Unit 334 Producing off-line programs for NC/CNC laser profiling machines

UAN:	Y/600/5721
Level:	3
Credit value:	84
GLH:	231
Relationship to NOS:	This unit has been derived from National Occupational Standard engineering technical support Unit No 34: Producing off-line programs for NC/CNC laser profiling machines (Suite 3).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to produce computer/numerically controlled (NC/CNC) laser profiling programs off-line, in accordance with approved procedures. The learner will be required to set up and activate the programming software, to produce the program, and to check the system is operating correctly. The learner must ensure that they have been provided with accurate, current, complete data and information, in order to produce the program. The learner will be required to produce efficient and effective programs, combining a range of different operations. The program format will avoid unnecessary operations and laser beam movements, by using appropriate commands, such as repeat programs/sub-routines, correct reference codes, and preparatory commands for the machine management and auxiliary functions. On completion of the programming activities, the learner will be required to save and/or convert the program in the correct format and to save it in the correct location.
	The learner's responsibilities will require them to comply with organisational policy and procedures for producing the NC/CNC laser profiling programs, and to report any problems with these activities that they

cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying the NC/CNC laser profiling programming methods and procedures. The learner will understand the NC/CNC laser profiling machining capabilities, laser beam power and focusing, the materials being machined and the effect this has on cutting speeds and feeds and surface finish. The learner will know about the NC/CNC programming codes, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the program produced will manufacture the components to the required specification in the most efficient way.

The learner will understand the safety precautions required when working on computer systems and associated equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will:
1.   produce off-line programs for NC/CNC laser profiling machines
Assessment criteria
The learner can:
1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines
1.2 produce computer control programs that contain all the relevant and necessary data for the engineering activity to be carried out
1.3 carry out all of the following in preparation for the NC/CNC programming: • check that all the equipment is correctly connected, and is in a safe and usable condition (such as cables undamaged, correctly connected, safely routed) • power up the equipment and activate the programming software • set up the computer system to be able to produce the program

- ensure that they have the necessary component data and information to produce the program
- identify and deal with problems (such as information based and/or technical)

1.4 carry out all of the following, as applicable to the programming method selected:
- import the component data file, and/or produce the shape/geometry of the component
- select a suitable or specified datum point
- select absolute and/or incremental system of measurement
- select imperial or metric system of measurement
- input the safe start position
- input material parameters
- select appropriate reference codes
- input required positional information
- input cutting parameters (such as beam intensity, direction, feed in/out)
- input preparatory commands and machine management/auxiliary functions
- use repetitive programs (sub-routines, canned cycles, labels, macros)
- determine the cutting path order and sequence
- input any additional information (such as a work-shift position)
- convert the program into the correct format (post processing)

1.5 produce laser cutting/profiling programs, combining different operations that will produce seven of the following features:
- square/rectangular profiles
- angular profiles
- curved profiles
- circles
- ellipses
- holes linearly positioned
- holes radially positioned
- slots and apertures
- other features

1.6 produce the control programs in the appropriate formats

1.7 make sure that codes and other references used in the programs are applicable to the type of controller used

1.8 produce programs using one of the following methods:
- Computer Aided Machining (CAM)
- G code
- conversational code
- other specific method (such as macros)

1.9 pass on the programs to the appropriate people, within agreed timescales

1.10 save and back up the program detail, and store securely in accordance with organisational requirements

1.11 carry out all of the following on completion of the programming

activity:

- check and review the program format and content
- edit the program using the correct procedure (where appropriate)
- check that the program is correctly titled and referenced
- ensure that programs are stored safely and correctly, in the correct format and location
- ensure that the program has been checked and approved before forwarding to the end user
- send the approved program to the correct location for the end user
- create a separate back-up copy of the program, in case of file corruption

1.12 undertake changes to program details, within agreed control procedures.

Learning outcome
The learner will:
2. know how to produce off-line programs for NC/CNC laser profiling machines
Assessment criteria
The learner can:
2.1 describe the specific safety precautions to be taken when working with computer systems (to include safety guidance relating to the use of Visual Display Unit (VDU), equipment and workstation environment (such as lighting, seating, positioning of equipment), Repetitive Strain Injury (RSI); the dangers of trailing leads and cables; how to spot faulty or dangerous electrical leads, plugs and connections)
2.2 describe the good housekeeping arrangements (such as cleaning down work surfaces; putting disks, manuals and unwanted items of equipment into safe storage; leaving the work area in a safe and tidy condition)
2.3 describe the basic set-up and operation of the computer system, and any peripheral devices that are used
2.4 describe the correct start-up and shutdown procedures to be used for the computer system
2.5 explain how to access the specific programming software, and the use of manuals and related documents to solve problems and aid the efficient programming of NC/CNC laser profiling machines
2.6 describe the importance of protecting the computer system from viruses, and the implications if the correct procedure is not followed
2.7 explain how to power up, log on and activate the computer system and programming software correctly
2.8 explain how to deal with system problems (such as error messages received, peripherals which do not respond as expected)
2.9 describe the checks to be carried out to ensure peripheral devices are connected correctly
2.10 describe the correct procedure to shut down the operating and programming system
2.11 explain how to create and structure directories and files correctly

(such as importing, copying, transferring, exporting, deleting, backing up and saving files)

2.12 describe the different types of storage media that can be used to save program files

2.13 describe the off-line programming methods used in NC/CNC laser profiling (such as Computer Aided Machining (CAM), G code and conversational code)

2.14 describe the different programming codes used to identify factors such as machine axes, positional information, laser beam cutting direction, cutting feeds, machine management and auxiliary functions

2.15 describe the main machine controllers that are available, and the importance of understanding that a different machine controller may use completely different codes for similar functions

2.16 describe the information and data required in order to produce complete and accurate NC/CNC laser profiling programs

2.17 explain how to extract and interpret general and technical data and information from different sources (such as drawings, computer models, symbols and conventions, BS or ISO standards), in order to produce the NC/CNC laser profiling program

2.18 describe the factors to be taken into account when producing NC/CNC programs (including the type of laser profiling machine and its cutting capabilities, laser power, safety, the material being cut, component tolerances and surface finish required)

2.19 explain how to produce effective and efficient programs to avoid unnecessary operations, laser beam movements (including the use of macro programs and canned cycles, to reduce program size)

2.20 describe the methods and procedures used to check that the completed program will produce the required component safely, accurately and efficiently

2.21 explain how to save the completed programs in the appropriate format, and the need to store programs safely and correctly, away from contaminants and electromagnetic sources

2.22 explain how to back up completed or edited programs, and the implications if this is not carried out effectively

2.23 describe the problems that can occur with the downloading and running of the NC/CNC laser profiling program, and how these can be overcome

2.24 describe the correct procedure to be followed before the program is released to the end user

2.25 describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve.