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How to improve the durability of paint on wood

By Steve Smith

The highest quality paints combined with the most professional surface preparation and paint application still don't always give the best results. Painted surfaces sometimes crack and peel all too quickly, leading to unhappy customers, extra costs and lost business.

One of the biggest sources of failed paint is on older buildings, on weathered, slightly deteriorated wood. Even after cleaning off the loose wood then filling and priming the surface it is not uncommon to see the paint starting to fail only one to three years later.

Why is this? Why is the paint coming loose from the wood?

The answer is that the surface of the wood is actually rotting away from under the paint.

Water from external rain may not get under the paint from the outside, but water can still get under the paint and start the rot process. When things like cars or buildings get cold enough at night, moisture in the air condenses onto those cold surfaces, forming dew. The temperature at which moisture condenses onto a surface is the dew point and it varies with the humidity of the air. When you see dew on the outside of a painted surface, you can expect there will also be dew forming on the inside of that same paint film.

Wood contains over a thousand times as much moisture as the same volume of air. Thus, when the outer surface of the building is cold enough for condensation to form on the outside of the paint, the wood just below that painted surface will draw water vapor from inside the wood and condense it on the inside surface of the paint film as well.

The wood can become completely waterlogged in a microscopic layer just below the painted surface.

Further into the structure, the wood provides enough thermal insulation to keep the temperature above the dew point.

When the sun comes up in the morning, the outer painted surface is warmed, the dew on the outside evaporates, and a new day begins. Below the paint film, however, there now exists warm, damp wood. These are perfect conditions for fungal spores to hatch, grow, eat the wood, multiply rapidly and teach their young. Fungal spores are present everywhere, especially on older wood surfaces. Fungi need only air, moisture, warmth and food and they now have all four. There are thus a few hours in the morning when the wood rots on a microscopic scale just beneath the paint.

The wood just beneath the paint also swells as it gets damp overnight, then shrinks again as it gradually dries out during the day. Paint films are more brittle when cold, and softer when warm, and small cracks may occasionally form as a result of this daily shrink/swell cycle. These allow external condensation and rain to enter the wood, keeping it even more damp for a longer period, thereby accelerating the decay process beneath the paint.

In the past, the lead used in many paint formulations acted as a built-in fungal inhibitor. However, most modern exterior paints and primers lack anti-fungal additives [some may contain these or have them added but most do not]. Unintentionally, this change in the way paint products are formulated has led to a greater tendency in recent years for rot to develop under the dried paint film.

It is therefore not unusual for wood surfaces, especially old or weathered wood, to show paint failure in one to three years. This reflects badly on the paint store, the paint manufacturer and the painting contractor, despite their best efforts.

Clear Penetrating Epoxy Sealer

Thirty years ago I invented Clear Penetrating Epoxy Sealer™ (CPES™), also known as MultiPrime™. Today, this product has a long history of helping wood resist fungal deterioration beneath paint films. This is done without the need for any fungicide additives. The natural properties of wood and its resins are used in a novel way to discourage the start-up and continuation of fungal activity under a paint film.

MultiPrime™ stops the wood immediately beneath the paint from becoming saturated by dew and also keeps the paint glued to the wood, thus helping prevent the microscopic fungal activity that causes paint failure.

The resin system of MultiPrime™ is made largely from the natural resins of wood itself. This was done so that, when it was finally cured, the impregnated and microscopically restored wood surface would have a toughness and a flexibility comparable to the original wood. This eliminates the failures so commonly seen when a stiff resin coating or hard filler is used to "repair" wood. The proof of treated and untreated wood having similar mechanical properties, and the impregnated wood being if anything stronger, are published in a scientific paper at www.woodrestoration.com.



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Since there is naturally a high percentage of water in wood (normally 8-12% but often 20-30% by weight when abnormally wet) the solvent system in MultiPrime was formulated to dissolve much of this excess water. This allows MultiPrime to penetrate damp wood far better than any other product. Our main distributor in the USA, The Rotdoctor, (www.rotdoctor.com) has done a study that shows this superior penetration.

The selective penetration of MultiPrime into the deteriorated parts of wood is shown on the Smith & Company web site [www.smithandcompany.org /glulam.html](http://www.smithandcompany.org/glulam.html), as well as in the time-lapse photographs at the www.woodrestoration.com web-site mentioned above. These show that even in apparently sound wood there are microscopic channels of abnormal porosity. These were invisible until discovered by the research staff of Smith & Co. while preparing the woodrestoration paper. No one knew that the fungi had eaten microscopic channels into the wood, along single wood fibres, farther than anyone could see. This is one of the reasons why the failure of paint on old but apparently sound wood had remained a mystery all these years.

MultiPrime rapidly absorbs into the natural porosity of low-quality wood, as well as deteriorated areas of wood. After the solvent content of MultiPrime has evaporated, the impregnated wood has a porosity comparable to dense, sound natural wood, thus allowing the wood to "breathe", allowing the normal movement of water and water vapor within wood. This is important, because the accumulation of excess amounts of liquid water anywhere in wood promotes rot. Fungi do not flourish when the moisture content of wood is below about fifteen percent. The normal moisture content of wood protected from the weather is about eight to twelve percent. Fungi flourish when the moisture content of wood is above roughly twenty-five percent. A small amount of water on wood in a small region will not immediately promote rot, as the water migrates into the greater volume of the wood and some excess evaporates, and the natural ability of wood to pass water internally maintains the overall moisture content in a safe range. However, water does not migrate rapidly enough to prevent rot under a paint film, as less than an hour of warmth is enough to allow a little more decay each morning.

The thin layer of MultiPrimed-impregnated wood under the paint discourages rot in another way. It is hydrophobic, thus discouraging the condensation of liquid water in the area immediately beneath the paint film.

The resin system of MultiPrime takes several days to cure, and so it acts as an epoxy glue to chemically bond the paint film to the wood. This eliminates the microscopic air gap among the fibres behind a paint film on wood, and replaces it with a flexible glue that bonds the paint to those fibres and further bonds those fibres into the sound wood.

The wood impregnated with the wood-derived resin of MultiPrime is no longer plain cellulose, and is not easy for fungi to digest, and tastes bad to such small life.

In this manner moisture in wood is reduced, air is reduced, and the available food supply is made less attractive. By removing these key elements necessary for fungal growth, and by actually gluing the paint to the wood, the early failure of painted wood is reduced to negligible levels and many more years of paint life are commonly seen.