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PERFORMANCE ASSESSMENT REPORT

DAMAX ECOLAY 5070 UNDER-ROOF MEMBRANE

Prepared for Agrément South Africa

Report detail	Information
Sample identification	SA2940-001
Product description	Under-roof membrane - DAMAX ECOLAY 5070
Assessment	Mechanical performance and accelerated-ageing durability
Prepared by	Erich Seeger, Pr. Nat. Sci. (Materials Science)

1. Purpose and basis of assessment

Scientific Testing and Consulting Services (PTY) LTD was approached by **Mr. Deon Enslin** representing Brits Bags Manufacturers to assess the DAMAX ECOLAY 5070 under-roof membrane for Agrément Certification. This report provides a mechanical and technical durability assessment of the DAMAX ECOLAY 5070 under-roof membrane for consideration by Agrément South Africa. The assessment is based on the independent laboratory results reported by CEISLAB SA under Job JN2940 v1. The watertightness test was performed by STACS in Queenswood Pretoria.

The laboratory program considered tensile strength, elongation at break, nail-shank tear resistance, watertightness and the effect of accelerated thermal ageing. STACS reviewed the measured results first and then applied a simple Q10/Arrhenius-type ageing calculation and an exponential tensile-retention model to determine the longer-term durability of the membrane.

2. Laboratory testing

Test	Method / condition
Tensile properties of sheeting	EN 12311-1
Nail-shank tear resistance	EN 12310-1
Accelerated ageing	SANS 952-2; 82 °C for 72 h
Post-ageing conditioning	24 h at 23 °C before mechanical testing
Watertightness	24 hours with a vertical head of a 1000 mm

3. Test results and technical comment

The measured results are summarized below. The comments are based on the direction and magnitude of the measured changes and are intended to explain their durability significance.

Property	Before ageing	After 82 °C / 72 h	Change	STACS comment
Machine-direction tensile strength	13.89 N/mm	13.69 N/mm	-1.41%	Very small reduction. Tensile strength was substantially retained after ageing.
Machine-direction elongation at break	24.61%	30.14%	+22.46%	Elongation increased. No indication of heat-induced embrittlement was observed.
Transverse tensile strength	13.19 N/mm	13.49 N/mm	+2.27%	No deterioration was measured; the average increased slightly after ageing.
Transverse elongation at break	21.51%	23.37%	+8.69%	Elongation increased, supporting retention of flexibility after ageing.
Longitudinal nail-shank tear resistance	579.86 N	Not repeated after ageing	-	High measured tear resistance provides supporting evidence of resistance to local tearing.
Transverse nail-shank tear resistance	512.18 N	Not repeated after ageing	-	High measured tear resistance in the transverse direction.

3.1 Overall comment on the measured results

The results show a stable mechanical response to the accelerated exposure. Of the four properties measured both before and after ageing, only the machine-direction tensile strength decreased, and the reduction was limited to 1.41%. The transverse tensile strength increased slightly, while elongation increased in both directions.

This pattern is important from a durability perspective. A material undergoing significant thermal degradation would normally be expected to show a progressive loss of strength and/or flexibility. That behaviour was not evident in this test series. The results therefore do not indicate meaningful deterioration or embrittlement after 72 hours at 82 °C.

4. Watertightness under hydrostatic head

A separate watertightness check was carried out on the membrane using a vertical water column with an internal diameter of 95 mm and a water head of 1000 mm (1.0 m). The water head was maintained continuously for 24 hours. No leakage or visible water penetration through the membrane was observed during the test period.

Test parameter	Test condition / result	STACS technical comment
Water-column internal diameter	95 mm	Defines the circular area of membrane subjected to the hydrostatic head.
Water head	1000 mm (1.0 m)	Equivalent static hydrostatic pressure at the membrane is approximately 9.81 kPa.
Approximate water volume	7.09 L	Calculated from a 95 mm internal diameter × 1000 mm high water column.
Exposure duration	24 h	Provides a sustained rather than momentary assessment of resistance to water penetration.
Observed leakage	None	No leakage or visible water penetration was observed during the 24-hour exposure.
Assessment	PASS	The tested membrane remained watertight under the applied 1.0 m water head for 24 hours.

The test arrangement used by STACS is a simple constant-head water-column test utilizing a 1000 mm water head that applies a hydrostatic pressure of approximately 9.81 kPa on the membrane. Maintaining this head for 24 hours gives a useful practical indication of resistance to liquid-water penetration. The fact that no leakage occurred during the full exposure supports the membrane's intended function as a secondary barrier beneath the roof covering.

$$p = \rho gh = 1000 \times 9.81 \times 1.0 = 9810 \text{ Pa} = 9.81 \text{ kPa}$$

$$V = \pi \frac{D^2}{4} h = \pi \times \frac{0.095^2}{4} \times 1.0 = 0.00709 \text{ m}^3 = 7.09 \text{ L}$$

5. Accelerated-ageing assessment

5.1 Ageing principle

The laboratory ageing condition was 82 °C for 72 hours. To provide a practical indication of the severity of this exposure, a Q10 = 2.0 ageing assumption has been used with a reference service temperature of 25 °C. Under this assumption, the rate of the relevant ageing process doubles for each 10 °C increase in temperature.

$$AF = Q10^{\frac{T_a - T_s}{10}}$$

$$AF = 2^{\frac{82 - 25}{10}} = 51.98$$

The equivalent exposure time at 25 °C is therefore:

$$t_{eq} = 3 \text{ days} \times 51.98 = 155.9 \text{ days}$$

$$t_{eq} = 0.427 \text{ years at } 25^{\circ}\text{C}$$

Accordingly, 72 hours at 82 °C represents approximately 5.1 months of equivalent exposure at 25 °C under the adopted Q10 = 2.0 model. This is a modelling equivalence and not a statement that all environmental ageing mechanisms are reproduced by thermal exposure alone.

5.2 Exponential tensile-retention model

For the decay calculation, the machine-direction tensile result is used because it is the only measured tensile property that showed a reduction after ageing. This provides the conservative basis for the projection. The transverse tensile result could not be used for decay modelling because it increased slightly after ageing.

$$R = \frac{P_t}{P_0} = \frac{13.69}{13.89} = 0.9856$$

The measured machine-direction tensile-strength retention was therefore 98.56%. A simple exponential model is applied:

$$P(t) = P_0 e^{-kt}$$

$$k = \frac{-\ln(\frac{P_t}{P_0})}{t}$$

$$k = -\ln((13.69/13.89))/0.427 = 0.03397 \text{ year}^{-1}$$

$$P(t) = 13.89 e^{-0.03397t}$$

5.3 Projected tensile-retention periods

Tensile retention level	Projected time at 25 °C	Interpretation
90%	3.1 years	High-retention screening level
70%	10.5 years	Conservative durability level
50%	20.4 years	Long-term fit-for-purpose retention level

$$t_{50}(25^{\circ}\text{C}) = 20.4 \text{ years}$$

5.4 Interpretation of the ageing model

The calculated 50% tensile-retention period of approximately 20.4 years is a mathematical projection based on the small 1.41% machine-direction tensile reduction measured after the accelerated exposure. It should therefore be interpreted as supporting durability evidence rather than as an exact service-life guarantee.

The measured data are, in fact, more favourable than a simple decay curve suggests: transverse tensile strength and both elongation values increased after ageing. For this reason, no exponential decay model has been forced onto elongation, since the test results do not show elongation decay.

6. Durability conclusion for Agrément consideration

The DAMAX ECOLAY 5070 under-roof membrane showed good retention of its mechanical properties after accelerated thermal ageing at 82 °C for 72 hours. Machine-direction tensile strength retained approximately 98.6% of its initial average value, while transverse tensile strength and elongation in both directions did not deteriorate.

The laboratory results therefore provide no indication of significant thermal degradation or embrittlement under the ageing condition applied. The nail-shank tear results of 579.86 N longitudinally and 512.18 N

transversely provide additional supporting evidence of the membrane's mechanical robustness in the tested condition.

The watertightness test provides useful supporting evidence of functional performance. No leakage was observed after 24 hours under a 1000 mm water head, equivalent to approximately 9.81 kPa. This is relevant to the intended under-roof use because the membrane is expected to provide a secondary barrier against water that may pass the primary roof covering.

Using the conservative Q10 = 2.0 screening model and a 25 °C reference temperature, the 72-hour exposure at 82 °C corresponds to approximately 0.43 years of equivalent thermal exposure. Applying the small measured machine-direction tensile reduction to a simple exponential model gives a projected time to 50% tensile-strength retention of approximately 20.4 years.

Based on the test results and the durability calculations presented in this report, the DAMAX ECOLAY 5070 under-roof membrane demonstrated satisfactory mechanical performance, resistance to accelerated thermal ageing and resistance to water penetration. Based on the properties assessed, the membrane is considered fit for its intended purpose as an under-roof membrane.

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