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

COMPETENCY BASED CURRICULUM

WELDER (GMAW & GTAW)

(Duration: One Year)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 2.5

SECTOR – CAPITAL GOODS AND MANUFACTURING

Directorate General of Training

WELDER (GMAW & GTAW)

(Engineering Trade)

(Revised in March 2023)

Version: 2.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 2.5

Developed By

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1. COURSE INFORMATION

During the one-year duration of "Welder (GMAW & GTAW)" trade, a candidate is trained on Professional Skill, Professional Knowledge, Engineering Drawing and Employability Skill related to job role. In addition to this, a candidate is entrusted to undertake project work, extracurricular activities and on-the-job training to build up confidence. The broad components covered under Professional Skill subject are as below:-

Trainee learns about elementary first aid, firefighting, environment regulation and housekeeping etc. Performs joining of MS sheet by Gas welding in different positions, Joins MS plates by SMAW in different positions, performs straight, bevel & circular cutting on MS plate by Oxy-acetylene cutting process. The trainee leans joining of different types of MS pipe by Gas welding (OAW), SMAW. The Trainee sets up GMAW/ GTAW plant and weld M.S, S.S and Aluminium sheets in all positions, performs Arc gauging on MS plate, joins MS/ Aluminium /SS sheets/plates by GMAW, GTAW& FCAW process in various positions using different modes of metal transfer. Cuts ferrous and non-ferrous metal using plasma Arc cutting. The trainee tests welded joint by visual inspection Dye penetrant & Magnetic particle testing methods.

Professional Knowledge subject is simultaneously taught in the same fashion to apply cognitive knowledge while executing task. In addition components like Physical properties of engineering materials, different types of iron, properties and uses. In addition to above components the core skills components viz., employability skills are also covered. These core skills are essential skills which are necessary to perform the job in any given situation.

2. TRAINING SYSTEM

2.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under the aegis of Directorate General of Training (DGT). Craftsman Training Scheme (CTS) with variants and Apprenticeship Training Scheme (ATS) are two pioneer schemes of DGT for strengthening vocational training.

Welder (GMAW & GTAW) trade under CTS is one of the courses delivered nationwide through network of ITIs. The course is of one year duration. It mainly consists of Domain area and Core area. In the Domain area (Trade Theory & Practical)imparts professional skills and knowledge, while Core area (Employability Skills) imparts requisite core skills, knowledge and life skills. After passing out of the training program, the trainee is awarded National Trade Certificate (NTC) by DGT which is recognized worldwide.

Broadly candidates 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 & employability 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

- Can join industry as Technician and will progress further as Senior Technician, Supervisor and can rise up to the level of Manager.
- Can become Entrepreneur in the related field.
- Can take admission in diploma course in notified branches of Engineering by lateral entry.
- Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.

- Can join Advanced Diploma (Vocational) courses under DGT as applicable

2.3 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of one year:-

S No.	Course Element	Notional Training Hours
1	Professional Skill (Trade Practical)	840
2	Professional Knowledge (Trade Theory)	240
5	Employability Skills	120
	Total	**1200**

Every year 150 hours of mandatory OJT (On the Job Training) at nearby industry, wherever not available then group project is mandatory.

On the Job Training (OJT)/ Group Project	150
Optional Courses (10th/ 12th class certificate along with ITI certification or add on short term courses)	240

Trainees of one-year or two-year trade can also opt for optional courses of up to 240 hours in each year for 10th/ 12th class certificate along with ITI certification, or, add on short term courses.

2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of course through formative assessment and at the end of the training programme through summative assessment as notified by the DGT from time to time.

a) The **Continuous Assessment (Internal)** during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning outcomes. The training institute have to maintain individual trainee portfolio as detailed in assessment guideline. The marks of internal assessment will be as per the formative assessment template provided on www.bharatskills.gov.in

b) The final assessment will be in the form of summative assessment. The All India Trade Test for awarding NTC will be conducted by Controller of examinations, DGT as per the guidelines. The pattern and marking structure is being notified by DGT from time to time. **The learning outcome and assessment criteria will be the basis for setting question papers for final assessment. The examiner during final examination will also check** the individual

trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

For the purposes of determining the overall result, weightage of 100% is applied for six months and one year duration courses and 50% weightage is applied to each examination for two years courses. The minimum pass percent for Trade Practical and Formative assessment is 60% & for all other subjects is 33%.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking the assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising some of the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work
- Computer based multiple choice question examination
- Practical Examination

Evidences and records of internal (Formative) assessments are to be preserved until forthcoming examination for audit and verification by examining body. The following marking pattern to be adopted for formative assessment:

Performance Level	Evidence
(a) Marks in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should produce work which demonstrates	• Demonstration of good skill in the use of hand tools, machine tools and

attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices	workshop equipment. • 60-70% accuracy achieved while undertaking different work with those demanded by the component/job. • A fairly good level of neatness and consistency in the finish. • Occasional support in completing the project/job.
(b) Marks in the range of 75%-90% to be allotted during assessment	
For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices	• Good skill levels in the use of hand tools, machine tools and workshop equipment. • 70-80% accuracy achieved while undertaking different work with those demanded by the component/job. • A good level of neatness and consistency in the finish. • Little support in completing the project/job.
(c) Marks in the range of more than 90% to be allotted during assessment	
For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	• High skill levels in the use of hand tools, machine tools and workshop equipment. • Above 80% accuracy achieved while undertaking different work with those demanded by the component/job. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Welder Gas; fuses metal parts together using welding rod and oxygen acetylene flame. Examines parts to be welded, cleans portion to be joined, holds them together by some suitable device and if necessary makes narrow groove to direct flow of molten metal to strengthen joint. Selects correct type and size of welding rod, nozzle etc. and tests welding, torch. Wears dark glasses and other protective devices while welding. Releases and regulates valves of oxygen and acetylene cylinders to control their flow into torch. Ignites torch and regulates flame gradually. Guides flame along joint and heats it to melting point, simultaneously melting welding rod and spreading molten metal along joint shape, size etc. and rectifies defects if any.

Welder Electric; fuses metals using arc-welding power source and electrodes. Examines parts to be welded, cleans them and sets joints together with clamps or any other suitable device. Starts welding power source and regulates current according to material and thickness of welding. Connect one lead to part to be welded, selects required type of electrode and clamps other lead to electrode holder. May join parts first at various points for holding at specified angles, shape, form and dimension by tack welding. Establish arc between electrode and joint and maintain it throughout the length of the joint.

Gas Cutter; cuts metal to require shape and size by gas flame either manually or by machine. Examines material to be cut and marks it according to instruction of specification. Makes necessary connections and fits required size of nozzle in welding torch. Releases and regulates flow of gas in nozzle, ignites and adjusts flame. Guides flame by hand or machine along cutting line at required speed and cuts metal to required size.

Welder (GMAW& GTAW)while doing Gas Tungsten Arc welding(GTAW)also known as Tungsten Inert Gas (TIG) welding reads fabrication drawing, examines parts to be welded, cleans them and sets joints with clamps or any other suitable device. Selects suitable tungsten electrode, grinds the edges and fit in to the GTA welding torch. Selects gas nozzle and fit in to the GTA welding torch. Selects suitable filler rods and cleans them. Connects work piece with earth cable, Connects the machine with Inert gas Cylinder, regulator and flow meter. Starts the constant current GTA welding machine, sets suitable welding current & polarity and inert gas flow. Establish arc through across a column of highly ionized inert gas between work piece and Tungsten electrode. Melts the metal and deposit weld beads on metal surfaces by passing the suitable filler rod in to the weld puddle. Joins Steel, Stainless steel & Aluminium sheets and Aluminium & SS tubes.

Welder (GMAW & GTAW) while doing Gas Metal Arc welding also known as MIG/MAG Welding, reads fabrication drawing, examines parts to be welded, cleans them and sets joints with clamps or any other suitable device. Connects work piece with earth cable. Connects the machine with suitable gas Cylinder, regulator and flow meter. Connects preheater when CO2 is used as shielding gas. Selects suitable wire electrode, feed it to welding GMA Welding torch through wire feeder. Selects contact tip gas nozzle and fit in to the GMA welding torch. Preheats joints as required. Starts the Constant Voltage GMA welding machine, sets suitable welding

voltage & wire feed speed and shielding gas flow, produces arc between work piece and continuously fed wire electrode. Melts the metal and deposit weld beads on the surface of metals or joins metal pieces such as Steel, Stainless steel and aluminium metals. Also will do mixed shielding gas welding. May experience with tubular wire welding called Flux Cored Arc Welding (FCAW)

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

Reference NCO-2015:

(i) 7212.0100 – Welder, Gas
(ii) 7212.0200 – Welder, Electric
(iii) 7212.0300 – Welder, Machine
(iv) 7212.0400 – Gas Cutter

Reference NOS:

i) CSC/N0204
ii) CSC/N0201
iii) CSC/N0212
iv) CSC/N0209
v) CSC/N0205
vi) CSC/N0207
vii) CSC/N9401
viii) CSC/N9402

4. GENERAL INFORMATION

Name of the Trade	**Welder (GMAW & GTAW)**
Trade Code	DGT/1061
NCO - 2015	7212.0100, 7212.0200, 7212.0300, 7212.0400
NOS Covered	CSC/N0204, CSC/N0201, CSC/N0212, CSC/N0209, CSC/N0205, CSC/N0207, CSC/N9401, CSC/N9402
NSQF Level	Level-2.5
Duration of Craftsmen Training	One year (1200 Hours + 150 hours OJT/Group Project)
Entry Qualification	Passed 8th class examination
Minimum Age	14 years as on first day of academic session.
Eligibility for PwD	LD, LC, DW, AA, DEAF, HH
Unit Strength (No. Of Student)	20(There is no separate provision of supernumerary seats)
Space Norms	100 sq. m
Power Norms	16 KW
Instructors Qualification for	
1. Welder (GMAW & GTAW) Trade	B.Voc/Degree in Mechanical / Metallurgy / Production Engineering/ Mechatronics from AICTE/UGC recognized university/ college with one year experience in relevant field. OR 03 years Diploma in Mechanical/ Metallurgy/ Production Engineering/ Mechatronics from AICTE/ recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in relevant field. NTC/ NAC passed in "Welder" Trade with 3 years' experience in relevant field. **<u>Essential Qualification</u>:** Relevant Regular / RPL variants of National Craft Instructor Certificate (NCIC) under DGT. ***NOTE: Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications. However both of them must possess NCIC in any of its variants.***
2. Workshop Calculation & Science	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field. **OR** 03 years Diploma in Engineering from AICTE / recognized

	board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. **OR** NTC/ NAC in any one of the engineering trades with three years' experience. **Essential Qualification:** Regular / RPL variants of National Craft Instructor Certificate (NCIC) in relevant trade **OR** Regular / RPL variants NCIC in RoDA or any of its variants under DGT
3. Engineering Drawing	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field. **OR** 03 years Diploma in Engineering from AICTE / recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. **OR** NTC/ NAC in any one of the engineering/ Draughtsman group of trades with three years' experience. **Essential Qualification:** Regular / RPL variants of National Craft Instructor Certificate (NCIC) in relevant trade OR Regular/RPL variants NCIC in RoDA or any of its variants under DGT
4. Employability Skill	MBA/ BBA / Any Graduate/ Diploma in any discipline with Two years' experience with short term ToT Course in Employability Skills. (Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above) **OR** Existing Social Studies Instructors in ITIs with short term ToT Course in Employability Skills.
5. 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. Perform joining of MS sheet by Gas welding in different positions following safety precautions. (NOS: CSC/N0204)
2. Join MS plates by SMAW in different positions. (NOS: CSC/N0204)
3. Perform straight, bevel & circular cutting on MS plate by Oxy-acetylene cutting process. (NOS: CSC/N0201)
4. Perform different types of MS pipe joints by Gas welding (OAW). (NOS: CSC/N0204)
5. Weld different types of MS pipe joints by SMAW. (NOS: CSC/N0204)
6. Setup GMAW / GTAW plant and weld M.S, S.S and Aluminium sheets in all positions. (NOS: CSC/N0212)
7. Perform Arc gauging on MS plate. (NOS: CSC/N0204)
8. Join MS/ Aluminium /SS sheets/plates by GMAW in various positions using different modes of metal transfer. (NOS: CSC/N0209)
9. Use of mixed shielding gas for GMAW welding. (NOS: CSC/N0204)
10. Welding of metals by FCAW process. (NOS: CSC/N0205)
11. Join Aluminium & Stainless Steel sheets by GTAW in different position. (NOS: CSC/N0212)
12. Weld pipe joints by GTAW. (NOS: CSC/N0212)
13. Cut ferrous and nonferrous metal using plasma Arc cutting. (NOS: CSC/N0207)
14. Test welded joint by visual inspection Dye penetrant & Magnetic particle testing methods. (NOS: CSC/N0204)
15. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)
16. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)

6. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
1. Perform joining of MS sheet by Gas welding in different positions following safety precautions. (NOS: CSC/N0204)	Plan and select the nozzle size, working pressure type of flame, filler rod as per requirement.
	Prepare, set and tack the pieces as per drawing.
	Setting up the tacked joint in specific position.
	Deposit the weld following proper welding technique and safety aspect.
	Carry out visual inspection to ascertain quality weld joint.
2. Join MS plates by SMAW in different positions. (NOS: CSC/N0204)	Plan and select the type & size of electrode, welding current, type of edge preparation etc. as per requirement.
	Prepare, set and tack the pieces as per drawing.
	Set up the tacked pieces in specific position.
	Deposit the weld maintaining appropriate arc length, electrode angle, welding speed, weaving technique and safety aspects.
	Clean the welded joint thoroughly.
	Carry out visual inspection for appropriate weld joint.
	Inspect the weld using DPT/MPT.
3. Perform straight, bevel & circular cutting on MS plate by Oxy-acetylene cutting process. (NOS: CSC/N0201)	Plan and mark on MS plate surface for straight/bevel/circular cutting.
	Select the nozzle size and working pressure of gases as per requirement.
	Set the marked plate properly on cutting table.
	Perform the straight and bevel cutting operation maintaining proper techniques and all safety aspects.
	Perform the circular cutting operation by using profile cutting machine maintaining proper techniques and all safety aspects
	Clean the cutting burrs and inspect the cut surface for soundness of cutting.
4. Perform different type of MS pipe joints by Gas welding (OAW). (NOS: CSC/N0204)	Plan and prepare the development for a specific type of pipe joint.
	Mark and cut the MS pipe as per development.
	Select the size of filler rod, size of nozzle, working pressure etc.
	Set and tack the pieces as per drawing.
	Deposit the weld bead maintaining proper technique and safety aspects.
	Inspect the welded joint visually for poor penetration, uniformity of bead and surface defects.
5. Weld different types of MS pipe joints by SMAW. (NOS: CSC/N0204)	Plan and prepare the development for a specific type of pipe joint.
	Mark and cut the MS pipe as per development.
	Select the electrode size and welding current for welding.
	Set and tack the pieces as per drawing.

	Deposit the weld bead maintaining proper technique and safety aspects.
	Insect the welded joint visually for root penetration, uniformity of bead and surface defects.
6. Setup GMAW/ GTAW plant and weld M.S, S.S and Aluminium sheets in all positions. (NOS: CSC/N0212)	Select the welding machine, as per requirement.
	Connect the torch/welding gun to the machine.
	Connect the earth cable to the welding table.
	Set the welding current & Voltage.
	Set the wire feed rate.
	Set the gas flow rate.
7. Perform Arc gauging on MS plate. (NOS: CSC/9479)	Plan and select the size of electrode for Arc gouging.
	Select the polarity and current as per requirement.
	Perform gouging adapting proper gouging technique.
	Clean and check to ascertain the required stock removed.
8. Join MS /Aluminium/SS sheets/plates by GMAW in various positions using different modes of metal transfer. (NOS: CSC/N0209)	Select size of electrode wire, welding voltage, gas flow rate, wire feed rate as per requirement.
	Prepare, set and tack the pieces as per drawing.
	Set up the tacked joint in specific position.
	Deposit the weld adapting proper welding technique and safety aspects.
	Carry out visual inspection to ensure quality of welded joint.
	Inspect the weld using Dye-penetration Test (DPT)/Magnetic particle Test (MPT).
9. Using of mixed shielding gas for GMAW welding. (NOS: CSC/N0204)	Select size of electrode wire, welding voltage, gas flow rate, wire feed rate as per requirement.
	Prepare, set and tack the pieces as per drawing.
	Set up the tacked joint in specific position.
	Deposit the weld adapting proper welding technique and safety aspects.
	Carry out visual inspection to ensure quality of welded joint.
	Inspect the weld using Dye-penetration (DPT)/Magnetic particle Test (MPT).
10. Welding of metals by FCAW process. (NOS: CSC/N0205)	Select size of electrode wire, welding voltage, gas flow rate, wire feed rate as per requirement.
	Prepare, set and tack the pieces as per drawing.
	Set up the tacked joint in specific position.
	Deposit the weld adapting technique and safety aspects.
	Carry out visual inspection to ensure quality of welded joint.
	Inspect the weld using Dye-penetration (DPT)/Magnetic particle Test (MPT).
11. Join Aluminium &	Select power source as per material, size and type of Tungsten

Stainless Steel sheets by GTAW in different position. (NOS: CSC/N0212)	electrode, welding current, gas nozzle size, gas flow rate and filler rod size as per requirement.
	Prepare, set and tack the pieces as per drawing.
	Set up the tacked joint in specific position.
	Deposit the weld by adapting proper welding technique and safety aspects.
	Carry out visual inspection to ensure quality of welded joint.
12. Weld pipe joints by GTAW. (NOS: CSC/N0212)	Plan and prepare development or edge preparation for specific type of pipe joint.
	Mark and cut the MS pipe as per development.
	Select the type of welding current, size and type of tungsten electrode, size of nozzle, gas flow rate and welding current as per requirement.
	Set and tack the piece as per drawing.
	Deposit the weld bead maintaining proper technique and safety aspects.
	Inspect the welded joint visually for root penetration, bead uniformity and surface defects.
13. Cut ferrous and nonferrous metal using plasma Arc cutting. (NOS: CSC/N0207)	Plan and mark on Ferrous/Non ferrous metal plates surface for plasma cutting.
	Select the torch/nozzle size, current and working pressure of gas as per requirement.
	Set the marked plate properly on cutting table.
	Perform the cutting operation by adapting proper techniques and safety aspects.
	Clean and inspect the cut surface for quality of cutting.
14. Test welded joint by visual inspection Dye penetrant & Magnetic particle testing methods. (NOS: CSC/N0204)	Plan and select the job and clean the surface thoroughly.
	Select the appropriate testing methods.
	Perform testing of welded joints adapting standard operating procedure.
	Accept/reject the job based on test result.
15. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)	Read & interpret the information on drawings and apply in executing practical work.
	Read &analyze 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.
16. Demonstrate basic	Solve different mathematical problems

mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)	Explain concept of basic science related to the field of study

7. TRADE SYLLABUS

SYLLABUS - WELDER (GMAW & GTAW)			
DURATION: ONE YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional Skill 43Hrs; Professional Knowledge 08 Hrs	Perform joining of MS sheet by Gas welding in different positions following safety precautions.	Induction training: 1. Familiarization with the Institute. 2. Importance of trade Training. 3. Machinery used in the trade. Introduction to safety equipment and their use etc. 4. Hack sawing, filing square to dimensions. Marking out on MS plate and punching.	- General discipline in the Institute - Elementary First Aid. - Importance of Welding in Industry - Safety precautions in Shielded Metal Arc Welding, and Oxy-Acetylene Welding and Cutting.
		5. Setting up of Arc welding machine & accessories and striking an arc. 6. Setting of oxy-acetylene welding equipment, Lighting and setting of flame.	- Introduction and definition of welding. - Arc and Gas Welding Equipments, tools and accessories. - Various Welding Processes and its applications. - Arc and Gas Welding terms and definitions.
Professional Skill 23Hrs; Professional Knowledge 04 Hrs	Join MS plates by SMAW in different positions.	7. Fusion run without and with filler rod on M.S. sheet 2 mm thick in flat position. 8. Edge joint on MS sheet 2 mm thick in flat position without filler rod. 9. Marking and straight line cutting of MS plate. 10 mm thick by gas.	- Different process of metal joining methods: Bolting, riveting, soldering, brazing, seaming etc. - Types of welding joints and its applications. Edge preparation and fit up for different thickness. - Surface Cleaning
Professional Skill 164Hrs; Professional Knowledge 32 Hrs	Perform straight, bevel & circular cutting on MS plate by Oxy-acetylene cutting process.	10. Straight line beads on M.S. plate 10 mm thick in flat position. 11. Weaved bead on M. S plate 10mm thick in flat position.	- Basic electricity applicable to arc welding and related electrical terms & definitions. - Heat and temperature and its terms related to welding

			- Principle of arc welding. And characteristics of arc.
		12. Square butt joint on M.S. sheet 2 mm thick in flat Position. 13. Fillet "T" joint on M. S. Plate 10 mm thick in flat position.	- Common gases used for welding & cutting, flame temperatures and uses. - Types of oxy-acetylene flames and uses. - Oxy-Acetylene Cutting Equipment principle, parameters and application.
		14. Beveling of MS plates 10 mm thick. By gas cutting. 15. Open corner joint on MS sheet 2 mm thick in flat Position. 16. Fillet lap joint on M.S. plate 10 mm thick in flat position.	- Arc welding power sources: Transformer, Rectifier and Inverter type welding machines and its care & maintenance. - Advantages and disadvantages of A.C. and D.C. welding machines.
		17. Chair fabrication without hand rest, with square pipe of 25mm width 1 mm (GMAW/GTAW welding machine) 18. Fillet "T" joint on M S she et 2 mm thick in flat position. 19. Open Corner joint on MS plate 10 mm thick in flat position. 20. Fillet Lap joint on MS sheet 2 mm thick in flat position. 21. Single "V" Butt joint on M S plate 12 mm thick in flat position (1G).	- Welding positions as per EN & ASME: flat, horizontal, vertical and over head position. - Weld slope and rotation. - Welding symbols as per BIS & AWS. - Arc length - types - effects of arc length. - Polarity: Types and applications.
		22. Square Butt joint on M.S. sheet. 2 mm thick in Horizontal position. 23. Straight line beads and multi layer practice on M.S. Plate 10 mm thick in Horizontal position. 24. Fillet "T" 10 mm thick in Horizontal position.	- Calcium carbide uses and hazards. - Acetylene gas properties. - Acetylene gas Flash back arrestor
		25. Fillet Lap joint on M.S. sheet 2 mm thick in	- Oxygen gas and its properties

		horizontal position. 26. Fillet Lap joint on M.S. plate 10 mm thick in horizontal position.	- Charging process of oxygen and acetylene gases - Oxygen and Dissolved Acetylene gas cylinders and Color coding for different gas cylinders. - Uses of Single stage and double stage Gas regulators.
		27. Fusion run with filler rod in vertical position on 2mm thick M.S. sheet. 28. Square Butt joint on M.S. sheet. 2 mm thick in vertical position. 29. Single Vee Butt joint on M.S. plate 12 mm thick in horizontal position (2G).	- Oxy acetylene gas welding Systems (Low pressure and High pressure). Difference between gas welding blow pipe(LP & HP) and gas cutting blow pipe - Gas welding techniques. Rightward and Leftward techniques.
		30. Small tool fabrication with 25mm square pipe of Width iMM& dimension 12*9*9 inch. (GMAW/GTAW process). 31. Fillet "T" joint on M.S sheet 2 mm thick in vertical position. 32. Fillet "T" 10 mm thick in vertical position.	- Arc blow - causes and methods of controlling. - Distortion in arc & gas welding and methods employed to minimize distortion - Arc Welding defects, causes and Remedies.
Professional Skill 54Hrs; Professional Knowledge 12 Hrs	Perform different types of MS pipe joints by Gas welding (OAW).	33. Structural pipe welding butt joint on MS pipe 0 50 and 3mm WT in 1G position. 34. Fillet Lap joint on M.S. Plate 10 mm in vertical position.	- Specification of pipes, various types of pipe joints, pipe welding positions, and procedure. - Difference between pipe welding and plate welding.
		35. Open Corner joint on MS plate 10 mm thick in vertical position. 36. Pipe welding - Elbow joint on MS pipe 0-50 and 3mm WT.	- Pipe development for Elbow joint, "T" joint, Y joint and branch joint - Uses of Manifold system
		37. Pipe welding "T" joint on MS pipe 0 - 50 and 3mm WT.	- Gas welding filler rods, specifications and sizes. - Gas welding fluxes - types

		38. Single "V" Butt joint on M S plate 12 mm thick in vertical position (3G).	and functions. - Gas Brazing &Soldering : principles, types fluxes & uses - Gas welding defects, causes and remedies.
Professional Skill 61Hrs; Professional Knowledge 11 Hrs	Weld different types of MS pipe joints by SMAW.	39. Pipe welding 45 ° angle joint on MS pipe 0 - 50 and 3mm WT. 40. Straight line beads on M.S. plate 10mm thick in over head position.	- Electrode: types, functions of flux, coating factor, sizes of electrode. - Effects of moisture pick up. - Storage and baking of electrodes.
		41. Pipe Flange joint on M.S plate with MS pipe 0 - 50 mm X 3mm WT. 42. Fillet "T" 10 mm thick in over head position. 43. Pipe welding butt joint on MS pipe 0 - 50 and 5 mm WT. in 1G position. 44. Fillet Lap joint on M.S. plate 10 mm thick in over head position.	- Weldability of metals, importance of pre heating, post heating and maintenance of inter pass temperature. - Welding of low, medium and high carbon steel and alloy steels.
		45. Single "V" Butt joint on MS plate 10mm thick in over head position (4G). 46. Pipe butt joint on M. S. pipe 0 - 50mm WT 6mm (1G Rolled).	- Effects of alloying elements on steel - Stainless steel: types- weld decay and weldability.
Professional Skill 25 Hrs; Professional Knowledge 05 Hrs	Setup GMAW / GTAW plant and weld M.S, S.S and Aluminium sheets in all positions.	47. Square Butt joint on S.S. sheet. 2 mm thick in flat position. 48. Square Butt joint on S.S. Sheet 2 mm thick in flat position. 49. Square Butt joint on Brass sheet 2 mm thick in flat position.	- Brass - types - properties and welding methods. - Copper - types - properties and welding methods.
Professional Skill 23Hrs; Professional Knowledge 04 Hrs	Perform Arc gauging on MS plate.	50. Square Butt & Lap joint on M.S. sheet 2 mm thick by brazing. 51. Single "V" butt joint C.I. plate 6mm thick in flat position. 52. Arc gouging on MS plate 10 mm thick.	- Aluminium, properties and weldability, Welding methods - Arc cutting & gouging,

Professional Skill 20Hrs; Professional Knowledge 04 Hrs	Join MS/ Aluminium /SS sheets/plates by GMAW in various positions using different modes of metal transfer.	53. Square Butt joint on Aluminium sheet. 3 mm thick in flat position. 54. Bronze welding of cast iron (Single "V" butt joint) 6mm thick plate.	- Cast iron and its properties types. - Welding methods of cast iron.
Professional Skill 107Hrs; Professional Knowledge 22 Hrs	Using of mixed shielding gas for GMAW welding.	55. Familiarization with the machinery used in the trade. 56. Introduction to safety equipment and their use etc. 57. Setting up of GMAW/GTAW welding machine & accessories.	- Outline of the subjects to be covered. - Safety precautions pertaining to GTAW & GMAW.
		58. Straight line beads on MS plate by GMAW welding. 59. Lap joint on MS plate by GMAW welding in down hand position.	- Introduction to GMAW – equipment – accessories. - Various names of the process.(MIG-MAG/ CO2 WELDING, FCAW). - Advantages & Limitations.
		60. Open corner joint on MS plate in down hand position. 61. "T" joint on MS sheet in flat position.	- Power source & accessories Wire Feed unit. - Types of shielding gases &advantages.
		62. "T" joint on MS sheet in horizontal position. 63. "T" joint on MS sheet in vertical position. 64. "T" joint on MS sheet in overhead position.	- Welding Gun & its parts. - Modes of metal transfer - Dip, Globular, spray &pulsed transfer and its significance.
		65. Single "V' butt joint by C02 welding in down hand position. 66. Single "V' butt joint by Argo shield welding in flat position (Gas: Argon and CO_2 mixture).	- Flux cored arc welding. - Welding wire types and specification.
Professional Skill 41Hrs; Professional Knowledge 09 Hrs	Welding of metals by FCAW process.	67. Straight line beads on MS plate by Flux cored Arc welding (FCAW). 68. Single "V' joint by Flux cored Arc welding.	- Trouble shooting in MIG welding. - Data and Tables related to CO2 welding.
		69. Straight line beads on S.S plate by GMAW welding.	- Reading of Welding

		70. Lap & Square butt and T joint on S.S. sheet.	procedure specifications (WPS). - Reading of Procedure qualification Record (PQR)
Professional Skill 171Hrs; Professional Knowledge 31 Hrs	Join Aluminum & Stainless-Steel sheets by GTAW in different position.	71. Straight line beads on Aluminum plate by GMAW welding. 72. Single "V' and fillet joint on Aluminum plate. 73. Setting up GTAW welding plant and establishing the arc. 74. Beading practice on MS sheet by GTAW. 75. Square butt joint on MS in down hand position.	- Types of weld defects, causes and remedy in GMAW process. - Introduction to GTAW welding - Equipment& accessories. - Advantages & Limitations.
		76. Open corner joint on MS sheet in down hand position. 77. Lap joint on MS sheet in down hand position.)	- Power source - Types, polarity and application -
		78. Tee joint on MS sheet in down hand position.) 79. Lap joint on MS sheet in Horizontal position.	- Tungsten electrode, Types, sizes, and uses. - Type of shielding gases- Types & properties.
		80. Square butt joint on MS sheet in Horizontal position. 81. Square butt joint on MS sheet in Vertical position.	- GTAW Welding consumables - Types & Specifications as per BIS & AWS
		82. Lap & Tee joint on MS sheet in Vertical position. 83. Square butt joint on MS sheet in overhead position.	- Tables & data relating to TIG welding. - Different type of weld joints- plates & pipes.
		84. Beading practice on SS sheet. 85. Square butt joint on SS sheet by TIG in flat position. 86. Open corner joint on SS sheet by TIG in flat position.	- Edge preparation of plates & pipes. - Fitting of joint plates for TIG Welding.
		87. Square butt joint on SS sheet in Vertical position. 88. Lap joint on SS sheet in vertical position.	- Advantages of root pass welding of pipes by TIG welding
		89. Tee joint on SS sheet in Vertical position. 90. Square butt joint welding of	- Types of weld defects, causes and remedy in

		SS sheet with back purging Technique.	GTAW process.
Professional Skill 64Hrs; Professional Knowledge 12 Hrs	Weld pipe joints by GTAW.	91. Beading practice on Aluminium sheet by GTAW. 92. Square butt joint on Aluminium sheet by GTAW in flat position. Open corner joint on Aluminium sheet in flat position.	- Purging: Importance, Method of giving.
		93. Square butt joint on Aluminium sheet in Vertical position. Single V butt joint on Aluminum sheet by TIG.	- Weldability of metals.
		94. Square butt joint on Tube welding practice on M.S. & S.S tube metals in rolled position. Square butt joint on Tube welding practice on Aluminium in rolled position.	- Preheating and Post heating - Distortion and methods of control. - Submerged Arc welding - Principles, application- Types of fluxes, welding head, power source and Parameter setting.
Professional Skill 23Hrs; Professional Knowledge 04 Hrs	Cut ferrous and nonferrous metal using plasma Arc cutting.	95. Plasma cutting of SS sheets & Aluminum plates. Dimensional inspection of weldments. 96. Weld test specimen preparation. 97. Visual inspection of weldments.	- Plasma welding principles, Equipment, power source, parameter settings, Advantages & limitations - Plasma cutting principles and advantages.
Professional Skill 21Hrs; Professional Knowledge 04 Hrs	Test welded joint by visual inspection Dye penetrant & Magnetic particle testing methods.	98. Dye penetrant. 99. Magnetic particle testing.	- Inspection & testing of weldments - Visual inspection methods - Inspection kits - universal gauge, Fillet gauge, etc. - Non-destructive Testing methods, PT, MPT, UT & RT - Destructive testing - Bend test & tensile test.
Engineering Drawing: 40 Hrs.			
Professional Knowledge ED- 40 hrs	Read and apply engineering drawing for different application in the field of work.	**ENGINEERING DRAWING** - Introduction to Engineering Drawing and Drawing Instruments; Conventions Sizes and layout of drawing sheets Title Block, its position and content	

		Drawing Instrument - Free hand drawing of; Geometrical figures and blocks with dimension Transferring measurement from the given object to the free hand sketches. Free hand drawing of hand tools and measuring tools. - Lines Types and applications in drawing - Drawing of Geometrical figures; Angle, Triangle, Circle, Rectangle, Square, Parallelogram. Lettering & Numbering – Single Stroke, double stroke, inclined - Reading of dimension and Dimensioning Practice. - Reading of fabrication drawing, sectional view of different types of welding Joints. Sectional view of different pipe joints - Symbolic representation different symbols used in the related trades Reading of Job Drawing of related trades.
Workshop Calculation & Science: 38 hrs.		
Professional Knowledge WC – 38 hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	**WORKSHOP CALCULATION & SCIENCE** - Unit, Fractions - Square root, Ratio and Proportions, Percentage - Material Science - Mass, Weight, Volume and Density - Heat & Temperature and Pressure - Basic Electricity - Mensuration - Trigonometry

SYLLABUS FORCORE SKILLS
1. Employability Skills (Common for all CTS trades) (120 hrs.)

Learning outcomes, assessment criteria, syllabus and Tool List of Core Skills subjects which is common for a group of trades, provided separately in www.bharatskills.gov.in / dgt.gov.in

ANNEXURE-I

LIST OF TOOLS AND EQUIPMENT			
WELDER (GMAW & GTAW) (For Batch of 20 Candidates)			
SNo.	**Name of the Tool &Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOLS KIT			
1.	Welding helmet fibre		21(20+1) Nos.
2.	Welding hand shield fibre		21(20+1) Nos.
3.	Chipping Hammer with metal handle	250 grams	21(20+1) Nos.
4.	Chisel cold flat	19 mmx 150 mm	21(20+1) Nos.
5.	Centre punch	9mm x 127 mm	21(20+1) Nos.
6.	Dividers	200 mm	21(20+1) Nos.
7.	Stainless steel Rule	300 mm	21(20+1) Nos.
8.	Scriber	150 mm	21(20+1) Nos.
9.	Tongs flat	350 mm	21(20+1) Nos.
10.	Hacksaw frame fixed	300mm	21(20+1) Nos.
11.	File half round bastard	300 mm	21(20+1) Nos.
12.	File flat	350 mm bastard	21(20+1) Nos.
13.	Hammer ball peen	1 Kg with handle	21(20+1) Nos.
14.	Try square	6''	21(20+1) Nos.
15.	Tip Cleaner		21(20+1) Nos.
B. GENERAL MACHINERY SHOP OUTFIT			
16.	Spindle key		4 Nos.
17.	Screw Driver	300mm blade and 250 mm blade	1 each
18.	Number punch	6 mm	2 set
19.	Letter punch	6 mm	2 set
20.	Magnifying glass	100 mm. dia.	2 Nos.
21.	Universal Weld measuring gauge		2 Nos.
22.	Spanner D.E.	6 mm to 32mm	2 sets
23.	C-Clamps	10 cm and 15 cm	2 each
24.	Hammer sledge double faced 4 kg		2 No.
25.	S.S tape 5 meters flexible in case		5 No.
26.	H.P. Welding torch	with 5 nozzles	2 sets
27.	Oxygen Gas Pressure regulator double stage		2 Nos.
28.	Acetylene Gas Pressure regulator double stage		2 Nos.
29.	CO_2 Gas pressure regulator, with flow meter		2 set
30.	Argon Gas pressure regulator with flow meter		2 set
31.	Metal rack	182 cm x 152 cm x 45 cm	1 No.

32.	First Aid box		1 No.
33.	Steel lockers with 8 Pigeon holes		2 Nos.
34.	Steel almirah / cupboard		4 Nos.
35.	Black board and easel with stand		1 No.
36.	Flash back arrester (torch mounted)		4 pairs
37.	Flash back arrester (cylinder mounted)		4 pairs
C. GENERAL INSTALLATION			
38.	Welding Transformer with all accessories	400A , OCV 60 - 100 V, 60% duty cycle	2 sets
39.	Welding Transformer or Inverter based welding machine with all accessories	300A , OCV 60 - 100 V, 60% duty cycle	2 sets
40.	D.C Arc welding rectifiers set with all accessories	400 A. OCV 60 -100 V, 60% duty cycle	1 sets
41.	GMAW welding machine 400A capacity with air cooled torch, Regulator, Gas preheater, Gas hose and Standard accessories		2 set
42.	AC/DC GTAW welding machine with water cooled torch, Argon regulator, Gas hose, water circulating system and standard accessories.	torch 300 A	2 set
43.	Air Plasma cutting equipment with all accessories, capacity to cut 25 mm clear cut		1 set
44.	Air compressor suitable for air plasma cutting system		1 No.
45.	Auto Darkening Welding Helmet		5
46.	Portable abrasive cut-off machine		1 No.
47.	Pug cutting machine Capable of cutting Straight & Circular with all accessories		1 set
48.	Pedestal grinder fitted with coarse and medium grain size grinding wheels	dia. 300 mm	2 No.
49.	Bench grinder fitted with fine grain size silicon carbide green grinding wheel	dia. 150 mm	1 No.
50.	AG 4 Grinder		4 Nos.
51.	Suitable gas welding table with fire bricks		2 Nos.
52.	Suitable Arc welding table with positioner		9 Nos.
53.	Trolley for cylinder (H.P. Unit)		2 Nos.
54.	Hand shearing machine capacity to cut 6 mm sheets and flats		1 No.
55.	Power saw machine	18''	1 No.
56.	Portable drilling machine	Cap. 6 mm	2 No.
57.	Oven, electrode drying min. depth 450-500mm	0 to 250°C, 10 kg capacity	1 No.
58.	Work bench	340x120x75 cm with 4 bench vices of 150 mm jaw opening	5 sets
59.	Oxy Acetylene Gas cutting blow pipe		2 sets

60.	Oxygen, Acetylene Cylinders		#2 each
61.	CO_2 cylinder 30kg to 45 kg capacity		#2 Nos.
62.	Argon gas cylinder	7 m^3 or 10 m^3	#2 Nos.
63.	Anvil	24 sq. inches working area with stand	1 No.
64.	Swage block	16x16x16 inch	1 No.
65.	Magnetic particle testing Kit		1 set
66.	Fire extinguishers (foam type and CO2 type)		1 No.
67.	Fire buckets with stand		4 nos.
68.	Suitable gas cutting table		1 No.
69.	Welding Simulators for SMAW/GTAW/GMAW		1 each (Optional)
D. LIST OF CONSUMABLE			
70.	Leather Hand Gloves	14 "	21 Pairs
71.	Cotton hand gloves	8 "	21 pairs
72.	Leather hand sleeves	16 "	21 pairs
73.	Leg guards leather		21 pairs
74.	Leather Apron		21 Nos.
75.	Gas welding Goggles with filter glass	3A or 4A DIN	21 Nos.
76.	Wire brush (M.S & SS) 5 rows and 3 rows		21 Nos. each
77.	Spark lighter /cup lighter for welding purpose only		6 Nos.
78.	Safety boots for welders	Size 7,8,9,10	21 pairs
79.	Bubble face shield clear with rubber band		21 Nos.
80.	AG 4 Grinding wheels		50 nos.
81.	Welding rubber hose, oxygen and acetylene 8 mm dia. As per BIS		30 mtr each
82.	Rubber hose clips ½ inch		20 nos.
83.	Arc welding filter glasses DIN 9A 11 A & 13 A	108 mm x 82 mm x 3 mm	20 each
84.	Plain glasses for helmets	108 mm x 82 mm x 3 mm	40nos
85.	AG 4 cutting wheels		100 nos.
86.	Electrode holder	600 amps	6 Nos.
87.	Earth clamp	600A	6 Nos.
88.	Die penetrant testing kit		1 set
89.	Hexa Blade		6 Nos

Note:

1. Internet facility is desired to be provided in the class room.
2. No additional items are required to be provided for unit or batch working in the Second shift except the items under trainee's tool kit and steel lockers.

ANNEXURE-II

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts, trainers of ITIs, NSTIs, faculties from universities and all others who contributed in revising the curriculum.

Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

List of Expert members participated in preparation of course curriculum of Welder (GMAW & GTAW) trade			
S No.	**Name & Designation Shri/Mr./Ms.**	**Organization**	**Remarks**
MEMBERS OF SECTOR MENTOR COUNCIL			
1.	Dr.G. Buvanashekaran, AGM	WRI, Trichy - Chairman	Chairman
2.	Dr.K. Ashokkumar, AGM	BHEL, Trichy	Member
3.	Prof. Jyothi Mukhopadhya	IIT, Ahmedabad	Member
4.	B. Pattabhiraman, MD	GB Engineering, Tricgy	Member
5.	Dr. Rajeev kumar	IIT, Mandi	Member
6.	Dr. Vishalchauhan	IIT, Mandi	Member
7.	D.K. Singh	IIT, Kanpur	Member
8.	Navneet Arora	IIT, Roorkee	Member
9.	R. K. Sharma, Head	SDC, JBM Group, Faridabad	Member
10.	Puneet Sinha, Deputy Director	MSME, New Delhi	Member
MENTOR			
11.	Deepankar Mallick, DDG (C&P)	DGT Hq,	Mentor
MEMBERS OF CORE GROUP			
12.	M Thamizharasan, JDT	CSTARI, Kolkata	Member
13.	M Kumaravel, DDT	FTI , Bangalore	Team Leader
14.	Sushil Kumar, DDT	DGT HQ,	Member
15.	S.P.Khatokar, T.O.	ATI, Mumbai	Member
16.	V.L. Ponmozhi, TO	CTI, Chennai	Member
17.	D. Pani, TO	ATI, Howrah	Member
18.	Amar Singh, TO	ATI, Ludhiyana	Member
19.	Gopalakrishnan, TO	NIMI, Chennai	Member
20.	Manjunatha B.S, JTO	GITI, K.G.F. Karnataka	Member
21.	Venugopal PC	ITI Chalakudi, Kerala	Member

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
LD	Locomotor Disability
CP	Cerebral Palsy
MD	Multiple Disabilities
LV	Low Vision
HH	Hard of Hearing
ID	Intellectual Disabilities
LC	Leprosy Cured
SLD	Specific Learning Disabilities
DW	Dwarfism
MI	Mental Illness
AA	Acid Attack
PwD	Person with disabilities


कौशलं बलम्