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

COMPETENCY BASED CURRICULUM

FITTER (OF)

(Duration: 1200 hrs.)

FLEXI MoU SCHEME
NSQF Level 4

Sector – Capital Goods & Manufacturing

Directorate General of Training

FITTER (OF)

FLEXI MoU SCHEME

(Designed in 2020)

Version: 1.0

NSQF LEVEL - 4

Developed By

Ministry of Defense

Directorate General of Ordnance Factories

ORDNANCE FACTORY BOARD

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Ministry of Skill Development and Entrepreneurship

Directorate General of Training

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1. COURSE INFORMATION

During the 40 Weeks duration a candidate is trained on subjects Professional Skill, Professional Knowledge & Engineering Drawing. The practical skills are imparted in simple to complex manner to understand the operations & simultaneously basic theory subject is taught to understand the terminology and definition of the topics while executing tasks.

The trainees will be imparted safety aspects which covers components like use of PPs, Fire extinguishers, First Aid, OSH&E. In addition, trainees will be imparted knowledge of 5S and safely use of Tools and equipment's. The practical part starts with basic fitting to the complex operations. The topics covered under this course are filing, chipping, drilling, turning, Pipe joints, measurement etc.

The course element of employability skills, library & extracurricular activities, project work and revision & examination has not been considered in this course being as trainees are NCVT complied Govt. Servants and course is meant to re-skill the working employees to other engineering trades.

2. TRAINING SYSTEM

2.1 GENERAL

OFB is a giant industrial setup which functions under the Department of Defence Production of the Ministry of Defence Mission of OFB is Production of State of the Art Battle Field Equipment. It needs large number of skilled resources in various fields. With the changing need of the armed forces there is shift in production requirements because of which there is a pressing need for re-skilling of employees working in the tailoring and other trades.

Flexible Memorandum of Understanding or Flexi-MoU scheme, a pioneer program of DGT, is designed to cater to the needs of both industry as well as trainee, allowing industries to train candidates as per their skill set requirements and providing trainees with an industry environment aligned with the market demand and latest technology to undergo training. The scheme gives the industry the flexibility to create tailored skilling programs with customized courses, having content and curriculum that is market relevant and meets the industry requirements.

Candidates broadly need to demonstrate that they are able to:

- Read & interpret technical parameters/document, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional skill, knowledge& core skills while performing jobs.
- Check the job/assembly as per drawing for functioning, identify and rectify errors in job/assembly.
- Document the technical parameters related to the task undertaken.

2.2 PROGRESSION PATHWAYS:

Training is imparted to re-skill the employees in other trades to make them align with the changing demands. The carrier progression will be as : -

Semi-Skilled (SS) > Skilled (SK) > High Skilled-II (HS-II) > High Skilled-I (HS-I) > Master Craftsman (MCM).

2.3 COURSE STRUCTURE:

Table below depicts the distribution of training hours across various course elements: -

S No.	Course Element	Hours
1	Professional Skill (Trade Practical)	900
2	Professional Knowledge (Trade Theory)	220
3	Workshop Calculation & Science	40
4	Engineering Drawing	40
	Total	**1200**
	NOTE : Employability subject is exempted as entrants are NCVT qualified Govt Employees	

2.4 ASSESSMENT & CERTIFICATION:

The training will be tested for skill and knowledge during the period of course. There will be internal assessment in every two months conducted by faculty/trainer for the course element covered during the period.

The final assessment will be in the form of summative assessment method. The Trade Test for awarding NCVT equivalent certification will be conducted by Controller of examinations, DGT as per the guidelines. The pattern and marking structure are being notified by DGT from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment in accordance with above course elements. The examiner during final examination will also check** individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

The minimum pass percentage for practical is 60% & minimum pass percentage of theory subjects is 33%. There will be no Grace marks.

2.4.2 ASSESSMENT GUIDELINE

Assessment will be evidence based comprising the following:

- Job carried out in workshop
- Record book/Daily Diary maintained by trainee and countersigned by Trainer.
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality

Evidences and records of internal assessments are to be preserved until forthcoming examination for audit and verification by examination body.

3. JOB ROLE

Fitter: Sizes metal parts to close tolerances and fits and assembles them using hand tools for production or repairs of machines, or other metal products. Studies drawings to understand specification of different parts, fittings or assembles to be made and their functions. They select appropriate tool and equipment to carry out their work. Holds the work in Vice, Cuts and shapes required parts to dimensions and specifications by processes of sawing, chipping, filing, grinding, drilling holes, screw cutting, scrapping etc., using hand tools for making specimens or finished components. Measures object while working using foot rules, calipers, micrometer, gauges etc. and checks for correct filing with square. Gets half-finished object marked or marks it himself using face plate, marking block scriber, vernier, height gauges, vee-blocks, angle plate, sine plate, slip gauges, combination set, etc. depending on accuracies required, to indicate guide lines for finished sizes, holes to be drilled and pitch centres, threads to be cut and other working details as specified in drawing or sample. Clamps object securely in correct position in vice and files it to required dimensions according to punch marks and guide lines frequently measuring it with calipers, micrometre, vernier, gauges etc, makes holes with drill, cuts threads with taps and dies ensuring that they are square or at required angle to base. Measures finished article with dial indicator, micrometre, vernier, height gauges, screw gauges, plug gauges, sine bar, slip gauge, etc according to prescribed accuracies. May make parts separately and assemble those with screws, rivets, pins, etc. as specified so as to make complete unit according to drawing. Dismantles or removes worn out, broken or defective parts using hand tools or power tools and replaces them by repaired or new ones.

In addition, Fitter have the ability to visualize the job, good coordination, mechanical attitude, manual dexterity and perform work related mathematical calculations.

Plan and organize assigned work and detect & resolve issues during execution. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

May be designated as FITTER O F according to nature of work done.

Reference NCO 2015:

i) 7233.0100 –Fitter, General
ii) 7233.0200 – Fitter, Bench

4. GENERAL INFORMATION

Name of the Trade	**FITTER (OF)**
Trade Code	DGT/7012
NSQF Level	**Level 4**
Duration of Craftsmen Training	1200 Hours
Entry Qualification	NCVT qualified Govt Employees
Minimum Age	18 years as on first day of academic session.
Eligibility for PwD	N/A
Unit Strength (No. Of Student)	20
Space Norms	88 Sq.m
Power Norms	3.51 KW
Instructors Qualification for	
1. Fitter OF Trade, Workshop Calculation & Science and Engineering Drawing	B.E./B.Tech/B.Voc. Degree in Mechanical Engineering from recognized Engineering College/ university **OR** 03 years Diploma in Mechanical Engineeringfrom AICTE / recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT. ***Note- Trainer should have minimum3-4 years' experience in the field of Engg. production.***
2. Minimum Age for Instructor	21 Years
List of Tools and Equipment	As per Annexure – I

5. LEARNING OUTCOME

Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.

5.1 LEARNING OUTCOMES

1. Plan and organize the work to make job as per specification applying different types of basic fitting operation and Check for dimensional accuracy following safety precautions.
2. Manufacture simple sheet metal items as per drawing**.**
3. Join metal components by observing standard procedure**/**operation**.**
4. Produce components by different operations and check accuracy using appropriate measuring instruments**.**
5. Make different fit of components for assembling as per required tolerance observing principle of interchange ability and check for functionality**.**
6. Produce components involving different operations on lathe observing standard procedure and check for accuracy**.**
7. Make & assemble components of different mating surfaces as per required tolerance by different surface finishing operations using different fastening components, tools and check functionality**.**
8. Make different gauges by using standard tools & equipment and checks for specified accuracy**.**
9. Make drill jig & produce components on drill machine by using jigs and check for correctness**.**
10. Plan & perform basic day to day preventive maintenance, repairing and check functionality**.**

6. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
1. Plan and organize the work to make job as per specification applying different types of basic fitting operation and Check for dimensional accuracy following safety precautions.	Plan & Identify tools, instruments and equipment for marking and make this available for use in a timely manner.
	Mark as per specification applying desired mathematical calculation and observing standard procedure.
	Measure all dimensions in accordance with standard specifications and tolerances.
	Identify Hand Tools for different fitting operations and make these available for use in a timely manner.
	Prepare the job for Hacksawing, chiselling, filing, drilling, tapping, grinding.
	Perform basic fitting operations viz., Hacksawing, filing, drilling, tapping and grinding to close tolerance as per specification to make the job.
	Observe safety procedure during above operation as per standard norms and company guidelines.
	Check for dimensional accuracy as per standard procedure.
	Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
2. Manufacture simple sheet metal items as per drawing	Identify Hand Tools for Sheet Metal work.
	Mark and develop various forms as per drawing using sheet metals.
	Make of simple items with sheet metal as per drawing.
	Prepare the job for joint operations.
	Identify tools for drilling and use these tools.
	Mark according to drawing.
	Drill through holes on the job.
	Observe safety procedure during operation as per standard norms and company guidelines.

3. Join metal components by observing standard procedure**/**operation**.**	Identify Tools and equipment.
	Prepare the job as per requirment.
	Identify tools for drilling and use these tools.
	Mark according to drawing.
	Drill through holes on the job.
	Observe safety procedure during operation as per standard norms and company guidelines.
4. Produce components by different operations and check accuracy using appropriate measuring instruments.	Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	Plan work in compliance with standard safety norms.
	Produce component by observing standard procedure.
	Check the dimensions of the produced components to ensure dimensions are within prescribed limit.
	Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
5. Make different fit of components for assembling as per required tolerance observing principle of interchangeability and check for functionality.	Recognize general concept of Limits, Fits and tolerance necessary for fitting applications and functional application of these parameters.
	Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	Set up workplace/ assembly location with due consideration to operational stipulation
	Plan work in compliance with standard safety norms and collecting desired information.
	Demonstrate possible solutions and agree tasks within the team.
	Make components according to the specification for different fit using a range of practical skills and ensuring interchangeability of different parts.
	Assemble components applying a range of skills to ensure proper fit.
	Check functionality of components.

6. Produce components involving different operations on lathe observing standard procedure and check for accuracy.	Ascertain basic working principles and safety aspect of lathe machine.
	Understand functional application of different levers, stoppers, adjustment etc.
	Identify different lubrication points and lubricants, their usage for application in lathe machine as per machine manual.
	Identify different work and tool holding devices and collect information for functional application of each device.
	Mount the work and tool holding devices with required alignment and check for its functional usage to perform lathe operations.
	Solve problem by applying basic methods, tools, materials and information during setting.
	Observe safety procedure during mounting as per standard norms.
	Produce components observing standard procedure.
	Check accuracy/ correctness of job using appropriate equipment/gauge.
	Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
7. Make &assemble components of different mating *surfaces* as per required tolerance by different surface finishing operations using different fastening components, tools and check functionality.	Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	Plan work in compliance with standard and collecting necessary information.
	Set up workplace/ assembly location with due consideration to operational stipulation
	Produce different components with appropriate accuracy by observing standard procedure& method as per specification using appropriate tools & machines.
	Perform scraping and lapping of components to obtain required surface finish of different mating surface.
	Comply with safety rules when performing the above

	operations.
	Check tolerance and accuracy of components as defined with appropriate instruments observing standard procedure.
	Assemble different components using different fastening components, tools and check the functionality.
8. Make different gauges by using standard tools & equipment and checks for specified accuracy.	Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	Plan work in compliance with standard safety norms.
	Produce gauge by observing appropriate method and as per specification of drawing.
	Perform Lapping of gauge to obtain required finish as per drawing.
	Check tolerance and specified accuracy of gauge with appropriate measuring instruments as per drawing.
	Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
9. Make drill jig & produce components on drill machine by using jigs and check for correctness.	Set up workplace/ assembly location with due consideration to operational stipulation
	Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	Collect information related to standard procedure, methods and tools to make drill jigs.
	Mark the components as per drawing.
	Make drill jigs by turning, drilling, reaming, filing, taping, etc.
	Test the functionality of jig.
	Select suitable jigs for drilling considering desired result and collecting necessary information.
	Produce component by using jig observing standard procedure and check the correctness of the job.
	Comply with safety rules when performing the above operations.

10. Plan & perform basic day *to* day preventive maintenance, repairing and check functionality.	Ascertain preventive maintenance/repair procedure as per manual of machine and select appropriate tools & equipment for undertaking job.
	Interpret construction, alignment and assembly of different parts of machine.
	Plan to carry out the preventive maintenance/repair task with appropriate accuracy of simple machine by collecting necessary information.
	Demonstrate possible solutions and agree tasks within the team.
	Perform preventive maintenance/dismantle, repair parts and assemble sub-assemblies of simple machine as per layout plan and standard procedure.
	Put the machine in operation complying Standard operating procedure.
	Check for proper functioning of repaired machine and other parameters of simple machine as per manual after erection.
	Dispose unsalvageable materials as per standard procedures.

FITTER (OF)			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional Skills – 150 Hrs Professional Knowledge – 36 Hrs	Plan and organize the work to make job as per specification applying different types of basic fitting operation and Check for dimensional accuracy following safety precautions.	Importance of trade training, List of tools & Machinery used in the trade. Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE). First Aid Method and basic training. Safe disposal of waste materials like cotton waste, metal chips/burrs etc. Hazard identification and avoidance. Safety signs for Danger, Warning, caution & personal safety message. Preventive measures for electrical accidents & steps to be taken in such accidents. Use of Fire extinguishers. Practice and understand precautions to be followed while working in fitting jobs. Safe use of tools and equipment used in the trade. Identification of tools &equipment as per desired specifications for marking & sawing Selection of material as per application. Visual inspection of raw material for rusting, scaling, corrosion etc. Marking out lines, gripping	All necessary guidance to be provided to the new comers 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 and electrical safety. 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. Basic understanding on Hot work, confined space work and material handling Linear measurements- its units, dividers, callipers, hermaphrodite, centre punch, dot punch, their description

		suitably in vice jaws, hacksawing to given dimensions. Sawing different types of metals of different sections. Filing Channel parallel lines). Filling -Flat and Square (Rough Finish) Filing practice, surface filing marking of straight and parallel lines with odd leg calipers and steel rule marking practice with dividers, odd leg calipers and steel rule (circles, ARCs parallel lines) Marking off straight lines and ARCs using scribing block and dividers. Chipping flat surfaces along a marked line. Marking, filing, filing square and check using trisquare. Marking according to simple blue prints for locating, position of holes, scribing lines on chalked surfaces with marking tool. Finding center of round bar with the help of 'V' block and marking block. Joining straight line to an ARC. Chipping, Chamfering, Chip slots & oils grooves (Straight). Filing flat, square, and parallel to an accuracy of 0.5mm. Chip curve along a line-mark out, key ways at various angles & cut key ways. File thin metal to an accuracy of 0.5 mm. Saw along a straight line, curved line, on different sections of metal.	and uses of different types of hammers. Description, use and care of 'V' Blocks, marking off table. Bench vice construction, types, uses, care & maintenance, vice clamps, hacksaw frames and blades, specification, description, types and their uses, method of using hacksaws. Files- specifications, description, materials, grades, cuts, file elements, uses. Types of files, care and maintenance of files. Measuring standards (English, Metric Units), angular measurements. Marking off and layout tools, dividers, scribing block, odd leg calipers, punches- description, classification, material, care & maintenance. Try square, ordinary depth gauge, protractor- description, uses and cares. Calipers- types, material, constructional details, uses, care & maintenance of cold chisels- materials, types, cutting angles. Marking media, marking blue, Prussian blue, red lead, chalk and their special application, description. Use, care and maintenance of scribing block. Surface plate and auxiliary marking equipment, 'V' block, angle plates, parallel block, description, types, uses, accuracy, care and maintenance.

		Straight saw on thick section, M.S. angle and pipes. File steps and finish with smooth file to accuracy of ± 0.25 mm. File and saw on M.S. Square and pipe. File radius along a marked line (Convex & concave) & match. Chip sheet metal (shearing). Chip step and file. Mark off and drill through holes. Drill and tap on M.S. flat. Punch letter and number (letter punch and number punch) Practice use of different punches.	Physical properties of engineering metal: colour, weight, structure, and conductivity, magnetic, fusibility, specific gravity. Mechanical properties: ductility, malleability hardness, brittleness, toughness, tenacity, and elasticity. Power Saw, band saw, Circular saw machines used for metal cutting. Micrometer- outside and inside – principle, constructional features, parts graduation, leading, use and care. Micrometer depth gauge, parts, graduation, leading, use and care. Digital micrometer. Vernier callipers, principle, construction, graduations, reading, use and care. Vernier bevel protractor, construction, graduations, reading, use and care, dial Vernier Caliper, Digital Vernier caliper. Drilling processes: common type (bench type, pillar type, radial type), gang and multiple drilling machine. Determination of tap drill size.
Professional Skills – 60 Hrs **Professional Knowledge – 15 Hrs**	Manufacture simple sheet metal items as per drawing and join them by soldering, brazing and riveting.	Marking of straight lines, circles, profiles and various geometrical shapes and cutting the sheets with snips. Marking out of simple development Marking out for flaps for soldering and sweating. Make various joints: wiring, hemming, soldering and brazing,	Safety precautions to be observed in a sheet metal workshop, sheet and sizes, Commercial sizes and various types of metal sheets, coated sheets and their uses as per BIS specifications. Shearing machine- description, parts and uses.

		form locked, grooved and knocked up single hem straight and curved edges form double hemming. Punch holes-using hollow and solid punches. Do lap and butt joints. Bend sheet metal into various curvature form, wired edges-straight and curves. Fold sheet metal at angle using stakes. Make simple Square container with wired edge and fix handle.	Marking and measuring tools, wing compass, Prick punch, tin man's square tools, snips, types and uses. Tin man's hammers and mallets type-sheet metal tools, Soldering iron, types, specifications, uses. Trammel- description, parts, uses. Hand grooves-specifications and uses. Stakes-bench types, parts, their uses. Various types of metal joints, their selection and application, tolerance for various joints, their selection & application. Wired edges.
Professional Skills – 60 Hrs **Professional Knowledge – 15 Hrs**	Join metal component observing standard procedure/ operation	Make riveted lap and butt joint. Make funnel as per development and solder joints. Drill for riveting. Riveting with as many types of rivet as available, use of counter sunk head rivets.	Various rivets shape and form of heads, importance of correct head size. Rivets-Tin man's rivets types, sizes, and selection for various works. Riveting tools, dolly snaps description and uses. Method of riveting, The spacing of rivets. Flash riveting, use of correct tools, compare hot and cold riveting.
Professional Skills – 90 Hrs **Professional Knowledge – 22 Hrs**	Produce components by different operations and check accuracy using appropriate measuring instruments	Mark off and drill through holes. Drill on M.S. flat. File radius and profile to suit gauge. Sharpening of Drills. Practice use of angular measuring instrument. Counter sink, counter bore and ream split fit (three piece) Drill through hole and blind holes. Form internal threads with taps to standard size	Drill- material, types, (Taper shank, straight shank) parts and sizes. Drill angle-cutting angle for different materials, cutting speed feed. R.P.M. for different materials. Drill holding devices-material, construction and their uses. Counter sink, counter bore and spot facing-tools and nomenclature, Reamer-material, types (Hand and

		(through holes and blind holes) Prepare studs and bolt Form external threads with dies to standard size Prepare nuts and match with bolts File and make Step fit, angular fit, angle, surfaces (Bevel gauge accuracy 1 degree) Make simple open and sliding fits	machine reamer), kinds, parts and their uses, determining hole size (or reaming), Reaming procedure. Screw threads: terminology, parts, types and their uses. Screw pitch gauge: material parts and uses. Taps British standard (B.S.W., B.S.F., B.A. & B.S.P.) and metric /BIS (course and fine) material, parts (shank body, flute, cutting edge). Tap wrench: material, parts, types (solid &adjustable types) and their uses removal of broken tap, studs (tap stud extractor). Dies: British standard, metric and BIS standard, material, parts, types, Method of using dies. Die stock: material, parts and uses. Drill troubles: causes and remedy. Equality of lips, correct clearance, dead centre, length of lips. Drill kinds: Fraction, metric, letters and numbers, grinding of drill.
Professional Skills – 90 Hrs **Professional Knowledge – 22 Hrs**	Make different fit of components for assembling as per required tolerance observing principle of interchange ability and check for functionality.	Make sliding 'T' Fit File fit- combined, open angular and sliding sides File internal angles 30minutes accuracy open, angular fit Make sliding fit with angles other than 90o Scrap on flat surfaces, curved surfaces and parallel surfaces and test Make & assemble, sliding flats, plain surfaces File and fit combined radius and	Interchange ability: Necessity in Engg, field definition, BIS. Definition, types of limit, terminology of limits and fits- basic size, actual size, deviation, high and low limit, zero-line, tolerance zone Different standard systems of fits and limits. British standard system, BIS system Method of expressing tolerance as per BIS Fits: Definition, types, description of each with sketch.

		angular surface (accuracy ± 0 Locate accurate holes & make accurate hole for stud fit Fasten mechanical components / sub-assemblies together using screws, bolts and collars using hand tools Make sliding fits assembly with parallel and angular mating surface	Vernier height gauge: material construction, parts, graduations (English & Metric) uses, care and maintenance. Wrought iron: properties and uses. Steel: plain carbon steels, types, properties and uses. Non-ferrous metals (copper, aluminium, tin, lead, zinc) properties and uses. Simple scraper- circular, flat, half round, triangular and hook scraper and their uses. Blue matching of scraped surfaces (flat and curved bearing surfaces) Vernier micrometer, material, parts, graduation, use, care and maintenance. Calibration of measuring instruments. Introduction to mechanical fasteners and its uses. Screw thread micrometer: Construction, graduation and use. Dial test indicator, construction, parts, material, graduation, Method of use, care and maintenance.
Professional Skills – 120 Hrs **Professional Knowledge – 29 Hrs**	Produce components involving different operations on lathe observing standard procedure and check for accuracy.	Lathe operations- True job on four jaw chuck using knife tool Face both the ends for holding between centers Using roughing tool parallel turning. Measure the diameter using outside caliper and steel rule	Safely precautions to be observed while working on a lathe, Lathe specifications, and constructional features. Lathe main parts descriptions- bed, head stock, carriage, tail stock, feeding and thread cutting mechanisms. Holding of job between centers, works with

		Holding job in three jaw chuck Perform the facing, plain turn, step turn, parting, deburr, chamfer-corner, roundthe ends, and use form tools Shoulder turn: square, filleted, beveled undercut shoulder, turning-filleted under cut, square beveled Sharpening of -Single point Tools Cut grooves- square, round,'V' groove Make a mandrel-turn diameter to sizes Knurl the job Bore holes –spot face, pilot drill, enlarge hole using boring tools Make a bush step bore-cut recess, turn hole diameter to sizes Turn taper (internal and external) Turn taper pins Turn standard tapers to suit with gauge Practice threading using taps, dies on lathe by hand Make external 'V' thread	catch plate, dog, simple description of a facing and roughing tool and their applications. Lathe cutting tools- Nomenclature of single point & multipoint cutting tools, Tool selection based on different requirements and necessity of correct grinding, solid and tipped, throw away type tools, cutting speed and feed and comparison for H.S.S., carbide tools. Use of coolants and lubricants. Chucks and chucking the independent four-jaw chuck. Reversible features of jaws, the back plate, Method of clearing the thread of the chuck-mounting and dismounting, chucks, chucking true, face plate, drilling - method of holding drills in the tail stock, Boring tools and enlargement of holes. General turning operations-parallel or straight, turning. Stepped turning, grooving, and shapeing of tools for the above operations. Appropriate method of holding the tool on tool post or tool rest, Knurling: - tools description, grade, uses, speed and feed, coolant for knurling, speed, feed calculation. Taper – definition, use and method of expressing tapers. Standard taperstaper, calculations morse taper.

			Screw thread definition – uses and application. Square, worm, buttress, acme (non standard-screw threads), Principle of cutting screw thread in centre lathe –principle of chasing the screw thread – use of centre gauge, setting tool for cutting internal and external threads, use of screw pitch gauge for checking the screw thread.
Professional Skills – 150 Hrs Professional Knowledge – 36 Hrs	Make & assemble components of different mating surfaces as per required tolerance by different surface finishing operations using different fastening components, tools and check functionality.	Power tools: Practice operation of power tool for fastening Tightening of bolt/ screw with specified torque Selection of right tool as for Tightening or loosening of screw/bolt as per accessibility Assembly sliding for using keys, dowel pin and screw, ± 02 mm accuracy on plain surface and testing of sliding fitting job File & fit angular mating surface within an accuracy of ± 02 mm & 10 minutes angular fitting Drill through and blind holes at an angle using swivel table of drilling machine Precision drilling, reaming and tapping and Test- Job Make Dovetailed fitting and radius fitting File and fit, combined fit with straight, angular surface with ± 02 mm accuracy and check adherence to specification and quality standards using equipment like Vernier calipers, micrometers etc Drilling and reaming, small dia Perform drilling using 'V' block and a clamp Make male and female fitting	Screws: material, designation, specifications, Property classes (e.g. 9.8 on screw head), Tools for tightening/ loosening of screw or bolts, Torque wrench, screw joint calculation uses. Power tools: its constructional features, uses & maintenance. Locking device: Nuts- types (lock nut castle nut, slotted nuts, swam nut, grooved nut) Description and use. Various types of keys, allowable clearances & tapers, types, uses of key pullers. Special files: types (pillar, Dread naught, Barrow, warding) description & their uses. Testing scraped surfaces: ordinary surfaces without a master plate Templates and gauges- Introduction, necessity, types. Limit gauge: Ring gauge, snap gauge, plug gauge, description and uses. Description and uses of gauge- types (feeler, screw, pitch, radius, wire gauge)

		parts, drill and ream holes not less than 12.7 mm. Lap flat surfaces using lapping plate Lapping holes and cylindrical surfaces Dovetail and Dowel pin assembly Scrape cylindrical bore Scrapping cylindrical bore and to make a fit Scrapping cylindrical taper bore and check taper angle with sine bar Make a cotter jib assembly Hand reams and fit taper pin Drilling and reaming holes in correct location, fitting dowel pins, stud, and bolts	Slip gauge: Necessity of using, classification & accuracy, set of blocks (English and Metric). Details of slip gauge. Metric sets 46: 103: 112. Wringing and building up of slip gauge and care and maintenance. Application of slip gauges for measuring, Sine bar-Principle, application & specification. Procedure to check adherence to specification and quality standards. Lapping: Application of lapping, material for lapping tools, lapping abrasives, charging of lapping tool. Surface finish importance, equipment for testing-terms relation to surface finish. Equipment for tasting surfaces quality – dimensional tolerances of surface finish. Honing: Application of honing, material for honing, tools shapes, grades, honing abrasives. Frosting- its aim and the methods of performance. Metallurgical and metal working processes such as Heat treatment, various heat treatment methods normalizing, annealing, hardening and tempering, purpose of each method, tempering colour chart. Annealing and normalizing, Case hardening and carburising and its methods, process of carburising (solid, liquid and gas).

			Tapers on keys and cotters permissible by various standards. The various coatings used to protect metals, protection coat by heat and electrical deposit treatments. Treatments to provide a pleasing finish such as chromium silver plating, nickel plating and galvanizing.
Professional Skills – 60 Hrs **Professional Knowledge – 15 Hrs**	Make different gauges by using standard tools & equipment and checks for	Making a snap gauge for checking a dia of 10 ± 0 Scrape external angular mating surface and check angle with sine bar Scrape on internal surface and check Practice in dovetail fitting assembly and dowel pins and cap screws assembly Preparation of gap gauges Perform lapping of gauges(hand lapping only)(10 hrs Preparation of drill gauges File and fit straight and angular surfaces internally Identify different ferrous metals by spark test(2 hrs	Gauges and types of gauge commonly used in gauging finished product-Method of selective assembly 'Go' system of gauges, hole plug basis of standardization. Bearing-Introduction, classification (Journal and Thrust), Description of each, ball bearing: Single row, double row, description of each, and advantages of double row. Roller and needle bearings: Types of roller bearing. Description & use of each. Bearing metals – types, composition and uses. Synthetic materials for bearing: The plastic laminate materials, their properties and uses in bearings such as phenolic, teflon polyamide (nylon). The importance of keeping the work free from rust and corrosion.
Professional Skills – 60 Hrs **Professional Knowledge**	Make drill jig & produce components on drill machine by using jigs and	Make a simple drilling jig Use simple jigs and fixtures for drilling as aluminium/ brass/ copper / stainless steel, marking out,	Drilling jig-constructional features, types and uses. Fixtures- Constructional features, types

– **15 Hrs**	check for correctness.	cutting to size, drilling, tapping etc	and uses.
Professional Skills – 60 Hrs **Professional Knowledge – 15 Hrs**	Plan & perform basic day to day preventive maintenance, repairing and check functionality	Simple repair work: Simple assembly of machine parts from blue prints Rectify possible assembly faults during assembly Perform the routine maintenance with check list Monitor machine as per routine checklist (3 hrs Prepare different types of documentation as per industrial need by different methods of recording information 189. Dismantle, overhauling, & assemble cross-slide & hand-slide of lathe carriage. Simple repair of machinery: - Making of packing gaskets. Use hollow punches, extractor, drifts, various types of hammers and spanners, etc. for repair work. Dismantling, assembling of different types of bearing and check for functionality. Perform routine check of machine and do replenish as per requirement.	**Maintenance** -Total productive maintenance -Autonomous maintenance -Maintenance schedule - Retrieval of data from machine manuals Preventive maintenance-objective and function of Preventive maintenance, section inspection. Visual and detailed, lubrication survey, system of symbol and colour coding. Revision, simple estimation of materials, use of handbooks and reference Method or fixing geared wheels for various purpose drives. General cause of the wear and tear of the toothed wheels and their remedies, method of fitting spiral gears, helical gears, bevel gears, worm and worm wheels in relation to required drive. Care and maintenance of gears. Method of lubrication-gravity feed, force (pressure) feed, splash lubrication. Cutting lubricants and coolants: Soluble off soaps, sudsparaffin, soda water, common lubricating oils and their commercial names, selection of lubricants. Clutch: Type, positive clutch (straight tooth type, angular tooth type). Washers-Types and calculation of washer sizes. The making of joints and fitting packing.

			Chains, wire ropes and clutches for power transmission. Their types and brief description.

SYLLABUS FOR CORE SKILLS

Workshop Calculation & Science

LEARNING OUTCOME	ASSESSMENT CRITERIA
1. Demonstrate basic mathematical concept and principles to perform practical operations.	Solve different problems like unit conversion etc. with the help of a calculator.
	Demonstrate conversion of Fraction to Decimal and vice versa.
	Solve simple problems on area, perimeter etc of regular shapes.
	Solve simple trigonometric ratios and height & distance.
2. Understand and explain basic science in the field of study including simple machine.	Explain concept of basic science related to the field such as Material science, Mass, weight, density, speed, velocity, heat & temperature, force, motion, pressure.
	Explain relationship between different scales of temperature, concept of heal and temperature.
	Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials.

Sl. No.	Syllabus	Time in hrs.
I.	**Unit, Fractions**	**4**
1	Classification of Unit System	
2	Fundamental and Derived Units F.P.S, C.G.S, M.K.S and SI Units	
3	Measurement Units and Conversion	
4	Factors, HCF, LCM and Problems	
III.	**Material Science**	**4**
1	Types of metals	
2	Physical and Mechanical Properties of metals	
3	Types of ferrous and non-ferrous metals	
IV.	**Mass, Weight, Volume, and Density**	**4**
1	Mass, volume, density, weight & specific gravity	
2	Related problems for mass, volume, density, weight & specific gravity	
V.	**Speed and Velocity, Work Power and Energy**	**6**

1	Rest, motion, speed, velocity, difference between speed and velocity, acceleration and retardation	
2	Related problems on speed and velocity	
VI.	**Heat &Temperature and Pressure**	**4**
1	Concept of heat and temperature, effects of heat, difference between heat and temperature	
2	Scales of temperature, Celsius, Farenhieght, Kelvin and Conversion between scales of temperature	
VII.	**Basic Electricity**	**6**
1	Introduction and uses of electricity, molecule, atom, how electricity is produced, electric current AC, DC and their comparison, voltage , resistance and their units	
2	Conductor, Insulator, types of connections- Series and Parallel,	
	Ohm's Law, relation between VIR & related problems	
3	Electrical power, energy and their units, calculation with assignments	
VIII.	**Mensuration**	**6**
1	Area and perimeter of square, rectangle and parallelogram	
2	Area an Perimeter of Triangle	
3	Area and Perimeter of Circle, Semi-circle , circular ring, sector of circle, hexagon and ellipse	
X.	**Trigonometry**	**6**
1	Measurement of Angle, Trigonometrical Ratios, Trigonometric Table	
2	Trigonometry-Application in calculating height and distance (Simple Applications)	
	Total	**40**

Engineering Drawing

LEARNING OUTCOME WITH ASSESSMENT CRITERIA

ENGINEERING DRAWING	
LEARNING OUTCOME	**ASSESSMENT CRITERIA**
1. Read and apply engineering drawing for different application in the field of work.	Read & interpret the information on drawings and apply in executing practical work.
	Read & analyses the specification to ascertain the material requirement, tools and assembly/maintenance parameters.
	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.

Fitter (OF)

Sl. No.	Topic	Time in hrs.
1.	Engineering Drawing – Introduction Introduction to Engineering Drawing and Drawing Instruments – • Conventions • Viewing of engineering drawing sheets. • Method of Folding of printed Drawing sheet as per BIS SP: 46-2003	1
2.	Drawing Instrument • Drawing board, T-square, Drafter (Drafting M/C), Set squares, Protector, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), pencils of different grades, Drawing pins/ Clips.	1
3.	Free hand drawing of – • Lines, polygons, ellipse etc. • Geometrical figures and blocks with dimension • Transferring measurement from the given object to the free hand sketches. • Solid objects – Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone with dimensions.	6
4.	Lines • Definition, types and applications in drawing as per BIS: 46-2003 • Classification of lines (Hidden, centre, construction, extension, Dimension, Section) • Drawing lines of given length (Straight, curved) • Drawing of parallel lines, perpendicular line	2
5.	Drawing of Geometrical figures: Definition, nomenclature and practice of – • Angle: Measurement and its types, method of bisecting. • Triangle: different types • Rectangle, Square, Rhombus, Parallelogram. • Circle and its elements	4
6.	Dimensioning and its Practice • Definition, types and methods of dimensioning (functional, non-functional and auxiliary) • Position of dimensioning (Unidirectional, Aligned) • Types of arrowhead	4
7.	Sizes and layout of drawing sheets	2

	• Selection of sizes • Title Block, its position and content • Item Reference on Drawing Sheet (Item list)	
8.	Method of presentation of Engg. Drawing • Pictorial View • Orthographic View • Isometric View	2
9.	Symbolic representation – different symbols used in the trades • Fastener (Rivets, Bolts and Nuts) • Bars and profile sections • Weld, Brazed and soldered joints • Electrical and electronics element • Piping joints and fitting	6
10.	Projections • Concept of axes plane and quadrant • Orthographic projections • Method of first angle and third angle projections (definition and difference) • Symbol of 1st angle and 3rd angle projection in 3rd angle.	8
11.	Reading of fabrication drawing	4
Total		**40**

ABBREVIATIONS

CTS	Craftsmen Training Scheme
ATS	Apprenticeship Training Scheme
CITS	Craft Instructor Training Scheme
DGT	Directorate General of Training
MSDE	Ministry of Skill Development and Entrepreneurship
NTC	National Trade Certificate
NAC	National Apprenticeship Certificate
NCIC	National Craft Instructor Certificate

ANNEXURE-I

FITTER			
LIST OF TOOLS AND EQUIPMENT (For batch of 20 candidates)			
S no.	**Name of the Tool &Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT			
1.	Steel Rule with metric & British graduation	150 mm, Stainless steel	(20+1) Nos.
2.	Try Square.	150 mm blade	(20+1) Nos.
3.	Caliper inside spring type.	150 mm	(20+1) Nos.
4.	Caliper hermaphrodite spring type	150 mm	(20+1) Nos.
5.	Caliper outside spring type	150 mm	(20+1) Nos.
6.	Divider spring type	150 mm	(20+1) Nos.
7.	Scriber	150 mm	(20+1) Nos.
8.	Centre Punch	10 mm and Length - 120 mm	(20+1) Nos.
9.	Screw driver	150mm insulated flat type	(20+1) Nos.
10.	Chisel cold flat	20 mm X 150 mm High carbon steel	(20+1) Nos.
11.	Hammer ball peen with handle	450 grams (1 lb)	(20+1) Nos.
12.	Hammer ball peen with handle.	220 grams (1/2 lb)	(20+1) Nos.
13.	File flat - second cut	250 mm	(20+1) Nos.
14.	File flat smooth	250 mm.	(20+1) Nos.
15.	File half round second cut	150 mm.	(20+1) Nos.
16.	Hacksaw frame fixed type	300 mm	(20+1) Nos.
17.	Safety goggles.		(20+1) Nos.
18.	Dot punch	100 mm	(20+1) Nos.
B. INSTRUMENTS AND GENERAL SHOP OUTFIT			
INSTRUMENTS			
19.	Steel Rule Graduated both in Metric and English Unit	300 mm Stainless steel	4 nos.
20.	Straight edge steel	300 mm or above	2 nos.
21.	Spirit Level metal Type - 2	300 mm Basic Length Accuracy 0.1mm/Meter	1 no.
22.	Stud Extractor EZY - out	Set of 8	2 sets
23.	Combination Set	300 mm	2 nos.
24.	Micrometer outside.	0 - 25 mm	2 nos.

25.	Micrometer outside.	25 - 50 mm	2 nos.
26.	Micrometer outside.	50 - 75 mm	2 nos.
27.	Micrometer inside with extension rods.	Accuracy 0.01 mm with extension rods up to 150 mm	1 no.
28.	Vernier caliper	150 mm	4 nos.
29.	Vernier height gauges	0 - 300 mm with least count = 0.02 mm	1 no.
30.	Vernier bevel protractor Blade with Acute Angle Attachment	300 mm	1 no.
31.	Screw pitch gauge Metric	0.25 to 6 mm	1 no.
32.	Wire gauge, metric standard.		1 no.
GENERAL SHOP OUTFIT			
33.	Surface plate C.I/Granite with Stand and Cover	600 x 600 mm	1 no.
34.	Marking table (Mild steel)	900X900X900 mm	1 no.
35.	Universal scribing block.	220 mm	2 nos.
36.	V-Block pair with clamps	150 x 100 x 100 mm	2 nos.
37.	Angle plate	150 X 150 X 250 mm	2 nos.
38.	Punch letter set.	3 mm	1 no.
39.	Punch number set.	3 mm	1 no.
40.	Portable hand drill (Electric)	0 to 13 mm Capacity	1 no.
41.	Drill twist straight shank	3 mm to 12 mm by 0.5 mm H.S.S.	2 sets
42.	Drill twist Taper shank	8 mm to 20 mm by 0.5 mm H.S.S.	2 sets
43.	Taps and dies complete set in box.	Whitworth	1 no.
44.	Taps and dies complete set	5, 6, 8, 10 & 12mm set of 5	2 Sets
45.	File knife edge smooth	150 mm	4 nos.
46.	File feather edge smooth	150 mm	4 nos.
47.	File triangular smooth	200 mm	10 nos.
48.	File round second cut	200 mm	10 nos.
49.	File square second cut	250 mm	10 nos.
50.	Feeler gauge	Gauge Feeler / Thickness - 0.05 mm to 0.3 mm by 0.05 and 0.4 mm to 1 mm by 0.1 mm - 13 leaves	1 set
51.	File triangular second cut.	200 mm	10 nos.
52.	File flat second cut safe edge.	300 mm	10 nos.

Fitter (OF)

53.	File flat bastard	200 mm	10 nos.
54.	File flat bastard.	300 mm	10 nos.
55.	File Swiss type needle	Set of 12, Length = 150 mm	2 sets
56.	File half round second cut.	250 mm	10 nos.
57.	File half round bastard.	250 mm	10 nos.
58.	File round bastard.	250 mm	10 nos.
59.	File hand second cut.	150 mm	10 nos.
60.	File card.	3"x5" size, brass or steel wire	10 nos.
61.	Oil Can	250 ml	2 nos.
62.	Pliers combination insulated	150 mm	2 nos.
63.	Wooden handle forged Soldering Iron copper bit.	230V, 250 W, 350 gm	2 nos.
64.	Blow Lamp	0.5 litre	2 nos.
65.	Spanner- Double Ended	6x7, 8x9, 10x11, 12x13, 14x15, 16x17, 18x19, 20x22	1 set each
66.	Spanner adjustable	150 mm	2 nos.
67.	Interchangeable ratchet socket set	12 mm driver, sized10-32 mm set of 18 socket & attachments.	1 set
68.	Double Ended tubular Box spanner set with Tommy bar.	A/F 6-25 mm set of 10 Tommy Bar Dia. 6, 8, 10, 12, 14, 16	1 set
69.	Glass magnifying	75 mm	2 nos.
70.	Clamp toolmaker	5 cm and 7.5 cm set of 2.	2 nos.
71.	Clamp "C"	100 mm	2 nos.
72.	Clamp "C"	200 mm	2 nos.
73.	Hand Reamer set (Taper pin straight flute)	Nominal Dia. 6, 8, 10, 12, 16mm	1 set
74.	Machine Reamer parallel (Helical flute)	12 - 16mm set of 5.	1 no.
75.	Scraper flat	150 mm	10 nos.
76.	Scraper triangular	150 mm	10 nos.
77.	Scraper half round	150 mm	10 nos.
78.	Chisel cold crosscut& diamond point.	9 mm X 150 mm	10 each
79.	Chisel cold flat	9 mm X 100 mm	10 nos.
80.	Chisel cold round nose	9 mm X 100 mm	10 nos.
81.	Drill chuck with key	12 mm.	1 no.
82.	Pipe wrench	400 mm	1 no.
83.	Pipe vice	100 mm	1 no.

Fitter (OF)

84.	Adjustable pipe die set BSP	cover pipe size 1" or 3/4"	1 Set
85.	Wheel dresser (One for 4 units) Star/Dresser with Holder	Length 150 mm, diamond point	1 no.
86.	Sleeve drill Morse	No. 0 - 1, 1 - 2, 2 - 3, 3 - 4, 4 - 5	1 Set
87.	Vice bench	150 mm	20 nos.
88.	Bench working.	2400 x 1200 x 900 mm	4 nos.
89.	Almirah.	1800 x 900 x 450 mm	2 nos.
90.	Lockers with 8 drawers (standard size).	One locker for each trainee	3 nos.
91.	Metal rack	1820 x 1820 x 450 cm	1 no.
92.	Instructor Table		
93.	Instructor Chair		
94.	Black board with easel.		
95.	Fire extinguisher (For 4 Units)	CO2 type, 3 kg capacity	
96.	Fire buckets.		
97.	Machine vice.	100mm	2 nos.
98.	Wing compass.	254 mm or 300 mm	2 nos.
99.	Hand hammer with handle.	1000 gm	1 nos.
100.	Torque wrench (Standard/Ratchet type)	14 to 68 Nm	1 no.
101.	Power tools for fastening	Capacity 10-18mm	1 No.
102.	Different Profile gauges (Plate type) - For demonstration	Metric standard	4 nos.
103.	Knurling tool (Diamond, straight & Diagonal)		1 each
104.	Temperature gauge	Range 0 - 150°C	1 each
105.	Dowel pin (straight)	Dia. -1" Length -4" (Mat: Stainless Steel)	1 each
106.	Standard Tap screws	M3, M4, M5, M6, M8, M10, M12, M14, M16	1 each
107.	Lapping plate	Dia. -6"	2 each
108.	Drill gauges	Letter drill gauge (A to Z), Number drill gauge (1 to 60), Metric drill gauge (1.5mm to 12.5mm, 30 holes)	2 nos.
109.	Jigs & Fixture (sample)-For demonstration (May be manufactured in-house)		1 no.
110.	Pulleys (for V-belt or Flat belt)	to fit on 50mm dia. Shaft with key slot	1 no.

111.	Bearing extractor	Universal gear puller 2 or 3 jaws adjustable	1 no.
112.	Pulley extractor	- do -	1 no.
C. TOOLS FOR TRADE - SHEET METAL WORKER			
113.	Trammel	300 mm	1 no.
114.	Pocker		2 nos.
115.	Prick punch	100 mm	2 nos.
116.	Mallet.	Dia. 100 mm X 150 mm	2 nos.
117.	Aviation Snips straight Cut	300 mm	2 nos.
118.	Flat headed hammers with handle.		2 nos.
119.	Planishing hammer.		2 nos.
120.	Snip bent Left Cut	250 mm	2 nos.
121.	Stake hatchet with Leg.	300 X 200 X 20 mm	2 nos.
122.	Stake grooving.	100 X 100 X 300 mm	2 nos.
GENERAL SHOP OUTFIT			
123.	Carbide Wear Block.	1 mm - 2 mm	2 each
124.	Lathe tools H.S.S. tipped set.		2 nos.
125.	Lathe tools bit.	6 mm x 75 mm HSS/Carbide	4 nos.
126.	Lathe tools bit.	8 mm x 75 mm HSS/Carbide	4 nos.
127.	Lathe tools bit.	10 mm x 75 mm HSS/Carbide	4 nos.
128.	Arm strong type tool bit holder.	Right hand	2 nos.
129.	Arm strong type tool bit holder.	Left hand	2 nos.
130.	Arm strong type tool bit holder.	Straight	2 nos.
131.	Stilson wrenches	250 mm	2 nos.
132.	Pipe cutter wheel type.	6 mm to 25 mm	1 no.
133.	Pipe bender machine spool type with stand manually operated.	up to 25 mm cold bending	1 no.
134.	Adjustable pipe chain tonge to take pipes	up to 300 mm	1 no.
135.	Adjustable spanner.	380 mm long	1 no.
E. GENERAL MACHINERY INSTALLATION			
136.	SS and SC centre lathe (all geared) with minimum specification	Centre height 150 mm and centre distance 1000 mm along with 3 & 4 jaw chucks, auto feed system, safety guard, taper turning attachment, motorized coolant system, lighting arrangement & standard	2 Nos.

		accessories.	
137.	Pillar Type Drilling machine	Sensitive 0-20 mm cap. with swivel table motorized with chuck & key.	1 no.
138.	Drilling machine bench	Sensitive 0-12 mm cap motorized with chuck and key.	2 nos.
139.	D.E. pedestal Grinding machine with wheels rough and smooth	2 H.P.-3Phase-415V, 1500 rpm,250 dia. wheel	1 no.


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