

Class I Insulated Steel Deck Roofs

Class Number 4450

February 1989

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Approval Standard for Class 1 Insulated Steel Deck Roofs

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Foreword

Factory Mutual Research Approvals are intended to verify that the products and services described will meet stated conditions of performance, safety and quality useful to the ends of property conservation. The purpose of Factory Mutual Research Approval Standards is to present the criteria for Factory Mutual Research Approval of various types of products and services, as guidance for Approvals Division personnel, manufacturers, users and authorities having jurisdiction.

Products submitted for Approval shall demonstrate that they meet the intent of the Approval Standard, and that quality control in manufacturing shall ensure a consistently uniform and reliable product. Factory Mutual Research Approval Standards strive to be performance-oriented rather than design-oriented. They are intended to facilitate technological development.

For examining equipment, materials and services, Factory Mutual Research Approval Standards:

- a) must be useful to the ends of property conservation by preventing, limiting or not causing damage under the conditions stated by the Approval listing; and
- b) must be readily identifiable.

Continuance of Approval and Listing depends on compliance with the Approval Agreement, satisfactory performance in the field, on successful re-examinations of equipment, materials, and services as appropriate, and on periodic follow-up audits of the manufacturing facility.

Factory Mutual Research reserves the right in its sole judgement to change or revise its standards, criteria, methods, or procedures.

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1 INTRODUCTION

1.1 Purpose

This standard states Factory Mutual Research requirements for Approval of Class I – Insulated steel roof decks. A Class I insulated steel roof deck is one which meets the criteria of this standard for fire, wind uplift, live load resistances, corrosion of metal parts, and fatigue of plastic parts. The Standard applies to all components as assembled in the system below the roof cover. The roof cover is tested in accordance with Factory Mutual Research Approval Standard 4470.

1.2 Scope

- 1.2.1 Insulated steel deck roof components, incorporated in a complete insulated steel deck roof assembly(s), which exhibit low fire spread below the deck, adequate simulated wind uplift resistance, minimum heat damage potential and adequate strength during the Approval examination will qualify as a Class I assembly.
- 1.2.2 This standard applies to the assembling of an insulated steel deck. Weatherability is not a part of the Approval evaluation. Roof cover performance is evaluated in accordance with Factory Mutual Research Approval Standard for Class I Roof Covers (4470). Steel deck performance is qualified by Factory Mutual Research Approval Standard for Steel Deck (4451).
- 1.2.3 The performance of an insulated steel deck roof depends in part on all components in the roof system makeup, and on how they interact. It is therefore necessary to evaluate the roof assembly as a whole when measuring the potential for fire spread on the underside of the roof, and/or its windstorm resistance classification.
- 1.2.4 This standard is intended to evaluate only those hazards investigated, and is not intended to determine suitability for the end use of a product.

1.3 Basis for Factory Mutual Research Approval

Factory Mutual Research Approval is based upon satisfactory evaluation of the product and the manufacturer in the following major areas:

- 1.3.1 Examination and tests on production samples to evaluate the suitability of the product;
 - the performance of the product as specified by the manufacturer and required by Factory Mutual Research; and, as far as practical,
 - the durability and reliability of the product
- 1.3.2 An examination of the manufacturing facilities and audit of quality control procedures to evaluate the manufacturer's ability to consistently produce the product which is examined and tested, and the marking procedures used to identify the product. These examinations may be repeated as part of Factory Mutual Research's Approved Product Follow-Up Program.

1.4 Basis for Continued Approval

Continued Approval is based upon:

- production or availability of the product as Approved;
- the continued use of acceptable quality control procedures;
- satisfactory field experience;
- compliance with the terms stipulated in the Approval Agreement; and
- re-examination of production samples for continued conformity to requirements.

1.5 Basis for Requirements

- 1.5.1 The requirements of this standard are based on experience, research and testing and/or the standards of other organizations. The advice of manufacturer's, users, trade associations and loss control specialists was also considered.
- 1.5.2 A Class I Insulated Steel Deck Roof of itself is not a significant fire hazard, and can withstand expected wind uplift forces, live load resistance, corrosion of metal parts, and fatigue of plastic parts, when installed in accordance with all Approval requirements. Approval requirements prohibit substitution of components in the roof system makeup without prior authorization.
- 1.5.3 The requirements of this standard reflect tests and practices used to examine characteristics of Class I Insulated Steel Deck Roofs for the purpose of obtaining Factory Mutual Research Approval. Class I Insulated Steel Deck Roofs having characteristics not anticipated by this standard may be Approved if performance equal or superior to that required by this standard is demonstrated, or if the intent of the standard is met. Alternatively, Class I Insulated Steel Deck Roofs which do not meet all the requirements identified in this standard may not be Approved if other conditions which adversely affect performance exist or if the intent of this standard is not met.

1.6 Effective Date

- 1.6.1 The effective date of an Approval Standard mandates that all products tested for Approval after the effective date shall satisfy the requirements of that standard. Products Approved under a previous edition shall comply with the new version by the effective date or else forfeit Approval. The effective date shall apply to the entire Approval Standard, or, where so indicated, only to specific paragraphs of the standard.
- 1.6.2 The effective date for this standard in **March 1, 1990**, for full compliance with all requirements.

1.7 System of Units

Units of measurement are U.S. customary units. These are followed by their arithmetic equivalents in International System (SI) units, enclosed in parentheses. Appendix A lists the selected units for qualities dealt with in testing these products; conversions to SI units are included. Conversion of U.S. customary units is in accordance with ASTM E 380.

2 GENERAL INFORMATION

2.1 Product Information

Class I Insulated Steel Deck Roofs are usually comprised of steel deck, insulation and roof covering. They are often constructed by first securing rigid insulation board to the top surface of the deck with insulation fasteners. A weatherproof covering is then installed above the insulation. When a vapor retarder is needed, it can be placed directly on the deck with fasteners driven through the insulation and retarder, or in conjunction with a sandwich-style construction, i.e., adhered over insulation board which has been attached to the steel deck with insulation fasteners prior to applying a second layer of insulation. All materials within the installation shall meet all criteria required of that category.

2.2 Requirement

- 2.2.1 The requirements of this standard shall be used to measure and describe the performance of Class I Insulated Steel Deck Roofs in response to exposure from heat, wind, live load resistance, corrosion of metal parts and fatigue of plastic parts under controlled laboratory conditions. The results of these controlled exposures shall not be used to describe or appraise actual exposure conditions, since such conditions may vary widely.
- 2.2.2 The Approval examination includes fire, simulated wind uplift, live loading, and other tests as noted. A complete review of construction and applications specifications shall be conducted to assure, as far as possible, a practical and reliable installation. Inspection of the product manufacturing facility and of at least one field installation, at the discretion of Factory Mutual Research, shall be conducted to assure conformance with the required tests and specifications.

3 APPLICABLE DOCUMENTS AND GLOSSARY

3.1 Applicable Documents

The following are standards, test methods and practices referenced in this standard and summarized in Appendixes A through J:

FIRE HAZARD TEST PROCEDURE FOR CLASS I INSULATED STEEL DECK ROOFS,
Factory Mutual Research

UPLIFT PRESSURE TEST PROCEDURE FOR CLASS I INSULATED STEEL DECK ROOFS,
Factory Mutual Research

SUSCEPTIBILITY TO HEAT DAMAGE TEST FOR CLASS I ROOF INSTALLATIONS,
Factory Mutual Research

CORROSION TEST PROCEDURE FOR FASTENERS AND STRESS DISTRIBUTION PLATES,
Factory Mutual Research

SMALL SCALE QC AND PHYSICAL PROPERTIES TESTS FOR SPECIFIC COMPONENTS IN
CLASS I INSULATED STEEL DECK ROOFS, Factory Mutual Research

CLASS I ROOF COVERS,

Factory Mutual Research Approval Standard 4470

STEEL DECK NOMINAL 1½ IN. (38.1 mm) DEEP AS A COMPONENT IN CLASS 1

INSULATED STEEL DECK ROOF CONSTRUCTION,

Factory Mutual Research Approval Standard 4451

3.2 Glossary

For purposes of this standard, the following terms apply:

Fastener Plates — A wide variety of devices of mechanical assemblies used to attach insulation boards to a substrate or deck. Plate attachments generally consist of a square- or circular-shaped metal or plastic plate with a hole in the center, through which a screw or nail-like clip may be inserted. They are generally set in place with a drill-like device.

Heat Release Rate — The fuel contributed by a material within specific time frames. The total heat released is added over the length of the calorimeter test (30 minutes). The maximum or peak heat release is measured over a shorter period of time (3 minutes).

Insulation — A material applied to reduce the flow of heat.

Live Loads — Roof installation equipment, wind, snow, ice, water or personnel.

Multi-Layer Insulations — Roof insulations installed in two or more layers with all joints offset between the upper and lower layers.

Plastic Components — Components which may be utilized in a roof assembly, usually comprised of thermoplastic or thermosetting polymers which have been molded, cast, extruded, drawn, expanded or laminated into a specific shape.

Roof Assembly — An assembly of interacting roof components (including the roof deck) designed to weatherproof and normally, to insulate a building's top surface, and to support anticipated loads.

Roof System — A system of interacting roof components (NOT including the roof deck) designed to weatherproof and, normally, to insulate a building's top surface.

Sandwich-Style Construction — An application incorporated within the roof assembly, usually consisting of a vapor retarder between layers of roof insulation.

Thermoplastic — Polymers which soften when heated and harden when cooled. This process is repetitive provided the material is not heated above the point at which decomposition occurs.

Thermoset — A material that solidifies or "sets" irreversibly when heated. This property is usually associated with cross linking of the molecules induced by heat or radiation.

Vapor Retarder — A layer of material used to retard or prevent the passage of moisture into a construction.

Waterproofing — Treatment of a surface or structure to prevent the passage of water under hydrostatic pressure.

Wind Uplift — The force generated by wind on a roof system or components in a roof system resulting from wind-induced pressures. Wind that is deflected around and across the surfaces of a building causes a drop in air pressure immediately above the roof surface (negative pressure); the air in the building will flow beneath the roof deck (positive pressure), and the combined uplift pressures tend to lift the roof upward. Wind uplift may also be caused by the introduction of wind underneath the roof edges where it can cause the roof assembly to pull away from the substrate. Roof loss by wind can be minimized, or prevented, by proper installation and adequate adhesion or attachment.