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APPROVAL REPORT

DOUBLE-LOK AND SUPERLOK STANDING SEAM ROOF SYSTEMS AS CLASS 1 PANEL ROOFS

Prepared For:

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3005245
Class 4471
Date: July 24, 2000
Supercedes Report J.I. 1D0A7.AM Dated June 25, 1998
Supercedes Report J.I. 4D8A1.AM Dated February 26, 1999

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FROM

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I INTRODUCTION

1.1 NCI Building Systems, Inc. requested a report for the combination of NCI Building Systems Weather Roof III Standing Seam Roof System and Metal Building Components Inc. Double-Lok and SuperLok Standing Seam Roof Systems. The Weather Roof III and the Double-Lok Systems are the same standing seam roof systems. This report reflects the changes in corporate identity and product names. No tests were completed in this program. This report is a combination of test results achieved in Factory Mutual Research Approval projects, J.I. 1D0A7.AM dated June 25, 1998 and J.I. 4D8A1.AM dated February 26, 1998.

1.2 NCI Building Systems submitted their Double-Lok and SuperLok Standing Seam Roof Systems to determine if they would meet the Factory Mutual Research 4471 (1986) test requirements for Class 1 panel roofs. Double-Lok and SuperLok Standing Seam Roof Panels can be manufactured by the following divisions:

- MBCI
- Metallic Building Company
- Mid-West Steel Building Company
- A&S Building Systems
- Mesco metal Buildings
- Steel Systems
- All American Building Systems

1.3 Examination included simulated wind uplift, foot traffic, susceptibility to hail damage, ASTM E108 fire testing for potential exterior fire spread and Factory Mutual Research

1.4 Test results show that the NCI Double-Lok and SuperLok Standing Seam Roof Systems meet the Factory Mutual Research Standard 4471 Approval requirements for Class 1 panel roofs when installed as described in the CONCLUSIONS of this report.

II MATERIALS TESTED

2.1 Double-Lok Standing Seam Roof System consists of the Double-Lok roof panels, the HW-214 Low Articulating Clips, HW-216 High Articulating Clips or NCI HW 3140 Low or HW 3160 High Floating Clips and associated components. The panels are seamed to the clips which are secured directly to the purlins with two screws per clip. Optional glass fiber blanket insulation, maximum 6 in. (152 mm) thick, or Celotex Thermax insulation maximum 4.25 in. (108 mm) thick in conjunction with "M" or "R" Liner Panels, is placed between the roof panels and the supporting members.

2.1.1 Double-Lok standing seam roof panels are minimum 0.0299 in. (0.76 mm, 22 ga.) or 0.0239 in. (0.61 mm, 24 ga.) thick roll-formed steel panels joined together by an interlocking seam and secured to the structure with screws and an interlocking clip. The panels are coated with Signature 200 or Signature 300 paint or Galvalume. The panels are produced from steel having a minimum yield strength of 50 ksi (345 N/mm²). The panels are supplied 18 in. (457 mm) or maximum 24 in. (610 mm) wide and are manufactured to various lengths. Each side of the panel has a 3 in. (76 mm) high vertical seam. The adjacent panels are interlocked with a roof seaming apparatus. The finished seam includes the metal panel clips.

2.1.2 Double-Lok HW-214 Low Articulating Clips and HW-216 High Articulating Clips by Elco Textron consist of a base, intermediate piece (low or high), top piece, and Double-Lok clip top (tab). When assembled the Double-Lok clip top is sandwiched between the top piece and the intermediate piece and the top piece and Double-Lok clip top are allowed to slide within the slot of the intermediate piece. The Double-Lok clip top fits between adjacent panel side laps and the assembly is secured to steel purlins with two Construction Fasteners #14 x 1" 1/4 HWH SD w/15 mm Bonded Washer Screws or two Atlas 1/4 - 14x11/4 HWH Long PilotTCP2 screws with a # 14x0.594 in. dia. galvanized EPDM sealing washers per clip. The components that make up the assembled clip are:

2.1.2.1 The base is produced from 0.075 in. (1.9 mm) thick red-oxide, mild steel having a min. yield strength of 50 ksi (345 N/mm²). The formed base has a 90° break and is 4 in. (102 mm) long. The dimension of the horizontal segment is 1.605 in. (41 mm) and the major and minor dimensions of the vertical segment are 1.232 in. (31 mm) and 0.915 in. (23.2 mm), respectively. The horizontal segment has a 0.312 in. (8 mm) diameter hole located in the longitudinal center and another equally sized hole on either side, 0.75 in. (19 mm) o.c. to accommodate the fasteners. The vertical segment has a 0.328 in. (8.3 mm) hole located in the longitudinal center to accept the rivet which is produced from 1006 steel and fastens the base to the intermediate piece.

2.1.2.2 The intermediate piece is produced from 0.104 in. (2.6 mm) thick red-oxide, mild steel having a minimum yield strength of 50 ksi (345 N/mm²). The intermediate piece is 4.574 in. (116 mm) long with a 0.50 in. (12.7 mm) long tab on each end at the top at a 90° break. The high intermediate piece is used on the High Articulating Clip and is 3.1 in. (78.7 mm) tall at its tallest point. The low intermediate piece is used on the Low Articulating Clip and is 2.1 in. (53.3 mm) tall at its tallest point. A 3.574 in. (90.8 mm) long by 0.319 in. (8.1 mm) wide slot is located 0.440 in. (11.2 mm) from the top edge of the intermediate piece to

accommodate the two rivets which are produced from 1008 steel which secures the top piece and the Double-Lok clip top to the intermediate piece.

2.1.2.3 The top is produced from 0.075 in. (1.9 mm) thick red-oxide, mild steel having a min. yield strength of 50 ksi (345 N/mm²). The formed top piece has a 90° break and is 4.00 in. (102 mm) long. The dimension of the horizontal segment is 0.580 in. (14.7 mm) and the dimension of the vertical segment is 1.29 in. (32.8 mm). The vertical segment contains two 0.260 in. (6.6 mm) diameter holes each located 1.625 in. (41.3 mm) from the longitudinal edge and approximately in the vertical center to accommodate the rivets used to secure the top piece to the intermediate piece.

2.1.2.4 The Double-Lok clip top (tab) is produced from 0.0336 in. (0.85 mm) thick Type II aluminized steel having a min. yield strength of 48 ksi (331 N/mm²). The formed double-Lok clip top (tab) has two 90° breaks forming a J-section profile and is 4.00 in. (102 mm) long. The dimension of the major vertical segment is 2.39 in. (60.7 mm) vertical segment, the dimension of the horizontal segment is 0.640 in. (16.3 mm), and the dimension of the minor vertical segment is 0.50 in. (12.7 mm). The major vertical segment contains two 0.265 in. (6.7 mm) diameter holes each located 1.625 in. (41.3 mm) from the longitudinal edge and 1.79 in. (45.5 mm) from the top accommodate the rivets used to secure the Double-Lok clip top (tab) to the intermediate piece.

2.1.3 Floating Clip Assembly - Low or High clips consist of the clip base with sliding slot and seam tab. The clip base is produced from minimum 0.069 in. (1.7 mm, 14 ga.) thick red oxide steel having a min. yield strength of 57 ksi (394 N/mm²). The clip base is 5 in. (127 mm) long with a 1-3/8 in. (35 mm) wide bottom, 90° to vertical, having 4 predrilled 5/16 in. (7.9 mm) diameter holes. The clip base is 2-3/8 in. (60.3 mm - low clip) or 3-3/8 in. (85.7 mm - high clip) high. The clip tab is attached to the base at the base sliding slot and is produced from minimum 0.035 in. (0.9 mm, 20 ga.) thick galvalume steel having a min. yield strength of 57 ksi (394 N/mm²). The tab is 2 in. (51 mm) wide, 1.975 in. (50.1 mm) high and is formed to fit between adjacent panel side laps. The base of the clip is secured to min.0.0598 in. (1.5 mm), 16 ga. thick steel purlins with two fasteners per clip.

2.1.4 Construction Fasteners #14 x 1" 1/4 HWH SD w/15 mm Bonded Washer Screw is the same as the Construction Fasteners #1/4 - 14 x 1 1/4 HWH SD Screws with an additional 19/32 in. (0.59 mm) outside diameter metal washer with an 0.020 in. (0.51 mm) thick EPDM backing. The fasteners are for use in securing the MBCI Double-Lok HW-214 Low Articulating Clips and HW-216 High Articulating Clips to 0.0598 to 0.10 in. (1.5 to 2.5 mm) thick steel supports.

2.1.5 Construction Fasteners #14 x 1" HWH SD Screw is a self drilling steel screw with a 5/16 in. (7.9 mm) hexagon drive head and a self drilling # 2 point. The fasteners are for use in securing the Floating Clip to 0.060 to 0.10 in. (1.5 to 2.5 mm) thick steel supports. The screws are 1 in. (25 mm) long and contain 14 threads per 1 in. (25 mm) length of threaded shaft.

2.1.6 "M" Liner Panels are corrugated decks of Galvalume coated steel or painted Galvalume steel having a min. yield strength of 50 ksi (345 N/mm²). The panels are min 0.017 in. (0.4 mm) thick, 13/16 in. (21 mm) deep, and have a 36 in. (914 mm) coverage width.

2.1.7 "R" Liner Panels are corrugated decks of Galvalume coated steel or painted Galvalume steel having a min. yield strength of 50 ksi (345 N/mm²). The panels are

min 0.017 in. (0.4 mm) thick, 1-1/4 in. (32 mm) deep, and have a 36 in. (914 mm) coverage width.

2.1.8 NCI Bearing Plate is a 16 ga. (0.060 in. - 1.5 mm) red oxide primed steel plate having a min. yield strength of 50 ksi (345 N/mm²). The plate measures 4 in. x 5 in. (102 mm x 127 mm) and has one recessed 1/4 in. (6.4 mm) diameter center hole and two 1/4 in. (6.4 mm) wide by 1 in. long slots on each side of the center hole, 9/16 in. (14.3 mm) from the plate center and parallel to the plate 5 in. (127 mm) dimension.

2.2 SuperLok Standing Seam Roof System consists of SuperLok roof panels, the SuperLok Low or High Float G-90 Galv. Clips by Constructions Fasteners and associated components. The panels are seamed to the clips which are secured directly to the purlins with two screws per clip. Optional glass fiber blanket insulation maximum 6 in. (152 mm) thick is placed between the roof panels and the supporting members. Celotex Thermax Insulation Board as Approved (see Celotex listing) can be used in conjunction with Approved "M" or "R" liner panels to a maximum width of 5 ft.

2.2.1 SuperLok standing seam roof panels are minimum 0.0299 in. (0.76 mm, 22 ga.) or 0.0239 in. (0.61 mm, 24 ga.) thick roll-formed Signature 200 or Signature 300 paint or Galvalume coated steel panels joined together by an interlocking seam and secured to the structure with an interlocking clip. The panels are produced from steel having a minimum yield strength of 50 ksi (345 N/mm²). The panels are supplied maximum 16 in. (406 mm) wide and are manufactured to various lengths. Each side of the panel has a 2 in. (51 mm) high seam. The adjacent panels are interlocked with a roof seaming apparatus. The finished seam includes the low or high floating metal clips.

2.2.2 The SuperLok Low Float G-90 Galvanized Clip by Construction Fasteners is a clip for use with blanket insulation thickness up to 4 in. (102 mm). The SuperLok Low Float G90 Galvanized Clip consists of a minimum 0.060 in. (1.5 mm) thick steel base with an interlocking 0.030 in. (0.76 mm) thick steel tab. The base of the clip is secured to min. 16 ga (0.0598 in., 1.51 mm) steel roof purlins with two Construction Fasteners #14 x 1" 1/4 HWH SD Screws or two Atlas 1/4- 14 x 1" SD Long Pilot TCP2 Screws per clip.

2.2.2.1 The base is produced from G90 galvanized steel. The base is formed from one piece of steel and has a top and bottom section. The bottom section is 1.88 in. (47.8 mm) wide by 1.60 in. (40.6 mm) long. Top section is 1.3 in. (33.0 mm) wide by 1.35 in. (34.3 mm) long. The top section is folded over the bottom section and are connected via a 0.5 in. (13 mm) wide neck which is approximately 0.5 in. (13 mm) long. The top section has two minimum 0.242 in. (6.1 mm) diameter holes with centers that line up over two 0.34 in. (8.6 mm) diameter holes in the bottom section. The bottom section has a 0.30 in. (7.6 mm) folded overlap that receives and holds the vertical tab.

2.2.2.2 The tab is 4.3 in. (109 mm) long and 2.3 in. (58 mm) high on the low clip and 2.91 in. (74 mm) high on the high clip. The tab is formed at the top to fit between adjacent panel side laps and at the bottom to fit in the base.

2.2.3 Construction Fasteners #14 x 1" 1/4 HWH SD Screw is a self drilling steel screw with a 5/16 in. (7.9 mm) hexagon drive head and a self drilling #2 point. The fasteners are for use in securing the SuperLok Low Float G90 Galvanized Clip to 0.0598 to 0.10 in. (1.5 to 2.5 mm) thick steel supports. The screws are 1-1/4 in. (32 mm) long and contain 14 threads per 1 in. (25 mm) length of threaded shaft.

2.2.4 Atlas 1/4 - 14x11/4 HWH Long PilotTCP2 screws with a # 14x0.594 in. dia. galvanized EPDM sealing washers.

III TESTS: CRITERIA AND PROCEDURES

3.1 Tests conducted were as required by the Factory Mutual Research Standard 447.1 for Class 1 Roof Covers.

3.2 Factory Mutual Research Windstorm Classification Tests - Tests were conducted using the Factory Mutual Research Uplift Pressure Test Apparatus to evaluate the ability of the above deck components of the roofing system to resist simulated minimum wind uplift pressures of 60 psf (2.9 kPa) without failure of the assemblies.

3.2.1 The simulated wind uplift pressure tests utilized a 24 ft (7.3 m) long by 12 ft (3.7 m) wide by 2 in. deep steel pressure vessel arranged to apply air pressure at preestablished standard rates to the underside of the test panel which formed the top of the pressure vessel. The vessel was pressurized with compressed air.

3.2.2 A net pressure of 30 psf (1.4 kPa) was applied to the test sample and maintained for 1 minute. The pressure was increased to 45 psf (2.2 kPa), then to 60 psf (2.9 kPa) and held for 1 minute at each increment. The pressure was increased in increments of 15 psf (0.7 kPa) every minute until failure occurred.

3.3 Factory Mutual Research Resistance to Foot Traffic Tests - Tests were conducted using the Factory Mutual Research Resistance to Foot Traffic Test Apparatus to evaluate the ability of the roof panel to resist simulated foot traffic without damage. There must be no puncture of the roof panel or disengagement of the laps.

3.3.1 A 3 in. (76 mm) square steel plate with rounded corners was located on the edge of one 24 in. (610 mm) wide test panel and positioned midway between two purlins. A 200 lb. (91 kg) load was imposed on the plate and then removed. This cycle was repeated four additional times. Penetration and residual readings were taken after each cycle without removing the plate. The panels were inspected for damage after the last cycle at the steel plate interface.

3.4 Factory Mutual Research Simulated Hail Damage Test - A test was conducted using the Factory Mutual Research Simulated Hail Damage Test Apparatus to evaluate the ability of the roof panel to withstand a hailstorm without damage to the panel. After each drop the sample is inspected and there must be no evidence of splitting, delamination or rupture of the roof panel.

3.4.1 A 1-3/4 in. (49 mm) diameter steel ball weighing 0.78 lbs. (0.3 kg) was dropped on the test sample from a 17 ft 9-1/2 in. (5.4 m) height through a 33-3/4 in. (0.86 m) length of PVC pipe with a 2 in. (51 mm) inside diameter. This procedure was repeated several times on various sections of the sample. After each drop the sample was inspected for damage to the panel.

3.5 ASTM E108 (96) Spread of Flame Tests - The fire tests from above the roof panel were conducted in accordance with ASTM E108 Spread of Flame Tests.

3.5.1 The wind velocity over the top of the standard panel was adjusted to 12±0.5 mph (5.4±0.2 m/s).

3.5.2 Flame exposure: The flame was adjusted to 1400±50°F (760±28°C). The flame temperature was measured by a thermocouple located 1 in. (25.4 mm) above the surface of the standard panel and ½ in. (13 mm) toward the flame source from the lower edge of the standard panel. The flame was applied to each panel for 10 minutes.

3.5.3 During and after the application of the flame, each panel was observed for the distance of maximum flame spread, glowing brands and other damage.

3.6 Factory Mutual Research Calorimeter Fire Test - The fire test from below the roof deck was conducted using the Factory Mutual Research Construction Materials Calorimeter which measures the maximum rate of fuel contribution by the sample roof, also expressed as maximum heat release rate (HRR); e.g., for a Class I rating, the assembly must exhibit an HRR no greater than 410 Btu/ft^2/min (77.6 kW/m^2) in any 3 minute time frame during the 30 minute fire exposure.

IV TEST SAMPLES AND TEST RESULTS

4.1 Factory Mutual Research Windstorm Classification Test Panels - Six 12 by 24 ft (3.7 by 7.3 m) panels were constructed. Three tests utilized the SuperLok roof panels, three utilized the Double-Lok roof panels, and all samples used 16 ga. [0.0598 in. (1.5 mm)] purlins. In each construction, adjacent panels were seamed together along side laps with an NCI electric seaming tool. Testing of Sample No. 1 through 6 was conducted under J.I. 1D0A7.AM. The components and sequence of installation were as follows:

Sample No. 1: 0.0260 in. (66 mm, 24 ga.) thick by 16 in. (406 mm) wide painted SuperLok panels secured using SuperLok Low Float G-90 Galv. Clips by Construction Fasteners and two Atlas 1/4 x 14 x 1 HWH Ultra Z3 410 SS Screws per clip. Purlins were spaced at 4 ft (1.2 m) o.c.

Results: Due to excessive air leaks in the air barrier, the equipment was unable to attain 105 psf (4.9 kPa) and thus reached the limit of the test apparatus. Meets Class 1-90.

Sample No. 2: 0.0308 in. (0.78 mm, 22 ga.) thick by 16 in. (406 mm) wide painted SuperLok panels secured using SuperLok Low Float G-90 Galv. Clips by Construction Fasteners and two Construction Fasteners #14 x 1" 1/4 HWH SD Screws per clip. Purlins were spaced at 4 ft (1.2 m) o.c.

Results: The sample failed during the incremental pressure increase from 135 to 150 psf (6.4 to 7.1 kPa) as a result disengagement of the clip at its base. Meets Class 1-135.

Sample No. 3: 0.0303 in. (0.77 mm, 22 ga.) thick by 16 in. (406 mm) wide painted SuperLok panels secured using SuperLok Low Float G-90 Galv. Clips by Construction Fasteners and two Construction Fasteners #14 x 1" 1/4 HWH SD Screws per clip. Purlins were spaced at 5 ft (1.5 m) o.c.

Results: The sample failed during the incremental pressure increase from 105 to 120 psf (4.6 to 5.7 kPa) as a result disengagement of the clip at its base. Meets Class 1-105.

Sample No. 4: 0.0325 in. (0.83 mm, 22 ga.) thick by 24 in. (610 mm) wide painted Double-Lok panels secured using Double-Lok HW-214 Low Articulating Clips by Elco Textron and two Construction Fasteners #14 x 1" 1/4 HWH SD w/15 mm Bonded Washer Screws per clip. Purlins were spaced at 4 ft (1.2 m) o.c.

Results: Permanent deformation of the panel happened during the 75 psf (3.6 kPa) pressure level. The sample failed during the incremental pressure increase from 105 to 120 psf (4.9 to 5.7 kPa) as a result of the panel edge pulling free from the rake angle. Meets Class 1-105.

Sample No. 5: 0.0261 in. (0.66 mm, 24 ga.) thick by 24 in. (610 mm) wide painted Double-Lok panels secured using Double-Lock HW-214 Low Articulating Clips by Elco Textron and two Construction Fasteners #14 x 1" 1/4 HWH SD w/15 mm Bonded Washer Screws per clip. Purlins were spaced at 4 ft (1.2 m) o.c.

Results: Permanent deformation of the panel happened during the 60 psf (2.9 kPa) pressure level. The air bag was visible and there was disengagement of the panel seam at several clips after 1 minute at the 75 psf (3.6 kPa) pressure level. Meets Class 1-60.

Sample No. 6: 0.0266 in. (0.68 mm, 24 ga.) thick by 18 in. (457 mm) wide painted Double-Lok panels secured using Double-Lock HW-214 Low Articulating Clips by Elco Textron and two Construction Fasteners #14 x 1" 1/4 HWH SD w/15 mm Bonded Washer Screws per clip. Purlins were spaced at 5 ft (1.5 m) o.c.

Results: Permanent deformation of the panel happened during the 60 psf (2.9 kPa) pressure level. There was disengagement of the panel seam at several clips after 1 minute at the 105 psf (4.9 kPa) pressure level. Meets Class 1-90.

4.2 Factory Mutual Research Windstorm Classification Test Panels - Four 12 by 24 ft (3.7 by 7.3 m) panels were constructed. All samples used 16 ga. [0.0598 in. (1.5 mm)] purlins. In each construction, adjacent panels were seamed together along side laps with an NCI electric seaming tool. Testing of Sample No. 7 through 10 was conducted under J.I. 4D8A1.AM. The components and sequence of installation were as follows:

Sample No. 7: 0.024 in. (24 ga.) thick by 24 in. wide galvalume coated Double-Lok panels secured using Floating Clips and two Construction Fasteners 1/4 - 14 x 1 HWH SD w/15 mm Bonded Washer Screws per clip. Purlins were spaced at 5 ft - 0 in. o.c.

Results: The sample failed during the incremental pressure increase from 60 to 75 psf (2.9 to 3.6 kPa) as a result of panel disengagement from clip tab. Meets Class 1-60.

Sample No. 8: 0.032 in. (22 ga.) thick by 24 in. wide galvalume coated Double-Lok panels secured using Floating Clips and two Construction Fasteners 1/4 - 14 x 1 HWH SD w/15 mm Bonded Washer Screws per clip. Purlins were spaced at 5 ft - 0 in. o.c.

Results: Seam disengagement was noted upon inspection after 90 psf (4.2 kPa) pressure level. Meets Class 1-75.

Sample No. 9: 0.030 in. (22 ga.) thick by 24 in. wide galvalume coated Double-Lok panels secured using Floating Clips and two Construction Fasteners 1/4 - 14 x 1 HWH SD w/15 mm Bonded Washer Screws per clip. Purlins were spaced at 3 ft - 6 in. o.c.

Results: The sample failed during the incremental pressure increase from 105 to 120 psf (4.9 to 5.7 kPa) as a result of clip tab disengagement from clip base. Meets Class 1-105.

Sample No. 10: 0.031 in. (22 ga.) thick by 24 in. wide galvalume coated Double-Lok panels secured using Low Floating Clips and two Construction Fasteners 1/4 - 14 x 1 HWH SD w/15 mm Bonded Washer Screws per clip. Purlins were spaced at 4 ft - 0 in. o.c.

Results: Seam disengagement was noted upon inspection after 105 psf (4.9 kPa) pressure level. Meets Class 1-90.

4.3 Factory Mutual Research Resistance to Foot Traffic Test Panel - Sample No. 1 & 6 described in 4.1.1 above were tested for foot traffic. After each load application, the samples were observed for puncture of the panel, and separation and disengagement of the lap. At no time did the samples show any sign of puncture of the panel or separation or disengagement of the lap. Testing of Sample No. 1 and 6 was conducted under J.I. 1D0A7.AM

4.4 Factory Mutual Research Simulated Hail Damage Test Panel - Two 2 by 4 ft (0.6 by 1.2 m) test panels were constructed using 0.026 in. (24 ga.) thick by 24 in. (610 mm) wide SuperLok Panels. One sample had brown Signature 300 paint and one sample had blue Signature 200 paint. After each drop of the impactor the samples were observed for chipping, peeling, blistering, cracking and crazing of the coating. At no time did the samples show any sign of chipping, peeling, cracking or crazing. Testing of both samples was conducted under J.I. 1D0A7.AM

4.5 ASTM E108 Spread of Flame Test Panels - Three 3-1/3 by 8 ft (1.0 by 2.4 m) panels were constructed over 0.5 in. (13 mm) thick plywood with 6 in. (152 mm) thick white vinyl faced fiberglass batt insulation from BAY-STAR Insulation loose laid on the plywood. Testing of Sample No. 1 through 3 was conducted under J.I. 1D0A7.AM. The roof cover components were as follows:

Sample No.1: 0.026 in. (0.7 mm) thick SuperLok panel with Blue Signature 200 coating secured through the insulation to the plywood deck.

Results: The maximum flame spread was 5 in. (127 mm).

Sample No.'s 2 & 3: 0.026 in. (0.7 mm) thick SuperLok panel with Brown Signature 300 coating secured through the insulation to the plywood deck.

Results: The maximum flame spreads were 16 in. (406 mm) and 6 in. (152 mm) respectively.

4.5.1 Both coatings meet requirements for a Class A rating. At no time during the Spread of Flame tests were flying brands developed or excessive lateral flame spreads observed.

4.6 Factory Mutual Research Calorimeter Test Panel - One 4-1/2 by 5 ft (1.4 by 1.5 m) panel was constructed using 6 in. (152 mm) thick white vinyl faced fiberglass batt insulation from BAY-STAR Insulation held in place with wire fencing. 0.026 in. (0.7 mm) thick SuperLok panel with Blue Signature 200 coating secured in test frame above the insulation. Testing of the sample was conducted under J.I. 1D0A7.AM.

4.6.1 The calorimeter test showed the test panel to have fuel contribution rates below the maximum permissible rates for Class 1 Roof Construction. These rates and the Class 1 limits are given as follows:

Maximum Ave. Rate of Fuel Contribution
Btu/ft²/min. (kw/m²) for Various intervals of time

	3 min.	5 min.	10 min.	Ave.
Class 1 Standard	410 (77.6)	390 (73.8)	360 (68.1)	285 (53.1)
Test Sample	187 (35.4)	180 (34.0)	176 (33.3)	112 (21.1)

V CONCLUSIONS

5.1 The results indicate that NCI Double-Lok and SuperLok Standing Seam Roof Systems meet the Factory Mutual Research Standard 4471 requirements when used in the manner as stated below: Approvals for 5.1.1 through 5.1.2.3 were attained through testing under J.I. 1D0A7.AM. Approvals for 5.1.3 through 5.1.3.4 were attained through testing under J.I. 4D8A1.AM.

5.1.1 SuperLok Standing Seam Roof Panels, maximum 16 in. (406 mm) wide painted panels are secured to steel supports using two screws with either the SuperLok Low or High Float G-90 Galv. Clips. Clips are secured to 0.0598 to 0.10 in. (1.5 to 2.5 mm) thick steel supports using two Construction Fasteners #14 x 1" 1/4 HWH SD Screws or two Atlas 1/4- 14 x 1" SD Long Pilot TCP2 Screws per clip. Adjacent panels are seamed together along side laps with a NCI electric seaming tool.

5.1.1.1 SuperLok Standing Seam Roof Panels, minimum 0.0239 in. (0.61 mm, 24 ga.) thick are secured to steel supports spaced at maximum 4 ft (1.2 m) o.c. Meets Class 1-90.

5.1.1.2 SuperLok Standing Seam Roof Panels, minimum 0.0299 in. (0.76 mm, 22 ga.) thick are secured to steel supports spaced at maximum 4 ft (1.2 m) o.c. Meets Class 1-135.

5.1.1.3 SuperLok Standing Seam Roof Panels, minimum 0.0299 in. (0.76 mm, 22 ga.) thick are secured to steel supports spaced at maximum 5 ft (1.5 m) o.c. Meets Class 1-105.

5.1.2 Double-Lok Standing Seam Roof Panels, maximum 18 in. (406 mm) or 24 in. (610 mm) wide painted panels are secured to steel supports using two screws with either the Double-Lok HW-214 Low Articulating Clips or HW-216 High Articulating Clips or NCI HW 3140 Low or HW 3160 High Floating Clips. Clips are secured to 0.0598 to 0.10 in. (1.5 to 2.5 mm) thick steel supports using two Construction Fasteners #14 x 1" 1/4 HWH SD w/15 mm Bonded Washer Screws per clip. Adjacent panels are seamed together along side laps with an NCI electric seaming tool.

5.1.2.1 Double-Lok Standing Seam Roof Panels, minimum 0.0299 in. (0.76 mm, 22 ga.) thick by maximum 24 in. (610 mm) wide are secured to steel supports spaced at maximum 4 ft (1.2 m) o.c. Meets Class 1-105.

5.1.2.2 Double-Lok Standing Seam Roof Panels, minimum 0.0239 in. (0.61 mm, 24 ga.) thick by maximum 24 in. (610 mm) wide are secured to steel supports spaced at maximum 4 ft (1.2 m) o.c. Meets Class 1-60.

5.1.2.3 Double-Lok Standing Seam Roof Panels, minimum 0.0239 in. (0.61 mm, 24 ga.) thick by maximum 18 in. (457 mm) wide are secured to steel supports spaced at maximum 5 ft (1.5 m) o.c. Meets Class 1-90.

5.1.3 Double-Lok Standing Seam Roof Panels, 24 in. (610 mm) wide painted panels are secured to steel supports using two screws with either the NCI HW 3140 Low or HW 3160 High Floating Clips or the Double-Lok HW-214 Low Articulating Clips or HW-216 High Articulating Clips. Clips are secured to 0.0598 to 0.10 in. (1.5 to 2.5 mm) thick steel supports using two Construction Fasteners #14 x 1" HWH SD w/15 mm Bonded Washer Screws or two Atlas 1/4 - 14x11/4 HWH Long PilotTCP2 screws with a # 14x0.594 in. dia. galvanized EPDM sealing washers per clip. Adjacent panels are seamed together along side laps with an NCI electric seaming tool.

5.1.3.1 Double-Lok Standing Seam Roof Panels minimum 0.0239 in. (0.61 mm, 24 ga.) thick by maximum 24 in. (610 mm) wide steel roof panels are secured to steel supports spaced a max. 5 ft. (1.5 m) o.c. Meets Class 1-60.

5.1.3.2 Double-Lok Standing Seam Roof Panels minimum 0.0299 in. (0.76 mm, 22 ga.) thick by maximum 24 in. (610 mm) wide steel roof panels are secured to steel supporting spaced a max. 5 ft. (1.5 m) o.c. Meets Class 1-75.

5.1.3.3 Double-Lok Standing Seam Roof Panels minimum 0.0299 in. (0.76 mm, 22 ga.) thick by maximum 24 in. (610 mm) wide steel roof panels are secured to steel supports spaced a max. 4 ft. (1.2 m) o.c. Meets Class 1-90.

5.1.3.4 Double-Lok Standing Seam Roof Panels minimum 0.0299 in. (0.76 mm, 22 ga.) thick by maximum 24 in. (610 mm) wide steel roof panels are secured to steel supports spaced a max. 3 ft. 6 in. (1.1 m) o.c. Meets Class 1-105.

5.1.4 Constructions 5.1.1 through 5.1.3.4 may also include insulation and liner panels as follows:

5.1.4.1 Vinyl faced glass fiber blanket insulation, 3 in. to 6 in. (76 mm to 152 mm) thickness or Factory Mutual Research Approved Thermax roof insulation, maximum 4.25 in. (108 mm) thickness (maximum supporting members spacing 5 ft. (1.5 m) o.c.), placed between the roof panels and the supporting members and used in conjunction with either the "M" or "R" liner panel. These insulations are not Approved for use on walls unless they have been Approved for that application under one or more Factory Mutual Research Approval programs. Steel Bearing Plates are positioned over the rigid insulation. Panel clips, as described above, are secured through the bearing plate and insulation to the steel supporting members.

5.1.4.2 NCI "M" or "R" liner panel may be applied over the purlins and secured per manufacturers installation requirements followed by Factory Mutual Research Approved Celotex Thermax roof insulation, maximum 4.25 in. (108 mm) thickness. Steel Bearing Plates are positioned over the rigid insulation. Panel clips, as described above, are secured through the bearing plate, insulation and liner panel to the steel supporting members.

5.1.5 Double-Lok and SuperLok Standing Seam Roof System panels meet Class 1-SH hail damage requirements.

5.1.6 Double-Lok and SuperLok Standing Seam Roof System Panels having Signature 200 or Signature 300 paint or Galvalume coating meet ASTM E108 Class A non-combustible deck exterior fire ratings at a maximum roof slope of 5 in 12.

5.2 The roof system must be installed using a Factory Mutual Research Approved perimeter flashing system. See the current edition of the Factory Mutual Research Approval Guide for details.

5.3 Test results from this and previous Factory Mutual Research Approval programs for NCI Building Systems L.P. show that the above roof constructions, in and of themselves alone, would not create a need for automatic sprinkler protection.

5.4 The spacing of the supporting members in the roof perimeter and/or corners shall be decreased in accordance with the FM Global Property Loss Prevention Data Sheet 1-31.

5.5 The tested panel systems, when installed as described above, meet the Factory Mutual Research Approval Standards and when Approval is effective, will continue to be listed in the Factory Mutual Research Approval Guide, Roof Panel section.

5.6 Approval is effective when the Approval Agreement is signed and received by Factory Mutual Research.

5.7 Continued Approval will depend on satisfactory field experience and periodic Quality Audit Inspections.

VI MARKINGS

6.1 Class 1 roof panels are palletized and stacked in bundles and strapped. Each individual roof panel or each pallet or bundle of panels and each package of clips and each package of screws shall be labeled with at least one label. The label shall contain, at a minimum, the manufacturer's name, product trade name, the Factory Mutual Research Approval mark, and the words, "Subject to the conditions of Approval as a Class 1 roof panel - (or "standing seam roof clip" or "roof fastener" as appropriate) when installed as shown in the current edition of the Factory Mutual Research Approval Guide".

6.2 Markings denoting Factory Mutual Research Approval shall be applied by the manufacturer only within and on the premises of manufacturing locations that are under the Factory Mutual Research Facilities and Procedures Audit Program.

6.3 The manufacturer agrees that the use of the Factory Mutual Research name or Approval Mark is subject to the conditions and limitation of Factory Mutual Research Approval. Such conditions and limitations must be included in all references to Factory Mutual Research Approval.

VII MANUFACTURERS RESPONSIBILITIES

7.1 To assure compliance with his procedures in the field, the manufacturer shall supply the roofer with necessary instructions or assistance required to produce the desired

performance achieved in the tests.

7.2 The manufacturer shall notify Factory Mutual Research of any planned change in the Approved product prior to the general sale or distribution using form 797, Approved Product Revision Report.

VIII QUALITY AUDIT INSPECTIONS AND REEXAMINATION

A reexamination and manufacturing inspection will be conducted periodically on the Approved products at the NCI Building Systems, Inc. manufacturing locations in Houston, TX; Lithia Springs, GA; Hernando, MS; Rome, NY; Salt Lake City, UT; Matton, IL; Atwater, CA; Adel, GA; Caryville, TN; Monterrey (Apdaca), Mexico; at Construction Fasteners Inc. manufacturing locations in Wyomissing, Pa and Hamburg, PA; and at Elco Textron manufacturing location in Logansport, IN to determine that the quality and uniformity of the products have been maintained and will provide the same level of performance as originally tested.

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