SEMPEO218

Preparing and using industrial robots

Overview

This standard covers a broad range of basic competences you need to produce, load and prove programs on industrial robot controllers, and which will prepare you for entry into the engineering or manufacturing sectors, creating a progression between education and employment, or that will provide a basis for the development of additional skills and occupational competences in the working environment.

You will be required to produce the control programs, by using a teach pendant and by producing and downloading programs from a computer. You will need to check/prove the program, using single block run and program edit facilities. You will also be required to adjust the robot program, following proving/editing procedures to achieve the control specification. You must ensure that any edited programs are saved and backed up safely and correctly.

In preparing the robot, you will be expected to select the appropriate workholding devices, and to mount and secure them in the appropriate location. You will also be required to select the appropriate tools or accessories, and to mount and secure them to the robot arm. You will need to ensure that all the tools/accessories have been allocated a relevant tool number, and that the relevant data on their co-ordinates and datum positions is entered into the robot's operating program.

Your responsibilities will require you to comply with health and safety requirements and organisational policy and procedures for preparing and using industrial robots. You will need to take account of any potential difficulties or problems that may arise with the robot related activities, and to seek appropriate help and advice in determining and implementing a suitable solution. You will work under a high level of supervision, whilst taking responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will provide an understanding of your work, and will enable you to apply appropriate robot programming and operating techniques safely. You will understand the robotic process, and its application, and will know about the sensors and actuators used in the process, the programming, editing and proving process, workholding devices, tooling/accessories and setting-up procedures, to the required depth to provide a sound basis for carrying out the activities to the required specification.

You will understand the safety precautions required when working with industrial robots, and with their associated tools and equipment. You will be required to demonstrate safe working practices for any robotic cell you are working on, 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 legislation, regulations, directives and other relevant guidelines
2. plan the programming activities before you start them
3. determine an operational sequence that avoids wasted robot arm movements and tool/accessory changes
4. produce industrial robot control programs, in the appropriate formats, containing all the relevant and necessary data for the engineering activity to be carried out
5. load/input the program to the robot controller, and check the program for errors using the approved procedures
6. make sure that codes and other references used in the programs are applicable to the type of controller used
7. save and store the program, in line with organisational procedures
8. mount and set the required workholding devices and robot tooling
9. run the operating program, and check and adjust the operating parameters to achieve the component specification
10. measure and check that all dimensional and geometrical aspects of the component are to the specification
11. deal promptly and effectively with problems within your control, and seek help and guidance from the relevant people if you have problems that you cannot resolve
12. shut down the equipment to a safe condition on completion of the robotic activities

Knowledge and understanding

You need to know and understand:

1. the safe working practices and procedures to be followed when developing and proving industrial robot operating programs
2. the hazards associated with using industrial robots (such as automatic/sudden movements of arm, power operated accessories), and how they can be minimised
3. the importance of wearing the appropriate protective clothing and equipment (PPE), and of keeping the work area clean and tidy
4. the safety mechanisms on the robot and operating envelope (such as emergency stop buttons, movement/hazard sensors), and the procedure for checking that they function correctly
5. how to stop the robot in both normal and emergency situations, and the procedure for restarting after an emergency
6. the correct operation of all available modes (such as automatic operation, teach pendant, program operating and control buttons)
7. how to drive the robot in each type of coordinate frame (such as tool, global, joint, user)
8. how to drive the robot at different speeds, including jog mode
9. the main robot types that are available, and the importance of understanding that a different robot may use a completely different syntax for similar functions
10. the information and data required in order to produce complete and accurate robot programs
11. 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 robot program
12. the factors to be taken into account when producing robot programs (including the type of robot and its control capabilities, safety, the product/environment being controlled)
13. how to produce effective and efficient programs to avoid unnecessary operations (including the use of macro programs and canned cycles, to reduce program size)
14. the methods and procedures used to check that the completed program will perform safely, accurately and efficiently (such as conducting trial runs, using single block run, dry run and speed override controls)
15. how to save the completed programs in the appropriate format, and the

importance of storing program safely and correctly, away from contaminants and possible corruption

16. how to back up completed or edited programs, and the implications if this is not carried out effectively
17. the methods and procedures used to minimise the chances of infecting a computer with a virus
18. the implications if the computer you are using does become infected with a virus and who to contact if it does occur
19. the problems that can occur with the downloading and running of the robot program, and how these can be overcome
20. the various workholding devices that are used for robot applications, and the methods of positioning and setting them in relation to the robot's operating parameters (such as jigs and fixtures)
21. the various tools and end effector equipment that are used for the particular robot operations (such as mechanical grippers, welding torches, stud guns, spray guns, drilling attachments)
22. why you need to ensure that tools are positioned correctly in relationship to the robot's reference points and tool centre points
23. the importance of checking that the tool change positions (where appropriate) are clear of the workpiece and can be safely and quickly achieved
24. the need to ensure that all guards are in place and that the interlock systems are in correct working order
25. running the robot operating program and checking that all operations are carried out safely and correctly
26. how to check that the finished operations meet the work specification
27. typical problems that can occur with the programming, loading and editing activities, and what to do if they occur
28. when to act on your own initiative and when to seek help and advice from others
29. the importance of leaving the work area and machine in a safe condition on completion of the activities (such as correctly isolated, operating programs closed or removed, cleaning the machine, and removing and disposing of waste)

Scope/range related to performance criteria

1.

Ensure that you apply **all** of the following checks and practices during the robot programming activities:

1.1 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment (PPE)and other relevant safety regulations
1.2 check that all the teach pendant/computer equipment is correctly connected, and is in a safe and usable working condition (such as cable undamaged, safely routed and tested)
1.3 power up the equipment and activate the programming software
1.4 set up the computer system to produce the program
1.5 ensure that the correct process input/output and control data to produce the program is obtained and checked for currency and validity
1.6 store completed program media safely and correctly, away from contaminants or possible corruption

2.

Prepare and use **one** of the following types of industrial robot:

2.1 Cartesian (gantry)
2.2 SCARA
2.3 articulated
2.4 parallel
2.5 other specific type

3.

Prepare, load and prove programs using **one** of the following types of robot programming methods:

3.1 positional commands (x, y, z)
3.2 teach pendant
3.3 lead by the nose
3.4 off-line programming
3.5 other specific method

4.

Produce robot programs for **one** of the following engineering applications:

4.1 welding
4.2 logistics movement/control
4.3 surface coating
4.4 packaging
4.5 gluing/sealing
4.6 stud welding
4.7 machine loading/unloading
4.8 assembly
4.9 other specific activity

5.

Select and set up **one** of the following types of robot end effectors for the engineering application of:

5.1 welding guns
5.2 spot welders
5.3 spray guns
5.4 grippers
5.5 drills
5.6 vacuum devices
5.7 other specific tooling

6.

Develop programs that contain **all** of the following, as applicable to the robot type:

6.1 safe start and stop positions
6.2 all necessary positional information
6.3 type of motion (such as joint interpolated, linear, circular)
6.4 preparatory commands and process management/auxiliary functions
6.5 repetitive programs (sub-routines, canned cycles, labels)
6.6 speed/acceleration parameters
6.7 sensor information
6.8 part programs downloaded from a computer (such as patch programs)
6.9 use of workframes (such as tool, global, joint, user)

7.

Prove the robot program using **four** of the following:

7.1 single block run
7.2 full dry run
7.3 search facilities
7.4 edit facilities
7.5 program override controls
7.6 data input facilities
7.7 all modes (such as auto, T1, T2 and remote)

8.

Carry out operations for **one** of the applications identified in scope 4, to include **all** of the following:

8.1 checking that all safety mechanisms are in place and that the equipment is set correctly for the required operations
8.2 positioning work in relation to the robot parameters (such as securing in the workholding device)
8.3 running the operating program in accordance with operating procedures
8.4 checking that all operations are carried out safely and correctly
8.5 editing programs using the correct procedure (where appropriate)
8.6 examining the completed work visually and/or using suitable test/measuring instruments, gauges or checking fixtures, as appropriate to the operations performed
8.7 determining if the completed setup completes the operations to the required

specification, including repeatability and accuracy

Behaviours

Additional Information

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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