

MAINTENANCE GUIDEBOOK VI - PAINTING MAINTENANCE

CHAPTER TWO - SURFACE PREPARATION

SECTION A PURPOSE OF SURFACE PREPARATION

Surface preparation includes making repairs, and treatment and cleaning of surfaces before painting. Its purpose is to ensure a clean and sound base for the paint, so that it will perform as expected.

CAUTION! THE CAUSE OF AN UNSOUND SUBSTRATE OR UNCLEAN SURFACE SHOULD BE DETERMINED AND ADDRESSED BEFORE ANY SURFACE PREPARATION OR PAINTING IS DONE.

For instance, if a wall is soft, yielding, or covered in mildew, the cause should first be determined—a leaky roof, termite-damaged studs, condensation, or any other malady—and corrected before surface preparation or painting is begun.

SECTION B SUBSTRATES

The substrate is the surface upon which the first coat of paint or coating is applied. It is the foundation which receives the initial primer, sealer, filler, or first coat. The surface preparation of a substrate is addressed in new construction, and when repair, remodeling, rehabilitation, or a certain type of abatement produces an uncoated surface. All substrates should be clean and free of surface contaminants. Preparation of major substrates should be as follows:

- Gypsum board/dry wall surfaces should be free of excess joint compound, tool marks, and ridges, and smoothed (wet-sanding preferred) without raising the grain of the paper facing.
- Plastered surfaces should not be sanded because sanding a smooth limecoat trowelled polish can easily cause scratches.
- Wood should be sanded smooth, in the direction of the grain. Do not putty or otherwise fill nail holes until after a primer or sealer has been applied.
- Concrete surfaces should be free of form oils, curing compounds, and laitances, and bug (air) holes opened up.
- Concrete Block (CMU) should be made free of excess mortar by rubbing with the flat side of a broken piece of concrete block.
- Ferrous Metal surfaces should be free of corrosion, mill scale, weld spatter, fins, and other sharp edges. Corrosion should be removed down to the bare metal by hand or power wire-brushing, and the metal coated with a rust-inhibitive primer.
- Non-Ferrous Metal surfaces may require etching before primer application, if required by the primer manufacturer.

The assumption underlying these requirements is that the finished surface will be smooth. If a textured

finish is required, appropriate adjustments should be made. For example, if a textured wood finish were specified, such as Texture 111, the requirement for surface preparation of a wood surface by sanding smooth would be waived. Similar accommodations would be made for all other substrates.

SECTION C SURFACE PREPARATION MATERIALS AND METHODS

"Surface preparation" is done after repair, rehabilitation, remodeling, and abatement work, and before painting. A sound surface may not always be ready for repainting. For instance, a high-gloss extra-hard finish designed to repel grease, oil, and other contaminants will also repel subsequent coats of paint or coatings. So vigorous surface preparation is required to avoid subsequent paint-delamination failures.

When using surface preparatory materials such as detergents, surface conditioners, or patching compounds, special attention should be paid to the manufacturers' recommendations. **ANY SURFACE PREPARATORY WORK THAT GENERATES DUST OR FUMES MUST UTILIZE DUST- AND FUME-CONTROL EQUIPMENT. THIS COULD INCLUDE, BUT IS NOT LIMITED TO, PROPER RESPIRATORY PROTECTION, PROTECTIVE CLOTHING, ON-SITE PROPERLY EQUIPPED SHOWERS, ENCLOSURE MATERIALS, HEPA FILTER-EQUIPPED VENTILATORS, HEPA VACUUMS, AND DUST MONITORS.**

Although most interior housing surface-preparatory work is done with hand tools, power tools and equipment are more effective and are usually safer to use. The following materials and methods are generally used in surface preparation.

1. WASHING

If properly done, washing can substitute for repainting. Most washing utilizes some kind of cleaning solution. However, there are several compounds, such as trisodium phosphate, which are banned in parts of the country as contributors to pollution, since the infusion of phosphates compromises some wastewater treatments. It is recommended that the local EPA or the authority in charge of sewers or wastewater be asked about the acceptability of chemicals proposed for this use. There are regulation-compliant commercially available products on the market that do an excellent job.

Washing solutions that "keep the surface shine," should be suspected of containing small amounts of wax or oil, which might interfere with the adhesion of subsequent coats of paint. It is best that all washing solutions be rinsed off with clean water.

The method of washing depends on the surface to be washed. The following methods involve washing by hand; power-washing equipment is covered under Blasting. Use appropriate and recommended safety equipment such as gloves and safety goggles.

a. Smooth Surfaces to be Painted or Coated

Equipment required for washing smooth surfaces to be painted or coated include:

- Two wash buckets (could be 5-gallon plastic);
- Cleaning solution;
- Two large natural sponges (Be sure that the cleaning solution is not harmful to the natural sponges. Thoroughly rinse them clean after use.);
- Two artificial sponges (could be pole-mounted);
- Abrasive (scouring) pads;
- Drop Cloths (plastic is slippery when wet; canvas is better).

b. Smooth Gloss Surfaces Not to Be Painted

Equipment required for work on smooth gloss surfaces not to be painted include:

- All equipment listed above, except that a cleanser should be substituted for abrasive pads;
- Towel (to remove water drops).

c. Rough Surfaces Such as Brick and Masonry

Equipment required for rough surfaces such as brick and masonry include:

- Two wash buckets (could be 5-gallon plastic);
- Scrub brushes (available in a wide variety of sizes, configurations, and bristle types to meet the needs of the job).

2. SCRAPING

Scraping is done to remove built-up, loose, or failing paints or coatings, and bumps. It can also remove excessive joint compound from dry wall and waste mortar from masonry. Although it is a simple method, it is often improperly done because of incorrect selection of tools. Typical scraping tools are stiff, and should be kept sharp. They include:

- Hand or draw-scrapers (available in various sizes and configurations);
- Putty or broad knife (typically rigid, bent, sharp, and a maximum of 3 inches wide);
- Multiple-use scrapers (sometimes referred to as a 4-in-1, or 5-in-1) effective for scraping off paint with their sharp, stiff, 2-1/2-inch wide blades.

3. **SANDING BY HAND OR POWER TOOL**

Sanding can also remove bumps and loose and failing paint, but it does so by abrading the surface. It is also used to smooth rough surfaces and dull shiny ones. Most sanding is done with sandpaper, although there are other media available, such as abrasive blocks. The abrasive in sandpaper comes in a variety of grit or abrasive sizes. Sandpaper is also available in a waterproof form, which lends itself well to use when low, or no, airborne dust is desired, as when a hazardous material like lead might be encountered. Now available are open-weave, abrasive-coated, waterproof cloth sheets that are exceptional for this use.

To control dust, wet sanding is recommended. Materials required include:

- Waterproof silicone-carbide sandpaper (available in a wide variety of grits or coarseness from very coarse 12 grit to very fine 600 grit);
- Sanding blocks (to hold the sandpaper) greatly enhance productivity and the effectiveness of the abrasive);
- Artificial sponge (used to "wet sand" dry-wall joint compound).

4. **ABRADING BY HAND OR POWER TOOL**

The following abrading tools are used for smoothing or removing protruding materials, and completing the work in a low-dust or dust-free manner.

- Steel wool (in both pads and roll form):
Steel wool is available in various degrees of coarseness from Number 5, which is very coarse, to Number 5/0, the finest. It is most often used with a cleaning solution to scrub off the residue left after stripping paints and coatings from a surface. Steel "splinters" should be carefully removed before painting to avoid their rusting in place.
- Abrasive pads (available in a wide variety of sizes and shapes):
Some have built-in handles for easier, more effective handling. Most are nonwoven synthetic fibers with an abrasive either adhered to, or impregnated in, the fibers. They are available in a wide range of coarseness, but are not graded as are sandpaper and steel wool. Unlike steel wool, they don't cause rusting problems. Some have built-in or attached artificial sponges for convenience, but these are usually small for maintenance work. Maintenance supply houses usually have larger pads, more appropriate for this kind of work.
- Steel brushes (also referred to as wire brushes):
These are most often used to remove failing paint and rust from metal surfaces. They are available in a wide variety of sizes and shapes. Also available are wire brushes with built-in scrapers. Some of the more popular include the long-handle, the shoe-handle, and the flat-back brushes. Stainless-steel wire brushes are recommended, since other types tend to leave metallic

residue that can rust. For heavy-duty corrosion removal, steel brushes made for power tools are recommended.

5. BLASTING

Blasting involves directing air or water under pressure, with or without abrasive or detergent additives, at the surface to be cleaned. The various methods include:

- Low-pressure water washing using water pressures under 5,000 PSI;
- High-pressure water cleaning at pressures from 5,000 to 10,000 PSI;
- High-pressure water jetting at water pressures from 10,000 to 25,000 PSI;
- Ultra-high water jetting at pressures above 25,000 PSI;
- Abrasive blasting, which uses air to propel a variety of abrasives, such as sand or slag;
- Wet-abrasive blasting, which propels an abrasive at a surface using water, with or without air under pressure, as the propellant.

Abrasive blasting and high-pressure water blasting require highly sophisticated equipment and are most often used in an industrial setting. Low-pressure water washing (under 5,000 PSI) requires a pump capable of converting tap-water pressures to up to 5,000 PSI, although typical pressures are in the 2,000 to 4,000 PSI range. These pumps are also called power washers, spray cleaners, high-pressure washers, and water blasters. When equipped with a chemical injector, they can be used to apply cleaning agents, mildewcides, and rust inhibitors. Dispersive nozzles and heads include:

- Fan nozzle (used for general cleaning);
- Round nozzle (which uses a straight, solid stream for maximum impact);
- Rotary head (utilizes spinning pulsating water jets to remove paint and foreign material aggressively);
- Extension handles (a minimum of three feet long, for comfortable work at higher levels);
- Adjacent-area protection (extremely important to avoid damage to adjacent areas). This could include:
 - Duct tape,
 - Plywood,
 - Rubber matting,
 - Corrugated fiberglass,
 - Canvas tarps,
 - Plastic sheeting 4 to 6 mils thick.

6. STRIPPING

Stripping, also referred to as removing, is most often done to remove deteriorated or unwanted paints or coatings. The methods used include:

- Dry-scraping or abrading using scrapers or abrasive to wear away or chip off unwanted material;
- Chemical stripping using both solvents and solutions (most often caustics) which dissolve or soften paints and coatings for subsequent removal with scrapers or steel brushes;
- Heat-aided stripping which applies heat to the material to be removed.

The use of stripping or removing tools, equipment, and materials is affected by regulations on handling hazardous materials. Many old procedures and tools (such as use of the blow torch) are not used today due to environmental concerns.

CAUTION! OPEN-FLAME BURNING TO REMOVE PAINTS AND COATINGS IS EXTREMELY HAZARDOUS AND SHOULD NOT BE ALLOWED ON HA PROPERTY. Electric heat guns should be used to soften paint or coatings for removal with a scraper only with great care. Hazards of this method are not only the heat (about 1200 degrees F, close to the ignition point of some building materials), but also the fumes emitted during the process.

a. Dry Scraping or Abrading

For completing such work, the following equipment, materials, and tools are used.

Hand-Scraping:

- Hook-type or draw-scraper (also called a paint or varnish scraper) that workers pull toward themselves. They are typically stronger than putty knives and often have a bend for better handling. Some have long handles to protect the worker when heat is used in this process. Quality blades are made of high-carbon steel, which can be sharpened with a file.
- File (to sharpen draw-scraper).
- Water spray device (to settle airborne dust).
- Water bucket and sponge (in lieu of water spray to control dust).
- Metal container or bucket (to gather the paint chips and debris).

Hand-Sanding:

- Waterproof abrasive (sand) paper, as described in sanding section;
- Abrasive pads, as described in abrading section;
- Sanding block (to hold the abrasive);
- Water bucket and sponge.

b. Chemical Stripping

CAUTION! PAINT AND VARNISH REMOVERS MUST BE HANDLED WITH GREAT CARE SINCE THEY CAN BURN SKIN AND CLOTHING, AND CAN DAMAGE OTHER SURFACES WITH WHICH THEY COME IN CONTACT. THE MANUFACTURER'S INSTRUCTIONS AND CAUTIONS MUST BE FOLLOWED CAREFULLY.

Strippers require the following:

- Chemical-resistant gloves;
- Applicator for the chemical remover, per manufacturer's recommendations;
- Scrapers, to remove softened coatings;
- Waste bucket, appropriate for the type of remover used;
- Wash buckets;
- Wash abrasives, sponges, or rags appropriate for the type of remover used;
- Sand (abrasive) paper or abrasive pads.

Additional tools or materials may be needed, as recommended by the manufacturer. The stripping chemicals are available in various forms and classifications, such as liquid, semi-paste, or heavy-bodied paste form. They are also classified as fast- or slow-drying (the slower drying is the more effective) and flammable or nonflammable.

c. Heat-Aided Stripping

The following tools and materials are required:

- Heavy gauntlet-style gloves;
- Electric heat gun;
- HEPA respirator;
- Long-handled scraper;
- Heat-tolerant floor cover;
- Metal bucket to collect removed materials;
- Abrasive paper or pad;
- Fire extinguisher.

7. PATCHING

Patching is usually done to repair cracks and holes in substrates, but is also used to fill in areas of failed or delaminated paint to level the surface. The type of substrate usually determines the type of filler to be used. Plaster walls should be patched with plaster or spackling compound. Small holes in wood should be patched with putty. Cracks between dissimilar substrates such as wood and plaster, should be corrected with caulking. Small holes in gypsum board may be patched with joint

compound, but larger holes will probably require gypsum-board backing or some other method of filling the hole. Joint compound should not be used as a general patching material because most are very water sensitive, have poor adhesion, and do not hold up well except when applied to the paper face of bare gypsum board.

a. Gypsum Board (Dry Wall)

Bare Substrate (Unpainted): Patching small flaws in this substrate is best done with joint compound, which is designed to adhere well to gypsum-board paper and itself. Unlike plaster or spackle, it easily redissolves in water, making it easy to avoid forming dry lumps while working with it. Joint compound comes in different forms for different tasks, such as bedding and topping. It is also graded by its hardness and drying time.

A hole fist-size requires either a gypsum-board patch or a backing-and-mud patch. If a stud is exposed, a gypsum-board patch can be screwed to it; if not, it is fastened to the adjacent gypsum board with adhesive or glue. There are also commercially available products, most in kit form, which use stainless-steel mesh or fiberglass screening to bridge the hole when no stud is exposed. These kits supply the bridging, the "mud" compound to cover it, instructions, and the required tools and fasteners. Patch larger holes with gypsum board for strength and durability.

Patching tools required for unpainted gypsum-board substrate include:

- Taping knife, to apply joint compound;
- Joint compound appropriate for repair;
- Joint-compound pan (used to hold and mix the compound) and a straight edge on which to clean off taping knife;
- Utility knife to cut gypsum board;
- Drywall or keyhole saw to cut gypsum board;
- Joint tape;
- Gypsum board for backing;
- Glue to attach backing;
- Screws to attach backing;
- Water bucket and flat sponge for wet sanding;
- Pole sander to sand joint compound.

Painted or Coated: Patching is usually done with a spackling or patching compound. Unlike joint compounds, these materials are designed to adhere well to painted or coated surfaces. Their drying and hardening characteristics vary considerably from product to product. Some harden in a few minutes and are ideal for patching larger holes, in preference to joint compounds, which

would have to be built up in layers. Others are slower to harden and are best suited for smaller holes. Patching compounds also vary in their adhesive strength.

Spackling compounds usually have better adhesion, and would be the product of choice for leveling a surface with missing paint or indentations which require a shallow and well-adhered repair. These products are available in a wide variety of generic types—from simple latex, gypsum, and casein to exotic epoxies—and come in both interior and exterior grades. Some are ready-mixed, while others require mixing. It is always best to use these products in the areas and for the purposes recommended on their labels.

Tools and equipment used to patch nail-size holes and damage to painted surfaces are:

- Spackling compound to make small and shallow repairs;
- Plastic mixing container for compound;
- Broad knife for applying and smoothing the spackling compound;
- Utility scraper to remove loose paint and material;
- Screwdriver, hammer, and nailset to reset screws and nails that have popped above the drywall surface;
- Water bucket and sponge, both to wet hole or repaired area prior to patching for better adhesion to the surface and to clean up tools after use;
- Pole sander.

b. Plaster

Bare Substrate (Unpainted): Patching of unpainted plaster is usually done with plaster of paris (fast-hardening), dental plaster (less shrinkage and harder), or patching plaster (longer working time and better sanding properties). Plaster containing wood fibers or some other fibrous reinforcement material is also used when large and deep repairs are made. Spackling compound can be used for smaller holes and cracks because it has better adhesion to the substrate and allows longer working time for the applicator before hardening.

For patching and repairs to holes and cracks in plaster where there is no paint or coating, use the following tools:

- Trowel or broad knife;
- Patching plaster appropriate for the job;
- Hatchet or chipping hammer to remove loose plaster;
- Utility knife and scraper to open cracks and remove loose plaster;
- Water bucket, sponge, and fiber brush to wet and clean work area and tools.

Painted or Coated Substrate: Larger holes usually require plaster to build up the area to the level of the plaster substrate. Where only paint has peeled, spackling compound should be considered to bring the surface level, because of its superior adhesion to painted or coated surfaces. Joint compounds generally should not be used for this purpose because they have poorer adhesion and less moisture- and humidity-tolerance, though they are easier to work.

Where cracks recur, fiberglass membranes can be used to bridge and reinforce the work area. These bridging systems are commercially available and should be used only in accordance with the manufacturers' instructions.

Because the patching material needs to adhere to both plaster and a coated surface, a spackling compound should be used. Tools needed for this procedure include:

- Broad knife to apply and smooth spackling material;
- Spackling compound;
- Utility scraper to remove loose paint and plaster;
- Water bucket and sponge to wet and clean the work area and tools;
- Pry-bar and screwdriver to remove unwanted nails and screws;
- Sand (abrasive) paper or abrasive pad to clean and smooth surface.

c. Wood

Painted: Consolidation or replacement should be considered for damaged painted wood surfaces, as indicated below. Loose, peeling, or delaminating paint should be scraped to a sound surface and sanded smooth. Shallow cracks in wood are caulked with a caulk suited to the particular application. Some are not paintable, and some can't be used outdoors.

The following is a list of tools and materials needed to repair or patch nail and screw holes, cracks, separations, failing paint, putty, or caulk.

- Utility scraper to remove loose material;
- Hammer and nail set;
- Screwdriver;
- Putty knife and putty or glazing compound to fill holes or replace missing glazing putty;
- Caulking gun and caulk;
- Sanding block and sand (abrasive) paper or abrasive pad to clean and smooth surface;
- Pole sander;
- Water bucket and sponge;
- Duster to sweep dust out of corners and edges;
- Rags and appropriate solvent to wipe off excess caulk or putty.

Clear-Coated Wood (Varnished, Lacquered, and Stained): Because it is difficult to match a patched area with an adjacent clear-coated surface, component replacement should be considered. Nail and screw holes are best patched with colored putty or putty sticks, matching the color of the adjacent wood.

The following tools and materials are required:

- Colored putty sticks and putty knife;
- Colored caulk and caulking gun;
- Rags and appropriate solvent, to remove excess putty or caulk.

d. Trowelled Concrete

Painted: These surfaces are usually floors and stair treads. Patching materials range from latex to epoxy-fortified cement/concrete patching compounds which are trowelled in place. There are commercially available epoxy and epoxy-fortified cement/concrete self-leveling patching compounds which are pourable and require a minimum amount of trowelling.

Clear-Coated: Clear-coated trowelled concrete floors are also patched with fortified cement/concrete patching materials. These must be fully cured before clear recoating.

The following tools, equipment, and materials are used for the repair of these surfaces:

- Chipping hammer,
- Ice scraper,
- Utility scraper,
- Duster or compressed air,
- Appropriate patching material,
- Concrete pre-treatment, per manufacturer's instructions,
- Metal straight-edge for leveling,
- Wire brush,
- Trowel.

e. Precast or Poured Concrete

Bare Substrate (Uncoated): Patching is usually done with cement/concrete patching compound. It may be necessary to use a form to hold the patch in place while it is curing.

Painted or Coated: Holes and cracks can be patched with a concrete patch or mortar. If the original coating system included a block filler, reapply one to match the original texture.

Materials for surface preparation include:

- Chipping hammer,
- Wire brush,
- Duster or compressed air,
- Concrete patch or mortar,
- Water bucket and sponge to wet area (as directed by patch manufacturer) and to clean tools.

f. Concrete Block

Bare Substrate: Holes and cracks are generally patched with mortar.

Painted or Coated: Holes and cracks can be patched with concrete patch or mortar. It may be necessary to reapply block filler in order to duplicate the original finish.

Surface preparation requires the following tools:

- Chipping hammer,
- Utility scraper,
- Duster or compressed air,
- Mortar,
- Water bucket and sponge to wet area to be patched,
- Spray device to wet area to be patched,
- Block filler (if used previously) to duplicate existing texture,
- Brush, roller, or broad knife to duplicate original texture.

g. Ferrous Metal

Painted or Coated: Holes and rusted-away metal can be patched prior to painting with epoxy caulk or auto-body filler. It is important to follow the manufacturer's recommendations.

Materials required include:

- Epoxy caulk or auto-body filler,
- Utility scraper,
- Abrasive paper/cloth or pad,
- Steel brush,
- Abrasive blaster, (if warranted by job size),
- Plastic (polypropylene) scraper to apply and smooth patching material.

h. Non-Ferrous Metal

Painted or Coated: Patch holes with the appropriate metal and thoroughly clean the entire surface by hand or solvent cleaning. Caulk joints. The following materials are required:

- For hand cleaning: scraper, wire brush, or steel wool;
- For solvent cleaning: rags and appropriate solvent;
- Appropriate caulk and caulking gun.

8. CONSOLIDATING

Consolidating is a high-tech replacement method used for impregnating deteriorated wood with wood fiber, which not only replaces lost material but also penetrates and stiffens any fibrous material to which it is applied. Once consolidated wood is cured, it can be sanded, sawn, or chiselled, and primed and finished as is the original wood. Most consolidating is done on exterior surfaces where deteriorating wood is difficult to patch and replacement of the member is impractical or costly.

Consolidation requires the following tools and materials:

- Wood consolidant material;
- Buckets for mixing;
- Utility scraper;
- Chisel to remove deteriorated wood;
- Polyester brush to spread consolidant;
- Hammer;
- Putty knife and broad knife;
- Duster brush;
- Rasp;
- Abrasive paper;
- Disinfectant;
- Mildew retarder.

9. REPLACEMENT

Despite the desirability of retaining certain architectural building components, it is sometimes necessary to replace some of them, such as doors and windows, especially during lead-based paint abatement procedures. Such decisions however, should be based on cost-effectiveness. The total costs to be considered include:

- Dismantling the component;
- Disposing of (possibly hazardous) old components;

- Retrofitting existing support framing;
- Procuring, fitting, and installing replacement components;
- The value of architecturally desirable components.

a. Wood

The following tools are required for replacement of architectural elements prior to painting:

- Pry-bar, claw hammer, utility scraper;
- Screwdriver, saw, nail set and nails, screws;
- Replacement architectural elements;
- Primer, for back-priming;
- Abrasive paper and block;
- Rasp, plane, chisel;
- Glue;
- Caulk and caulking gun;
- Replacement or refurbished hardware;
- Tape measure, level, square, utility knife;
- Putty and putty knife, wood filler;
- Solvents appropriate to materials used;
- Bucket and rags.

b. Gypsum Board/Dry Wall

Tools for the replacement of walls or full sheets of gypsum board are covered here, as opposed to patching, as previously described.

- Pry-bar, crow bar, claw hammer, nippers;
- Utility knife, square, straight edge;
- Key-hole or plasterboard saw;
- Screwdriver and dry-wall screws;
- Panel adhesive and applicator;
- Gypsum board, joint compound, joint tape, and corner beads appropriate to job;
- Taping knife or trowel;
- Water bucket and dry-wall sponge.

END OF CHAPTER TWO