THE CONSTRUCTION

# SPECIFIER

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## Restoring the Royal York Hotel

**Steel Doors**

**Tough Ceilings**

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# STAINLESS STEEL DOORS

Specifying stainless steel doors for the best performance possible.

**by John Schechter**

Whenever I fly over New York City, I take inspiration from the Chrysler Building, whose trademark dome and gargoyles still shine in the sun. The building, which has needed cleaning only twice in nearly 70 years, is a great example of what stainless steel can do when it's specified, manufactured, and installed with thought and care.



Photos and figure courtesy Next Door Company

*The Type 304, #4 finish on these stainless steel doors in South Florida offers protection from the elements.*

My brother and I operate a company devoted exclusively to manufacturing stainless steel doors. Every day, we review specifications, many of which are well done. Some are innovative and imaginative. Unfortunately, a distressing number of stainless steel specifications are incomplete, ambiguous, and occasionally dangerous.

Specifying stainless steel can be easy once its unique properties are understood.

Stainless steel's primary benefit is its ability to resist corrosion and oxidation without special finishes. Little maintenance is required. Stainless can be cleaned with soap and water, and it will outlast carbon steel, galvanized steel, aluminum, or just about any other door material.

Stainless steel doors are commonly specified for harsh environments where other materials fail, such as in sewage treatment and food processing plants. They're often required for "clean rooms" and swimming pool areas.

But more and more, stainless is specified for its durability in such areas as subway, prison, and housing project entrances. And architects are selecting it more often for its aesthetics.

Stainless steel can be made into just about any type of door that carbon steel can, with as wide a range of options for sizes, shapes, visions, and louvers.

Stainless steel doors can be manufactured with fire and sound ratings. Our company, for example, offers all-stainless doors labeled by Underwriters Laboratory or Warnock Hersey, complying with NFPA 80, and tested in accordance with ASTM E 152. These doors carry a fire rating up to three hours.

Sound-rated doors should be tested according to ASTM E 90-90 and classified according to ASTM E 413 up to STC 51, or to STC 43 for vision doors.

Fire and sound ratings can be combined for fire-rated STC openings.

Another special application, bullet-resistant doors, can be manufactured in stainless with ballistic-grade fiberglass woven roving to protect against a .44 Magnum, 240 grain lead S.W.C., G.C. bullet.

**Figure A. Clad doors versus all-stainless**

| | Clad Doors | All-Stainless |
|---|---|---|
| Fire label | According to UL, cladding a labeled door violates the label. | Can be manufactured with rating up to three hours |
| Durability | Unknown, with no likely testing standards. Susceptible to problems such as delamination, galvanic corrosion, seam splitting, oil canning, sag | Excellent. Can be manufactured to standards of SDI/ANSI 100-92, grade III, extra heavy duty, and HMMA/NAMM 860-92 |
| Edges | Unfinished, with exposed seams | Can be continuously welded and polished |
| Delamination | Occurs frequently, especially starting at high stress points such as door bottom or top hinge | Impossible—no lamination |
| Warrantee | Check carefully. As many as three manufacturers may be involved in manufacturing, clouding responsibilities. | Yes |



*This heavy-gauge stainless steel door at New York's Marble Hill Houses was installed to ensure a long, trouble-free service life.*

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### Stainless Steel

The Stainless Steel Industry of North America (SSINA) lists over 50 stainless steel alloys, classified by their metallurgical structure, The American Iron and Steel Institute (AISI) Numbering System, and the Unified Numbering System, developed by ASTM and the Society of Automotive Engineers (SAE) to apply to all commercial metals and alloys. SSINA offers detailed information on these alloys, as well as a wealth of other stainless steel facts.

In practice, stainless steel doors are commonly specified with one of two alloys. In most cases, Type 304 stainless is specified (or intended, if not specified). Type 304 resists dyes, organic chemicals, various inorganic chemicals, and ordinary rusting in architectural uses.

Some applications can benefit from Type 316 stainless, which is an alloy with slightly more nickel than Type 304 and 2 to 3 percent molybdenum. Type 316 resists corrosion (especially in chloride environments) and sulfuric acid compounds. Applications include chemical processing environments and swimming pool areas.

I often see Type 304 (or no type) specified when Type 316 is really called for, and I sometimes see specifications calling for Type 316 where a less expensive Type 304 would do the job.

### Carbon Steel and Cladding

Whether specifying Type 304 or Type 316 stainless, all components must be the same grade and alloy of steel. Any contact between stainless and carbon steel can set up galvanic corrosion.

Too often, stainless steel doors are made with nonstainless interior reinforcements. This defeats the entire notion of a corrosion-resistant door, since the door can actually rot from the inside out, self-destructing in spectacular premature failure. For this reason, all-stainless construction should be specified not only for the door and every component, but for frames, floor anchors, hardware, and every metal item that will come into contact with the stainless units.

The entire manufacturing facility should be devoted to stainless so that no ferrous steel will get picked up on the tooling and transferred to the stainless product, as often happens when doors are made by manufacturers whose larger line is standard hollow metal doors. These minute contaminations often show up later as rust spots, ruining the door's appearance.

It is common practice to clad a pre-manufactured hollow metal (or even wood) door with a skin of another material to achieve the surface effect the architect has envisioned for the project. But cladding a carbon steel door with stainless is a formula for disaster. Many construction specifiers (as well as many door and hardware dealers and distributors) believe that a fire-rated door wrapped in a sheet of stainless is still fire rated. However, unless a particular assembly is tested and rated, it has no fire rating at all, regardless of the rating of its components.

Just as important, a door made this way is a poor quality product. Because it is laminated onto a substrate of a different material, it is going to delaminate. It's also subject to an unsightly rippled condition called "oil-canning."

In addition, clad doors usually have mechanical fasteners on their edges, such as rivets or screws, that are bound to work loose sooner or later. By definition, edges can't be seamless if they are clad, and they will always have an unsightly exposed metal edge.

### Cores

If it is not specified otherwise, my company generally manufactures stainless steel doors with a solid polystyrene slab insulating core, which is permanently bonded to the face skins. But there are several alternatives available.

One option is a honeycomb core, permanently bonded to the face skins. Another is to construct doors with full-length vertical stainless steel stiffeners, and to fill the voids between them with mineral rock wool or fiberglass batt insulation.

### Welding

A top-quality stainless steel door has fully finished and seamless edges. Furthermore, these edges and welds should all be finished to the same specifications as the face of the door or frame. This requires special equipment, skills, and care on the manufacturer's part and should be carefully specified.

Only continuous welding will do; there is no way to use the spot, tack, or "plug" welding techniques common on hollow metal doors. Welds should be made with gas tungsten arc (TIG) equipment by certified welders to avoid the heat discoloration, arc strikes, and welding spatters that can easily spoil a door.

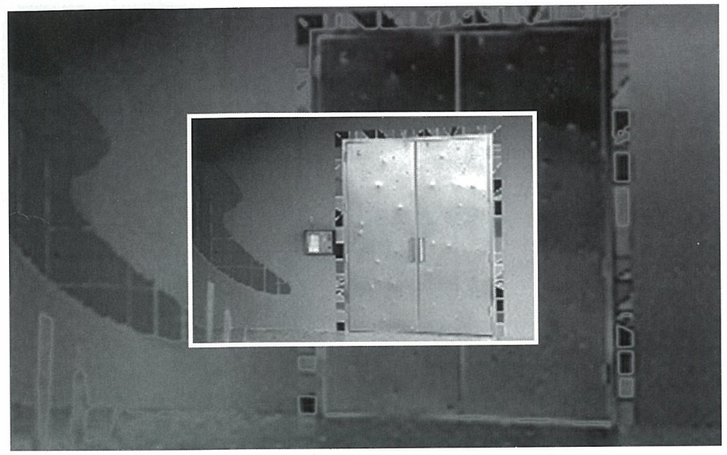
Stainless steel welding rods must be used to avoid embedding carbon steel in the doors during welding. Throughout the welding process, components should be held fast with jigs to avoid the warping or "alligatoring" that sloppy welding can produce.

### Finishes

Although a #4 satin finish is common for stainless steel doors, quality doors can be made with finishes from a #2B mill (commonly specified when painting is intended) to a dazzling #8 polish (mirror).

Specialty stainless steels are manufactured in a range of textured finishes. Embossments can be applied to the door surfaces. Custom etching can produce lettering, logos, and designs.

New developments in steel manufacturing have produced stainless steel with a black finish and in a spectrum of colors ranging from bronze and gold to green, blue, and red. Stainless is even available finished in 24-karat gold.



*The stainless doors at Arquitectonica, a Miami design firm, feature a distinctive embossing pattern.*

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### A Growing Market

In the United States, use of stainless in architecture has yet to reach its potential; in Japan, about 20 percent of the stainless steel produced goes into building components, compared to about 4 percent here. But for those who have discovered its many benefits and use it well, stainless is a lasting expression of their vision. ◆

### Note

For more detailed technical information about stainless, the following publications are available from Mr. Brian Leslie at SSINA, 3050 K Street, N.W., Suite 400, Washington, DC 20007, or from Next Door Company, 6555 North Powerline Road, Suite 301, Fort Lauderdale, Florida 33309; (954) 772-6666:

*Design Guidelines for the Selection and Use of Stainless Steel*

*Finishes for Stainless Steel*

*Stainless Steel Fabrication*

*Stainless Steel Architectural Facts*

*Life Cycle Costing Software* (Compares three material alternatives. Includes a written guide and online help.)

*Stainless Solutions* newsletter (A complimentary subscription is available from Next Door Company.)

Canada's Nickel Development Institute (NiDI) offers the following publications, also available from SSINA or Next Door Company:

*Architecture—A Demanding Market for Stainless Steel*

*Stainless Steel in Architecture*

*Answers for Architects Who Design for Beauty, Performance, Utility, and Prestige with Nickel Stainless Steel*

*Advantages for Architects Who Design For Beauty, Permanence, Utility, and Prestige with Nickel-Containing Stainless Steel; an Architect's Guide to Corrosion Resistance.*

**JOHN SCHECHTER** is president of Next Door Company in Fort Lauderdale, Florida.

# A Specification Guideline

The critical elements to address in a project specification that includes stainless steel doors and frames are listed below.

1. The material should be 14 gauge, Type 304, #4 satin finish for frames; 16 gauge, Type 304, #4 finish for doors.

- Frames may be 16 gauge. (I recommend 14 gauge for exterior openings and 16 gauge for interior openings.)
- Special heavy-duty conditions may require up to 12 gauge frames and 14 gauge for doors.
- Type 316 stainless steel may be used for severe corrosive conditions.
- The finish may be #2B or #8 in lieu of #4 to suit alternative aesthetic requirements.

2. Frame corners should be welded, ground smooth, and repolished to a #4 satin finish to match adjacent surfaces.

3. There should be no exposed spot welds or any other weld marks on any exposed surfaces.

4. All components, including wall anchors, floor anchors, hardware reinforcements, etc., should be stainless steel with gauges as specified.

5. Welding should be done with gas tungsten arc (T.I.G.) equipment using rods made from alloyed Type 308 stainless. Only technicians qualified to weld stainless steel with T.I.G. equipment should be employed. Maintain proper welding temperature to avoid discoloring the adjacent metal. Components should be clamped in appropriate jigs during the welding process to avoid alligatoring and warpage. Discolored, alligatored, and warped work will not be accepted. Work should comply with American Welding Society Standard D9.1 as a minimum.

6. All mortised hardware components should be at minimum 5 mm (3⁄16 in.) thick stainless steel to suit hardware templates. Closer reinforcements should be 12 gauge stainless steel to run the full door width. All other surface hardware reinforcements should be 12 gauge stainless steel.

7. Door edges should be fully seamless. Welds should be continuous, except at hardware cutouts, for the full door height. Intermittent welds (tack, spot, plug, etc.) are not acceptable. Welds should be ground smooth and edges should be repolished to restore a #4 satin finish.

8. Doors should be integrally manufactured using face sheets of prime stainless steel. No cladding or substrate will be allowed.

9. Door cores should be permanently affixed to face sheets.

10. All mortised hardware components should be a minimum 5 mm thick stainless steel to suit hardware templates. Closer reinforcements should be 12 gauge stainless steel to run the full door width. All other surface hardware reinforcements should be 12 gauge stainless steel.

11. Doors and frames should be manufactured by a company with a facility specifically dedicated to stainless steel doors and frames and with a minimum of 5 years experience in stainless steel manufacturing. ◆

**J.S.**



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