



*National Competency Standards  
“Metal Forming & Processing Technician” Level 03*



**National Competency Standards for  
“Metal Forming & Processing Technician”  
Level 03**



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



*National Competency Standards  
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## **ACKNOWLEDGEMENTS**

National Vocational and Technical Training Commission (NAVTTTC) 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 Qualification for the trade of **Metal Forming & Processing Level 02 - 05**. This work would not have been possible without the technical support of all the stakeholders.

NAVTTTC 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. NAVTTTC efforts have received full support from the Ministry of Federal Education and Professional Training that highly facilitated the 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, NAVTTTC 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 on-going process and already 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. NAVTTTC will ensure to keep the qualifications abreast with the changing demands of both national and international job markets.

**Engr. Sajid Baloch**  
**Executive Director (NAVTTTC)**



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## 1. Introduction

The Metal Forming & Processing industries are an essential part of our society that processes metals in order to manufacture machine components, machinery, instruments and tools needed by industries as well as by other sectors of the economy.

The products and components created by the different metal shaping techniques are used in creating everything from scaffolding and heavy machinery, to designing and creating microprocessors and artificial intelligence.

When it comes to metal forming, there are several processes to choose from, with each offering its own list of benefits and detriments, each suited to certain applications and for different types of metals.

That includes:

- Knowing the principles of common forming processes and their typical applications
- Identifying the key factors in the product to be made which will guide the forming process selection
- Applying basic metallurgy to the situation so as to make an appropriate recommendation.

Keeping in view of the above, the competency based national vocational qualifications have been developed by NAVTTC to train the unskilled human resource on the technical and entrepreneurial skills.

Being conscious of the emerging trends in the market, National Vocational & Technical Training Commission (NAVTTC) has developed competency standards in consultation with the stakeholders including academia, researchers, industry, chambers and TEVTAs for **Metal Forming & Processing Level 02 - 05** under National Vocational Qualifications Framework (NVQF). The competency standards document has been designed in such a way that helps trainees develop professional skills and facilitates them in targeting job market on national and international level especially middle east.

The National Competency Standards could be used as a referral document for the development of curriculum to be used by training institutions.



## 2. Purpose of the Qualification

The purpose of this qualification is to set the highly professional standards for **Metal Forming & Processing Level 02 - 05** in order to compete local and international job market requirements. The specific objectives of developing these qualifications are as under:

- Empower the youth with locally and globally required employable skills
- Produce competitive **Metal Forming & Processing Skilled Personnel**
- Improve the quality and effectiveness of the training and assessment for **Metal Forming & Processing Industry**

## 3. Date of Validation

The National Competency Standards **Metal Forming & Processing Level 02 - 05** has been validated by the Qualifications Validation Committee (QVC) members on **01 - 05 November 2021 (5 days)** and will remain valid for **ten years**.

## 4. Date of Review

The National Competency Standards for **Metal Forming & Processing Level 02 - 05** has been reviewed by the Qualifications Validation Committee (QVC) members on **01 - 05 November 2021 (5 days)** and will remain valid for **ten years**.

## 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
0715-MF&P-1	2 <sup>nd</sup> Level National Certificate of level-5, in <b>Metal Forming &amp; Processing Assistant/Helper</b>
0715-MF&P-2	3 <sup>rd</sup> Level National Certificate of level-5, in <b>Metal Forming &amp; Processing Technician</b>
0715-MF&P-3	4 <sup>th</sup> Level National Certificate of level-5, in



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	<b>Metal Forming &amp; Processing Senior Technician</b>
<b>0715-MF&amp;P-4</b>	5 <sup>th</sup> Level National Certificate of level-5, in <b>Metal Forming &amp; Processing Supervisor</b>

## 6. Members of Qualification Development Committee

The following members participated in the qualification development process of the **Metal Forming & Processing Level 02 - 05** at PITAC, Lahore.

**Date: 9<sup>th</sup> - 13<sup>th</sup> August 2021**

S#	Name	Designation	Organization
1.	Engr. Salman Khalid Chaudhary	Assistant Director (Technical) Metallurgy	PITAC, Lahore
2.	Engr. Sohail Naseer	Assistant Professor	GSPCT, Gujrat
3.	Engr. Jamal Akbar	Associate Professor	GCT, Peshawar
4.	Engr. Bismillah Kakar	Deputy Director (Technical)	PITAC, Lahore
5.	Muhammad Ismail	Assistant Foreman	PITAC, Lahore
6.	Engr. Amina Irfan	Lecturer	UOL, Lahore
7.	Engr. Ahsan Shahbaz	Manager	PSS, Lahore
8.	Engr. Rashid Bashir	Senior Instructor	Pak Swiss Training Center, Lahore
9.	Dr. Gull Hamid Awan	Chairman Department of Metallurgy	UET, Lahore
10.	Mr. Javed Afzal	Assistant Manager	SMEDA, Lahore
11.	Engr. Tashiq Semab Amin	Deputy Manager	HIT, Taxila
12.	Engr. Muhammad Umar	Project Engineer	PNAC, Islamabad
13.	Engr. Farooq Iftikhar	Senior Engineer	PCSIR, Lahore



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14.	Engr. Fahad Qaiser	Assistant Director (Technical) Mechanical	PITAC, Lahore
15.	Engr. Muhammad Hafeez	Principal (R)	P-TEVTA, Lahore
16.	Engr. Amir Amin	DACUM Facilitator	Malaysian Institute, Lahore
17.	Engr. Muhammad Ishaq	Deputy Director	NAVTTC HQ, Islamabad

### 7. Qualification Validation Committee

The following members participated in the qualification validation process of **Metal Forming & Processing Level 02 - 05** at PITAC, Lahore.

**Date: 01<sup>st</sup> – 05<sup>th</sup> November, 2021**

S#	Name	Status in Committee	Organization
1.	Engr. Salman Khalid Chaudhary	Assistant Director (Technical) Metallurgy	PITAC, Lahore
2.	Engr. Farooq Iftikhar	Senior Engineer	PCSIR, Lahore
3.	Engr. Umer Farooq	Instructor Mechanical	GSPCT, Gujrat
4.	Engr. Saif Ullah Khan	Assistant Director (Technical) Mechanical	PITAC, Lahore
5.	Engr. Rashid Bashir	Senior Instructor	Pak Swiss Training Center, Lahore
6.	Engr. Tehrim Ijaz	Teaching Assistant	Punjab University, Lahore
7.	Mr. Mushtaq Ahmad	Director M&E Representative of P-TEVTA	P-TEVTA
8.	Engr. Jamal Akbar	Associate Professor Representative of KPK-TEVTA	GCT, Peshawar
9.	Engr. Liaqat Jamro	Director Academics, Representative of S- TEVTA	S-TEVTA



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10.	Engr. Muhammad Umar	Project Engineer	PNAC, Islamabad
11.	Ms. Syeda Fatima Iqbal	System Analyst Representative of PBTE	PBTE Lahore
12.	Mr. Shoaib Anwar Sherazi	Principal Representative of B-TEVTA	TTC Quetta
13.	Engr. Abdul Maqsood	DACUM Facilitator	GPI, Mardan
14.	Engr. Muhammad Yasir	Deputy Director, NAVTTC Coordinator	NAVTTC HQ, Islamabad

### 8. Entry Qualification

The entry for National Competency Standards for **Metal Forming & Processing Level 02 - 05** would be Middle Certificate (8th Class).

### 9. Regulation of the qualification and schedule of units

Not Applicable

### 10. Summary of Competencies

Sr No	Occupation	Competency Standards	NVQF Level	Category	Contact Hours			Cr. Hrs.
					Th	Pr	T	
1.	Computer Operator	CS 14 Use system software	3	Generic	3	15	18	1.8
		CS 15 Use Application Software	3	Generic	3	18	21	2.1
		CS 16 Draft office documents	3	Generic	6	21	27	2.7
		CS 17 Perform web browsing and manage emails	3	Generic	6	18	24	2.4
2.	Draughtsman	CS 18 Manage graphic user interface on CAD Software	3	Technical	3	15	18	1.8
		CS 19 Develop 2D drawings on CAD Software	3	Technical	6	27	33	3.3
		CS 20 Develop 3D	3	Technical	6	27	33	3.3



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		drawings on CAD Software						
<b>3.</b>	Machining Technician	CS 21 Perform Drilling Operation	3	Technical	6	24	30	3
		CS 22 Perform Basic Grinding Operations	3	Technical	6	27	33	3.3
		CS 23 Perform Assembly Operations	3	Technical	9	27	36	3.6
<b>4.</b>	Welding Technician	CS 24 Carry out Gas Welding Operations	3	Technical	9	24	33	3.3
		CS 25 Perform Brazing & Soldering Operation	3	Technical	6	24	30	3
<b>5.</b>	Metal Casting Technician	CS 26 Perform Green Sand Mold Casting	3	Technical	6	36	42	4.2
		CS 27 Perform CO2 Sand Mold Casting	3	Technical	6	36	42	4.2
<b>6.</b>	Metal Forming Technician	CS 28 Perform Shearing, Bending and Punching Operations	3	Technical	12	36	48	4.8
		CS 29 Perform Forging Operations	3	Technical	12	36	48	4.8
		CS 30 Perform Extrusion Process	3	Technical	6	36	42	4.2
		CS 31 Perform Deep drawing operations	3	Technical	6	36	42	4.2
<b>Total</b>					<b>117</b>	<b>483</b>	<b>600</b>	<b>60</b>



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### 11. Occupations of Qualification

Level 02	Level 03	Level 04	Level 05
<ul style="list-style-type: none"><li>• Health and Safety Officer</li><li>• Drawing Assistant</li><li>• Machining Assistant</li><li>• Welding Assistant</li><li>• Metal forming Assistant</li><li>• Maintenance Assistant</li></ul>	<ul style="list-style-type: none"><li>• Computer Operator</li><li>• Draughtsman</li><li>• Machining Technician</li><li>• Welding Technician</li><li>• Metal Casting Technician</li><li>• Metal Forming Technician</li></ul>	<ul style="list-style-type: none"><li>• Soft Skills</li><li>• Machining Sr. Technician</li><li>• Welding Sr. Technician</li><li>• Metal Casting Sr. Technician</li><li>• Metal Forming Sr. Technician</li><li>• Heat Treatment Technician</li><li>• Destructive Testing Technician</li></ul>	<ul style="list-style-type: none"><li>• Machining Supervisor</li><li>• Welding Supervisor</li><li>• Metal Processing Supervisor</li><li>• Metal Forming Supervisor</li><li>• Quality Testing Inspector</li><li>• Coating Supervisor</li><li>• Entrepreneurial skills</li></ul>



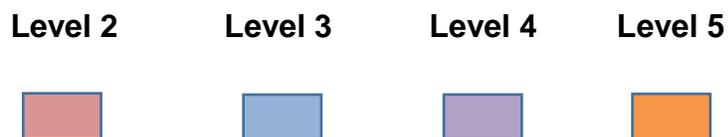
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Sr. No	Occupation	Duties/CS
<b>Level-3 Metal Forming &amp; Processing Technician</b>		
1.	Computer Operator	CS 14 Use system software
		CS 15 Use Application Software
		CS 16 Draft office documents
		CS 17 Perform web browsing and manage emails
2.	Draughtsman	CS 18 Manage graphic user interface on CAD Software
		CS 19 Develop 2D drawings on CAD Software
		CS 20 Develop 3D drawings on CAD Software
3.	Machining Technician	CS 21 Perform Drilling Operation
		CS 22 Perform Basic Grinding Operations
		CS 23 Perform Assembly Operations
4.	Welding Technician	CS 24 Carry out Gas Welding Operations
		CS 25 Perform Brazing & Soldering Operation
5.	Metal Casting Technician	CS 26 Perform Green Sand Mold Casting
		CS 27 Perform CO2 Sand Mold Casting
6.	Metal Forming Technician	CS 28 Perform Shearing, Bending and Punching Operations
		CS 29 Perform Forging Operations
		CS 30 Perform Extrusion Process
		CS 31 Perform Deep drawing operations

## 12. Levelling and Packaging of Qualification

### OCCUPATIONS AND LEVELS DESCRIPTOR



Sr. #	Occupations	No of Modules/CS	Level	Occupation Credit Hours	Training Duration
1.	Metal Forming and Processing Assistant/Helper	13	02	612	6 Months
2.	Metal Forming and	18	03	600	6 Months



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	<b>Processing Technician</b>				
<b>3.</b>	<b>Metal Forming and Processing Senior Technician</b>	<b>24</b>	<b>04</b>	<b>1200</b>	<b>12 Months</b>
<b>4.</b>	<b>Metal Forming and Processing Supervisor</b>	<b>18</b>	<b>05</b>	<b>1206</b>	<b>12 Months</b>

### 13. Generic Modules with respective levels

- Health and Safety

LEVEL 2

- Digital Skills

LEVEL 3

- Soft Skills

LEVEL 4

- Entrepreneurial Skills

LEVEL 5



**14. Level 03 - Metal Forming & Processing Technician**

**1. Computer Operator**

**0715-MF&P 14. Use system software**

**Overview:** This competency standard covers the skills and knowledge required to Install system software, Update /upgrade system software, Perform tasks using operating system

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

**Knowledge & Understanding**

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



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- K1.** Define different types of operating system
- K2.** Describe the OS Installation process
- K3.** Demonstrate how to apply Operating system updates/patches

### **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

### **Tools and Equipments**

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

- Computer System
- Internet Connection
- Web Browser
- Search Engines
- Internet or Intranet Connectivity
- UPS
- Operating System (Windows, Linux)



### 0715-MF&P 15. Use Application Software

**Overview:** This competency standard covers the skills and knowledge required to Install application Software, Update / upgrade application Software, Install and upgrade antivirus software, Perform virus scan, Un-install application software

Competency Unit	Performance Criteria
<b>CU1.</b> Install application Software	<b>P1.</b> Install application software in the PC/computers by following instructional manual. <b>P2.</b> Trouble Shoot installation errors
<b>CU2.</b> Update / upgrade application Software	<b>P1.</b> Check for the update <b>P2.</b> Update/upgrade application software
<b>CU3.</b> Install and upgrade antivirus software	<b>P1.</b> Select appropriate antivirus software <b>P2.</b> Install antivirus software <b>P3.</b> Update/upgrade antivirus software.
<b>CU4.</b> Perform virus scan	<b>P1.</b> Identification of virus <b>P2.</b> Perform scanning of the hard disc to remove the virus <b>P3.</b> Delete / quarantine the viruses
<b>CU5.</b> Un-install application softwares	<b>P1.</b> Uninstall the application software <b>P2.</b> 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:

- K1.** Differentiate between system software and application software.
- K2.** Describe Installation process of application software
- K3.** Define the benefits of software up gradation

### Critical Evidence(s) Required



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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

**Tools and Equipments**

- Computer System
- Internet Connection
- Web Browser
- Search Engines
- Professional Office Suite (MS Office)/ Compatible office suite as per Operating System
- Application Software
- Antivirus software



**0715-MF&P 16. Draft office documents**

**Overview:** This competency standard covers the skills and knowledge required to Prepare document on word, Prepare spreadsheet, Prepare presentation, Prepare in-page files, Create backup of office record by maintaining integrity of files, Convert files into different formats

Competency Unit	Performance Criteria
<b>CU1.</b> Prepare document on MS word	<ul style="list-style-type: none"> <li><b>P1.</b> Select the MS word program</li> <li><b>P2.</b> Create new document / open already existing word document</li> <li><b>P3.</b> Set page Layout</li> <li><b>P4.</b> Perform basic Formatting (text, paragraph, page)</li> <li><b>P5.</b> Perform insert command (picture, shapes, charts, tables, smart art, clip art, hyperlinks, page numbers, header/footers, bullets/numbering, columns) in the word document</li> <li><b>P6.</b> Check the spellings in the word file through available dictionary</li> <li><b>P7.</b> Save document</li> <li><b>P8.</b> Print document</li> </ul>
<b>CU2.</b> Prepare spreadsheet	<ul style="list-style-type: none"> <li><b>P1.</b> Select the spreadsheet application</li> <li><b>P2.</b> Create / open Spread Sheet</li> <li><b>P3.</b> Set page Layout</li> <li><b>P4.</b> Perform basic Formatting</li> <li><b>P5.</b> Perform insert command (picture, charts, smart art, clip art, hyperlinks, page numbers, header/footers, bullets / numbering) in the spread sheet</li> <li><b>P6.</b> Insert / use arithmetic functions/formulas</li> <li><b>P7.</b> Save Spreadsheet</li> <li><b>P8.</b> Print Spreadsheet</li> </ul>
<b>CU3.</b> Prepare presentation	<ul style="list-style-type: none"> <li><b>P1.</b> Select the MS PowerPoint (PPT) program</li> <li><b>P2.</b> Create / open presentation</li> <li><b>P3.</b> Set page Layout</li> <li><b>P4.</b> Perform basic Formatting</li> <li><b>P5.</b> Perform insert command (slides, picture, shapes, charts, tables, smart art, clip art, hyperlinks, page numbers, bullets/numbering) in the presentation.</li> </ul>



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	<p><b>P6.</b> Select various template designs <b>P7.</b> Apply animation to slides <b>P8.</b> Check the spellings in the presentation through available dictionary <b>P9.</b> Run power point presentation <b>P10.</b> Save power point presentation <b>P11.</b> Print power point presentation</p>
<p><b>CU4.</b> Create backup of office documents record (internal/external)</p>	<p><b>P1.</b> Identify the external storage devices <b>P2.</b> Create backup on external storage.</p>
<p><b>CU5.</b> Convert files into different formats</p>	<p><b>P1.</b> Identify file conversion procedure <b>P2.</b> Convert files into different formats</p>

### **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:

- K1.** Demonstrate proficiency in creating a Word Document.
- K2.** Describe spread sheets, use formulas and apply necessary formats
- K3.** Explain qualities of a robust presentation.
- K4.** Write a note on Urdu Word Processing.
- K5.** Understand types of files and their conversions to various file types

### **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



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- Convert file to different formats

### **Tools and Equipments**

- 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
- In-page Software
- Application Software



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**0715-MF&P 17. Perform web browsing and manage emails**

**Overview:** This competency standard covers the skills and knowledge required to Perform browsing using different browsers, Download / upload data from the internet, Create email account, Sort emails, Manage address book, Archive emails, Send and receive emails

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

- K1.** How to use various browsers
- K2.** Describe types of search engines



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- K3.** Describe management of emails on various platforms.
- K4.** How to configure email accounts on outlook Differentiate between downloading and uploading data

### **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

### **Tools and Equipments**

- Computer System
- Internet Connection
- Web Browser
- Search Engines
- Internet or LAN Connectivity
- Operating System (Windows, Linux)



## 2. Draughtsman

### 0715-MF&P 18. Manage graphic user interface on CAD Software

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

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



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- 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

**Tools & Equipments**

- Computer with all accessories
- AutoCAD software disk
- Models



### 0715-MF&P 19. Develop 2D drawings on CAD Software

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

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



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

**Tools and Equipments**

- Computer with all accessories
- AutoCAD software disk
- Models



### 0715-MF&P 20. Develop 3D design on CAD Software

**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
<b>CU1.</b> Develop 3D Objects	<b>P1.</b> Setup & save 3D drawing interface for required specifications. <b>P2.</b> Setup 3D user interface settings for required specifications. <b>P3.</b> Create 3D objects with given measurements.
<b>CU2.</b> Manipulate 3D objects using 3D Editing Tools	<b>P1.</b> Modify 3D objects in line with the requirements. <b>P2.</b> Make customized 3D models according to the requirement of given job. <b>P3.</b> Convert 3D Face objects into a single mesh objects.
<b>CU3.</b> Render 3D Model	<b>P1.</b> Apply material to required 3D Model as per given specification <b>P2.</b> Apply lights to get the requisite scene of required 3D model <b>P3.</b> Assign cameras to execute different views of required 3D Model. <b>P4.</b> Render and print the 3D model according to required size & orientation. <b>P5.</b> 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



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**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**

**Tools and Equipments**

- Computer with all accessories
- AutoCAD software disk
- Models



### 3. Machining Technician

#### 0715-MF&P 21. Perform Drilling Operation

**Overview:** This competency standard covers the skills and knowledge required to Carry out drilling, counter sinking and counter boring, reaming, tapping, according to instructions.

Competency Units	Performance Criteria
<b>CU1. Carry out Drilling</b>	<p><b>P1.</b> Identify the required tools and equipment as per job requirement</p> <p><b>P2.</b> Interpret the given drawing</p> <p><b>P3.</b> Select tool &amp; clamping device according to the job requirement.</p> <p><b>P4.</b> Use the marking tool and measuring instruments as per job requirement.</p> <p><b>P5.</b> Clamp the work piece as per job requirement.</p> <p><b>P6.</b> Perform drilling as per standard procedures</p> <p><b>P7.</b> Perform post drilling operations</p> <p><b>P8.</b> Check quality of the component at suitable intervals.</p> <p><b>P9.</b> Verify the final job with the given drawing</p>
<b>CU2. Carry out Counter Sinking &amp; Counter Boring</b>	<p><b>P1.</b> Identify the required tools and equipment as per job requirement</p> <p><b>P2.</b> Interpret the given drawing</p> <p><b>P3.</b> Select marking tool and mark layout of job as per drawing</p> <p><b>P4.</b> Select clamping device and clamp the work piece</p> <p><b>P5.</b> Select counter sinking tool according to the drawing</p> <p><b>P6.</b> Perform drilling operation as per drawing</p> <p><b>P7.</b> Perform counter sinking and counter boring as per standard procedures</p> <p><b>P8.</b> Verify the final job with the given drawing</p>
<b>CU3. Carry out Reaming</b>	<p><b>P1.</b> Identify the required tools and equipment as per job requirement</p> <p><b>P2.</b> Interpret the given drawing</p>



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	<p><b>P3.</b> Select marking tool and mark layout of job as per drawing</p> <p><b>P4.</b> Select clamping device and clamp the work piece as per job requirement</p> <p><b>P5.</b> Select reamer according to the job specification</p> <p><b>P6.</b> Perform drilling to produce hole according to the size of reamer</p> <p><b>P7.</b> Perform reaming as per job specification</p> <p><b>P8.</b> Verify the final job with given drawing</p>
<b>CU4. Carry out Tapping</b>	<p><b>P1.</b> Identify the required tools and equipment as per job requirement</p> <p><b>P2.</b> Interpret the given drawing</p> <p><b>P3.</b> Select marking tool and mark layout of job as per drawing</p> <p><b>P4.</b> Select clamping device and clamp the work piece as per job requirement</p> <p><b>P5.</b> Select tap according to the job specification</p> <p><b>P6.</b> Perform drilling to produce hole according to tap size</p> <p><b>P7.</b> Perform tapping as per job specification</p> <p><b>P8.</b> Verify the final job with given drawing</p>

### 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.** Safety precautions.
- K2.** Procedure of the setting up of a drilling machine.
- K3.** Safe procedure for an operating drilling machine.
- K4.** Types of the drilling machines.
- K5.** Selecting and adjusting speed and feed of drilling machine.
- K6.** Importance of coolants in drilling operations.
- K7.** Methods and techniques of quality checks.
- K8.** Different types of drilling tools and their implications.
- K9.** Importance of selecting right drilling tool for the job specifications.
- K10.** Methods and techniques for positioning the workpiece in the drill to ensure proper



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- K11.** Alignment and stability during drilling.
- K12.** Using speeds and feeds chart for different types of materials and their hardness.
- K13.** Specific safety precautions during boring and sinking operations.
- K14.** Selecting reamer according to hole size.
- K15.** Types of reamers (straight teeth or helical teeth).
- K16.** Method of setting reamer in the drill chuck.
- K17.** Importance of using lubricants during reaming.
- K18.** Importance of alignment of the reamer during operations.

### **Critical Evidence(s) Required**

The candidate must present evidence of practical observations showing their ability to perform drilling operations. The observation measures include.

- Make a hole in steel plate and wood
- Perform counter sinking and counter boring.
- Perform reaming.

### **Tools & Equipments**

- Drilling Machines and accessories
- Machine Vice
- Marking Tools
- Counter sinking and counter boring tools.
- Reamer.
- Measuring Tools
- Drill Sleeve and Socket
- Personal Protective Equipment



### 0715-MF&P 22. Perform Basic Grinding Operations

**Overview:** This competency standard covers the skills and knowledge required to adjust grinding wheel, prepare single point cutting tool, dress the grinding wheel and perform angle grinding for finishing.

Competency Units	Performance Criteria
<b>CU1.</b> Install Grinding wheel on the machine	<b>P1.</b> Select the right tool for removing the safety guard of grinding wheel. <b>P2.</b> Remove the safety guard of grinding wheel. <b>P3.</b> Select the wheel type according to material/speed. <b>P4.</b> Mount the wheel on the spindle. <b>P5.</b> Balance the wheel. <b>P6.</b> Put back the safety covers. <b>P7.</b> Inspect the wheel for proper mounting and balancing.
<b>CU2.</b> Dress the grinding Wheel	<b>P1.</b> Select dressing tools <b>P2.</b> Inspect that wheel is properly mounted. <b>P3.</b> Use proper dressing tool to remove the burring material from grinding wheel. <b>P4.</b> Inspect the grinding wheel after dressing.
<b>CU3.</b> Prepare single point cutting tool	<b>P1.</b> Identify single point cutting tool geometry <b>P2.</b> Give the angle to the cutting tool according to cutting requirement. <b>P3.</b> Inspect the cutting tool
<b>CU4.</b> Perform surface grinding	<b>P1.</b> Inspect the job before grinding <b>P2.</b> Perform job mounting and alignment on grinding machine <b>P3.</b> Perform surface grinding operation as per job requirement

### Knowledge & Understanding

- K1.** Define types of grinding wheels
- K2.** Describe basic measuring



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- K3.** Types of Grinding machines.
- K4.** Describe work piece clamping/holding methods.
- K5.** Define safe working distance from grinding wheel for tool rest
- K6.** Describe basic measuring /marking /cutting tools
- K7.** Types of cutting tools.
- K8.** Type of dressing tools.
- K9.** Describe safety precautions during handling of angle grinder

### **Critical Evidence(s) Required**

The candidate must present evidence of practical observations showing their ability to maintain safety at site. The observation measures include.

- Prepare single point tool bit as per given requirement.
- Perform balancing and dressing of grinding wheel.

### **Tool & Equipment**

- Offhand Grinding Machine
- Bench vices
- Hammer
- Pedestal grinder
- Scriber
- Vernier calliper
- Set of spanners
- Angle Grinding Machine
- Grinding wheels
- Wheel dressers



### 0715-MF&P 23. Perform Assembly Operations

**Overview:** This competency standard covers the skills and knowledge required to use assembly aids, perform riveting operation, Clamp work pieces using bolt and nuts, perform assembly operation through welding, perform assembly operation through seaming, perform assembly operations through adhesion.

Competency Units	Performance Criteria
<b>CU1.</b> Use assembly aids	<b>P1.</b> Identify the assembly aids according to the job requirements. <b>P2.</b> Follow required procedure for lifting. <b>P3.</b> Use required lifting equipment. <b>P4.</b> Position the job accurately using positioning aids. <b>P5.</b> Apply the assembly aids.
<b>CU2.</b> Perform riveting operation	<b>P1.</b> Select required tools for riveting. <b>P2.</b> Select the type and size of rivet. <b>P3.</b> Aligned the work pieces. <b>P4.</b> Clamp the work pieces firmly. <b>P5.</b> Insert/ set the rivet in to the bore hole <b>P6.</b> Clean the work piece / component from dirt and other contamination.
<b>CU3.</b> Clamp work pieces using bolt and nuts	<b>P1.</b> Select required tools for fastening the nut bolt. <b>P2.</b> Align the work pieces. <b>P3.</b> Align the holes in the work pieces. <b>P4.</b> Insert the bolt in the holes. <b>P5.</b> Screw the nut on the bolts using required tools.
<b>CU4.</b> Perform assembly operation through welding	<b>P1.</b> Comply with health and safety rules regulations <b>P2.</b> Clean the tools / equipments and work pieces <b>P3.</b> Select welding type according to the job requirements. <b>P4.</b> Use tools and equipments as per requirement <b>P5.</b> Set the welding equipments according to given job. <b>P6.</b> Place the work pieces in required position. <b>P7.</b> Perform welding operation as per standards.



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<b>CU5.</b> Perform assembly operation through seaming	<b>P1.</b> Select required method of seaming. <b>P2.</b> Identify the required tools and equipments <b>P3.</b> Set the machine according to the job requirements <b>P4.</b> Carryout pre-cleaning of tools / equipments and work pieces from dirt, foreign object and contaminations. <b>P5.</b> Make the groves at the joining edges as required. <b>P6.</b> Interlock the two sheets as per standards. <b>P7.</b> Apply pressure to make the Seam.
<b>CU6.</b> Perform assembly operations through adhesion	<b>P1.</b> Select the adhesive according to the work piece requirements. <b>P2.</b> Use required PPEs with respect to adhesives. <b>P3.</b> Clean and dry the surfaces with proper detergents (Degreasing). <b>P4.</b> Abrade the surfaces with wire brush and emery cloth etc. <b>P5.</b> Degrease the surfaces again. <b>P6.</b> Apply the adhesive to both surfaces according to the company procedure for particular adhesive. <b>P7.</b> Compress the surfaces firmly. <b>P8.</b> Check the joint for proper adhesiveness. <b>P9.</b> Remove the excess adhesive.

### 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.** State types of rivets.
- K2.** Explain different types of riveted joint
- K3.** Identify different clamping tools.
- K4.** Difference between permanent and temporary fasteners.
- K5.** Explain conventional fastening methods.
- K6.** Explain different types of nuts & bolts and their uses.
- K7.** Enlist riveting tools.
- K8.** Define torque.
- K9.** Describe jig and fixture.
- K10.** Describe different types of welding
- K11.** Define seaming.



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- K12.** Enlist different types of seaming.
- K13.** Explain factors affecting the selection of adhesive.
- K14.** Enlist different types of adhesive used for ferrous and non-ferrous metal.
- K15.** State Safety relevant to tools, tackles, & components of scaffolding as per job.

### **Critical Evidence(s) Required**

The candidate must present evidence of practical observations showing their ability to :

- Perform riveting operation on the given job.
- Perform permanent fastening operation on the given job.
- Perform temporary fastening operation on the given job.

### **Tools and Equipments**

- Nuts and Bolts
- Clamping Devices
- Revit
- Welding Machine with accessories
- Seaming Machine and accessories
- Mechanical tool Kit
- Adhesive Machine with accessories



#### 4. **Welding Technician**

##### **0715-MF&P 24. Carry out Gas Welding Operation**

**Overview:** This competency standard covers the skills and knowledge required to setup gas welding Equipment, arrange materials for welding, prepare base material for welding, perform Gas Welding

<b>Competency Units</b>	<b>Performance Criteria</b>
<b>CU.1 Set-up gas Welding Equipment</b>	<p><b>P1.</b> Select the required size of the gas nozzle</p> <p><b>P2.</b> Adjust pressures of both gas cylinders (Acetylene and Oxygen) with the help of regulator</p> <p><b>P3.</b> Set gas welding torch as per SOPs</p> <p><b>P4.</b> Adjust Acetylene gas knob of welding torch to make Carburizing flame</p> <p><b>P5.</b> Make Neutral flame by adjusting uniform quantity of both gases</p> <p><b>P6.</b> Make Oxidizing flame by increasing oxygen gas quantity</p>
<b>CU2. Arrange materials for welding</b>	<p><b>P1.</b> Arrange material(s) as per job requirements</p> <p><b>P2.</b> Arrange marking tools as per job requirements</p> <p><b>P3.</b> Mark the area to be cut as per drawing/job requirements</p> <p><b>P4.</b> Arrange relevant welding consumables as per job requirement</p>
<b>CU3. Prepare Base Material for Welding</b>	<p><b>P1.</b> Arrange cutting tools and equipment as per job requirement</p> <p><b>P2.</b> Set-up cutting equipment as per manufacturer’s instructions/job requirements</p> <p><b>P3.</b> Cut the base material as per job specification and dimensions provided in the drawing</p> <p><b>P4.</b> Prepare edge(s) of the base materials as per drawing</p> <p><b>P5.</b> Check dimensions of the prepared edge(s) as per drawing with the help of measuring tools</p> <p><b>P6.</b> Use tools and chemicals for material cleaning</p> <p><b>P7.</b> Clean the edge(s) of the base material as per job requirements</p>
<b>CU4. Perform Gas Welding</b>	<p><b>P1.</b> Arrange Work piece as per drawing</p> <p><b>P2.</b> Perform straightening of work piece with the help of hammer and anvil</p> <p><b>P3.</b> Perform grinding of work piece to prepare the edges flat</p>



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	<p>and parallel to each other</p> <p><b>P4.</b> Adjust the flame of welding torch as per requirement</p> <p><b>P5.</b> Place the work piece on working table</p> <p><b>P6.</b> Perform welding operation to make Tee Joint / Lap Joint / Butt Joint as per specifications.</p> <p><b>P7.</b> Complete the welding bead as per standard</p> <p><b>P8.</b> Perform visual inspection of the job as per standard</p>
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### Knowledge & Understanding

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

- K1. Describe Gas welding plant and accessories
- K2. Describe welding torch and its use
- K3. Identify Gas pressure regulators
- K4. Explain temperature and its units
- K5. Describe pre-heating procedures
- K6. Explain importance of preheating
- K7. Define carburizing flame
- K8. Define neutral flame
- K9. Define oxidizing flame
- K10. Differentiate Ferrous and Non-Ferrous materials
- K11. Explain metal properties
- K12. Describe types of grinders
- K13. Explain use of tri square
- K14. Describe importance of filing
- K15. Describe the properties of filler metal
- K16. Describe purpose of flux
- K17. Explain position of gas torch according to work
- K18. Describe importance of cleaning of surface to be welded
- K19. Describe sheet metal gauges
- K20. Knowledge of WPS (Welding Procedure Specifications)

### Critical Evidence

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



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- Make Tee Joint using gas welding
- Make Lap Joint using gas welding
- Make Butt Joint using gas welding

### **Tools and Equipment**

- Oxygen gas cylinder
- Acetylene gas cylinder
- Pressure regulators
- Cylinder key
- Welding torch
- Rubber house pipe
- Flash back arrester
- Spark lighter
- Steel wire brush
- Work bench
- Bench vice
- Hammer
- Tri-square
- Hand hacksaw
- Scriber
- Vernier caliper
- Flat File
- Pedestal grinder
- Disk grinder
- Pin grinder
- Metal Filler rod
- Welding flux



### 0715-MF&P 25. Perform Brazing & Soldering Operation

**Overview:** This competency standard covers the skills and knowledge required to setup Perform brazing Operation, Perform Soldering Operation

Competency Units	Performance Criteria
<b>CU1. Perform Brazing Operation</b>	<b>P1.</b> Arrange Work piece as per drawing <b>P2.</b> Perform cutting of work piece as per the requirement <b>P3.</b> Perform file work if required <b>P4.</b> Arrange filler wire as per requirement <b>P5.</b> Perform Brazing operation as per standard <b>P6.</b> Perform visual inspection of the job as per standard
<b>CU2. Perform Soldering Operation</b>	<b>P1.</b> Identify soldering tools/equipment/material as per requirement <b>P2.</b> Arrange soldering tools/equipment/material as per requirement <b>P3.</b> Perform cleaning of the metal work piece <b>P4.</b> Adjust work pieces as per job requirement <b>P5.</b> Carry out the Melting of the Solder (filler metal) <b>P6.</b> Apply Solder on the work piece <b>P7.</b> Perform post soldering cleaning <b>P8.</b> Perform visual inspection of the job

### Knowledge & Understanding

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

- K21.** Explain temperature and its units
- K22.** Describe pre-heating procedures
- K23.** Explain importance of preheating
- K24.** Define carburizing flame
- K25.** Define neutral flame
- K26.** Define oxidizing flame
- K27.** Differentiate Ferrous and Non-Ferrous materials
- K28.** Explain metal properties
- K29.** Describe importance of filing
- K30.** Describe the properties of filler metal
- K31.** Describe purpose of flux
- K32.** Describe soldering



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**K33.** Describe sheet metal gauges

**K34.** Describe brazing

### Critical Evidence

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

- Prepare the required job using brazing
- Prepare the required job using soldering

### Tools and Equipment

- Oxygen gas cylinder
- Acetylene gas cylinder
- Pressure regulators
- Cylinder key
- Welding torch
- Rubber house pipe
- Flash back arrester
- Spark lighter
- Steel wire brush
- Work bench
- Bench vice
- Hammer
- Tri-square
- Hand hacksaw
- Scriber
- Vernier caliper
- Flat File
- Pin grinder
- Metal Filler rod
- Welding flux
- Brazing nozzle
- Solder gun
- Solder wire



## 5. Metal casting Technician

### 0715-MF&P 26. Perform Green Sand Mold Casting

**Overview:** This competency standard covers the skills and knowledge required to Perform pre-casting operations, perform green sand mold casting process and perform post casting operations

Competency Units	Performance Criteria
<b>CU1. Perform pre-casting operations</b>	<p><b>P1.</b> Identify tools/equipment/material as per requirement for sand casting</p> <p><b>P2.</b> Arrange sand casting molds as per requirement</p> <p><b>P3.</b> Arrange raw material for melting operations</p> <p><b>P4.</b> Set casting parameters as per SOPs</p> <p><b>P5.</b> Check the melting equipment availability as per requirement</p> <p><b>P6.</b> Check the tilting operation of casting ladles</p>
<b>CU2. Perform Green sand mold casting process</b>	<p><b>P1.</b> Carryout pouring with the defined work standards and specifications</p> <p><b>P2.</b> Regulate the speed of the molten metal into sand molds through gating system</p> <p><b>P3.</b> Monitor casting temperature by observing the readings on various panels/ meters to prevent deviation from desired specifications</p> <p><b>P4.</b> Prevent metal spillage in the work area</p> <p><b>P5.</b> Take preventive actions to avoid parting leak, gas evolution and interrupted pouring</p> <p><b>P6.</b> Maintain maximum limit of melt in down sprue during pouring as per the process mentioned in the work instructions/ SOPs</p> <p><b>P7.</b> Remove the sand molds with metal cast as per SOPs</p>
<b>CU3. Perform post casting operations</b>	<p><b>P1.</b> Analyze any irregularity in the casting process to take preventive steps in next casting</p> <p><b>P2.</b> Check the in-line composition/ soundness of the casting</p> <p><b>P3.</b> Inspect the conformance of final metal casting as per specification given in work order</p> <p><b>P4.</b> Send the casting for further processing in terms of chipping, fettling, wedge cutting etc.</p>



### **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.** Casting components
- K2.** Parts of sand molding
- K3.** Preparation of sand mould
- K4.** Gating system
- K5.** Types of Sand casting mold materials
- K6.** Casting defects and their remedies
- K7.** Types of raw materials
- K8.** Furnace operation, melting process, charging method
- K9.** Handling hot liquid iron
- K10.** Furnace lining process and control
- K11.** Metallurgical properties of the metal used in the process

### **Critical Evidence(s) Required**

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

- Perform pre-casting operations
- Perform casting operation as per given requirement
- Perform post casting operations

### **Tools and Equipment**

- Raw Material
- Silica Sand
- Sand Mold
- Melting Furnace and accessories
- Crucible ring
- Tongs
- Pouring Ladles
- Transfer ladles
- Ladle Pre-Heater
- Overhead Chain Conveyer



### 0715-MF&P 27. Perform CO<sub>2</sub> Sand Mold Casting

**Overview:** This competency standard covers the skills and knowledge required to Prepare CO<sub>2</sub> sand Mold for Casting, Perform pre-casting operations, perform CO<sub>2</sub> sand mold casting process and perform post casting operations

Competency Units	Performance Criteria
<b>CU1.</b> Prepare CO <sub>2</sub> sand Mold for Casting	<b>P1.</b> Carry out mixing of silica sand (clean, dry and free from clay) by weight of sodium silicate <b>P2.</b> Perform mixing of mixture with liquid base binder in the muller <b>P3.</b> Put mixture into the core-boxes by conventional methods <b>P4.</b> Perform Ramming of the mould <b>P5.</b> Carry out hardening of mold with CO <sub>2</sub> <b>P6.</b> Perform assembling of mold <b>P7.</b> Force CO <sub>2</sub> into the mold at required pressure
<b>CU2.</b> Perform pre-casting operations	<b>P1.</b> Arrange CO <sub>2</sub> sand molds as per requirement <b>P2.</b> Arrange raw material for melting operations <b>P3.</b> Set casting parameters as per SOPs <b>P4.</b> Check the melting equipment availability as per requirement <b>P5.</b> Check the tilting operation of casting ladles
<b>CU3.</b> Perform CO <sub>2</sub> sand mold casting process	<b>P1.</b> Carryout pouring with the defined work standards and specifications <b>P2.</b> Regulate the speed of the molten metal into CO <sub>2</sub> sand molds as per SOPs <b>P3.</b> Prevent metal spillage in the work area <b>P4.</b> Take preventive actions to avoid parting leak, gas evolution and interrupted pouring <b>P5.</b> Maintain maximum limit of melt in down sprue during pouring as per the process mentioned in the work instructions/ SOPs <b>P6.</b> Remove the CO <sub>2</sub> sand molds with metal cast at a designated place to discard used sand
<b>CU4.</b> Perform post casting operations	<b>P5.</b> Analyze any irregularity in the casting process to take preventive steps in next casting <b>P6.</b> Check the in-line composition/ soundness of the casting



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	<p><b>P7.</b> Inspect the conformance of final metal casting as per specification given in work order</p> <p><b>P8.</b> Send the casting for further processing in terms of chipping, fettling, wedge cutting etc.</p>
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### 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:

- K12. Casting components
- K13. Parts of CO2 sand molding
- K14. Preparation of CO2 sand mold
- K15. Gating system
- K16. Types of CO2 Sand casting mold materials
- K17. Casting defects and their remedies
- K18. Types of raw materials
- K19. Furnace operation, melting process, charging method
- K20. Handling hot liquid iron
- K21. Furnace lining process and control
- K22. Metallurgical properties of the metal used in the process
- K23. Properties of CO2 Sand molding
- K24. Affects of CO2 sand molding on cast

### Critical Evidence(s) Required

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

- Perform pre-casting operations
- Perform CO2 sand casting operation as per given requirement
- Perform post casting operations

### Tools and Equipment

- Raw Material
- Silica Sand
- CO2 cylinders
- CO2 Pipe with nozzles
- Sodium silicate
- binders



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- CO2 Sand Mold
- Melting Furnace and accessories
- Crucible ring
- Tongs
- Pouring Ladles
- Transfer ladles
- Ladle Pre-Heater
- Overhead Chain Conveyer



## 6. Metal Forming Technician

### 0715-MF&P 28. Perform Shearing, Bending and Punching Operations

**Overview:** This competency standard covers the skills and knowledge required to arrange the raw material, arrange tools and equipment, prepare the required tools and equipment, prepare work piece as per drawing, perform Shearing operation, perform punching operation, perform bending operation, Perform Deburring of product and carryout inspection of the finished products.

Competency Units	Performance Criteria
<b>CU1.</b> Arrange the raw material	<b>P1.</b> Select the raw material according to job requirements. <b>P2.</b> Select form/shape of raw material on near net Shape principle
<b>CU2.</b> Arrange tools and equipment	<b>P1.</b> Identify standard techniques as per safety procedures <b>P2.</b> Select forming tools and equipment based on manufacturers specification <b>P3.</b> Select the desired Die according to the job requirement. <b>P4.</b> Select the Punch according to the job requirement.
<b>CU3.</b> Prepare the required tools and equipment	<b>P1.</b> Measure the strip dimensions for given operation <b>P2.</b> Set parameters of forming machine (Pressure, Time, Temperature etc) according to job specifications <b>P3.</b> Energize the machine as per SOPs <b>P4.</b> Prepare the metal stock as per SOPs. <b>P5.</b> Set number of Dies according to requirement. <b>P6.</b> Set the Punch according to the job requirement
<b>CU4.</b> Prepare work piece as per drawing	<b>P1.</b> Interpret job’s drawing <b>P2.</b> Perform measurement for marking on job as per drawings/ specifications <b>P3.</b> Apply Dimensional data and shape according to the given task <b>P4.</b> Clamp the work piece using PPEs as per job requirement



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<b>CU5.</b> Perform Shearing operation	<b>P1.</b> Energize Shearing Machine as per SOPs <b>P2.</b> Load continuous feed of stock as per production requirements. <b>P3.</b> Operate Shearing machine as per SOP <b>P4.</b> Unload finished product as per SOP <b>P5.</b> Maintain production record of work <b>P6.</b> Verify product deviations and report
<b>CU6.</b> Perform punching operation	<b>P1.</b> Energize Punching Machine as per SOPs <b>P2.</b> Select Punch (Steel, Carbide etc) as per requirement <b>P3.</b> Select the Die cutout in the shape of requirement <b>P4.</b> Assemble sheet metal stock, Punch and Die. <b>P5.</b> Position sheet metal stock between the Punch and Die inside the punch press <b>P6.</b> Press Punch downward at high speed through the Sheet and Die <b>P7.</b> Remove the slug that is punched out of the sheet <b>P8.</b> Maintain production record of work <b>P9.</b> Verify product deviations and report
<b>CU7.</b> Perform bending operation	<b>P1.</b> Energize Bending Machine as per SOPs <b>P2.</b> Select tool as per job requirement (production quantity, sheet metal material and degree of bending etc) <b>P3.</b> Select Die for Bending operation as per requirement. <b>P4.</b> Position the sheet over the Die and held in place by the back gauge <b>P5.</b> Energize press brake to perform Bending operation <b>P6.</b> Apply force to the sheet with the help of press Die <b>P7.</b> Maintain production record of work <b>P8.</b> Verify product deviations and report



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<b>CU8.</b> Perform Deburring of product	<b>P1.</b> Insert deburring blade into product <b>P2.</b> Apply a small amount of pressure between the blade and interior wall <b>P3.</b> Perform rotation of blade around the interior wall of the tube while applying pressure <b>P4.</b> Use a deburring machine to grind the burr off in case of Mechanical deburring <b>P5.</b> Use combustive gases to generate thermal energy and essentially scald the burrs out of the metal in Thermal deburring <b>P6.</b> Use a solution of salt or glycol to conduct energy through the burrs in Electrochemical deburring.
<b>CU9.</b> Carryout inspection of the finished products	<b>P1.</b> Follow standard procedure of inspection <b>P2.</b> Measure the work piece for conformance to specification <b>P3.</b> Carryout product repair (if required) <b>P4.</b> Inspect products after rework or repair <b>P5.</b> Record the deviations, if any, according to SOPs

### Knowledge & Understanding

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

- K1.** Types of punch presses.
- K2.** Types of punch and dies.
- K3.** Punching characteristics.
- K4.** Punch forces.
- K5.** Types of bending angles.
- K6.** Bending machines and dies
- K7.** Technical drawing
- K8.** Material specifications
- K9.** Process specifications
- K10.** Importance of surface finishing
- K11.** Shearing machine setting procedures
- K12.** Types of shearing
- K13.** Shearing machine operating procedures
- K14.** Feed stocks and their characteristics



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- K15. Measuring Techniques
- K16. Shearing machine tool types
- K17. Signs of wear and tear of tool
- K18. Describe material behavior in metal forming processes
- K19. Explain temperature in metal forming
- K20. Explain strain rate sensitivity
- K21. Explain friction and lubrication in metal forming
- K22. State Standard procedure of handling, storing and stacking raw material.
- K23. State types of sheet metal waste and its safe disposal.
- K24. State Basic ergonomic principles as per machine operation.
- K25. State Reporting procedures in cases of unwanted situation

### **Critical Evidence(s) Required**

The candidate must present evidence of practical observations showing their ability to maintain safety at site. The observation measures include:

- Perform shearing press operations as per given requirement.
- Perform bending press operations as per given requirement.
- Perform punching press operations as per given requirement.

### **Tools and Equipment**

- Shearing Machines and its accessories
- Bending Machines and its accessories
- Punching Machines and its accessories
- Inspection tools
- Raw Materials
- Layout tools
- Fire extinguishers
- Punches
- Dies
- Blank Holder
- Check sheets
- PPEs



### 0715-MF&P 29. Perform Forging Operations

**Overview:** This competency standard covers the skills and knowledge required to Arrange the raw material, Calculate material requirement, Pre-heat the Job, Perform forging operation, Inspect the product

Competency Units	Performance Criteria
<b>CU1.</b> Arrange the raw material	<b>P1.</b> Select the raw material according to job requirements. <b>P2.</b> Select form/shape of raw material on near net Shape principle.
<b>CU2.</b> Calculate material requirement	<b>P1.</b> Interpret Engineering Drawing / Job sheet of the product. <b>P2.</b> Determine the dimensions of the finish product. <b>P3.</b> Measure the stock dimensions & weight. <b>P4.</b> Calculate Material volume as per job requirements.
<b>CU3.</b> Pre-heat the Job	<b>P1.</b> Select the heating equipment as per Job requirement. <b>P2.</b> Energize the heating equipment as per SOPs <b>P3.</b> Focus the heat on job specified area. <b>P4.</b> Heat-up the work piece to the specified working Temperature range.
<b>CU4.</b> Perform forging operation	<b>P1.</b> Arrange forging tools as per requirement according to open or closed Die Forging. <b>P2.</b> Perform safe handling of tools <b>P3.</b> Maintain allowances for material shrinkage and oxidation <b>P4.</b> Apply the force several times to get the desired shape of the Job. <b>P5.</b> Perform finishing operation as per requirement.
<b>CU5.</b> Inspect the product	<b>P1.</b> Check all dimensions of the product <b>P2.</b> Perform measurements and calculations of the product. <b>P3.</b> Report the error, if any, in the final product. <b>P4.</b> Recommend corrective action(s) as per required specifications.



## **Knowledge & Understanding**

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

- K1.** Enlist hand tools and their applications.
- K2.** Define heating equipment
- K3.** Explain forging temperatures and heat specifications for multiple pieces.
- K4.** Types of forging processes
- K5.** Open and close Die forging.
- K6.** Heat treatment Furnaces
- K7.** Explain the effects of material shrinkage and oxidization on the dimensions of the forged article
- K8.** Explain Safety Practices and PPEs used in Forging.

## **Critical Evidence(s) Required**

The candidate must present evidence of practical observations showing their ability to

- Perform pre-heating process for forging (if needed)
- Perform forging operation as per the given requirement

## **Tools & equipment**

- Forging machine and accessories
- Anvil
- Heating furnaces
- Clamping devices
- Tongs
- Punch
- Fuller
- Flatter
- Swage
- Swage block
- PPEs



### 0715-MF&P 30. Perform Extrusion Process

**Overview:** This competency standard covers the skills and knowledge required to Prepare the raw material, Install the required die for direct/indirect extrusion, Preparation for hot extrusion Process, Perform direct/Indirect extrusion process and Inspect the product.

Competency Units	Performance Criteria
<b>CU1.</b> Prepare the raw material	<b>P1.</b> Select the raw materials for extrusion as per requirement. <b>P2.</b> Identify lubricants and additives required in extrusion operations. <b>P3.</b> Identify the suitability of a material for extrusion depends on: the temperature range over which extrusion is possible
<b>CU2.</b> Install the required die for direct/indirect extrusion	<b>P1.</b> Place the suitable die on machine with lifting equipment. <b>P2.</b> Clamp the die as per requirement <b>P3.</b> Align the die on machine. <b>P4.</b> Operate machine manually and match the upper and lower dies <b>P5.</b> Perform the trial of die to verify the operation. <b>P6.</b> Identify risk associated with job. <b>P7.</b> Use required PPEs.
<b>CU3.</b> Prepare for hot extrusion Process	<b>P1.</b> Identify the temperature as per requirement. <b>P2.</b> Control the temperature of Die, Container and Billet as per standard operating procedure <b>P3.</b> Preheating the die prior to extrusion <b>P4.</b> Set required temperature for die
<b>CU4.</b> Perform direct/Indirect extrusion process.	<b>P1.</b> Select device required for given metal extrusion process. <b>P2.</b> Follow instructions to carry out extrusion processing <b>P3.</b> Check the dies are installed as per job requirement. <b>P4.</b> Set the pressure as per requirement. <b>P5.</b> Carry out simple preventive maintenance for metal extrusion equipment. <b>P6.</b> Report the problems if any during metal extrusion



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	processing <b>P7.</b> Remove burs if applicable.
<b>CU5.</b> Inspect the product	<b>P1.</b> Check all dimensions of the product <b>P2.</b> Perform measurements and calculations of the product. <b>P3.</b> Report the error, if any, in the final product. <b>P4.</b> Recommend corrective action(s) as per required specifications

### 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 extrusion
- K2.** Types of dies
- K3.** Types of raw material for extrusion process.
- K4.** Types of lubricants for extrusion process
- K5.** Types of coolant for different processes'
- K6.** Pressure and temperature control and measurements.
- K7.** Advantages and disadvantages of different types of extrusions.
- K8.** Extrusion defects.
- K9.** Characteristics of extrusion
- K10.** Methods of removing burs
- K11.** Inspection techniques
- K12.** Inspection tools

### Critical Evidence(s) Required

The candidate must present evidence of practical observations showing their ability to perform injection and extrusion process. The observation measures include.

- Prepare required job using direct extrusion process.
- Prepare required job using indirect extrusion process.

### Tools & Equipment

- Extrusion machine and accessories
- Dies



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- Inspection tools.
- Measuring tools
- PPEs
- Lubricants
- Raw materials



### 0715-MF&P 31. Perform Deep drawing operations

**Overview:** This competency standard covers the skills and knowledge required to perform Annealing on raw material, Arrange dies for deep drawing operation, Perform deep drawing operation and Inspect the product dimension

Competency Units	Performance Criteria
<b>CU1.</b> Perform Annealing on raw material.	<b>P1.</b> Handle the work piece as per SOP <b>P2.</b> Place the workpiece in the heating furnace <b>P3.</b> Set standard soaking time of the heat treatment cycle as per requirements <b>P4.</b> Control the temperature of the furnace as per requirements <b>P5.</b> Turn off the furnace once the required temperature and soaking time is achieved. <b>P6.</b> Cool the workpiece in the furnace. <b>P7.</b> Remove the workpiece from the furnace once the temperature drops to room temperature.
<b>CU2.</b> Arrange dies for deep drawing operation	<b>P1.</b> Measure the size of the workpiece <b>P2.</b> Select suitable die for drawing operation <b>P3.</b> Check the surface and other working requirements of dies <b>P4.</b> Carryout measurements of dies according to desired final size
<b>CU3.</b> Carry out deep drawing operation	<b>P1.</b> Check the working condition of drawing machine <b>P2.</b> Prepare the drawing machine for working <b>P3.</b> Calculate maximum draw force for given job <b>P4.</b> Placed the workpiece in the dies. <b>P5.</b> Operate the machine for drawing <b>P6.</b> Set constant speed to maintain uniformity <b>P7.</b> Remove the final drawn product from drawing machine <b>P8.</b> Allow the final drawn product to cool <b>P9.</b> Follow safety rules during drawing operation.



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<b>CU4.</b> Inspect the product dimension	<b>P1.</b> Measure the final size of the product <b>P2.</b> Compare the final dimensions with required final size <b>P3.</b> Record the data
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### 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 basic difference between drawing and extrusion process.
- K2.** Define heat treatment process.
- K3.** Describe different purposes of heat treatment.
- K4.** Describe basic types of heat treatment.
- K5.** Define annealing.
- K6.** Describe types of annealing process.
- K7.** State Reporting procedures in cases of breaches or hazards for site safety, accidents, and emergency situations as per guidelines
- K8.** Use required PPEs for different situations
- K9.** State Safety relevant to tools, tackles, & components of scaffolding as per job.
- K10.** Describe the deep drawing process.
- K11.** Describe basic difference between wire drawing and deep drawing process.
- K12.** Describe different types of dies used for deep drawing operation.
- K13.** Describe different types of materials used for making deep drawing dies.

### Critical Evidence(s) Required

The candidate must present evidence of practical observations showing their ability to maintain safety at site. The observation measures include.

- Perform annealing on given raw material
- Perform deep drawing operation as per given requirement.



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**Tools & Equipments**

- Deep Drawing Machine and accessories
- Raw Material
- Measuring tools
- Dies
- Cutting tools
- Heat treatment Equipment