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Independent News & Media plc.
Tegral Composite Floor Decking

The Helix, Dublin.
Tegral Roof Decking

Central Park, Leopardstown, Dublin.
Tegral Composite Floor Decking

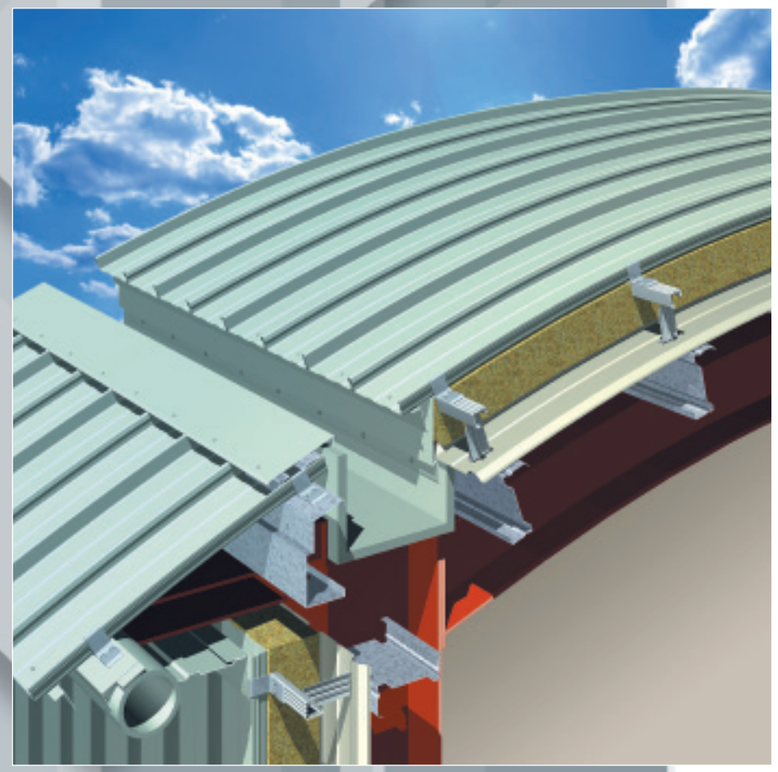
Built-up Systems

Roofing and Cladding

Tegral
METAL FORMING

Designers Guide to:

- Architectural Profiles
- Curved Roof & Walls
- Firewall Systems
- Acoustic Systems
- Sustainable Systems



A world of experience

Our Company

Tegral Metal Forming is part of the Tegral Group and a subsidiary of the Etex Group, a world-renowned international building products company. For over 25 years, Tegral Metal Forming has been to the forefront of development with regard to roofing, cladding and flooring systems.

Based in Athy, Co. Kildare, the Tegral Group consists of Tegral Building Products and Tegral Metal Forming. Tegral Building Products is Ireland's largest manufacturer and distributor of roofing products and Tegral Metal Forming Ltd. is a leading manufacturer and supplier of metal roofing and flooring systems for the construction industry.

The comprehensive product range is designed to suit most applications in modern commercial, industrial and agricultural construction. Over the years, Tegral Metal Forming has developed an expertise in every aspect of metal systems application.

Project: Colaiste de h'Idé, Dublin
Architects: Campbell Conroy Hickey
Product: Tegral Fineline 19

Our Partners

Through a long-standing partnership with Corus, a world-renowned manufacturer of steel and aluminium, Tegral customers and specifiers are assured of the highest standards and quality in all Tegral products.

Our Standards

All manufacturing in Athy meets with the stringent requirements of Quality Assurance systems to ISO 9001:2000 and ISO 14001 Environmental Management Standard.

Our People

People really do matter at Tegral Metal Forming. Recently the company proudly embraced and succeeded in achieving the "Excellence Through People" award, Ireland's national standard for human resource development.

Our Industry Associates

Tegral Metal Forming takes an active role in the promotion of the metal industry and is involved in the Roof Manufacturers and Suppliers Association (RMSA) in Ireland, the Metal Cladding and Roofing Manufacturers Association (MCRMA) in the UK and also the Irish Farm Buildings Association.

corus

I·F·B·A

DESIGNER'S ROOFING AND CLADDING GUIDE Introduction

Using the Guide

This guide covers the key elements, issues and considerations the designer faces when selecting roofing and cladding materials. We offer metal cladding solutions that include twin-skin systems, site assembled composites, factory assembled PIR and mineral wool core composite panels. This range presents the designer with a unique opportunity to objectively analyse the characteristics of the different systems and to select the best solution for any building.

Our guiding principles are objectivity and professionalism, our goal is to help our customer find the right solution and our commitment to quality and excellence in everything we do, remains constant.

For further technical information on all Tegral products please refer to the individual product brochures or alternatively contact our Technical Services Department.
Tel: 00 + 353 (0) 59 86 40750
Email: metaltech@tegral.com
or Sales Department
Tel: + 353 (0)59 86 40740
Email: metalsales@tegral.com

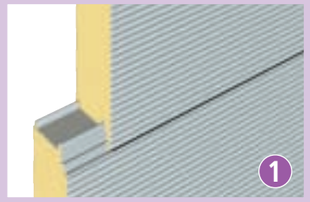
Project: Associated Hardware Ltd., Dublin
Architects: Integrated Development Services
Product: Tegral Shadowline 47™

Tegral Metal Forming supplies a range of systems for roofing and cladding

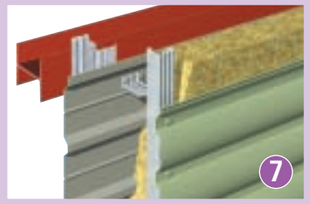
DESIGNER'S ROOFING AND CLADDING GUIDE

Tegral product range

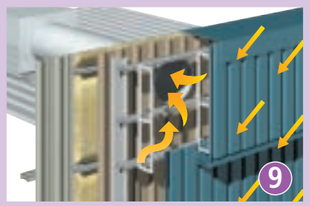
Tegral product range



LPCB & FM approved Insulated Panel Range



Built-Up Roofing and Wall Cladding Systems

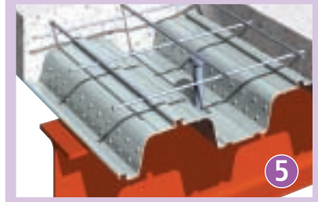


SolarWall™

Aluseam® and Seam-Loc Standing Seam Roofing

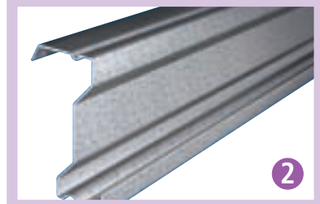
Superdeck Membrane-faced Insulated Roof Panel

Complete Tegral Systems Range including the World's first CarbonNeutral building envelope through Confidex Sustain™ from Corus with Colorcoat® assessed systems.

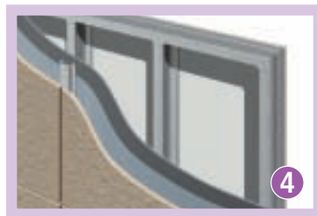


ComFlor® Flooring Range

Flat Roof Deck Range



Zeta Purlin Range



Tegframe® Light Gauge Steel Framing

Flashings

Project: St. Vincent's Centre, Dublin
Architects: Burke-Kennedy Doyle
Product: Tegral Seam-Loc

Table of Contents

Outline of roofing and cladding systems

Application Options

The choice of application system will be dictated by the building type, structural frame, extent of cladding and aesthetic, internal design requirements. Metal systems are suited equally to both entire building envelope enclosure and small-scale feature infill cladding panels.
The common feature in all applications is the need for a support element for the chosen metal product.

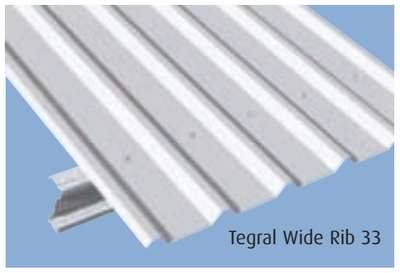
Metal roofing may be fixed to either steel (cold-rolled galvanised or hot-rolled) or timber purlins. In addition, it may be fixed to profiled metal decking or timber decking. Similar options exist for metal cladding with the addition of rainscreen application methods.
The following typical application methods are given for guidance purposes – other options can be discussed directly with the Tegral Technical Services Department.

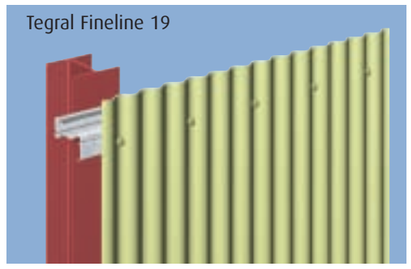
Single Skin Application

1

An uninsulated profiled metal sheet fixed directly to the roof purlin or cladding rail.

Example
Tegral Fineline 19
Tegral Wide Rib 33


Tegral Wide Rib 33

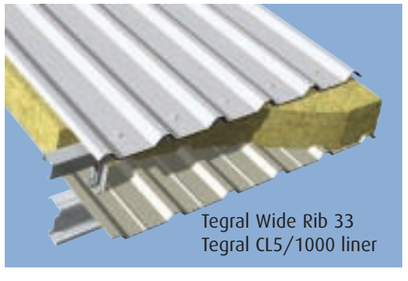

Tegral Fineline 19

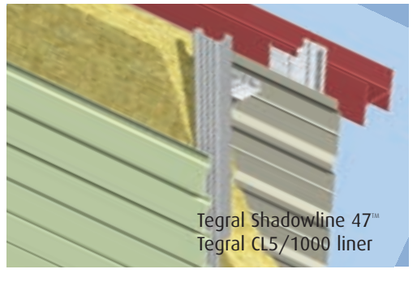
Twin Skin Application

2

A popular form of construction consisting of a profiled metal liner sheet, a metal spacer system and an external profiled metal weathering sheets. The system is insulated with glass or mineral wool quilt.

Example
Tegral CL5/1000 liner
Tegral Wide Rib 33
Tegral CL5/1000 liner
Tegral Shadowline 47™


Tegral Wide Rib 33
Tegral CL5/1000 liner

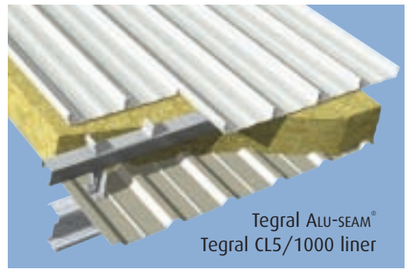

Tegral Shadowline 47™
Tegral CL5/1000 liner

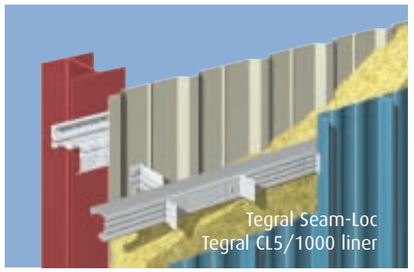
Secret fix (standing seam) systems

3

Similar in concept to 2., the weather sheet in this case has virtually no exposed fasteners and permits use on very low roof pitches and curved roofs.

Example
Tegral CL5/1000 liner
Tegral Alu-seam®
Tegral CL5/1000 liner
Tegral Seam-Loc


Tegral Alu-seam®
Tegral CL5/1000 liner

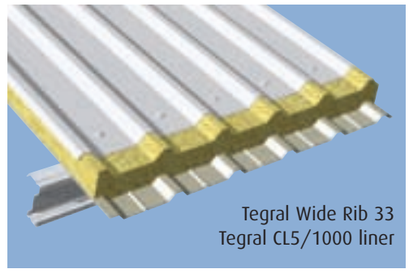

Tegral Seam-Loc
Tegral CL5/1000 liner

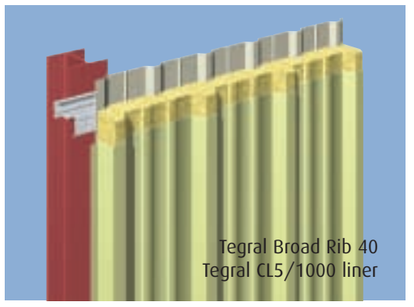
Tegral site assembled composite systems

4

Comprises similar liner sheet and weather sheets as in 2. and 3., in this case the insulation core consists of pre-formed rigid mineral wool profiled to suit the shape of the sheets. No metal spacer system is required.

Example
Tegral CL5/1000 liner
Tegral Wide Rib 33
Tegral Broad Rib 40


Tegral Wide Rib 33
Tegral CL5/1000 liner


Tegral Broad Rib 40
Tegral CL5/1000 liner

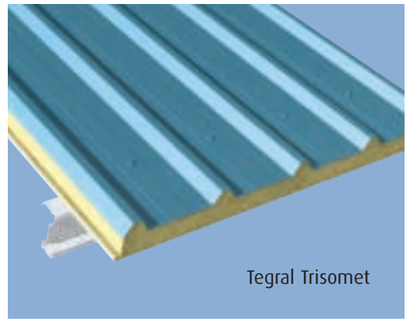
Composite panel systems

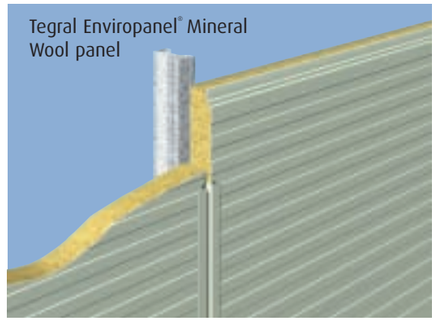
5

These panels combine a metal liner sheet, rigid insulation (PIR or mineral wool) and profiled weather sheet in a single factory – made product

Example
Tegral Trisomet
Tegral Enviropanel®

'For information on Tegral Composite Panels, see separate section 1 of this guide.


Tegral Trisomet


Tegral Enviropanel® Mineral Wool panel

Project: Sharptext Ltd., Dublin
Architects: Scott Tallon Walker
Product: Tegral Shadowline 47™

Key Benefits of Tegral Built-Up Systems

Twin-Skin roofing and cladding systems are a popular form of construction consisting of an internal profiled metal liner sheet, a metal spacer system and an external profiled metal weathering sheet. The system is insulated using glass or mineral wool quilt or slab and built up on-site. For maximum flexibility Tegral also supply a secret fix system (Alu-Seam® and Seam-Loc) and a site-assembled composite system (Trinsul).

Tegral's Twin-Skin roofing and cladding systems can offer the designer the opportunity to achieve both aesthetic appeal and the required functionality to meet regulatory design standards.

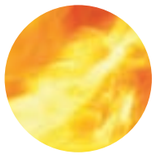
Tegral Twin-Skin systems can also be specified to provide key functional benefits such as fire resistance and acoustic protection - direct advantages not found in other roofing and cladding systems. The five key benefits of Tegral Twin-Skin systems are presented as follows:

1 Freedom to Curve

Tegral's Twin-Skin Systems can be curved to create interesting designs for BOTH roofing and cladding.

2 The Potential of Shape

Tegral produce a range of profiles to suit all design needs. Used on large elevations they can create striking shadow effects or combined with innovative detailing, they can create arresting design features.



3 Strength & Protection

Tegral's Twin-Skin systems are proven as the best choice for fire and acoustic protection.

4 Green Credentials

Tegral Built-Up systems are fully recyclable and in addition offer the World's first Cradle-to-Grave Carbon Neutral Building Envelope with Confidex® Sustain from Corus.

Confidex SUSTAIN

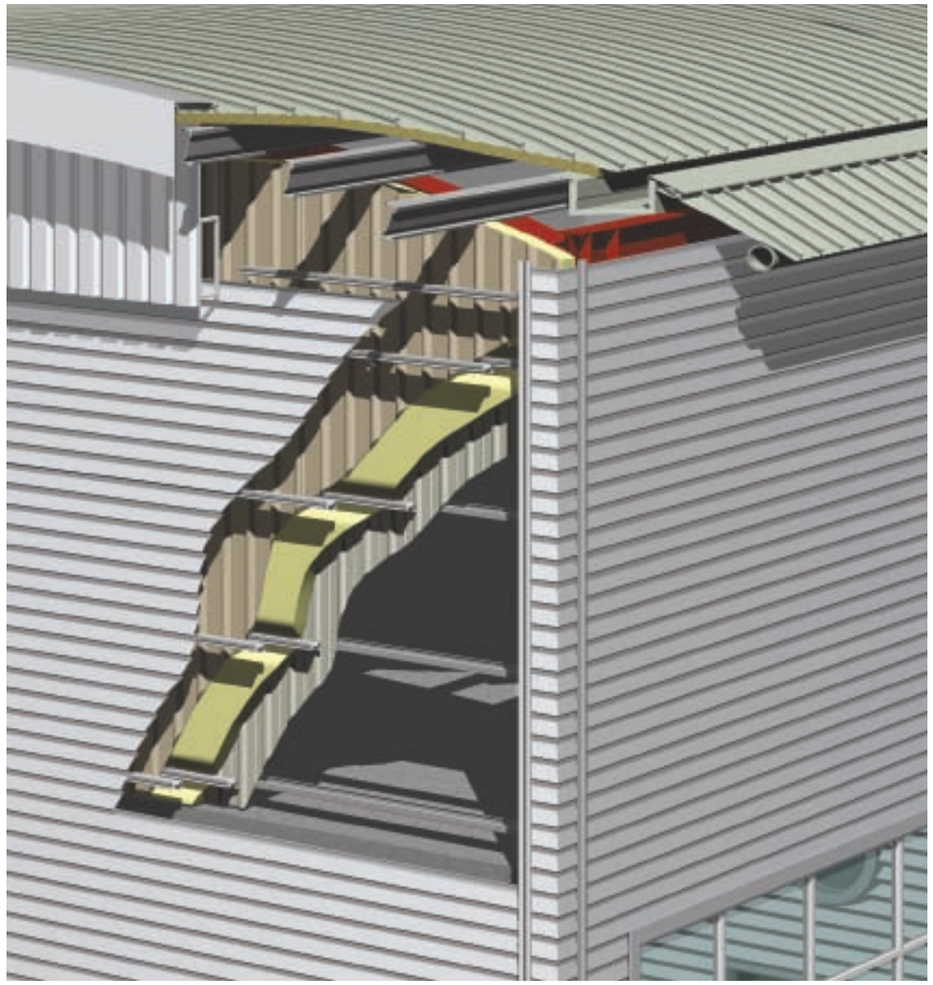
5 Colour - Nature's True Bounty

Available in a vast array of standard and bespoke colours with up to 30 years Confidex Guarantee from Corus, Tegral's Built-Up Roofing and Cladding may be specified to match any colour requirement.

Tegral System Assurance

The specification of building materials is becoming increasingly complicated by the need to consider not just aesthetic and structural qualities, but also energy efficiency, cost effectiveness, health and safety and sustainability. Tegral are pleased to manufacture and supply a range of state-of-the-art roofing and cladding products that are independently assessed across multi-performance criteria to offer the specifier and building owner the highest possible levels of assurance.

This comprehensive assurance package applies to ALL Tegral Built-Up systems and covers weatherproofing, structural integrity, thermal performance, airtightness, fire and acoustic protection and sustainability.



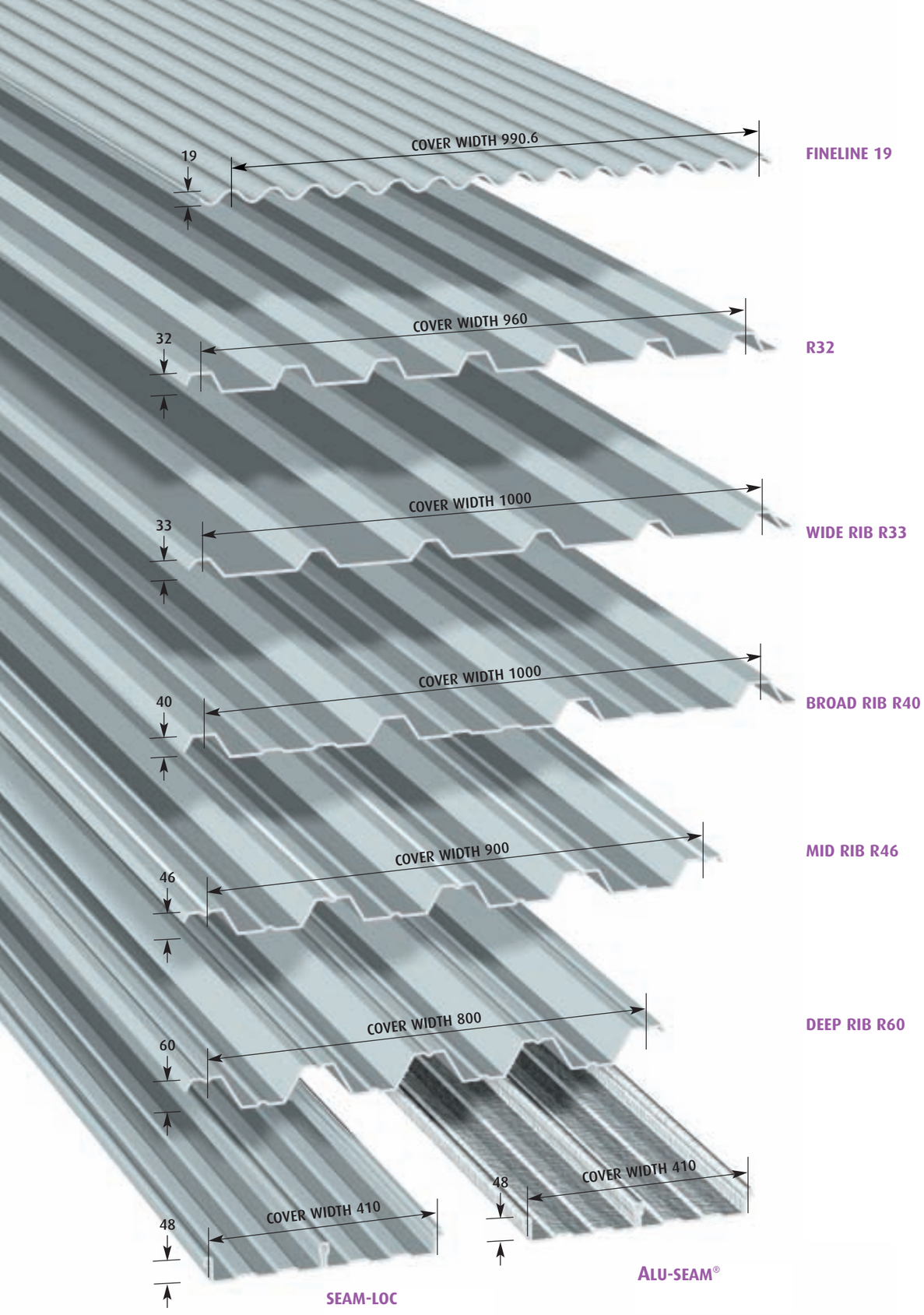
DESIGNER'S ROOFING AND CLADDING GUIDE

Tegral System Assurance

The Benefits of Tegral System Assurance:

The Tegral System Assurance package for our Built-Up systems is backed by a full Irish-based technical support team that is available to provide guidance and advice on all aspects of compliance with the latest building regulations, as well as environmental issues, design challenges and specification details.

- Insert 3-D diagram of built up wall & roof with bullet points to diagram.
- System durability & Weatherproofing - Up to 40 years weatherproofed coating guaranteed
- Thermal Performance – Proven thermal performance and assured compliancwith Energy Performance of Buildings Directive (EPBD).
- Airtightness – System design and assembly codes of practice to optimise airtightness for assured EPBD compliance.
- Structural Performance – Structural Design to British Standards and profile integrity independently assessed & approved by the Steel Construction Institute.
- Quality Assurance – Manufactured to ISO 9001: 2000 Q.C. System and CE marked for quality consistency.
- Fire Safety – Insurer classified as non-combustible and assemblies independently assessed & approved by Warrington Fire Research Centre
- Acoustic Performance – Cost effective acoustic systems to meet Building regulations
- Health & Safety – Assembly is independently tested for achievable non-fragility classification
- Sustainability – Independently assessed & approved:
  - highest rating 'class A' by British Research Establishment (BRE)
  - CORUS assessed as most economically recycled metal cladding systems.
  - CORUS assessed Environmental Product Declarations available for Carbon offsetting.
  - Manufactured to Environmental Management standard ISO14001



FINELINE 19

R32

WIDE RIB R33

BROAD RIB R40

MID RIB R46

DEEP RIB R60

ALU-SEAM®

SEAM-LOC

Tegral Roof Cladding

Product Range

Roof cladding from Tegral comes in trapezoidal, sinusoidal and standing seam profiles. Each profile can be used for single-skin or insulated twin-skin roof applications and for curved roof applications. ALU-SEAM® and Seam-Loc offer the option for secret-fix standing seam, either in aluminium or Colorcoat® pre-finished steel.

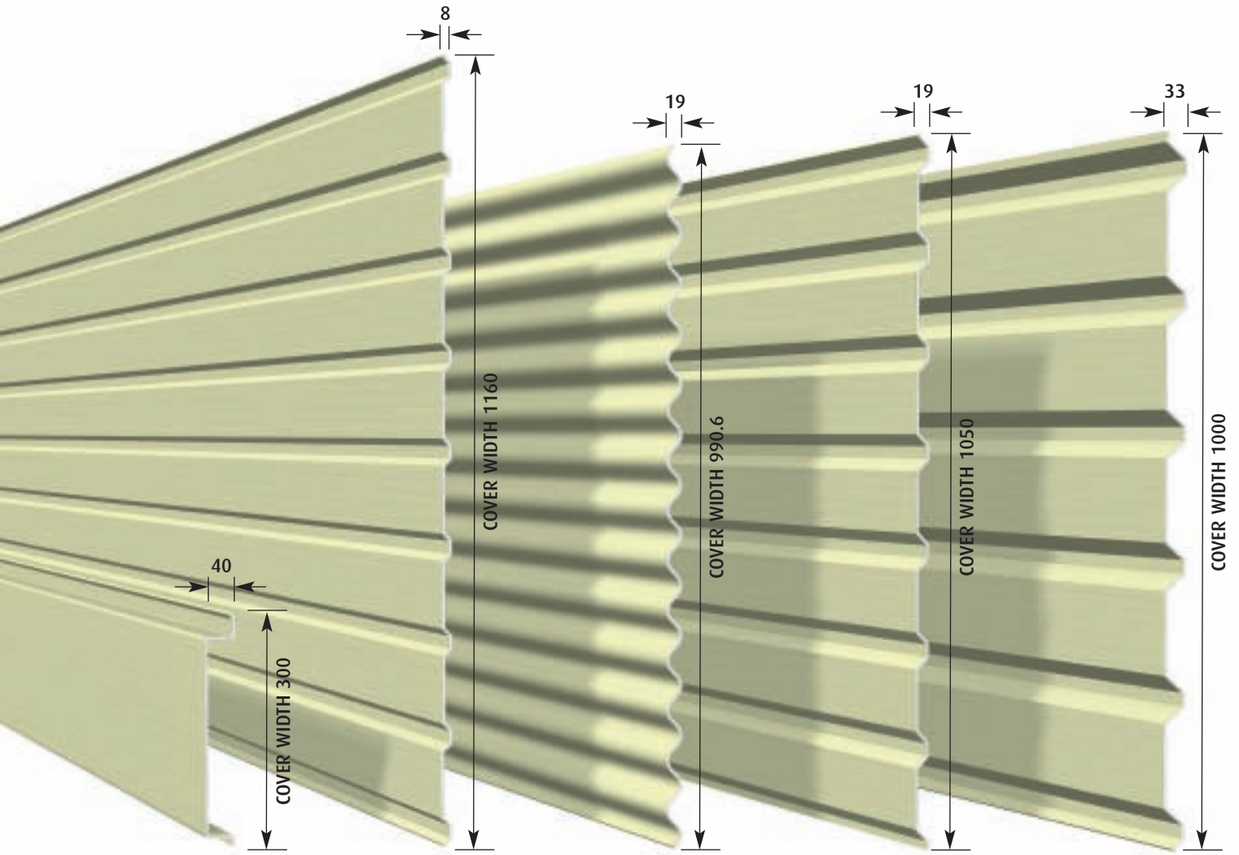
Features

- Offer the highest level of property protection and are non-combustible.
- Are 100% recyclable and satisfy the requirements of sustainable construction.
- Allow design flexibility in the provision of acoustic performance and curvability.

Project: Stena Freight Terminal, Dublin
Architects: Traynor O'Toole
Product: Tegral ALU-SEAM®

Tegral Wall Cladding

Project: Office Development, Dublin
Architects: Tony Mullen Architects
Product: Tegral Shadowline 47™



DESIGNER'S ROOFING AND CLADDING GUIDE Tegral Product Range

Tegral Wall Cladding

Product Range

Wall cladding profiles from Tegral have a reputation for proven weather protection, durability and fire performance. Each profile can be used in a choice of economical applications. The profile range is distinct and extensive and allows for the choice of horizontal and vertical designs. The range includes:

Tegral Shadowline 47™

A louvre-like profile with sharp lines, Shadowline 47™ provides strong contrast to flat wall panelling, making this the most popular cladding profile for horizontal application in Ireland.

Tegral Arcline 40™

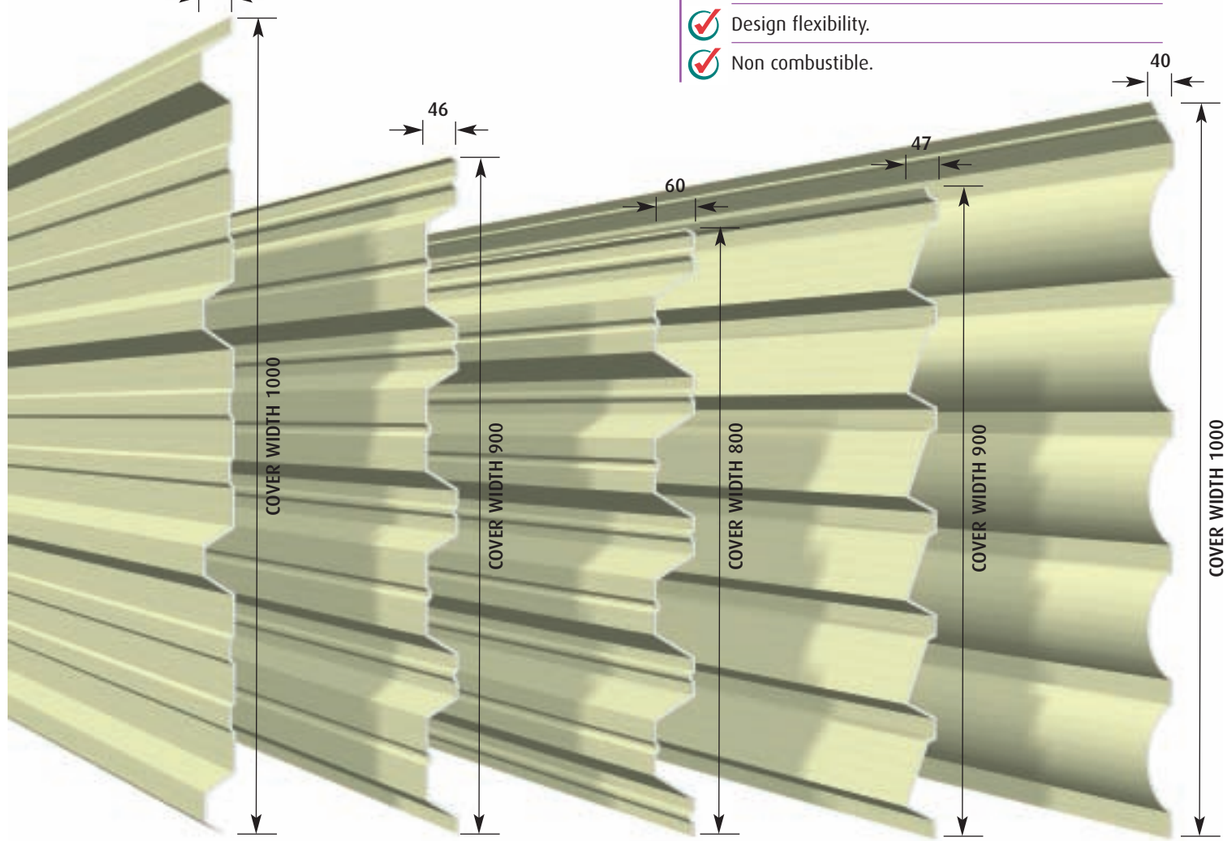
This profile has a distinct half-round shape and compliments the growing trend for feature elevations and curved building forms. Ideal for large-scale projects, Arcline 40™ maintains a strong visual impact even when viewed from a distance.

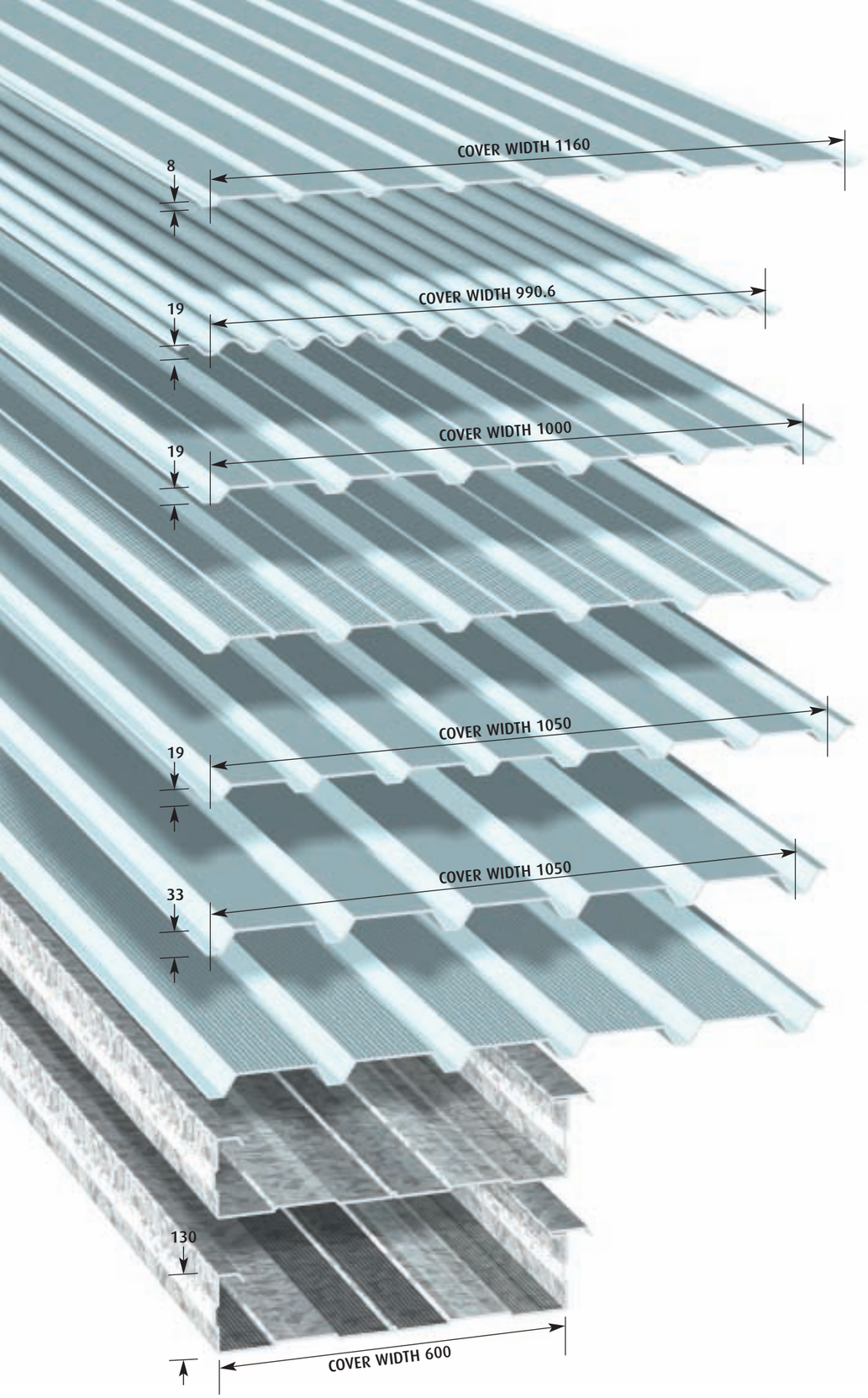
Tegral Fineline 19

The most versatile profile in the range, this sinusoidal profile has a scale and form that contrasts with other materials on all building types.

Features

- Unique Arcline 40™ and Shadowline 47™ architectural cladding profiles.
- Fully recyclable and satisfy requirements of sustainable construction.
- Design flexibility.
- Non combustible.





Note: Perf = perforated web (percentage of open air)

Tegral Liner Sheets

Tegral liner sheets form pre-finished metal ceiling and wall surfaces, suitable for a variety of building applications. In the case of roofing, the choice of liner sheet profile is typically dictated by load/span conditions and cover width of external sheet. In the case of wall cladding, the key considerations are design and fire performance.

All profiles are available in traditional white lining enamel, Colorcoat® pre-finished steel or aluminium material to suit specific internal conditions. The HL600® structural liner tray permits the omission of secondary purlins or cladding rails, by spanning between the main steel frame. Perforated liner sheets, in conjunction with suitable insulation, allow for effective acoustic absorption on either wall or ceiling surfaces.

Features

- Extensive range.
- Manufactured from galvanised or Colorcoat® pre-finished steel or aluminium.
- Available with web perforation to allow for acoustic absorption.
- Use of structural liner trays.

Tegral HL600 Liner Tray

Tegral CL5/1000 Liner Sheets

Tegral Composite Panels

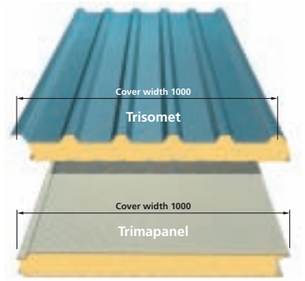
Tegral Metal Forming offers three different types of composite panels...

PIR - core composite panels

Tegral PIR foam-filled composite panels provide effective thermal insulation, good load/span characteristics and are relatively lightweight. All panels within the range are available in a choice of Colorcoat® pre-finished steel finishes.

Features

- LPCB and Factory Mutual approval for Trisomet roof panels.
- Single component assembly with minimal installation costs.
- Choice of PIR core thickness available.
- Panel lengths up to 14m available.



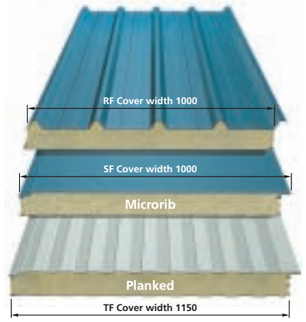
Tegral Enviropanel™ mineral - wool core composite panel

With its non-combustible mineral wool core, Tegral Enviropanel™ guarantees fire resistance and property protection, all in one product. Tegral Enviropanel™ is fully recyclable and is suitable for use as a fire-rated partition. The product can also offer acoustic benefits and provides effective sound reduction or sound absorption.

Tegral Enviropanel™ mineral-wool core panels are available in a choice of Colorcoat® pre-finished steel finishes.

Features

- Suitable for use as a Firewall (60 minute insulation) to BS 476, protecting against fire attack from either side.
- Fully recyclable and satisfies sustainable construction standards.
- Available with perforated internal face to allow for acoustic absorption.

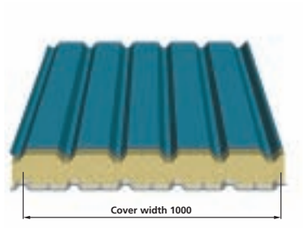


Trinsul

Trinsul is a site-assembled composite cladding system consisting of a Tegral external roof or cladding profile, a shaped non-combustible insulation core and a Tegral liner sheet. The Trinsul system does not require metal spacer systems as continuous mineral wool insulation is incorporated in the system.

Features

- Fire tested to BS 476 and provides fire resistance of 60 minute insulation and 240 minute integrity.
- Provides fire resistance for both external cladding and partition walls.
- Excellent acoustic performance.
- Fully recyclable and satisfies construction sustainable standards.



'For information on Tegral Composite Panels, see separate section 1 of this guide.

Tegral Flashings

- Extensive Range.
- Flashings for Structural, Roofing & Cladding & Gutters.
- Custom Orders.
- Professional Support.
- 24 Hour Turnaround Service.

Product Range

As part of our on-going commitment to develop integrated solutions for the construction industry, Tegral Metal Forming offers a comprehensive array of metal flashings. The range is divided into five categories:-

1. **Roofing and Cladding Flashings**
2. **Structural Flashings**
3. **Metal Design Flashings**
4. **Pressed Profile Flashings**
5. **Pressed Metal Gutters**

The Flashings Team

Tegral Metal Forming has a dedicated Flashings Team that includes two manufacturing technicians and a customer service professional. The Sales Team liaises closely with the Flashings Team and serve as the conduit between the customer and manufacturing. Each member of the Flashings Team has extensive product knowledge and is available to provide information and support.

Standard Selection

At Tegral Metal Forming our standard range of Flashings is the result of over 25 years experience and was created with the customer in mind.

Our extensive standard range consists of the most requested and popular flashings orders and we have now standardised our range so that we can provide even better support service. Flashings orders can be finished with welted ends by request.

Standard Length

Standard roofing and cladding flashings are manufactured in 4m lengths (other lengths up to a max of 9.6m, to special order).

Standard Materials and Gauges

Flashings are offered in a selection of pre-finished steel by Corus including Colorcoat HPS200® and 'Colorcoat Prisma®. Other products available include Colorgalv®, Agribild®, Galvanized steel and aluminium.

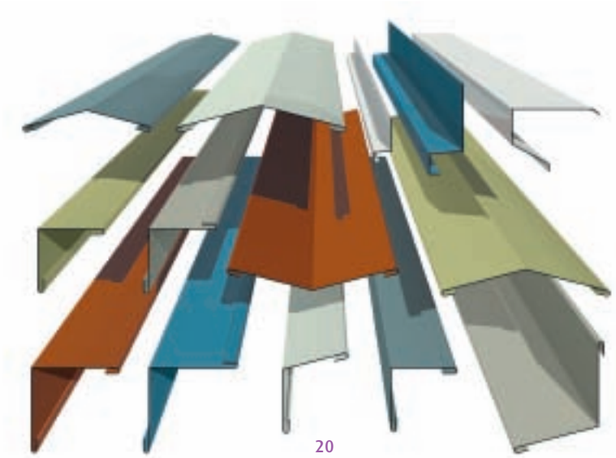
Standard Colours

These were selected based on most requested and popularity. Colours include Van Dyke Brown, Goosewing Grey, Olive Green, Merlin Grey, Mushroom, Metallic SIlver, Curragh Green®, Barrow Brown®, Kilkea Grey®, Coolmine Grey, Ballitore Brown and Woodstock Green.

Custom Designs

When it comes to manufacturing customised flashings, the technicians at Tegral Metal Forming have the experience and expertise to produce superior quality one-of-a-kind product. These include curved flashings, mitred corners, gutter corners and louvres. Each product can be made to the exact requested specification in a wide range of girths, gauges and in an array of colours.

Note: Certain restrictions apply to 24 hour turnaround service. Please check with your customer service representative.

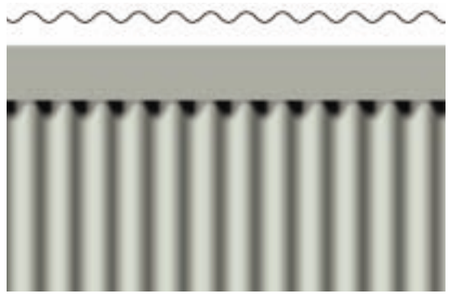


Project: Genzyme, Waterford
Architects: ??????????????
Product: Tegral Arcline 40™

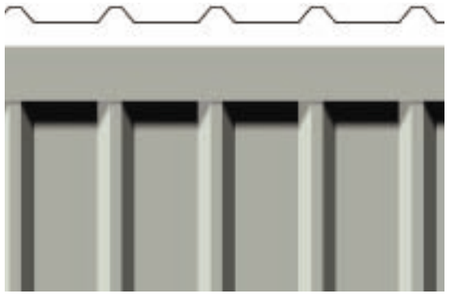
Roofing Profiles

All Tegral products are designed to provide the correct combination of aesthetic appeal and function required of the finished building, whether planned by the building designer or imposed by local planning requirements.
Tegral is pleased to be able to offer practical roofing solutions that are design focused. In modern-day architecture, curved roofing is a growing trend. Tegral's Alu-seam® standing seam can be used in complex convex or concave roof shapes while Wide Rib R33 and Fineline 19 are widely used for feature barrel vault curves.

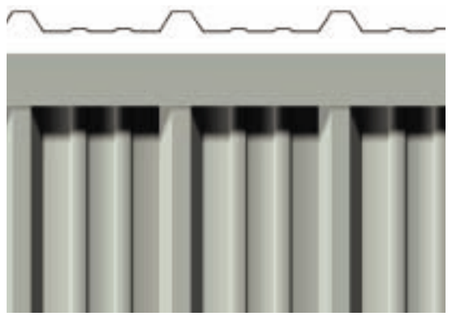
Tegral Fineline 19 profile



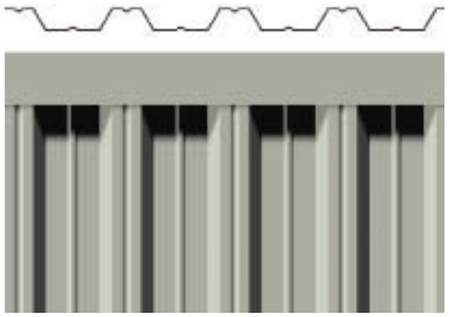
Tegral Wide Rib R33 profile



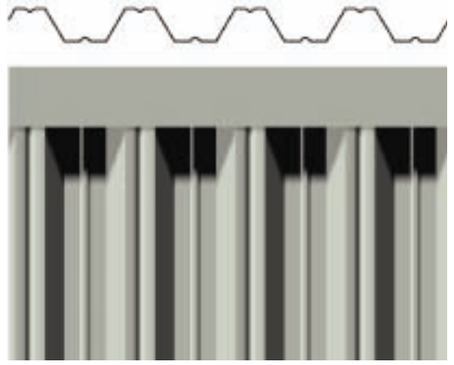
Tegral Broad Rib R40 profile



Tegral Mid Rib R46 profile



Tegral Deep Rib R60 profile



Tegral Alu-seam® profile

Cladding Profiles

The Tegral range of Profiles can be applied vertically, horizontally and diagonally providing excellent design flexibility. In addition, Sinusoidal and Trapezoidal can be combined on different cladding areas creating extra interest.

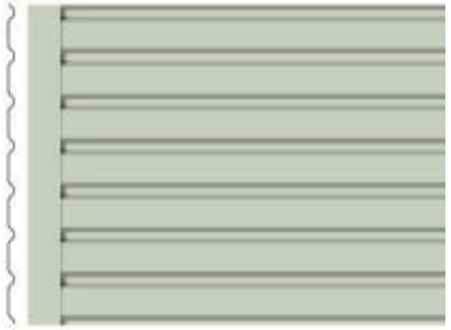
Shadowline 47™, Arcline 40™ and Alu-Seam® profiles are formed to maximise the contrast between light and shadow. It is this contrast that creates the greatest design impact when used on large areas.

Symmetrical cladding profiles such as Tegral Fineline 19 can also be used to superb effect in conjunction with other materials, or with contrasting cladding profiles.

Tegral Fineline 19

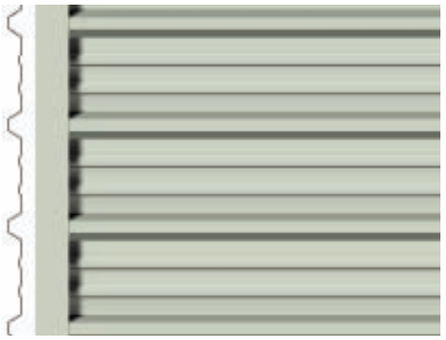
Tegral Fineline 19 profile

Tegral PL 19 profile



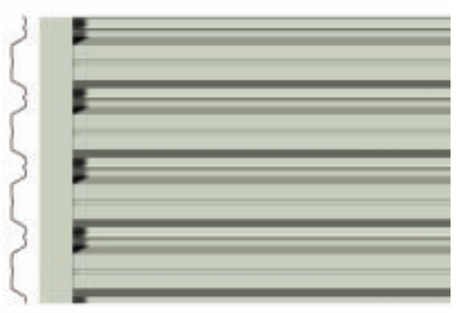
Tegral Wide Rib C33 profile

Tegral Broad Rib C40 profile



Cladding Profiles

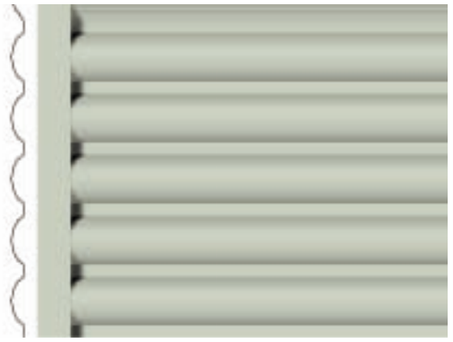
Tegral Mid Rib C46 profile



Tegral Shadowline 47™ profile

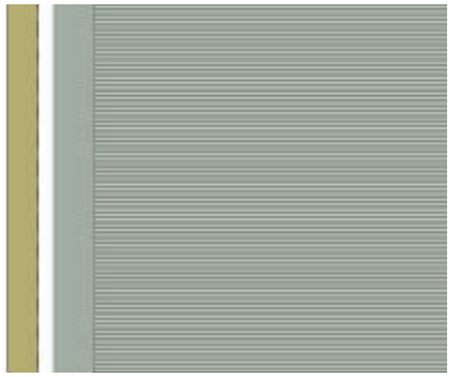
Tegral Deep Rib C60 profile

Tegral Arcline 40™ profile

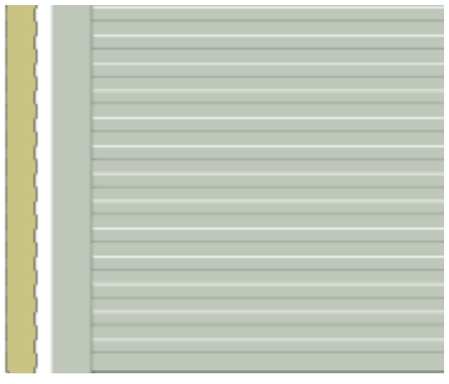


Composite Panels

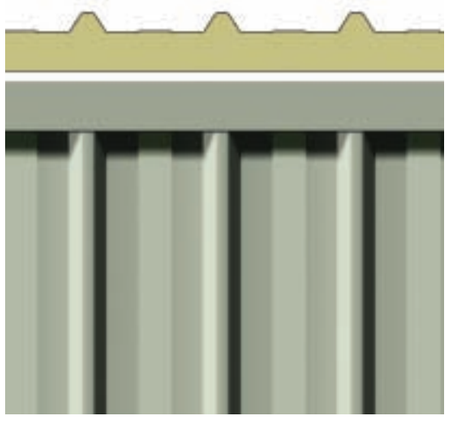
Tegral Enviropanel®TF Micro Rib



Tegral Enviropanel® TF Planked



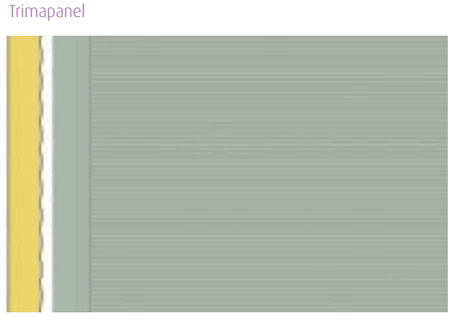
Tegral Enviropanel® RF



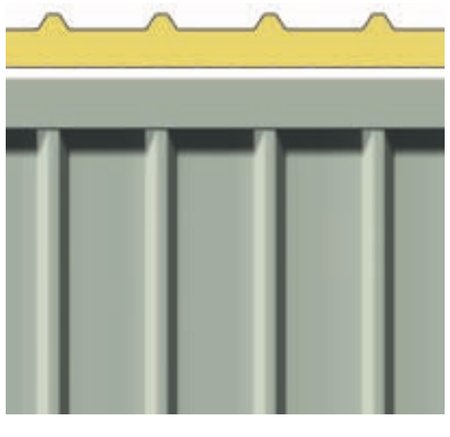
Tegral Enviropanel®, Trisomet, and Trimapanel are modular in appearance and work well in high-tech construction or urban style office buildings. These products also contrast with curtain wall glazing and profiled cladding. The roof space can also vary considerably from ultra low pitch with high-level parapets to steep-pitch feature roofs.

'For information on Tegral Composite Panels, see separate section 1 of this guide.

Trimapanel



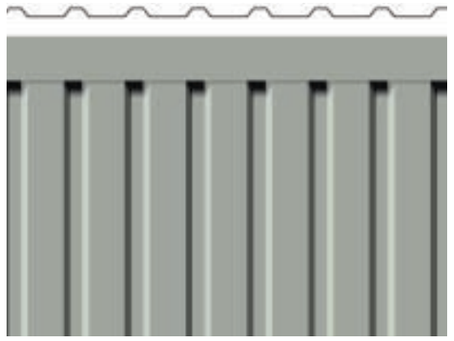
Trisomet



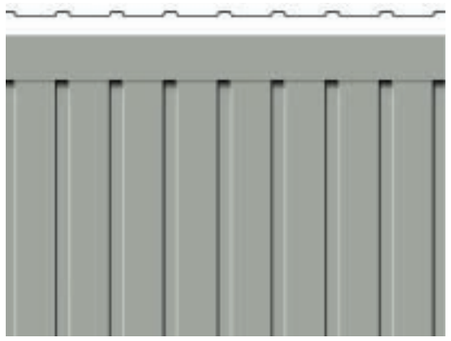
Liner Sheets

Our range of liner sheets includes 6 different profiles which can be combined with a wide range of coatings, to provide the required internal finish to a building. The use of our structural liner tray eliminates secondary steel and creates an unobstructed ceiling or internal wall.

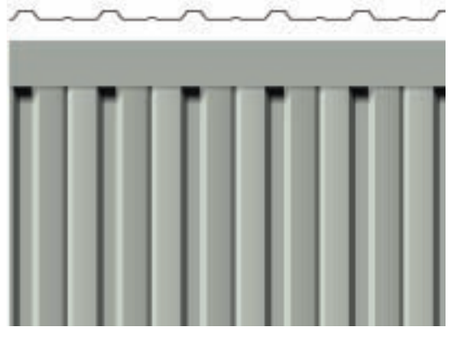
Tegral PL 19 profile



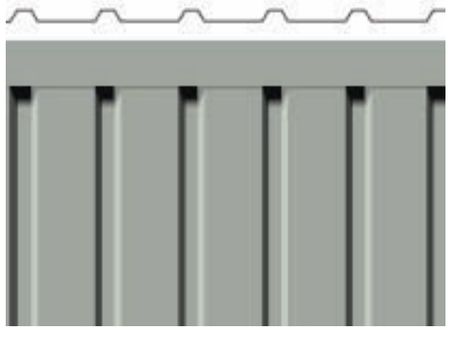
Tegral Mini Rib profile



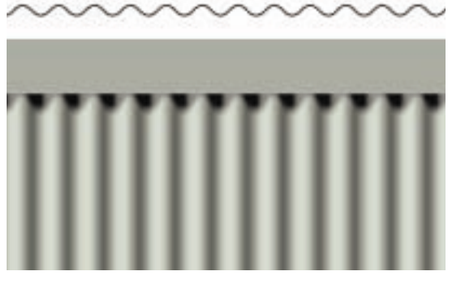
Tegral CL5-1000 profile



Tegral 33-1000 profile



Tegral Fineline 19 profile



Liner tray

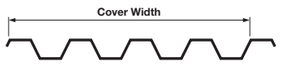
Tegral Lining Tray profile - HL600/130

Profile terminology

The cross-sectional shape of the cladding sheet is referred to as the profile. Sheet Profiles are normally categorised into sinusoidal or trapezoidal shapes.

Further information is available from the relevant National Standard **IS EN 508-1 : 2000** Roofing Products from Metal Sheet- Specification for self-supporting products for steel, aluminium and stainless steel sheet.

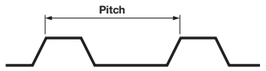
Cover width
The distance covered by an individual sheet



Trough
The portion of the profile which recedes

Crown stiffener
A change of profile across the width of the crown

Pitch
The distance between any repeated portion of a profile

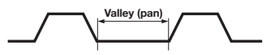


Web
The angled walls of the profile

Valley (trough) stiffener
A change of profile across the width of the valley

Depth
The distance from the top of the crown to the bottom of the valley measured from the front face of the profile

Valley (pan)
The bottom face of the trough



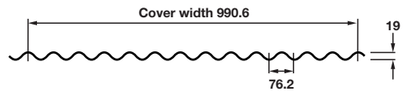
Web stiffener
A change of profile across the width of the web

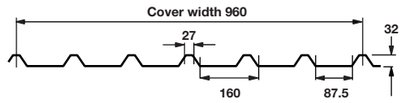
Rib
The portion of the profile which protrudes

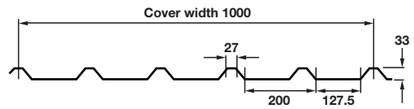
Crown (top flange)
The top of the rib

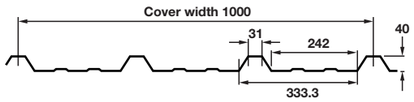
Sinusoidal

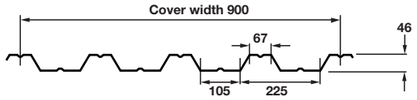
Tegral roof profiles

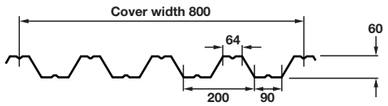


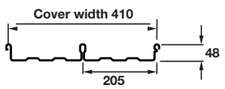


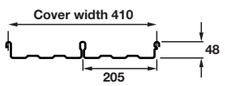










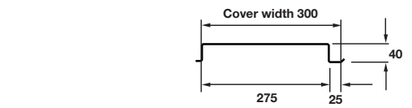


Note: Profiles are subject to IS EN 508 -1 tolerances

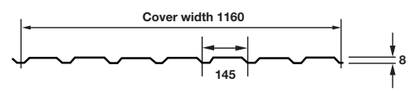
	Material	Gauge (mm)	Weight (kg/m2	Minimum self curve (m)	Minimum factory curve (mm)	Minimum roof pitch (degrees)
Fineline 19	S	0.7	6.81	20 (h), 30 (p)	1000	10
	A	0.9	3.05	20 (sa/ca), 25 (ma)	1000	10
R 32	S	0.7	7.01	40 (h), 50 (p)	400	4
	A	0.9	3.01	40 (sa/ca), 45 (ma)	400	4
Wide Rib R33	S	0.7	6.75	40 (h), 50 (p)	400	4
	A	0.9	3.02	40 (sa/ca), 45 (ma)	400	4
Broad Rib R40	S	0.7	6.75	40 (h), 50 (p)	400	4
	A	0.9	3.02	40 (sa/ca), 45 (ma)	400	4
Mid Rib R46	S	0.7	7.5	55 (h), 65 (p)	400	4
	A	0.9	3.36	55 (sa/ca), 60 (ma)	400	4
Deep Rib R60	S	0.7	8.44	70 (h), 80 (p)	N/A	4
	A	0.9	3.78	70 (sa/ca), 75 (ma)	N/A	4
Seam-Loc	S	0.7	7.99	65 (h)	12000	1.5
					convex	1.5
Alu-Seam®	A	0.9	3.75	30 (sa/ca), 35 (ma)	7000	1.5
					convex	

Key
S - Steel
A - Aluminium
h - Colorcoat HPS200® **p** - Colorcoat® Prisma
ca - Coated aluminium
ma - Metallic coated alum.
sa - Stucco embossed mill aluminium
N/A - Not applicable

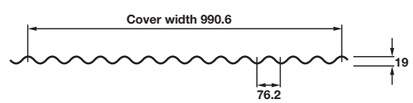
Tegral cladding profiles



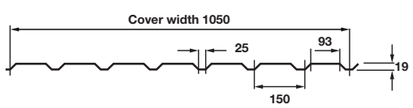
	Material	Gauge (mm)	Weight (kg/m2	Minimum self curve (m)	Minimum factory curve (mm)	
WP 40	S	0.7	7.50	60 (h), 70 (p)	N/A	j
	A	0.9	3.36	60 (sa/ca), 65 (ma)	N/A	j



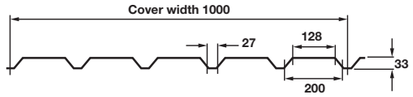
Mini Rib	S	0.7	5.73	20 (h), 30 (p)	N/A	
	A	0.9	3.02	20 (sa/ca), 25 (ma)	N/A	

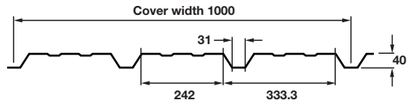


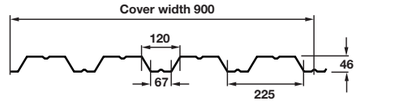
Fineline 19	S	0.7	6.79	20 (h), 30 (p)	1000	
	A	0.9	3.05	20 (sa/ca)	1000	

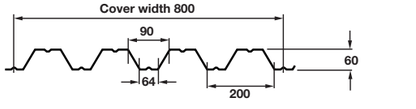


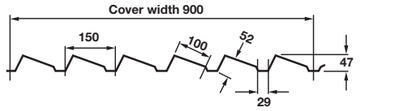
PL 19	S	0.5	4.52	20 (h), 30 (p)	N/A	j
	S	0.7	6.75	20 (h), 30 (p)	N/A	
	A	0.9	3.02	20 (sa/ca), 25 (ma)	N/A	

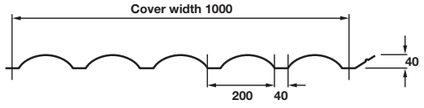












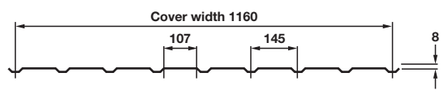
Wide Rib C33	S	0.5	4.82	40 (h), 50 (p)	400	j
	S	0.7	6.75	40 (h), 50 (p)	400	
	A	0.9	3.02	40 (sa/ca), 45(ma)		
Broad Rib C40	S	0.5	4.82	40 (h), 50 (p)	350	j
	S	0.7	6.75	40 (h), 50 (p)	350	
	A	0.9	3.02	40 (sa/ca), 45 (ma)	400	
Mid Rib C46	S	0.5	4.82	55 (h), 65 (p)	400	j
	S	0.7	7.5	55 (h), 65 (p)	400	
	A	0.9	3.36	55 (sa/ca), 60 (ma)		
Deep Rib C60	S	0.5	6.03	70 (h), 80 (p)	N/A	j
	S	0.7	8.44	70 (h), 80 (p)	N/A	
	A	0.9	3.78	70 (sa/ca), 75 (ma)		
Shadowline 47™	S	0.7	6.56	70 (h), 80 (p)	N/A	
	A	0.9	3.36	70 (sa/ca), 80 (ma)	N/A	
Arcline 40™	S	0.7	6.74	70 (h), 80 (p)	N/A	
	A	0.9	3.02	70 (sa/ca), 80 (ma)	N/A	

Note: Profiles are subject to IS EN 508 -1 tolerances

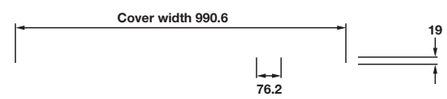
Key

S - Steel
A - Aluminium
h - Colorcoat HPS200® **p** - Colorcoat® Prisma
ca - Coated aluminium
ma - Metallic coated alum.
sa - Stucco embossed mill aluminium
N/A - Not applicable

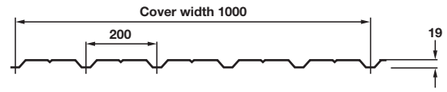
Tegral Liner sheet profiles



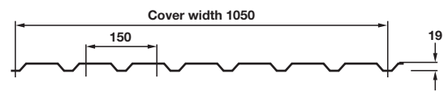
	Material	Gauge (mm)	Weight (kg/m2	Minimum self curve (m)	Minimum factory curve (mm)
Mini Rib	S	0.7	5.73	20 (le), 25 (h)	N/A



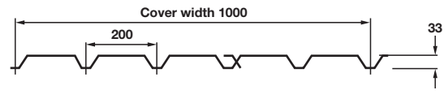
Fineline 19	S	0.4	3.88	20 (le/h)	1000
	S	0.7	6.79	20 (le/h)	1000
	A	0.9	3.05	20 (sa/ca)	

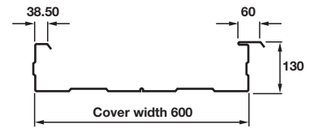


CL5-1000	S	0.4	3.75	30 (le/h)	350
	S	0.7	6.75	30 (le/h)	350
	S	0.7	4.40	30 (sa/ca)	350



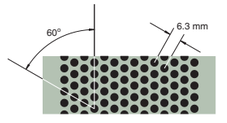
PL 19	S	0.7	6.33	20 (le/h)	350
	A	0.9	2.33	20 (sa/ca)	350





Wide Rib 33C	S	0.4	3.88	40 (le/h)	350
	S	0.7	6.75	40 (le/h)	350
	A	0.9	3.03	40 (sa/ca)	350
HL600/130	S	1.00	13.08		N/A
	S	0.75	9.81		N/A

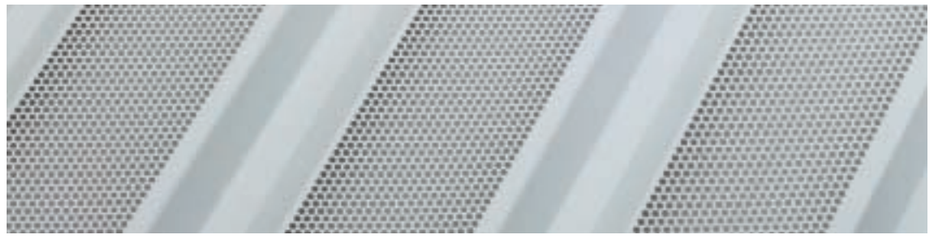
Note: Profiles are subject to IS EN 508 -1 tolerances



Note: CL5-1000 / Wide Rib 33C / HL 600/130 are available with web perforations.

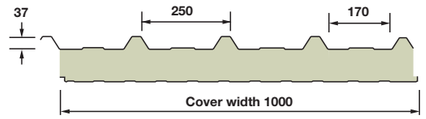
Key

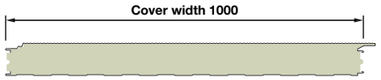
le - Lining enamel
h - Colorcoat HPS200® **ca** - Coated aluminium
sa - Stucco embossed mill aluminium
N/A - Not applicable

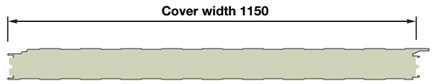


Composite Panels

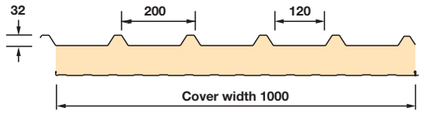
Mineral wool core Insulation

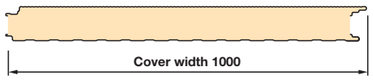






PIR core insulation





	Material	Internal gauge (mm)	External gauge (mm)	Weight (kg/m2)	
Enviropanel® RF	S	0.4	0.63	24.6	(120mm thickness)
Enviropanel® SF	S	0.4	0.63	20.7	(120mm thickness)
Enviropanel® TF	S	0.4	0.63	22.3	(120mm thickness)
Trisomet	S	0.4	0.55	12.05	(80mm thickness)
Trimapanel	S	0.4	0.55	11.17	(80mm thickness)

Can be micro-rib or planked. Other coverwidths available: 600mm & 900mm. For further information see separate section 1 of this guide.

Note: Profiles are subject to IS EN 508 -1 tolerances

Tegral Trimapanel

Tegral Enviropanel® TF

Project: Mahonpoint Shopping Centre, Cork
Architects: [illegible]
Product: Tegral Shadowline 47™

Trinsul Roof or Wall Cladding

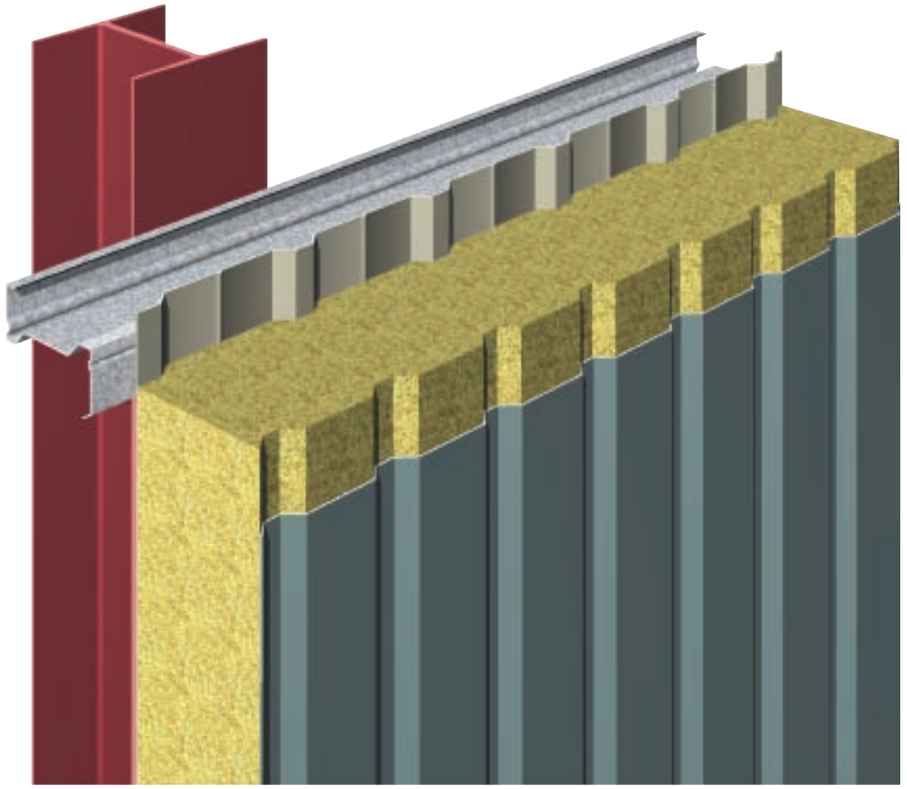
Trinsul

The Trinsul site- assembled composite cladding system incorporates many of the profiles from the Tegral twin-skin range.

This means it can provide many of the aesthetic features normally associated with our built-up systems such as light and shadow contrast and striking repeat patterns.

Typical profiles include:
Shadowline 47™, Wide Rib 33, Broad Rib 40 and WP 40, and liner sheet profiles: CL5-1000 and 33/1000. The Trinsul system provides good fire and acoustic performance, and can also eliminate the need for secondary steel support for external sheet.

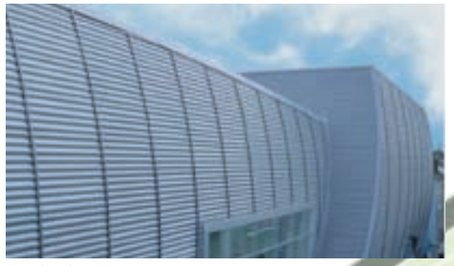
Trinsul is not suitable for mounting as diagonal wall cladding.



Freedom to Curve

Tegral's roofing and cladding profiles can be curved to provide the designer with many creative opportunities. The nature of Tegral's Twin-Skin profiled metal systems allows for either self-curving or machine curving of the individual profile sheet depending on the radius involved. The Tegral Alu-Seam® standing seam roofing system allows for both concave and convex curving with the benefit of secret fixing. The sinusoidal form of Tegral Fineline 19 allows for curving to very tight radii. Further information is available from Tegral.

Tegral have over 25 years experience in helping architects achieve their design goals



Tegral Arcline 40™

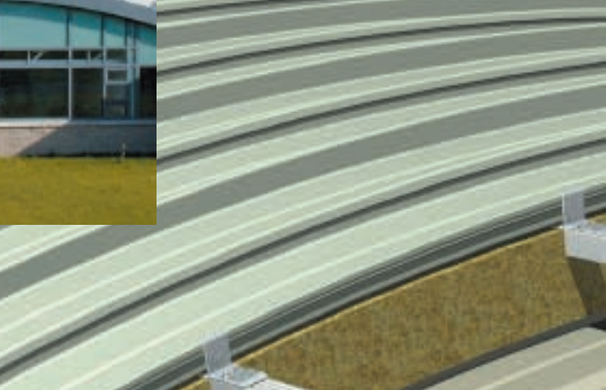
Tegral Alu-Seam®

Tegral Alu-Seam®

DESIGNER'S ROOFING AND CLADDING GUIDE Tegral Product Range

Freedom to Curve

Tegral Fineline 19



Tegral Wide Rib C33

Curved Roof & Walls

1.1 Technical specifications

Alu-Seam® and Seam-loc profile

Maximum sheet lengths

- 12m without additional handling or carriage charge.
- 26m subject to feasibility of site access and carriage and handling costs.

Longer lengths than 26m are possible but these are subject to direct enquiry.

This information may be updated subsequent to the publication of this manual.

Minimum roof pitch

- 1½º - continuous sheet ridge to eaves.
- 1½º - continuous sheet eaves to eaves. (curved roof).
- 3º - sheet with end-lap*
- 3º - sheet with penetrations*

* *unless welded*

⚠ *The minimum roof pitch must be achieved at sheet ends. When determining the roof pitch, the loading and deflection of the sheet must be taken into account.*

Material specification

Alu-Seam®

0.9mm thick alloy AA3004 H34. 0.2% min tensile proof stress 200N/mm². Minimum ultimate tensile strength 225N/mm². Modulus of elasticity 70kN/mm².

Self-weight of Alu-Seam® profile 3.75kg/m².

Seam-loc

Colorcoat HPS 200 steel. Galvalloy substrate to BS EN 10326 : 2004 S220GD+ZA265, nominal thickness 0.7mm, with Corus standard colour Colorcoat finish to the external face and light grey high performance polyester to the reverse. Design minimum yield stress 220 N/mm².

Self-weight of Seam-loc profile 8.45kg/m².

Curved Roof & Walls

Clips

1. Alu-Seam® 101 extruded side lap clip.
2. Alu-Seam® 102 extruded middle rib clip.
3. Seam-loc steel clip.

NOTE: Alu-Seam® 101 and 102 extruded aluminium clips are also used for the Seam-loc system in place of the steel clip, where the roof is curved.

Fire Performance

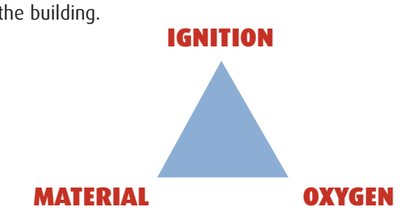
"Using the right roofing and cladding product in the right application.....secures safety, minimises risk and is the responsibility of every conscientious designer".

Tegral Products and Fire performance

The Fire Triangle

The most important issue in relation to fire performance when specifying metal faced roofing and cladding for commercial and industrial buildings is that the materials specified should relate to the fire risk associated with the building. In a landmark case in the UK High Court in March 2003, an insurance company succeeded in winning the first liability judgement against negligent architects who inappropriately specified the use of combustible insulated panels. Now, more than ever the manner in which elements of building construction perform in the event of a fire is of prime concern to the designer, the occupant, the building owner and the building insurance company.

The diagram on this page illustrates the three elements of the fire triangle. Ignition refers to any source of fire or heat that might exist in the building either through planned usage or through the building services. The second element is oxygen which of course is present in all buildings and the third is any material that can fuel the fire. Consideration of the elements of the fire triangle will impact on the fire safety requirements of the building.



TEGRAL PRODUCTS AND FIRE PERFORMANCE

	TWIN SKIN SYSTEM	TRINSUL	TEGRAL ENVIROPANEL®	TRISOMET	TEGRAL ALU-SEAM®
	Twin Skin system	*Site assembled composite*	*Mineral Wool core composite panel*	*PIR core composite panel*	*Standing seam roofing*
Building Regulations	*Class 0*	*Class 0*	*Class 0*	*Class 0*	*Class 0*
Insurance Company requirements	*Refer to LPC Design Guide for the Fire Protection of Buildings 2000*	*Refer to LPC Design Guide for the Fire Protection of Buildings 2000*	*LPCB approved tested to LPS 1181 : 2003* *FM Approved*	*LPCB approved tested to LPS 1181 : 2003* *FM Approved*	*Refer to LPC Design Guide for the Fire Protection of Buildings 2000*
Insulation core	*Non-combustible glass or mineral wool quilt*	*Non-combustible mineral wool*	*Non-combustible mineral wool*	*Limited combustible PIR*	*Non-combustible glass or mineral wool quilt*

Warrington FIRE research

Fire performance - The Specifier's choice

Essentially, the issue concerns the fire performance of the individual metal system's insulation core. The new European method of classification of fire performance EN 1350-1, categorises building materials into classes based upon their time to flashover, from A1 to F. In the case of mineral wool and glasswool, these insulation materials achieve Euroclass A1, the lowest possible fire-risk classification.

A great deal of confusion reigns in the area of fire performance specification of metal cladding systems. This has increased considerably in recent years and has been caused by several factors.

1. Most companies that supply insulated systems only offer one type of system. This had led directly to the fire performance characteristics of generic materials and systems becoming an issue of competitive product benefit and thus propaganda, rather than an objective study of requirement. The latter would be far more useful to specifiers. Tegral Metal Forming supplies a range of system options.
2. Insurance concerns frequently drive decision making rather than regulatory requirement. Experience has proven that insurance requirements are more difficult to pin down than Building Regulations; also they may change in time and with different building use.
3. The insurance industry reaction to several disastrous fires in food processing factories using polystyrene cored panels as internal partitions and cold room enclosures, exacerbated by the events of 9/11, had the effect of over sensitising the entire industry. Whilst these things are not related to external cladding using PIR-core panels, they have had a profound effect on attitude to them.

Tegral Metal Forming offer metal cladding solutions that include Twin-Skin systems, site assembled composites, PIR-core composite panels and mineral wool panels. This presents us with a unique opportunity to give unbiased advice and there follows an analysis of the characteristics of the different systems.

Fire Insurance and Tegral Systems

Typically these systems use metal components and glass or mineral wool insulation, which wholly or partly fills the void between an inner and an outer metal sheet. The insulation may be of two types, glass fibre or rock fibre. Both insulation types are non-combustible to BS476 Part 4. Metal systems using either forms of insulation are intrinsically fire safe.

Twin-Skin systems (or composite panels) using these materials are thus usually acceptable to insurers without further qualification.

The two principal reference authorities for fire insurance assessments are Factory Mutual (FM) and the Loss Prevention Council (LPC).

Factory Mutual (FM Global)

Factory Mutual highlight their preference for non-combustible materials and indeed only constructions containing combustibles have to be FM Approved, which means that standard twin-skin glassfibre or mineral wool insulated built up systems and mineral wool composite or site assembled composite panels are acceptable per se.

LPC

Other insurance companies refer to the Loss Prevention Council Design Guide for the Fire Protection of Building 2000. Section 2.2 of this guide states.

2.2 Contribution to fire growth

The main objective in relation to all elements of construction, including roofs, is that they should not significantly contribute to the growth and spread of fire, either internally or externally. In this respect it is important that the complete building design is analysed to ensure that as a result of its behaviour in a fire no element of fire protection will be compromised.

This is equally applicable to internal non-structural features such as linings, ceilings and partitioning systems, thereby reducing the potential fire spread and growth.

This should be achieved by use of materials which are:

(a) non-combustible or of limited combustibility (see Appendix 3A1 of Part 3) or, if timber, they comply with the fire resistance requirements given in this Design Guide (see Tables 2.1 and 2.2);

(b) Loss Prevention Certification Board (LPCB) approved products which include combustible materials and have been tested and satisfy the requirements in accordance with LPS 1181 and have thereby been shown not to make a significant contribution to fire growth;

All Tegral Twin-Skin Systems, mineral wool core composite or site-assembled composite panels meet the requirements of (a) above.

Tegral Trisomet PIR-insulated panels meet the requirements of (b) above, for roof applications and certain wall applications.

In addition, there are other benefits to the avoidance of all combustible materials in cladding systems. A common cause of fire in buildings is vandals setting fire to material such as timber pallets outside the building. The heat and flame from this source combusts with the outer surface igniting insulation in the wall construction and then spreading through the building. If the materials used in the cladding and roofing system are non-combustible, a lower fire risk for the property inevitably follows.

Statutory Requirements and Tegral Systems

The manner in which all elements of building construction perform in the event of fire is of prime concern of the designer, the accupant, the building owner and the building insurance company. Profiled metal cladding constructions must therefore conform to specific requirements which are defined in the Building Regulations Technical Guidance Document B - Fire Safety. They may also have to comply with other requirements defined by building insurance organisations, such as the Loss Prevention Council (LPC).

Warrington FIRE research

The purpose of Building Regulations is to ensure the health and safety of people in or about the building. The main requirements are:

a) To provide a safe means of escape for the building occupants by preventing internal fire spread.
b) To prevent the spread of fire to neighbouring property.
c) To prevent an external fire from setting fire to the building.
d) To provide access for the Fire Brigade.

Generally metal roof cladding has to limit the spread of fire on its internal liner face, prevent the spread of fire through any cavity, and resist the spread and penetration of fire on its weathersheet side. Roofs do not usually need to provide any period of fire resistance.

European Standard test methods have now been published, and it is now possible to claim compliance with Document B using either the original BS 476 tests or the new European tests.

The Building Regulations TGD B provides guidelines on acceptable forms of fire resistant structures encompassing construction, material performance, means of escape and appropriate active fire control techniques.

These are categorised in the following requirements:

B1 – Means of escape
B2 – Internal Fire Spread (linings)
B3 – Internal Fire Spread (structure)
B4 – External Fire Spread
B5 - Access & Facilities for the Fire Service

All of these stipulations require close design integration in order to establish effective building fire containment systems and suitable evacuation procedures.

Whilst for the purpose of this brochure it is impractical to cover all the conditions contained within this document, Requirements B2 and B4 are the most relevant when considering the use of steel cladding systems. The following information has been produced as a guide to highlight some of the basic criteria.

B2 - Internal Fire Spread (linings)

(1) To inhibit the spread of fire within the building, the internal linings shall:-
(a) resist the spread of flame over their surfaces; and
(b) have, if ignited, a rate of heat release which is reasonable in the circumstances. All Tegral cladding products manufactured from Corus organic coated steel meet Classification 0. A description as to how this classification is obtained can be found within the British Standard 476 section of this brochure

Classification of Linings

Location	Class
Small rooms of area not more than 4m² in a residential building and 3m² in a non-residential building	3
Other rooms. Circulation spaces within dwellings	1
Other circulation spaces, including the common area of flats and maisonettes	0

B4 - External Fire Spread

1) The external walls of the building shall resist the spread of fire over the walls and from one building to another, having regard to the height, use and position of the building.

2) The roof of the building shall resist the spread of fire over the roof and from one building to another, having regard to the use and position of the building.

Fire resistance standard:
The external walls of the building should have the appropriate fire resistance given in Table A1, Appendix A of TGD B.

This table stipulates specific provisions of test for fire resistance of elements of structure stating required method of exposure, integrity and insulation periods based on the distance from a relevant boundary.

Table A1 refers to Table A2 which in turn gives a specific breakdown of fire resistance periods for buildings in certain purpose groups, building heights and whether sprinklered or not.

For example, an external non-loadbearing wall on an industrial unit up to 20m from ground level requires a minimum fire resistance period of 90 minutes (non-sprinklered) with an insulation period of 15 minutes.

All certified/assessed Tegral Twin-Skin FireWall systems and certain Tegral Trisomet and Trimapanel Insulated panels achieve 4 hours integrity and 15 minutes insulation and therefore would satisfactorily meet this criteria.

External Surfaces:
The external surfaces of walls should meet the provisions laid out in Table 4. 1 of Requirement B4.1. 4. A brief summary of this diagram is tabulated below:

Provisions for external surface of walls

Building Height	Distance from Boundary	Classification
<20m	<1m	0
<20m	>1m	No provision
>20m	<1m	0
>20m	>1m	For the initial 20m index 'I' should not exceed 20. Areas above 20m the classification should be 0

All Tegral cladding products manufactured from Corus organic coated steel meet Classification 0. A description as to how this classification is obtained can be found within the British Standard 476 section of this brochure.

External Wall Construction:
It must be noted that even though the provisions for external surfaces may have been satisfied, on buildings that are in excess of 15m above ground level the insulation material used in the external wall construction should be of limited combustibility.

All insulation specified for use within Tegral FireWall systems can be deemed 'non-combustible' in accordance with BS476 Part 4 and would therefore meet the criteria of this stipulation.

British Standard 476 provides an acceptable framework for meeting these requirements within Ireland and the U.K. and focuses on test related physical measurement in order to establish fire rated performance for steel cladding systems.

Reference is made to this standard in TGD B sections B2 to B4 - Internal and External Fire Spread.

Reaction to Fire

In Approved Document B, the most favourable performance in reaction to fire is given by a Class 0 spread of flame rating to the Building Regulations. This combines results from **BS476 Part 6** : Methods of test for Fire Propagation for Product and **BS476 Part 7** : Methods for Classification of the Surface Spread of Flame. Alternatively a Class 0 may be shown by Euroclass B or better to **EN1350-1**. All Tegral Cladding Profiles meet Class 0 requirement.

Fire Resistance

The regulations demand that certain walls, in addition to providing a satisfactory performance in reaction to fire, must show a fire resistance performance in terms of integrity and insulation measured in minutes. Examples of these are, external walls constructed on or near boundaries, or walls used as partitions. These constructions have to be tested to **BS476 Part 22** : Methods for the Determination of the Fire Resistance of Non-load Bearing Elements of Construction. These requirements do not apply to roofs.

BS476 is the recognised standard referred to in the Building Regulations and provides a framework for meeting fire performance requirements within Ireland and the U.K.

This standard concentrates on test related physical measurement in order to establish the fire rating performance of elements/constructions. The most relevant in relation to Tegral organic coated steel cladding products/systems can be highlighted as follows:–

BS476 Part 3: External Fire Exposure Roof Test

Roofs are graded according to the resistance they offer to external fire (e.g. from an adjacent building or compartment). This is measured in terms of penetration and flame spread. The Irish and U.K. Building Regulations designate pitched roofs using profiled sheets produced from galvanised steel or organic coated steel as Classification AA, the highest designation possible. Therefore, it can be satisfied that roofs constructed with Tegral profiles in accordance with manufacturer's instructions will achieve this rating.

Note: This standard has been withdrawn by the British Standards Institution but continues to be cited in the Building Regulations. The relevant test method has therefore been included as an annex within **BS5427**: 1996 Code Of Practice for the use of Profiled sheet for roof and wall cladding on buildings.

BS476 Part 4: Non-Combustibility Test for Materials

All insulation products specified for use within Tegral Profiles FireWall systems achieve 'non-combustible' classification and therefore meet the requirements laid down within TGD B, Section B4, External Wall Construction.

BS476 Part 6: Methods of Test for Fire Propagation for Products

This test determines the contribution a material makes to the fire and is measured in terms of heat contributed over a period of twenty minutes. This is expressed as an index of performance 'I' together with sub-indices i1, i2 & i3 which are assessed from empirical formulae. These sub-indices relate to heat contributed over shorter time periods.

Organic coated steel Tegral cladding products with for example Corus HPS200® and Lining Enamel type finishes have an index 'I' not exceeding 12 and a sub-index i1 (heat contributed in the first 3 minutes) not exceeding 6.

BS476 Part 7: Methods for Classification of the Surface Spread of Flame of Products

This test grades material into classes 1 to 4 according to the rate of flame spread across it's surface. All Tegral cladding products produced from Corus organic coated steel achieve Class 1 - the highest grade offering the best resistance to spread of flame.

The Building Regulations have a higher Classification defined as Class 0, which combines results from **BS476 Parts 6 and 7**. A Class 0 surface must have a Class 1 result from **BS476 Part 7** and a maximum index 'I' of 12 and maximum sub-index i1 value of 6 from **BS476 Part 6**.

Therefore, Tegral cladding has a finish that achieves Class 0 spread of flame in accordance with the Building Regulations.

BS476 Part 11: Method for assessing the Heat Emission from Building Materials

A material which is deemed 'non-combustible' in accordance with BS476 Part 4 automatically complies with the requirements laid down for limited combustibility in accordance with **BS476 Part 11**.

This standard adopts a similar test methodology to **BS476 Part 4** but uses a different method for the calculation of results.

All insulation products specified for use within Tegral FireWall systems achieve 'non-combustible' classification in accordance with **BS476 Part 4** and would therefore meet the limited combustibility classification.

BS476 Part 22: Methods for determination of the Fire Resistance of non-loadbearing elements of Construction

This standard concerns itself with the exposure of fire on one or both faces of the wall construction, the growth of which is designed to simulate a real fire occurrence i.e. in terms of speed of temperature rise, flashover point and eventual temperature peak.

Definitions of fire resistance are met in the context of two criteria:

Integrity:
The time taken before failure of the wall system to satisfactorily prevent the passage of flames and hot gases in accordance with the test procedures laid down in this standard.

Insulation:
This must be non-combustible and restrict the transmittance of heat from the source of the fire to the unexposed face of the wall construction.

Point of failure is deemed when the mean temperature on the unheated side of the construction exceeds 140°C above ambient or when the temperature of any surface point across the unexposed face reaches 180°C above the initial ambient.

Tables A1 and A2 in Appendix A of TGD B stipulate actual requirements which can vary from 1/2 hour integrity to 2 hours.

A comprehensive range of Tegral FireWall cladding systems have been developed and certified/assessed to **BS476 Part 22**. These offer a range of insulation performance from 15 minutes to the more stringent 1 hour requirement laid down for partitional/separating walls.

These are shown in the Tegral FireWall system selector section of this brochure. A quick reference table has also been included.

Updating Fire Requirements

As a result of the ongoing programme for the revision of British standards it is inevitable that some will be withdrawn yet will still remain being cited by the Building Regulation Approved Documents. It is therefore recommended that designers review standards and approved documents for current status.

Fire Resistance and Tegral Systems

Twin-Skin Cladding;
The combination of Class 0 profiled metal external cladding and Internal lining sheets together with the use of non-combustible glass or mineral wool insulation have been tested to **BS 476: Part 22** for fire resistance. Independently certified by Warrington Fire Research Centre Ltd, Tegral Twin-Skin Firewalls meet the requirements for integrity and insulation to suit and variety of system applications.

Trinsul Site assembled composite

Using high density rock fibre insulation this system offers excellent fire performance characteristics. Thus in addition to the general attributes described above for Twin-Skin systems, the Trinsul system has been tested and assessed to **BS476 Part 22** to provide 60 minutes insulation and 4 hours integrity – making it suitable for many boundary and partition applications.

Tegral Enviropanel® Mineral wool core composite panel

The use of mineral wool as an insulating core for a composite panel confers upon it exceptional fire properties. The use of non combustible materials makes these panels generally acceptable to insurers. However The Tegral Tegral Enviropanel® system also been successfully tested to LPS1181 (Loss Prevention Certificate Board LPCB Certificate No. 460 A Issue 5).

The Tegral Enviropanel® system has also been successfully tested to **BS476 Part 22** for fire resistance and provides 60 minutes insulation and integrity.

Tegral Trisomet and Trimapanel PIR insulated Panels

Tegral insulated Trisomet and Trimapanel PIR core insulated panels offer Loss Prevention Certificate Board (LPCB) approval under certificate numbers 460a/12 (Trisomet Vertical or Horizontal 60mm/80mm/100mm), and 460a/13 (Trimapanel 70mm & 90mm).

Trisomet PIR-Core Composite Panels

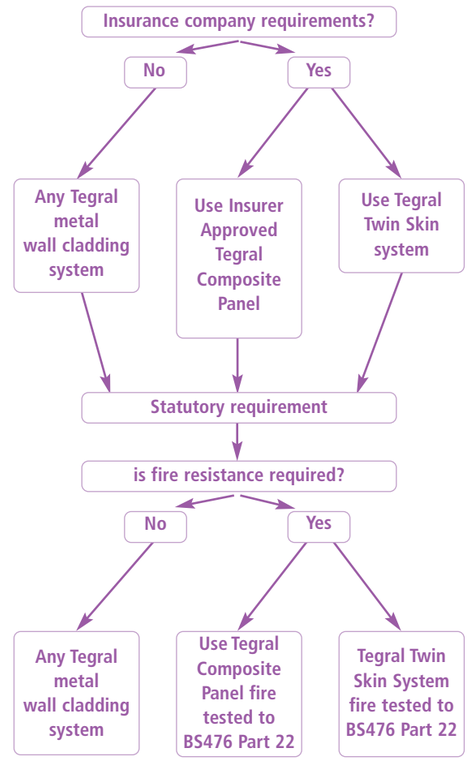
Whilst there is a long history of minimal fire risk presented by polyurethane composite panels used externally, as shown above in the excerpt from the LPC Design Guide, insurers now will frequently demand that sandwich panels show compliance to LPS1181 (or in the case of Factory Mutual carry FM Approval). Compliance with either of these two test regimes is dependent on a number of factors, most importantly the panel's foam formulation, the side and end lap details and the construction details. Polyisocyanurate (PIR) is a version of Polyurethane; to qualify as PIR the ratio of isocyanate to polyol must be greater than 1.8. However not all PIR formulations perform the same in a fire and so exactly the same formulation as that tested must be used in reality, for compliance to LPS 1181. In fact, where a complying wall construction is required the entire panel and fixing specification must also be in accordance with the specification used for the test.

Tegral offer the Trisomet system with necessary FM and LPC approval.

Loss Prevention Certificate Board LPCB Certificate No. 460a Issue 5. (Roof panel only).

FM Approval: Project ID: 3016409 Class 4880, 4771 for wall and roof panels.

Decision Tree for Wall Cladding or Insurer apporved Insulated Panel Specification



Tegral Fire Wall System Selector

Description	Orientation	Construction Type	Fire resistance period (stability and integrity -hours)	Insulation criteria (mins.)	Exposed face	Boundary distance (m)	Page No.	WFRC* certificate No.
Trinsul Fire Wall	Vertical	Outside rail	4	60	Either face	within 1m	36	C127164
Trinsul Fire Wall	Horizontal	Outside rail	4	60	Either face	Within 1m	37	C113875
Twin Skin Fire Wall with Instaloc 40 Spacer System & Glassfibre Quilt	Vertical	Outside rail	4	15	Inside face	1m or more	35	C107677
Twin Skin Fire Wall with Instaloc 40 Spacer System & Mineral Wool quilt	Vertical	Outside rail	4	15	Inside face	1m or more	39	C107675
Twin Skin Fire Wall Mineral Wool quilt	Vertical	Inside rail	4	15	Inside face	1m or more	40	C107670
Structural Liner Tray Fire Wall Mineral Wool quilt	Vertical	Liner Tray	4	15	Inside face	1m or more	41	C54353
Structural Liner Tray Fire Wall Mineral Wool quilt	Vertical	Liner tray	4	60	Either face	Within 1m	42	C80289
Twin Skin Fire Wall Glass fibre	Horizontal	Inside rail	4	15	Inside face	1m or more	43	C118450
Twin Skin Fire Wall Mineral Wool quilt	Horizontal	Inside rail	4	15	Inside face	1m or more	44	C107659
Twin Skin Fire Wall Mineral Wool quilt	Vertical	Inside rail	4	30	Either face	Within 1m	41	C52869
Trisomet 60mm/ 80mm/ 100mm	Vertical or Horizontal	Outside Rail	4	15	Inside Face	1m or more	See separate section 1: 'Insulated Panels'	LPCB cert. 460a/12
Trimapanel 70mm/ 90mm	Horizontal	Outside Rail	4	15	Outside Face	1m or more	See separate section 1: 'Insulated Panels'	LPCB cert. 460a /13
Enviropanel Through fix and secret fix 120mm core	Horizontal	Outside Rail	4	60	Either Face	Within 1m	See separate section 1: 'Insulated Panels'	LPCB cert. 460a/10
Enviropanel Through fix and secret fix 135mm core	Horizontal	Outside Rail	4	90	Either Face	Within 1m	See separate section 1: 'Insulated Panels	LPCB cert. 460a/10

* Warrington Fire Research Centre Limited.

Tegral, in conjunction with our partners Corus Panels and Profiles, have commissioned independent firetests and assessments for assemblies incorporating their metal profiles.

Note; Please see page 52 for General Construction Requirements applicable to all systems.

DESIGNER'S ROOFING AND CLADDING GUIDE Fire Performance

60 minutes Insulation 4 Hour Integrity Fire Wall

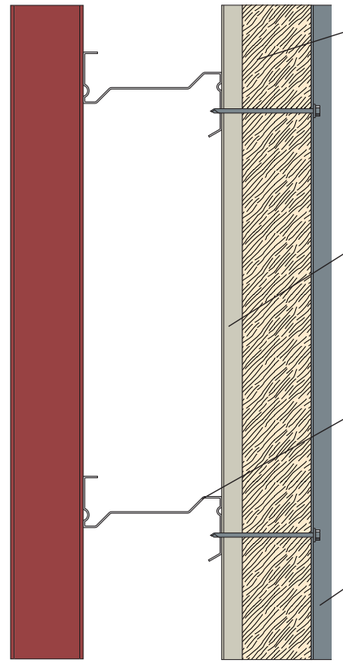
Warrington Fire Research Centre Number C127164.

Trinsul Mineral Wool Fire Wall (vertical cladding/liner outside rail/horizontal cladding rails)

Tegral Trinsul outside rail cladding system has a 1 hour fire resistance from either direction when fixed within 1 metre of relevant boundary.

LPC

Tegral Trinsul meets fully the requirements of part 2.2 of the LPC Design Guide for the Fire Protection of Buildings 2000.



Insulation

80kg/m³ nominal density profiled rockfibre Trinsul insulation board. Minimum thickness to achieve 0.27W/m²K 'U' value for fire resistance.

Liner sheet

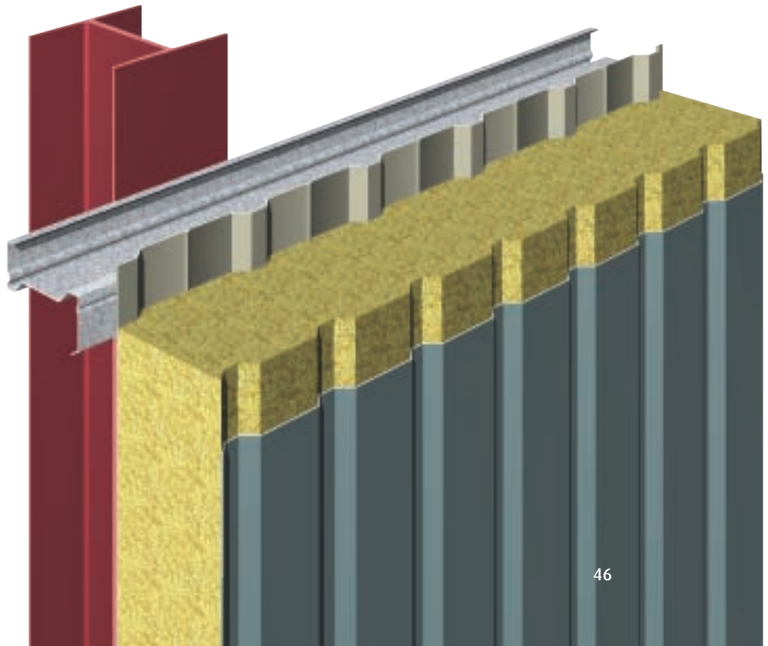
Tegral Colorcoat® steel liner sheet profile. 0.4/0.7mm gauge.

Cladding Rail

Tegral cladding rails. The rail is not fire protected but a facility for expansion is required (i.e. slotted fixing holes).

Outer Cladding

Tegral Colorcoat® steel cladding profile. 0.5/0.7mm gauge.



Construction Notes

All fixings and components to be steel. All outer sheet side laps must be stitched at not more than 400mm centres. Liner sheet does not require stitching.

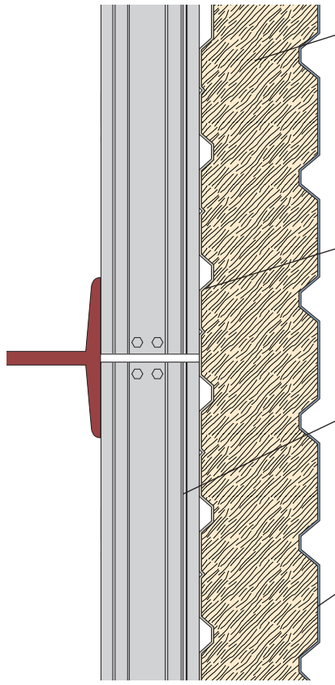
Please contact Tegral Metal Forming Technical Services Department for information on the insulation thickness needed for this system to meet the requirements of the Building Regulations Draft TGD Part L.

60 minutes Insulation 4 Hour Integrity Fire Wall

Warrington Fire Research Centre Number C113875

Trinsul Mineral Wool Fire Wall (horizontal cladding/liner outside rail/horizontal cladding rails)

Tegral Trinsul outside rail cladding system has a 1 hour fire resistance from either direction when fixed within 1 metre of relevant boundary.



Insulation
80kg/m³ nominal density profiled rockfibre Trinsul insulation board. Minimum thickness to achieve 0.27W/m2K 'U' value for fire resistance.

Liner sheet
Tegral Colorcoat® steel liner sheet profile. 0.4/0.7mm gauge.

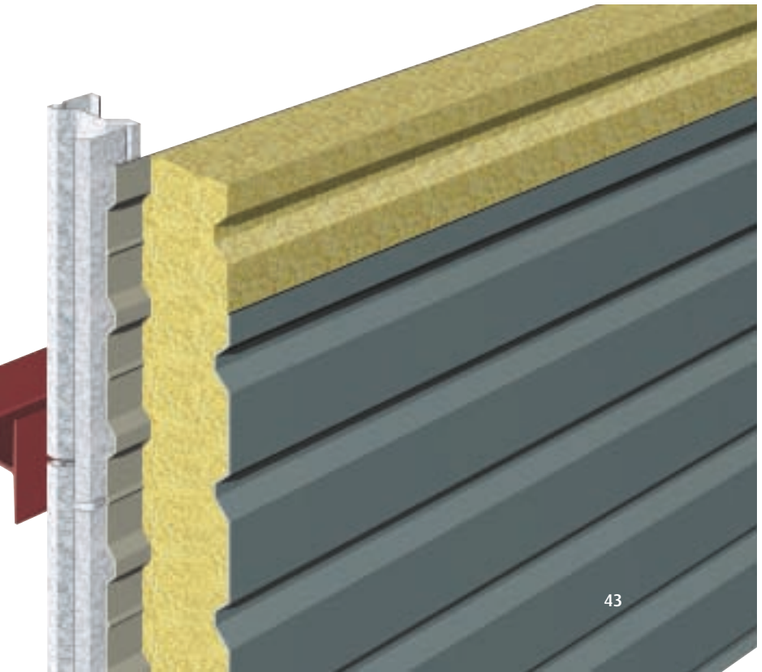
Cladding Rail
Tegral cladding rails. The rail is not fire protected but a facility for expansion is required (i.e.slotted fixing holes).

Outer Cladding
Tegral Colorcoat® steel cladding profile. 0.5/0.7mm gauge.

Construction Notes
All fixings and components to be steel. All outer sheet side laps must be stitched at not more than 400mm centres. Liner sheet does not require stitching.

LPC
Tegral Trinsul meets fully the requirements of part 2.2 of the LPC Design Guide for the Fire Protection of Buildings 2000.

Please contact Tegral Metal Forming Technical Services Department for information on the insulation thickness needed for this system to meet the requirements of the Building Regulations Draft TGD Part L.



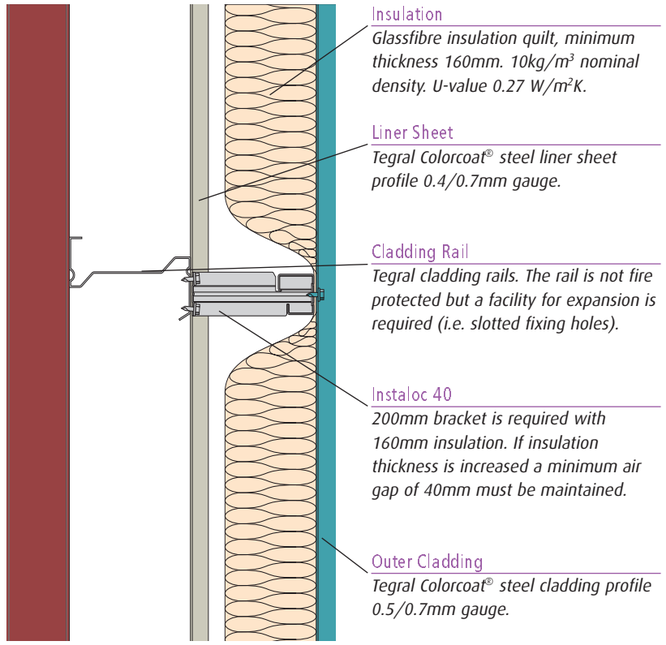
DESIGNER'S ROOFING AND CLADDING GUIDE Fire Performance

15 minutes Insulation 4 Hour Integrity Fire Wall

Warrington Fire Research Centre Number C107677

Twin-Skin system Fire Wall with Instaloc 40 Spacer System & Glassfibre Quilt (vertical cladding / liner outside rail / horizontal cladding rails)

This system is intended for use as an external wall, sited at least 1 metre from a relevant boundary. It is not suitable for partitions.
Assessment of fire resistance refers to cladding system which must be supported at base or by a fire rated eaves beam. The assessment refers to non-load bearing walls. The cladding system carries no vertical load other than its own dead weight. Installation of this system to be in accordance with Building Regulations TGD Part B (Fire Safety)



Insulation
Glassfibre insulation quilt, minimum thickness 160mm. 10kg/m³ nominal density. U-value 0.27 W/m²K.

Liner Sheet
Tegral Colorcoat® steel liner sheet profile 0.4/0.7mm gauge.

Cladding Rail
Tegral cladding rails. The rail is not fire protected but a facility for expansion is required (i.e. slotted fixing holes).

Instaloc 40
200mm bracket is required with 160mm insulation. If insulation thickness is increased a minimum air gap of 40mm must be maintained.

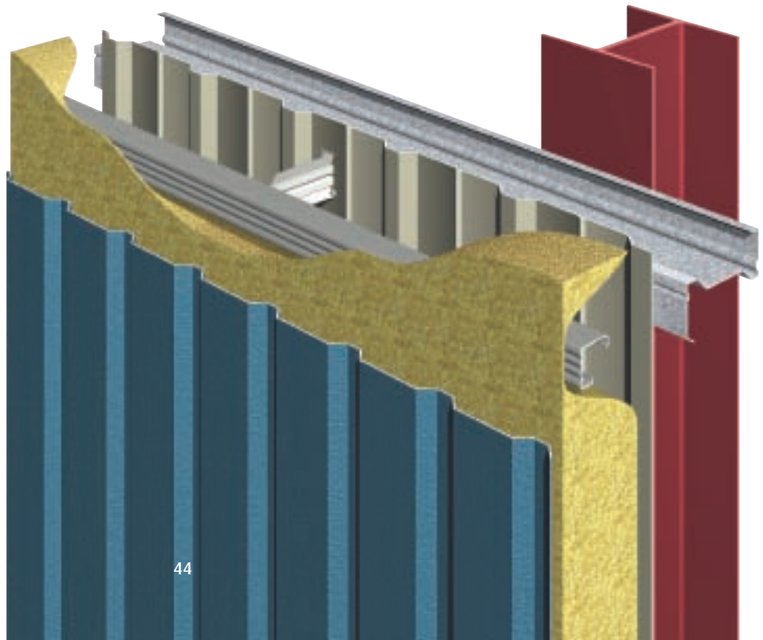
Outer Cladding
Tegral Colorcoat® steel cladding profile 0.5/0.7mm gauge.

Construction Notes
All fixings and components to be steel. All outer sheet side laps must be stitched at not more than 600mm centres and liner sheet at not more than 300mm centres.

System assessment to comply with BS476 Part 22 1987 in relation to internal fire.

Stability	=	240 minutes
Integrity	=	240 minutes
Insulation	=	15 minutes

Please contact Tegral Technical Services Department for information on the insulation thickness needed for this system to meet the requirements of the Building Regulations Draft TGD Part L.

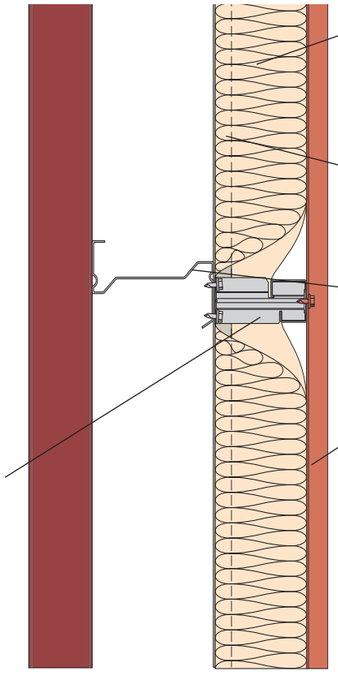


15 minutes Insulation 4 Hour Integrity Fire Wall

Warrington Fire Research Centre Number C107675

Twin-Skin system Fire Wall with Instaloc 40 Spacer System & Mineral Wool Quilt (vertical cladding / liner outsider rail / horizontal cladding rails)

This system is intended for use as an external wall, sited at least 1 metre from a relevant boundary. It is not suitable for partitions. Assessment of fire resistance refers to cladding system which must be supported at base or by a fire rated eaves beam. The assessment refers to non-loadbearing walls. The cladding system carries no vertical load other than its own dead weight. Installation of this system to be in accordance with Building Regulations TGD Part B (Fire Safety)



Insulation
Rockfibre insulation quilt, minimum thickness 160mm. 23kg/m³ nominal density. U-value 0.27 W/m²K

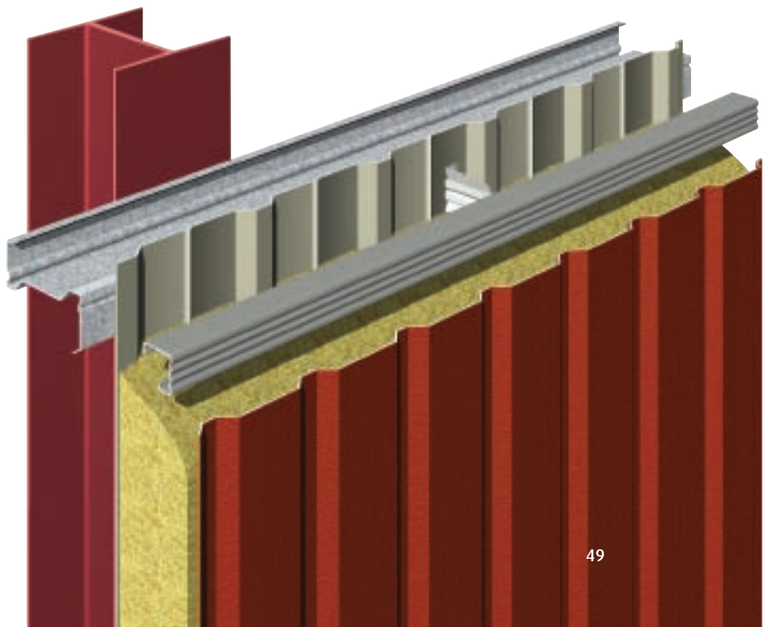
Liner Sheet
Tegral Colorcoat® steel liner sheet profile 0.4/0.7mm gauge.

Cladding Rail
Tegral cladding rails. The rail is not fire protected so a facility for expansion is required (i.e. slotted fixing holes).

Outer Cladding
Tegral Colorcoat® steel cladding profile 0.5/0.7mm gauge.

Instaloc 40
120mm bracket is required with 120mm insulation. For thicker insulation increase bracket size accordingly.

Construction Notes
All fixings and components to be steel. All outer sheet side laps must be stitched at not more than 600mm centres.
Liner sheets do not require stitching.



System assessment to comply with BS476 Part 22 1987 in relation to internal fire.
Stability = 240 minutes
Integrity = 240 minutes
Insulation = 15 minutes

Please contact Tegral Technical Services Department for information on the insulation thickness needed for this system to meet the requirements of the Building Regulations Draft TGD Part L.

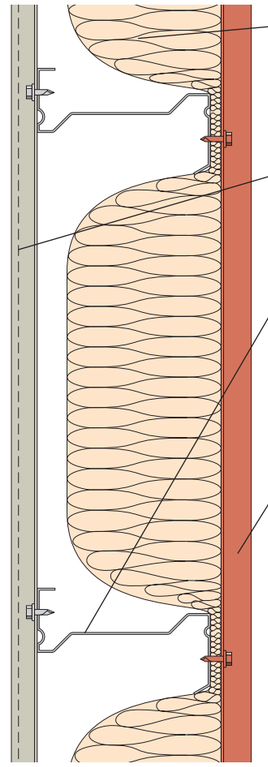
DESIGNER'S ROOFING AND CLADDING GUIDE Fire Performance

15 minutes Insulation 4 Hour Integrity Fire Wall

Warrington Fire Research Centre Number C107670

Twin-Skin system, Fire Wall with Mineral Wool or Glassfibre Quilt Insulation (vertical cladding / liner inside rail / horizontal cladding rail)

This system is intended for use as an external wall, sited at least 1 metre from a relevant boundary. It is not suitable for partitions. Assessment of fire resistance refers to cladding system which must be supported at base or by a fire rated eaves beam. The assessment refers to non-loadbearing walls. The cladding system carries no vertical load other than its own dead weight. Installation of this system to be in accordance with Building Regulations TGD Part B (Fire Safety)



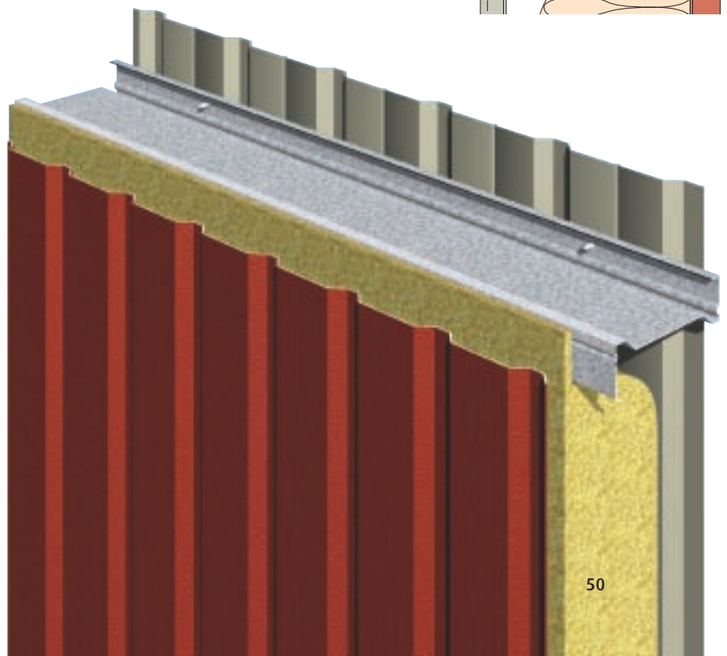
Insulation
Rockfibre 23kg/m³ nominal density or glassfibre 10kg/m³ nominal density, minimum thickness 180mm. U-value 0.27 W/m²K

Liner Sheet
Tegral Colorcoat® steel liner sheet profile 0.4/0.7mm gauge.

Cladding Rail
Tegra cladding rail to be 175mm deep minimum for 180mm thick quilt. For thicker insulation increase rail depth accordingly. The rail is not fire protected so a facility for expansion is required (i.e. slotted fixing holes).

Outer Cladding
Tegral Colorcoat® steel cladding profile 0.5/0.7mm gauge.

Construction Notes
All fixings and components to be steel. All outer sheet side laps must be stitched at not more than 600mm centres. Liner sheets do not require stitching with rockfibre insulation, otherwise to be stitched at 300mm.



System assessment to comply with BS476 Part 22 1987 in relation to internal fire.
Stability = 240 minutes
Integrity = 240 minutes
Insulation = 15 minutes

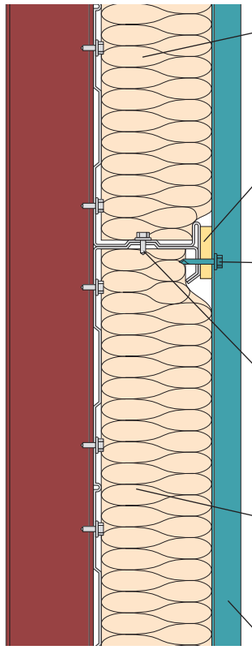
Please contact Tegral Technical Services Department for information on the insulation thickness needed for this system to meet the requirements of the Building Regulations Draft TGD Part L.

15 Minutes Insulation 4 Hour Integrity Fire Wall

Warrington Fire Research Centre Number C54353

Structural Liner Tray with Mineral Wool Insulation (vertical cladding onto liner tray)

This system is intended for use as an external wall, sited at least 1 metre from a relevant boundary. It is not suitable for partitions. Assessment of fire resistance refers to cladding system which must be supported at base or by a fire rated eaves beam. The assessment refers to non-loadbearing walls. The cladding system carries no vertical load other than its own dead weight. Installation of this system to be in accordance with Building Regulations TGD Part B (Fire Safety)



Tegral HL600/130 Structural Liner Tray.

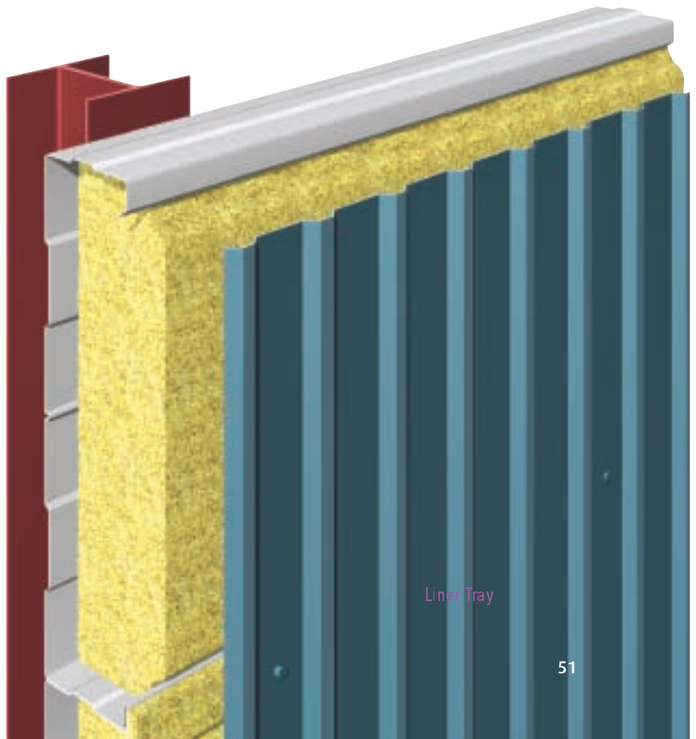
Thermal Break Strip
Rockfibre fire barrier strip 50mm x 25mm 240kg/m³ density.

Fastener
5.5mm diameter by 35mm long selfdrilling fastener e.g. SD3-T15-5.5x35.

Side Stitching
Side stitching in web at tray interlocks, 400mm maximum centres.

Insulation
Rockfibre insulation, minimum 160mm gauge 23kg/m³ nominal density. U-value 0.27 W/m²K

Outer Cladding
Tegral Colorcoat® steel cladding profile 0.5/0.7mm gauge.



System assessment to comply with BS476 Part 22 1987 in relation to internal fire.

Stability = 240 minutes
Integrity = 240 minutes
Insulation = 15 minutes

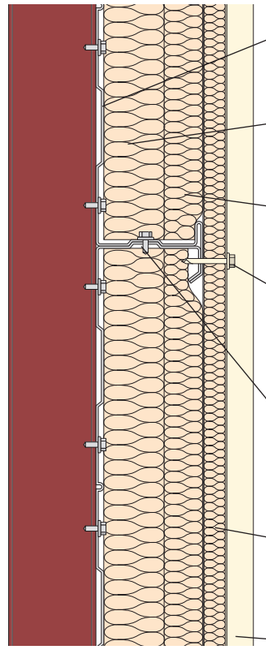
Please contact Tegral Technical Services Department for information on the insulation thickness needed for this system to meet the requirements of the Building Regulations Draft TGD Part L.

60 Minute Insulation 4 Hour Integrity Fire Wall

Warrington Fire Research Centre Number C80289

Structural Liner Tray with Mineral Wool Insulation (vertical cladding onto liner tray)

This system can be used for an external or internal partition wall, sited within 1 metre from a relevant boundary. It is suitable for partitions. Assessment of fire resistance refers to cladding system which must be supported at base or by a fire rated eaves beam. The assessment refers to non-loadbearing walls. The cladding system carries no vertical load other than its own dead weight. Installation of this system to be in accordance with Building Regulations TGD Part B (Fire Safety)



Liner Tray
Tegral HL600/130 Structural Liner Tray.

Insulation
Rockfibre insulation minimum 80mm x 100kg/m³.

Insulation
Rockfibre insulation minimum 50mm x 23kg/m³. U-value 0.27 W/m²K

Fastener
5.5mm diameter by 45mm long selfdrilling fastener e.g. SD3-T15-5.5x45.

Side Stitching
Side stitching in web at tray interlocks, 400mm maximum centres.

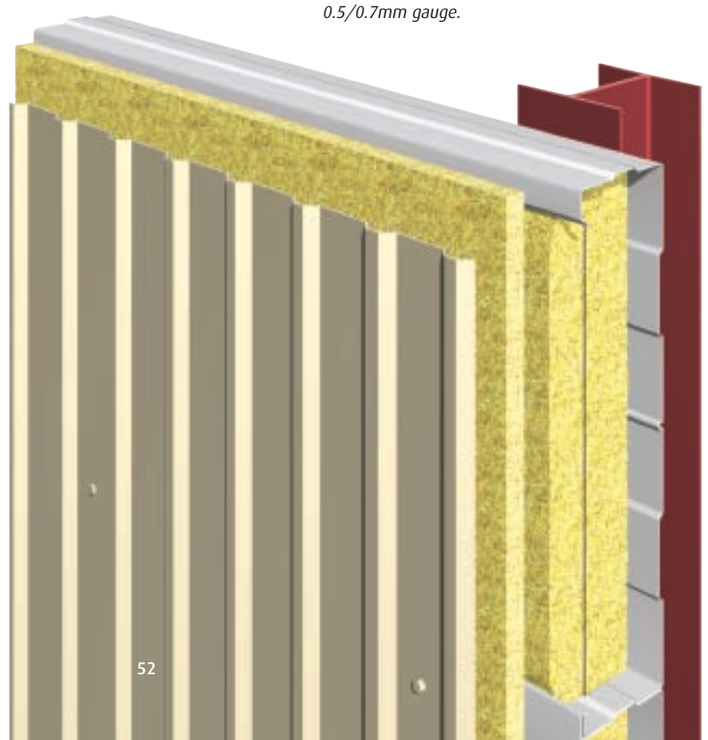
Insulation
Rockfibre insulation, minimum 30mm gauge 100kg/m³ nominal density.

Outer Cladding
Tegral Colorcoat® steel cladding profile 0.5/0.7mm gauge.

System assessment to comply with BS476 Part 22 1987 in relation to internal fire.

Stability = 240 minutes
Integrity = 240 minutes
Insulation = 60 minutes

Please contact Tegral Technical Services Department for information on the insulation thickness needed for this system to meet the requirements of the Building Regulations Draft TGD Part L.

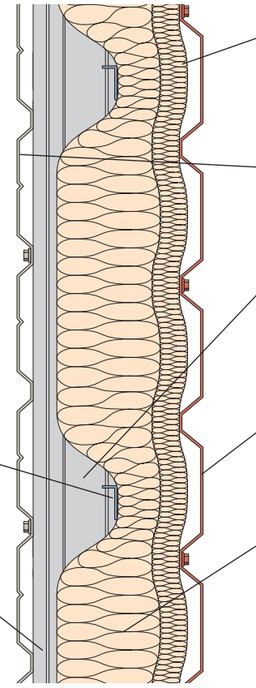


15 Minute Insulation 4 Hour Integrity Fire Wall

Warrington Fire Research Centre Number C118450

Twin-Skin system Fire Wall & Glassfibre Quilt Insulation (horizontal cladding / liner inside rail / vertical cladding rails)

This system is intended for use as an external wall, sited at least 1 metre from a relevant boundary. It is not suitable for partitions. Assessment of fire resistance refers to cladding system which must be supported at base or by a fire rated eaves beam. The assessment refers to non-loadbearing walls. The cladding system carries no vertical load other than its own dead weight. Installation of this system to be in accordance with Building Regulations TGD Part B (Fire Safety)



Galvanised Steel Strap
50mm x 0.9mm galv. steel straps screw to fixed rails and spaced at 1200mm centres

Air Gap
30mm minimum air gap between insulation and inner face of liner sheet.

Insulation Strip
Glass wool insulation quilt, 600mm width, minimum thickness 100mm. 10kg/m³ nominal density.

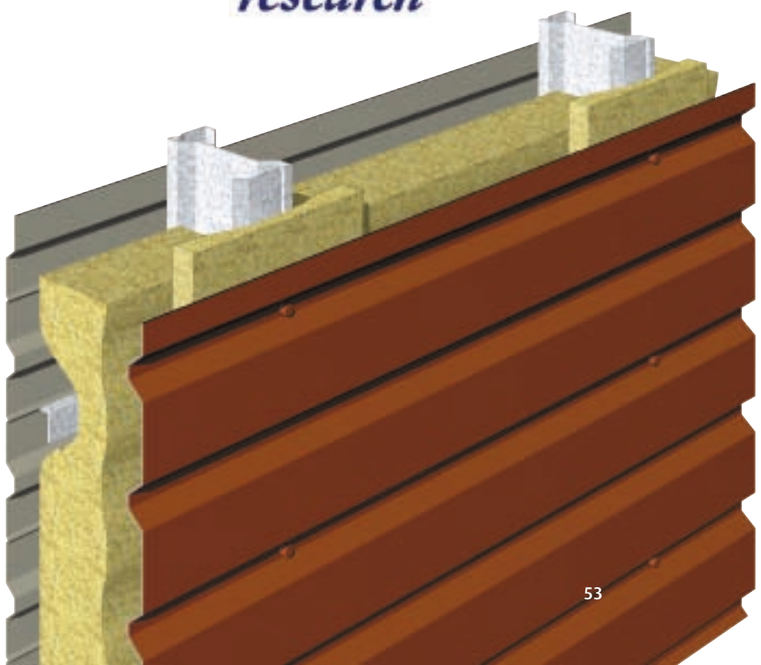
Liner Sheet
Tegral Colorcoat® steel liner sheet profile 0.4/0.7mm gauge.

Cladding Rail
Tegral cladding rails. The rail is not fire protected so a facility for expansion is required (i.e. slotted fixing holes).

Outer Cladding
Tegral Colorcoat® steel cladding profile 0.5/0.7mm gauge. Laps stitched at 300mm max. centres

Insulation
Glass wool insulation quilt minimum thickness 160mm, 10kg/m³ nominal density U-value 0.27 W/m²K

Construction Notes
All fixings and components to be steel. All outer sheet side laps must be stitched at not more than 300mm centres. Liner sheets to be stitched at 300mm centres



System assessment to comply with BS476 Part 22 1987 in relation to internal fire.

Stability = 240 minutes
Integrity = 240 minutes
Insulation = 15 minutes

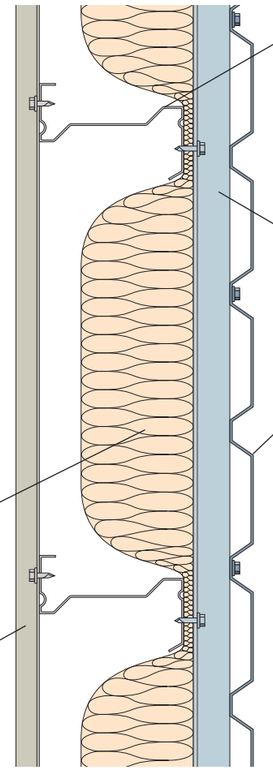
Please contact Tegral Technical Services Department for information on the insulation thickness needed for this system to meet the requirements of the Building Regulations Draft TGD Part L.

15 Minutes Insulation 4 Hour Integrity Fire Wall

Warrington Fire Research Centre Number C107659

Twin-Skin system Firewall, Mineral Wool Insulation (horizontal cladding / liner inside rail / horizontal sheeting rails)

This system is intended for use as an external wall, sited at least 1 metre from a relevant boundary. It is not suitable for partitions. Assessment of fire resistance refers to cladding system which must be supported at base or by a fire rated eaves beam. The assessment refers to non-loadbearing walls. The cladding system carries no vertical load other than its own dead weight. Installation of this system to be in accordance with Building Regulations TGD Part B (Fire Safety)



Insulation
160mm foil faced rockfibre. (WFRC number C43554) or 160mm glassfibre, 10kg/m³ nominal density. ¹U-Value: 0.27W/m2k

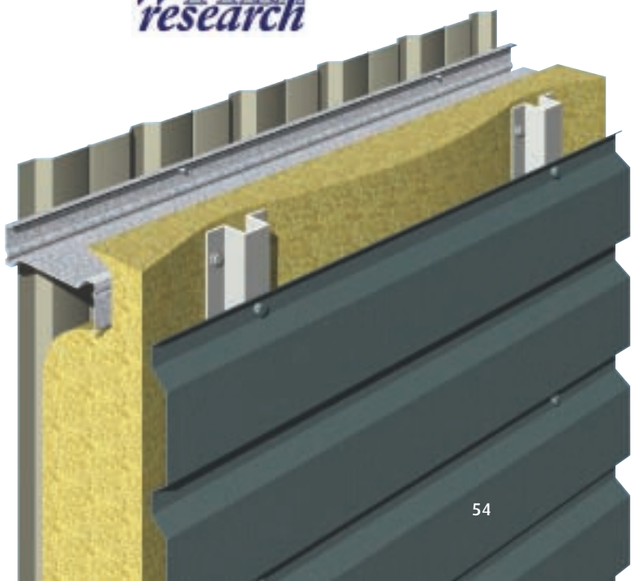
Liner Sheet
Tegral Colorcoat steel liner sheet profile 0.4/0.7mm gauge.

Cladding Rail
Tegral Cladding rails to be 150mm minimum for 160mm insulation. The rail is not fire protected so a facility for expansion is required. (i.e. slotted fixing holes). For thicker insulation increase rail depth accordingly.

Top Hat
1.60mm min. gauge galvanized steel top hat section min. 45mm deep by Tegral Metal Forming. To be fixed with self drilling/self tapping fasteners, 2 at each sheeting rail.

Outer Cladding
Tegral Colorcoat® steel cladding profiles 0.5/0.7mm gauge.

Construction Notes
All fixings and components to be steel. All joints in the insulation to be overlapped by 100mm and aluminium pins used to prevent joints from separating. Fix insulation to rails in accordance with insulation manufacturers recommendations (note that the cladding sheet does not pin insulation to rails in this system). Outer sheet to be stitched at 450mm centres. Liner sheet does not require stitching when rockfibre insulation is used, otherwise to be stitched at 300mm



System assessment to comply with BS476 Part 22 1987 in relation to internal fire.

Stability = 240 minutes
Integrity = 240 minutes
Insulation = 15 minutes

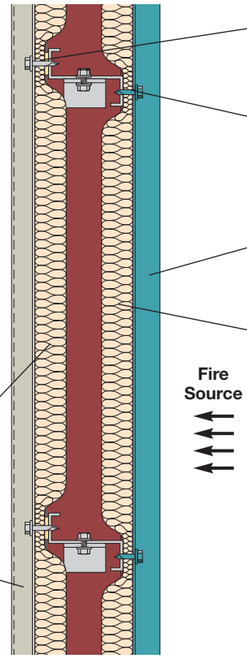
Please contact Tegral Technical Services Department for information on the insulation thickness needed for this system to meet the requirements of the Building Regulations Draft TGD Part L.

30 Minutes Insulation 4 Hour Integrity Fire Wall

Warrington Fire Research Centre Number C52869

Twin-Skin system Firewall, with Mineral Wool Insulation (vertical cladding onto horizontal cladding rails)

This system is intended for use as an external wall or internal partition.
Assessment of fire resistance refers to cladding system which must be supported at base or by a fire rated eaves beam. The assessment refers to non-loadbearing walls.
The cladding system carries no vertical load other than its own dead weight.
Installation of this system to be in accordance with Building Regulations TGD Part B (Fire Safety).



Thermal Break Strip
Rockfibre Fire barrier strip
50mm x 12mm 240kg/m³ density

Cladding Rail
Tegral cladding rail
150mm deep minimum.

Outer Cladding
Tegral Colorcoat® steel cladding profile
0.5/0.7 gauge

Insulation
80mm rockfibre
23kg/m³ nominal density.

Insulation
80mm rockfibre 23kg/m³ nominal density.

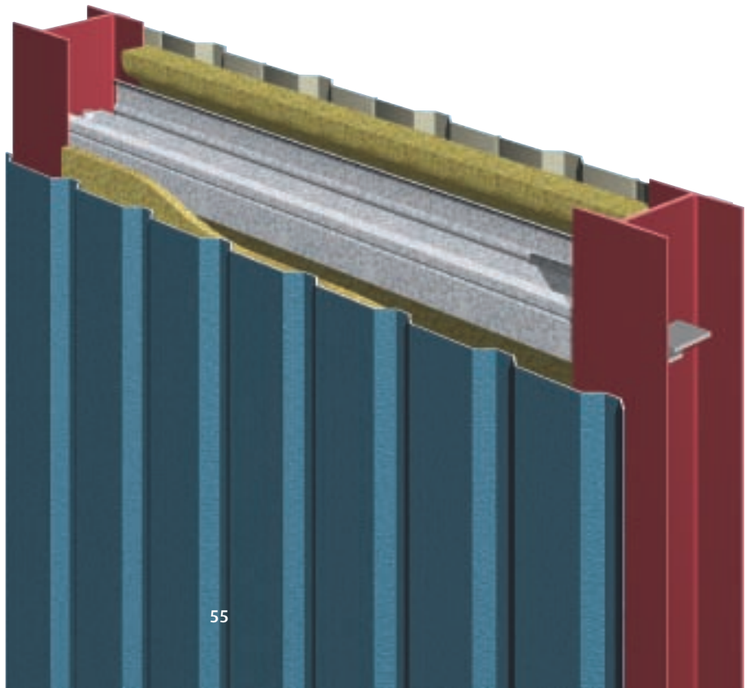
Liner Sheet
Tegral Colorcoat® Steel liner sheet profile
0.4/0.7 mm gauge.

Construction Notes
All side laps to be stitched at 450mm centres.

System assessment to comply with BS476 Part 22 1987 in relation to internal fire.

Stability	=	240 minutes
Integrity	=	240 minutes
Insulation	=	30 minutes

Please contact Tegral Technical Services Department for information on the insulation thickness needed for this system to meet the requirements of the Building Regulations Draft TGD Part L.



DESIGNER'S ROOFING AND CLADDING GUIDE Fire Performance

General Construction Requirements

Support Structures

Sheeting Rails

To accommodate the thermal expansion generated during fire, all sheeting rails must be fixed to support cleats with slotted holes and bolts used must have both steel plastic low melt washers under the head.

The rails should be positioned to create maximum support centres for the Firewall not greater than 2m. Allowance must be made for expansion in the rail length and span condition for the rails themselves should be single but may be sleeved to achieve continuity (see Tegral Zeta Design Manual).

Structural Frame

When sheeting rails heat up during a fire they cease to function as structural members. Therefore, to prevent the wall moving downwards under its own self weight either a support at the head or the base of the wall is required. All Tegral Firewalls can be designed to be supported from eaves beams/stanchions or rafters and posts if situated on a gable end. However, these elements must be protected using conventional fire protection materials to give the same period of fire resistance as the Firewall.

Cavity Barriers

Where a cavity is created within the wall construction cavity barriers are required to be introduced at positions identified by Building Regulations, TGD B (Fire Safety)

On Firewalls which use non-combustible mineral fibre insulant and where the design allows the quilt/board to effectively seal the cavity against the steel sheeting no additional barrier is necessary. However, on systems where the design incorporates an air gap a cavity barrier is required positioned to the full height of the wall at intervals not exceeding 20m.

The basic technical performance requirement for a cavity barrier is that it must maintain integrity for 30 minutes and provide at least 15 minutes fire insulation as determined by test in accordance with **BS476 Part 22**.

Cavity barriers should be fixed in a manner that prevents displacement under normal service conditions or in a fire.

References

BS476 FIRE TESTS ON BUILDING MATERIALS & STRUCTURES

Part 3:1975 - External Fire Exposure Roof Test

Part 4: 1970(1984) - Non Combustibility Test for Materials Part 6: 1989 - Methods of test for Fire Propagation for Products.

Part 7: 1987 - Methods for Classification of the Surface Spread of Flame of Products

Part 11: 1982 - Method for assessing the Heat Emission from Building Materials

Part 22- 1987 Methods for determination of the Fire Resistance of non - loadbearing elements of Construction

THE BUILDING REGULATIONS TGD B (Fire Safety)

B1 Means of Escape

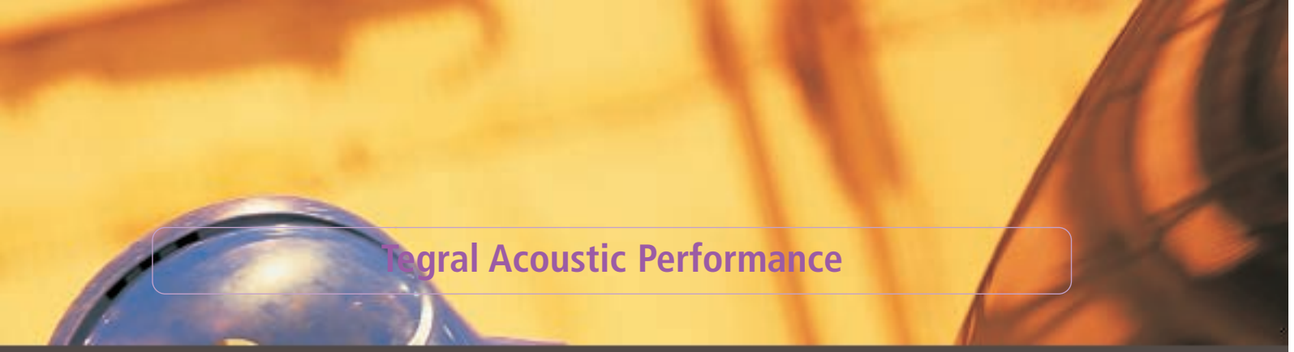
B2 Internal Fire Spread (Linings)

B3 External Fire Spread (Structure)

B4 External Fire Spread

B5 Access & Facilities for the Fire Service

THE LOSS PREVENTION COUNCIL
The LPC Design Guide for the Fire Protection of Buildings 2000



Tegral Acoustic Performance

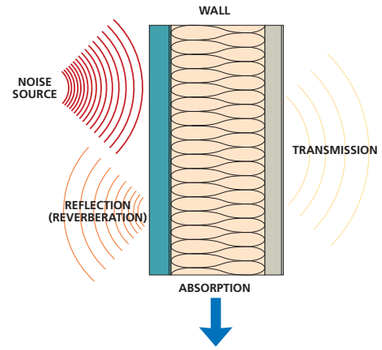
"Tegral provides options for both Sound Absorption and Sound Reduction, to allow for noise control measures to meet Health and Safety and Environmental Health regulations".....

The nature of acoustic performance

When something vibrates it creates waves of pressure which are carried through a medium such as air or water as sound waves. The greater the pressure created by the waves then the louder the sound. The greater the speed of the vibration then the higher the frequency of the sound. Sound is measured using decibels (dB).

There are generally four ways to reduce the extent of noise heard by a receiver

1. **Reduce the noise at source.**
2. **Increase distance from source** - as sound waves spread out from a source, provided there are no reflections, they gradually decay.
3. **Use sound absorption** - sound pressure waves can be absorbed by open structured, textured or fibrous material. In contrast, hard smooth surfaces will reflect sound and have an adverse effect on the acoustics inside a building because multiple reflections increase the internal sound level. Sound which is relected back into a building is referred to as Reverberant Sound. Sound absorption may therefore be used to reduce noise levels within a building.
4. **Use sound insulation** - the reduction in noise levels provided by walls, roofs, windows etc. is generally referred to as sound reduction or sound insulation. Laboratory testing can accurately measure the sound transmitted through an assembly. The sound reduction or insulation provided by the assembly may then be referred to as the Sound Reduction Index (SRI).



In the case of commercial or industrial buildings, Tegral profiled metal roofing and cladding systems can provide options for both Sound Absorption and Sound Reduction, to allow for noise control measures to meet Health and Safety and Environmental Health regulations.

General principles

Acoustic Design

Metal cladding systems offer effective acoustic systems, to provide acoustic reduction, absorption or both. However, actual priorities with regard to noise control on any given project must be determined as providing sound absorption will reduce the potential for sound reduction and advice from acoustic consultants may be required.

Sound Absorption

Sound Absorption (i.e. the damping of reverberant sound that would normally reflect back from smooth hard internal surfaces) can be provided by the use of Tegral perforated liner sheets, in conjunction with suitable mineral wool insulation material.

(Note: Where perforated liners are used, a separate vapour control layer must be provided. This must be fully sealed at all junctions and at rooflights to ensure that the construction meets air tightness requirements).

Sound Reduction

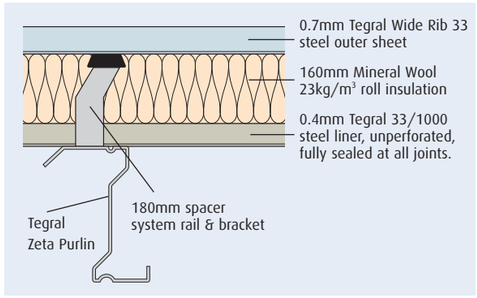
Sound Reduction is a measure of the reduction in sound level of noise escaping from a building. Tegral roofing or cladding systems are very effective at providing sound reduction, as they can incorporate proven mineral wool acoustic insulation, combined with the relative high density of the metal internal liner and external cladding sheets.

Tegral Acoustic Systems

Tegral offer a wide range of acoustic systems. The following examples indicate the most typical applications. Variations in choice of metal profile and insulation specification can be accommodated. Please contact Tegral Technical Services Department for further information.

Tegral Acoustic systems

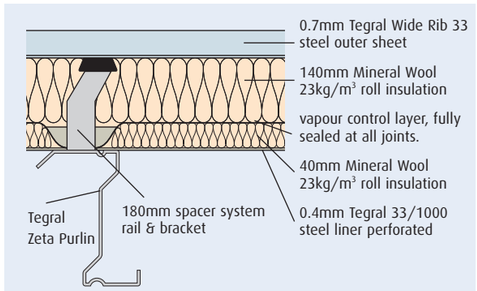
Note:
The predicted Sound Reduction Index and Sound Absorbtion Coefficient values listed should be used only to provide guidance for preliminary design appraisal of cladding systems. Laboratory measurements should be used to provide definitive acoustic data.



System 1

Predicted acoustic performance
Twin-Skin roof and plain liner sheet

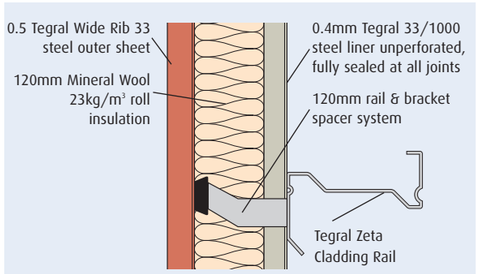
Frequency Hz	*125*	*250*	*500*	*1000*	*2000*	*4000*
Sound Reduction Index (SRI) values dB	*16.5*	*33.6*	*46.4*	*50.0*	*58.9*	*63.2*
Weighted SRI Rw = 41.8 dB						



System 2

Predicted acoustic performance
Twin-Skin Roof and perforated liner sheet

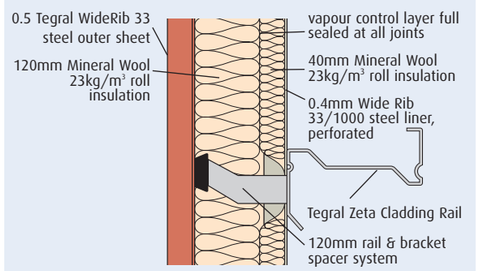
Frequency Hz	*125*	*250*	*500*	*1000*	*2000*	*4000*
Sound Absorption Coefficient	*0.14*	*0.22*	*0.36*	*0.72*	*0.80*	*0.82*
Sound Reduction Index (SRI) values dB	*12.4*	*19.8*	*24.9*	*28.9*	*38.8*	*43.6*
Weighted SRI Rw = 29.1 dB						



System 3

Predicted acoustic performance
Twin-Skin cladding and plain liner sheet

Frequency Hz	*125*	*250*	*500*	*1000*	*2000*	*4000*
Sound Reduction Index (SRI) values dB	*13.2*	*27.9*	*42.7*	*48.3*	*56.0*	*62.2*
Weighted SRI Rw = 37.3 dB						

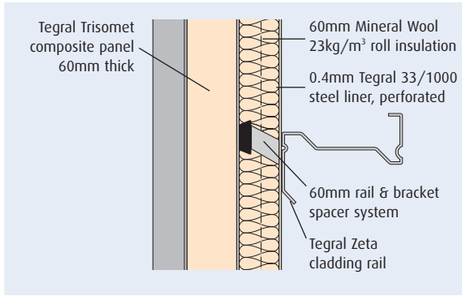


System 4

Predicted acoustic performance
Twin-Skin cladding and perforated liner sheet

Frequency Hz	*125*	*250*	*500*	*1000*	*2000*	*4000*
Sound Absorption Coefficient	*0.10*	*0.15*	*0.24*	*0.45*	*0.42*	*0.77*
Sound Reduction Index (SRI) values dB	*9.2*	*17.5*	*20.7*	*27.6*	*35.6*	*44.7*
Weighted SRI Rw = 26.3 dB						

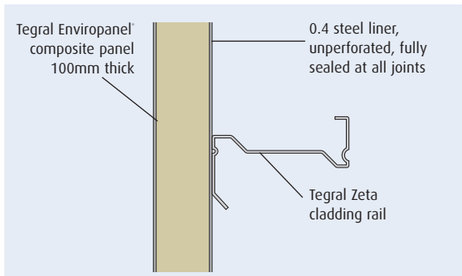
Tegral Acoustic systems



System 5

Predicted acoustic performance
Trisomet composite panel with separate perforated liner

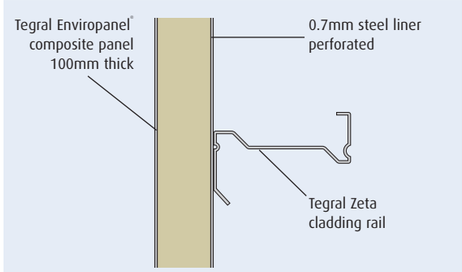
Frequency Hz	*125*	*250*	*500*	*1000*	*2000*	*4000*
Sound Absorption Coefficient	*0.05*	*0.07*	*0.10*	*0.16*	*0.33*	*0.31*
Sound Reduction Index (SRI) values dB	*13.7*	*20.2*	*26.2*	*27.1*	*43.0*	*62.9*
Weighted SRI Rw = 29.2 dB						



System 6

Enviropanel® Composite panel with plain liner sheet
Predicted acoustic performance

Frequency Hz	*125*	*250*	*500*	*1000*	*2000*	*4000*
Sound Reduction Index (SRI) values dB	*25*	*33*	*38*	*40*	*38*	*56*



System 7

Tegral Enviropanel® Composite panel with perforated liner sheet Predicted acoustic performance

Frequency Hz	*125*	*250*	*500*	*1000*	*2000*	*4000*
Sound Absorption Coefficient	*0.36*	*0.68*	*0.81*	*0.28*	*0.89*	*0.78*

Notes to systems 1-7

1. The performance data shown is predicted by calculation, not generated from test results.
2. The sound absorption data assumes a 30% open area for the perforated steel liner.
3. Insulation thickness and where a vapour control layer is shown, must be fully sealed at all junctions and at rooflights to ensure that the construction will meet requirements of Building Regulations Draft TGD Part L: Section 2.

Sustainable Roofing & Cladding Systems

European Union buildings should reduce energy waste by 22%

Insulation will be a key instrument to fulfil the EU Energy Performance of Buildings Directive that was passed in 2002. The EU expects the Directive to save 220 million tonnes of CO^2 per year, of which 150 million tonnes can be saved in a profitable or cost neutral way.

There are five main environmental impacts of human activity

1. The Greenhouse Effect:

This is the term used to explain the natural phenomenon that increases the temperature of the earth's surface. The incoming solar radiation is absorbed by the earth and reflected back towards the atmosphere at longer wavelengths. Certain gases within the atmosphere (carbon dioxide, water vapour, methane and chloroflurocarbons) exhibit properties that in turn absorb this reflected radiation and elevate the temperature of the lower atmosphere. The concentration of these greenhouse gases is believed to influence the effectiveness of the phenomenon and hence the steady-state of temperature of the earth. It is believed that man's increased emissions of greenhouse gases is contributing to the greenhouse effect. The resulting general increase in temperature could alter atmospheric and oceanic currents which could in turn lead to potentially significant changes in weather patterns. A rise in sea levels is also predicted due to thermal expansion of the oceans and melting of the polar ice sheets.

2. Resource Depletion:

Abiotic resource depletion can be defined as the decreasing availability of natural, non-living, non-renewable resources.

3. Photochemical Oxidant Formation:

Under certain climatic conditions, air emissions from industry and transportation can be trapped at ground level where they react with sunlight to produce photochemical smogs.

These are often seen in busy cities during the summer and can be harmful. One of the components of smog is ozone, which is not emitted directly but is produced through the interactions of volatile organic compounds (VOCs) and oxides of Nitrogen (NOx). Ozone is a valuable substance in the earth's stratosphere. However, ozone in the lower atmosphere is harmful and should not be confused with the ozone layer.

4. Acidifaction:

This is the process whereby acidifying gases released into the atmosphere change the pH of terrestrial watercourses and soils. The most significant compounds in this process are sulphur and nitrogen compounds. Acidifying compounds in a gaseous state may either be dissolved in water or fixed in solid particles. They reach ecosystems through dissolution in rain or by wet deposition. The effects of acidification can be seen in the lakes of Scandinavia and North America, in coniferous forest decline, in soil and in the erosion of building materials.

5. Eutrophication:

Eutrophication is a form of water pollution. It is defined either in the enrichment in mineral salts of marine or lake waters when it refers to the natural process or in the enrichment of nutritive elements of waters when referring to human intervention. Eurtrophication is primarily a natural process. However, human activities have dramatically accelerated eutrophication by releasing phosphorus compounds (fertilisers, detergents etc.) nitrogen compounds (fertilisers) and organic matter (urban and industrial effluents) into watercourses.

DESIGNER'S ROOFING AND CLADDING GUIDE Environmental Sustainability

Sustainable Roofing & Cladding Systems

The world's first CarbonNeutral Building Envelope

The impact of global warming

The impact of human activity could be significant at an economic, social and environmental level. The Stern Report (2006) predicts if nothing is done about global warming then the world economy could shrink by as much as 20% as global output reduces. To maintain manageable levels, emissions would need to stabilise in the next 20 years and fall between 1% and 3% after that. This would cost 1% of GDP.

Developing countries which are least likely to be able to cope with climate change are most likely to be affected. Their access to drinking water, for example, would be further reduced, affecting the health of the poorest and posing a real threat to food security. Rising sea levels could leave 200 million people permanently displaced.

Consensus from the 2005 Conference of Scientific Experts was that a temperature increase of 2ºC above the pre-industrial levels may trigger melting of the Greenland ice cap. Were this to happen the sea level would rise dramatically changing the world map substantially.

How is this being addressed?

The UN Framework Convention on Climate Change was developed in 1992 and committed countries to take action to prevent the enormous climate change. Following 5 years of negotiation, the Kyoto Protocol was agreed which made reductions mandatory among the developed economies. Although a number of significant countries have signed up to the Kyoto Protocol, including those in the EU including the UK, many large CO2 emitters such as the USA remain outside the framework.

The Kyoto Protocol commits countries rather than individuals or companies to achieve emissions reductions. The European Union has established an Emissions Trading Scheme (EU-ETS) as a way to meet its Kyoto commitments. This scheme imposes caps on the level of emissions for certain sectors such as power generation and cement and steel manufacture, and uses a trading platform so that regulated parties and others can trade carbon to ensure that the reduction targets are met.

In addition to this regulatory approach, a number of companies are looking at voluntary initiatives to go beyond compliance on climate change. Companies such as the CarbonNeutral Company have been set up to help businesses achieve this voluntary action and reduce to net zero their unavoidable emissions. This involves assessing green house gas emissions, putting in place actions to reduce these wherever possible and off-setting the remaining through high quality renewable energy and energy efficiency projects.

Confidex Sustain™

Tegral Metal Forming are proud to introduce Confidex Sustain? from their pre-finsihed steel supply partners, Corus. Confidex Sustain? offers the first Carbon Neutral building envelope in the world, measuring and offsetting its impact from cradle to grave i.e. manufacture through to installation, use and end of life. As part of Corus continued commitment to going beyond mere compliance on environmental issues, action is being taken to reduce to net zero the unavoidable CO2 emissions produced by Colorcoat HPS200® and Colorcoat Prisma® pre-finished steel products and the cladding systems they become part of. Corus has been working over a number of years to make Colorcoat HPS200® and Colorcoat Prisma® the most sustainable pre-finished steel products on the market.

Importantly Confidex Sustain™ will offset the impact from the entire building envelope system rather than just one element such as the prefinished steel.

What is Confidex Sustain™?

Confidex Sustain™ offers the first Carbon Neutral building envelope in the world, measuring and offsetting its impact from cradle to grave i.e. manufacture through to installation, use and end of life. This means for every 1kg of CO2 emitted by the pre-finished steel, cladding, fixings and insulation, Corus will off-set 1kg in climate friendly projects overseas. These have a social as well as environmental benefit and will see Corus investing in projects such as replacing kerosene lamps with solar panels for communities in India.

Sustainable Roofing & Cladding Systems

Building on the success of the Corus Confidex® Guarantee, the first and most reliable construction product guarantee, Confidex Sustain™ offers a zero carbon building envelope system. It goes beyond considering just one element of the cladding system to assess and off-set all parts including the inner and outer pre-finished steel cladding sheets, fixings and insulation. Confidex Sustain™ is available when a Colorcoat HPS200® or Colorcoat Prisma® pre-finished steel product is used as part of a Colorcoat® assessed cladding system.

Balance for the environment

Using Life Cycle Assessment data for each part of the cladding system, Corus can accurately identify how much carbon has been emitted at each stage of the process from manufacture, and installation to use and end of life disposal/recycling. This will be balanced and offset by Corus proactively investing in climate friendly projects which make use of renewable sources such as wind and solar and also improve the efficiency with which energy is used.

Key benefits of Confidex Sustain™

- Assesses the environmental impact of the pre-finished steel cladding system from cradle to grave.
- **Covers the whole pre-finished steel cladding system, not just one element.**
- Tangibly demonstrates the construction supply chain's commitment to sustainability by specifying the first Carbon Neutral building envelope in the world.
- Provides peace of mind for the supply chain in the specification of the most sustainable pre-finished steel products and cladding systems available. These will deliver long-term building envelope solutions with the ultimate levels of performance.
- Provides an important source of differentiation for designers and building owners as more people select climate friendly brands and products.
- Offered by Corus who has an excellent track record for developing well researched, robust and credible products and services, which deliver peace of mind and real benefit for the supply chain.

Key features of Confidex Sustain™

- Offsets the unavoidable CO2 emissions associated with the pre-finished steel, cladding system, insulation and fixings.
- Includes emissions from pre-finished steel cladding system during manufacture,

installation, use and disposal/recycling.

- Backed by a robust, reliable and fully traceable process for investing in climate friendly projects, underpinned by the CarbonNeutral protocol.
- Does not need to be passed along or traded within the supply chain to secure the benefits of zero carbon.
- Provides a direct link between Corus and the client, who will be the main beneficiary of the Carbon Neutral building envelope.
- **Simple to register for, applications can be made at project design stage.**

Applying for Confidex Sustain™

To benefit from the Confidex Sustain™ zero carbon building envelope, building projects will need to:-

- Ensure Corus Colorcoat HPS200® and/or Colorcoat Prisma® pre-finished steel products are specified for exterior of roof and walls
- Ensure Corus Colorcoat® liner is specified for interior of roof and walls
- Use a Corus Colorcoat® assessed cladding system. Full details of these are available on www.colorcoat-online.com

Applications should be made at the start of the building project using the Confidex Sustain™ pre-registration form. This is available electronically on www.tegral.com or telephone Tegral Sales on 00 + 353 (0) 59 86 40740.

Once the building has been completed, the building owner/occupier will receive a Confidex Sustain™ certificate with details of how much carbon has been off-set and the types of project Corus is investing in.

DESIGNER'S ROOFING AND CLADDING GUIDE Environmental Sustainability

Sustainable Roofing & Cladding Systems

Supporting Confidex Sustain™

Environmental Product Declaration

An Environmental Product Declaration (EPD) provides a summary of the environmental impacts of a product or system from cradle to crave. The data published for each of the Colorcoat® assessed cladding systems is based on an initial Life Cycle Assessment (LCA) study conducted by Corus in 2002 in accordance with the international standard ISO 14040-3.

This LCA has subsequently been refined and extended to include more products and systems. Some important points arise from the work Corus has done:-

- The durability of a product will always affect the results of an LCA because of the environmental impact of maintenance. Over 40 years of development makes Corus Colorcoat® products the most advanced pre-finished steel available with the most comprehensive and extensive guarantees of long-term durability.
- A series of sensible assumptions have been made to take into account transport of cladding materials between manufacturing locations, installation and site practice.
- End of life scenarios for pre-finished steel cladding systems are based upon current practice. For built up systems this means the steel content is recycled, whilst insulation is sent to landfill. Factory insulated composite panels are recovered via the fridge recycling route to minimise the escape of blowing agents which have a high impact on global warming.
- There are many reasons why the Colorcoat® assessed cladding systems have slightly different environmental impacts, although steel and insulation content predominates the analysis. Confidex Sustain™ allows all of the assessed cladding systems to achieve zero carbon status.
- The EPD summarises the environmental credentials of a cladding system. This information can be used in conjunction with whole life cost data, aesthetic considerations, appropriate maintenance regimes and other building specific factors such as speed of construction to determine the optimum cladding solution for a particular building.

Our Partners

CarbonNeutral® Company

Working with the leading climate change company The CarbonNeutral Company, Confidex Sustain™ provides a robust and fully auditable process to neutralise unavoidable emissions. The CarbonNeutral Company have over 10 years experience and work with over 200 clients including BSkyB, Honda, Avis Europe, Barclays Bank, The World Conservation Union, Berkeley Homes, Ricoh and the Radio Taxis Group as well as celebrities and 50,000+ consumer clients.

CarbonNeutral® is the registered trademark of The CarbonNeutral Company (TCNC) and provides the leading brand mark and quality standard for action on climate change. It means global warming emissions have been measured, reductions recommended, and the remaining emissions 'offset' in accordance with the CarbonNeutral protocol. This protocol assures quality of offset projects, and carbon footprint assessments. TCNC commissions an independent verification of CarbonNeutral programmes to further underpin their carbon promise.

Climate friendly projects

The CarbonNeutral Company will invest in a range of climate friendly projects around the world on behalf of Corus. These include projects which reduce the use of fossil fuels, for example by providing energy efficient lighting, invest in renewable energy such as wind turbines or photovoltaic electricity and sequestration projects which soak up or remove carbon dioxide from the atmosphere.

"Working with the leading climate change company The CarbonNeutral Company, Confidex Sustain™ provides a robust and fully auditable process to neutralise unavoidable emissions."

Steel and sustainable construction

Alongside the work Corus is doing to minimise the environmental impact of our operations, consideration can also be given to how steel can provide a sustainable solution during the construction, operation and end of life phases of a building.

Sustainable Roofing & Cladding Systems

Other benefits of using Tegral Built-Up Systems

As a material, steel can deliver more adaptability to buildings than those made using other materials and its strength can provide large open floor areas, giving flexibility of use throughout a building's life. The pre-finished steel cladding can last over 40 years, and be over-painted at intervals to prolong the life of the building envelope further.

Steel provides an engineered solution with tight tolerances, pre-engineered in factory controlled conditions. For construction, this offers speed and predictability on site, reducing waste, minimising disruption for local communities and enabling a quicker handover to the client. Corus continuously looks for ways to improve the performance of our products both functionally and environmentally, and as part of this we evaluate how our products are used during their lifetime.

Life cycle assessment

To demonstrate the environmental impacts of a steel product during the manufacture, construction and operational phases of a building, Corus has carried out a comprehensive life cycle assessment study, comparing Colorcoat® pre-finished steel products to assess their environmental impact against a wide range of environmental indicators. These found that the durability of the products always affects the results because of the environmental impact of maintenance. It also found that the environmental impact of the pre-finished steel coating

during manufacture is minimal compared with the overall construction process and the building's full lifetime.

Airtightness

50% of UK energy consumption is used in the operational phase of buildings and there are opportunities to enhance the thermal performance of a building and reduce energy costs, using pre-finished steel cladding systems. The Corus Colorcoat® Centre for the Building Envelope based at Oxford Brookes University, has developed one of the world's most advanced testing facilities for assessing the air tightness of building details. These facilities were used to test air leakage rates for different joint configurations and provide best practice in terms of detailing for the building envelope. Air infiltration accounts for approximately 30%

of the energy loss in a building and identifying ways to optimise the air-tightness of the building envelope can play a major role in conserving energy during a building's life.

Refurbish, Re-Use, Recycle

When it comes to the end of a building's life, the steel used in its construction can effectively be refurbished, reused or recycled. There is a well established and very efficient steel recycling infrastructure which ensures all the scrap collected at end of life across all applications, goes back into steel manufacture. Steel is 100% recyclable and the use of steel scrap will not compromise the quality of the new steel produced. Over 80% of all steel used in any construction project is reused or recycled at the end of the building's life. Of this a significant proportion is pre-finished steel from roof and wall cladding and tests have demonstrated that Corus Colorcoat® pre-finished steel products can be recycled as steel scrap without any additional burden in terms of emissions to the atmosphere.

An excellent example of how the recycling of steel can help save energy comes from the Lackenby open hearth steelmaking building at Teesside. Demolished in 2004, the building contained over 20,000 tonnes of structural steel and cladding, 100% of which was recovered as scrap. Recycling this steel saved enough energy to supply over 3700 homes with their energy requirements for one year and provided new high quality steel products for applications such as structural sections used in the construction of Heathrow Terminal 5.

Summary of End of Life Options

Summary of end of life options

Refurbishment

Refurbishment offers a well proven method for extending the life of the pre-finished steel building envelope either through overpainting, overcladding or recladding.

Re-use

Built-up systems which are easy to disassemble are more frequently re-used, mainly in agricultural applications. There is very little re-use of factory insulated composite panels (foam filled or mineral wool) mainly because of specific fixing requirements and the need for careful removal of panels which can take extra time. Reduced timescales for building demolition and the impact of Work at Height Regulations 2005, mean that re-use rates are likely to reduce further.

Recycling/disposal

Built-up systems

A well established process is in place for handling built-up systems at end of life which is easy and cost effective.

- The pre-finished steel can be separated and is 100% recyclable.

- Glass-fibre and mineral wool insulation can be processed for re-use at lower grade and mineral wool could be recycled effectively through the manufacturing process. At present the majority of mineral wool and glass-fibre insulation liberated at disposal goes to landfill.

Demolition contractors are happy to recover built-up systems and use the scrapvalue of the steel to offset their costs.

Factory insulated foam filled composite panels

Different recycling/disposal options need to be considered because of the potential risk of ozone depleting or global warming potential gases being released if not handled appropriately.

- Landfill is not an option for the disposal of factory insulated foam filled composite panels containing CFC and HCFC blowing agents and this may also extend to Pentane and HFCs in the future. Practically very few landfill sites will now accept any factory insulated foam filled composite panels.

- Fragmentation/shredding would release the blowing agents from factory insulated foam filled composite panels, so is not an option for those which contain, or may contain, CFCs or HCFCs. While this is technically a feasible route for small amounts of panels blown with HFCs or pentane, the high global warming potential of these gases mean that this process would cause significant environmental damage and so cannot be recommended. If legislation in the UK and EU changes to ban the release of such gases, as is anticipated, then this route would in any event no longer be available.

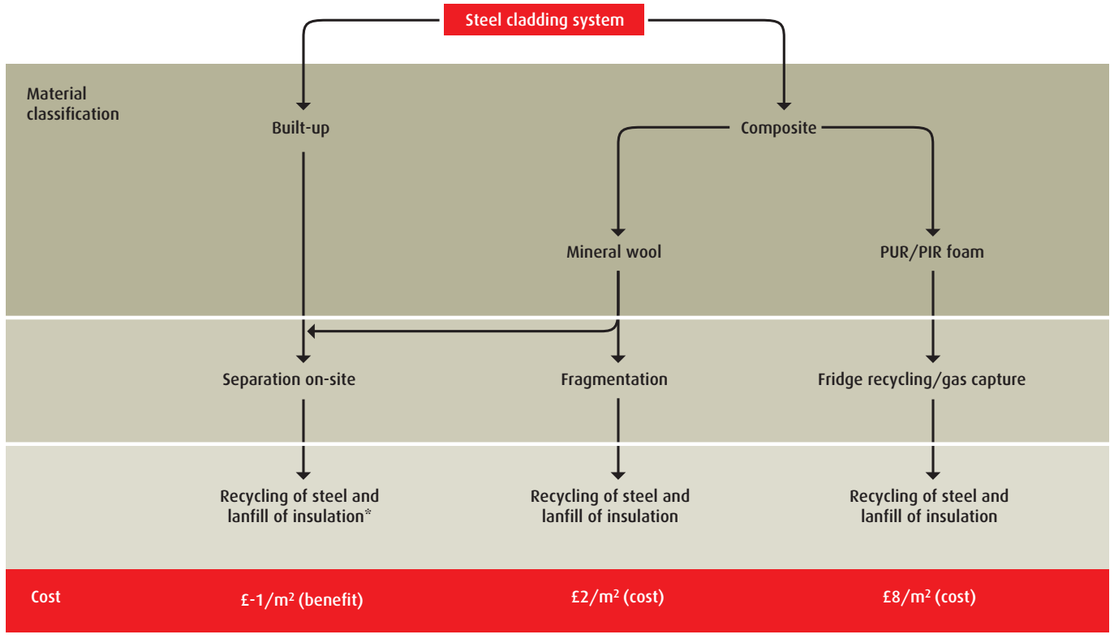
- Fridge recycling is likely to offer the most practical option for disposal and recycling of factory insulated foam filled composite panels when blowing agents need to be collected (as is currently the case for CFC/HCFC and in the future likely for HFC/Pentane) However, panels would need to be cut down to fit the current dimensions of the machines and this route is relatively costly.

- Incineration could be used to process the foam core with the steel inner and outer sheet falling through as slag, mixed in with other materials. This reduces the scrap value of the steel as it will be contaminated with other materials and has similar constraints to fridge recycling in terms of panel size. This route is also the most expensive.

Panels need to be treated carefully during demolition to ensure no release of gases.
There is little industry experience in handling factory insulated foam filled composite panels at end of life However, there will be a significant increase in the amounts coming through in the next 10 years. Demolition contractors perceive factory insulated composite panels as more difficult and expensive to deal with than built-up systems.
One difficulty for the demolition contractors is the inability to distinguish between CFC/HCFC and hydrocarbon blown panels, prompting the question 'how do we know which is which?'. For this reason, it is essential that accurate records are kept of products used in the construction process. Current options for landfilling are disappearing as environmental controls become stricter and fragmentation/shredding is only an option for certain panels (dependent on blowing agents used) and in small volumes. Incineration is very expensive and destroys much of the steel scrap value

Summary of End of Life Options

Fig.5. Best practice route for disposal and recycling of pre-finished steel-based cladding systems



*Note that recycling routes are available for fibre and mineral wool insulation. These insulants do not contain blowing agents.

Table 1: Summary of anticipated costs for recycling and/or disposal of pre-finished steel cladding systems

System	Current route	Cost	Possible future route
Built-up system pre-finished steel	Steel scrap recycling	Up to £1.00/m2 scrap benefit	Steel scrap recycling
Built-up system insulation	Landfill	£0.60/m2	Recycling into manufacturing process (available now but not prevalent)
Factory insulated foam filled composite panel	Fridge recycling	£7.00 – £9.00/m2	Fridge recycling
Factory insulated foam filled composite panel	Incineration	£15.00/m2	Fridge recycling
Factory insulated mineral wool composite panel	Separated on-site	£2.00/m2	Fragmentation/shredding

Note: Includes transport up to 100miles.

International Standards

Reassurance of International Standards:
Tegral Metal Forming have been manufacturing in Ireland for over 30 years and have recently been awarded the ISO 14001 International Standard for Environmental Management.

The Colorcoat® brand is the recognised mark of quality and metal envelope expertise from our supply partners Corus. With over 40 years experience, Corus actively develop Colorcoat® products and processes to reduce their environmental impact to a level beyond mere compliance. All Colorcoat® products are manufactured in factory controlled conditions, providing clear advantages on-site in terms of speed of construction and minimising social disruption.

Colorcoat® products manufactured in the UK are certified to the independently verified international management system, ISO14001 and are 100% recyclable. The Colorcoat® manufacturing site in North Wales contains a number of sites of special scientific interest within its boundaries, demonstrating an ability to manage our operations and their environmental impact without compromising biodiversity. This site has also been a winner of the Business Commitment to the Environment prize on numerous occasions most recently in 2004.

Environmental Product Declarations: Introduction

Confidex Sustain™

Confidex Sustain™ offers the first Carbon Neutral building envelope in the world, measuring and offsetting its impact from cradle to grave i.e. manufacture through to installation, use and disposal/recycling.

Available when Colorcoat HPS200® and/or Colorcoat Prisma® are specified as part of a Colorcoat® assessed cladding system, Confidex Sustain™ covers the whole cladding system, from the pre-finished steel used for the inner and outer sheets, to the cladding, fixings and insulation.

Life cycle assessment

Environmental impact categories:

Global warming

The rising of global temperatures due to emissions of green house gases. Measured in kg eq.CO2. Includes the impact of high global warming potential gases such as the Hydrofluorocarbons (HFCs) used in PIR foam manufacture.

Acidification

The damage caused to trees and life in lakes and rivers as a result of the increase in pH of terrestial watercourses due to the release of acidifying gases to atmosphere.

Eutrophication

A form of water pollution that can result in the loss of plants and animals in aquatic ecosystems. The release of nitrogen and phosphorus from fertilisers and detergents and organic matter from effluent can lead to an acceleration of the natural oxygen depletion in water courses.

Photochemical oxidant formation

Emissions of Volatile Organic Compounds (VOCs) and nitrogen oxides can interact in the lower atmosphere to cause smog which can be harmful to human health and the environment.

Resource depletion

The depletion of natural resources such as oil, coal and metals due to their extraction and consumption.

Embodied energy

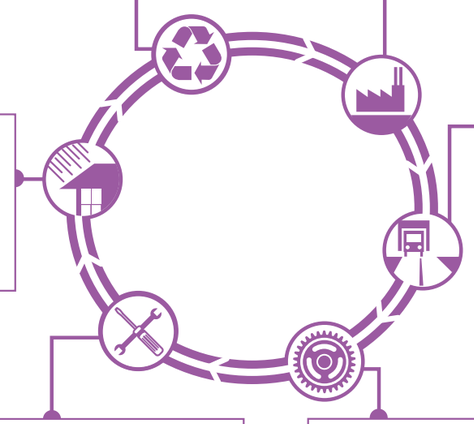
The quantity of energy required to manufacture, and supply to the point of use, a product, material or service. The embodied energy of pre-finished steel is comparable to many other construction materials. However, as it can be recycled without effecting quality, the embodied energy is reduced over multiple life cycles. Therefore, the embodied energy is much less significant than the energy consumed through heating, cooling and lighting of a typical building.

DESIGNER'S ROOFING AND CLADDING GUIDE Environmental Sustainability

Environmental Product Declarations: Introduction

Cradle to grave analysis

The cradle to grave analysis covers all life cycle stages.



End of life

Includes impacts from:
- built-up system steel content 79% recycled, 15% re-used, 6% landfill.
- composite panel steel content 100% recycled, 0% re-used, 0% landfill.
- all insulation to landfill (foam and mineral wool). Although they have the potential to be recycled current practice for demolition, and infrastructure limitations, results in most insulants being landfilled.
- 95% recovery of composite panel blowing agent by fridge recycling process.

Production of system components

Includes impacts from:
- production of pre-finished steel and spacer bars.
- production of insulation.
- production of fixings and plastic components.

Use

As Colorcoat HPS200® and Colorcoat Prisma® are maintenance free, no significant environmental exchanges occur during the building lifetime.

Resource depletion

Includes impacts from:
- delivery from Corus to system manufacturer.
- delivery to site.
- delivery of insulation and other system components to site.

The difference between the number of vehicles required to transport built-up and composite systems to site is also accounted for.

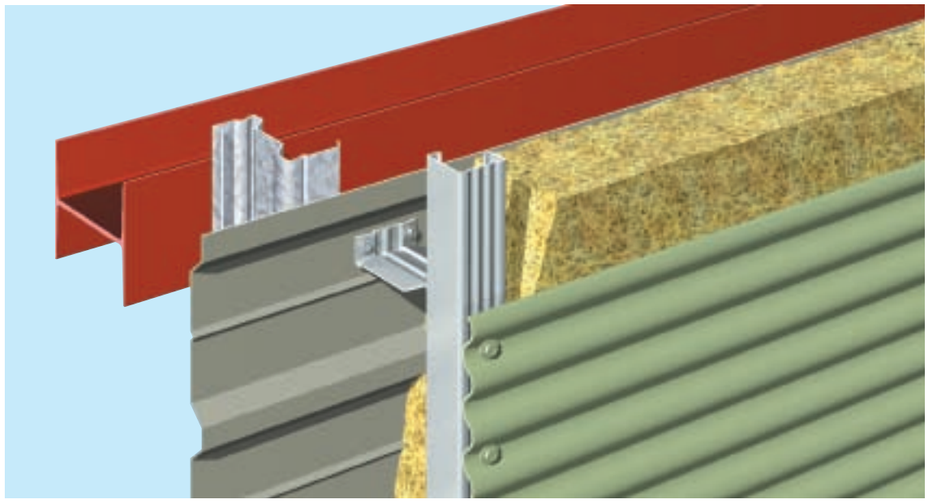
System installation

Includes impacts from:
- allowances made for cladding side and end-laps.

System manufacture

Includes impacts from:
- profiling of pre-finished steel for cladding.
- composite panel manufacture (foam and mineral wool).
- 6% of composite panel blowing agent lost in manufacture.

Fineline 19 Wall



Material declaration

Steel	kg	%
Cladding (inner and outer sheet)	11,016.71	70.63
Spacer	864.69	5.54
Fixings (stainless steel)	35.39	0.23

Others	kg	%
Insulation	3,680.00	23.60

Fineline 19 Wall

With a reputation for proven weather protection, durability and fire performance, Tegral Fineline 19 is the most versatile profile in the range, this sinusoidal profile has a scale and form that contrasts with other materials on all building types.

The distinct profile allows for the choice of horizontal and vertical designs and can be used in a choice of economical applications.

An Environmental Product Declaration (EPD) provides a summary of theenvironmental impacts of a product or system from cradle to grave.

The data published here is based on an initial Life Cycle Assessment (LCA) study conducted by Corus in 2002 in accordance with the international standard ISO 14040-3. This LCA has been subsequently refined and extended to include more products and systems.

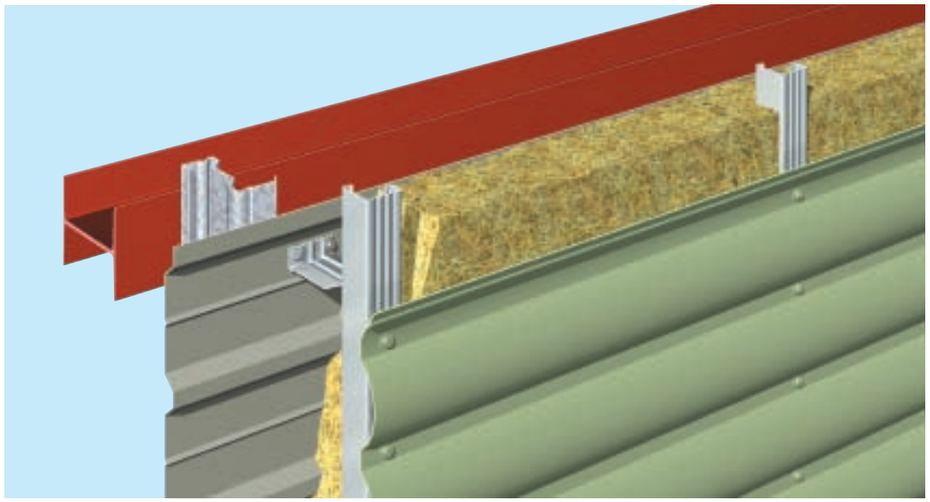
It is important that all LCA studies are carried out using this standard and that a critical review is used to ensure high levels of quality and consistency. This will make the results more meaningful for all parties.

Cladding System Assumptions

- The functional unit is 1000m^2 of pre-finished steel cladding in the main body of the roof or wall excluding rooflights and edge details at eaves, ridges and walls.
- The cladding system is covered in entirety and includes fixings, insulation and the inner and outer pre-finished steel cladding sheets and their associated spacers. Sealant strips, mastics and tapes have been excluded due to their negligible impact on the whole system analysis.
- The cladding system lifetime is defined as the appropriate Confidex® Guarantee Period for the pre-finished steel product e.g. Colorcoat HPS200® or Colorcoat Prisma® specified.
- Thermal performance is specified in accordance with the Irish Building Regulations Part L, Elemental Heat Loss Calculation Method, nominal U-value 0.27 Wm-^{2}K for walls and 0.20 Wm-^{2}K for roof systems. Detailing and installation are in accordance with the MCRMA, system manufacturers installation guide and Corus best practice.

DESIGNER'S ROOFING AND CLADDING GUIDE Environmental Sustainability

Arcline 40™ Wall



Material declaration

Steel	kg	%
Cladding (inner and outer sheet)	10,949.66	70.36
Spacer	648.52	4.23
Fixings (stainless steel)	35.39	0.23

Others	kg	%
Insulation	3,680.00	25.18

Arcline 40 Wall

With a reputation for proven weather protection, durability and fire performance, Tegral Arcline 40™ has a distinct half-round shape and complements the growing trend for feature elevations and curved building forms. Ideal for large-scale projects, Arcline 40™ maintains a strong visual impact even when viewed from a distance.

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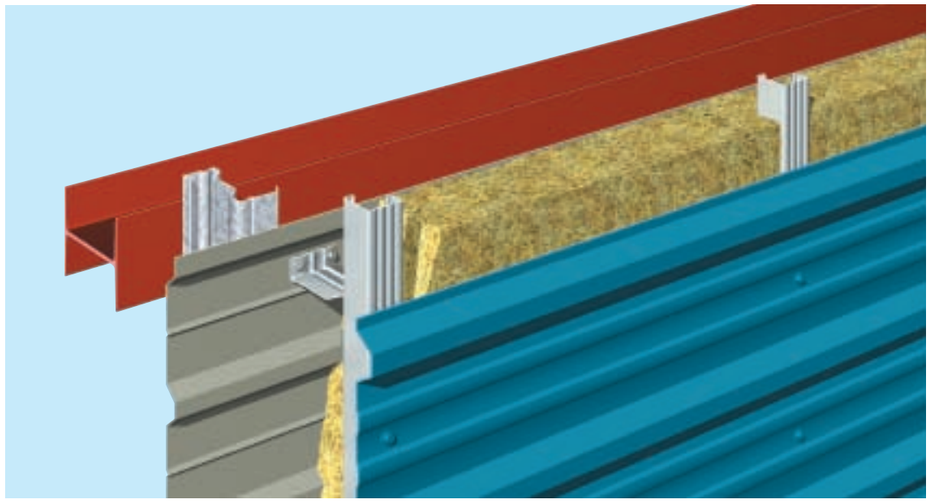
- Thermal performance is specified in accordance with Part L Building Regulations 2006, nominal U-value 0.32 Wm-^{2}K for wall and 0.25 Wm-^{2}K for roof systems, with an air permeability bettering 10m 3/hr/m^2. Detailing and installation are in accordance with the MCRMA, system manufacturers installation guide and Corus best practice.

Broad Rib C40 Wall



Material declaration

Steel	kg	%
Cladding (inner and outer sheet)	13,643.62	72.00
Spacer	670.00	3.53
Fixings (stainless steel)	35.39	0.19

Others	kg	%
Insulation	4,600.00	24.28

Broad Rib C40 Wall

Broad Rib C40 is a trapezoidal profile with an efficient 1000 mm cover width and 40 mm deep ribs. Between the ribs each pan is characterised by twin stiffening ribs.

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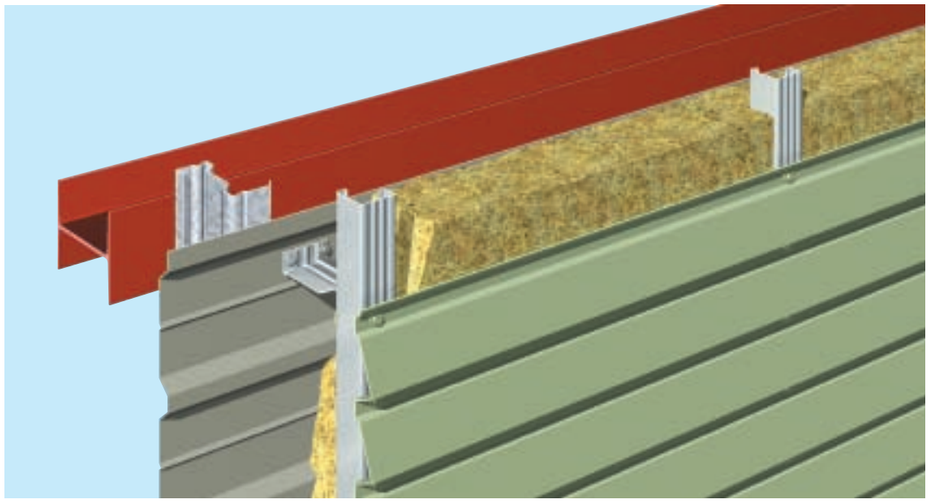
DESIGNER'S ROOFING AND CLADDING GUIDE Environmental Sustainability

Shadowline 47™ Wall



Material declaration

Steel	kg	%
Cladding (inner and outer sheet)	11,734.77	72.89
Spacer	648.52	4.03
Fixings (stainless steel)	35.39	0.22

Others	kg	%
Insulation	4,600.00	23.63

Shadowline 47 Wall

With a reputation for proven weather protection, durability and fire performance, Tegral Shadowline 47™ is a louvre-like profile with sharp lines, providing strong contrast to flat wall panelling, making this the most popular cladding profile for horizontal application in Ireland.

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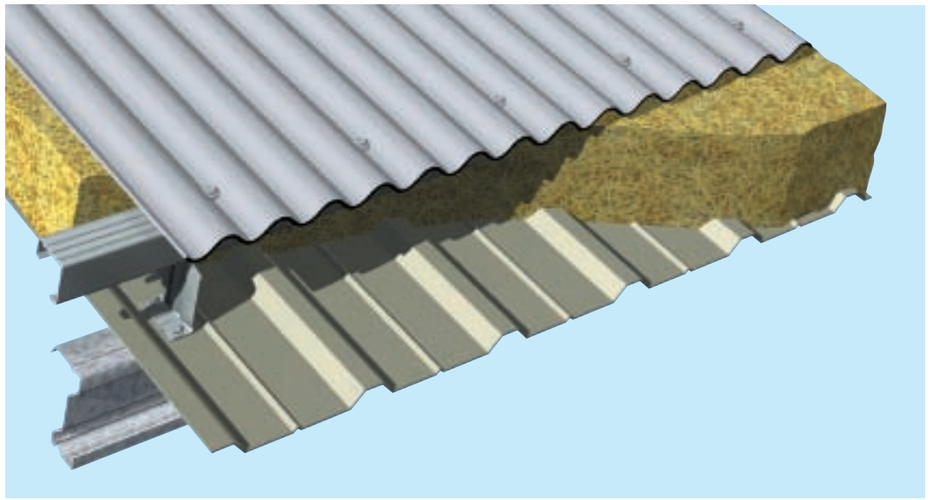
Fineline 19 Roof



Material declaration

Steel	kg	%
Cladding (inner and outer sheet)	13,710.67	70.45
Spacer	1,116.67	5.74
Fixings (stainless steel)	35.39	0.18

Others	kg	%
Insulation	3,680.00	22.86

Fineline 19 Roof

Used as a roofing profile, Fineline 19 offers a traditional effect that can contrast well with other contemporary cladding materials.

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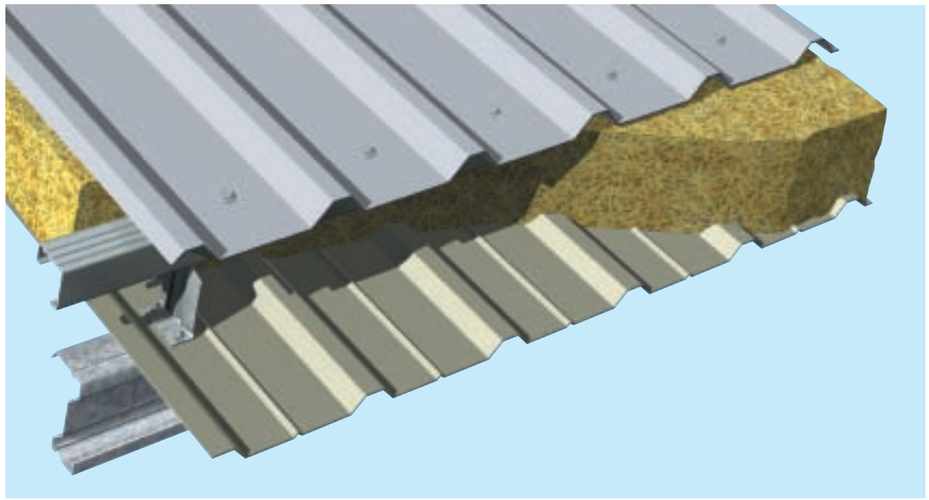
Wide Rib R33 Roof



Material declaration

Steel	kg	%
Cladding (inner and outer sheet)	13,643.62	72.00
Spacer	670.00	3.53
Fixings (stainless steel)	35.39	0.19

Others	kg	%
Insulation	4600.00	24.28

Wide Rib R33 Roof

A trapezoidal profile offering an efficient 1000 mm coverwidth and providing a functional linear rib design with rib depths of 33 mm.

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Weather Proofing

'Climate is what we expect.....
weather is what we get' (Mark Twain)

Weather Proofing

Weatherproofing

Metal roofing and cladding systems have been successfully used in buildings in vast quantities over many years and are by now a tried and trusted form of construction.

The Code of Practice for the Use of Profiled Sheet for Roof and Wall Cladding on Buildings **(BS5427 Part 1 Design)** gives recommendation for the design and construction of external cladding assemblies for roof and walls of buildings using profiled sheeting as the external surface. The Code considers the following factors, and others-

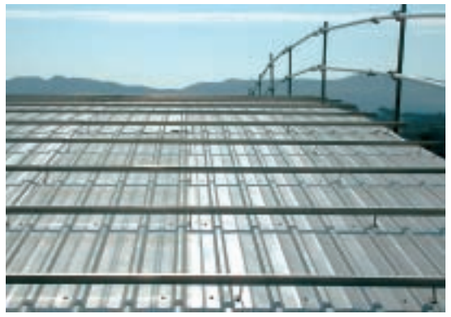
a) weathertightness
b) strength and rigidity
c) thermal insulation
d) control of condensation
e) temperature and thermal movement
f) sound insulation
g) fire precautions
h) appearance
i) durability and maintenance
j) daylighting
k) external attachments
l) lightning protection
m) design detailing
n) maintenance, remedial work and renewal

Metal roofing and cladding has demonstrably withstood the ravages of the rain, snow and winds of Northern Europe. The key issue when considering the weatherproofing of any building however is the sealing of the joints, junctions and penetrations. The risk of leaks increases as the roof pitch decreases and the run off of water is slower. The risk is greater again, the more exposed the building is to the elements.

Ultimately however, it is the standard of workmanship and the quality of fasteners and sealants which will determine the quality of the seals at the risk areas around rooflights, apertures, side and end laps, ridges and penetrations.

Tegral Alu-seam®

Tegral Deep Rib R60 roofing
Tegral Broad Rib R40 cladding



Tegral CL5/1000 liner sheet

Roof Pitches & Lap Sealing

Minimum recommended roof pitch

Profile type	Minimum pitch
Secret fix	*1.5º*
Trapezoidal (minimum 32mm height)	*4º*
Sinusoidal (Fineline 19) and Trapezoidal (minimum19mm height)	*10º*

Note: BS 5427 : Part 1 requires that the supporting structure is set 1.5º in excess of the above figures.

End laps and Sealants

A brief summary of sealant types used in metal roof and wall cladding is given below. For more detailed specification information, refer to MCRMA Technical Paper No.16 Guidance for the Effective Sealing of End Lap Details in Metal Roof Construction.

Sealant types

Application	Sealant type
Inside joint profiled metal sheeting. Inside joint flashing to flashing. Inside joint flashing to profiled metal sheeting.	*High performance round bead minimum diameter 6mm or, 6mm x 5mm butyl strip sealant such as Hodgson Sealants HP400.*
Over joint for liner sheets. Over joint for all internal junctions.	*High performance barrier tape 50mm wide x 1mm thick such as Hodgson Sealants Polyband.*
Sealing filler blocks to profiles	*High performance flat tape sealant 30mm wide x 3mm thick.*

Liner sheet sealing

The metal lining layer should be regarded as a vapour control layer and also must be airtight.

It is therefore absolutely essential to ensure effective sealing, not only at liner sheet joints, but also at all junctions especially at penetrations and roof to wall interfaces.

Sealing method

Inside joint sealing is suitable for
- side laps of liner panels with fully supported (A section underlap)
- overlapping end laps of profiled liner sheets.

Over joint sealing is suitable for
- all liner panel side laps
- butting end laps
- sealing on to penetrations.

High performance barrier tapes should be securely adhered over joint.

The sealants or tape should be positioned in straight, unbroken lines. It should be placed into the profile troughs rather than being stretched into position. It is essential to ensure the continuity and effectiveness of seal, especially at the corners of sheets. The sealant should not be over-compressed.

Essential ancillaries

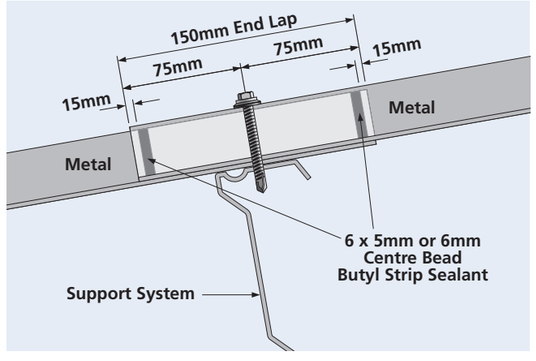
Filler blocks must be provided to close open ribs of liner sheets. The filler blocks are bedded top and bottom in continuous strip sealant.

Internal flashings are required to ensure continuity and effectiveness of the seal, especially at corners of sheets such as at roof/wall junctions and at all penetrations such as pipes, ducts and rooflights.

End laps for external sheeting

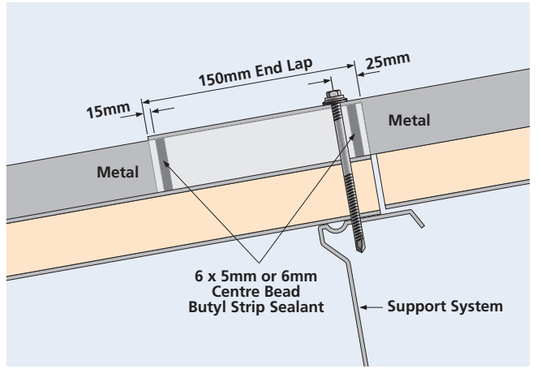
It is recommended that the sealant be placed within the end lap as close to the sheet end as possible, ideally 15mm. Typically two lines of sealant are used and these should be placed at each end of the lap.

Twin Skin systems (External sheet) End Lap

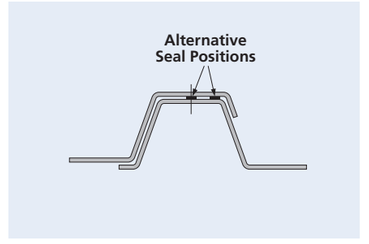


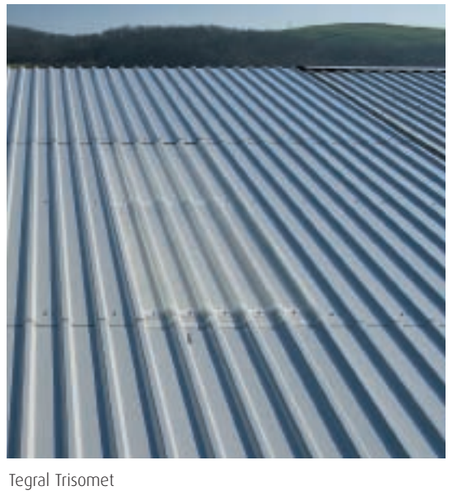
Roof Pitches & Lap Sealing

Composite Panels End Lap



Side Lap





Tegral Trisomet

Application	End lap length	Sealant Requirement
Roofs 4º - 15º	*150mm*	*2 lines of sealant*
Roofs 15º +	*150mm*	*1 line of sealant*
Walls—vertical cladding	*100mm*	*No sealant*
Walls—horizontal cladding (exposed conditions)	*150mm*	*1 line of sealant*

Side lap sealing

Sealant is required in the side laps of roofing profiles and horizontal wall cladding in exposed conditions. Place one line of 6 x 5 or 6mm diameter high performance butyl strip sealant between sheets, prior to fixing, along the profile crown within the lap. In side laps as in end laps it is essential to ensure the continuity and effectiveness of seal, especially at the corners of sheets.

Tegral Arcline 40™

Fastener recommendations

Fastener Types

Fasteners are either considered as primary or secondary. Primary fasteners are designed to transfer the relevant loads to the support structure and, in the case of external sheet fixings, provide a weathertight seal. They are usually positioned in the valley of the sheet profile, and come complete with a 16mm or 19mm diameter EPDM/metal combination sealing washer, and integral or push-on colour matched p.v.c. caps.

Secondary fasteners are used to stitch side laps, flashings etc. The main function of secondary fixings is to provide a weathertight seal. However they also transfer load from sheet to sheet and are critical in stressed skin design.

See the next page for description and application of fastener types.

Fastener Frequency

The table indicates satisfactory fixing arrangements for Tegral profiles. However there may be a requirement for more fixings than indicated here if the fastener limits are exceeded. The limits are exceeded if either the pull out value or the pull over value of the fastener in question is less than the actual load acting on the fixing, multiplied by the load factor (usually 2).

Long span sheets used in high wind load areas are especially subject to fastener limitations and the fasteners should always be checked.

Reputable manufacturers such as SFS Intec and EJOT will supply pull out and pull over figures. Note that the pull out value of a fastener is dependent on the material and thickness of material of the support and the specification of the fixing. The pull over value is dependent on the material and thickness of material of the profile and the washer type and diameter

Fasteners are available in either plated carbon steel or stainless steel.

EJOT **00 44 113 247 0880**

SFS Intec **00 44 113 208 5500**

For further guidance refer to MCRMA Technical Paper No. 12: Fasteners for Metal Roof and Wall Cladding: Design, Detailing and Installation Guide.

For Tegral Insulated Panels refer to Section 1: Insulated Panels of this Guide.

Roof Cladding

Profile	Main fixings at sheet ends	Main Fixings (intermediate)	Side lap fixings
Fineline 19	5 per sheet*	3 per sheet*	450mm*
R32	5 per sheet	3 per sheet	450mm
Wide Rib 33	5 per sheet	3 per sheet	450mm
Broad Rib 40	6 per sheet	3 per sheet	450mm
Mid Rib 46	4 per sheet	2 per sheet	450mm
Deep Rib 60	4 per sheet	2 per sheet	450mm
Seam-Loc	2 per Seam-Loc clip		
Alu-seam®	2 per Alu-seam® clip		
Trinsul	As per the chosen outer sheet above.		

*Fix through profile crown.

Wall Cladding

Profile	Main fixings at sheet ends	Main Fixings (intermediate)	Side lap fixings
WP 40	1 per sheet	1 per sheet	450mm
Mini Rib	5 per sheet	3 per sheet	450mm horizontal 600mm vertical
Fineline 19	5 per sheet	3 per sheet	450mm horizontal 600mm vertical
PL 19	5 per sheet	3 per sheet	450mm horizontal 600mm vertical
Wide Rib 33	5 per sheet	3 per sheet	450 mm horizontal 600mm vertical
Broad Rib 40	6 per sheet	3 per sheet	450mm horizontal 600mm vertical
Mid Rib 46	4 per sheet	2 per sheet	450mm horizontal 600mm vertical
Deep Rib 60	4 per sheet	2 per sheet	450mm horizontal 600mm vertical
Shadowline47™	5 per sheet	3 per sheet	600mm horizontal 600mm vertical
Arcline 40™	5 per sheet	3 per sheet	600mm horizontal 600mm vertical

* NOTE: Certain Firewall assemblies may require side lap stitching at closer centres - please refer to Fire Performance Section

Liner Sheets

Profile	Gauge	Main Fixings at sheet ends	Main Fixings (intermediate)	
Mini Rib	0.7mm	8 per sheet	6 per sheet	Roofing
	0.7mm	6 per sheet	4 per sheet	Wall Cladding *
Fineline 19	0.4mm	6 per sheet	6 per sheet	Roofing/Wall Cladding *
	0.7mm	5 per sheet	5 per sheet	Roofing/Wall Cladding *
CL5/1000	0.4mm	6 per sheet	6 per sheet	Roofing
	0.7mm	6 per sheet	6 per sheet	Roofing
	0.4mm	5 per sheet	3 per sheet	Wall Cladding *
	0.7mm	5 per sheet	3 per sheet	Wall Cladding *
PL-19	0.4mm	6 per sheet	6 per sheet	Roofing
	0.7mm	6 per sheet	6 per sheet	Roofing
	0.4mm	5 per sheet	3 per sheet	Wall Cladding *
	0.7mm	5 per sheet	3 per sheet	Wall Cladding *
Wide Rib 33-1000	0.4mm	5 per sheet	3 per sheet	Roofing
	0.7mm	5 per sheet	3 per sheet	Roofing
	0.4mm	5 per sheet	3 per sheet	Wall Cladding *
	0.4mm	5 per sheet	3 per sheet	Wall Cladding *
HL 600	1.0mm	3 per sheet	3 per sheet -	Stitching at 400mm centres. Roofing/Wall Cladding*

Note: Fixings required for brackets of support systems included.
* NOTE: Certain Firewall assemblies may require side lap stitching at closer centres - please refer to Fire Performance Section

Fastener types

Fixing Type	Illustration	Application
Primary Fasteners		
Short drill screws with sealing washers. Typical specification 5.5mm diameter self-drilling austenitic stainless steel or carbon steel fasteners with 15mm or 19mm sealing washers. SFS, EJOT or similar approved.		1 to fix outer cladding directly to spacer bar. 1 to fix liner panels, or decks to purlins, where liner is either required to act as a vapour control layer or as a non-fragile liner or both. Into steel up to 6mm thick
High thread drill screws with sealing washers. Typical specification 5.5mm diameter self-drilling high thread austenitic stainless steel or carbon steel fasteners with sealing ring and load spread washer SFS, EJOT or similar approved.		1 to fix composite panels to steel purlins 1 to fix Trinsul to steel purlins. Into steel up to 6mm thick
Short drill screws without sealing washers. Typical specification 5.5mm diameter self-drilling austenitic stainless steel or carbon steel SFS, EJOT or similar approved.		1 to fix spacer brackets to purlins
Self tapping screw with sealing washers Typical specification 6.3mm diameter self-tapping austenitic stainless steel or carbon steel SFS, EJOT or similar approved.		1 to fix outer cladding directly to spacer bar. 1 to fix liner sheets, or decks to purlins, where liner is either required to act as a vapour control layer or as a non-fragile liner or both. Into timber at least 25mm thick.
Wafer head short drill screws 5.5mm diameter low profile head self-drilling austenitic stainless steel or carbon steel SFS, EJOT or similar approved.		1 to fix Standing seam profile clips to spacer bar
Secondary Fasteners		
Stitcher drill screws with sealing washers. Typical specification 5.5mm diameter self-drilling austenitic stainless steel or carbon steel fasteners with 15mm or 19mm sealing washers.		1 to fix sheet to sheet 1 to fix side laps on cladding 1 to fix flashings to cladding.
Sealed rivets		1 to fix sheet to sheet 1 to fix side laps on cladding 1 to fix flashings to cladding.

Tegral Products - Structural Performance

The most commonly used structural type for buildings using metal roof and wall systems is a hot rolled steel structural frame. The cladding systems are supported from secondary steelwork consisting of purlins and rails made from light gauge cold rolled zinc coated steel (Tegral Zeta purlins and rails). Alternatively in older buildings the purlins and rails may be timber, hot rolled steel sections or even pre-stressed concrete.

Long span structural decking or structural liner trays can be used to span directly between the main frames, which dispenses with the need for secondary supports altogether.

Timber framing is used for institutional, educational and domestic buildings and in some cases these will utilise metal cladding systems. Reinforced or pre-stressed concrete is sometimes used for portal frames.

STRUCTURE TYPE	MATERIAL	BRITISH STANDARD
Main Frame	*Hot rolled steel frame*	*BS 5950-1: 2000 Structural use of steelwork in building. Code of practice for design. Rolled and welded sections.*
	Timber	*BS 5268-2:2002 Structural use of timber. Code of practice for permissible stress design, materials and workmanship. BS EN 408:1995 Timber structures. Structural timber and glued laminated timber. Determination of some physical and mechanical properties.*
	Reinforced concrete	*BS 8110-1:1997 Structural use of concrete. Code of practice for design and construction.*
Secondary supports (purlins for the roof and rails for the walls)	*Cold formed steel*	*BS 5950-5:1998 Structural use of steelwork in building. Code of practice for design of cold formed thin gauge sections.*
	Hot rolled steel	*BS 5950-1:2000 Structural use of steelwork in building. Code of practice for design. Rolled and welded sections.*
	Timber	*BS 5268-7.7:1990 Structural use of timber. Recommendations for the calculation basis for span tables. Purlins supporting sheeting or decking.*
	Reinforced concrete	*CP 115:1969 The structural use of prestressed concrete in buildings.*
Structural Decking and structural liner trays	*Profiled steel*	*BS 5950-6:1995 Structural use of steelwork in building. Code of practice for design of light gauge profiled steel sheeting.* *BS 5950-9:1994 Structural use of steelwork in building. Code of practice for stressed skin design.*

It is essential that tolerances specified in the relevant standards are adhered to. In some cases (for example where horizontal cladding is being used) tighter tolerances may be needed or special adjustments may be required.

DESIGNER'S ROOFING AND CLADDING GUIDE Structural Performance

Structural Requirements of profiled metal sheeting

The structural performance of profiled sheeting may be determined either by testing or by calculation. Normally, it is determined by calculation, except for some profiles, such as concealed fix or raised seam profiles, which are outside the scope of the design rules.

Structural design is carried out in accordance with **BS 5950 : Part 6 : 1995** Structural use of steelwork in building. Part 6 : Code of practice for design of light gauge profiled steel sheeting. Further requirements on structural design are to be found in **BS 5427 : Part 1 : 1996** The use of profiled sheet for roof and wall cladding on buildings. Part 1. Design.

Limit state

In line with current practice, **BS 5950 : Part 6** is based on 'Limit State' design principles. The load bearing capacity of profiled sheeting is determined by two limiting loads: the ultimate limit load, i.e. actual failure load, and the serviceability limit load, i.e. deflection limit load. (In the past design codes for profiled sheeting were traditionally based on elastic design principles in which the upper limit on loading is determined by limiting the maximum stresses in the profile to the yield stress divided by a safety factor.)

Load tables

If the principles of limit state design were followed exactly, load tables would show the collapse (ultimate limit) load for the profile. However this would obviously be an unsafe practice and indeed **BS 5427** requires that published load/span tables should be expressed as safe working loads. Therefore, in Tegral's published load tables, the limiting collapse load is divided by 1.5. Serviceability (deflection) defined loads are not divided by a factor. The load shown in the table is the least of the lowest collapse load divided by 1.5 and the deflection-limited load.

Failure modes

In determining the collapse load, the following failure modes are considered:

Tensile Fracture

In practice, tensile failure is extremely unlikely since with thin plate elements the compressive instability of the thin flanges is more critical.

Compressive Buckling

Compressive buckling, rather than tensile failure, is much more likely to be a limit on performance. In calculation, the actual width of the compressive elements is reduced to account for the loss of strength caused by localised buckling. Compressive buckling is particularly relevant to wide compressive flanges, which are usually stiffened by longitudinal ribs.

Shear Failure

Shear failure is unlikely except in the webs of very deep profiles when they are used over short spans. For this reason, very deep profiles often contain web stiffener elements.

Web Buckling

Web buckling can be a limiting factor in profiled sheeting, particularly when the sheets are used in double span or multi-span conditions. In these circumstances, failure would occur over intermediate purlins, as a result of an interaction between compressive buckling of the flanges and buckling of the webs.

Calculations required by BS 5950 : Part 6

Taking into account the above failure modes **BS 5950 : Part 6** requires the following calculations:

Single spans:	Mid-span bending moment under upward and downward loading, web crushing and shear at the supports.
Double and multi spans:	Mid-span bending moment under upward and downward loading, combined bending and web crushing at inner supports.
	Combined bending and shear at inner supports.

Structural Requirements of profiled metal sheeting

Deflection limits

A high deflection does not necessarily constitute a structural failure of the profiled sheet. In many cases it would be possible to exceed greatly the permitted deflection of a sheet, and still achieve 100% recovery on removal of the loading.

Deflection limits are usually chosen to prevent consequential problems such as

- inadequate drainage at low pitches, due to ponding
- broken seals at joints, causing leaking
- undue strain at fixings on overlaps
- damage to or excessive strain between other connecting components or lining materials
- surface distortions on flat panels. The designer of the building should choose the deflection limit, based on the combination of the profile and the design and nature of the building. Apart from specialised architectural cladding, the considerations for walling are not as critical as for roofing. This factor is reflected in the relevant standards.

Deflection limits are normally specified by the ratio of the maximum deflection divided by the span. The following span ratios are shown in **BS 5950 : Part 6**.

L:120 Wall Cladding under dead and wind load.
L:200 Roof Cladding under dead and imposed load.
L:500 Roof Cladding under dead load.

L:250 Is not shown in **BS 5950 : Part 6** but is the normal ratio used for structural roof decking under dead and imposed load.

Limiting criteria

In practice the limiting load on a profile may be any of the above, but longer spans tend to be deflection limited. This is especially noticeable on single span sheeting which deflects far more than sheeting in double or multi span.

Project: St. Vincent's Centre, Dublin
Architects: Burke-Kennedy Doyle
Product: Tegral Seam-Loc

Loading

	Wind Load kN/m²	*Snow load kN/m²*	*Uniformly distributed imposed load kN/m²*	*Concentrated load kN*
Roof with access	*As determined by BS 6399 Part 2*	*As determined by BS 6399 Part 3*	*1.5 kN/m²*	*1.8 kN*
Roof with no access	*As determined by BS 6399 Part 2*	*As determined by BS 6399 Part 3*	*0.6 kN/m²*	*0.9 kN*
The loads are not considered to act at the same time				

Imposed loads

Two types of imposed load are considered, uniformly distributed load (UDL) and concentrated load.

These are defined by **BS 6399 : Part 3** which differentiates between roofs with access and roofs without access, as may be seen in the above table.

Concentrated load is assumed to act over a square with sides of 125mm, **BS 5950: Part 6** considers that concentrated load is equivalent to the line loading as follows:

Concentrated Load	Line Load
0.9kN	*1.5kN/m²*
1.8kN	*3.0kN/m²*

Imposed load normally has a factor of 1.6 applied to it, dead load has a factor of 1.4.

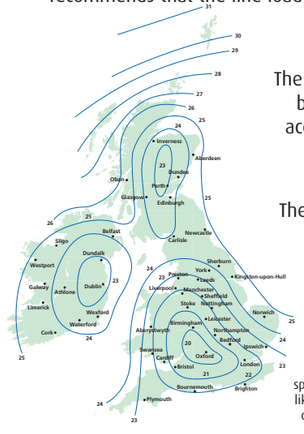
Construction Loads

Where it is likely that construction loads will occur on roof sheeting designed for the minimum imposed roof loads for roofs with no access, **BS 5950 Part 6** recommends that the line load of 1.5 kN/m should be increased to 2 kN/m.

Wind Load

The wind loading acting on buildings is calculated in accordance with **BS 6399: Part 2** Code of Practice for Wind Loads.

The basic wind speed V_b is chosen according to geographical location as shown on the map.



Basic Wind Speed for UK & Ireland
Map taken from **BS 6399: Part 2: 1997** Basic wind speed in m/s - maximum gust speed likely to be exceeded on the average only once in 50 years at 10m above the ground in open level country.

There are two methods given in the BS, a standard method and a directional method. The latter is a more accurate method determining the load from wind in each direction, which allows for some refinement in design.

Using the standard method:

The basic wind speed V_b is selected as above and the loading is derived by the following procedure.

1. The site wind speed V_s = V_b x altitude factor x directional factor x seasonal factor x probability factor.
2. Select the "Terrain & Building Factor" S_b, from Table 4; this depends on the distance to the sea, the building height and town or country location.
3. Effective wind speed $V_e = V_s \times S_b$
4. Dynamic pressure $q_s = 0.613 \times V_e^2$
5. Select "External Pressure Coefficients" C_{pe}, from sections 2.4 and 2.5. These depend on whether it is a wall or roof, the building shape and the location of nearby buildings. Each building face is separated into zones with higher pressure coefficients at the perimeters and corners.
6. External wind suction/pressure = $q_s \times C_{pe}$ kN/m²
7. Select "Internal Pressure Coefficients" C_{pi}, from section 2.6. This depends on the building size and especially the openings.
8. Internal wind pressure = $q_s \times C_{pi}$ kN/m²

Quick Estimates

Various quick estimating methods exist which are reasonably accurate for simple buildings. The MCRMA / NFRC "Roofing Industry Wind Design Guide 'First Estimate Method'" is one such.

Wind load normally has a factor of 1.4 applied to it in limit state design.

Loading

Snow Load

The snow loading acting on buildings is calculated in accordance with **BS6399 : Part 3** Code of Practice for Imposed Roof Loads.

The basic snow load s_b is chosen according to geographical location as shown on the map below.

The snow load on the roof is determined by the following procedure:

1. The site snow load s_0 is calculated by simple formula depending on altitude.
   For altitudes of 100m or less $s_0 = s_b$
2. The "snow shape coefficient" μ_i is derived.
   For roofs with pitch less than 30° $\mu_i = 0.8$.
3. The snow load on the roof $s_d = \mu_i \times S_0$ kN/m²
4. Local drifting can cause much higher load than this and must be calculated for on roofs where it might occur. Examples of these are roofs with valleys, roofs abutting walls or close to taller structures, roofs with parapets, roofs with tee intersections, roofs with local projections greater than 1m². Simple procedures are given in **BS6399 : Part 3** to calculate the drift loading.

The basic snow load normally will have a load factor of 1.6 and snowdrift load will have a load factor of 1.05 applied to it.

Map taken from **BS6399: Part 3: 1988** Basic snow load on the ground, S_0 in kN/m². Ground level is assumed to be 100m above mean sea level.

Load / Span Tables

The Load/Span tables for each Tegral product may be found in the relevant product technical data sheet.

The following table indicates conservative load/span limits for the range of Tegral roofing and cladding profiles.

LINER SHEETS					
TEGRAL PRODUCT	**MATERIAL**	**GAUGE (mm)**	**WEIGHT (Kg/m²)**	**LOAD/SPAN Maximum Span Load Span (mm)**	**LOAD/SPAN Maximum Span Multi Span (mm)**
Mini Rib	S	0.7	5.73	800	900
Fineline 19	S	0.4	3.88	1200	1500
	S	0.7	6.79	1200	1500
CL5-1000	S	0.4	3.75	1500	2000
	S	0.7	6.57	1500	2000
CL5-1000 Perforated (20%)	S	0.7	6.57	1200	1700
PL19	S	0.7	6.22	1400	1600
Wide Rib 33-1000	S	0.4	3.88	1800	2000
	S	0.7	6.75	1800	2000
	A	0.9	3.03	1500	1800
Wide Rib 33-1000 Perforated (20%)	S	0.7	6.75	1500	1800
	A	0.9	3.03	1200	1500
HL600/130 Liner Tray	S	1.00	13.08	6000	6000
HL600/130 Liner Tray Perforated (30%)	S	0.75	9.81	5000	5000

Note; S = Steel. A = Aluminium.

ROOF PROFILES					
TEGRAL PRODUCT	**MATERIAL**	**GAUGE (mm)**	**WEIGHT (Kg/m²)**	**LOAD/SPAN Maximum Span Load Span (mm)**	**LOAD/SPAN Maximum Span Multi Span (mm)**
Fineline 19	S	0.7	6.81	1200	1500
	A	0.9	3.05	900	1200
R32	S	0.7	7.01	1800	2000
	A	0.9	3.01	1400	1800
Wide Rib 33	S	0.7	6.75	1900	2000
	A	0.9	3.02	1500	1800
Broad Rib 40	S	0.7	6.75	2000	2000
	A	0.9	3.02	1600	1800
Mid Rib 46	S	0.7	7.5	2700	3200
	A	0.9	3.36	2100	2600
Deep Rib 60	S	0.7	8.44	3300	3800
	A	0.9	3.78	2600	3200
Seam Loc	S	0.7	7.99	1300	1800
Alu-Seam®	A	0.9	3.75	1500	2000

Note: S = Steel. A = Aluminium.
Note: assumes load of 1.20kN/m² and deflection limit of L/200

Load / Span Tables

CLADDING PROFILES					
TEGRAL PRODUCT	MATERIAL	GAUGE (mm)	WEIGHT (Kg/m²)	LOAD/SPAN Maximum Span Single Span (mm)	LOAD/SPAN Maximum Span Multi Span (mm)
WP 40	S	0.7	7.50	2000	2200
	A	0.9	3.36	1700	2000
Mini Rib	S	0.7	5.73	800	900
Fineline 19	S	0.5	4.86	1200	1400
	S	0.7	6.79	1300	1600
	A	0.9	3.05	1100	1400
PL19	S	0.7	6.22	1400	1600
Wide Rib C33	S	0.5	4.82	1800	1800
	S	0.7	6.75	1800	2250
	A	0.9	3.02	1700	2100
Broad Rib C40	S	0.5	4.82	1800	1400
	S	0.7	6.75	1800	1800
	A	0.9	3.02	1700	1700
Mid Rib C46	S	0.5	5.35	2800	2200
	S	0.7	7.5	3100	3600
	A	0.9	3.36	2400	3000
Deep Rib C60	S	0.5	6.03	3400	2600
	S	0.7	8.44	3900	4000
	A	0.9	3.78	3000	3700
Shadowline 47™	S	0.7	6.56	2100	2600
	A	0.9	3.02	1800	2200
Arcline 40™	S	0.7	6.74	2200	2600
	A	0.9	3.02	1800	2200

Note: S = Steel. A = Aluminium.
Note: assumes an effective positive wind load of 1.00kN/m² and a deflection limit of L/150
Note: Loadspan tables for Tegral Insulated Panels are included in Section 1 : Insulated Panels of this Guide.

Non Fragile Roof Assemblies

When people walk on roofs during construction or maintenance there is always a risk. In accordance with Health and Safety guidance, and specifically, the HSA Draft Code of Practice for Safety in Roofwork, all new roof assemblies should be designed to achieve non-fragility classification, and avoid the risk of injury or death caused by falls through roof coverings. The appropriate method of test in this regard is ACR[M] 001:2000 Test for Fragility of Roofing Assemblies".
Where buildings are unlikely to have regular ongoing maintenance needs and access to the roof can be strictly controlled, the roof assembly should be designed to a minimum non-fragile standard – Class C to "Test for Fragility of Roofing Assemblies" ACR[M]001:2000.

It is important to note that the assembly (the combination of roofing product, fasteners and method of fixing, sealant and purlin spacing) is subjected to the non-fragility test and hence this assembly must be replicated on site to ensure compliance.

The following table indicates the general requirements in the case of Tegral Twin-Skin and Tegral composite panel roof assemblies –

Note, the non-fragility performance of any metal roofing assembly is subject to the influence of weathering, ultraviolet exposure, environmental pollution and internal and external building environment. Tegral Metal Forming Ltd. therefore cannot indicate a specific period of time for non-fragility performance of any roof assembly containing it's products.

Recommendations and guidance for safe access to roofs and working at heights may be obtained from the Health and Safety Authority.

PRODUCT	MAXIMUM SPAN (mm)	FIXING SPECIFICATION	NUMBER OF FIXINGS	SPAN TYPE	MINIMUM END DISTANCE[2] (mm)	NON-FRAGILE CLASS
19mm deep 0.4mm gauge liner sheets	1800mm	5.5mm Ø self drill screws with 15mm washers	6 per sheet at all supports.	single	100	C
				double & multi	30	C
		5.5mm Ø self drill screws with 19mm washers	3 per sheet at all supports	single	100	C
				double & multi	30	C
19mm deep 0.55mm gauge liner sheets	as shown in the Load/ span section	5.5mm Ø self drill screws with 15mm washers	7 per sheet at sheet ends, 4 per sheet at intermediate supports	single	30	C
				double & multi	30	B
32mm deep 0.7mm gauge liner sheets	as shown in the Load/ span section	5.5mm Ø self drill screws with 15mm washers	3 per sheet at all supports	single	30	C
				double & multi	30	B
0.7mm gauge roof Fineline 19 sheeting	"	5.5mm Ø self drill screws with 15mm washers	every third pitch at all supports	single	30	C
				double & multi		B
0.7mm roof sheeting	as shown in the Load/ span section	5.5mm Ø self drill screws with 15mm washers	5 per sheet at sheet ends, 3 per sheet at intermediate supports	single	30	C
				double & multi		B
Trisomet Composite Panel	"	5.5mm Ø self drill screws with 15mm washers	5 per sheet at sheet ends, 3 per sheet at intermediate supports	double & multi	30	B

1. The number of fixings per sheet must be increased proportionally when the sheet is cut at rake i.e. at hips.
2. Min. end distance is the minimum dimension between the centreline of the screws to the end of the sheet
3. Every other pitch is based on always starting with a fixing in the first pitch of every sheet.

Non Fragile Roof Assemblies

In-plane GRP (Glass-fibre Reinforced Polyester) and polycarbonate rooflights

Roof Application	GRP		Polycarbonate	
	Minimum Recommended GRP Sheet Weight	Non-fragile Classification (when new)	Minimum Recommended Polycarbonate Sheet Weight	Non Fragile Classification (When New)
Single Skin Rigid trapezoidal profiles	3.0kg/m²	Class B	1.2kg/m2 (1mm)*	Class B
Single Skin Rigid sinusoidal profiles	2.4kg/m²	Class C	1.2kg/m2 (1mm)	Class C
Composite Panel Factory assembled continuous box for use with composite panels	Liner sheet - 1.5 kg/m² Outer sheet - 2.4 kg/m²	Class B	Liner Sheet – 1.2kg/m2 (1mm) Outer Sheet – 1.2kg/m2 (1mm)	Class B
Twin-Skin site assembled Rigid trapezoidal or rigid sinusoidal profile outer sheet, flexible trapezoidal liner sheet.	Liner sheet (0.4mm gauge) - 2.4 kg/m² Liner sheet (0.7mm gauge) - 3.0 kg/m² Outer sheet-1.8 kg/m²	Class C (outer sheet not yet fitted) Class B (outer sheet not yet fitted) Class B (fitted liner sheet/outer sheet assembly)	Liner Sheet – 1.2kg/m2 (1mm) Outer Sheet – 1.2kg/m2 (1mm)	Class B

* Note: Sinusoidal profiles from 1mm to 1.4mm gauge and trapezoidal profiles from 1.0mm to 1.3mm gauge can be specified depending on load span requirements. Up to 2mm gauge is available for specific wind load or snow load conditions.

Note: in all cases, rooflight assemblies must be installed strictly to rooflight manufacturer specifications.

Note: classifications quoted above are for purlin spans of 1.35m - 2m, depending on roof profile capacity (applications outside this range to be referred to GRP manufacturer).

Note: ***never*** *walk on rooflights, irrespective of their non-fragility classification.*

In keeping with Health and Safety Authority guidance (ref. Draft Code of Practice for Safety in Roofwork), the rooflight assembly should have a minimum likely period of non-fragility, based on industry guidance, of at least 10 years taking into account the likely deterioration due to ultraviolet exposure, environmental pollution and external building environments. It should be noted that certain types of rooflight assemblies would have expected periods of non-fragility considerably longer than ten years and this should be considered when rooflight assemblies are being specified.

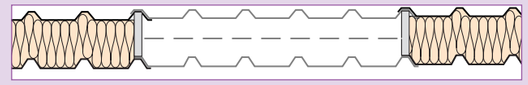
Teglites™

Natural daylight is a vital element that will significantly improve the environment within any building. Rooflights provide three times more light than the same area of vertical glazing.

Full guidance on how best to incorporate natural daylighting into building design may be obtained in the MCRMA Technical Paper 1 - "Recommended Good Practice for Daylighting in Metal Clad Buildings".

Single skin rooflight

Site Assembled Twin Skin Rooflight
This type of construction consists generally of a shallow profiled rooflight sheet to match the Tegral metal liner, a spacer system, perimeter closure and an outer rooflight sheet matching the Tegral metal weather sheet. This fully compliments the assembly of the metal roof.



Factory Assembled Rooflight
A factory made and assembled unit using a purpose designed box assembly of rooflight sheeting. It incorporates a rigid spacer at the purlin line to provide a secure fixing assembly. The units are designed to match and compliment Tegral composite panels.

Tegral supply Teglites™ GRP (glass-fibre reinforced polyester) translucent sheets to match the range of Roof, Cladding, Composite Panel and Liner Sheet profiles.

Tegral Teglites™ GRP translucent sheets to BS 4514:1985 may be supplied to suit Single-Skin, Twin-Skin, Secret-Fix, Site Assembled Composite and Composite Panel systems.

Tegral Trisomet

Fire Performance

The following grades of Teglites™ GRP translucent sheeting are available to meet current Building Regulations requirements:-

Single-Skin application - Grade SAA Class 1

External sheet of Twin Skin application
- Grade SAB Class 3

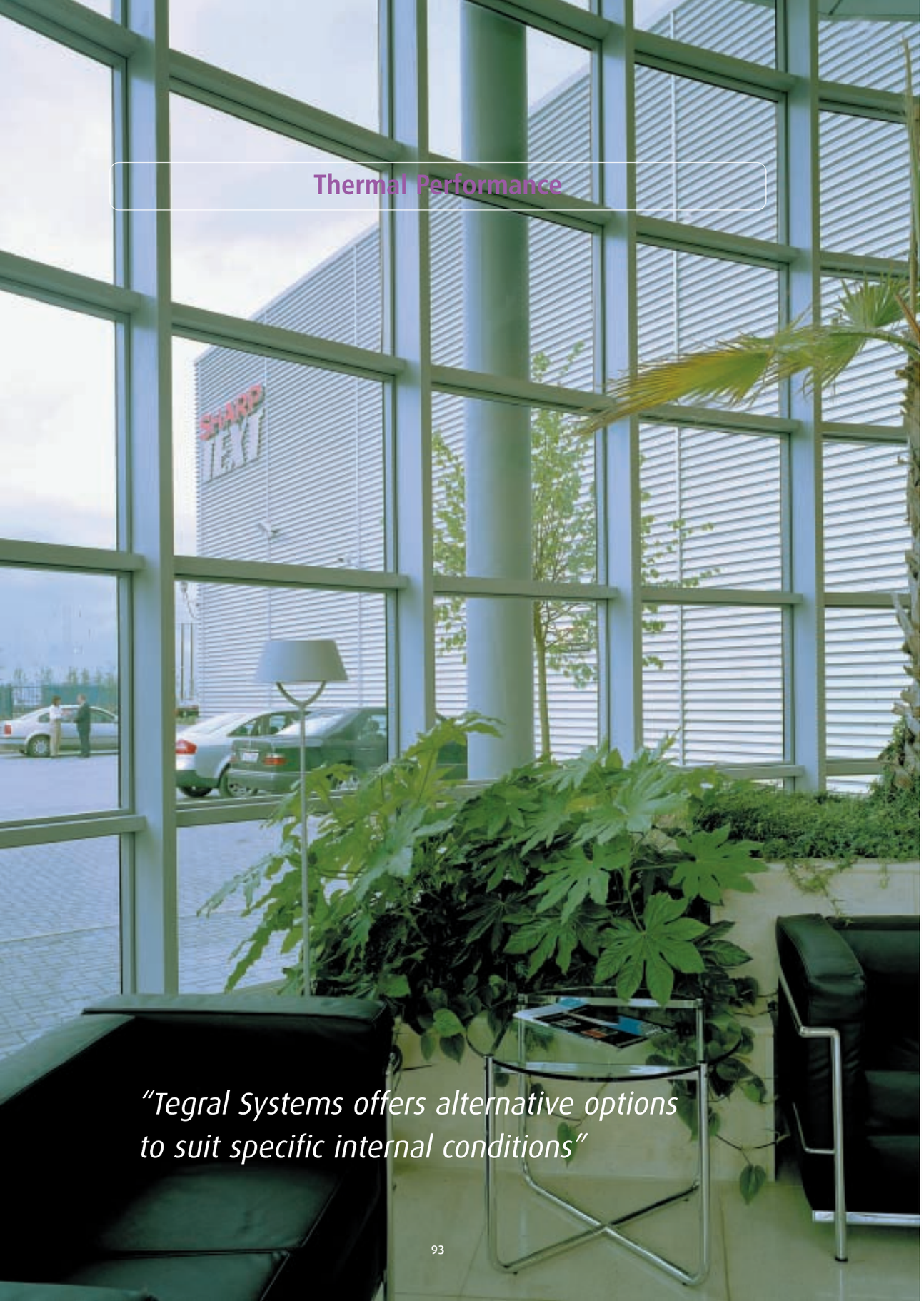
Liner sheet of Twin Skin application
- Grade SAA Class 1

External sheet of Site Assembled Composite system
- Grade SAB Class 3

Liner sheet of Site Assembled Composite system
- Grade SAA Class 1

External sheet of Composite Panel
- Grade SAB Class 3

Liner sheet of Composite Panel
- Grade SAA Class 1



Thermal Performance

"Tegral Systems offers alternative options to suit specific internal conditions"

Thermal Performance

The performance of building in terms of thermal efficiency is based on the efficacy of the envelope in controlling the transfer of heat between the internal and external environments, the resistance to wind and precipitation and the control of humidity. In order to maintain a consistent thermal performance over the life of the building, the individual properties of the materials used in the envelope must work together effectively.

Tegral Metal Forming products and systems can comply with the thermal performance standards included in the Draft Irish Building Regulations 2004 Draft Technical Guidance Document Part L Section 2: Buildings other than dwellings. The different products and systems also offer alternative features and benefits depending on the specific building requirements such as internal humidity levels, occupational usage, and fire safety requirements. Thermal design for non-domestic construction in Ireland should comply with Building Regulations Draft TGD L Section 2: Buildings other than dwellings. For full guidance designers should study the complete document (Ref. www.environ.ie - Building Standards).

The following is a summary of those parts of the Draft TGD that are relevant to Tegral roofing and cladding systems.

Draft Technical Guidance Document Part L Section 2 sets out two methods to demonstrate compliance to the new thermal regulations-

1. Overall Heat Loss method. Acceptable for all buildings.
2. Elemental Heat Loss method. While this method may be used for any building, it is primarily appropriate for small buildings, e.g. less than 300 m^2 floor area, small sections of large complex buildings, material alterations and material changes of use.

Whichever method is used, the building designer must be able to carry out the following steps-

1. Calculate or otherwise show U values for all parts of the building external surfaces.
2. Calculate the area and heat loss of windows doors and rooflights.
3. Calculate the heat lost through all thermal bridges.
4. Show that internal surface condensation will not occur at thermal bridges.
5. Demonstrate air infiltration will be reduced by provision of a continuous air barrier.
6. Show that solar overheating is avoided.

Overall Heat Loss Method

This method sets a maximum acceptable level of transmission heat loss through the fabric of a building, in terms of the maximum average U-value (U_m) of all fabric elements contributing to heat loss.

The level depends on the ratio of the total area of these elements (A_t) to the building volume (V), and is specified in the table below. The acceptable level of heat loss is expressed graphically in the chart opposite.

It is clear that this procedure can only be carried out by the overall building designer, requiring as it does detailed knowledge of all elements of the building fabric - not just the cladding and roofing systems. In particular the heat flow through windows, doors and rooflights must be included in the calculation of average U value of the roof and wall.

In addition to achieving the maximum average value set, average elemental U-values should not exceed the following-

- roofs 0.25 W/m^2K
- walls 0.37 W/m^2K
- exposed floors 0.37 W/m^2K
- ground floors 0.37 W/m^2K

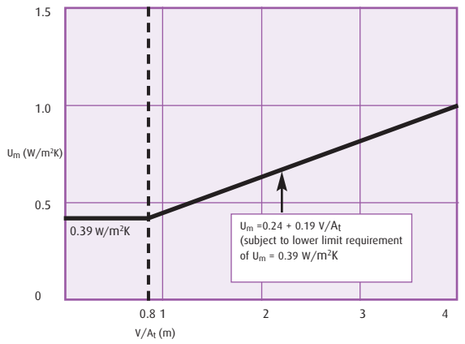
Maximum average U-Value (U_m) as a function of building volume (V) and fabric heat-loss area (A_t)

Area of Heat Loss Elements/ Building volume (A_t/V) (m^{-1})	Maximum Average U value (U_m) (W/m^2K)
1.3	*0.39*
1.2	*0.40*
1.1	*0.41*
1.0	*0.43*
0.9	*0.45*
0.8	*0.48*
0.7	*0.51*
0.6	*0.56*
0.5	*0.62*
0.4	*0.72*
0.3	*0.87*

NOTE 1: The expression $U_m = 0.24 + 0.19\ V/A_t$ can be used to establish U_m for intermediate values of A_t/V and for values below $0.3m^{-1}$.

Thermal Performance

Maximum average U-value (U_m) in relation to building volume (V) and total area of heat loss elements (A_t)



Elemental Heat Loss Method

To demonstrate acceptable transmission heat loss by this method, maximum average U-values for individual building elements should not exceed those set out in the table below.

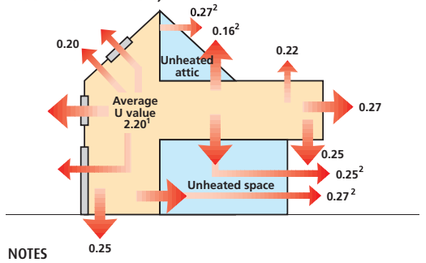
Maximum average elemental U-Value (W/m²K) (Elemental Heat Loss Method)

Fabric Elements	New Buildings & Extensions to Existing Buildings	Material Alteration to or Material Changes of Use of Existing Buildings
Pitched roof, insulation horizontal at ceiling level	0.16	0.35
Pitched roof, insulation on slope	**0.20**	**0.35**
Flat roof	0.22	0.35
Walls	**0.27**	**0.60**
Ground floors	0.25	
Other exposed Floors	0.25	0.60
External personnel doors, windows and rooflights	2.20[1]	2.20
Vehicle access and similar large doors	1.5	

NOTE 1: Permitted average U-value of of external personnel doors.windows and rooflights in building other than dwellings may vary as described in Paragraph 2.1.3.2 of TGD.

Figures in bold are the most relevant to Tegral roofing and cladding.

Summary of elemental U-values (Elemental Heat Loss Method)



NOTES

1. Windows, doors and rooflights should have maximum U-value of 2.2 W/m²K and maximum opening area as set out below. However areas and U-values may be varied provided the total heat loss through these elements is not increased.
2. The U-value includes the effect of unheated voids or other spaces.

Areas of Windows, Doors and Rooflights (Elemental Heat Loss Method only)

As part of using the elemental method, these areas must be limited. The combined area of window, door and rooflight openings should not exceed the values given in the table below when the average U-value is 2.2 W/m²K. However, this area may be varied provided the total heat loss through these elements is not increased.

Maximum area of openings for average U-value of 2.2 (W/m²K) (Elemental Heat Loss Method):

Building Type	Windows and doors as % of the area of exposed wall	Rooflights as % of area of roof
Industrial & storage buildings	15%	20%
Places of assembly offices & shops	40%	20%
Residential Buildings	30%	20%

Extensions

Draft TGD Part L Section 2 also contains detailed guidance as to how this table is applied to extensions.

Thermal Bridging

To avoid excessive heat losses and local condensation problems, provision should be made to limit local thermal bridging, e.g. around windows, doors and other wall openings, at junctions between elements and at other locations. Any thermal bridge should not pose a risk of surface or interstitial condensation and any excessive increase in heat loss associated with the thermal bridge should be taken account of in the calculation of average U-value.

Thermal Performance

For Tegral roofing and cladding systems, the calculation procedure as set out in Appendix D of Draft TGD Part L Section 2 is followed.

Details should be assessed in accordance with the methods described in **I.S. EN ISO 10211-1:1996** and **I.S. EN 10211-2:2001**. This assessment should establish the temperature factor (f_{Rsi}) and linear thermal transmittance (ψ). The temperature factor (f_{Rsi}) is defined as follows: $f_{Rsi} = (T_{si} - T_e) / (T_i - T_e)$ where: T_{si} = minimum internal surface temperature, T_e = external temperature, and T_i = internal temperature.

The linear thermal temperature (ψ) is the calculated correction factor for heat loss per unit length of a linear thermal bridge.

In order to facilitate compliance with this requirement Tegral Metal Forming can provide specification details which:

- are designed to reduce thermal bridging (i.e. have a low ψ value)
- are designed to reduce the risk of internal condensation (i.e. have a high f value)
- have been thermally modelled to produce known values of ψ and f, which are then used in the whole building calculation.

Permissible values for f & ψ

The temperature factor (f_{Rsi})

For dwellings, Technical Guidance Document Part L gives a minimum value f_{Rsi} of 0.75, however there is no specific guidance given for other buildings. Designers have to ensure however, that any thermal bridge should not pose a risk of surface or interstitial condensation. Although not mandatory, the following guidance may be helpful to this end: (Reference) Guidance for the Design of Metal Roofing and Cladding to Comply with L2 : 2001 - MCRMA Technical Guidance Paper No 14.

Humidity Class	Building Type	Min. f value
1	Storage Areas	0.30
2	Offices, Retail outlets	0.50
3	Dwellings with low occupancy	0.65
4	Sports Halls kitchens, canteens, buildings heated with un-flued gas heaters. Dwellings with high occupancy	0.80
5	Swimming pools, laundries, breweries	0.90

Additional heat loss (sum of ψ)

Elemental Heat Loss Method:

The additional heat loss associated with thermal bridges should be limited to less than 16% of the total calculated heat loss through the plane building elements

Overall Heat Loss Method:

Where the Overall Heat Loss method is used to show compliance, any additional heat loss above this level (16%) should be explicitly taken into account in calculating the Overall Heat Loss and the associated average U-value.

Air infiltration

Infiltration of cold outside air should be limited by reducing unintentional air paths as far as is practicable. A reasonably continuous air barrier should be provided over the whole thermal envelope, including elements separating the building from adjoining heated or unheated areas.

All Tegral roofing and cladding products and systems are designed to minimise air leakage, and enable air sealing criteria to be met, provided they are constructed correctly and that all other junctions and openings in the building are sealed properly. Regardless of the cladding material or system chosen, it is essential that contractors take considerable care over air sealing.

Thermal Performance

Standard U-values of Construction Elements (Draft TGD Part L Section 2)

Exposed Element	U-value W/m²K	Tegral Twin-Skin System	Tegral Composite Panel	Tegral Trinsul System
Roof with integral insulation	*0.20*	*All liners up to 33mm. For Insulation λ =0.04W/mk 'Bracket & Rail' system 220mm deep. Insulation 200mm thick*	*Refer to Technical Services*	*Refer to Technical Services*
Walls	*0.27*	*19mm liners. For insulation λ=0.04W/mK 'Bracket & Rail' system 160mm deep. Insulation 160mm thick*	*Refer to Technical Services*	*Refer to Technical Services*

Avoiding Solar Overheating

Buildings should be designed and constructed so that:

(a) those occupied spaces that rely on natural ventilation do not risk unacceptable levels of thermal discomfort due to overheating caused by solar gain, and

(b) those spaces that incorporate mechanical ventilation or cooling do not require excessive plant capacity to maintain the desired space conditions.

Where extensive use of glazing is proposed in the building design, particular care should be exercised to ensure compliance with this aspect of the regulations.

Alternative approaches to showing compliance include:

(a) showing that the average daily solar heat load per unit floor area during the period of occupancy would not be greater than 25W/m², when the average solar load for glazing of different orientations is taken to be as specified in the table below. Local weather data averaged over a period of 15 years, at least, can be used instead of the data given here.

Average solar load between 7.30 and 17.30 for different glazing orientations

Orientation	Average solar load (W/m²)
N	125
NE/NW	160
E/W	205
SE/SW	198
S	156
Horizontal	327

Note 1: This solar load is not likely to be exceeded on more than 2.5% of days in July. Source CIBSE Guide A, Section 5.

Responsibility

Tegral Metal Forming have offered this information in respect of Draft Technical Guidance Document L (2004 Edition) Conservation of Fuel and Energy: Section 2 - Buildings other than Dwellings, in good faith. Tegral provide the necessary technical information relating to their product range, but the responsibility for compliance with the requirements of the Draft Technical Guidance Document L Section 2 rests with the building designer.

Avoiding risk of Interstitial Condensation

Interstitial condensation may occur in a profiled metal roof assembly if water vapour, generated within the building, is able to penetrate through the metal liner and reach cold areas within the assembly, where it may condense, usually on the underside of the external sheet, or in the side and end laps of composite panels.

It is therefore essential that the recommendations of BS 5250:2002 - Code of Practice for Control of Condensation are followed. The moisture content of the internal environment should be assessed by the building designer and if appropriate, controlled by providing mechanical ventilation.

The following methods of alleviating the harmful effects of interstitial condensation in Tegral Twin Skin roofing should be considered with reference to the risk category based on building occupational use classes.

(see Table 1).

Method a)
is suitable for dry conditions within Classes 1, 2 and 3.

Method b)
in addition to method a) should be adopted for humid conditions in classes 1,2,3 and always for Class 4.

Method c)
in addition to methods a) and b), should be adopted for the high humidity conditions of Class 5.

Thermal Performance

Method a)
A vapour control layer is essential, which in normal environments may consist of sealed side and end laps of the metal liner sheet with continuity of the seal at penetrations and junctions. Alternatively, a separate vapour control membrane may be laid over the metal liner sheets with minimum 100 mm width sealed laps. The liner or vapour control layer should discharge any condensate externally.

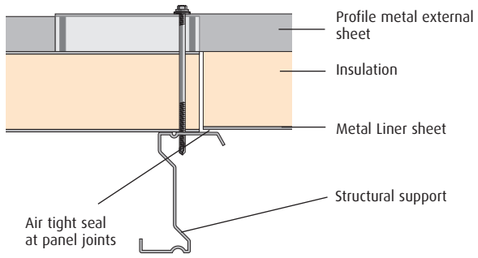
Method b)
The external sheet profile should be vented to the outside air at both ends of the sheeting through profile fillers incorporating venting openings. Experience has shown that proprietary ventilated fillers with an opening of not less than 5% of the profiled sheet void above the sheet support are generally satisfactory.

Method c)
In buildings with a high humidity internal environment, consideration should be given to the inclusion of a breather membrane on top of the insulation. The membrane should be detailed to allow any water on its surface to drain down to the gutter, and vented by eaves to ridge ventilation through the external sheet profile, incorporating proprietary ventilated fillers.

Composite panel roof

Composite panels form a warm roof type construction, in which the principal thermal insulation layer is placed immediately inside the outer profiled sheeting, resulting in the supporting structure and any voids being at a temperature close to that of the interior of the building. The condensation risk plane is also at the outer face of the insulation. Unless special precautions are taken, it is impracticable to expect airtight construction. Where voids in profiled sheeting are completely filled by insulation, such as in sandwich panels with a vapour impermeable undersheet (e.g. metal), local condensation cannot, in principle, occur. However, in practice, small voids will still occur at side and end laps where vapour leakage can occur and local condensation can develop, and therefore composite panel systems should be sealed at side and end laps to prevent moist air entering the joints between panels.

Composite panel roof



Site assembled built-up roof

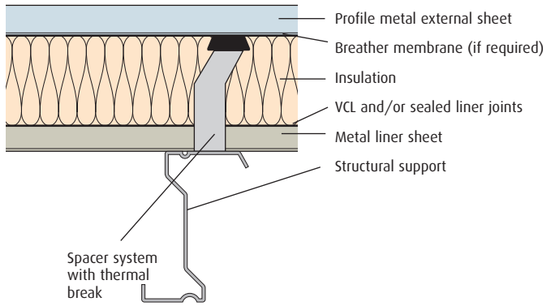


Table 1.

Internal Humidity Classes for Building Types

Humidity Class	Building Type
1	Storage Areas
2	Offices, shops
3	Dwellings with low occupancy
4	Dwellings with high occupancy, sports halls, kitchens canteens, buildings with unflued gas heaters
5	Special buildings; e.g. swimming pool, laundry, brewery

Corus Colorcoat® Products and Services

To ensure the long-term performance and appearance of the building, it is important that the pre-finished steel product is specified alongside the cladding system.

The Colorcoat® brand provides the recognised mark of quality and metal envelope expertise exclusively from Corus. Over the course of 40 years, Corus has developed a range of technically leading Colorcoat® pre-finished steel products which have been comprehensively tested and are manufactured to the highest quality standards. These are supported by a range of services such as comprehensive guarantees, colour consultancy and technical support and guidance.

Colorcoat HPS200®

Exclusive coating technology, superior performance and the unique Confidex® Guarantee make Colorcoat HPS200® the most specified pre-finished steel product in Europe for roof and wall cladding. Now maintenance free for up to 30 years.

Colorcoat Prisma®

The ideal choice to deliver eye-catching buildings that will stand the test of time. Technically and aesthetically superior to PVDF (PVF2), Colorcoat Prisma® is readily available in the most popular solid and metallic colours.

All backed up with the unique Confidex® Guarantee providing cover for up to 25 years on walls.

Colorcoat Celestia®

Offers the creative scope of a metallic effect combined with superior durability and performance all backed up with the Confidex® Guarantee.

Colorcoat Armacor®

Colorcoat Armacor® is a high-build pre-finished steel product with a tough and attractive textured top-coat.

As a medium term building envelope solution, Colorcoat Armacor® offers a price competitive durable alternative to leathergrain plastisols.

30 year maintenance free Confidex® Guarantee from Corus with Colorcoat HPS200®

DESIGNER'S ROOFING AND CLADDING GUIDE Corus Colorcoat® Products & Services

Corus Colorcoat® Products and Services

Repertoire® colour consultancy

The Repertoire® colour consultancy can advise on colours and colour strategies using a range of standard shades, as well as discussing individual bespoke colour requirements.

Corus can match almost any shade from physical swatches to commonly used references such as RAL, NCS and British Standard and more unusual standards.

Confidex® Guarantee

Evolved from 40 years' experience that Corus has in pre-finished steel development and manufacture.

Available with Colorcoat HPS200®, Colorcoat Celestia® and Colorcoat Prisma®, the Confidex® Guarantee is clear and simple to register, can easily be transferred if building ownership changes and provides peace of mind and reduced risk for the supply chain.

Colorcoat Connection® helpline

For more information about Corus Colorcoat® products and services visit www.colorcoat-online.com or call the Colorcoat Connection® helpline on +353 (0)1 631 0615.

Coatings

The combination of a Colorcoat® product, exclusively developed and manufactured by Corus, and a cladding system from Tegral Metal Forming, offers the highest quality and performance for a building envelope.

Selection

Typically the choice of Colorcoat® product is based on aesthetic design or planning requirements. Alternatively, the selection may be dictated by site conditions. A wide range of Colorcoat® products are available to suit practically every design or budget consideration. As a general rule, there are Colorcoat® products available through Tegral to suit most applications.

Materials

The choice of material depends on specific environmental conditions (internal and external) that pertain. Tegral roofing and cladding products are manufactured from:-

Substrate	Gauge
Galvanised steel to BS EN10147:1992	*0.4mm* *0.55mm* *0.7mm*
Galvalloy® steel to BS EN 10214 1995	*0.4mm* *0.55mm* *0.7mm*
Stucco Embossed aluminium mill-finish to IS EN 508-2:2000	*0.9mm*
Coated Aluminum to BS EN 1396:1996	*0.9mm*

Colorcoat® Products

Whereas the choice of a particular Colorcoat® product for any given Tegral roof and wall cladding system may be dictated by specific site conditions, typically the decision is based on aesthetic design considerations or planning requirements. The choice offered through Tegral allows for the selection of a suitable Colorcoat product to suit design or economic criteria.

Colorcoat® Products

Whereas the choice of a particular Colorcoat® product for any given Tegral roof and wall cladding system may be dictated by specific site conditions, typically the decision is based on aesthetic design considerations or planning requirements. The choice offered through Tegral allows for the selection of a suitable Colorcoat product to suit designor economic criteria.

Corus HPS200®

A pre-finished steel for roof and wall cladding. Colorcoat HPS200® uses an exclusive coating formulation and Galvalloy® substrate to offer superior durability and colour retention all backed up by the Confidex® guarantee, covering cut edges for up to 30 years. It has a 200 micron top coat and unique Scintilla® emboss on the weatherside and a high performance polyester backing coat as standard on the reverse side. Its Galvalloy substrate is to EN10124 with a 95%/5% zinc/aluminium metallic coating offering superior corrosion resistance and enhanced cut edge protection.

The standard range consists of 29 colours including two metallic effect finishes, with the further option of Repertoire® colour matching service.

More detail available on-
www.colorcoat-online.com

Double-sided Colorcoat HPS200® is also available on request.

Colorcoat® Lining Enamel

Colorcoat® Lining Enamel has been specially developed by Corus for steel lining sheets and trays to provide an efficient and durable internal lining system. It has good light reflecting properties and a smooth easy-to-clean surface. The standard reverse side coating is a specially formulated two coat protective system of corrosion resistant primer topped with a heat cured high-performance polyester.

Coated Aluminium

Aluminium's tough, inert, chemically stable oxide layer inhibits corrosive attack and reforms spontaneously if the surface is damaged.
The surface of rolled aluminium is ideally suited to receiving a choice of organic coatings, so producing a long decorative life, with low maintenance requirements.

ARS

A high durable coating with exceptionally good handling characteristics.

General practice

Metal roof and wall cladding should be fully detailed on cladding drawings for each individual building. The drawings should include all the necessary dimensions, components, fasteners, seals etc. to enable the sheeters to install the cladding in accordance with the designer's requirements, in order to achieve the specified performance. Responsible supervision and regular inspection is essential to ensure structural integrity, satisfactory performance, acceptable appearance and quality in general.

The steel framework should be surveyed prior to handover to the roofing/cladding contractor. Any deviations in line, level and plumb must be acknowledged by all parties and the necessary adjustments made to suit the cladding requirements before starting the installation.

Transport, handling and storage

Loading and off-loading packs by crane or fork-lift should be carried out with care to avoid damage to the outermost sheets or panels in the pack. Never off-load with chains, use only wide soft slings for lifting. Use lifting beams, if recommended.

Packs should be carefully positioned and stored on site to prevent damage or deterioration. Particular attention should be paid to the following points:

a) Position away from vehicle and pedestrian routes.
b) Site on bearers on firm flat ground.
c) Cover and ventilate.
d) Ensure labelling is intact.

Some sheets and panels are supplied with a protective plastic film on the weatherface to help prevent minor damage to the coating. This must be removed as soon as possible after the cladding has been installed because if it is left in place for long periods the film will become very difficult to remove. Manufacturer's instructions should always be followed.

Horizontal Wall Cladding

The long horizontal lines created by horizontal wall cladding emphasise any imperfections in the cladding or support steelwork. Therefore a higher standard of steelwork alignment and sheet fixing is required than is the case for vertical cladding.

It is also recommended that the cladding contractor allow for packing when fixing the outer sheet, to ensure that any deviations from a true plane can be compensated for. Even so it is still possible that there may be minute but visible deviation from a flat line in the material.

Mitred Corners

Mitred corners or curved corners can be manufactured by Tegral Metal Forming in the profile used for the horizontal wall cladding.
These replace conventional corner flashings, and allow the continuation of the wall cladding profile around the corner. Careful alignment on both planes is always required.

Liner Sheets

It is possible to fix the complete twin skin system progressively, or line out the building completely before the installation of outer sheets.

In both instances, attention is required to ensure a non-fragile assembly as outlined on page 64.

It is recommended that the metal liner sheet be utilised both as a vapour control layer and to provide the air sealing required by Draft Technical Guidance Document L. All laps and junctions in the lining layer must be effectively sealed - See page 75 for sealing recommendations.

Laying outer sheets

Where possible, the outer sheets should be laid with the exposed joints of the side laps away from the prevailing wind unless shown otherwise on drawings. Should this not be possible the side laps should always be sealed.

Rail and Bracket Support Systems

See relevant fixing information for the system being used.

Generally brackets are fitted at not more than 1 metre centres. Anti sway brackets may be required on roofs, for some systems.

Insulation material

Glass fibre or mineral wool roll or quilt insulation should be used and the thermal properties must match the design values used for the U-values shown on pages 71.

Install the insulation as work proceeds ensuring all edges are close butt jointed to achieve continuity between spacers. There must be no gaps. The insulation can be installed in more than one layer, if so the joints in each layer should be offset. The insulation quilt must be cut and tucked under the spacer bar so that there is no air gap under the bar. It is important to keep the insulation dry.

General practice

Sheet Cutting

Much sheet cutting may be avoided by ordering correct length sheets from Corus Panels and Profiles. Where site cutting is essential, such as at openings or ends of run, nibblers or reciprocating saws should be used. Any other form of sheet cutting should be avoided especially abrasive wheel cutters because they generate heat and will damage the sheet coating. For optimum durability, site cut edges should be painted.

Sheets and flashings should be cut to give clean true lines, with no distortion and burrs and any lubricant removed. Openings in sheets for outlets, vent pipes, flues etc. should be the minimum size necessary and the edges of openings reinforced.

Support sheet ends

The ends of sheets, and end laps must be fully supported with fixings at the top of the lap and raking cut edges at hips and valleys similarly fully supported.

Leave no gaps

It is vital that there should never be gaps in sealant lines or insulation. Under ADL2, these will cause the building to fail air tightness and/or thermal imaging tests, which will necessitate very expensive remedial work.

Clean off sheets

Dust and any other foreign matter should be removed before finally fixing sheets into position.

Install fasteners accurately

Holes must be drilled and fasteners installed perpendicular to the surface of the cladding. Fasteners are to be positioned at regular intervals in straight lines, centred on support bearings. Where holes are oversized, fasteners should be located centrally within them.

Clean up swarf

Swarf, which is the term for the small shards of metal produced when any drilling or cutting of metal is carried out, appears in quantity during a sheeted roof installation. It is absolutely essential that swarf be cleared right away at the end of each working shift. If left, swarf corrodes rapidly and can cause early failure of roofing components.

Inspection and Maintenance

Metal roof cladding is designed and manufactured to give many years of reliable service, but to achieve this, a regular inspection and maintenance programme is required.

Roof cladding and gutters should be inspected at regular intervals and any deposits such as leaves, soil or litter must be removed. Any areas of corrosion or damage should be repaired in accordance with the manufacturer's maintenance manual.

Roof traffic should be kept to a minimum and must be restricted to authorised trained personnel only, using appropriate safety measures, in accordance with HSA guidance.

Tegral Shadowline 47™

References

Building Regulations
The Building Regulations 1997-2002.
Technical Guidance Documents 1997-2004 Parts A-M

The Metal Cladding and Roofing Manufacturers Association (MCRMA) Technical Papers

No 1 Recommended good practice for daylighting in metal clad buildings.

No 2 Curved sheeting manual.

No 3 Secret fix roofing design guide.

No 4 Fire and external steel-clad walls: guidance notes to the revised Building Regulations, 1992 (out of print).

No 5 Metal wall cladding design guide.

No 6 Profiled metal roofing design guide.

No 7 Fire design of steel sheet clad external. walls for building: construction performance standards and design.

No 8 Acoustic design guide for metal roof and wall cladding.

No 9 Composite roof and wall cladding design guide.

No 10 Profiled metal cladding for roofs and walls: guidance notes on revised Building Regulations 1995 parts L and F (out of print).

No 11 Flashings for metal roof and wall cladding: design, detailing and installation guide.

No 12 Fasteners for metal roof and wall cladding: design, detailing and installation guide.

No 13 Composite slabs and beams using steel decking: best practice for design and construction.

No 14 Guidance for the design of metal roofing and cladding to comply with Approved Document L2: 2001.

No 15 New Applications: composite construction

No 16 Guidance for the effective sealing of end lap details in metal roofing constructions.

No 17 Design Guide for Metal Roofing & cladding for compliance with UK Building Regs 2006

No 18 Conventions for Calculating U-Values

British Standards
BS 5250 : 2002 Code of practice for control of condensation in buildings.

BS 5427-1 : 1996 Code of practice for the use of profiled sheet for roof and wall cladding on buildings. Design.

BS 5950-6 : 1995 Structural use of steelwork in building. Code of practice for design of light gauge profiled steel sheeting.

BS 6399-2 : 1997 Loading for buildings. Code of practice for wind loads.

BS 6399-3 : 1988 Loading for buildings. Code of practice for imposed roof loads.

BS 476-3 : 2004 Fire tests on building materials and structures. External fire exposure roof test.

BS 476-6 : 1989 Fire tests on building materials and structures. Method of test for fire propagation for products.

BS 476-7 : 1997 Fire tests on building materials and structures. Method of test to determine the classification of the surface spread of flame on products.

BS 476-22 : 1987 Fire tests on building materials and structures. Methods for determination of the fire resistance of non-loading-bearing elements of construction.

Corus
The Colorcoat® Building

Help and Safety Authority
Draft Code of Practice for Safety in Roofwork

Contacts

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Rockwool	0044 1656 862 621
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Corus	www.colorcoat-online.com
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