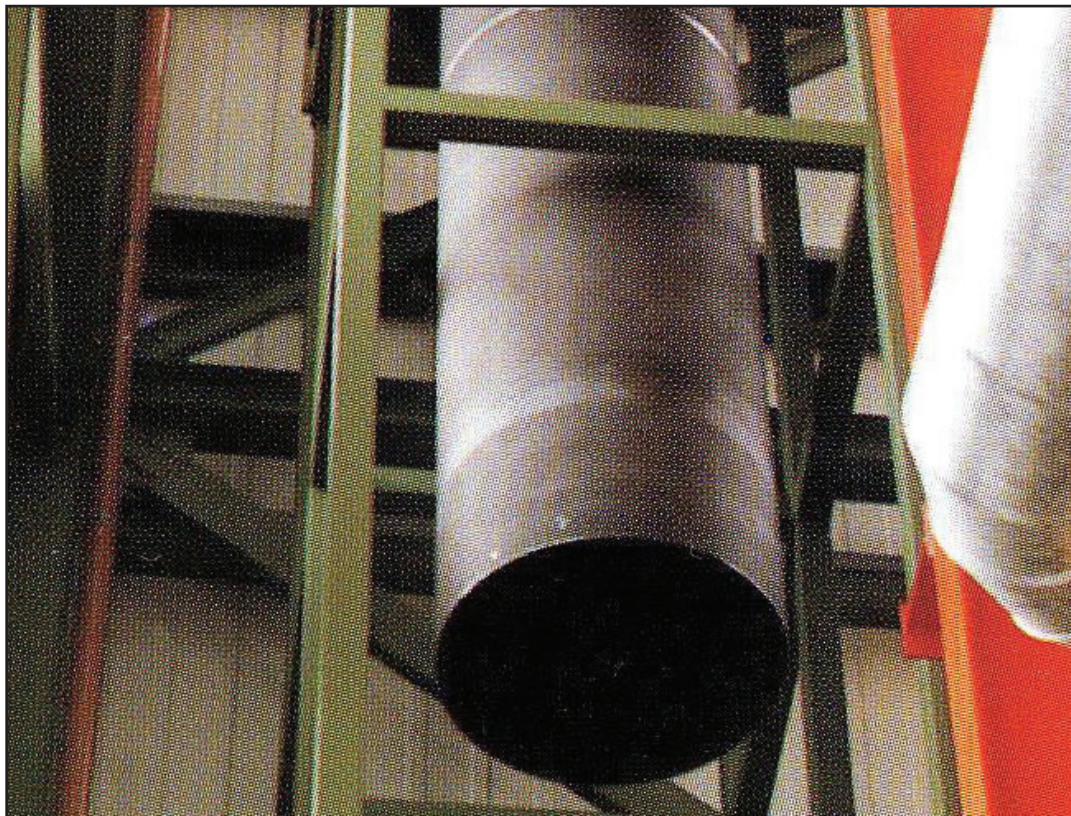


## RA 602 CA® replaces 314 Stainless in Bright Annealing Muffle



### Specifications

UNS: N06025 W. Nr./EN: 2.4633 ASTM: B 168, B 166 ASME: SB-168, SB-166, Code Case 2359

### Chemical Composition, %

	Cr	Ni	Cu	P	S	Fe	C	Al	Ti	Y	Zr	Si	Mn
MIN	24.0	—	—	—	—	8.0	0.15	1.8	0.1	0.05	0.01	—	—
MAX	26.0	Balance	0.1	0.02	0.01	11.0	0.25	2.4	0.2	0.12	0.1	0.5	0.15

### Case History

- RA 602 CA muffle installed in July 1993
- Weight of muffle: 20 tons
- Bright annealing of stainless steel
- Original service life: <4 years (314 stainless)
- Temperatures: 1800-2150°F (980-1180°C)
- New muffle life: 8+ years (RA 602 CA)

### Case History

RA 602 CA was chosen as the alloy of choice for an upgrade to a vertically oriented bright annealing muffle. Previously, the muffle had been constructed of 314 stainless steel which is commonly used in applications for extreme temperatures up to 2100°F (1150°C). This is due to its tenacious oxide that forms as a result of the high chromium and silicon levels in the alloy.

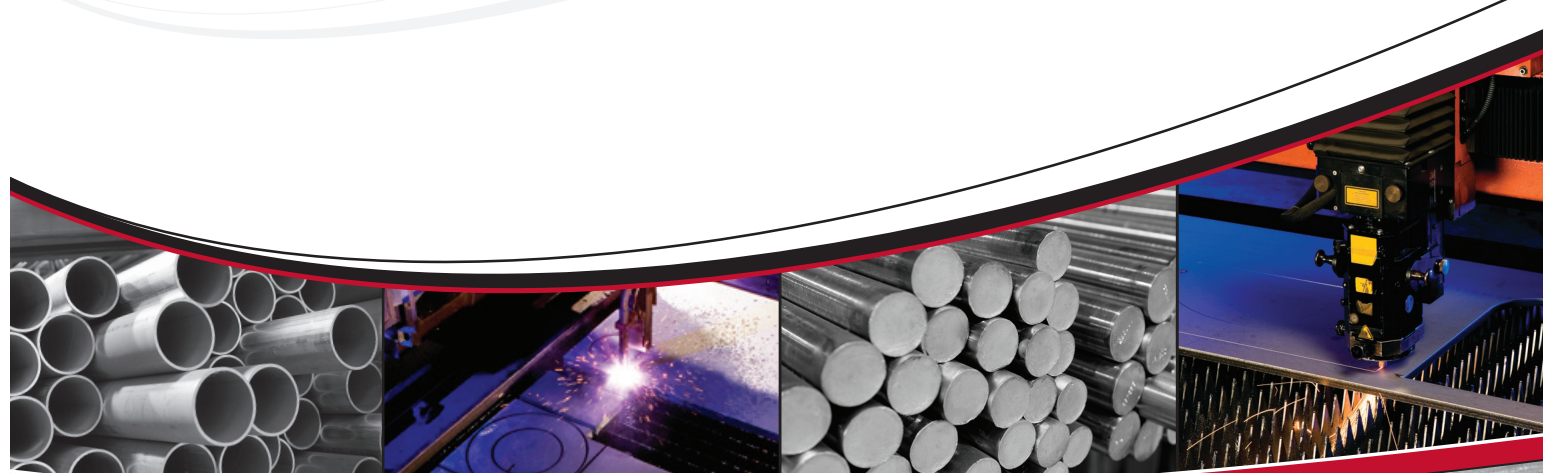
## Case History, Continued

Vertically oriented muffles like this typically fail due to mechanical creep and loss of material thickness. Over time, as the muffle expands and creeps, the muffle will become significantly longer and need to be trimmed at the bottom. Once the walls of the muffle have thinned too much, the muffle must be scrapped and taken out of service. At the end of this muffle's service life, the alloy 314 used lasted less than 4 years.

After some consideration, RA 602 CA alloy was chosen as the best candidate to replace the previous 314 stainless muffle. RA 602 CA alloy is the most oxidation resistant/high strength nickel alloy available. It is capable of extreme temperature use up to 2250°F (1232°C). For thermal processing applications where minimal product contamination is necessary, the oxidation/scaling resistance of RA 602 CA is extremely desirable. High chromium levels, along with aluminum and yttrium additions, allow the alloy to develop a tightly adhering oxide scale.

A relatively high carbon content combined with the alloying additions of titanium and zirconium results in high creep rupture strength. RA 602 CA provides 150% of the strength of other commonly used nickel alloys such as alloy 600.

	RA 602 CA	314
Average Yield Stress	51 ksi	45 ksi
Minimum Yield Stress	40 ksi	33 ksi
Average Stress for 1% Total Creep (in 10,000 hours at 2000°F)	0.33 ksi	N/A (no data)
Average Stress for 1% Total Creep (in 10,000 hours at 1650°F)	1.89 ksi	1.45 ksi



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