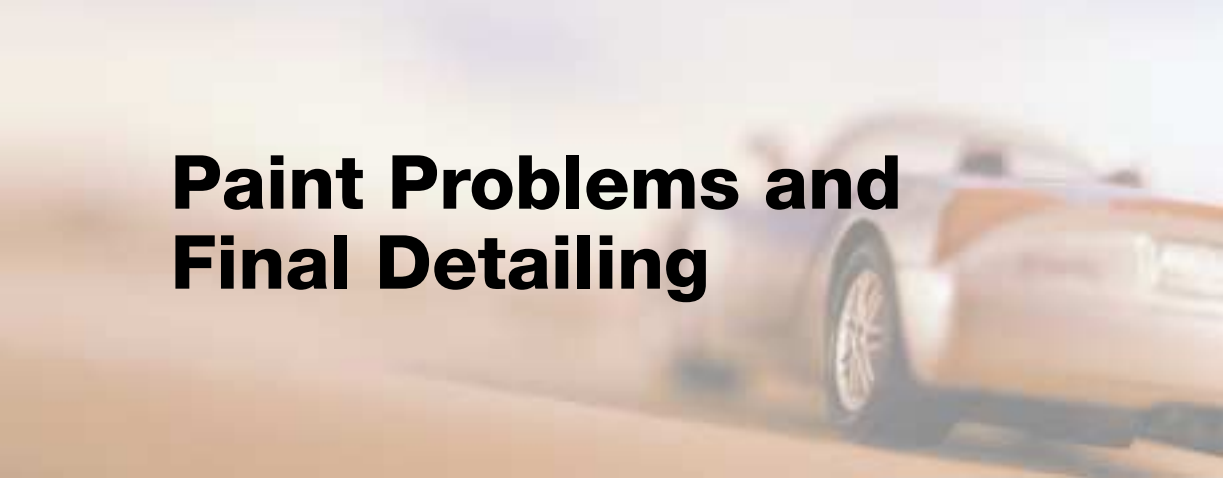


Paint Problems and Final Detailing

CHAPTER 28

OBJECTIVES

After studying this chapter, you should be able to:

- Visually identify and define automotive paint problems.
- Explain the causes and symptoms of finish flaws.
- Use a logical sequence of operations to repair a finish.
- Detail or finesse sand paint flaws using the right tool and abrasive.
- Explain how to avoid damaging a paint job by cutting through the clearcoat when sanding and compounding.
- Summarize things you should do to protect unpainted parts from being damaged during paint repair.
- Hand rub and machine compound a finish using different types of products.
- Describe how to operate a buffing machine without burning through the clearcoat.
- Touch up small chips in the finish on unrepaired panels.
- Final clean and detail a vehicle for improved customer satisfaction.
- Answer ASE-style review questions relating to paint problems and final detailing.

INTRODUCTION

Paint problems include a wide range of defects that can be found before or after painting. To maintain repair quality and satisfy customers, you must be able to analyze and correct finish problems efficiently.

If everyone in the shop does their job, there will seldom be a reason to fix costly, time-consuming paint problems. Ideally, every vehicle can be released to the customer after paint baking and a minor clean-up.

Regretfully, even the best, most professional collision repair businesses will encounter minor paint flaws that must be fixed. On rare occasions, shop and paint company personnel will have to solve major paint problems on existing and freshly painted surfaces.

The technical information provided in previous chapters will help you avoid mistakes that result in paint problems and repainting. This chapter will continue your study of collision repair by teaching you about paint problem conditions, causes, prevention, and correction. The last section of the chapter summarizes how to clean a vehicle before it is released to the customer.

28.1 REPAIRING PAINT PROBLEMS

Most refinishing problems can usually be repaired, but this "reworking" requires time and money. Smart technicians take the time to prevent paint problems before they occur. Unfortunately, there are a variety of causes for defects in a vehicle's finish. They usually originate as a result of problems in the preparation of the body surface, painting procedure, environment, paint ingredients, and other sources.

PROBLEMS IN WET PAINT

If you see paint defects while spraying, you must decide whether to stop work immediately or whether the problem can be fixed so you can continue painting. This depends on the type and extent of the paint problem.

For example, if the problem is poor, wavy bodywork, you should stop right away. A rough body surface will look even rougher after being sprayed with a shiny coat of paint. With an improper body repair, perhaps someone forgot to properly block sand and featheredge a small area body filler. The metalworking, body filler, or other work

problem would have to be corrected before continuing to paint the vehicle.

When painting in even the cleanest paint booth, tiny particles of dust, dirt, hair, and so on can sometimes fall or blow into the paint. There are several things you can do to keep foreign matter out of your freshly applied paint. Keep the spray booth doors closed for several minutes before starting to tack rag and blow off vehicle surfaces. This gives any airborne dust and dirt enough time to settle out of the air.

Do not let anyone open the spray booth doors while you are spraying. If someone opens the booth doors, wind can blow dust, hair, lint, and dirt into the spray booth and onto wet paint. Place a "Keep Out" or "Do Not Open!" sign on the spray booth doors when you are painting.

REMOVING FOREIGN MATTER IN WET PAINT

Paint foreign matter includes anything you see in the paint that will adversely affect the finish (dust, lint, hair, etc.). Sometimes you can remove a tiny bit of foreign matter while the paint is still wet, or you may have to wait until the paint dries to sand out the flaw before continuing.

If you notice something in the wet paint, try to remove it right away—the sooner the better since today's catalyzed paints flash so quickly. A tiny piece of lint or dust can often be lifted out of the wet paint so you can continue painting. Depending on the type of matter in the paint, there are several ways to remove debris from wet paint.

Sharp tweezers can sometimes be used to grab and remove lint and hair from wet paint. Be careful to only touch the debris without disturbing the paint surface.

A piece of fine wire or a toothpick can also be used to lift and remove small flakes of dust from wet paint. Very fine wire can reach into the wet paint and reach under the piece of dust and lift it out of the finish. If done quickly, this will allow the wet paint to flow back out and partially fill the paint surface imperfection.

After removing debris in the paint, blend spray another coat of paint over that area right away. This will help fill in any paint surface flaw that remains where the hair, dust, or lint was removed.

WET SANDING BETWEEN COATS

If you notice small particles or imperfections in the colorcoat, repair them before spraying the clearcoats. Try lifting the particles out of the colorcoat while still wet. If the paint still looks too flawed to be hidden by another coat, you will have to let the basecoat flash enough to wet sand the surface flaw.

Carefully wet sand right over the top of the flawed paint with ultrafine #1,000 to #1,200 grit sandpaper. Wrap the wet sandpaper around a soft sponge-type sanding block. Concentrate your wet sanding action right over the paint flaw. Sand lightly since the paint is flashed but not fully dry.

After you have sanded the flaw level, wipe the area dry. Clean and tack rag the area before giving it another coat of color. Lightly mist and blend the basecoat over the surface flaw to cover any visible problem in the color.

Do not allow the colorcoat to fully dry or cure before applying the clearcoat. Most clearcoats are designed to be applied before the basecoat fully cures. If the colorcoat dries fully, you should scuff sand the surface before clearcoating to provide good adhesion. This is why you must work quickly when trying to remove foreign matter from newly applied paint.

If the piece of dust or dirt in the clearcoat is too small to be lifted out, you can usually repair the problem after the finish dries. As you will learn later, the clearcoat can normally be finesse sanded and compounded to repair minor paint problems.

PAINT COLOR MISMATCH

A **paint color mismatch** causes a repair area to look a different color than the original color on the vehicle. The value (lightness or darkness), hue (color, cast, or tint), or chroma (cleanliness, grayness, or muddiness) may not be exactly the same in the two paints (Figure 28–1).

Causes of Paint Color Mismatch

As detailed in the previous chapter, there are several reasons for a paint color mismatch. The most common causes of a color difference include improper paint mixing and not spraying the paint on properly.

Preventing Color Mismatch

To prevent a color mismatch, always use spray-out test panels and let-down test panels. Use a spray-out panel with

FIGURE 28–1 Note the difference in paint color after this improper panel repair. The metallic paint on the right looks much darker. This could be due to spraying the metallic too wet or to improper tinting.

two-stage, basecoat/clearcoat paints; use a let-down test panel with three-stage pearl paints.

Correcting Color Mismatch

To correct a paint mismatch, you must repaint the area. You might have to tint the paint a slightly different color or use different spraying techniques.

ORANGE PEEL

Orange peel is an uneven surface formation, much like that on the skin of an orange (Figure 28–2). When viewed under a magnifying glass, the paint surface looks rough, bumpy, or textured. Orange peel is caused by poor fusion of atomized paint droplets. Paint droplets dry out before they can flow out and level smoothly together.

Note that some degree of orange peel can be found in most finishes, both OEM and repainted. It is when the orange peel becomes obvious or offensive that it becomes a paint problem.

Causes of Orange Peel

- Improper gun adjustment and spraying techniques often cause orange peel. Too little air pressure, wide fan patterns, and spraying at excessive gun distances cause droplets to become too dry during their travel time to the work surface. Improper adjustment does not let the paint flow out smoothly.
- High paint booth temperature can cause orange peel. When air temperature is too high, droplets lose more solvent and dry before they can flow out and level properly on the body surface.
- Improper flash or recoat time between coats can cause orange peel. If the first coat is allowed to flash too much, solvent in the paint droplets of subsequent coats will be absorbed into the first coat before proper flow is achieved.
- Using the wrong reducer can cause orange peel. Underdiluted paint or paint thinned with fast-evaporating thinners or reducers causes the atomized droplets to become too dry before reaching the surface.
- If you improperly mix in too little thinner or reducer, the paint can be too thick and will not flow out smoothly, causing orange peel.

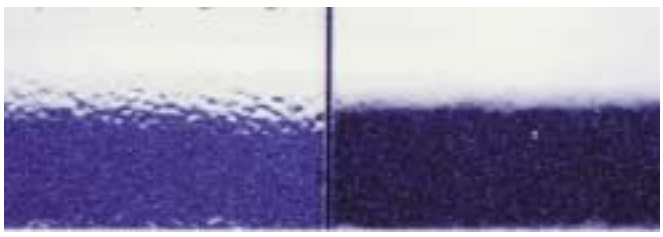


FIGURE 28–2 Orange peel is excessive on the left and normal on the right.

- Materials not uniformly mixed can also cause orange peel. Many finishes are formulated with components that aid fusion. If these are not properly mixed, orange peel will result.

Preventing Orange Peel

- Use proper gun adjustments, techniques, and air pressure.
- Schedule painting to avoid temperature and humidity extremes. Select the reducer that is suitable for existing conditions. The use of a slower evaporating thinner or reducer will overcome an orange peel problem.
- Allow sufficient flash and dry time. Do not dry by fanning.
- Allow proper drying time for undercoats and topcoats (not too long or not too short).
- Reduce to recommended viscosity with proper thinner/reducer.
- Stir all pigmented undercoats and topcoats thoroughly.

Correcting Orange Peel

Two full wet coats of clear, properly applied, with the correct flash times between each coat will normally correct an orange peel problem.

Minor orange peel can be corrected by machine buffing or compounding the finish after it has dried. In extreme cases, wet sand the orange peel area before compounding.

RUNS AND SAGS

Paint runs occur when gravity produces a mass slippage of an overwet and thick paint film. The weight of the uncured paint causes it to slide or flow down the surface. A large area of paint may flow down and form large globules of paint. Large bumps form in the paint surface where the run stops flowing (Figure 28–3A).

A *paint sag* is a partial slipping down of the paint created by a film that is too heavy to support itself. It appears like a "curtain" (Figure 28–3B). Runs and sags are more of a problem on vertical panels (fenders, doors, and quarter panels) because of gravity. Runs and sags are not as much of a problem on horizontal panels (roof, hood, and trunk lid).

Causes of Runs/Sags

- Applying too much paint in one coat
- Triggering paint spray incorrectly when changing spray gun directions
- Not allowing enough flash time between coats
- Wrong temperature rating of solvent (reducer or thinner)
- Low air pressure, causing lack of atomization
- Holding gun too close or making too slow a gun pass
- Shop or surface too cold

A

B

FIGURE 28–3 Paint runs and sags are caused by spraying on too much paint at once or by not allowing enough flash time between coats. (**A**) A paint run in clearcoat can sometimes be wet sanded out to fix the problem. (**B**) A metallic sag in colorcoat requires repainting with a lighter, mist coat.

A

B

FIGURE 28–4 If materials are not allowed to cure properly before sanding and painting, problems like these can develop. (**A**) Sand scratch swelling is enlarged sand scratches caused by the swelling action of topcoat solvents. (**B**) A bull's-eye is normally caused by sanding filler or putty before it has fully cured. It will shrink and form an indentation in the paint film.

Preventing Runs/Sags

- Use proper spray gun motion, distance, and speed of pass with equal overlaps of coats.
- Select the proper thinner/reducer.
- Do not pile on paint coats too thickly. Allow sufficient flash or dry time in between coats.
- Use proper gun adjustment, techniques, and air pressure.
- Allow the vehicle surface to warm up to at least room temperature before attempting to refinish. Try to maintain an appropriate shop temperature for paint areas.

Correcting Runs/Sags

On a small area of wet paint, you can use solvent to wash off the run or sag before repainting. If the run/sag is on a larger panel, allow the paint to dry enough for wet sanding. Use a relatively coarse #600 grit wet sandpaper and a stiff rubber sanding block to level off the run or sag. Then block sand the area again with finer #1,000 grit wet sandpaper to avoid sand scratches.

If the run or sag is in the clearcoat, try to wet sand the area without cutting through the clear. If you cut into the colorcoat, the panel will have to be sprayed again with clear.

SAND SCRATCH SWELLING

Sand scratch swelling is enlarged sand scratches caused by the swelling action of topcoat solvents. This problem is shown in Figure 28–4A.

Causes of Sand Scratch Swelling

- Improper surface cleaning or preparation. Use of too coarse sandpaper or omitting a sealer in panel repairs greatly exaggerates swelling caused by thinner penetration.
- Improper solvent (reducer or thinner), especially a slow-dry solvent when sealer has been omitted.
- Underreduced or too fast a solvent (reducer or thinner) used in primer-surfacer causes "bridging" of scratches.

Preventing Sand Scratch Swelling

- Use appropriate grits of sandpaper.
- Apply a sealer over the primer to eliminate sand scratch swelling. Select thinner or reducer suitable for existing shop conditions.
- Use proper thinner and reducer for primer-surfacer.

Correcting Sand Scratch Swelling

Sand the affected area down with ultrafine sandpaper and apply appropriate sealer before applying paint.

BULL'S-EYE FEATHEREDGE

A *bull's-eye featheredge* is an indented area that results from shrinkage of spot putty or filler, producing an area that is lower over the top of the putty or filler. This problem is shown in Figure 28–4B.

Causes of Bull's-Eye Featheredge

- Not allowing the spot putty to cure enough before block sanding. The use of older, slow-drying one-part lacquer-based spot putty is another cause.
- Not allowing body filler to cure fully.
- Improper mixing of two-part filler or putty.

Preventing Bull's-Eye Featheredge

Bull's-eye featheredge can be prevented by only using two-part spot putty and allowing proper time for putty or filler to cure. Also be sure to mix putty and filler thoroughly.

Correcting Bull's-Eye Featheredge

Correcting bull's-eye featheredging requires that you sand and refinish the affected areas.

FEATHEREDGE SPLITTING

Featheredge splitting appears as stretch marks, or cracking, along a featheredge.

Causes of Featheredge Splitting

- Using too much primer or primer-surfacer in heavy and wet coats over a repair area can cause featheredge splitting. Solvent is trapped in lower layers that have not had sufficient time to set up.
- Material has not uniformly mixed. Because of the high pigment content of primer-surfacers, it is possible for settling to occur after it has been thinned. Delayed use of the material without frequent stirring results in applying a film with loosely held pigment containing voids and crevices throughout. This causes the film to act like a sponge.
- The wrong solvent is used. For example, if you use lacquer thinner as an enamel reducer, featheredge splitting and other problems can result.
- Improper surface cleaning or preparation. When not properly cleaned, primer-surfacer coats can crawl or draw away from the edge because of poor wetting and adhesion.
- Excessive putty use and film buildup.

Preventing Featheredge Splitting

- Apply properly reduced primer-surfacer in medium to full wet coats with enough flash time between coats. This will allow solvents and air to escape.
- Stir all pigmented undercoats and topcoats thoroughly. Select a paint solvent temperature that is suitable for existing shop conditions.
- Select only reducers that are recommended for existing shop conditions.
- Thoroughly clean areas that will be painted before sanding.
- Spot putty should be limited to filling minor imperfections. Putty applied too heavily or too thickly will eventually shrink, causing featheredge splitting.

Correcting Feaheredge Splitting

To correct featheredge splitting, you must remove the finish from the affected areas and refinish.

WATER SPOTTING

Water spotting is the general dulling of gloss in spots or masses of spots (Figure 28–5A).

Causes of Water Spotting

- Water evaporating on the finish before it is thoroughly dry
- Washing the finish in bright sunlight

Preventing Water Spotting

- Do not apply water to a fresh paint job and try to keep a newly finished vehicle out of the rain and snow. Allow sufficient drying time before delivering the vehicle to your customer.
- Wash the car in the shade and wipe it completely dry.

Correcting Water Spotting

Compound or polish the vehicle with rubbing or polishing compound. In severe cases, sand the affected areas and refinish.

CHEMICAL SPOTTING

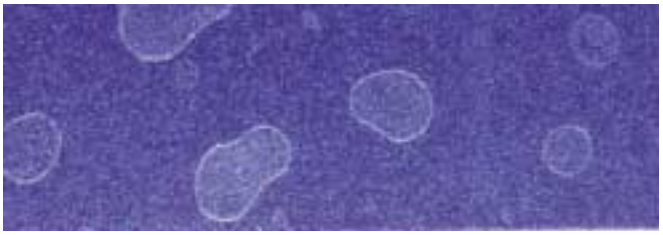
Chemical spotting, such as acid and alkali spotting, causes an obvious discoloration of the paint surface. Various paint pigments react differently when they come into contact with acids or alkalies (Figures 28–5A, B, and C).

Causes of Chemical Spotting

The cause of acid and alkali spotting is a chemical change of pigments. This chemical change results from atmospheric contamination or in the presence of moisture. This problem is often found on older finishes that have been exposed to industrial pollution.

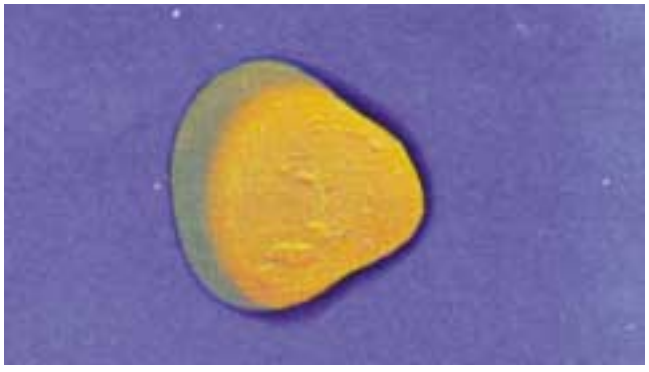
Preventing Chemical Spotting

- Keep the finish away from a contaminated atmosphere if possible.
- Immediately following contamination, the body surface should be vigorously flushed with cool water and detergent.



A

B



C

FIGURE 28–5 Note the different types of paint spotting. (**A**) Water spotting on fresh paint. (**B**) Chemical spotting is normally due to contamination of paint. (**C**) Acid or alkali spotting is due to a chemical change in the paint pigments. *(Courtesy of PPG Industries, Inc)*

Correcting Chemical Spotting

- Wash with detergent and water and follow with a vinegar bath.
- Sand and refinish. You might try wet sanding and compounding if there is only minor spotting.
- If contamination has reached the metal or substrate, the spot must be sanded down to the metal before refinishing.

CURING/DRYING FAILURE

A *curing/drying failure* is the abnormally slow hardening of a refinish product. The material remains wet or soft for a prolonged period of time. This might involve a body filler, spot putty, primer, sealer, paint, or corrosion protection material.

Causes of Curing/Drying Failure

- Improper stirring or mixing of product ingredients
- Sloppy surface cleaning and preparation, allowing chemical contamination of refinish materials, splashing chemical paint remover, for example
- Wet sanding with contaminated water
- Faulty refinish product; product ingredients were mixed incorrectly during manufacturing
- Shelf life of product exceeded

Preventing Curing/Drying Failure

- Thoroughly clean all areas to be repaired with a wax and grease remover to avoid chemical contamination.
- Finger knead (mix) cream hardener for spot putty and body filler.
- Do not forget to add a hardener or catalyst.

Correcting Curing/Drying Failure

- Wash or sand all affected areas thoroughly as needed and then refinish.
- Properly dispose of aged refinish products.

PAINT FISH-EYES

Paint fish-eyes are small, "BB-sized" dimples or craters that form in the liquid paint film right after spraying. If watched closely when forming, the paint will actually flow up and out of the small dimple or crater. Contaminants mixed with the paint are pushing the paint out of the area. If these flaws in the paint are deep enough, you can sometimes see the primer or sealer under the colorcoat (Figure 28–6).

Causes of Paint Fish-Eyes

- Fish-eyes are commonly caused by improper body surface cleaning or preparation. Many waxes and polishes contain silicone, the most common cause of fish-eyes. Silicones adhere firmly to the paint film and require extra effort to remove. Even small quantities in sanding dust, rags, from cars being polished nearby, or from touching the vehicle body with dirty hands can cause this paint film failure.
- Effects of the old finish or previous repair. The old finish or a previous repair can contain excessive amounts of silicone from additives used during their application. Even washing with a prepainting cleaning solution will not remove embedded silicone.
- Contamination of shop air lines and hoses. Contaminants can blow out of air sanders, a spray gun, and other power tools onto the car body.

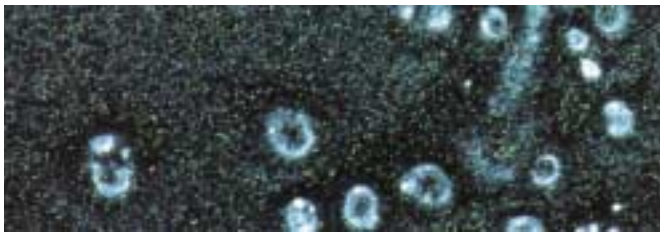


FIGURE 28–6 Fish-eyes can form when painting a silicone or oil contaminated surface. Paint additives can help correct fish-eye problems if sprayed again before full flashing.

- Using the wrong type of air tool lubricating oil. It is best to use spray gun oil in all shop air tools, even grinders and sanders. Spray gun lubricant is formulated not to contaminate a paint job and cause fish-eye and other chemical interaction problems.

Preventing Paint Fish-Eyes

- Do not touch the body surface with anything that could have silicone or another contaminant on it. Wear clean gloves when touching body surfaces.
- Use only clean disposable cloths when wiping body surfaces that will be painted. Clean off all traces of silicone and other contaminants by thoroughly washing all surfaces with wax and grease remover. Wipe the cleaning solution off the body before it dries.
- Routinely drain and clean air filters and driers. The shop air compressor tank should be drained daily. Also replace air line filters and driers periodically.

Correcting Paint Fish-Eyes

- Mix in a small amount of fish-eye eliminator additive with the paint. Spray another coat over the affected area as soon as possible to see if the paint film will flow out smoothly over the fish-eye dimples.
- If the area cures too much or if the problem is too severe, allow the paint to cure or dry. Then, wet sand or power dry sand the area to level the dimples in the paint surface. Repaint the spot or panel as needed.

BLUSHING

Blushing is a problem that makes the finish turn white or "milky looking" (Figure 28–7).

Causes of Blushing

- In hot humid weather, moisture droplets can become trapped in the wet paint film. Air currents from the spray gun and the evaporation of the paint solvent tend to lower the temperature of the surface being sprayed below that of the surrounding atmosphere. This causes moisture in the air to condense on the wet paint film.
- Excessive air pressure.
- Using too fast a thinner or reducer.

FIGURE 28–7 Blushing is a whitish blotch in paint, normally due to moisture buildup on the painted surface.

Preventing Blushing

- In hot humid weather, try to schedule painting early in the morning when temperature and humidity conditions are more suitable.
- Use proper gun adjustments and techniques.
- Select the thinning solvent or reducer that is suitable for existing shop conditions. Add retarder to the thinned or reduced color and apply additional coats.

Correcting Blushing

- If the blushing problem is in the colorcoat, recoat the area using the proper booth temperature, the correct reducer, and the recommended spray methods.
- If the problem is in the clearcoat or if the paint has cured, scuff sand and repaint the area or panel as needed.

BLEEDING

Bleeding is the original finish discoloring—or color seeping through—the new topcoat color.

Causes of Bleeding

Bleeding is usually caused by not using a sealer before painting. Contamination can also cause bleeding—usually in the form of soluble dyes or pigments on the older finish before it was repainted.

Preventing Bleeding

Thoroughly clean areas to be painted before sanding, especially when applying lighter colors over darker colors. Avoid using lighter colors over older shades of red without sealing first.

Correcting Bleeding

Apply two medium coats of paint sealer. Seal and flash dry according to label instructions. Then reapply colorcoat.

PRIMECOAT SHOW-THROUGH

Primecoat show-through is a variation in the surface color.

Causes of Primecoat Show-Through

- Insufficient colorcoats used
- Sealer not used or not tinted to match basecoat

Preventing Primecoat Show-Through

- Apply a good coverage of color.
- Tint the sealer to match the vehicle color.

Correcting Primecoat Show Through

To correct primecoat show-through, you must sand and refinish.

FIGURE 28–8 Paint blistering is normally caused by excessively fast solvent evaporation.

BLISTERING

Blistering shows up as small, swelled areas on the finish that look like a "water blister" on human skin. There will be a lack of gloss if blisters are small. You will find broken edged craters if the blisters have burst (Figure 28–8).

Causes of Blistering

- Improper surface cleaning or preparation. Tiny specks of dirt left on a surface can act like a sponge and hold moisture. When the finish is exposed to the sun or abrupt changes in atmospheric pressure, moisture expands and builds up pressure. If the pressure is great enough, blisters form.
- Use of the wrong thinner or reducer, such as using a fast-dry thinner or reducer, especially when the material is sprayed too dry or at an excessive pressure. Air or moisture can be trapped in the film.
- Excessive film thickness. Insufficient drying time between coats or too heavy an application of primecoats can trap solvents that escape later and blister the colorcoat.
- Contamination of compressed air lines, such as with oil, water, or dirt.

Preventing Blistering

- Thoroughly clean areas to be painted before sanding. Be sure the surface is completely dry before applying either primecoats or topcoats. Do not touch a cleaned area because the oil on your hands can contaminate the surface.
- Select the thinner or reducer most suitable for existing shop conditions.
- Allow proper drying time for primecoats and topcoats. Be sure to let each coat flash before applying the next coat.
- Drain and clean the air pressure regulator on a daily basis to remove trapped moisture and dirt. The air compressor tank should also be drained daily.

Correcting Blistering

If damage is extensive and severe, the paint must be removed down to primecoat or metal, depending on the depth of the blisters. Then the surface can be refinished. In less severe cases, blisters can be sanded out, resurfaced, and topcoated again.

SOLVENT POPPING

Solvent popping is "blisters" or "pimples" on the paint surface caused by the paint topcoats trapping evaporating solvent gases during curing and drying. The gas bubbles try to escape by pushing up small "blisters" in the wet paint or topcoat. Solvent popping is further aggravated by forced drying and baking because the trapped solvents evaporate even more quickly.

Causes of Solvent Popping

- Surface is improperly cleaned or prepared.
- The wrong solvent or reducer is used. Use of fast-dry solvent or reducer, especially when the material is sprayed too dry or at excessive pressure, can cause solvent popping by trapping air in the film.
- Excessive film thickness formed by too many layers of material. Insufficient drying time between coats and too heavy an application of undercoats can trap solvents, causing popping of the colorcoat as they later escape.

Preventing Solvent Popping

- Thoroughly clean areas to be painted.
- Select the thinner or reducer suitable for existing shop conditions.
- Do not pile on primecoats or topcoats. Allow for sufficient flash and dry times. Allow proper primer and sealer drying time by spraying topcoats. Allow each coat of primer-surfacer to flash naturally. Do not fan.

Correcting Solvent Popping

If damage is extensive and severe, the paint must be removed down to an unaffected layer or to bare metal, depending on the depth of the blisters. Then the affected area must be refinished using proper flash times and drying/baking temperatures.

PAINT CRACKING

Paint cracking is a series of deep cracks resembling mud cracks in a dry pond or lake bed. Often taking the form of three-legged stars in no definite pattern, they usually go through the topcoat and sometimes the primecoat as well. Figure 28–9 shows the different kinds of paint cracking.

Causes of Paint Cracking

- Excessive film thickness. Excessively thick topcoats magnify normal stresses and strains that can result in cracking even under normal conditions.

A

B

C

FIGURE 28–9 Note the different kinds of paint cracking: (**A**) line cracking, (**B**) crow's feet cracking, and (**C**) cold cracking.

- Materials not uniformly mixed.
- Insufficient flash time.
- Incorrect use of additive.

Preventing Paint Cracking

- Do not pile on topcoats. Allow sufficient flash and drying times between coats. Do not dry by gun fanning.
- Stir all pigmented undercoats and topcoats thoroughly. Strain and add fish-eye eliminator to topcoats, when necessary.
- Read and carefully follow label instructions. Additives not specifically designed for a colorcoat can weaken the final paint film and make it more sensitive to cracking.

Correcting Paint Cracking

The affected areas must be sanded to a smooth finish or, in extreme cases, removed down to the bare metal and refinished.

LINE CHECKING

Line checking is similar to cracking, except that the lines or cracks are more parallel and range from very short to very long.

Causes of Line Checking

- Excessive film thickness
- Improper surface preparation, often due to the application of a new finish over an old film that had cracked and was not completely removed

Preventing Line Checking

- Do not pile on topcoats. Allow sufficient flash and drying times. Do not dry by gun fanning.
- Thoroughly clean all areas that will be painted before sanding. Be sure the surface is completely dry before applying any undercoats or topcoats.

Correcting Line Checking

Remove clearcoat and colorcoat down to the sealer or primer and apply new topcoats.

CRAZING

Crazing results in fine splits or small cracks—often called "crow's-feet"—that completely checker an area in an irregular manner (Figure 28–9B). This problem was common with older lacquer finishes.

Causes of Crazing

- Shop temperature is too cold.
- Surface tension of the original material is under stress, and it literally shatters under the softening action of the solvents being applied.
- OEM lacquer crazes due to age and temperature extremes.

Preventing Crazing

- Select the thinner or reducer that is suitable for existing shop conditions.
- Schedule painting to avoid temperature and humidity extremes in the shop or between the temperature of the shop and the job.
- Bring the vehicle to room temperature before refinishing.

Correcting Crazing

- Continue to apply wet coats of topcoat to melt the crazing and flow pattern together, using the wettest/slowest possible solvent that shop conditions will allow.
- Remove crazed finish and repaint with appropriate materials for shop conditions.

MICROCHECKING

Microchecking appears as severe dulling of the film, but when examined with a magnifying glass it contains many small, microscopic cracks.

Causes of Microchecking

Microchecking is the beginning of film breakdown and might be an indication that film failures such as cracking or crazing will develop.

Preventing Microchecking

- Do not pile on topcoats. Allow sufficient flash and drying times. Do not dry by gun fanning.
- Thoroughly clean all areas that will be painted before sanding. Be sure the surface is completely dry before applying any undercoats or topcoats.

Correcting Microchecking

Sand off the colorcoat to remove the cracks, then recoat as required. Make sure you sand down deep enough to remove all microscopic cracks in each refinish material.

LIFTING

Lifting is a condition that causes surface distortion or shriveling, while the topcoat is being applied or while drying (Figure 28–10A).

Causes of Lifting

- Use of incompatible materials. Solvents in the new topcoat attack the old surface, which results in a distorted or wrinkled effect.
- Insufficient flash time. Lifting will occur when the paint film is an alkyd enamel and is only partially cured. The solvents from the coat being applied cause localized swelling or partial dissolving that later distorts the final surface.
- Improper drying. When synthetic enamel-type undercoats are not thoroughly dry, topcoating with lacquer can result in lifting.

A

B

FIGURE 28–10 (A) Lifting and (B) wrinkling are usually caused by incompatible chemicals or using the wrong paint ingredients when mixing.

- The effect of an old finish or a previous repair. Lacquer applied over a fresh air-dry enamel finish will cause lifting.
- Improper surface cleaning or preparation. Use of an enamel-type primer or sealer over an original lacquer finish that is to be topcoated with a lacquer will result in lifting due to a sandwich effect.
- Wrong thinner or reducer. The use of lacquer thinners in enamel increases the amount of substrate swelling and distortion, which can lead to lifting, particularly when two-toning or recoating.

Preventing Lifting

- Avoid incompatible materials, such as a thinner with enamel products or incompatible sealers and primers.
- Do not pile on topcoats. Allow sufficient flash and drying times. The final topcoat should be applied when the previous coat is still soluble or after it has completely dried and is impervious to topcoat solvents.
- Select the correct thinner or reducer for the finish applied and suitable for existing shop conditions.

Correcting Lifting

To correct a lifting problem, remove the finish from all affected areas and refinish.

PAINT WRINKLING

Paint wrinkling is a severe puckering of the paint film that appears like the skin of a prune. It is more common with enamel paints. There is a loss of gloss as paint dries. Minute wrinkling may not be visible to the naked eye (Figure 28–10B).

Causes of Wrinkling

- Improper drying. When a freshly applied topcoat is baked or force dried too soon, softening of the undercoats can occur. This increases topcoat solvent penetration and swelling. In addition, baking or force drying causes surface layers to dry too soon. The combination of these forces causes wrinkling.
- Using too many heavy or wet coats. When enamel coats are too thick, the lower wet coats are not able to release their solvents and set up at the same rate as the surface layer, which results in wrinkling.
- Improper reducer or incompatible materials. A fast-drying reducer or the use of a lacquer thinner in enamel can cause wrinkling.
- Improper or rapid change in shop temperature. Drafts of warm air cause enamel top to "skin" or set up and shrink before sublayers have released their solvents. This results in abnormal surface drying and wrinkling in uneven patterns.

Preventing Wrinkling

- Allow proper drying time for undercoats and topcoats. When force drying alkyd enamel, baking additive is required to retard surface setup until the lower layers harden. Lesser amounts can be used in hot weather. Read and carefully follow product instructions.
- Do not use too many topcoats. Allow sufficient flash and drying times.
- Select the proper reducer and avoid using incompatible materials such as a reducer with lacquer products or thinner with enamel products.
- Schedule painting to avoid temperature extremes or rapid temperature changes.

Correcting Wrinkling

To correct this paint problem, you must remove the wrinkled enamel and refinish the area.

MOTTLING

Paint mottling occurs only in metallics when the metal flakes float together to form a more silver appearance in the paint color.

Causes of Mottling

- Wrong solvent (reducer or thinner)
- Materials not uniformly mixed
- Spraying too wet
- Holding spray gun too close to work
- Uneven spray pattern
- Low shop temperature

Preventing Mottling

- Select the paint solvent that is suitable for existing shop conditions and mix properly. In cold, damp weather use a faster drying solvent.
- Stir all pigmented topcoats—especially metallics—thoroughly.
- Use proper gun adjustments, techniques, and air pressure.
- Keep your spray gun clean (especially the needle fluid tip and air cap) and in good working condition.

Correcting Mottling

To correct mottling, first spray two medium coats of metallic color. Apply a lighter third mist coat of color to help distribute the metal flakes evenly throughout the paint.

PINHOLING

Paint pinholing is tiny holes in the finish, which are usually the result of trapped solvents, air, or moisture. Refer to Figure 28–11.

FIGURE 28–11 Pinholes look a lot like chips in the paint.

Causes of Pinholing

- Improper surface cleaning or preparation. Moisture left on primer or sealer will pass through the wet topcoat to cause pinholing.
- Contamination of air lines. Moisture or oil in air lines will enter the paint while it is being applied and cause pinholes when released during the drying stage.
- Wrong gun adjustment or technique. If adjustments or techniques result in an application that is too wet, or if the gun is held too close to the surface, pinholes will occur when air or excessive solvent is released during drying.
- Wrong solvent. The use of a solvent that is too fast for shop temperature tends to make the refinisher spray too close to the surface in order to get adequate flow. When the solvent is too slow, it is trapped by subsequent topcoats.
- Improper drying. Fanning a newly applied finish can drive air into the surface or cause a dry skin, both of which result in pinholing when solvents retained in lower layers come to the surface.

Preventing Pinholing

- Thoroughly clean all areas to be painted. Be sure the surface is completely dry before applying undercoats or topcoats.
- Drain and clean the air pressure regulator on a daily basis to remove trapped moisture and dirt. The air compressor tank should also be drained daily.
- Use proper gun adjustments, techniques, and air pressure.
- Select the solvent (reducer or thinner) that is suitable for existing shop conditions.
- Allow sufficient flash and drying times. Do not dry by fanning.

Correcting Pinholing

To correct pinholes, sand the affected area down as deep as needed and refinish the area.

PEELING

Paint peeling is caused by a loss of adhesion between refinish products (primer, sealer, or topcoats). The different coats of paint materials separate and one peels off another (Figure 28–12).

FIGURE 28–12 Peeling is a catastrophic paint failure of older finishes.

Causes of Peeling

- Improper cleaning or preparation. Failure to remove sanding dust and other surface contaminants will keep the finish coat from coming into proper contact with the substrate.
- Metal is not treated properly.
- Materials are not uniformly mixed.
- The proper sealer is not used.

Preventing Peeling

- Thoroughly clean areas to be painted. It is good shop practice to always wash the sanding dust off the area to be refinished with a cleaning solvent.
- Use the correct metal conditioner and conversion coating.
- Stir all pigmented undercoats and topcoats thoroughly.
- In general, sealers are recommended to improve adhesion of topcoats.

Correcting Peeling

Remove the finish from an area slightly larger than the affected area and refinish.

CHALKING

Paint chalking is a problem that produces a lack of gloss on the paint surface. Extreme cases show up as a powdery surface. Chalking is also used to refer to an old finish that has deteriorated over time (Figure 28–13).

Causes of Chalking

- Wrong thinner or reducer, which can harm topcoat durability
- Materials not uniformly mixed

FIGURE 28–13 Chalking, seen on the left, often happens to very old paint that has not been waxed and polished periodically. The paint gloss will be very dull and the surface will be powdery.

- Excessive mist coats when finishing a metallic color application
- Paint surface exposed to bright sunlight and the elements for too long

Preventing Chalking

- Select the thinner or reducer that is best suited for existing shop conditions.
- Stir all pigmented undercoats and topcoats thoroughly.
- Meet or slightly exceed the minimum film thickness.
- Apply metallic color as evenly as possible so that misting is not required. When mist coats are necessary to even out flake, avoid using straight reducer.
- Store the vehicle in an enclosed garage to protect paint from sunlight damage.

Correcting Chalking

To correct chalking, remove the surface in the affected area by sanding, and then clean and refinish.

PAINT COLOR FADE

Paint color fade means color pigments have changed after exposure to prolonged sunlight. Even with compounding, the old finish that has been exposed to sunlight will look like a weaker hue or color than unexposed surfaces (Figure 28–14).

Causes of Paint Color Fade

- Finish is old and has been in bright sunlight too much.
- Inferior paint product was used when the vehicle was painted or there is a paint pigment problem.

Preventing Paint Color Fade

- Keep paint protected from bright sunlight when the vehicle is not in use.
- Only use quality paint products from reputable manufacturers.

Correcting Paint Color Fade

- Refinish the faded area.
- If the vehicle is a solid color, machine buff the paint to remove the faded surface layer.

FIGURE 28–14 Color fade, seen on the left, is primarily due to exposure to the sun.

DULLED FINISH

A *dulled finish* means the paint does not have, or nor longer has, its normal gloss or shine. Dulled finishes are the result of improper repair procedures or paint deterioration.

Causes of Dulled Finish

- Compounding or buffing before paint has cured fully
- Using too coarse of a compound (e.g., rubbing compound)
- Poorly cleaned surface
- Topcoats put on wet subcoats
- Washing with caustic cleaners

Preventing Dulled Finish

- Allow paint to cure properly before buffing.
- Use recommended materials.
- After using rubbing compound, follow up by using a finer glazing compound.
- Never use hand rubbing compound with a buffing machine.

Correcting Dulled Finish

Allow the finish to dry hard and use the correct methods to hand or machine compound the paint to a high gloss.

DEBRIS IN THE FINISH

Debris in the finish simply means foreign particles have gotten into the paint film. Debris includes dust particles, human hair, sand, dirt, lint from rags, and other small pieces of foreign matter. This is one of the most common and easily avoidable paint problems (Figure 28–15).

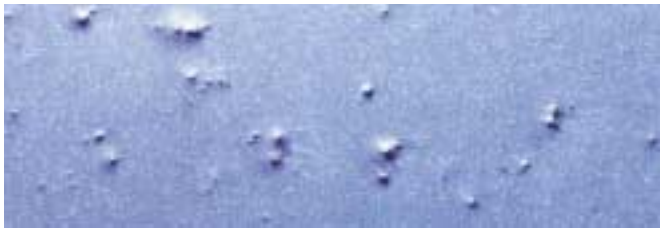
Causes of Debris in the Finish

- Improper surface cleaning, blowing off, and tack rag wiping of the surface to be painted
- A dirty or failed air line filter
- A dirty spray booth
- Defective or dirty air booth inlet filters
- A dirty spray gun; not straining paint material into the spray gun cup
- Wearing improper clothing or dirty or dusty shop coveralls
- Opening and closing spray booth doors right before or while painting vehicle

Preventing Debris in the Finish

- Blow out all cracks and body joints with an air nozzle while wiping with a tack cloth.
- Service air line filters and driers regularly.

A Dust particles in the basecoat require repainting. Dust in the clearcoat can often be wet sanded out of the finish.



B Dirt in the finish results from larger pieces of lint and larger flakes of dust. This is a highly magnified view.

C Sand in the finish can occur if areas were sandblasted during rust repair and someone did not blow out all of the repair areas to remove all sand before painting.

FIGURE 28–15 Compare different types of foreign matter that can get into the finish when painting.

- Sweep and blow out the spray booth on a regular basis. Maintain spray booth door seals and blow out cracks around booth doors and the bottoms of walls.
- Periodically replace booth and air line filters.
- Clean dry paint off the spray gun with paint remover.
- Wash coveralls and the paint hood when dirty. Wear a paint suit and head/hair covering.
- Use a paint strainer when pouring material into the spray gun. Keep all containers closed when not in use to prevent contamination.
- Close paint booth doors. Wait several minutes, then blow off the body with the spray gun while wiping with a tack rag.

Correcting Debris in the Finish

- Use tweezers, a piece of fine wire, or a toothpick to remove debris while the paint is still wet.
- If the paint has cured, wet sand the debris area level with the paint surface. Then hand or machine compound the area to return gloss.

- If dirt is deep in the finish, the area may have to be repainted.

RUST UNDER THE FINISH

Rust under the finish will show up as raised surface spots or peeling or blistering in the paint. In this instance, rusting steel has oxidized, started to flake, and pushed the paint upward and away from the body.

Causes of Rust under the Finish

- Poor corrosion protection or forgetting to apply weld-through and self-etch primer is the main reason for rusting. Was weld-through primer sprayed on panel flanges to be welded? Were correction protection materials injected into the closed box sections on the steel unibody panels?
- Broken paint film allows moisture to creep under the surrounding finish.
- Water in air lines can blow out of air tools to contaminate surfaces and cause rusting.
- Fingerprints (moisture on the skin) also also cause rusting over time.
- Not applying seam sealer to newly welded panel flanges.
- The vehicle is very old and has been subjected to road salt in cold climates.

Preventing Rust under the Finish

- Coat bare metal with self-etch primer. Do not leave bare metal exposed in the shop; spray it with self-etch primer right away.
- When replacing ornaments or molding, be careful not to break the paint film and allow dissimilar metals to come in contact with each other.
- Periodically drain the air compressor tank, air line filters, and driers.
- Wear plastic or rubber gloves when touching body surfaces.
- Apply all corrosion-protection materials according to the vehicle manufacturer's recommendations.
- Keep the vehicle cleaned and waxed. Occasionally pressure wash the underbody to remove road salts.

Correcting Rust under the Finish

- Seal off possible entrance points for moisture from the inner part of panels.
- Sand down to bare metal, prepare the metal, and treat it with phosphate before refinishing.
- Cut off the rusted panel and install a new or salvage one.

28.2 MASKING PROBLEMS

After the topcoat has dried, the masking paper and tape must be removed. If the finish has been force dried, the masking should be removed while the paint finish is still warm. If the finish is allowed to cool, the tape is more difficult to remove and may leave adhesive residue on the vehicle. You will then need to take extra time to clean off the adhesive with an adhesive solvent.

The tape should be removed slowly so that it comes off evenly. Pull the tape away from the paint edge—never across it. If the vehicle was not force dried, take care not to touch any painted areas because the paint might not be completely dry. Fingerprints or tape marks can result if the surface is touched. Also, be aware of loosely fitting clothing or belt buckles that can accidentally rub against the paint.

28.3 FINAL DETAILING

Final detailing involves a series of steps to properly clean and shine all visible exterior and interior surfaces of the vehicle, taking special care not to harm newly painted surfaces. Basically, surfaces without new paint are hand washed and the interior is vacuumed.

Some shops or work orders stipulate a complete vehicle detailing, including paint touch-up work to unrepaired body panels. If minor paint problems were found in the new paint, such as debris in the finish, these problems must also be repaired before the vehicle is released to the customer.

Corrective steps for paint detailing include the following:

1. Detail wet sand the flaws in new paint.
2. Machine compound with an abrasive liquid and high-speed buffer equipped with a wool pad.
3. Machine glaze with a finer abrasive liquid and a buffer equipped with a foam pad.
4. Hand rub and glaze small areas that cannot be machine buffed.
5. Clean all interior and exterior surfaces.

Each of these steps has its own requirements. As a general rule, increasingly finer grades of products—wet sandpaper and compounds—are used for all of these steps. Also, a single product line should be used throughout the repair and the manufacturer's recommendations should be followed.

INSPECTING PAINTED SURFACES

After all masking materials have been removed, walk around the vehicle to closely inspect all repair work and repainting. Try to find anything that may offend the customer (dirt in paint, paint run, overspray, etc.). Use a drop light and check reflections off the painted surface to find any finish surface flaws, as shown in Figure 28–16.

If everything went as planned during all shop repair operations, you will not find any paint flaws. The vehicle can be released to the customer after an interior and exterior cleaning.

A **paint protrusion** is a particle of debris (dust, dirt, lint, etc.) sticking out of the paint film after refinishing.

FIGURE 28–16 Look closely to check that there are no problems in your repair work.

These problems result from a lack of cleanliness during body repair and repainting processes. Something or someone was not clean enough when doing their repair work.

Use a **paint-safe marker** to identify any flaws in the new paint film (Figure 28–17). Touch the marker on the piece of dust or dirt so you will know where to detail sand without having to search closely again. Take your time when marking flaws. Methodically look back and forth across each panel to make sure you find every tiny surface imperfection.

FIGURE 28–17 Use only a paint-safe marker to identify surface imperfections.

WARNING

Use only a paint-safe marker when denoting flaws in new paint. If you use a permanent marker or one not formulated for automotive paints, you can damage the finish. Some markers can bleed down and leave a mark deep in the paint that is difficult to detail sand out of the finish.

DIRT-NIB FILING

Dirt-nib files can be used to partially remove tiny protrusions sticking up above the rest of the paint surface. A dirt-nib file will remove the protrusion with minimum damage to the surrounding paint film. Dirt-nib files are available commercially or you can make your own.

To use a dirt-nib file, place the file lightly on the paint film. Do not push down or you could scratch the fresh paint. Use short, straight strokes in one direction only. Make two or three light passes to remove most but not all of the defect. After gentle filing, the area must be sanded with an ultrafine grit to further level out the paint flaw.

DETAIL SANDING

Detail sanding involves using a small dirt-nib sanding block and ultrafine sandpaper to level and smooth small specks of debris (dust, dirt, hair, etc.) in the paint (Figure 28–18). A small detail sanding block held in your fingers is used on dust and dirt in the finish. A larger handheld sanding block is used on larger paint flaws, such as paint runs.

In the past, detail technicians used a dirt-nib file and a whetstone to rub and abrade off minor paint flaws. Now, technicians use a detail sanding block and very fine grits of wet sandpaper to repair paint flaws.

A *detail sanding block* uses Velcro to attach and hold small round, wet sanding mini-discs. This allows you to change to new sandpaper when they become clogged

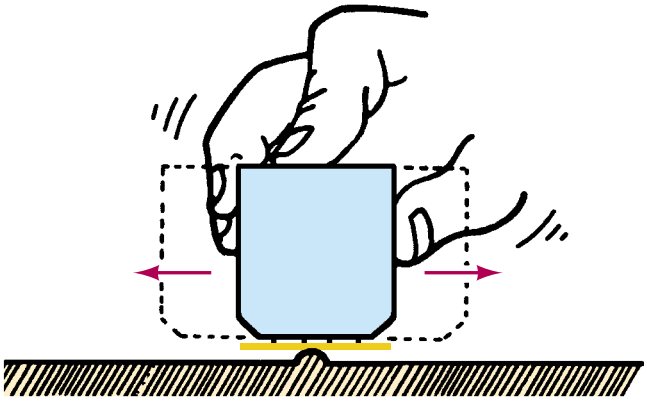


FIGURE 28–18 A detail sanding block will concentrate sanding action over the top of paint protrusions. Press lightly to remove only the high spot on the nib.

FIGURE 28–19 Here a detail technician is dry sanding dirt in the paint finish with a detail sanding block and ultrafine sandpaper. Dry sanding will more easily let you see how much you have sanded off.

with paint. You can also use different grits of mini-discs for each repair situation. Detail sanding mini-sandpaper discs commonly used during minor paint repair range from #600 grit up to #1500 grit.

Some technicians like to dry sand small dirt particles in the paint first (Figure 28–19). Others prefer to wet sand them through the whole paint repair process.

Dry sanding allows you to see which areas have been sanded and which areas have not been sanded enough. Dry sanding turns the clearcoat white so you can see where clearcoat has been removed. When you wet sand a clearcoat, the sanding marks and dust will stay clear and transparent. It might be best to dry sand dirt in the paint first. Then wet sand to help smooth and level the surface. Refer to Figure 28–20.

Attach the appropriate grit sandpaper using the Velcro backing. The larger the surface flaw, the more coarse a grit sandpaper you should use. For example, on a small piece of dust, use #1000 grit first and then finer #1,500 grit as you final level the flaw. This finer grit will make it easier to buff out the sand scratches. Place the detail sanding block over the protrusion. Move it back and forth gently in different directions. Do not press down very hard. Only sand where needed—on the high spot or protrusion in the paint.

FIGURE 28–20 Only sand enough to knock off the dirt nib. This will dull the finish. *(Photo courtesy of Norton)*

FIGURE 28–21 After dry sanding dirt nibs, wet sand them with #1500 grit sandpaper and water. Wet sand the scratches left from dry sanding. *(Photo courtesy of Norton)*

When the protrusion has all but disappeared, inspect the paint flaw closely. Sand as little as possible. Remember that the clearcoat is only a few thousandths of an inch (mils) thick. You must not cut through the clearcoat or the panel will have to be repainted. You must leave enough clearcoat on the area for buffing, compounding, or polishing to return the paint gloss or shine.

After the paint flaw or protrusion has been sanded level, wet sand with #1500 grit or #2000 grit wet sandpaper to remove sand scratches in the paint. This will ready the area to be machine buffed back to a high gloss (Figure 28–21).

The water on the paint will let you find any remaining surface flaws. Use a soft rubber sanding pad or block to squeegee the water off the flawed area. See Figure 28–22.

Table 28–1 summarizes detail or finesse sanding procedures.

FIGURE 28–22 When wet sanding, squeegee off the water so you can see if the flaw has been leveled. *(Photo courtesy of Norton)*

TABLE 28-1 DETAIL SANDING PROCEDURES

Paint Type	Paint Condition	Procedure			
		Wet Sanding	Compounding	Machine Glazing	Hand Glazing
Refinish paints: cured enamels/ urethanes* (air-dried more than 48 hours or baked)	1. Minor dust nibs or mismatched orange peel (light sanding)	1. Ultrafine #1,500	1. —	1. Finishing material	1. Hand glaze
	2. Heavy orange peel, dust nibs, paint runs or sags	2. #1,000 then #1,500	2. Microfinishing compound	2. Finishing material	2. Hand glaze
Refinish paints: fresh enamels/ urethanes* (air-dried 24 to 48 hours)	1. Minor dust nibs or mismatched orange peel (light sanding)	1. Ultrafine #1,500	1. Microfinishing compound	1. Microfinishing glaze	1. Hand glaze
	2. Heavy orange peel, dust nibs, paint runs or sags	2. #600, #1,000, then #1,500	2. Microfinishing compound	2. Microfinishing glaze	2. Hand glaze
Refinish paints: acrylic lacquer	1. Low gloss or overspray	1. —	1. —	1. Machine glaze	1. Hand glaze
	2. Low gloss, minor orange peel, or overspray	2. —	2. Paste or rubbing compound (heavy cut)	2. Machine glaze	2. Hand glaze
	3. Low gloss, moderate orange peel, or dust nibs	3. Ultrafine #1,200	3. Microfinishing compound (medium cut)	3. Machine glaze	3. Hand glaze
	4. Low gloss, heavy orange peel, paint runs or sags	4. Ultrafine #1,000	4. Paste or rubbing compound (heavy cut)	4. Machine glaze	4. Hand glaze
All factory applied (OEM)	1. New car prep or fine wheel marks	1. —	1. —	1. —	1. Hand glaze liquid polish
	2. Coarse swirl marks, chemical spotting, or light oxidation	2. —	2. —	2. Finishing material	2. Hand glaze
	3. Overspray or medium oxidation	3. —	3. Microfinishing compound (medium cut)	3. Finishing material	3. Hand glaze
	4. Heavy oxidation or minor acid rain pitting	4. —	4. Rubbing compound (heavy cut)	4. Finishing material	4. Hand glaze
	5. Dust nibs, minor scratches, or major acid rain pitting	5. Ultrafine #1,500	5. —	5. Finishing material	5. Hand glaze
	6. Orange peel, paint runs or sags	6. Ultrafine #1,200 or #1,500	6. Microfinishing compound (medium cut)	6. Finishing material	6. Hand glaze

*Enamels/urethanes—as referred to in this table—are catalyzed paint systems (including acrylic enamel, urethane, acrylic urethanes, acrylic urethane enamels, polyurethane enamels, and polyurethane acrylic enamels) and nonisocyanate-activated paint systems used in color or clear coats.

WARNING

If you fail to catalyze enamel paints with a hardener, you may not be able to wet sand and repair minor paint problems right away. If slight defects in the finished surface appear, they should not be compounded until the paint has had a chance to cure. This can involve a period of several days if the material is not catalyzed.

REPAIRING PAINT RUNS

To repair a paint run without repainting, you must carefully wet sand the run while trying not to sand through the clearcoat and into the colorcoat. Use a full-size stiff rubber sanding block and coarser #600 grit wet sandpaper first. Then final sand the paint run with finer #1,500 wet sandpaper until smooth and level. If you get lucky, you will not sand through to the colorcoat. If you do, the area will have to be repainted.

With a paint run, you want to plane off the high points without cutting through the clearcoat. If you initially try to block sand a run with fine sandpaper, you will cut too deep in the low spots and "wallow out" the low spots, usually cutting through the clearcoat.

The low spots in a paint run will be softer than the high spots. This is because softer resins will tend to flow down and collect in the low spots of a paint run.

Fill a bucket with clean water. Some technicians like to add a mild soap to the water. The soap and water solution will help keep the wet sandpaper from sticking and digging into the fresh paint.

First, block sand the paint run using #600 sandpaper on a stiff rubber sanding block. Only use this grit sandpaper to cut the tops off the run. Use plenty of water and watch how the surface dulls to see where you are sanding and removing clearcoat. Stop as soon as the high spots of the run are sanded level. A few more passes with #600 grit sandpaper could cut into the colorcoat and require repainting.

SHOP TALK

A good detail technician can "feel" the sandpaper and how deep the wet sanding process has cut into the clearcoat. When the wet sandpaper begins to feel "sticky" as it is moved back and forth, you have cut down into the softer, less cured clearcoat. This is when you should wet sand very lightly and be ready to stop sanding. If you do not cut through the clearcoat when wet sanding and buffing a run, you have saved yourself hours of work.

Next, lightly block sand the paint run area with #1,000 grit wet sandpaper. Use the finer grit wet sandpaper to feather and level the run with the surrounding paint surface.

As soon as the run is sanded level, use the sanding block with finer #1,500 grit wet sandpaper to smooth the surface and prepare it for machine buffing. Sand very gently because the clearcoat will be very thin at this point.

REPAIRING CHIPPED PAINT

Chipped paint results from mechanical impact damage to the paint film. It is a condition where small flakes or areas of paint have been crushed and damaged. The areas around the missing paint chip have lost adhesion with the substrate.

Chipped paint is normally caused by the impact of stones or hard objects. Chipped paint also happens when someone opens a car door and it hits another car or object. Chips in the paint are most common on the front bumper, front edge of the hood, doors, and around the rear of wheel openings on fenders and quarter panels.

If the whole vehicle is not refinished, you may need to touch up chipped paint on panels that have not been painted. Use the paint mixed for the repair. It will usually have hardener in it to speed curing.

Degrease the area with wax and grease remover. If you use a small paint brush, slowly move the touch-up paint straight into each chip. On smaller chips, a toothpick will reach into the chip more efficiently. If you are using a solid color, use a thicker viscosity touch-up paint to fill the chip in one application. If you have metallic paint, use thinner touch-up paint and several coats to help match the color.

Allow the paint to cure sufficiently before wet sanding and polishing the chip repairs to level the repair (Figure 28–23).

PANEL DETAIL SANDING

Panel detail sanding can be done to smooth the paint surface on larger areas, as when removing orange peel. It is detail sanding but over a large surface area, using a larger sanding block and sandpaper.

Panel detail sanding should normally be done with a backing pad or rubber sanding block to avoid crowning of the paint surface. A pad or block will help keep large, relatively flat surfaces level and uncrowned. On restricted and curved surfaces, you can use only your hand to color sand.

Sanding blocks and sandpapers are available in a variety of grit sizes. For major surface repairs, use coarser wet sandpapers, #400 to #600. For detail sanding, use #1,000, #1,500, and finer grits of wet sandpaper.

Wet sand in a back-and-forth or small circular motion depending on the shape of the surface problem and the contour of the body panel. Use plenty of water to flush away paint debris. Dip the block in a bucket of water. You

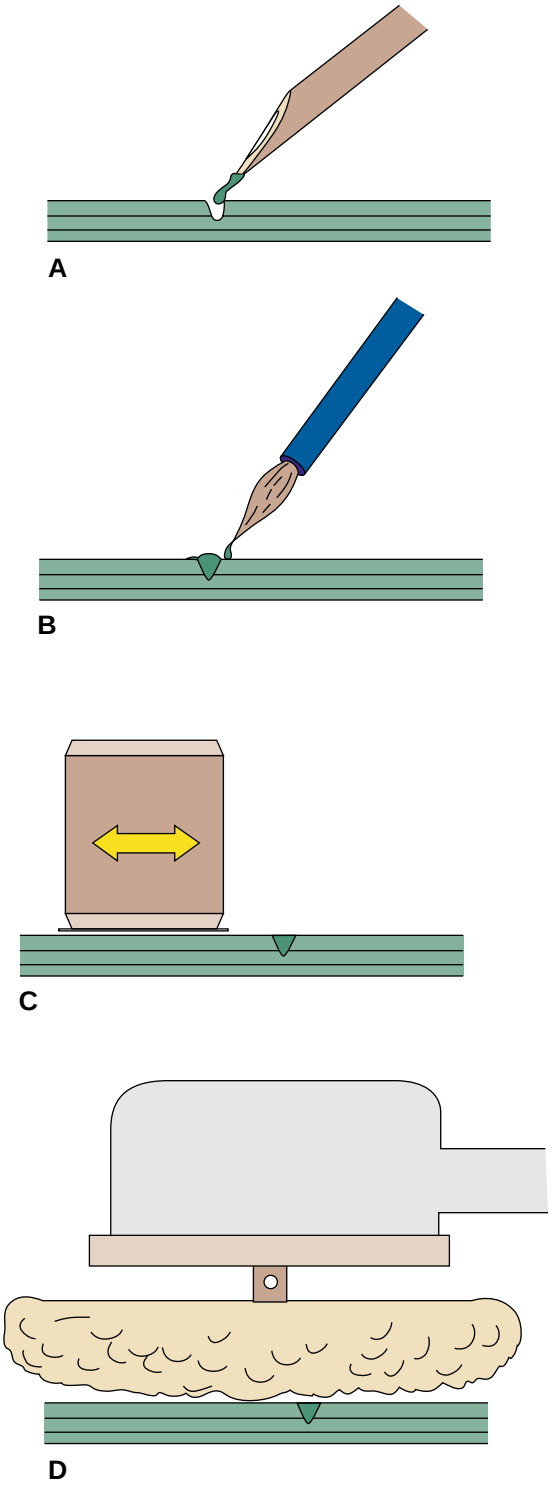


FIGURE 28–23 Study the basic steps for touching up a paint chip. (**A**) Use a toothpick or small brush to apply catalyzed paint into the chip. (**B**) Let the first coat flash and apply another drop of paint over the chip. (**C**) After allowing the paint to cure, detail wet sand the paint flush. (**D**) Hand or power buff the repair area to return the gloss.

can also use a sponge, garden hose, or spray bottle to flow water over the area. Some air sanders are equipped with a wet sanding attachment that uses a small plastic hose to feed flushing water up to the sanding pad.

Check the defect often when using a sanding block. You do not want to cut too deeply into the finish. If you cut through the clearcoat or color, repainting will be necessary. Wash surfaces thoroughly with clean water and a sponge after panel detail sanding.

28.4 PAINT COMPOUNDING

Paint compounding involves using different abrasive pastes and liquids to hand and machine polish a surface to a high gloss or shine. You must be familiar with each type of compounding material to select and use them correctly.

RUBBING COMPOUND

Rubbing compounds, also called hand compounds, generally contain the coarsest grit abrasive. They are used to abrade and smooth a surface film by hand to level minor surface imperfections. Rubbing compounds remove the surface gloss and must be followed up with a hand glazing compound to restore paint shine. They are commonly used on smaller parts or areas that cannot be compounded with a buffing machine.

Rubbing compounds are available in various cutting strengths. Hand compounds are oil-based to provide lubrication. Small or blended areas are best treated by hand compounding. On large surfaces, machine compounding is recommended.

Rubbing compounds are used to:

- Eliminate fine sand scratches around a repair area
- Correct a gritty surface
- Smooth and bring out some of the gloss of lacquer topcoats
- Repair paint on areas that cannot buffed with a machine

HAND COMPOUNDING

Fold a soft, lint-free cloth into a thick pad or roll it into a ball and apply a small amount of hand compound to it. Use straight, back-and-forth strokes and medium-to-hard pressure until the desired smoothness is achieved.

Hand compounding takes a lot of elbow grease and is time-consuming. To keep the compounding of topcoats to a minimum, it is important to apply the clearcoats as full wet coats, without sags or runs.

When using hand polishes or glazes, apply the glaze to the surface using a clean dry cloth. Rub the glaze thoroughly into the surface. Then wipe it dry.

Table 28–2 shows some applications for different rubbing and polishing compounds.

MACHINE COMPOUNDING

Machine compounds are water-based to disperse the abrasive while using a power buffer. Some product manufacturers rate their compounds or liquids and pastes by a

TABLE 28-2 POLISHING AND RUBBING COMPOUNDS

Grade	Liquid	Paste	Use and Application
Very fine	Machine or hand	—	Used to remove swirl marks on topcoat. Spread material evenly with buffing wheel pad before starting compounding.
Fine	Machine or hand	Hand (add water for machine use)	Used to level orange peel. Can also be used to clean, polish, and restore older finishes leaving no wheel marks or swirls.
Medium	Machine or hand	Paste (add water for machine use)	Used for quick-leveling orange peel. Can be used to repair other minor paint defects.
Coarse	Machine	Machine	Used for compounding before final topcoating.

grit rating system: #1,000, #1,500, #2,000, and finer. Just like sanding, you would start out with a coarser rated compound and follow up with finer compounds to bring the paint to a high gloss and shine (Figure 28–24).

Refer to the label directions for the machine compound or glaze to learn about its cutting and polishing characteristics. The label directions will give instructions for buffer speed, surface temperature, and so on for properly using their buffing product (Figure 28–25).

A **buffing pad** is rotated by an electric or air buffer to force the compound over the paint surface. If done properly, this will quickly bring the wet sanded paint surface back to a glossy shine. There are different kinds of machine buffing compounds and pads.

A **buffing machine** uses a spinning or rotating action to level and quickly smooth a paint surface. Machine buffing can be done with either a soft wool pad or a foam rubber pad to apply abrasive compound to the paint. Most paint repair technicians use the wool pad first and the softer foam pad second. A **polishing machine** uses an orbital action to bring out the full paint gloss or shine. Instead of spinning the pad in a circle, the pad is spun and moved sideways by the dual action of the machine. An orbital action polishing machine is needed to bring out a "show-type finish" in a paint. It will remove swirl marks and the finish will look like it has been hand polished. Figure 28–26 compares buffing and polishing machines.

Paint swirl marks are patterns of very fine scratches produced when power buffing or compounding. They are caused by a dirty, worn buffing pad, too much pressure on the buffer, or using too coarse a compound. Always keep your buffing pad clean and replace it when worn.

To avoid swirl marks, most detail technicians first buff the surface with a wool pad and a coarser machine compound. Then they follow with a foam pad used with finer glazing compound. The wool pad buffs more quickly and the foam pad smooths the surface to take out any remaining swirl marks. Some shops like to follow the wool and foam pads with an orbital action polisher to remove any remaining trace of swirl marks.

FIGURE 28–24 Various types of compounds and buffing pads are available.

FIGURE 28–25 Compounding removes a thin layer of paint and is needed to return the paint gloss after wet sanding. *(Dynabrade Inc.)*

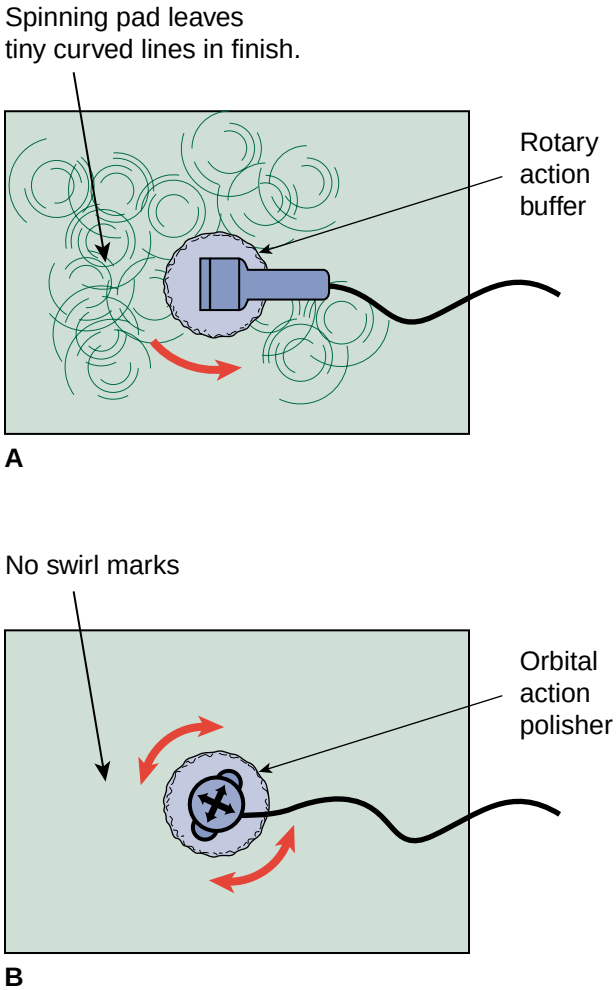


FIGURE 28–26 Compare the action of buffing and polishing machines. (**A**) A buffing machine spins a pad in a rotary motion for fast action. Swirl marks can remain after using a single-action buffer. (**B**) A polishing machine uses dual actions to avoid swirl marks. Though slower, it is often used as a final way to bring out paint shine.

USING BUFFERS AND POLISHERS

When using buffing and polishing pads, there are several things you must remember to avoid paint damage. In untrained hands, an air or electric buffer can quickly cut through and damage a paint job—a costly mistake.

DANGER Wear eye protection when machine compounding or buffing. It is very easy for the abrasive liquid to fly into your face and eyes. It is also possible for chunks of buffing pad to fly into your face. Buff so that any debris flies away from your body and face, not toward it.

Inspect, clean, or replace buffing pads often to avoid problems. If a wool pad is worn and no longer fluffy, replace it. If a foam pad is torn or worn, replace it. When machine compounding paint, the buffing pad should be in good condition to help avoid damaging the finish.

A **pad spur tool** is used to clean and fluff up a wool buffing pad before machine compounding. It has a handle and a spoked metal wheel (like a cowboy's spur) that will remove dry compound from the buffing pad. Lay the buffing machine on the ground and hold the spur on the pad as shown in (Figure 28–27A).

While wearing eye protection, turn the buffer on and move the spur over the pad while pressing lightly. Hold the spur on the side of the pad that is spinning away from you. This will keep the debris from flying in your direction. Spin spur on the pad until all dried compound is forced out of the pad and the wool fibers are fluffed up and soft.

Foam pads should be washed thoroughly before each use. You should clean the pores of the foam pad out so they can hold compound and polish properly (Figure 28–27B).

WARNING Do not use a spur cleaning tool on a foam pad or you can damage the pad. Remove the foam pad from the buffer and wash it in a sink.

AVOIDING PAINT BURN-THROUGH

Paint burn-through is damage caused by the machine buffing pad removing too much clearcoat (Figure 28–28). This is a costly, time-consuming mistake that necessitates repainting of the panel. There are several things you can do to avoid burn-through and paint damage. Refer to Figure 28–29.

A

B

FIGURE 28–27 Your buffing pad should be clean before using it on any vehicle. (**A**) This technician is using a spur tool to clean and fluff a wool buffing pad. (**B**) Foam pads should be washed and wetted before use.

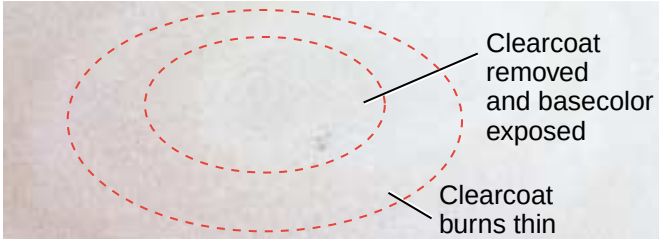


FIGURE 28–28 Clearcoat burn-through is hard to see. The exposed colorcoat area will be slightly duller than the clearcoat. The clearcoat was cut through into the basecoat in the center area of this photo.

Edge masking involves taping over panel edges and body lines prior to machine buffing to protect the paint from burn-through. Masking tape is applied to these surfaces to protect them. Buff right up to the tape. After buffing surfaces and removing tape, hand compound these edges. Place masking tape over all sharp body edges. A buffing pad can burn the paint on sharp edges almost instantly. Place masking tape on panel edges so you can buff over the tape without danger of burning through the paint.

You should also mask door handles, emblems, trim, plastic headlight and taillight lenses, and similar parts. The spinning buffing pad can easily damage these parts, requiring their replacement. Today's flat black trim pieces are very prone to damage from a buffer. The black coating can be instantly marred if touched with a high-speed buffing pad. Tape over any part that could be damaged when buffing the paint.

Use separate pads for different grades and types of products. One wool pad should be used for initial buffing with a coarser machine compound. Another foam pad should only be used for applying a finer machine glaze.

To avoid paint burn-through always move the buffer in even passes over the body surface, as when you paint a car. Make one pass across the panel and then move down a little. Buff in passes across the panel so you can keep track of how much paint has been buffed (Figure 28–30). Avoid buffing too much in one location. Do not press down on the buffing machine. Let the weight of the machine do the work. Stay off crowned body contours and sharp edges with the buffing pad. If needed, these surfaces can be hand compounded quickly after you are done machine compounding.

MACHINE BUFFING PROCEDURES

Make sure you are using the appropriate machine compound. Read the directions on the bottle before use (Figure 28–31).

When applying the compound, apply an "X" of the product to the surface. Only apply enough compound to buff an "arm's length" area on the panel. Work the compounding liquid around the face of the pad and over the surface before hitting the machine's trigger (Figure 28–32). This will help prevent compound from flying and spraying all over when you first turn on the buffing machine.

Because the compound has a tendency to dry out, do not try to buff too large an area at one time. Always keep the machine moving to prevent cutting through or burning the topcoat. As the compounds start to dry out, lift up a little on the machine so the pad speed increases. This will make the surface start to shine.

Buffer speed and pressure have an effect on the paint cutting and polishing action. For example, the higher the rpm, the higher the cutting rate; the lower the rpm, the lower the cutting rate.

The faster the buffer is moved across the panel, the slower the cutting rate. The slower the buffer is moved, the higher the cutting rate.

The flatter the panel surface, the slower the buffer will cut into clearcoat. The more round or sharp a panel surface, the faster the buffer will cut into the paint.

Excessive buffing heat can cause swirl marks, warping, discoloring, and hazing and make the material dry out too quickly. If the area is hot to the touch, there is too much heat. Cool it with water.

When using a buffer, the detail technician should use the following procedures:

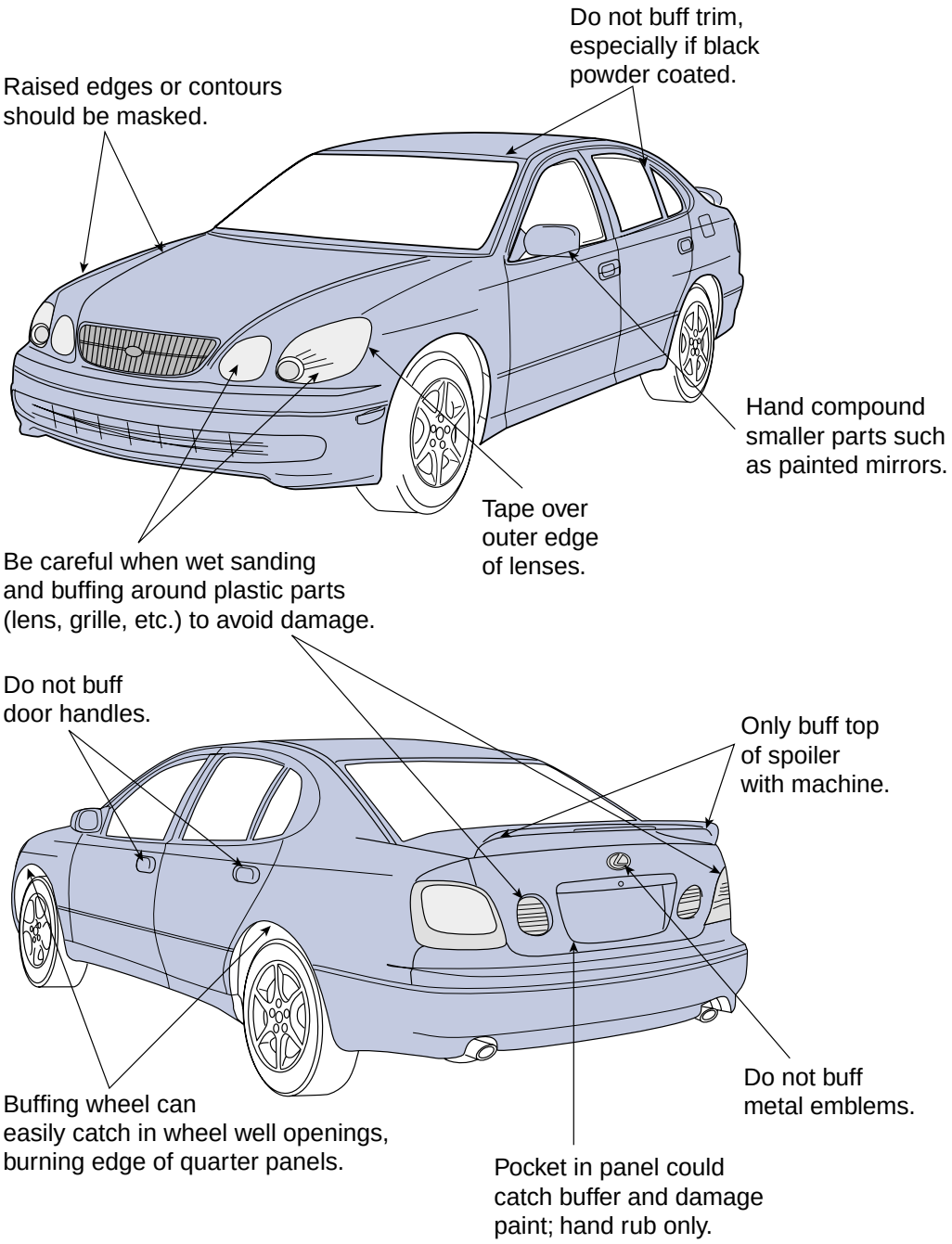


FIGURE 28–29 Study things you can do to keep from burning through the paint when machine buffing. *(Reprinted with permission)*

FIGURE 28–30 Buff a panel in passes, just as you would paint it. Move the buffer back and forth in long passes so you can keep track of the amount of paint thickness removal.

FIGURE 28–31 Only apply enough compound to buff a small area at a time.

FIGURE 28–32 Before hitting the trigger, spread compound over the area with a pad. This will keep the compound from spraying off the pad.

1. Keep the pad flat or at about a 5-degree angle to the surface on flat body surfaces. Only tilt the pad to reach into or match a curved surface on the body. Refer to Figure 28–33.
2. Let the weight of the machine do the work. If you press down on a buffing machine, it can quickly cut through the clearcoat.
3. Use care around panel edges and body lines to avoid burn-through. Do not let the edge of the buffing pad get down into panel gaps, or you can even burn through your protective masking tape and the paint (Figure 28–34).
4. Check the repair area often and apply more product as needed. Buff as little as possible to smooth and shine the paint surface.
5. Compound until the product begins to dry. Do not keep buffing if the compound has dried because you will burn through the paint surface.
6. Never lay the face of a buffing pad on a workbench or any surface that could contaminate the pad with dirt and debris. One speck of sand in the pad can badly scratch the paint.

FIGURE 28–33 Normally, you should hold the buffing pad square on the body surface to avoid cutting too deeply into the clearcoat.

FIGURE 28–34 Be careful when buffing next to the edges of panels. The buffing pad can catch on sharp edges and damage paint or trim pieces.

7. Never use a power buffer with a hand rubbing compound. This will cause deep scratches, swirl marks, and burn-through. Only use machine compounds when power buffing.
8. Place masking tape over gaps in panels. This will keep compound out from behind panels so time is not wasted cleaning these areas after buffing.
9. Hand rub small parts and internal pockets in panels that could be easily damaged by the spinning buffing pad. Hand compound these areas to avoid burn-through.
10. After initial compounding with a wool pad, buff again lightly with a foam pad and finer glazing compound. This will help remove swirl marks and bring out the paint gloss.
11. After the machine compounding, remove the tape and hand compound all edges and contours just enough to produce a smooth finish. Keep in mind that body lines usually retain less paint than flat surfaces and thus should get only minimal compounding.

SHOP TALK

A common mistake for the beginner is to burn through new paint while machine compounding. In an effort to make the paint job really shine, he or she cuts right through the paint to the basecoat. The result is usually a time-consuming repaint of the panel.

HAND AND MACHINE GLAZING AND POLISHING

Glazing or polishing involves using very fine grit compound to bring the paint surface up to full gloss. It is usually done after compounding. You can hand polish small or hard-to-reach areas. Machine polish larger areas to save time.

Slight defects in the topcoat can be repaired by polishing. The choice of compounds depends on the extent of the damage. Final polishing should always be done with an ultrafine polishing compound.

When using rubbing compounds and machine glazes be sure to follow these procedures:

1. Use a single manufacturer's product line.
2. Follow the manufacturer's recommendations for use.
3. Use the materials sparingly.
4. Use the buffing wheel to evenly distribute the material over the area that is being repaired (Figure 28–35).
5. Keep the pad flat and directly over the surface being repaired.
6. Use a slow, methodical motion so you can keep track of how much area has been buffed (Figure 28–36).
7. Use the finest grit product possible last. Using a finer grit product may take a little longer initially but will generally require less time to complete the repair.
8. Reduce swirl marks by avoiding coarse products and worn buffing pads.

FIGURE 28–35 After buffing with a wool pad, many detail technicians like to machine glaze the paint with a softer foam pad. This will bring out more of the paint shine or gloss.

FIGURE 28–36 Note how the plastic headlight lens, plastic parts on the bumper, and sharp body contours have been protected with masking tape.

Instead of a circular action buffer, you should use an orbital action machine for final polishing. An orbital action polisher will move the polishing compound in a random manner to remove swirl marks from buffing.

28.5 FINAL CLEANING

Final cleaning or *get ready* is the last, thorough cleanup before returning a vehicle to a customer. You must do all the "little things" that make a big difference to customer satisfaction. The interior and exterior of the vehicle should be cleaner than when the customer brought it in.

Vacuum the interior of the vehicle carefully. Clean the seats, door panels, seat belts, and carpets. If dusty, clean and treat vinyl surfaces with a conditioner. Be sure to remove all excess cleaner/conditioner from the seat crevices and folds. Stubborn stains, such as blood, should be cleaned with a recommended cleaning solution (Figure 28–37).

Avoid using strong cleaning agents on the plastic parts in the dash panel. Some cleaners will dissolve and damage plastic, a costly mistake. You should also avoid having any product with silicone in it in the body shop.

Carefully remove any overspray that may have been left on windows or chrome. If it can be done without dripping on the new finish, use paint solvent (thinner or reducer). Clean and polish chrome, moldings, and bumpers. Thoroughly clean all the glass, including windows, mirrors, and lights.

FIGURE 28–37 Here a detail technician is using an air-powered scrubber to clean bloodstains out of carpeting. *(Dynabrade Inc.)*

WARNING Steel wool should not be used to polish chrome because pieces of the wool can easily become embedded in the new finish. Instead, use a commercial chrome polish.

Use a brush with soap and water to clean the tires and wheels. Do not let dirty wheels and tires spoil the appearance of an otherwise quality job. Coat them with a conditioner.

Spray rubberized undercoating to blacken wheel openings and any other exposed undercarriage parts, since color overspray often gets on these areas. The customer generally will not necessarily notice the undercoating, but certainly will notice if it is not done.

Replace wipers, moldings, and emblems that were removed before finishing. Take the time to clean off these items and be certain that everything is replaced. Make sure all weatherstripping is installed properly.

If the vehicle has a vinyl top, do not forget to wipe it with a damp cloth or a commercial vinyl cleaner.

As a finishing touch, clean the engine compartment using a pressure washer. A clean engine compartment usually makes a big impression on the customer. Be careful not to damage any new paint on the fenders when pressure washing. Keep strong engine degreasing agents off the paint.

Finally, inspect the vehicle with a careful eye for details. If a window is smeared, clean it again. If a piece of masking tape remains, remove it. If an emblem is missing, replace it before the customer asks where it is.

If the vehicle gets dirty while waiting to be picked up, wipe it down with a clean cloth. The number one objective should always be a satisfied customer (Figure 28–38).

FIGURE 28–38 If everyone in the body shop did their jobs properly, the repair will look as good as new. *(Reprinted with permission)*

28.6 CARING FOR A NEW FINISH

A newly refinished vehicle must receive special care, as the paint can still be curing for several days or months. Each paint manufacturer will have specific recommendations for caring for a new finish. Explain all of these precautions to the vehicle owner.

To care for a new finish, you and the customer should:

- Avoid commercial car washes and harsh cleaners for one to three months.
- Hand wash using only water and a soft sponge for the first month. Dry with cotton towels only. Do not use a chamois.
- Avoiding waxing and polishing for up to three months. After that time, use a wax designed for basecoat/clearcoat finishes, as they are the least aggressive.
- Avoiding scraping ice and snow near newly refinished surfaces.
- Flush gas, oil, or fluid spills with water as soon as possible for the first month. Do not wipe off.

SUMMARY

1. Paint problems include a wide range of troubles that can be found before or after painting. You must be able to efficiently analyze and correct paint problems.
2. If you see paint defects while spraying, you must decide whether to stop work immediately or wait until the painting is finished to correct the problem. Your decision will depend on the type and extent of the problem.
3. The objective in final detailing is to locate and correct any defect that may cause customer complaints.
4. Paint surface chips result from mechanical impact damage to the paint film: door dings, damage from road debris, and so on.
5. A paint surface protrusion is a particle of paint or other debris sticking out of the paint film after refinishing.
6. A detail sanding block is commonly used to remove any defect on or above the surface of the paint.
7. Wet block sanding can be done to smooth the paint surface on larger areas, as when removing orange peel.
8. Hand rubbing compounds contain coarser grit abrasives than machine compounds and glazes.
9. Machine compounds are waterbased to disperse the abrasive while using a power buffer.
10. Edge masking involves taping over panel edges and body lines prior to machine buffing or polishing to protect the paint from burn-through.

EXERCISES

On a separate sheet of paper, complete the following learning activities for this chapter. Write definitions for the key terms and answer the ASE-style review questions, essay questions, critical thinking problems, and math problems. You can also do the outside activities, possibly for extra credit.

KEY TERMS

blistering
blushing
buffing machine
buffing pad
chipped paint
detail sanding
final detailing
lifting
line checking
machine compounds
orange peel
pad spur tool
paint chalking
paint color mismatch
paint fish-eyes
paint mottling
paint protrusion
paint-safe marker
paint wrinkling
polishing machine
sand scratch swelling
solvent popping

ASE-STYLE REVIEW QUESTIONS

1. After a panel repair and repainting, the masking paper is removed and it is discovered that the new metallic paint is darker than the original color. Technician A says that the last color coat might have been sprayed too wet. Technician B says that the painter might not have made a spray-out test panel to check the new paint color. Who is correct?

A. Technician A
B. Technician B
C. Both A and B
D. Neither A nor B

2. A new spot repair has a small paint run in it. Technician A says that the spray gun may have been moved too slowly or not moved in controlled passes over this area. Technician B says that a slower drying solvent should have been used. Who is correct?

A. Technician A
B. Technician B
C. Both A and B
D. Neither A nor B

3. A small paint run is being repaired. Technician A says to block sand the run with #600 grit wet sandpaper to quickly plane the area level. Technician B says to start by sanding with much finer sandpaper, such as #1,500 grit. Who is correct?

A. Technician A
B. Technician B
C. Both A and B
D. Neither A nor B

4. A paint job shows a few small fish-eyes. Technician A says to let the paint cure, sand, and refinish the area. Technician B says mixing a little fish-eye eliminator additive in the paint may correct the problem. Who is correct?

A. Technician A
B. Technician B
C. Both A and B
D. Neither A nor B

5. Which condition can sometimes be found on OEM finishes and repair finishes, to a certain degree?

A. Bull's-eye
B. Lifting
C. Orange peel
D. Chalking

6. Technician A says to use a light mist coat when applying the last color coat. Technician B says to always use a full wet coat with metallics. Who is correct?

A. Technician A
B. Technician B
C. Both A and B
D. Neither A nor B

7. Which should not be done when machine buffing a finish?

A. Mask over sharp edges
B. Mask over plastic parts, trim, etc.
C. Keep buffing pad level on surface
D. Push down on buffing machine

8. Technician A says to try panel detail sanding and polishing if acid spotting is not too severe. Technician B says that sanding and refinishing might be needed. Who is correct?
   A. Technician A
   B. Technician B
   C. Both A and B
   D. Neither A nor B
9. Which of these types of buffing pads is used last when machine compounding a finish?
   A. Wool
   B. Foam
   C. Rubber
   D. Steel
10. A new paint job shows signs of blushing. Technician A says to lower air pressure at the gun. Technician B says to use a slower reducer. Who is correct?
   A. Technician A
   B. Technician B
   C. Both A and B
   D. Neither A nor B

ESSAY QUESTIONS

1. Explain how to prevent paint cracking.
2. Describe some causes of crazing.
3. How can you prevent orange peel?
4. Summarize final detailing.

CRITICAL THINKING PROBLEMS

1. Explain when a hand rubbing compound should be used.
2. How can you prevent burn-through on edges when machine polishing?
3. How do you care for a new finish?

MATH PROBLEM

1. Instructions for a decal overlay state that it should be trimmed to extend off each end of a panel by ¾ inch. The panel measures 21-¼ inches long. How long should the overlay be cut to fit?

ACTIVITIES

1. Inspect several vehicles to analyze the condition of the paint. Try to find as many paint problems as you can. Write a report on the causes and corrections of the paint problems you find.
2. Visit a body or detail shop. After receiving permission from the shop owner, observe a professional detail technician at work. Report on things you learned by watching this person work.