National Competency Standards
for
"Assistant Foreman in Metallurgy and Metal casting"
Level-3

National Vocational and Technical Training Commission (NAVTTC),
Government of Pakistan

ACKNOWLEDGEMENT

National Vocational and Technical Training Commission (NAVTTC) extends its gratitude and appreciation to representatives of business, industry, academia, government agencies, provincial TEVTAs, sector skill councils and trade associations who spared time and extended their expertise for the development of National Vocational Qualifications for the trade of **Metallurgy and metal casting.** This work would not have been possible without the technical support of the above personnel.

NAVTTC initiated development of CBT&A based qualifications for 200 traditional / hi-tech trades under the Prime **Minister's Hunarmand Pakistan Program,** focusing on Development & Standardization of 200 Technical & Vocational Education & Training (TVET) Qualifications. NAVTTC efforts have received full support from the Ministry of Federal Education and Professional Training, which highly facilitated progress under this initiative.

It may not be out of place to mention here that all the experts of Industry, Academia and TVET experts of TEVTAs, BTEs and PVTC work diligently for making this qualification worthy and error free for which all credit goes to them. However, NAVTTC accepts the responsibility of all the errors and omissions still prevailing in the qualification document.

It is also noteworthy that development of Skill Standards is a dynamic and ongoing process, and the developed skill standards needs periodic review and updating owing to the constant technological advancements, development in scientific knowledge, and growing experience of implementation at the grass root level as well as the demand of industry. NAVTTC will ensure to keep the qualifications abreast with the changing demands of both national and international job markets.

Dr. Nasir Khan,
Executive Director,
NAVTTC

Contents

1. Introduction

Metallurgy and metal casting is a manufacturing process. A liquid metal is somehow delivered into a mold (usually by a crucible) that contains a negative impression (i.e., a three dimensional negative image) of the intended shape in a process. The metal is poured into the mold through a hollow channel called a sprue. The metal and mold are then cooled, and the metal part (the casting) is extracted. Casting is most often used for making complex shapes that would be difficult or uneconomical to make by other methods.

Casting processes have been known for thousands of years, and have been widely used for sculpture (especially in bronze), jewelry in precious metals, and weapons and tools. Traditional techniques include lost-wax casting (which may be further divided into centrifugal casting and vacuum assist direct pour casting), plaster mold casting and sand casting.

The modern casting process is subdivided into two main categories: expendable and non-expendable casting. It is further broken down by the mold material, such as sand or metal, and pouring method, such as gravity, vacuum, or low pressure.

Being cognizant of this fact, National Vocational & Technical Training Commission (NAVTTC) developed competency standards for metallurgy and metal casting under National Vocational Qualifications Framework (NVQF). These competency standards have been developed by a Qualifications Development Committee (QDC) and validated by the Qualifications Validation Committee (QVC) having representation from the leading development houses and research labs of the country.

2. Purpose of the Qualification

The competency based NVQ has been developed to train the unskilled men and women of Pakistan on the technical and entrepreneurial skills to be employed / self-employed and inevitably set sustainable impact on their lives by enhancing their livelihood income.

The purpose of these qualifications is to set professional standards for upcoming experts, who will serve as key elements enhancing quality of Pakistan's manufacturing sector. The specific objectives of developing these qualifications are as under:

- Improve the professional competencies of individual in metallurgy and metal casting
- Capacitate the local community and trainers in modern CBT trainings, methodologies and processes as envisaged under NVQF
- Provide flexible pathways and progressions in metallurgy and metal casting
- Enable the trainees to perform their duties in efficient manner
- Establish a standardized and sustainable system of training in Pakistan
- Enabling the youth with greater employment opportunities

3. Date of Validation

The level 5 metallurgy and metal casting qualification has been validated on 12 to 16 January, 2021 at PITAC, Lahore, by the qualification validation committee (QVC) members.

4. Date of Review

The level 5 Computer networking and cloud computing qualification has been reviewed on 12-16 January,2021 by the qualification validation committee (QVC) members.

5. Codes of Qualifications

The International Standard Classification of Education (ISCED) is a framework for assembling, compiling and analyzing cross-nationally comparable statistics on education and training. ISCED codes for these qualifications are assigned as follows:

ISCED Classification	
Code	**Description**
1	2nd Level National Certificate of level-5 Qualification, in "Metallurgy and Metal casting"
2	3rd Level National Certificate of level-5 Qualification, in "Metallurgy and Metal casting"
3	4th Level National Certificate of level-5 Qualification, in "Metallurgy and Metal casting"
4	5th Level National Certificate of level-5 Qualification, in "Metallurgy and Metal casting"

6. Members of Qualification Development Committee

The following members participated in the qualification development process at PITAC, Lahore.

Date: 18 to 22 December 2020

S#	Name	Designation
1.	Muhammad Yasir	Deputy Director, NAVTTC
2.	Engr. Farooq Iftikhar	Jr.Engineer,PITMAEM Lahore
3.	Engr.Umer Farooq	Instructor P-TEVTA Swedish college, Gujrat
4.	Engr.Noman	Jr.Engineer PCSIR,Lahore
5.	Engr.Rashid Bashir	PCSIR,Lahore
6.	Engr.Salman Khalid Ch.	Assistant Director PITAC,Lahore
7.	Engr.Amina Irfan	Lecturer,UOL Lahore
8.	Engr.Asad Malik	Assistant director, PITAC Lahore
9.	Engr.Saba Sadiq	DACUM FACILITATOR,UOL Islamabad
10.		
11.		
12.		
13.		
14.		
15.		

7. Members of Qualification Validation Committee

The following members participated in the qualification development process at PITAC, Lahore.

Date:

S#	Name	Designation
1.	Muhammad Yasir	Deputy Director, NAVTTC
2.	Engr. Farooq Iftikhar	Jr.Engineer,PITMAEM Lahore
3.	Engr.Sohail	Instructor P-TEVTA Swedish college, Gujrat
4.	Engr.Noman	Jr.Engineer PCSIR,Lahore
5.	Engr.Rashid Bashir	PCSIR,Lahore
6.	Engr.Salman Khalid Ch.	Assistant Director PITAC,Lahore
7.	Engr.Saba Sadiq	DACUM FACILITATOR, Islamabad
8.		
9.		
10.		
11.		

8. Entry Requirements

Entry requirement for this level 5 qualification would be matric and certification of level 4 in metallurgy and metal casting.

9. Regulation of the Qualification and schedule of units

Not applicable

10. Summary of Competency Standards

Sr. No	Occupation	Competency Standards	NVQF Level	Category	Estimated Contact Hr.			Credit Hr.
					Th.	Pr.	Total	
Technicain in metallurgy and metal casting-LEVEL 2								
1	**Manual Drawing Expert**	Perform Basic Manual Drawing	2	**Technical**	4	24	28	2.8
		Construct different Engineering Curves.			6	30	36	3.6
		Construct multi-view drawings			6	30	36	3.6
		Total			16	84	100	10
2	**Basic Machining Operator**	Perform metal/bench work	2	**Technical**	2	12	14	1.4
		Perform cutting on Metal Circular/Power Heck Saw			2	6	8	0.8
		Perform Grinding operation			2	9	11	1.1
		Perform Basic Lathe Machine Operations			4	21	25	2.5
		Perform Drilling Machine Operations			2	9	11	1.1
		Perform Shaper, Planar and Slotter Machining Operations			2	18	20	2
		Perform Milling Operations			3	18	21	2.1
		Total			17	93	110	11
3	**Health and Safety Officer**	Perform basic safety practices	2	**Technical**	10	15	25	2.5
		Apply basic Occupational Health & Safety regulations			10	15	25	2.5
		Total			20	30	50	5
4	**Raw Material Inspector**	Carry out inspection and receiving of raw material	2	**Technical**	9	21	24	2.4
		Perform Raw Material Sampling			9	21	28	2.8
		Total			18	42	60	6
5	**Assistant Pattern Maker**	Operate general wood working machines	2	**Technical**	9	15	24	2.4
		Manufacture Wooden Pattern			6	15	21	2.1
		Manufacture polymer pattern			4	15	19	1.9
		Maintain tools and equipment			3	3	6	0.6
		Total			22	48	70	7

6	**Assistant Molder**	Prepare sand mold for casting	**2**	**Technical**	10	24	34	3.4
		Perform core making			5	21	26	2.6
		Total			15	45	60	6
7	**Assistant Caster**	Maintain Safe Work Environment	**2**	**Technical**	4	9	13	1.3
		Perform Sand Casting			8	21	29	2.8
		Perform Gravity Die Casting			7	21	28	2.8
		Total			19	51	70	7
8	**Fettling Operator**	Fettle and trim metal casting	**2**	Technical	2	9	11	1.1
		Perform surface cleaning by sand blasting			4	12	16	1.6
		Perform shot blasting			5	15	20	2
		Perform cutting and grinding operations			3	9	12	1.2
		Perform basic welding operations			6	15	21	2.1
		Total			20	60	80	8
Total(Level 2)								
Assistant foremen in metallurgy and metal casting-LEVEL 3								
1	**Pattern Designer**	Manage graphic user interface	**3**	Technical	11	9	20	
		Develop 2D drawings			6	18	24	
		Develop 3D pattern design			8	18	26	
		Total			25	45	70	
2	**Pattern Maker**	Manufacture match plate gated pattern	**3**	**Technical**	8	21	20	
		Manufacture Pattern on CNC router			8	33	20	
		Total			16	54	70	
3	**Melter**	Work Safely with Molten Metal	**3**	**Technical**	6	6	12	1.6
		Melt Ferrous Material (Cast Steel) in Induction Furnace			8	24	32	2
		Melt Ferrous Material (Cast Iron) in Cupola Furnace			8	24	32	2
		Melt Non-Ferrous Material in Pit Furnace			6	18	24	2
		Total			28	72	100	7.6
4	**Molder**	Operate molding machines	**3**	Technical	7	33	30	1.5
		Operate core making machines			5	15	30	1.5
		Total			12	48	60	6
5	**Furnace operator**	Operate Non-Electric Melting Furnaces	**3**	Technical	10	30	40	4
		Operate Electric Melting Furnaces			10	30	40	4
		Total			20	60	80	8
6	**Caster**	Operate Pressure Die Casting	**3**	Technical	10	30	40	3
		Perform Centrifugal Casting Process			13	27	40	3
		Total			23	57	80	3
7	**Assistant Heat Treatment Technician**	Perform quenching, annealing and normalizing process	**3**	Technical	10	30	40	
		Perform Heat Treatment of Non-Ferrous Materials			10	30	40	
		Total			20	60	80	
8	**Basic computer operator**	Install/Use system software	**3**	Generic	4	9	13	
		Install / Use Application Software			3	9	12	
		Draft office document			4	12	16	

		Perform web browsing and manage emails			3	6	9	
		Total			14	36	50	
Foremen in metallurgy and metal casting-LEVEL 4								
1	**Soft skills**	Manage the meetings	**4**	Generic	5	15	20	2
		Manage workforce planning			5	15	20	2
		Undertake project work			5	15	20	2
		Identify and communicate trends in career development			5	15	20	2
		Apply interpersonal skills			5	15	20	2
		Work safely in an office environment			5	15	20	2
		Maintain professionalism in workplace			5	15	20	2
		Total			35	105	140	14
2	**Senior Caster**	Perform Shell Mold Casting	**4**	Technical	19	81	100	
		Perform Investment Casting			19	81	100	
		Total			38	162	200	
3	**Heat treatment technician**	Perform stress relieving, austempering and martempering	**4**	Technical	24	51	75	
		Perform Case Hardening process			21	54	75	
		Total			45	105	150	
4	**Destructive Testing Technician**	Perform Hardness Tests	**4**	Technical	8	30	38	
		Perform Impact Tests			6	24	30	
		Perform Mechanical Testing on Universal Testing Machine			16	48	64	
		Perform Torsion Test and Fatigue test			8	30	38	
		Total			38	132	170	
5	**Jr.Metallographic technician**	Perform Sectioning, Cutting and Rough Grinding	**4**	**Technical**	9	24	33	
		Perform Mounting Operation			9	24	33	
		Perform Fine Grinding Operation			15	24	39	
		Perform Fine Polishing Operation			`15	30	30	
		Total			33	102	135	
6	**Jr.Surface coating technican**	Perform Galvanizing Coating	**4**	**Technical**	11	24	35	
		Perform Conversion Coating (Anodizing)			11	24	35	
		Perform Electrochemical Coating (Electroplating)			10	30	40	
		Perform Electrochemical Coating (Electrolesis Electroplating)			10	30	40	
		Total			42	108	150	
7	**Metal forming technician**	Perform forging process	**4**	Technical	8	27	35	3
		Perform extrusion process			6	24	30	3
		Perform wire drawing and deep drawing process			6	24	30	3
		Perform rolling process			8	27	35	3
		Total			28	102	130	12
8	**Assistant QC Inspector**	Perform inspection	**4**	Technical	9	21	30	
		Select and control inspection process and procedures			9	21	30	
		Ensure calibration			9	21	30	

		Total			27	63	90	
Associate Engineer in metallurgy and metal casting-LEVEL 5								
1	**Sr.Metallography Technician**	Perform Etching Operation	**5**	Technical	18	36	54	2
		Perform Microscopic Examination Operation			21	45	66	2
		Total			39	81	150	12
2	**QC Inspector**	Conduct process and product capability analysis	**5**	Technical	10	30		2
		Perform advanced statistical quality control			10	30		2
		Total			20	60	100	9
3	**Non Destructive Testing Technician**	Perform dye penetrant, magnetic and ultrasonic test	**5**	Technical	15	45	60	9
		Perform radiography and eddy current test			12	36	48	3
		Total			78	81	200	3
4	**Service Coating Technician**	Perform Vapor Deposition Coatings (PVD)	**5**	Technical	15	24	39	3
		Perform Vapor Deposition Coatings (CVD)			15	24	39	3
		Perform Thermal Spray Coatings (Plasma)			12	24	36	3
		Perform Thermal Spray Coatings (Electric Arc Value)			12	24	36	
		Perform Thermal Spray Coatings (LVOF)			12	24	36	
		Total			66	120	150	15
7	**Powder Metallurgy**	Handle Powder for required process	**5**	Technical	12	24	36	1.5
		Perform Consolidation Operation			12	24	36	1.5
		Perform Sintering Operation			18	24	42	1.5
		Perform Finishing Operations			12	24	36	1.5
		Total			54	96	150	6
8	**Entrepreneur**	Develop Project Proposal	**5**	Generic	6	9	15	1.5
		Apply management and communication techniques			3	9	12	1.2
		Create human resource management plan			3	9	12	1.2
		Develop project management plan			3	9	12	1.2
		Develop sales plan			6	9	15	1.5
		Conduct research for customer needs and satisfaction			3	6	9	0.9
		Manage finances			4	9	13	1.3
		Identify and resolve problems			4	9	13	1.3
		Create/Manage profile on Non-traditional Freelancing Platform			4	9	13	1.3
		Create/Manage profile on a Traditional Freelance Platform			3	9	12	1.2
		Write professional proposals for freelance projects			3	9	12	1.2
		Develop communication skills			3	9	12	1.2
		Total			45	105	150	15

11. Levelling and Packaging of the Qualification

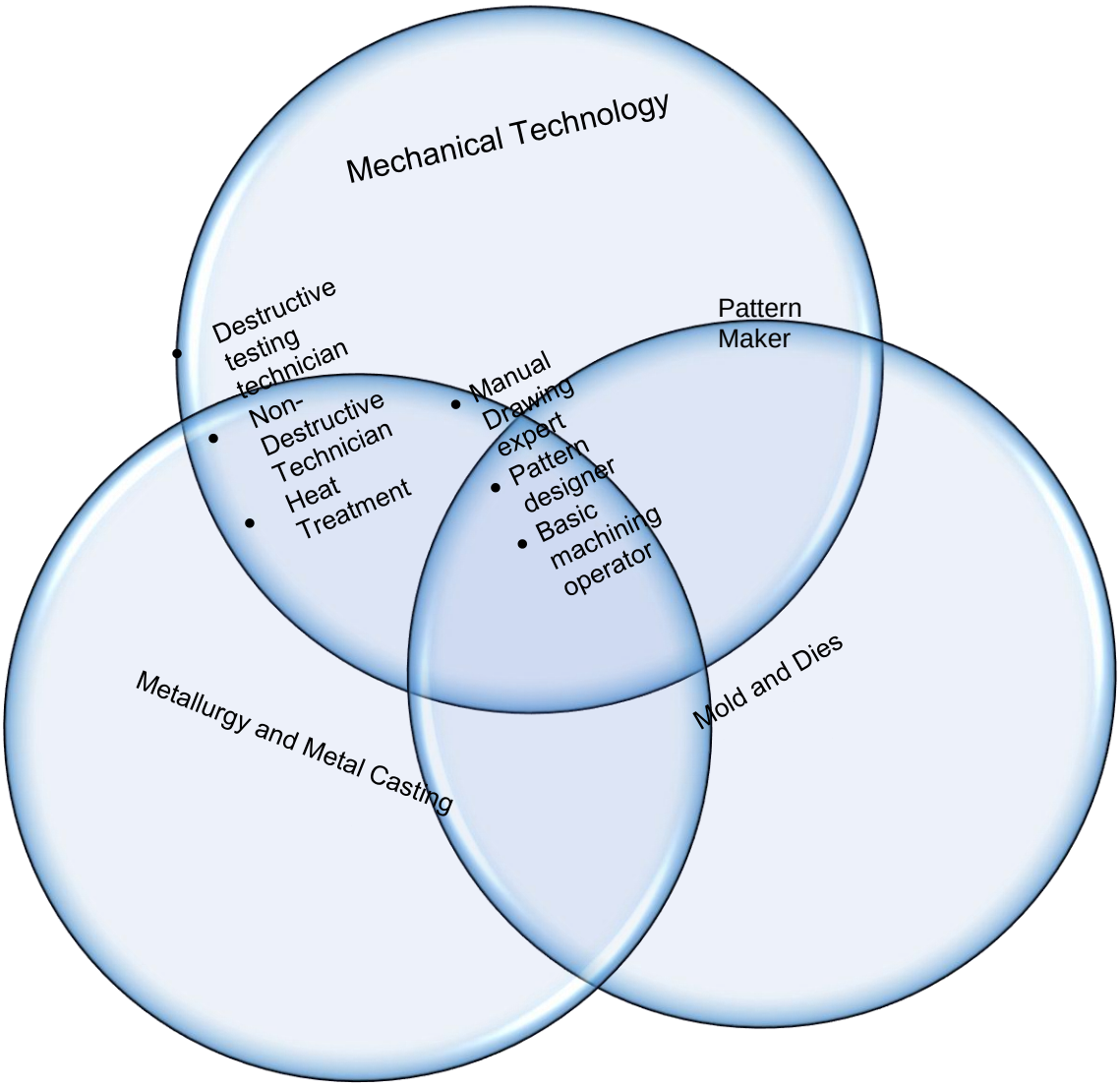
Sr.	Occupation	Duties/Competency Standards
	Level 2 **Technician in metallurgy and metal casting**	
1	**Manual Drawing Expert**	1. Perform Basic Manual Drawing 2. Construct different Engineering Curves. 3. Construct multi-view drawings
2	**Basic Machining Operator**	4. Perform metal/bench work 5. Perform cutting on Metal Circular/Power Heck Saw 6. Perform Grinding operation 7. Perform Basic Lathe Machine Operations 8. Perform Drilling Machine Operations 9. Perform Shaper, Planar and Slotter Machining Operations 10. Perform Milling Operations
3	**Health and Safety Officer**	11. Perform basic safety practices 12. Apply basic Occupational Health & Safety regulations
4	**Raw Material Inspector**	13. Carry out inspection and receiving of raw material 14. Perform raw material sampling
5	**Assistant Pattern Maker**	15. Operate general wood working machines 16. Manufacture Wooden Pattern 17. Manufacture match plate gated pattern 18. Maintain tools and equipment
6	**Assistant Molder**	19. Prepare sand mold for casting 20. Perform core making
7	**Assistant Caster**	21. Maintain Safe Work Environment 22. Perform Sand Casting 23. Perform Gravity Die Casting
8	**Fettling Operator**	24. Fettle and trim metal casting 25. Perform surface cleaning by sand blasting 26. Perform shot blasting 27. Perform cutting and grinding operations 28. Perform basic welding operations
	Level 3 **Assistant foremen in metallurgy and metal casting**	
9	**Pattern Designer**	29. Manage graphic user interface 30. Develop 2D drawings 31. Develop 3D pattern design

10	**Pattern Maker**	32. Manufacture Polymer Pattern 33. Manufacture Pattern on CNC router
11	**Melter**	34. Work Safely with Molten Metal 35. Melt Ferrous Material (Cast Steel) in Induction Furnace 36. Melt Ferrous Material (Cast Iron) in Cupola Furnace 37. Melt Non-Ferrous Material in Pit Furnace
12	**Molder**	38. Operate molding machines 39. Operate core making machines
13	**Furnace operator**	40. Operate Non-Electric Melting Furnaces 41. Operate Electric Melting Furnaces
14	**Caster**	42. Operate Pressure Die Casting 43. Perform Centrifugal Casting Process
15	**Assistant Heat Treatment Technician**	44. Perform quenching, annealing and normalizing process 45. Perform Heat Treatment of Non-Ferrous Materials
16	**Basic computer operator**	46. Install/Use system software 47. Install / Use Application Software 48. Draft office document 49. Perform web browsing and manage emails
Level 4 Foremen in metallurgy and metal casting		
17	**Soft Skills**	50. Manage the meetings 51. Manage workforce planning 52. Undertake project work 53. Identify and communicate trends in career development 54. Apply interpersonal skills 55. Work safely in an office environment 56. Maintain professionalism in the workplace
18	**Senior Caster**	57. Perform Shell Mold Casting 58. Perform Investment Casting
19	**Heat treatment technician**	59. Perform stress relieving, austempering and martempering 60. Perform Case Hardening process
20	**Destructive Testing Technician**	61. Perform Hardness Tests 62. Perform Impact Tests 63. Perform Mechanical Testing on Universal Testing Machine 64. Perform Torsion Test and Fatigue test

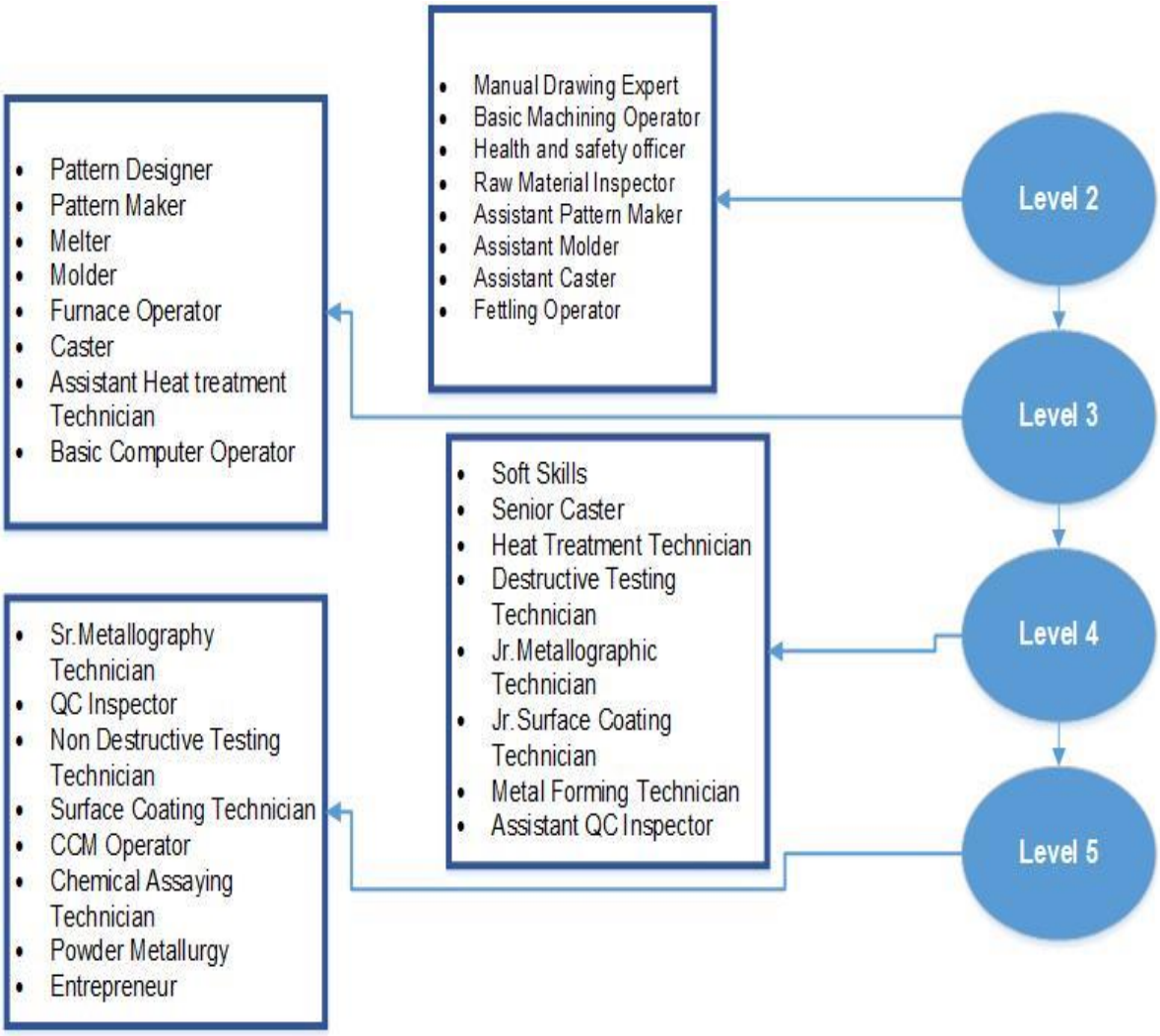
21	**Jr.Metallographic technician**	65. Perform Sectioning, Cutting and Rough Grinding 66. Perform Mounting Operation 67. Perform Fine Grinding Operation 68. Perform Fine Polishing Operation
22	**Jr.Surface coating technician**	69. Perform Galvanizing Coating 70. Perform Conversion Coating (Anodizing) 71. Perform Electrochemical Coating (Electroplating) 72. Perform Electrochemical Coating (Electrolesis Electroplating)
23	**Metal forming technician**	73. Perform forging process 74. Perform extrusion process 75. Perform wire drawing and deep drawing process 76. Perform rolling process
24	**Assistant QC Inspector**	77. Perform inspection 78. Select and control inspection process and procedures 79. Ensure calibration
Level 5 Associate Engineer in metallurgy and metal casting		
25	**Sr.Metallography Technician**	80. Perform Etching Operation 81. Perform Microscopic Examination Operation
26	**QC Inspector**	82. Conduct process and product capability analysis 83. Perform advanced statistical quality control
27	**Non Destructive Testing Technician**	84. Visual 85. LPT MPT 86. UT Rt Eddy current
28	**Service Coating Technician**	87. Perform Vapor Deposition Coatings (PVD) 88. Perform Vapor Deposition Coatings (CVD) 89. Perform Thermal Spray Coatings (Plasma) 90. Perform Thermal Spray Coatings (Electric Arc Value) 91. Perform Thermal Spray Coatings (LVOF)
29	**CCM operator**	92.
30		93.
31	**Powder Metallurgy**	94. Handle Powder for required process 95. Perform Consolidation Operation 96. Perform Sintering Operation 97. Perform Finishing Operations

32	**Entrepreneur**	98. Develop project proposal 99. Apply management and communication techniques 100. Create human resource management plan 101. Develop project management plan 102. Develop sales plan 103. Conduct research for customer needs and satisfaction 104. Manage finances 105. Identify and resolve problems 106. Create Manage profile on Non-Traditional Freelancing platform 107. Create Manage profile on Traditional Freelancing platform 108. Write professional proposal for projects 109. Develop communications skills

12. Mapping of the Qualification



13. Mapping of Occupations



14. Detail of Qualification and its Competency Standards

LEVEL 3

1. Pattern Designer

CS 1 Manage graphic user interface

Overview: This competency standard covers the skills and knowledge required to install software, create new file, and create basic drawing.

Competency Units	Performance Criteria
CU1. Install software and Create New File	**P1.** Install latest software version **P2.** Create New Template **P3.** Save the File **P4.** Create Drawing **P5.** Select units as per requirements **P6.** Select drawing Limits
CU2. Create Basic Drawings	**P1.** Select Coordinate System as per requirements **P2.** Draw a rectangle using line command **P3.** Draw an ARC **P4.** Draw a circle with given requirements **P5.** Draw a circle with 3-P touching outer corner of Equilateral Triangle **P6.** Use the Erase Command

Knowledge & Understanding: This competency standard will provide knowledge related to

K1. Basic Drawing Settings
K2. Unit setting
K3. Limits setting
K4. User coordinate system Workspace setting
K5. Object Snap Settings
K6. Basic Commands and Concepts Angles and lines
K7. Differentiate between absolute, relative and polar system
K8. DIMSTYLE and MTEXT commands
K9. HATCHING concepts in AutoCAD
K10. Differentiate between CHAMFER and FILLET command
K11. Types of Array
K12. OFFSET, CIRCLE and ROTATE short commands
K13. Zooming options
K14. Tools palettes window
K15. Design centre
K16. Scale and paper sizes
K17. Modify dimension style and text size according to paper size
K18. Backup file

Tool & Equipment

- Computer with all accessories
- AutoCAD software disk
- Models

CS 2 Develop 2D drawings

Overview: This competency standard covers the skills and knowledge required to Develop and prepare 2D objects

Competency Units	Performance Criteria
CU1. Develop 2D Objects	**P1.** Setup drawing interface for required specifications **P2.** Setup user interface settings for required specifications **P3.** Save AutoCAD drawing files in different file formats (DWG, PDF, and JPG). **P4.** Create 2D Objects with given measurements **P5.** Edit 2D Objects to meet set standards
CU2. Prepare Final Set of 2D Drawings	**P1.** Use appropriate command and tools to develop 2D Drawing **P2.** Develop 2D Drawing with given project specifications and measurements **P3.** Create title block layout as required **P4.** Plot drawing on scale according to required size and orientation

Knowledge & Understanding

K1. Basic Drawing Settings
K2. Unit setting
K3. Limits setting
K4. User coordinate system Workspace setting
K5. Object Snap Settings
K6. Basic Commands and Concepts Angles and lines in AutoCAD.
K7. Differentiate between absolute, relative and polar system
K8. DIMSTYLE and MTEXT commands
K9. HATCHING concepts in AutoCAD
K10. Differentiate between CHAMFER and FILLET command
K11. Types of Array
K12. OFFSET, CIRCLE and ROTATE short commands
K13. Zooming options
K14. Tools palettes window
K15. Design center
K16. Scale and paper sizes

K17. Modify dimension style and text size according to paper size
K18. Backup file

Tool and Equipment

- Computer with all accessories
- AutoCAD software disk
- Models

CS 3 Develop 3D pattern design

Overview: This competency standard covers the skills and knowledge required to develop 3D objects, manipulate and Edit 3D objects and render 3D objects.

Competency Units	Performance Criteria
C1. Develop 3D Objects	**P1.** Setup & save 3D drawing interface for required specifications. **P2.** Setup 3D user interface settings for required specifications. **P3.** Create 3D objects with given measurements.
C2. Manipulate 3D objects using 3D Editing Tools	**P1.** Modify 3D objects in line with the requirements. **P2.** Make customized 3D models according to the requirement of given job. **P3.** Convert 3D Face objects into a single mesh objects.
C3. Render 3D Model	**P1.** Apply material to required 3D Model as per given specification **P2.** Apply lights to get the requisite scene of required 3D model **P3.** Assign cameras to execute different views of required 3D Model. **P4.** Render and print the 3D model according to required size & orientation. **P5.** Apply texture to 3D model as per given specification.

Knowledge & Understanding

K1. 3D modelling in AutoCAD

- 3D solids,
- surfaces,
- meshes, and
- Wireframe objects.
- Differentiate between Surface Modelling and Solid Modelling.

K2. 3D face and Edges

- Boolean operation concepts
- Subtraction
- Intersection
- Union

K3. 3D Navigate control

- Functions of different camera settings.

- Importance of scene creation
- Pre-set views such as isometric, top, bottom, front, left, etc.
- Perspective projection and parallel projection
- Walk
- Constrained Orbit

K4. Material and light control

K5. Planner mapping

K6. Texture map

K7. Opacity control

K8. Render context

K9. Render sampling

Tool and Equipment

- Computer with all accessories
- AutoCAD software disk
- Models

2. Pattern Maker-II

CS 4 Manufacture match plate gated pattern

Overview: This competency standard covers the skills and knowledge required about pattern and its types, layout of the pattern ,advantages and disadvantages of different type of patterns , allowances used in pattern making, pattern making tools and equipment, and finishing of pattern.

Competency Units	Performance Criteria
CU1. Interpret Drawing of given Pattern	**P1.** interpret the Pattern drawing **P2.** Recognize basics of lines used in pattern drawings **P3.** Identify manufacturing requirements according to drawings
CU2. Prepare layout of pattern	**P1.** Identify wood for pattern layout using full scale **P2.** Add allowances (shrinkage, machining, draft,) as required **P3.** Add core prints, pattern in layout as per requirements **P4.** Mark Top, Bottom, Side, and elevation view on layout **P5.** Use appropriate tool for required job (drilling, cutting tapping, flat, round edges)
CU3. Construct wooden match plate pattern	**P1.** Ensure wooden plate size according to mold box **P2.** Adjust guide pin bush according to mold box **P3.** Mount wooden pattern on wooden plate **P4.** Mount runner and in-gate on wooden plate in alignment with pattern **P5.** Add 5-10 degree draft allowance on in-gate and runner bar as per required **P6.** Create in-gate neck on pattern side **P7.** Assemble pattern parts as per specifications **P8.** Ensure safety practices to avoid any incident

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge

K1. Describe types of pattern

K2. Define allowance and allowances used for pattern making

K3. Types of woods used for pattern making

K4. Advantages and Disadvantage of metallic pattern.

K5. Describe pattern-making machines.

K6. Brief note on woodwork lath.

K7. Describe types of chisels and their uses.

K8. Describe CNC machine operations.

K9. Define pattern drafting.

K10. Describe flat pattern techniques.

K11. Tools required for pattern making.

K12. Importance of pattern making.

K13. Different types of pattern

K14. What are the pattern making techniques?

K15. Process of making pattern

K16. Types of wood work saws

K17. Methods of preserving wooden pattern.

Tools & Equipment

- Vernier caliper
- Deodar wood
- Hacksaw
- Tri square
- Steel tape
- Vernier caliper
- Wood work lath
- Chisels
- Wood work files
- CNC router machine
- Paper
- Varnish
- Wood block
- Abrasive paper.
- Paint
- Wood router machine tool
- Pattern material
- Measuring instruments

- Turning tool
- Hammer
- Spanner
- Plane drill
- Wood saw
- CNC router
- Cutting tools
- Wood work files

CS 5 Manufacture Pattern on CNC Router

Overview: This competency standard covers the skills and knowledge required about pattern and its types, layout of the pattern ,advantages and disadvantages of different type of patterns, allowances used in pattern making, pattern making tools and equipment, and finishing of pattern.

Competency Units	Performance Criteria
CU1. Prepared CAD/CAM Data	**P1.** Prepare the drawing in CAD system **P2.** Add allowance as per requirement **P3.** Send the drawing in CAD/CAM system
CU2. Perform CNC Operation	**P1.** Arrange a wood block as per required size **P2.** Clamped the wooden block on the table of CNC router **P3.** Select the cutting tool as per material and operation. **P4.** Enter the raw material detail **P5.** Check the tool off setting **P6.** See the simulation before starting the work **P7.** Locate the pattern. **P8.** Press the push bottom to start the operation **P9.** Draw out pattern from fixture **P10.** Operate the machine as per SOP **P11.** Practice standard health and safety procedures

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

K1. Describe types of Pattern,
K2. Define allowance and allowances used for pattern making
K3. Types of woods used for pattern making
K4. Advantages and Disadvantage of metallic pattern.
K5. Describe pattern making machines.
K6. Brief note on wood work lath.
K7. Describe types of chisels and their uses.
K8. Describe CNC machine operations.
K9. Define pattern drafting.

K10. Describe flat pattern techniques.

K11. Tools required for pattern making.

K12. Importance of pattern making.

K13. Different types of pattern

K14. What are the pattern making techniques?

K15. Process of making pattern

K16. Types of wood work saws

K17. Methods of preserving wooden pattern.

Tools & Equipment

- Vernier caliper
- Deodar wood
- Hacksaw
- Tri square
- Steel tape
- Vernier caliper
- Wood work lath
- Chisels
- Wood work files
- CNC router machine
- Paper
- Varnish
- Wood block
- Abrasive paper.
- Paint
- Wood router machine tool
- Pattern material
- Measuring instruments
- Turning tool
- Hammer
- Spanner
- Plane drill
- Wood saw
- CNC router

- Cutting tools
- Wood work files

3. Melter

CS 6 Work Safely with Molten Metal

Overview: This competency standard covers the skills and knowledge required to identify the need for personal protective equipment, Adhere to emergency procedures with molten metal, Identify hazardous conditions at Workplace, Observe good OHS practices.

Competency Units	Performance Criteria
CU1. Identify the need for personal protective equipment(PPE	**P1.** Use appropriate personal protective equipment as specified in standard operating procedures (SOP). **P2.** Interpret regulations & guidelines specific to Melting process. **P3.** Interpret common safety rules and tips. **P4.** Identify employer safety rules and policies.
CU2. Adhere to emergency procedures with molten metal	**P5.** Use emergency equipment located in accordance with workplace policies and procedures. **P6.** Response to emergency procedures as demonstrated in approved safety procedures and instructions.
CU3. Identify hazardous conditions at Workplace	**P7.** Identify hazards and report to maintain a healthy and safe work environment. **P8.** Follow workplace procedures and work instructions for controlled risks accurately.
CU4. Observe good OHS practices	**P9.** Identify hazardous areas and materials associated with molten metal and risks associated. **P10.** Identify safety signs and symbols displayed. **P11.** Use PPE equipment according to the specifications and standard operating procedures. **P12.** Inspect personal protective equipment to maintain in a good order for reuse. **P13.** Identify hazardous items associated with hot material area. **P14.** Perform housekeeping duties according to standard operating procedure to maintain a safe working environment.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- **K1.** Hazardous materials and hazard control measures associated with molten metal
- **K2.** Procedures relevant to raising OH&S issues
- **K3.** Designated personnel responsible for OH&S
- **K4.** Applicable personal protective equipment
- **K5.** Safety signs, symbols and labels
- **K6.** Procedures for correct inspection and service of equipment including PPEs
- **K7.** Routine maintenance procedures for equipment
- **K8.** Workplace procedures for working in hazardous areas
- **K9.** Consequences of not maintaining a clean and safe working environment
- **K10.** Safe manual handling procedures
- **K11.** Location of emergency equipment including first aid facilities

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify material specifications according to manufacturing drawing
- Identify bill of material (BOM) according to manufacturing drawing
- Interpret dimensional tolerances according to manufacturing drawing
- Assemble and tack weld parts according to manufacturing drawing

Tools and Equipment

- Steel-toed footwear
- Hard hat
- Safety gloves
- Appropriate safety glasses
- Site emergency response plan
- Fire extinguishers
- Fire blankets
- Fire hoses

CS 7 Melt Ferrous Material (Cast Steel) in Induction Furnace

Overview: This competency standard covers the skills and knowledge required to Read and Understand to Identify required specifications for melting, Select materials, Verify metal charges to melting, Charge furnace, Monitor furnace operation, Take sample of molten metal, Perform refractory repair to crucible, Monitor tapping of molten metal, Tap the furnace, Control hazards.

Competency Units	Performance Criteria
CU1. Identify required specifications for melting	**P1.** Identify mould requirements **P2.** Identify any special melting requirements for the job **P3.** Identify safety procedures for the required melting operation **P4.** Follow regulations relevant to foundry and individual melting
CU2. Select materials	**P5.** Raise requisition as required according to standard operating procedures. **P6.** Take charge analysis in accordance with standard operating procedures. **P7.** Convert charge analysis to furnace charge weight using standard operating procedures. **P8.** Weigh the charge according to standard operating procedures.
CU3. Verify metal charges to melting	**P9.** Select required components to give the required metal specification **P10.** Calculate required charge of each component **P11.** Recommend changes/additions to the charge **P12.** Monitor the preparation of the charge including checking for contaminants
CU4. Charge furnace	**P13.** Follow emergency/safety procedures as necessary. **P14.** Pre-Heat materials if required according to standard operating procedures. **P15.** Charge materials into furnace using standard operating procedures. **P16.** Identify suitable areas for emergency unloading of molten metal and kept available.

CU5. Monitor melting process	**P17.** Check furnace is in operational condition **P18.** Maintain furnace at optimum operating condition to standard operating procedures. **P19.** Identify metal/alloy specification for required melting **P20.** Charge batches of scrap periodically to attain required melt quantity **P21.** Monitor melt to ensure the product meets specification
CU6. Take sample of molten metal	**P22.** Take sample for chemical analysis **P23.** Apply remedial action as required to standard operating procedures. **P24.** Hold furnace temperature to standard operating procedures. **P25.** Add alloying elements if required **P26.** Achieve final melt charge as per requirement **P27.** Check temperature of metal and adjustment if necessary.
CU7. Perform refractory repair to crucible	**P28.** Identify specific areas of the refractory if repair is required **P29.** Select appropriate refractory materials to meet specifications. **P30.** Install refractory using appropriate techniques and tools to meet the job specification.
CU8. Monitor tapping of molten metal	**P31.** Check pouring area is secure and that all non-essential personnel are excluded **P32.** Check all members of pouring crew are wearing appropriate and in good condition personal protective equipment **P33.** Ensure escape routes are known in advance by all members of the pouring crew **P34.** Check pouring is undertaken at correct temperature and in efficient order **P35.** Ensure moulds are ready to receive liquid metal **P36.** Ensure proper placing of ladle **P37.** Attach purging pipe to the ladle
CU9. Tap the furnace	**P38.** Identify quantity of the required metal **P39.** Carry out tap rate to standard operating procedures.

	P40. Tap heat safely according to standard operating procedures. **P41.** Perform purging operation **P42.** Remove purging pipe attached to ladle
CU10. Control hazards	**P43.** Identify hazards in the metal melting/pouring process **P44.** Assess the risks arising from those hazards **P45.** Implement procedures to control those hazards in line with procedures and duty of care

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- **K1.** types of alloy additions and their effects on casting behavior and finished product
- **K2.** induction furnace melting and refractories suitable for steelmaking
- **K3.** Influence of carbon and silicon contents
- **K4.** the grades of steel and their applications including carbon steel and alloy steels
- **K5.** methods of controlling physical properties
- **K6.** advantages/disadvantages of density of each type of ferrous metal
- **K7.** the influence of melting points on production processes
- **K8.** the shrinkage percentage of the types of ferrous metals
- **K9.** how to control metal fluidity
- **K10.** casting temperature
- **K11.** make a selection of ferrous metal based on required properties
- **K12.** conduct metal analysis on ferrous metal
- **K13.** types and pouring characteristics of metals
- **K14.** types and characteristics of ladles
- **K15.** procedures for maintaining condition and integrity of ladle
- **K16.** procedures for safe handling and transference of molten metal
- **K17.** metal treatments, applications and procedures for making additions to melt
- **K18.** slag and dross removing procedures
- **K19.** techniques for sampling and testing molten metal
- **K20.** metal identification and tagging procedures
- **K21.** use and application of personal protective equipment
- **K22.** hazards and control measures associated with pouring molten metal

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify welding requirements according to welding symbols given in the manufacturing drawings
- Identify material specifications according to manufacturing drawing
- Identify bill of material (BOM) according to manufacturing drawing
- Interpret dimensional tolerances according to manufacturing drawing
- Assemble and tack weld parts according to manufacturing drawing

Tools and Equipment

- Induction melting Furnace
- Immersion type Thermo-couple (1300 C° min.)
- Transfer ladle
- Iron rods
- Weighing scale (10, 50, 100, 500, 1000 Kgs capacity)
- Charging hoist (1 ton capacity)
- Charging box (200Kgs capacity)
- Optical Pyro-meter (for ferrous metals)
- Coating for metal
- handling tools
- PPE kit

CS 8 Melt Ferrous Material (Cast Iron) in Cupola Furnace

Overview: This competency standard covers the skills and knowledge required to Read and Understand to Identify casting requirement, Select melting, Melt base iron materials, Perform duplexing with control activities, Perform inoculation procedure, Conduct gray iron casting inspection

Competency Units	Performance Criteria
CU1. Identify casting Requirement	**P1.** Select base metal as per ASTM specifications **P2.** Identify type of cast iron as per requirement **P3.** Determine chemical and physical properties of cast iron from instruction sheet
CU2. Select melting Materials	**P4.** Select high-grade raw material consistent with quality **P5.** Undertake charge analysis and convert to appropriate furnace charge. **P6.** Complete requisitions as required according to standard operating procedures. **P7.** Weigh furnace charge according to standard operating procedures.
CU3. Melt base iron	**P8.** Prepare cupola furnace as per standard operating procedures. **P9.** Charge cupola furnace as per standard operating procedures. **P10.** Monitor cupola melt temperature **P11.** Test chemical composition of melt as per standard operating procedures. **P12.** Adapt corrective measures to attain required chemical composition. **P13.** Conduct wedge chill testing as per standards **P14.** Undertake rectification measures to attain desired results. **P15.** Transfer molten metal to cupola fore-hearth as per standard operating procedures.
CU4. Perform duplexing with control activities	**P16.** Desulfurized metal (0.02% max) if making nodular (Ductile) cast iron **P17.** Transfer molten metal to an induction furnace/duplexing furnace in accordance with standard operating procedures

	P18. Add required alloying elements to the melt as per standard operating procedures. **P19.** Undertake chemical composition analysis **P20.** Adjust composition of melt if required as per standard operating procedures. **P21.** Raise metal temperature to tapping value **P22.** Take wedge chill test as per standard operating procedures. **P23.** Transfer molten metal to pouring ladle for inoculation **P24.** Pour melt as per standard operating procedures.
CU5. Perform inoculation procedure	**P25.** Select appropriate inoculants compatible with casting **P26.** Perform inoculation to improve metal properties in accordance with recommended inoculation procedures **P27.** Take wedge chill value after inoculation as per standard operating procedures. **P28.** Control dead melt time as per standard operating procedures. **P29.** Control pouring time as per standard operating procedures. **P30.** Transport ladle to pouring station to pour metal into molds.
CU6. Conduct gray iron casting inspection	**P31.** Conduct visual inspection using color check **P32.** Perform file test to determine chills on casting edges. **P33.** Lead scrap diagnosis in coordination with process engineering personnel.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

K1. Foundry melting production process (from material selection to fettling and trimming).
K2. Procedure of quality assurance and control system including inspection and testing.
K3. Crucible conditions, faults and repair limits.
K4. Metallic charge materials, ferro-alloys, additives, ladle additions.
K5. Weighing procedure and scale types.
K6. Thermocouple condition monitoring and adjustment mechanism.
K7. Interpretation of carbon equivalent (thermal analysis) and wedge chill test result.
K8. Coagulant agents, application and removal procedures.
K9. Applicable industry standard, JIS, ASTM, SAE, DIN, BS, AS etc.
K10. Metallic charge materials and its characteristics.

K11. Metal composition and its effects on the mechanical physical properties of the metal.
K12. Pouring temperature and its effect on the casting integrity.
K13. Proper pouring techniques.
K14. Effect of charge material on the mechanical / physical properties of the metal.
K15. Effect of inoculation, ductile treatment, fade time or molten metal.
K16. Use and application of personal protective equipments.
K17. Safe work practice and procedures.

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify welding requirements according to welding symbols given in the manufacturing drawings
- Identify material specifications according to manufacturing drawing
- Identify bill of material (BOM) according to manufacturing drawing
- Interpret dimensional tolerances according to manufacturing drawing
- Assemble and tack weld parts according to manufacturing drawing

Tools and Equipment

- Cupola melting Furnace
- Immersion type Thermo-couple (1300 C° min.)
- Transfer ladle
- Chill mold (wedge)
- Weighing scale (10, 50, 100, 500, 1000 Kgs capacity)
- Charging hoist (1 ton capacity)
- Charging box (200Kgs capacity)
- Degasser
- Modifier
- Grain refiner
- Inoculant (stabilizer)
- Inoculant (graphitizer)
- Optical Pyro-meter (for ferrous metals)
- Coating for metal
- handling tools
- Slag coagulants
- PPE kit

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CS 9 Melt Non-Ferrous Material in Pit Furnace

Overview: This competency standard covers the skills and knowledge required to Read and Understand to Identify job requirement, Perform melting of metal, Perform metal treatment process, Identify casting quality requirement, Identify defects cause by unsound melting, Recycle scraps / turnings.

Competency Units	Performance Criteria
CU1. Identify job requirement	**P1.** Identify alloy melting requirements as per manufacturers/ suppliers instruction sheets. **P2.** Cross check required specifications with corresponding international specification **P3.** Determine casting method with available mold **P4.** Determine metal treatment based on available product bulletin. **P5.** Coat all tools which comes into contact with the melt to avoid melt contamination **P6.** Select appropriate melting furnace as per required metal treatment and type of crucible (stationary/dip-out or tilting).
CU2. Perform melting of metal	**P7.** Feed Metal charges as per standard operating procedures. **P8.** Perform fluxing technique based on composition of metal charges (virgin ingot and recycled scrap). **P9.** Start furnace as per standard operating procedures. **P10.** Weigh specified amounts of scrap metal **P11.** Charge metal into furnace by hand or by directing crane operator **P12.** Regulate the injection of fuel and air into furnace **P13.** Apply appropriate degassing technique as per standard operating procedures. **P14.** Add melt refining agent of the alloy as per standard operating procedures. **P15.** Observe melt temperature with the help of thermocouple **P16.** Take test sample of molten metal from crucible using hand ladle **P17.** Record data from each melt on form

CU3. Perform metal treatment process	**P18.** Apply structured modification of the alloy as per standard operating procedures. **P19.** Monitor speed of melting to avoid oxidation. **P20.** Control pouring temperature corresponding to the alloy **P21.** Apply filtration method and location corresponding to the alloy **P22.** Tap metal from crucible with minimum turbulence to avoid oxide formations. **P23.** Accompany pouring in accordance with OH & S requirements
CU4. Identify casting quality requirement	**P24.** Identify content of contaminants, which will affect integrity of the casting in accordance with procedures. **P25.** Apply structural modification in accordance with procedures **P26.** Carry out chemical analysis results in process control **P27.** Follow written procedures during casting as per quality standards
CU5. Identify defects caused by unsound melting	**P28.** Identify remedial actions in accordance with standard operating procedures. **P29.** Show up defective castings with the respective sections in accordance with company procedures **P30.** Re-orient the correct melting and treatment of given alloy.
CU6. Recycle scraps / turnings	**P31.** Accomplish re-melting in accordance with company standard operating procedures **P32.** Remove dross completely from the melt before pouring into molds. **P33.** Ensure label ingot type as per standard operating procedures **P34.** Enter production reports in performa with recommendation for future production reference.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

K1. Effects of chemical composition on integrity of the casting
K2. (strengths, ductility, surface finish)
K3. Charging sequence of metallic charges and melt treatment
K4. Pouring temperature range limits.
K5. Countermeasures to eliminate / minimize casting defects.
K6. Safety test applied to casting.

K7. Operation of emission spectrometer analyzer
K8. Safe work practice and procedures.
K9. Use and application of personal protective equipments.
K10. advantages/disadvantages of density of each type of non-ferrous metal
K11. methods of controlling tensile strength of non-ferrous metals
K12. methods of controlling the hardness of non-ferrous metals
K13. influence of melting points on production processes
K14. shrinkage percentage of the types of non-ferrous metals
K15. how to control metal fluidity
K16. be able to make a refractory selection for non-ferrous alloys
K17. the use of degassing to control gas defects
K18. be able to take action to control grain size
K19. the grades of brass and their applications
K20. the grades of bronze and their applications
K21. the grades of gunmetal and their applications
K22. the grades of other copper based alloys and their applications
K23. the grades of aluminium based alloys and their applications
K24. the grades of lead based alloys and their applications
K25. the grades of zinc based alloys and their applications
K26. the grades of magnesium based alloys and their applications

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify welding requirements according to welding symbols given in the manufacturing drawings
- Identify material specifications according to manufacturing drawing
- Identify bill of material (BOM) according to manufacturing drawing
- Interpret dimensional tolerances according to manufacturing drawing
- Assemble and tack weld parts according to manufacturing drawing

Tools and Equipment

- Pit Furnace
- Burners
- Iron rods
- Molds/dies
- Immersion type Thermo-couple
- Transfer ladle

- Weighing scale Charging hoist (1 ton capacity)
- Charging box (200Kgs capacity)
- Optical Pyro-meter (for ferrous metals)
- Coating for metal
- handling tools
- repair tool kit
- Slag coagulants
- PPEs kit

4. Molder-II

CS 10 Operate molding machine

Overview: This competency standard covers the skills and knowledge required to Basic moulding /moulding machine with two piece pattern in sand molding for metal casting process

Competency Units	Performance Criteria
• **CU1. Operate Muller mixture machine**	**P1.** Add sand in Muller mixture machine as required **P2.** Add water in Muller mixture machine as required **P3.** Add additives (binders) as required **P4.** Operate the machine as per SOP **P5.** Practice standard health and safety procedures **P6.** Unload the materials from machine
• **CU2. Operate Jolt machine**	**P1.** Place the mold box on the surface of machine table **P2.** Place the pattern in mold box on the surface of machine table **P3.** Fill sand in the mold box on the surface of machine table **P4.** Perform jolting operation **P5.** Remove the mold from the machine **P6.** Operate the machine as per SOP **P7.** Practice standard health and safety procedures
• **CU3. Operate squeeze machine**	**P1.** Place the mold box on the surface of machine table **P2.** Place the pattern in mold box on the surface of machine table **P3.** Fill sand in the mold box on the surface of machine table **P4.** Align the plate/rubber frame diaphragm with mold upper surface

	P5. Apply pneumatic pressure on the surface of the loose sand in mold **P6.** Remove the mold from the machine **P7.** Operate the machine as per SOP **P8.** Practice standard health and safety procedures
• **CU4. Operate Jolt Squeeze Machine**	**P1.** Assemble the match plate pattern **P2.** Place the assembled pattern on machine surface **P3.** Place the drag upside **P4.** Fill the drag with sand **P5.** Perform machine as per SOP **P6.** Rollover the assembled mold using hand **P7.** Fill the cope with the sand **P8.** Perform machine as per SOP **P9.** Perform the vibrating operation **P10.** Remove the mold from the machine **P11.** Practice standard health and safety procedures

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

K1. Basic Molding
K2. Molding and its types.
K3. Properties of green sand
K4. Molding accessories.
K5. Repairing mound and its precautions.
K6. Cleaning process
K7. Molding machines
K8. Molding techniques
K9. Gating system

Tools & Equipment

- Shovel
- Riddle
- Lifter
- Trovel
- Gate cutter
- Molding box
- Sprue pin
- Runner
- Sprue pin
- Vent wire
- rammer
- Shovel
- Riddle
- Lifter
- Trovel
- Gate cutter
- Molding box
- Sprue pin
- rammer
- Sodium silicate
- CO2 cylinder
- Silica sand
- Molding tools
- Three piece pattern

CS 11 Operate core making machines

Overview: This competency standard covers the skills and knowledge required to Basic core making / core making machines machine in sand molding for metal casting process

Competency Units	Performance Criteria
• **CU1. Prepare Core sand**	**P1.** Prepare sand for core making **P2.** Add additives (water, Binders) as required **P3.** Mix sand using hand tools/machine
• **CU2. Operate Core Shooter Machine**	**P1.** Fill core pattern with core sand **P2.** Place sand filled core pattern in core shooter machine **P3.** Operate the machine as per SOP **P4.** Apply pressurized air to the core box **P5.** Remove the core box from machine **P6.** Extract core from the box **P7.** Practice standard health and safety procedures
• **CU3. Operate Core Baking Oven**	**P1.** Energize electric/gas fired baking oven **P2.** Place cores batch inside oven **P3.** Operate oven as per SOP **P4.** Remove batch of baked core from oven **P5.** Practice standard health and safety procedures

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

K1. Core
K2. Types of core
K3. Properties of molasses sand
K4. Types of core venting
K5. Steps for core making
K6. Methods of supporting core
K7. Core making accessories
K8. Core baking machine/oven

Tools & Equipment

- Molding tools
- Split box
- core sand
- Molding tools
- Split box
- Left and right hand core box.

5. Furnace Operator

CS 12 Operate Non-Electric Melting Furnace

Overview: This competency standard covers the skills and knowledge required to operate Pit furnace for melting of suitable metallic material and operate the Cupola furnace for the melting of suitable metallic material

Competency Units	Performance Criteria
CU1. Operate Pit furnace for melting of suitable metallic material	**P1.** Inspect the lining of pit. **P2.** Repair the lining of pit, with suitable refractory material, if required. **P3.** Inspect the crucible. **P4.** Replace the crucible, if required. **P5.** Inspect the accessories (valves, flow meter gauges and pipes) of gas supply system. **P6.** Inspect the blower accessories (power supply,RPM and valves) **P7.** Place the empty crucible in the pit furnace on specific position for preheating. **P8.** Open gas valve and ignite gas in the pit furnace. **P9.** Switch off furnace after suitable preheating time. **P10.** Receive the metallic charge and put incrucible. **P11.** Open the gas valve again and ignite gas in the furnace for melting. **P12.** Place the cover on the pit. **P13.** Switch ON the blower to increase the intensity of fire. **P14.** Check the temperature of the charge with temperature gun after specific intervals of time during melting. **P15.** Remove the slag with the help of crucible tongs. **P16.** Switch off the furnace, after proper melting and heating of charge. **P17.** Remove cover for picking out the crucible. **P18.** Transfer molten metal to relevant person for mold filling.

	P19. Repeat the necessary steps for the next heat.
CU2. Operate cupola furnace for the melting of suitable metallic material	**P1.** Inspect the interior lining of the cupola furnace. **P2.** Inspect the condition of slag hole and tap hole. **P3.** Repair damaged areas of furnace with refractory material. **P4.** Close the bottom door of furnace and put prop under it. **P5.** Prepare coke bed on bottom plate of cupola with suitable slope towards tap hole **P6.** Put soft wood pieces on the coke bed. **P7.** Ignite wood pieces with cotton soaked in kerosene oil. **P8.** Toss some coke on burning pieces of wood through charging door. **P9.** Add more coke in cupola when it becomes red hot **P10.** Add metallic charge on the red-hot coke. **P11.** Add coke and metal charge periodically up to charging door. **P12.** Wait for soaking time **P13.** Close tap and slag hole **P14.** Start air blast to increase the melting speed of molten metal. **P15.** Pour out the slag from slag hole and close the slag hole. **P16.** Pour molten metal into the ladle and close tap hole. **P17.** Hand over the molten metal to relevant person for mold filling **P18.** Repeat necessary steps for the next heat.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

K1. Define refractory materials.

K2. Describe different types of refractories.

K3. Enlist different types of fuel used in pit furnace.

K4. Discuss advantages and limitations of different types of fuels.

K5. What is difference between coal and coke?

K6. How coke is produced by coal.

K7. Define slag.

K8. Explain different types of slags produced during melting of non-ferrous metals.

K9. Explain different types of slags produced during melting of cast iron and steel.

K10. Describe different possible deterioration ways of furnace lining.

K11. Explain different parts of pit furnace.

K12. Explain different parts of cupola furnace.

K13. Describe charging and taping of a furnace.

K14. Describe melting points and other properties of some common non-ferrous metals.

K15. Explain safety parameters required to operate pit furnace.

K16. Explain safety parameters required to operate cupola furnace.

Critical Evidence(s) Required

Tools and Equipment

- **Pit Furnace**
- **Crucible**
- **Refractory material for lining**
- **Crucible Tongs**
- **Safety Accessories**

CS 13 Operate Electric Melting Furnace

Overview: This competency standard covers the skills and knowledge required to operate induction furnace for melting of given metallic charge, operate direct arc furnace for melting of given metallic charge and operate indirect arc furnace for melting of given metallic charge.

Competency Units/Task	Performance Criteria/Step
CU1. Operate induction furnace for melting of given metallic charge	**P1.** Inspect the lining of the crucible **P2.** Inspect the condition of induction coils **P3.** Fill the crucible of the induction furnace with raw material **P4.** Maintain the pressure of circulating water for cooling of induction coils. **P5.** Switch on the furnace power supply. **P6.** Inspect the movement of trunnion and tilting bail. **P7.** Adjust the frequency of thyristor according to the requirements. **P8.** Reset control panel to delete the previous settings. **P9.** Increase the amperes of the supply to maintain the required temperature. **P10.** Tilt the furnace to pour out the slag as per requirement. **P11.** Tilt the furnace to pour out the molten metal in ladle **P12.** Hand over the molten metal to relevant person for filling of the molds. **P13.** Repeat the necessary steps for the next heat.
CU2. Operate direct arc furnace for melting of given metallic charge	**P1.** Inspect the lining of electric furnace. **P2.** Inspect the condition of tap hole and slag hole of the furnace **P3.** Inspect the condition of electrodes and their movement **P4.** Inspect the oxygen supply accessories **P5.** Inspect the accessories associated with tilting mechanism of furnace **P6.** Allow to enter the charge to be melted into the electric arc furnace from an overhead crane **P7.** Follow the safety precautions of charging **P8.** Place the lid containing the three electrodes into position. **P9.** Adjust the position of electrodes to adjust proper distance between electrodes and charge.

	P10. Allow the electric current to pass through the electrodes to carry out melting process **P11.** Add alloying additions, during melting, if required. **P12.** Allow the oxygen to enter into the melt at suitable time, to oxidize elements, if required. **P13.** Tilt the furnace to one side to allow the slag to pour out. **P14.** Tilt the furnace to other side to allow the molten metal to pour out **P15.** Handed over the molten metal to relevant person for filling of moulds. **P16.** Repeat the necessary steps for the next heat
CU3. Operate Indirect arc furnace for melting of given metallic charge	**P1.** Inspect the lining of indirect arc furnace. **P2.** Inspect the charging door and lining of the door. **P3.** Inspect the condition of tap hole of the furnace. **P4.** Inspect the condition of electrodes. **P5.** Inspect and set the oxygen supply accessories **P6.** Inspect the gas hole and other related accessories. **P7.** Charge the furnace with material to be melted through charging door. **P8.** Follow the safety precautions of charging. **P9.** Allow the electric current to pass through the electrodes to carry out melting process **P10.** Allow the oxygen to enter into the melt at suitable time **P11.** Remove the slag from the surface of molten metal with safety precautions. **P12.** Open the taping hole to pour out the molten metal. **P13.** Handed over the molten metal to relevant person for filling of moulds. **P14.** Repeat the necessary steps for the next heat

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

K1. Define electric current.

K2. Define electric induction.

K3. Describe types of induction furnaces.

K4. Describe types of refractories used in electric furnaces.

K5. Explain different parts of an induction furnace.

K6. Define electric Arc.

K7. Describe different types of electric arc furnaces.

K8. Explain different components of an electric arc furnace.

K9. Discuss material and dimensions of electrodes of electric arc furnaces.

K10. Describe different safety precaution required to operate induction furnace.

K11. Describe different safety precaution required to operate electric arc furnace.

Critical Evidence(s) Required

Tools and Equipment

- Electric induction furnace
- Electric arc furnace
- Different instruments required to operate electric furnaces
- Safety Accessories

6. Caster-II

CS 14 Operate Pressure Die Casting

Overview: This competency standard covers the skills and knowledge required to conduct pre-operational checks, Operate machine control panel, Monitor melt in furnace, Operate machine to produce castings, perform post casting operation.

Competency Units	Performance Criteria
CU1. Conduct pre-operational checks	**P1.** Start machine according to standard operating procedures. **P2.** Clamp the two halves of the die inside the die casting machine as per SOP **P3.** Inspect the opening and closing function of die as per SOP **P4.** Inspect function of ejector and cooling system of die **P5.** Adjust component gripper if necessary. **P6.** Adjust die spray nozzles as necessary.
CU2. Operate machine control panel	**P1.** Set die opening limit **P2.** Adjust shot size as per requirement **P3.** Make functional check of the picking robot if required **P4.** Adjust operating parameters of machine at given specifications
CU3. Monitor melt in furnace	**P1.** Handle furnace according to standard operating procedures. **P2.** Maintain liquid metal as per die operating condition **P3.** Control furnace temperature at optimum operating condition **P4.** Ensure safe work practices in handling furnace
CU4. Operate machine to produce castings	**P1.** Clean each die half as per requirement **P2.** Lubricate die to facilitate the ejection of part **P3.** Close two halves of the die and clamp mold together **P4.** Apply sufficient force to the die to keep it securely closed **P5.** Transfer molten metal into the chamber as per SOPs **P6.** Inject the molten metal with required pressure into the die/mold **P7.** Fill the entire cavity of die **P8.** Open the die after casting solidification **P9.** Eject the casting out of the die cavity **P10.** Clamp shut the die for the next injection
CU5. Perform Post Casting Operation	**P11.** Trim excess material along with any flash from castings **P12.** Ensure efficient flow of finished product i.e. breaking of runners, stacking baskets, bins, conveyors **P13.** Inspect castings visually for porosity, cracks, tears, splits, sinks, cold shuts, tinning and die surface crazing

	P14. Handle castings to minimise risk of damage to the casting and injury to personnel

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

- **K1.** procedures for pre-start checks
- **K2.** procedures for starting up the die casting machine
- **K3.** adjustments that can be made to ensure correct operation of the machine
- **K4.** procedures for adjusting the shot size
- **K5.** the effects of incorrect shot size on the quality of the die casting
- **K6.** the function of nitrogen and vacuum systems in the die casting process
- **K7.** the procedures for checking/ adjusting nitrogen and/or vacuum systems
- **K8.** the function of a picking robot and the component gripper
- **K9.** procedures for adjusting the picking robot
- **K10.** the effects of adjustments on robot performance
- **K11.** the reasons for spraying the die
- **K12.** procedures for adjusting the die spray nozzles
- **K13.** operations to be performed subsequent to the die casting of the product
- **K14.** methods of transporting/conveying the die cast product
- **K15.** the effect of adjusting each machine control on the quality of the die casting produced
- **K16.** procedures to adjust the operation of the die casting machine
- **K17.** procedures to remove runners from the die casting
- **K18.** procedures to inspect die castings
- **K19.** common faults in die castings and probable causes
- **K20.** damage that can be caused to castings through inappropriate handling and storage
- **K21.** procedures for checking first-off castings for conformance to specification
- **K22.** specifications of the die cast product
- **K23.** safe work practices and procedures
- **K24.** use and application of personal protective equipment

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify welding requirements according to welding symbols given in the manufacturing drawings
- Identify material specifications according to manufacturing drawing
- Identify bill of material (BOM) according to manufacturing drawing

- Interpret dimensional tolerances according to manufacturing drawing
- Assemble and tack weld parts according to manufacturing drawing

Tools and Equipment

- Clamping unit
- Die assembly unit
- Injection unit
- Transfer Ladles
- Tongs
- crucible
- Dies
- Molds
- Die coats
- Pump
- Metal holding pot
- Furnace
- Shot chamber
- Hydraulic plunger
- Flasks

CS 15 Perform Centrifugal Casting Process

Overview: This competency standard covers the skills and knowledge required to Read and Understand to Prepare mold for casting, Cast the molten metal, carry out cooling process, Remove the castings from mold, Clean the cast metal, Undertake preventive maintenance.

Competency Units	Performance Criteria
CU1. Prepare mold for casting	**P1.** Apply refractory ceramic coating to cylindrical mold walls **P2.** Perform rotation of mold to spread coating properly **P3.** Perform drying of ceramic coat as per standard operating procedures **P4.** Rotate mold about its axis at high speeds typically at 1000 RPM on casting machine rollers
CU2. Cast the molten metal	**P5.** Pour molten metal into the pouring tub with transfer ladle **P6.** Transfer molten metal into the rotating mold at required temperature **P7.** Avoid spillage of molten metal while pouring
CU3. Carry out cooling process	**P1.** Perform continuous rotation of mold with the molten metal **P2.** Allow melt to spread inside mold walls to let it cool **P3.** Stop the mold rotation after the casting has cooled
CU4. Remove the Castings from mold	**P1.** Perform solidification of melt to room temperature **P2.** Shake out the solidified casting from mold as per SOPs
CU5. Clean the cast metal	**P1.** Remove less dense impurities at the inner surface of the casting as per SOP **P2.** Remove dross by machining/grinding operation **P3.** Perform shot blasting to smooth the inner diameter of the part.
CU6. Undertake preventive maintenance	**P1.** Ensure general maintenance of the machine **P2.** Ensure no shut down of machines due to improper maintenance **P3.** Perform regular cleaning process as prescribed by manufacturer

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

K1. Understand centrifugal casting process
K2. types of centrifugal casting process
K3. Identify various centrifugal casting process
K4. Knowledge of true centrifugal casting
K5. Knowledge of semi centrifugal casting
K6. Knowledge of centrifuge centrifugal casting

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify welding requirements according to welding symbols given in the manufacturing drawings
- Identify material specifications according to manufacturing drawing
- Identify bill of material (BOM) according to manufacturing drawing
- Interpret dimensional tolerances according to manufacturing drawing
- Assemble and tack weld parts according to manufacturing drawing

Tools and Equipment

- Die assembly unit
- Pouring basin
- Transfer Ladles
- Top rollers
- Guide rollers
- Pouring basin
- fastners
- Tongs
- Thermal insulation
- crucible
- Dies
- Molds
- Die coats
- Pump
- Metal holding pot
- Furnace
- PPEs

7. Heat Treatment-I

CS 16 Perform quenching, annealing and normalizing process

Overview: This competency standard covers the skills and knowledge required to perform Quenching, Annealing and Normalizing treatment.

Competency Units	Performance Criteria
CU1. Perform quenching process	Handle the job as per SOP Place the job in the heating furnace **Control** the temperature of the furnace as per given job Set standard soaking time of the heat treatment cycle as per given job **T**urn off the furnace, once the required temperature and soaking time is achieved. Remove the job from the furnace and quench into the quenching media. Clean the job and refer it to the next section.
CU2. Perform annealing treatment on steel	Handle the job as per SOP Place the job in the heating furnace **Control** the temperature of the furnace as per given job Set standard soaking time of the heat treatment cycle as per given job **T**urn off the furnace, once the required temperature and soaking time is achieved. **P5**. Let the workpiece to cool in the furnace. **P6**. Remove the workpiece from the furnace, once the temperature drops to room temperature. **P7**. Clean the workpiece and prepare observation data sheet
CU3. Perform normalizing process	**P1**. Handle the job as per SOP **P2**. Place the job in the furnace **Control** the temperature of the furnace as per given job Set standard soaking time of the heat treatment cycle as per given job **T**urn off the furnace, once the required temperature and soaking time is achieved.

	P5. Remove the job from furnace and let it cool in the air. **P6**. Clean the job and prepare observation data sheet.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

Knowledge & Understanding

K1. Types of carbon steel.

K2. Explain the effect of carbon on hardness.

K3. Explain Iron-Carbon diagram

K4. Explain the effect of heat treatment on the formation of different phases.

Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify the required temperature w.r.t desired treatment.
- Identify the soaking time w.r.t the size of workpiece.
- Identify the cooling medium w.r.t the desired treatment

Tools & Equipment

- ❖ Heating Furnaces
- ❖ Long tong
- ❖ Quenching bath

CS 17 Perform Heat Treatment of Non-Ferrous Materials

Overview: This competency standard covers the skills and knowledge required to Perform Solution Treatment and Aging of Non-Ferrous materials.

Competency Units	Performance Criteria
CU1. Perform Solution Treatment	**P1**. Handle the workpiece with appropriate care **P2**. Place the workpiece in the furnace **P3**. Adjust the temperature and soaking time of the furnace according to the material type and size. **P4**. Turn of the furnace once the required temperature and soaking time is achieved. **P6**. Remove the workpiece from the furnace and quench into the quenching media. **P7**. Clean the workpiece and referred it to the next section.
CU2. Perform Aging	**P1**. Handle the workpiece with appropriate care **P2**. Place the workpiece in the furnace **P3**. Adjust the temperature and soaking time of the furnace according to the type and size of the material. **P4**. Turn of the furnace once the required temperature and soaking time is achieved. **P5**. Let the workpiece to cool in the furnace. **P6**. Remove the workpiece from the furnace, once the temperature drops to room temperature. **P7**. Clean the workpiece and referred it to the next section.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes the knowledge of:

K1. Differentiate between ferrous and non-ferrous materials

K2. Properties of Aluminum metal and its alloys

K3. Properties of Copper metal and its alloys

K4. Describe Soaking time

K5. Purposes of heat treatment of non-ferrous alloys

K6. Describe heat treatment furnace

K7. Describe quenching media used for non-ferrous materials

K8. Describe Aging.

8. Basic Computer Operator

CS 18 Install/Use system software

Overview: After this competency standard candidate will be able to install and configure system software / operating systems (windows/Linux) and resolve installation errors on computers.

Competency Unit	Performance Criteria
CU1. Install system software	**P1.** Prepare drive/partitions before OS installation. **P2.** Format mass storage on a PC/computer **P3.** Ensure that after formatting the mass storage device memory is empty when open. **P4.** Perform Partitioning of hard drive **P5.** Install operating system in the PC/computers by following instructional manual. **P6.** Trouble Shoot installation errors
CU2. Update /upgrade sytem software	**P1.** Schedule operating system update **P2.** Run operating system update using internet **P3.** Download and run windows/application patches
CU3. Perform tasks using operating system	**P1.** Create folders/directories **P2.** Open folders/directories and view files in desired format **P3.** Copy files, folder/ directories to different location (Hard drive, external storage, cloud) **P4.** Move files, folder/ directories to different location (Hard drive, external storage, cloud) **P5.** Rename files and directories/folder **P6.** Search files / folder/directories against various search criterion (File name, date, text etc) **P7.** Explore task Manager to view running process/tasks **P8.** Configure desktop settings

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:

- Define different types of operating system
- Describe the OS Installation process
- Demonstrate how to apply Operating system updates/patches

Tools and Equipment

The tools and equipment required for this competency standard are given below:

S. No.	Items
1.	Computer System
2.	Internet Connection
3.	Web Browser
4.	Search Engines
5.	Internet or Intranet Connectivity
6.	UPS
7.	Operating System (Windows,Linux)

Critical Evidence(s) Required

The candidate needs to produce following **Critical Evidence**(s) in order to be competent in this competency standard:

- Install operating system
- Resolve Installation errors.

CS 19 Install / Use Application Software

Overview: After this competency standard candidate will be able to install, configure and upgrade application software on computers.

Competency Unit	Performance Criteria
CU1. Install application Software	**P1.** Install application software in the PC/computers by following instructional manual. **P2.** Trouble Shoot installation errors
CU2. Update /upgrade application Software	**P1.** Check for the update **P2.** Update/upgrade application software
CU3. Install and upgrade antivirus software	**P1.** Select appropriate antivirus software **P2.** Install antivirus software **P3.** Update antivirus database/repository **P4.** Update/upgrade antivirus software. **P5.** Schedule antivirus software update **P6.** Make sure that antivirus software is up-to-date
CU4. Perform virus scan	**P1.** Perform complete virus scan on any infected system. **P2.** Detect the viruses available on the hard disk. **P3.** Delete / quarantine all the viruses successfully which are detected as a result of scan.
CU5. Un-install application softwares	**P1.** Uninstall the application softwares **P2.** Make sure that the action is done from control panel.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:

- Differentiate between system software and application software.

- Describe Installation process of application software
- Define the benefits of software upgradation

Tools and Equipment

The tools and equipment required for this competency standard are given below:

S. No.	Items
1	Computer System
2	Internet Connection
3	Web Browser
4	Search Engines
5	Professional Office Suite (MS Office)/ Compatible office suite as per Operating System
6	Application Software
7	Antivirus software

Critical Evidence(s) Required

The candidate needs to produce following **Critical Evidence**(s) in order to be competent in this competency standard:

- Install application software
- Install and run antivirus software
- Uninstall application software

CS 20 Draft office documents

Overview: After this competency standard candidate will be able to prepare office documents, take offline and online backups, perform files conversions efficiently.

Competency Unit	Performance Criteria
CU1. Prepare document on word	**P1.** Explore and select appropriate word processing application **P2.** Create new document / open already existing word document **P3.** Set page Layout **P4.** Perform basic Formatting (text, paragraph, page) **P5.** Perform insert operation (picture, shapes, charts, tables, smart art, clip art, hyperlinks, page numbers, header/footers, bullets/numbering, columns) in the word document **P6.** Check the spellings in the word file through available dictionary **P7.** Save document **P8.** Print document
CU2. Prepare spreadsheet	**P1.** Explore and select appropriate spreadsheet application **P2.** Create / open Spread Sheet **P3.** Set page Layout **P4.** Perform basic Formatting **P5.** Perform insert operation (picture, charts, smart art, clip art, hyperlinks, page numbers, header/footers, bullets / numbering) in the spread sheet **P6.** Insert / use arithmetic functions/formulas **P7.** Save Spreadsheet **P8.** Print Spreadsheet
CU3. Prepare presentation	**P1.** Explore and Select appropriate presentation tool. **P2.** Create / open presentation **P3.** Set page Layout **P4.** Perform basic Formatting

	P5. Perform insert operation (slides, picture, shapes, charts, tables, smart art, clip art, hyperlinks, page numbers, bullets/numbering) in the presentation. **P6.** Select various template designs **P7.** Apply animation to slides **P8.** Check the spellings in the presentation through available dictionary **P9.** Run power point presentation **P10.** Save power point presentation **P11.** Print power point presentation
CU4. Prepare in-page files	**P1.** Set Keyboard preferences **P2.** Set page Layout **P3.** Perform basic Formatting in Inpage File **P4.** Toggle between languages **P5.** Perform insert operation (picture etc.) in the Inpage file **P6.** Insert Columns **P7.** Save Inpage File **P8.** Print Inpage File
CU5. Create backup of office record by maintaining integrity of files	**P1.** Manage electronic record's backup **P2.** Create backup on cloud based storage. **P3.** Verify the integrity of backup by restoring backup
CU6. Convert files into different formats	**P1.** Identify file conversion software **P2.** Convert files into different formats **P3.** Use online convertor to give a practical demonstration

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:

- Demonstrate proficiency in creating a Word Document.
- Describe spread sheets, use formulas and apply necessary formats
- Explain qualities of a robust presentation.

- Write a note on Urdu Word Processing.
- Understand types of files and their conversions to various file types

Tools and Equipment

The tools and equipment required for this competency standard are given below:

S. No.	Items
	Computer System
	Internet Connection
	Search Engines
	Internet or LAN Connectivity
	UPS
	DVD or BLU-RAY writer
	Professional Office Suite (MS Office))/ Compatible office suite as per Operating System
	Inpage Software
	Application Softwares

Critical Evidence(s) Required

The candidate needs to produce following **Critical Evidence**(s) in order to be competent in this competency standard:

- Create, open, save and print files
- Perform necessary formatting according to provided document format.
- Designs CVs
- Create result Sheet
- Make presentation
- Convert file to different formats

CS 21 Perform web browsing and manage emails

Overview: After this competency standard candidate will be able perform searching on web using various search engines. The candidate shall be able to manage email accounts efficiently and use cloud services i.e Google drive, one drive, drop box etc.

Competency Unit	Performance Criteria
CU1. Perform browsing using different browsers	**P1.** Perform the components of browsing as per given instructions. **P2.** Surfing through different browsers to search required data.
CU2. Download / upload data from the internet	**P1.** Explore different downloading tools **P2.** Search and download required information. **P3.** Upload required information on cloud.
CU3. Create email account	**P1.** Create email accounts on various platforms. **P2.** Identify and remove Errors while Email configuration **P3.** Configure email account on outlook.
CU4. Sort emails	**P1.** Demonstrate sorting of emails on the PC **P2.** Perform successfully sorting of emails as per instructions
CU5. Manage address book	**P1.** Open address book. **P2.** Demonstrate the method of managing the address book by adding some contacts, removing contacts, importing, exporting, sorting and updating etc
CU6. Archive emails	**P1.** Perform the procedure of Archiving Emails **P2.** Demonstrate practically the procedure of archiving emails, as per requirements
CU7. Send and receive emails	**P1.** Compose emails using attachments **P2.** Demonstrate the procedure to send an email. **P3.** Demonstrate the procedure to receive an Email. **P4.** Print emails.

Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out tasks covered in this competency standard. This includes:

- How to use various browsers
- Describe types of search engines
- Describe management of emails on various platforms.
- How to configure email accounts on outlook Differentiate between downloading and uploading data

Tools and Equipment

The tools and equipment required for this competency standard are given below:

S. No.	Items
1.	Computer System
2.	Internet Connection
3.	Web Browser
4.	Search Engines
5.	Internet or LAN Connectivity
6.	Operating System (Windows, Linux)

Critical Evidence(s) Required

The candidate needs to produce following **Critical Evidence**(s) in order to be competent in this competency standard:

- Use search engines efficiently
- Configure email account on outlook.
- Create and send emails