CHAPTER 8. EXTERIOR PAINTING

Section 1. GENERAL

8.1.1 SCOPE. This chapter covers the types of paints and painting operations necessary to adequately finish and protect exterior walls, trim, and similar surfaces of buildings, structures, and facilities, including housing, administration buildings, warehouses, storage facilities, hospitals, and exposed steel structures such as tanks, towers, and utility systems. The surfaces to be painted include wood, concrete, masonry, and metal which are exposed to rural, marine, humid, or industrial environments. The painting of special surfaces and those exposed to most severe environments and conditions, e.g., underwater and underground structures, swimming pools, reservoirs, and tanks, waterfront bulkheads and piling, hot stacks and mufflers, air conditioning and evaporative cooling equipment, and piping systems is covered in Chapter 10.

8.1.2 PURPOSE OF EXTERIOR PAINTING. Exterior painting is intended primarily for the protection of substrates which would normally deteriorate if left unprotected. Durability of the coating system, rather than general appearance, is therefore of prime concern. The choice of coatings for exterior exposure is limited to those systems which will remain intact and will economically protect the substrate under a specific set of exposure conditions.

8.1.3 CHOICE OF FINISHES. Finishes used for exterior painting are generally not the same as those used for interior painting. The available ranges of gloss and color for exterior finishes are relatively limited as compared with interior finishes. The type of surface, the degree of surface preparation attainable, and the conditions of exposure form the principal criteria for choosing a coating system. No single coating system will perform economically or adequately on the multitude of surfaces to be protected or for the potential or actual environmental conditions encountered. In several instances, more than one coating system may perform equally well, thereby providing a wider latitude in availability and in choice of gloss, color, or cost. The choice of gloss or color is secondary to the prime consideration for exterior painting, namely, durability and protection.

8.1.3.1 Substrate. The surface to be painted may be one of the following unpainted substrates:

a. Wood: This might be any of the standard structural types, e.g., pine, fir, or oak. Its form may be either solid lumber or plywood.

b. Metals: The most common metal used in exterior construction is steel. However, it may also be iron, galvanized steel, aluminum, brass, or copper. Steel may be in the form of relatively thick and rough structural steel or in the form of thin smooth sheet metal. Iron, as such, is usually in the form of wrought railings. The other metals listed are usually used as sheet metals.

c. Concrete and Masonry: This group includes all construction materials made with, or held together with, cement. Among these are poured concrete, concrete block, cement asbestos surfaces, brick, stone, and stucco. All are commonly used in exterior construction.

d. Hardboard: This is made of compressed ground wood which is impregnated with synthetic resins. It is similar to wood except that the finished surface is very smooth and should be sanded prior to painting to improve adhesion.

8.1.3.2 Painted Surfaces. Once the above substrates have been painted, the old paint becomes a more important factor than the base substrate in determining the choice of paint for recoating. The new coating must be compatible with the old paint to avoid problems such as lifting or loss of adhesion. This is especially important on exterior substrates, e.g., wood or metal which may change considerably in dimension during extreme changes in temperature and humidity (see 5.2.4.2).

8.1.3.3 Type of Finish. Exterior finishes are available as clear or pigmented products. Pigmented finishes are available in varying degrees of gloss. Primers are used to a much greater extent than in interior finishes because of the much more severe environmental conditions during the service life of the coating (see 8.1.4). This is especially so with steel substrates which will rust unless protected by primers which both physically cover the surface and also inhibit corrosion. Primers are discussed in detail in 8.2.4.

8.1.4 EXPOSURE CONDITIONS. Structural materials, especially iron and steel, will deteriorate if not protected, hence the need for an adequate paint system which will resist the particular environment. The exposure conditions discussed in this chapter include rural environment, marine environment, and exposure to industrial fumes, high humidity, and heavy rainfall.

8.1.4.1 Rural Environments. This is an exposure where the only deteriorating effect is the weather. Under these conditions of exposure, surface preparation, and performance requirements are less critical than under more corrosive environments. Note: urban environments can be similar to rural environments except that locations near industrial areas or the seacoast are mildly corrosive

8.1.4.2 Environments Contaminated with Industrial Fumes. The environment near industrial areas may be contaminated with hydrogen sulfide which will react with lead-containing pigments to form black lead sulfide. As a result, white paints which contain lead pigments will turn gray and unsightly.

8.1.4.3 Marine Environments. Structures near, and especially along the coast, are exposed to atmospheres containing high concentrations of salt laden moisture. This is an excellent environment for rapid corrosion of most metals, especially iron and steel. Careful surface preparation and the use of durable coating systems, e.g., vinyl alkyds, are of greater importance than is the case in rural environments.

8.1.4.4 Environments of High Humidity or Heavy Rainfall. Excessive amounts of moisture in the atmosphere are also harmful to coating systems and structures. Areas such as Puerto Rico, Panama, Florida, and the Gulf States are subject to excessive humidity and/or rainfall. It is important to use coating systems which are durable under these circumstances, e.g., phenolic, rubberbase, pigmented urethane, and vinyl coatings. If excessive sunshine is also present, as in the tropics, be sure to use nonchalking white paints. (See 8.4.1.4)

8.1.4.5 Corrosive Environments. The most severe environments for coatings are either those in which complete or partial immersion in sea water takes place or those near heavy industrial complexes which contaminate the air with corrosive chemicals. Use only the most careful surface preparation and the most resistant coatings such as those based on epoxy, urethane (two component), and vinyl resins.

Section 2. TYPES OF PRODUCTS AVAILABLE

8.2.1 GENERAL. A knowledge of the types of products available is useful in determining the capabilities and limitations of those which are recommended. There are sound reasons for the existence of each product specification, and these become more apparent with some insight into the makeup of the finishes used. See Chapter 6 for a complete discussion of paint materials.

8.2.2 BASIC TYPES OF COATINGS. Most of the types of finishes described in Chapter 6 are used in exterior painting. Refer to the following for specific discussions on each type:

a. Alkyd: See 6.2.2.
b. Cement: See 6.2.3.
c. Epoxy: See 6.2.4.
d. Inorganic: See 6.2.6.
e. Latex: See 6.2.7.
f. Oil: See 6.2.8.
g. Oil-alkyd: See 6.2.9.
h. Oleoresinous: See 6.2.10.
i. Phenolic: See 6.2.11.
j, Rubber-base: See 6.2.13.
k. Silicone: See 6.2.14.
l. Silicone-alkyd: See 6.2.15.
m. Urethane: See 6.2.16.
n. Vinyl: See 6.2.17.
0. Vinyl-alkyd: See 6.2.18.

These finishes are compared in Table 8-1.

8.2.3 SPECIALIZED COATINGS. Paints for the following major specialized uses are covered in Chapters 9, 10, and 11.

a. Floor Finishes: These are fully described in Chapter 9.

b. Special Painting Materials: These include fire-retardant and heat-resistant paints, nonslip coatings and textured finishes (see 10.2.2).

c. Coatings for Special Areas and Objects: These include paint for hot stacks and mufflers, combustible areas, reservoirs and storage tanks, underground and underwater structures, and swimming pools (see 10.2.3).

d. Coatings for Special Surfaces: Typical surfaces include bituminous surfaces, insulation fabric, glass, and plastic (see 10.2.4).

TABLE 8-1
Types of Exterior Finishes

Type	Solvent	Finish Clear	Finish Paint	Gloss	Caution	Notes
Alkyd	MS	0	X	Any	Avoid use on alkaline and damp surfaces.	All purpose; primarily for metal.
Cement	Water	0	X	F	Do not use on wood or metal.	Powder; provides thick, textured porous, moisture resistant coatings.
Inorganic	Water	0	X	F	For metal only.	Used in zinc-rich paints; excellent corrosion resistance.
Latex	Water	0	X	F	Do not use on unprimed wood or metal.	Non-flammable, easy to apply, fast dry, durable.
Oil	MS	0	X	Oil	Avoid use on alkaline and damp surfaces.	Used in house paints on wood and in primers for structural steel.
Oil-alkyd	MS	0	X	H, SG	Avoid use on alkaline and damp surfaces	Faster dry than above; used in trim paints, house paints and primers for steel.
Oleoresinous	MS	X	X	H, M	Avoid use on alkaline and damp surfaces.	Mixing varnish for producing aluminum paint.
Phenolic	Arom	X	X	H, F, M	Dark colors only except aluminum.	Spar varnish; resistant to moisture and high humidity.
Rubber base	Arom	0	X	Any	Not compatible with all undercoats	Fast dry; resistant to moisture and moderate corrosion.
Silicone	Arom	X	X	F	For porous masonry only.	Colorless; water repellent.
Silicone alkyd	Arom	0	X	H	Not compatible with all undercoats.	Outstanding weather resistance.
Urethane	Lacq	0	X	H	Dries slowly at low humidity.	Ex. hardness, resistance to abrasion, chemicals and solvents.
Vinyl	Lacq	0	X	SG, F	Do not use on wood.	Fast dry; excellent corrosion resistance.
Vinyl alkyd	Lacq	0	X	SG, F	Do not use on wood.	Better adhesion than above; very good corrosion resistance.

*Key:

MS--Mineral spirits
Lacq--Lacquer type solvents
Arom--MS + aromatic solvents

X--Available
H--High gloss
0--Not available

SG--Semigloss
F--Flat
M--Metallic

e. Traffic Marking Paints: See Chapter 11, section 2 for a complete discussion on traffic and zone marking paints.

8.2.4 PRIMERS. Primers are of utmost importance in exterior finishes because of the exposure of the substrate to the elements and to extreme variations in temperature and humidity. The primer is the paint coating in direct contact with the substrate and thus both protects the substrate and also protects the top coat from any possible problems with the substrate, e.g., bleeding in cedar, alkalinity in concrete and masonry, and adhesion to galvanized steel.

8.2.4.1 Primers for Wood. The essential qualities required for wood primers are controlled penetration, good adhesion, and flexibility. Penetration must be controlled to allow enough to obtain adequate adhesion but not so much as to lose binder and thus adversely affect flexibility. Adhesion and flexibility should be good enough to withstand the extreme stresses, especially across the grain, during extreme changes in temperature, humidity, and rainfall without any loss in adhesion. (See Appendix D-4, Table 13.)

8.2.4.2 Primers for Concrete and Masonry. The essential quality in a primer for concrete and masonry is that it be alkali resistant. Therefore, these primers are based on alkali resistant binders such as latex, cement, and rubber-base resin. Since most exterior top coats for concrete and masonry are also alkali resistant, they are self-priming and do not require any special primers. (See Appendix D-4, Table 14.)

8.2.4.3 Primers for Iron and Steel. Iron and steel are subject to rapid corrosion to a greater degree than other exterior substrates. They require the use of special primers which contain corrosion inhibiting pigments. Consequently, a variety of primers are available depending on the degree of surface preparation attainable, the speed of dry and hardness desired, the top coat to be used, which must be compatible, and the service required.

a. Anticorrosive Pigments: The following corrosion inhibiting pigments are available. All are represented in the primers recommended.

Red lead
Zinc chromate
Basic lead-silico-chromate
Zinc dust

Red lead has the longest history of performance and is still a major pigment. Zinc chromate was developed just before World War II when it was the major pigment in marine primers. Basic lead-silico-chromate is similar to red lead but remains durable when exposed so that it can also be used in body and top coats. Zinc dust has long been used in coatings for galvanized steel because of its excellent adhesion. Zinc dust also is available in zinc-rich primers which contain at least 72 percent of zinc dust by weight. Zinc-rich primers protect iron and steel from corrosion even when the coating is damaged exposing the substrate. They are especially useful for protection in marine environments. However, these primers are more expensive and require the greatest degree of surface preparation (see 4.4.2.7, class 4).

b. Primer Types: The major primers are available in a variety of types depending on the vehicle used. See Table 8-2. The types vary from slow to fast drying vehicles and include a phenolic vehicle for humid conditions. Also see Appendix D-4, Table 15. Note that faster drying primers require better surface preparation. On the other hand, ferrous surfaces which are less well prepared or old and corroded require the use of a slower, drying oil-containing primer which will penetrate into the crevices of the relatively rough surfaces and thereby provide protection.

TABLE 8-2
Selection of Typical Primers for Iron and Steel

Specification no. and other factors	Oil	Oil/alkyd	Alkyd	Phenolic
		Type		
TT-P-57 (Zinc chromate)		I	II	III
TT-P-86 (red lead)	I	II	III	IV
TT-P-615 (basic lead silico chromate)		I, II, V	III	IV
TT-P-641 (zinc dust + zinc oxide)	I		II	III
		(For galvanized steel)		
TT-P-645 (zinc chromate)			Only type	
Substrate		Structural iron and steel	Smooth iron and steel	
Minimum surface preparation (4.4.2.7)		Class 1 increases to class 4		
Speed of dry (hr)	36	16-36	6-16	6-16
Type of service	Rural	Rural and marine environments	High humidity. Fresh water immersion	

8.2.4.4 Primers for Nonferrous Metals. Nonferrous metals do not present any serious problems with corrosion. The major problem is adhesion, especially with galvanized steel. Aluminum, tin, lead, copper, and brass, when painted, are pretreated with wash primer followed by a zinc chromate primer. Galvanized steel is primed with zinc-containing primers. See Appendix D-4, Table 16.

8.2.5 ACCESSORY PRODUCTS. Other painting materials contribute to paint performance by their use in preparing the surface before paint or varnish is applied. Their contribution in exterior finishes is even greater than with interior paints since their proper use can prevent or inhibit deterioration of the substrate in hostile environments. There are two major groups of these products: those used to put the surface in good condition and those used to prepare the surface for finishing. They are discussed in detail in Chapter 4.

8.2.5.1 Surface Preparation. The following products are used to prepare exterior surfaces for painting. Their choice depends on the type of

substrate, its condition, the type of paint system to be applied, and the service required. See the appropriate section in Chapter 4 for details.

a. Paint Removers: See 4.4.3.6.
b. Phosphate Treatments: See 4.4.4.1 and 4.4.4.2.
c. Wash Primers: See 4.4.4.3.
d. Masonry Conditioners: See 4.4.5.1.
e. Knot Sealers: See 4.4.5.2.
f. Wood & Masonry Fillers: See 4.4.5.3. Also see Chapter 4, Tables 4-4 and 4-5.

8.2.5.2 Surface Repair. The following products are used to repair defects, fill crevices and openings, and otherwise repair exterior surfaces:

a. Caulking Compounds and Sealants: See 4.5.2.
b. Putty: See 4.5.3.
c. Glazing Compounds: See 4.5.4.
d. Portland Cement Grout: See 4.5.6.4.

8.2.6 APPLICABLE SPECIFICATIONS. The specification products recommended for use on exterior surfaces are numerically listed in their appropriate groups as follows:

8.2.6.1 General Purpose Coatings. The products most commonly used for exterior painting are listed in Appendix D-1, Table 4.

8.2.6.2 Primers. Since primers are of such importance in increasing durability of coatings applied to iron and steel, the more common types are also listed separately in Table 8-1.

8.2.6.3 Specialized Coatings. The coatings recommended for specialized uses are listed in the following tables:

a. Floor Finishes (See Appendix D-1, Table 5.)

b. Special Purpose Coatings. (See Appendix D-1, Table 6 which lists special painting materials, coatings for specialized areas and coatings for special surfaces.)

c. Traffic Marking Paints. (See Appendix D-1, Table 8.)

8.2.6.4 Accessory Products. Materials used for surface preparation and repair are listed in the following tables:

a. Surface Preparation: See Appendix D-1, Table 1.

b. Surface Repair: See Appendix D-l, Table 2.

Section 3. SURFACE PREPARATION AND REPAIR

8.3.1 GENERAL. One of the most essential parts of any paint job is proper surface preparation and repair. Paint will not adhere well, provide the required protection, nor have the desired appearance, unless the surface is in

proper condition for painting. This is of special importance in exterior painting, where the hostile environment can accelerate deterioration of the coating and the substrate if any defect causes loss of adhesion or allows entrance of moisture or corrosive materials to come between the coating and the substrate.

8.3.2 TECHNIQUES. Methods of preparation and repair of exterior surfaces are similar to those used on interior surfaces of the same substrate. However, the operation must be done with more care, since durability of the entire coating system can be adversely affected by poor surface preparation, especially in corrosive environments. The techniques used are described in Chapter 4, sections 4 and 5. They are referred to or described in more detail below, as required by the surface to be painted.

8.3.2.1 Wood. Use same methods as in 7.3.2.1.

8.3.2.2 Concrete and Masonry. Use same methods as in 7.3.2.2. For cement-asbestos surfaces, remove dirt, loose paint, chalk, oil, grease, and other foreign substances by methods outlined in Chapter 4. However, do not use wire brushing to clean cement asbestos surfaces. When chalk removal is required, use Tampico brush, trisodium phosphate, detergent, and water to clean the surface. When treatment of the chalked surface is required, use an exterior solvent type conditioner conforming to TT-P-620. Where the cement binder has eroded leaving exposed asbestos fibers, use a surface conditioner conforming to TT-P-620 to stabilize the surface.

8.3.2.3 Iron and Steel. Proper preparation of iron and steel surfaces is especially important since any substrate exposed as a result of paint failure, will corrode rapidly. Remove all loose rust and mill scale, oil, and grease by methods outlined in Chapter 4, section 4. Follow the treatments outlined in 4.4.2 and 4.4.3 to prepare the surface properly. The care and degree of treatment is especially critical with some coatings and for severe environments. Note the "Preparation" column in Appendix D-4, Table 15. Pretreatment, as outlined in 4.4.4, may also be necessary to improve the adhesion of high performance coatings, such as vinyls. On old paint surfaces which are generally intact, mechanically remove all loose material, being careful to feather edges around all areas in which the metal is exposed. To the extent possible, treat the exposed area as in new work and spot prime. Shop-coated iron and steel should be stored out of contact with the ground and should be protected from corrosion before installation. However, these surfaces may develop abraded or corroded areas by accidental contacts. Immediately upon detection, the abraded or corroded spots should be recleaned in the same manner as specified for the original surface preparation and touched up with the same coating material(s).

8.3.2.4 Nonferrous Metals. Other metals, such as galvanized iron and aluminum, are less subject to corrosion than iron and steel. They often present greater problems in obtaining adequate adhesion. Mechanical pretreatment must be applied carefully to avoid wearing through the galvanized layer or through aluminum which is relatively soft. They must be thoroughly cleaned of all dirt, oil and grease and then a metal treatment should be applied. (See Appendix D-4, Table 16.) On old painted surfaces, treat as in 7.3.2.3 but with more care where the metal is exposed.

8.3.2.5 Removal of Very Old Paint. When multiple coats of paint have built up on exterior surfaces, especially wood, they may present an unsightly appearance due to the presence of numerous cracks, peeling or uneven areas where loose paint has often been removed and repainted. The cracks may also allow moisture to enter and cause deterioration beneath the paint, especially on steel, and subsequent flaking down to the substrate. It is best to remove such paint completely, if at all possible. It can be removed from steel, concrete, and masonry by blast cleaning. Removal of paint from wood or sheet metal requires the use of some method of heating the coating to relatively high temperatures, as by use of a blow torch or infrared heat gun. This is effective if used carefully, but can be dangerous if misused; therefore, blow torches are generally not recommended for use on valuable wood structures. As a precautionary measure when using a blow torch or infrared gun, one man should always be assigned to watch one or two blow torch or infrared gun handlers and to stand by with a fire extinguisher during the operation. When using blow torches, use the largest possible blue flame and hold the torch far enough from the wall so that the edge of the flame just touches the surface. Keep the torch moving slowly, allowing it to remain in any area just long enough to cause the paint to blister, but not fume. Follow up with the scraper immediately while the paint is still warm. If done correctly, the paint will come off down to the substrate. Allow the surface to cool and then treat it mechanically to remove any traces of paint or carbon and to smooth the surface.

8.3.2.6 Surface Preparation. The methods used for the preparation of exterior surfaces are covered in the paragraphs in Chapter 4, section 4 referred to below.

a. Mechanical Cleaning: Use either hand tools, such as scrapers, fiber brushes, and wire brushes, or power tools, such as chipping hammers, rotary scalers, needle scalers, grinders, sanders, and wire brushes. The latter are preferred because of their much higher area coverage per hour. The best and fastest method is blast cleaning using abrasive grit. It is more expensive then other methods, especially when a thorough job is desired, e.g., cleaning to white metal. It should be used, when possible, particularly for cleaning steel, concrete, and masonry. Do not blast-clean wood or sheet metal or in areas where abrasive grit and dust cannot be tolerated (see 4.4.2).

b. Solvent Cleaning: Use stiff fiber brushes and rags to clean with solvents. (See 4.4.3.1).

c. Chemical Treatments: Apply dilute alkaline cleaners, such as TSP, or dilute acids, such as phosphoric, using a stiff fiber brush. Scrub the surface thoroughly to remove contaminants. Pickling acids, such as sulfuric, hydrochloric, and nitric acid, and hot phosphate treatments should be applied in the paint shop using dip tanks. Cold phosphate treatments are applied with a brush (see 4.4.3.2, 4.4.3.4, 4.4.4.1, and 4.4.4.2).

d. Steam Cleaning: A rapid method of cleaning surfaces is the use of pressurized steam or hot water, to which a detergent has been added. Portable steam cleaners are available for this purpose (see 4.4.3.3).

e. Paint Removers: Use same methods as in 7.3.2.5. Use removers only on small areas since they may dry too rapidly outdoors to be effective.

f. Wash Primers: Use same methods as in 7.3.2.6e.

g. Masonry Conditioners: Apply liberally by brush or spray. Wipe off any excess (see 4.4.5.1).

h. Knot Sealers: Use same method as in 7.3.2.6f.

i. Masonry Fillers: Apply with a fiber paint brush, broad knife or trowel. Smooth the surface carefully, wetting the tool with water, if necessary (see 4.4.5.3b).

8.3.2.7 Surface Repair. The methods used for the repair of exterior surfaces are covered in the paragraphs in Chapter 4, section 5 referred to below.

a. Caulking Compounds and Sealants: Remove bulk material from the container and mix thoroughly before use. Mix two component products very thoroughly to be sure that they are completely mixed and uniform throughout. Apply gun grade products with a caulking gun and knife grade products with a putty or broad knife. Preformed products can be placed directly into the joint or crevice and pressed into place. For details see 4.5.5.

b. Putty and Glazing Compounds: Apply with a putty knife (see 4.5.5).

c. Portland Cement Grout: Apply the grout with a trowel or broad knife. Add hydrated lime if necessary to increase working time (see 4.5.6.6).

Section 4. SELECTION, PREPARATION AND APPLICATION OF COATING SYSTEMS

8.4.1 SELECTION OF COATINGS. The choice of the coating system to be used depends on the following factors:

1. The substrate, e.g., wood, concrete, steel

2. Its condition, e.g., rough, smooth, painted

3. Limits in surface preparation, if any, e.g., class 1, class 2 (see 4.4.2.7)

4. Finish desired, e.g., high gloss, flat

5. Color desired

6. Environmental conditions.

(a) During painting operations, e.g., low surface and ambient temperatures

(b) During service, e.g., rural, marine Review Chapter 6, paragraph 8.2.2, and Chapter 8, Table 8-1 for the comparative properties of the types of

exterior coatings available before selection of a coating system. *Coating systems recommended for exterior painting are listed in Appendix D-4 as follows:

Table 13 Recommended Coating Systems for Exterior Wood

Table 14 Recommended Coating Systems for Exterior Concrete and Masonry

Table 15 Recommended Coating Systems for Exterior Iron and Steel

Table 16 Recommended Coating Systems for Exterior Metal (Nonferrous and Miscellaneous)

8.4.1.1 Wood. Paints for wood must be quite flexible to withstand the natural tendency of wood to expand and contract as changes occur in temperature. (See 5.2.2.1 for potential problems with wood and Appendix D-4, Table 13 for recommended paint systems.)

8.4.1.2 Treated Wood. Wood in contact with the ground or exposed in humid tropical climates should be treated with preservatives to prevent decay. Improperly selected preservatives are harmful to subsequently applied paints, either in inhibiting dry, adversely affecting adhesion due to incompatibility, or bleeding through the paint. Wood that is to be painted should be treated with water repellent preservative conforming to TT-W-572. Wood treated with water-thinned preservatives, if thoroughly dry, may be painted. Lumber treated before purchase should be ready to paint when installed; lumber treated at the site with water-thinned preservatives should dry at least a week (see 7.3.2.1). Do not paint wood treated with creosote or preservatives in a nonvolatile solvent, e.g., fuel oil (see 5.2.4.1). If bleeding is a problem, apply 1 or 2 coats of exterior aluminum paint.

8.4.1.3 Concrete and Masonry. Construction materials made with or held together with cement, e.g., poured concrete, concrete blocks, stucco, brick, stone, and cement-asbestos surfaces tend to be alkaline, especially

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*Note.-A numerical listing of the coatings and accessory products, described in this manual, is given in Appendix D-3. Appendix D-4 is designed for the selection of coatings for new work. On previously painted surfaces, it is necessary only to prime areas where the substrate has become exposed as a result of removal of old paint and cleaning. Then apply the intermediate or body coat plus one coat of topcoat. If the hiding and protection are sufficient, apply the body coat over the primed area only and then one full topcoat. When old paint has completely deteriorated, it must be entirely removed, and the substrate treated as for new work. The selection of coatings for all surfaces is based on the degree of surface preparation attainable, the conditions of exposure and degree of service required. Appearance is of secondary importance. It is not necessary to use extremely durable coatings in rural environments, whereas they are required in severe or corrosive environments.

when new, and also tend to be porous. Coatings used on these surfaces should be alkali-resistant and self-priming. They should also be low in water sensitivity since porous concrete and masonry may also be damp. (See 5.2.2.3 for potential problems and Appendix D-4, Table 14 for recommended paint systems.)

8.4.1.4 Moisture Permeable Materials. (See 5.2.7.2) If blistering and peeling cannot be eliminated from porous materials including wood and masonry by ordinary means, seal the inside surface of exterior walls with one coat of aluminum primer and two coats of high gloss or semigloss enamel. Paint the outside surface with breathing type paints, such as latex or cement paints. All coats of the exterior paint system must be of the same porous type down to the substrate.

8.4.1.5 Iron and Steel. Iron and steel, especially the latter, are major construction materials. They are unique, as compared with wood and concrete and masonry, since they will corrode rapidly if left unpainted, especially in corrosive environments. Consequently, they require special primers (see 5.2.2.2 and 8.2.4). The recommended primer and top coats are listed in Appendix D-4, Table 15. There is a minimum effective coating system thickness for the economical protection of iron and steel. The minimum effective thickness is not a constant, but is related to the durability and permeability of paints, the degree of surface preparation as well as the environment. (In the past this figure was often given as 5 mils.) Table 15a in Appendix D-4 was prepared as a supplement to Table 15, and it shows the total estimated dry film thickness of each recommended coating system.

8.4.1.6 Nonferrous and Miscellaneous Metals. This group includes galvanized steel, aluminum, brass and copper. Although they will corrode, this problem is much less severe than with iron and steel except in corrosive environments. On the other hand, adhesion can be a problem with these metals, when new, especially with galvanized steel. Pretreatments and primers are chosen with this in mind. The primers and top coats recommended are listed in Appendix D-4, Table 16.

8.4.2 PREPARATION OF COATINGS FOR USE. The preparation of exterior paints prior to use is identical to that for interior paints (see 4.3.2). Some primers have a tendency to settle more than other paints because of the type of anticorrosive pigments used, e.g., red lead. Be especially careful to mix contents thoroughly so that no sediment remains at the bottom of the container. Also keep material well mixed during use.

8.4.3 APPLICATION OF COATINGS. The application of exterior coatings is generally similar to that of interior paints. Environmental conditions during painting cannot be controlled and must be taken into consideration when painting, e.g., low or excessive temperatures, high humidity, rainfall, etc. Also, overspray onto adjacent buildings, parked cars, etc., must be controlled very carefully when applying by spray.

8.4.3.1 Vinyl Finishes. Pure vinyl solution coatings are best applied by spray. Brushing is not recommended because of their rapid dry. (See 4.6.5 for proper spray application.) Adhesion of these finishes is critical. Be sure to use a metal pretreatment first when specified by the supplier of the vinyl coating, (MIL-P-15328) (see 4.4.4.3).

8.4.3.2 Vinyl--Alkyd Finishes. Coatings based on vinyl alkyd combinations can be brushed or sprayed. They are handled in the same manner as rubber base paints because of the strong solvent used. Be especially careful of lifting when recoating with these finishes (see 5.2.4.2).

8.4.3.3 Silicone Water Repellents. A water repellent treatment can only be effective in minimizing water penetration through the normal pores and capillaries of masonry surfaces. Remove dirt and loose particles from surface. Make certain that the surface is dry. For best results, application should not be attempted if it has rained in the past 3 or 4 days or if rain is anticipated within 2 hours of application. Apply by brush, roller, or spray. Spray guns using low pressures give excellent results. Flood the surface with the solution to create a rundown of 6 to 12 inches. One coat is effective, but if two coats are desired for very porous surfaces, allow at least 2 hours for airdrying between applications. With some silicone treatments, a second coat cannot be applied successfully after the first coat is fully water repellent. One gallon of dilute solution will cover 75 to 100 square feet of surface, depending on the coarseness of the surface. Silicone-treated masonry surfaces should not be painted since the silicone can adversely affect adhesion. Check the surface by wetting it with water. If the water is absorbed, the surface can be painted. If it is not, let the surface weather until the water is absorbed which shows that the silicone treatment has worn off.

8.4.3.4 Zinc Rich Paint. If the zinc powder is packaged separately, mix with the vehicle must before use. Furthermore, all types should be well mixed during use to prevent settling of the zinc pigment. The surface must first be blast cleaned to white metal (see 4.4.2.4). Apply by brush, roller, or spray.