सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

Qualification Pack

Transforming the skill landscape

Tool and Die Maker

QP Code: CSC/Q0306

Version: 2.0

NSQF Level: 5

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Contents

CSC/Q0306: Tool and Die Maker

Brief Job Description

The incumbent at this job performs various machining, fitting and assembling activities to manufacture tool and die as per the work requirements.

Personal Attributes

The job holder must have an eye for detail as well as the patience and discipline required to carry out detailed and repetitive tasks. The candidate should be able to read and understand technical manuals, instructions and warnings.

Applicable National Occupational Standards (NOS)

Compulsory NOS:

1. CSC/N1335: Follow the health and safety practices at the workplace
2. CSC/N1336: Coordinate with co-workers to achieve work efficiency
3. CSC/N0307: Prepare for the making of tools and die
4. CSC/N0316: Perform machining operations
5. CSC/N0308: Perform fitting operations
6. CSC/N0309: Perform assembly operations

Qualification Pack (QP) Parameters

Sector	Capital Goods
Sub-Sector	1. Machine Tools 2. Dies, Moulds and Press Tools 3. Plastics Manufacturing Machinery 4. Textile Manufacturing Machinery 5. Process Plant Machinery 6. Electrical and Power Machinery 7. Light Engineering Goods
Occupation	Fitting and Assembly
Country	India

NSQF Level	5
Aligned to NCO/ISCO/ISIC Code	NCO-2015/7222.050
Minimum Educational Qualification & Experience	12th Pass + ITI Fitter or Machinist with 2 years of relevant experience Or 12th Pass with 4 years of experience Or CNC programmer – Level - 4 with 2 years of relevant experience
Minimum Level of Education for Training in School	
Pre-Requisite License or Training	NA
Minimum Job Entry Age	18 Years
Last Reviewed On	
Next Review Date	
Deactivation Date	
NSQC Approval Date	
Version	2.0
Reference code on NQR	
NQR Version	2.0

CSC/N1335: Follow the health and safety practices at work

Description

This OS unit is about following the appropriate health and safety practices at work. It covers responsibilities towards self and others to ensure a safe work environment.

Scope

This unit/task covers the following:

- Maintain personal health and safety
- Assist in hazard management
- Check the first aid box, firefighting and safety equipment
- Assist in waste management
- Follow the fire safety guidelines
- Follow the emergency and first-aid procedures
- Carry out relevant documentation and review

Elements and Performance Criteria

Maintain personal health and safety

To be competent, the user/individual on the job must be able to:

PC1. follow the recommended practices to ensure protection from infections and transmission to others, such as the use of hand sanitiser and face mask

PC2. check the work conditions, assess the potential health and safety risks, and take appropriate measures to mitigate them

PC3. select and use the appropriate Personal Protective Equipment (PPE) relevant to the task and work conditions

PC4. follow the recommended techniques while lifting and moving heavy objects to avoid injury

PC5. follow the manufacturer's instructions and workplace safety guidelines while working on heavy machinery, tools and equipment

Assist in hazard management

To be competent, the user/individual on the job must be able to:

PC6. identify existing and potential hazards at work

PC7. assess the potential risks and injuries associated with the identified hazards

PC8. coordinate with the supervisor or other relevant personnel to prevent or minimise the identified hazards

PC9. handle hazardous materials safely and store them in the designated storage

Check the first aid box, firefighting and safety equipment

To be competent, the user/individual on the job must be able to:

PC10. check the first aid box to ensure it is updated with the relevant first aid supplies

PC11. check and test the firefighting and various safety equipment to ensure they are in usable condition

PC12. coordinate with the supervisor for the repair and replacement of firefighting and safety equipment

Assist in waste management

To be competent, the user/individual on the job must be able to:

PC13. segregate waste into appropriate categories

PC14. recycle the recyclable waste appropriately

PC15. dispose of the non-recyclable waste in an environment-friendly manner, complying with the applicable regulations

Follow the fire safety guidelines

To be competent, the user/individual on the job must be able to:

PC16. use the appropriate type of fire extinguisher to extinguish different types of fires safely

PC17. follow the recommended practices for a safe rescue during a fire emergency

PC18. coordinate with the fire department to request assistance to extinguish a serious fire

Follow the emergency and first-aid procedures

To be competent, the user/individual on the job must be able to:

PC19. follow the organisational health and safety guidelines during workplace emergencies to ensure own and co-workers' safety

PC20. follow the recommended practices to minimise loss to organisational property during an emergency

PC21. follow the recommended procedure to free a person from electrocution

PC22. administer appropriate first aid to the injured personnel

PC23. perform Cardiopulmonary Resuscitation (CPR) on a potential victim of cardiac arrest

PC24. coordinate with the emergency services to request medical assistance for seriously injured/ ill personnel requiring professional medical attention or hospitalisation

Carry out relevant documentation and review

To be competent, the user/individual on the job must be able to:

PC25. carry out appropriate documentation following a health and safety incident at work, including all the required information

PC26. coordinate with the relevant personnel to review health and safety conditions at work regularly or following an incident

PC27. assist in implementing appropriate changes to improve the health and safety conditions at work

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. 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

KU2. the importance and process of checking the work conditions, assessing the potential health and safety risks, and take appropriate measures to mitigate them

KU3. the importance and process of selecting and using the appropriate PPE relevant to the task and work conditions

KU4. the recommended techniques to be followed while lifting and moving heavy objects to avoid injury

KU5. the importance of following the manufacturer's instructions and workplace safety guidelines while working on heavy machinery, tools and equipment

KU6. the importance and process of identifying existing and potential hazards at work

KU7. the process of assessing the potential risks and injuries associated with the various hazards

KU8. how to prevent or minimise different types of hazards

KU9. how to handle and store hazardous materials safely

KU10. the importance of ensuring the first aid box is updated with the relevant first aid supplies

KU11. the process of checking and testing the firefighting and various safety equipment to ensure they are in a usable condition

KU12. the criteria for segregating waste into appropriate categories

KU13. the appropriate methods for recycling the recyclable waste

KU14. the process of disposing of the non-recyclable waste safely and the applicable regulations

KU15. use of different types of fire extinguishers to extinguish different types of fires

KU16. the recommended practices to be followed for a safe rescue during a fire emergency

KU17. how to request assistance from the fire department to extinguish a serious fire

KU18. the appropriate practices to be followed during workplace emergencies to ensure safety and minimise loss to organisational property

KU19. common health and safety hazards present in a work environment, associated risks, and how to mitigate them

KU20. safe working practices to be followed while working at various hazardous sites and using electrical equipment

KU21. the importance of ensuring easy access to firefighting and safety equipment

KU22. the appropriate preventative and remedial actions to be taken in the case of exposure to toxic materials, such as poisonous chemicals and gases

KU23. various causes of fire in different work environments and the recommended precautions to be taken to prevent fire accidents

KU24. different methods of extinguishing fire

KU25. different materials used for extinguishing fire, such as sand, water, foam, CO2, dry powder, etc.

KU26. the applicable rescue techniques to be followed during a fire emergency

KU27. the importance of placing safety signs and instructions at strategic locations in a workplace and following them

KU28. different types of first aid treatment to be provided for different types of injuries

KU29. potential injuries associated with incorrect manual handling

KU30. how to move an injured person safely

KU31. various hazards associated with the use of various machinery, tools, implements, equipment and materials

KU32. the importance of ensuring no obstruction and free access to fire exits
KU33. how to free a person from electrocution safely
KU34. how to administer appropriate first aid to an injured person
KU35. how to perform Cardiopulmonary Resuscitation (CPR)
KU36. the importance of coordinating with the emergency services to request urgent medical assistance for persons requiring professional medical attention or hospitalisation
KU37. the appropriate documentation to be carried out following a health and safety incident at work, and the relevant information to be included
KU38. the importance and process of reviewing the health and safety conditions at work regularly or following an incident
KU39. the importance and process of implementing appropriate changes to improve the health and safety conditions at work

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. maintain work-related notes and records
GS2. communicate clearly and politely with co-workers and clients
GS3. read the relevant literature to get the latest updates about the field of work
GS4. listen attentively to understand the information being shared
GS5. plan and prioritise tasks to ensure timely completion
GS6. take quick decisions to deal with workplace emergencies and accidents
GS7. identify possible disruptions to work and take appropriate preventive measures
GS8. coordinate with the co-workers to achieve the work objectives
GS9. evaluate all possible solutions to a problem to select the best one

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Maintain personal health and safety	**7**	**12**	**-**	**-**
PC1. follow the recommended practices to ensure protection from infections and transmission to others, such as the use of hand sanitiser and face mask	2	3	-	-
PC2. check the work conditions, assess the potential health and safety risks, and take appropriate measures to mitigate them	1	2	-	-
PC3. select and use the appropriate Personal Protective Equipment (PPE) relevant to the task and work conditions	1	2	-	-
PC4. follow the recommended techniques while lifting and moving heavy objects to avoid injury	1	3	-	-
PC5. follow the manufacturer's instructions and workplace safety guidelines while working on heavy machinery, tools and equipment	2	2	-	-
Assist in hazard management	**4**	**10**	**-**	**-**
PC6. identify existing and potential hazards at work	1	1	-	-
PC7. assess the potential risks and injuries associated with the identified hazards	1	3	-	-
PC8. coordinate with the supervisor or other relevant personnel to prevent or minimise the identified hazards	1	3	-	-
PC9. handle hazardous materials safely and store them in the designated storage	1	3	-	-
Check the first aid box, firefighting and safety equipment	**3**	**7**	**-**	**-**
PC10. check the first aid box to ensure it is updated with the relevant first aid supplies	1	2	-	-
PC11. check and test the firefighting and various safety equipment to ensure they are in usable condition	1	3	-	-
PC12. coordinate with the supervisor for the repair and replacement of firefighting and safety equipment	1	2	-	-
Assist in waste management	**3**	**8**	**-**	**-**
PC13. segregate waste into appropriate categories	1	3	-	-

PC14. recycle the recyclable waste appropriately	1	3	-	-
PC15. dispose of the non-recyclable waste in an environment-friendly manner, complying with the applicable regulations	1	2	-	-
Follow the fire safety guidelines	**3**	**12**	**-**	**-**
PC16. use the appropriate type of fire extinguisher to extinguish different types of fires safely	1	4	-	-
PC17. follow the recommended practices for a safe rescue during a fire emergency	1	4	-	-
PC18. coordinate with the fire department to request assistance to extinguish a serious fire	1	4	-	-
Follow the emergency and first-aid procedures	**7**	**12**	**-**	**-**
PC19. follow the organisational health and safety guidelines during workplace emergencies to ensure own and co-workers' safety	1	2	-	-
PC20. follow the recommended practices to minimise loss to organisational property during an emergency	1	3	-	-
PC21. follow the recommended procedure to free a person from electrocution	1	2	-	-
PC22. administer appropriate first aid to the injured personnel	1	2	-	-
PC23. perform Cardiopulmonary Resuscitation (CPR) on a potential victim of cardiac arrest	1	2	-	-
PC24. coordinate with the emergency services to request medical assistance for seriously injured/ ill personnel requiring professional medical attention or hospitalisation	2	1	-	-
Carry out relevant documentation and review	**3**	**9**	**-**	**-**
PC25. carry out appropriate documentation following a health and safety incident at work, including all the required information	1	3	-	-
PC26. coordinate with the relevant personnel to review health and safety conditions at work regularly or following an incident	1	3	-	-
PC27. assist in implementing appropriate changes to improve the health and safety conditions at work	1	3	-	-
NOS Total	**30**	**70**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N1335
NOS Name	Follow the health and safety practices at the work
Sector	Capital Goods
Sub-Sector	Generic
Occupation	Generic
NSQF Level	3
Credits	TBD
Version	2.0
Last Reviewed Date	
Next Review Date	
Deactivation Date	
NSQC Clearance Date	

CSC/N1336: Coordinate with co-workers to achieve work efficiency

Description

This OS unit is about working in coordination with co-workers to achieve the work objectives efficiently. It also covers practising inclusion at work.

Scope

This unit/task covers the following:

- Work effectively with co-workers
- Communicate effectively with co-workers
- Practice inclusion at work

Elements and Performance Criteria

Work effectively with co-workers

To be competent, the user/individual on the job must be able to:

PC1. plan daily tasks at work to ensure their timely completion and efficient use of time

PC2. carry out work responsibilities adhering to the limits of authority

PC3. follow the supervisor's instructions to ensure adherence to the applicable quality standards and timescales

PC4. coordinate with the co-workers to achieve the work objectives efficiently

PC5. prepare the relevant documents and reports as per the supervisor's instructions, providing appropriate information clearly and systematically

PC6. coordinate with the supervisor or relevant personnel to deal with out of authority tasks and concerns

PC7. mentor and assist subordinates in the execution of their work responsibilities

PC8. identify possible disruptions to work through coordination with the relevant stakeholders and take appropriate preventive measures

PC9. use various resources efficiently to ensure maximum utilisation and minimum wastage

PC10. follow the recommended practices to avoid and resolve conflicts at work

PC11. follow the relevant organisational policies to ensure disciplined behaviour with maximum productivity at work

Communicate effectively with co-workers

To be competent, the user/individual on the job must be able to:

PC12. follow the organisational policy for the efficient and timely dissemination of information to the authorised personnel

PC13. communicate clearly and politely to ensure effective communication with co-workers

PC14. follow the appropriate techniques for active listening during interactions

Practice inclusion at work

To be competent, the user/individual on the job must be able to:

PC15. empathise with Persons with Disabilities (PwD)

PC16. adopt gender-neutral behaviour at work

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. the importance and process of effective communication in the workplace
KU2. the barriers to effective communication and how to overcome them
KU3. the importance of teamwork in an organisation's and individual's success
KU4. the importance of active listening in the work environment
KU5. the appropriate techniques to be followed for active listening
KU6. importance of tone and pitch in effective communication
KU7. importance of avoiding casual expletives and unpleasant terms while communicating professional circles
KU8. the importance of maintaining discipline and ethical behaviour at work
KU9. the common reasons for interpersonal conflict and how to resolve them
KU10. the importance of developing effective working relationships for professional success
KU11. how expressing and addressing grievances appropriately and effectively
KU12. the importance and process of planning daily tasks to ensure their timely completion and efficient use of time
KU13. the importance of adhering to the limits of authority at work
KU14. the importance of following the applicable quality standards and timescales at work
KU15. the importance of coordinating with the co-workers to achieve the work objectives efficiently
KU16. the relevant documentation requirements
KU17. the importance of providing appropriate information clearly and systematically in work documents
KU18. the escalation matrix to be followed to deal with out of authority tasks and concerns
KU19. the importance and process of mentoring and assisting subordinates in the execution of their work responsibilities
KU20. how to identify possible disruptions to work prevent them
KU21. how to use various resources efficiently to ensure maximum utilisation and minimum wastage
KU22. the recommended practices to be followed at work to avoid and resolve conflicts at work
KU23. the importance and process of efficient and timely dissemination of information to the authorised personnel
KU24. how to communicate clearly and politely to ensure effective communication
KU25. the importance of following the recommended practices to ensure an inclusive environment for PwD and all genders at work

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. maintain work-related notes and records
GS2. read work-related and other relevant literature
GS3. communicate politely and -professionally
GS4. listen attentively to understand the information or instructions being shared
GS5. plan and prioritise tasks to ensure timely completion
GS6. take prompt decisions to deal with workplace emergencies and accidents
GS7. evaluate all possible solutions to a problem to select the best one

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Work effectively with co-workers	20	24	-	-
PC1. plan daily tasks at work to ensure their timely completion and efficient use of time	2	4	-	-
PC2. carry out work responsibilities adhering to the limits of authority	2	4	-	-
PC3. follow the supervisor's instructions to ensure adherence to the applicable quality standards and timescales	2	4	-	-
PC4. coordinate with the co-workers to achieve the work objectives efficiently	2	4	-	-
PC5. prepare the relevant documents and reports as per the supervisor's instructions, providing appropriate information clearly and systematically	2	4	-	-
PC6. coordinate with the supervisor or relevant personnel to deal with out of authority tasks and concerns	2	4	-	-
PC7. mentor and assist subordinates in the execution of their work responsibilities	2	4	-	-
PC8. identify possible disruptions to work through coordination with the relevant stakeholders and take appropriate preventive measures	2	4	-	-
PC9. use various resources efficiently to ensure maximum utilisation and minimum wastage	2	4	-	-
PC10. follow the recommended practices to avoid and resolve conflicts at work	1	4	-	-
PC11. follow the relevant organisational policies to ensure disciplined behaviour with maximum productivity at work	1	3	-	-
Communicate effectively with co-workers	6	15	-	-
PC12. follow the organisational policy for the efficient and timely dissemination of information to the authorised personnel	2	5	-	-
PC13. communicate clearly and politely to ensure effective communication with co-workers	2	5	-	-
PC14. follow the appropriate techniques for active listening during interactions	2	5	-	-
Practice inclusion at work	4	12	-	-

PC15. empathise with Persons with Disabilities (PwD)	2	6	-	-
PC16. adopt gender-neutral behaviour at work	2	6	-	-
NOS Total	**30**	**70**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N1336
NOS Name	Coordinate with co-workers to achieve work efficiency
Sector	Capital Goods
Sub-Sector	Generic
Occupation	Generic
NSQF Level	3
Credits	TBD
Version	2.0
Last Reviewed Date	
Next Review Date	
Deactivation Date	
NSQC Clearance Date	

CSC/N0307: Prepare for making of tools and die

Description

This unit is about planning and preparing for making of tools and die as per the given work order and the standards specified by the organization.

Scope

This unit/task covers the following:

- Identify work requirements
- Prepare for tools and die manufacturing process

Elements and Performance Criteria

Identify work requirements

To be competent, the user/individual on the job must be able to:

PC1. identify work requirements by interpreting and analysing drawings; blueprints; planning documentation; quality control documents; operation sheets; process specifications etc. and instructions received from supervisor

PC2. compute dimensions, sizes, shapes and tolerances of sub-assemblies of the tools and dies as specified in drawing/blue print

PC3. Identify and select appropriate machining, fitting and assembling operations on the basis of drawing/design requirements

PC4. identify the tools, lifting equipment, machine and input materials required for the job

Prepare for tools and die manufacturing process

To be competent, the user/individual on the job must be able to:

PC5. plan sequence of machining, fitting and assembling operations for tools & die manufacturing on the basis of drawing/blue print

PC6. use appropriate Personal Protective Equipment (PPE) for safe working in toolroom

PC7. select and arrange the raw material, tools, equipment, machines and consumables as per the SOP and job requirements

PC8. check the raw material, tools, lifting equipment and machines for any defects and required quality standards

PC9. check and calibrate the tools and equipment before use

PC10. plan timelines and establish milestones for each task accurately

PC11. obtain necessary approvals for the plan by following organizational procedures

PC12. allocate responsibilities to machine operators and hand over tools, equipment and metal components to be machined to them

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. relevant legislation, standards, policies, and procedures followed in the organization

KU2. valid sources for information about job specifications

Valid sources: job instruction sheet/job card; work drawings and instructions; planning documentation; quality control documents; operation sheets; process specifications; instructions from supervisor

KU3. how to read and establish various types of job specification documents for job requirements

Job requirements: raw materials or components required (type, quality, quantity); dimensions; limits and tolerances; surface texture requirements; operations required (list, sequence and procedures where applicable); shape or profiles to be fabricated; cutting, bending and rolling allowances for fabricated forms; instruments and tools to be used; interdependencies; timelines

KU4. various fitting activities to be carried out

Fitting activities: measuring and marking out; fabrication using hand tools; fabrication using manually operated power tools (cutting, forming, grinding, drilling, threading, tapping, reaming, polishing, boring, etc.)

KU5. various hand fitting methods such as cutting out the rough profile using saws (e.g. hacksaw, band saw), cutting a screw thread (e.g. tapping or dieing), filing (flat, square, curved), drilling holes, tapping

KU6. basic tool and die manufacturing process

KU7. how to access the specific computer modelling software to be used

KU8. geometric dimensioning and tolerancing -- GD&T

KU9. required dimensional parameters and components quality standards as per the process

Parameters: linear dimensions (e.g. lengths, depths); diameters (e.g. external, internal); flatness; squareness; angles; profiles; hole size and position; thread; size and fit; surface finish

Quality standards: components to be free from false tool cuts, burrs and sharp edges; dimensional tolerance +/-0.020mm; flatness and squareness 0.05mm; angles within +/- 1 degree; screw threads to fit as per standard; reamed and bored holes within interference: -0.025mm (hole) + 0.025mm (shaft), transition: - 0.1mm (hole) + 0.1 (shaft) , clearance: 50microns; radius: 0.5 r; surface finish 63in or 1.6 m

KU10. various types of machining processes such as drilling, grinding, boring, turning, milling etc.

KU11. various assembly operations and methods like bolting, torqueing, tightening, fitting, greasing, hammering, sealing, clamping etc.

KU12. the impact of various machining parameters on the final product

KU13. SOP recommended by the organisation for operating CNC and conventional machine

KU14. SOP recommended by the manufacturer for using tools and machines like grinders, lathe machines, CNC machines and tools like bolting guns, rivet guns, nuts, bolts, screw drivers, wrenches, hacksaws, hammers etc. required during tool and die manufacturing operations

KU15. impact of various assembly process like bolting, torqueing, tightening, fitting, greasing, hammering, sealing, clamping on the final product

KU16. how to select material to be used based on properties like hardness and tolerance for forming the tool

KU17. various work holding devices and equipment such as bench / machine vice; clamps (e.g.

toolmakers); three jaw chuck; four-jaw chuck; collet chuck; drive plate and centres; magnetic chucks (holding devices); special purpose tool holders (3R for holding electrodes)

KU18. properties of metals

Properties: plasticity, elasticity, ductility, malleability, toughness, hardness, tensile strength, compressive strength, shear strength, corrosion resistance, density)

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. note the information related to work and processes
GS2. write reports and observations related to work in English/regional language
GS3. read and interpret and process flowchart for all operations
GS4. read manuals and operation documents to understand the Equipment used into operation
GS5. discuss task lists, schedules and activities with the seniors and team members
GS6. follow organization rule-based decision making process
GS7. take decisions with systematic course of actions and/or response
GS8. plan and organize tasks to meet deadlines
GS9. find ways of modifying difficult operating stages to make it operation friendly
GS10. apply domain information to set and define operation parameters that ensures economy and quality of the product
GS11. analyse the complexity of work to determine if it can be successfully carried out or needs to be referred to a superior/specialist
GS12. recognise a workplace problem and take suitable action to resolve it

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Identify work requirements	**14**	**14**	**-**	**10**
PC1. identify work requirements by interpreting and analysing drawings; blueprints; planning documentation; quality control documents; operation sheets; process specifications etc. and instructions received from supervisor	2	3	-	2
PC2. compute dimensions, sizes, shapes and tolerances of sub-assemblies of the tools and dies as specified in drawing/blue print	2	3	-	1
PC3. identify and select appropriate machining, fitting and assembling operations on the basis of drawing/design requirements	5	4	-	4
PC4. identify the tools, lifting equipment, machine and input materials required for the job	5	4	-	3
Prepare for tools and die manufacturing process	**16**	**36**	**-**	**10**
PC5. plan sequence of machining, fitting and assembling operations for tools & die manufacturing on the basis of drawing/blue print	2	5	-	1
PC6. use appropriate Personal Protective Equipment (PPE) for safe working in toolroom	1	2	-	-
PC7. select and arrange the raw material, tools, equipment, machines and consumables as per the SOP and job requirements	3	7	-	2
PC8. check the raw material, tools, lifting equipment and machines for any defects and required quality standards	3	7	-	2
PC9. check and calibrate the tools and equipment before use	2	5	-	2
PC10. plan timelines and establish milestones for each task accurately	1	2	-	1
PC11. obtain necessary approvals for the plan by following organizational procedures	2	4	-	1
PC12. allocate responsibilities to machine operators and hand over tools, equipment and metal components to be machined to them	2	4	-	1
NOS Total	**30**	**50**	**-**	**20**

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0307
NOS Name	Prepare for making of tools and die
Sector	Capital Goods
Sub-Sector	1. Machine Tools 2. Dies, Moulds and Press Tools 3. Plastics Manufacturing Machinery 4. Textile Manufacturing Machinery 5. Process Plant Machinery 6. Electrical and Power Machinery 7. Light Engineering Goods
Occupation	Fitting and Assembly
NSQF Level	5
Credits	TBD
Version	2.0
Last Reviewed Date	
Next Review Date	
NSQC Clearance Date	

CSC/N0316: Perform machining operations

Description

This unit is about performing various machining operations i.e. drilling, grinding, turning, milling etc. for the manufacturing of tools and die as per organizational standards

Scope

This unit/task covers the following:

- Prepare for machining operations
- Perform machining operations
- Perform post-machining activities

Elements and Performance Criteria

Prepare for machining operations

To be competent, the user/individual on the job must be able to:

PC1. plan machining operations for tools & die manufacturing on the basis of drawing/blue print

PC2. ensure that the components used are free from foreign objects, dirt or other contamination

PC3. prepare and maintain the work area as per procedure or operation specification

PC4. confirm with the machine setter that the machine is ready for production

PC5. ensure that machine guards are in place and are correctly adjusted

PC6. identify and fix different types of cutters or cutting tools in the CNC or conventional machines required for various machining operations

PC7. clamp the workpiece securely and without distortion in a chuck/work holding device such as vice, V-block, clamp, angle plate, etc.

PC8. ensure that machine settings are adjusted as per SOP to maintain the required accuracy and quality standards

Quality standards: components to be free from false tool cuts, burrs and sharp edges; dimensional tolerance 0.020 to 0.030 mm; flatness and squareness within 0.125mm; surface finish 63in or 1.6m; angles within +/- 1 degree

PC9. measure and mark reference points/cutting lines on the metal blocks by using appropriate marking and measuring tools

PC10. lift the metal blocks manually or by hoist and place the same securely on the working platform as indicated in the drawing/work instructions

PC11. cut the metal blocks into required size by using power operated/manual/automatic cutting tools as per the requirement

Perform machining operations

To be competent, the user/individual on the job must be able to:

PC12. perform rough machining for initial block sizing of work piece

PC13. ensure that the right programme is selected in the CNC machine as defined in the SOP

PC14. perform various machining operations such as drilling, boring, grinding, turning, milling etc. on the metal block to get the shape and dimension as per the drawing/work order

PC15. operate the machine controls in both hand and power modes

PC16. produce components as per given quality standards e.g. components to be free from false tool cuts, burrs and sharp edges; dimensional tolerance 0.020 to 0.030 mm; flatness and squareness within 0.125mm; surface finish 63in or 1.6m; angles within +/- 1 degree, etc.

PC17. cut, shape and trim the metal block to specified lengths and shapes by using CNC machines

PC18. apply cutting fluids with regard to a range of different materials

PC19. monitor the process parameters by reading the various gauges and correct them if not within standards

PC20. monitor the machine operations for any malfunctions/defects in the component and inform the supervisor/maintenance team for correction

PC21. measure the machined pieces and compare with the dimensions as prescribed in the work order and engineering drawing

PC22. shut down the machine to a safe condition on completion of the machining activities

Perform post-machining activities

To be competent, the user/individual on the job must be able to:

PC23. check the machined components for any defects and required quality standards

PC24. segregate the machines components in to Ok pieces, defective pieces which can be repaired/reworked and pieces that are beyond repair

PC25. maintain and update all the records and reports related to production of tools and die as per the organisational guidelines

PC26. dispose scrap or waste material into the disposal area in accordance with the company's policies and environmental regulations

PC27. report any difficulties or problems that may arise with the machining activities, and carry out any agreed actions

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. relevant legislation, standards, policies, and procedures followed in the organization

KU2. how to read and establish various types of job specification documents for job requirements

Job requirements: raw materials or components required (type, quality, quantity); dimensions; limits and tolerances; surface texture requirements; operations required (list, sequence and procedures where applicable); shape or profiles to be fabricated; cutting, bending and rolling allowances for fabricated forms; instruments and tools to be used; interdependencies; timelines

KU3. various types of machining processes such as drilling, grinding, boring, turning, milling etc.

KU4. carious types of CNC and conventional machines i.e. milling machines, CNC lathe etc.

KU5. different types of cutting tools and their uses

KU6. the impact of various machining parameters on the final product

KU7. SOP recommended by the organisation for operating CNC and conventional machine

KU8. SOP recommended by the manufacturer for using tools and machines like grinders, lathe machines, CNC machines and tools like bolting guns, rivet guns, nuts, bolts, screw drivers,

wrenches, hacksaws, hammers etc. required during tool and die manufacturing operations

KU9. how to select material to be used based on properties like hardness and tolerance for forming the tool

KU10. how to select cutting tools, tool materials, chip breaker geometry, selecting cutting parameters from tool catalogues, selecting coolant

KU11. various work holding devices and equipment such as bench / machine vice; clamps (e.g. toolmakers); three jaw chuck; four-jaw chuck; collet chuck; drive plate and centres; magnetic chucks (holding devices); special purpose tool holders (3R for holding electrodes)

KU12. effects of backlash in machine slides and screws, and how this can be overcome

KU13. effects of clamping the workpiece in a chuck/work holding device, and how this can cause distortion in the finished components

KU14. how to use measurement instruments like rulers, Vernier calipers, micrometer, weighing scale, gauges and other inspection equipment

KU15. problems that can occur with the machining activities, and how these can be overcome

KU16. various type of defects in machined products

KU17. how to check defects in the machined products

KU18. safety requirements during the tool and die manufacturing work

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. note the information related to work and processes

GS2. write reports and observations related to work in English/regional language

GS3. read and interpret and process flowchart for all operations

GS4. read manuals and operation documents to understand the equipment used into operation

GS5. discuss task lists, schedules and activities with the seniors and team members

GS6. follow organization rule-based decision making process

GS7. take decisions with systematic course of actions and/or response

GS8. plan and organize tasks to meet deadlines

GS9. find ways of modifying difficult operating stages to make it operation friendly

GS10. apply domain information to set and define operation parameters that ensures economy and quality of the product

GS11. analyse the complexity of work to determine if it can be successfully carried out or needs to be referred to a superior/specialist

GS12. recognise a workplace problem and take suitable action to resolve it

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Prepare for machining operations	**12**	**19**	**-**	**7**
PC1. plan machining operations for tools & die manufacturing on the basis of drawing/blue print	1	1	-	1
PC2. ensure that the components used are free from foreign objects, dirt or other contamination	1	1	-	-
PC3. prepare and maintain the work area as per procedure or operation specification	1	2	-	1
PC4. confirm with the machine setter that the machine is ready for production	-	1	-	-
PC5. ensure that machine guards are in place and are correctly adjusted	1	1	-	-
PC6. identify and fix different types of cutters or cutting tools in the CNC or conventional machines required for various machining operations	2	3	-	1
PC7. clamp the workpiece securely and without distortion in a chuck/work holding device such as vice, V-block, clamp, angle plate, etc.	1	2	-	1
PC8. ensure that machine settings are adjusted as per SOP to maintain the required accuracy and quality standards **Quality standards:** components to be free from false tool cuts, burrs and sharp edges; dimensional tolerance 0.020 to 0.030 mm; flatness and squareness within 0.125mm; surface finish 63in or 1.6m; angles within +/- 1 degree	2	2	-	1
PC9. measure and mark reference points/cutting lines on the metal blocks by using appropriate marking and measuring tools	1	2	-	1
PC10. lift the metal blocks manually or by hoist and place the same securely on the working platform as indicated in the drawing/work instructions	1	2	-	-
PC11. cut the metal blocks into required size by using power operated/manual/automatic cutting tools as per the requirement	1	2	-	1
Perform machining operations	**14**	**24**	**-**	**11**

PC12. perform rough machining for initial block sizing of work piece	1	2	-	-
PC13. ensure that the right programme is selected in the CNC machine as defined in the SOP	2	2	-	1
PC14. perform various machining operations such as drilling, boring, grinding, turning, milling etc. on the metal block to get the shape and dimension as per the drawing/work order	3	5	-	3
PC15. operate the machine controls in both hand and power modes	1	1	-	-
PC16. produce components as per given quality standards e.g. components to be free from false tool cuts, burrs and sharp edges; dimensional tolerance 0.020 to 0.030 mm; flatness and squareness within 0.125mm; surface finish 63in or 1.6m; angles within +/- 1 degree, etc.	2	3	-	2
PC17. cut, shape and trim the metal block to specified lengths and shapes by using CNC machines	1	2	-	1
PC18. apply cutting fluids with regard to a range of different materials	1	1	-	1
PC19. monitor the process parameters by reading the various gauges and correct them if not within standards	1	1	-	1
PC20. monitor the machine operations for any malfunctions/defects in the component and inform the supervisor/maintenance team for correction	1	2	-	1
PC21. measure the machined pieces and compare with the dimensions as prescribed in the work order and engineering drawing	1	2	-	1
PC22. shut down the machine to a safe condition on completion of the machining activities	-	1	-	-
Perform post-machining activities	**4**	**9**	**-**	**2**
PC23. check the machined components for any defects and required quality standards	2	3	-	1
PC24. segregate the machines components in to Ok pieces, defective pieces which can be repaired/reworked and pieces that are beyond repair	1	2	-	-
PC25. maintain and update all the records and reports related to production of tools and die as per the organisational guidelines	1	2	-	1
PC26. dispose scrap or waste material into the disposal area in accordance with the company's	-	1	-	-

policies and environmental regulations				
PC27. report any difficulties or problems that may arise with the machining activities, and carry out any agreed actions	-	1	-	-
NOS Total	**30**	**50**	**-**	**20**

National Occupational Standards (NOS) Parameters

NOS Code	CSC/0316
NOS Name	Perform machining operations
Sector	Capital Goods
Sub-Sector	1. Machine Tools 2. Dies, Moulds and Press Tools 3. Plastics Manufacturing Machinery 4. Textile Manufacturing Machinery 5. Process Plant Machinery 6. Electrical and Power Machinery 7. Light Engineering Goods
Occupation	Fitting and Assembly
NSQF Level	5
Credits	TBD
Version	2.0
Last Reviewed Date	
Next Review Date	
NSQC Clearance Date	

CSC/N0308: Perform fitting operations

Description

This unit is about performing fitting of metal components for making of tools and die using hand tools and manually operated machines as per given specifications.

Scope

This unit/task covers the following:

- Prepare for fitting operations
- Perform marking on the components
- Perform fitting operations
- Perform post-fitting activities

Elements and Performance Criteria

Prepare for fitting operations

To be competent, the user/individual on the job must be able to:

PC1. plan fitting operations for tools & die manufacturing on the basis of drawing/blue print

PC2. prepare the work area for the fitting operations as per procedure or operational specification

PC3. ensure that all measuring equipment is calibrated and approved for usage

PC4. set work pieces as per job requirements using appropriate positioning and/or holding devices and support mechanisms

Perform marking on the components

To be competent, the user/individual on the job must be able to:

PC5. use a range of marking out equipment and mark the dimensions on the workpiece by applying an appropriate method of marking out

PC6. mark out a range of features (Features: datum/centre lines, lines (perpendicular, parallel), circles, profiles (square/rectangular, radial, angles/angular), hole positions (radial, linear), allowances for bending, simple pattern development) on the workpiece

PC7. mark out templates for tracing/transferring the specified features on the workpieces as per job specification

PC8. trace/transfer the specified features from the templates onto the workpieces as per job specification

Perform fitting operations

To be competent, the user/individual on the job must be able to:

PC9. perform fitting operations on various forms of metal components using a range of hand tools and manually operated machines by following organizational specified sequence and procedure as per job specifications

PC10. produce components with various features as per standards applicable to the process (Features of components produced: flat; parallel and angular faces; perpendicular plates; radii and curved profiles; drilled holes(through, to a depth); internal and external threads;

sliding or mating parts; counter bore, countersink, or spot face; chamfers; reamed holes; faces which are square to each other; faces which are parallel to each other)

PC11. interpret in-built fault indicators and error codes of equipment and respond to the same as per operating manual/organizational guidelines

PC12. check the fitted components to ensure completeness of work

Perform post-fitting activities

To be competent, the user/individual on the job must be able to:

PC13. perform necessary quality checks or tests for correct fitting, dimensional accuracy and required quality standards

PC14. use the appropriate measuring equipment for checking activities

PC15. report conditions and seek appropriate assistance in a timely manner to address risk of failure to comply with necessary targets and specifications

PC16. deal with finished components as per organizational guidelines

PC17. prepare job card, progress records, incident reports etc. for the higher authorities as per organizational procedures

PC18. clean and store all the tools, machine and equipment after completion of work

PC19. dispose scrap or waste material into the disposal area in accordance with the company's policies and environmental regulations

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. relevant legislation, standards, policies, and procedures followed in the organization

KU2. common terminology used in fitting

KU3. importance of using correct procedures as per type and form of materials and metal components

Forms of metal components: square/rectangular (e.g. bar stock, sheet material, machined components); circular/cylindrical (e.g. bar stock, tubes, turned components, flat discs); sections (e.g. angles, channel, tee section, joists, extrusions); irregular shapes/profile (e.g. castings, forgings, odd shaped components)

KU4. marking methods i.e. direct marking using instruments, use of templates, tracing/transfer methods

KU5. methods of marking out cutting guidelines for square and rectangular profiles, circular and radial profiles, angles and hole positions

KU6. marking out features i.e. datum/centre lines, lines (perpendicular, parallel), circles, profiles (square/rectangular, radial, angles/angular), hole positions (radial, linear), allowances for bending, simple pattern development

KU7. ways of laying out the marking-out shapes or patterns to optimize use of materials

Marking out tools: scales/tapes, dividers/trammels, scribers, punches, scribing blocks, squares, protractor, depth/internal/external micrometres, callipers (vernier, inside and outside, depth), gauges (height Vernier, feeler, bore/hole, slip, radius/profile, thread, plug), stick micrometres, dial stand and comparator, vee block with u-clamp

KU8. SOP recommended by manufacturer for using various measuring instruments, marking and fitting tools and equipment required during work

KU9. importance of following specified fitting sequences and procedures

KU10. suitability of workpieces/materials and consumables: e.g. correct type and code, correct form, correct dimensions, damage free, correctly issued, etc.

KU11. correct techniques and procedures to carry out and fitting operations by hand tools and manually operated machines

Hand tools: hacksaws; hammers; punches; screwdrivers; sockets; wrenches; spanners; scrapers; chisels; gouges; files; taps; vices and clamps

Manually operated machine tools: drills (power drills, pedestal drills), grinders (hand held power grinders, pedestal grinders), saws (jigsaws, cutting saws), shears (hand shear, mechanized shears), nibblers, press V-shape, punching machines, bending machines, threading machines

Fitting techniques: filing, drilling, chiselling, threading(external, internal), hand tapping, scraping, manual lapping

KU12. how to secure and position the workpiece/raw material correctly using appropriate holding devices and mechanisms

Positioning and holding devices: belts; braces; clamps; jigs and fixtures; bolt straps; blocks and tables; manual lifts; ropes; jacks

KU13. common problems that can occur in the fitting operations and their implications

KU14. ways to address problems commonly encountered during fitting operations

KU15. importance of reporting problems immediately and accurately

KU16. how to check the quality and dimensionmal accuracy of the shaped components against the specified quality standards

Components quality standards: flat; parallel and angular faces; perpendicular plates; radii and curved profiles; drilled holes(through, to a depth); internal and external threads; sliding or mating parts; counter bore, countersink, or spot face; chamfers; reamed holes; faces which are square to each other; faces which are parallel to each other

Dimensional parameters: linear dimensions; flatness; squareness; depths; angles; profiles; hole position; hole size/fit; thread size and fit

KU17. how to check the workpiece and the measuring equipment that is used

Measuring equipment: external micrometers, vernier/digital/dial caliper, surface finish equipment (e.g. comparison plates, machines), rules, squares, protractors, depth micrometers, depth verniers, feeler gauges, bore/hole gauges, slip gauges, radius/profile gauges, thread gauges, height gauge, hardness tester, dial test indicators (DTI), surface roughness tester, coordinate measuring machine (CMM), profile projectors, form testers

KU18. how to measure internal and external dimensions

KU19. safety practices need to follow during fitting activities

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. note the information related to work and processes
GS2. write reports and observations related to work in English/regional language
GS3. read and interpret and process flowchart for all operations
GS4. read manuals and operation documents to understand the Equipment used into operation
GS5. discuss task lists, schedules and activities with the seniors and team members
GS6. follow organization rule-based decision making process
GS7. take decisions with systematic course of actions and/or response
GS8. plan and organize tasks to meet deadlines
GS9. find ways of modifying difficult operating stages to make it operation friendly
GS10. recognise a workplace problem and take suitable action to resolve it
GS11. apply domain information to set and define operation parameters that ensures economy and quality of the product
GS12. analyse the complexity of work to determine if it can be successfully carried out or needs to be referred to a superior/specialist

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Prepare for fitting operations	8	12	-	5
PC1. plan fitting operations for tools & die manufacturing on the basis of drawing/blue print	2	3	-	1
PC2. prepare the work area for the fitting operations as per procedure or operational specification	2	3	-	2
PC3. ensure that all measuring equipment is calibrated and approved for usage	2	3	-	1
PC4. set work pieces as per job requirements using appropriate positioning and/or holding devices and support mechanisms	2	3	-	1
Perform marking on the components	6	10	-	4
PC5. use a range of marking out equipment and mark the dimensions on the workpiece by applying an appropriate method of marking out	1	2	-	1
PC6. mark out a range of features (Features: datum/centre lines, lines (perpendicular, parallel), circles, profiles (square/rectangular, radial, angles/angular), hole positions (radial, linear), allowances for bending, simple pattern development) on the workpiece	2	3	-	1
PC7. mark out templates for tracing/transferring the specified features on the workpieces as per job specification	2	3	-	2
PC8. trace/transfer the specified features from the templates onto the workpieces as per job specification	1	2	-	-
Perform fitting operations	8	14	-	6
PC9. perform fitting operations on various forms of metal components using a range of hand tools and manually operated machines by following organizational specified sequence and procedure as per job specifications	3	5	-	2
PC10. produce components with various features as per standards applicable to the process (Features of components produced: flat; parallel and angular faces; perpendicular	3	5	-	2

plates; radii and curved profiles; drilled holes(through, to a depth); internal and external threads; sliding or mating parts; counter bore, countersink, or spot face; chamfers; reamed holes; faces which are square to each other; faces which are parallel to each other)				
PC11. interpret in-built fault indicators and error codes of equipment and respond to the same as per operating manual/organizational guidelines	1	2	-	1
PC12. check the fitted components to ensure completeness of work	1	2	-	1
Perform post-fitting activities	**8**	**14**	**-**	**5**
PC13. perform necessary quality checks or tests for correct fitting, dimensional accuracy and required quality standards	2	3	-	2
PC14. use the appropriate measuring equipment for checking activities	2	3	-	1
PC15. report conditions and seek appropriate assistance in a timely manner to address risk of failure to comply with necessary targets and specifications	1	2	-	1
PC16. deal with finished components as per organizational guidelines	1	1	-	-
PC17. prepare job card, progress records, incident reports etc. for the higher authorities as per organizational procedures	1	2	-	1
PC18. clean and store all the tools, machine and equipment after completion of work	1	2	-	-
PC19. dispose scrap or waste material into the disposal area in accordance with the company's policies and environmental regulations	-	1	-	-
NOS Total	**30**	**50**	**-**	**20**

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0308
NOS Name	Perform fitting operations
Sector	Capital Goods
Sub-Sector	1. Machine Tools 2. Dies, Moulds and Press Tools 3. Plastics Manufacturing Machinery 4. Textile Manufacturing Machinery 5. Process Plant Machinery 6. Electrical and Power Machinery 7. Light Engineering Goods
Occupation	Fitting and Assembly
NSQF Level	5
Credits	TBD
Version	2.0
Last Reviewed Date	
Next Review Date	
NSQC Clearance Date	

CSC/N0309: Perform assembly operations

Description

This unit is about performing assembly and final quality check activities to make tools and die of features as per given specifications.

Scope

This unit/task covers the following:

- Prepare for assembling operations
- Perform assembling operations
- Perform post-assembly activities

Elements and Performance Criteria

Prepare for assembling operations

To be competent, the user/individual on the job must be able to:

PC1. plan assembling operations for tools & die manufacturing on the basis of drawing/blue print

PC2. prepare the work area for the assembling operations as per procedure or operational specification

PC3. select standard and specialized measuring instruments based on tolerances required and take measurements of tools and die components

PC4. compare measurements to drawings and sketches to ensure conformity, fits and clearances

PC5. record critical dimensions as required by workplace procedures

PC6. lift the work pieces manually or by hoist and place the same securely on the designated slot/space as indicated in the drawing/work instructions

Perform assembling operations

To be competent, the user/individual on the job must be able to:

PC7. assemble and secure the components and sub-assemblies in their correct positions by using appropriate assembly methods and techniques

PC8. perform drilling, tapping and reaming operation to create holes in the components as per the requirement

PC9. fasten components permanently by using engineered fasteners, applying adhesives, soldering and brazing

PC10. produce mechanical assemblies by combining the components as per job specifications

PC11. dismantle mechanical assemblies without damage to components and/or subassemblies

PC12. deal promptly and effectively with problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve

PC13. report to the supervisor about any problems faced or anticipated during the complete process

Perform post-assembly activities

To be competent, the user/individual on the job must be able to:

PC14. perform necessary quality checks or tests for correct assembly parameters and functioning of the tool and die

PC15. use the appropriate measuring equipment for checking activities

PC16. produce components within all of the applying quality standards (Quality standards: omponents to be free from false tool cuts, burrs and sharp edges; dimensional tolerance +/- 0.020mm; flatness and squareness 0.05mm; angles within +/- 1 degree; screw threads to fit as per standard; reamed and bored holes within interference: - 0.025mm (hole) + 0.025mm (shaft), transition: - 0.1mm (hole)+ 0.1 (shaft) , clearance: 50microns; radius: 0.5 r; surface finish 1.6 m)

PC17. prepare inspection and work completion reports for the higher authorities

PC18. clean and store all the tools, machine and equipment after completion of work

PC19. dispose scrap or waste material into the disposal area in accordance with the company's policies and environmental regulations

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. relevant legislation, standards, policies, and procedures followed in the organization

KU2. methods of holding the workpiece assembly activities

KU3. how to mount workpiece

KU4. various assembly methods, techniques and procedures to be used (

Hand fitting methods: cutting out the rough profile using saws (e.g. hacksaw, bandsaw), cutting a screw thread (e.g. tapping or dieing), filing (flat, square, curved), drilling holes, tapping

KU5. how the components are to be aligned, adjusted and positioned prior to securing them, and the tools and equipment

Alignment: slideways: flat, vee, dovetail, cylindrical, comparison of their capabilities, main features, accuracy of movement, means of adjustment, lubrication, protection

Typical checks: coaxial alignment between main spindle axis, coaxial alignment between two spindles, alignment of spindle to guideway, squareness of slideways movement, concentricity and end float of spindle, squareness of planes to spindle, setting of guards, stops and automatic safety cut-outs; bearings: plain bush (radial, radial and axial) ball (radial, axial, radial and axial) roller (radial, axial, radial and axial);

Methods of alignment: standard tests, straight edge, precision level, autocollimator and reflector, roundness measuring machineKU20. various mechanical fastening devices that are used

KU6. how to mount and secure the tools in the tool holding devices

Workholding tools: in a bench vice; machine vice; chuck; clamps (e.g. toolmakers); three-jaw chuck; four-jaw chuck; collet chuck; drive plate and centres; magnetic chucks(holding devices); special purpose tool holders (3R for holding electrodes), collets etc.

KU7. types of production tools such as jigs, fixtures, dies, cutting tools and moulds

KU8. specifications for standard assembly fits and clearances

KU9. impact of various assembly process like bolting, torqueing, tightening, fitting, greasing, hammering, sealing, clamping on the final product

KU10. various assembly methods i.e. assembling components having interference fits (e.g. by pressure, expansion or contraction); securing components using threaded fasteners (e.g. nuts, bolts, machine screws, cap screws); securing components using spring clips (e.g. external circlips, internal circlips, special clips); using locking and retaining devices (e.g. tab washers, locking nuts, wire locks, special purpose types); securing components using rivets (e.g. countersunk, roundhead, blind, special purpose types); applying sealing compounds or adhesives; electrical bonding of components; setting and adjusting components to give correct working parameters (e.g. shimming and packing); torque setting of nuts and bolts

KU11. types of fasteners such as screws and dowels

KU12. types of adhesives such as temporary and permanent

KU13. types of solder such as hard and soft

KU14. types of joints such as lap and dovetail

KU15. types of dies such as cutting, forming, progressive and compound

KU16. methods to dismantle fittings i.e. procedure for isolation and locking off a device/system; sequence of operations used to dismantle a device/system; proof marking, correct storage procedures for removed parts; release of pressure/force; extraction

KU17. precautions to be taken when using the adhesives, cements and sealing compounds (such as adequate ventilation, fume extraction, away from naked flames, avoiding skin contact) and gas torches to form the joint

KU18. mechanical fastenings and joining techniques i.e. non-permanent - nuts, bolts, studs, permanent - welded, soldered, brazed, riveted

KU19. techniques of taking trial cuts and checking dimensional parameters; the application of roughing and finishing cuts, and the effect on tool life, surface finish and dimensional parameters

Dimensional parameters: linear dimensions (e.g. lengths, depths); diameters (e.g. external, internal); flatness; squareness; angles; profiles; hole size and position; thread size and fit; surface finish

KU20. how to check the workpiece and the measuring equipment that is used

Measuring equipment: external micrometers, vernier/digital/dial caliper, surface finish equipment (e.g. comparison plates, machines), rules, squares, protractors, depth micrometers, depth verniers, feeler gauges, bore/hole gauges, slip gauges, radius/profile gauges, thread gauges, height gauge, hardness tester, dial test indicators (DTI), surface roughness tester, coordinate measuring machine (CMM), profile projectors, form testers

KU21. how to measure internal and external dimensions

KU22. various type of defects in final products

KU23. how to check defects in the completed products

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. note the information related to work and processes
GS2. write reports and observations related to work in English/regional language
GS3. read and interpret and process flowchart for all operations
GS4. read manuals and operation documents to understand the Equipment used into operation
GS5. discuss task lists, schedules and activities with the seniors and team members
GS6. follow organization rule-based decision making process
GS7. take decisions with systematic course of actions and/or response
GS8. plan and organize tasks to meet deadlines
GS9. find ways of modifying difficult operating stages to make it operation friendly
GS10. apply domain information to set and define operation parameters that ensures economy and quality of the product
GS11. analyse the complexity of work to determine if it can be successfully carried out or needs to be referred to a superior/specialist
GS12. recognise a workplace problem and take suitable action to resolve it

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Prepare for assembling operations	**10**	**15**	**-**	**8**
PC1. plan assembling operations for tools & die manufacturing on the basis of drawing/blue print	1	2	-	1
PC2. prepare the work area for the assembling operations as per procedure or operational specification	2	2	-	2
PC3. select standard and specialized measuring instruments based on tolerances required and take measurements of tools and die components	2	3	-	2
PC4. compare measurements to drawings and sketches to ensure conformity, fits and clearances	2	3	-	1
PC5. record critical dimensions as required by workplace procedures	1	2	-	1
PC6. lift the work pieces manually or by hoist and place the same securely on the designated slot/space as indicated in the drawing/work instructions	2	3	-	1
Perform assembling operations	**13**	**21**	**-**	**8**
PC7. assemble and secure the components and sub-assemblies in their correct positions by using appropriate assembly methods and techniques	2	3	-	2
PC8. perform drilling, tapping and reaming operation to create holes in the components as per the requirement	3	5	-	3
PC9. fasten components permanently by using engineered fasteners, applying adhesives, soldering and brazing	2	3	-	1
PC10. produce mechanical assemblies by combining the components as per job specifications	3	5	-	1
PC11. dismantle mechanical assemblies without damage to components and/or subassemblies	1	2	-	1
PC12. deal promptly and effectively with problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve	1	2	-	-

PC13. report to the supervisor about any problems faced or anticipated during the complete process	1	1	-	-
Perform post-assembly activities	**7**	**14**	**-**	**4**
PC14. perform necessary quality checks or tests for correct assembly parameters and functioning of the tool and die	2	3	-	1
PC15. use the appropriate measuring equipment for checking activities	1	2	-	-
PC16. produce components within all of the applying quality standards (Quality standards: omponents to be free from false tool cuts, burrs and sharp edges; dimensional tolerance +/-0.020mm; flatness and squareness 0.05mm; angles within +/- 1 degree; screw threads to fit as per standard; reamed and bored holes within interference: - 0.025mm (hole) + 0.025mm (shaft), transition: - 0.1mm (hole)+ 0.1 (shaft) , clearance: 50microns; radius: 0.5 r; surface finish 1.6 m)	2	4	-	2
PC17. prepare inspection and work completion reports for the higher authorities	1	2	-	1
PC18. clean and store all the tools, machine and equipment after completion of work	1	2	-	-
PC19. dispose scrap or waste material into the disposal area in accordance with the company's policies and environmental regulations	-	1	-	-
NOS Total	**30**	**50**	**-**	**20**

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0309
NOS Name	Perform assembly operations
Sector	Capital Goods
Sub-Sector	1. Machine Tools 2. Dies, Moulds and Press Tools 3. Plastics Manufacturing Machinery 4. Textile Manufacturing Machinery 5. Process Plant Machinery 6. Electrical and Power Machinery 7. Light Engineering Goods
Occupation	Fitting and Assembly
NSQF Level	5
Credits	TBD
Version	2.0
Last Reviewed Date	
Next Review Date	
NSQC Clearance Date	

Assessment Guidelines and Assessment Weightage

Assessment Guidelines

1. Criteria for assessment for the Qualification Pack will be created by CGSC.

2. Performance Criteria (PC) have been assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC.

3. The assessment for the theory part will/may be based on knowledge bank of questions approved CGSC.

4. Assessment will be conducted for all compulsory NOS, and where applicable, on the selected elective/option NOS/set of NOS.

5. Assessment Agencies will create Assessor Guides comprising of Theory and Practical Assessment Set and Guidelines for each examination/training centre (as per assessment criteria below). The same will be approved by CGSC for adequacy.

6. To successfully attain Certification on the Qualification Pack, the trainee must score a minimum of 70% in each Core NOS and minimum of 50% in all non-core NOS. In addition, a candidate needs to attain a minimum overall pass percentage of 70% for certification.

7. In case of unsuccessful completion, the trainee may seek reassessment on the Qualification Pack.

Minimum Aggregate Passing % at QP Level : 70

(**Please note**: Every Trainee should score a minimum aggregate passing percentage as specified above, to successfully clear the Qualification Pack assessment.)

Assessment Weightage

Compulsory NOS

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
CSC/N1335.Use basic health and safety practices at the workplace	30	70	-	-	100	15
CSC/N1336. Coordinate with co-workers to achieve work efficiency	30	70	-	-	100	15
CSC/N0307. Prepare for the making of tools and die	30	50	-	20	100	10
CSC/Nxxxx. Perform machining operations	30	50	-	20	100	20

CSC/N0308.Perform fitting operations	30	50	-	20	30	20
CSC/N0309.Perform assembly operations	30	50	-	20	30	20
Total	**180**	**340**	**-**	**80**	**600**	**100**

Acronyms

NOS	National Occupational Standard(s)
NSQF	National Skills Qualifications Framework
QP	Qualifications Pack
TVET	Technical and Vocational Education and Training
CNC	Computer Numerically Controlled
EDM	Electric Discharge Machine
VMC	Vertical Machining Centre
CMM	Co-Ordinate Measuring Machine
DTI	Dial Testing Indicators
GD&T	Geometric Dimensioning And Tolerancing
CO2	Carbon Dioxide
CPR	Cardiac Pulmonary Resuscitation
PPE	Personal Protective Equipment
ISO	International Organization For Standardization

Glossary

Sector	Sector is a conglomeration of different business operations having similar business and interests. It may also be defined as a distinct subset of the economy whose components share similar characteristics and interests.
Sub-sector	Sub-sector is derived from a further breakdown based on the characteristics and interests of its components.
Occupation	Occupation is a set of job roles, which perform similar/ related set of functions in an industry.
Job role	Job role defines a unique set of functions that together form a unique employment opportunity in an organisation.
Occupational Standards (OS)	OS specify the standards of performance an individual must achieve when carrying out a function in the workplace, together with the Knowledge and Understanding (KU) they need to meet that standard consistently. Occupational Standards are applicable both in the Indian and global contexts.
Performance Criteria (PC)	Performance Criteria (PC) are statements that together specify the standard of performance required when carrying out a task.
National Occupational Standards (NOS)	NOS are occupational standards which apply uniquely in the Indian context.
Qualifications Pack (QP)	QP comprises the set of OS, together with the educational, training and other criteria required to perform a job role. A QP is assigned a unique qualifications pack code.
Unit Code	Unit code is a unique identifier for an Occupational Standard, which is denoted by an 'N'
Unit Title	Unit title gives a clear overall statement about what the incumbent should be able to do.
Description	Description gives a short summary of the unit content. This would be helpful to anyone searching on a database to verify that this is the appropriate OS they are looking for.
Scope	Scope is a set of statements specifying the range of variables that an individual may have to deal with in carrying out the function which have a critical impact on quality of performance required.

Knowledge and Understanding (KU)	Knowledge and Understanding (KU) are statements which together specify the technical, generic, professional and organisational specific knowledge that an individual needs in order to perform to the required standard.
Organisational Context	Organisational context includes the way the organisation is structured and how it operates, including the extent of operative knowledge managers have of their relevant areas of responsibility.
Technical Knowledge	Technical knowledge is the specific knowledge needed to accomplish specific designated responsibilities.
Core Skills/ Generic Skills (GS)	Core skills or Generic Skills (GS) are a group of skills that are the key to learning and working in today's world. These skills are typically needed in any work environment in today's world. These skills are typically needed in any work environment. In the context of the OS, these include communication related skills that are applicable to most job roles.
Electives	Electives are NOS/set of NOS that are identified by the sector as contributive to specialization in a job role. There may be multiple electives within a QP for each specialized job role. Trainees must select at least one elective for the successful completion of a QP with Electives.
Options	Options are NOS/set of NOS that are identified by the sector as additional skills. There may be multiple options within a QP. It is not mandatory to select any of the options to complete a QP with Options.