

Overview

This standard identifies the competencies you need to produce components by rapid prototyping techniques, in accordance with approved procedures. You will be required to select the appropriate prototyping equipment, based on the type and size of the components and the surface finish required. You will be expected to prepare the equipment in readiness for the required operations, to import a stereolithography (STL) file from a computer aided design (CAD) system, to load the file into the rapid prototyping software, and to orientate the file to its optimal manufacturing position.

In operating the equipment, you will need to access the software and produce a suitable file to drive the rapid prototyping equipment. In producing the components, you will need to set up all of the machine operating functions, parameters and safety devices, and to produce components that have features such as regular parallel, angular and symmetrical surfaces and forms, angular and circular profiles, and irregular and variable surface forms and profiles.

Your responsibilities will require you to comply with organisational policy and procedures for using rapid prototyping software and for operating rapid prototyping equipment. You will report any problems with the hardware, software, materials or equipment that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You will be expected to work with minimum supervision, whilst working to verbal or written instructions and component drawings, taking personal responsibility for your own actions and for the quality and accuracy of the work that you produce.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to the design of components using solid modellers. You will understand the rapid prototyping equipment, and its application, and will know about the materials and consumables used, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring the components produced are to the required specification.

You will understand the safety precautions required when working with the rapid prototyping equipment. You will be required to demonstrate safe working practices throughout, and will understand the responsibility you owe to yourself and others in the

workplace.

Performance criteria

You must be able to:

1. work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
2. follow instructions and any relevant specifications to produce the component
3. set up the rapid prototyping equipment using appropriate methods and techniques
4. produce the required components using appropriate prototyping manufacturing methods and techniques
5. check that the finished component meets the requirements and make any necessary adjustments
6. complete relevant data and documentation
7. deal promptly and effectively with problems within your control and report those that cannot be solved

Knowledge and understanding

You need to know and understand:

1. the safe working practices and procedures to be observed when setting and operating rapid prototyping equipment (such as care when working with laser beams; machine guards; ventilation and fume extraction; machine safety devices)
2. how to start and stop the machine in normal and emergency situations, and how to close the machine down on completion of activities
3. the importance of ensuring the machine is isolated from the power supply before working with the equipment
4. the importance of wearing the appropriate protective clothing and equipment (PPE), and of keeping the work area clean and tidy
5. the hazards associated with rapid prototyping machines (dangers from laser beams; live electrical components; materials; fumes/gases), and how they can be minimised
6. the principles of rapid prototyping (using a laser beam / inkjet printer heads to form material profile; process principles; using software packages; methods of guiding and optical focusing of the beam; how variation in the parameters influences the component feature, quality and output; equipment calibration procedures; terminology used in rapid prototyping; the importance of creating effective component support structures)
7. the key components and features of the equipment (types of rapid prototyping equipment; power ranges; beam guiding and focusing arrangements; material capabilities; facilities for manipulating the components for production; and safety features)
8. the benefits and limitations of the different types of rapid prototyping equipment
9. the rapid prototyping techniques used, and how to differentiate between the different processes (including the advantages and disadvantages)
10. the finishing techniques that are required, and how they are applied to the different rapid prototyping processes
11. how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS or ISO standards in relation to work undertaken)
12. how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing

13. how to import appropriate files (STL) from a data system into the rapid prototyping software, how to orientate these for processing, and how to create operating files to drive the process
14. setting up the rapid prototyping equipment to achieve the component specification (such as electrical and optical conditions; focal distance; forming speed)
15. how to place the machine in the correct operating mode, and how to access the program edit facility, in order to make minor adjustments for production
16. the different materials used to produce components by the rapid prototyping process, and how the various materials used will affect the operating conditions that can be applied
17. the reasons why certain materials are suitable for producing components by the rapid prototyping process
18. the importance of knowing when components can be unloaded from the machine in relation to the different rapid prototyping processes
19. the importance of handling and storing materials correctly
20. how and where to dispose of any waste materials, including damaged components
21. how finished components are stored and transported
22. problems and defects that can occur in components produced by rapid prototyping processes, how these have occurred, and what preventative actions are needed to overcome them
23. the extent of your responsibility and whom you should report to if you have problems that you cannot personally resolve

Scope/range related to performance criteria

1. Prepare the system and data for operation by carrying out all of the following:

- 1.1. check that all the equipment is in a safe and usable working condition (undamaged, safety devices in place and operational)
- 1.2. obtain sufficient quantities of all required materials
- 1.3. obtain all the necessary data, documentation and specifications for the components to be produced
- 1.4. ensure the machine build calibration is current
- 1.5. create operating files to drive the equipment
- 1.6. check data files are suitable for application, and modify where appropriate
- 1.7. set operating parameters (layer thickness, shrinkage, beam offset and material type)
- 1.8. orientate the files for processing
- 1.9. apply safe working practices and procedures at all times

2. Set up the rapid prototyping equipment, to include carrying out all of the following:

- 2.1. powering-up the equipment and activating the appropriate software
- 2.2. setting up the software ready to receive the component information
- 2.3. importing files from system
- 2.4. loading files into the 'build' software

3. Produce components using one of the following types of rapid prototyping equipment:

- 3.1. stereo lithography apparatus (SLA)
- 3.2. fused deposition modelling (FDM)
- 3.3. selective laser sintering (SLS)
- 3.4. direct metal laser sintering (DMLS)
- 3.5. selective laser melting (SLM)
- 3.6. 3D printing (thermojet)
- 3.7. laminated object manufacturing (LOM)

4. Produce components which combine features and techniques and cover all of the following:

- 4.1. regular parallel and square surfaces and forms
- 4.2. angular and symmetrical surfaces and forms
- 4.3. circular and curved surfaces and forms
- 4.4. irregular and variable surface forms and profiles

5. Produce components which comply with all the following quality and accuracy requirements:

- 5.1. correctly formed
- 5.2. free from manufacturing defects
- 5.3. dimensionally accurate, within tolerance
- 5.4. satisfactory visual appearance/finish
- 5.5. meets customer and/or drawing specification

6. Produce components made from one of the following materials:

- 6.1. photo-polymer resin

Producing Components by Rapid Prototyping Techniques

6.2 plastics

6.3 wax

6.4 metal

6.5 laminated paper

7. Complete the relevant data/documentation from one of the following, and pass it to the appropriate person:

7.1 job cards

7.2 production records

7.3 company specific documentation/computerised system

Behaviours

You will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as:

- strong work ethic
- positive attitude
- team player
- dependability
- responsibility
- honesty
- integrity
- motivation
- commitment

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