

# Crucible 304L Data Sheet

Issue No. 1

CRUCIBLE 304L is a non-hardenable, low carbon austenitic chromium-nickel steel designed for special applications. It is particularly suitable for applications requiring welding operations where it is not practical to anneal after welding. This grade is non-magnetic in the annealed condition but slightly magnetic when cold worked. Typical applications are screw machine products and all machined parts requiring good corrosion resistance or non-magnetic properties.

## Analysis

Carbon 0.03% max.

Manganese 2.00% max.

Silicon 1.00% max.

Phosphorus 0.045% max.

Sulfur 0.03% max.

Chromium 18.00/20.00%

Nickel 8.00/12.00%

## Typical applications

Screw machine products

Machined shafts

Valves and accessories

Architectural

Bar and fountain accessories

Dairy Equipment

for chemical handling

applications

Household appliances

Homogenizers

equipment

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

## Forging

CRUCIBLE 304L should be forged at 1900 to 2100F and finished above 1700F. Reheating should be used if necessary.

## Annealing

For maximum resistance to corrosion, CRUCIBLE 304L should be annealed at 2000F followed by a water quench. However, fully-annealed properties can be obtained by cooling rapidly from 1850/2050F to room temperature.

## Hardening

CRUCIBLE 304L in small sections can be hardened by cold working. The effect of cold working is shown on Page 4.

Note: Temperatures throughout data sheet are steel temperatures.

## Forming

CRUCIBLE 304L will withstand moderate cold working. Machining stock is supplied to a hardness for best machining and cold forming should be kept to a minimum.

## Welding

CRUCIBLE 304L should be welded using AISI Type 308 electrodes. Type 347 electrodes can also be used successfully to weld this grade. Type 347 electrodes, however, are not recommended where subsequent grinding and polishing are required for appearance, as a line of demarcation will be noticeable between the weld metal and the parent metal caused by the weld metal having a slightly duller appearance. CRUCIBLE 304L, because of its 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 weak electrolytes.

## Resistance to scaling

CRUCIBLE 304L scales at approximately 1650F. This temperature can vary with the type of atmosphere and application.

## General corrosion resistance

CRUCIBLE 304L possesses superior general corrosion resisting properties, being better than CRUCIBLE 302 in this respect. For applications at normal temperatures and pressures, this steel is resistant to a great variety of corrosive agents.

## Galvanic Corrosion in Salt Water

The following materials do not affect CRUCIBLE 304L and their own rates of corrosion are not materially affected by contact in salt water:

Hytensile bronze	Phosphur bronze	Aluminum bronze	Cast iron	Copper
Manganese bronze	SAE 1050	Tobin bronze	Brass	Graphite

The following materials do not affect CRUCIBLE 304L, but their own rate of corrosion are appreciably accelerated by contact in salt water:

Aluminum	CRUCIBLE 410
Lead	CRUCIBLE 430
Babbitt material	

The following materials should not be used in contact with CRUCIBLE 304L in salt water:

Any packing material containing sulphur	Rubber asbestos packing
Monel metal	

## Intergranular Corrosion

When 18-8 chromium-nickel steels such as CRUCIBLE 304L are heated within the range of 800-1650F, 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 1800F or above will cause the precipitated carbides to be dissolved, making the material homogeneous and not subject to intergranular corrosion. The low carbon in CRUCIBLE 304L substantially reduces the amount of carbides precipitated, thereby providing satisfactorily resistance for use with weak electrolytes. CRUCIBLE 304L is preferred for those applications involving welding where the finished product cannot be annealed subsequent to the welding operation.



## Specifications

CRUCIBLE 304L has found wide industry acceptance and meets the following specifications:

QQ-S-763	ASTM A479	AMS 5647	ASTM A-276	ASTM A-580
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## Machining data

Operation	Tool Width or Depth of Cut (in)	CRUCIBLE 304 LUS			
		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)	72.0
Specific heat (Btu/lb./°F) 32-212°F	0.12
Specific gravity	7.94
Weight (lb./cu.in.)	0.287
Thermal conductivity (Btu/hr./sq.ft./°F/ft.)	
200°F	9.4
1000°F	12.5
Mean coefficient of thermal expansion (in/in/°F x 10 <sup>-6</sup> ) (See fig. 3)	
32- 212°F	9.6
32- 600°F	9.9
32-1000°F	10.2
32-1200°F	10.4
Melting point range (°F)	2550/2650

## Mechanical properties

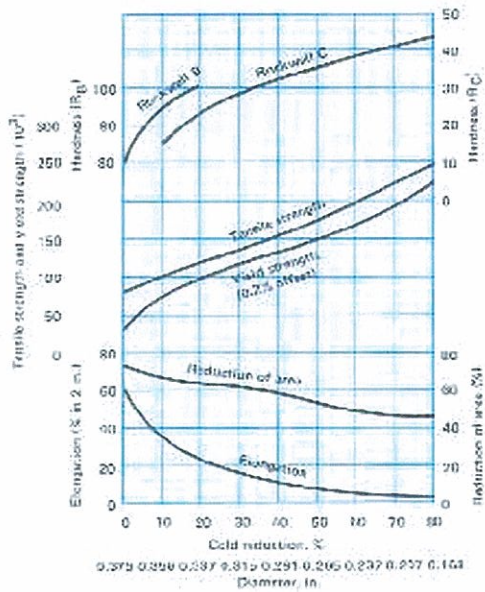
(All values are representative properties in the annealed condition)

### Room Temperature

	Bar (1 in. rd.)
Tensile strength - psi	80,000
Yield strength (0.2% offset) - psi	30,000
Elongation in 2 in. (%)	60
Reduction of area (%)	70
Izod impact resistance (ft.lbs.)	110
Hardness (BHN)	160
Cold bend, (deg.)	180

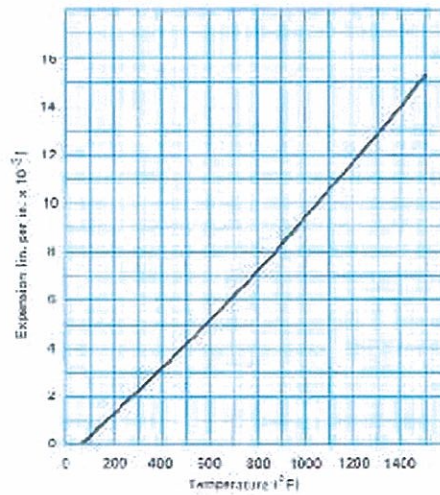
### Mechanical properties as cold worked

Heat treatment: annealed,  
1950°F, water quenched.  
Size: 3/8 in. rd., unstraightened  
and untempered.



### Thermal expansion

Annealed 2050°F, water quench.



Note: Properties shown throughout this data sheet are typical values. Normal variation in chemistry, size, and conditions of heat treatment may cause deviations from these values.



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