JOYCE
GROUP LTD

VERIFICATION OF INDEX MEMBRANES

FOR HITCHINS NEW ZEALAND LTD

May 2005

JN:6420

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INDEX MEMBRANES FOR
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1.0 INTRODUCTION

1.1 SCOPE

The Managing Director of Hitchins New Zealand Ltd has commissioned the Joyce Group Limited to review the performance of the product "INDEX Membrane" and prepare a verification report identifying compliance with the NZ Building Code for the following clauses.

- Clause B2 Durability
- Clause E2 External Moisture

1.2 VERIFICATION REPORT

The report considers the data provided by Hitchins New Zealand Ltd and the manufacturer of INDEX Membranes and product appraisals carried out by leading Testing Authorities throughout the world.

2.0 TECHNICAL SPECIFICATION

2.1 Product Information

INDEX modified reinforced bituminous membranes are manufactured by INDEX Construction Products Spa of Italy under stringent quality control to standards set by UEATC (European Union of Agreement) and marketed to over 100 countries worldwide.

2.2 The Technical Specification

INDEX Systems are designed for application to concrete, plywood and compressed sheet substrates.

INDEX Membranes General

These are polymer-bitumen torch-on membranes. The INDEX range of membranes is extensive to provide.

- Vapour barrier/shield layer.
- Venting base sheet.
- Cap or finishing sheet.
- Specialised membranes.

INDEX or finishing membranes are either mineral surfaced, (do not require protection coating) or plain with a painted finish.

The system can be single layered, double reinforced membrane, two layered or multi layered

This verification report specifically covers a double layered system including a base sheet of either **Testudo** 20P or **Autotene** and **Nova P** plain and coated.

Autotene Base sheet is a 3.0mm thick torch-on membrane.

The underside of Autotene Base is coated with a special heat-activated adhesive. When the membrane is laid on the insulating panel and the silicone film that protects the self-adhesive face is removed, it is sufficient to have the indirect heat generated by torching of the subsequent layer to produce simultaneous adhesion also of the base layer in contact with the polystyrene foam.

With the energy necessary for laying one layer, using Autotene Base glues two, limiting the emission of fumes and odours, avoiding solvent emissions and the production of problematic waste materials, and avoid the use of an additional layer, with the added benefit of using a type of thermal insulation that is economically advantageous. Moreover, eliminating one heating phase halves the amount of time the installer is exposed to heat, which is a significant advantage, particularly in the summer.

Autotene P Base sheet can be installed directly to the primed substrate of either plywood or concrete. The primer is **Indever** E**.**

Autotene Base is a waterproofing membrane composed of distilled bitumen, selected for industrial use, with a high content of elastomeric and plastomeric polymer additives to obtain a phase inversion compound whose continuous phase is formed by polymers in which the bitumen is dispersed.

The performance of the bitumen is therefore incremented along with durability and resistance to high and low temperatures, while the already optimum adhesive and waterproofing qualities of the bitumen remain unchanged.

Autotene P Base sheet incorporates a rot-proof composite reinforcement composed of a non woven polyester fabric stabilised with fibreglass, which combines the stability of the glass with the elastically and resistance of the polyester fibre.

Testudo P20 Base sheet.

Testudo membranes are manufactured from distilled bitumen selected for industrial use modified with high content to elastocene polyester and reinforcement of high grammage, rot-proof, single strand spot bond polyester, isotropic, thermally stabilise non-woven 200 gram fabric to produce an extremely strong, puncture and tear resistant membrane.

Nova Mineral is a 4.00mm torch-on membrane.

The **Nova** membranes are made up of distilled bitumen, selected for industrial use, with elastomeric and plastomeric polymers added to obtain a phase inversion compound whose continuous phase is formed by polymers in which the bitumen is dispersed, where the characteristics are determined by the polymeric matrix and not by the bitumen even though this is the most consistent ingredient.

The performance of the bitumen is therefore increased along with the durability and the resistance to high and low temperatures while the already optimum adhesive and impermeable qualities of the bitumen remain unchanged.

The membranes are reinforced with high weight, isotropic, thermally fixed, rot-proof, “non-woven” single strand Spunbond polyester 180gram/m2 fabric. The reinforcement is very strong, has a notable ultimate elongation and an optimal resistance to puncture and tearing.

Mineral Nova P is reinforced with a composite, high weight, rot-proof, “non-woven” polyester 160gram/m2 fabric, stabilized with fibreglass 60gram/m² mat. This reinforcement has a high tensile strength, is flexible and has optimal dimensional stability in hot conditions which reduces the problems of the banana effect and the retraction of head lap joints as it is 2 to 3 times more stable than normal reinforcements in “non woven” polyester fabric.

Indever Primer is a bituminous primer made up of a compound of solvents and oxidized bitumens. The primer produces a film with a strong anchorage on every type of substrate without any degree of superficial stickiness.

Indever Primer is a bituminous primer with a higher concentrate of oxidised bitumen and plasterciser to produce a resin rich film on the substrate to provide a stronger anchorage on all types of substrates.

Ideal for regions or building designs that could experience strong winds.

3.0 HANDLING AND STORAGE

3.1. Handling and storage of all materials whether on or off site is under the strict control of the Hitchins New Zealand Ltd trained installers.

Dry storage must be provided. The rolls should always be stored in an upright position on a smooth, flat surface.

4.0 DESIGN INFORMATION

4.1. Typical INDEX Roofing Protection systems comprise the following principal elements:

Load bearing structure that may be made of:

Concrete (site-cast concrete or a mixture of concrete tiles and prefabricated concrete panels). This may be lined with a lightened cementitious cope of variable thickness used to create the minimum incline necessary for the downflow of rainwater on flat roofs; timber, planking or various types of wood compound panels; Metal, in ridged sheeting.

4.2. **Vapour barrier or vapour shield**, which is generally made of a polymer bitumen membrane in the roofing if there is also thermal insulation. Its function is to protect the insulation from humidity originating internally.

4.3. **Waterproof covering** made from overlapping polymer bitumen membranes, which protect the roof from inclement weather. It is used for flat roofs but is necessary for inclined roofs lined with tiles or other discrete elements.

4.4 **Roofing protection** is not strictly necessary nor always utilised but if a flat roof is used as a terrace and subject to foot traffic, some kind of pavement must be put down on top of the covering. Likewise if the roof is used for parking. Often, a layer of gravel is used even if this increases the costs of the load-bearing structure and so is becoming less common.

Such systems are known as “heavy protection”. Often, however, the waterproof covering is itself uncovered (an open covering) and can be painted or the membrane may incorporate a slate chip protection known as “protected” membranes. INDEX products of this nature are found in the Mineral range.

4.5. **Other features:** perimeter walls, skylights, rainwater drain holes, guttering, cornices etc. which are fundamental for a roof to do its job properly which should be carefully designed and constructed.

Different but associated layers in the same roofing system interact as they contract and expand with fluctuations in temperature. It is essential that these movements are restricted by careful design, correct construction of the points of connection and through careful choice of the system components. The different natures of the various layers affect the mechanical resistance of the adjacent layers.

4.6 Plywood must comply with AS/NZS 2269 and be H3.1 treated. LOSP treated plywood must not be used under any circumstances.

It must be CD Grade Structural Plywood with sanded C face upwards. It must comply with NZ Building Code Acceptable Solution E2/AS1 February 2005.

4.7 Resistance to foot traffic

The membranes can accept, without damage, the limited foot traffic and light commercial loads associated with installation and maintenance operations. Where traffic in excess of this is envisaged, additional protection to the membrane, in accordance with the marketing company's instructions must be provided. Reasonable care is required, however, to avoid puncture by sharp objects.

5.0 BUILDINGS TO NZBC ACCEPTABLE SOLUTION E2/AS1 FEBRUARY 2005

5.1 Substrate

5.2 Existing concrete substrate if infected with mould, apply **Hitchins** Mosskill. Leave for 3 days and water-blast clean. Leave to dry and carry out any repairs required using **Hitchins Formcrete F**.

5.3 New concrete should be clean and free from defects, cured at a minimum of 14 days, preferably 28 days, incorporating fillets to upstands, with sufficient falls and outlets. Dense concrete needs to be etched or abraded and pre-sealed with thinned down primer.

5.4 Plywood shall be 17.5mm tanalised CD grade structural plywood over joists and noggins at 600mm centres shall be glued and fixed with stainless steel screws approximately 55mm length at 150mm centres on perimeter and 200mm centres throughout the sheet. Plywood to be laid in a brick-like pattern with face grain running in one direction at right angles (across) purlins or joists. Falls to be a minimum of 1 in 50.

5.5 Compressed sheet shall be 20mm thick over joists and noggins at 400mm centres, which will be glued and fixed with 55mm to 60mm x 10 gauge stainless steel Pozidrive Comsheet screws at 200mm centres. Sheets must be laid across the joist and falls to be 1.50mm minimum. The sheet installation shall also follow the manufacturer's specific instructions.

5.6 On large structures involving steel trusses, purlin and noggins (spacing greater than 800mm centres) and involving tongue and groove plywood. **INDEX Autotene** or **Kontabit Bandage** must be laid over plywood sheets and mechanically fixed on one edge of strip. This provides a slip membrane to stress points.

5.7 Before any primer is applied or membrane installed, carry out an inspection to ensure that all preliminaries have been carried out satisfactorily, including formation of falls, timber fillets to the corners, gutters, outlets, vents, upstands, fascias, balustrades and any other protrusions, sky lights, ducting, rebates to walls and expansion joints if required. Ensure the plywood is free of defects, smooth, clean and dry.

5.8 **Priming**

5.8.1 If possible pre-prime sheets before installation or as soon as practical after sheets have been installed.

5.8.2 To dry surface apply **Hitchins Indever** primer at 5m² to all sheet faces and edges, including fillets. Leave to dry.

5.9 **Roof Drainage**

5.9.1 Roofs must be constructed so that falls and drainage comply with Paragraph 8.5.6 of NZBC Acceptable Solution E2/AS1 February 2005. Roof must be constructed with 1:50 minimum falls, and gutters must be constructed with 1:25 minimum falls, with no seams in the gutters closer than 1 metre to an outlet.

5.10 **Junctions and Penetrations**

5.1.1 Junctions of the roof to walls must comply with paragraph 8.5.8 of NZBC Acceptable Solution E2/AS1 February 2005, and penetrations must comply with paragraph 8.5.9.

6.0 SPECIFICALLY DESIGNED BUILDINGS

6.1 Concrete Substrates

6.1.1 Concrete substrates must be to a specific engineering design to meet the requirements of NZBC.

6.2 Plywood Substrates

6.2.1 Plywood substrates must be supported by a framing system meeting the requirements of the NZ Building Code and the specifications of the plywood manufacturer. Plywood must be of a thickness and grade to meet specific structural design requirements.

Plywood must be secured to the structure to resist wind uplift and all other forces acting on the roof, such as deflection from gravity and incidental live loads.

In high wind regions, the design of the building must provide maximum protection against wind up-lift forces on the membrane and its installation will incorporate adequate mechanical fixing of the base sheet at parapet and perimeter of the roof.

The membrane system shall be able to with stand uplift to wind loads as specified in NZS 3604:1999, Timber Framed Buildings or AS/NZS 1170.2. 2002 Structural Design Actions –wind Actions or AS 4055-1992 Wind Load for Housing or other Constructions.

6.3 Roof Drainage Junctions and Penetrations

A specific weathertightness design must be undertaken for each roof for roof drainage, junctions and penetrations to meet the requirements of the NZ Building Code.

7.0 STRUCTURE

7.1 The Load-Bearing Structure

This is the surface on which the roofing protection system rests. Its function is to resist deformation from the permanent load of its own weight and by temporary loads imposed by the use to which it is put, maintenance and weather conditions such as snow, rain, wind etc.

7.2 The Laying Surfaces and Inclination

The load-bearing structure also creates the laying surface for the layers above which, except in particular cases, are layers of constant thickness.

It is the load-bearing structures function to ensure there is sufficient incline for the downflow of rainwater.

This is not a problem for sloping roofs or for roofs made from timber or metal, but for cementitious flat roofs another solution is required.

A lightweight concrete cope is laid over the load-bearing structure in variable thicknesses and is divided into a series of areas no greater than 500 m² each and with variable inclines.

Each area has its own water drainage system proportional in section to the area of roof it serves.

The laying surface must be smooth and on a cementitious surface. There should be no depressions greater than 1 cm under a 2m. straight-edge laid on the surface, or greater than 3 mm using a 20cm rule. Variations in level between timber planks should not exceed 2mm.

Edging lines between prefabricated panels are covered with bridging strips to insulate them.

7.3. Structural movement of the substrate must be adequately allowed for, and movement joints provided. The configuration and location of the joints in the substrate should be carefully considered. Conventional construction and movement (including seismic) joint details may be used.

The BRANZ Good Roofing Membrane Practice gives guidance in this area.

7.4. The membrane needs to be considered as part of the total roof design, and as such will need to be stopped at formed waterproof construction and structural movement control joints where these are installed. Construction/control joints must be constructed in accordance with the details of the current Technical Literature for the **INDEX Roofing Membranes**.

In common with any roof membrane system, the ability of the product to resist structural movement will decrease with age.

As a result, premature failure may occur at structural movement joints if these are not designed and installed correctly.

7.5 Large roof structures require expansion joints to be designed and constructed at 10 metre centres or at stress points such as change of direction or corridors abutting the main building, (Refer appendix 3 for details).

7.6 Ventilation to the roof cavity must allow for airflow throughout the cavity. The number of airvents required will depend on the depth of the cavity and whether soffit vents are installed. Therefore the ratio of air vents can very from 1 in 20m² to 1 in 40m².

8.0 DURABILITY

8.1 Serviceable Life

INDEX roofing membranes are expected to have a serviceable life of at least 15 years provided they are designed, used, installed and maintained in accordance with the technical literature of the manufacturer.

8.2 Chemical Resistance

Industrial air pollutants and wind-borne salt deposits should not significantly affect durability of the membranes.

However, the long-term properties of the material may be affected by contact to petroleum-based products such as oils, greases and solvents.

9.0 MAINTENANCE

9.1 Preventive maintenance is very important to provide the long term performance of the membrane system

9.2 After any structural alteration or the installation of plant or equipment, these membranes should be inspected by the installer and corrective work carried out.

9.3 The membrane roof system must be regularly (at least 2 times per year) checked for damage, to remove rubbish or debris and to ensure gutter outlets do not become blocked.

9.4 Moss or mould growth must be treated and surface cleaned and any plant growth removed when infestations occur.

9.5 Care must be taken when inspecting the membrane system to ensure the continuing prevention of moisture ingress and repairs must be undertaken where required.

Damage such as small punctures and tears must be repaired by an approved applicator.

Protective coating shall be reinstated after seven years.

10.0 OUTBREAK OF FIRE

10.1 Separation or protection must be provided to the membranes and plywood substrate from heat sources such as flues and chimneys.

10.2 NZBC Acceptable Solution C/AS1 Part 9 and Verification Method C/VM1 provide methods for separation and protection of combustible materials from heat sources.

11.0 SPREAD OF FIRE

11.1 The membranes may be used on roofs of buildings intended for all Purpose Groups, including SC and SD, subject to the requirements of NZBC Acceptable Solution C/AS1 Part 7, Paragraph 7.11.1.

11.2 The membranes may be used for cladding fire-rated roof construction, providing the roof construction complies with the requirements of NZBC Acceptable Solution C/AS1 Part 7.

12.0 EXTERNAL MOISTURE

12.1 INDEX Roofing Membranes, when installed in accordance with the Technical Literature, will provide a roof that will shed precipitated water and melted snow, and prevent the penetration of water that could cause undue dampness or damage to building elements.

12.2 The membrane systems must be installed and maintained in a weatherproof state at a minimum recommended fall of 1:50. All membrane joints must be as detailed in the Technical Literature.

12.3 At penetrations, the membrane must be raised to a level above that of any possible ponding that may be caused by blockage of roof drainage facilities.

12.4 Side laps must be a minimum of 100mm and end laps must be a minimum of 150mm. All laps joints must be torch sealed and staggered.

12.5 **Provisions for Snow**

Specific weather tightness design for preventing the ingress of snow melt water is required in accordance with the requirements of NZBC Acceptable Solution E2/AS1 February 2005 Paragraph 1.3.

13.0. INTERNAL MOISTURE

13.1 The impermeability of the membranes requires that consideration must be given to the effective control of moisture in the roof structure, and closed-in construction spaces under the membrane must have adequate ventilation to prevent the accumulation of moisture venting and vapour barrier requirements will depend on the level of moisture that is present in the construction at the time of the installation, the value of the ceiling/roof construction, and the type of occupancy.

14.0 INSTALLATION INFORMATION

14.1 **Installation Skill Level Requirement.**

Installation of membranes must be completed by Hitchins New Zealand Limited trained and approved applicators.

15.0 SYSTEM INSTALLATION

15.1 **Substrate Preparation**

All surfaces must be checked to ensure they are clean and dry, smooth and free from sharp edges, loose or foreign materials, oil, grease or other deleterious materials that may affect adhesion of the membranes or may damage the membranes.

15.2 A concrete surface is acceptable if no bumps greater than 10mm are found under a 2m rule in any direction and no bumps greater than 3mm are found under a rule of 0.20m.

The surface should be trowelled and all cracks and gaps should be filled with mortar.

Any projections and site residue such as nails, sheeting, bits of wood etc. must be removed.

15.3 17.5mm plywood must be fixed using glue and 55mm long stainless steel counter sink head screws only, at 150mm centres on perimeter and 300mm centres throughout the sheets. Sheets must have 3mm gaps between joints except where tongue-in-groove joints are used.

Plywood must be laid in a brick bond pattern with the face grain at right angles to the main support forming with grain going in one direction.

A 20mm triangular fillet shall be used at the base of any 90º upstand and external edges shall be chamfered with a minimum radius of 5mm.

15.4 20mm compressed sheet must be fixed using glue and 55mm to 60mm x 10 gauge stainless steel Pozidrive Comsheet screws at 200mm centres. Sheets must be laid across the joists and the installation procedure shall be in accordance with the specific instruction of the manufacturer of the sheet.

15.5 Plywood and framing at the time of membrane application must have a maximum moisture content of 20% or lower if specified by the plywood manufacturer.

15.6 The relative humidity of the concrete must be 75% or less before laying the membrane. Concrete slabs can be checked for dryness by using a hygrometer.

15.7 **Priming**

Prior to the application of membrane all plywood sheet faces, edges and fillets must be primed at a rate of 5m² per litre. Concrete surfaces should also be primed.

15.8 **Membrane Installation**

The membrane must be installed in accordance with the technical literature of the manufacturer.

The installation of the base sheet to buildings in high wind regions is over Indever E Primer and will incorporate mechanical fixing (large flat head fasteners) to parapet and perimeter of roof as per technical literature of the manufacture.

Installation of the membrane is to commence at the lowest point working up the grade of the roof orderly.

15.9 Bonding of torch-on sheets is achieved by melting the lower surface by torching and pressing the membrane down. Press the membrane to the surface with a broom or roll smooth carefully without forming wrinkles or air bubbles.

Care must be taken to not overheat the coating. A bead of molten material must exude from all laps to indicate a satisfactory seal and should be leveled out using a heated rounded tip trowel.

The sheet joints to the finish membrane shall be offset to the sheets of the base sheet.

The membrane shall be torched down on the underside to fuse the membrane to the substrate for maximum adhesion.

Form mould and weld additional layers of membrane to provide flashings to wall upturns, fascia down turns, into gutters, hip ridges, skylights, expansion joints, air vents, mechanical services pipes/ducts balustrade posts, rain water heads and other penetrations in accordance with detailed drawings (Refer Appendices 3).

On joints of the mineral capping layer the exuded bead must have extra mineral chip applied while still hot.

15.10 **Coatings**

Where a coloured coating system is specified all debris and dexterous material must be removed from the surface and the surface must be dry and free from contaminants before application.

The Hitchins acrylic coating in selected colour should be applied at the rate of 6m² per litre. Each coat must be allowed to dry for a period of 2 hours before application of the second coat.

INDEX Solaris Plus, a bituminous aluminium coating, silver colour should be applied to a rate 7m² per litre coat. Each coat must be allowed to dry for a period of 3 hours before the application of the second coat.

The approved applicator and building contractor must complete the **Hitchins / INDEX Quality Control Schedule** for each project' (Refer Appendix 2). The completed document is to be made available to the building owner at the completion of the contract.

15.11 Inspections

The technical literature must be referred to by Building Consent Authorities during the inspection of membrane applications.

16.0 WARRANTIES

Hitchins New Zealand Ltd will provide a written product performance warranty. The type of system will determine the duration of warranty period.

Refer appendix 1.

The installer of the **INDEX Membrane System** will provide a written workmanship warranty.

Refer appendix 2.

17.0 HEALTH AND SAFETY

Safe use and handling procedures for the membrane systems is provided in the Technical Literature.

18.0 BUILDING REGULATIONS

18.1 In my opinion **INDEX Roofing Membranes**, if designed, used, installed and maintained in accordance with the statements and conditions of the manufacturer's technical data and the conditions of this report, will meet or contribute to meeting the following provisions of the NZBC.

Clause B2 Durability
Performance B2.3.1(b) 15 years.
INDEX Roofing membranes, meet this requirement. See paragraphs 8.1 and 8.2 of this report.

Clause E2 External Moisture
Performance E2.3.1 and E2.3.2. **INDEX Roofing Membranes** meet these requirements.

See paragraphs 12.1 to 12.5 of this report.

19.0 QUALITY

19.1 The manufacture of the materials forming the system has not been examined in this assessment. An examination of the manufacturing practice and quality control procedures employed in the manufacture of the materials is subject to the ongoing validity of the current BBA (British Board of Agreement) and Bureau Veritas Control Reports.

19.2 The quality of materials supplied by Hitchins NZ Ltd is the responsibility of Hitchins NZ Ltd.

19.3 Quality on site is the responsibility of Hitchins NZ Ltd trained installers.

A Quality Control Schedule will be completed for each project, (Refer appendix 2 for copy).

19.4 Designers are responsible for the building design, and building contractors are responsible for the quality of construction of substrate systems in accordance with the instructions of Hitchins NZ Ltd.

19.5 Building owners are responsible for the maintenance of the membrane systems in accordance with the instructions of Hitchins NZ Ltd.

SOURCES of INFORMATION

- AS/NZS 2269: 1994 Plywood-Structural.
- Approved Document for New Zealand Building Code External Moisture Clause E2, Building Industry Authority, February 2005.
- NZ Building Code Handbook and Approved Documents, Building Industry Authority 1992.
- BRANZ Good Roofing Membrane Practice Reprint October 2003.

Ron Thurlow
JOYCE GROUP LIMITED

APPENDICES

1. **Product Performance Warranties.**

2. **Quality Control Schedule.**

3. **Installation Details.**

Appendix 1

PRODUCT PERFORMANCE WARRANTIES

Appendix 2

QUALITY CONTROL SCHEDULE

Appendix 3

INSTALLATION DETAILS

Appendix 4

CURRICULUM VITAE

of

RONALD FREDERICK THURLOW

and

TERRENCE HUGH O'CONNER