Case Study 12 Milan Building Exterior

Moderate Industrial Pollution Exposure
No Salt Exposure

One of Italy's leading engineering firms, Torno Internazionale Spa, asked the design firm Dante Benini & Partners to renovate their existing Milan, Italy offices and to design a new adjoining office building. The modernization of the existing 1960's eight-story building was completed in 2002 and includes a seven-story, micro-perforated, Type 316 (UNS S31600, EN 1.4401, SUS 316) stainless steel trapezoidal screen that conceals communication grids and walkways on the northeast side of the building.

In 2004, the new addition was completed on the south side of the original building. A seven-story Type 316L (UNS S31603, EN 1.4404, SUS 316L) stainless steel sail covers one side of the new building and functions as a sunscreen to minimize building heat gain. Types 316 and 316L provide equivalent corrosion resistance. Type 316L has lower carbon levels and is preferred for welding. **(Figure A)**

Figure A The new office building has a perforated, seven-story Type 316L stainless steel "sail" that also serves as a sunscreen. Photo courtesy of Centro Inox.

Figure B Type 316L stainless steel covers the columnar elevator shaft at the point where the buildings were joined. Photo courtesy of Centro Inox.

Milan is known for its air pollution (smog), which concentrates in the mountain valley. Although pollution levels have been reduced, the architects had to consider the presence of acid rain and high particulate levels. Minimal maintenance cleaning was expected. They selected the textured, dull, rolled-on Ugitop® stainless steel finish. Although the pattern's surface texture appears rough, it is achieved by pressing a pattern into a very smooth finish and generally provides good corrosion performance. Rolled on finishes perform better than finishes produced by other methods with similar texture depth. Performance will vary with particulate levels, the frequency of rain and manual cleaning, and pattern depth, type and orientation. Milan's frequent rain should minimize surface deposits.

The stainless steel was perforated to create sunscreens. The edges of perforations are often rough, retain more corrosive deposits and are not effectively rain-washed. This increases the likelihood of corrosion unless there is manual washing to remove deposits. Types 316 and 316L stainless steels, containing 2% molybdenum, were selected for the project. They provide good resistance to the crevice corrosion that can occur under surface deposits, and they were needed because of the high particulate levels, the probable lack of manual cleaning, and the presence of perforations. Both Types 316 and 316L have performed well.

INTERNATIONAL MOLYBDENUM ASSOCIATION

Stainless Steel Selection Criteria

The IMOA publication, *Which Stainless Steel Should Be Specified for Exterior Applications?*, provides stainless steel selection assistance. The site and design scores below are based on the guidelines in that brochure. Copies can be downloaded from www.imoa.info or ordered by emailing info@imoa.info.

Section 1: Environment — Score = 3

During the design and construction period, there was some minor year-to-year variation in pollution data. The average mean pollution data for the construction period was as follows: sulfur dioxide, 3 µg/m^3; PM10, 35 µg/m^3; and PM 2.5, 21 µg/m^3. The sulfur dioxide levels are low but the particulate levels (PM10 and PM 2.5) were in the high end of the moderate range. The particulate contains industrial by-products making it more corrosive. Acid rain, which can increase corrosion rates, is also reported to be a problem. Based on available data, Milan has low to moderate industrial pollution levels.

Section 2: Coastal & Deicing Salt Exposure — Score = 0

Milan is an inland city so there is no coastal salt exposure. The climate is relatively warm, so that deicing salt is rarely used and it is generally limited to bridges and some walkways. The building's panels are unlikely to have any salt exposure.

Section 3: Local Weather Pattern — Score = -1

Average low and high temperatures range from -3ºC (25ºF) to 28ºC (82ºF). The average annual precipitation is 970 mm (38 inches) and there is rainfall throughout the year. The average relative humidity level ranges from 60% (evening) to 90% (morning). On average, there are 49 thunderstorms per year with as many as 10 storms per month during the summer and 343 days a year with at least some fog, but it is not salt fog. This is a temperate climate with regular heavy rain.

Section 4: Design Considerations — Score = 1

The boldly exposed stainless steel panels take advantage of natural rain cleaning. Although the surface texture appears rough, the pattern is pressed into a very smooth mill finish and finishes of this type generally perform well unless particulate levels are high. Surface perforations, particularly the rough edge areas, can trap and retain surface deposits that would otherwise not accumulate. The presence of the perforations increases the design score in areas with potentially corrosive industrial particulate or salt exposure.

Section 5: Maintenance Schedule — Score = 0

The stainless steel was selected because the surfaces would be quite difficult to clean. No regular maintenance cleaning is planned.

Stainless Steel Selection — Score = 3

Type 316 stainless steel is a cost effective choice for locations where potentially corrosive particulate is likely to collect on surfaces and where regular cleaning is unlikely. A score of 3 means that either Type 316/316L or 444 (UNS S44400, EN 1.4521, SUS 444) stainless steel is usually the most cost effective choice. The attractive appearance of the stainless steel after several years of service indicates that the designer selected an appropriate stainless steel and finish combination. If pollution or particulate levels were to increase over time, periodic maintenance cleaning might become necessary.

Acknowledgement: The author would like to acknowledge the assistance of Centro Inox in the preparation of this case study.

International Molybdenum Association
e-mail: info@imoa.info · www.imoa.info

Prepared by IMOA consultant Catherine Houska, TMR Consulting (www.tmrconsulting.com), layout Martina Helzel, circa drei (www.circadrei.de)

IMOA ABC 12/09