



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

COMPETENCY BASED CURRICULUM

CERTIFICATE COURSE ON

WELDING (GMAW & GTAW)



NSQF LEVEL- 2.5

SECTOR – CAPITAL GOODS & MANUFACTURING

WELDING (GMAW & GTAW)

Duration: 240 Hours

NSQF LEVEL- 2.5

(Version: 1.0)

Designed in 2025

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

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1. COURSE INFORMATION

1.1 GENERAL

This course has been developed for CTS/CITS trainees to take up as optional courses during course of study for technical and behavioural upgradation of trainees to meet industry related job roles. During the 240 hours duration of Welding (GMAW & GTAW) course, a candidate is trained on professional skills & knowledge related to job role. The Broad components covered during the course are given below:

During this course learners will gain competency in Gas Metal Arc Welding (GMAW) and Gas Tungsten Arc Welding (GTAW), covering equipment setup, parameter selection, arc initiation, and safe operation. Learners gain hands-on experience welding mild steel, stainless steel, and aluminium sheets and plates in different welding positions using both processes. The course emphasizes correct selection of machines, current, polarity, and consumables, along with strict adherence to safety practices. Trainees are also trained to maintain weld quality and perform basic inspection in accordance with relevant standards such as IS, ISO, AWS, and En, ensuring industry-ready skills for precision welding applications.

1.2 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of 6 weeks: -

S No.	Course Element	Notional Training Hours
1.	Professional Skill (Trade Practical)	180
2.	Professional Knowledge (Trade Theory)	60
	Total	240

1.3 ASSESSMENT & CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of course through assessment at the end of the course through skill testing at Training Center & CBT through examination conducted by DGT.

The minimum pass percentage for skill test is 60% and for theory will be 33% as in main CTS examination.

2. JOB ROLE

Brief description of Job roles:

Welder (GMAW & GTAW) is a skilled professional responsible for joining metal components using various welding processes such as SMAW, GMAW, GTAW, FCAW, and SAW in accordance with industry and Indian Railway (IR) standards. The role involves selecting appropriate electrodes and shielding gases, preparing materials, interpreting engineering drawings and weld symbols, and ensuring high-quality welds under diverse working conditions. Welders must identify and prevent welding defects, manage distortion and residual stresses, and follow proper storage and handling of consumables. They should understand and know the basics of non-destructive tests.

Reference NCO-2015:

- i) 7212.0303 - Gas Metal Arc Welder/Metal Inert Gas/Metal Active Gas/Gas Metal Arc Welder (MIG/MAG/GMAW)

3. GENERAL INFORMATION

Name of the Trade	WELDING (GMAW & GTAW)
Reference NCO – 2015	7212.0303
NSQF Level	2.5
Duration of Craftsmen Training	240 Hours
Entry Qualification	8 th Class passed and pursuing/ passed out Welder, Welder (Fabrication & Fitting)/ Welder (Pipe)/ Welder (Structural)/ Welder (Welding & Inspection) under CTS OR Welder under CITS Candidates
Unit Strength (No. of Student), Space & Power Norms	Same as Welder/ Welder (Fabrication & Fitting)/ Welder (GMAW & GTAW)/ Welder (Pipe)/ Welder (Structural)/ Welder (Welding & Inspection) under CTS OR Welder under CITS Candidates.
Instructors Qualification	<p>B.Voc/Degree in Mechanical / Metallurgy / Production Engineering/ Mechatronics from AICTE/UGC recognized university/ college with one year of teaching or industry experience in the welding with GMAW & GTAW field.</p> <p style="text-align: center;">OR</p> <p>03 years Diploma in Mechanical/ Metallurgy/ Production Engineering/ Mechatronics from AICTE/ recognized board of technical education with two years of teaching or industry experience in the welding with GMAW & GTAW field.</p> <p style="text-align: center;">OR</p> <p>NTC/ NAC passed in “Welder” Trade with three years' of teaching or industry experience in welding with GMAW & GTAW field.</p> <p>Essential Qualification: Regular/ RPL variants of National Craft Instructor Certificate (NCIC) in Welder trade under DGT.</p> <p>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.</p>
List of Tools and Equipment	As per Annexure – I

4. LEARNING OUTCOME

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

4.1 LEARNING OUTCOMES

1. Setup GMAW plant, parameter setting for the process and establishing of arc by following safety precautions.
2. Weld MS and SS sheets and plates in different welding positions by GMAW.
3. Setup GTAW plant, select types of welding machine, welding current, polarity and establishing of arc for the process by following safety precautions.
4. Weld MS, SS and Aluminium sheets in different welding positions by GTAW.
5. Maintain quality and inspection criteria as per relevant Standards (viz. IS, ISO, AWS & En).

5. SYLLABUS

SYLLABUS – WELDING (GMAW & GTAW)			
Duration: 240 Hours			
Duration	Reference Learning outcome	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
Professional skills 20 Hrs. Professional Knowledge 10 Hrs.	1. Setup GMAW plant, parameter setting for the process and establishing of arc by following safety precautions.	<ol style="list-style-type: none"> 1. Familiarization with the machinery used in the GMAW plant. 2. Demonstrate safety aspects in GMAW. 3. Setting up of GMAW welding machine & accessories. 4. Perform Welding straight line beads on MS & SS plate by GMAW. 5. Perform different modes of metal transfer by adjusting current, voltage, shielding gas on same base metal. 	<ul style="list-style-type: none"> • General awareness about common welding terminology, basic welding processes and their usage. • Introduction to GMAW – equipment – accessories. • Various names of the process. (MIG-MAG/ CO₂ WELDING, FCAW). • Introduction to different types of steels and relevant specifications.
Professional skills 57 Hrs. Professional Knowledge 18 Hrs.	2. Weld MS and SS sheets and plates in different welding positions by GMAW.	<ol style="list-style-type: none"> 6. Perform Lap joint on MS & SS plates of different thickness by GMAW in down hand position. 7. Perform open corner joint on MS & SS plate (2 mm and above) in down hand position. 8. "T" joint on MS & SS sheet/ plate in horizontal position. 9. "T" joint on MS & SS sheet/ plate in vertical position. 10. Perform single "V" butt joint on MS & SS plate (10mm) by CO₂ welding 	<ul style="list-style-type: none"> • Advantages & Limitations • Principle of Power sources, power factor & accessories Wire Feed unit. • Types of shielding gases & advantages. • Welding Gun & its parts. • Modes of metal transfer - Dip, Globular, spray & pulse/ synergic transfer and its significance. • Flux Cored Arc Welding (FCAW) and its application. • Welding wire types and specification. (IRS and AWS) • Safety precautions pertaining to GMAW

		<p>in down hand position.</p> <ol style="list-style-type: none"> 11. Perform straight line beads on MS & SS plate by Flux cored Arc welding (FCAW). 12. Perform single "V" butt joint on MS & SS plate (10mm) by Flux cored Arc welding. 13. Perform GMAW of dissimilar metals (MS to SS and different types of SS). 	<ul style="list-style-type: none"> • Types of weld defects, causes and remedy in GMAW process. • Trouble shooting in MIG welding. • Data and Tables related to CO2 welding.
<p>Professional skills 22 Hrs.</p> <p>Professional Knowledge 08 Hrs.</p>	<p>3. Setup GTAW plant, select types of welding machine, welding current, polarity and establishing of arc for the process by following safety precautions.</p>	<ol style="list-style-type: none"> 14. Familiarisation with the machinery used in GTAW plant. Introduction to safety equipment and their use in GTAW. 15. Setting up GTAW plant and establishing the arc. 16. Perform beading practice on MS & SS sheet by GTAW. 	<ul style="list-style-type: none"> • Introduction to GTAW welding • Equipment & accessories. • Advantages & Limitations • Introduction to different types of Aluminium and relevant specifications.
<p>Professional skills 57 Hrs.</p> <p>Professional Knowledge 18 Hrs.</p>	<p>4. Weld MS, SS and Aluminium sheets in different welding positions by GTAW.</p>	<ol style="list-style-type: none"> 17. Perform Square butt joint on MS & SS in down hand position. 18. Perform Lap joint on MS & SS sheet in down hand position.) 19. Perform Square butt joint on MS & SS sheet in Horizontal position. 20. Perform Square butt joint on MS & SS sheet in Vertical position. 21. Perform beading practice on Aluminium sheet by GTAW. 22. Perform Square butt joint on Aluminium 	<ul style="list-style-type: none"> • Power source - Types, power factor, polarity and application • Tungsten electrode, Types, sizes, and uses. • Type of shielding gases- Types & properties. • GTAW Welding consumables • Types & Specifications as per BIS & AWS • Tables & data relating to TIG welding. • Different type of weld joints- plates & pipes. • Edge preparation of plates

		<p>sheet by GTAW in flat position.</p> <p>23. Perform Square butt joint on Aluminium sheet in Vertical position.</p>	<p>& pipes.</p> <ul style="list-style-type: none"> • Fitting of joint plates for TIG Welding. • Advantages of root pass welding of pipes by TIG welding • Introduction to pulse TIG and its application. • Types of weld defects, causes and remedy in GTAW process.
<p>Professional skills 24 Hrs.</p> <p>Professional Knowledge 06 Hrs.</p>	<p>5. Maintain quality and inspection criteria as per relevant Standards (viz. IS, ISO, AWS & EN).</p>	<p>24. Identify inspection criteria on quality parameters for pre and post welding.</p> <p>25. Perform visual inspection for cracks, porosity, undercut, overlap, incomplete fusion, etc.</p> <p>26. Perform weld measurement viz, leg length, undercut depth, internal misalignment (Butt joint), reinforcement, depth of undercut, groove angle/ edge preparation angle using instruments fillet weld gauge, misalignment gauge, bevel protractor, etc.</p>	<ul style="list-style-type: none"> • Discussion on relevant clauses and criteria's of ISO 5817/IS 822, IS7310, IS1182, ISO 6520, ISO 15614, ISO 9606 (AWS D1.1/ ASME section IX) with respect to quality inspection criteria.

6. ASSESSMENT CRITERIA

LEARNING OUTCOME	ASSESSMENT CRITERIA
1. Setup GMAW plant, parameter setting for the process and establishing of arc by following safety precautions.	Identify machineries used in the GMAW plant.
	Demonstrate safety aspects in GMAW.
	Set up GMAW welding machine & accessories.
	Perform Welding straight line beads on MS/SS plate by GMAW.
	Perform metal transfer by adjusting current, voltage, shielding gas on given base metal.
2. Weld MS and SS sheets and plates in different welding positions by GMAW.	Perform Lap joint on MS / SS plates of given thickness by GMAW in down hand position.
	Perform open corner joint on MS / SS plate (2 mm and above) in down hand position.
	Perform "T" joint on MS / SS sheet/ plate in horizontal & vertical position.
	Perform single "V" butt joint on MS / SS plate (10mm) by CO ₂ welding in down hand position.
	Perform straight line beads on MS / SS plate by Flux cored Arc welding (FCAW).
	Perform single "V" butt joint on MS / SS plate (10mm) by Flux cored Arc welding.
	Perform GMAW of dissimilar metals (MS to SS and different types of SS).
3. Setup GTAW plant, select types of welding machine, welding current, polarity and establishing of arc for the process by following safety precautions.	Identify machineries used in GTAW plant.
	Select safety equipment and demonstrate their use in GTAW.
	Set up GTAW plant and establish the arc.
	Perform beading practice on MS / SS sheet by GTAW.
4. Weld MS, SS and Aluminium sheets in different welding positions by GTAW.	Perform Square butt joint on MS / SS in down hand position.
	Perform Lap joint on MS / SS sheet in down hand position.)
	Perform Square butt joint on MS / SS sheet in Horizontal & Vertical position.
	Perform beading practice on Aluminium sheet by GTAW.
	Perform Square butt joint on Aluminium sheet by GTAW in flat position.
	Perform Square butt joint on Aluminium sheet in Vertical

	position.
5. Maintain quality and inspection criteria as per relevant Standards (viz. IS, ISO, AWS & EN).	Identify inspection criteria on quality parameters for pre / post welding.
	Perform visual inspection for cracks, porosity, undercut, overlap, incomplete fusion, etc.
	Perform weld measurement viz, leg length, undercut depth, internal misalignment (Butt joint), reinforcement, depth of undercut, groove angle/ edge preparation angle using instruments fillet weld gauge, misalignment gauge, bevel protractor, etc.

ANNEXURE-I

LIST OF TOOLS & EQUIPMENT			
S No.	Name of the Tools and Equipment	Specification	Quantity
Same as Welder/ Welder (Fabrication & Fitting)/ Welder (GMAW & GTAW)/ Welder (Pipe)/ Welder (Structural)/ Welder (Welding & Inspection) under CTS OR Welder under CITS			
Additional Tools & Equipment required			
1.	GMAW welding machine 400A capacity with air cooled torch, Regulator, Gas preheater, Gas hose and Standard accessories		1 set
2.	AC/DC GTAW welding machine with water cooled torch, Argon regulator, Gas hose, water circulating system and standard accessories.	torch 300 A	1 set

ANNEXURE-II

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts and all others who contributed in designing/ revising the curriculum. Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

List of members attended the Trade Committee Meeting for designing of Welding (GMAW & GTAW) syllabus under Short Term Courses held on 18th December 2025 at IRIMEE Jamalpur.			
Sl. No.	Name and Designation (Shri/Smt./Kumari)	Organization with Address	Remarks
1.	Prasenjeet Kumar, DDG & Secretary to DG IRIMEE	IRIMEE Jamalpur	Chairman
2.	T. Ragulan, Director	CSTARI, Kolkata	Member
3.	Dr. Suhas Deshmukh, Director	NCVET, New Delhi	Member
4.	R C Mandal, Jt. Director	RDSDE Bihar, Patna	Member
5.	R K Jha, Jt. Director	CSTARI, Kolkata	Member
6.	Rajendra Kumar Jha, Lecture (EM)	IRIMEE Jamalpur	Member
7.	Pratyush Anand, CI (EM)	IRIMEE Jamalpur	Member
8.	Alok Kumar, Dy. Director	DET, Bihar	Member
9.	Abhishek Kumar, Dy. Director	RDSDE Bihar/NSTI (W)	Member
10.	Brindaban Das, Dy. Director	CSTARI, Kolkata	Member
11.	Harish Chander, Dy. Director (Recognition)	NCVET, New Delhi	Member
12.	Debasis Pani, Asst. Director	CSTARI, Kolkata	Member
13.	Archana Singh, Asst. Director	CSTARI, Kolkata	Member
14.	Altaf Hussain, Asst. Director	CSTARI, Kolkata	Member
15.	Shashi Kumar Mandal, Principal	Govt. ITI Tarapur, Munger	Member
16.	Binoy Kumar, Group Instructor	Govt. ITI Tarapur, Munger	Member
17.	Md. Burhan Ansari, Group Instructor	Govt. ITI, Munger	Member
18.	B. K. Nigam, Training Officer	CSTARI, Kolkata	Member
19.	P. K. Bairagi, Training Officer	CSTARI, Kolkata	Member
20.	B. Biswas, Training Officer	CSTARI, Kolkata	Member