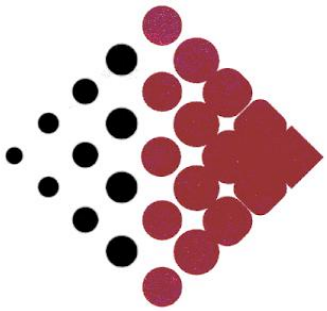

Automotive Composites Alliance

Serving the Car and Truck Industries

RRIM PAINT MANUAL ADDENDUM FOR EXTERIOR BODY PANELS

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Post Molding Handling and Finishing
(Top Coating)

Typical RIM parts are trimmed, postcured, power washed, primed and (sometimes) painted before shipping to an assembly plant. This serves several purposes:

- Postcure develops ultimate mechanical properties and completes the reaction in a timely fashion, driving gases from the polymer
- Power washing removes contamination from the part surface that could otherwise cause paint adhesion failures or poor paint wetout
- Prime coating provides a quality control measure to prevent defective parts from being shipped, plus, if it is conductive, it improves the transfer efficiency of topcoats
- Priming can also assist the prevention of long-term ultraviolet light discoloration of the molded panel

Generally, the topcoat is applied at the assembly plant for color match; however, it may be applied immediately after curing the prime coat if desired. A breakdown of each of the post molding handling steps follows.

Trimming

Once a RIM polymer has been demolded, the part must be trimmed to remove the aftermixer, runner and residual flash. Some operations may include a stamping operation to punch mounting holes in the part (but this is usually not necessary). After these steps, the part must be inspected for any molding defects so that tooling or equipment modifications can be made. This inspection will also prevent defective parts from being accidentally run through the paint line. The trimming, stamping, and inspection are generally carried out by the operator and one trimmer. After the trimming operation, the parts are transported to the paint line typically by conveyors.

Postcure

RIM parts are to be postcured before washing and painting. Usually it is recommended that parts be postcured for one hour at 280°F (138°C) for non-E-coat polymers and 365°F (185°C) for one hour for E coat capable polymers. If parts are not postcured, excessive outgassing of the plastic can occur, trapping bubbles in the paint. If parts are to be painted at temperatures above 280°F (138°C), higher postcure temperatures of up to 320°F (160°C) are suggested for the non-E-coat capable polymer.

When the molded parts are received in the paint facilities, they are placed on painting fixtures, called “bucks”, which are generally made of aluminum. The bucks are mounted on a conveyor and run through the paint facilities. These fixtures are designed to provide dimensional support during the entire paint process. They should also provide for expansion and contraction of the part.

Substrate Cleaning

The purpose of cleaning plastic in the automotive industry is to prepare the surface for painting. Painting exterior plastic is necessary to achieve a Class A finish, cover molding imperfections and to protect it from weathering. Sources of contamination include material handling soils, shop soils, machine soils, fingerprints, and external and internal mold release agents.

External mold release should be used sparingly on parts that are going to be painted. Poor paint adhesion results from too much external mold release build up on the tool, because thick layers of mold release are difficult to wash off RIM parts.

RIM substrates containing internal mold release (IMR) are cleaned primarily by aqueous power washing. Spray impingement pressure removes the contaminants and prevents redeposition. The aqueous power washing system that our lab recommends most often is a five-stage system. Wash chemistries have been developed using acidic cleaning solutions followed by a metal phosphatizing acid in a later stage. Systems like this are currently running with less than 1% scrap rate due to cleaning. Several suppliers of cleaning chemicals are in existence. The recommended cleaning procedure is applicable to systems designed to operate when either soap or wax external mold release is used. The cleaning system is shown on Page 4 in Table 1.

The variables to be monitored and recorded are spray time, spray pressures, temperatures, chemical concentrations and water conditions. The spray pressures should be in the range of 25 to 30 psi (0.17–0.21 MPa) minimum.

To reduce water spotting, the parts should be racked so that they do not drip from one onto another. For consistent results, control checks must be made on:

- Chemical Concentrations (pH)
- Deionized Water Quality
- Rinse Water Cleanliness

An automatic controller and feeder are recommended to control wash chemical concentration. The controller will maintain the desired concentration by feeding in the necessary make-up chemical. The tap water rinse should be surface overflowing at a rate which turns over the whole volume in the rinse tank every eight hours of production. This will maintain water cleanliness. The conductivity of the final de-ionized water rinse should be a maximum of 10 micro-ohms/cm. A poor quality final rinse will cause water spots. A daily check of the spray nozzles is also recommended. The nozzles can easily become clogged by plastic flash pieces.

TABLE 1 – CLEANING SYSTEM

STAGE	CLEANING SOLUTION	VOLUME	PH	TIME SECONDS	MIN. TEMP., °F
1	TAP WATER	100	-	30	150
2	ACID DETERGENT	3	3-3.5	60	150
3	TAP WATER	100	-	30	150
4	ACID RINSE	2	3.5-4	30	AMBIENT
5	RECIRCULATED DEIONIZED WATER	100	-	30	AMBIENT
6	OVERFLOWING DEIONIZED WATER	100	A	15	AMBIENT

A – THE CONDUCTIVITY OF THE FRESH WATER SHOULD BE A MAXIMUM OF 10 MICRO-OHMS/CM.

Dry-Off

From the power washer, the parts are immediately sent to a dry-off section. In order to ensure IMR does not migrate during dry-off, do not exceed 180°F (82°C) air temperature.

The result of IMR migration is poor primer wetout, either in the form of primer crawl or fisheyes. IMR migration is accelerated by heat. It is recommended that the delay between washing and priming be no longer than two hours. Cleaned parts with longer dwell time should be rewashed before painting.

Testing For Sufficient Wash

The only accurate method to determine if a part has been cleaned sufficiently is to paint it. If the part has poor paint wetout, it is a good indication of problems in the wash system. Other tests to determine if the part has been cleaned sufficiently include appearance of the paint after it has cured and the adhesion of the paint to the part.

Poor wetout is characterized by primer crawl or fisheyes. Primer crawl occurs when the paint moves away from a contaminated surface. The result is an uneven coating thickness that is rough and may have areas where the plastic substrate has no paint covering it. Fisheyes are also caused by paint moving away from a localized spot of surface contamination. They are characterized by round depressions in the paint film. The most common causes of fisheyes are grease, oil and silicone.

Painting

Paint conditions will vary with each paint used and with the type of application equipment used. The paint supplier should be consulted for paint selection and specific conditions required. However, standard operations include primer application followed by a solvent flash and then a primer bake to cure the primer.

Standard conditions for primer baking are 250° - 300°F (121° - 149°C) for approximately 30 minutes. The prime bake temperature is usually lower than the postcure temperature to prevent paint popping of the topcoat. This may be followed by a topcoat and then a cool off period prior to off-loading of the parts from the fixtures.

E-coat capable products were developed to be painted on-line in the assembly plant. Primed panels are assembled at body-in-white and go through the entire E-coat process, including high temperature bake ovens. Standard primer/surface, topcoat, and clearcoat paints are applied during the assembly plant process.

Non-E-coat capable polymers were developed to be shipped unprimed and assembled on the vehicle after the E-coat process. These parts would be painted along with the other vehicle parts in the assembly plant. Non-E-coat capable products can be topcoated off line and shipped fully painted, or can be shipped primed.

Quality Control

After painting, a quality control inspector evaluates every part. If the part requires rework, he/she marks the part and sends it to a repair area (RIM paint defects can typically be repaired and repainted). These parts will either be sanded and placed back on the paint line or declared scrap and thrown away. Otherwise, the part is placed in a crate with proper packing for shipment to the assembly plant.