INTERNATIONAL STANDARD

ISO 8873-2

First edition
2007-05-01

Rigid cellular plastics — Spray-applied polyurethane foam for thermal insulation —

Part 2: **Application**

Plastiques alvéolaires rigides — Mousse de polyuréthanne projetée pour l'isolation thermique —

Partie 2: Application

Reference number
ISO 8873-2:2007(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 8873-2 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 10, *Cellular plastics*.

This first edition of ISO 8873-2, together with ISO 8873-1 and ISO 8873-3, cancels and replaces ISO 8873:1987, which has been technically revised.

ISO 8873 consists of the following parts, under the general title *Rigid cellular plastics — Spray-applied polyurethane foam for thermal insulation*:

— *Part 1: Material specifications*

— *Part 2: Application*

— *Part 3: Test methods*

Introduction

Spray polyurethane foam for thermal insulation is made by combining two liquid components on the project site to manufacture a product. As the manufactured product is what provides the physical and thermal properties desired by the user, it only becomes spray polyurethane foam when it is installed. As such, an International Standard for the application and installation is required.

This part of ISO 8873 outlines the obligations for the installer of the liquid components that produce the actual material.

ISO 8873-1 outlines obligations for the manufacturers of spray polyurethane foam liquid components.

ISO 8873-3 provides test methods which have not previously been specified in International Standards.

This page is intentionally blank.

Rigid cellular plastics — Spray-applied polyurethane foam for thermal insulation —

Part 2: Application

WARNING — Persons using this document should be familiar with normal laboratory practice, if applicable. This document does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any regulatory requirements.

1 Scope

This part of ISO 8873 outlines requirements for the application of rigid cellular plastic spray polyurethane foam for thermal insulation. The primary application of the material is for use as thermal insulation. Spray polyurethane foam can also be used as the air barrier material which forms part of an air barrier assembly in buildings. Under specific application conditions, the material can be used in vapour barrier applications in a building assembly (details of the conditions can be obtained from the manufacturer). The application requirements are for the installation of spray polyurethane foam whether applied on a building site or in a prefabrication (manufacturing) facility.

This part of ISO 8873 can be used for non-building applications when agreed to by the supplier and the purchaser.

The requirements include obligations for the manufacturer, the contractor and the installer. The requirements include the selection of chemical components, application requirements, quality control and documentation of the application, limitations for the application and requirements for safety and for disposal of associated waste material and packaging.

Installation of spray polyurethane foam for thermal insulation, according to this part of ISO 8873 requires the use of materials and/or equipment that could be hazardous (see Warning).

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 8873-1, *Rigid cellular plastics — Spray-applied polyurethane foam for thermal insulation — Part 1: Material specifications*

ISO/IEC 17024, *Conformity assessment — General requirements for bodies operating certification of persons*

3 Terms and definitions

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

3.1
authority having jurisdiction
officer or officers having authority, under appropriate regulatory instruments, to exercise enforcement

3.2
apprentice installer
individual who applies spray polyurethane foam on the job site, under the direct supervision of a spray polyurethane installer

3.3
certification organization
impartial body possessing the necessary competence and reliability to operate a certification system in accordance with ISO/IEC 17024, in which the interests of all parties concerned with the functioning of the system are represented

3.4
equipment manufacturer
manufacturer of equipment designed for spray-application of rigid polyurethane cellular plastic thermal insulation

3.5
***in-situ* thermal insulation**
thermal insulation product produced or taking its final form at the site of application and which achieves its properties after installation

3.6
site quality assurance programme
quality assurance programme (QAP) based upon quality standards, which ties the chemical system components manufacturer (supplier), the contractor and the installer together for the installation of spray polyurethane foam

NOTE 1 The QAP should outline the responsibilities and obligations of each of the three parties. The QAP should outline the training and certification requirements for each of the three parties and should include a site inspection of the installation of spray polyurethane foam.

NOTE 2 ISO 9001 and ISO 12576-2 are examples of quality standards.

3.7
spray polyurethane foam
rigid cellular plastic material with substantially closed cell structure based on polyurethanes, which is foamed *in situ* by the catalysed reaction of polyisocyanates and polyhydroxyl compounds, expanded with blowing agents

3.8
spray polyurethane foam contractor
individual, organization or corporation who is responsible for all requirements and obligations for the installation of the product

3.9
spray polyurethane foam installer
individual or worker who applies the chemical components by mixing and spraying them to form the rigid cellular plastic spray polyurethane foam product

NOTE The installer is responsible for the actual installation and site requirements identified by the manufacturer and/or this part of ISO 8873 for application of the product. The installer should be trained and qualified as having

demonstrated the required knowledge for proper application of the product by a certification organization (CO). The installer should follow the requirements for installation and the obligations for installers identified by the manufacturer and this part of ISO 8873.

3.10
spray polyurethane foam system manufacturer
manufacturer/supplier of the liquid chemical components, polyisocyanates and polyhydroxyl blends containing also flame retardants, blowing agent and catalysts (system), which are designed to be mixed and sprayed to form rigid polyurethane foam insulation material *in situ*

4 Requirements

4.1 Manufacturer

The manufacturer (supplier)

a) shall produce material that meets the requirements of ISO 8873-1,

b) shall mark and label the shipping containers to declare that the material meets the requiements of ISO 8773-1,

c) shall declare the certification organization that is responsible for delivering the site quality assurance programme for their product, and

d) shall ensure that the material is installed by a spray polyurethane foam contractor using a spray polyurethane foam installer in accordance with this part of ISO 8873 and the instructions given by the chemical manufacturer.

4.2 Spray polyurethane foam contractor

The spray polyurethane foam contractor

a) shall produce material that meets the requirements of ISO 8873-1 and shall comply with all requirements of this part of ISO 8873;

b) shall select the material that is appropriate for the installation;

c) shall procure material which complies with ISO 8873-1 from a spray polyurethane foam system manufacturer;

d) shall verify, through the use of drum labels or other documentation, that the material received complies with ISO 8873-1;

e) shall have at least one trained and certification organization approved spray polyurethane foam installer on each job site during the application of the spray polyurethane foam thermal insulation;

f) shall be responsible for all aspects of the installation of the material; all regulations shall be complied with during the installation of the material; the completed application shall comply with all appropriate regulations such as building codes;

g) shall ensure that the spray polyurethane foam installer has successfully completed a training course approved by the manufacturer and the certification organization; the spray polyurethane foam installer shall successfully complete the training and have obtained certification as a spray polyurethane foam installer;

h) shall provide the spray polyurethane foam installer with proper equipment to install spray polyurethane foam; equipment may include, but is not limited to, transfer pumps, a proportioner unit, hoses, hose heaters, spray guns, compressors and generators;

i) shall provide, or ensure that the spray polyurethane foam installer has, proper personnel protection, which shall include a positive fresh-air-supplied full-face respirator; other protection includes head protection, eye protection, ear protection, body protection, hand protection and foot protection;

j) shall provide, on each job site, a test kit meeting the requirements outlined in Annex K for use by the spray polyurethane foam installer to conduct the testing required for thermal insulation in accordance with this part of ISO 8873;

k) shall ensure that the spray polyurethane foam installer conducts the daily testing;

l) shall ensure that the installer completes daily work records in accordance with the site quality assurance programme; this daily work record shall contain

   — information on the job site, date and material used,

   — name of the installer and certification number,

   — application conditions and environmental conditions,

   — results of the testing completed on site,

   — whether the material complies with ISO 8873-1,

   — whether the project required isolation and ventilation, and

   — whether the material used has been evaluated by a third party;

m) shall supply the installer with all the forms required; the daily work record shall be completed at the beginning of each day, each time a material batch is changed, and when the job site is changed within a given day;

n) shall keep the daily work records for a period of seven years; these records shall be made available upon request, within a reasonable time, to the manufacturer or the certification organization; the minimum information required for a daily work record is shown in Annex H;

o) shall provide a job site declaration form containing the minimum information outlined in Annex I to the customer within 30 days of completion of the project;

p) shall ensure that the spray polyurethane foam installer follows the site quality assurance programme developed by the certification organization; a copy of the site quality assurance programme shall be made available upon request;

q) shall maintain the installation equipment in proper working order;

r) where a separate contractor is responsible for the thermal barrier installation and when the authority having jurisdiction requires a thermal barrier for that application, the spray polyurethane foam contractor shall notify the building owner or the owner’s representative in writing of the requirement for a thermal barrier and the flammability hazard, which could exist until such time that the foam is covered.

4.3 Spray polyurethane foam installer

The installer

a) shall produce material that meets the requirements of ISO 8873-1 in accordance with this part of ISO 8873, the instructions provided by the spray polyurethane foam system manufacturer and the spray polyurethane foam contractor;

b) shall confirm, using drum labels or other documentation, that the liquid chemicals to be used on site have been declared by the manufacturer to comply with ISO 8873-1 before commencing installation;

c) shall be responsible for the on-site installation of the material, safe handling and storage of the material, proper isolation of the spray area, warning signs when spraying is in progress, site housekeeping, and their own personal and the crew's health and safety; the spray polyurethane foam installer shall wear proper personnel protection, which includes head protection, eye protection, a positive fresh-air-supplied full-face respirator, ear protection, body protection, hand protection and foot protection in compliance with regulations;

d) shall successfully complete a training course approved by the manufacturer and the designated certification organization; the installer shall obtain certification from the designated certification organization as a spray polyurethane foam installer; a recommended training outline is shown in Annex J;

e) shall follow all operating instructions for the equipment provided by the equipment manufacturer; this equipment may include, but is not limited to, transfer pumps, a proportioner unit, hoses, hose heaters, guns, compressors and generators; the installer shall follow instructions from the equipment manufacturer for the operation, maintenance and cleaning of the equipment used for installation; the spray polyurethane foam installer shall follow all safety procedures required by the equipment manufacturer;

f) shall verify, through a material label, that the material on site has been declared by the manufacturer to comply with ISO 8873-1;

g) shall verify that the substrate has been properly prepared;

h) shall verify that the environmental conditions are within the range approved by the spray polyurethane foam system manufacturer;

i) shall set the equipment to the proper operating parameters;

j) shall install the material in accordance with this part of ISO 8873 and the manufacturer’s instructions;

k) shall comply with all requirements of the site quality assurance programme provided by the certification organization;

l) shall apply the spray polyurethane foam so that the surface is reasonably smooth and of consistent thickness;

m) shall exercise an ongoing visual and physical quality control check throughout the spray application to ensure proper adhesion to the substrate and proper quality of the spray polyurethane foam;

n) shall check with a depth gauge (see Figure 1) the thickness of the the applied foam on a continual basis and shall provide the minimum thickness specified by the owner;

o) shall conduct density, adhesion, cohesion and substrate verification at the beginning of each day, each time a material batch is changed, and when the job site is changed within a given day;

p) shall complete daily work records in accordance with the site quality assurance programme; this daily work record shall contain

- information on the job site (see Annex D), date and material used,
- name of the installer and certification number,
- application conditions and environmental conditions,
- results of the testing completed on site,
- whether the material complies with ISO 8873-1,

— whether project required isolation and ventilation, and

— whether the material used has been evaluated by a third party;

q) shall at the end of each working day, remove all waste from the construction site and dispose of it in a safe and proper manner, in accordance with local, provincial and federal requirements;

r) shall, in cases where an apprentice installer is applying the material, ensure that the apprentice is under the direct supervision of the spray polyurethane foam installer who has the responsibility for the application.

The daily work record shall be completed at the beginning of each day, each time a material batch is changed, and when the job site is changed within a given day; the minimum information required for a daily work record is shown in Annex H.

4.4 Apprentice installer

The apprentice installer

a) shall only install spray polyurethane foam thermal insulation under the direct and constant supervision of a spray polyurethane foam installer,

b) shall be required to meet all the same requirements as a spray polyurethane foam installer when installing spray polyurethane foam, and

c) shall wear proper personnel protection, which includes head protection, eye protection, a positive fresh-air-supplied full-face respirator, ear protection, body protection, hand protection and foot protection in compliance with regulations.

4.5 Material

The spray polyurethane foam system, when stored in accordance with the chemical manufacturer's instructions, properly mixed and spray applied as required in 4.3, and within the shelf life of the chemicals as declared by the manufacturer, shall produce a finished product that meets the requirements of the ISO 8873-1.

Application requirements, which will affect the performance of the finished product, shall be considered when choosing the chemical components (see Annex B).

When installed as given in 4.3, the spray polyurethane foam shall not present a health hazard to the potential occupants, nor shall the cured insulation have any residual odour.

4.6 Equipment

The chemical components shall be mixed and sprayed with a commercially available spray gun and a fixed-ratio, positive-displacement proportioning unit, specially designed for the application of spray polyurethane foam. The manufacturer shall recommend appropriate equipment to be used.

Operation, maintenance, safety and cleaning procedures detailed in the equipment manufacturer's manual shall be strictly followed.

4.7 Installation

Special applications which require properties in addition to those specified in this part of ISO 8873 shall be agreed upon by the interested parties prior to commencement of the installation.

Prior to application, a test shall be run to ensure that proper equipment settings have been selected. Consideration shall be given to reactivity, spray pattern, adhesion to substrate and the appearance of the spray polyurethane foam to ensure that each of these properties meets the requirements specified by the

spray polyurethane foam system manufacturer. The spray polyurethane foam installer shall confirm that the density of the installed material meets the minimum density declared by the spray polyurethane foam system manufacturer.

The spray polyurethane foam system shall be applied in passes to a clean, dry and sound substrate, prepared in accordance with Annex A. The thickness of the insulation shall be ascertained by using a thickness gauge as shown in Figure 1. Successive passes shall overlap to ensure a smooth surface, free of ridges.

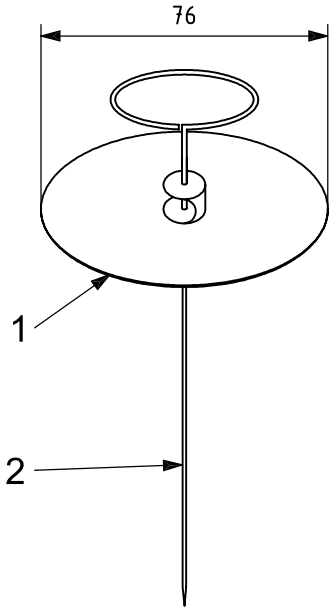
Each pass should not be less than 15 mm thick because of the possibility of reduced foaming, which adversely affects the adhesion to the substrate. Each pass should not be more than 50 mm thick to avoid elongated cell formation and to minimize the possibility of stress cracking. When several passes are required, allow for cooling of the foam to prevent scorching.

In any interior building installations, where required by the authority having jurisdiction, a thermal barrier shall cover the interior side of spray polyurethane foam for fire protection.

In permanently exposed exterior installations, coatings or coverings are necessary for protection from ultraviolet degradation. Coatings or coverings shall meet the requirements as specified by the application.

Adverse ambient environmental conditions can produce condensation on the substrate. If necessary, the spray polyurethane foam installer shall confirm this through dew point temperatures. Additional climatic factors which affect the installation of spray polyurethane foam are outlined in Annex C.

Dimension in millimetres



Key

1 transparent plastic disc and sleeve weighing 10 g ± 0,1 g; disc approx. 2 mm thick

2 stainless-steel pin, of 3 mm diameter, minimum length 100 mm, tapered to a sharp point

Figure 1 — Depth gauge

5 Applications

5.1 General

When installed as a specific application, spray-applied polyurethane foam shall meet the requirements of that application.

5.2 Air barrier system application

When using spray-applied rigid polyurethane, medium density, foam material in an air barrier assembly application, the installation of the spray polyurethane foam shall conform to the standard for the installation of air barriers assemblies.

5.3 Vapour barrier application

Spray-applied rigid polyurethane foam can provide the properties required for a vapour barrier application under specific thickness, based on the substrate and other installation requirements. The spray polyurethane foam contractor shall contact the spray polyurethane foam system manufacturer to obtain all such requirements and limitations for this application.

5.4 Exterior foundation insulation application

The spray-applied polyurethane foam shall be contoured at the wall/footing interface to allow for positive water drainage.

The exposed spray-applied polyurethane foam shall be protected from ultraviolet degradation and mechanical damage. Protective covering shall be installed on all exposed spray polyurethane foam and to a depth of 0,3 m (minimum) below ground level.

5.5 Interior foundation insulation application

Application of spray polyurethane foam acting as the sole insulation applied directly to a foundation wall does not require an additional material to be installed as a vapour barrier.

Spray polyurethane foam can be applied directly to the foundation wall above ground level as there is no air space between the spray polyurethane foam and the foundation wall.

When spray-applied polyurethane foam is installed in the interior of occupied buildings, all requirements of D.7 shall be met.

5.6 Cathedral ceilings, flat ceilings and decks over heated spaces

There are no additional requirements for these applications.

5.7 Attic application, exterior (cavity) and interior wall application

There are no additional requirements for these applications.

6 Sampling

Unless otherwise specified, randomly choose an area that represents the average application. Obtain one specimen from the surface area where spray polyurethane foam insulation is being installed. In case of dispute, three equally spaced specimens shall be obtained from a 3 m by 3 m area chosen by the inspector.

The specimens shall be taken from the installation site and removed from the substrate. Remove any loose or compacted spray polyurethane foam material from the specimens. Remove the top and bottom skin from the specimen by cutting a 6 mm slice from the top and bottom. Record the number of passes within the specimen in the daily work record.

7 Test methods

7.1 Determination of density

7.1.1 General

The density of the specimen prepared according to Clause 6 and determined in accordance with this test method shall be equal to or higher than the density declared by the spray polyurethane foam system manufacturer.

7.1.2 Principle

After determination of the mass of the specimens, the volume shall be determined by water displacement. The density shall be calculated based on the values determined above.

7.1.3 Apparatus

7.1.3.1 **Analytical balance**, accurate to 0,01 g.

7.1.3.2 **Knife**, with a blade of at least 180 mm, or a coring tool capable of cutting a sample.

7.1.3.3 **Graduated cylinder**, of minimum size 1 000 ml, with 10 ml maximum graduation.

7.1.4 Procedure

Cut and remove three specimens (approximately 70 mm in diameter and 50 mm to 100 mm long) through the full thickness of the spray polyurethane foam from the middle of the test area (see Clause 6).

Perform the following operations for the specimen.

— A Without wetting the specimen, make sure that they are of the correct size to fit into the graduated cylinder. Cut into pieces or trim if necessary. Gently shake off loose particles.

— B Weigh the specimen and record its mass (in grams), ensuring that the minimum mass is 5,5 g.

— C Fill graduated cylinder with the required volume of water and record the volume (in millilitres).

— D Submerge the specimen completely using a thin-wall plastic tube, wire or other thin instrument, and record the new volume (in millilitres) within 1 min.

— E Calculate the water (in millilitres) displaced by subtracting the volume recorded in A from the volume recorded in C.

— F Divide the specimen mass (in grams) by the water displacement volume calculated in E (in millilitres). Convert the results from grams per litre to kilograms per cubic metre.

In case of dispute, the samples shall be submitted to an accredited laboratory for the density testing.

7.2 Cohesion and adhesion test

7.2.1 General

The cohesive and adhesive strengths of the spray polyurethane foam shall be determined as outlined below. The test specimens shall not show delamination or separation. The adhesion and cohesion tests should be performed on site with the specimen attached to the substrate.

7.2.2 Principle

A circular plywood disc equipped with a hook, is bonded with an adhesive to the surface of the insulation to be tested. The spray polyurethane foam insulation is cut 70 mm in diameter through the full thickness of the insulation. A specified load is attached to the hook perpendicular to the surface, and any rupture is observed.

7.2.3 Apparatus

7.2.3.1 **Round plywood discs**, of diameter 70 mm, thickness 20 mm.

7.2.3.2 **Two-component epoxy glue**, or a shot of spray polyurethane.

7.2.3.3 **Tool**, made from thin-wall tempered pipe to make 70 mm cylindrical cuts in the insulation.

7.2.3.4 **Wires with two hooks** (to be attached to the plywood discs), wire length 600 mm.

7.2.3.5 **Support frame** for the test, as given in Figure 2.

7.2.3.6 **Weight**, of mass 1 kg.

7.2.4 Test procedure

Select a location in the middle of the sampling area (see Clause 6) and make a cylindrical cut through the entire thickness of the insulation.

Bond the discs with hooks and wire to the test specimen using two-component epoxy glue or spray polyurethane foam.

Pass each of the other ends of the wire through a support and attach to a 1 kg weight. The attachment shall be made without placing any tension on the specimen.

Lower the weight very slowly to avoid impact loading of the specimen (see Figure 2).

Observe for any rupture (delamination) at the interface between the spray polyurethane foam and the substrate for adhesion. Observe for any rupture (delamination) between the passes of the spray polyurethane foam for cohesion. Any rupture constitutes a failure of the foam system.

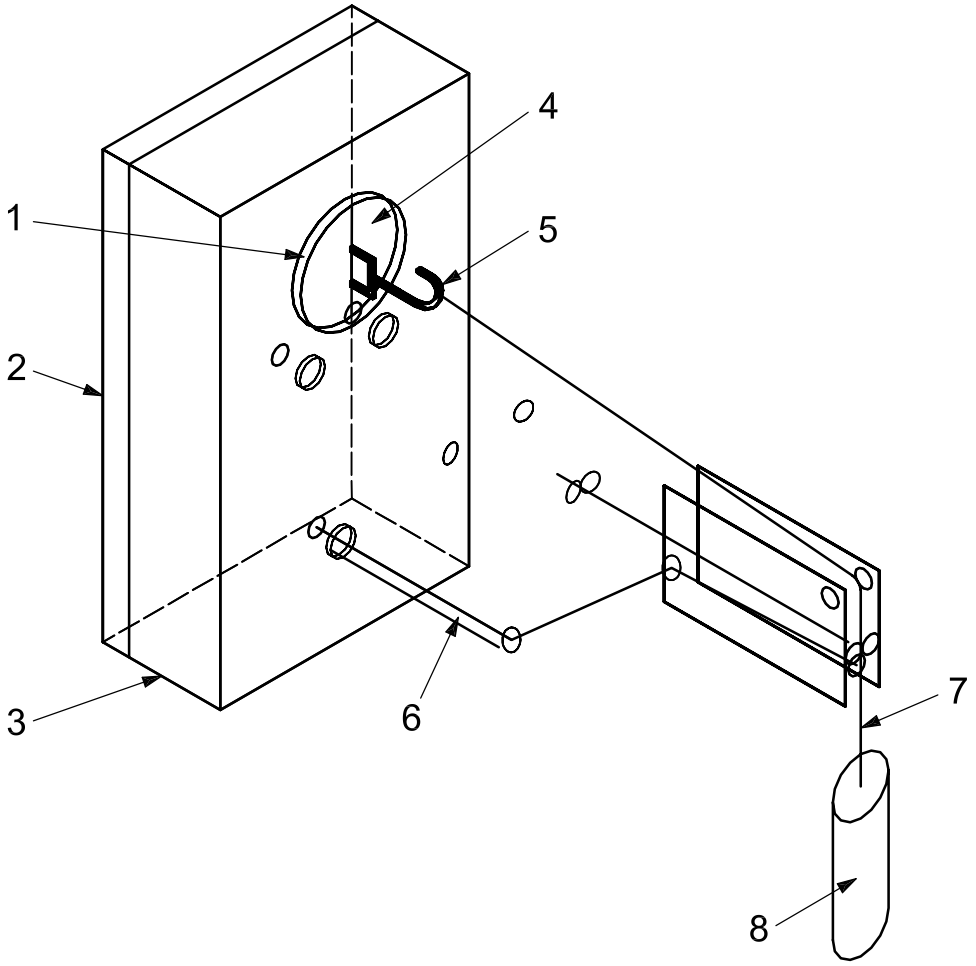
Any material that does not pass the adhesion/cohesion test shall be removed, the substrate properly prepared and new material installed.

7.3 Verification of substrate (application surface) preparation

When required by the quality assurance site auditor or the authority having jurisdiction, the preparation of the actual application surface shall be visually verified in three places in the same manner as given in 7.2.4. The cylindrical cuts shall be made at least 200 mm apart. After the test, the holes shall be cleaned and refilled with the spray polyurethane foam (see requirements of Annex A).

7.4 Reporting requirements

The results of all on-site testing shall be recorded on the daily work record.



Key

1 foam cut out
2 substrate
3 foam
4 plywood plug (glued to foam cut)
5 hook
6 test frame, of 4 mm diameter steel, tapered to a sharp point
7 wire
8 weight of mass 1 kg

Figure 2 — Apparatus for adhesion/cohesion strength test

8 Manufacturer's marking

The spray polyurethane foam contractor/spray polyurethane foam installer shall obtain information from the manufacturer about what means the manufacturer is using to identify easily and uniquely, on the job site, products which the spray polyurethane foam system manufacturer declares complies with ISO 8873-1.

NOTE Examples of a manufacturer's marking are a distinct ink colour added, or a material added to their system, which could be identified at the installation site.

The installer shall identify, verify and record how the material was marked on the daily work record.

9 Manufacturer's documentation

The spray polyurethane foam contractor shall obtain from the spray polyurethane foam system manufacturer, and provide to the spray polyurethane foam installer, information on the material which should include, as a minimum, the following:

a) description of the chemical components including their properties;

b) material safety data sheet for both the resin and the isocyanate;

c) instructions for safe handling, use and disposal of the chemical components;

d) recommendations for suitable types of proportioning spray equipment, safety and operating parameters;

e) ambient temperature, substrate temperature and relative humidity limitations at application;

f) type of substrate and its preparation;

g) physical properties of the spray polyurethane foam, as well as toxicity, flammability/combustibility and reactivity data;

h) limitations for use of the spray-applied polyurethane foam;

i) expiry date of the components;

j) method used by the manufacturer to identify the installed spray polyurethane foam insulation on site that the manufacturer declares complies with ISO 8873-1.

10 Limitations

Because spray polyurethane foam is combustible, it shall not be used at a continuous service temperature in excess of +80 °C (such as in contact with chimneys, heater vents, steam pipes). Where applications require a continuous service temperature in excess of +80 °C, the spray polyurethane foam system manufacturer shall be contacted and a foam specifically formulated for the application shall be obtained.

Spray polyurethane foam shall not be

a) used on or in the vicinity of heat-emitting devices (such as recessed lighting fixtures) at a distance less than 75 mm, or as specified by the authority having jurisdiction, nor

b) used inside electrical outlets or junction boxes, nor

c) left exposed to continuous ultraviolet light.

Annex A
(normative)

Substrate preparation

A.1 General

Spray polyurethane foam can be applied to a wide variety of substrates. Good adhesion between the substrate and the insulation is extremely important. It can be achieved by proper surface preparation prior to the application of the insulation. All substrates should therefore be clean, dry and free of grease, oil, loose scale or rust, solvents and other contaminants that may impair the bond of the foam to the substrate. Each substrate shall be prepared in accordance with the directions specified by the chemical manufacturer for the specific application.

A.2 Wood, gypsum board and fibreboard

The moisture content of wood, gypsum or fibreboard should be less than 19 %. Special care should be taken in the case of laminates with surface treatment, because the treatment can adversely affect the adhesion of the insulation to the substrate.

A.3 Concrete

Concrete shall be dry on surface before applying spray polyurethane foam. Form release shall not be present on the concrete surface. Proper ageing of the concrete shall be provided for applications involving new concrete so as not to inhibit the concrete cure. If the adhesion is suspect because of high moisture content of the concrete, the adhesion test as specified in 7.2 shall be performed.

A.4 Galvanized steel

New galvanized steel shall be primed with a primer containing a high percentage of solvents, or washed with a mineral spirit, then allowed to dry and finally primed using a thin film etching primer.

A.5 Pre-painted substrates

The strength of adhesion can vary with the type of paint used. When the adhesion is uncertain, the paint should be mechanically scored or abraded by sand blasting.

A.6 Bare steel

Spray polyurethane foam can usually be sprayed directly onto bare steel after the removal of any loose scale and rust. However, steel tanks shall be primed before insulation.

A.7 Stainless steel

Stainless steel shall be primed with a primer containing a high percentage of solvents, or washed with a mineral sprit, allowed to dry and finally primed using a thin film etching primer. In some cases, to achieve adequate adhesion between the primer and the stainless steel, it may be necessary to abrasive blast.

A.8 Aluminium

Aluminium shall be cleaned with a mineral spirit. Caustic solution shall not be used. Aluminium shall always be primed prior to the application of the insulation to prevent corrosion of the aluminium. After application, acids are formed at the surface between the spray polyurethane foam and the aluminium and they can cause corrosion.

A.9 Glass

Except for cleaning, no special preparation is required for glass. However, when the insulation is applied to the interior of a window, an ultraviolet-blocking coating should be applied to the glass prior to application to prevent degradation of the insulation by sunlight.

A.10 Poly(vinyl chloride) (PVC)

Washing with a mild solvent, such as mineral spirits, is sufficient to prepare the surface of PVC. PVC should be used as a substrate with caution. If the plasticizer content is high, the plasticizer may migrate to the surface of the PVC after the application of the spray polyurethane foam, resulting in loss of adhesion. (Plasticizer content is usually highest in new flexible PVC and is usually lower in rigid PVC and aged PVC membranes.)

A.11 Acrylonitrile butadiene styrene (ABS)

The ABS surface should be cleaned with mineral spirit and primed.

A.12 Polypropylene and polyethylene

The ahesion of spray polyurethane foam to these two plastics is extremely poor. The only practical way to apply the insulation is to provide some sort of mechanical attachment to the substrate, such as chicken wire.

A.13 Asphalt and tar

The asphalt or tar shall be solvent-free when the insulation is applied over it. Therefore, the asphalt or tar must be old enough to assume that there is no solvent present. Spray polyurethane foam should not be applied over fresh asphalt or tar.

A.14 Solvents

The presence of solvents in the substrate or on the surface of it shall be avoided. Many primers are solvent-borne and thus adequate time for the complete evaporation of the solvent should be allowed prior to application of the insulation.

A.15 Sprayed polyurethane foam

Care shall be taken to ensure the foam is dry prior to application of more insulation. Previously sprayed polyurethane foam that has been exposed to ultraviolet light for a period of time and which shows ultraviolet degradation (as evidenced by chalking on the surface) shall be cleaned by wire brushing prior to the application of more insulation.

A.16 Earth

Ponding water or saturated soil conditions shall not be present when installing spray polyurethane foam directly on the earth. No special requirements are needed when installing spray polyurethane foam in contact with earth. The manufacturer shall be consulted in cases where a constant hydrostatic pressure will be exerted on the spray polyurethane foam.

A.17 Modified bitumen membrane

The modified bitumen membrane must be adhered to the substrate. The installer shall have the membrane manufacturer confirm that the material has been installed properly.

Annex B
(normative)

Selection of chemical components (system)

B.1 General

The installer shall select the appropriate chemical components in consultation with the chemical manufacturer, taking into account the type of substrate (see Annex A), the treatment of the substrate and the environmental conditions.

B.2 Density

The density shall meet the minimum as declared and tested by the spray polyurethane foam system manufacturer.

B.3 Combustibility

The chemical components shall be chosen in such a way that the final insulation meets the requirements of all national regulations.

B.4 Service temperature

The continuous service temperature should be within the range of –60 °C to +80 °C, unless the spray polyurethane foam is specially designed for other service temperatures.

Annex C
(informative)

Climatic factors

C.1 Ambient/substrate temperature

Systems are available for use in a wide variety of ambient temperatures. When there is a difference of more than 17 °C between the ambient temperature and the substrate temperature (e.g. when spraying in a heated interior during winter), the chemical manufacturer should be consulted prior to the application.

C.2 Moisture/humidity

Care should be taken whenever the relative humidity rises above 80 %. High relative humidity could cause a blistering problem and could weaken foam adhesion.

C.3 Wind

Spray polyurethane foam should not be sprayed outside when the wind speed exceeds 15 km/h, unless windscreens are used. The wind amplifies the possibility of overspray and thereby reduces the installed foam yield performance.

C.4 Sun/shade

Especially in the case of exterior substrates, the temperature differences in the substrate between those areas in direct sun versus those in the shade affect reaction times. It may help to follow the sun, i.e spray on those areas exposed to direct sun instead of shaded areas.

Annex D
(normative)

Job-site set up

D.1 General

The licensed contractor and the licensed installer shall be familiar with all local, provincial and federal requirements and regulations. They shall use all necessary construction, public and employee safety procedures such as those given in this part of ISO 8873.

D.2 Outdoor spraying

Any outside spraying is influenced by the wind. When the wind speed exceeds 15 km/h, precautions should be taken to rope off the site. Tarps or plastic sheets should be used to cover possible problem areas. Posting of signs explaining why the area is roped off is good practice.

D.3 Warning signs

Installers should have warning signs made available for job sites, such as “No Smoking”, “Breathing apparatus must be worn when entering this work area”, “Do not enter while spraying”, and “Stay clear, overspray possible”.

D.4 Garbage disposal

The work site should be kept clean of debris. Garbage containers of the proper size for the job, with lids, should be provided.

D.5 Fire extinguisher

A properly charged fire extinguisher shall be available at all times in trucks and on job sites. The fire extinguisher shall meet the minimum rating and classification requirements for extinguishing foamed plastic fires. The net content of the extinguisher shall not be less than 4,5 kg.

D.6 Masking

Masking shall be securely fastened to those areas that must be protected from over-spray.

D.7 Requirements when installing spray polyurethane foam in inhabited buildings

D.7.1 Isolation during spraying

In applications where spray polyurethane foam is to be installed in inhabited buildings, the installer shall isolate the area of the building that is being sprayed. One acceptable means of isolation is to drape polyethylene sheets over openings to separate the occupied space from the application area. Intakes to

mechanical systems that circulate air to other parts of the building shall be blocked. At no time shall the installer allow any person into the application area during spraying without proper personal protection.

D.7.2 Ventilation of spray area during spraying

The licensed installer shall provide mechanical ventilation of the spray area during application. The ventilation rate shall be 0,3 air changes per hour or greater.

D.7.3 Ventilation of spray area after spraying

The licensed installer shall provide ventilation of the spray area for the time period declared by the manufacturer. The ventilation rate shall be 0,3 air changes per hour or greater.

This does not apply to new construction or uninhabited buildings.

Annex E
(informative)

Trouble shooting and repair

E.1 Colour

Most systems have a characteristic colour that can vary from system to system. Any change in the usual colour may indicate problems. A shift in colour during the application may indicate poorly mixed chemical components. The machine should be carefully checked to ensure that the transfer pumps are operating properly, the screens are not clogged, etc. Standard machine trouble-shooting techniques should be used.

A sample of the insulation should also be taken and the core examined for any discoloration to a brownish colour, which may indicate scorching. Scorching may be caused by excessive thickness of passes, too high a substrate temperature or the use of a system that generates too much heat.

E.2 Hardness

It is very difficult to determine minor changes in hardness (compressive strength) but those areas that are obviously different should be examined. A very hard, brittle insulation, especially one that is darker in shade, may indicate poorly mixed chemical components. Similarly, a soft or spongy spray polyurethane foam with a wet appearance may be caused by an off-ratio mix.

The proportioner unit should be checked to ensure that it is on ratio. Changes in hardness may also be caused by poor mixing in the chamber (heat and pressures being too low).

E.3 Cell size

Cell structure should be very fine. Any tendency towards coarseness (average cell diameter greater than 0,5 mm) should be checked. Coarse spray polyurethane foam will often have reduced thermal resistance (R value), strength and stability.

Coarse cell structure may be caused by poor mixing, contamination of the chemicals by oil or water, or surfactant failure in the chemicals themselves.

E.4 Friability

The spray polyurethane foam should be checked for friability (brittleness) by running a fingernail over its surface. If a fine powder results, the insulation is probably too friable. Some spray polyurethane foams may exhibit initial friability and should be rechecked after 48 h, or before enclosing the insulation.

Excessive friability can also be caused by a system that is not suitable for low application temperatures, or when a substrate acts as a heat sink, drawing off the heat of reaction.

E.5 Thermal cracking

Loss of adhesion, especially during cold weather spraying, is sometimes characterized by sharp cracking noises. When a cracking noise is heard, the installer should check the adhesion strength.

Thermal cracking is usually caused by improper system selection or by spraying too thickly and too rapidly. Spray polyurethane foam that exhibits cracking during application may not be dimensionally stable.

E.6 Surface tack

Any insulation surface that remains tacky after spraying is suspect. Tackiness is usually an indication of poor mixing, too low heater temperatures or applying too thin a pass, or perhaps an improper system selection or use of a chemical which has exceeded its shelf life.

E.7 Speed of reaction

The speed of reaction of any system depends on the chemical components, temperature, processing, type of substrate, etc. After extensive use of a system, most installers become familiar with the reaction speed of the chemicals in a given set of circumstances. Any deviation from the normal speed should be viewed with concern and the chemical manufacturer contacted.

E.8 Product verification

When it is suspected that the spray polyurethane foam applied may be off standard, the installer should take a sample. Minimum sample size should be 300 mm $\times$ 300 mm $\times$ 25 mm. This sample should be sent to the chemical manufacturer for testing and advice for the exact procedure to follow for correction.

Annex F
(normative)

Handling and safety precautions

F.1 Health hazards of isocyanates

Isocyanates are strong irritants to the skin, eyes and the respiratory tract. They are strong sensitizers and are a common cause of allergic sensitization of the respiratory tract. Persons suffering from respiratory disease or sensitive to isocyanates should not be allowed to enter work sites involving the usage of isocyanates.

Inhalation of isocyanates shall be strictly controlled. The maximum isocyanate concentration in a work place atmosphere is 0,005 ppm (parts per million) in most jurisdictions and shall be observed at all times (this is the threshold limit value (TLV) specified in Reference [3]).

Before handling isocyanates, the product safety information available through the Workplace Hazardous Materials Information System (WHMIS), the Material Safety Data Sheets (MSDS) and the chemical manufacturer's documentation should be read.

F.2 Employee safety requirements

Because isocyanates are strong irritants to the skin, eyes, respiratory tract and any mucous membranes and strong sensitizers, the following precautions are mandatory:

a) proper ventilation equipment, including a properly fitting breathing apparatus supplying fresh air shall be worn by the installers (and apprentices working within 10 m of the installer) at all times, while spraying;

b) skin protection shall be worn, including gloves and overalls; skin should not be uncovered if exposure to isocyanates is possible;

c) eye protection shall be worn, with hoods or goggles and safety glasses to avoid eye exposure to isocyanate vapours during spraying;

d) safety shoes and hard hats shall be worn.

WARNING — Isocyanates can cause occupational asthma and contact dermatitis.

F.3 First aid

F.3.1 Inhalation

Breathing vapours or mists of isocyanates shall be strictly controlled at all times. The appropriate product safety information, such as the Material Safety Data Sheet and the chemical manufacturer's documentation, should be read for detailed advice. Persons affected by inhalation of isocyanates should immediately seek medical attention.

F.3.2 Skin contact

Persons who have significant skin contact with isocyanates should wash with soap and water or shower to cleanse the skin, and should then wash the affected areas with alcohol. Contaminated clothing should be removed and discarded or cleaned before reuse. Before being laundered, contaminated clothes shall be

placed in a decontaminating solution of water containing 10 % ammonia in a container that is impervious to isocyanates.

Medical attention should be obtained if skin contact is extensive. Persons who have skin contact with the resin component should thoroughly wash the affected area with soap and water.

F.3.3 Eye contact

For eye contact with resin or isocyanate, the eye(s) should be flushed immediately for at least 20 min with plenty of lukewarm water. Protect eyes with loosely tied bandage if the victim cannot tolerate light. Medical attention should be obtained. Contact lenses shall not be worn during spray application.

F.3.4 Ingestion

If isocyanate is ingested and the patient is alert, the patient should drink large amounts of water. Vomiting must not be induced. Medical attention should be obtained.

If the resin is ingested, vomiting should be induced promptly and medical attention should be obtained.

F.4 Handling of spills

Isocyanates are hazardous chemicals. Therefore, extreme caution and proper safety procedures shall be followed. In a situation that is considered a major spill of isocyanate, the following procedure is recommended for decontamination.

a) Clear the area of all unprotected personnel. (This is particularly important for spills onto or near hot surfaces.)

b) If water has been contaminated, seek assistance from the local authorities to police waterways for 36 h. Obtain approval before usage is resumed.

c) If the spill is on a hard surface or can be controlled in a pool:

   — protect personnel with self-contained breathing apparatus or equivalent, and with protective clothing, such as rubber boots, rubber gloves;

   — cover the spill with an absorbent material, such as dry sand, sweeping compound, diatomaceous earth, kitty litter, cement powder; do not use sawdust;

   — collect the material in open-top drums and take it to safe isolated area, preferably out of doors;

   — fill the drums with water and allow them to stand at least 48 h;

   — treat the remaining spill area with a solution of water (85 % to 90 %), concentrated ammonia solution (3 % to 8 %), liquid detergent (0,2 % to 5 %) to neutralize any residual isocyanate;

   — to minimize the residue, flush the equipment before neutralization, using a solvent such as ethylene glycol monoethyl ether.

d) If the spill is in a porous area, such as a railway bed, flood it with water, and add a dilute solution of ammonium hydroxide. Keep the area isolated for at least 48 h.

F.5 Guidelines for fire safety and extinguishing

F.5.1 Precautions

Fire is a serious concern during construction. Good practice suggests the following safety precautions.

Spray polyurethane foam should be applied only by installers trained in its proper use and who are familiar with its limitations. It should be installed in accordance with the chemical manufacturer's recommendations.

The following are prohibited in chemical storage and installation areas:

— open flames;

— cutting and welding torches;

— lighted pipes, cigars and cigarettes.

If metal in contact with the spray polyurethane foam has to be welded or cut, the insulation shall be stripped away from the affected area. Special precautions shall be taken when welding in the vicinity of the insulation. If hot work must be done near exposed rigid polyurethane insulation, the insulation shall be shielded from heat and sparks by a thermal barrier. A fire watch should be maintained and fire extinguishers shall be readily available.

Warning signs shall be posted and shall be clearly visible in all sprayed areas. Spray polyurethane foam shall not be exposed to flames or other sources of intense heat.

Fire-extinguishing equipment shall be provided at both storage and installation sites.

Liquid chemical components shall be stored and opened out of direct sunlight in a well-ventilated location. Drums of warm chemicals should be opened slowly to allow the gradual release of vapours. Liquid waste components shall not be mixed together for disposal because spontaneous combustion could occur. Empty drums should be decontaminated by filling them with water out of doors and allowing them to stand for 36 h uncapped. The drums shall not be recapped (see Annex G).

Waste insulation should be disposed of daily in a designated location with due regard for its combustible characteristics. Large buns of waste insulation should be cut open and doused with water.

Spray polyurethane foam insulation shall not be used in contact with chimneys, heater vents, steam pipes (unless specifically designed for this application), or other areas that could be subject to surface temperatures exceeding those recommended by the chemical manufacturers.

F.6 Extinguishing of fire

In the event of a fire involving isocyanates, all unessential personnel shall be evacuated from the area.

The types of extinguishing media to be used in fighting isocyanate-supported fires are

— dry chemical powder,

— carbon dioxide, or

— fire-fighting foam.

Water should be used only if large quantities are available.

In the case of a fire involving spray polyurethane foam, fire fighters shall wear a positive fresh-air supplier respirator.

After the fire has been extinguished, the area shall be inspected by properly protected personnel and shall be decontaminated to remove any suspected isocyanate residues before unprotected workers are permitted to enter the area. In cases where drums are observed to bulge, contact the manufacturer for instructions.

Annex G
(normative)

Disposal and detoxification of drums

G.1 Isocyanate drums

G.1.1 General

The re-use and the disposal of contaminated empty drums and containers is not permissible because of the hazards associated with isocyanates remaining on the walls of the drums. As a matter of principle, all residues of isocyanates in containers shall be decontaminated in an appropriate way.

G.1.2 Decontamination of isocyanate drums

G.1.2.1 General

Isocyanates or isocyanate prepolymers can be delivered in drums. These drums are designed to be one-way packages and can therefore not be taken back by the suppliers.

Isocyanate residues will remain on the walls of depleted drums and the precautions associated with handling isocyanates will apply.

Therefore, it is not permissible to re-use or to dispose of emptied isocyanate drums, unless they are decontaminated completely (which should be done as soon as practical after emptying).

The decontamination shall be carried out in properly ventilated areas. All personnel shall be protected from the inhalation hazards of isocyanate vapours. The maximum workplace atmosphere concentration for isocyanates is 0,005 ppm (parts per million) in most Canadian jurisdictions and it shall be strictly observed (this equals TLV as specified in Reference [3]).

The following decontamination procedure has proven to be effective for emptied and well-drained isocyanate drums.

a) Spray or pour 5 l to 25 l of decontamination solution into the drum, making sure the walls are well rinsed. (This can be achieved by use of a spray head or by rolling the drum for several minutes.)

b) Leave the drum standing unsealed for 25 h to allow complete reaction. Avoid sealing of the drum to prevent build-up of pressure by evolved carbon dioxide.

c) Pour out liquid decontaminant into storage vessel. (This solution may be used several times.)

Disposal of liquid decontaminant should only be carried out in accordance with local regulations and requirements.

Drums previously used for isocyanates shall never be reused for foodstuffs or food additives.

The empty decontaminated drums may then be tipped (landfill) or scrapped, as appropriate.

G.1.2.2 Decontaminants

Decontaminants are products for the “neutralization” of isocyanates by rapidly converting them to harmless, insoluble solids. Supplies of decontaminates shall always be available in the working area. The choice of decontaminant should relate to local safety regulations and to the chemical manufacturer’s recommendations. Besides being used for cleaning drums, decontaminates are also used for the treatment of spillage and for making equipment safe for maintenance and repair operations.

The following formulations of liquid decontaminates are principally designed for use in emergency situations, drum disposal, spillage, etc. (the percentages may be expressed by mass or by volume):

— water (85 % to 90 %), concentrated ammonia solution (3 % to 8 %), liquid detergent (0,2 % to 5 %), or

— water (90 % to 95 %), sodium carbonate (5 % to 10 %), liquid detergent (0,2 % to 5 %).

G.2 Resin drums

No special precautions are required for the disposal of waste resin components or their containers. These may be disposed after draining by crushing and landfill.

Annex H
(informative)

Daily work record

As a minimum, the daily work sheet should contain the following information.

Contractor: _____ Date: _____

Installer: _____ Certification No. _____

Apprentice: _____ Apprentice No. _____

Project information

Project Name: _____

Project Address: _____

Customer Name: _____

Material information

Manufacturer: _____ Product: _____

	"A" Component	**"B" Component**
Lot No.	_____	_____
Expiry date / Mfg date:	_____	_____

Quantity of foam used (today): _____ (kg)

Equipment

Mixing chamber size: _____ Hose length: _____

Heater temperature: Primary: _____ °C Hose: _____ °C

Pressure: "A": _____ KPa "B": _____ KPa

Environmental conditions

Time	Ambient temp (°C)	Relative humidity	Wind velocity (Km/h)	Substrate temp (°C)

Test results

Density test: mass: _____ g volume: _____ ml

Density = g/ml × 1 000 = _____ kg/m^3

Adhesion test: pass ☐ fail ☐

Cohesion test: pass ☐ fail ☐

Thickness: Number of passes: _____ Thickness per pass: _____ mm

Total foam thickness: _____ mm

Substrate conditions

Conditions: Clean ☐ Dry ☐ Properly fastened/Proper adhesion ☐

Special conditions

Preparation required: _____

_____

_____

_____

Details: _____

_____

Protective coating required: Yes ☐ No ☐

Details: _____

_____

Signature

Annex I
(informative)

Example of job site label

Job Site Label

This Job Site certificate indicates that the installed spray applied rigid polyurethane foam insulation meets the CAN/ULC-S705.1 - medium density - product standard. This product has been installed according to the CAN/ULC-S705.2 installation standard.

Job Site Address: _____

Product Name: _____ CCMC# _____

Licensed Contractor: _____ ID# _____

Certified Installer: _____ ID# _____

Daily Work Sheet #: _____ Date: _____

Signed: _____

Address: _____ Phone: _____ Fax: _____

Annex J
(informative)

Outline of licensed installer training programme

Function A Introduction to spray polyurethane foam

- Task A.1 What is spray polyurethane foam
- Task A.2 History of spray polyurethane foam

Function B Codes and standards

- Task B.1 Building code
- Task B.2 Material standard
- Task B.3 Application standard
- Task B.4 Industry standards
- Task B.5 Job standards

Function C Health and safety

- Task C.1 First aid level one
- Task C.2 Workplace health and safety
- Task C.3 Workers' safety regulations
- Task C.4 Personal protection
  - Task C.4.1 Head
  - Task C.4.2 Respirator
  - Task C.4.3 Eye
  - Task C.4.4 Ear
  - Task C.4.5 Body
  - Task C.4.6 Hands
  - Task C.4.7 Feet
- Task C.5 Transportation of dangerous goods
- Task C.6 Confined spaces
- Task C.7 Electrical hazards
- Task C.8 Trenching/Excavation/Shoring

Function D Site equipment

Task D.1 Ladders

Task D.2 Scaffolding

Task D.3 Hoisting/Rigging/Swing stage

Task D.4 Fall protection

Task D.5 Fork lift/Scissor lift/Cherry picker

Function E Fire protection

Task E.1 Fire extinguishers

Task E.2 Warning signs

Task E.3 Smoking

Task E.4 Welding

Task E.5 Cutting

Task E.6 Grinding

Function F Site isolation

Task F.1 Warning signs

Task F.2 Barriers

Task F.3 Protection of helper

Task F.4 Protection of others

Task F.4.1 Trades

Task F.4.2 Vehicles

Task F.4.3 Building components

Function G Environmental conditions

Task G.1 Ambient temperature

Task G.2 Humidity

Task G.3 Wind

Task G.4 Substrate temperature

Function H Material selection

Task H.1 Factors effecting material selection

Function I Equipment

- Task I.1 Drum heaters
- Task I.2 Transfer pumps
- Task I.3 Proportioners
- Task I.4 Hoses
- Task I.5 Hose heaters
- Task I.6 Guns
- Task I.7 Compressors
- Task I.8 Generators

Function J Start up procedure

- Task J.1 Check equipment
  - Task J.1.1 Pressures
  - Task J.1.2 Temperature
  - Task J.1.3 Conditions
- Task J.2 Check material supply
- Task J.3 Test pattern
- Task J.4 Checklist
- Task J.5 Work order/Job requirements
- Task J.6 Manufacturer's instructions

Function K Substrate preparation

- Task K.1 Material
- Task K.2 Moisture
- Task K.3 Cleaning
- Task K.4 Priming
- Task K.5 Masking

Function L Application methodology

- Task L.1 Distance
- Task L.2 Angle of spray
- Task L.3 Cross hatching
- Task L.4 Thickness

Task L.5 Finish

Task L.6 Coverage

Task L.7 Hot/Cold weather application

Task L.8 High wind application

Function M Air barrier requirements

Task M.1 Material requirements

Task M.2 Transition membrane

Task M.3 Testing requirements

Function N Thermal barrier requirements

Task N.1 Building code requirements

Task N.2 Contractor's responsibility

Task N.3 Installer's responsibilities

Function O Heating & Hording

Task O.1 Heater requirements

Function P Trouble-shooting

Task P.1 Blisters

Task P.2 Resin rich

Task P.3 ISO rich

Task P.4 Thermal cracks

Task P.5 Scorching

Task P.6 Friability

Task P.7 Tackiness

Function Q Quality control

Task Q.1 Site testing

Task Q.1.1 Visual

Task Q.1.2 Density

Task Q.1.3 Adhesion

Task Q.1.4 Cohesion

Task Q.1.5 Temperature

Task Q.1.6 Adhesion to failure

Task Q.1.7 Air barrier testing

Task Q.2 Documentation

Task Q.2.1 Checklist

Task Q.2.2 Daily work records

Task Q.2.3 Job site label

Function R Storage and handling

Task R.1 Proper storage of material

Task R.2 Handling of drums

Task R.3 Water seepage

Function S Maintenance

Task S.1 Equipment

Function T Isolation and ventilation

Task T.1 Isolation requirements

Task T.2 During spraying

Task T.3 Post installation ventilation

Function U Drum decontamination

Task U.1 ISO drums

Task U.2 Resin drums

Function V Spill handling

Task V.1 Spill containment

Task V.2 Spill clean up

Task V.3 Decontamination

Task V.4 Disposal

Function W Housekeeping

Task W.1 Removing excess foam

Task W.2 Clean up

Task W.3 Site waste

Task W.4 Buns of foam

Task W.5 Disposal

Function X **Job management**

Task X.1 Customer relations

Task X.2 Time management

Task X.3 Selling your company

Task X.4 Communications

Function Y **Installer ethics**

Task Y.1 Work habits

Task Y.2 Attitudes

Annexes

Annex A Product literature

Chemical supplier

Equipment supplier

Safety equipment

Annex B ISO 8873-2

Annex C Quality assurance programme manual

Annex D Installation specifications

Annex K
(normative)

Minimum equipment for site test kit

As a minimum, the installer site test kit shall contain the following:

a) analytical balance, accurate to 0,10 g;

b) graduated cylinder of minimum size 1 000 ml, with 10 ml maximum graduations;

c) circular disk with hook, of maximum diameter 70 mm;

d) coring tool made from thin-wall tubing with 70 mm inside diameter;

e) two-component epoxy glue;

f) support frame as per Figure 2;

g) weight of mass 1 kg;

h) picture hanging wire, 30 cm in length, with hooks on both ends;

i) calculator;

j) thermometer and hygrometer (may be combined or separate units);

k) thickness gauge;

l) knife.

Bibliography

[1] ISO 9001, *Quality management systems — Requirements*

[2] ISO 12576-2, *Thermal insulation — Conformity control systems — Part 2: In-situ products*

[3] *Threshold Limit Values for Chemical Substances and Physical Agents*. American Conference of Governmental Industrial Hygienists (ACGIH) [1)]

1) Glenway Avenue, Building D-7, Cincinnati, Ohio, 45211, USA. Telephone: (513) 661-7881, www.acgih.org

ICS 83.100

Price based on 37 pages