Apprenticeships

SCIENCE MANUFACTURING PROCESS OPERATIVE

DIPLOMA IN POLYMER OPERATIONS

Intermediate Apprenticeship

Course Guide

The College of West Anglia

Ofsted Good Provider

Welcome to the

SOLUTIONS 4 POLYMERS GUIDE TO APPRENTICESHIPS

Our aim is to provide a skilled, technical workforce for the polymer processing operations industries that will enable them to compete in a global market.

Solutions 4 Polymers Limited was formed to provide a cost-effective solution to company needs. We focus on providing polymer training and support solutions including Polymer Apprenticeships, technical support, within the sector to resolve problems and concerns.

Whether your need is for Injection moulding, Blow moulding, Extrusion thermoforming or a support area, we can help. The newly developed Level 3 Diploma qualification has been specifically created for the polymer sector, following detailed discussions with a wide range of polymer processing businesses across the UK.

Solutions 4 Polymers firmly believes that the Apprenticeship Standard should equip the individual with all the necessary knowledge, skills and behaviours to perform to the highest level possible in a modern manufacturing environment. We have strived to include additional skills development and associated occupational support knowledge to give your business the competitive edge.

We look forward to working with you.

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Overview

What is it?

This apprenticeship is aimed at both new and existing employees who work in any of the many processes in the Polymer processing industry and would benefit from a structured development to enable them to operate at an Operator level.

How long does it take?

Typically, 12 to 18 months. This is dependent on the ability and time commitment of the apprentice, as well as the number of visits which can be made per month.

What does it cover?

The operational skills and understanding for a particular or specific polymer process.
To ensure a well-rounded operative it also covers General Performance or Behavioural skills i.e. effective communications, teamwork, and management of change.

Which qualifications are gained?

- PIABC Diploma in Polymer Operations
- Functional Skills English and Maths (if not already held)

How is it delivered?

S4P provide continual training, support and assessment throughout the programme all in the apprentice's company where appropriate using the company's equipment, materials and systems.

End Point Assessment

This is a mandatory requirement for all apprenticeships where the apprentice is tested towards the end of the scheme to ensure that all aspects have been delivered to the correct standard. This is carried out by an external assessment organisation.

What help can a company expect?

S4P, together with COWA have years of experience running polymer processing apprenticeships in a whole range of companies. They will guide the company from day one with identifying suitable apprentices, the choice of qualification options available, funding, identifying training and support needs.

What can an apprentice expect?

- Full support along the way with a dedicated assessor who will be their main point of contact
- A company mentor
- Student memberships and discounts

Professional Recognition

Upon successful completion of the programme, apprentices will then be eligible to apply for membership of Iom3 (Institute of Materials, Minerals and Mining.

BENEFITS OF APPRENTICESHIPS

WHAT EMPLOYERS SAY

96% of employers with apprentices have experienced at least one benefit from taking on apprentices, and most can count at least **8** benefits.

69% of employers say that employing apprentices improved staff retention. **65%** of apprentices stay working for the company that trained them when they complete their apprenticeship.

74% of employers say that apprentices improved products or service quality, and **78%** say that they improved productivity. Apprentices become highly skilled even before they finish their training.

73% of employers say that staff morale is improved by having apprentices.

67% of employers say that employing apprentices improved their image in the sector.

86% of employers said that apprentices helped to develop relevant skills for the organisation, and to fill the skills gap.

How to measure the benefits of apprenticeships

Measuring the impact of apprentices within your company does not have to be difficult or demanding. For instance, key performance indicators (KPIs) can be used to monitor apprentices' performance during their apprenticeship. The same indicators can be used to compare and contrast apprentices' performance with that of other staff as part of existing business processes.

How can you evaluate the benefits of apprenticeships?

Regularly analysing the performance and outcomes of your apprentices will allow you to see the current and future benefits to your business. Your performance metrics will depend on what is important in your specific business context. For example,

if high staff turnover is an issue in your company, you could track the length of time that apprentices remain with the business. If you have a significant skills gap, you can monitor the percentage of unfilled roles in the company, and whether apprentices are promoted to fill these positions.

DELIVERY

All delivery is undertaken at your site, on your machines, at a date and time to suit the needs of your business.

This on-site approach has the following benefits over the alternative off-site delivery:

- No additional costs of travel and accommodation which are not fundable by the levy system
- Shift working can be catered for to minimise disruption to work rotas
- Opportunity for managers and the apprentices' colleagues to be involved in training sessions, in fact we encourage this
- Practical training, wherever possible, is carried out using company equipment, tooling and materials, for theory training, applications of topics e.g. quality systems can be examined using examples within the company
- Practical training will also include working with company products which may have specific quality, safety or confidentiality requirements which would not feature in more generalised off-site training
- The importance of safe, effective and efficient production procedures is a theme throughout, again company procedures can be used, including their evaluation and possible suggestions for improvement
- But it is people who are the key to successful production, apprentices will learn about the job roles of others and if possible, we suggest apprentices work for a short period in related departments e.g. Tool Room
- By having a S4PL trainer assessor regularly on-site the apprentice and the company have a single point of contact who is also available when not on site

The apprenticeship demands knowledge in a range of theory subjects as determined by the units in the Diploma in Polymer Processing Level 3 qualification. These subjects are delivered using a dedicated suite of presentations, and challenging classroom and shop floor activities.

In between visits apprentices will be given projects and objectives to undertake which not only reinforce knowledge and practical skills but can contribute to achieving the qualification

Achievement pf the apprenticeship is dependent on achievement of the Diploma in Polymer Processing Level 3 qualification. To reduce bureaucracy and to make the creation and gathering of evidence easier we have designed bespoke knowledge assignment templates that help apprentices provide evidence in an efficient and involving manner to meet the qualification's criteria.

Assessment for the Diploma in Polymer Processing Level 3 qualification is also carried out entirely on-site by the S4PL trainer assessor via continuous assessment of course work with a multiple-choice knowledge test.

The quality of training and assessment is closely monitored in two ways, by a S4PL qualified Internal Quality Assurer and College of West Anglia quality monitoring visits, this also ensures compliance with regulatory requirements that are audited by outside organisations such as Ofsted.

Our aim is not just to equip the apprentice for their current role, but to equip the apprentice with both the transferable and company specific knowledge and skills they need for a long career within the industry.

DIPLOMA IN POLYMER OPERATIONS

This regulated qualification, PIABC Level 2 Diploma in Polymer Operations has been designed for learners who work with one polymer processing technique (e.g. extrusion, injection moulding, transfer moulding, material mixing/preparation, finishing/assembly operations, etc.) It covers the knowledge and skills of the specific processing equipment and polymer materials used, safety principles, quality aspects, together with communication, basic mathematics and team work.

Learners can gain an Advanced Diploma by completing an extra unit covering the installation and preparation of a forming tool for the specific polymer process, including basic engineering principles.

AIM

This national qualification is both knowledge and skills based and aims to provide process specific competences appropriate for running and monitoring a process.

Those achieving the qualification will be able to understand where their company's processes and products fits in to the industry; the requirements of the process with regards equipment, materials, control, safety, and quality; the ability to start up, make appropriate process adjustments and close down the process safely and effectively; having basic mathematical, commination and team skills. Those taking the Advanced Diploma will be able to safely prepare and install a forming tool using appropriate hand tools, safely according to basic engineering procedures.

PIABC Level 2 Diploma in Polymer Processing is intended for those learners who will have worked in a polymer processing environment for approximately 2 to 6 months prior to starting.

OUTCOMES

1. Provide and enhance the skills competency, knowledge and job satisfaction of learners - providing them with a means of progression to higher level job roles and qualifications.
2. Provide employers with an open and transparent basis for judging the suitability of learners for employment and promotion.
3. Facilitate job movement within an organisation and throughout the polymer processing industry and related sectors.

TARGET GROUP

This Level 2 qualification is appropriate for those wanting to enhance their employment and progression opportunities in their organisation or the polymer processing industry and relates sectors. There are two broad target groups:

1. People within the polymer processing industry who want to extend their knowledge and skills to gain a recognised qualification.

2. People within the polymer processing industry who want to operate more professionally and effectively.

Diploma Units

DPO 1 - Principles and Requirements of Polymer Processing

This knowledge-based unit introduces the learner to the polymer processing industry including products produced, processes used and materials processed.

It also explores how their production company fits into the industry including their organisational structures, individual roles within the company and company policies and procedures which relate to ethical practices and codes of conduct e.g. employment, environmental, social, etc.

The unit covers one polymer processing technique in more detail (e.g. extrusion, injection moulding, transfer moulding, material mixing/preparation, finishing/assembly operations, etc.) In particular; the operation of equipment used, the behaviour of the polymer material during each phase of production, the methods of machine/equipment heating and cooling, any pre-processing, process support and post processing equipment and how any ancillary support equipment is integrated and controlled in the process operation.

The unit also covers the operation and functional requirements of a typical process forming tool (e.g. mould, die, cutter, sieve, mixer, etc.) together with their key parts, their construction including materials used, any related downstream forming operations and typical service and maintenance routines.

The unit reviews the different types of polymer materials and their processing requirements for one type of polymer process including; their basic flow/processing behaviour, additives used and any preparation requirements (e.g. mixing, drying, preheating, etc.)

DPO 2 - Health, Safety and Environmental Principles when Operating Polymer Processes

This knowledge-based unit introduces the learner to the importance of health, safety and environmental issues when working in the polymer processing sector.

The unit covers the type of potential hazards, dangerous occurrences and risks associated with one type of polymer processing technique (e.g. extrusion, injection moulding, transfer moulding, material mixing/preparation, finishing/assembly operations, etc.) including, hazardous substances, electricity, fire, fumes, working at height, manual handling, collision with vehicles, together with managing and reducing equipment and processing hazards.

The unit also covers the importance of safe working practices and procedures including the importance of safe systems of work, standard operating procedures and permits to work and the benefits of maintaining a tidy well organised workplace.

It also covers the importance of statutory health and safety regulations codes of practice and company procedures that apply to a polymer processing activities as well as fire prevention and emergency procedures within a work area.
The unit covers safety equipment and safe handling techniques when working in a polymer processing environment, especially the different types and uses of personal protective equipment typically used in one type of polymer processing work area, the different classes of health and safety signage and the techniques used for safe manual handling.

The unit introduces the learner to environmental regulations, organisational requirements, environmental management systems and common environmental signage and notices used in the polymer processing sector. The importance of processing of polymers in an energy effective way and the benefits of processing reused polymers are also covered

DPO 3 - Quality, Process Control and Improvement Techniques used in Polymer Processing

This knowledge-based unit introduces the learner to the behaviour and basic control of polymer materials when they are being processed for one polymer processing technique (e.g. extrusion, injection moulding, transfer moulding, material mixing/preparation, finishing/assembly operations, etc.) In particular; how polymer materials flow and their processing behaviour, key parameters that need to be monitored and how equipment uses feedback and monitoring techniques (e.g. thermocouples, transducer, etc.)

The unit covers quality requirements when polymers are being processed, including the benefits of reducing waste, the explanation of key quality terms (quality assurance, quality control and quality management) the need for quality standards, working instructions and standard operating procedures. It also covers basic process fault finding, including identifying symptoms, possible cause, solutions and the knock-on effect of adjusting certain parameters.

The unit also covers the need for manufacturing process improvement techniques, including the main manufacturing quality improvement and housekeeping techniques used in polymer processing and benefits and limitations of implementing these quality improvement techniques.

Introduces the learner to the processing behaviours of a range of thermosetting and thermoplastic materials when undergoing different manufacturing process techniques, it also looks at the thermoplastic material processing tests and how processing characteristics affect both the processing capability and product properties

It evaluates different methods of shaping and processing polymer composites, thermosets and thermoplastics, it reviews batch and continuous polymer process techniques, the prime equipment, support equipment and forming equipment. It also evaluates the set up and running resources and costs required for different types of polymer process techniques

The unit investigates the need and techniques for a range of polymer materials to be prepared prior to processing including pre-heating, adding colourants and additives for a range of processes

It also looks at the range of post processing techniques, including thermoset and thermoplastic products e.g. cooling operations, post curing, printing/decorating techniques, product moving and handling techniques, finishing techniques; all used for both “batch” and “continuous” type production

DPO 4 - Prepare, Start Up and Shut Down a Polymer Process

This Skills based unit introduces the learner to starting up and shutting down one type of polymer processing technique (e.g. extrusion, injection moulding, transfer moulding, material mixing/preparation, finishing/assembly operations, etc.) within the limits of their authority.

The unit includes the processing preparations required and covers; identifying the work and processing instructions, identifying machine/equipment and materials required, pre-conditioning of materials and pre-setting equipment parameters, ensuring a safe working environment including the wearing of appropriate PPE and confirming that any safety and processing checks are complete.

The unit covers the starting up of a polymer processing technique in a safe and effective manner including; any purging or cleaning, integrating equipment and process setting, monitoring the quality, taking representative samples for testing, making appropriate process adjustments within the limits of authority, referring to colleagues when problems cannot be rectified, confirming the products meets specification, carrying out appropriate assembly or finishing operation and carrying out any recommended process improvement techniques.

The unit also covers the stopping or closing-down of one type of polymer processing production equipment safely and effectively within the limits of authority by; isolating any material feed in the system, shutting down and securing processing equipment and any relevant ancillary equipment and services, completing any documentation accurately and clearly and ensuring the area is clean tidy and hazard free

DPO 5 - Basic Skills in Mathematics, Communication and Behaviour required in a Polymer Processing Environment

This unit introduces the learner to working as part of a team and includes: communicating effectively, the importance of punctual and reliable work behaviour, treating colleagues in an appropriate and positive manner, identifying opportunities to help colleagues when they are experiencing difficulties, checking and adapting work activities to meet goals and positively adjusting work patterns to meet changing work objectives.

The unit also introduces the learner to use a range of basic workplace communication skills including; identifying the key issues and background 'in a given subject, planning and preparing for a discussion, making relevant and logical contributions to discussions in a clear positive manner using the key topic points and ideas, also planning and preparing for written communications including the types of recipient, presenting the information in a clear, logical and coherent manner on the correct document/format.

It also introduces the use of basic workplace mathematical techniques for typical processing problems or issues including; identifying key data and suitable approaches, identify and deduce information from tables and graphs, identifying and laying out formulae in a structured way, accurately calculating solutions, carry out checks to confirm results and producing applicable ways to represent the results clearly and accurately including the use of tables and graphs

DPO 6 - Install and Prepare a Polymer Processing Forming Tool and Ancillary Equipment for Production

This optional unit makes the diploma an advanced diploma.

This unit introduces the learner to basic engineering requirements when processing polymer materials for one polymer processing technique (e.g. extrusion, injection moulding, transfer moulding, material mixing/preparation, finishing/assembly operations, etc.) including; SI units used, common thread forms, the use of calibrated measuring and processing equipment, how temperature affects dimensions of engineering materials, the basic ways to clamp/retain processing equipment together and the different types of hand and hand held power tools commonly used.

The unit also covers the underpinning knowledge and skill to prepare and install a polymer processing forming tool (e.g. mould, die, cutter, sieve, mixer, etc.) to one type of process operation including; information and installation procedures required, safety issues to be considered including the use of PPE, preparations requirements prior to the installation including checks on hand tools, lifting and manoeuvring equipment, aligning and securing forming tools and final checks to ensure the installation meets requirements including a safe working area.

SCIENCE MANUFACURING PROCESS OPERATIVE

Level
2 (intermediate Apprenticeship)

Duration
Typically, 12-18 months.

Details of Standard
Science manufacturing process operatives are employed across the science sector. The sector includes companies working in Nuclear, Petrochemical, Pharmaceutical, Biotechnology, Formulated Products, Packaging and Polymers. A science manufacturing process operative will undertake basic operations and monitoring of plant and equipment, including pumps, valves, temperature gauges, filtration equipment, tanks, vessels and production/processing machinery; or they will safely operate machines to process/manufacture, assemble and finish component parts or finished products by hand, appropriate to their level of responsibility.

The working environment may require the use of specialist safety equipment. They may also have to comply with the requirements of Good Manufacturing Process (GMP) regulations if operating in a 'clean room' environment. A science manufacturing process operative will be expected to work in a supervised environment either individually or as part of a team. They will be expected to contribute to the maintenance of product quality and be involved in basic process improvement opportunities. They will have an appropriate level of knowledge of health and safety requirements within the industry, basic operating procedures and take a multi skilled approach to achieving production/processing targets.

Requirements
Science manufacturing process operative are able to:

Knowledge
Science manufacturing process operative are able to:

1. Science manufacturing industry plant and equipment, including: pumps, valves, temperature gauges, filtration equipment, tanks, vessels and production/processing machinery such as automated production lines and assembly operations.
2. How to operate the above plant and equipment, to process/manufacture, assemble and finish industry component parts or finished products and materials in a science manufacturing environment.
3. Process manufacturing improvement techniques for example 5S Methodology and Good House Keeping improvements and their application in a science manufacturing environment.
4. The organisational structure of their science manufacturing company and their role within it.
5. Their organisation's ethical practices and codes of conduct.
6. Regulatory compliance and policies typically required by science manufacturing employers, for example external GMP and internal polices required for 'clean room' practices.
7. The hazards and risks associated with the science manufacturing plant operation and environment and the use of correct personal protective equipment (PPE) and safety equipment to ensure safe plant operation and safety in the workplace.

Skills

8. Prepare science manufacturing materials, plant and equipment, for hand or machine based process operations, typically using pumps, valves, temperature gauges, filtration equipment, tanks and vessels; including checking availability and quality of materials, correct conditions and safety checks according to standard operating procedures
9. Start-up a basic science manufacturing machine based or hand based processes, typically using equipment as above, following process operating instructions.
10. Perform operations and monitor basic science manufacturing process according to company safe working practices as directed by line manager.
11. Produce a representative sample of science manufacturing product for quality test purposes and inspect products to ensure quality is maintained in line with company quality procedures.
12. Carry out assembly and finishing operations for a machine or hand based process operation in science manufacturing process.
13. Make simple adjustments to the science manufacturing process to remedy problems, reporting any problems or abnormal conditions when unable or unauthorised to resolve.
14. Shut down/complete a basic science manufacturing process following process operating instructions.
15. Comply with the Health, Safety and Environmental regulations, including correct use of PPE.
16. Comply with and meet the requirements of their company quality standards.
17. Work to and meet the requirements of standard operating procedures relevant to their scope of work.
18. Comply with instructions pertaining to the internal and external regulatory requirements set by the relevant competent authority and/or specified by the relevant competent authority and/or specified by the company.
19. Complete routine documentation such as quality inspection sheets and production records.
20. Perform simple calculations associated with the operation, for example raw material quantity and production calculations
21. Support process manufacturing improvement activities, for example implementing plant improvements as directed and responding to plant and process change requirements.

Behaviours

22. Communicates appropriately to support the working of the team
23. Accepts responsibility of own work and the impact of own work on others
24. Displays a willingness to contribute to the work of others.
25. Shows respect for others, having regard for diversity and equality
26. Manages own time, being punctual, reliable and completes work to agreed schedule
27. Responds positively to change in the working environment.

Qualifications

Apprentices without level 1 English and mathematics will need to achieve this level prior to completion of their apprenticeship.

Apprentices must complete the Diploma in Polymer Operations, which is recognised for professional registration by PIABC, prior to completing the apprenticeship's end-point assessment.

Link to professional registration

In association with the awarding organisation, PIABC, apprentices achieving the standard will gain the newly developed Diploma in Polymer Processing Level 3 which has been specifically developed for industry by the industry. This can lead to professional membership through the Institute of Materials, Minerals and Mining (IOM3)

END POINT ASSESSMENT

End Point Assessment (EPA)

The EPA should only commence once the employer has confirmed that the apprentice has developed all the KSBs defined in the apprenticeship standard and they have met the requirements below. Employers may wish to take advice from a training provider.

English & maths: apprentices without English and mathematics at level 2 must achieve level 1 English and mathematics and take the tests for level 2 prior to taking their EPA.

Evidence Portfolio (portfolio): during the on-programme period the apprentice must compile an evidence portfolio. It must contain evidence mapped against the standard's KSBs, with at least one piece of evidence mapped to each KSB. Evidence may be mapped against more than one KSB. Evidence sources may include, performance reviews, training records/certificates, photographs, production reports or appropriate documents; this list is not definitive. During the VCD the apprentice will have the opportunity to refer to the portfolio.

Vocational competence evaluation log (log): A summary record of on-programme vocational competence evaluation, signed off by a technical expert (see below) nominated by the apprentice's employer, must be recorded in a log. The log must signpost to the evidence, which is held in the portfolio that was used to confirm the apprentice demonstrated competence. This signed log will be used as the evidence that the employer has confirmed the apprentice is competent. The signed log is a mandatory gateway requirement and it must be provided to the EPAO gateway in order for EPA to go ahead. It is not assessed as part of the EPA. EPAOs must provide guidance on what format the log might take.

End-point Assessment Methods & Timescales

The end-point assessment consists of 2 distinct assessment methods:

1. Practical Observation (PO), with questioning
2. Vocational Competence Discussion (VCD), underpinned by the portfolio

The order in which apprentices can take assessments is not fixed, to allow EPAOs flexibility and efficiency in scheduling. It is anticipated that the PO and VCD will take place on the same day and be assessed by the same independent assessor; however, this is not a requirement.

Practical Observation, with questioning

A practical observation, with questioning will assess the apprentice holistically against a range of knowledge and skills in their workplace setting. The independent assessor following discussion with the employer should select the 2 contexts to be observed as part of the PO, in either a batch or continuous process, from the following:

1. Prepare
2. Start-up
3. Perform
4. Shut down
5. Assemble & finish

EPAOs must work with employers to ensure the planned tasks meet the specification for the PO, whilst fitting in with the operational needs of the business. EPAOs must ensure all POs are of the same size and complexity.

Vocational Competence Discussion, underpinned by the portfolio

Apprentices will take part in a VCD on a one-to- one basis with an independent assessor. This will be a structured discussion supported by the portfolio with 4 questions, one from each of these areas from the standard:

- Working safely
- Regulatory compliance
- Problem solving
- Process manufacturing improvement techniques

Questioning will explore underpinning behaviours and the independent assessor may ask follow-up questions for clarification. The apprentice must support their response with reference to the evidence held in their portfolio.

FURTHER INFORMATION

www.solutions4polymers.co.uk

https://www.cwa.ac.uk/

http://www.piabc.org.uk/

https://www.iom3.org/

https://www.gov.uk/take-on-an-apprentice

Apprenticeships

PIABC

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