

# FINISHING

## General

Finishes described in this Section are intended for interior applications only. Finishes protect wood from moisture, handling, and harsh chemicals. The sooner moisture is restricted from entering or leaving, the longer wood lasts and the finer it looks. It should be noted, however, that finishing only retards moisture penetration, it will not prevent it. .

Transparent finishes allow the substrate to remain visible. Transparent finishes provide the architect or designer an opportunity to create a striking visual effect by modifying the color, look, and sheen of the door. Opaque finishes protect the wood and provide a solid color painted appearance.

A finish shall be applied to flush wood doors in the controlled environment of the door manufacturer's plant, or it shall be applied in the field by a painting contractor.

The majority of architectural wood doors are now finished at the factory as opposed to the jobsite. It is highly recommended that specifications require factory finishing to achieve the best overall door appearance and durability.

## F-1: Factory Finishing

Factory finishing is generally specified when a project requires high quality performance and superior appearance. Factory finishing offers many benefits.

- Factory finishing utilizes state-of-the-art equipment in a dust-free environment provides uniform color, texture, and sheen - conditions normally unavailable in the field.
- Often in field finishing, numerous limitations prevent proper sanding. If improperly sanded, a door lacks the clarity of finish and uniformity of color that is achieved by factory finishing.
- Factory finishing provides adequate drying time in a dust free environment.
- Door manufacturing facilities are subject to strict State and Federal environmental standards which result in the proper handling, application, and disposal of finishing materials. Specifying factory finish improves environmental compliance.
- Factory finishing ensures that wood is protected from unfavorable moisture conditions at the earliest possible time.
- In most cases, the cost of factory finishing is lower than the cost of using a separate finishing contractor.
- Factory finished doors can immediately be installed after delivery, which means faster project completion.

## F-2: Finish Selection

Normally, door manufacturers will only supply their standard finishing system. The factory finishing information provided by the specified door manufacturer should be consulted before specifying the type and extent of finishing desired.

Section P1 of this standard identifies varying minimum finish systems for doors based on their performance duty level. However, many door manufacturers supply a TR-6/OP-6 or TR-8/OP-8 finish system as their standard finish regardless of duty level. These systems provide the highest levels of wear and chemical resistance at an economical cost. Other systems are available, based on individual door manufacturer's processes and policies.

Non-standard stain colors to match architect's selection are available from most manufacturers. Some manufacturers may offer more than one finish system or grain textures (i.e., open grain or filled grain). Specifying non-standard finishes may increase the cost over standard finishes. Should special door finishes be desired, they must be fully described in the specifications.

Since appearance and other finish characteristics are somewhat subjective, just the selection of a finishing system does not ensure that the final finish will be acceptable. Selection of a finish should be based on physical samples provided by the door manufacturer.

## F-3: Finish System Descriptions

A variety of wood finishes are available, from single stains to multi-step processes. When selecting a finish, consider the desired appearance, exposure, and maintenance it will require.

By identifying a particular finish system, an expectation of performance characteristics for the factory finish is established. There are eight finishing systems that are commonly referenced for architectural wood flush doors. These are:

TR-2 & OP-2 (Catalyzed Lacquer)

TR-4 & OP-4 (Conversion Varnish)

TR-6 & OP-6 (Catalyzed Polyurethanes)

.....TR-8 & OP-8 (UV Cured Acrylated Polyester/Urethanes)

The performance levels established by specifying one of these systems are found in the table located in Section F-7. Finish performance levels can also be specified by referencing the duty level identified in this same table. Unless otherwise specified, manufacturers will furnish their standard finish system.

This standard is not an attempt to identify all available finish systems, or to limit the types of finishes which may be offered by door manufacturers. Other formulations may exhibit similar performance characteristics as the systems described in this Section, but must meet or exceed the performance levels for the system specified to be considered as equal. Also, the listing of a finish system in this standard does not imply compliance with the requirement of Local and/or Federal Environmental Protection Agencies.

Finishes are available in different bases and curing methods. The basic types are solvent, water reducible or ultra violet cure. Solvent bases cure by the evaporation of volatile organic compounds (VOC's) into the atmosphere and their use is regulated by environmental agencies. Water base systems evaporate water for curing. Ultra violet (UV) finishes are cured using light to create a chemical reaction within the finishing material. UV finishes are typically the most environmentally friendly of the systems used for architectural door production finishing.

Common finishing systems used by many door manufacturers are described below. "TR" indicates a transparent finish, while "OP" indicates an opaque finish.

### TR-2 & OP-2 Catalyzed Lacquer

Catalyzed lacquer systems contain an ingredient for faster drying and harder film. They have the strength and higher solids of conversion coatings. Vinyl lacquer systems are catalyzed lacquers that have a vinyl resin rather than a nitrocellulose base.

### TR-4 & OP-4 Conversion Varnish

Conversion varnish is a high solids catalyzed alkyd based coating, offering high resistance to chemicals, moisture, and scratches. Similar in composition to catalyzed lacquer, except for nitrocellulose, the solids in this finish make it economical; one coat of conversion varnish can equal two coats of lacquer. Conversion varnishes are also available in waterborne formulations.

### TR-6 & OP-6 Catalyzed Polyurethane

Catalyzed polyurethanes have higher solids content than lacquers and provide high build and excellent hardness, providing one of the highest chemical wear and impact resistance ratings of all available finishes. These finishes are very durable and offer excellent chemical, mar, and impact resistance. Many door manufacturers provide a catalyzed polyurethane system that is cured using ultraviolet (UV) technology.

### TR-8 & OP-8 UV Cured Acrylated Polyester/Urethane

Since polyesters have strong filling, build, leveling, and hardness traits, they can be combined with polyurethanes to achieve high gloss and endurance. This finish system excels in appearance, burnish, texture, and overall durability and is the highest rated performance of all the standard door finishes

## F-4: Sample Submission

Door manufacturers shall provide standard colors for selection.

To specify non-standard colors and sheens, the architect is to provide two or more samples at least 8 inches x 8 inches (200 x 200 mm) showing the desired effect on the wood species and cut of veneer to be used.

Samples are to bear identification of the project and door supplier. The door manufacturer shall be permitted to submit samples in sets of two or more, illustrating the possible range of variations. Exposure to sunlight and ultraviolet light will cause changes in wood by accelerating bleaching and oxidation. Approved finish samples must be covered and protected from effects of light during the period between approval and delivery of the finished doors.

Variations in color and appearance can be expected due to the nature of wood. Barber pole effect in book matched veneers is not a defect, but is a result of tight and loose sides of veneer created during the slicing process. This can affect color from veneer leaf to veneer leaf within a door face because of light reflection and stain absorption.

Color variation from door to door due to veneers from different logs, color variation within veneers from the same log, and variations from heartwood and sapwood, can also cause differences in appearance from door to door and are acceptable in standard door grades. Specification of uniform color and grain or flitch selection can narrow color variation.

Some veneers are susceptible to grain variations (typically end grain) which can cause a blotchy or uneven color appearance. The darker the stain, the more prevalent the variation can be. Veneers that are more likely to exhibit this effect are Birch and Maple, although it can present itself in any species. Proper sanding can reduce, but not entirely eliminate, the contrast in color.

## F-5: Job Site Finishing

Because of the many uncontrollable variables that exist at a job site, such as temperature, dust and other factors, door manufacturers' warranties do not cover the appearance of finishes applied in the field. See Section J1 for information on field finishing.

## F-6: Visual Inspection Standards

Architectural flush door faces sometimes require touch up due to natural, manufacturing or installation marks. The chart below outlines the allowable defects based on visual inspection from a described distance.

Factory finished doors must be final inspected in the vertical position, at the opening, viewed under lighting identical to final job site conditions, prior to installation.		
Defect Type	Premium Grade	Custom Grade
Glue Spots	Not permitted	Not permitted
Fine Sanding Scratches	Not permitted	Not noticeable at 3 feet (0.9 m)
Finish runs, orange peel, blisters, blushing, cracking, sags or checking	Not permitted	Not permitted
Filled holes or splits	Not noticeable at 3 feet (0.9 m)	Not noticeable at 6 feet (1.8 m)
Repair or touch-up	Not noticeable at 3 feet (0.9 m)	Not noticeable at 6 feet (1.8 m)

## F-7: Standard Wood Door Finishing System Ratings

The ratings described in the following chart indicate overall performance scores to provide the specifier with a guide to select the system that meets the resistance needs of the project. These systems are those typically available from architectural door manufacturers. Other systems may be available upon request, subject to individual manufacturer's capabilities. Specify system number and chemical description for clarity, i.e., TR-6 Catalyzed Polyurethane.

CHEMICAL / WEAR	SYSTEM NAME / NUMBER							
	Catalyzed Lacquer		Conversion Varnish		Catalyzed Polyurethane		UV Cured Acrylated Polyester/Urethane	
	Transparent	Opaque	Transparent	Opaque	Transparent	Opaque	Transparent	Opaque
	TR-2	OP-2	TR-4	OP-4	TR-6	OP-6	TR-8	OP-8
Vinegar	5	5	5	5	5	5	5	5
Lemon Juice	5	5	5	5	5	5	5	5
Orange Juice	5	5	5	5	5	5	5	5
Catsup	5	5	5	5	5	5	5	5
Coffee	5	5	5	5	5	5	5	5
Olive Oil	5	5	5	5	5	5	5	5
Boiling Water	5	5	5	5	5	5	5	5
Cold Water	5	5	5	5	5	5	5	5
Nail Polish Remover	3	3	4	4	4	4	5	5
Household Ammonia	5	5	5	5	5	5	5	5
VM&P Naphtha	5	5	5	5	5	5	5	5
Isopropyl Alcohol	3	3	5	5	5	5	5	5
Wine	5	5	5	5	5	5	5	5
Windex™	4	4	5	5	5	5	5	5
409 Cleaner™	4	4	5	5	5	5	5	5
Lysol™	5	5	5	5	5	5	5	5
33% Sulfuric Acid	5	5	5	5	5	5	5	5
77% Sulfuric Acid	3	3	1	1	4	4	4	4
28% Ammonium Hydroxide	3	3	5	5	5	5	5	5
Gasoline	5	5	5	5	5	5	5	5
Murphy's Oil Soap™	5	5	5	5	5	5	5	5
Vodka 100 Proof	5	5	5	5	5	5	5	5
1% Detergent	5	5	5	5	5	5	5	5
10% TSP	5	5	4	4	5	5	5	5
<b>TOTAL</b>	<b>110</b>	<b>110</b>	<b>114</b>	<b>114</b>	<b>118</b>	<b>118</b>	<b>119</b>	<b>119</b>
Wear Index	4	3	5	5	5	4	5	4
Cold Check	5	5	5	5	5	5	5	5
Adhesion	5	5	5	5	5	5	5	5
<b>SCORE</b>	<b>124</b>	<b>123</b>	<b>129</b>	<b>129</b>	<b>133</b>	<b>132</b>	<b>134</b>	<b>133</b>

The chemical and wear resistance characteristics of these eight standard door finishing systems were evaluated in an ISO 9000 certified laboratory using the following ASTM test criteria: Chemical Resistance Testing - ASTM D1308; Wear Index - Abrasion Resistance Testing - ASTM D4060; Cold Check Resistance - ASTM D1211; Cross Hatch Adhesion - ASTM D3359. Base line data for application prior to testing: A - 45 - 55% humidity at 70 - 80 degrees Fahrenheit (21 - 26 degrees Celsius); B - Water borne coatings must be cured in a dehumidified atmosphere and can be assisted with Infrared light and good air movement.

Performance indicator numbers on the Standard Wood Door Finishing Systems chart are used, with the following definitions:

### For Chemical Resistance and Wear Index - Abrasion Resistance:

- 5 - No effect from the test
- 4 - Minimal effect or slight change and little repair required
- 3 - Some effect, noticeable change and the coating will recover with minimal repairs
- 2 - Moderate effect, performance adversely affected and repairs required
- 1 - Poor performance and film failure is imminent and repairs difficult

### For Cross Hatch Adhesion

- 5 - Edges of the cuts are completely smooth; none of the squares of the lattice is detached
- 4 - Small flakes of the coating are detached at intersections; less than 5% of the area is affected
- 3 - Small flakes of the coating are detached along edges and at intersections of cuts; 5 to 15% of the area is affected
- 2 - Coating has flaked along the edges and on parts of the squares; 15 to 35% of the area is affected
- 1 - Coating has flaked along the edges of the cuts in large ribbons and whole squares have detached; 35 to 65% of the area is affected.