**PRIEST & ASSOCIATES CONSULTING, LLC**

# ENGINEERING EVALUATION

Engineering Evaluation of SFS NVELOPE Cladding Attachment

Systems for Compliance to NFPA 285

Project No. 104446A, Revision 1

Prepared for:

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*Abstract*

*SFS Intec manufactures various types of cladding attachment systems for exterior walls. These incorporate designs which minimize thermal transmission through exterior walls and for some designs separate dead load from wind load using separate attachment clips. The systems reviewed are the NVELOPE NV1, NV2, NV3, NV4, NV5, NV6, NV7, NV8, NVF2F, NH1, NH2, and the EKO systems. Normally, attachment systems are not considered as the main component being evaluated in an NFPA 285 test. However, after analyzing the various systems, it is evident that these attachment systems will not detract from approved NFPA 285 wall designs with specific limitations.*

The conclusions reached by this evaluation are true and correct, within the bounds of sound engineering practice. All reasoning for our decisions is contained within this document.

Submitted by,

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April 24, 2020

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President

April 24, 2020

## INTRODUCTION

Normally, attachment systems are not considered as the main component being evaluated in an NFPA 285 test. Typically, combustible cladding systems, insulation, or weather barriers are evaluated. Since the test is not a component test, manufacturers typically test worst-case wall assemblies so that alternate wall components can replace the tested components in use on real construction projects. The reason for this is because there are dozens of choices for each wall component (interior sheathing, studs, cavity insulation, exterior sheathing, WRB, exterior insulation, air gap, cladding, and attachment systems) and it is impractical to test every combination. Based on this, most approvals for alternate constructions (DRJ Evaluation Reports, ICC-ES ER Reports, Intertek Listings and CCRR reports, UL Listings and ER reports, IAPMO evaluation reports, etc.) are based on worst case system testing. In most cases, typical generic attachment systems are used. For this evaluation, we will consider if the NVELOPE attachment systems will or will not affect test results.

Most approvals for insulation or weather barriers are based on tests with brick, or ACM claddings. These two claddings are the accepted baseline claddings from which most other claddings can be approved. All other claddings are evaluated as being improvements to the tested design (or equivalent or deemed to not affect results). For combustible cladding approvals (ACM, HPL, etc.), these are typically tested with mineral fiber insulation, but may in some cases (for ACM only) be tested with combustible insulation and WRB materials. HPL claddings are typically only allowed to be used with mineral fiber insulation covering a combustible WRB material.

## REFERENCE DOCUMENTS

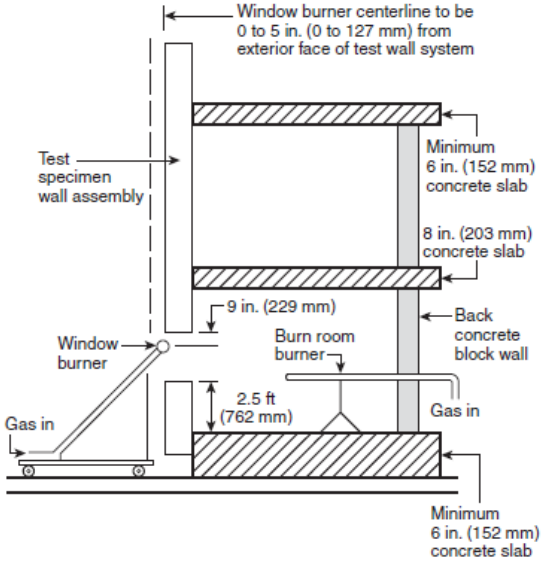
1) *NVELOPE Brochure*
2) *NVELOPE Thermal Isolator Product Data Sheet*
3) *Hughes Associates Letter 1JJB00024.002 StoneLite Panel NFPA 285 Test with NVELOPE Rain-screen Thermal Isolation System*
4) *NFPA 285-12 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-loadbearing Wall Assemblies Containing Combustible Components*
5) *SWRI Report 01.19577.01.610(1) NFPA 285 Test on StoneLite Panel System with NVELOPE Attachment System*
6) *Dow Thermax ESR 1659*
7) *EKO Product Brochure*

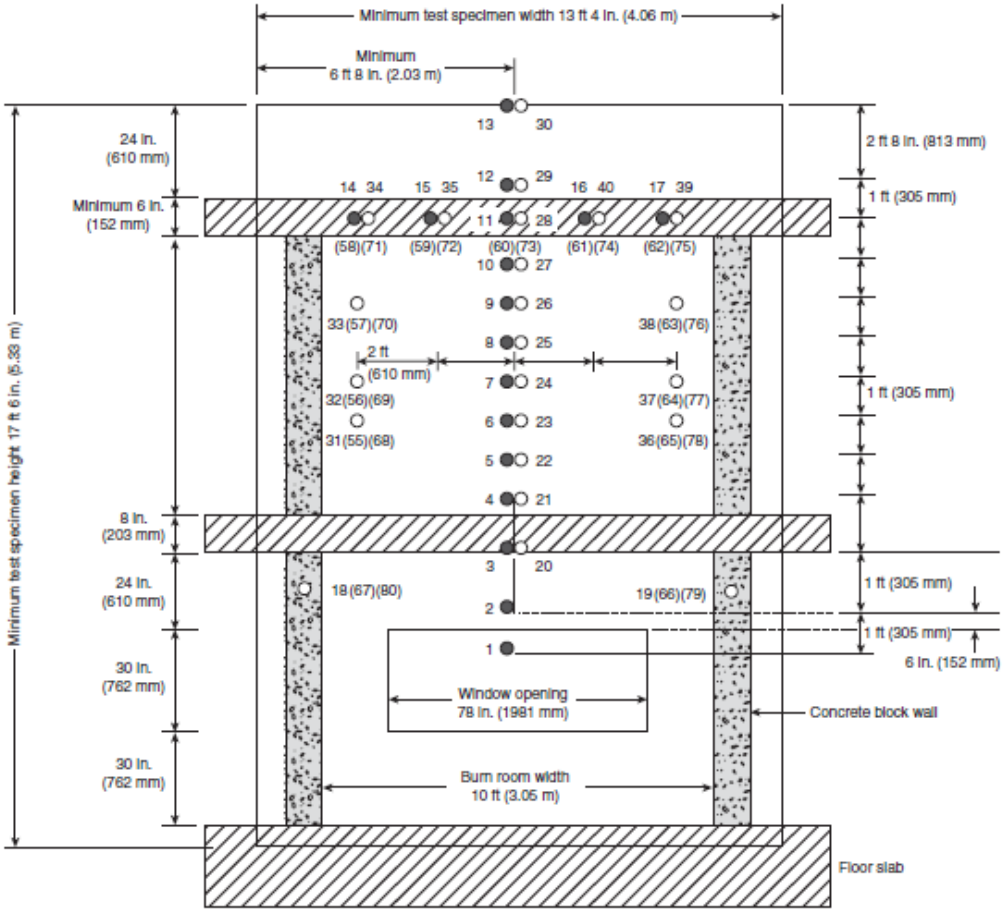
## EVALUATION METHOD

### NFPA 285 Criteria

The NFPA 285 fire test (Ref. 4) is designed to test the flame spread properties of exterior walls containing combustible components. Two noncombustible rooms are stacked to simulate two stories of a multi-story building. The wall assembly is then attached to the exterior face of the rooms. A typical test wall measures 14 ft x 18 ft with a 30 in. x 78 in. window opening placed on the bottom floor.

Two burners are ignited to produce a specific time-temperature profile in the room and on the exterior face of the wall. Thermocouples are placed at strategic locations to monitor temperature as an indicator of flame spread. In the depiction below, Thermocouples 1 - 10 and 20 - 27 are not used for compliance purposes. The remainders are used to monitor flame spread.

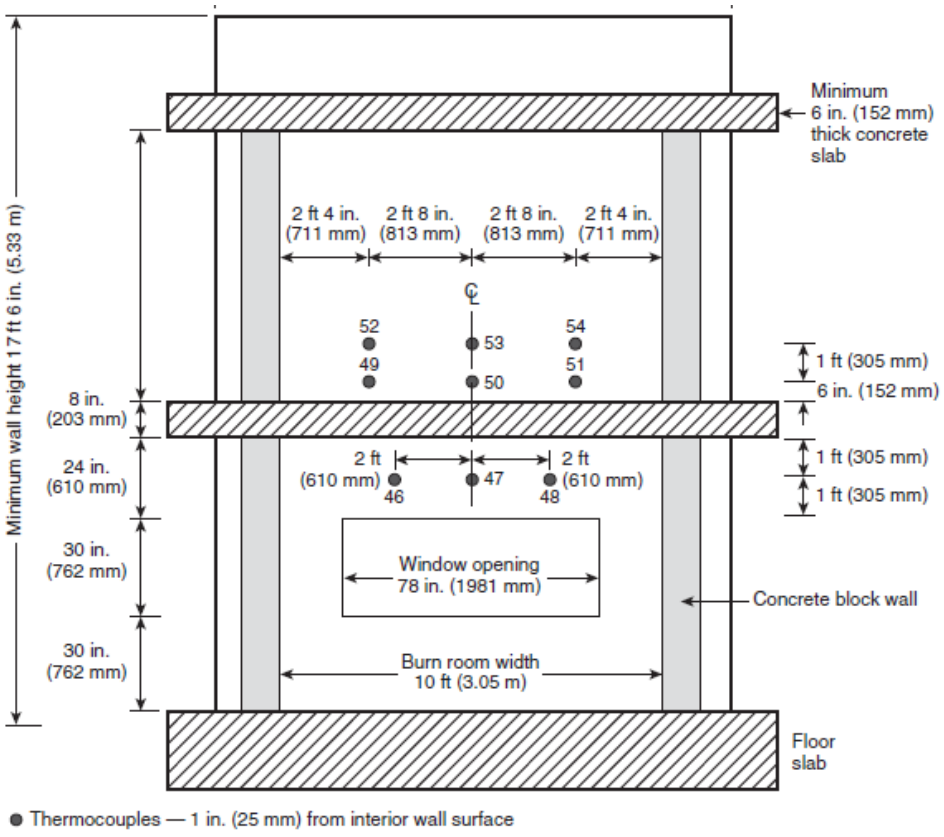



● Thermocouples — 1 in. (25 mm) from exterior wall surface

○ Thermocouples — in the wall cavity air space or the insulation, or both, as shown in Figure 6.1(b) Details A through I.

( ) Thermocouples — Additional thermocouples in the insulation or the stud cavity, or both, where required for the test specimen construction being tested, as shown in Figure 6.1(b) Details C through I.




During a test, a calibrated fire starts in the bottom room. After 5 minutes, the exterior burner is ignited to produce a specific heat flux/temperature pattern on the exterior of the wall. Both burners remain ignited during the remainder of the 30-minute test. Personnel monitor flame spread visually during the course of the test. A computer data acquisition system monitors and records the thermocouple temperatures. The criteria for passing (Ref. 4) are as follows (reworded in simpler terms for this analysis):

1) Flames shall not spread vertically 10 ft above the window opening as determined visually or by thermocouples located at the 10 ft level. Failure occurs when Thermocouples 11 or 14 - 17 exceed 1000 °F.
2) Flames shall not spread (visually) horizontally 5 ft on either side of the centerline of the window opening.
3) Flames shall not spread inside the wall cavity as determined by thermocouples placed within the wall cavity insulation and air gaps if present. Failure occurs when Thermocouples 28, 31 - 40, or 55 - 65 and 68 - 79 exceed 750 °F above ambient.
4) Flames shall not spread horizontally within the wall cavity past the interior room dimension as determined by wall cavity thermocouples. Failure occurs when Thermocouples 18 - 19, 66 - 67, or 79 - 80 exceed 750 °F above ambient.
5) Flames shall not spread to the second story room as determined by interior wall surface thermocouples. Failure occurs when Thermocouples 49 - 54 exceed 500 °F above ambient.
6) Flames shall not occur in the second story (visually).
7) Flames shall not escape (visually) from the interior to the exterior at the wall/wall intersection of the bottom story room.

**Analysis of Typical Wall Test Components**

When analyzing flammability comparisons of NFPA 285 wall systems, the elements which could potentially cause increased flame spread should be considered. Justifications are established for interchanging/removing/adding brands/types/models of components for each element.

1) **Interior Gypsum Wallboard** – Most approvals list ⅝ inch type X gypsum wallboard as the only option. Our experience has shown that using ½ inch regular gypsum wallboard causes failures of thermocouples 18 and 19 (Foam Core Thermocouples). Therefore, the use of ½ inch regular gypsum board is not permitted as the interior sheathing.
2) **Steel Studs** – Most NFPA 285 tests use 3⅝ inch deep 20 GA. steel studs spaced 24 inch OC with lateral horizontal bracing every 4 ft as the worst case. Field applications typically use 16 or 24-inch spacing. Wider spacing is the worst case since the wall is potentially more flexible and prone to warping. Therefore thicker studs, deeper stud depth, and 16-inch spacing is allowed based on testing the worst case. Testing with steel stud base walls allows the use of concrete or CMU masonry base walls as replacements.
3) **Cavity Insulation** – Some tests incorporate stud cavity insulation. Various types are used, such as SPF foam, fiberglass matt, or mineral fiber. Typically, testing with none allows the use of faced or unfaced fiberglass or mineral wool matt or sheets. Testing with SPF will allow less-flammable SPF brands or models based on cone calorimeter flammability data analysis or previous NFPA 285 base wall tests insulated with SPF insulation.
4) **Exterior Sheathing** – Tests usually incorporate ½ and ⅝ inch thick gypsum sheathing or glass matt sheathing such as Densglass Gold. The exterior sheathing may be replaced with any other tested, listed, or approved exterior sheathings of the same thickness or greater. Some approvals allow none based on tests with no sheathing. However, allowing no exterior sheathing may allow the exterior insulation to burn from both sides, or may ignite combustible cavity insulations. For the case of allowing no exterior sheathing, specific approvals (such as Ref. 6, ESR 1659) should be followed carefully.
   *Note: It is our opinion that the base wall reacts independently of the products exterior to the base wall when the wall is sheathed with gypsum board on both sides. The gypsum layer prevents the direct ignition of the cavity insulation and prevents flames from spreading vertically when floor line fire stopping is used.*

5) **WRB Over Exterior Sheathing** - Some tests incorporate a WRB product over the exterior sheathing. Testing with a WRB will allow less-flammable WRB brands or models based on cone calorimeter flammability data analysis.
6) **Exterior Insulation** – Some tests incorporate exterior insulation. Various types are used such as mineral fiber, SPF, Polyisocyanurate, EPS and XPS. Typically, interchanging insulation types is not allowed. But reducing the thickness of a combustible insulation is allowed since the wall has less fuel load than the tested system. However, removing the insulation totally may expose the WRB product to direct flame exposure (for light, low melting point claddings). Some WRB products are more flammable than the overlying foam insulation. Because of this, we do not allow "none" to be an option for insulation in wall designs incorporating WRB's unless that WRB has been proven to not cause failures with tests on ACM clad walls. However, some WRB's are less flammable than the overlying foam insulation or do not combust under NFPA 285 heating conditions. These cases must be addressed on a case by case basis using cone calorimeter analysis of the foam and/or WRB.
7) **Exterior WRB** - Some tests incorporate a WRB product over the exterior insulation. Testing with a WRB will allow less-flammable WRB brands or models based on cone calorimeter flammability data analysis.
8) **Air Gap** –Testing with ACM or brick both incorporate an air gap. For brick, the tested air gap is typically 2 inches. For ACM, the air gap is typically between ½ inch and 2¼ inches. It is important that the air gap not be greater than what was tested.
9) **Exterior Cladding** – As previously stated, most approvals for insulation or weather barriers are based on tests with brick, or ACM claddings. These two claddings are the accepted baseline claddings from which most other claddings can be approved. All other claddings are evaluated as being improvements to the tested design (or equivalent or deemed to not affect results). For combustible cladding approvals (ACM, HPL, etc.), these are typically tested with mineral fiber insulation.
10) **Attachment System**
    As previously stated, most tests incorporate generic cladding attachment systems. For brick tests, common brick ties are used. Testing with brick allows use of other heavy masonry systems. Since these products are durable under fire conditions, the attachment system never gets exposed to

direct flames from the test. However, if the window header fails, melts, falls apart, or allows heat to ignite wall core combustibles, a test failure can occur if the foam insulation burns severely enough to trigger thermocouple failures (Usually TC #28). It has been our experience that wall core temperature failures occur before exposing the attachment system to enough heat to cause cladding collapse. In fact, we have never witnessed a cladding collapse in the many hundreds of tests we've personally witnessed (or reports we've read).

For ACM, there is no common attachment system. Most ACM manufacturers do not manufacture attachment systems. But they sell their product to ACM fabricators who cut, bend and create attachment systems. Most approvals do not list attachment systems only because it is not practical to include every possible cladding attachment which would qualify. There are simply too many to list. But engineering evaluations (such as this report) are written to qualify these details on a case-by-case basis.

Testing with ACM is considered the worst-case due to the fact that ACM can melt and ignite and typically utilize semi-open joint designs. During a fire test, as the ACM melts, this creates a simulated open joint design in the worst possible location – the fire source. The melt pattern for NFPA 285 fire tests on ACM is usually large (approx 3 ft wide x 3 ft tall in a triangular pattern). Because of this extreme opening size, we allow any cladding that has superior fire properties than ACM as an allowed alternate using any commonly approved attachment system.

An NVELOPE system was tested in an NFPA 285 assembly with a heavy combustible cladding (Ref. 5). In that test, the attachment system performed well with rainsceen joints (considered worst case), exposing the attachment points to significant heat from the NFPA 285 fire test. See post-test photos and temperature data below.

**Figure C-15. Close-up of Window Opening immediately after Exposure.**

**Figure C-16. Post Test Assembly Dissection – Exterior Surface of Mineral Wool Layer after Exposure.**

**Figure C-17. Post Test Assembly Dissection – Interior Surface of *StoneLite® Panels (SP-1-10-3)* Panels following Exposure.**

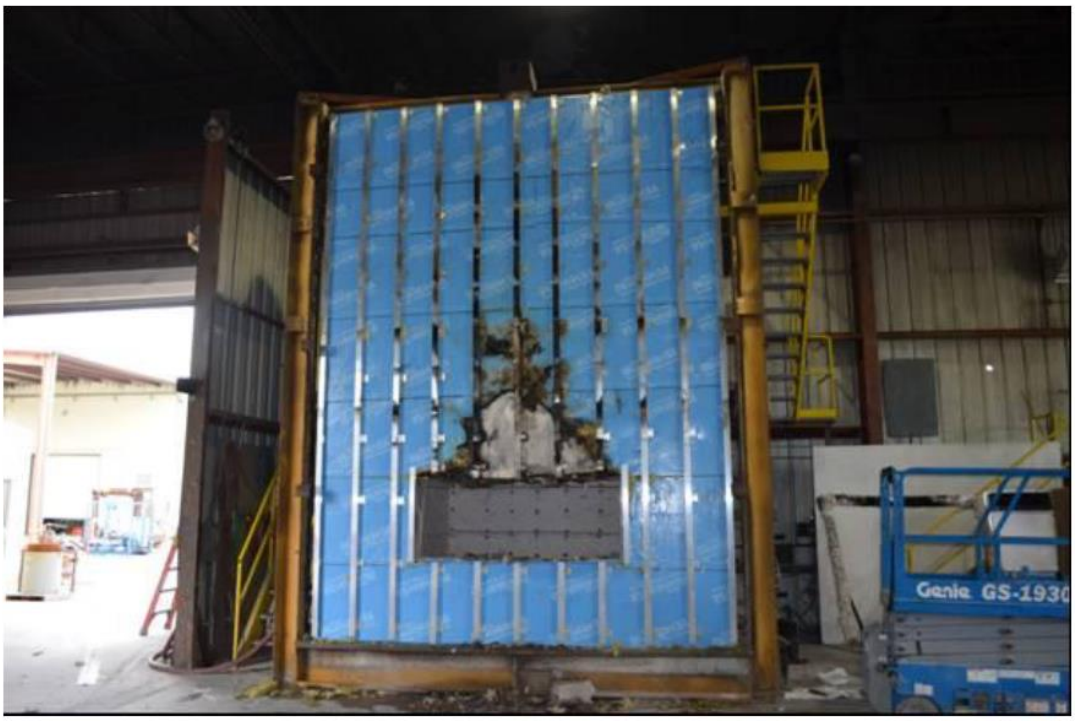



**Figure C-18. Post Test Assembly Dissection – Mineral Wool Removed. Condition of Henry Blueskin following Exposure.**

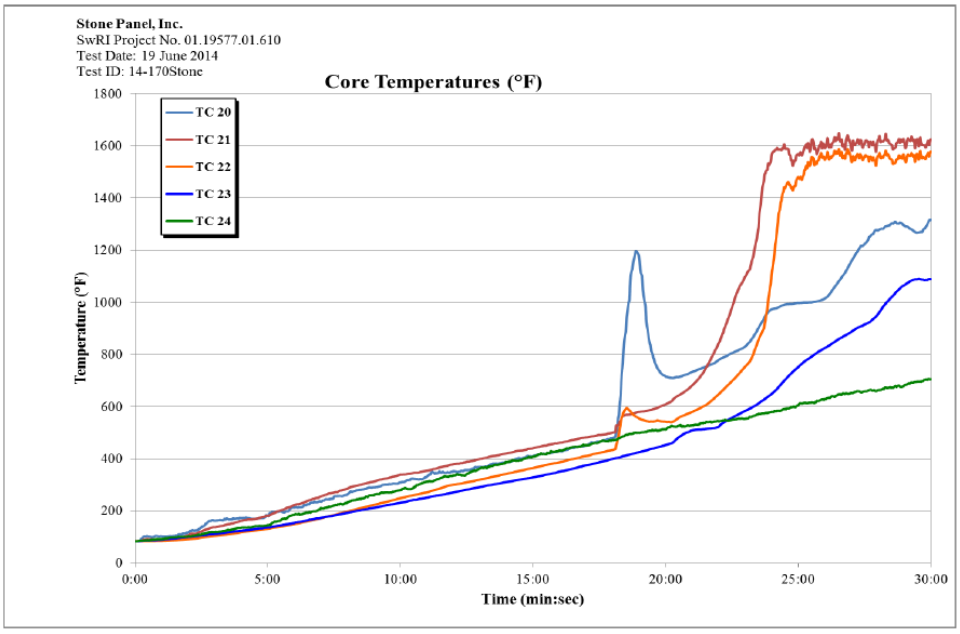



**Figure D-5. *StoneLite® Panels (SP-1-10-3)* Wall Panel Assembly Core Temperatures (TCs 20–24).**

The results of the fire test (Ref. 5) indicate that the attachment system remained intact, held the heavy cladding panels in place, and did not contribute to flame spread.

**Analysis of SFS Intec Attachment Systems**

SFS Intec submitted designs of their NVELOPE attachment systems for evaluation in this report (see Appendix A and Refs. 1, 2 & 7). These are the NVELOPE NV1, NV2, NV3, NV4, NV5, NV6, NV7, NV8, NVF2F, NH1, NH2, and the EKO systems. It should be noted that an NVELOPE System has been previously tested (Ref. 5) and evaluated for use (Ref. 3) in various NFPA 285 assemblies incorporating StoneLite panel systems. The various systems are listed below (Ref. 1, 2, 7)

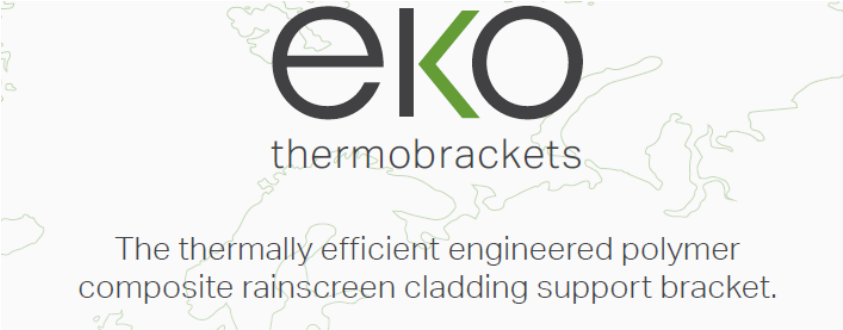
| | |
|---|---|
| **NV1** | NV1 is the NVELOPE back frame – vertical cladding applications. |
| **NV2** | NV2 is suitable for concealed fix cladding applications – structural bond (Sika sikatack panel system). |
| **NV3** | NV3 is the NVELOPE system for concealed fix / mechanically fixed applications. |
| **NV4** | NV4 (ts200) is the NVELOPE system for concealed fix / mechanically fixed applications – vertical cladding applications. |
| **NV5** | NV5 (ts300) is the NVELOPE system for concealed fix applications – vertical cladding applications (trespa meteon HPL only). |
| **NV6** | NV6 is the NVELOPE system for supporting a timber batten – vertical cladding applications (to support vertical and / or horizontal cladding elements). |
| **NV7** | NV7 is the NVELOPE system for secret fix cassette (ACM / zinc / aluminium) – vertical cladding applications. |
| **NV8** | NV8 is the NVELOPE system for concealed fix / mechanically fixed and structurally bonded applications. |
| **NVF2F** | NVF2F is the NVELOPE back frame – vertical floor to floor cladding applications. |
| **NH1** | NH1 is the NVELOPE system used to support vertical elements. |

NH2 shown below.

The NH2 system is used to attach horizontal rails which allow for direct façade attachment along the length of the horizontal rail. This provides a means of façade attachment if building wall studs are irregularly spaced (example: not at 16" on center), or façade panels of irregular sizes. The NH2 system, with an attached horizontal rail also allows other rails (Omega or Zed) to be vertically installed for use in certain wall assembly applications.

NH2 is always attached over the NV1 system.

| Generic - Cladding types | NV1 | NV2 | NV3 | NV4 (ts200) | NV5 (ts300) | NV6 | NV7 | NV8 | NVF2F | NH1 |
|---|---|---|---|---|---|---|---|---|---|---|
| ACM | Ok | Ok | | | | | Ok | Ok | Ok | Ok |
| Aluminium | Ok | Ok | | | | | Ok | Ok | Ok | Ok |
| Brick slip | Ok | | | | | | | | Ok | Ok |
| Ceramic | Ok | Ok | Ok | | | | | Ok | Ok | Ok |
| Copper | Ok | Ok | | | | Ok | Ok | Ok | Ok | Ok |
| Fibre cement | Ok | Ok | Ok | | | | | Ok | Ok | Ok |
| Fibre concrete | Ok | Ok | Ok | | | | | Ok | Ok | Ok |
| GRC | Ok | Ok | Ok | | | | | Ok | Ok | Ok |
| GRP | Ok | Ok | Ok | | | | | Ok | Ok | Ok |
| Glass (non-vision) | Ok | Ok | | | | | | Ok | Ok | Ok |
| HPL - high pressure laminate | Ok | Ok | Ok | Trespa | Trespa | | | Ok | Ok | Ok |
| Photovoltaic | Ok | | | | | | Ok | Ok | Ok | Ok |
| Render | Ok | | | | | Ok | | Ok | Ok | Ok |
| Stainless steel | Ok | Ok | | | | Ok | Ok | Ok | Ok | Ok |
| Terracotta | Ok | | | | | | | | Ok | Ok |
| Timber | Ok | | | | | Ok | | | Ok | Ok |
| Timber laminate | Ok | Ok | | | | | | Ok | Ok | Ok |
| Thin stone | Ok | Ok | Ok | | | | | Ok | Ok | Ok |
| Weatherboarding | Ok | | | | | Ok | | | Ok | Ok |
| Zinc | Ok | | | | | Ok | Ok | | Ok | Ok |




Note: The EKO system is always used as a hybrid system in which aluminum brackets hold the dead load, while the EKO clips hold the wind load. This is called the NVELOPE Hybrid system.

All of the N-series systems use metallic construction with a thin plastic thermal isolator cover (on the interior side) to reduce thermal transmission of the attachment system. These systems do not incorporate any combustible components (see Appendix A) except for the thermal isolator. From a fire performance point of view, they are manufactured from mostly metal components in sufficient thickness and mass as to be similar to most of the attachment systems we've seen tested. It is assumed that these attachment systems have undergone wind load testing for structural performance. However, structural integrity is outside the scope of this evaluation. The small amount of material used for thermal isolation is not considered to cause NFPA 285 test failures for the following reasons (includes EKO brackets):

1) The thermal isolator (closest to the interior side) is behind the exterior insulation. It is expected that the flame spread of the insulation will occur before the fire exposes the cap. If enough insulation burns to expose the cap, a test failure due to foam flame spread will occur before the cap has time to melt or ignite.
2) The thermal isolators and EKO brackets are discontinuous over the wall surface area. If an isolator (or EKO bracket) ignition occurs, the burning is localized and cannot spread flame on its own. It is common to allow flammable joint tapes for foam board joints. These are allowed due to the discontinuous nature of installation and the use of staggered joints. These products cannot spread flame uncontrollably due to the small amount of material used and the discontinuous application. If these products are allowed, it is our judgment that the thermal isolators or EKO brackets have even less potential for flame spread due to the small size.

**Joint Location**
All known NFPA 285 approvals do not limit the position of joints. This report will be consistent with that philosophy. If an approval lists specific joint limitations, those limitations will apply.

**CONCLUSIONS**
Based on the information above, we have determined that previously approved NFPA 285 wall systems may use the NVELOPE NV1, NV2, NV3, NV4, NV5, NV6, NV7, NV8, NVF2F, NH1, NH2, and the EKO (Hybrid) systems and can meet the criteria of NFPA 285 with specific limitations as per the table below.

**Allowed NFPA 285 Assemblies**
Walls not requiring NFPA 285 compliance (per the International Building Code) may use NVELOPE NV1, NV2, NV3, NV4, NV5, NV6, NV7, NV8, NVF2F, NH1, NH2, and the EKO (Hybrid) systems, since these components will not contribute to flame spread of noncombustible constructions.

NFPA 285 Compliance Requirements: Items listed below must be a part of the wall assembly in order for the assembly with the NVELOPE NV1, NV2, NV3, NV4, NV5, NV6, NV7, NV8, NVF2F, NH1, NH2, and the EKO (Hybrid) systems to be NFPA 285 compliant. Refer to foam or WRB manufacturer NFPA 285 approval tables for actual allowances other than those shown below. *Approvals from DrJ Engineering, ICC-ES, Intertek, UL, and IAPMO are considered valid for this report.*

**NFPA 285 Table of Allowed Components on the next page…..**

| Wall Component | Specific Component |
|---|---|
| **Base Wall**<br>Use 1, 2 or 3 | 1) Concrete<br>2) CMU<br>3) One layer of ⅝ inch thick type X gypsum wallboard installed on the interior side of minimum 3⅝ inch deep (min.), minimum 20 gauge galvanized steel studs spaced a maximum of 24 inches on center, minimum of 1 layer of ½" thick exterior gypsum sheathing installed on the exterior side. Lateral bracing installed minimum every 4 ft vertically or as required. |
| **Fire Stopping in Stud Cavity at floor lines** | 4 inch, 4 pcf mineral wool (e.g., Thermafiber) in each stud cavity at each floor line. The insulation is friction fit between studs or installed with Z clips. |
| **Cavity Insulation**<br>Use 1, 2, 3, 4 or 5<br>*Note 1. Approvals from DRJ Engineering, ICC-ES, Intertek, UL, and IAPMO are considered valid for this report.*<br>*Note 2: See the special requirement below if exterior sheathing is not used.* | 1) None (see note 2)<br>2) Fiberglass (faced or unfaced)<br>3) Mineral wool insulation (faced or unfaced)<br>4) Any other noncombustible insulation material (faced or unfaced)<br>5) Any approved SPF spray foam insulation approved for use in stud cavities in NFPA 285 compliant assemblies.<br><br>*See Note 1 for approval agencies.* |
| **Exterior Sheathing**<br>*Note. Specific approvals require specific minimum exterior sheathings and brands/types.* | 1) Minimum ½ or ⅝ inch thick listed or certified exterior-type gypsum sheathing (see Note).<br>2) NONE - only for those approvals that allow no exterior sheathing and specific cavity insulations (including no cavity insulation).<br><br>*For those cases where no exterior sheathing is allowed, use the specific cavity insulation in the approval.* |
| **WRB over Base Wall**<br>Use 1, 2 or 3<br><br>*Note. Approvals from DrJ Engineering, ICC-ES, Intertek, UL, and IAPMO are considered valid for this report.* | 1) None<br>2) Any WRB/AVB barrier that has been approved to be used in an NFPA 285 compliant assembly paired with mineral wool, Polyisocyanurate, EPS or XPS insulation. See Note for approval agencies.<br>3) Any WRB that meets the 2015 IBC Exceptions for WRB's (Only for walls in which the WRB is the only combustible). |
| **Exterior Insulation** –<br>Use either 1, 2, 3 or 4<br><br>*Note. Approvals from DrJ Engineering, ICC-ES, Intertek, UL, and IAPMO are considered valid for this report.* | 1) None – For constructions requiring a WRB, the construction must incorporate a WRB or AVB that meets the 2015 IBC exceptions for WRB's. These WRB's can only be used with noncombustible claddings and insulations per the 2015 code exceptions.<br>2) 2 inch thick (min.) 4 pcf mineral fiber insulation allowed for use with WRB item 2 or 3 above (Note - WRB Item 3 must use Cladding 1a below)<br>3) Any Polyisocyanurate, EPS or XPS insulation that has been approved (see Note) to be used in an NFPA 285 compliant assembly paired with the WRB's in item 2 above)<br>4) Any closed-cell SPF insulation that has been approved (see Note) to be used in an NFPA 285 compliant assembly that has also qualified to be an effective WRB. |

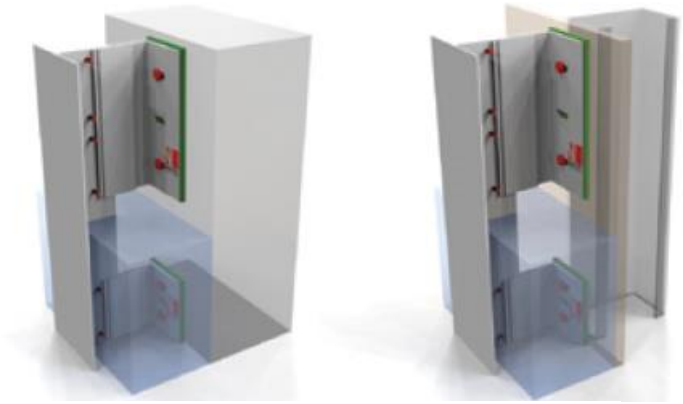
| | |
|---|---|
| **Exterior Cladding** - Use 1 or 2 with cladding installation technique shown for NVELOPE or EKO (Hybrid) Wall Systems<br><br>*Note. Approvals from DRJ Engineering, ICC-ES, Intertek, UL, and IAPMO are considered valid for this report.* | 1) Claddings below may only be used with noncombustible exterior insulation Item 2 above (mineral fiber).<br>a. Any noncombustible cladding. Any standard installation technique can be used. (Such as stone, terra cotta, fiber cement, concrete, solid metal, etc.)<br>b. Combustible cladding. Use any cladding that has been successfully tested by the panel manufacturer (or fabricator) via the NFPA 285 test method. Any standard installation technique can be used.<br>c. Adhered Masonry (minimum ¾ inch thick clay brick or stone; ⅜ inch thick tile) bonded with cementitious mortar (standard or polymer-modified) to a minimum ½ inch thick cement board or gypsum sheathing.<br>2) Claddings below may be used with any approved (see Note) combustible exterior insulation.<br>Any cladding (combustible or noncombustible) that has been approved to be used in an NFPA 285 compliant assembly paired with approved Polyisocyanurate, EPS, XPS, or SPF insulation. Each insulation must be specifically approved for the exact cladding types listed in the approval.<br><br>Cladding Installation Technique<br>All claddings listed above (or in the approvals in the Note) may use NVELOPE NV1, NV2, NV3, NV6, NV7, NV8, NVF2F, NH1, NH2, or the EKO (Hybrid) systems.<br><br>NVELOPE NV4, NV5, may only be used for Trespa HPL NFPA 285 approved systems.<br><br>EKO (Hybrid) must use metallic dead load brackets and EKO wind load brackets.<br><br>**IMPORTANT**: See the next item (Window/Door Header/Jamb details) for specific insulation types that require special detailing. |
| **Window/Door Headers/Jambs**<br><br>. | Must use approved design for specific system being considered (see Note)<br>*Note. EPS and XPS require specific door/window header and jamb details to be compliant to NFPA 285. Polyiso and SPF may or may not require specific header/jamb details. See approvals from DRJ Engineering, ICC-ES, Intertek, UL and IAPMO for the specific header/jamb detail required for each insulation type* |

# APPENDIX A

SFS NVELOPE Attachment Systems

**NV1 is the NVELOPE back frame – vertical cladding applications.**

Suitable as a back frame system – NV1 is suitable for face fixing / rivet fixing cladding elements to e.g. fibre cement, high-pressure laminate (HPL), ACM and metal rainscreen panels.



# NH2 System for Horizontal Cladding Attachment

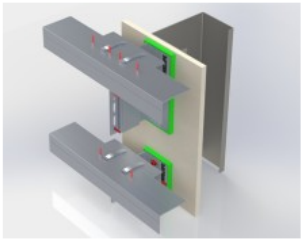
NH2 brackets and fasteners enable easy application and adjustment in order to accommodate horizontal rails and cladding installation.

## Application

The NH2 system is used to attach horizontal rails which allow for direct façade attachment along the length of the horizontal rail. This provides a means of façade attachment if building wall studs are irregularly spaced (example: not at 16" on center), or façade panels of irregular sizes. The NH2 system, with an attached horizontal rail also allows other rails (Omega or Zed) to be vertically installed for use in certain wall assembly applications.

NH2 is always attached over the NV1 system.

## System Components for Horizontal Cladding Installation



- Brackets
- Rails
- Adaptor
- Fasteners

## Suitable Cladding

- ACM
- HPL
- Fiber Cement
- Metal sheets (copper, zinc, stainless)
- Terracotta
- Fiber Concrete
- Ceramic and many more

## NV2 is the NVELOPE system for concealed fix / structural bonding applications.

NV2 is suitable for concealed fix cladding applications – structural bond (Sika sikatack panel system).

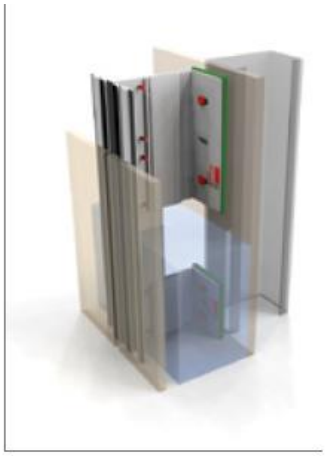
NV2 is the NVELOPE system for secret fix / structural bonding applications – vertical cladding applications.

NVELOPE 'T' and 'L' profiles are fixed using NVELOPE support brackets, fixed through a series of fixed and flexible points.

NVELOPE flexible point brackets absorb wind loading and allow for expansion and contraction.

NVELOPE fixed point brackets absorb both vertical dead loads.

NVELOPE bracket spacing is determined by cladding options such as the dimensions and weight of the facade cladding and local wind loads.



## More about NV2

**Material:**

## NV3 is the NVELOPE system for concealed fix / mechanically fixed applications.

NV3 elements – fibre cement, high-pressure laminate (HPL), ceramic, thin stone etc. Horizontal NVELOPE channel profiles are fixed to the vertical profiles. Rainscreen panels are hung from and secured with hangers.

## Features

NV3 is the NVELOPE system for secret fix / mechanically fixed applications – vertical cladding applications.

Secured using hangers and undercut stud anchors or screws to provide a concealed fixing.

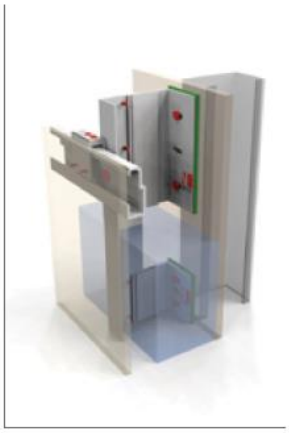
Horizontal NVELOPE channel profiles are fixed to the vertical profiles. Rainscreen panels are hung from and secured to the horizontal profiles with hangers and adjustable hangers.

NVELOPE 'T' and 'L' profiles are fixed using NVELOPE support brackets, fixed through a series of fixed and flexible points.

NVELOPE fixed point brackets absorb both vertical dead loads.

NVELOPE bracket spacing is determined by cladding options such as the dimensions and weight of the façade cladding, local wind loads.

NVELOPE flexible point brackets absorb wind loading and allow for expansion and contraction.



## More about NV3

**Material:**
Manufactured from extruded aluminium alloys conforming to EN 573-3 (material) and EN 755 production standards.

**Approvals:**
British Board of Agrément (BBA) - 09 / 4678

**Options:**
NVELOPE brackets (V): allows adjustment between the face of the primary support to outer face of vertical profile. Thermal isolators: hard PVC isolator assembled as standard (located between the NVELOPE bracket and the primary structural support system).

*For more visit: www.nvelope.com/cladding-systems-NV3-vertical-cladding.html* ■

**NV4 is the NVELOPE suitable system for concealed fix / mechanically fixed applications.**

NV4 elements –Trespa Meteon HPL. Horizontal NVELOPE channel profiles are fixed to the vertical profiles. Rainscreen panels are hung from and secured with hangers.

## Features

NV4 (ts200) is the NVELOPE system for concealed fix / mechanically fixed applications – vertical cladding applications – Trespa.

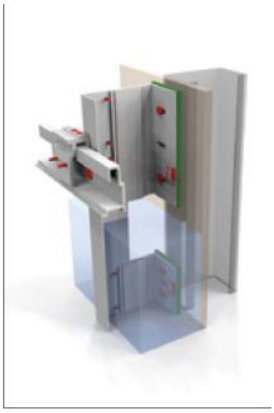
Horizontal NVELOPE channel profiles are fixed to the vertical profiles. Rainscreen panels are hung from and secured to the horizontal profiles with hangers and adjustable hangers.

NVELOPE 'T' and 'L' profiles are fixed using NVELOPE helping hand support brackets, fixed through a series of fixed and flexible points.

NVELOPE flexible point brackets absorb wind loading and allow for expansion and contraction.

NVELOPE fixed point brackets absorb both vertical dead loads.

NVELOPE bracket spacing is determined by cladding options such as the dimensions and weight of the façade cladding, local wind loads.



## More about NV4 (ts200)

**Material:**
Manufactured from extruded aluminium alloys conforming to EN 573-3 (material) and EN 755 production standards.

**Approvals:**
British Board of Agrément (BBA) - 09 / 4678

**Options:**
NVELOPE brackets (V): allows adjustment between the face of the primary support to outer face of vertical profile. Thermal isolators: hard PVC isolator assembled as standard (located between the NVELOPE bracket and the primary structural support system).

*For more visit: www.nvelope.com/cladding-systems-NV4-vertical-cladding.html* ■

**NV5 is the NVELOPE system for concealed fix applications.**

NV5 elements – Trespa Meteon HPL only. Panels are supported at the bottom by the horizontal NV5 channel profile which provides restraint to panel tops. Vertical joints can be open, baffled or formed by half laps with appropriately designed panel edges providing a concealed fixing.

## Features

NV5 (ts300) is the NVELOPE system for concealed fix applications – vertical cladding applications (Trespa meteon HPL only).

The panels are supported at the bottom by the horizontal NVELOPE NV5 (ts300) channel profile which provides restraint to panel edges.

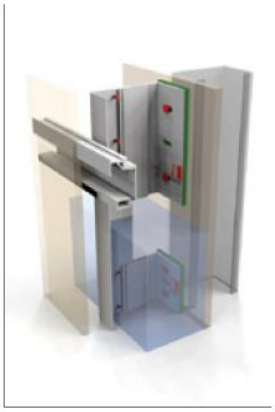
Vertical joints can be open, baffled or formed by half laps with appropriately designed panel edges providing a concealed fixing.

Individual panels can be removed for maintenance or replacement.

NVELOPE 'T' and 'L' profiles are fixed using NVELOPE support brackets, fixed through a series of fixed and flexible points.

NVELOPE flexible point brackets absorb wind loading and allow for expansion and contraction. NVELOPE fixed point brackets absorb both vertical and dead loads.

NVELOPE bracket spacing is determined by cladding options such as the dimensions and weight of the façade cladding, local wind loads.



## More about NV5 (ts300)

**Material:**
Manufactured from extruded aluminium alloys conforming to EN 573-3 (material) and EN 755 production standards.

**Approvals:**
British Board of Agrément (BBA) - 09 / 4678

**Options:**
NVELOPE brackets (V): allows adjustment between the face of the primary support to outer face of vertical profile. Thermal isolators: hard PVC isolator assembled as standard (located between the NVELOPE bracket and the primary structural support system).

*For more visit: www.nvelope.com/cladding-systems-NV5-vertical-cladding.html* ■

**NV6 is the NVELOPE system for supporting a timber batten.**

Suitable for supporting vertical or horizontal timber or cement weatherboarding. Panels may then be attached to support other materials, e.g. copper, zinc, etc.

Supporting timber cladding / weatherboarding and ply.

## Features

NV6 is the NVELOPE system for supporting a timber batten – vertical cladding applications (to support vertical and / or horizontal cladding elements).

Timber batten can be used to support timber cladding / weatherboarding and ply (used as a substrate for other materials e.g metal).

Concealed fix system, utilising NVELOPE brackets plus NVELOPE carrier.

NVELOPE flexible point brackets absorb wind loading and allow for expansion and contraction.

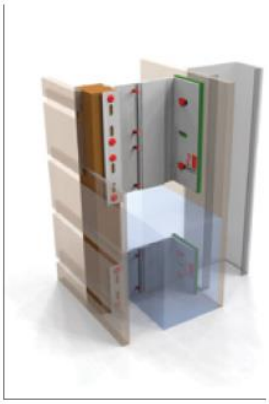
NVELOPE fixed point brackets absorb both vertical dead loads.

NVELOPE bracket spacing is determined by cladding options such as the dimensions and weight of the facade cladding, local wind loads.

## Support

Vertical timber cladding: vertical timber bearers are supported with NVELOPE carriers brackets fixed back to NVELOPE support brackets.

Horizontal timber cladding: vertical timber bearers are supported with NVELOPE carriers fixed back to NVELOPE support brackets, then counter battened.



## More about NV6

**Material:**
Manufactured from extruded aluminium alloys conforming to EN 573-3 (material) and EN 755 production standards.

**Approvals:**
British Board of Agrément (BBA) - 09 / 4678

**Options:**
NVELOPE brackets (V): allows adjustment between the face of the primary support to outer face of vertical profile. Thermal isolators: hard PVC isolator assembled as standard (located between the NVELOPE bracket and the primary structural support system).

*For more visit: www.nvelope.com/cladding-systems-NV6-vertical-cladding.html* ■

**NV7 is the NVELOPE system for supporting cassettes.**

Suitable for supporting ACM / ZCM / Aluminium cassettes.

Speak to our technical team.

## Features

NV7 is the NVELOPE system for concealed fix cassette (ACM / zinc / aluminium) – vertical cladding applications.

Secured using cassette hangers to provide a concealed fixing.

NVELOPE 'T' and 'L' profiles are fixed using NVELOPE support brackets, fixed through a series of fixed and flexible points.

NVELOPE fixed point brackets absorb both vertical and dead loads.

NVELOPE bracket spacing is determined by cladding options such as the dimensions and weight of the facade cladding, local wind loads, cladding zone and substrate.

NVELOPE flexible point brackets absorb wind loading and allow for expansion and contraction.

## More about NV7

**Material:**
Manufactured from extruded aluminium alloys conforming to EN 573-3 (material) and EN 755 production standards.

**Approvals:**
British Board of Agrément (BBA) - 09 / 4678 (Brackets)

**Options:**
NVELOPE brackets (V): allows adjustment between the face of the primary support to outer face of vertical profile. Thermal isolators: hard PVC isolator assembled as standard (located between the NVELOPE bracket and the primary structural support system).

*For more visit: www.nvelope.com/cladding-systems-NV7-vertical-cladding.html* ■

**NV8 is the NVELOPE system for concealed fix / mechanically fixed and structurally bonded applications.**

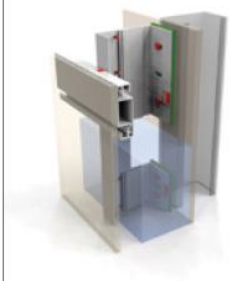

## Features

NV8 is an alternative NVELOPE system for secret fix / mechanically fixed / structurally bonded applications. On site or off site secured using hangers and undercut stud anchors, screws or structural adhesive (Sika) to provide a concealed fixing.

Horizontal NVELOPE channel profiles are fixed to the vertical profiles. Rainscreen panels are hung from and secured to the horizontal profiles with hangers and adjustable hangers.

NVELOPE 'T' and 'L' profiles are fixed using NVELOPE support brackets, fixed through a series of fixed and flexible points. NVELOPE fixed point brackets absorb both vertical dead loads.

NVELOPE bracket spacing is determined by cladding options such as the dimensions and weight of the façade cladding, local wind loads. NVELOPE flexible point brackets absorb wind loading and allow for expansion and contraction.



## More about NV8

**Material:**
Manufactured from extruded aluminium alloys conforming to EN 573-3 (material) and EN 755 production standards.

**Approvals:**
British Board of Agrément (BBA) - 09 / 4678 (Brackets).

**Options:**
NVELOPE brackets (V): allows adjustment between the face of the primary support to outer face of vertical profile. Thermal isolators: hard PVC isolator assembled as standard (located between the NVELOPE bracket and the primary structural support system).

*For more visit: www.nvelope.com/cladding-systems-NV8-vertical-cladding.html* ■

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**NVF2F is the NVELOPE back frame – vertical floor to floor cladding applications.**

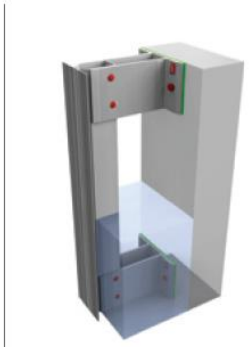
Suitable as a back frame system – NVF2F is suitable for face fixing / rivet fixing cladding – elements to e.g. fibre cement, high-pressure laminate (HPL), ACM and metal rainscreen panels. NVF2F can support NV3 / 4 / 5 / 6 / 7 and 8.

## Features

NVF2F is the NVELOPE back frame – vertical floor to floor cladding applications.

NVELOPE floor to floor (mullion) box 'T' profiles are fixed using NVELOPE support brackets. NVELOPE brackets absorb wind loading and allow for expansion and contraction and both vertical dead loads.

NVELOPE Bracket spacing is determined by cladding options such as the dimensions and weight of the façade cladding, local wind loads and cladding zone.



## More about NVF2F

**Material:**

Manufactured from extruded aluminium alloys conforming to EN 573-3 (material) and EN 755 production standards.

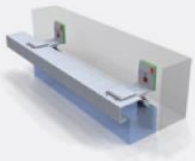
**Options:**

NVELOPE brackets (V): allows adjustment between the face of the primary support to outer face of vertical profile. Thermal isolators: hard PVC isolator assembled as standard (located between the NVELOPE bracket and the primary structural support system) are available.

*For more visit: www.nvelope.com/cladding-systems-NVF2F-vertical-cladding.html* ■

**NH1 is the NVELOPE system used to support vertical elements.**

Allowing for varied façade design options.



## Features

NH brackets are orientated horizontally.

An NVELOPE NH brace bar can be inserted into the bracket pocket in the underside of the bracket to create a horizontal NH bracket.

NH1 is the NVELOPE back frame – horizontally orientated system.

NVELOPE horizontal 'L' is fixed into the support brackets, fixed through a series of fixed and flexible points.

NVELOPE flexible point brackets absorb wind loading and allow for expansion and contraction.

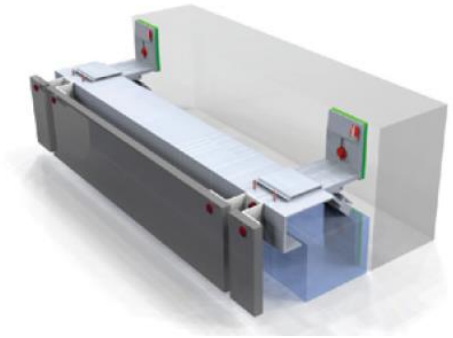
NVELOPE fixed point brackets absorb dead loads.

## More about NH1

**Material:**
Manufactured from extruded aluminium alloys conforming to EN 573-3 (material) and EN 755 production standards.

**Approvals:**
British Board of Agrément (BBA) - 09 / 4678

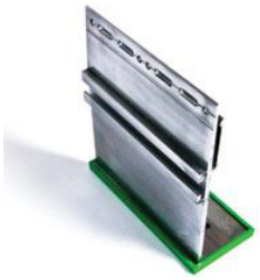
*For more visit: www.nvelope.com/cladding-systems-NH1-horizontal-cladding.html* ■

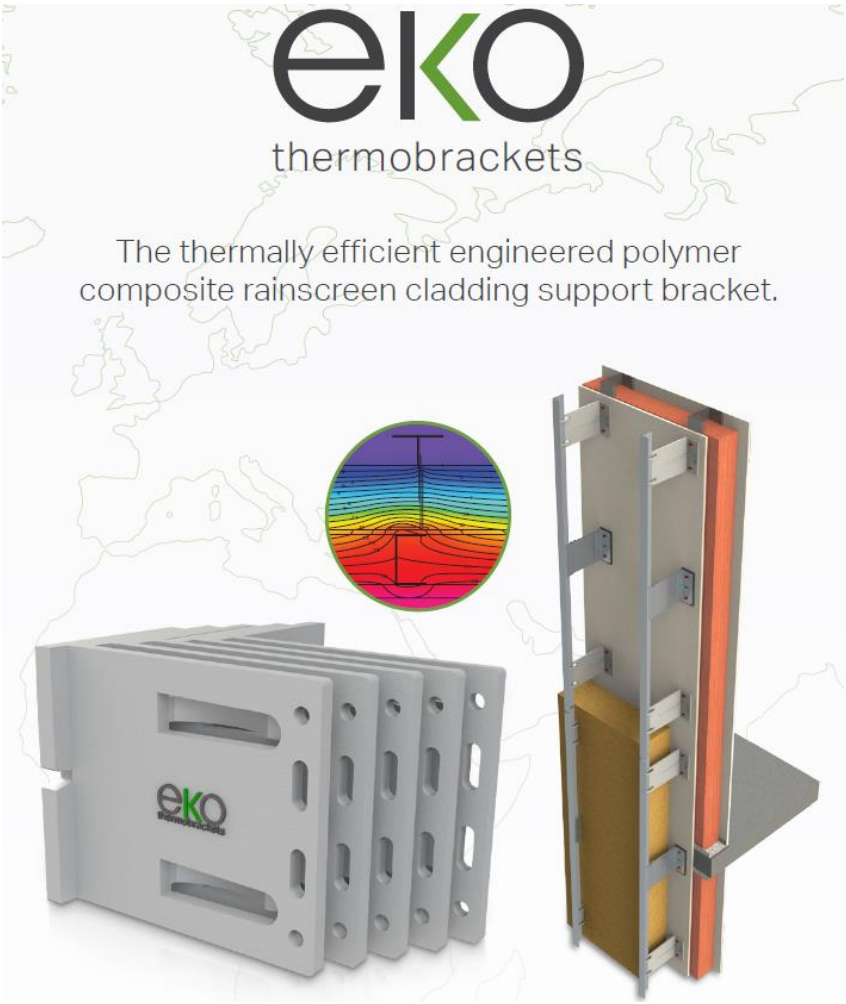


NVELOPE
MAKING CLADDING HAPPEN

THERMAL ISOLATOR PRODUCT DATA

| Property | Test Standard | Unit | Value |
|---|---|---|---|
| density | ISO 1183 | g/cm3 | 0.91 |
| tensile strength | ISO 527-1 | N/mm2 | 36 |
| breaking elongation | ISO 527-1 | % | 6 |
| tensile modulus | ISO 527-1 | N/mm2 | |
| impact resistance | ISO 179/1eU | kJ/m2 | 90 |
| notch impact resistance | ISO 179/1eA | kJ/m2 | 3.5 |
| heat conductivity | DIN 52612 | W/mK | 0.117 |
| flame-resistant | DIN 4102 | - | B1 |
| physiological harmlessness to BGA | - | - | Yes |
| heat or chemically weldable | | | Yes |
| bonding | | | Yes |
| painting | | | Yes |






The comparison of EKO rainscreen brackets with Aluminium brackets has been determined using three dimensional thermal modelling with predetermined basic construction(s).

The software used, models with supplied manufacturer thermal conductivities (Wmk) set out over a typical façade layout. 3D U-value modelling was carried out in accordance with BS EN 10211 and BS EN 6946 requirements. To understand the effect of EKO brackets, Single and Double Aluminium brackets were compared using incremental insulation thicknesses with each bracket depth).

It is important to note that the external wind loading and chosen façade material will alter these dimensions and it is advised a Project Builder should be completed.

~~~ End of Report ~~~
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