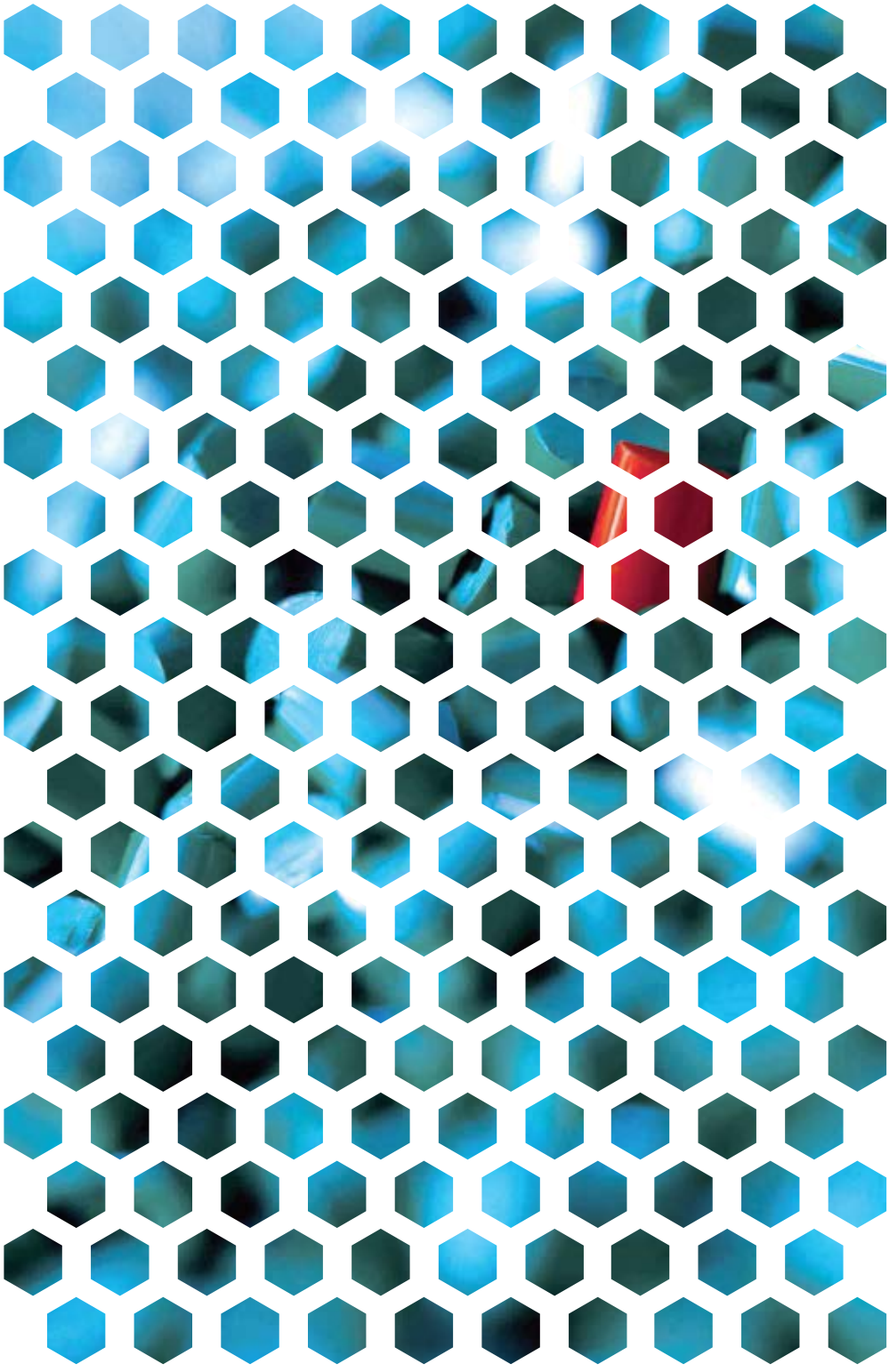


RADICI GROUP

AUTOMOTIVE COOLING & HEATING SOLUTIONS

RADILON

Radici Plastics offers a complete range of products for automotive cooling systems including high performance PA66 materials as replacement for metals and special polymers.

Radici Plastics introduces a series of high performance PA66 products for use in the most critical components of car cooling systems: radiator tanks, thermostat housings, water hoses, inlet/outlet pipes.

All these materials have been engineered to have high thermal resistance when in contact with water and glycol. In the case of the highest performance polymer the continuous operation temperatures may reach up to 135°C.

Cooling & Heating System Materials

PROPERTIES		ISO STANDARD	TEST CONDITIONS	UNIT	RADILON® A RV300RG 3900 BK
RHEOLOGICAL	Melt flow rate	1133	190° 2.16 kg	ml/10 min	
	Total shrinkage (3mm wall thickness)		1000 bar/90°C	%	
MECHANICAL	Tensile strength at break	527	23°C	MPa	180
	Elongation at break	527	23°C	%	3,5
	Tensile modulus	527	23°C	MPa	9900
	Flexural modulus	178	23°C	MPa	8800
	Charpy notched impact strengt	179/1eA	23°C	kJ/m^2	10
THERMAL	Heat deflection temperature	75	1.8 MPa	C°	240
	Melting temperature	3146	DSC	C°	260
	Vicat softening temperature	306	50 N	C°	250
	Flammability	UL 94	1 mm		HB
PHYSICAL	Density	1183	23°C	g/cm^3	1,35
	Water absorption	62	23°C	%	

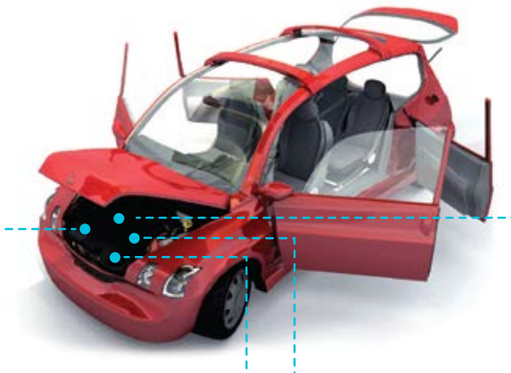
RADILON® A RV300HRG 3900 BK	RADILON® WIT 30/28	RADILON® A RCV3015RKC	RADILON® A RV300RKC 339 BK 07056	RADILON® A NER GF300RKC	PRODUCT	DESCRIPTION
					RADILON® A RV300RG 3900 BK	Automotive cooling liquid resistant PA66-GF30 standard grade
180	155	123	180	150	RADILON® A RV300HRG 3900 BK	Automotive cooling liquid resistant PA66-GF30 grade designed to operate even under the most severe operating conditions. It is considered a "top of the class" material
3,8	4	2,3	3,5	2,6		
10100	8400	6650	9900	8900	RADILON® WIT 30/28	Automotive cooling liquid resistant PA66-GF30 grade designed to be processed applying WIT technology
9600	7200	6100	8800			
13	8		10	7	RADILON® A RCV3015RKC	Automotive cooling liquid resistant PA66-GF30 grade designed to be processed applying GIT technology
240	230		240			
260	260	260	260	260	RADILON® A RV300RKC 339 BK 07056	Automotive cooling liquid resistant PA66-GF30 standard grade
250			250			
HB	HB	HB	HB	HB	RADILON® A NER GF300RKC	Automotive cooling liquid resistant PA66-GF30 grade that contains a portion of post industrial recycled polyamide
1,35	1,35	1,35	1,35	1,36		
1,5	1,7		1,7			

For hoses, special materials have been developed that can be processed using gas injection technology (GIT) or water injection technology (WIT). With either of these technologies, by using Radilon® products, you can obtain hoses with high quality internal surfaces, which drastically reduce the pressure drop caused by surface roughness and satisfy the strictest auto maker specifications, even for last generation engines.

For all car cooling system applications, our glycol resistant PA66 filled materials ensure:

- High thermal resistance in contact with engine cooling fluids
- High creep resistance, even at high temperatures
- Vibration and fatigue resistance
- Excellent chemical resistance to engine compartment fluids

A RANGE OF SOLUTIONS FOR CAR COOLING SYSTEMS...



RADIATOR TANKS

RADILON® A RV300RG 3900 BK *RADILON® A RV300HRG 3900 BK*
RADILON® A RV300RKC 339 BK 07056 *RADILON® A NER GF300RKC*

EXPANSION (OVERFLOW) TANKS

RADILON® A RV300RG 3900 BK
RADILON® A RV300HRG 3900 BK

COOLING HOSES

RADILON® A RCV3015RKC
RADILON® WIT 30/28

INLET, OUTLET PIPES, THERMOSTAT HOUSINGS

RADILON® A RV300RG 3900 BK
RADILON® A RV300HRG 3900 BK

...THE RADILON® HYDROLYSIS-RESISTANCE PA66 RANGE

Injection moulding products resistant to contact with engine cooling liquids: extending PA66 applications to highly critical components

Radilon® PA66 materials for injection moulding are ideal for cooling circuit components, such as radiator tanks, thermostat housings and expansion (overflow) tanks.
In addition to Radilon® A RV300RG, a standard hydrolysis-resistant 30% glass fibre filled material, Radici Plastics presents Radilon® A RV300HRG, an innovative product for the most critical applications.

Radilon® A RV300HRG was designed using an original RadiciGroup technology and can be utilized in all kinds of applications where components must operate under severe operating conditions, such as high temperatures and/or pressures. A typical example would be the thermostat housing right at the engine head. Our product, which has been approved by a number of important end users, opens up new possibilities, as it can be used as a replacement for metals and special polymer materials, such as PPA and PPS.

The charts in Figs. 1, 2, 3 and 4 compare the characteristics of Radilon® A RV300W, a standard PA66-GF30 material; Radilon® A RV300RG a standard glycol-stabilized material; and high performance Radilon® A RV300HRG, after ageing in a 50/50 glycol/water mix.

Fig. 1

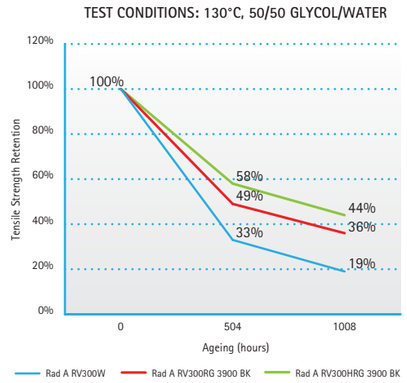


Fig. 2

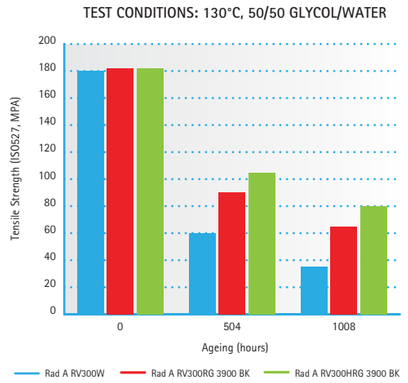


Fig. 3

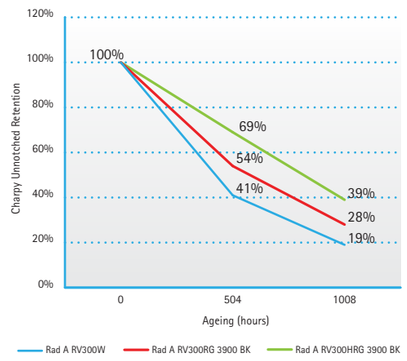
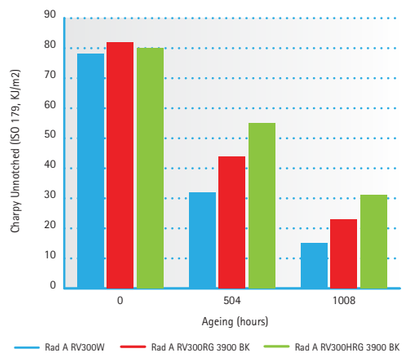


Fig. 4



As we can see from Fig. 3, in the case of Radilon® A RV300HRG, the time to Charpy unnotched impact half life in a glycol/water mix at 130°C is:

- About +30% compared to Radilon® A RV300RG, the standard material used in the manufacture of cooling system components
- About +90% compared to 30% glass fibre filled PA66

A similar trend can also be seen in tensile strength (Fig. 2). An increase in the ageing time needed to reach 50% of the initial property in glycol/water mixes translates into a proportional increase in the expected useful life of the component installed in a car, all operating conditions being equal.

Figs. 5, 6, and 7 show how the product with high glycolysis resistance behaves in contact with a cooling media used for engine cooling at a temperature of 120°C, with ageing extended up to 3000 hours! These tests were performed at end-user sites during the material approval process.

Fig. 5

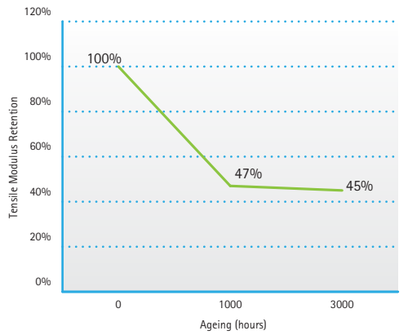


Fig. 6

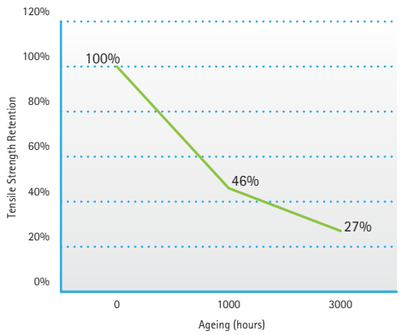
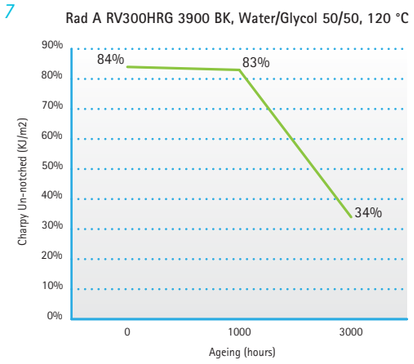


Fig. 7



Radilon® A RV300HRG exhibits excellent resistance to ageing up to 3000 hours at 120°C, thus substantiating the "Top of the Class" status awarded by important end users for use in car cooling systems.

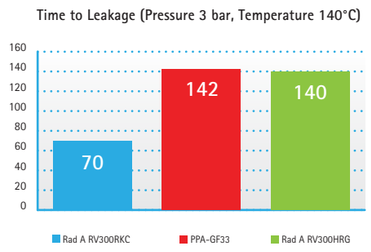
Another test was carried out using an expansion tank filled with a cooling liquid with a vibration welded cover. Constant pressure of 3 bar was applied at 140°C, and the times to leakage were recorded until failure at the welding line.

We can see that the Rad A RV300HRG (Fig. 9) behaves like 33% glass fibre filled polyphthalamide (PPA) with enhanced hydrolysis resistance.

Fig. 8

Static pressure leakage test of an expansion tank (Fig. 8) filled with engine cooling liquid at a temperature of 140°C at 3 bar constant relative pressure.

Fig. 9



In a leakage test with a vibration welded tank cover, Radilon® A RV300HRG exhibits the same behaviour as polyphthalamide (PPA), which is usually recommended for use in contact with engine cooling liquids.

Metal alternatives suitable for GIT and WIT moulding of cooling system hoses

Two other Radilon® PA66 materials, which round out the GIT and WIT range, can be used for the manufacture of liquid cooling system hoses. Besides having good glycol/water resistance, materials used to produce hoses must also be processable into complex shapes by specific technologies. These features make such polymers good candidates as replacements for metals.

Two materials are available:
- Radilon® A RCV3015RKC for GIT moulding
- Radilon® WIT 30/28 for WIT moulding

In both cases, in the engineering phase our technical staff worked hard to ensure the superior quality of the hose internal surface and compliance with the strictest regulations on pressure drops allowed during operation. The use of Radilon® materials for GIT and WIT moulding will achieve complete coverage of the glass fibres by the polyamide matrix, thus preventing glass fibres from being released during the component's life and avoiding possible damage to the car cooling system.

The charts in Figs. 10 and 11 show the results of the glycolysis tests performed during the material approval process.

Fig. 10

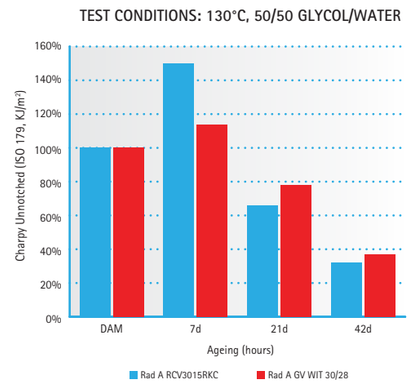
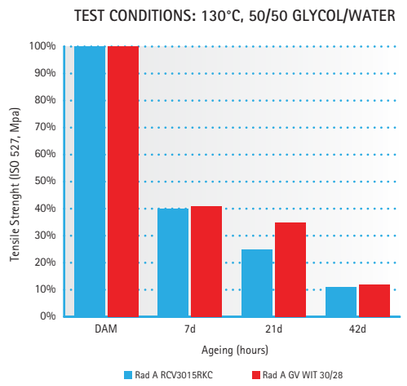


Fig. 11



Radici Plastics: commitment to innovation in products for the automotive industry and more...

Radici Plastics can provide a complete range of materials ideal for car engine cooling systems.
The range of products for this important market segment spans from standard materials to specialty materials and features Radilon® A RV300HRG 3900 BK, classified as "Top of the Class" by important end users.
The latter product was developed for use in very critical applications, in which metal is still the material of choice.
Furthermore, Radici Plastics is a recognized player in the sector of technical plastics for the following reasons:

- Upstream integration in the polyamide production chain (PA66, PA6 and PA copolymers)
- Strategic importance of Research and Development
- Customer-orientation in innovation and technical support
- Global presence, including emerging markets in Asia and South America
- Complete range of materials and willingness to search for tailored customer solutions

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