Model Curriculum

QP Name: Forger

QP Code: CSC/Q1101

QP Version: 2.0

NSQF Level: 4

Model Curriculum Version: 2.0

Capital Goods Skill Council || 1st Floor, L-29, Outer Circle, Connaught PlaceNew Delhi – 110001 ||
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Training Parameters

Sector	Capital Goods
Sub-Sector	Light Engineering Goods
Occupation	Forging
Country	India
NSQF Level	4
Aligned to NCO/ISCO/ISIC Code	NCO-2015/NIL
Minimum Educational Qualification and Experience	10th Class with 2 years of experience in the relevant field Or 10th Class + ITI (2 years Or 12th Pass with 6 Months of experience in the relevant field Or Fitter Mechanical Assembly – 3 with 1 year of experience in the relevant field
Pre-Requisite License or Training	NA
Minimum Job Entry Age	18 years
Last Reviewed On	31/03/2022
Next Review Date	31/03/2025
NSQC Approval Date	31/03/2022
QP Version	2.0
Model Curriculum Creation Date	31/03/2022
Model Curriculum Valid Up to Date	31/03/2025
Model Curriculum Version	2.0
Minimum Duration of the Course	450 Hours 00 Minutes
Maximum Duration of the Course	450 Hours 00 Minutes

Program Overview

This section summarizes the end objectives of the program along with its duration.

Training Outcomes

At the end of the program, the learner should have acquired the listed knowledge and skills.

- Interpret drawing/work instructions/SOPs for identification of raw material, tools and equipment required for the heat treatment and forging operations.
- Carry out pre-forging activities such as lifting of workpiece, inspection of tools and equipment etc.
- Carry out heat treatment, forging and post-forging operations
- Work effectively and efficiently as per schedules and timelines.
- Implement safety practices.
- Optimize the use of resources to ensure less wastage and maximum conservation.

Compulsory Modules

The table lists the modules and their duration corresponding to the Compulsory NOS of the QP.

NOS and Module Details	Theory Duration	Practical Duration	On-the-Job Training Duration (Mandatory)	On-the-Job Training Duration (Recommended)	Total Duration
Bridge Module					
Module 1: Introduction to the role of a Forger	8:00	0:00	0:00	00:00	8:00
CSC/N1335 – Follow the health and safety practices at work NOS Version- 2.0 NSQF Level- 3	**20:00**	**40:00**	**0:00**	**0:00**	**60:00**
Module 2: Health and safety practices	20:00	40:00	0:00	00:00	60:00
CSC/N1336 – Coordinate with co-workers to achieve work efficiency NOS Version-2.0 NSQF Level- 3	**20:00**	**30:00**	**0:00**	**00:00**	**50:00**
Module 3: Process of coordinating with co-workers to achieve work efficiency	20:00	30:00	0:00	00:00	50:00
CSC/N1001 – Perform heat treatment operations on ferrous & non-ferrous metals and alloys NOS Version No. – 2.0 NSQF Level – 3	**55:00**	**90:00**	**0:00**	**00:00**	**145:00**
Module 4: Perform heat treatment operations	55:00	90:00	0:00	00:00	145:00
CSC/N1101 – Perform forging techniques on ferrous & non-ferrous metals and alloys NOS Version No. – 2.0	**77:00**	**110:00**	**0:00**	**00:00**	**187:00**

NSQF Level – 3					
Module 5: Perform forging operations	77:00	110:00	0:00	00:00	187:00
Total Duration	**180:00**	**270:00**	**0:00**	**00:00**	**450:00**

Module Details

Module 1: Introduction to the role of a Forger

Bridge module

Terminal Outcomes:

- Discuss the role and responsibilities of a Forger.

Duration: 08:00	Duration: 00:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• List the role and responsibilities of a Forger. • Discuss the job opportunities of a Forger. • Describe the size and scope of the capital good industry and its sub-sectors. • Explain about Indian capital goods manufacturing market. • Discuss the standards and procedures involved in the different operations of forging.	
Classroom Aids:	
Whiteboard, marker pen, projector, standard checklists and schedules	
Tools, Equipment and Other Requirements	

Module 2: Health and safety Practices

Mapped to CSC/N1335 v2.0

Terminal Outcomes:

- Demonstrate ways to maintain personal health and safety.
- Describe the process of assisting in hazard management.
- Explain how to check the first aid box, firefighting and safety equipment.
- Describe the process of assisting in waste management.
- Explain the importance of following the fire safety guidelines.
- Explain the importance of following the emergency and first-aid procedures.
- Demonstrate the process of carrying out relevant documentation and review.

Duration: 20:00	Duration: 40:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Explain the recommended practices to be followed to ensure protection from infections and transmission to others, such as the use of hand sanitiser and face mask. • Explain the importance and process of checking the work conditions, assessing the potential health and safety risks, and take appropriate measures to mitigate them. • Explain the importance and process of selecting and using the appropriate PPE relevant to the task and work conditions. • Explain the recommended techniques to be followed while lifting and moving heavy objects to avoid injury. • Explain the importance of following the manufacturer's instructions and workplace safety guidelines while working on heavy machinery, tools and equipment. • Explain the importance and process of identifying existing and potential hazards at work. • Describe the process of assessing the potential risks and injuries associated with the various hazards. • Explain how to prevent or minimise different types of hazards. • Explain how to handle and store hazardous materials safely. • Explain the importance of ensuring the first aid box is updated with the relevant first aid supplies. • Describe the process of checking and testing the firefighting and various safety equipment to ensure they are in a usable condition.	• Demonstrate the use of appropriate Personal Protective Equipment (PPE) relevant to the task and work conditions. • Demonstrate how to handle hazardous materials safely. • Demonstrate the process of testing the firefighting and various safety equipment to ensure they are in usable condition. • Demonstrate the process of recycling and disposing different types of waste appropriately. • Demonstrate how to use the appropriate type of fire extinguisher to extinguish different types of fires safely. • Demonstrate how to administer appropriate first aid to the injured personnel. • Demonstrate the process of performing Cardiopulmonary Resuscitation (CPR) on a potential victim of cardiac arrest. • Demonstrate the process of carrying out appropriate documentation following a health and safety incident at work, including all the required information.

• Explain the criteria for segregating waste into appropriate categories. • Describe the appropriate methods for recycling recyclable waste. • Describe the process of disposing of the non-recyclable waste safely and the applicable regulations. • Explain the use of different types of fire extinguishers to extinguish different types of fires. • State the recommended practices to be followed for a safe rescue during a fire emergency. • Explain how to request assistance from the fire department to extinguish a serious fire. • Explain the appropriate practices to be followed during workplace emergencies to ensure safety and minimise loss to organisational property. • State the common health and safety hazards present in a work environment, associated risks, and how to mitigate them. • State the safe working practices to be followed while working at various hazardous sites and using electrical equipment. • Explain the importance of ensuring easy access to firefighting and safety equipment. • Explain the appropriate preventative and remedial actions to be taken in the case of exposure to toxic materials, such as poisonous chemicals and gases. • Explain various causes of fire in different work environments and the recommended precautions to be taken to prevent fire accidents. • Describe different methods of extinguishing fire. • List different materials used for extinguishing fire. • Explain the applicable rescue techniques to be followed during a fire emergency. • Explain the importance of placing safety signs and instructions at strategic locations in a workplace and following them. • Explain different types of first aid treatment to be provided for different types of injuries. • State the potential injuries associated with	

incorrect manual handling. • Explain how to move an injured person safely. • State various hazards associated with the use of various machinery, tools, implements, equipment and materials. • Explain the importance of ensuring no obstruction and free access to fire exits. • Explain how to free a person from electrocution safely. • Explain how to administer appropriate first aid to an injured person. • Explain how to perform Cardiopulmonary Resuscitation (CPR). • Explain the importance of coordinating with the emergency services to request urgent medical assistance for persons requiring professional medical attention or hospitalisation. • State the appropriate documentation to be carried out following a health and safety incident at work, and the relevant information to be included. • Explain the importance and process of reviewing the health and safety conditions at work regularly or following an incident. • Explain the importance and process of implementing appropriate changes to improve the health and safety conditions at work.	
Classroom Aids	
Computer, Projection Equipment, PowerPoint Presentation and Software, Facilitator's Guide, Participant's Handbook.	
Tools, Equipment and Other Requirements	
Personal Protective Equipment, Cleaning Equipment and Materials, Sanitizer, Soap, Mask	

Module 3: Process of coordinating with co-workers to achieve work efficiency

Mapped to CSC/N1336 v2.0

Terminal Outcomes:

- Demonstrate ways to work and communicate effectively with co-workers.
- Discuss ways to promote diversity and inclusion at the workplace.

Duration: 20:00	Duration: 30:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Explain the importance and process of effective communication in the workplace. • Explain the barriers to effective communication and how to overcome them. • Explain the importance of teamwork in an organisation's and individual's success. • Explain the importance of active listening in the work environment. • State the appropriate techniques to be followed for active listening. • Explain the importance of tone and pitch ineffective communication. • Explain the importance of avoiding casual expletives and unpleasant terms while communicating professional circles. • Explain the importance of maintaining discipline and ethical behaviour at work. • State the common reasons for interpersonal conflict and how to resolve them. • Explain the importance of developing effective working relationships for professional success. • Describe the process of expressing and addressing grievances appropriately and effectively. • Explain the importance and process of planning daily tasks to ensure their timely completion and efficient use of time. • Explain the importance of adhering to the limits of authority at work. • Explain the importance of following the applicable quality standards and timescales at work. • Explain the importance of coordinating with co-workers to achieve the work objectives efficiently. • Explain the relevant documentation requirements. • Explain the importance of providing	• Demonstrate the process of preparing the relevant documents and reports as per the supervisor's instructions, providing appropriate information clearly and systematically. • Demonstrate how to mentor and assist subordinates in the execution of their work responsibilities. • Demonstrate the process of using various resources efficiently to ensure maximum utilisation and minimum wastage. • Demonstrate how to communicate clearly and politely to ensure effective communication with co-workers. • Demonstrate appropriate verbal and non-verbal communication that is respectful of genders and disability.

appropriate information clearly and systematically in work documents. • State the escalation matrix to be followed to deal with out of authority tasks and concerns. • Explain the importance and process of mentoring and assisting subordinates in the execution of their work responsibilities. • Explain how to identify possible disruptions to work prevent them. • Explain how to use various resources efficiently to ensure maximum utilisation and minimum wastage. • Explain the recommended practices to be followed at work to avoid and resolve conflicts at work. • Explain the importance and process of efficient and timely dissemination of information to the authorised personnel. • Explain the procedure to report inappropriate behaviour e.g., harassment.	
Classroom Aids:	
Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop	
Tools, Equipment and Other Requirements	
NA	

Module 4: Perform heat treatment operations

Mapped to CSC/N1001, v2.0

Terminal Outcomes:

- Identify tools and equipment required for heat treatment operations.
- Perform heat treatment on ferrous, non- ferrous metals and alloys.

Duration: 55:00	Duration: 90:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Describe mechanical and heat laws applicable on forging. • Discuss the information derived from the engineering drawings, work order, SOPs and instructions from supervisor. • List the tools, heat treatment apparatus and input materials required during heat treatment work. • Describe the selection criteria of tools, heat treatment apparatus and input materials required during work. • Describe metallurgical properties of the material used. • Discuss the organisational process of collecting and arranging the tools, heat treatment apparatus and input materials from the store. • Summarise the steps to be performed for checking the tools, heat treatment apparatus and input materials before use. • Discuss various heat treatment parameters and their impact on output. • Discuss the necessary precautions to avoid any hazard and accident during heat treatment activities. • Describe various heat treatment processes e.g. tempering heat treatment process, annealing heat treatment process, normalizing/stress relieving heat treatment process, carburising heat treatment process. • Discuss the process of lifting and placing the billets in the furnace as per the work instructions. • Discuss the importance of appropriate temperature levels of heating zones when the billets are passing through the furnace. • Explain methods of inspecting the quality, geometry, dimension and material of heat treated output. • Discuss the process of segregating bad	• Demonstrate the standard operating procedure to use tools and heat treatment apparatus required during heat treatment work. • Show how to select and arrange the required tools, heat treatment apparatus and input materials from the store. • Apply appropriate ways to check tools, heat treatment apparatus and input materials for proper functionality and calibration work before use. • Show how to prepare the work area and material for heat treatment work as per SOP. • Show how to set the tools, equipment and heat treatment apparatus and its parameters as per the work instructions. • Show how to set the induction heater temperature for pre-heating, heating as well as post-heating process. • Perform the steps of lifting and placing the billets in the furnace manually or by using lifting tools. • Apply appropriate ways to monitor the temperature levels of heating zones when the billets are passing through the furnace. • Demonstrate organisational procedure of performing various heat treatment processes on the work piece. • Show how to observe the uniform heating of metal. • Apply appropriate ways to cool the treated object as per SOP. • Demonstrate organisational procedure of performing quenching/cooling process on the components by using the appropriate medium and technique. • Employ appropriate ways of inspecting and measuring the heat treated output for required quality standards, dimensions, geometry and material.

quality and good quality billets.	• Show how to shut down the heat treatment equipment to a safe condition. • Show how to segregate the bad quality billets and send the good quality billets for next process. • Perform steps to report any emergencies/ deviations from the Work Instructions/ SOP to the supervisor.
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	
• Basic tool box, Work bench with vice • Various metal samples- carbon steel, stainless steel, cast steel, tool steel, bronze, bronze alloys, copper, copper alloys, Various types of furnaces (gas, electric, oil fired). hearth, pit, induction heating, kilns, tempering ovens, heated baths, gas torches, specialized tongs, lifting equipment etc. • **Safety materials**: Fire extinguisher, leather safety gloves, leather aprons, safety glasses with side shields, ear plug, safety shoes and first-aid kit • **Cleaning material**: Tip cleaner, wire brush (M.S.), cleaning agents, cleaning cloth, waste container, dust pan and brush set, liquid soap, hand towel	

Module 5: Perform forging operations

Mapped to CSC/N1101, v2.0

Terminal Outcomes:

- Identify tools and equipment required for forging operations.
- Perform forging techniques on ferrous, non- ferrous metals and alloys.

Duration: 77:00	Duration: 110:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Describe different types of forging processes. • Describe basic process followed for forging of the pieces. • Discuss the information derived from the engineering drawings, work order, SOPs and instructions from supervisor. • List the tools, equipment, dies and forging apparatus required during forging work. • Describe the selection criteria of tools, equipment, dies and forging apparatus required for forging work. • Discuss the organisational process of collecting and arranging the tools, equipment, dies and forging apparatus from the store. • Summarise the steps to be performed for checking the tools, equipment, dies and forging apparatus before use. • Discuss various forging machine parameters such as temperature of the furnace, cycle time for various temperature levels & time duration during the heating, pressing, cooling etc and their impact on output. • Discuss the necessary precautions to avoid any hazard and accident during forging activities. • Discuss the importance of selecting correct program in the forging machine for operation as per the work instructions. • Discuss various pressing process parameters such as cycle time, force applied, gear and pinion movements, friction, torque etc. and their impact on output. • Elaborate ways for feeding the hot metal bars into forging presses. • Discuss the importance of monitoring process parameters during the forging process and correcting them as per the requirements.	• Demonstrate the standard operating procedure to tools, equipment, dies and forging apparatus required during forging work. • Show how to select and arrange the required tools, equipment, dies and forging apparatus from the store. • Apply appropriate ways to check tools, equipment, dies and forging apparatus before use. • Apply appropriate ways to check that dies and forging apparatus are clean and free from dust and unwanted material. • Show how to set the forging machine and its parameters as per the work instructions. • Show how to fit the die in the forging machine. • Apply appropriate ways to measure and mark the specified features for plate bending and forming operations on the workpieces as per job specification. • Perform the steps of lifting and placing the heat treated pieces on the pressing machine manually or by using lifting tools. • Show how to attach hammer tools and fixtures to power hammer correctly. • Show how to select the program in the forging machine and modify it as per the production requirements and WI. • Show how to adjust the temperature of the die and various parameters of main press machine including blocker, finisher and trimmer as per the output requirement. • Read the measurement gauges to monitor the process parameters and maintain the quality standards. • Apply appropriate ways to monitor the forging operations and record the operational data as per the control plan. • Demonstrate organisational procedure of

• List the steps to be performed for observing and recording machine performance. • Discuss post-forging activities like inspection, cleaning, maintenance etc. • Explain methods of inspecting the quality of forged workpieces. • List the commonly occurring defects in the casted workpieces. • Describe various testing methods i.e. destructive and non-destructive tests. • Discuss the process of segregating, tagging and storing of damaged and ok workpieces and maintaining records of segregation as per organisational guidelines. • List the steps to be performed for checking the machine operations for any defects in its component and informing the supervisor. • Discuss documents and records needed to prepare and update related to forging work.	performing common heat treatments of normalising and annealing on forged steel. • Show how to remove the forged pieces from the machine after completion of forging process. • Demonstrate organisational specified procedure of finishing operations such as twisting, straightening etc. get the desired specifications. • Employ appropriate ways of measuring and comparing the final workpiece dimensions with the specified dimensions in the work order and engineering drawing. • Show how to adjust the parameters of the corresponding presses for the finishing operations to get the desired specifications. • Prepare a sample report about any problems faced during the forging process. • Apply appropriate inspection and testing methods for identifying the defects and checking the quality of forged workpieces as per the control plan. • Demonstrate organisational specified procedure of various testing methods i.e. destructive and non-destructive, eddy current testing and magnetic particle inspection for checking the defects and quality of forged pieces. • Demonstrate the standard operating procedure to use measurement instruments like rulers, Vernier calipers, micrometer, weighing scale, gauges and other inspection equipment • Employ appropriate ways for comparing the forged piece texture, color, surface properties, hardness and strength with the specified product specifications. • Show how to remove the minor defects like shape deformation, sharp edges, rough surfaces, extra material from grooves, holes, parting line area etc. from forged pieces. • Show how to segregate, tag, store and record data of damaged and ok workpieces as per organisational guidelines. • Employ appropriate ways for checking the machine operations for any defects in the component. • Show how to clean the tools and forging apparatus after completion of work.

Classroom Aids:
Whiteboard, marker pen, projector
Tools, Equipment and Other Requirements
• Basic tool box, Work bench with vice • Hydraulic press, mechanical press, various types of hammers, tongs, punches, chisel, anvil, leg vice, swage block, floor mandrel, swages, jig setter, shafted tools, wired tools, shovel, blower, poker, fullers, flatters, various ferrous & nonferrous metal samples, Upsetter, Material cutting machine • **Safety materials**: Fire extinguisher, leather safety gloves, leather aprons, safety glasses with side shields, ear plug, safety shoes and first-aid kit • **Cleaning material**: Tip cleaner, wire brush (M.S.), cleaning agents, cleaning cloth, waste container, dust pan and brush set, liquid soap, hand towel

Annexure

Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	**Specialization**	**Relevant Industry Experience**		**Training Experience**		**Remarks**
		Years	***Specialization***	***Years***	***Specialization***	
Diploma	Mechanical	3	Forging	1	Forging	NA
B.E/B.Tech	Mechanical	2	Forging	1	Forging	NA

Trainer Certification	
Domain Certification	**Platform Certification**
"Forger, CSC/Q1101, version 2.0". Minimum accepted score is 80%.	"Trainer, MEP/Q2601 v1.0" Minimum accepted score is 80%.

Assessor Requirements

Assessor Prerequisites						
Minimum Educational Qualification	**Specialization**	**Relevant Industry Experience**		**Training/Assessment Experience**		**Remarks**
		Years	***Specialization***	***Years***	***Specialization***	
Diploma	Mechanical/Fitter	3	Forging	1	Forging	NA
B.E/B.Tech	Mechanical	2	Forging	1	Forging	NA

Assessor Certification	
Domain Certification	**Platform Certification**
"Forger, CSC/Q1101, version 2.0". Minimum accepted score is 80%.	"Assessor; MEP/Q2701 v1.0" Minimum accepted score is 80%.

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Assessment Strategy

1. Assessment System Overview:
    - Batches assigned to the assessment agencies for conducting the assessment on SDMS/SIP or email
    - Assessment agencies send the assessment confirmation to VTP/TC looping SSC
    - Assessment agency deploys the ToA certified Assessor for executing the assessment
    - SSC monitors the assessment process & records

2. Testing Environment:
    - Confirm that the centre is available at the same address as mentioned on SDMS or SIP
    - Check the duration of the training.
    - Check the Assessment Start and End time to be as 10 a.m. and 5 p.m.
    - If the batch size is more than 30, then there should be 2 Assessors.
    - Check that the allotted time to the candidates to complete Theory & Practical Assessment is correct.
    - Check the mode of assessment—Online (TAB/Computer) or Offline (OMR/PP).
    - Confirm the number of TABs on the ground are correct to execute the Assessment smoothly.
    - Check the availability of the Lab Equipment for the particular Job Role.

3. Assessment Quality Assurance levels / Framework:
    - Question papers created by the Subject Matter Experts (SME)
    - Question papers created by the SME verified by the other subject Matter Experts
    - Questions are mapped with NOS and PC
    - Question papers are prepared considering that level 1 to 3 are for the unskilled & semi-skilled individuals, and level 4 and above are for the skilled, supervisor & higher management
    - Assessor must be ToA certified & trainer must be ToT Certified
    - Assessment agency must follow the assessment guidelines to conduct the assessment

4. Types of evidence or evidence-gathering protocol:
    - Time-stamped & geotagged reporting of the assessor from assessment location
    - Centre photographs with signboards and scheme specific branding
    - Biometric or manual attendance sheet (stamped by TP) of the trainees during the training period
    - Time-stamped & geotagged assessment (Theory + Viva + Practical) photographs & videos

5. Method of verification or validation:
    - Surprise visit to the assessment location
    - Random audit of the batch
    - Random audit of any candidate

6. Method for assessment documentation, archiving, and access
    - Hard copies of the documents are stored
    - Soft copies of the documents & photographs of the assessment are uploaded / accessed from Cloud Storage
    - Soft copies of the documents & photographs of the assessment are stored in the Hard Drives

References

Glossary

Term	Description
Declarative Knowledge	Declarative knowledge refers to facts, concepts and principles that need to be known and/or understood in order to accomplish a task or to solve a problem.
Key Learning Outcome	Key learning outcome is the statement of what a learner needs to know, understand and be able to do in order to achieve the terminal outcomes. A set of key learning outcomes will make up the training outcomes. Training outcome is specified in terms of knowledge, understanding (theory) and skills (practical application).
OJT (M)	On-the-job training (Mandatory); trainees are mandated to complete specified hours of training on site
OJT (R)	On-the-job training (Recommended); trainees are recommended the specified hours of training on site
Procedural Knowledge	Procedural knowledge addresses how to do something, or how to perform a task. It is the ability to work, or produce a tangible work output by applying cognitive, affective or psychomotor skills.
Training Outcome	Training outcome is a statement of what a learner will know, understand and be able to do upon the completion of the training.
Terminal Outcome	Terminal outcome is a statement of what a learner will know, understand and be able to do upon the completion of a module. A set of terminal outcomes help to achieve the training outcome.

Acronyms and Abbreviations

NOS	National Occupational Standard(s)
NSQF	National Skills Qualifications Framework
QP	Qualifications Pack
TVET	Technical and Vocational Education and Training
SOP	Standard Operating Procedure
WI	Work Instructions
PPE	Personal Protective equipment