

Protection of Magnesium and Aluminium

The Rockhard Range of Baking and Two Component Room Temperature Cure Sealants, Primers and Finishes

Indestructible Paint has been involved for more than 50 years with the development and production of coatings for magnesium and aluminium. Our first experience with magnesium was as far back as the 1950's with the introduction of the Rockhard range of coatings, initially for the SRN1 hovercraft and the Westland Widgeon helicopter. These initial coatings were stoving (baking) systems, and still form the basis of the range, albeit with considerable and on going development in the ensuing years.

We believe that the American AMS 3132 phenolic based system which appears to be their standard magnesium protection is the fore runner of our Rockhard range of products. This was the technology used for protecting magnesium in the 1940's in the UK, and has been superseded a long while ago. However, some of the thin film principles are still used today in obsolete, but still called for, specifications.

As with many other industries, current aerospace prime manufacturers have been formed from the amalgamation of several older companies. As an example Rolls-Royce aero engines includes Hawker-Siddeley and Bristol Aerospace among others. Each of the companies had their own system for magnesium protection; consequently the Rockhard range includes differing products released to differing specifications to achieve similar results. We still hear references to Glasgow systems, Derby systems, Bristol systems and even Leavesdon systems.

Latest developments have included work on both the traditional baking and room temperature cure (touch up) ranges, to take account of improved performance requirements and constantly evolving environmental and safety legislation. These new additions are detailed in the listing of products. New work is on-going into room temperature cure two component systems to give corrosion and protection performance to match the baking products, a development we consider to be particularly exciting. Like all our product ranges, we continue to engineer Rockhard products to meet specific client requirements.

Pre-treatment

Historically we have worked with commercially available pre-treatments which in the UK have been chromate based. In the USA, there has been a move to chrome free systems, and heavy anodizing and new anodic technologies including HAE, Tagnite, Magoxid and Keronite have been employed. This trend is now being seen throughout the world, and several additional chrome free systems are being introduced.

We now believe that there needs to be more synergy between the pre-treatment and the sealing / priming operation, and we can now offer a chrome free immersion pre-treatment system



aluminium. This is undergoing ongoing development to improve the protection on magnesium. Please refer to our **Iptreat** information leaflet for full details.

Mag Sol

Work conducted with a UK University has developed a "SOL-GEL" system that provides excellent corrosion protection on varying grades of Magnesium. This is now being evaluated, as part of a UK Government funded work package, on typical Aerospace Aluminium Alloys. Please refer to our Mag-Sol information sheet.

We believe that in aerospace applications all pre-treatment methods benefit from the use of a full surface treatment system. On magnesium it is our conviction that the use of a penetrative sealant is essential prior to application of further primers or colour coats. Whilst, on aluminium, either a chromate, or now more commonly, a chromate-free primer is the choice.

Rockhard Baking Sealants

There are two basic ranges, both which are used to successfully seal magnesium and aluminium. Each have slightly different properties:

961 Type

576-450-002-R1 has good high temperature capability; 1000 hours at 220°C is a normal test. It is also significantly better for intercoat adhesion for subsequent primer or decorative coats. However, it is less colour stable at temperature, with the clear coat going a dark chocolate brown if cured correctly. White versions go a very dark cream / brown when used at elevated temperatures. The latest R1 version is formulated to be Ethyl-Glycol and Acetate free.

The product is widely used on magnesium helicopter gearbox castings, and is specified by a number of manufacturers such as Sikorsky. It is also used as the sealant on magnesium engine casings, prior to application of decorative colour coats.

A recent development, at a specific client behest, is a reduced VOC version, formulated for dip / flow coating application. Utilising latest generation formulation techniques to include reactive diluents, a greater than 25% reduction in VOC's at application viscosity has been achieved. This is being adopted on aluminium heat exchangers. For further information, request our technical data sheet on **IP576-4675**.

985 Type

985-111-800 clear is slightly more complicated in its application parameters, but it does have some distinct advantages. It is possible to build up quite thick coats by part curing between coats with a final full cure after application of the topcoat. This material then retains its colour better than the 961 grade and can be used as a decorative coating. 985 systems are understood to have slightly better resistance to chemicals used in anodising baths, making this range more suitable where re-anodising is part of the production process.

Again, a recent development is a toluene free, reduced VOC version (**IP985-547**), which is now widely specified and used, with approvals from the Safran Group and Airbus Helicopters.

In overhaul situations, it is not always possible to utilise high temperature baking sealants; components to be coated can include several differing metal parts, with resultant differing rates of expansion at elevated temperatures. For these types of application, we have developed a low cure version, which gives technical performance approaching the full baking grade.

985-111-002 has been adopted by McDonnell-Douglas Boeing for use on overhaul of Apache helicopter gearboxes.

A commercially available product from this low cure range, **IP985-125** is being evaluated in several other aerospace and industrial areas where cure temperatures below 150°C are essential.

Rockhard Baking Primers

For protection of aluminium, it is possible to utilise a primer system in addition to, or as an alternative to, clear sealants. It is also quite common to use a primer over both 576 and 985 sealants on magnesium.

The Rockhard primers are based on the 985 system, and have traditionally utilised chromate pigments, well proven as an anti-corrosive system. **700-155-003** has been used in many applications, including on aluminium fan cases on turbine engines. This is still the product specified by Rolls-Royce to MSRR 9226.

However, changes in environmental and safety legislation is forcing a move to chrome free systems. This is especially so in Europe and America. Much development work has been conducted into alternative chrome free anti-corrosive pigments; the resulting primer, **IP985-6500** also being produced toluene free.

The primer has been tested at the Rolls-Royce main test laboratory to give over 6000 hours neutral salt spray performance to ASTM B-117 on aluminium. The product has now been approved and adopted across the Safran group in France and by Airbus Helicopters where technical performance has actually been improved over the previous chrome containing system.

Rockhard Baking Finishes

As with Rockhard primers, the range of finishes are based on the 985 system, which ensures colour stability across a wider temperature range.

Black gloss (**614-150-002**), black matt (**615-155-001**) and aircraft grey gloss (**985-000-693**) have been used for many years on a variety of projects, including undercarriages, heat exchangers, engine casings and control gear. Normally released to DTD 5562, these products also meet the requirements of MSRR 9226.

Mirroring the work conducted with the 985 sealants and primers, an additional range of finishes (**IP985 Range**) is now available with reduced VOC's and toluene free.

A wide colour range is available, which has been approved and is in use throughout the Safran group for both aerospace and military applications, and by Airbus Helicopters.

This range will of course still meet the requirements of DTD 5562 and MSRR 9226.

Rockhard baking systems are extremely chemical resistant, very hard and erosion resistant. For example, both systems are still used for coating turbine blades and varying engineering parts in aerospace, military and other high performance applications.

Rockhard Cold Cure Two Component Systems

Originally designed as touch up systems for Rockhard baking systems, Rockhard twocomponent systems are used where baking / stoving is not desirable or possible, and where good corrosion or chemical resistance is required.

By nature of their room temperature cure capabilities, these products can be used on temperature sensitive substrates, including composites, some plastics, and even wood and asbestos.

As such specific products from the range have been used in untypical aerospace applications, including as the primer-filler of composite airframe panels on the HAL DHRUV advanced light helicopter.

A range of sealants, primers and finishes are available, in both traditional low solids, high VOC grade and the latest technology low VOC, HAPS solvent free grade. Again, to mirror the work conducted on the baking products, primers containing chromate and non-chromate anti-corrosive pigments are available.

The products have been approved and are used against a wide range of specifications, including Def-Stan 80-161 (DTD 5555); MSRR 9064; LB 568; PWA 36568/9 and CPW 714/5.

Examples of the ranges include 750-450-004 (clear sealant); IP3-6700 (low VOC chromate free primer); 750-152-009 and 700-155-005 (gloss and matt black finishes) and the IP3 Range of low VOC gloss colours. all used with the relevant catalyst's.

Ongoing development work investigating methods of increasing surface hardness and corrosion and chemical resistance, including nano technology, will, we expect produce a range of cold cure products with equivalent performance characteristics to the baking ranges.



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