

Viking Roofspec Warmroof Load vs. Span Testing

Substrate substitution

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Report Produced By:



Andrew Sarratt, B.E. (Hons)
DESIGN & TEST ENGINEER

Report Reviewed By:



Didier Pettinga Ph.D
SENIOR ENGINEER

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| 0.1 | 22/09/2017 | First internal draft |
| 0.2 | 03/10/2017 | Revised internal draft |
| 1.0 | 05/10/2017 | Client comment - draft |
| 1.1 | 25/10/2017 | ST900 substituted for ST7. Additional content and revisions made as required |
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1 EXECUTIVE SUMMARY

Viking Roofspec engaged Holmes Solutions LP (HSLP) to conduct a comparative analysis of the existing substrate used in their Warmspan system, Metcom7, with Steel and Tube's ST900 profile, and advise of actions required to make the substitution in confidence of maintaining a structurally sufficient Warmspan system.

Based on the similarity of the geometry, and the slight increase in section modulus of the ST900, it was concluded that a substitution of the ST900 profile may be made for the existing Metcom7 profile without the need for further testing. Due to the increased crest size of the ST900, the PIR layer must now span a greater unsupported distance of 75 mm, however this is within the manufacturer's advised limits. Additionally, the maximum span of the Warmspan system may not exceed 3500 mm when used with the ST900 profile without validation through testing as this exceeds the maximum span specified by Steel and Tube for the ST900 profile.

2 INTRODUCTION

In October 2015 Holmes Solutions LP (HSLP) was contracted by Viking Roofspec to generate, via testing, load span tables suitable for specifying a Viking Roofspec product: the Viking Warmspan. The results of this testing are summarised in report 113359 RP 0815 (1.0).

During this process, HSLP was engaged to offer engineering guidance on specifying materials for use within the Warmspan product, in particular the steel substrate which forms the base of the product. Due to external factors, it is now in the interest of Viking Roofspec to substitute the selected and tested substrate for a substrate of an alternative supplier. Viking Roofspec engaged HSLP to undertake a comparative study of products suitable for use in place of the existing substrate such that the Warmspan system will still function as required following implementation of the substitution.

3 TECHNICAL DISCUSSION

3.1 Application

The Viking Warmspan product is a three layer product consisting of a steel substrate layered with rigid polyisocyanurate (PIR) panels, and completed with a sheet of waterproofing membrane.

Viking Roofspec's chosen PIR panels are suitable for spanning troughs of a maximum length of 70 mm under the manufacturer's specification when used in roofing applications. To avoid creating spans of longer than 70 mm the current substrate, Metalcraft's Metcom7, must be installed upside down in the Warmroof system. The engineering justification for this variation, and associated fixing details is based on testing and summarised in 113359 RP 0815 (1.0).



Figure 1: Cross-section of Warmspan Roof

3.2 Analysis of Substrates

Steel and Tube's ST900 profile possesses similar but not identical properties which shall form the basis of the comparison in this report. Appended to this report are the publically available technical data sheets for both the Metcom7, and the ST900.

3.2.1 Geometry

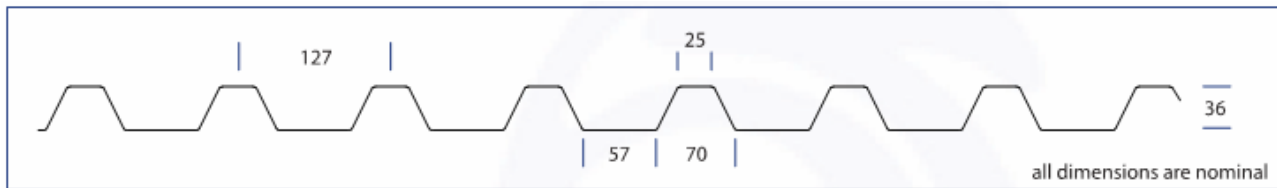


Figure 2: Existing Substrate - Metcom7, Geometry

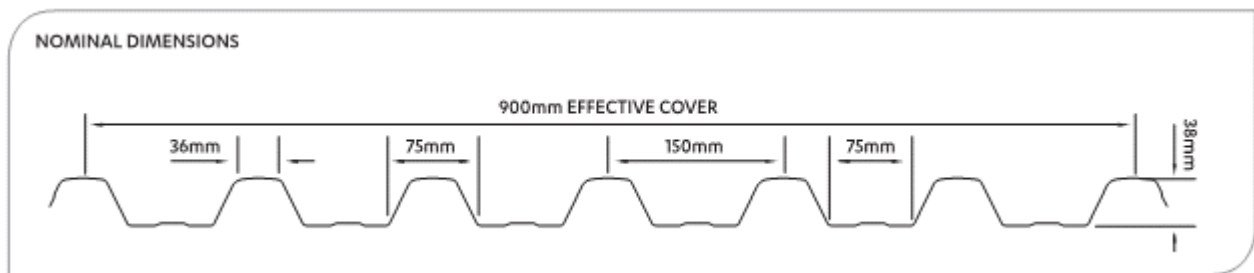


Figure 3: Proposed Substrate - ST900, Geometry

The two steel substrate types are compared in Figure 2 and Figure 3. It can be seen that the proposed substrate, ST900, has a 2 mm deeper profile, with an 11 mm wider crest (when viewed in its intended orientation as shown). Both profiles are rolled from grade 550 MPa, 0.55 mm BMT steel. PIR overlaid on the ST900 must span an unsupported distance of 75 mm which is within the manufacturer's advised limits (See Appendix for detail).

3.2.2 Sectional Properties

Metalcraft does not make sectional properties of their substrates publically available, however CAD modelling and analysis of the above geometry have allowed for calculation of the properties of the Metcom7 as displayed in Table 1 below. The CAD model of the Metcom7 from which the sectional properties are derived is shown in Figure 4.

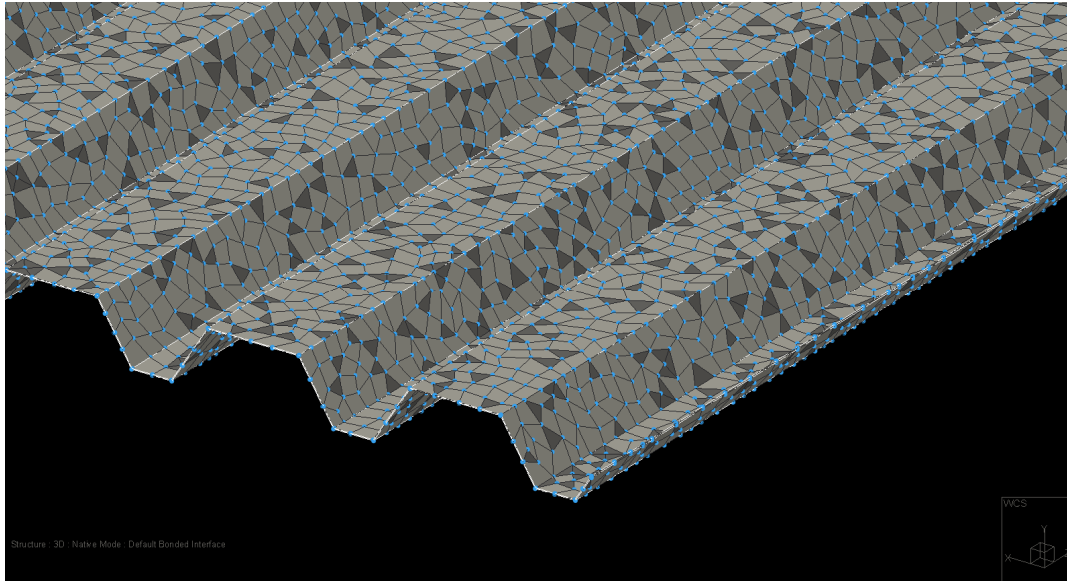


Figure 4: CAD Modelling of Metcom7

Sectional properties of the ST900 profile are available in the ST900 datasheet, and are tabulated for comparison against the derived properties of Metcom7 in Table 1. Both data sets are based on a 1 m width of substrate.

Table 1: Comparison of Sectional Properties for Metcom7 and ST900

| Substrate | Area [mm ²] | I [mm ⁴] | Z _{TOP} [mm ³] | Z _{BOTTOM} [mm ³] | Y[Centroid] [mm] | Maximum quoted internal span [mm] |
|-----------|----------------------------|-------------------------|--|---|---------------------|---|
| Metcom7 | 726 | 157369 | 6487 | 9079 | 14.7 | 3600 |
| ST900 | 714 | 163480 | 7465 | 10154 | 16.1 | 3500 |

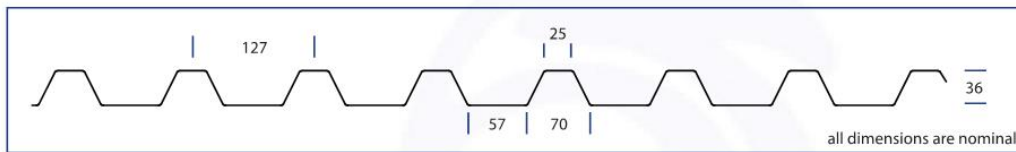
4 DISCUSSION

As the substrate is installed upside down, the wider crests (as shown) are subject to compression stresses due to bending from wind uplift conditions; It is likely, as observed in testing, that localised buckling of the crest as a result of bending will initiate failure of the specimen, therefore the section modulus with regard to the distance from the centroid to the crest (Z_{TOP}) is the pertinent mechanical property to compare.

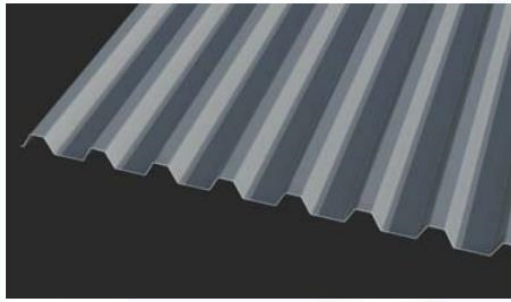
Table 1 shows that the ST900 profile has larger section moduli in both top and bottom orientations for a given 1 m wide span. Based on the similarity of the geometry, and the increase in section modulus of the ST900, the ST900 profile may be substituted for the existing Metcom7 profile without the need for further testing. However, despite the similarity of the two substrates, the maximum span of the Warmspan system may not exceed 3500 mm as specified by Steel and Tube for the ST900 profile.

Metcom7

Metcom7 is an aesthetically pleasing profile used in commercial roof and wall cladding applications. Metcom7 has excellent spanning capabilities and adds great value and appearance to any project. Metcom7 is available in Zincalume, Galvsteel, Colorsteel Endura and Colorsteel Maxx.



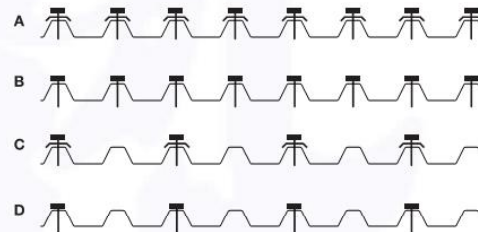
Cover: 889mm Sheet Width: 933mm Min Pitch: 3°



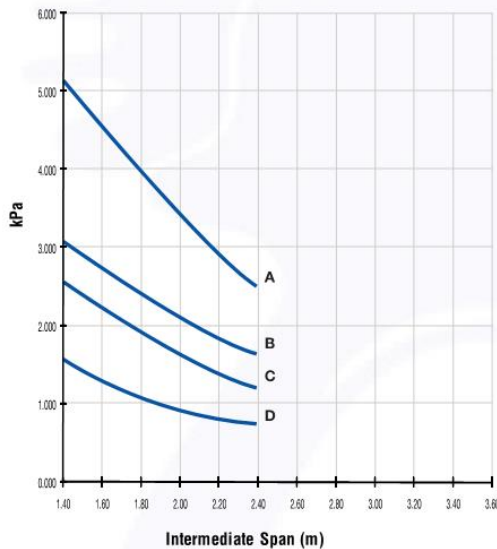
Recommended Fixings

Timber: 14G x 75mm or 14G x 90mm with load spreading washer
Steel: 12G x 65mm or 12G x 75mm with load spreading washer

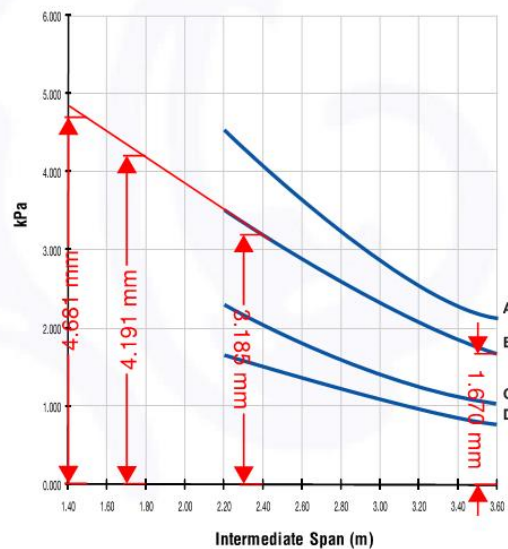
Fixing Patterns



Metcom7 0.40mm UDL



Metcom7 0.55mm UDL



Note: The intermediate spans shown in the graphs above are based on G550 Steel as the base metal. To calculate end spans please multiply the intermediate span calculated by 0.66. Spans are based on restricted access. For alternative metals please contact your local Metalcraft branch.

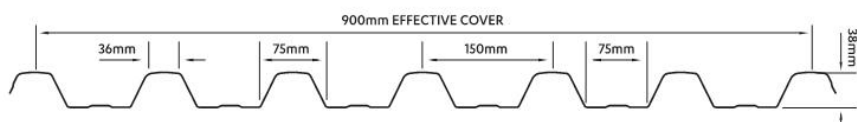
Manufacturing Locations Wellington

Metcom 7 is available for purchase from all Metalcraft branch locations

www.metalcraftroofing.co.nz

✦ *Profiled Metal Roofing and Cladding*

NOMINAL DIMENSIONS



DESCRIPTION

ST900 is a medium rib profile. Developed for the commercial/industrial roofing and cladding markets, it is equally at home in residential settings where a bolder look is desired.

APPLICATIONS

- Residential Roofing and Cladding
- Industrial/Commercial Roofing and Cladding
- Curving

FEATURES

ST900 is distinguished by a subtle swage pan that adds stiffness to the pan, minimising canning and purlin line marking. Lapping ribs are interchangeable male/female, allowing flexibility to the installer, and feature a well-defined anti-capillary detail.

OPTIONS

ST900 in .55mm thickness can be crimp-curved to a minimum radius of 400mm. Matching translucent sheeting is available in GRP (fibreglass). The product can also be manufactured without the pan swage, in which case it should be specified and ordered as **STN900**.

MATERIALS

Available in metallic coated and pre-painted steel in .40mm and .55mm B.M.T. (base metal thickness) aluminium plain and prepainted in .70mm and .90mm, and other non-ferrous metals.

FASTENERS

Typically: Steelfix 12g x 65mm, Timberfix 12g x 75mm, Class 4 minimum, of material compatible with that being fastened and durability no less than the sheet material. Category 5 or non-ferrous fasteners are recommended for very severe marine environments.

DURABILITY

All material selections must be compatible with prevailing environmental conditions and adjacent materials, see *Roofing Solutions Product Guide* or *Specifiers Guide* for details. Areas not exposed to rain washing will require programmed maintenance.

WARRANTY PLUS

Steel & Tube **WarrantyPlus** is the most comprehensive warranty available in the industry. **WarrantyPlus** covers an extended range of performance criteria, is supported back-to-back by our suppliers, includes site-specific maintenance requirements and is transferable to subsequent owners.

SECTIONAL PROPERTIES

| Measure Unit | Mass kg/m ² | Area mm ² | I mm ⁴ | Z Top mm ³ | Z Bottom mm ³ | Y (centroid) mm |
|--------------|------------------------|----------------------|-------------------|-----------------------|--------------------------|-----------------|
| .40mm B.M.T. | 4.49 | 519 | 118851 | 5427 | 7382 | 16.1 |
| .55mm B.M.T. | 6.08 | 714 | 163480 | 7465 | 10154 | 16.1 |

Notes: 1. Properties are for 1 metre width of cladding. 2. Values are nominal only. 3. Yield strength is 550 MPa typical.

PERFORMANCE DATA

Maximum spans for Normal and Heavy Traffic in millimetres. Distributed loads in kPa at maximum spans using 6 fasteners per sheet per support. Loads for alternative fastener frequencies available on request.

| Gauge | Controlled Traffic* | | | |
|-------|---------------------|---------|------|---------|
| | Internal | | End | |
| | Span | Load | Span | Load |
| .40mm | 2400 | 2.95 st | 1700 | 4.30 st |
| | | 2.19 sv | | 3.40 sv |
| .55mm | 3500 | 3.15 st | 2800 | 3.25 st |
| | | 1.90 sv | | 1.75 sv |

| Gauge | Heavy Traffic** | | | |
|-------|-----------------|---------|------|---------|
| | Internal | | End | |
| | Span | Load | Span | Load |
| .40mm | 1000 | 8.50 st | 1000 | 7.10 st |
| | | 7.34 sv | | 6.40 sv |
| .55mm | 2300 | 4.55 st | 1700 | 6.10 st |
| | | 3.51 sv | | 3.00 sv |

* Supports 1.1kN to PAN at midspan. ** Supports 1.1kN to RIB at midspan.

st = Limit State Strength Load. sv = Limit State Serviceability Load.

Products tested in accordance with NZMCM recommendations.

MINIMUM PITCH

In accordance with Acceptable Solution E2, the minimum pitch for **ST900** is 3°. Roof runs in excess of 65 metres should be checked for water runoff capacity.

FOOT TRAFFIC

Foot traffic up the roof must take place with load spread equally across two ribs, or in the pan and against an adjacent rib. Traffic across the roof must take place along the purlin lines.

SPECIFICATIONS

Recommended specifications are available in the branded sections of MasterSpec **BASIC** or MasterSpec **STANDARD**, or from your local Steel & Tube branch or visit our website.

DESIGN DETAILS

Design details covering many applications are available on our website in CAD and PDF under each product section. Visit www.steelandtube.co.nz.

IMPORTANT PUBLICATIONS

For your installation to perform to its potential, it is essential that it is designed, installed and maintained in accordance with good trade practice. Please refer to:

- Steel & Tube: Roofing Solutions Product Guide
- New Zealand Steel: Installation Guide
- New Zealand Steel: Builders and Specifiers Guide
- BRANZ: Good Profiled Metal Roofing Practice
- MRM: New Zealand Metal Roofing and Wall Cladding Code of Practice
- E2/AS1

INSTALLERS

A list of local installers for your area and contract type is available from your local Steel & Tube branch or visit www.steelandtube.co.nz.

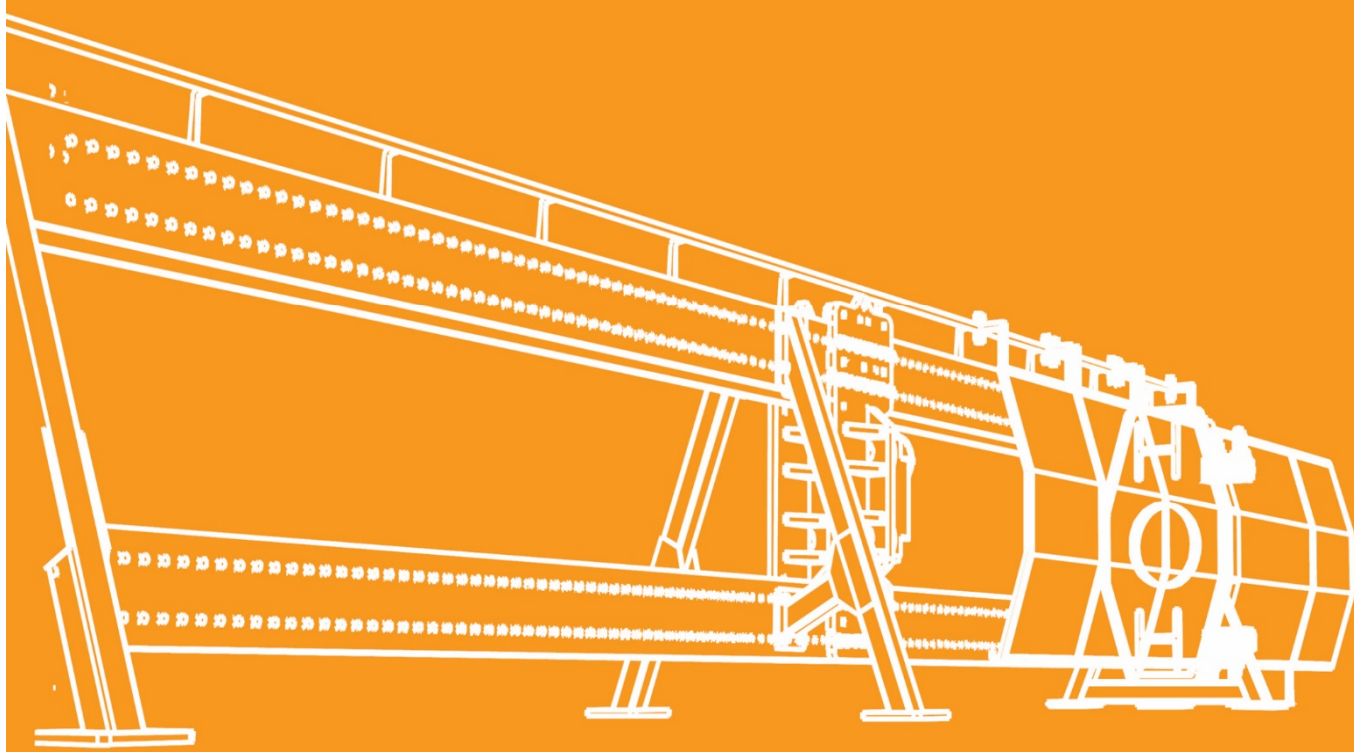
Note:

Trademarks apply to the following products presented in this publication: ST900, MasterSpec **BASIC** and MasterSpec **STANDARD**.

Spanning on Metal Decks

The designer's attention is drawn to the requirement that insulation boards are of the minimum thicknesses shown in the table below, when used over metal decks with trough openings as shown.

| Trough Opening (mm) | Minimum Insulant Thickness (mm) |
|---------------------|---------------------------------|
| ≤75 | 25 |
| 76 – 100 | 30 |
| 101 – 125 | 35 |
| 126 – 150 | 40 |
| 151 – 175 | 45 |
| 176 – 200 | 50 |
| 201 – 225 | 55 |
| 226 – 250 | 60 |



HOLMES HQ

Level 2, 254 Montreal Street
Christchurch City Centre
Christchurch 8013
New Zealand

LABORATORY

7 Canterbury Street
Hornby
Christchurch 8042
New Zealand

IMPACT TESTING FACILITY

107 Hasketts Road
Templeton
Christchurch 7675
New Zealand

POSTAL ADDRESS

PO Box 6718
Upper Riccarton
Christchurch 8442
New Zealand

Holmes

Australia Netherlands New Zealand USA

holmessolutions.com