

Modern outlook

Stainless-steel windows

The traditional choice for windows in corrections facilities has been cold-rolled steel. But with all the benefits that stainless steel frames have to offer, specifiers may be changing their views

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Change has never come easily to the world of corrections. Long-established ideas and ways of doing things, many of which grew out of sound rationales and worked well when first introduced, have tended to endure. Adhering to the tried and true is not necessarily a bad thing. But the old adage “we’ve always done it this way” is no longer acceptable in today’s forward-looking criminal-justice design community.

This desire for newer and better ways of approaching the same old problems is also driven by a more ingenious criminal element – individuals determined to out-smart designers and manufacturers by doing some (creative) research and development of their own. Never mind that locking devices have been honed to near perfection or that cells (be they modular concrete, steel or block) have never been better from a quality, design and security perspective. Where there is a will, there is a way.

Although designers and manufacturers of detention windows may want to push the technology boundaries as well, introducing better products for the application has not been easy given that the material of choice for all types of frames – doors as well as windows – has always been cold-rolled steel.

The use of cold-rolled steel dates from the early 1900s and for good reason. The material was (and still is) readily available. Moreover, the performance of cold-rolled steel is proven and there is an experienced work force out there capable of putting virtually any design together.

The picture is not entirely rosy, however. Over time, as more manufacturers have entered the marketplace, steel prices have increased and deliveries have become longer. Thus, despite strong demand for cold-rolled steel through the 1980s and into the 1990s, the industry began to lose some of its lustre.

Material of choice

In recent years, stainless steel – principally 304 stainless steel, which contains 0.08 per cent carbon, 2 per cent manganese, 0.045 per cent phosphorus, 0.03 per cent

sulfur, 1 per cent silicon, 18-20 per cent chromium, and 8-10 per cent nickel – has emerged as the material of choice for window manufacturers in the correctional field.

Besides being anti-corrosive, stainless steel is so strong that manufacturers can use 14 or even 16 gauge (as opposed to 12 gauge) without compromising performance or security. This is a direct material cost saving that owners can really appreciate.

The chart below compares the mechanical properties of 12-gauge hollow metal with those for 14-gauge 304 stainless steel.

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Another advantage of lower-gauge steel is the reduction of surface area of metal conducting cold and heat in and out of the facility. Thus, from a thermal standpoint, the lower-gauge material actually helps to improve the building’s insulation value. So 12-gauge cold-rolled mild steel has a value of 2.86 BTU/hr/ft² °F while 14-gauge 304 stainless steel’s insulation value is 0.67 BTU/hr/ft² °F.

From a maintenance perspective, stainless steel windows also come out ahead. With mild steel windows, sanding, filling and painting has to be done on a regular

Stainless Steel Mechanical Properties Comparison

	12-gauge, hollow	14-gauge, stainless
Yield strength	31ksi	50ksi
Tensile strength	50ksi	95ksi
Hardness Rockwell B	47HRB	85HRB
Impact resistance	47ft-lb	110ft-lb



basis (this is especially true in jails and correctional facilities, where in unsupervised cells or day rooms, windows tend to get rough treatment). Not so with 304 stainless steel with a 2B interior finish, which stands up to abuse much better than 12-gauge cold-rolled steel and is virtually maintenance-free, keeping upkeep costs to a minimum.

Outside concerns

What about exterior elements? Unlike cold-rolled steel, which is a ferrous metal that corrodes when exposed to rainwater and oxygen, stainless steel withstands anything Mother Nature can throw at it. Corrosion of cold-rolled steel may initially be only an aesthetic problem, but corrosion can eventually become a security concern as well. Yet preventing corrosion is as simple as foregoing cold-rolled steel in favor of 304 stainless steel.

The stumbling block for many when considering stainless-steel windows is the cost. The common misconception is that stainless-steel windows generally should cost more. In point of fact, pricing is driven by the simple economics of bid day coupled with simple engineering. Moreover, there are hidden costs inherent in the use of conventional steel windows that must be taken into account. Take priming and painting on site. Stainless steel windows come pre-finished, reducing handling time as well as the time required for field inspection by the architect.

In terms of window viewing area, American Correctional Association standards dictate that there must be 3ft² of net glass viewing area for a 72ft² cell. Stainless steel windows typically have smaller frames. This permits designers and owners to get the 3ft² into a

Unlike cold-rolled steel, which corrodes when exposed to the elements, stainless steel windows can withstand the elements without detriment to security or the appearance of the building

It's a steel

An austenitic, chromium-nickel stainless steel, American Iron and Steel Institute (AISI) type 304 is characterized by a comparatively low carbon content and higher chromium and nickel contents than AISI types 301 and 302. It is thus well suited to applications requiring welded construction and where the finished product must resist most severe forms of corrosion.

In light sections, type 304 can be welded with a small amount of resulting carbide precipitation or loss of corrosion resistance. In most cases, post-weld annealing is not necessary. The homogeneous structure, high ductility and excellent strength of this stainless steel provide good performance in deep drawing, cold forming, spinning, roll forming and bending. It is non-magnetic in the annealed condition and becomes slightly magnetic when cold worked.

In the fully annealed condition, type 304 is highly resistant to ordinary rusting and corrosive action, and is immune to foodstuffs, sterilizing solutions, most organic chemicals and drystuffs, as well as a variety of inorganic acids. It resists nitric acid well, sulfuric acids moderately and halogen acids poorly. This grade also has good scaling resistance up to 870°C (1,600°F) in continuous service, and up to 790°C (1,450°F) in intermittent service.

In machining, rigid machine set-ups, heavy feeds and slow spindle speeds are most suitable. ▲

smaller-sized window opening, thereby helping to reduce building costs as well as positively impacting the thermal efficiency of the building envelope.

Precise fabrication

Of course, one cannot manufacture stainless steel windows with 12-gauge hollow metal manufacturing technology. The labor-intensive process of mitering corners, face welding, grinding, galvanizing, prime painting and finished coating must be eliminated in favor of a re-engineered product. It must also be clearly understood that this new hybrid needs to meet all the stringent code requirements specified by the designer.



Windows constructed of 12-gauge steel can be rendered inoperable by corrosion [left] while 14-gauge stainless steel [right] is virtually maintenance-free

Corrosion of cold-rolled steel may initially be only an aesthetic problem, but corrosion can eventually become a security concern as well

Stainless steel windows also demand more precise fabrication methods, as mistakes are not easily corrected. Manufacturers thus tend to be specialists who rely on more sophisticated techniques. A fabricator who makes conventional steel windows 90 per cent of the time will lack the expertise and experience to correctly fabricate stainless steel windows. So choice of manufacturer for any given project is key.

A final point concerns installation. General contractors and installers who begin to install stainless steel windows quickly see that the product is not only much lighter and easier to install than conventional windows, but does not need to stay on a critical path as a touch-up item after installation. And that is a benefit that is seldom obvious on bid day. ▲

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