Crucible Data Sheet

Issue #3

CRUCIBLE 347 STAINLESS STEEL

Carbon	**0.08% max.**
Sulfur	**0.030% max.**
Chromium	**17.00/19.00%**
Manganese	**2.00% max.**
Nickel	**9.00/13.00%**
Phosphorus	**0.045% max.**
Silicon	**1.00% max.**
Columbium-Tantalum	**10 x C min.**

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Columbium-Tantalum	**10 x C min.**
Tantalum	**0.10 max.**

CRUCIBLE 348 was established to meet certain limited but significant applications. For example, in the case of nuclear energy projects, a low tantalum - bearing stabilized grade has been found desirable.

CRUCIBLE 347 and 348 are non-hardenable austenitic chromium-nickel steels which are particularly adaptable for use at temperatures between 800 and 1650 F. These grades are non-magnetic in the annealed condition but are slightly magnetic when cold worked.

Typical Applications:

Aircraft engine exhaust manifolds
Boiler shells
Collector rings
Expansion joints
High temperature chemical handling equipment

Note: The above are some *typical* applications. Your *specific* application should not be undertaken without independent study and evaluation for suitability.

Forging:

CRUCIBLE 347 and 348 should be forged at 2150 to 2200 F and finished above 1500 F. Reheating should be used if necessary.

When CRUCIBLE 347 and 348 are to be upset, temperatures should be such that the work is finished between 1700 and 1800 F.

Annealing:

For maximum softness, CRUCIBLE 347 and 348 should be annealed at 2000 F, followed by a water quench. However, fully-annealed properties can be obtained by cooling rapidly from 1850/2050 F to room temperature.

Hardening:

CRUCIBLE 347 and 348 in small or thin sections can be hardened by cold working. The effect of cold working is shown in Figure 1.

Forming:

The forming properties of CRUCIBLE 347 and 348 vary within composition limits. It is recommended, therefore, when severe forming operations are planned, that special attention be given in ordering, so that ma-

Note: Temperatures shown throughout this data sheet are metal temperatures.

terial having suitable properties can be supplied.

Since this steel is susceptible to work hardening, an anneal should precede and follow each drastic forming operation.

Welding:

CRUCIBLE 347 and 348 should be welded using Type 347 and 348 filler weld metal, respectively. CRUCIBLE 347 and 348, because of their resistance to intergranular corrosion, is recommended for those applications where the welded product cannot be annealed subsequent to welding and is to come into contact with active electrolytes.

Intergranular Corrosion:

When 18-8 chromium-nickel steels are heated within the range of 800- 1650 F, carbides are precipitated at the grain boundaries. If these grades are then exposed to active electrolytes, the zones of precipitated carbides are subject to failure by intergranular corrosion. An annealing treatment of 1800 F or above will cause the precipitated carbides to be dissolved, making the material homogeneous and therefore not subject to intergranular corrosion. The presence of an active carbide former such as columbium in CRUCIBLE 347 and 348 practically eliminates the possibility of excess carbide precipitating in the grain boundaries during heating in this 800 to 1650 F range. Therefore this steel has satisfactory resistance to corrosion without a subsequent annealing treatment.

General Corrosion Resistance:

The general corrosion resistance (intergranular corrosion excluded) of CRUCIBLE 347 and 348 are practically the same as that for CRUCIBLE 302.

Resistance to Scaling:

CRUCIBLE 347 and 348 scale at approximately 1650 F. This temperature will vary with the type of atmosphere, type of construction and cycle of operation.

Specifications

CRUCIBLE 347/348 have found wide industry acceptance and are covered by the following specifications:

QQ-S-763d (347 only)	AMS 5646 (347 only)	ASTM A-276-67	ASTM A-580-67

Machining data

Operation	Tool Width or (in) Depth of Cut	CRUCIBLE 347/348 High Speed Tooling*		Carbide Tooling	
		Speed (fpm)	Feed (in/rev)	Speed (fpm)	Feed (in/rev)
Turning single point	0.050	90	0.0055	200	0.010
	0.250	85	0.0050	200	0.020
	0.500	80	0.0045	175	0.025
Forming	1/2 wide	90	0.0015	180	0.0022
	1 wide	85	0.0012	170	0.0022
	1½ wide	85	0.0012	170	0.0020
	2 wide	80	0.0010	160	0.0015
Cutoff	1/16 wide	80	0.0015	160	0.0020
	1/8 wide	80	0.0015	160	0.0020
	3/16 wide	85	0.0015	170	0.0022
	1/4 wide	85	0.0020	170	0.0030
Drilling	1/16 dia.	50	0.0015		
	1/8 dia.	50	0.0020		
	1/4 dia.	50	0.0030		
	1/2 dia.	50	0.0035		
	3/4 dia.	55	0.0040		
	1 dia.	55	0.0050		
Threading†		5-15	—		
Tapping†		5-15	—		

†Use the higher speeds for the finer threads.

*Details on tool life test techniques and Crucible High Speed and Tool Bit recommendations are described in the booklet, "Machining Crucible Stainless Steels."

Physical properties

Modulus of elasticity in tension - psi	28,000,000
Electrical resistivity	
Room temperature (microhm — centimeters)	73.0
Specific heat (Btu/lb./° F) 32-212° F	0.12
Specific gravity	8.02
Weight (lb./cu. in.)	0.290
Thermal conductivity (Btu/hr./sq. ft./° F/ft.)	
200° F	9.2
1000° F	12.5
Mean coefficient of thermal expansion (in/in/° F x 10^{-6})	
32- 212° F	9.3
32- 600° F	9.5
32-1000° F	10.3
32-1200° F	10.6
Melting point range (° F)	2500/2550

Mechanical properties

(All values are representative properties in the annealed condition)

Room Temperature

	Bar-1 in. Rd.
Tensile strength - psi	90,000
Yield strength (0.2% offset) - psi	40,000
Elongation in 2 in., (%)	50
Reduction of area, (%)	65
Izod impact resistance, (ft. lbs.)	100
Hardness (BHN)	170
Cold bend, (deg.)	180

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