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

COMPETENCY BASED CURRICULUM

WELDER

(Duration: One Year)
Revised in July 2022

CRAFTSMEN TRAINING SCHEME (CTS)
NSQF LEVEL- 3

SECTOR – CAPITAL GOODS AND MANUFACTURING

WELDER

(Engineering Trade)

(Revised in July 2022)

Version: 2.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL - 3

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

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7. TRADE SYLLABUS

SYLLABUS - WELDER				
DURATION: ONE YEAR				
Duration	**Reference Learning Outcome**	**Process code**	**Professional Skills (Trade Practical) With Indicative Hrs.**	**Professional Knowledge (Trade Theory)**
Professional Skill 47Hrs; Professional Knowledge 11Hrs	Set the gas welding plant and join MS sheet in different position following safety precautions. *[Different position: - 1F, 2F, 3F, 1G, 2G, 3G.]* Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. *[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G] (Mapped NOS: CSC/N0204)*		1. Demonstration of Machinery used in the trade. 2. Identification to safety equipment and their use etc. 3. Hack sawing, filing square to dimensions. 4. Marking out on MS plate and punching.	- Importance of trade Training. - 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.
		OAW-01 SMAW-01	5. Setting of oxy-acetylene welding equipment, Lighting and setting of flame. 6. Perform fusion run without filler rod on MS sheet 2mm thick in flat position. 7. Setting up of Arc welding machine & accessories and striking an arc. 8. Deposit straight line bead on MS plate in flat position.	- 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 21Hrs; Professional Knowledge 05Hrs	Set the gas welding plant and join MS sheet in different position following safety precautions. *[Different position: - 1F, 2F, 3F, 1G, 2G,*	OAW-02 OAW-03	9. Depositing bead with filler rod on M.S. sheet 2 mm thick in flat position. 10. Edge joint on MS sheet 2 mm thick in flat	- 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

	3G.]		position without filler rod.	different thickness. - Surface Cleaning
Professional Skill 20Hrs; Professional Knowledge 05Hrs	Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. *[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G] (Mapped NOS: CSC/N0204)*	SMAW-02 SMAW-03	11. Straight line beads on M.S. plate 10 mm thick in flat position. 12. 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.
Professional Skill 23Hrs; Professional Knowledge 05Hrs	Set the oxy- acetylene cutting plant and perform different cutting operations on MS plate. *[Different cutting operation – Straight, Bevel, circular] (Mapped NOS: CSC/N0201)*	OAGC-01 OAGC-02 OAGC-03 OAGC-04 OAGC-05 OAGC-06	13. Setting up of oxy-acetylene and make straight cuts (freehand) 14. Perform marking and straight line cutting of MS plate 10 mm thick by gas. Accuracy within ±2mm. 15. Beveling of MS plates 10 mm thick, cutting regular geometrical shapes and irregular shapes, cutting chamfers by gas cutting. 16. Marking and perform radial cuts, cutting out holes using oxy-acetylene gas cutting. 17. Identify cutting defects viz., distortion, grooved, fluted or ragged cuts; poor draglines; rounded edges; tightly adhering slag.	- 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.

Professional Skill 126Hrs; Professional Knowledge 31Hrs	Set the gas welding plant and join MS sheet in different position following safety precautions. *[Different position: - 1F, 2F, 3F, 1G, 2G, 3G.]* Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. *[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G] (Mapped NOS: CSC/N0204)*	OAW-04 SMAW-04 OAW-05	18. Square butt joint on M.S. sheet 2 mm thick in flat Position. **(1G)** 19. Fillet "T" joint on M.S. Plate 10 mm thick in flat position. **(1F)** 20. Open corner joint on MS sheet 2 mm thick in flat Position **(1F)**	- 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
		SMAW-05 OAW-06 SMAW-06	21. Fillet lap joint on M.S. plate 10 mm thick in flat position. **(1F)** 22. Fillet "T" joint on MS sheet 2 mm thick in flat position. **(1F)** 23. Open Corner joint on MS plate 10 mm thick in flat position. **(1F)**	- Welding positions as per EN &ASME: flat, horizontal, vertical and over head position. - Weld slope and rotation. - Welding symbols as per BIS & AWS.
		OAW-07 SMAW-07 I&T-01	24. Fillet Lap joint on MS sheet 2 mm thick in flat position**. (1F)** 25. Single "V" Butt joint on MS plate 12 mm thick in flat position **(1G)**. 26. Testing of weld joints by visual inspection. 27. Inspection of welds by using weld gauges.	- Arc length – types – effects of arc length. - Polarity: Types and applications. - Weld quality inspection, common welding mistakes and appearance of good and defective welds - Weld gauges &its uses.
		OAW-08 SMAW-08 SMAW-09	28. Square Butt joint on M.S. sheet. 2 mm thick in Horizontal position. **(2G)** 29. Straight line beads and multi layer practice on M.S. Plate 10 mm thick in Horizontal position. 30. Fillet "T" joint on M.S. plate 10 mm thick in Horizontal position**. (2F)**	- Calcium carbide uses and hazard. - Acetylene gas properties and flash back arrestor.
		OAW-09	31. Fillet Lap joint on M.S. sheet 2 mm thick in horizontal position **(2F)** 32. Fillet Lap joint on M.S.	- Oxygen gas and its properties, uses in welding. - Charging process of oxygen

		SMAW-10	plate 10 mm thick in horizontal position. **(2F)**	and acetylene gases - Oxygen and Dissolved Acetylene gas cylinders and Color coding for different gas cylinders. - Uses of single and double stage Gas regulators.
		OAW-10 OAW-11 SMAW-11	33. Fusion run with filler rod in vertical position on 2mm thick M.S sheet. 34. Square Butt joint on M.S. sheet. 2 mm thick in vertical position **(3G)** 35. 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.
		SMAW- 12 OAW-12 SMAW-13	36. Fillet "T" joint on M.S sheet 2 mm thick in vertical position. **(3F)** 37. Fillet "T" joint on M.S. plate 10 mm thick in vertical position. **(3F)**	- 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 80 Hrs; Professional Knowledge 17Hrs	Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. *[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G] (Mapped NOS: CSC/N0204)* Perform welding in different types of MS pipe joints by Gas	OAW-13 SMAW-14	38. Structural pipe welding butt joint on MS pipe Ø 50 and 3mm WT in 1G position. 39. Fillet Lap joint on M.S. Plate 10 mm in vertical position. **(3G)**	- Specification of pipes, various types of pipe joints, pipe welding all positions, and procedure. - Difference between pipe welding and plate welding.
		SMAW-15 OAW-14	40. Open Corner joint on MS plate 10 mm thick in vertical position. **(2F)** 41. Pipe welding - Elbow joint on MS pipe Ø 50 and 3mm WT. **(1G)**	- Pipe development for Elbow joint, "T" joint, Y joint and branch joint - Brief use of Manifold system
		OAW-15	42. Pipe welding "T" joint on MS pipe Ø 50 and 3mm WT. **(1G)**	- Gas welding filler rods, specifications and sizes. - Gas welding fluxes – types and functions.

	welding (OAW). *[Different types of MS pipe joints – Butt, Elbow, T-joint, angle (45°) joint, flange joint] (NOS: CSC/N0204)*	SMAW-16	43. Single "V" Butt joint on MS plate12 mm thick in vertical position (3G).	- Gas Brazing &Soldering : principles, types fluxes & uses - Gas welding defects, causes and remedies
		OAW-16 SMAW-17	44. Pipe welding 45 ° angle joint on MS pipe Ø 50 and 3mm WT. **(1G)** 45. Straight line beads on M.S. plate 10mm thick in over head position.	- Electrode : types, functions of flux, coating factor, sizespecifications of electrode. - Effects of moisture pick up. - Storage and baking of electrodes.
Professional Skill 61Hrs; Professional Knowledge 06Hrs	Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. *[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G] (Mapped NOS: CSC/N0204)* Set the SMAW machine and perform welding in different types of MS pipe joints by SMAW. *[Different types of MS pipe joints – Butt, Elbow, T-joint, angle (45°) joint, flange joint] (NOS: CSC/N0204)*	SMAW-18 SMAW-19	46. Pipe Flange joint on M.S plate with MS pipe Ø 50 mm X 3mm WT **(1F)** 47. Fillet "T" joint on M.S. plate 10 mm thick in over head position. **(4F)**	- Weldability of metals, importance of pre heating, post heating and maintenance of inter pass temperature.
		SMAW-20 SMAW-21	48. Pipe welding butt joint on MS pipe Ø 50 and 5 mm WT. in 1G position. 49. Fillet Lap joint on M.S. plate 10 mm thick in over head position. **(4G).**	- Welding of low, medium and high carbon steel and alloy steels.
		SMAW-22 SMAW-23	50. Single "V" Butt joint on MS plate 10mm thick inover head position**(4G)** 51. Pipe butt joint on M. S. pipe Ø 50mm WT 6mm (**1G** Rolled).	- Stainless steel types- weld decay and weldability.
Professional Skill 25 Hrs; Professional Knowledge 04Hrs	Choose appropriate welding process and perform joining of different types of metals and check its correctness. *[appropriate welding*	OAW-17 SMAW -24	52. Butt joint of copper pipe ½ inch by brazing process by induction welding machine 53. Square Butt joint on S.S. Sheet 2 mm thick in flat position. **(1G)**	- Induction welding, brazing of copper tubes. - Brass – types – properties and welding methods. - Copper – types – properties and welding methods.

	process – OAW, SMAW; Different metal – SS, CI, Brass, Aluminium] (Mapped NOS: CSC/N0204)	OAW-18	54. Corner/T joint of copper pipe of ½ inch and of length 75 mm	- Brazing cutting tools.
Professional Skill 21Hrs; Professional Knowledge 04Hrs	Choose appropriate welding process and perform joining of different types of metals and check its correctness. *[appropriate welding process – OAW, SMAW; Different metal – SS, CI, Brass, Aluminium] (Mapped NOS: CSC/N0204)* Demonstrate arc gauging operation to rectify the weld joints.	OAW-19 SMAW-25 AG-01	55. Square Butt & Lap joint on M.S. sheet 2 mm thick by brazing in flat position. 56. Single "V" butt joint C.I. plate 6mm thick in flat position. **(1G)** 57. Arc gouging on MS plate 10 mm thick.	- Aluminium properties and weldability, Welding methods - Arc cutting & gouging,
Professional Skill 20Hrs; Professional Knowledge 04Hrs	Choose appropriate welding process and perform joining of different types of metals and check its correctness. *[appropriate welding process – OAW, SMAW; Different metal – SS, CI, Brass, Aluminium] (Mapped NOS: CSC/N0204)*	OAW-20 OAW-21	58. Square Butt joint on Aluminium sheet. 3 mm thick in flat position.(10hrs) 59. Bronze welding of cast iron (Single "V" butt joint) 6mm thick plate (10hrs)	- Cast iron and its properties types. 60. Welding methods of cast iron. .(04hrs) -
Professional Skill 25 Hrs; Professional Knowledge 04Hrs	Test welded joints by different methods of testing. *[different methods of testing- Dye penetration test, Magnetic particle test, Nick break test, Free band test, Fillet fracture test]*	I&T-02 I&T-03 I&T-04 I&T-05 I&T-06	61. Dye penetrant test. 62. Magnetic particle test. 63. Nick- break test. 64. Free bend test. 65. Fillet fracture test.	- Types of Inspection methods - Classification of destructive and NDT methods - Welding economics and Cost estimation.

	(Mapped NOS: CSC/N0204)			
Professional Skill 166Hrs; Professional Knowledge 32Hrs	Set GMAW machine and perform welding in different types of joints on MS sheet/plate by GMAW in various positions by dip mode of metal transfer. *[different types of joints- Fillet (T-joint, lap, Corner), Butt (Square & V); various positions- 1F, 2F, 3F,4F, 1G, 2G, 3G]* *(Mapped NOS: CSC/N0209)*	GMAW- 01 GMAW - 02	66. Introduction to safety equipment and their use etc. 67. Setting up of GMAW welding machine & accessories and striking an arc. 68. Depositing straight line beads on M.S Plate. 69. Fillet weld – "T" joint on M.S plate 10mm thick in flat position by Dip transfer. **(1F)**	- Safety precautions in Gas Metal Arc Welding and Gas Tungsten Arc welding. - Introduction to GMAW - equipment – accessories. - Various other names of the process. (MIG/MAG/CO_2 welding.)
		GMAW -03 GMAW -04 GMAW -05	70. Fillet weld – Lap joint on M.S. sheet 3mm thick in flat position by Dip transfer. **(1F)** 71. Fillet weld – "T" joint on M.S. sheet 3mm thick in flat position by Dip transfer. **(1F)** 72. Fillet weld – corner joint on M.S. sheet 3mm thick in flat position by Dip transfer. **(1F)**	- Advantages of GMAW welding over SMAW , limitations and applications - Process variables of GMAW.
		GMAW -06 GMAW -07	73. Butt weld – Square butt joint on M.S sheet 3mm thick in flat position **(1G)** 74. Butt weld – Single "V" butt joint on M.S plate 10 mm thick by Dip transfer in flat position. **(1G)**	- Wire feed system – types – care and maintenance. - Welding wires used in GMAW, standard diameter and codification as per AWS.
		GMAW -08	75. Fillet weld – "T" joint on M.S plate 10mm thick in Horizontal position by Dip transfer. **(2F)** 76. Fillet weld – corner	- Name of shielding gases used in GMAW and its applications. - Flux cored arc welding – description, advantage, welding wires, coding as

		GMAW -09	joint on M.S plate 10mm thick in Horizontal position by Dip transfer. **(2F)**	per AWS.
		GMAW -10 GMAW -11	77. Fillet weld – "T" joint on M.S. sheet 3mm thick in Horizontal position by Dip transfer. **(2F)** 78. Fillet weld – corner joint on M.S. sheet 3mm thick in Horizontal position by Dip transfer. **(2F)**	- Edge preparation of various thicknesses of metals for GMAW. - GMAW defects, causes and remedies
		GMAW -12 GMAW -13	79. Fillet weld – "T" joint on M.S plate 10mm thick in vertical position by Dip transfer. **(3F)** 80. Fillet weld – corner joint on M.S plate 10mm thick in vertical position by dip transfer. **(3F)**	- Heat input and techniques of controlling heat input during welding. - Heat distribution and effect of faster cooling
		GMAW -14 GMAW -15	81. Fillet weld – Lap joint on M.S. sheet 3mm thick in vertical position by Dip transfer. **(3F)** 82. Fillet weld – corner joint on M.S. sheet 3mm thick in vertical position by Dip transfer. **(3F)**	- Pre heating & Post Weld Heat Treatment - Use of temperature indicating crayons.
		GMAW -16 GMAW -17	83. Fillet weld – Lap and "T" joint on M.S sheet 3mm thick inoverhead position by Dip transfer. **(4F)** 84. Tee Joints on MS Pipe Ø 60 mm OD x 3 mm WT 1G position – Arc constant (Rolling)	- Submerged arc welding process –principles, equipment, advantages and limitations

		GMAW -18 GMAW -19	85. Depositing bead on S.S sheet in flat position. 86. Butt joint on Stainless steel 2 mm thick sheet in flat position by Dip transfer.	- Thermit welding process- types, principles, equipments, Thermit mixture types and applications. - Use of backing strips and backing bars
Professional Skill 80 Hrs; Professional Knowledge 14Hrs	Set the GTAW machine and perform welding by GTAW in different types of joints on different metals in different position and check correctness of the weld. *[different types of joints- Fillet (T-joint, lap, Corner), Butt (Square & V) ; different metals- Aluminium, Stainless Steel; different position- 1F & 1G] (Mapped NOS: CSC/N0212)*	GTAW -01 GTAW -02	87. Depositing bead on Aluminium sheet 2 mm thick in flat position. 88. Square butt joint on Aluminium sheet 1.6mm thick in flat position.	- GTAW process - brief description. Difference between AC and DC welding, equipments, polarities and applications. - Power sources for GTAW - AC &DC
		GTAW -03 GTAW -04	89. Fillet weld – "T" joint on Aluminium sheet 1.6 mm thick in flat position. **(1F)** 90. Fillet weld – Outside corner joint on Aluminium sheet 2 mm thick in flat position. **(1F)**	- Tungsten electrodes – types & uses, sizes and preparation - GTAW Torches- types, parts and their functions - GTAW filler rods and selection criteria.
		GTAW -05	91. Butt weld - Square butt joint on Stainless steel sheet 1.6 mm thick in flat position with purging gas **(1G)**	- Edge preparation and fit up. - GTAW parameters for welding of different thickness of metals
		GTAW -06	92. Fillet weld – "T" joint on Stainless steel sheet 1.6 mm thick in flat position. **(1F)**	- Argon / Helium gas properties – uses. - GTAW Defects, causes and remedy.
Professional Skill 20Hrs; Professional Knowledge 04Hrs	Perform Aluminium & MS pipe joint by GTAW in flat position. *(Mapped NOS: CSC/N0212)*	GTAW -07	93. Pipe butt joint on Aluminium pipe Ø 50 mm x 3 mm WT in Flat position. **(1G)**	- Friction welding process- equipment and application - Laser beam welding (LBW).
Professional Skill 20Hrs; Professional Knowledge 03Hrs	Perform Aluminium & MS pipe joint by GTAW in flat position. *(Mapped NOS: CSC/N0212)*	GTAW -08 PAC-01	94. "T" Joints on MS Pipe Ø 50 mm OD x 3 mm WT, position – Flat **(1F)** 95. Straight cutting on	- Plasma Arc Welding (PAW) and cutting (PAC) process – equipments and principles of operation. - Types of Plasma arc,

	Set the Plasma Arc cutting machine and cut ferrous & non-ferrous metals. *(Mapped NOS: CSC/N0207)*		ferrous and non ferrous	advantages and applications.
Professional Skill 20Hrs; Professional Knowledge 02Hrs	Set the resistance spot welding machine and join MS & SS sheet. *(Mapped NOS: CSC/N0206)*	RW-01 RW-02	96. Lap joint on Stainless steel sheet by Resistance Spot welding. 97. MS sheets joining by Resistance Spot welding	- Resistance welding process -types, principles, power sources and welding parameters. - Applications and limitations.
Professional Skill 41Hrs; Professional Knowledge 10Hrs	Perform joining of different similar and dissimilar metals by brazing operation as per standard procedure. *[different similar and dissimilar metals- Copper, MS, SS] CSC/N9410*	OAW-01 OAW-02	98. Square butt joint on Copper sheet 2mm thick in flat position. **(1G)** 99. "T" joint on Copper to MS sheet 2mm thick in flat position by Brazing **(1F)**	- Metalizing – types of metalizing principles. - Manual Oxy – acetylene powder coating process- principles of operation and applications
		OAW-03 OAW-04	100. Silver brazing on S.S Sheet with copper sheet "T" joint. 101. Silver brazing on copper tube to tube.	- Reading of assembly drawing - Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR)
Professional Skill 24Hrs; Professional Knowledge 01Hrs	Repair Cast Iron machine parts by selecting appropriate welding process. *[Appropriate welding process- OAW, SMAW] CSC/N9411* Hard facing of alloy steel components / MS rod by using hard facing electrode. CSC/N9412	OAW - 05 SMAW-01 SMAW-02	102. Repair welding of broken C.I. machine parts by oxy-acetylene welding with C.I and bronze filler rod. 103. Repair welding of broken C.I machine parts by C.I. electrode. 104. Repair plastic broken parts or pipes by plastic welding machine. 105. Make a plastic tank with plastic sheet of PVC. Dimensions 150*100*100	- Hard facing/ surfacing necessity, surface preparation, various hard facing alloys and advantages of hard facing. - Plastic welding machine with hot air gun and plastic material: Polypropylene (PP) Polyethylene (PE) Polyvinylchloride (PVC)

Engineering Drawing: 40 Hrs.		
Professional Knowledge ED - 40 hrs.	Read and apply engineering drawing for different application in the field of work. CSC/N9401	**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. CSC/N9402	**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 FOR CORE 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