RA333® Flare Tip Completes its 3½ Year Tour of Duty and is Readied for a Second

Specifications

UNS: N06333 **W. Nr./EN:** 2.4608 **AMS:** 5593, 5717 **ASTM:** B 718, B 719, B 722, B 723, B 726

Chemical Composition, %

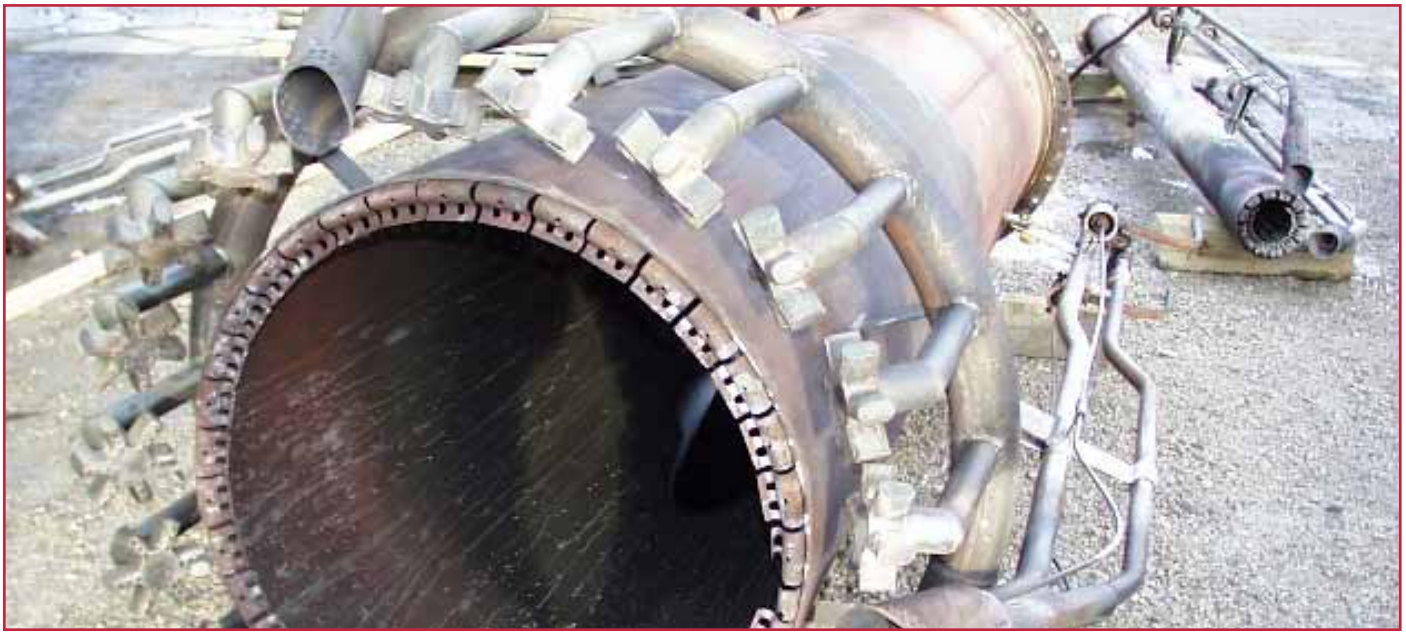
	Cr	Ni	Mn	Si	Mo	Co	W	P	S	C	Fe
MIN	24.0	44.0	–	0.75	2.5	2.5	2.5	–	–	–	–
MAX	27.0	47.0	2.0	1.5	4.0	4.0	4.0	0.03	0.03	0.08	balance

Case History

RA333 continues to be the material of choice for flare tips at one Midwestern refinery. The refinery, prior to 1992, had been using a refractory lined 310 stainless steel flare tip. This design was problematic for several reasons. One problem was the refractory broke away from the tip and dropped down into the stack. This created concerns of blockages in the stack and also led to increased maintenance costs. The 310 stainless possessed insufficient creep strength at temperature. It was prone to distortion whenever the refractory failed or there was flame impingement on the tip during high winds or low fire conditions. The distortion could negatively impact the flame characteristics of the flare and result in smoke. These issues also made it difficult to get continuous, reliable service in between shutdown periods. Improved service life and reliability of these flares were critical issues as this refinery was attempting to extend the operating period between scheduled major shutdowns. RA333 was selected for a new design of flare using no refractory lining.

This refinery now has nearly 10 years of service experience with the RA333 alloy flare tips. The first RA333 tip was installed on one side of the refinery in the autumn of 1992 and was used continuously until a plant shutdown in October 1995. At this point, the refinery installed a new RA333 flare in its place and did some repairs on this first tip. During the next scheduled shutdown, in the autumn of 1998, the refurbished RA333 flare tip was put back into service for a second time on the other side of the refinery.

The second RA333 tip, installed October 1995 was taken down during a shutdown in March 1999. After 3½ years service, the RA333 portion was like new. The only items requiring repair were those portions still made of 310 or HK castings such as steam nozzles and the pilot flares. The flare will be kept on hand as a spare and will be installed during the next scheduled shutdown.



Case History, Continued

It was reported that one refractory lined 310 tip had failed in about one year of service. At the time of this writing, the first RA333 flare tip was in its fifth year of actual service. The second RA333 flare had provided 3½ years of service to date.

The flare tips here consist of a 66 inch long cylinder of 3/8 inch thick RA333 plate at the top, (1676 mm long, 9.5 mm plate) butt welded to a like cylinder of carbon steel. The stack itself is a 30 inch diameter pipe, 237 feet tall from base to top (762 mm diameter, 72 m tall). Maximum capacity is 640,000 pounds per hour of waste gas. To get a "Smokeless Flame" steam injection is used to increase combustion of the hydrocarbons. Flare tips are subjected to flame impingement on the outside, low flow conditions, and/or internal burning. Strong winds can blow the flame onto the flame retention rings, and on the outside. If the old refractory lining failed, air infiltration could cause internal burning to the point where the tip was seen to glow red.

RA333 alloy is a nickel base superalloy with outstanding resistance to high temperature carburization, oxidation, and flame impingement. The chemistry of RA333 provides resistance to aqueous corrosion and stress corrosion cracking as well as to oxidizing hot corrosive environments.

Other applications for RA333 include rotary heat treating retorts, radiant tubes, muffles, catalyst, calciners, thermowells, mixer blocks in petroleum coke calciners and crude unit tube hangers.

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