ENAC ENSAYOS Nº 4 / L E 0 2 4

The calculations included in Annex 1 are not within the scope of the ENAC accreditation.

REPORT No. 083345

CUSTOMER	QLR SYSTEMS Sp. Z o.o.
APPLICANT	ALOJZY THIEL
ADDRESS	Ul. DROBIARSKA 2ª 45-410 OPOLE (POLAND)
PURPOSE	SRI INDEX IN ACCORDANCE WITH ASTM E1980-11
SAMPLE TESTED	WHITE COATING REF. «QLR ONE»
DATE OF RECEIPT	13.09.2019
TEST DATE	17.09.2019
DATE ISSUED	19.09.2019

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Susana Santamaría
Technical Consultant
Industry – Lab Services

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TECNALIA RESEARCH & INNOVATION
Área anardi, 5
E-20730 Azpeitia (Gipuzkoa)

T 902 760 000
T +34 946 430 850 (International calls)

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CHARACTERISTICS OF THE SAMPLES

On 13th September 2019, TECNALIA received from the company QLR SYSTEMS Sp. Z o.o., four test specimens of coating applied by the Customer measuring 100 mm x 100 mm and referred to as:

«QLR ONE»

The annex 2 includes the technical data sheet for the product tested supplied by the customer.

CALCULATION REQUESTED

The calculation requested is the determination of the **SRI index** of the test specimen received in accordance with **ASTM E1980-11** «Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces».

Two tests must be done prior to the determination of the SRI index;

- Determination of the **solar reflectance** in accordance with **ASTM E903-12** «Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres».

- Determination of the **emissivity** in accordance with **ASTM C1371-15** «Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers».

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TESTS CARRIED OUT

SOLAR REFLECTANCE

The determination of the reflectance between 280 and 2,500 nm was carried out using a Perkin-Elmer Spectrometer Lambda 900 UV/VIS/NIR spectrophotometer with an integrating sphere of 150 mm in diameter and white standard.

The test was carried out under laboratory conditions at (23±2) ºC and a relative humidity of under 70%. The test specimens were conditioned for 24 hours under the laboratory conditions described above.

The method used has the following characteristics:

- Wavelength interval: 5 nm
- Scan speed: 284.6 nm/min
- Slit UV/VIS:1
- Detector gain NIR:4

Six measurements were taken on the test specimens received.

Based on each reflectance measure, solar reflectance was calculated using the selected ordinate method set out in Section 8.3.4.. Ordinates were selected from the values of direct normal solar irradiance specified in Table X2.3 of the ASTM E903-12 «50 Selected Ordinates for G173 Direct Normal Irradiance AM 1.5». The average of the solar reflectance values was calculated.

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EMISSIVITY

The measuring equipment used was an emissometer model AE manufactured by Device & Services Company for low and high emissivity.

The test was carried out under laboratory conditions at (23±2) ºC and a relative humidity of under 70%. The test specimens and test device (Emissometer Model AE) were conditioned for 24 hours under the laboratory conditions described above.

Emissivity values are determined by comparing the minimum standard value estimated at 0.04 using a silver and copper alloy disc and the maximum standard value estimated at 0.88 using a black disc close to perfect black with a value of 1, made of galvanized aluminium and coated with Teflon. The values of these materials of reference are described in technical note 78-2 provided by the Device & Services Company, which explains how these standard emissivity values have been reached.

Ten measurements were taken on the test specimens received and the average was calculated.

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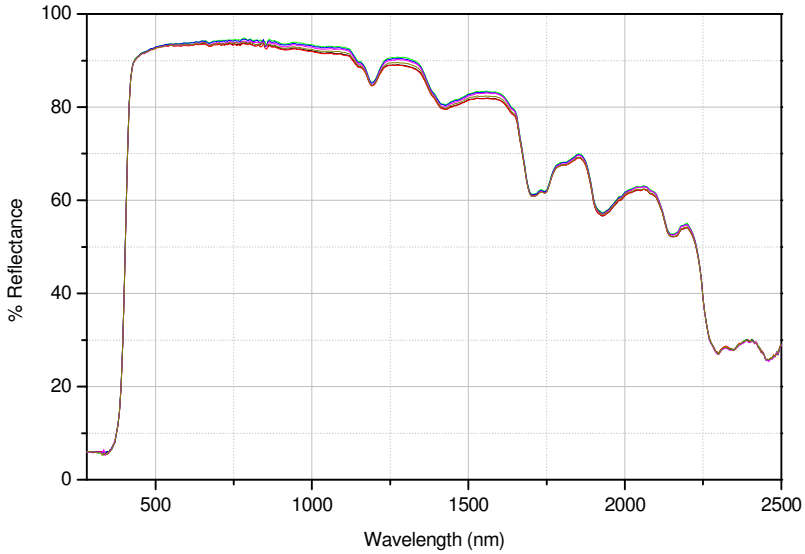
RESULTS

SOLAR REFLECTANCE

The following graph shows the data of the spectral reflectance of the test specimen.



The result of solar reflectance of the test specimen referenced as «**QLR ONE**» is:

Solar reflectance (%)	**86.0 ± 0.7**
Standard deviation	**0.3**

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EMISSIVITY

The results of emissivity are:

Measurement	1	2	3	4	5	6	7	8	9	10
Emissivity	0.84	0.82	0.83	0.83	0.84	0.83	0.84	0.84	0.84	0.84

Therefore, the mean emissivity value of the test specimen referenced as **«QLR ONE»** is:

Emissivity	**0.84 ± 0.04**

SRI

Using the solar reflectance and emissivity values obtained, the following **SRI index** values are obtained, in accordance with the ASTM E1980-11 Standard for different convection coefficients:

Convective coefficient	Wind	SRI
Low (5 W/m²K)	0-2 m/s	106.7 ± 1.2
Medium (12 W/m²K)	2-6 m/s	107.0 ± 1.1
High (30 W/m²K)	6-10 m/s	107.4 ± 1.0

DECLARATION OF UNCERTAINTY

The expanded uncertainty of measurement has been obtained by multiplying the standard uncertainty by the coverage factor k=2 which, for a normal distribution, corresponds to a coverage probability of approximately 95%.

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ANNEX 1

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The ASTM E1980-11 Standard defines the **steady-state surface temperature** T_S as the temperature of the surface, in K, under the standard solar and ambient conditions. For the purpose of the surface temperature calculation the conditions are defined as a solar flux of 1,000 W/m^2, ambient air temperature of 310 Kelvin y sky temperature of 300 K.

The next table shows the surface temperature value in K for each convective coefficient:

Convective coefficient	T_s (K)
Low (5 W/m^{2}K)	318.4
Medium (12 W/m^{2}K)	315.3
High (30 W/m^{2}K)	312.4

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ANNEX 2

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QLR ONE

www.qlrsystems.com
info@qlrsystems.com

QLR ONE

PRODUCT DESCRIPTION

QLR One is a high performing protective barrier for a variety of architectural surfaces and roofing substrates. Applied in liquid form, upon cure, QLR One forms a durable and weatherproof roofing membrane that is highly resistant to degradation from UV and natural weathering.

Trusted by professionals, QLR One coating offers superior coverage and performance as one component coat applicated in one mm thickness only. QLR One is highly reflective, seamless, waterproofing coating for flat and slope roofs. QLR One is designed for new and refurbished roofs, as an efficient, fast and economical solution for investors and contractors. Primerless adhesion to most substrates and best-in-class ponding water resistance ensure that the job is done quickly and confidently.

ADVANTAGES

- High reflectance ,
- Easy application,
- Primerless adhesion to most substrates,
- Best-in-class ponding water resistance,
- Superior UV resistance,
- Abrasion resistance,
- Severe weather resistance,
- Unaffected by standing water,
- Ultra-low VOC,
- Versatile temperature application range: +10°C - +40°C; call if substrate > 50°C,
- Environmentally responsible; solvent free.

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QLR ONE

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KEY FEATURES AND TYPICAL BENEFITS

- high SRI = up to 60% lower roof temperature, up to 10°C lower indoor temperature and up to 30% lower air conditioning costs,
- High Build Formulation – Allows for proper application on vertical surfaces and hangs on peaks without sagging,
- Unaffected by Standing Water - Ponding water resistant,
- Ease of Use – can be applied with common airless equipment, roller or brush, and it is a single component material that requires no mixing of separate components,
- Durability – cured polymer exhibits excellent long-term resistance to natural weathering including: extreme temperatures, ultraviolet radiation, rain and snow,
- VOC Compliant – high solids solvent-free formulation and low Volatile Organic Compounds content is very low and does not threaten the health of applicators and the environment,
- Storage & Shelf Life – QLR One should be stored in heated warehouses during cooler months in the temperature 0-40°C. Shelf life is 24 months from date of manufacture when properly stored.

BASIC USES

QLR One roof coating is an excellent product to consider for coating structurally sound roofing applications including: concrete, modified bitumen, BUR, single ply synthetic membranes (PVC, TPO, FPO, EPDM), synthetic liquid membranes (PU, PUA), PU foams, metal sheets and sandwich panels, other horizontal and vertical roofing, and existing coatings.

Perform an adhesion test on each surface type to ensure a secure bond has been made.

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QLR ONE

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info@qlrsystems.com

PHYSICAL PROPERTIES

PARAMETER	NORM	QLR
Consistency	MB/02/1/2015	dense liquid
Colour		White= RAL 9003 Grey = RAL 7030
Density, [g/ml]	PN EN ISO 2811-1	1,40
Brookfield viscosity (mPa·s): 20 RPM, 25 oC, spindle 6	PN-ISO 3219	11 000-13 000
Curing time of first layer [h]	PN-EN ISO 9117-3	2.0
Curing time of coating [h]	ASTM D1640	24
VOC, g/l	1999/13/EC	<24
Temperature resistance [°C]		-35, +85
Modulus @ 100%, MPa , 23°C,50% humidity	PN-ISO 527-1	1,5
Tensile strength at break, MPa 23°C,50% humidity	PN-ISO 527-1	2,2
Elongation at brake, %23°C,50% humidity with/without reinforcement	PN-ISO 527-1	300%
Elasticity in low temperatures [°C]	PN-EN 1109:2013-07	- 35
-20 (MDL)		
Water tightness [kPa]	EN-PN 1928:2002	250
Water vapour diffusion resistant factor [μ]	ETAG 005	3500
Working life of product	ETAG 005	W3
Resistance to external fire	EN 13501-5+A1:2010	BRoof (t1)
SRI (Solar Reflectance Index)	ASTM E1980-11	106.7
Reflectance	ASTM E903-12	0.86
Emissivity	ASTM C1371-15	0.84
Weight burden to 1m2 of roof [kg]	x	1,4
Shore hardness A	ISO 868	85

QLR WARRANTY

- Dedicated objects warranty,
- Executive and as-built supervising service,
- 3rd party independent warranty inspection,
- Efficient warranty administration,
- Up to 15 years available.

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QLR ONE

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PACKAGING

QLR One roof coating is available in nominal 14 kg plastic pails.

GLOBAL TECHNICAL SERVICES

For additional technical resources, please contact your local customer Service Center. Any technical advice furnished by QLR Service Center or any representative of QLR concerning any use or application of any QLR product is believed to be reliable, but QLR makes no warranty, expressed or implied, of suitability for use in any application for which such advice is furnished.

PRODUCT SAFETY, HANDLING AND STORAGE

Customers considering the use of this product should review the latest Safety Data Sheet and label for product safety information, handling instructions, personal protective equipment if necessary, and any special storage conditions required. Safety Data Sheets are available at www.qlrsystems.com Use of other materials in conjunction with QLR products (for example, primers) may require additional precautions. Please review and follow the safety information provided by the manufacturer of such other materials.

INSTALLATION CONSIDERATIONS

SURFACE PREPARATION

QLR One roof coating can be applied to itself as well as a variety of roofing materials and substrates including: single ply membranes (TPO, PVC, EPDM - they may require priming), spray-applied polyurethane foam, metal, concrete, and common parapet/coping materials. Asphaltic substrates such as; modified bitumen, smooth BUR, and granulated cap sheet may require bleed blocker. Surfaces to which QLR One is to be applied must be clean, dry, structurally sound and free of loose particles, dirt, dust, oil, frost, mildew and other contaminants. Damage to the underlying roof system, such as cracks, openings, holes, etc. should be properly repaired prior to application. Saturated substrates must be removed and repaired appropriately.

QLR One roof coating should verify that suitable adhesion can be attained to all existing

roofing materials to be coated prior to large scale application of the coating. It is recommended that a test patch be cleaned and coated with QLR One to

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verify the effectiveness of the asphalt bleed cleaning method and adhesion to the surface(s).

APPLICATION GUIDELINES

QLR One roof coating should be applied as received and dilution with solvent is not recommended. If settling in the package has occurred, stir or shake the material prior to use. Care should be taken to avoid overspray onto adjacent building materials, vehicles, plants, etc. Overspray can be cleaned up before it has cured by washing with water. Cured material can be removed from surfaces with a razor blade or scrubbed off with steel wool or synthetic abrasive pads and solvent. To control overspray, avoid spraying in winds that may cause drift. Surfaces not intended for coating should be masked or covered.

QLR One roof coating should be sprayed or rolled ensuring uniform build and thorough coverage and can be applied in two coats. If applying in multiple coats, allow adequate time between each coat for the coating to cure before applying additional coat. Final cured film thicknesses must be free of voids, pinholes, cracks or blisters.

APPLICATION TEMPERATURE

QLR One roof coating can be applied throughout the year as long as the substrates being coated are completely dry. Frost and/or moisture will interfere with adhesion. Lower temperatures will lengthen the skin over, tack free and ultimate cure time and may require an overnight cure in cold months to allow the top coat application to proceed (film build may not be sufficient to allow walk over). Higher temperatures will accelerate the cure rate and decrease the open time of the coating. Contact manufacturer if applying to substrates over 50°C.

APPLICATION EQUIPMENT

QLR One roof coating can be applied by spraying, rolling or brushing. QLR One works with most commercially available spray application equipment that can deliver a minimum of 200 bar at the spray tip for at least 3,0 liters per minute. Always use components rated for the required pump pressure.

Equipment and tools have to be cleaned with water before products cures.

APPLICATION THICKNESS

A in order to achieve the minimum required dry coat thickness of 1 mm, QLR One should be applied in two layers, assuming product consumption in the amount of 0.8 kg /sqm in each layer. Coverage rates are approximate. Irregular surfaces, use of reinforcing textile and other factors may yield different coverage rates. Testing should be performed to determine actual coverage rates necessary to achieve desired thickness in accordance with the applied technology.

LIMITATIONS

QLR One roof coating should not be considered for:

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- Use on pedestrian deck or frequent traffic bearing surfaces; pedestrian traffic is allowed only for maintenance of the roof or devices installed on it,
- Roofs without vapor barrier,
- Water tanks, swimming pools as where there is constant water pressure. Not designed for potable water containment,
- Unprepared surfaces including but not limited to those that are wet, dusty, oily, mildewed, heavily chalked, blistered or other-wise structurally unsound,
- Building materials that might bleed oil or solvents. These include, but are not limited to, certain vulcanized rubber products, tapes, failed sealants, some caulking compounds and asphaltic/mastic materials unless appropriate preparation or primers are used. Consult Technical Services for primer recommendations,
- Surfaces where adhesion has not been verified,
- Inclement weather may negatively affect uncured QLR One roof coating by displacement of uncured material; therefore, application of coating should not proceed if heavy rain, hail or snowfall is impending or expected within 3-6 hours of application.