Appendix-A Plating/Baking/Passivating

Finish	Description
Electro-Zinc & Clear	Zinc is the most popular of all commercial platings because it is relatively economical and offers good corrosion resistance in environments not subject to excessive moisture. Our commercial-grade parts receive what is referred to as a "flash" plating that is not measured for thickness. A clear or blueish chromate finish is applied on top of the zinc to provide additional protection against white oxidation spots which can form due to moisture. Electroplating is the most common way of applying zinc coatings to fasteners. It is recommended by certain industry experts that case-hardened parts which are electro-plated should be baked after plating to minimize the risk of hydrogen embrittlement (see below).
Electro-Zinc & Yellow	Our commercial-grade zinc-yellow parts receive what is referred to as a "flash" plating that is not measured for thickness. A yellow chromated finish offers a greater degree of protection from white corrosion than does clear chromate. Electroplating is the most common way of applying zinc coatings to fasteners.
Electro-Zinc & Black	Commercial zinc-black plating offers comparable to slightly better corrosion resistance compared to zinc-clear. It offers significantly better corrosion-resistance compared to black oxide. It is also a smoother and more scratch-resistant finish than black oxide.
Electro-Zinc & Wax	A wax lubricant is added to the zinc coatings of certain fasteners to improve the ease of assembly. This is the standard plating for thread rolling screws and two-way reversible center-lock nuts. Case-hardened parts are still recommended to be baked after plating (see below).
Mechanical Zinc & Clear	Mechanically applying zinc to fasteners reduces the risk of hydrogen embrittlement forming within the parts. This minimizes the need for the precautionary practice of baking the parts soon after plating. A clear or bluish chromate finish is applied on top of the zinc to provide additional protection against white oxidation spots, which can form due to moisture. It is common for lock washers made from spring steel to be plated this way to avoid brittleness after baking.
Mechanical Zinc & Yellow	This finish is identical to mechanical zinc but with a yellow chromate finish. This is the standard plating for high-alloy split lock washers and for tooth lock washers used with zinc yellow machine screws.
Electro-Zinc & Clear for Sockets	Socket cap screws can receive a zinc plating of 0.0002 inches thickness. A clear chromate finish is applied on top of the zinc to provide additional protection against white corrosion. The manufacturer must be told prior to the thread rolling process that the parts are to be plated. The plated parts are then baked at 375ºF for 24 hours within one hour of plating then subjected to a 72-hour stress test.
Electro-Zinc & Green	Commercial zinc green is the finish applied to machine screws and thread-cutting screws that will be used a "grounding screws" in electrical applications.
Nickel	Nickel has more of a silver color to it than zinc and has similar corrosion resistant characteristics. It is the standard finish of cap nuts and countersunk finishing washers.
Tin	Tin plating is sometimes used on parts in the food handling industry because it resists organic acid. It improves the lubricity of steel and offers a high degree of corrosion resistance.
Silver	Silver is an excellent conductor of electricity. Its benefits are both decorative and protective as it resists thread galling when mated parts are under extreme pressure or exposed to extreme heat.
Hot-Dip Galvanized	Hot dip galvanizing is generally the most effective way to apply a sufficient thickness of zinc to threaded fasteners for the zinc to serve as a corrosion protectant is harsh environments. During the galvanizing process, steel reacts with molten zinc, forming layers of zinc-iron alloy layers, which are metallurgical bonded to the steel surface. This hard barrier has a low corrosion rate and resists mechanical damage. Bolts and nuts 3/8 inch diameter and smaller shall have a zinc coating with an average thickness of 0.0017 inches with no individual both having a coating of less than 0.0014 inches. Bolts and nuts over 3/8 inches diameter and all sizes if washers shall have a zinc coating with an average thickness of 0.0021 inches with no individual both having a coating of less than 0.0017 inches.
Baking of case Hardened Parts	Electroplated screws, which are case hardened, should be baked for a minimum of 4 hours within the temperature range of 375-450ºF no later than 4 hours after the plating operations. However, this process does not guarantee that hydrogen embrittlement will not still be present after baking or that it will not occur at a later date while in service. Specialized testing or a substitute part may be required, depending on the application. This heat treatment practice is recommended for tapping screws, drywall screws, SEMS screws, clinch nuts and clinch studs.
Passivation of Stainless Fasteners	This process enhances stainless steel's corrosion resistance. The fasteners are dipped in a solution, which removes surface imperfections and produces a slight film on the surface of the parts.

Plating/Black Oxide Finish

Finish	Description
Cadmium & Wax	Cadium plating results in a smoother surface and greater resistance to white oxidation spots than zinc plating. However, cadmium is a much more toxic metal than zinc, which makes the plating process more difficult and costly. The standard most commercial platers use when applying cadmium is a minimum thickness of .0002 inches. A supplemental wax coating is often added as a lubricant when cadmium is used on prevailing torque lock nuts.
Black Phosphate	This is the standard finish for most drywall screws, particle board screws and retaining rings. It can have either a dull or bright appearance. No additional oil treatment is required.
Black Phosphate & Oil	The most common standard coating of black phosphate and oil is 1100mg per sq./ft., minimum. The oil serves as a rust inhibitor and a lubricant. Some fasteners with this plating are required to pass a salt-spray test, the duration and cost of which must be agreed upon between buyer and seller prior to the sale. Floorboard screws, frame bolts, Grade-GT locknuts and spring nuts are usually supplied with a black phosphate and oil finish.
Black Oxide	This is a "conversion coating" which means it is formed by a chemical reaction with the metal to form an integral surface, as opposed to an "applied coating" like zinc which bonds to the metal. An oil finish is applied as a rust inhibitor. For more information about black oxide, see below.
Chrome	Chrome plating can be done in two ways: 1) A "hard chrome" finish deposits a thick layer of chrome on the part. This gives the fastener a very hard finish and superior wear resistance but does not offer much protection to corrosion; 2) A "nickel-chrome" finish is achieved by applying a flash of chrome on top of the nickel plating. This offers resistance to tarnishing and corrosion.
Dacro	Dacro is a pollution-free ceramic coating for fasteners used with treated lumber. The coating offers corrosion protection comparable to hot-dip galvanizing without discoloring the wood. Screws with a proper dacro coating can typically withstand a 500-hour salt-spray test. A dacro finish minimizes greatly the risk of hydrogen embrittlement so baking the part is not required after the finish is applied.
Blue Ruspert	Ruspert metal finish is a high-quality corrosion-resistant coating that is comprised by three layers: (1) metallic zinc; (2) a chemical conversion film (to resist corrosion); and (3) a ceramic surface coating that is baked.
Green Ceramic	Ceramic finish is also a barrier coating used to offer corrosion resistance. It is used, through not exclusively, on certain types of construction fasteners and typically provides over 500 salt spray hours of protection.

Black Oxide Finish

Black oxide is a conversion coating (as opposed to an applied coating) because it results from a chemical reaction with the iron present in the metal fastener and forms and integral protective surface. It is a color of the base metal, which neither removes nor deposits metal; therefore it adds, at the most, 5 to 10 millionths of an inch to the fastener's dimensions. Likewise, it cannot chip, peel or rub off. Also, the item maintains 99% of its conductivity making black oxide a popular finish for electrical parts.

When a black oxide finish is specified, it is interpreted as "Black Oxide and Oil". Other supplementary coatings such as wax or lacquer may be ordered, but fasteners with those finished are usually not available from a distributor's stock.

Typically, the oil after-finish is dry to the touch, which gives the part a lustrous appearance and improved lubricity without excessive residue. The color is a deep black rather than the grayish-black appearance of a black phosphate, and remains consistent at temperatures as high as 900ºF. Black oxide also resists abrasions better than phosphate.

One of the most important advantages of black oxide is that there is almost no risk of hydrogen embrittlement because the process does not involve electro-plating nor does it require an acid-activation. Case hardened parts need not be baked after receiving a black oxide finish.

Black oxide neither enhances nor detracts from a fastener's resistance to corrosion. The post-treatment oil application offers good indoor corrosion protection, but a zinc-plated part is more resistant to rust. However, parts with a black oxide finish will not suffer from white corrosion, which can occur over time with electro-plated parts. To avoid the risk of white corrosive particles (which can cause electrical shorts) many in the electronics industry opt for black oxide instead of zinc-plated fasteners.

The popularity of black oxide stainless fasteners is also growing. In addition to being used for decorative purposes, the finish reduces light glare and reflection, and makes the surface of the fastener smoother. The automotive aftermarket utilizes them in tail-light assemblies, luggage racks, grills and windshield wiper assemblies, to name a few.