



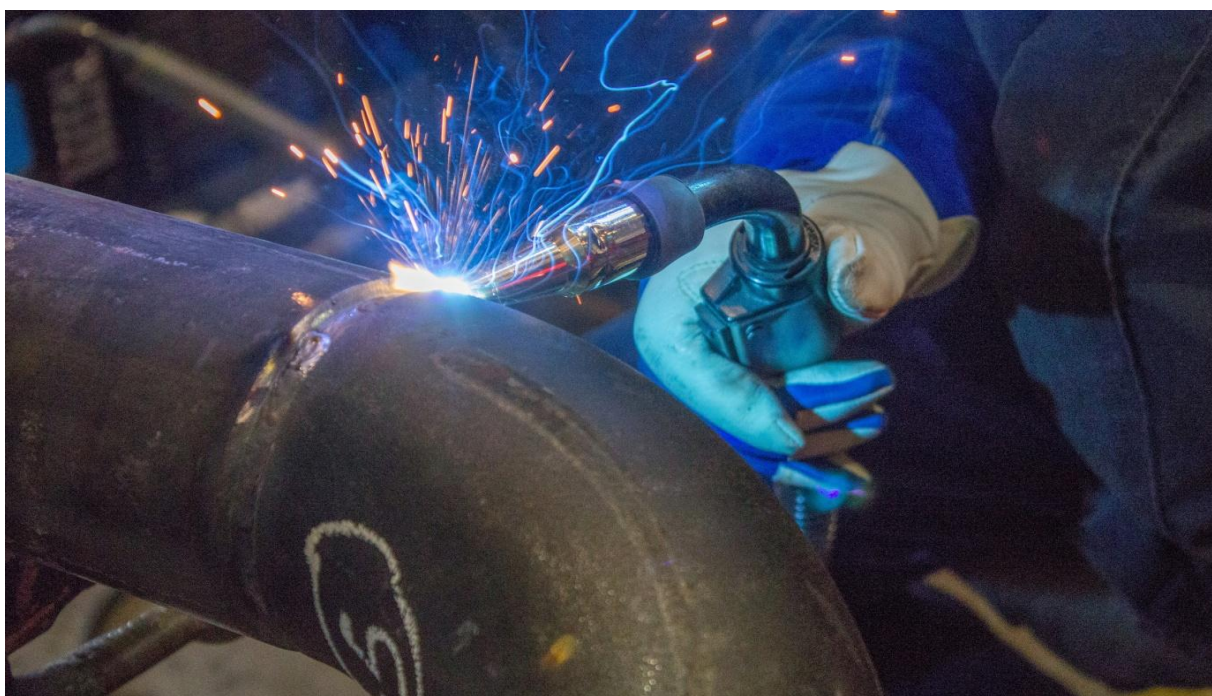
GOVERNMENT OF INDIA  
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP  
DIRECTORATE GENERAL OF TRAINING

**COMPETENCY BASED CURRICULUM**

# **WELDER** **(FABRICATION & FITTING)**

(Duration: One Year)

**CRAFTSMEN TRAINING SCHEME (CTS)**  
**NSQF LEVEL- 3**



**SECTOR – CAPITAL GOODS AND MANUFACTURING**



Directorate General of Training

# **WELDER**

## **(FABRICATION & FITTING)**

**(Engineering Trade)**

**(Revised in 2019)**

**Version: 1.2**

**CRAFTSMEN TRAINING SCHEME (CTS)**

**NSQF LEVEL- 3**

Developed By

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Directorate General of Training  
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## 1. COURSE INFORMATION

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During the one-year duration of “Welder (Fabrication & Fitting)” trade, a candidate is trained on Professional Skill, Professional Knowledge, Engineering Drawing, Workshop Science & Calculation 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:-

The trainee learns about elementary first aid, firefighting, environment regulation and housekeeping etc. The practical part starts with basic welding work on stainless steel, cast iron, aluminium and brass viz. cutting of pipes, brazing, arc gauging etc. Cutting of MS sheets & plates in different angles as per drawing, related to structural and pressure parts. Joining of pipes of different diameter and angles by gas welding, thread cutting on different types of pipes & fitting accessories and carry out drilling machine operations to steel structures for fabrication of structures. On completion of each welding job the trainees will also evaluate their jobs by visual inspection and identify the defects for further correction/improvement. They learn to adapt precautionary measures such as preheating; maintaining inter-pass temperature and post weld heat treatment for Welding Alloy steel, Cast Iron etc. The Workshop calculation taught will help them to plan and cut the required jobs economically without wasting the material and also used in estimating the Electrodes, filler metals etc. The Workshop Science taught will help them to understand the materials and properties, effect of alloying elements etc. Engineering Drawing taught will be applied while reading the job drawings and will be useful in understanding the location, type and size of weld to be carried out.

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, introduction to GTAW & GMAW, Heat & Temperature are also covered under theory part. In addition to above components the core skills components viz., Workshop calculation & science, Engineering drawing and Employability skills are also covered. These core skills are essential skills which are necessary to perform the job in any given situation.

### 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 (Fabrication & Fitting) 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. The Domain area (Trade Theory & Practical) imparts professional - skills and knowledge, while Core area (Workshop Calculation science, Engineering Drawing and 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)	1000
2	Professional Knowledge (Trade Theory)	280
3	Workshop Calculation & Science	80
4	Engineering Drawing	80
5	Employability Skills	160
	<b>Total</b>	<b>1600</b>

## 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](http://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%. There will be no Grace marks.

### 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 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

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 while assessing:

Performance Level	Evidence
(a) Weightage in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and	<ul style="list-style-type: none"> <li>• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment.</li> <li>• 60-70% accuracy achieved while</li> </ul>

due regard for safety procedures and practices.	<p>undertaking different work with those demanded by the component/job.</p> <ul style="list-style-type: none"> <li>• A fairly good level of neatness and consistency in the finish.</li> <li>• Occasional support in completing the project/job.</li> </ul>
<b>(b) Weightage in the range of 75%-90% to be allotted during assessment</b>	
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.	<ul style="list-style-type: none"> <li>• Good skill levels in the use of hand tools, machine tools and workshop equipment.</li> <li>• 70-80% accuracy achieved while undertaking different work with those demanded by the component/job.</li> <li>• A good level of neatness and consistency in the finish.</li> <li>• Little support in completing the project/job.</li> </ul>
<b>(c) Weightage in the range of more than 90% to be allotted during assessment</b>	
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.	<ul style="list-style-type: none"> <li>• High skill levels in the use of hand tools, machine tools and workshop equipment.</li> <li>• Above 80% accuracy achieved while undertaking different work with those demanded by the component/job.</li> <li>• A high level of neatness and consistency in the finish.</li> <li>• Minimal or no support in completing the project.</li> </ul>



### 3. JOB ROLE

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**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. May join part at various spots to prevent distortion of shape, form dimension etc. May preheat materials like cast iron prior to welding. May also weld by other gases such as argon coal etc.

**Welder, Electric;** Arc Welder fuses metals using arc-welding apparatus and electrodes (welding material). Examines parts to be welded, cleans them and sets joints together with clamps or any other suitable device. Starts generator or transformer (welding apparatus and regulates current according to material and thickness of welding. Clamps one lead (insulated wire carrying current from generator) to part to be welded, selects required type of electrode and clamps it to holder connected with other lead). Generates sparks between electrode and joint, simultaneously guiding and depositing melting electrode uniformly for welding. Takes precautionary measures such as wearing rubber gloves, holding welding screen of dark glass etc. May join parts first at various points for holding at specified angles, shape, form and dimension.

**Welder, Machine;** operates gas or electric welding machine to joint metal parts by fusion. Sets machine for operation by igniting burners and adjusting flames or by switching on current. Regulates flow of gas or current and adjusts machine according to material to be welded. Checks cooling system and adjusts movement of conveyor, if any. Feeds material to be welded with either one by one or in batch according to type of machine and welds them by pressing paddle, or by automatic arrangements. May use fixtures or other suitable devices for mass production work. Is designated as Spot Welder, Flash Welder, etc. according to machine and type of work done.

**Gas Cutter;** Flame Cutter cuts metal to required shape and size by gas flame either manually or by machine. Examines material to be cut and marks it according to instruction of specification. Mounts template and sets machine to cut to specifications. Makes necessary connections and fits required size of nozzle or burner in welding torch. Releases and regulates flow of gas in nozzle or burner, ignites and adjusts flame. Guides flame by hand or machine along cutting line at required speed and cuts metal to required size. May use oxyacetylene or any other appropriate gas flame.

**Brazer;** fuses metal parts by heating using flux and fillings. Cleans and fastens parts to be joined face to face by wire, by seaming or by any other suitable means and prepares paste of flux and fillings. Applies it to joint and heats in furnace or by torch to melt filling into joint. Allows it to cool down. Examines joint and cleans them by filing, buffing etc.

**Reference NCO-2015:**

- (i) 7212.0100 – Welder, Gas
- (ii) 7212.0200 – Welder, Electric
- (iii) 7212.0300 – Welder, Machine
- (iv) 7212.0400 – Gas Cutter
- (v) 7212.0500 – Brazer

## 4. GENERAL INFORMATION

<b>Name of the Trade</b>	<b>Welder (Fabrication &amp; Fitting)</b>
<b>Trade Code</b>	DGT/1073
<b>NCO - 2015</b>	7212.0100, 7212.0200, 7212.0300, 7212.0400, 7212.0500
<b>NSQF Level</b>	Level-3
<b>Duration of Craftsmen Training</b>	One year (1600 Hours)
<b>Entry Qualification</b>	Passed 8 <sup>th</sup> class examination
<b>Minimum Age</b>	14 years as on first day of academic session.
<b>Eligibility for PwD</b>	LD, LC, DW, AA, DEAF, HH
<b>Unit Strength (No. Of Student)</b>	20 (There is no separate provision of supernumerary seats)
<b>Space Norms</b>	80 Sq. m
<b>Power Norms</b>	16 KW
<b>Instructors Qualification for</b>	
<b>1. Welder (Fabrication &amp; Fitting) Trade</b>	<p>B.Voc/Degree in Mechanical/ Metallurgy/ Production Engineering/ Mechatronics from AICTE/UGC recognized university/ college with one year experience in the relevant field.</p> <p style="text-align: center;"><b>OR</b></p> <p>03 years Diploma in Mechanical and allied trades from AICTE/ recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years experience in relevant field.</p> <p style="text-align: center;"><b>OR</b></p> <p>NTC/ NAC passed in “Welder/ Welder (Fabrication &amp; Fitting)” Trade with three years experience in relevant field.</p> <p><b><u>Essential Qualification:</u></b></p> <p>Relevant National Craft Instructor Certificate (NCIC) in any of the variants under DGT.</p> <p><b><i>Note: Out of two Instructors required for the unit of 1+1, one must have Degree/Diploma and other must have NTC/NAC qualifications. However both of them must possess NCIC in any</i></b></p>

	<b><i>of its variants.</i></b>
<b>2. Workshop Calculation &amp; Science</b>	<p>B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field.</p> <p style="text-align: center;"><b>OR</b></p> <p>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.</p> <p style="text-align: center;"><b>OR</b></p> <p>NTC/ NAC in any one of the engineering trades with three years' experience.</p> <p><b><u>Essential Qualification:</u></b></p> <p>National Craft Instructor Certificate (NCIC) in relevant trade</p> <p style="text-align: center;"><b>OR</b></p> <p>NCIC in RoDA or any of its variants under DGT</p>
<b>3. Engineering Drawing</b>	<p>B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field.</p> <p style="text-align: center;"><b>OR</b></p> <p>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.</p> <p style="text-align: center;"><b>OR</b></p> <p>NTC/ NAC in any one of the Engineering trades with three years experience.</p> <p><b><u>Essential Qualification:</u></b></p> <p>National Craft Instructor Certificate (NCIC) in relevant trade</p> <p style="text-align: center;"><b>OR</b></p> <p>NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT.</p>
<b>4. Employability Skill</b>	<p>MBA/ BBA / Any Graduate/ Diploma in any discipline with Two years' experience with short term ToT Course in Employability Skills from DGT institutes.</p> <p>(Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above)</p> <p style="text-align: center;"><b>OR</b></p> <p>Existing Social Studies Instructors in ITIs with short term ToT</p>

		Course in Employability Skills from DGT institutes.			
5. Minimum Age for Instructor		21 Years			
List of Tools and Equipment		As per Annexure – I			
Distribution of training on Hourly basis: (Indicative only)					
Total Hrs /week	Trade Practical	Trade Theory	Workshop Cal. & Sc.	Engg. Drawing	Employability Skills
40 Hours	25 Hours	7 Hours	2 Hours	2 Hours	4 Hours

## 5. LEARNING OUTCOME

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

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### 5.2 LEARNING OUTCOMES (TRADE SPECIFIC)

1. Perform joining of MS sheets by Gas welding in different positions following safety precautions.
2. Join MS plates by SMAW in different positions.
3. Perform straight, bevel & circular cutting on MS plate by Oxy-acetylene cutting process.
4. Perform different type of MS pipe joints by Gas welding (OAW).
5. Weld different types of MS pipe joints by SMAW.
6. Weld Stainless steel, Cast iron, Brass & Aluminum by OAW.
7. Perform Arc gauging on MS plate.
8. Perform linear and angular measurement and check surface level using specified gauges and carry out marking using marking block.
9. Perform drilling machine operations to steel structures for fabrication of structures.
10. Mark, cut and bevel the parts and prepare edges by Oxy acetylene Gas cutting for fabrication of structures.
11. Develop and make different geometrical shapes.
12. Study the design drawing related to structural and pressure parts and identify of metals, bars, plates, flats, channels, I section, T section, and box /hollow section etc for the purpose of fabricating structure.
13. Mark and cut sheet metals to required size using guillotine shearing machine.
14. Perform bending, straightening and edge planning for fabrication of structures.
15. Make fit up and carry out tack welding to fabricate structures as per the standard tack welding procedure.
16. Mark and prepare riveted joints.
17. Mark and prepare edges for different types of pipe joints viz T, Y & K joints and Tack welding Pipes.
18. Make templates for simple objects and fixtures.
19. Perform Marking on Girder and Trusses and make a simple lattice structure.
20. Make pipeline Assembly, welded section and cylindrical Tanks by SMAW.
21. Rectify distorted welded structure by flame straightening.
22. Carry out dimensional inspection of fit ups, Perform Cleaning & Painting on fitted structures.

## 6. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
1. Perform joining of MS sheets by Gas welding in different positions following safety precautions.	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.	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.	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	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.

welding (OAW).	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.	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.
	Inspect the welded joint visually for root penetration, uniformity of bead and surface defects.
6. Weld Stainless steel, Cast iron, Brass & Aluminum by OAW.	Plan and prepare the pieces for welding.
	Select the type and size of filler rod and flux, size of nozzle, gas pressure, preheating method and temperature as per requirement.
	Set and tack plates as per drawing.
	Deposit the weld maintaining appropriate technique and safety aspects.
	Cool the welded joint by observing appropriate cooling method. Use post heating as per requirement.
	Clean the joint and inspect the weld for its uniformity and different types of surface defects.
7. Perform Arc gouging on MS plate.	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. Perform linear and angular measurement and check surface level using specified gauges and carry out marking using marking block.	Measure inside & outside dimensions using Vernier caliper.
	Check surface Level using spirit level.
	Measure heights using Vernier height gauge.
	Measure angle using Bevel protractor.
	Mark dimensions using marking block.



9. Perform drilling machine operations to steel structures for fabrication of structures.	Drill different diameter of through holes by drilling.
	Drill Blind holes.
	Perform Countersinking.
10. Mark, cut and bevel the parts and prepare edges by Oxy acetylene Gas cutting for fabrication of structures.	Clean surface of plate by grinding and filing.
	Mark on plates for bevelling and chamfering.
	Prepare edge for Single "V" butt joint, Single bevel butt joint and Double V butt joint by Oxy acetylene Gas cutting.
	Grind and file for maintaining root face.
11. Develop and make different geometrical shapes.	Develop Prism to the given dimensions out of sheet metal.
	Develop Cylinder to the given dimensions out of sheet metal.
	Develop Cylinder to the given dimensions out of sheet metal.
	Develop Cone to the given dimensions out of sheet metal.
12. Study the design drawing related to structural and pressure parts and identify of metals, bars, plates, flats, channels, I section, T section, and box /hollow section etc for the purpose of fabricating structure.	Read fabrication drawings and identify the metal bars, plates, flats, channels, I section, T section, and box /hollow section etc. Identify specification of metals.
	Identify metal by colour code and measure dimension of Bars, Plates, Flats, Channels, I section, T' section, L section and Box section.
13. Mark and cut sheet metals to required size using guillotine shearing machine.	Identify the safety Precautions, and operate power Shearing machine.
	Mark on sheets to the require Size.
	Shear different sizes of sheets by adapting safety precaution.
14. Perform bending, straightening and edge planning for fabrication of	Bend plates & pipe by using plate/pipe bending machine.
	Bend pipes to different angles and shapes by using Pipe bending machine.
	Straighten plates by hammering (cold straightening)

structures.	Straighten plates by heating and hammering (hot straightening).
15. Make fit up and carry out tack welding to fabricate structures as per the standard tack welding procedure.	Cut high pressure pipe to required size by Gas cutting.
	Mark and bevel the pipes to required bevel angle and root face size by Gas cutting.
	Grind and file pipe edges pipes to required bevel angle and root face and clean the pipe surface.
	Tack weld the pipes together by SMAW.
16. Mark and prepare riveted joints.	Prepare single riveted lap joint.
	Prepare Double riveted lap joint.
	Single cover plate riveted butt joint.
	Bolted joints.
17. Mark and prepare edges for different types of pipe joints viz T, Y & K joints and Tack welding Pipes.	Develop templates for Gas cutting Pipes for „T' „Y' and „K' joint.
	Fit up the Pipes and tack weld the pipes as per the standard procedure for „T' „Y' and „K' joint.
	Mark for assembly and tack welding of gusset plates using height gauge.
	Mark on joint section beam using height gauge.
	Mark on joint column using height gauge.
	Mark on curved and bend plates and sections using measuring and marking tools.
	Mark on build up sections using measuring and marking tools.
	Mark using pantograph.
18. Make templates for simple objects and fixtures.	Make templates for marking on Simple objects.
	Make templates for Gussets and joint sections.
	Make simple fixtures.
19. Perform Marking on Girder and Trusses and make a simple lattice structure.	Making simple riveted plate assembly - Girder, trusses.
	Make Girder and trusses.
	Make a simple lattice structure.
20. Make pipeline Assembly, welded section and	Make pressure pipe line assembly by SMAW.
	Make welded section assembly by SMAW

cylindrical Tanks by SMAW.	Make cylindrical tanks by SMAW
21. Rectify distorted welded structure by flame straightening.	Rectify distorted welded structure by flame straightening with the use of oxy-acetylene flame heating, hammer and pull rod.
22. Carry out dimensional inspection of fit ups, Perform Cleaning & Painting on fitted structures.	Check dimensions of welded structures using measuring tape, try square, Levelling instruments etc.
	Clean the structures properly using chipping hammer, wire brush etc.
	Perform Painting.

## 7. TRADE SYLLABUS

SYLLABUS - WELDER (FABRICATION & FITTING)			
DURATION: ONE YEAR			
Duration	Reference Learning Outcome	Professional Skills (Trade Practical) With Indicative Hours	Professional Knowledge (Trade Theory)
Professional Skill 50 Hrs;  Professional Knowledge 14 Hrs	Perform joining of MS sheets 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. 4. Introduction to safety equipment and their use etc. 5. Hack sawing, filing square to dimensions. 6. Marking out on MS plate and punching. (25 hrs.)	<ul style="list-style-type: none"> <li>- General discipline in the Institute.</li> <li>- Elementary First Aid.</li> <li>- Importance of Welding in Industry.</li> <li>- Safety precautions in Shielded Metal Arc Welding, and Oxy-Acetylene Welding and Cutting. (07 hrs.)</li> </ul>
		7. Setting up of Arc welding machine & accessories and Striking an arc 8. Setting of oxy-acetylene welding equipment, Lighting and setting of flame. (25 hrs)	<ul style="list-style-type: none"> <li>- Introduction and definition of welding.</li> <li>- Arc and Gas Welding Equipments, tools and accessories.</li> <li>- Various Welding Processes and its applications.</li> <li>- Arc and Gas Welding terms and definitions. (07 hrs.)</li> </ul>
Professional Skill 25 Hrs;  Professional Knowledge	Join MS plates by SMAW in different positions.	9. Fusion run without and with filler rod on M.S. sheet 2 mm thick in flat position. 10. Edge joint on MS sheet 2 mm thick in flat position without filler rod.	<ul style="list-style-type: none"> <li>- Different process of metal joining methods: Bolting, riveting, soldering, brazing, seaming etc.</li> <li>- Types of welding joints and</li> </ul>

07Hrs		11. Marking and straight line cutting of MS plate. 10 mm thick by gas. (25 hrs.)	its applications. Edge preparation and fit up for different thickness. - Surface Cleaning. (07 hrs.)
Professional Skill 175 Hrs;  Professional Knowledge 49 Hrs	Perform straight, bevel & circular cutting on MS plate by Oxy-acetylene cutting process.	12. Straight line beads on M.S. plate 10 mm thick in flat position.	- Basic electricity applicable to arc welding and related electrical terms & definitions.
		13. Weaved bead on M. S plate 10mm thick in flat position.	- Heat and temperature and its terms related to welding.
		14. Square butt joint on M.S. sheet 2 mm thick in flat Position.	- Principle of arc welding. And characteristics of arc.
		15. Fillet "T" joint on M.S. Plate 10 mm thick in flat position. (25 hrs.)	- Common gases used for welding & cutting, flame temperatures and uses. - Chemistry of oxy-acetylene flame. - Types of oxy-acetylene flames and uses. - Oxy-Acetylene Cutting Equipment principle, parameters and application. (07 hrs.)
		16. Beveling of MS plates 10 mm thick. By gas cutting.	- Arc welding power sources: Transformer, Motor Generator set, Rectifier and Inverter type welding machines and its care & maintenance.
		17. Open corner joint on MS sheet 2 mm thick in flat Position	- Advantages and disadvantages of A.C. and D.C. welding machines. (07 hrs.)
		18. Fillet lap joint on M.S. plate 10 mm thick in flat position. (25 hrs.)	
		19. Circular gas cutting on MS	- Welding positions as per

		<p>plate 10 mm thick by profile cutting machine.</p> <p>20. Fillet "T" joint on M S sheet 2 mm thick in flat position</p> <p>21. Open Corner joint on MS plate 10 mm thick in flat position. (25 hrs.)</p>	<p>EN &amp; ASME: flat, horizontal, vertical and overhead position.</p> <ul style="list-style-type: none"> <li>- Weld slope and rotation.</li> <li>- Welding symbols as per BIS &amp; AWS. (07 hrs.)</li> </ul>
		<p>22. Fillet Lap joint on MS sheet 2 mm thick in flat position.</p> <p>23. Single "V" Butt joint on M S plate 12 mm thick in flat position (1G). (25 hrs.)</p>	<ul style="list-style-type: none"> <li>- Arc length - types - effects of arc length.</li> <li>- Polarity: Types and applications. (07 hrs.)</li> </ul>
		<p>24. Square Butt joint on M.S. sheet. 2 mm thick in Horizontal position.</p> <p>25. Straight line beads and multi layer practice on M.S. Plate 10 mm thick in Horizontal position.</p> <p>26. F "T" 10 mm thick in Horizontal position. (25 hrs.)</p>	<ul style="list-style-type: none"> <li>- Calcium carbide properties and uses.</li> <li>- Acetylene gas properties and generating methods.</li> <li>- Acetylene gas Purifier, Hydraulic back pressure valve and Flash back arrestor. (07 hrs.)</li> </ul>
		<p>27. Fillet Lap joint on M.S. sheet 2 mm thick in horizontal position.</p> <p>28. Fillet Lap joint on M.S. plate 10 mm thick in horizontal position.</p> <p>29. Fusion run with filler rod in vertical position on 2mm thick M.S. sheet</p> <p>30. Square Butt joint on M.S. sheet. 2 mm thick in vertical position.</p> <p>31. Single Vee Butt joint on M.S. plate 12 mm thick in horizontal position (2G). (25 hrs.)</p>	<ul style="list-style-type: none"> <li>- Oxygen gas and its properties.</li> <li>- Production of oxygen by Air liquefaction.</li> <li>- Charging process of oxygen and acetylene gases.</li> <li>- Oxygen and Dissolved Acetylene gas cylinders and Color coding for different gas cylinders.</li> <li>- Gas regulators, types and uses.</li> <li>- Oxy acetylene gas welding Systems (Low pressure and High pressure). Difference</li> </ul>

			<p>between gas welding blow pipe(LP &amp; HP) and gas cutting blow pipe.</p> <ul style="list-style-type: none"> <li>- Gas welding techniques. Rightward and Leftward techniques. (07 hrs.)</li> </ul>
		<p>32. Weaved bead on M.S Plate 10mm in vertical position.</p> <p>33. Fillet "T" joint on M.S sheet 2 mm thick in vertical position.</p> <p>34. F "T" 10 mm thick in vertical position. (25 hrs.)</p>	<ul style="list-style-type: none"> <li>- Arc blow - causes and methods of controlling.</li> <li>- Distortion in arc &amp; gas welding and methods employed to minimize distortion.</li> <li>- Arc Welding defects, causes and Remedies. (07 hrs.)</li> </ul>
Professional Skill 50 Hrs;  Professional Knowledge 14 Hrs	Perform different type of MS pipe joints by Gas welding (OAW).	<p>35. Structural pipe welding butt joint on MS pipe 0 50 and 3mm WT in 1G position.</p> <p>36. Fillet Lap joint on M.S. Plate 10 mm in vertical position.</p> <p>37. Open Corner joint on MS plate 10 mm thick in vertical position.</p> <p>38. Pipe welding - Elbow joint on MS pipe 0 -50 and 3mm WT. (25 hrs.)</p>	<ul style="list-style-type: none"> <li>- Specification of pipes, various types of pipe joints, pipe welding positions, and procedure.</li> <li>- Difference between pipe welding and plate welding.</li> <li>- Pipe development for Elbow joint, "T" joint, Y joint and branch joint.</li> <li>- Manifold system. (07 hrs.)</li> </ul>
		<p>39. Pipe welding "T" joint on MS pipe 0 5 0 and 3mm WT.</p> <p>40. Single "V" Butt joint on M S p late 12 mm thick in vertical position (3G). (25 hrs.)</p>	<ul style="list-style-type: none"> <li>- Gas welding filler rods, specifications and sizes.</li> <li>- Gas welding fluxes - types and functions.</li> <li>- Gas Brazing &amp; Soldering : principles, types fluxes &amp; uses.</li> <li>- Gas welding defects, causes and remedies. (07 hrs.)</li> </ul>

Professional Skill 75 Hrs;  Professional Knowledge 21 Hrs	Weld different types of MS pipe joints by SMAW.	41. Pipe welding 45 ° angle joint on MS pipe 0 50 and 3mm WT.	<ul style="list-style-type: none"> <li>- Electrode : types, functions of flux, coating factor, sizes of electrode Coding of electrode as per BIS, AWS,</li> <li>- Effects of moisture pick up.</li> <li>- Storage and baking of electrodes.</li> <li>- Special purpose electrodes and their applications.</li> <li>- Weldability of metals, importance of pre heating, post heating and maintenance of inter pass temperature. (07 hrs.)</li> </ul>
		42. Straight line beads on M.S. plate 10mm thick in over head position.	
		43. Pipe Flange joint on M.S plate with MS pipe 0 50 mm X 3mm WT	
		44. F "T" 10 mm thick in over head position. (25 hrs.)	<ul style="list-style-type: none"> <li>- Classification of steel.</li> <li>- Welding of low, medium and high carbon steel and alloy steels. (07 hrs.)</li> </ul>
		45. Pipe welding butt joint on MS pipe 0 50 and 5 mm WT. in 1G position.	
		46. Fillet Lap joint on M.S. plate 10 mm thick in over head position. (25 hrs.)	
		47. Single "V" Butt joint on MS plate 10mm thick in over head position(4G)	<ul style="list-style-type: none"> <li>- Effects of alloying elements on steel</li> <li>- Stainless steel: types- weld decay and weldability. (07 hrs.)</li> </ul>
		48. Pipe butt joint on M. S. pipe 0 50mm WT 6mm (1G Rolled). (25 hrs.)	
Professional Skill 25 Hrs;  Professional Knowledge 07 Hrs	Perform welding of Stainless steel, Cast iron, Aluminium and Brass by OAW.	49. Square Butt joint on S.S. sheet. 2 mm thick in flat position.	<ul style="list-style-type: none"> <li>- Brass - types - properties and welding methods.</li> <li>- Copper - types - properties and welding methods. (07 hrs.)</li> </ul>
		50. Square Butt joint on S.S. Sheet 2 mm thick in flat position.	
		51. Square Butt joint on Brass sheet 2 mm thick in flat position. (25 hrs.)	
Professional	Perform Arc gauging on MS	52. Square Butt & Lap joint on M.S. sheet 2 mm thick by	<ul style="list-style-type: none"> <li>- Aluminium and its alloys, properties and weldability,</li> </ul>



Skill 50 Hrs;  Professional Knowledge 14 Hrs	plate.	brazing. 53. Single "V" butt joint C.I. plate 6mm thick in flat position. 54. Arc gouging on MS plate 10 mm thick. (25 hrs.)	Welding methods. - Arc cutting & gouging. (07 hrs.)
		55. Square Butt joint on Aluminium sheet. 3 mm thick in flat position. 56. Bronze welding of cast iron (Single "V" butt joint) 6mm thick plate. (25 hrs.)	- Cast iron and its properties types. - Welding methods of cast iron. (07 hrs.)
Professional Skill 50 Hrs;  Professional Knowledge 14 Hrs	Perform linear and angular measurement and check surface level using specified gauges and carry out marking using marking block.	57. Familiarization with the machinery Hand tools used in the trade. 58. Introduction to safety equipment and their use. 59. Handling of measuring instruments - Steel tape, Vernier caliper, Spirit level, Micrometer, Try square, Height gauge, Marking blocks, Bevel protractor etc. (25 hrs.)	- Outline of the subjects to be covered. - Role of fabrication in industry. - Basic Trigonometric calculations. - Marking of Angles, Triangles, Square, Rectangle, Parallelogram, Hexagon, Octagon and Circles. (07 hrs.)
		60. Development practice of surface of prism, cylinder, pyramids, cones, etc. (25 hrs.)	- Calculation of volume and surface area of rectangular prism, cubes and cylinders. - Development of right solids, prisms, cylinders, pyramids, cones, frustum of pyramid, cone etc. (07 hrs.)
Professional Skill 25 Hrs;  Professional Knowledge	Perform drilling machine operations to steel structures for fabrication of structures.	61. Marking on plates for drilling practice. 62. Drilling required diameter hole. (25 hrs.)	- Workshop practice - Hack sawing, Filing, Chipping, Hand grinding, Marking, Punching, Drilling, Tapping, Die-passing, etc.

07 Hrs			<ul style="list-style-type: none"> <li>- Drilling machine - construction and operation feature. (07 hrs.)</li> </ul>
Professional Skill 25 Hrs;  Professional Knowledge 07 Hrs	Mark, cut and bevel the parts and prepare edges by Oxy acetylene Gas cutting for fabrication of structures.	63. Marking on plates for beveling and chamfering. 64. Beveling and chamfering to required Angle. (25 hrs.)	<ul style="list-style-type: none"> <li>- Machine shop practice.</li> <li>- Milling machine construction and operation.</li> <li>- Milling cutter -Types of Milling etc.</li> <li>- Lathe - construction and operation.</li> <li>- Turning - Facing - Taper Turning - Threading etc. (07 hrs.)</li> </ul>
Professional Skill 25 Hrs;  Professional Knowledge 07 Hrs	Develop and make different Geometrical shapes.	65. Straight line beads on M S plate by SMAW 66. Tack welding on M S plate & channels by SMAW in different position. 67. Square butt joint weld on M S plate in down hand position by SMAW. (25 hrs.)	<ul style="list-style-type: none"> <li>- Principles of Shielded metal Arc welding (SMAW).</li> <li>- Basic Electricity of welding power source.</li> <li>- AC / DC power source advantages and disadvantages.</li> <li>- Polarity types &amp; Arc length. (07 hrs.)</li> </ul>
Professional Skill 75 Hrs;  Professional Knowledge 21 Hrs	Study the design drawing related to structural and pressure parts and identify of metals, bars, plates, flats, channels, I section, T section, and box /hollow section etc for the purpose of fabricating	68. Fillet, Tee and Lap joint weld in down hand position by SMAW. 69. Fillet weld open corner joint on MS plate in down hand position by SMAW. 70. Single V butt joint on MS flat in down hand position by SMAW. (25 hrs.)	<ul style="list-style-type: none"> <li>- Electrode - Types, description &amp; Specification - BIS, AWS, etc.</li> <li>- Functions of flux &amp; Characteristics of flux &amp; arc.</li> <li>- Selection of electrodes and coating factors.</li> <li>- Tack welding procedure on plate, channels &amp; pipe: Length &amp; pitch. (07 hrs.)</li> </ul>

	structure.	71. Identification of metals, bars, plates, flats, channels, I section, T section, and box section etc. (25 hrs.)	<ul style="list-style-type: none"> <li>- Metals used in fabrication.</li> <li>- Types of fabrication joints.</li> <li>- Types and classification of steel and application.</li> <li>- Framed structures - shell structure - Rolled sections, I section, channel section, angle section, T-section. (07 hrs.)</li> </ul>
		72. Study of design drawing related to structural and pressure parts and preparation of fitting square. (25 hrs.)	<ul style="list-style-type: none"> <li>- Welding symbols.</li> <li>- Structural/ Pressure vessel design drawing reading and understanding the concepts. (07 hrs.)</li> </ul>
Professional Skill 25 Hrs; Professional Knowledge 07 Hrs	Mark and cut sheet metals to required size using guillotine shearing machine.	73. Using guillotine shearing machine, marking and cutting of sheet metals to required size. (25 hrs.)	<ul style="list-style-type: none"> <li>- Description and operation of croppers, shearing machine, Guillotine shears, punching machines, Edge planning machine and nibbling machine etc.</li> <li>- Description and operation of straightening machines. (07 hrs.)</li> </ul>
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs	Perform bending, straightening and edge planning for fabrication of structures.	74. Practice on bending of plates and pipes to required shape.	<ul style="list-style-type: none"> <li>- Methods of bending plates, angle iron etc.</li> <li>- Cold bending and hot bending etc.</li> <li>- Bending of angles and channels.</li> <li>- Press work.</li> <li>- Flame straightening methods. (07 hrs.)</li> </ul>
		75. Straightening plates and section. 76. Edge planning as per requirement. (25 hrs.)	
		77. Preparation of pipe joint for high pressure pipe welding. 78. Pipe Welding - preparation	<ul style="list-style-type: none"> <li>- Pipes and pipe fitting - Pipe schedule - types - methods of bending - use</li> </ul>

		of edges – cleaning the joint surface - Fit up the pipes. (25 hrs.)	of bending fixture - pipe bending machine - use of pipe cutter, pipe wrenches - pipe vices - pipe threads - pipe dies and taps etc.(07 hrs.)
Professional Skill 25 Hrs; Professional Knowledge 07 Hrs	Make fit up and carry out tack welding to fabricate structures as per the standard tack welding procedure.	79. Tack weld two pipes together 80. Pipe work - cutting - bending - threading -joining and assembly. (25 hrs.)	- Edge preparation for pressure line pipes. - Fit up procedure. (07 hrs.)
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs	Mark and prepare riveted joints.	81. Preparation of single riveted lap joint. 82. Double riveted lap joint. (25 hrs.) 83. Single cover plate riveted butt joint. 84. Double cover plate riveted butt joint. 85. Bolted joints. (25 hrs.)	- Hand riveting, cold and hot - methods of riveting - use of pneumatic riveting, hydraulic riveting - checking rivets - removing of bad rivets. (07 hrs.) - Types of bolts - black bolt, turned bolt, high strength bolt etc. and their application. - Development of pipe templates for T,Y,K joints. (07 hrs.)
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs	Mark and prepare edges for different types of pipe joints viz T,Y&K joints and Tack welding Pipes.	86. Preparation of pipes for T, Y, K joints. 87. Marking gusset plates. 88. Marking joint section beam. 89. Marking joint column using height gauge. (25 hrs.) 90. Marking on curved and bend	- Kind of structures - Column base, plate girders, Gantry girders, Root trusses -description, types and use - Beam connection, beam to column connection - framed connection and seated connection. (07 hrs.) - Type of pressure vessels -

		<p>plates and section.</p> <p>91. Marking on built up section.</p> <p>92. Usage of pantograph for marking. (25 hrs.)</p>	<p>Boilers, Heat exchangers, High pressure pipe lines etc. - Marking for cutting to size, marking for beveling and chamfering and marking for pipes and intersection. (07 hrs.)</p>
<p>Professional Skill 50 Hrs;</p> <p>Professional Knowledge 14 Hrs</p>	<p>Make templates for simple objects and fixtures.</p>	<p>93. Making templates for cutting to size and simple objects. (25 hrs.)</p>	<p>- Jigs and Template making - Design and description of templates for cutting - templates of gussets - templates for marking angle. (07 hrs.)</p>
		<p>94. Making templates for Gussets and joint sections.</p> <p>95. Making simple fixtures. (25 hrs.)</p>	<p>- Template for marking joint section.</p> <p>- Design and development of jigs for drilling and angles.</p> <p>- Design of simple fixture and clamping devices. (07 hrs.)</p>
<p>Professional Skill 25 Hrs;</p> <p>Professional Knowledge 07 Hrs</p>	<p>Perform Marking on Girder and Trusses and make a simple lattice structure.</p>	<p>96. Making simple riveted plate assembly - Girder, trusses.</p> <p>97. Making a simple lattice structure. (25 hrs.)</p>	<p>- Assembly: Procedure and technique for assembly.</p> <p>- Assembling of riveted plates, girders and trusses. (07 hrs.)</p>
<p>Professional Skill 25 Hrs;</p> <p>Professional Knowledge 07 Hrs</p>	<p>Make pipeline Assembly, welded section and cylindrical Tanks by SMAW.</p>	<p>98. Making pressure pipe line assembly.</p> <p>99. Making welded section assembly.</p> <p>100. Making cylindrical tanks. (25 hrs.)</p>	<p>- Assembly of welded section.</p> <p>- Assembly of cylindrical tanks including fitting and lining of vessels. (07 hrs.)</p>
<p>Professional Skill 25 Hrs;</p> <p>Professional Knowledge</p>	<p>Rectify distorted welded structure by flame straightening.</p>	<p>101. Rectification of distorted welded structure by flame straightening. (25 hrs.)</p>	<p>- Distortion &amp; methods of control.</p> <p>- Preventing and allowing for weld distortion.</p>

07 Hrs			<ul style="list-style-type: none"> <li>- Common welding defects.</li> <li>- Inspection and testing.</li> <li>- Non destructive method of flaw detection -PT, MPT, Ultrasonic &amp; Radiographic inspection. (07 hrs.)</li> </ul>
Professional Skill 25 Hrs; Professional Knowledge 07 Hrs	Carry out dimensional inspection of fit ups, perform Cleaning & Painting on fitted structures.	102. Dimensional inspection of fit ups Cleaning & Painting. (25 hrs.)	<ul style="list-style-type: none"> <li>- Chipping &amp; Grinding : Chisels &amp; pneumatic chisels used for chipping- Method of chipping and cutting - Types of grinding machines -Grinding wheels - Method of removing welds and rivets by chipping and grinding.</li> <li>- Finishing &amp; Painting: Common types of painting. Stenciling, marking and colour marking. (07 hrs.)</li> </ul>
<b>Industrial training / Project work</b>			

### SYLLABUS FOR CORE SKILLS

1. Workshop Calculation & Science(Common for one year courses) (80 Hrs)
2. Engineering Drawing (80 Hrs)
3. Employability Skills (Common for all CTS trades) (160 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](http://www.bharatskills.gov.in)

LIST OF TOOLS AND EQUIPMENT			
WELDER (FABRICATION & FITTING) (For Batch of 20 Candidates)			
S No.	Name of the Tool &Equipment	Specification	Quantity
<b>A. TRAINEES TOOLS KIT</b>			
1.	Welding helmet fibre		20+1 Nos.
2.	Welding hand shield fibre		20+1 Nos.
3.	Chipping Hammer with metal handle	250 grams	20+1 Nos.
4.	Chisel cold flat	19 mmx 150 mm	20+1 Nos.
5.	Centre punch	9mm x 127 mm	20+1 Nos.
6.	Dividers	200 mm	20+1 Nos.
7.	Stainless steel Rule	300 mm	20+1 Nos.
8.	Scriber	150 mm	20+1 Nos.
9.	Tongs flat	300 mm	20+1 Nos.
10.	Hacksaw frame adjustable / fixed	30 cm	20+1 Nos.
11.	File half round bastard	30 cm	20+1 Nos.
12.	File flat	35 cm rough/bastard	20+1 Nos.
13.	Hammer ball peen	1 Kg with handle	20+1 Nos.
14.	Try square	150 mm	20+1 Nos.
15.	Protractor with blade	150 mm	20+1 Nos.
16.	Steel Tape	2 meters	20+1 Nos.
<b>B. GENERAL MACHINERY SHOP OUTFIT</b>			
17.	Steel Square	450mm x 600 mm x 50 mm thick	4 Nos.
18.	Sheet Metal Gauge		2Nos.
19.	Stake Round and Bottom		4 Nos.
20.	Tinmans	300 mm	8 Nos.
21.	Snips straight	250 mm	8 Nos.
22.	Right cut snips	250 mm	4 Nos.
23.	Left cut Snips	250 mm	4 Nos.
24.	Hand Shear Universal	250 mm	4 Nos.
25.	Punch Round	3 mm dia	4 Nos.
26.	Rivet set and snap and dolly combined	3 mm ,4 mm, 6mm	4 Nos. each
27.	Chisel cold flat	25 mm x 250 mm	4 Nos.

28.	Punch Letter	4mm	1 set
29.	Punch Number	4 mm	1 set
30.	Hand Groover	3 mm, 4mm, 5mm	4 Nos. each
31.	Plier Combination	150 mm	2 Nos.
32.	Grip Wrench	200mm	2 Nos.
33.	H.S.S. Twist Drill (Parallel Shank)	3 mm, 4mm & 6 mm	3 Nos. each
34.	Hand Drill	0 to 6 mm, 8mm, 10mm & 12mm	2 Nos. each
35.	Pneumatic rivet gun		2 Nos.
36.	Trammel Point	with beam 600 mm	1 No.
37.	Vernier caliper	0mm -150mm	1 No.
38.	Micrometer outside	0 to 25mm	1 No.
39.	Rasp cut file	250 mm	4 Nos.
40.	D.E. Spanner G.P	6mm to 32mm (Set of 12 spanners)	2 set
41.	Hand vice	50mm	20+1 Nos.
42.	Raising Hammer with handle		4 Nos.
43.	Rawl Punch holder and bits	No.8,10, 12,14	2 sets
44.	Hollowing Hammer with handle		4 Nos.
45.	Trepanning tool	70mm	1 No.
46.	Crow bar	910 x 25mm	2 Nos.
47.	Trowel Medium		1 No.
48.	Crow bar	910 x 25mm	2Nos.
49.	Trowel Medium		1 No.
50.	Pop rivet gun		2 Nos.
51.	Screw Driver	250mm	2 Nos.
52.	C Clamp	6 "	6 Nos.
53.	Bench lever shears	250mm Blade x 3 mm Capacity	1 No.
54.	Air Compressor ( Pressure and displacement of air)		1 No.
55.	Circle Cutting Machine	300 mm Dia	1 No
56.	Pillar type drilling machine	12mm	1 No.
57.	Slip roll former	1.6mm x 1000 mm	1 No.
58.	D.E. Grinder Pedestal motorized	200 mm	1 No.
59.	Anvil	50 Kgs with Stand	1 No.
60.	Bench vice	120mm, 150mm	2 each



61.	Fly press Ball press	No.4 single body	1 No.
62.	Pipe Bending Machine ( Hydraulic type)	12mm to 30mm	1 No.
63.	Hand Press Brake Capacity	0.8mm	1 No.
64.	Tin smiths bench folder	600 x 1.6mm	1 No.
65.	Pipe bend machine Manual with Dies		1 No
66.	Plate bending machine (Roller type) capacity upto 8 mm thickness		1 No
67.	Pneumatic Screw Driver with	6 mm, 8mm, 10mm, 16 mm	1 No
68.	Pneumatic Riveting machine	depth of 50 mm	1 No
69.	Pneumatic Drilling machine with bits 4,5,6,8 & 12 mm capacity		1 No
70.	Pneumatic Chips 50mm		1 No
71.	Pantograph machine for marking	1 mtr	1 No
72.	Vernier Height gauge range	500 mm	1 No
73.	Surface plate with cover	100cm x 100 cm	1 No
74.	Plums		4 Nos.
75.	Hydraulic Jack	250 mm Capacity 1ton	2 Nos.
76.	Air compressor capacity	10 bar	1 No.
77.	Earth clamps	400A	6
78.	Pipe Cutting machine		1
79.	Oxy Acetylene Gas Welding Torch (H.P) with	5 nozzles	2 sets
80.	Oxy-Acetylene gas cutting torch with cutting nozzle	0.8 mm and 1.2 mm	2 set
81.	Electrode holder	400 amps	6
82.	Spindle key		2
83.	Pressure regulator oxygen double stage		2
84.	Pressure regulator acetylene double stage		2
85.	Tip cleaner		2
86.	Outfit spanner for Oxy Acetylene		2
87.	Metal Rack	182 cmx152 cmx45 cm	1 no.
88.	Trainees locker (with 8 pigeon holes)		3 nos.
89.	Storage shelf/Steel Almirah		2 no.
90.	White board		1 no.
91.	Flash back arrester (torch mounted)		2 pairs
92.	Flash back arrester (cylinder mounted)		2 pairs

93.	Firefighting equipment		As required
94.	First aid box		1 no
<b>C. GENERAL INSTALLATION</b>			
95.	Welding Transformer with all accessories	400A , OCV 60 - 100 V, 60% duty cycle	2 sets
96.	Welding Transformer or Invertors with all accessories	300A , OCV 60 - 100 V, 60% duty cycle	2 sets
97.	D.C .Arc welding rectifiers set with all accessories	400A,OCV 60-100V,60% duty cycle	1 set
98.	Welding cables to carry 400 A with flexible rubber as per BIS		30 mtr
99.	Lugs for Cables		21(20 +1) Nos.
100.	Trolley for cylinders		2 nos.
101.	Suitable Gas welding table		2 nos.
102.	Arc welding table/post all metal with positioner		5 nos.
103.	Hand shearing machine	capacity to cut 6 mm on sheet and flat	1 No.
104.	Power hacksaw		1 No.
105.	Angle Grinder AG4		2 nos.
106.	Electrode drying oven Temp.	Range 0-250 <sup>0</sup> C, 10Kg cap.	1 No.
107.	Dye penetrant Testing kit		2 set
108.	Power shearing machine	cutting capacity 4 mm on S.S	1 No.
109.	Work bench with 4 bench vices of 150mm jaw	approx. size 340x120x75 cm	5 No.
110.	Anvil	12 square inch working area	1 No.
111.	Portable abrasive cut-off machine		1 No.
112.	Oxygen and D.A cylinders (may be hired)		#2 each
113.	Pantograph	600mm with 30 adjustments	1 No.
<b>D. LIST OF CONSUMABLE</b>			
114.	Leather Hand Gloves	14 "	20+1 Nos.
115.	Cotton hand gloves	8 "	20+1 Nos.
116.	Leather hand sleeves	16 "	20+1 Nos.
117.	Leg guards leather		20+1 Nos.
118.	Leather Apron		20+1 Nos.
119.	Gas welding Goggles with filter glass 3A		20+1 Nos.

	or 4A DIN		
120.	Wire brush (M.S & SS) 5 rows and 3 rows		20+1 Nos.
121.	Spark lighter		6 Nos.
122.	Safety boots for welders		20+1 Nos.
123.	Safety goggles with plain glass		20+1 Nos.
124.	AG 4 Grinding wheels		10 nos.
125.	Welding rubber hose, oxygen and acetylene 8 mm dia. As per BIS		30 mtr. each
126.	Rubber hose clips		20+1 Nos.
127.	Arc welding filter glasses DIN 9A 11 A & 13 A	108 mm x 82 mm x 3 mm	20+1 Nos.
128.	Plain glasses for helmets	108 mm x 82 mm x 3 mm	32 nos.

**Note:**

1. Internet facility is desired to be provided in the class room.
2. # Optionally Gas cylinders can also be hired as and when required.
3. 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.

<b>List of Expert members participated in preparation of course curriculum of Welder (Fabrication &amp; Fitting) trade</b>			
<b>S No.</b>	<b>Name &amp; Designation Shri/Mr./Ms.</b>	<b>Organization</b>	<b>Remarks</b>
<b>MEMBERS OF SECTOR MENTOR COUNCIL</b>			
1.	Dr. G. Buvanashekar, AGM	WRI, Trichy - Chairman	Chairman
2.	Dr. K. Ashok Kumar, AGM	BHEL, Trichy	Member
3.	Prof. Jyothi Mukhopadhy	IIT, Ahmedabad	Member
4.	B. Pattabhiraman, MD	GB Engineering, Tricgy	Member
5.	Dr. Rajeev kumar	IIT, Mandi	Member
6.	Dr. Vishal Chauhan	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
<b>MENTOR</b>			
11.	Deepankar Mallick, DDG (C&P)	DGT Hq,	Mentor
<b>MEMBERS OF CORE GROUP</b>			
12.	M Thamizharasan, JDT	CSTARI, Kolkata	Member
13.	M Kumaravel, DDT	FTI , Bangalore	Team Leader
14.	Sushil Kumar, DDT	DGTHq,	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
OAW	Oxy-Acetylene gas Welding
OAGC	Oxy-Acetylene Gas Cutting
F	Fitting
WT	Wall Thickness.
SMAW	Shielded Metal Arc welding
GTAW	Gas Tungsten Arc Welding
SAW	Submerged Arc Welding
GMAW	Gas Metal Arc Welding

