Finishers' Think Tank

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Bridging the Gap

There are many ways to bridge a gap, because there are many reasons to do so. Brooklyn and Manhattan did so more than 100 years ago, providing us with a world-famous bridge over the East River. The same one that flim-flam artists are always offering for sale. Hippies of the 1960s tried "flower power" and rock music to bridge a generation gap. Searching the ocean depths consistently uncovers new secrets of nature, thus narrowing the gap of truly unexplored Earth. Military history is full of examples describing competing admirals and generals, employing strategic moves to bridge or close gaps in their adversaries' lines. Vacations are a popular way to bridge the gap of exhaustion. Medical research and clinical trials focus on narrowing the gap in overcoming disease and injury.

In metal finishing, our daily goal is to bridge the gap—whatever barrier it may be—to provide surface treatments and coatings that meet or exceed given specifications. There are many gaps to bridge—narrow, by-pass, or close. These can be related to chemistry, operating parameters, contaminants, metals & alloys, conditioning methods, equipment (selection, application, calibration), and other contributing factors. Let's review some of these gaps and some different ways to bridge them.

Objective

In a clear sense, we should focus on the true or correct objective. Any given finishing process provides specific treatments and its own unique cycle requirements to satisfy the understood goal. There are many ways to achieve this, but knowing what to do to meet the need, readily narrows the gap. The following table may serve as a handy method for understanding and clarifying the objective, so that even Bugs Bunny will get it right.

What's Up Doc?
Base Metal
Finishing Requirements
Finishing Limitations
ASTM / MIL Spec
Unique Specification
Quality Control
Post Finishing Test

Defining the objective confirms what needs to be done. Every step in planning should include the following rally cry: "Communicate, over-communicate!" Don't take any part of the objective for granted. Rejects cost money, reducing profit and endangering a sensitive species: the customer. Consider the following examples to fill out *What's Up Doc?*:

- Base Metal—Steel (cold- or hot-rolled, low or high carbon, etc...). Brass, copper alloy, aluminum or zinc (alloy or casting designation), magnesium or other metal or alloy.
- Finishing Requirements—Just a simple, shiny part with coverage, or with specific requirements. Type of deposit(s), top coats (lacquer, chromate, phosphate, paint or powder coat).
- Cycle Limitations—These could be cost-related to economics, to finishing parts, or inherent in the type of process. Environmental concerns related to chemical constituents are a concern.
- Finishing Limitations—Deposit thicknesses, turnover rate, production throughput may apply.
- Specifications—Many finishing cycles must adhere to written ASTM, MIL or other specifications.
- Quality Control—Either by a specification or on agreement between the finisher and customer. Corrosion, abrasion resistance, adhesion, thickness measurement are some criteria.
- Post Finishing Test—Assembly of parts and field application may be required.

Requirements

Confirming the finishing application leads us to the cycle requirements, a continual operation to bridge the gap. Maybe Elmer Fudd can't trap that

"kwazy wabbit," but give him a plan, and you can be sure he'll follow it. Seriously, we know this concept works and keeps our objective on track. Answering the questions: how much, how long, and what else, simplifies requirements and clarifies what is needed. Let's review a typical *Fudd's Facts* list.

Fudd's Facts
Equipment
Surface Preparation
Plating
Chromate
Lacquer
Phosphate
Paint or Powder Coat
Other Finish
Post Treatment
Post Handling

Knowing the requirements will enable the finisher to prepare the appropriate process cycle. Many specification finishes provide optional steps to meet the objective. Some customers have already approved cycles to meet their requirements. There are many "coverage and shiny" finishes that are loosely defined. Three factors usually affect individual process baths: time, temperature, and concentration. Confirming and standardizing these three control items to the given objective contributes strongly to obtaining targeted finishes. Whatever the situation, organizing the cycle requirements not only simplifies the finishing cycle, but also lays the foundation for an A-1 job. Let's consider how *Fudd's Facts* helps to bridge the finishing gap.

- Equipment—Tanks, racks, barrels, baskets, rectifiers. Pre-finishing needs might require: buffing, polishing, mass finishing, or stripping. Any of these operations may be part of the cycle, or they may be needed to correct substrate defects or precondition parts before entry into the actual finishing cycle.
- Plating—Bath types and chemical compositions should be confirmed. Analyze chemistry with appropriate adjustments.
- Chromate—Clear, blue, yellow, bronze, black, or green. Leach back is an option. Trivalent blue chromate may be specified. Perhaps an electrolytic chromate or a post-dip silicate is required.
- Lacquer—Water-based or solvent types are available. Dip or spray applications may be acceptable. Electrolytic lacquers are newer additions to this finish.
- Phosphate—Iron, manganese, and zinc phosphates are options. Types usually adhere to specifications by industry groups, such as: automotive, appliance, and consumer goods
- Paint or Powder Coat—These may be applied directly to metal substrates after phosphating, or after plating and chromating.
- There are other finishes such as black oxide, fusion coatings, and vapor deposition.
- Post Treatment—There are different types that collectively are applied as immersion treatments. These include: oils, rust inhibitors, antioxidant films, and improved lubricity.
- Post-handling—This can be a complex situation. Removing finished parts from the line may require the use of special gloves to prevent smudging or finger type grease etch. Another focus of post handling involves the packaging and shipping of finished parts. Sulfur-free wrapping papers and desiccants may be required. Many processed parts, especially those meeting given ASTM or MIL specs, may be shipped thousands of miles across oceans, expected to not corrode or fail the finish requirement. Another consideration is packaging to prevent abrasion during overland shipment.

Once the cycle has been set up and process baths analyzed, test parts can be run through. Appropriate finishing evaluations and testing will confirm that whatever the cycle, simple or complex, it meets the stated requirements. Knowing the objectives and requirements will clarify what the cycle should be and how it should be executed. Our industry is fueled by on-time delivery, minimal inventory stocks, adherence to finishing specifications, and a dose of healthy competition. Parts aren't just received and processed through the line. Instead, the finisher and customer review the objectives and requirements, confirming the requirements of finished parts beforehand. In fact, ISO formatting has become an integral part of many finishing jobs. Our focus should always begin with the stepping stones of *objective* and *requirement*, to effectively bridge the gap. Narrowing the gap of confusion, misunderstanding, and misinterpretation serves to increase productive, quality throughput and finishing. Take heart— that famous bridge in Brooklyn is not for sale. P&SF

Think Tank Trivia

- Powdery chromates over aluminum may be caused by any of the following conditions: drag in of sulfates and nitrates from desmutter, drying the chromate film in excess of 150 °F, and over-concentration of the chromating solution concentration.
- Process benefits of acid copper include: excellent deposition efficiency, promotes superior leveling characteristics, soft yet buffable, and preferred as an undercoat for exterior auto trim and aluminum wheels.
- A "no-dump bath" to strip copper and nickel plating deposits does exist. It's typically a near neutral pH bath, using anodic current as the primary oxidation source for stripping, with secondary oxidizing salts, in a buffered solution. Precipitated metal hydroxides are removed by filtration. P&SF