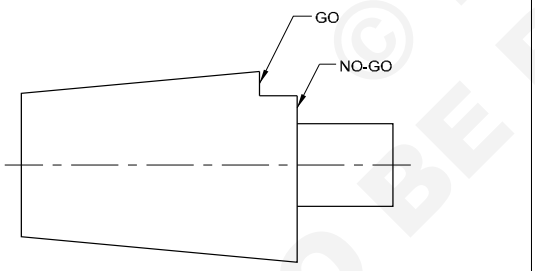
Finish the taper to size and fit it to the taper gauge.

Checking a tapered bore using a taper limit plug gauges

Objective: This shall help to you
- **check the internal taper with taper plug gauge.**

A taper limit plug gauge ensures the accuracy of the angle and the linear dimensions of the taper bore. (Fig 1)

Fig 1



TAPER LIMIT PLUG GAUGE

Clean the tapered bore.

Apply a thin layer of prussion blue on the traper limit plug gauge along its length. (120° apart) (Fig 2)

Assemble the taper plug gauge inside the tapered bore carefully with sufficient force to ensure positive contact between the gauge and the bore, and give one quarter twist to the plug gauge.

Carefully remove the taper limit plug gauge and check if the prussion blue is rubbed off uniformly, atleast to about 75% of its area. This ensures the accuracy of the angle required.

Then once again insert the taper plug gauge inside the taper bore and check, if the big dia, end of the bore falls within the 'Go' and 'No-Go' limits marked on the gauge, this ensures the dimensional accuracy of this tapered bore. (Fig 3)

Fig 2

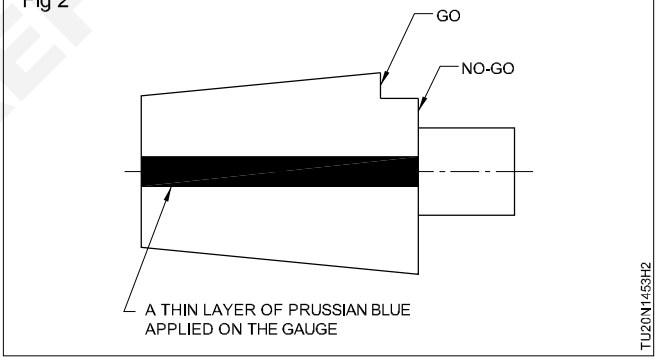
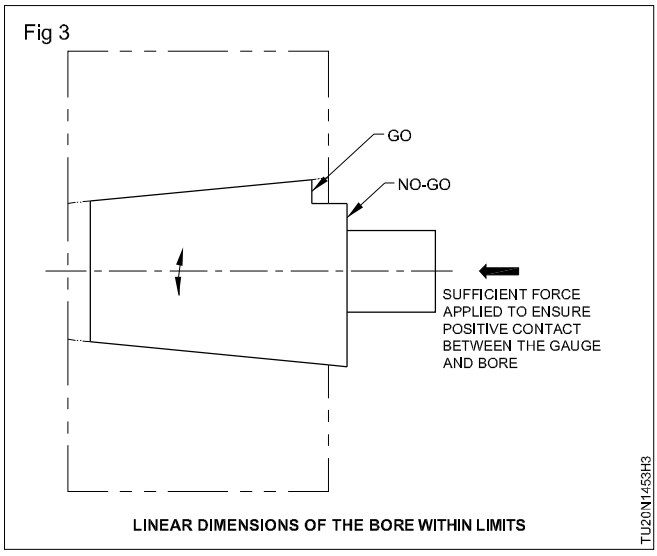


Fig 3

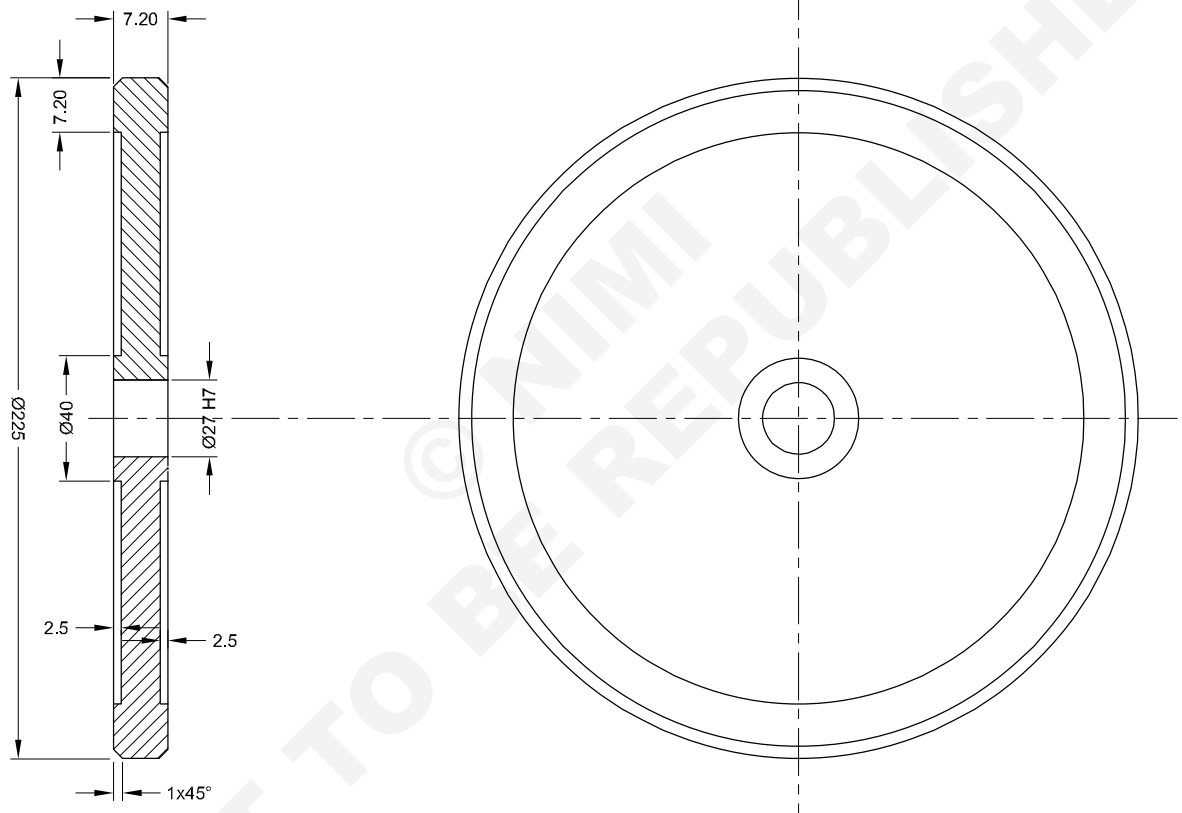


LINEAR DIMENSIONS OF THE BORE WITHIN LIMITS

Exercise 1.4.54

Turning and boring on cast iron

Objectives: At the end of this exercise you shall be able to
- **learn facing and grooving**
- **learn reaming operation**.



1	Ø230-25	–	FG15,IS:210	–		1.4.54
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1 : 1	**TURNING AND BORING ON CAST IRON**					TIME
					CODE NO. TU20N1454E1	

Job Sequence

- Check the raw material size.
- Hold the job in 4 jaw chuck and true it.
- Face one end.
- Turn ∅225mm to ∅ 18mm length chamfer the end.
- Groove the face side ∅ 189mm to ∅ 2.5mm depth maintaining the diameter at the centre portion 40 mm.
- Face the other end to maintain 18mm length.
- Turn ∅225mm to a remaining length chamfer the end.
- Centre drill the job.
- Drill and bore ∅ 26.70mm and chamfer both the edges of the hole.
- Ream the drilled hole to ∅ 27H7.
- Groove the face side ∅189mm to a 2.5mm depth and centre box step ∅ 40mm maintain.
- Remove and mount the job on the mandrel along with the bush and nut.

Skill Sequence

Facing work by hand feed method

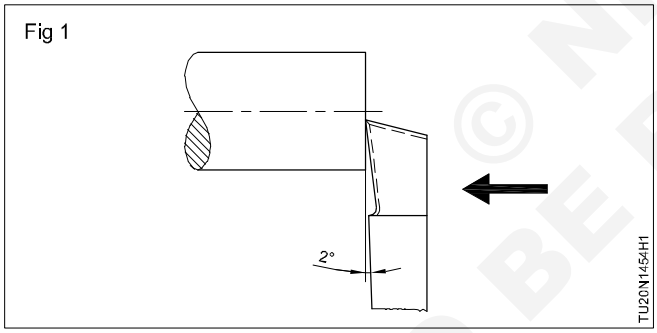
Objective: This shall help you to
" **face work by the hand feed method using right hand facing tool.**

To remove excess material at the end or to make the face of the work perpendicular to the lathe axis, the facing operation is done.

Hold the tool in the tool post to the correct centre height with a minimum overhang.

Touch the tool-point with the workface at about 4 to 10 mm from the centre. (Fig 1)

Fig 1

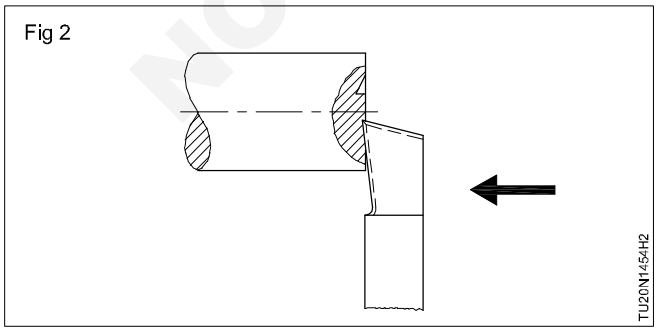


Set the top slide graduate collar to zero mark and also eliminate backlash.

Lock the carriage.

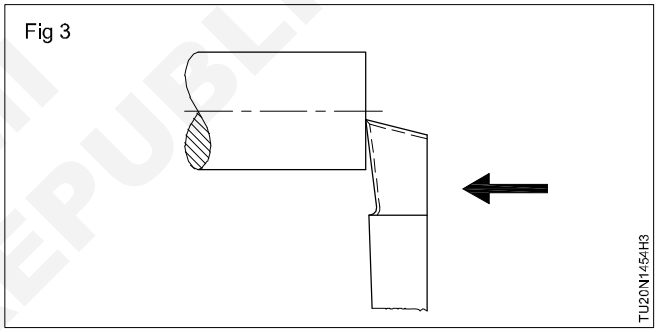
Feed the tool about 0.5 mm by the compound slide inside the face of the work.(Fig 2)

Fig 2



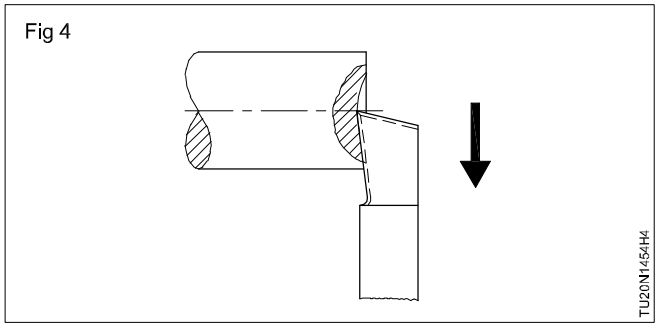
Feed the tool towards the centre of the work by the cross-slide till the tool tip crosses the centre(Fig 3)

Fig 3



Feed the tool towards the edge of the work using the cross-slide till the tool clears the work.(Fig 4)

Fig 4



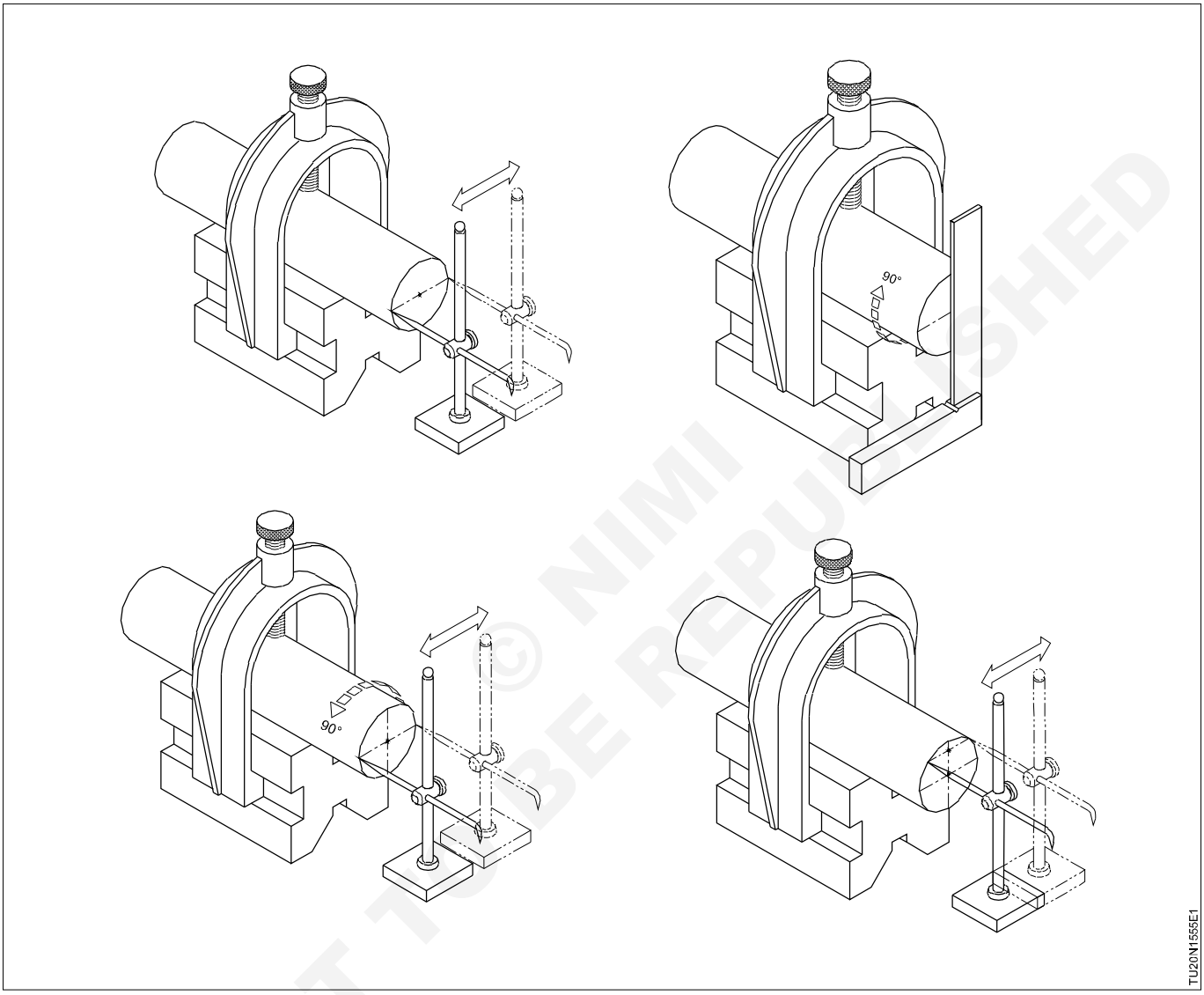
Measure the length of the job.

Refix the job to face the other end to size.

Repeat the sequence till the required amount of material is removed.

Eccentric marking practice

Objective: At the end of this exercise you shall be able to
- **mark of eccentric centre for turning external diameter**
- **mark by using 'V' block, surface gauge and try square.**



Job Sequence

- Remove the burrs and sharp edges on both the end faces of job.
- Clamp the workpiece to the 'V' block.
- Apply marking media to both end faces.
- Scribe horizontal lines through the centre of the faces.
- Unclamp & rotate the work piece through 90° set the scribed line vertical using the try square & reclamp.
- Scribe horizontal lines through the centre of the workpiece.
- Set the pointer of the scriber at a distance above the centre of the work piece to the amount of eccentricity.
- Scribe the line at this height on the end face of the work piece.
- Remove the work piece from the 'V' block.
- Dot punch intersection points on the end face to have concentric and eccentric centres.

Skill Sequence

Marking eccentric centres for eccentric turning

Objective: This shall help you to

- **mark eccentric centre for turning the external diameter.**

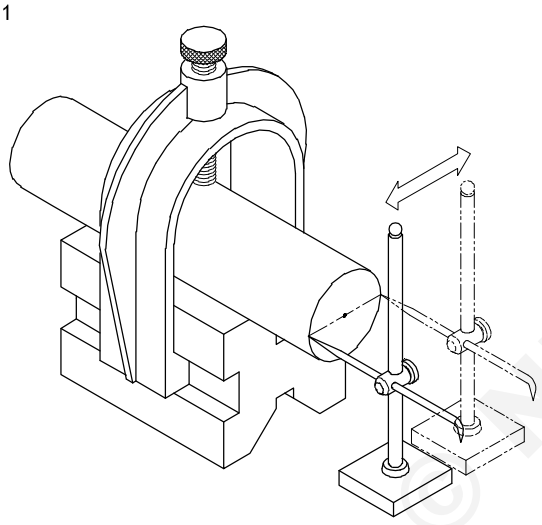
Marking by using 'V' Block, surface gauge and try square

Before marking, the job must be faced at both ends and must be free from burrs and sharp edges.

Clamp the workpiece to the 'V' Block.

Apply marking media to both the end faces and scribe horizontal lines through the centre of the face (both ends). (Fig 1)

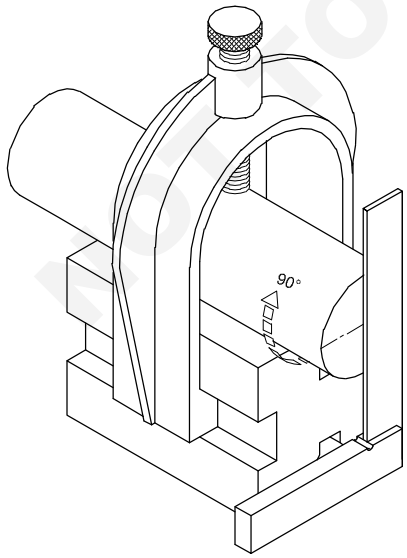
Fig 1



TU20N1556H1

Unclamp and rotate the workpiece through 90°. Set the scribed line vertical using the try square, and reclamp. (Fig 2)

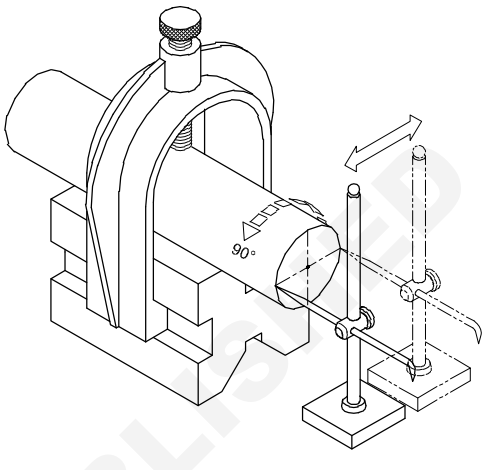
Fig 2



TU20N1555H2

Scribe horizontal lines through the centre of the workpiece on both the end faces. (Fig 3)

Fig 3

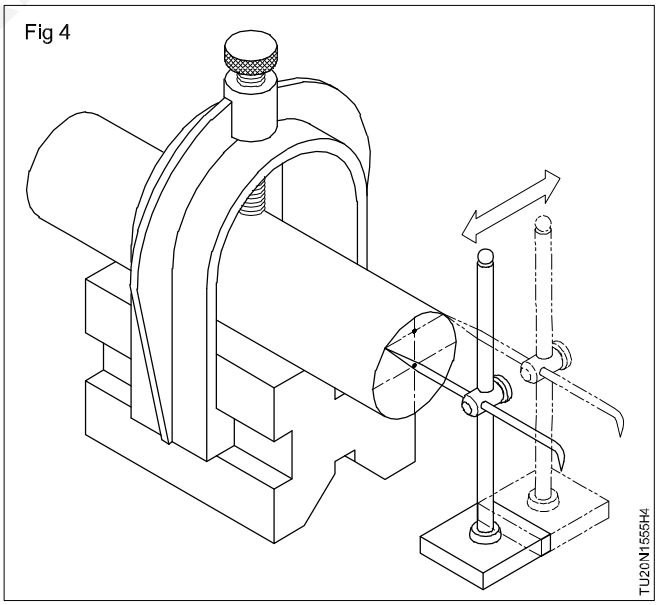


TU20N1555H3

Set the pointer of the scriber at a distance above the centre of the workpiece equal to the amount of eccentricity required. (Fig 4)

Scribe the line at this height on both the end faces of the workpiece. (Fig 4)

Fig 4



TU20N1555H4

Remove the workpiece from the 'V' Block.

Dot punch intersection points on both the end faces, to have concentric and eccentric centres.

When marking off centres of a workpiece, a 'V' Block, which can be laid on its side, may be used. This will avoid the need to unclamp the workpiece and square.

Centre drill the workpiece on both the end faces on the drilling machine.

While centre drilling make sure that the centre drill locates the centre dots accurately.

If the eccentric turning is meant for a 4 jaw chuck, scribe guide circles with eccentric centre as the centre of the guide circle, using a divider.

Marking by using angle plate, clamps, surface gauge and try square

This marking method is used for securing the workpiece on a face-plate. Before marking, the job must be faced at both ends and it should be free from burrs and sharp edges.

Check the locating face of the workpiece for flatness. Use a straight edge and light to ensure the flatness of the locating surfaces.

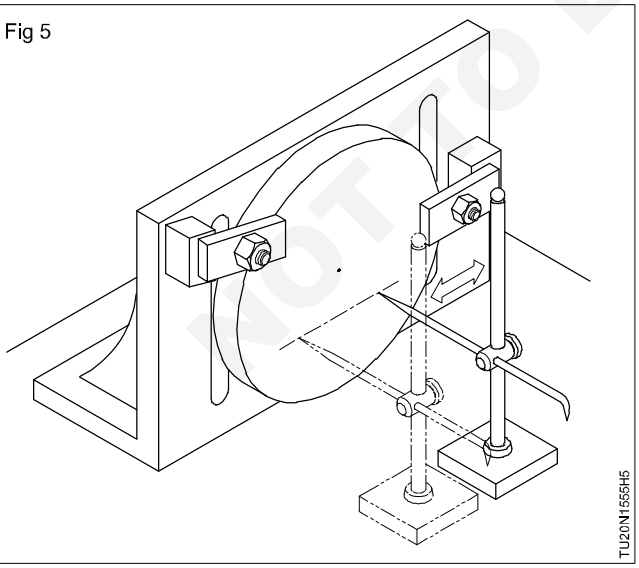
The workpiece must be clamped square to the angle plate to ensure squareness of the marking with reference to the previously machined faces.

Clamp the workpiece lightly to the angle plate with the outside diameter of the workpiece touching the marking off table. (Fig 5)

Measure the outside diameter of the workpiece; set the scriber point to half of the diameter minus bore eccentricity.

Scribe a horizontal line. (Fig 5)

Fig 5



Unclamp, swivel the work through 90°, and with a try square, check that the scribed line is vertical, and reclamp. (Fig 6)

Set the scriber point to mark off centre of the workpiece. Scribe a horizontal line to intersect the vertical line already scribed. (Fig 7)

Fig 6

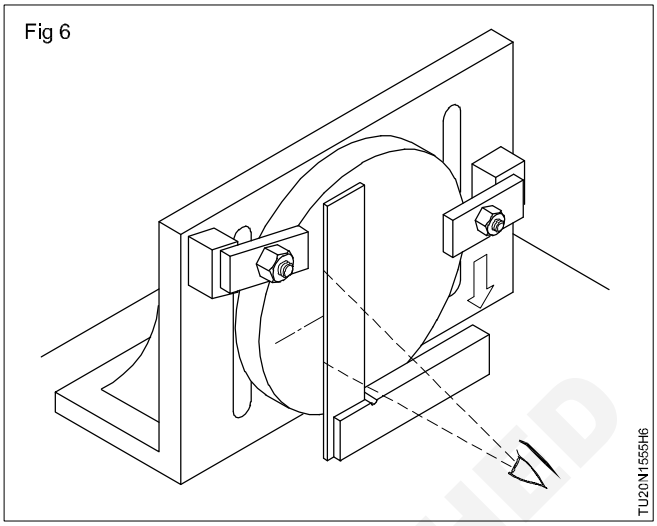
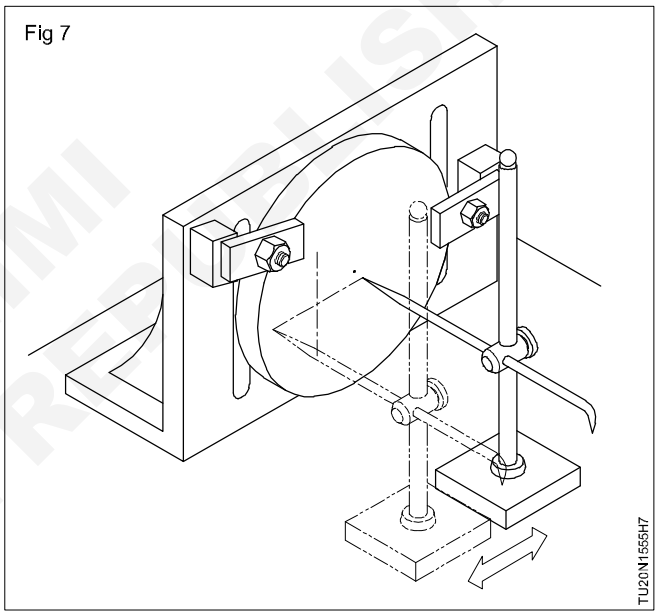


Fig 7



Unclamp and remove the workpiece from the angle plate. Place flat on the marking off table and with the marked off face uppermost. Dot punch intersection points.

Set the divider to the radius of the finished bore size.

Scribe a circle using the centre dot as centre point.

Unclamping of the workpiece may be avoided by laying the angle plate on its side. In such cases, the workpiece has to be set on the angle plate, such that the edges of the workpiece touch the marking table in both the positions i.e., before laying the angle plate on its side and after laying the angle plate on its side.

Marking eccentricity of a job with vernier height gauge to given dimensions

Objective: This shall help you to

- **mark concentric and eccentric centre lines of a job by using a vernier height gauge.**

The height gauge marking is more accurate than the scribing block marking.

The marking surface must be free from sharp edges and unevenness.

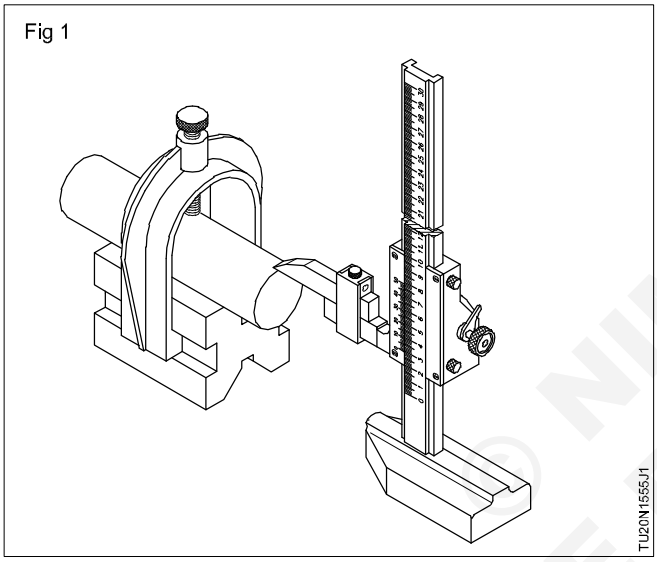
Clamp the finish turned rod in the 'V' Block with the help of the clamps.

Apply marking media on both faces of the job.

Set the scriber point on the top edge of the job. (Fig 1)

Move the height gauge scriber over the round surface to get a feel that the scriber bottom face is contacting the work periphery. (Fig 1)

Fig 1

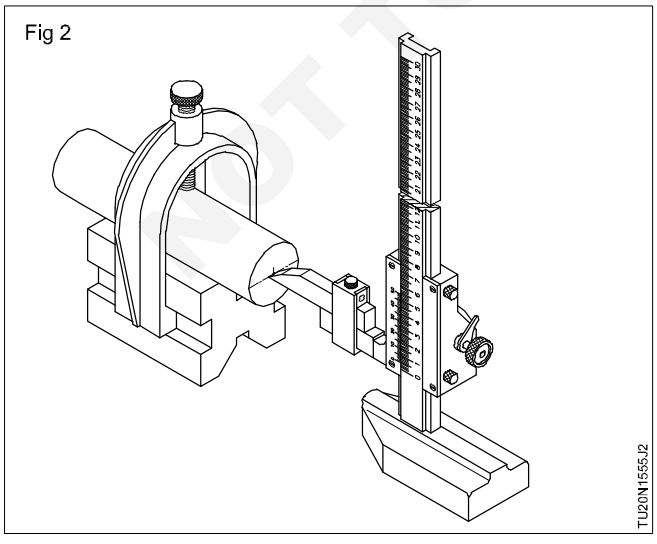


Lock the slides and note down the readings of the scales.

Subtract half the diameter from the reading and set the height gauge for that reading. (Fig 2)

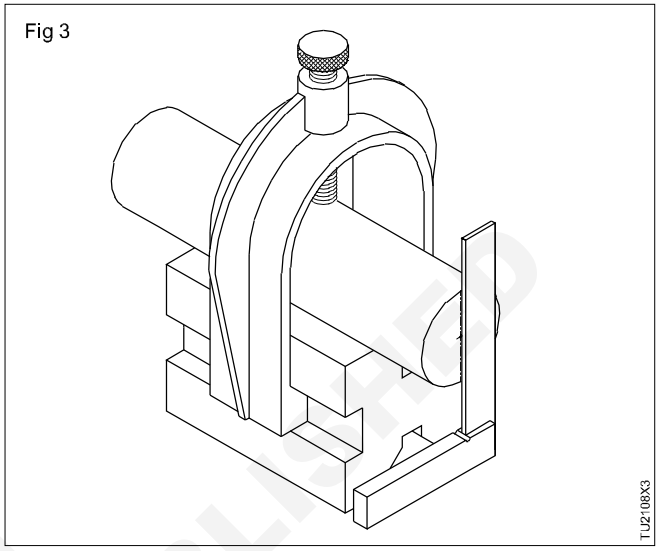
Scribe a horizontal line on both faces. (Fig 2)

Fig 2



Release the workpiece from the clamp and rotate the workpiece through 90°. Set the line at 90° with the help of a try square. (Fig 3)

Fig 3

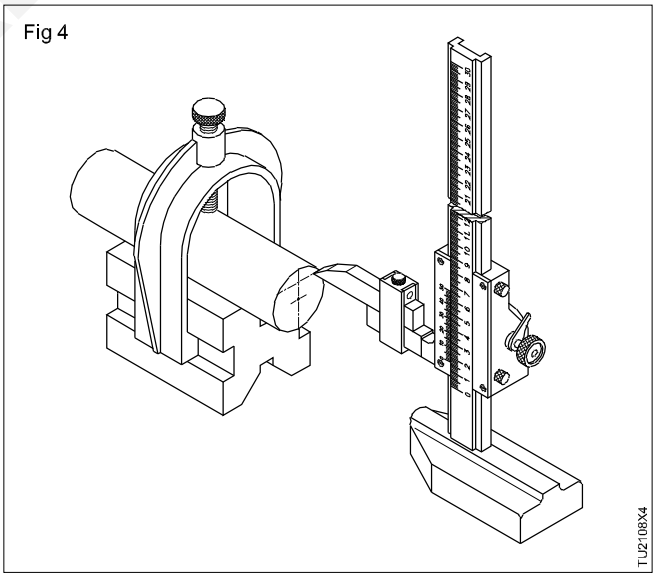


Clamp the workpiece to the 'V' block.

Scribe horizontal lines on both faces with the same reading which is set for centre position. (Fig 4)

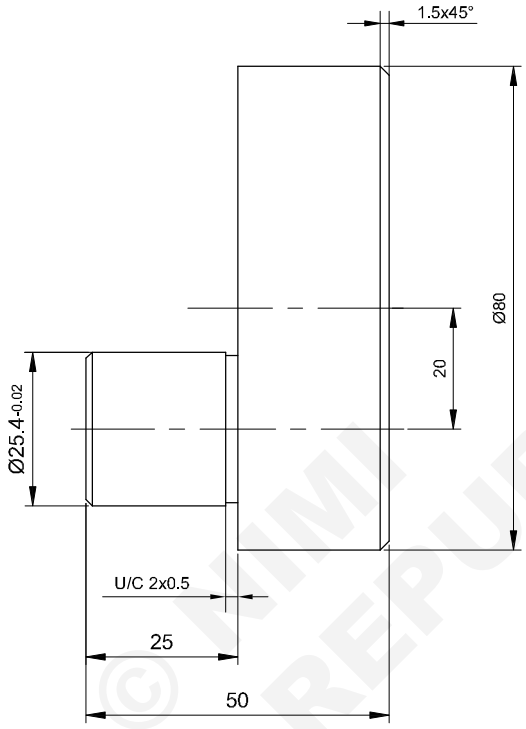
Add eccentricity amount to the above reading and reset the height gauge for the new reading (Fig 4)

Fig 4



Perform Eccentric Turning

Objective: At the end of this exercise you shall be able to
- **mark the eccentric centre and circle**
- **true the eccentric dia (external)**
- **learn eccentric turning.**



Job Sequence

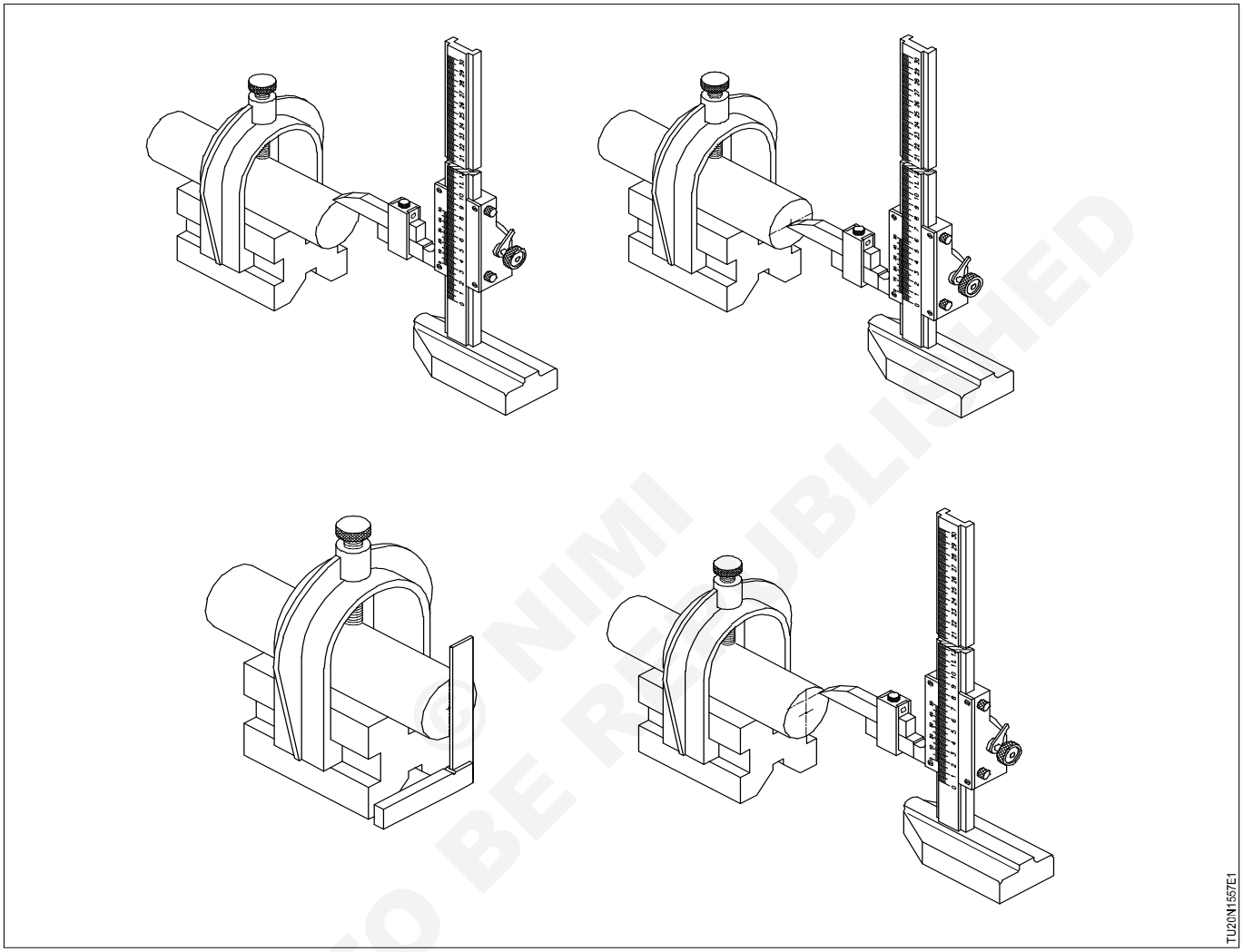
- Check the raw material size.
- Hold the material in a 4 Jaw independent chuck and true it.
- Face the one end.
- Turn ∅80mm to a maximum length.
- Chamfer 1 x 45°.
- Reverse the job hold and true it.
- Face the job maintain total length 50mm.
- Turn ∅80mm to remaining length.
- Remove the job from the chuck.
- Mark the centre line and eccentric centre line according to the drawing with the help of marking tools.
- Punch both the centre lines.
- Draw a guide circle of ∅26mm with the eccentric centre as the centre point.
- Punch the intersecting 4 points.
- Hold the job in a 4 jaw independent chuck on the turned diameter.
- True the concentric circle.
- Open one jaw and tighten the opposite jaw so that the centre of the work moves.
- Repeat the operation till the eccentric centre comes in line with the lathe center.
- Check & true eccentric circle with the help of the surface gauge.
- Turn eccentric dia 25.4 mm to a length of 25 mm.
- Chamfer 1 x 45°.
- Under cut 2 x 0.5mm and deburr by a smooth file.

1	Ø85 - 55	–	Fe 310	–	–	1.5.56
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1 : 1	PERFORM ECCENTRIC TURNING	TOLERANCE ±0.06 Unless otherwise stated	TIME :
		CODE NO. TU20N1556E1	

Use of vernier height gauge and 'V' block

Objective: At the end of this exercise you shall be able to
- **mark concentric and eccentric centre lines of a job using vernier height gauge.**



Job Sequence

- Remove the sharp edges to both the end faces of job.
- Apply marking media to both end faces.
- Clamp the work piece in the 'V' block.
- Set the vernier height gauge scriber point on the top edge of the job.
- Move the height gauge scriber over the round surface to get a feel that the scriber bottom face is contacting the work periphery.
- Lock the slides and note down the readings of the scales.

Subtract half diameter of the job from the initial height gauge reading.

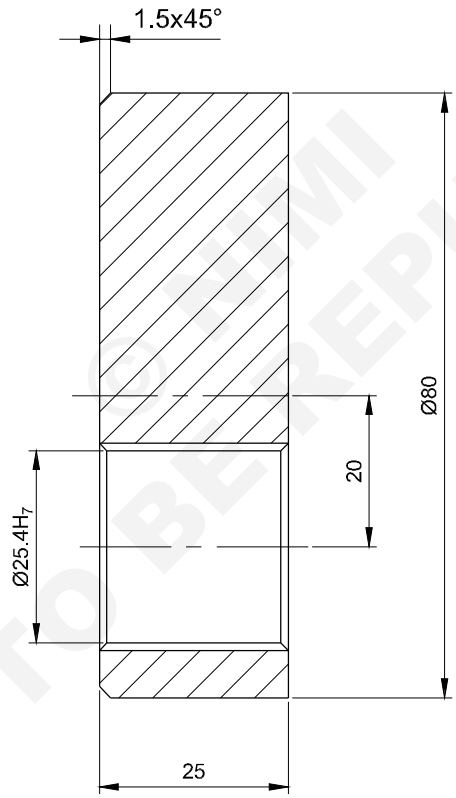
Now set this value in the height gauge to mark the centre line of the job

- Scribe a horizontal line on both faces.
- Unclamp and rotate the workpiece to 90° with the help of tri-square.
- Clamp the workpiece to the 'V' block.
- Set and add eccentricity amount to the reading.
- Scribe horizontal lines on both faces.
- Remove the workpiece from the 'V' block.
- Create witness mark with the help of centre punch on both sides of eccentric points.
- Draw circles of both ends with reference to eccentric centre, points.
- Punch dots for guidance of circle.

Perform eccentric boring

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

- **mark the eccentric centre and circle**
- **true the eccentric circle**
- **drill a hole on the eccentric centre**
- **bore the eccentric hole**
- **ream the eccentric hole**
- **chamfer the bored hole.**



1	Ø85 - 30	–	Fe 310	–	–	58
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.1.5.58

SCALE 1 : 1	ECCENTRIC BORING	TOLERANCE ±0.06 Unless otherwise stated	TIME:15 hrs
		CODE NO. TU20N1558E1	

Job Sequence

- Check the raw material size.
- Hold it in the independent chuck and true it with a surface gauge by keeping the maximum length outside the chuck.
- Set the facing tool and face one end.
- Set the R.H. turning tool and turn a diameter ∅80 mm to a maximum possible length.
- Reverse and true the workpiece.
- Set the facing tool and face the other end to maintain a total length of 25 mm.
- Set the chamfering tool and chamfer the end to 1.5 x 45°.
- Mark off centre for eccentric drilling and boring with a height gauge. Use surface plate and 'V' block.
- Scribe ∅20 mm guide circle for eccentric setting.
- Centre punch the eccentric centre and punch dots for the guide circle. Use centre punch and dot punch.

Open the jaws of the independent chuck and position the workpiece in the jaws such that the centre lines are centered with respect to the jaws. Keep the chamfered face outside the chuck.

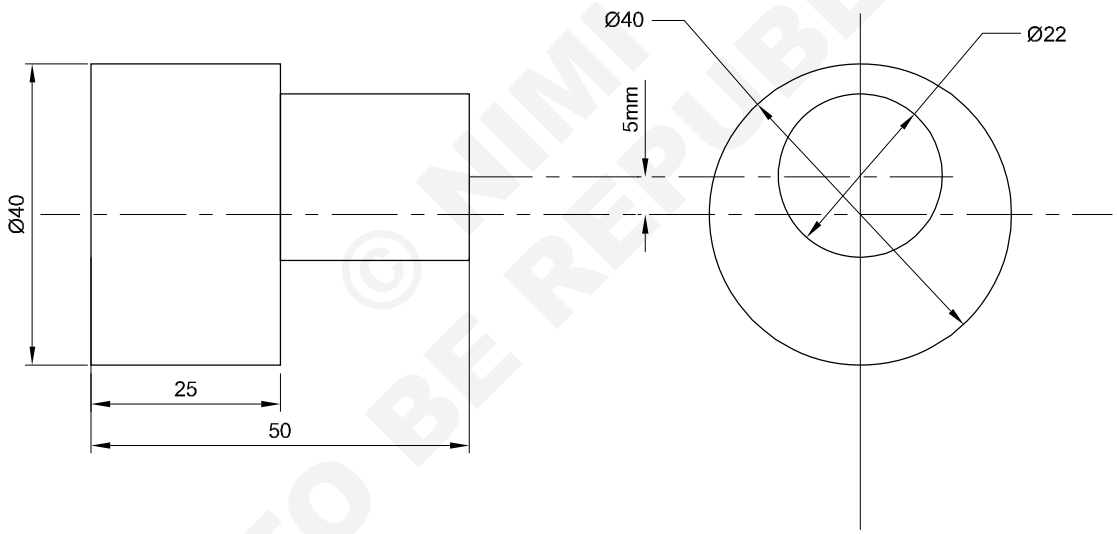
- Bring the dead centre very close to the eccentric centre and adjust the opposite jaws to coincide the dead centre point with the eccentric bore centre.
- True the ∅20 mm eccentric circle with the help of the surface gauge. Open out and tighten the opposite jaws such that the centre of the ∅20 mm moves and coincides with the dead centre.
- Centre drill at the eccentric center to be drilled.
- Drill hole using three drills ∅8, ∅12, and ∅16.
- Set the boring bar and bore ∅16 mm hole to ∅25.1 mm.
- Set ∅25.4 mm reamer and ream the hole to ∅25.4 H7.
- Use reduced speed for reaming.
- Set the chamfer tool and chamfer ∅25.4 mm hole.
- Set the boring bar at the rear side of the hole and chamfer.

Exercise 1.5.59

Make a simple eccentric with throw/offset

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

- **mark eccentricity**
- **set the job for eccentric turning in a 4 - jaw chuck and turn.**



1	Ø 45-50L	–	Fe 310	–	–	59
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.1.5.59
	SIMPLE ECCENTRIC TURNING (WITH Ø 22m AND THROW/OFFSET OF 5MM)				DEVIATIONS ±0.06	TIME 11 hrs
					CODE NO. TU20N1559E1	

Skill Sequence

Marking eccentricity of a job with vernier height gauge to given dimensions

Objective: This shall help you to
- **mark concentric and eccentric centre lines of a job by using a vernier height gauge.**

The height gauge marking is more accurate than the scribing block marking.

The marking surface must be free from sharp edges and unevenness.

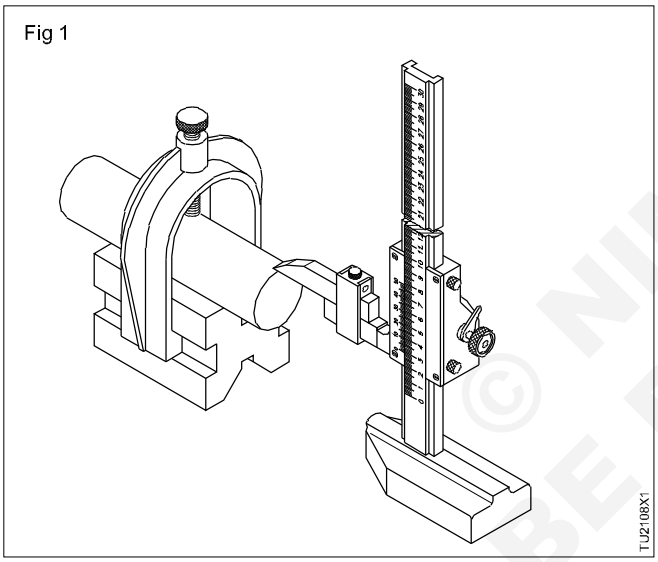
Clamp the finish turned rod in the 'V' Block with the help of the clamps.

Apply marking media on both faces of the job.

Set the scriber point on the top edge of the job. (Fig 1)

Move the height gauge scriber over the round surface to get a feel that the scriber bottom face is contacting the work periphery. (Fig 1)

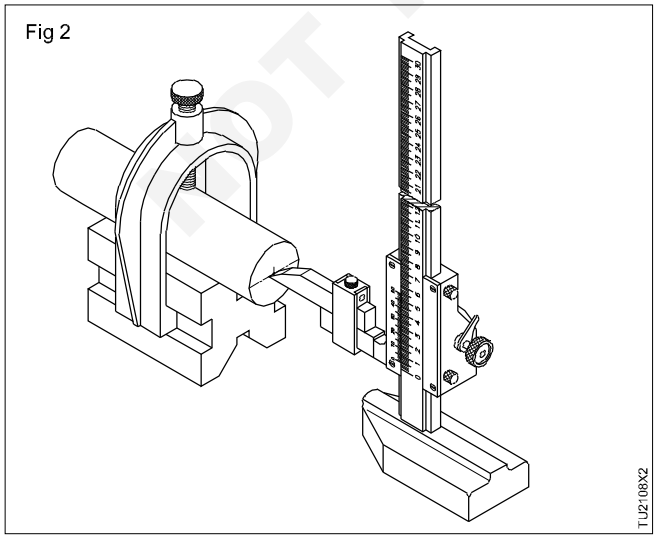
Fig 1



Lock the slides and note down the readings of the scales.

Subtract half the diameter from the reading and set the height gauge for that reading. (Fig 2)

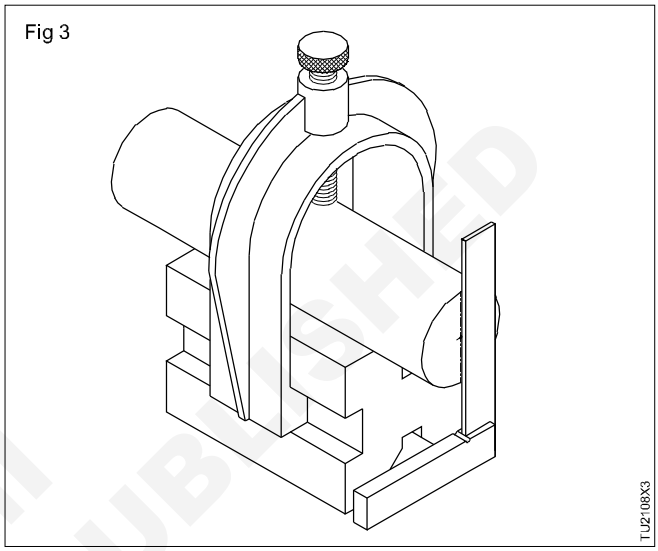
Fig 2



Scribe a horizontal line on both faces. (Fig 2)

Release the workpiece from the clamp and rotate the workpiece through 90°. Set the line at 90° with the help of a try square. (Fig 3)

Fig 3

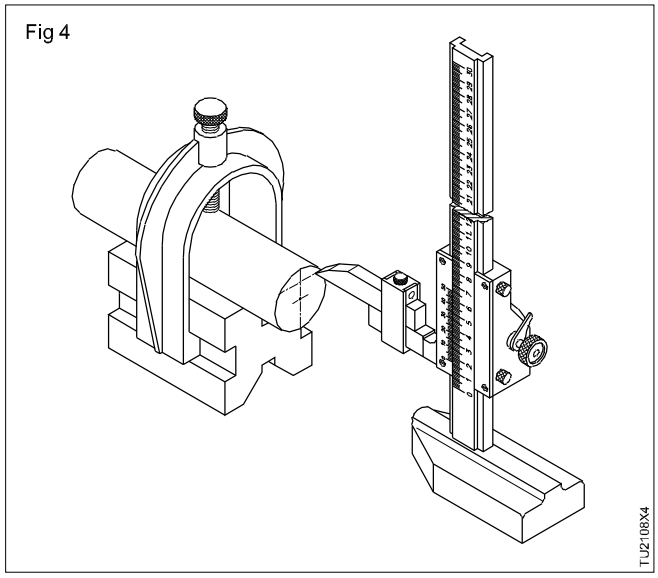


Clamp the workpiece to the 'V' block.

Scribe horizontal lines on both faces with the same reading which is set for centre position. (Fig 4)

Add eccentricity amount to the above reading and reset the height gauge for the new rading (Fig 4)

Fig 4



Scribe horizontal lines on both faces. (Fig 4)

Release the workpiece from the 'V' Block.

Punch mark on both sides both concentric and eccentric centre points.

Truing a job for eccentric turning

Objectives: This shall help you to
- **true the job for external eccentric turning**
- **true the job for internal eccentric boring.**

Truing the eccentric job in a four jaw chuck

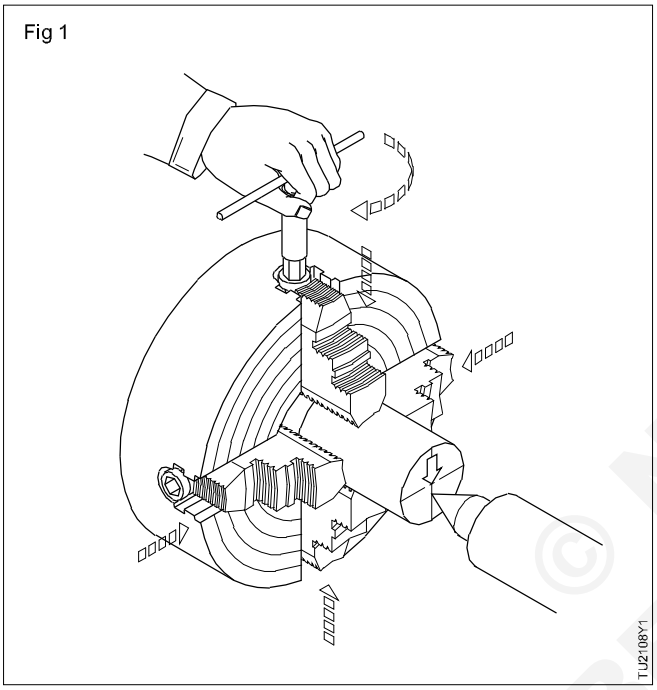
Open all the four jaws to give clearance to the workpiece.

Hold the workpiece up to the chuck face with the scribed lines towards the tailstock.

Insert the tailstock centre and slide the tailstock over the bed towards the headstock.

Position the workpiece until the tailstock centre locates in the eccentric centre dot on the workpiece. (Fig 1)

Fig 1



Move the tailstock centre until the pressure applied holds the workpiece against the chuck face.

Move the chuck jaws, tighten each jaw lightly in turn, taking care not to shift the workpiece.

Check and adjust the position of the workpiece so that it will protrude enough from the jaws to allow the total length of the eccentric portion to be machined.

Tighten the jaws.

Remove the tailstock.

Truing of eccentric job held in a four jaw chuck by using a surface gauge

Most of the eccentric truing is done with the help of guide circles scribed on the face of the chuck and the surface gauge. Since the guide circle has been scribed in concentric with the eccentric marking, truing the work to the guide circle gives the exact centre point of the eccentric turning.

Open all the four jaws to give clearance to the workpiece.

Hold the workpiece up to the chuck face.

Set the scriber of the surface gauge over the lathe bed.

Rotate the chuck by hand and check the running of the centre dot or guide circle with the surface gauge pointer.

Tighten each jaw slightly in turn, after necessary adjustments of the two sets of opposite jaws are made.

Recheck the centre dot or guide circle with the surface gauge.

Re-align the jaws, if required.

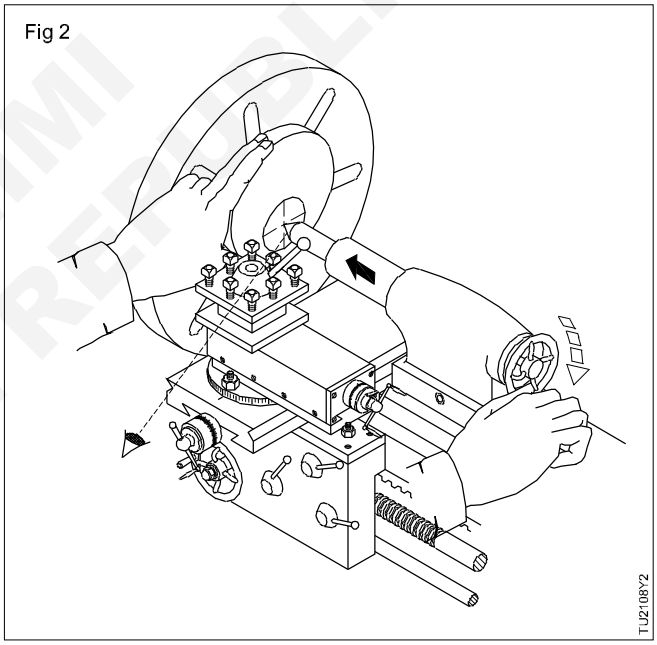
Tighten the jaws sufficiently.

Truing the eccentric job held on a face plate

Hold the workpiece on to the face plate.

Bring up the tailstock, locate the tailstock centre to the eccentric centre dot, apply pressure until the workpiece is held in position. (Fig 2)

Fig 2



If the eccentric bore in the workpiece is to be through then the parallel bars must be placed behind the workpiece to clear off the face plate during drilling and boring.

Select suitable clamps, Tee bolts, nuts, washers and packings as required.

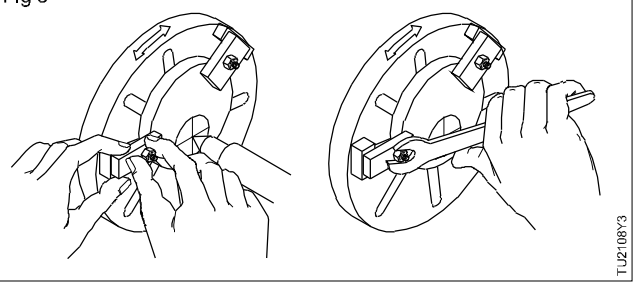
Clamp the workpiece to the face plate, clamp in positions which will give support ie., as near to the holes as possible but diametrically opposite. (Fig 3)

Remove the tailstock.

Recheck the tightness of the clamps.

Rotate the face plate by hand and check the concentricity of the marked off bore with the help of the surface gauge.

Fig 3



Realign the job, if required.

Recheck the tightness of the clamps.

If the amount of eccentricity is great, then the counter-balance weights must be clamped or bolted to the face plate to give a balanced condition.

Eccentric turning

Objective: This shall help you to
- **turn external eccentric diameter.**

Turning external eccentric diameter, work held in a 4 jaw chuck

The procedure of setting the work to turn the eccentric shaft has already been dealt with.

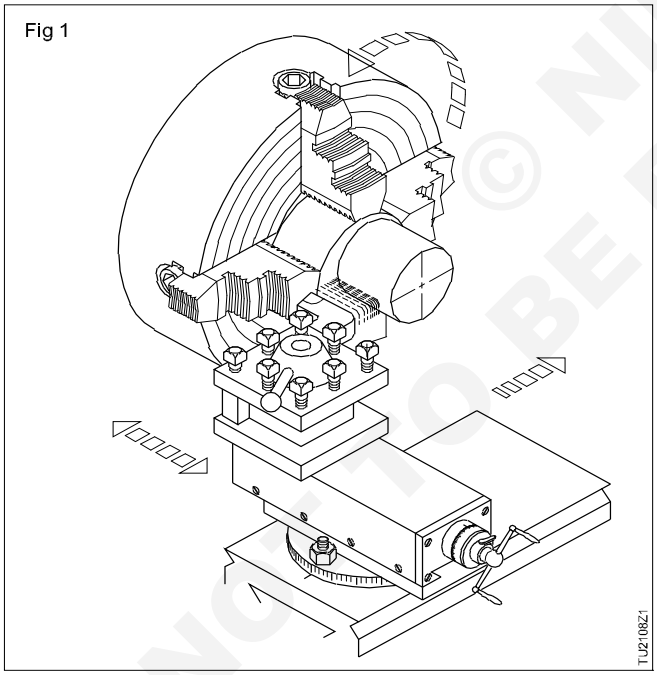
Further steps for turning are given below.

Set the tool to centre height with a minimum overhang.

Ensure that the tool tip is clear off the eccentric throw at the commencement of the operation as shown in Fig 1.

Rough turn by successive cuts the eccentric diameter leaving approximately 0.8 mm in the diameter for finish turning. (Fig 1)

Fig 1



Set the finishing tool and finish turn to the diameter.

Face to length.

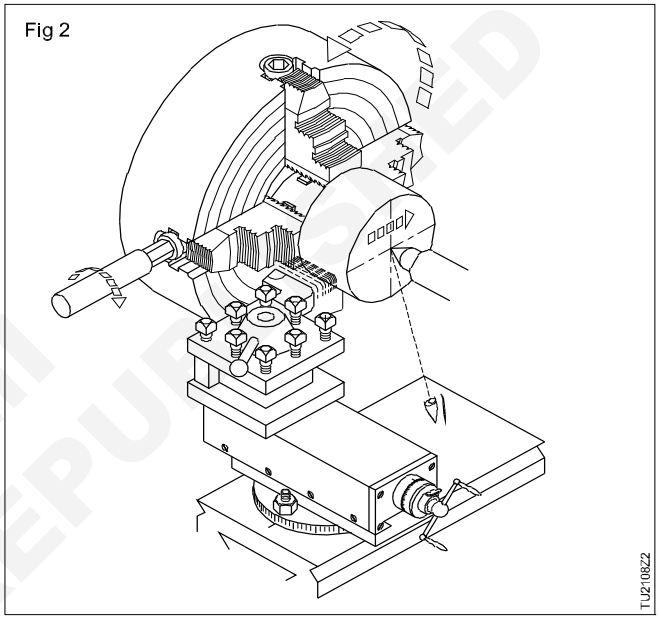
Remove the workpiece from the chuck.

Reverse and reset the job for turning concentric diameter. Use packing strips to protect the turned diameter held in chuck. (Fig 2)

Bring up the tailstock centre to the workpiece.

Release the chuck jaws, rotate the workpiece until the centre dot of the concentric centre is in line with the tailstock centre. (Fig 2)

Fig 2



Check that all packing strips are in position.

Tighten the jaws.

Remove the tailstock.

Check the running of the concentric centre dot with the help of the surface gauge.

Re-align the jaws, if required.

Give each jaw a final tightening.

Make sure that the running of the concentric centre dot is in line with the lathe axis.

Set the tool for rough turn.

Rough turn the concentric diameter.

Set the tool for finish turn, and finish turn the concentric diameter.

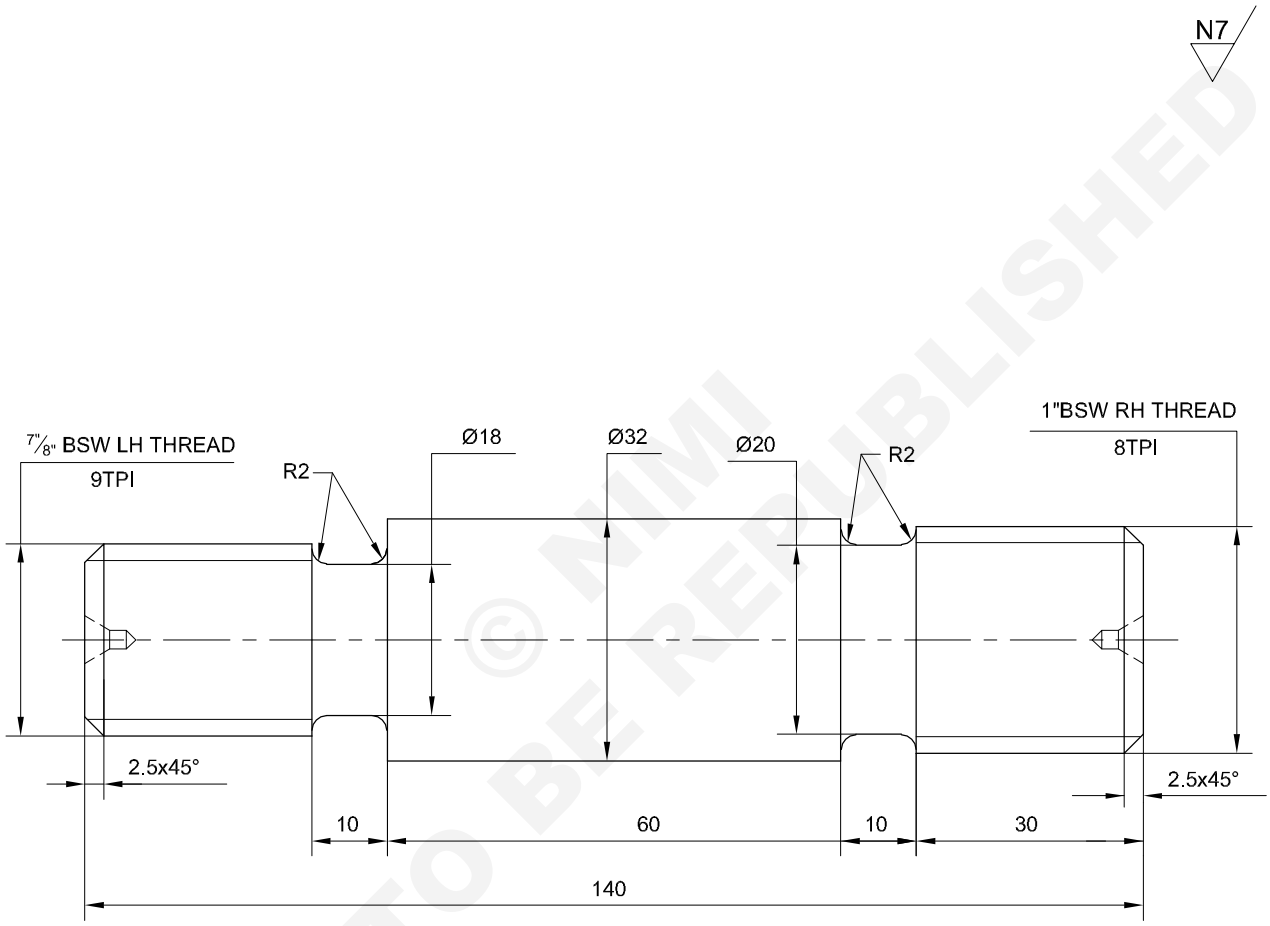
Face to length.

Remove the eccentric turned job from the chuck.

Rotate the face plate by hand to check that the clamps etc. are clear of the cross-slide and saddle.

Screw thread cutting (BSW) - RH & LH checking (External)

Objectives: At the end of this exercise you shall be able to
- **plain turn within close limits**
- **step turn within close limits**
- **cut R.H. B.S.W. threads**
- **cut LH B.S.W. threads.**



1	Ø36 - 145	–	Fe 310 IS :1977	–	–	1.6.61
NO.OFF	STOCK SIZE	SEMI PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	RH.LH THREAD CUTTING EXTERNAL (BSW)	TOLERANCE IS:2102 (M)	TIME
		CODE NO. TU20N1559E1	

Job Sequence

- Hold the job in a four-jaw chuck and face both the ends to maintain a total length of 140 mm.
- Centre drill at the ends and hold the job between centres using a catch plate having slots milled at 180° and a bent tail carrier.
- Turn the outer dia 32mm to full length and chamfer the ends.
- Turn the job Ø1" for 30mm length.
- Form the radius groove R2 Ø30 at both ends of 20 mm diameter portion, at a distance of 30 mm from the end face.
- Arrange the gear train to cut 1" BSW threads on the job.
- Cut RH threads.
- Reverse the job and turn the step Ø7/8" for 30 mm length and form the radius groove Ø 18 x 10 mm.
- Arrange the gear train to cut 7/8" BSW threads on the job.
- Change lead screw direction.
- Cut the LH thread from the end upto the groove.

Follow the recommended cutting speed & feed for the job.

Use coolant to cool the tool & washout chips.

Skill Sequence

Cutting 'V' thread by plunge cut method

Objective: This shall help you to
- **cut 'V' thread using a single point tool on a lathe by the plunge cut method.**

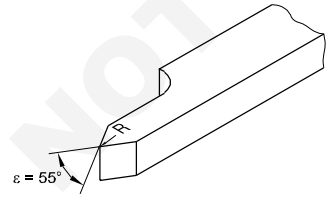
Thread has coarse and fine pitches according to their usage. Standard fine pitch threads, both external and internal, are generally cut by using taps and dies. When they are produced in large quantities, different methods are adopted on different machine tools. However, at times, it may be necessary to cut threads by a single point tool on a centre lathe.

The plunge cut method of threading by a single point tool is done by plunging the tool into the work to produce the thread form. The tip of the tool, as well as, the two flanks of the tool will remove metal during thread cutting and hence the load on the tool will be more. As the possibility of obtaining a good finish on the thread is limited, this method is applicable to fine pitch thread cutting.

The following is the procedural sequence in cutting the 'V' thread by the plunge cut.

Grind a 'V'thread tool for the required thread angle. (Fig 1)

Fig 1



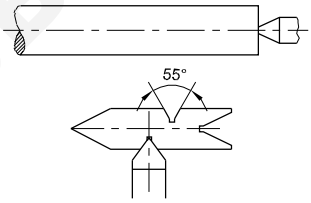
Ensure that the thread angle ground is symmetrical with respect to the axis of the tool.

Arrange the change gear train and set the quick change gearbox levers for the required pitch and hand of thread.

Clamp the tool in the tool-post and set the tool to centre height.

Set the tool perpendicular to the lathe axis by using centre gauge. (Fig.2)

Fig 2

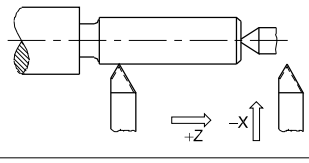


Ensure that the top slide is set at 0°, and slackness is removed by gab adjustment.

Set the machine to about 1/3rd of the rough turning r.p.m.

Start the machine and touch the tip to work. (Fig 3) set the cross-slide and the compound slide graduated collars to zero, eliminating backlash.

Fig 3

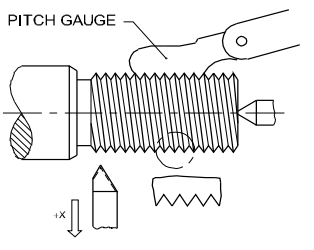


Bring the tool to the starting point and engage the half nut.

Allow the tool to take the trial cut, the depth being given 0.05 mm divisions of the cross-slide graduated collar.

Withdraw the tool at the end of the cut and stop the machine. (Fig 4)

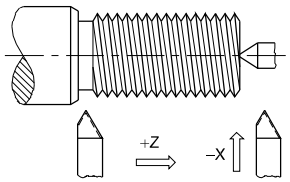
Fig 4



Check with the screw pitch gauge to confirm the gear box setting. (Fig.4)

Reverse the machine to bring the carriage to the starting point. (Fig.5)

Fig 5

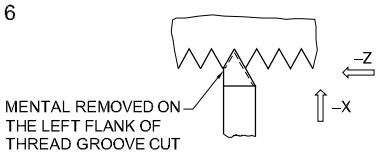


TU20N1660H5

Give successive cuts.

For every 3 depths of cuts by the cross-slide, give one axial cut by feeding the tool axially by half division of the compound slide. This relieves the load on the tool. (Fig.6)

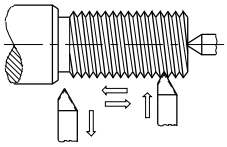
Fig 6



TU20N1660H6

Continue the sequence till the thread profile is formed. (Fig 7)

Fig 7



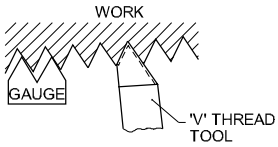
TU20N1660H7

Check with the screw pitch gauge for the thread form.

Match the mating component to ensure the class of fit.

If the tool is not set square to the axis of the work, the gauge will not match with the thread. (Fig 8)

Fig 8



THE GAUGE NOT MATCHING

TU20N1660H8

Use thread ring gauge to check external thread (Fig 9)

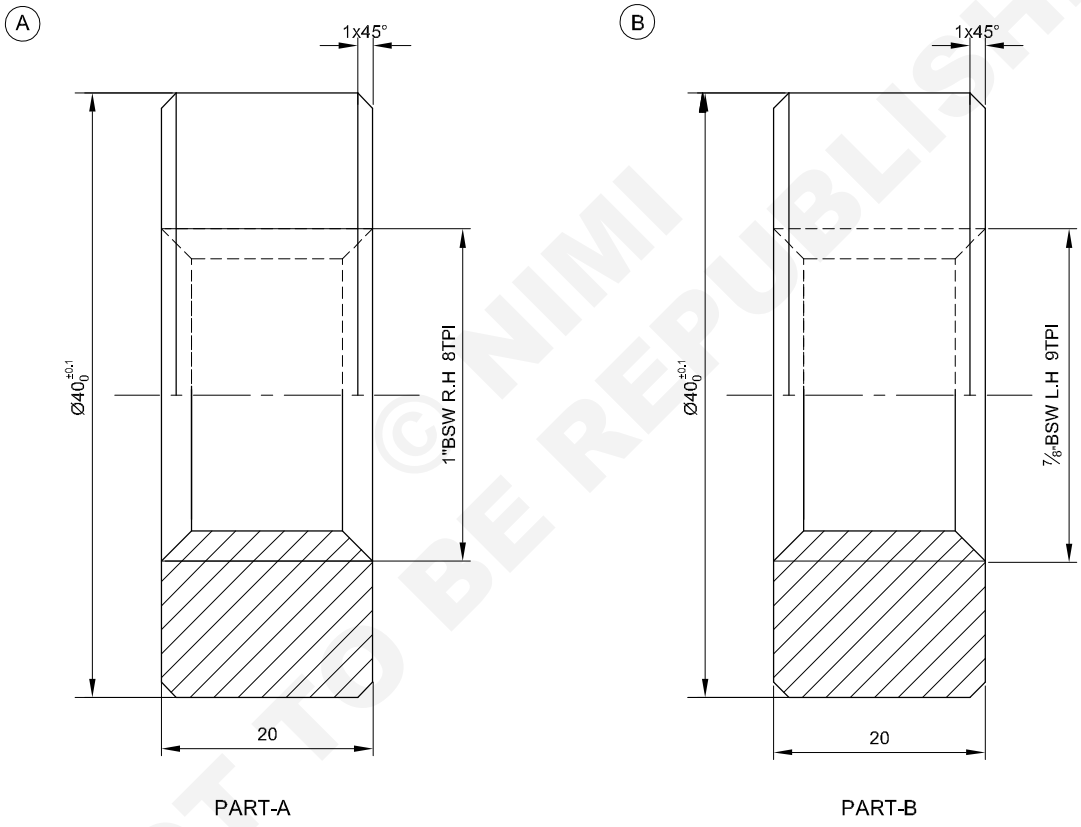
Fig 9

Exercise 1.6.61

Screw thread Cutting (BSW) RH & LH checking (Internal)

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

- **set the internal 'V' threading tool**
- **cut internal thread by using an internal threading tool**
- **match the internal thread with the external thread.**



PART-A PART-B

2	Ø45 - 25 L	–	Fe 310 IS :1977	–	–	1.6.62
NO.OFF	STOCK SIZE	SEMI PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 2:1	RH & LH THREAD CUTTING INTERNAL (BSW)	TOLERANCE ±0.06 Unless otherwise stated	TIME
		CODE NO. TU20N1661E1	

Job Sequence

Part A and Part B

- Check the given raw material for its size by rough measurement.
- Hold the work in a four jaw chuck about 10 mm inside the chuck and true it.
- Face the end, centre drill and support with centre.
- Rough and finish turn the outer dia. 40 mm to possible length.
- Chamfer the edge 1 x 45°.
- Drill a pilot hole Ø 10 mm through and enlarge it to Ø 18 mm by drilling.
- Bore the drilled hole to a core dia. of part A 22.8 mm. and part B 18.6 mm.
- Chamfer the bore 2 x 45° mm.
- Fix the internal threading tool in a tool-post and set it with the centre gauge.

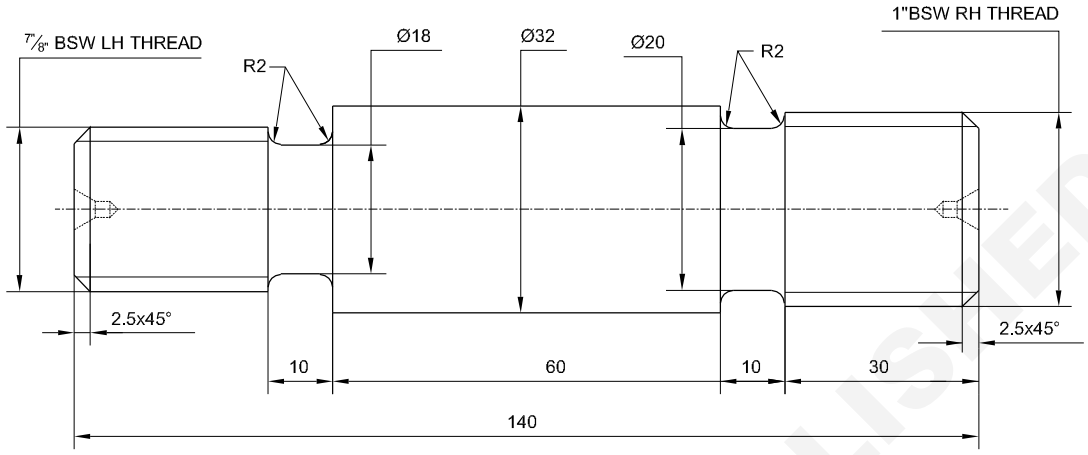
Ensure a minimum overhang of the tool.

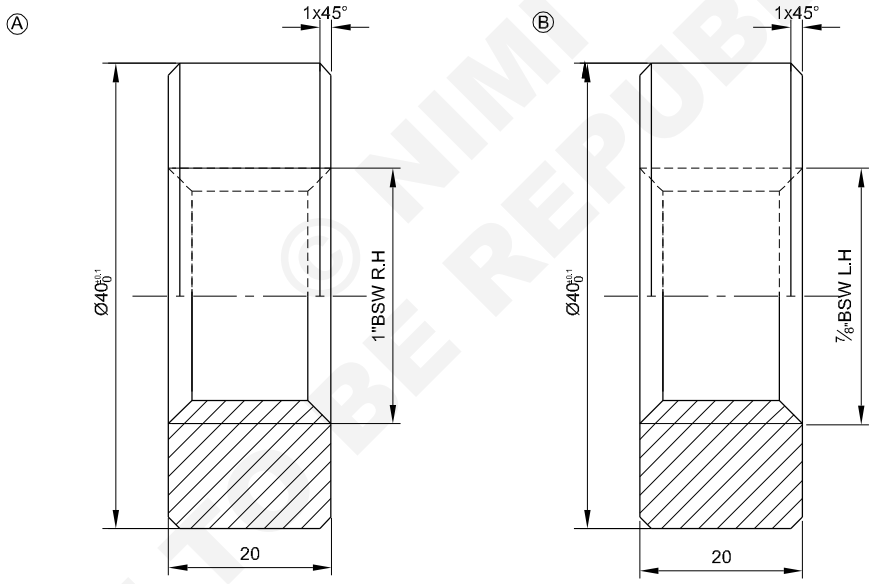
- Set the machine to 8 TPI mm pitch and the spindle speed levers to 1/3rd of the roughing speed.
- Touch the tool tip to the bore surface, and set the cross-feed graduated collar to zero.
- Rough and finish thread 1” RH and 7/8” LH BSW thread by giving successive cuts, ensuring the correctness of the pitch by checking with a pitch gauge.
- Check with the external thread mating part for the correctness of fit.
- Reverse and hold the work on Ø 40 mm and true.
- Face the end of the work, and maintain a total length of 14 mm.
- Rough and finish turn Ø 40 mm for the remaining length.
- Chamfer 1 x 45° on the outer edge and 2 x 45° on the threaded bore.
- Remove the sharp edges and have a final check.

Fitting of Male & Female threaded components (BSW)

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

- **fit the 7/8”BSW LH external and internal threaded components**
- **fit the 1” BSW RH external and internal threaded components.**





PART-A PART-B

Job Sequence

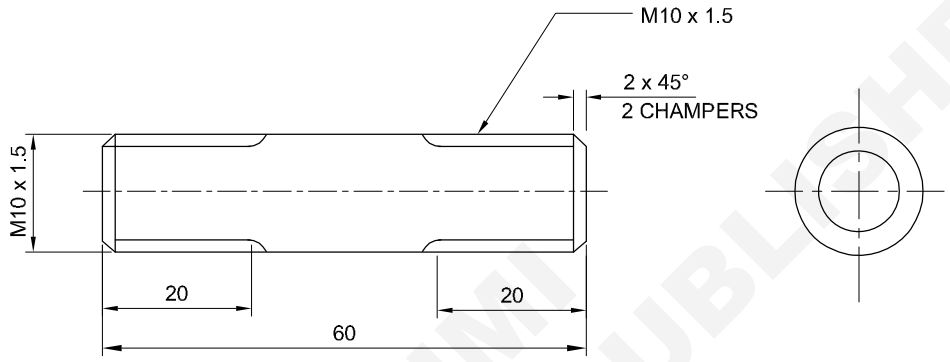
- Clean external internal 1” BSW threaded job and check thread profile.
- Check and select 1” BSW RH external and internal component.
- Fit the R.H internal component rotate clockwise direction to external component.
- Clean the external and internal 7/8” BSW threaded job.
- Check thread profile.
- Check and select 7/8” BSW L.H External and Internal component.
- Fit the L.H Internal component rotate anti clockwise direction to external component.

1	–	EX 1.6.60 ← EX 1.6.61 ←	Fe 310 IS :1977	–	–	1.6.63
NO.OFF	STOCK SIZE	SEMI PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
	FITTING OF MALE AND FEMALE THREAD COMPONENTS				TOLERANCE ±0.06 Unless otherwise stated	TIME
					CODE NO. TU20N1662E1	

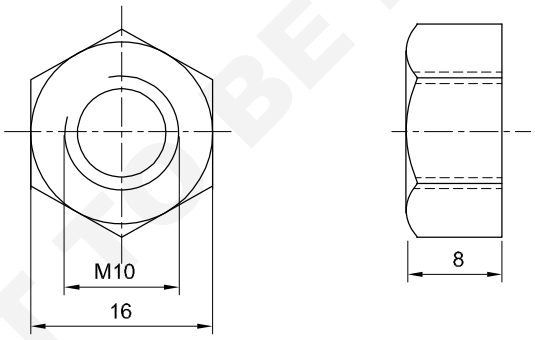
Prepare stud with nut (standard size)

Objectives: At the end of this exercise you shall be able to
- **prepare the blank size to form external threads using die**
- **drill through hole to form internal thread using tap.**

TASK-1



TASK-2



1	HEX A/F 16 mm	–	Fe 310	–	TASK-2	
1	Ø15 - 65	–	Fe 310	–	TASK-1	1.6.63
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
	STUD WITH NUT				TIME	
					CODE NO. TU20N1663E1	

Job Sequence

TASK 1: **Stud**

- Check the raw material.
- Hold the job in a 3 jaw check keeping about
- To 40 mm outside.
- Face the end
- Turn Ø 10 mm maximum length, chamfer end 2x43°
- Reverse the job, face to correct total length.
- Turn 10 mm, chamfer end 2x45°
- Hold the work piece on a bench vice, at 90° vertically, projecting 30 mm outside
- From threads by using m10x1.5 die
- Process may repeat other side with, Thread protecting pads.

— — — — — — — —

TASK 2: **Nut**

- Check the raw material size.
- Hold the job in a 3 jaw chuck.
- Face the one end.
- Reverse and hold the job in a 3 jaw chuck.
- Face the other end maintain a total length of 8 mm.
- Chamfer the edge 3 x 30°.
- Centre drill to the work.
- Drill through hole to Ø 8.5 mm.
- Counter sink the drilled hole using countersink bit.
- Form internal thread by M10 Tap using taps and tap wrench by supporting tailstock.

Skill Sequence

External threading using dies

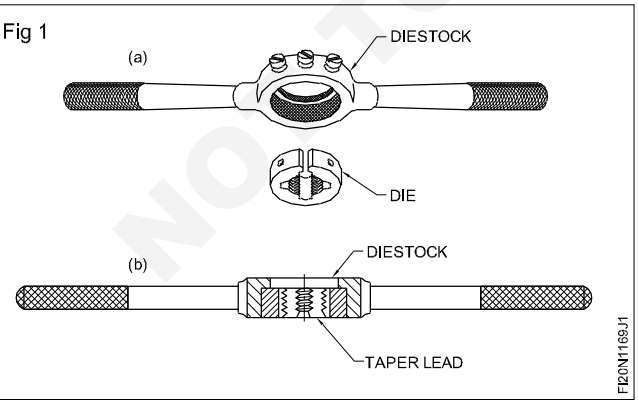
Objective: This shall help you to
- **Cut external threads using dies.**

Check blank size.

Blank size = Thread size - 0.1 x pitch of thread

Fix the die in the diestock and place the leading side of the die opposite to the step of the diestock. (Fig 1 & 2)

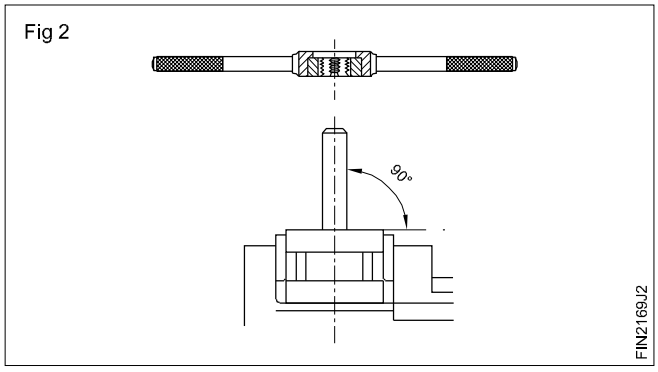
Fig 1



Use vice clamp for ensuring a good grip in the vice.

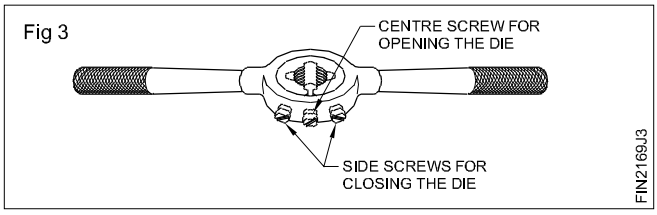
Project the blank above the vice - just the required thread length only.

Fig 2



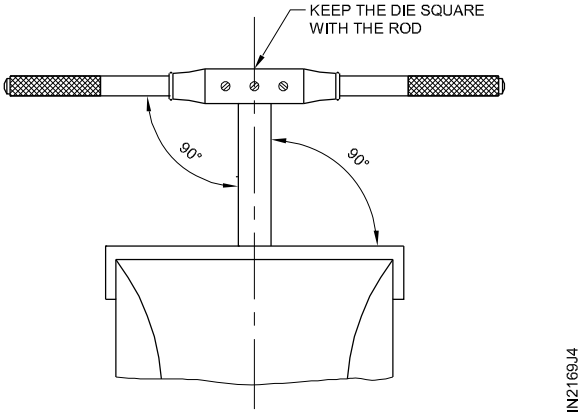
Place the leading side of the die on the chamfer of the work. (Fig 3)

Fig 3



Make sure that the die is fully open by tightening the centre screw of the diestock. (Fig 4)

Fig 4



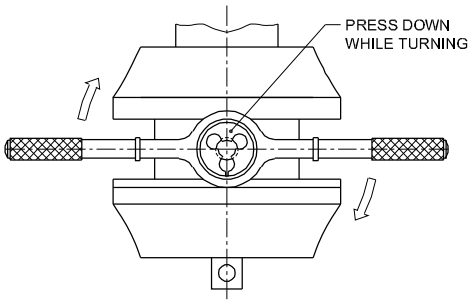
Start the die, square to the bolt centre line. (Fig 5)

Apply pressure on the diestock evenly and turn in a clockwise direction to advance the die on the bolt blank. (Fig 5)

Cut slowly and reverse the die for a short distance in order to break the chips.

Use a cutting fluid

Fig 5



Increase the depth of the cut gradually by adjusting the outer screws.

Check the thread with a matching nut.

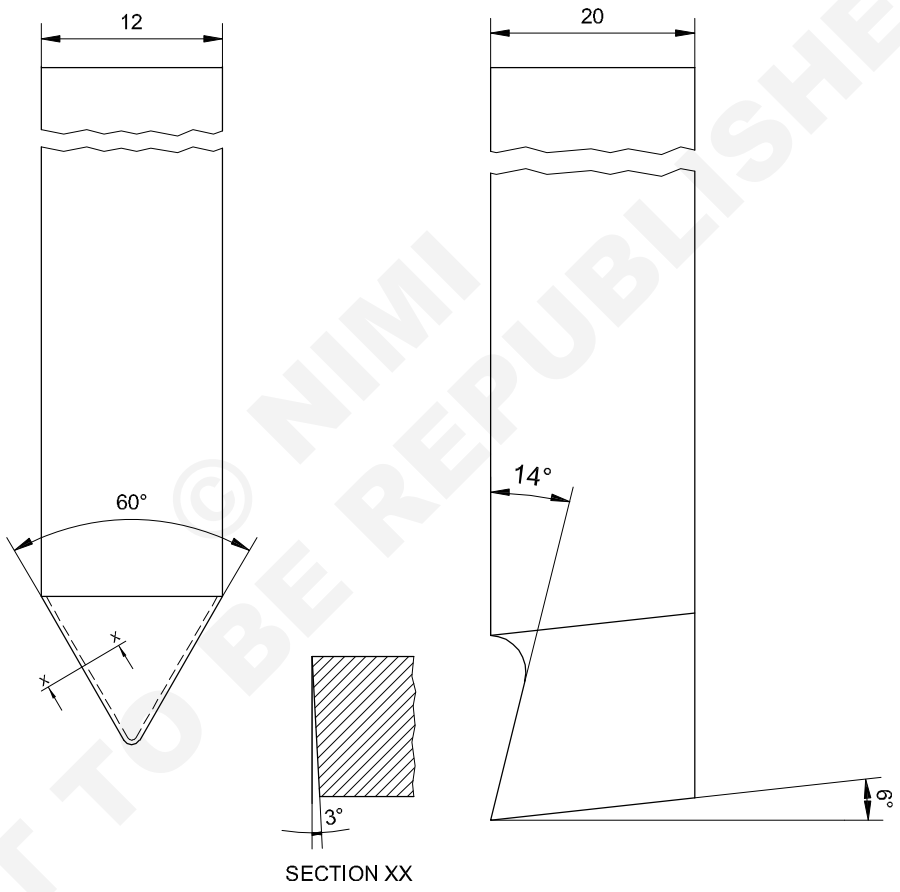
Repeat the cutting until the nut matches.

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.

Grinding of 'V'- Tools for threading of metric - 60° threads and check with gauge

Objectives: At the end of this exercise you shall be able to
- **grind 'V' threading tool (metric)**
- **check the profile of the 'V' tool.**



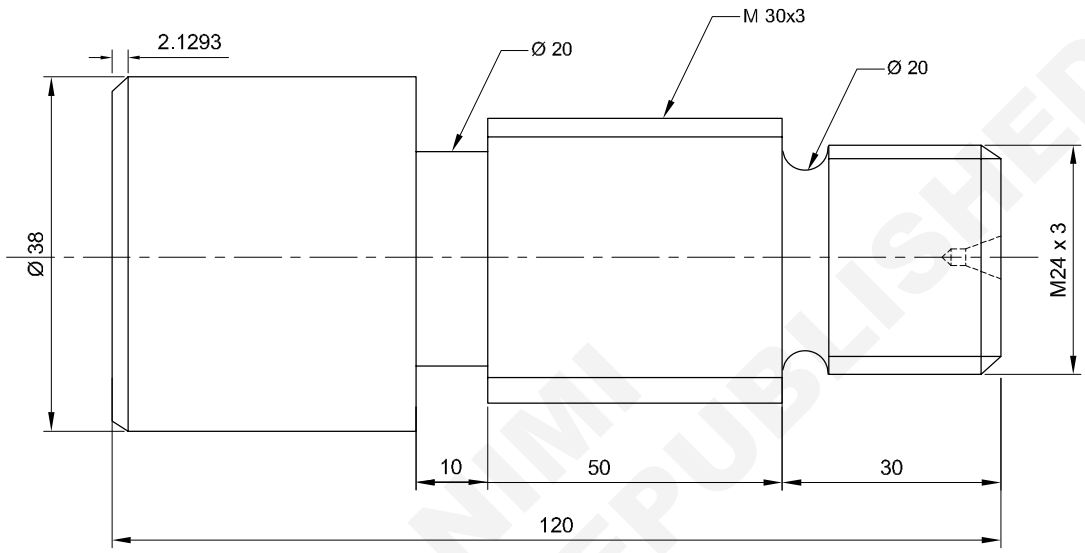
1	20 ISF 12-150	–	Fe310	–	–	1.6.64
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	**GRINDING `V' THREADING TOOL (FOR THREADING OF METRIC-60°)**				DEVIATIONS ±0.06	TIME
					CODE NO. TU20N1664E1	

Job Sequence

- Rotate the wheel by hand to observe for free rotation.
- Check the grinding wheels for true running.
- Wear goggles.
- Dress the wheels by a wheel dresser.
- Adjust the tool rest to maintain a minimum gap from the wheel face to a minimum of 2 to 3 mm.
- Hold the tool against the wheel to grind the front clearance angle 7°.
- Hold and grind the side flank of the tool to the front face of the grinding wheel at 30° to horizontal and side clearance angle 3° simultaneously.
- Hold and grind the other side flank of the tool to the front face of the grinding wheel at 30° to horizontal and side clearance angle 3° simultaneously.
- Grind a top rake angle of 14°.
- Lap the tool with the help of oil stone.

Screw thread cutting (External) - metric thread

Objectives: At the end of this exercise you shall be able to
- **form undercut on work held chuck to centre**
- **cut metric 'V' threads on external**
- **check the profile using pitch gauge metric.**



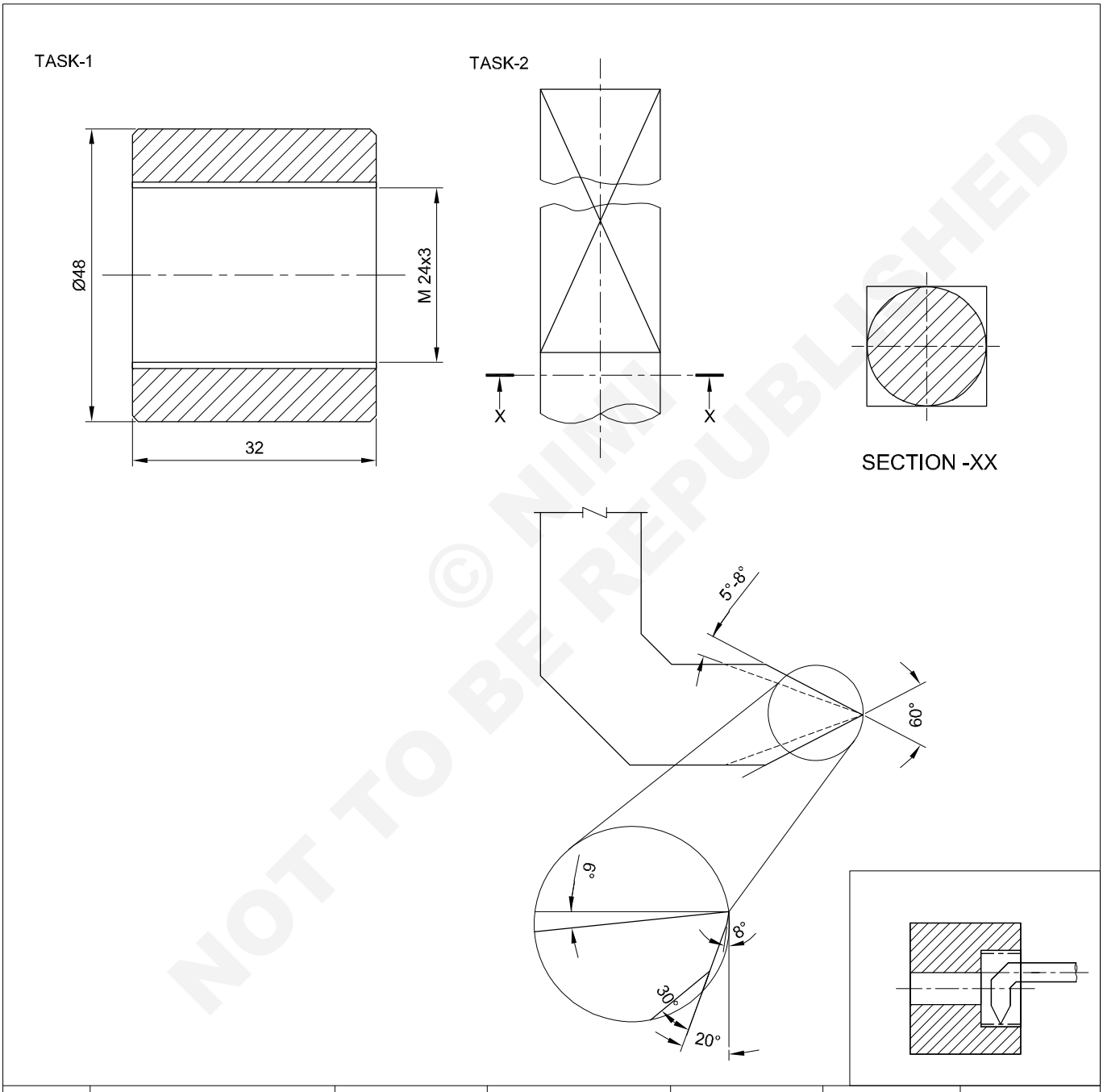
Job Sequence

- Check raw material size.
- Hold the job in a 4 jaw chuck keeping 60mm outside and face the one end.
- Turn Ø 38mm to a maximum length.
- Chamfer 2 x 45° as per drawing.
- Reverse and hold the job in the chuck and true it.
- Face the end maintain total length 120mm.
- Centre drill the job and support the job with centre.
- Turn Ø 30mm to 80mm length.
- Turn Ø 24mm to 30mm length.
- Undercut Ø 20 mm x 10 mm length.
- Form radius R2 on Ø20mm.
- Set the machine to 3mm pitch and the spindle speed levers to 1/3rd of the roughing speed.
- Set the 60° threading tool with the help and the centre gauge.
- Cut threads M24 x 3, M30 x 3.
- Check the threads with the help of a screw pitch gauge.

1	Ø 40 - 125	–	Fe 310	–	–	1.6.65
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
	SCREW THREAD CUTTING (EXTERNAL METRIC)					TIME :
					CODE NO. TU20N1665E1	

Screw thread cutting (Internal) - metric thread

Objectives: At the end of this exercise you shall be able to
- **cut internal thread**
- **grind internal 'V' threading tool**
- **check the angles with a tool angle gauge/protractor.**



NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
1	Ø50-35	–	Fe 310	–	TASK-1	
1	SQ 16-100	–	Forged HSS Tool	–	TASK-2	1.6.66

SCALE 1 : 1	SCREW THREAD INTERNAL (METRIC) AND THREADINGTOOL GRINDING	TOLERANCE	TIME
		CODE NO. TU20N1666E1	

Job Sequence

TASK 1: **Cutting internal thread**

- Check the raw material size.
- Hold the work in a four jaw chuck about 10mm inside the chuck and true it.
- Face the one end.
- Rough and finish turn the outer dia 48 mm to possible length.
- Chamfer 2 x 45° on the outer edge.
- Drill and bore the hole to the core dia of the thread.
- Fix the internal threading tool in a post and set it with the centre gauge.
- Set the machine to 3 mm pitch and the spindle speed levers to 1/3rd of the roughing speed.
- Touch the tool tip to the bore surface and set the cross feed graduated collar to zero.
- Rough and finish M24 x 3 by giving successive cuts ensuring the correctness of the pitch by checking with a pitch gauge.
- Reverse and hold the work on Ø 48 mm and chuck its run out.
- Face the end of work and maintain a total length of 32mm.
- Chamfer 1 x 45° on the outer edge.

— — — — — — — —

TASK 2: **Grinding 'V' tool**

- Prepare the pedestal grinder for grinding a threading tool.
- Grind front clearance angle of 8° and secondary clearance angle 20°.
- Grind a side clearance angle of 5° and a thread one side cutting angle of 30°.
- Grind the other side, clearance angle 95° and thread cutting angle of 30°.
- Grind top rake angle 6° and a side rake angle of 4°.
- Maintain a nose radius of 0.3 to 0.5 mm.
- Deburr with an oil stone and check with a tool angle gauge/ protractor.

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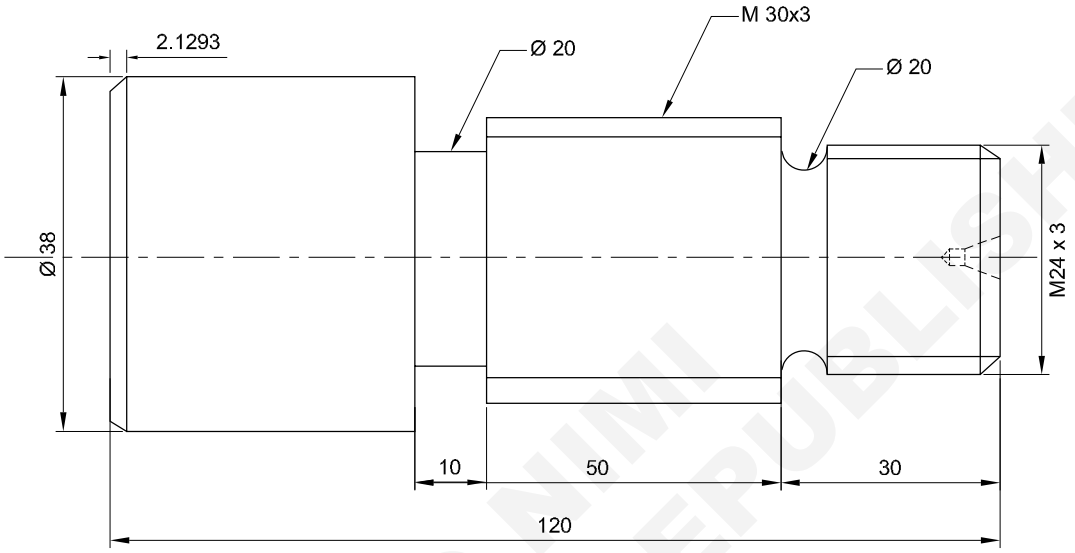
Fitting of Male & Female threaded components (metric)

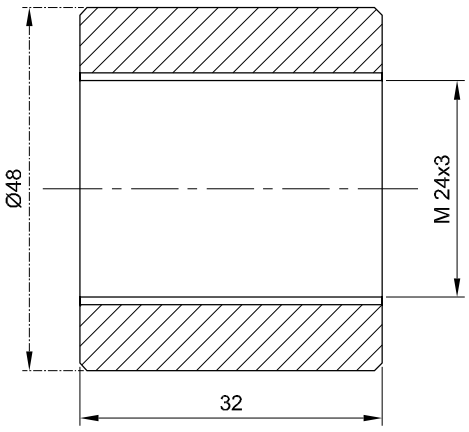
Objective: At the end of this exercise you shall be able to
- **fit the M24 x 3 pitch external and internal thread components.**



Job Sequence

TASK 1:

- Clean male and female threaded Components.
- Check thread dimension, pitch and thread profile use vernier caliper and pitch gauge.
- Assemble by screwing M24 x 3 female thread in to the external M24 x 3 threaded component.



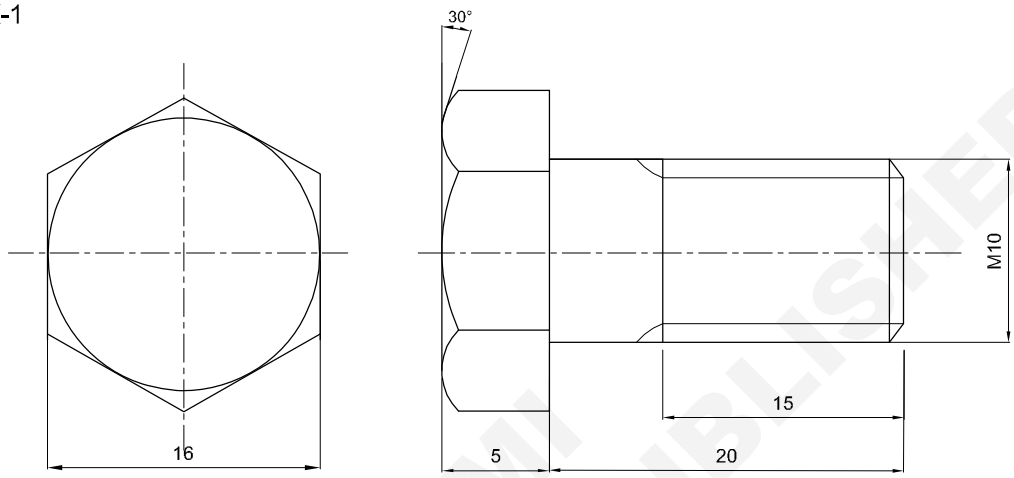
–	–	EX 1.6.65 ← EX 1.6.66 ←	–	–	–	1.6.67
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
	FITTING OF MALE AND FEMALE THREADED COMPONENT (METRIC)					TIME
					CODE NO. TUN2367E1	

Exercise 1.6.68

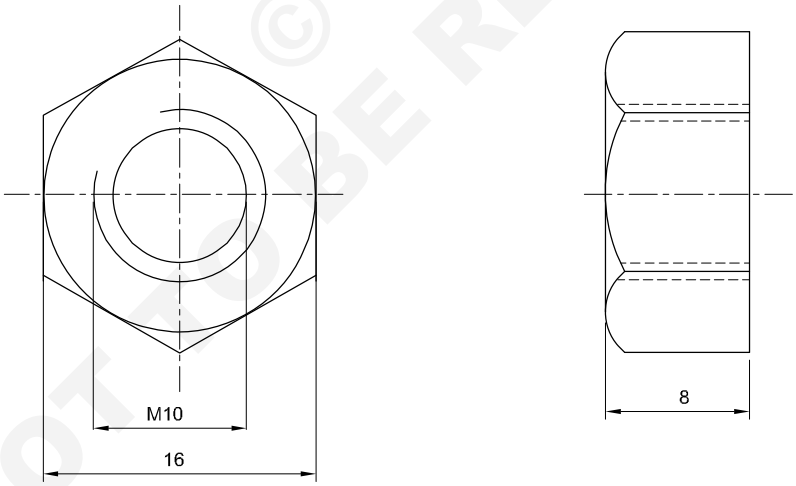
Make hexagonal bolt and nut (metric) and assemble

Objective: At the end of this exercise you shall be able to
- **cut external and internal threads using dies and tap set.**

TASK-1



TASK-2



1	⬡16 A/F-12 L	–	Fe 310	–	TASK-2	
1	⬡16 A/F-30 L	–	Fe 310	–	TASK-1	1.6.68
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 2 : 1	MAKE HEXAGONAL BOLT AND NUT (Metric)	TOLERANCE IS : 2012 (M)	TIME
		CODE NO. TU20N1668E1	

Job sequence

TASK 1

- Check the size of Hexagonal job.
- Hold the job in a four jaw check, face it.
- Make the chamfer as per given drawing.
- Reverse the job, keeping about 20 mm outside.
- Face into correct total length.
- Turn 22 mm length.
- Make chamfer on the end 1x 45°
- Release the job from 'The chuck'.
- Hold the job in a bench vice by using try square to check 90 ° vertical position
- Make thread M 10x 1.5 in to 15 mm length by using die set.
- Remove the job from vice and deburr.

— — — — — — — —

Task 2

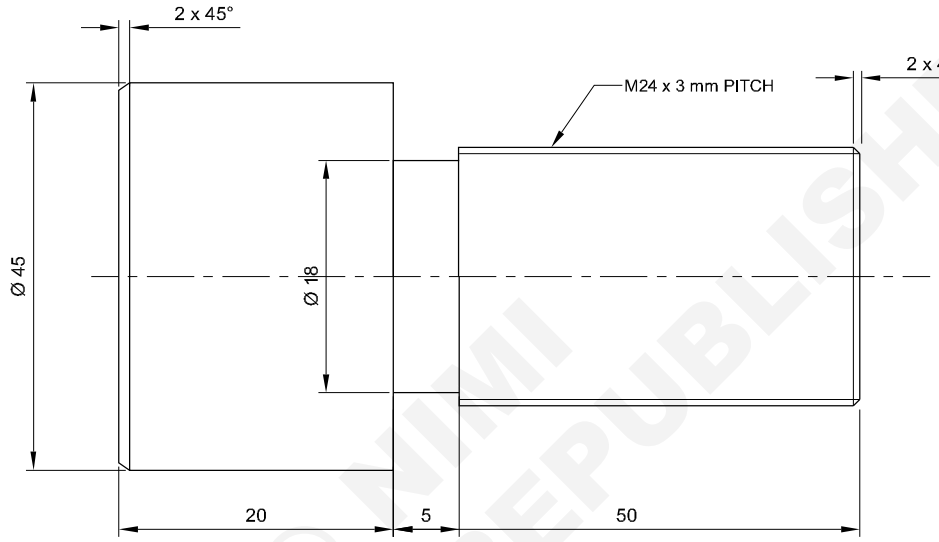
- Check the raw material.
- Hold the job in a four jaw chuck and face it.
- Face and chamfer the end.
- Make a centre drill on the face.
- Drill 8.5 mm, chamfer using counter sink tool.
- Reverse the job.
- Face to correct total length.
- Release the job from the check.
- Hold the job in a bench vice.
- Form thread M 10x 1.5 by using hand tap set.
- Remove the job from vice, and deburr.
- Check task 1 with task 2.

— — — — — — — —

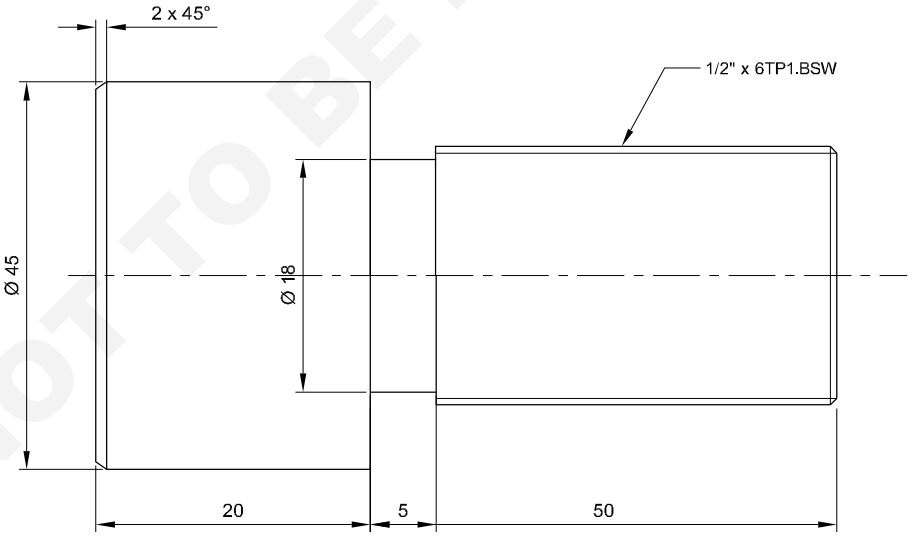
Cutting metric threads on inch lead screw and inch threads on metric lead screw

Objectives: At the end of this exercise you shall be able to
- **set the change gears/shift lever position in the gearbox**
- **cut external 'V' thread**
- **check thread profile pitch/TPI using pitch gauge.**

TASK-1



TASK-2



2	Ø50-75 mm	–	Fe 310	–		1.6.69
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

CUTTING METRIC / INCH THREADS

(METRIC THREAD IN METRIC LEAD SCREW AND INCH THREAD IN LEAD SCREW LATHE)

DEVIATIONS | TIME

CODE NO. TU20N1669E1

Job sequence

TASK 1: **(Use inch lead screw lathe)**

- Check the raw material size.
- Hold and true the job 50mm out side the chuck.
- Face the one end.
- Turn ∅ 30mm to a maximum length.
- Chamfer 2 x 45°.
- Reverse and hold the job.
- Face other side maintenance total length 70 mm.
- Turn step ∅ 24mm to a 50 mm length.
- Form an under cut to a width 5mm and maintain the under cut dia 18 mm.
- Chamfer 2 x 45°.
- Set the change gear to the required ratio (use special gear 127 teeth).

Gear calculation - Refer related theory

- Cut 3mm pitch thread to a 45m length.
- Check the thread formation.

— — — — — — — —

TASK 2: **(Use metric lead screw lathe)**

- Check the raw material size.
- Hold and true the job 50mm outside the chuck.
- Face the one end.
- Turn ∅ 30mm to a maximum length.
- Chamfer 2 x 45°.
- Reverse and hold the job.
- Face other side maintain total length 70mm.
- Turn step 1/1/2” or 34.6mm to 50 mm length.
- Form an undercut to a width 5mm and maintain the under cut dia18mm.
- Chamfer 2 x 45°.
- Set the change gear driver, driven in ratio (use special gear 127 teeth).

Gear calculation - Refer related theory

- Set the threading tool in the tool post to correct position.
- Cut 6TPI BSW thread to 45 mm length.
- Check the thread formation.

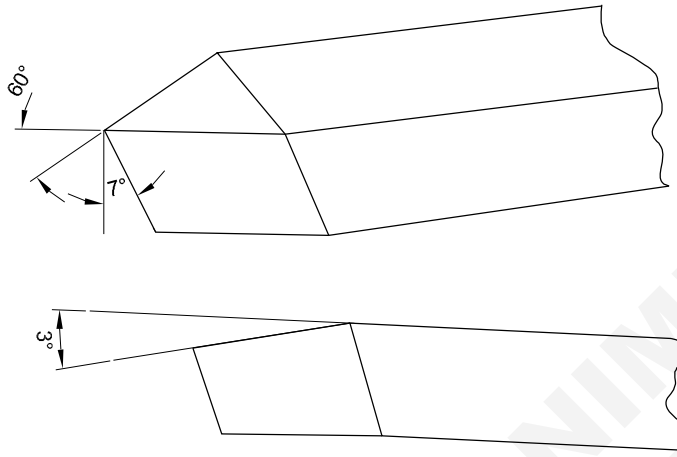
— — — — — — — —

Practice of negative rake tool on non - ferrous metal and thread cutting along with fitting with ferrous metal

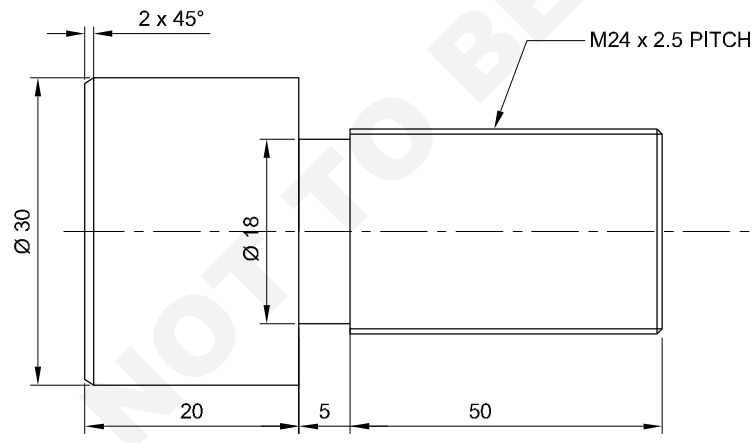
Objectives: At the end of this exercise you shall be able to

- **grind negative rake threading tool**
- **cut external and internal thread**
- **match the internal thread with the external thread for ferrous and nonferrous materials.**

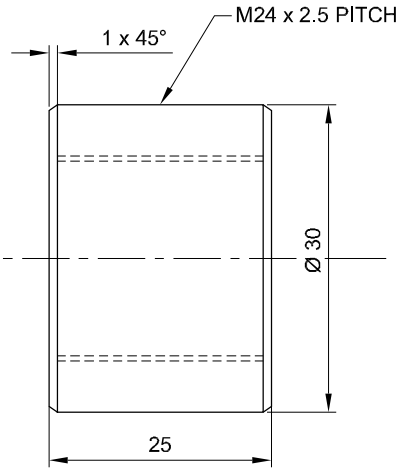
TASK-1



TASK-2



TASK-3



1	Ø 32 x 30	–	Fe 310	–	TASK-3	
1	Ø 32 x 75	–	CUZN Pb2	–	TASK-2	
1	12Sq x 150	–	Fe 310	–	TASK-1	1.6.70
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
	PRACTICE OF NEGATIVE RAKE TOOL ON NON- FERROUS METAL AND THREAD CUTTING ALONG WITH FITTING WITH FERROUS METAL					TIME
					CODE NO. TU20N1670E1	

Job Sequence

TASK 1: **Grinding negative rake**

- Rotate the wheel by hand and observe for free rotation.
- Check the grinding wheels for true running.
- Wear Goggles.
- Dress the wheels by a wheel dresser.
- Adjust the tool rest to maintain minimum gap.
- Hold the tool against the wheel to grind the front clearance angle 7°.
- Grind the other side flank of the tool 30° with side clearance angle 3°.
- Grind a negative top rake of 3°.
- Lap the tool with help of oil stone.

— — — — — — — —

TASK 2: **Threading on non - ferrous (Male)**

- Check the raw material size.
- Hold and true the job 50mm outside the chuck.
- Face the one end.
- Turn 30mm to a maximum length.
- Chamfer 1.5 x 45°.
- Reverse and hold the job.
- Face other end maintain total length 70mm.
- Turn step ∅24 to a 50 mm length.
- Form an under cut to a width 5mm and maintain the undercut dia 20 mm.
- Set threading tool in the tool post to correct position.
- Cut 2.5 mm pitch thread to a 45mm length.
- Check the thread formation.

— — — — — — — —

TASK 3: **Internal threading of nut (Female)**

- Check the raw material size.
- Hold and true the job 20 mm out the chuck.
- Face the one end.
- Turn ∅ 30 mm to a 15mm length.
- Chamfer 101 x 45°.
- Reverse and hold the job.
- Face other end maintain total length 25mm.
- Turn dia 30 mm to the balance length.
- Chamfer to 1 x 45°.
- Drill and bore the hole to the core dia 21mm of the thread.
- Cut internal metric 2.5 mm pitch thread.
- Check the threads formation.
- Fit the External and Internal thread components (Task 2 & 3).

— — — — — — — —

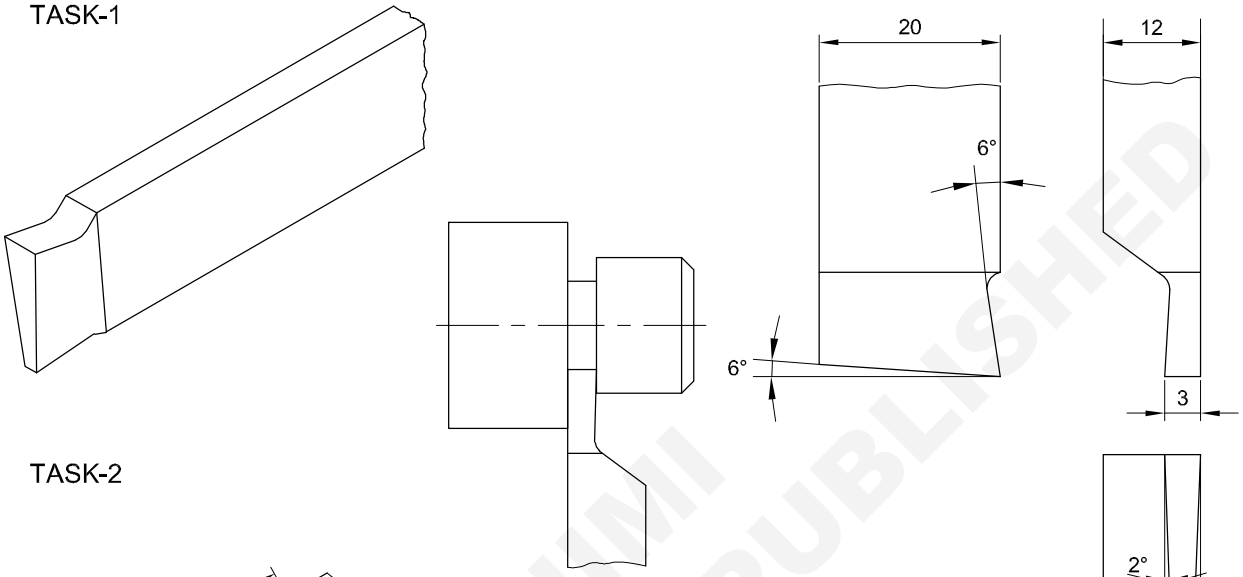
Exercise 1.7.71

Tool grinding for square thread (External & Internal)

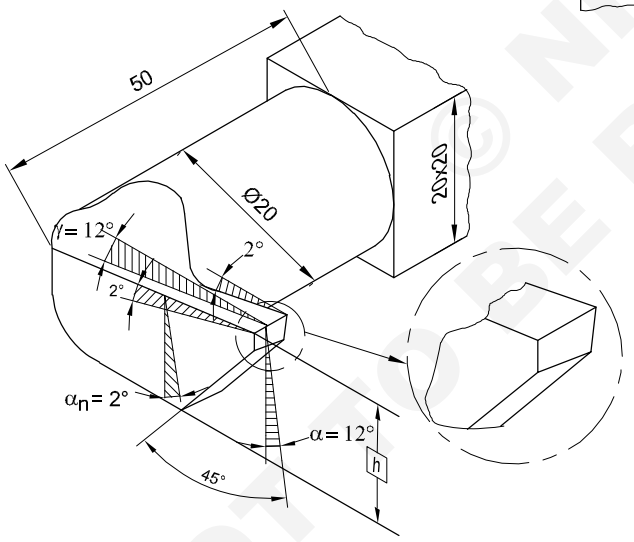
Objectives: At the end of this exercise you shall be able to

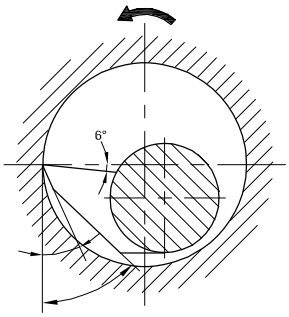
- **grind the angles of a square threading tool on the given blank for external & internal**
- **check the ground angles with a protractor.**

TASK-1



TASK-2





α - FRONT CLEARNACE

α_n - SIDE CLEARNACE

γ - BACK RAKE ANGLE

2° - SIDE RELIEF

45°- SECONDARY CLEARANCE

6° - NOSE ANGLE

1	20 ISF-150	–	Fe 310	–	TASK-2	
1	20 ISF-150	–	Fe 310	–	TASK-1	1.7.71
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE NTS	**TOOL GRINDING FOR SQUARE THREAD (EXTERNAL/INTERNAL)**	TOLERANCE	TIME
		CODE NO. TU20N1771E1	

Job Sequence

- Remove the excess material on the right hand side to the required width and length by using a rough grinding wheel.
- Grind a front clearance angle of 6° and an end cutting edge angle of 6°.
- Check with a protractor and maintain to an accuracy of ±1°.
- Grind a R.H. side relief angle of 1° and a side clearance angle of 2°.
- Grind a top rake angle of 6°.
- Hone the cutting edge with an oilstone.

Remember

- Avoid burning of the tools.
- The cutting edge should be visible during grinding.

Safety Precautions

- Wear safety goggles - use carborundum stick for dressing.
- Check the clearance between the grinding wheel and the tool rest.
- Ensure the wheel and the guards are properly mounted.
- Quench the tool frequently to prevent burning effect.
- Remove the excess material on the right hand side to the required width and length by using a rough grinding wheel.
- Grind a front clearance angle of 12° and secondary clearance angle 45°.
- Check with a protractor and maintain to an accuracy of $\pm$ 1°.
- Grind a RH side relief angle of 2° and a side clearance angle of 2°.
- Grind a top rake angle of 6°.
- Hence the cutting edge with an oil stone.

Skill Sequence

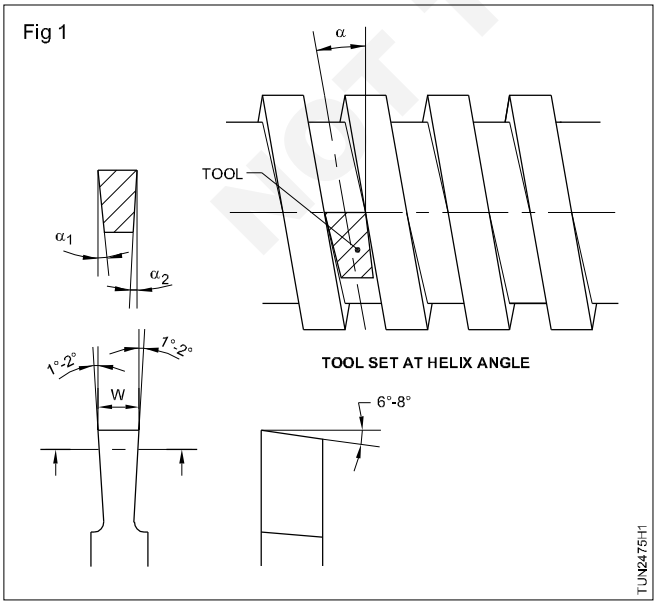
Grind an external, square threading tool

Objective: This shall be able to
- **grind an external square threading tool.**

Determine width and angles required for grinding the external square threading tool.

The side clearance of the square threading tool is of prime importance to prevent the tool from interfering or rubbing against the vertical flank of the thread. As a rule, the forward side clearance angle (a1) is determined by adding 1° to the helix angle of the thread and trailing side clearance angle is obtained by subtracting 1° from the helix angle.(Fig1)

Fig 1



a_1 = 1° + Helix angle of thread

Helix angle = $\tan^{-1}$ x and

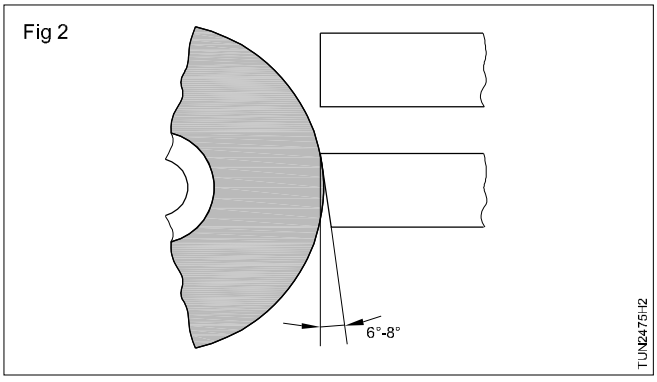
a_2 = Helix angle of the thread - 1°

Where helix angle = $\tan^{-1}$ x $\frac{\text{lead}}{\pi \times \text{outside} - \text{diameter}}$

The width of the nose of the square threading tool should be equal to half of the pitch of the square thread to be cut. W = 0.5 x p

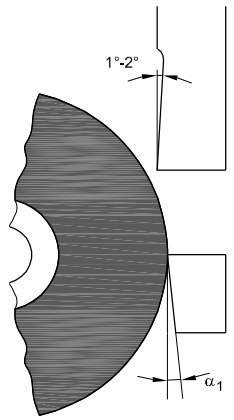
Grind the front flank of the tool to get the front clearance angle 6° to 8°. (Fig 2)

Fig 2



Grind the forward side flank of the tool to obtain side relief angle 1° to 2° and forward side clearance angle a1. (Fig 3)

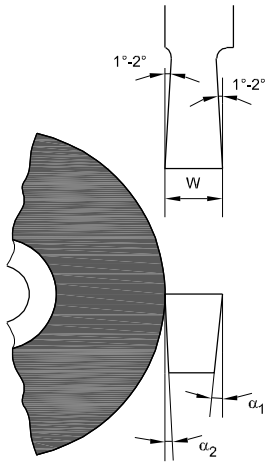
Fig 3



a_1 = a + (1° to 2°)

Grind the trailing side flank of the tool to maintain the side relief angle 1°- 2°, trailing side clearance angle a 2 (a2 = a-1°) and the width W (W=0.5 x p). (Fig 4)

Fig 4



Deburr and check the width of the angles using a vernier caliper and bevel protractor.

Square thread

Objective: This shall help you to
- **cut a square thread.**

Check the diameter of the portion to be threaded as indicated in the drawing.

Chamfer the edge of the job to 2 x 45 degree.

Set up the gearbox to cut the required pitch of thread, and hand of thread.

Set the square threading (roughing) tool in the tool post with its height to the centre height of the lathe.

Set the tool square to the axis of the job with the square thread gauge. (Figs 1 and 2)

Fig 1

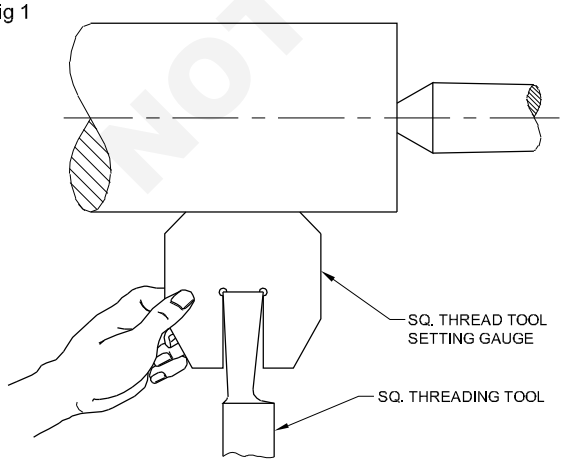
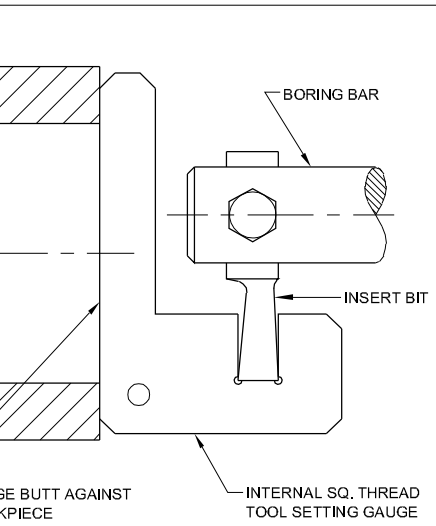


Fig 2



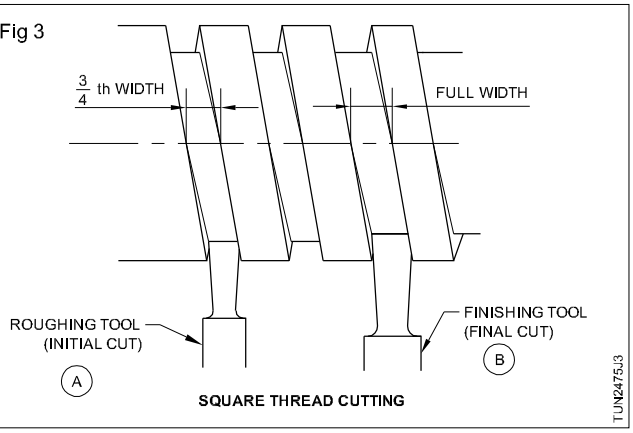
Care is to be taken to prevent overhanging of tool from the holder to avoid chatter.

Set the spindle speed about 1/4th of normal turning.

Cut the square thread, by repeated successive depth of cuts to reach 3/4th width and depth of thread. (Fig 3)

Set the finishing square thread tool for finishing cuts.

Fig 3



SQUARE THREAD CUTTING

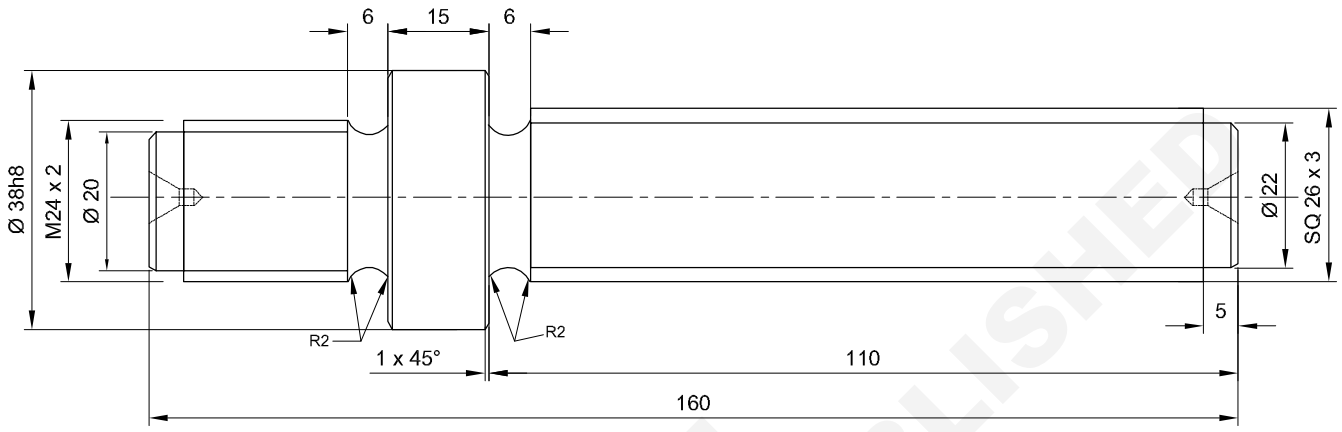
Cut the square thread to full depth and full width by taking successive cuts to complete the required thread form.

Deburr and check the square thread using a square thread gauge.

Exercise 1.7.72

Cutting square thread (External)

Objectives: At the end of this exercise you shall be able to
- **arrange the gears for square threading**
- **cut square thread (external)**



Job Sequence

- Hold the job in a four-jaw chuck, true and face both ends and maintain a total length of 160mm.
- Centre drill both ends.
- Remove the four-jaw chuck & mount a driving plate.
- Insert the headstock centre with the spindle sleeve and the tailstock centre.
- Hold the job in a suitable carrier in between centres.
- **Turn dia.38 h8 to a length of 125mm.**
- Turn ∅ 24 mm to a length of 35 mm.
- Turn ∅ 22 mm to a length of 5 mm.
- Finish radius R2 to a length of 6 mm.
- Finish chamfer 1 x 45° at the end of 20 mm dia.
- Set the threading tool to correct centre height.
- Finish thread cutting M 24 x 2 as per drawing.
- Reverse the job and hold in a suitable carrier with soft metal packing.
- Turn ∅ 26 - 0.08 to a length of 110 mm.
- Turn ∅ 22 mm to a length of 5 mm.
- Chamfer 1 x 45° at the end of ∅ 22 mm.
  Chamfer 1 x 45° at the collar on ∅ 38 h8 on both sides.
- Undercut to core dia. for 6 mm with and R2.
- Set the square threading tool, to correct centre height.
- Cut the thread a length of 99 mm.
- Release the job & deburr

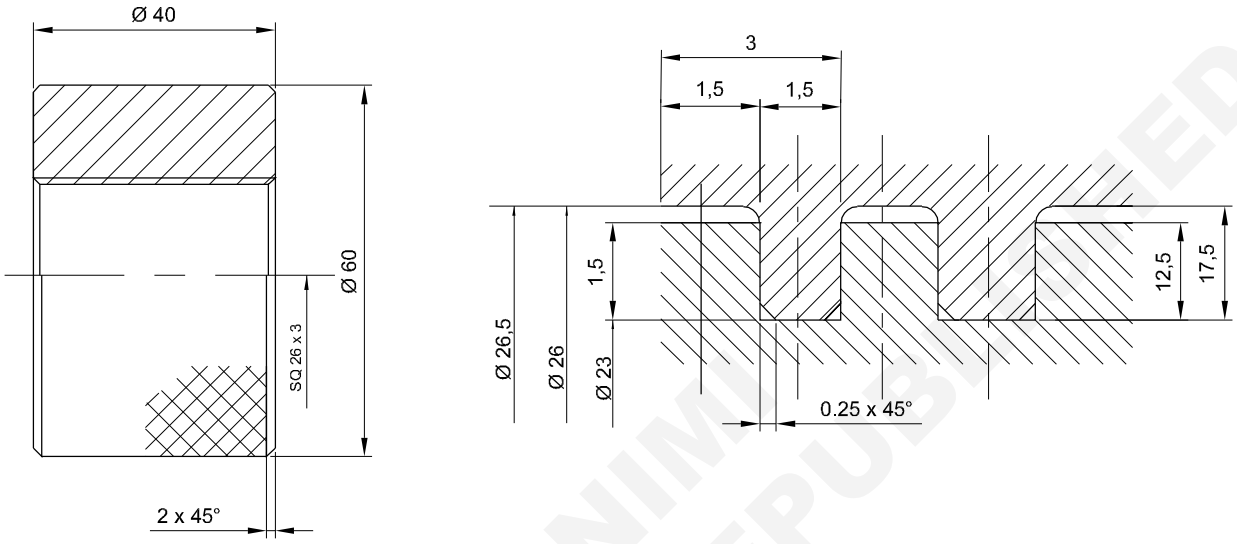
1	Ø40-165	–	Fe 310	–		1.7.72
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1 : 1	CUTTING SQUARE THREAD (EXTERNAL)	TIME
		CODE NO. TU20N1772E1

Exercise:1.7.73

Cutting square thread (Internal)

Objectives: At the end of this exercise you shall be able to
- **grind the internal square tool to required width**
- **cut the internal square thread.**



Job sequence

- Hold the job in a four-jaw chuck, true and face both ends maintaining a total length of 40 mm.
- Drill ∅ 18mm through hole.
- Bore the drilled hole to the size of the core diameter 23 mm.
- Grind the internal square threading tool to correct centre height.
- Set the internal square threading tool to correct centre height.
- Cut the thread length of 40 mm.
- Turn outside ∅ 60 mm to a length of 40 mm.
- Diamond knurl to a length of 40 mm.
- Chamfer 2 x 45° at both ends.

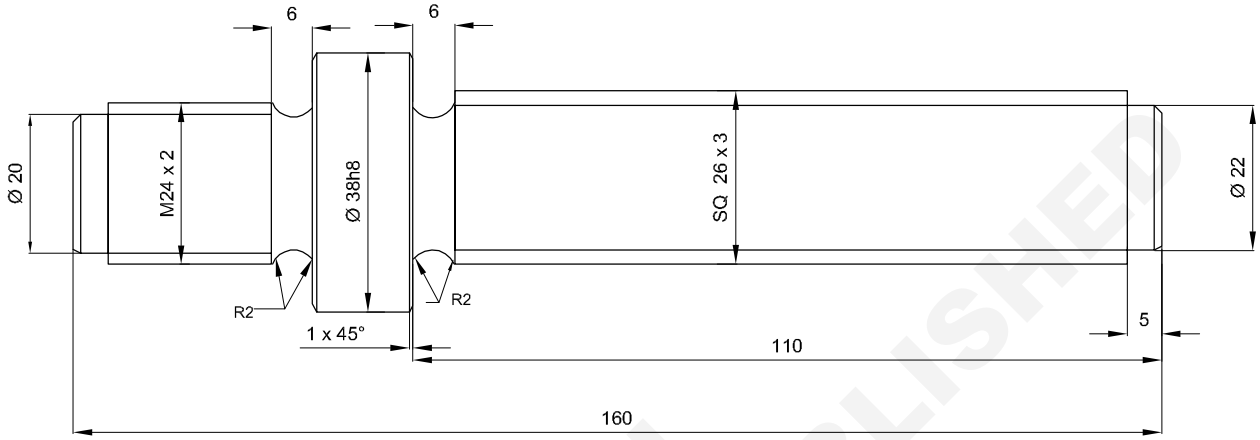
1	Ø 65 - 45 L	–	Fe 310	–	–	73
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

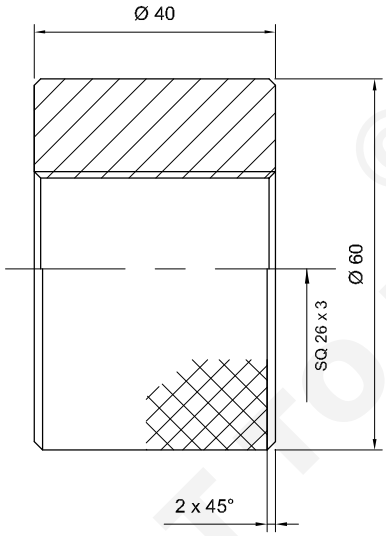
SCALE 1:1	CUTTING SQUARE THREAD (INTERNAL)	DEVIATION ± 0.02	TIME 18 hrs
		CODE NO. TUN2473E1	

Exercise 1.7.74

Fitting of Male & Female square threaded component

Objective: At the end of this exercise you shall be able to
- **fit the Male and Female square threaded components.**





Job sequence

- Clean the Male & Female square threaded job.
- Check thread dimension, pitch and thread profile use vernier caliper.
- Fit the square thread internal component rotate clock wise direction to external square threaded component.

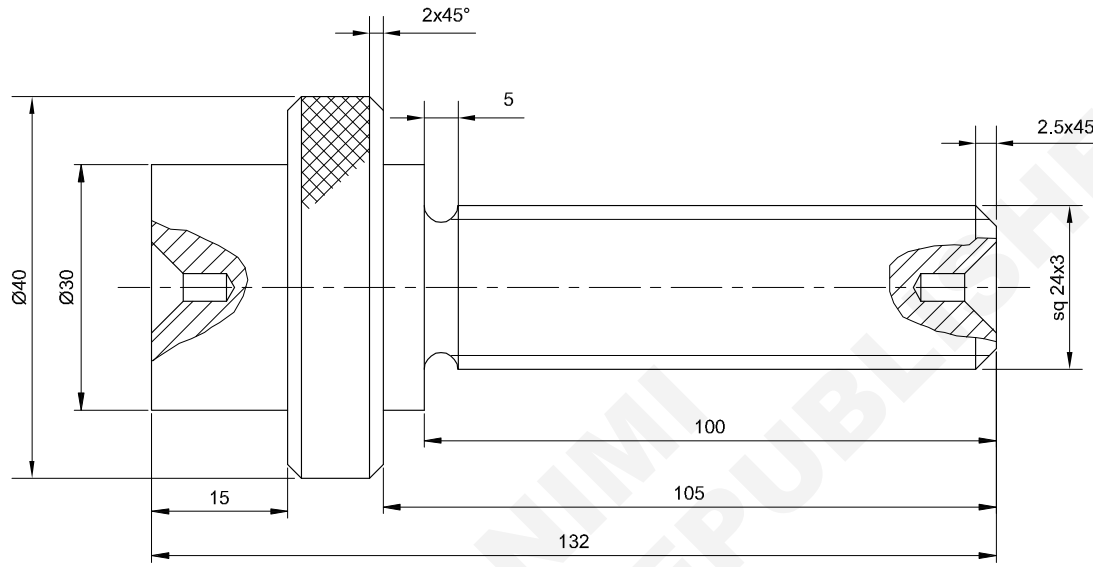
–	–	EX NO.1.7.72 ← EX NO.1.7.73 ←	Fe 310	–	–	1.7.74
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	FITTING OF MALE AND FEMALE SQUARE THREADED COMPONENT	DEVIATION	TIME
		CODE NO. TU20N1774E1	

Make square thread for screw jack (standard)

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

- **turn the job between centres**
- **set the thread cutting tool and cut threads by the plunge cut method**
- **set the knurling tool on the tool post and knurl different grades of knurling on the work**
- **cut radius groove by plunging**
- **cut external threads on work held between centres.**



Job Sequence

- Check the raw material size.
- Hold it in the independent chuck and true it with the surface gauge.
- Set the facing tool and face one end; centre drill the job.
- Reverse and true it in an independent chuck and face the job to 132 mm length and centre drill this end.
- Dismantle the chuck from the lathe spindle and fix the driving plate on the spindle.
- Clamp the job to a straight lathe carrier and hold the job between the live centre and the dead centre. Use grease on the centre before fixing.
- Set the R.H turning tool and turn Ø 39.8 x 27 L and step turn Ø 30 mm for 15 mm length.
- Set the diamond knurling tool and knurl to Ø 40 mm.
- Set the chamfering tool and chamfer 1 x 45° at knurled diameter.
- Hold the job on Ø 30 mm with carrier and prepare for turning in between centres.
- Set the R.H turning tool and turn Ø 30 mm for 45mm length and step turn Ø 24 mm for 100 mm length.
- Set the grooving tool and form a groove to a depth of core dia. minus 0.2 mm for 5 mm width.
- Set the chamfering tool and chamfer 2 x 45° on the knurled diameter.
- Also chamfer the end 1.5 x 45° on Ø 24 mm.
- Set the thread-cutting tool and set the change gear train to cut Sq 24x3 thread.
- Cut thread by the plunge cut method giving successive cuts.
- Check the workpiece with a precision measuring instrument.

While knurling, select a slow spindle speed.

NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
1	Ø45 - 135	–	Fe 310	–	–	1.7.75

SCALE 2 : 1	MAKE SQUARE THREAD FOR SCREW JACK	TOLERANCE ±0.06 Unless otherwise stated	TIME
		CODE NO. TU20N1775E1	

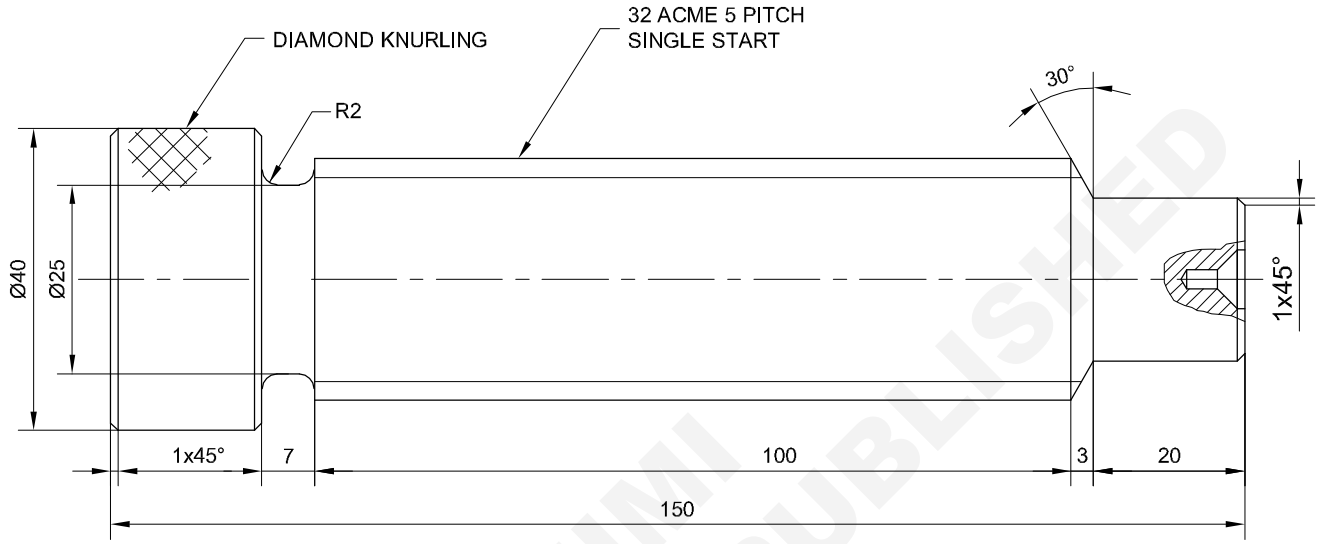
Exercise 1.7.76

ACME thread cutting (Male & Female) and tool grinding

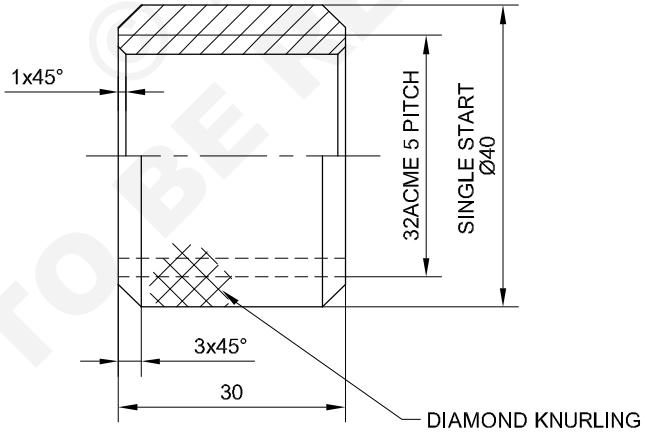
Objective: At the end of this exercise you shall be able to

- **cut internal and external single start ACME thread and match.**

TASK-1



TASK-2



1	Ø45 - 35L	–	Fe 310 - O	–	TASK-2	
1	Ø45 - 160L	–	Fe 310 - O	–	TASK-1	1.7.76
NO.OFF	STOCK SIZE	SEMI PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	**ACME THREAD CUTTING & TOOL GRINDING (MALE & FEMALE)**	DEVIATIONS IS:2102 (M)	TIME
		CODE NO. TU20N1776E1	

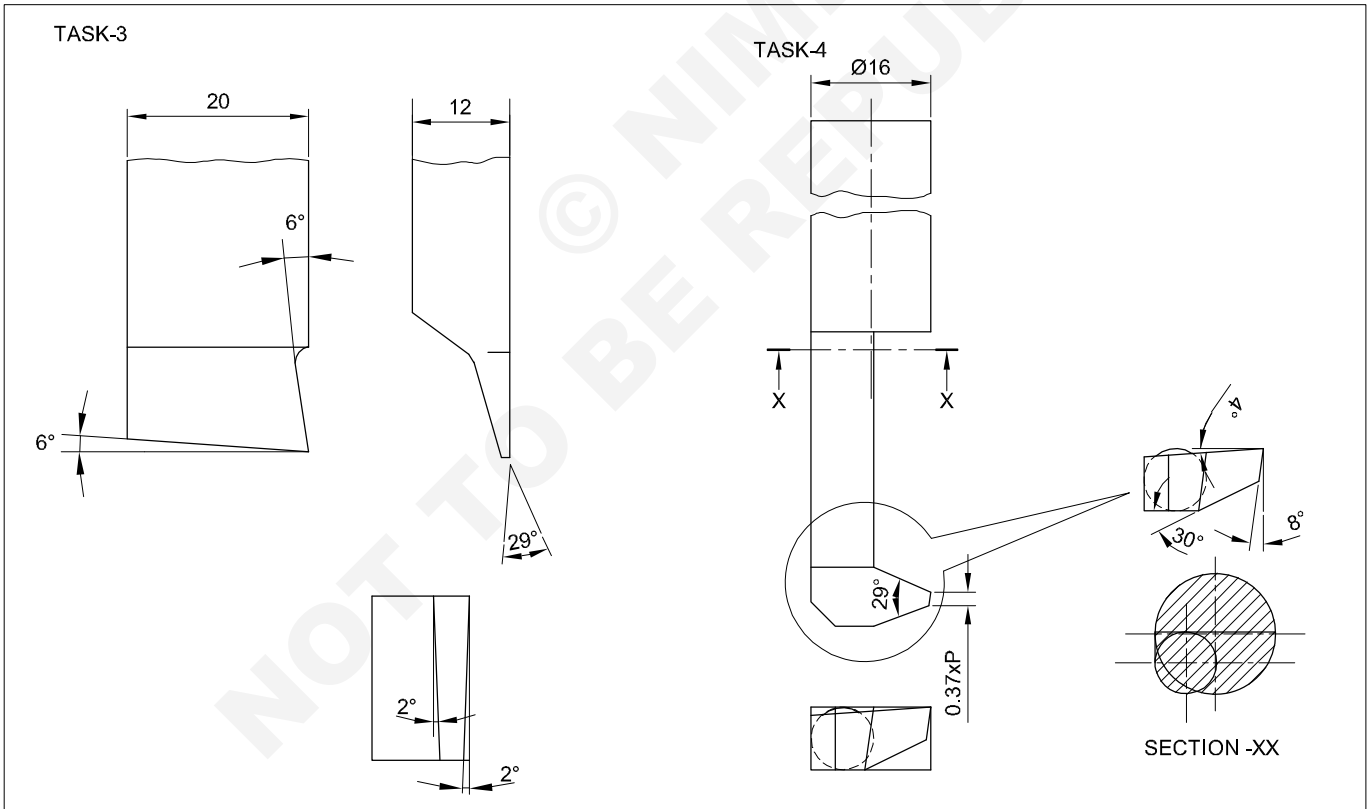
Job Sequence

- Hold the job in four jaw independent chuck & true the job.
- Turn Ø40 mm for possible length.
- Knurl on Ø40 mm and chamfer the edge 1 x 45.
- Reverse and hold on knurled dia & true the job.
- Finish 150 mm total length.
- Centre drill the end.
- Hold the job between the chuck and the centre.
- Finish turn Ø32+1 mm for 130 mm.
- Step turn to 25mm for a length of 20 mm.
- Form the radius groove for 7mm width and maintain Ø25mm.
- Chamfer the end to 1 x 45° chamfer threaded end to 3 x 30°
- Arrange the gear train for 5 mm pitch thread.
- Hold the ACME thread cutting tool in the tool post to centre height.
- Cut external ACME thread.
- Check the thread formation.

ACME Thread cutting (Female)

- Hold the job face the ends to length, turn Ø 40mm and chamfer the ends.
- Drill and bore the hole to the core dia. of the thread.
- Cut internal ACME threads and match.
- Hold the assembled male and female jobs between the chuck and the centre.
- Chamfer 3 x 45° at both the ends of the nut.
- Knurl on Ø 40mm.

ACME Tool grinding



1	Ø16 x 100	–	Fe 310-O	–	TASK-4	
1	20 ISF 12-150	–	Fe 310-O	–	TASK-3	1.7.76
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	ACME THREAD CUTTING TOOL GRINDING	TOLERANCE	TIME
		CODE NO. TU20N1776E2	

Job Sequence

- Remove the excess material on the right hand side to the required width and length by using a rough grinding wheel.
- Grind a front clearance angle 6° and an end cutting edge angle of 6°.
- Check with a protractor and maintain to an accuracy of ±1°.
- Grind R.H. side relief angle of 1° and a side clearance angle of 2°.
- Grind a LH side relief angle of 1° and a side clearance angle of 2°.
- Grind a top rake angle of 6°.
- Grind a form angle of 29°.
- Hone the cutting edge with an oil stone.

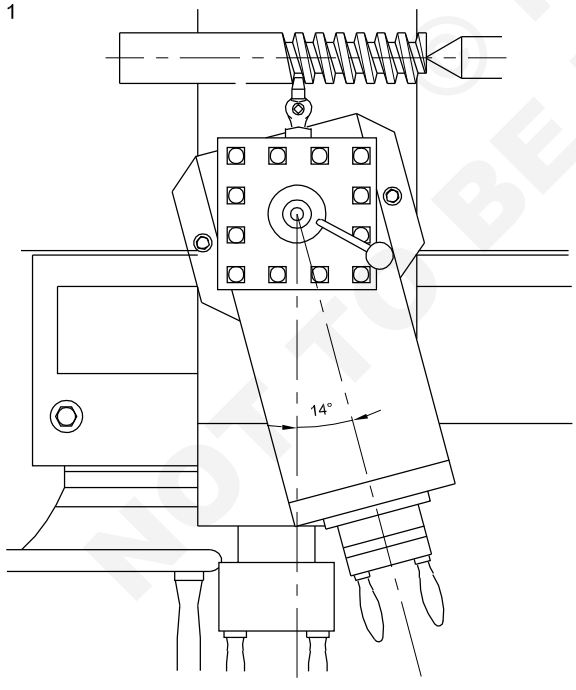
Skill Sequence

Cutting ACME thread by tilting the compound rest

Objective: This shall help you to
- **cutting ACME thread by tilting the compound rest method.**

The compound rest is used when cutting external acme thread. The workpiece should be properly mounted and finish turned to the major thread diameter. The tool should be correctly set and the compound rest swivelled to the right at an angle of 14° to the normal as shown in the (Fig.1). If you were to cut a left hand thread you would swivel the compound rest to the left at the same angle.

Fig 1

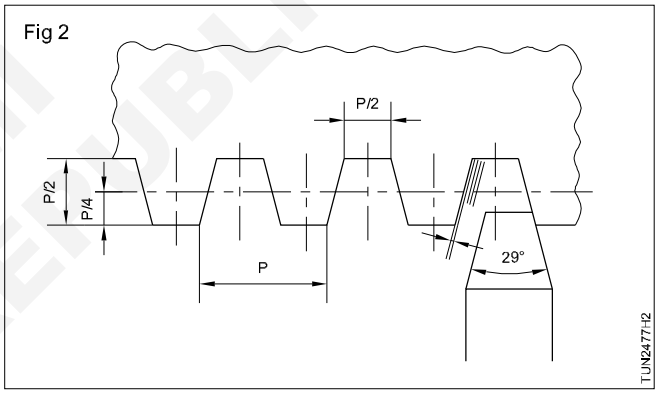


COMPOUND REST SET AT 14° TO THE RIGHT TO CUT A 60° INCLUDED ANGLE RIGHT HAND THREAD

TUN2477H1

The depth of cut is controlled by the compound rest feed screw. The offset angle of 14° makes the tool feed into the work at an angle. Because of the offset angle, most of the stock is removed by the left side of the tool. (Fig 2)

Fig 2



TUN2477H2

The chip also curls out of the way to the left. The right side of the threading tool shaves the newly cut thread smoothly.

The following is the procedural sequence in cutting acme thread by tilting the compound rest method.

Grind acme thread tool for the required thread angle and pitch. (29° - 4 mm pitch)

Ensure that the thread angle ground is symmetrical with respect to the axis of the tool

Arrange the gear train and set the quick change the gearbox levers for the required pitch and the direction of the thread.

Clamp the tool in the tool post to the centre height and align - with the centre gauge with minimum overhang.

Ensure that the tool is set to the centre height.

Check the diameter of the workpiece to be threaded by referring to the working drawing.

To provide thread clearance, it a good practice to turn the diameter of the workpiece about 0.05 mm undersize

Set the spindle speed to about 1/4th of the normal turning speed.

Set the compound rest to 1° less than half of the desired thread angle.

In the case of acme thread angle, the compound rest should be at 14° to the right for a right hand thread, or 14° to the left for a left hand thread.

The angle to which the compound rest is set affects the cutting action of the cutting tool by producing a shaving action on the trailing edge of the tool. This produces a cleaner cut

To prevent chaffer while thread cutting ensure that the overhang of tool, does not exceed more than 12.

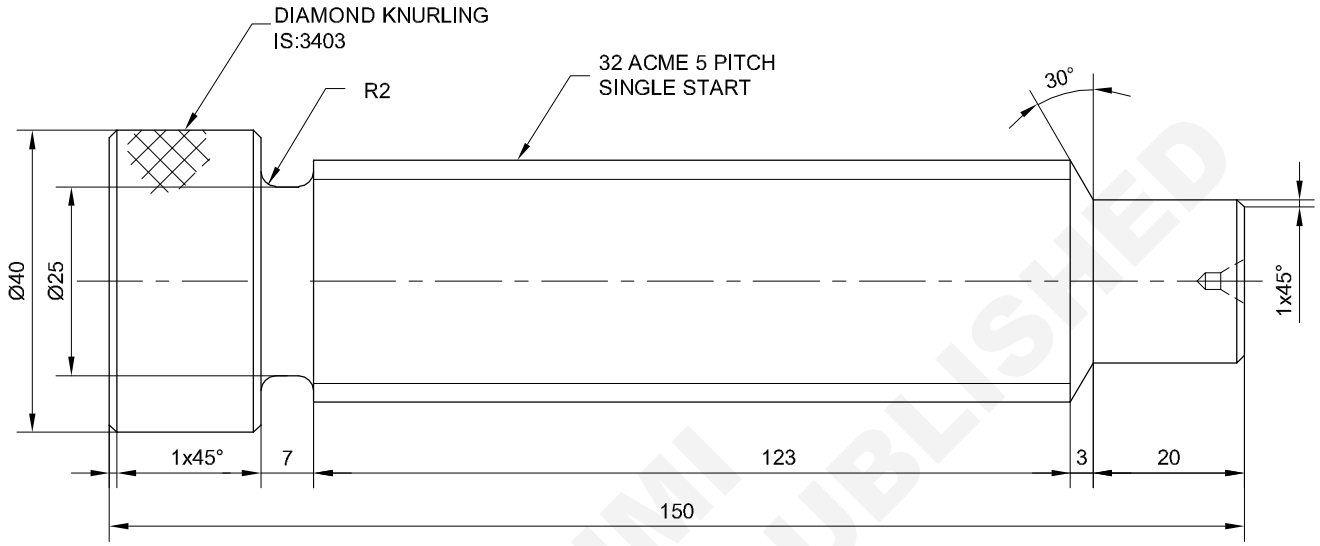
Set the cutting tool square to the axis of the work.

Mark out the exact length of the workpiece to be threaded.

Keep the tool clearly off from the work and engage the half nut. Withdraw the tool at the end of the cut by the cross-slide hand wheel and reverse the machine to bring the tool to the starting position. Rotate the cross-slide hand wheel in the clockwise direction for the zero position. Give depth of cut by the compound slide. Repeat the above sequences until the full calculated depth is given and the threads are formed.

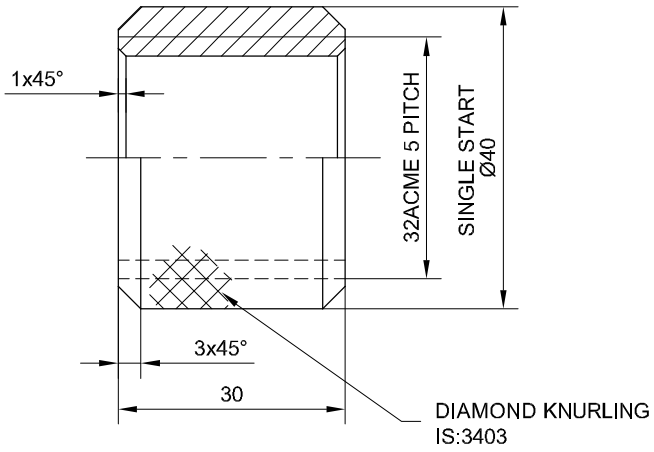
Fitting Male and Female threaded component

Objectives: At the end of this exercise you shall be able to
- **assemble the ACME thread**
- **inspect the assembly.**



Job Sequence

- Clean the external and internal ACME threaded job.
- Check thread dimension, pitch and thread profile.
- Hold the male job in vertical position using bench vice and packing piece.
- Tighten the female threaded component by rotating clock wise direction on to the male threaded component.

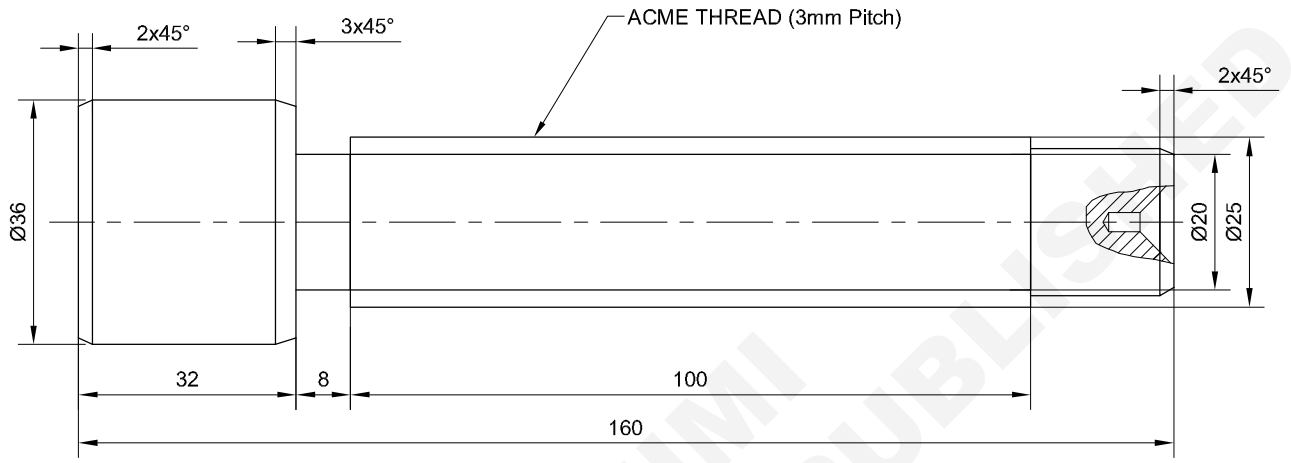


1	–	EX NO.1.7.76 ←		–	TASK-2	
1	–	EX NO.1.7.76 ←		–	TASK-1	1.7.77
NO.OFF	STOCK SIZE	SEMI PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
	FITTING OF ACME THREADED COMPONENTS					TIME
					CODE NO. TU20N1777E1	

Exercise 1.7.78

Cut ACME thread over 25 mm dia meter rod and with length of 100 mm

Objectives: At the end of this exercise you shall be able to
- **set the job in between chuck and centre**
- **set the change gear and the gear box lever position**
- **cut external ACME thread.**



Job Sequence

- Hold the job in four jaw independent chuck and true.
- Set the tool to the correct centre height.
- Face one end of the job.
- Turn ∅ 36 mm for possible length.
- Chamfer the end 2 x 45°.
- Reverse and hold the job.
- Finish to a total length of 160 mm.
- Centre drill the end.
- Hold the job between the chuck and the centre.
- Turn ∅ 25 mm to a length of 128 mm.
- Turn step dia 20mm to a length of 20mm.
- Form an undercut to a width 8 mm between the head and threaded portion of the job.
- Chamfer 2 x 45° and 3 x 45° as shown in drawing.
- Hold the ACME threading tool in the tool post to its correct position.
- Cut external ACME thread.
- Check the thread formation.

1	Ø40-170	–	Fe 310	–	–	1.7.78
NO.OFF	STOCK SIZE	SEMI PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

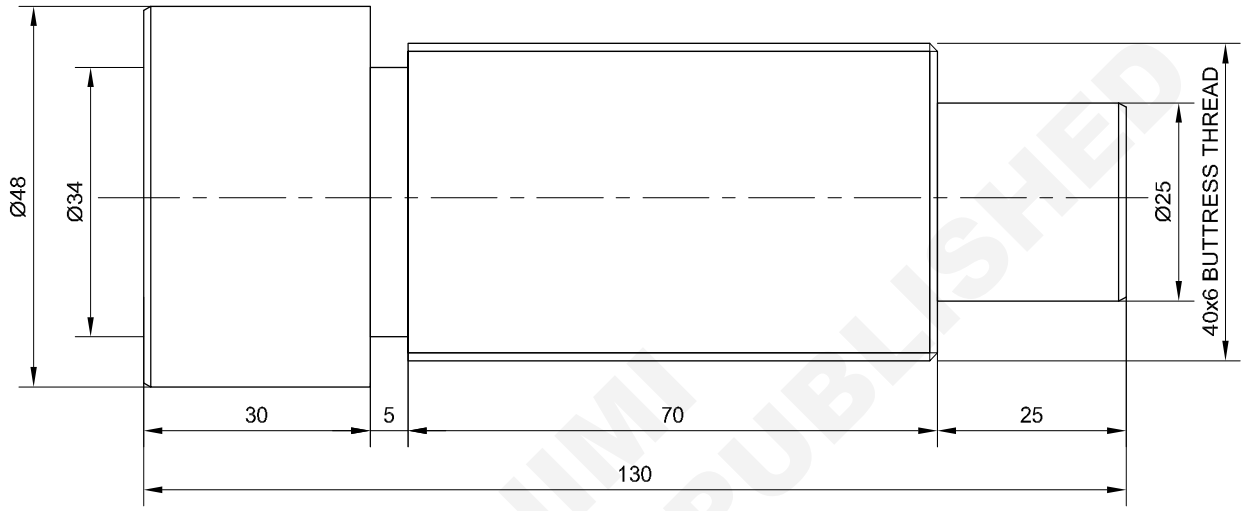
	CUT ACME THREAD OVER 25 mm DIA METER ROD	DEVIATIONS ±0.02 mm	TIME
		CODE NO. TU20N1778E1	

Buttress Thread cutting (Male & Female) & Tool grinding

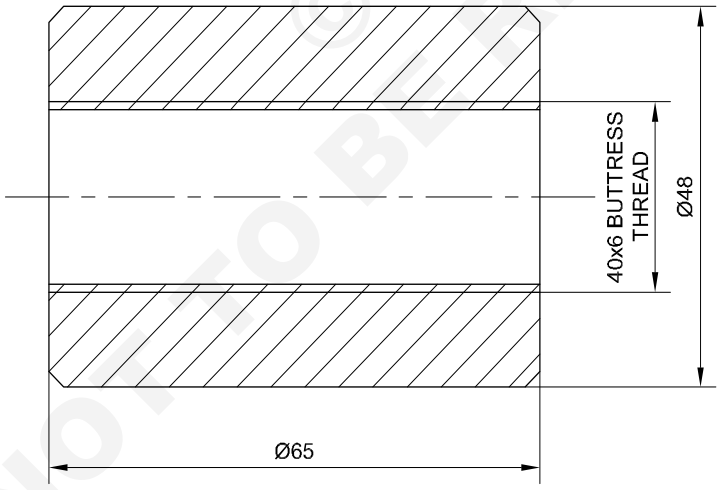
Objectives: At the end of this exercise you shall be able to

- **set buttress threading tool**
- **cut external & internal buttress threads**
- **fitting Male & Female threading parts.**

TASK-1



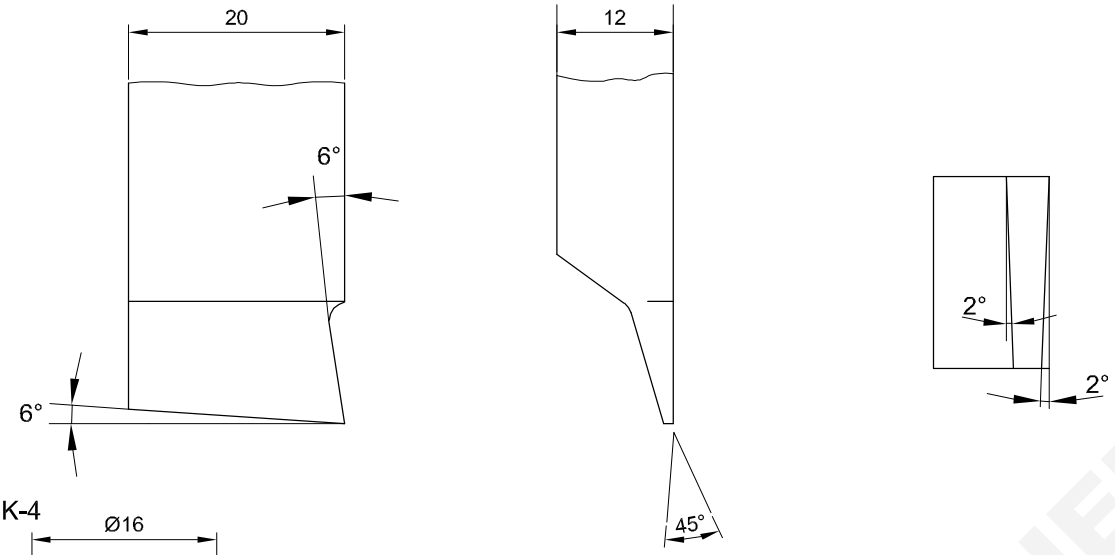
TASK-2



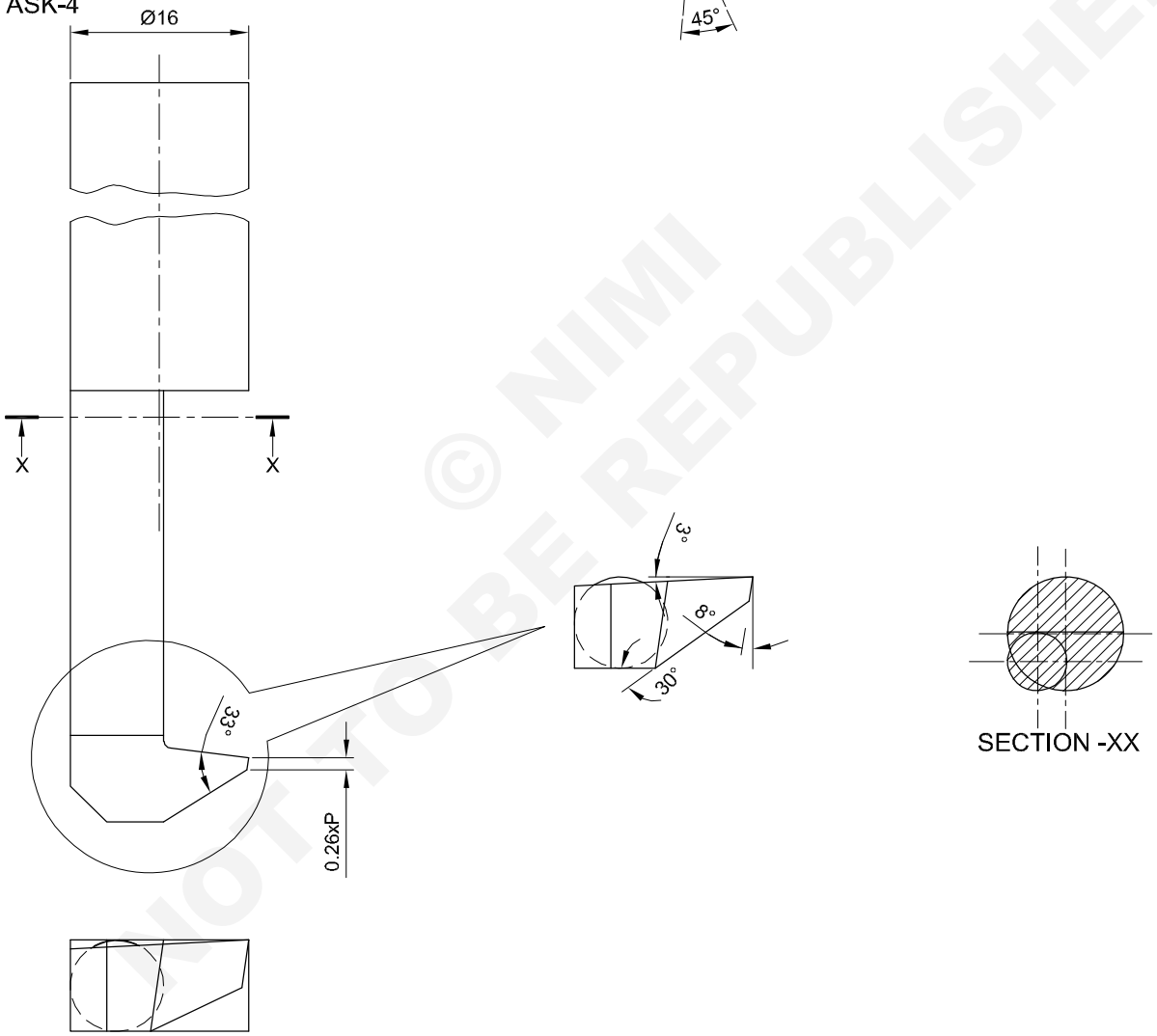
NO.OFF	STOCK SIZE	SEMI PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
1	Ø16-100L	–	Forged H. S. S Tool	–	TASK-4	
1	20ISF 12-250L	–	Fe 310-O	–	TASK-3	
1	Ø50-70L	–	Fe 310-O	–	TASK-2	
1	Ø50-140	–	Fe 310-O	–	TASK-1	80

SCALE 1:1	BUTTRESS THREAD CUTTING & TOOL GRINDING (MALE & FEMALE)	TOLERANCE IS:2102(M)	TIME
		CODE NO. TU20N1779E1	

TASK-3



TASK-4



–	–	–	–	–	–	79
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	**BUTTRESS THREAD CUTTING TOOL GRINDING (EXTERNAL & INTERNAL)**	TOLERANCE	TIME
		CODE NO. TU20N1779E2	

Job Sequence

TASK 1: **Making buttress Male component**

- Hold and true the job in a four jaw chuck.
- Turn Ø48mm for possible length.
- Again turn ∅40mm up to a length of 95mm from front end of the job.
- Make a step of Ø25 for a length of 25 mm.
- By using parting tool make the Ø34mm x 5mm step.
- Make use of buttress thread cutting (external) tool, cut the required thread to a length of 70 mm.
- Check the thread for its measurement and accuracy.

It is essential to cut a normal thread at sufficient depth by using a normal external threading tool before using the buttress thread cutting tool.

— — — — — — — —

TASK 2: **Making buttress Female component**

- Hold the job, face the ends to length and turn Ø48 mm, chamfer the ends.
- Drill 14 mm Ø and bore it up to 32.3 mm to a length of 65mm or more.
- Fix the internal buttress thread cutting tool and cut to the required thread after setting the change gear train.
- Check the accuracy of the thread.

Use an internal thread cutting tool and cut a normal internal thread at sufficient length and depth before using buttress thread cutting tool to cut the final buttress internal thread.

— — — — — — — —

TASK 3: **Grinding for buttress thread tool (Male)**

- Remove the excess material on the right hand side to the required width and length by using a rough grinding wheel.
- Grind a front clearance angle of 6° and end cutting edge angle of 6°.
- Check with a protractor and maintain an accuracy of ±1°.
- Grind RH side relief angle of 1° and a side clearance angle of 2°.
- Grind L.H side relief angle of 1° and a side clearance angle of 2°.
- Grind to a top rake angle of 6° and form angle of 45°.

— — — — — — — —

TASK 4: **Grinding for buttress thread (Female)**

- Prepare the pedestal grinder for grinding a internal buttress threading tool.
- Grind bottom clearance angle of 30° - 45º and end cutting angle of 10°.
- Grind a side clearance angle of 8° and a side cutting-edge angle of 20°.
- Grind a top rake angle of 10° and a side rake angle of 4°.
- Maintain a nose radius of 0.3 to 0.5 mm.
- Deburr with an oilstone and check the tool profile with a tool angle gauge/protractor.
- Grind the profile as per the drawing.

Points to Remember

- Avoid burning of tools.
- Make sure the cutting edge is visible/always, while grinding.
- Make use of the entire width of the grinding wheel i.e. don't grind in one particular place.

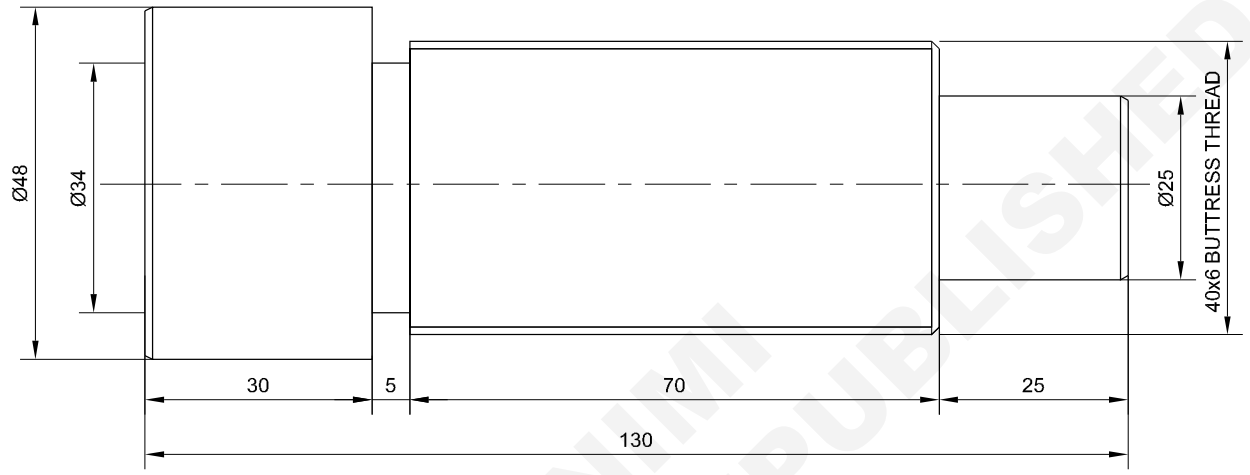
Grind a secondary clearance angle of 16° if necessary.

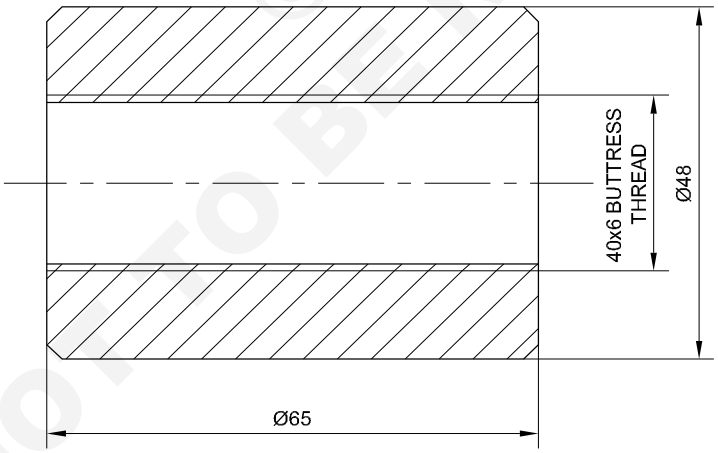
— — — — — — — —

Exercise 1.7.80

Fitting of Male & Female threaded components

Objective: At the end of this exercise you shall be able to
- **assemble buttress threaded component**





Job Sequence

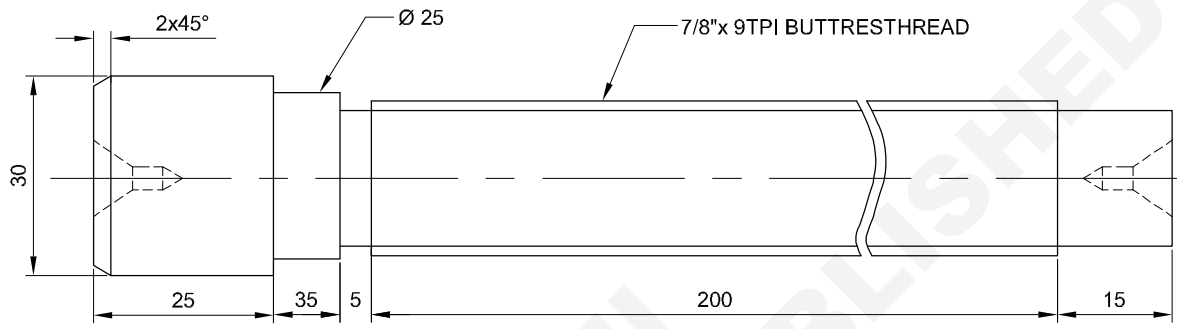
- Clean the external and internal buttress threaded job.
- Check thread dimension, pitch and thread profile.
- Hold the male threaded job in vertical position using bench vice and packing piece.
- Tighten match the male threaded component rotate clockwise direction to the female buttress threaded component.

–	–	–	Ex.No. 1.7.79 ←	–	–	81
NO.OFF	STOCK SIZE	SEMI PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
	FITTING OF MALE AND FEMALE THREADED COMPONENTS				TIME 2 hrs	
					CODE NO. TUN2481E1	

Exercise 1.7.81

Make carpentry vice lead screw

Objectives: At the end of this exercise you shall be able to
- **turn the component as per drawing**
- **to make buttress thread on the component.**



Job sequence

- Check the raw material size.
- Hold the job in a 4 jaw chuck and true it.
- Face one end and centre drill the job.
- Reverse the job and face the other end to a length of 280 mm and centre drill it.
- Hold the job in between centre.
- Turn ∅ 30 mm to a maximum possible length.
- Chamfer the end 2 x 45°.
- Reverse the job and turn the step ∅ 25 mm for 255 mm length.
- Turn the step ∅ 7/8” or 22.2 mm for a length of 215 mm.
- Turn the step ∅ 18 mm for 15 mm length.
- Set the undercut tool of 5 mm width and make under cutting to the given depth as per the drawing.
- Set the threading tool of 45° and 90° to the correct position.
- Set the machine to cut 9 TPI thread.
- Cut the 9TPI buttress thread.
- Deburr the job and check the dimensions.

1	32 x 290-1	–	Fe 310	–	–	1.7.81
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
	CARPENTARY VICE LEAD SCREW					TIME
					CODE NO. TU20N1781	

Make job using different lathe accessories (Driving plate, steady rest, Dog carrier & Different centres)

Objectives: At the end of this exercise you shall be able to
- **set the job in between centres using driving plate**
- **set the steady rest to support to lengthy job.**

TASK-1

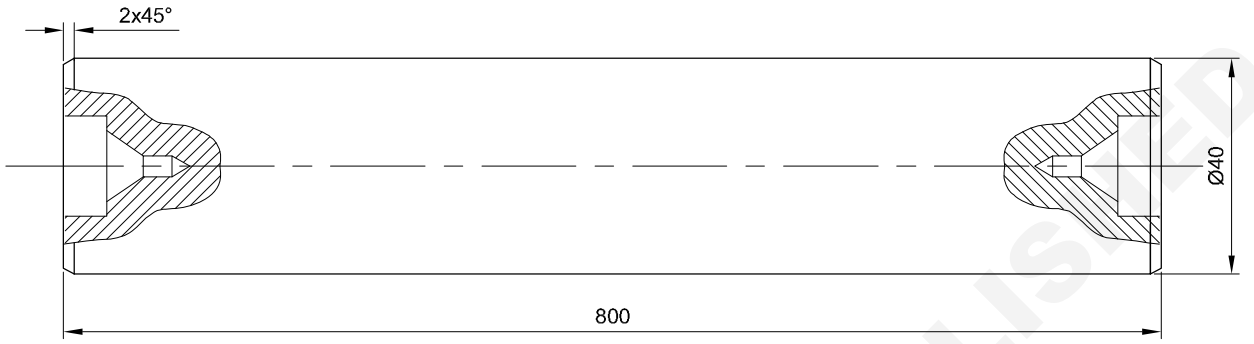
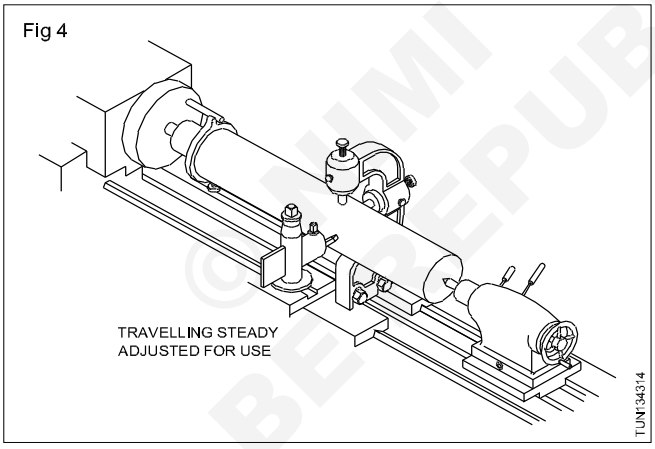


Fig 4



Job Sequence

- Check the raw material size.
- Hold the job outside Face end centre drill on face.
- Reverse the job repeal same, by correcting total length.
- Dismantle the check from lane spindle and fix driving plate on spindle.
- Mount live centre & deal centre.
- Attach a follower steady on saddle.
- Hold the work in between centres by using a suitable carrier.
- Support the job by follower steady. Apply greak on the touching pads of steady.
- Check the alignment between two centre by giving trial cut.
- Turn a40 mm in maximum possible length.
- Chamfer the end 2x 45°.
- Reverse the job.
- Turn 40 mm in remaining length.
- Chamfer the end 2x 45°.
- Reverse the job.
- Turn 40 mm in remaining length.
- Chamfer the end 2x 45°
- Check the dimensions as per drawing.

2	IS Ø 45 x 810	–	Fe 310	–	–	1.8.82
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

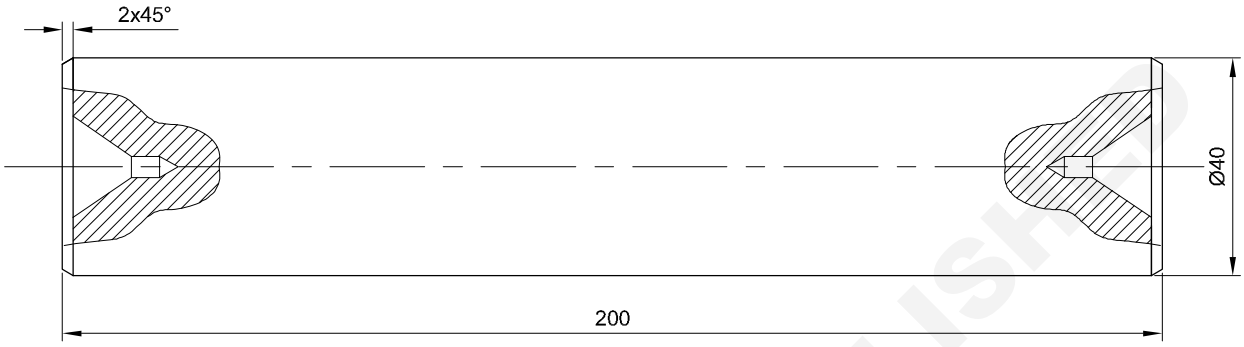
MAKE A JOB USING DIFFERENT LATHE ACCESSORIES
(VIZ .DRIVING PLATE , STEADY REST, DOG CARRIER AND CENTRES)

TIME

CODE NO. TU20N1882E1

Make test mandrel

Objectives: At the end of this exercise you shall be able to
- **set up the job in between centres, using straight tail carrier**
- **turn the job to the required accuracy.**



Job Sequence

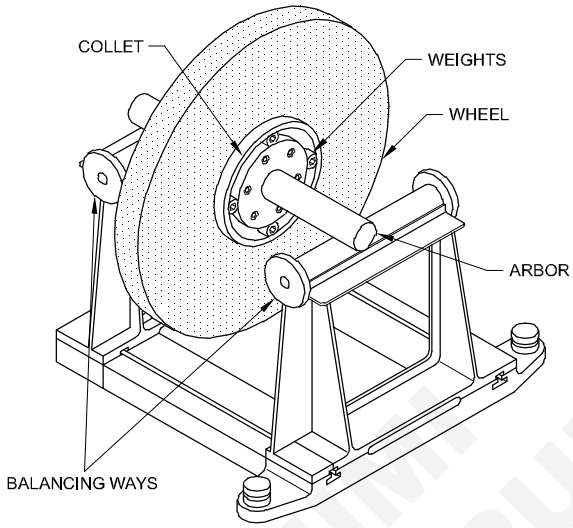
- Check the raw material size.
- Hold it in the independent chuck and true it with the surface gauge.
- Set the facing tool and face one end, centre drill the job and counter bore ∅ 20mm to a 5 mm depth and centre drill the job again as per drawing.
- Reverse and true it an independent chuck and face the job maintain total length 200mm and centre drill the job.
- Counter bore ∅ 20mm to 5 mm depth and re-centre drill the job.
- Dismantle the chuck from the lathe spindle and fix the driving plate on the spindle.
- Mount the live centre and dead centre.
- Check the lathe alignment of between two centres.
- Hold the job in between centres with the help of a straight tail carrier, use grease on the centre before fixing.
- Turn the job with an in feed of 1 mm to its max length.
- Check the diameter at both ends to ensure cylindricity of the job if necessary re - align the job.
- Turn the component again going another 1 mm feed second time reducing to ∅ 41 mm.
- Finish turn ∅ 40 mm to its maximum length.
- Chamfer 2 x 45°.
- Reverse and hold the job in between centre.
- Turn ∅ 40 mm to the remaining length of the job.
- Chamfer 2 x 45°.
- Check the dimension as per drawing.

1	Ø 45x205-1	–	Fe 310	–	–	1.8.83
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
	MAKE TEST MANDRAL					TIME 15 hrs
					CODE NO.	TU20N1883E1

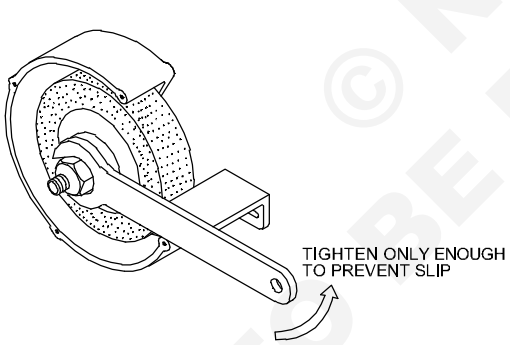
Balancing, mounting, dressing of grinding wheel (pedestal)

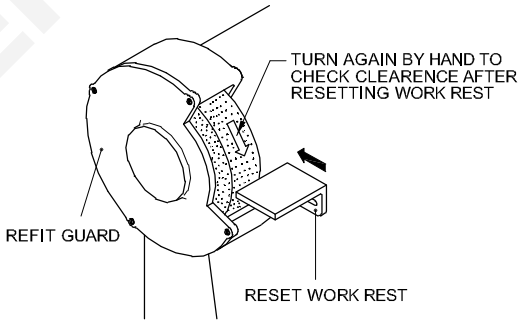
Objectives: At the end of this exercise you shall be able to
- **determine balancing of grinding wheel**
- **adjust the clearance between tool rest and grinding wheel**
- **learn the use of wheel dresser and types.**

TASK-1

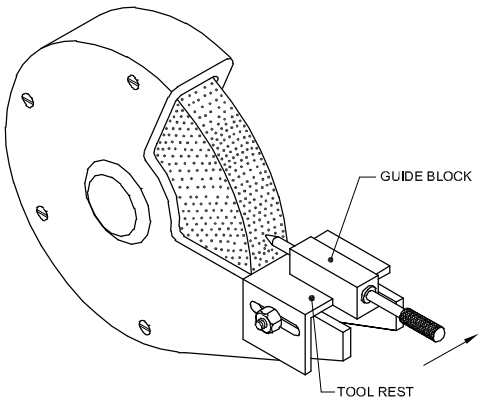


TASK-2





TASK-3



TU20N1884E1

Job Sequence

TASK 1: **Balancing grinding wheel**

- Check grinding wheel for cracks by light tapping.
- Unclamp balance weight of grinding wheel.
- Prepare the balancing unit.
- Clean the bore of the unit and the balancing mandrel.
- Mount the wheel assembly on the mandrel.
- Fix the protection guard.
- Place the wheel to be balanced on the top of the protection guards and lower gently on to the balancing stand.
- Rotate the grinding wheel so that it can rotate by itself due to its momentum & rests at a heavy point.
- Mark the lowest point on the wheel.
- Turn diametrically opposite point, add balancing weight, moving to lighter side.
- Repeat the above until the assembly remains static in any position.

— — — — — — — —

TASK 2: **Assembling grinding wheel**

- Clean the machine and remove any loose metal or abrasive particles.
- Loosen the work rest clamp and remove the rest.
- Remove the outer plate of the wheel guard.
- Check the nut direction before loosening.
- Remove the nut and the outer flange.
- Remove any paper, washer that has adhered to the flange.
- Clean the flange, spindle, thread and inside the guard.
- Push the wheel carefully against the driving flange and place the outer flange in position.
- Screw up the clamping nut by hand, firmly enough to hold the wheel in position.
- Turn the spindle and wheel a complete revolution.
- Ensure that the wheel is running true and it is clear of the inner part of the guard.
- Tighten the nut sufficently enough so that the flanges will drive the wheel without slipping, & held securely.
- Refit the outer plate of the wheel guard.
- Reset the work rest as close to the wheel face as possible.
- Tighten the work reset clamp firmly.
- Rotate the wheel by hand to ensure that the wheel runs freely.

— — — — — — — —

TASK 3: **Dressing the grinding wheel**

- Select the diamond dresser and holder.
- Insert the diamond dresser in the holder.
- Mount the holder on the work rest.
- Adjust the dresser slowly bring it in contact with the wheel face.
- Move the dresser across the wheel face for dressing and truing.
- The finish of truing obtained depends on the rate at which the dresser is moved across the face.

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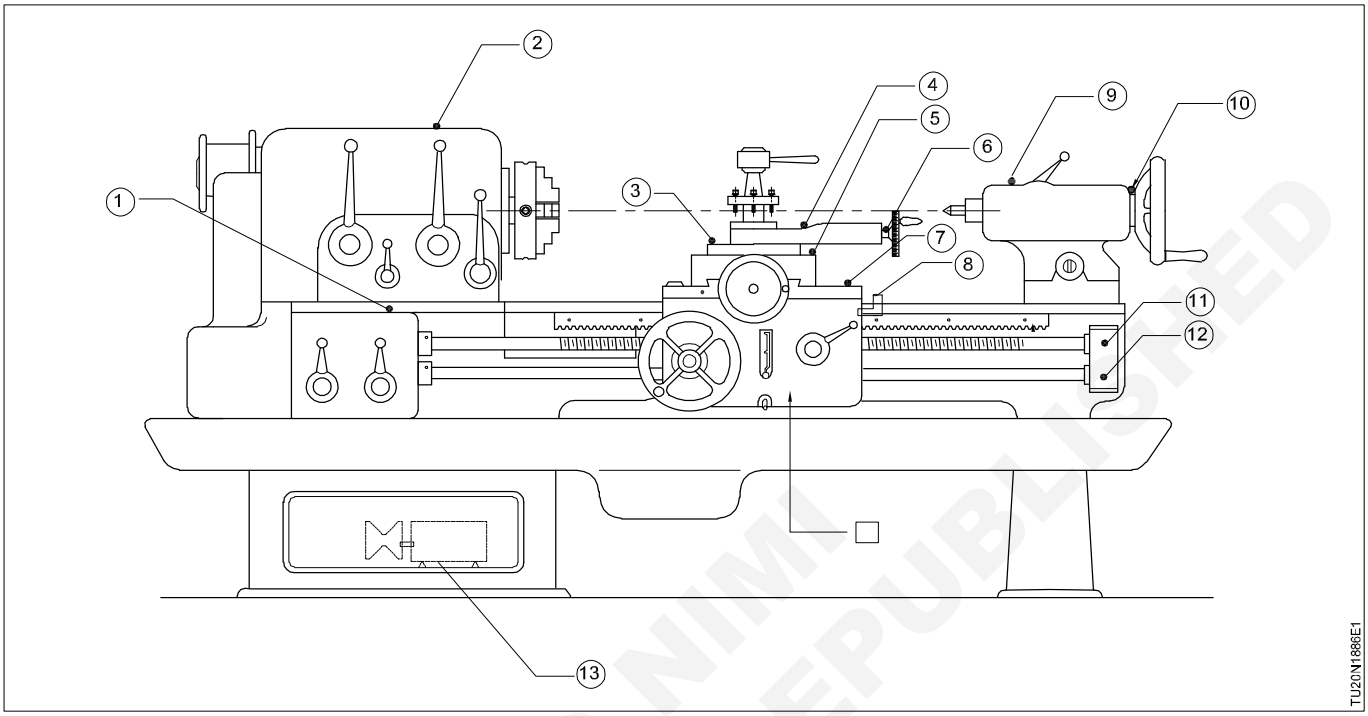
Periodical lubrication procedure on lathe

Objectives: At the end of this exercise you shall be able to
- **check the oil level in gear box of machine**
- **carryout lubrication as per the chart.**



Note

Instructor demo the lubrication points using different grade of oils

General purpose machinery oils - Lubrex 68

Spindle oils - Servospin 12

Gear oils - Servomesh 68

- Identify the daily lubrication points of the lathe machine
- **Record in table 1**

TABLE - 1

Indicate Number and part name	Specification of oil
Number - 3 Crossslide slideway	

- Identify the monthly lubrication filling of the lathe machine
- **Record in table 2**

TABLE - 2

Indicate Number & Part Name			Specification of oil

- Identify the half yearly lubrication filling in a lathe machine
- **Record in table 3**

TABLE - 3

Indicate Number & Part Name			Specification of oil

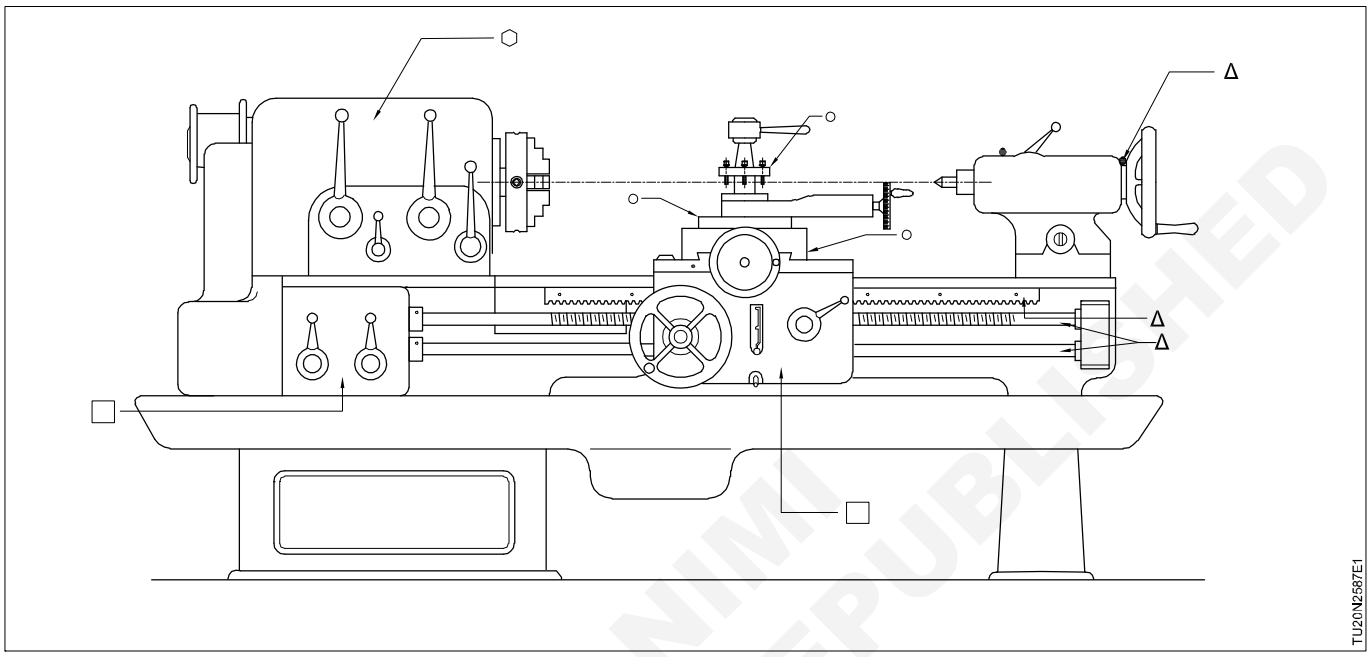
- Identify the annual lubrication filling in a lathe machine
- **Record in table 4**

TABLE - 4

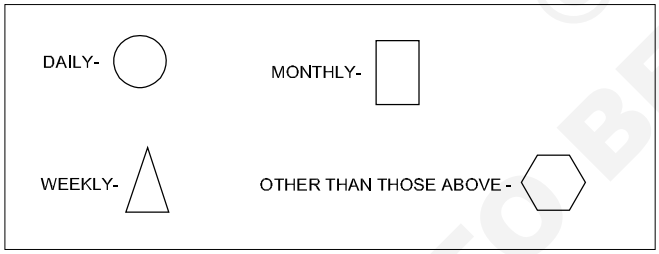
Indicate Number & Part Name			Specification of oil

Preventive maintenance of lathe

Objectives: At the end of this exercise you shall be able to
- **check the machine condition**
- **inspect the oil level of gear box**
- **understand importance of preventive maintenance.**



Maintenance Symbol



Preventive maintenance calls for taking an equipment for repair at planned intervals, so that uncalled for breakdowns could be prevented. The intervals keeps in the view of complexity of the equipment. The preventive maintenance help in prolonging the life of the machine and reduction in un - expected break downs and ensure the accuracy thus the accuracy of the product is continuously maintained.

The repairs which are carried out at a planned interval under preventive maintenance can be broadly classified in four categories (stages) involving different volume of work and each of which follows the other in a sequence.

These categories (stages) are-

B1. Inspection - I

B2. Small repair - S

B3. Medium repair - M

B4. Complete overhaul - C

These repairs are carried out on the equipment in a sequence which is well defined for the particular equipment.

(B1) Inspection - 1

1 External inspection for proper functioning of all the mechanisms at all speeds and feeds.

2 Regulation and adjustment of couplings, clutches, spindle bearings, wedges and clamping plates for smooth sliding, brakes, lead nut play.

3 Cleaning of oil and coolant filters, lubricating distributors, chips or dust removers from guides.

4 Tightening of all bolts and nuts and replacing damaged ones.

5 Replacing of oil.

(B2) Small repair - S

All operations of inspection and also

1 Dis - assembly of 2 to 3 units (e.g.tool post and Apron of the lathe) which are excessively worn - out / or dirty, dis - assembly of these units completely part wise, washing out the parts, restoring/replacing of worn - out parts and re - assembly of the units.

2 Carrying out various regulations as mentioned at 'Inspection' with necessary repairs (if called for).

3 Restoration of oil pockets on the guide surfaces, if necessary.

(B3) Medium repair - M

1 All the operations of small repair but more number of units (e.g. Head - stock, Apron, Tool post, Tail - stock of the lathe) as compared to the small repair are dis - assembled part wise, repaired and re - assembled.

2 Scraping/Grinding of all the guide surfaces (if the wear exceeds the permissible limit).

3 Painting of external unmachined surfaces of the machine.

4 The machine after repair is checked as per 'ACCURACY TEST CHARTS' given in chapter 10.

(B4) Complete overhaul - C

1 All the operations of the medium repair, but each and every unit is dis - assembled part wise, most of the worn - out parts replaced by new ones, and machine assembled.

2 Foundation of the machine (installed on deep foundations) is checked, and repaired, if necessary.

3 Grinding/Scraping of all the guide surfaces.

Step 1:

Turn the machine off from the main power point and fit your tag out of order to avoid someone may try to use the machine during your maintenance inspection.

Step 2:

Open side cover and check

- Driving belts, if the belts are damaged,say excessive cracks, or an excessive wear, they must be replaced.
- Check tension of belts.
- Check brake conditions (on models with pedal brake).

Step 3:

Turn the lathe ON and

- Run the lathe for a couple of minutes.
- Check level of lubricant oil on visor main gearbox.
- Refill if required with gear oil.

Step 4:

During running test check that:

All the automatic feeding movement are working properly.

Step 5:

Check tailstock locking condition.

Both lever must lock properly.

Step 6:

Check top bench lubricant manual pump.

Pull or pouch lever to verify that oil is coming to the sliding bench.

Check level of lubricant oil of tank, bench lubrication.

Step 7:

Lubrication, period - lubricant.

Some point will be required to lubricate with gun oiler.

Headstock - twice a year - SHELL TELLUS 27 OR compatible.

Compound slides, by gun oiler - daily - SHELL TONNA 33 or compatible.

Apron & carriage - hand pump - daily - SHELL TONNA 33 or compatible.

Tailstock nipple - by gun oiler - daily - SHELL TONNA 33 or compatible.

Change gear nipple - by gun oiler - daily - SHELL TONNA 33 or compatible.

Leadscrew nipple - by gun oiler - daily - SHELL TONNA 33 or compatible.

Bed ways - by gun oiler - daily - SHELL TONNA 33 or compatible.

Step 8:

Coolant:

- Check level of coolant, refill is required
- Empty tank and fill up with new coolant every 4 months or as & when it is contaminated.
- Avoid contact with coolant during the refilling process, you must wear rubber gloves.
- Test bottom of coolant tank to verify if there are solids sediments.
- Remove solids and try always to keep the coolant tank clean.
- Run the lathe and test coolant is supplied properly.

Step 9:

Electric: Check the main power cable for its conditions. If it is damaged, must be replaced.

Verify conditions of all external switches.

All damage switches must be repaired or replaced.

Check conditions of all limit switches. They must be strong in position. A loose or damage limit switch can generate a continuous fault on the machine.

Step 10:

Centre point alignment.

Once in a year, depending the precision required it would be convenient to verify alignment of centre tailstock with centre of headstock.

Alignment can be obtained by fitting a total parallel bar between centres, and the with a dial indicator, verifying parallelism between centres.