

REDESIGNED MODULES FOR THE SECTOR

OF

FABRICATION

UNDER

MODULAR EMPLOYABLE SKILLS (MES)

Redesigned in – 2014

By

Government of India

Directorate General of Employment & Training

Ministry of Labour & Employment (DGET)

Preface

The redesigned modules of Fabrication Sector consist of Eight modules with following details:

Module No	Module Name	Competency as per NCO Code	Space Norms	Power Norms	Unit Size	Entry Qualification /Duration
FAB RN 13001	ARC & GAS WELDER	7212.10, 7212.20 7212.40 7212.50	80 sq .m (Minimum size of one side to be 04m)	12 KW	20	8 th Pass + 14 yrs of age – 5 700 Hrs
FAB RW 13002	TIG WELDER	To be allotted	80 sq .m (Minimum size of one side to be 04m)	12 KW	20	8 th Pass + MES Certificate on ARC & GAS WELDER 300 Hrs
FAB RW 13003	CO2 WELDER	To be allotted	80 sq .m (Minimum size of one side to be 04m)	12 KW	20	8 th Pass + MES Certificate on ARC & GAS WELDER 300 Hrs
FAB RW 13004	PIPE WELDER (TIG & MMAW)	To be allotted	80 sq .m (Minimum size of one side to be 04m)	12 KW	20	8 th Pass + MES Certificate on ARC & GAS WELDER 300 Hrs
FAB RN 13005	WELDER (REPAIR & MAINTENANCE)	To be allotted	80 sq .m (Minimum size of one side to be 04m)	12 KW	20	8 th Pass + 14 yrs of age 500 Hrs
FAB RN 13006	SHEET METAL WORKER (PANELS,CABINS& DUCTS)	7213.40	80 sq .m (Minimum size of one side to be 04m)	8 KW	20	8 th Pass + 14 yrs of age 500 Hrs

Space & Power norms will be as under in cases, where VTPs are operating more than one Module simultaneously:

No of Modules	Space Norms	Power Norms
01	80 sq .m (Minimum size of one side to be 04m)	12 KW
02	80 sq .m (Minimum size of one side to be 04m)	12 KW
03	80 sq .m (Minimum size of one side to be 04m)	12 KW
04	80 sq .m (Minimum size of one side to be 04m)	12 KW
05	80 sq .m (Minimum size of one side to be 04m)	12 KW
06	80 sq .m (Minimum size of one side to be 04m)	8 KW

GENERAL INFORMATION FOR THE MODULE: ARC & GAS WELDER

Name of Sector	FABRICATION
Name of Module	ARC & GAS WELDER
MES Code	FAB 701
Competency as per NCO Code	7212.10,7212.20, 7212.40,7212.50
Duration of Course	700 Hrs
Entry Qualification of Trainee	8 th Pass + 14 yrs of age
Unit size (No. Of trainees)	20
Power Norms	12 KW
Space Norms (Workshop and Class Room)	80 sq.m Minimum size of one side to be 04m.
Instructors Qualification	Degree in Mechanical Engineering with one year Experience OR Diploma in Mechanical Engineering with two year Experience OR NTC/ NAC in Welder Trade Group with three years of Experience
Desirable	Craft Instructor Certificate (CIC)

Terminal Competency:

After completion of this training, the participants would be able to perform:

- a) Gas welding in Flat, Horizontal and Vertical positions
- b) Oxy acetylene gas cutting in down hand position.
- c) Gas brazing in down hand position
- d) Shielded Metal Arc Welding in Down hand, Horizontal and Vertical positions
- e) Repair components/parts used in household & industrial appliances by Gas welding, Brazing, and Shielded Metal Arc welding processes.

Contents

Practical Competencies	Underpinning Knowledge (Theory)
<ul style="list-style-type: none"> • Use of protective safety devices on shop floor. • Safe working practice to be observed during welding. • Introduction to safety equipment and their uses. • Identification of tools and accessories used for Gas welding, Gas cutting and Arc welding. • Setting up of Oxy Acetylene Gas welding plant and making fusion runs on MS sheet in flat position. 	<ul style="list-style-type: none"> • Introduction of MES scheme • Job /employment opportunity • Introduction to welding. • Safety precautions. • Types of welding processes and application. • Metals and weldability-Mild Steel, Alloy Steel, Cast iron, Copper and Brass. • Linear measurement metric and inches • Angular measurement. • Marking practice using Steel rule using

<ul style="list-style-type: none"> • Produce following welded joints in mild steel sheet in Flat positions by Gas welding <ol style="list-style-type: none"> a. Fillet Lap b. Fillet T joints c. Outside corner joint d. Square butt joint • Produce following welded joints in mild steel sheet in Horizontal positions by Gas welding <ol style="list-style-type: none"> a. Fillet Lap b. Fillet T joints c. Outside corner joint d. Square butt joint • Produce following welded joints in mild steel sheet in Vertical positions by Gas welding <ol style="list-style-type: none"> a. Fillet Lap b. Fillet T joints c. Outside corner joint d. Square butt joint • Produce Square but, lap and T joint on MS sheet by Brazing • Setting up of Oxy Acetylene Gas Cutting plant and cutting M.S Flats to the given size. • Marking and punching the required shapes by using different shapes and sizes by using templates on M.S plates. • Cutting circular work pieces to the given size by Gas cutting. • Practice to cut different thickness of plates. • Beveling and preparation of joint edges by Gas Cutting. • Setting up Arc Welding plant and depositing straight and weaving beads on MS in Flat position. <p>Produce arc welded joints:</p> <ul style="list-style-type: none"> a. Fillet „T“ joint on M.S. flat by SMAW in 1F, 2F, 3F and 4F positions b. Fillet lap joint on M.S. by SMAW in flat position c. Outside corner joint on MS by SMAW in flat position d. Single „V“ but joint on MS by SMAW in 1G, 2G, 3G and 4G position <ul style="list-style-type: none"> • Identification of defects SMAW welded joints by Visual inspection & correction of defects • Measurement of weld using gauges. 	<ul style="list-style-type: none"> metric and inches scale • Nomenclature of Fillet and groove welds • Welding terms and definitions • Weld symbol and reading of fabrication drawing. • Description and operating procedures of oxy-Acetylene welding and cutting equipments. • Description and safe operating procedures of oxy-acetylene regulators • Description & maintenance of oxy Acetylene welding and cutting blow pipes • Types of Oxy-Acetylene flames and their uses • Gas Welding parameters - selection of Nozzle size and Oxy acetylene gas pressure to cut different thickness of metals • Gas welding filler rods and fluxes and welding techniques. • Brazing principles, selection of nozzle size, filler metals and fluxes. • Gas cutting parameters - selection of Nozzle size and Oxy acetylene gas pressure to cut different thickness of plates • Gas Welding, brazing and cutting defects, their causes and remedy. • Principles of Shielded Metal Arc Welding (SMAW), advantages and limitations. • Basic Electricity applicable to welding. • Arc welding power source, AC Transformers, DC welding rectifier, DC generators. • Types of weld joints and edge preparation and fit up. • Arc Welding electrodes and selection • Coding of SMAW electrodes. • Arc welding procedure and technique • Welding defects in SMAW, causes and remedy • Distortion and methods of control • Inspection and Testing of Welds
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Tools and Equipments For a batch of 20 Trainees:

Sl.No.	Description of tools	QTY
List of Hand Tools		
1	Hand Gloves pair leather	10 pairs
2	Apron leather	10 Nos
3	Goggles pair with welding coloured glass	10 pairs
4	Centre punch	04 Nos
5	Dividers	04 Nos
6	Caliper outside	04 Nos
7	Steel rule 300 mm with metric and inches scale	04 Nos
8	Wire brush (M.S&SS)	08 Nos
9	Spark lighter	04 Nos
10	Scriber	04 Nos
11	Tongs holding 300 mm	08 Nos
12	Welding helmet type with filter glasses	08 Nos
13	Chipping hammer	08 Nos
List of Shop Outfit		
14	Hammer ball pen	04 Nos
15	Hacksaw frame	04 Nos
16	File flat bastard	04 Nos
17	Spanner set	01 set
18	Outfit spanner & spindle key for Gas welding outfit	02 sets
19	Work bench fitted 4 Bench vices	02 sets
20	D E grinder 30 cm wheel motorized pedestal type fitted with Aluminium oxide grinding wheels	01 No
21	Bench shear hand capacity up to 5mm thick sheet	01 No
22	Screw Driver set	01 set
23	Hammering blocks 5 cm thick 60 sq.cm	1 no
24	Gas welding table with fire bricks	1 no
25	Gas cutting table with debris tray	1 no
26	Arc welding table with protected weld filter glass/fire proof screens	1 no
27	Oxy-Acetylene Gas welding and cutting plant mounted on trolley with Oxy-Acetylene Gas cylinders, pressure regulators, hose connections, gas welding torch with nozzle No.1 & 2,3 & 5 and Gas cutting torch with 1.2 & 1.6 mm nozzles.	2 units
28	Transformer welding set with all accessories 300 A	2 units
29	Arc welding set DC, Rectifier or Inverter type, 300 Amps with all accessories.	2 units
30	Consumables, Oxy-acetylene Gases, raw materials, fluxes and filler wires.	As required.
31	Fire Fighting equipment	As required

Note:

1. Minimum testing for Gas Welding:-
 - a. Square butt joint in vertical position
 - b. Fillet T joint in vertical position.

2. Minimum testing for Gas cutting:-
 - a. Straight Cutting in d/h position
 - b. Circular cutting in down hand position.
 - c. Beveling on 12 mm thickness MS plate

3. Testing position for brazing: -
 - a. Square butt and T joints on MS in down hand position.

4. Minimum testing for SMAW :-
 - a. Single V butt joint in vertical position.

GENERAL INFORMATION FOR THE MODULE: TIG WELDER

Name of Sector	FABRICATION
Name of Module	TIG WELDER
MES Code	FAB 702
Competency as per NCO Code	To be allotted
Duration of Course	300 Hrs
Entry Qualification of Trainee	8 th Pass + MES Certificate on ARC & GAS WELDER
Unit size (No. Of trainees)	20
Power Norms	12 KW
Space Norms (Workshop and Class Room)	80 sq.m Minimum size of one side to be 04m.
Instructors Qualification	Degree in Mechanical Engineering with one year Experience OR Diploma in Mechanical Engineering with two year Experience OR NTC/ NAC in Welder Trade Group with three years of Experience
Desirable	Craft Instructor Certificate (CIC)

Terminal Competencies :

After completion of this training, the participants would be able to perform:

- a. TIG welding in all position.
- b. Welding on M.S, S.S., Aluminium metals
- c. Repair components/parts used in household & industrial items by TIG welding

Contents:

Practical Competencies	Underpinning Knowledge (Theory)
<ul style="list-style-type: none">• Use of protective safety devices on shop floor.• Safe working practice to be observed during welding.• Introduction to safety equipment and their uses.• Identification of tools and accessories used for TIG welding.• Setting up of AC/DC TIG Welding Plant and make beading practice on plate on MS sheet by TIG Welding• Produce Square butt and corner joint on MS sheet by TIG Welding in down hand position• Produce “T” joint on MS in Horizontal position by TIG Welding• Beading practice on SS by TIG Welding• Produce Square butt, Tee and Corner joints on SS by TIG Welding in down hand position• Welding of SS with back purging Technique.• Beading practice on Aluminium welding sheet by TIG welding in down hand position.• Produce Square Butt, “T” and Corner joints on Aluminium sheet by TIG Welding in down hand position• Produce Single “V” butt joint on Aluminium sheet 6mm thickness by TIG Welding in down hand position.• Identification of weld defects on TIG welded component by Visual inspection & correction of defects.• Measurement of weld using gauges	<ul style="list-style-type: none">• Introduction of MES scheme• Job /employment opportunity• Introduction to welding.• Safety precautions and necessity of using protective equipments such as shields, goggles, hand glows, sleeves, aprons safety shoes etc.• Types of welding processes and application.• Metals and weldability.• Marking practice using Steel rule using metric and inches scale• Nomenclature of Fillet and groove welds• Welding terms and definitions• Weld symbol and reading of fabrication drawing• Distortion and methods of control• Introduction to TIG welding & its application• Advantages of TIG welding process• Power source - Types, polarity and application• Accessories - HF unit and DC suppressor.• Tungsten electrode, Types, sizes, and uses.• Type of shielding gases• Edge preparation and fit up for TIG Welding MS,SS and Aluminium.• Necessity of purging and Purging Methods• Tables / Data relating to TIG welding.• Trouble shooting• TIG welding defects, causes and remedy• Inspection and testing of weldments

Tools and Equipments:

Sl.No.	Description of tools	QTY
List of Hand Tools		
1	Hand Gloves pair leather	10 pairs
2	Apron leather	10 Nos
3	Goggles pair with welding coloured glass	10 pairs
4	Centre punch	04 Nos
5	Dividers	04 Nos
6	Caliper outside	04 Nos
7	Steel rule 300 mm with metric and inches scale	04 Nos
8	Wire brush (M.S&SS)	08 Nos
9	Spark lighter	04 Nos
10	Scriber	04 Nos
11	Tongs holding	08 Nos
12	Welding helmet type with filter glasses	08 Nos
13	Chipping hammer	08 Nos
List of Shop Outfit		
14	Hammer ball pen	04 Nos
15	Hacksaw frame	04 Nos
16	File flat bastard	04 Nos
17	Spanner set	01 set
18	Outfit spanner & spindle key for Co2 and TIG welding outfit	02 sets
19	D E grinder 15 cm wheel motorized bench type fitted with silicon carbide grinding wheels	02 sets
20	Work bench fitted 4 Bench vices	01 No
21	D E grinder 30 cm wheel motorized pedestal type fitted with Aluminium oxide grinding wheels	01 No
22	Screw Driver set	01 set
23	Hacksaw frame adjustable	1 no
24	Hammering blocks 5 cm thick 60 sq	1 no
25	TIG Welding table with protected weld filter glass/fire proof screens	2nos
26	TIG welding machine complete, 300 amps AC / DC with water cooled torch	2 unit
27	Argon Gas cylinders with regulator flow meter and hose connections	2 set
28	Consumables, electrodes, filler rods and raw materials	As required.
29	Fire Fighting equipment	As required

Minimum testing for TIG welding:

- a. TIG Welding MS- Square butt joint on MS in down hand position.
- b. TIG Welding Stainless Steel: T joint in horizontal position.
- c. TIG Welding Aluminium: T joint and Single V butt joint in down hand position.

GENERAL INFORMATION FOR THE MODULE: CO₂ WELDER

Name of Sector	FABRICATION
Name of Module	CO₂ WELDER
MES Code	FAB 703
Competency as per N C O Code	To be allotted
Duration of Course	300 Hrs
Entry Qualification of Trainee	8 th Pass + MES Certificate on ARC & GAS WELDER
Unit size (No. Of trainees)	20
Power Norms	12 KW
Space Norms (Workshop and Class Room)	80 sq.m Minimum size of one side to be 04m.
Instructors Qualification	Degree in Mechanical Engineering with one year Experience OR Diploma in Mechanical Engineering with two year Experience OR NTC/ NAC in Welder Trade Group with three years of Experience
Desirable	Craft Instructor Certificate (CIC)

Terminal Competency:

After completion of this training, the participants would be able to perform:

- a) MAG/CO₂ welding in all positions
- b) Repair components/parts used in household & industrial appliances by CO₂ Welding process.

Contents:

Practical Competencies	Underpinning Knowledge (Theory)
<ul style="list-style-type: none"> • Use of protective safety devices on shop floor. • Safe working practice to be observed during welding. • Introduction to safety equipment and their uses. • Identification of tools and accessories used for MAG/CO2 Arc welding. • Setting up of MAG/CO2 Welding machine and depositing Straight line beads on MS plate by CO2 welding. • Produce Lap on MS plate in down hand position. • Produce Corner joint on MS plate in down hand position. • Produce Single 'V' butt joint in down hand position. • Produce "T" joint on MS plate in horizontal position by CO2 welding. • Produce "T" joint on MS plate in horizontal position by CO2 welding. • Produce Lap, "T" & corner joint on MS sheet 3 mm thick in vertical down ward position by CO2 welding. • Produce Lap, "T" & corner joint on MS sheet 3 mm thick in horizontal position by CO2 welding. • Produce Lap, "T" & corner joint on MS sheet 3 mm thick in vertical down ward position by CO2 welding. • Produce Lap, "T" & corner joint on MS sheet 3 mm thick in vertical overhead position by CO2 welding. • Identification of defects on CO2 welded joints by Visual inspection & correction of defects. • Measurement of weld using gauges 	<ul style="list-style-type: none"> • Introduction of MES scheme • Job /employment opportunity • Introduction to welding. • Safety precautions and necessity of using protective equipments such as shields, goggles, hand glows, sleeves, aprons safety shoes etc. • Types of welding processes and application. • Metals and weldability. • Linear measurement metric and inches • Angular measurement. • Marking practice using Steel rule using metric and inches scale • Nomenclature of Fillet and groove welds • Welding terms and definitions • Weld symbol and reading of fabrication drawing • Distortion and methods of control • Introduction to MAG/ CO2 welding Power source & accessories Wire Feed unit Welding Gun & its parts. Modes of metal transfers - Dip, Globular and Spray transfer • Welding wire types and specification Types of shielding gases & its importance • Principles & applications of Flux cored arc welding • Trouble shooting in MAG/CO2 welding • Data and Tables related to CO2 welding • Types of weld defects in CO2 Welding, causes and remedy • Inspection & testing of weldments

Tools and Equipment

Sl.No.	Description of tools	QTY
List of Hand Tools		
1	Hand Gloves pair leather	10 pairs
2	Apron leather	10 Nos
3	Goggles pair with welding coloured glass	10 pairs
4	Centre punch	04 Nos
5	Dividers	04 Nos
6	Caliper outside	04 Nos
7	Steel rule 300 mm with metric and inches scale	04 Nos
8	Wire brush (M.S&SS)	08 Nos
9	Spark lighter	04 Nos
10	Scriber	04 Nos
11	Tongs holding	08 Nos
12	Welding helmet type with filter glasses	08 Nos
13	Chipping hammer	08 Nos
List of Shop Outfit		
14	Hammer ball pen	04 Nos
15	Hacksaw frame	04 Nos
16	File flat bastard	04 Nos
17	Spanner set	01 set
18	Outfit spanner & spindle key for Co2 and TIG welding outfit	02 sets
19	D E grinder 15 cm wheel motorized bench type fitted with silicon carbide grinding wheels	02 sets
20	Work bench fitted 4 Bench vices	01 No
21	D E grinder 30 cm wheel motorized pedestal type fitted with Aluminium oxide grinding wheels	01 No
22	Screw Driver set	01 set
23	Hacksaw frame adjustable	1 no
24	Hammering blocks 5 cm thick 60 sq	1 no
26	CO2 welding table with welding positioner	2 nos
29	CO2welding machine complete 400 amps capacity with torch 300A	2 units
30	CO2 gas cylinders with pre heater, flow meter, and hose connections	2 set
31	Consumables, electrodes, filler rods and raw materials	As required.
32	Fire Fighting equipment	As required

Minimum testing for CO2 Welding:

- a. Single V butt Joint in down hand position
- b. T joint in Vertical downward progression

GENERAL INFORMATION FOR THE MODULE: PIPE WELDER (TIG & MMAW)

Name of Sector	FABRICATION
Name of Module	PIPE WELDER (TIG & MMAW)
MES Code	FAB 708
Competency as per N C O Code	To be allotted
Duration of Course	300 Hrs
Entry Qualification of Trainee	8 th Pass + MES Certificate on ARC & GAS WELDER
Unit size (No. Of trainees)	20
Power Norms	12 KW
Space Norms (Workshop and Class Room)	80 sq.m Minimum size of one side to be 04m.
Instructors Qualification	Degree in Mechanical Engineering with one year Experience OR Diploma in Mechanical Engineering with two year Experience OR NTC/ NAC in Welder Trade Group with three years of Experience
Desirable	Craft Instructor Certificate (CIC)

Terminal Competency :

After completion of this training, the participants would be able to perform :

- a. Weld high pressure pipes in 5G and 6G positions by MMAW
- b. Weld high pressure pipes in 5G and 6G positions by TIG root pass and cover pass by MMAW

Contents:

Practical Competencies	Underpinning Knowledge (Theory)
<ul style="list-style-type: none"> • Use of protective safety devices on shop floor. • Safe working practice to be observed during welding. • Introduction to safety equipment and their uses. • Setting up of Arc Welding plants • Striking and making straight and weaving beads in all position by MMAW. • Produce arc welded joints: <ul style="list-style-type: none"> a. Filler „T“ joint on M.S. flat by MMAW in 1F, 2F, 3F and 4F positions b. Fillet lap joint on M.S. by MMAW in flat position c. Outside corner joint on MS by MMAW in flat position d. Single „V“ but joint on MS by MMAW in 1G, 2G, 3G and 4G positions • Preparation of pipe joint for pipe welding • Produce Single ‘V’ butt joint on 6"schedule 60 mild steel pipe in down hand position (1G) by MMAW. • Produce Single ‘V’ butt joint on 6" schedule 60 mild steel pipe in horizontal position (2G) by MMAW (pipe axis vertical). • Produce Single ‘V’ butt joint on 6" schedule 60 mild steel pipe in 5G position (uphill) by MMAW (pipe axis horizontally fixed) • Produce Single ‘V’ butt joint on 6"schedule 60 mild steel pipe in 6G position (uphill) by MMAW (pipe axis 45degree inclined) – fixed • Setting up of Arc Welding and TIG Welding plants • Striking and making straight g beads in all position by TIG. • Root welding of pipes in 5G position by TIG Welding • Intermediate and cover pass welding in 	<ul style="list-style-type: none"> • Introduction of MES scheme • Job /employment opportunity • Introduction to welding. • Types of welding processes and application • Nomenclature of Fillet and groove welds • Welding terms and definitions. • Introduction to pipe welding. • Principles of Manual Metal Arc Welding (MMAW). • Types of power source, Polarity and its effects. • Types of Arc length and application • Welding positions and importance • Types of Electrodes and specification as per BIS, AWS, etc. • Selection of electrodes • Electrode storage and backing temperature • Preheating requirement for alloy steel pipe welding • Types of pipes and pipe schedule • Edge preparation and fit up for thick wall and thin wall pipes. • Basic pipe welding procedure – uphill welding and downhill welding. • Pipe welding position 1G, 2G, 5G & 6G • Procedure for welding thin wall pipes • Procedure for welding thick wall pipes in 1G position • Procedure for welding thick wall pipes in 2G position • Procedure for welding thick wall pipes in 5G position • Procedure for welding thick wall pipes in 6G position • Welding Symbols and reading of pipe fabrication drawings • Introduction to TIG welding • Advantages of TIG welding process • Power source – Types, polarity and application • Accessories - HF unit and DC suppressor. • Tungsten electrode, Types, sizes, and uses. • Type of shielding gases

5G position by SMAW <ul style="list-style-type: none"> • Root welding of pipes in 6G position by TIG • Intermediate and cover pass welding in 6G position by MMAW • Identification of defects by Visual inspection & correction of defects 	<ul style="list-style-type: none"> • Advantages of root pass welding of pipes by TIG welding • Types of pipes and pipe schedule • Inspection & testing of weldments
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Tools and Equipment:

Sl.No.	Description of tools	QTY
List of Hand Tools		
1	Hand Gloves pair leather	10 Nos
2	Apron leather	10 Nos
3	Wire brush (M.S&SS)	10 Nos
4	Spark lighter	8 Nos
5	Scriber	8 Nos
6	Tongs holding	8 Nos
7	Welding helmet type with filter glasses	10 Nos
8	Chipping hammer	8 Nos
List of Shop Outfit		
9	Hammer ball pen	4 Nos
10	Hacksaw frame	4 Nos
11	File flat bastard	4 Nos
12	Spanner set	1 set
13	Outfit spanner & spindle key for Organ gas cylinder	1 set
14	D E grinder 15 cm wheel motorized bench type fitted with silicon carbide grinding wheels	1 No
15	Work bench fitted 4 Bench vices	1 No
16	D E grinder 30 cm wheel motorized pedestal type fitted with Aluminium oxide grinding wheels	1 No
17	Screw Driver set	1 set
18	Hammering blocks 5 cm thick 60 sq.cm	1 no
19	Arc welding table with protected weld filter glass/fire proof screens and welding positioner	1 no
20	TIG welding table with protected weld filter glass/fire proof screens and welding positioner	1 unit
21	Arc welding set DC, Rectifier or Inverter type, 300 Amps with all accessories.	1 unit
22	D.C TIG welding machine 200A with water cooled torch 200A capacity	1 unit
23	Argon gas cylinder with regulator and flow meter	1 set

24	Welding consumables-Arc welding Electrodes,TungstenElectrodes,GasNozzles,Alloy steel TIG welding filler rod 2.5 mm	As required
25	Fire Fighting equipment	As required

Minimum testing for Arc welding High pressure pipes:

- a. High pressure pipe welding by MMAW in 6G position

Minimum testing for TIG and Arc Welding High pressure pipes:

- a. Welding High pressure pipe by TIG welding root pass in 6G position and cover pass by MMAW in 6Gposition

GENERAL INFORMATION FORTHE MODULE :WELDER(REPAIR & MAINTENANCE)

Name of Sector	FABRICATION
Name of Module	WELDER (REPAIR & MAINTENANCE))
MES Code	FAB 706
Competency as per NCO Code	To be allotted
Duration of Course	500 Hrs
Entry Qualification of Trainee	8 th Pass + 14 yrs of age
Unit size (No. Of trainees)	20
Power Norms	12 KW
Space Norms (Workshop and Class Room)	80 sq.m Minimum size of one side to be 04m.
Instructors Qualification	Degree in Mechanical Engineering with one year Experience OR Diploma in Mechanical Engineering with two year Experience OR NTC/ NAC in Welder Trade Group with three years of Experience
Desirable	Craft Instructor Certificate (CIC)

Terminal Competency:

After completion of this training, the participants would be able to perform:

- a) Gas and Arc welding in Edge, But, Lap, Tee and Corner joints in all positions.
- b) Repair work on Dies, Castings, Forgings, Tool brazing using Arc & gas welding.
- c) Repair on House hold items, sheet metal objects.
- d) Cutting & Gouging of metals.

Contents:

Practical Competencies	Underpinning Knowledge (Theory)
<ul style="list-style-type: none"> • Use of protective safety devices on shop floor. • Safe working practice to be observed during welding. • Introduction to safety equipment and their uses. • Identification of tools and accessories used for Gas welding, Gas cutting and Arc welding. • Setting up of Oxy Acetylene Gas welding plant and making fusion runs on MS in flat position. • Produce following welded joints in mild steel sheet in Flat positions by Gas welding <ul style="list-style-type: none"> a. Fillet Lap b. Fillet T joints c. Outside corner joint d. Square butt joint • Produce following welded joints in mild steel sheet in Horizontal positions by Gas welding <ul style="list-style-type: none"> a. Fillet Lap b. Fillet T joints c. Outside corner joint d. Square butt joint • Produce following welded joints in mild steel sheet in Vertical positions by Gas welding <ul style="list-style-type: none"> a. Fillet Lap b. Fillet T joints c. Outside corner joint d. Square butt joint • Produce Square butt joint on Stainless Steel by Gas welding • Produce Square butt joint on Brass by Gas welding • Produce Square butt joint on copper by Gas welding • Produce Single V butt joint on Cast iron 	<ul style="list-style-type: none"> • Introduction of MES scheme • Job /employment opportunity • Introduction to welding. • Safety precautions. • Types of welding processes and application. • Metals and weldability-Mild Steel, Alloy Steel, Cast iron, Copper and Brass. • Linear measurement metric and inches • Angular measurement. • Marking practice using Steel rule using metric and inches scale • Nomenclature of Fillet and groove welds • Welding terms and definitions • Weld symbol and reading of fabrication drawing. • Description and operating procedures of oxy-Acetylene welding and cutting equipments. • Description and safe operating procedures of oxy-acetylene regulators • Description & maintenance of oxy Acetylene welding and cutting blow pipes • Types of Oxy-Acetylene flames and their uses • Gas Welding parameters - selection of Nozzle size and Oxy acetylene gas pressure to cut different thickness of metals • Gas welding filler rods and fluxes and welding techniques. • Brazing principles, selection of nozzle size, filler metals and fluxes. • Gas cutting parameters - selection of Nozzle size and Oxy acetylene gas pressure to cut different thickness of plates • Procedure for welding Gray cast iron by gas welding - selection of gas

<p>by Gas welding</p> <ul style="list-style-type: none"> • Produce Single V butt joint on Cast iron by Bronze welding with Oxy-Acetylene flame. • Produce Square but, lap and T joint on MS sheet by Brazing • Produce Sheet metal joints on MS sheet and soldering • Tool brazing practice by brazing. • Setting up of Oxy Acetylene Gas Cutting plant and cutting M.S Flats to the given size. • Marking and punching the required shapes by using different shapes and sizes by using templates on M.S plates. • Cutting circular work pieces to the given size by Gas cutting. • Beveling and preparation of joint edges by Gas Cutting. • Gouging practice on MS plate surface by gas. • Setting up Arc Welding plant and depositing straight and weaving beads on MS in Flat position. • Produce arc welded joints: <ul style="list-style-type: none"> • a.Fillet „T“ joint on M.S. flat by MMAW in 1F, 2F, 3F and 4F positions • b.Single „V“ but joint on MS flat by MMAW in 1G, 2G, 3G and 4G position. • welding of Cast Iron, by Arc welding. • Welding of Stainless Steel by MMAW welding. • Gouging practice using gouging electrodes. • Stud welding of castings by MMAW. • Practice of repair work on Dies, Casting, and forgings by MMAW. • Practice on Hard facing and Powder Spraying. • Identification of defects MMAW welded joints by Visual inspection & correction of defects 	<p>nozzle,filler rod and flux, importance of pre heating post heating and slow cooling.</p> <ul style="list-style-type: none"> • Gas Welding, brazing and cutting defects, their causes and remedy. • Principle of soldering, applications, advantages and limitations. • Principles of Manual Metal Arc Welding (MMAW), advantages and limitations. • Basic Electricity applicable to welding. • Arc welding power source, AC Transformers, DC welding rectifier, DC generators. • Types of weld joints and edge preparation and fit up. • Arc Welding electrodes, Types of electrodes (MS electrodes, SS electrodes, C.I electrodes, Nickel electrodes, Hard facing electrodes, gouging electrodes,) and selection. • Coding of MMAW electrodes. • Arc welding procedure and technique. • Procedures of welding Gray cast iron by Arc welding and importance of peening. • Procedure for welding Gray cast iron by MMAW welding – selection of electrode and polarity, importance of pre heating post heating and slow cooling. • Principles of powder spraying, applications, advantages and Limitations. • Principles of Hard facing, applications, advantages and Limitations. • Principles of TIG and MIG welding, Equipment, applications and limitations. • Welding defects in MMAW, causes and remedy • Distortion and methods of control • Inspection and Testing of Welds
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Tools and Equipment For a batch of 20 Trainees:

Sl.No.	Description of tools	QTY
List of Hand Tools		
1	Hand Gloves pair leather	10 pairs
2	Apron leather	10 Nos
3	Goggles pair with welding coloured glass	10 pairs
4	Centre punch	04 Nos
5	Dividers	04 Nos
6	Caliper outside	04 Nos
7	Steel rule 300 mm with metric and inches scale	04 Nos
8	Wire brush (M.S&SS)	08 Nos
9	Spark lighter	04 Nos
10	Scriber	04 Nos
11	Tongs holding 300 mm	08 Nos
12	Welding helmet type with filter glasses	08 Nos
13	Chipping hammer	08 Nos
List of Shop Outfit		
14	Hammer ball pen	04 Nos
15	Hacksaw frame	04 Nos
16	File flat bastard	04 Nos
17	Spanner set	01 set
18	Outfit spanner & spindle key for Gas welding outfit	02 sets
19	Work bench fitted 4 Bench vices	02 sets
20	D E grinder 30 cm wheel motorized pedestal type fitted with Aluminium oxide grinding wheels	01 No
21	Bench shear hand capacity up to 5mm thick sheet	01 No
22	Screw Driver set	01 set
23	Hammering blocks 5 cm thick 60 sq.cm	1 no
24	Gas welding table with fire bricks	1 no
25	Gas cutting table with debris tray	1 no
26	Arc welding table with protected weld filter glass/fire proof screens	1 no
27	Angle grinder AG4	1 no
28	Metal container for slow cooling welded Cast Iron 1'x1'x1'	1 no
29	Oxy-Acetylene Gas welding and cutting plant mounted on trolley with Oxy-Acetylene Gas cylinders, pressure regulators, hose connections, gas welding torch with nozzle No.1 & 2,3, 5&7 and Gas cutting torch with 1.2 &1.6 mm nozzles.	2 units
30	Transformer welding set with all accessories 300 A	2 units
31	Arc welding set DC, Rectifier or Inverter type, 400 Amps with all accessories.	2 units
32	Oxy acetylene Metal Spraying unit	1 Unit
33	Consumables, Oxy-acetylene Gases, raw materials, fluxes and filler wires.	As required.
34	Fire Fighting equipment	As required

Note:

1. . Minimum testing for Gas Welding:-
 - a. Square butt joint in vertical position
 - b. Bronze of C.I in flat position.

2. Minimum testing for Gas cutting:-
 - a. Straight Cutting in d/h position
 - b. Gouging of metals

4. Minimum testing for MMAW :-
 - a. Single V butt joint in vertical position
 - b. Welding of C.I in flat position.

GENERAL INFORMATION FOR THE MODULE: SHEET METAL WORKER
(PANELS, CABINS & DUCTS)

Name of Sector	FABRICATION
Name of Module	Sheet Metal Worker (Panels, Cabins & Ducts)
MES Code	FAB 209
Competency as per NCO Code	7212.10
Duration of Course	500 Hrs
Entry Qualification of Trainee	8 th Pass + 14 yrs of age
Unit size (No. Of trainees)	20
Power Norms	4 KW
Space Norms (Workshop and Class Room)	80 sq.m Minimum size of one side to be 04m.
Instructors Qualification	Degree in Mechanical Engineering with one year Experience OR Diploma in Mechanical Engineering with two year Experience OR NTC/ NAC in Welder Trade Group with three years of Experience
Desirable	Craft Instructor Certificate (CIC)

Terminal Competency :

After completion of this training, the participants would be able to:

- a. Identify, select, use and store tools, equipments and materials used in sheet metal work in a safe manner
- b. Carry out Shearing, Cutting, Bending, Folding, Seaming, Wire edging of sheet metal
- c. Join sheets using folding, seaming and riveting
- d. Join sheets by brazing and soldering
- e. Fabricate steel Panels, cabins & Ducts

Content:

Practical Competencies	Underpinning Knowledge (Theory)
<ul style="list-style-type: none"> • Use of protective clothing and boots • Identify tools, equipments and materials used in fitting • Apply good housekeeping practices, proper handling of materials and disposal of waste, follow statutory regulations. • Carry out basic first aid treatment/notifying accident. • Store/lay materials at work in safe manner • Use and store tools and equipments in a safe manner • Select proper tools for a particular task • Take measurements using appropriate measuring tool • Measuring tools : Steel rule, inside and outside calipers, vernier caliper, inside and outside micrometer, depth gauge, vernier height gauge, • Bevel protector, radius gauge, • feeler gauge, wire gauge • Read and interpret simple workshop drawings • Mark layout of object on sheet metal as per drawing • Perform sheet metal operations • Select appropriate sheet metal hand tools and machine tools (Shearing tools, stakes, Hammers, Cutting tools, Grovers) • Perform appropriate sheet metal operation to make different shapes (Shearing, Cutting, Bending, Folding, Seaming, Wire edging) • Perform sheet metal joining operations • Join sheets using folding and appropriate seaming (Single seam, Double seam, Grove seam, Lap seam, Dovetail seam) • Select appropriate rivet for riveting operation (Snap head, Pan head, Countersunk head, Mushroom head, Flat 	<ul style="list-style-type: none"> • Introduction of MES scheme • Job /employment opportunity • Safety precautions, use of protective clothing and elementary first aid. • Functions and uses of various tools and equipment. • Reasons for carrying out good housekeeping practices • Care and use of tools, equipment and materials used in fitting • Selection and correct use of tools • Criteria for selection of tool for different operation. • Proper handling and correct use of hand tools • Types of measuring tools • Least count and errors • Measurement procedures • Safety precautions related to measuring tools • Introduction of marking tools. Application of marking tools. Safety, proper handling and use of marking tools. • Introduction to sheet metal hand tools and machine tools and safety precautions to be observed while using them. • Types of sheet metal and their applications. Different sizes of sheet available metal commercially • Metal joining method • Types of seams and allowances • Types of flux and selection criteria • Types of rivets and riveting methods • Knowledge of Limits, Fits and Tolerance Systematic steps of different operations and safety considerations of each operation. • Arc welding – Equipments, Principles, Electrodes, safety, applications, Advantages & Limitations • Gas welding – Equipments, Principles, Filler

<p>head)</p> <ul style="list-style-type: none"> • Perform riveting using appropriate joint • Single riveted lap joint • Double riveted lap joint • Practice on arc welding (tacking & beading) • Set up Oxy acetylene welding equipment and Produce Square but, lap and T joint on MS sheet by welding & Brazing • Perform soldering operations • Method of stiffening large size metal sheet • Practice of making steel racks. • Practice of making steel tables • Practice of making square/round ducts, • Practice of making cabins, panels. • Fabricate simple house hold articles by using sheet metals • Check joint for defects by hydraulic/pneumatic methods 	<p>rods, Fluxes, safety, applications, Advantages & Limitations</p>
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List of Tools and Equipments (for one batch of 20 trainees)

S.NO	DESCRIPTION	QTY
1	Metal Sheet 1mm, 2mm, 3mm GI/MS	5 sheets
2	Measuring tape 5 mm	5 nos.
3	Steel rule 300 mm	20
4	Steel rule 150 mm	20
5	Vernier Caliper 150 mm/0.02 mm	2
6	Micrometer 0.25 mm/0.02 mm	2
7	Thickness gauge set	2
8	Wire gauge	2
9	Drawing Instrument box	10
10	Drawing Board	10
11	Paper Chip	40
12	Set Square	10
13	French Curve	10
14	Scriber	20
15	Divider	10
16	Scratch awl	5
17	Steel square 8"	5
18	Center punch	20
19	Set Hammer	2
20	Flatter	2
21	Straight Snip	2
22	Bent Snip	2
23	Various types of stakes	2 sets
24	Grooving tool	2
25	Folder bar	5
26	C Clamp 4"	8
27	Rivet Set	2 sets
28	Punch & Drift	5 sets
29	Hand lever shearing machine	1
30	Fly press	1
31	Roller forming machine	1
32	Universal swaging machine	1
33	Dressing plate	1
34	Different types of rivet of Al, Copper & Ms	1 kg. each
35	Portable drill machine	1
36	Pillar drill machine ½"	1
37	Different types of soldering iron	2 sets

38	Solder	2 kg
39	Flux	2 kg
40	Hammers, 500 gm, 200 gm	5 each
41	Mallet (Various types)	10 each
42	Bench vice	5
43	File - rough, Second cut & Smooth	5 sets
44	Hacksaw Frame	10
45	Hacksaw blades	100
46	Paper knife	20
47	Scissors	10
48	Glue	20
49	Blow gun	1
50	1.5 book of rivets	1
51	First aid box	1
52	Cold Chisel flat	5
53	Set of Drill bit	2 sets
54	Oxy-Acetylene Gas welding plant mounted on trolley with Oxy-Acetylene Gas cylinders, pressure regulators, hose connections, gas welding torch with nozzle No.1 & 2..	1 unit
55	Filler wires for brazing and soldering M.S,SS,Tin,Brass and Copper	As required
56	Pop rivet gun	01 No
57	Arc welding transformer 300 AMPS with Accessories	01 set
58	Portable Arc welding Transformer 200 A with all accessories	01 set
59	Portable Nibbling machine Electrically operated	01 Nos
60	Spot welding Machine, with all accessories	01 set
61	Air compressor	01 No
62	Anvil 25 kg	01 No

LIST OF TRADE COMMITTEE MEMBERS

Sl. No	Names & Designation	Organisation	Remarks
Members of Sector Mentor council			
1	Dr.G.Buvashekar	AGM, WRI, Trichy - Chairman	Chairman
2	Dr.K.Ashokkumar	AGM, BHEL, Trichy	Member
3	Prof. JyothiMukhopadhy	IIT, Ahmedabad	Member
4	B.Pattabhiraman	MD, GB Engineering, Trichy	Member
5	Dr.Rajeevkumar	IIT, Mandi	Member
6	Dr. Vishalchauhan	IIT, Mandi	Member
7	Shri D.K.Singh	IIT, Kanpur	Member
8	Shri. Navneet Arora	IIT, Roorkee	Member
9	Shri. R. K. Sharma	Head, SDC, JBM Group, Faridabad	Member
10	Shri. Puneet Sinha	Deputy Director, MSME, New Delhi	Member
Mentor			
1	Shri. DeepankarMallick	Director of Training, DGE&T Hq,	Mentor
Members of Core Group			
1	Shri. M Thamizharasan	JDT, CSTARI, Kolkata	Member
2	Shri. M Kumaravel	DDT, FTI , Bangalore	Team Leader
3	Shri. SushilKumar	DDT, DGE&T Hq,	Member
4	Shri. S.P.Khataokar	T.O. ATI, Mumbai	Member
5	Shri. V.L. Panmozhi	TO, CTI, Chennai	Member
6	Shri. D.Pani	TO, ATI, Howrah	Member
7	Shri. Amar Singh	TO, ATI, Ludhiyana	Member
8	Shri. Gopalakrishnan	NIMI, Chennai	Member
9	Shri. Manjunatha B.S	JTO, GITI, K.G.F. Karnataka	Member
10	Shri. Balachandranachari A.V	Principal Govt,ITI , Kottayam, Kerala	Member