HAYNES® HR-160® alloy Applications in Waste Incinerators Tech Brief

Applications in Waste Incinerators

HAYNES® HR-160® alloy provides the best combination of resistance to harsh, high-temperature environments and life cycle cost effectiveness of any commercially available alloy. Components produced from HR-160® alloy have exhibited outstanding performance in waste incineration applications. Field trials have demonstrated that component life extensions greater than 10X are possible with direct material substitution. HR-160® alloy utilizes high chromium and silicon contents to promote the formation of a protective oxide scale which resists attack from sulfur, vanadium, chlorides, and other salt deposits. This makes the alloy ideally suited for waste incinerator components operating up to 2200°F (1204°C), such as T/C protection tubes, dampers, tube shields, tube supports, thermos wells, combustion chambers, ducts, heat exchangers, and vortex finders.

HAYNES® HR-160® Alloy Performance Capability		
Incinerator Type	**Field Test Conditions**	**Performance as Compared to Current Material**
Municipal Waste	800-2000°F (982-1093°C); sulfur, chlorides, K, Zn, etc. 1300-1400°F (704-760°C); sulfur chlorides, K, Zn, Pb	>17x better than stainless steels 9x better than 625 12x better than 825 15x better than 304 >12x better than 446
Industrial Waste	1600-1700°F (871-927°C); sulfur chlorides, K, etc	>20x better than stainless steels
Hospital Waste	1200-1400°F (649-760°C); sulfur chlorides, Zn, etc.	>7x better than 304 and 316
Chemical Waste	900°F (482°C); Pb, K, S, P, Zn, and Ca	15x better than carbon steel and 600

Product Description

HAYNES® HR-160® alloy is a Ni-Co-Cr-Si alloy with a stable austenitic structure. The alloy is easily fabricated using methods such as gas-tungsten-arc welding (TIG) process or gas-metal-arc welding (MIG) process. HR-160® filler metal is recommended for joining HR-160® alloy; when HR-160® alloy is welded to other alloys, such as stainless steels, 556® filler metal should be used.

Nominal Composition

Nickel:	Balance
Cobalt:	29
Chromium:	28
Iron:	2 max.
Molybdenum:	1 max.
Silicon:	2.75
Tungsten:	1 max.
Manganese:	0.5
Titanium:	0.5
Carbon:	0.005

Field Performance- Municipal Waste Incineration

Alloy	Metal Loss		Maximum Metal Affected	
-	mils	mm	mils	mm
HR-160®	**0**	**0**	**2.0**	**0.05**
556®	9.5	0.24	11.0	0.28
625	16.5	0.42	17.5	0.44
188	17.0	0.43	18.5	0.47
825	21.5	0.55	24.5	0.62
304SS	28.0	0.72	29.5	0.75
446SS	>23.5	0.60[c]	>23.5	0.60[c]
Carbon Steel	27.1	0.69	30.0	0.76

(a) test rack was exposed at 1300-1400F (704-760C) for 2 months
(b) metal loss + maximum internal penetration
(c) sample was perforated

Comparative Stress-Rupture Strengths

°F	°C	HR-160®	RA333	800HT	RA330	253 MA	RA85H	309 SS	310 SS
1100	593	**22.9**	25.0	-	-	-	-	-	-
1200	649	**15.6**	16.5	17.5	11.0	14.0	12.0	16.0	9.3
1300	764	**10.8**	12.0	11.0	-	8.5	-	-	-
1400	760	**7.4**	9.2	7.3	4.3	5.2	5.0	5.45	3.9
1500	816	**5.1**	5.7	5.2	-	3.75	-	-	-
1600	871	**3.6**	3.1	3.5	1.7	2.5	2.1	1.86	1.65
1700	927	**2.5**	1.8	1.9	-	1.65	-	-	-
1800	982	**1.8**	1.05	1.2	0.63	1.15	0.9	0.63	0.69

*ksi can be converted to MPa (megapascals) by multiplying by 6.895