National Occupational Standards

Sector: Building and Construction

Occupation: SPF (Spray Polyurethane Foam) Roofer

MQF Level: 4

Units:

- SPF401: Transport and Handling of Goods
- SPF402: Measurements and Maths
- SPF403: Materials and Technical Requirements in Waterproofing
- SPF404: Product Warranty
- SPF405: Health and Safety: Security During Work Practices
- SPF406: Product Application

Last updated: March 2022

SPF401: Transport and Handling of Goods

Proper handling and transport of tools and materials in a correct and safe way.

Performance Criteria

The candidate must have the necessary knowledge and skills to supervise and ensure that:

1. Communication is effective;
2. Duties are performed with manual dexterity;
3. Tools and machinery are handled in a basic manner;
4. Gun spraying is handled with basic dexterity;
5. Instructions are followed;
6. Literacy skills are evidenced;
7. Simple arithmetic calculations can be completed;
8. Basic health and safety regulations are understood;
9. Protective clothing is used when carrying out work duties;
10. Work is observed and there is the ability to provide all that is required to produce a good waterproofing job.

Required Knowledge

The SPF Roofer must know, demonstrate, and explain:

1. How to evaluate identified project tasks and identify the required corresponding activities to carry them out;
2. How to read and interpret instructions according to method statements;
3. How to determine and interpret the sequence of events required to carry out the assigned tasks;
4. How to use and service a spray gun;
5. How to operate the spraying machine;
6. How to observe all health and safety procedures which may include the removal of hazards and the erection of temporary perimeter walls;
7. Why they must not venture around the place of work before any protective barriers and other protections are in place;
8. Why they must wear and use all required protective equipment when on site (safety shoes, helmets, protective eyewear, gloves, and clothing).

Materials:

9. That cans cannot be opened in closed and unventilated areas without protective respiratory masks;
10. That polyurea and polyurethane products cannot be placed or stored in areas subject to direct sunlight or elevated temperatures;
11. That polyurea and polyurethane liquid components are highly flammable, and that tanks must be intact and opened away from heat sources or flames.

Required Skills
The SPF Roofer must be able to: 1. Transport and safely handle machinery and other components; 2. Transport and handle safely polyurethane and polyurea industrial tanks; 3. Carry all solvent-based primers and membranes with the use of appropriate protective clothing and store these at temperatures below 25°degrees; 4. Safely carry goods and other materials, avoiding heavy loads and long distances; 5. Avoid accidents while carrying goods; 6. Avoid product spills and loss of materials while carrying goods.

SPF402: Measurements and Maths

The Metric system is the most common and widely used system around the world. Measurements are important to determine the size, capacity, or quantity of an area. Candidates must have a basic knowledge of this.

Performance Criteria

The candidate must have the necessary knowledge and skills to supervise and ensure that:

1. Communication is effective;
2. Duties are performed with manual dexterity;
3. Tools and machinery are handled in a basic manner;
4. Gun spraying is handled with basic dexterity;
5. Instructions are followed;
6. Literacy skills are evidenced;
7. Simple arithmetic calculations can be completed;
8. Basic health and safety regulations are understood;
9. Protective clothing is used when carrying out work duties;
10. Work is observed and there is the ability to provide all that is required to produce a good waterproofing job.

Required Knowledge

The SPF Roofer must know, demonstrate, and explain:

1. How to evaluate identified project tasks and identify the required corresponding activities to carry them out;
2. How to read and interpret instructions according to method statements;
3. How to determine and interpret the sequence of events required to carry out the assigned tasks;
4. How to use and service a spray gun;
5. How to operate the spraying machine;
6. How to observe all health and safety procedures which may include the removal of hazards and the erection of temporary perimeter walls;
7. Why they must not venture around the place of work before any protective barriers and other protections are in place;
8. Why they must wear and use all required protective equipment when on site (safety shoes, helmets, protective eyewear, gloves, and clothing);
9. Basic mathematical knowledge (adding, subtraction, multiplication, and division);
10. Measurements in metres and centimetres;
11. Product consumptions.

Required Skills

The SPF Roofer must be able to:

1. Measure the surface area in square metres;
2. Take measurements prior to any works;
3. Include an extra 10cm connexion to vertical walls, plus a minimum of 10% installer wastage;
4. Establish the material consumption per square metre for the entire surface area.

SPF403: Materials and Technical Requirements in Waterproofing

Polyurethane expanding foam is a two-component product. It is the result of a chemical reaction between a polyol and a diisocyanate. These two chemicals tend to bond and expand when they come in contact with each other. The reaction is very fast and it only takes a few seconds to transform them from a liquid state into a dense thick foam. Candidates must have good product knowledge.

Performance Criteria

The candidate must have the necessary knowledge and skills to supervise and ensure that:

1. Communication is effective;
2. Duties are performed with manual dexterity;
3. Tools and machinery are handled in a basic manner;
4. Gun spraying is handled with basic dexterity;
5. Instructions are followed;
6. Literacy skills are evidenced;
7. Simple arithmetic calculations can be completed;
8. Basic health and safety regulations are understood;
9. Protective clothing is used when carrying out work duties;
10. Work is observed and there is the ability to provide all that is required to produce a good waterproofing job.

Required Knowledge

The SPF Roofer must know, demonstrate, and explain:

1. How to evaluate identified project tasks and identify the required corresponding activities to carry them out;
2. How to read and interpret instructions according to method statements;
3. How to determine and interpret the sequence of events required to carry out the assigned tasks;
4. How to use and service a spray gun;
5. How to operate the spraying machine;
6. How to observe all health and safety procedures which may include the removal of hazards and the erection of temporary perimeter walls;
7. Why they must not venture around the place of work before any protective barriers and other protections are in place;
8. Why they must wear and use all required protective equipment when on site (safety shoes, helmets, protective eyewear, gloves, and clothing);

Polyurethane Expanding Foam:

9. That polyurethane is for industrial purposes and is normally distributed in ready-to-use 200lt cans;
10. That a particular machine comprising of a special spray gun is required to spray polyurethane expanding foam;
11. That polyurethane spray machines require a 3-phase mobile generator, external heat belts, and an air compressor in order to function and be able to spray the polyurethane;

12. That polyurethane expanding foam comes in varies densities and can be applied in various thicknesses;
13. That the polyurethane spray machine is a complex piece of equipment designed to heat both components and channel the liquid polyurethane in apposite hoses at a predeterminate temperature of around 40°- 45°, until they reach the tip of the spray gun;
14. That polyurethane expanding foam can be applied at temperatures between 5° and 40°;
15. That polyurethane expanding foam must not be applied on wet or humid surfaces or on rainy days;

Polyurethane and Polyurea Spray Guns:

16. That the spray gun is professional piece of equipment made of high-quality materials. It is designed to receive the liquid components inside it and allow them to meet only when the trigger is pressed;
17. That the spray gun has an ergonomic handle and is equipped with a specific valve that regulates the extrusion pressure, allowing the operator to dose and spray the required amount of foam;

Polyurethane Expanding Foam:

18. The primary function of thermal insulation materials;
19. How the polyurethane expanding foam reduces the transmission of heat or cold inside buildings;
20. The properties of polyurethane expanding foam, including, density, closed cell properties, and thermal conductivity;
21. That expanding polyurethane foam is a polyol mixture admixed with catalyst additives and expanding agents to optimise its spray application;
22. That the foam contains agents not dangerous for the ozone layer and therefore has an ODP equal to Zero;
23. That polyurethane expanding foam has noise abatement properties when applied between floors or walls;
24. That the material can also be used as bedding for underfloor heating, preventing heat loss and reducing electric consumption.

Required Skills

The SPF Roofer must be able to:

1. Properly handle machinery and tools
2. Operate and service the polyurethane spray machine;
3. Produce a seamless homogenies surface in various thicknesses with expanding polyurethane foam according to the manufacturer's recommendations;
4. Produce a seamless surface with polyurea according to the manufacturer's recommendations
5. Dismantle all the components of the spray gun and reconstruct it to facilitate its cleaning;
6. Regulate the extrusion sprayed to achieve precision and general quality of the final result;
7. Handle the spray gun and be able to spray the right amount of product evenly in order to achieve the desired thickness;
8. Produce a certified waterproofing or insulating system that can be backed with a written guarantee.

SPF404: Product Warranty
The European law states that all products and services must carry a guarantee for a period of not less than 2 years. This unit covers the duties and obligations of the SPF Roofer in terms of international guarantees. **Performance Criteria** The candidate must have the necessary knowledge and skills to supervise and ensure that: 1. A certified waterproofing system can be created; 2. The purposes of guarantees is defined; 3. Written guarantees are issued, on the basis that these are promises to repair or replace the waterproofing system proven to be defective within a specified period of time; 4. Receipts are issued.
Required Knowledge
The SPF Roofer must know, demonstrate, and explain: 1. The definition of a guarantee and what it covers 2. The purpose of a guarantee, which is to reassure customers of good work and reliable waterproofing protection 3. The difference between guarantee and product duration; 4. That the guarantee must clearly state in full the name and address of the installer, together with the client's details and address.
Required Skills
The SPF Roofer must be able to: 1. Issue a written guarantee of the completion of works; 2. Issue a minimum two-year guarantee on works and labour as stated per EU Regulations; 3. Issue a fiscal receipt to accompany the guarantee when presented to the customer.

SPF405: Health and Safety: Security During Work Practices

Studies have shown and certified that polyurethane in its cured state does not pose a risk to our health. The material poses some risks only during the spray application phase and can be immediately hazardous to a person's health if not properly handled. Candidates must be familiar with health and safety regulations as well as secure work practices. The use of appropriate protective clothing is a must when spraying chemicals.

Performance Criteria

The candidate must have the necessary knowledge and skills to supervise and ensure that:

1. Communication is effective;
2. Duties are performed with manual dexterity;
3. Tools and machinery are handled in a basic manner;
4. Gun spraying is handled with basic dexterity;
5. Instructions are followed;
6. Literacy skills are evidenced;
7. Simple arithmetic calculations can be completed;
8. Good knowledge of health and safety regulations is demonstrated;
9. Protective clothing is used when carrying out work duties;
10. Work is observed and there is the ability to provide all that is required to produce a good waterproofing job.

Required Knowledge

The SPF Roofer must know, demonstrate, and explain:

1. How to properly handle and identify hazards;
2. The function of safety equipment required to be fully protected during the application of the polyurethane expanding foam;
3. That spray application generates isocyanate vapours and aerosols; inhalation and exposure to these harmful chemicals before it has a chance to fully cure can develop asthma or other breathing problems, along with eye and skin irritation;
4. That polyurethane and polyurea cannot be applied on rain and windy days;

Protective Clothing

5. The type of protective clothing required according to the potential exposure, including:
    - Disposable and secure coveralls to protect against spray and mist from coming in contact with skin and clothing;
    - An impermeable PVC coat, boots, and trousers to be used in case of any potential splashing;
    - Safety shoes that must be worn at all times, using disposable shoe coverings with skid resistant soles during spray;
    - Gloves for a firm grip and protection, which are an important safety piece of equipment during spraying of polyurea and polyurethane expanding foam
    - Chemical-resistant gloves (to be used during handling of the drums containing the polyol and a diisocyanate liquids)
    - Thermal-resistant gloves (to be used only during the spray application of the polyurea

and polyurethane);

6. The importance of good protective eyewear, safety goggles, and respirators, and how to wear them;
7. That airborne particles generated by spraying polyurethane foam can pose a serious risk to health, if swallowed or if in contact with eyes;

Product Spills

- How to minimise the impact following the remote possibility of its occurrence;
- How to keep storage compounds away from surface watercourses and drains;
- How to make sure that all drums and cans are properly labelled.

Required Skills

The SPF Roofer must be able to:

1. Follow basic health and safety procedures and specific work practice standards;
2. Wear the right size and kind of protective clothing according to the situation;
3. Keep masks and goggles well cleaned, and disinfect the respirator according to the manufacturer's instructions;
4. Change/replace any damaged/deteriorated parts of the respirator prior to its use, as well as check and replace respirator filters;
5. Check protective equipment for inadequacies, including cracks in masks and respirators, loose face shields, broken clasps, holes, and tears;
6. Shield habitable buildings from spray mists or vapours that might enter inside by covering with plastic any openings and induction vents close by;
7. Cover with plastic sheets any parked cars and other important equipment situated close by or below;
8. Take precautions when handing materials from one place to another; this includes vehicles properly equipped for transport of materials and storage facilities with controlled temperatures;
9. Observe the following protocol in case of a spill:
    - Clear the affected area of unnecessary personnel;
    - Inform the supervisor in charge;
    - Put on emergency protective equipment;
    - Prevent further spillage if possible;
    - Confine the spill using dikes of sand or earth;
    - Remove all liquid and residues from the spill and carry these away with the use of spill kits;
    - Decontaminate the area with plenty of water;
    - Clean the area with a mixture of 90% water to 0.05% liquid detergent and 9.5% sodium bicarbonate, so as to remove all trace of product;
10. Protect and adequately store equipment, materials, and machinery;
11. Take precautions to prevent spillage of hazardous material on site;
12. How to fit drums with water control taps to prevent spills.

SPF406: Product Application

Like with many other materials, sprayed polyurea and polyurethane expanding foam must be applied over a dry and cohesive surface. The expanding polyurethane foam is strongly influenced by the ambient temperature and humidity in which it must act. These two will determine the correct polymerisation, solidification, and quality of the foam. The correct application of spray polyurethane foam requires the perfect combination of heat, pressure, and spray gun configuration.

Additionally, the proper disposal of any remaining foam is a crucial part of the application. Likewise, the drums containing component "A" and "B" need to be properly prepared, decontaminated, and disposed of in accordance with regulatory requirements.

Performance Criteria

The candidate must have the necessary knowledge and skills to supervise and ensure that:

1. Communication is effective;
2. Duties are performed with manual dexterity;
3. Tools and machinery are handled in a basic manner;
4. Gun spraying is handled with basic dexterity;
5. Primer is applied correctly;
6. Instructions are followed;
7. Literacy skills are evidenced;
8. Simple arithmetic calculations can be completed;
9. Basic health and safety regulations are understood;
10. Protective clothing is used when carrying out work duties;
11. Hazards are correctly identified;
12. Work is observed and there is the ability to provide all that is required to produce a good waterproofing job.

Required Knowledge

The SPF Roofer must know, demonstrate, and explain:

Dusting Concrete:

1. How dust prevents the adhesion of the spray foam to the surface;
2. How dusting concrete can be cured with the application of a deep penetrating consolidator;
3. How the two-component water-based epoxy consolidator works;

Ambient Temperature:

4. The minimum and maximum application temperatures of polyurethane expanding foam and polyurea, these being 5°C and 40°C respectively;
5. That the best performing results will always be obtained with ambient temperatures around +18°C to +20°C;
6. How humidity can cause a major problem when spraying polyurea and polyurethane foam;
7. Why spray polyurethane expanding foam should not be sprayed in relative high humidity levels in excess of 70%;
8. That problems related to humidity include foam thickness, adhesion, and cell structure;
9. That presence of moisture can have serious consequences, especially during the mixing of the components or during the curing phase of polyurethane;

10. That a desiccant or refrigerated dryer is a must use equipment when it comes to spray polyurethane in Malta due to our hot and humid climate

Problems with Spray Polyurethane Expanding Foam:

11. That not properly calculating the combination of heat, pressure, and spray gun configuration can result in poor cell structure and dimensional instability, leading common problems such as foam shrinking and cracking, voids, and poor adhesion;
12. That the mixing of component "A" and component "B" must be in a ratio by volume of 1:1 or within a difference of not more than 2 percent, and that the wrong mixture ratio can lead to problems with the product formation and catalysis, and that an unbalanced ratio can have various visible effects;
13. That excess of component "A" tends to form a hard, friable, and brittle finish, and that excess of component "B" produces a soft and gummy finish and likely to have a high odour.
14. That off-ratio can occur due to various situations:
    - The most common are those related to unproper storage of the components and not within the recommend temperature range specified by their manufacturer (Recommended storage temperature 15°- 25° degrees).
    - Expired or out of date.
    - Contaminated components.
    - Faulty spray equipment can lead to off-ratio foam, like the two transfer pumps that send the "A" and "B" components to the proportioning pump.
    - Heating problems, when the materials are not properly heated and pressurized before pumped inside the hoses and to the spray gun. The foam may not get hot enough to react properly
    - Excess of component A caused by a cold component B
    - Dirty spray gun or the nozzle too large, the components won't mix well in the gun's mixing chamber when the trigger is pulled
    - Equipment malfunction can also lead to off ratio foam

Moisture Problems

15. That excessive moisture in the substrate can act as a blowing agent;
16. that excessive exothermic heat can actually scorch foam;
17. that the result of fast application can lead to exothermic heat build-up;
18. that polyurethane expanding foam cannot be applied on wet or damp surfaces;
19. that trapped moisture or damp will transform into vapour soon after, creating a negative pressure trust, and once this reaches 3.5% it will detach and bubble the expanding foam;
20. that moisture on the surface can react with component "A", resulting in off-ratio foam with poor physical cell structure and poor adhesion, leading to cracks between the foam and around the perimeter walls;

Concrete Curing

21. That curing the time of concrete is 28 days and nothing can be applied before it is cured;

Cell Structure

22. That polyurethane expanding foam must have a consistent cell structure without any significant colour changes, cell deformation or other anomalies;
23. that dark or scorched areas in the middle of the foam indicate high exothermic heat, which can result in cracks and shrinkage;

Density

24. That a softer or brittle crust is an indication of an off-ratio or poor mix;

Adhesion

25. That adhesion problems are usually related to concrete dust (apply consolidator) or an off-ratio mix;

Cracks from Foam Sprayed Too Thick

26. That when both components come together, there is a very rapid exothermic (heat-producing) chemical reaction;
27. That good expanding polyurethane foam has to be cooled quickly or it cracks and chars; if it's applied too thick, the insulating properties of the spray foam trap the heat, which can result in shrinking and cracks;

Expanding Joints

28. that polyurethane expanding foam can crack if applied on structural joints;
29. that proper sealing of joints and openings with an elastomer is required prior to spray application to prevent permanent deformation, as the stresses generated by the effects of expansion-contraction on very wide joints, from 2 to 4cm, cannot be absorbed by the foam;

Repairs

30. That cracking and other problems in expanding foam installation affect only small areas;
31. That repairs can be done without a total tear out of the existing insulation;
32. That repairs can be done by cutting a 45-degree angle to where it exhibits good adhesion and good physical properties; after the substrate has been cleaned, if necessary, the area should be once more reprimed and resprayed;

Disposal of SPF Chemicals and Drums

33. that it is never acceptable to abandon or discard a drum without following proper disposal procedures in accordance with legal requirements;
34. that any left overs of both chemicals can be reacted to produce foam. Cured foam is typically non-hazardous, and can be disposed of as non-hazardous waste;

Application Modalities

35. That fewer layers to obtain a cerin thickness will achieve a higher density foam and better thermal properties;
36. That thin layers are recommended only when spraying large thicknesses to prevent high exothermic heat reactions and to obtain quality foam.

Required Skills

The SPF Roofer must be able to:

1. Apply the epoxy consolidator by roller or brush at least 24 hours before the implementation of the polyurethane expanding foam;
2. Read the thermometer
3. Check the polyurethane expanding foam for rigidity, thickness, and yield, particularly on cool and humid days;

4. Ensure that no condensed water is trapped inside the air compressor during spray application;
5. Visually recognise when the material is not complaint with specifications, and notify relevant individuals when this is the case;
6. Use a hygrometer to check the humidity level inside the concrete prior to application;
7. Use a dryer to dry the surface area;
8. Modify the coating thickness by altering the application speed and/or mixing chamber of the gun;
9. Apply the polyurethane expanding foam in as few layers as possible and at an interval from each other, to allow the spray foam to cool down between applications;
10. Produce a seamless homogenies surface in various thickness with expanding polyurethane foam according to the manufacturer's recommendations;
11. Produce a seamless surface with polyurea according to the manufacture's recommendations.