BIODUR® 734 STAINLESS

Applicable specifications: ASTM F1586, ISO 5832-9

Type analysis

Single figures are nominal except where noted. Other, Each, max = 0.1%. For AMS 4930 rev. D, Hydrogen = 0.0125% and Yttrium = 0.005%.

Iron	Balance	**Chromium**	19.50 to 22.00 %	**Nickel**	9.00 to 11.00 %
Manganese	2.00 to 4.25 %	**Molybdenum**	2.00 to 3.00 %	**Columbium/Niobium**	0.25 to 0.80 %
Silicon	max 0.75 %	**Nitrogen**	0.25 to 0.50 %	**Copper**	max 0.25 %
Cobalt	< 0.10 %	**Carbon**	max 0.080 %	**Phosphorus**	max 0.025 %
Sulfur	max 0.010 %				

Forms manufactured

Bar-Rounds	**Billet**	**Strip**	**Wire-Rod**

Description

BioDur 734 stainless is a nitrogen-strengthened, austenitic stainless steel. The alloy exhibits improved tensile strength, impact strength, fatigue strength, and crevice and pitting corrosion resistance over standard BioDur 316LS. The microstructural integrity and cleanness of this alloy is insured through electro-slag remelting (ESR). The alloy is non-magnetic and is essentially free of ferrite. For a nickel-free alternative, BioDur 108 offers higher strength and corrosion resistance compared to both BioDur 316LS and BioDur 734.

Applications include implantable orthopedic parts such as bone plates, bone screws, and hip and knee components. These components are typically fabricated by forging and machining. The chemistry of BioDur 734 meets the recently implemented **EU MDR** regulatory labeling threshold of less than 0.10% cobalt by weight. Devices made from this alloy should not need to be labeled as containing a potential CMR (carcinogenic, mutagenic and reprotoxin) element.

Key Properties:

- Nitrogen-strengthened, austenitic stainless steel
- Improved tensile, impact, and fatigue strength
- Crevice and pitting corrosion resistance
- Non-magnetic and essentially ferrite-free

Markets:

- Medical

Applications:

- Implantable orthopedic parts
- Bone plates
- Bone screws
- Hip components
- Knee components

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Corrosion resistance

The superior corrosion resistance of BioDur 734 stainless over BioDur 316LS and the alloy's freedom from ferrite are a result of the balance of chromium, nickel, molybdenum, and nitrogen in the alloy. The material exhibits excellent resistance to pitting and crevice corrosion, as well as corrosion fatigue

The pitting resistance equivalent number (PREN) is a qualitative method for predicting the resistance to pitting corrosion attack of stainless steel alloys based on chemical composition. Stainless steel alloys with higher PREN values generally exhibit a higher resistance to localized pitting corrosion. The exact formula used to calculate PREN can vary slightly within industry, but a commonly accepted version is PREN = wt% Cr + (3.3 x wt% Mo) + (16 x wt% N). Using this formula, the PREN of BioDur 734 is calculated to be 33.4, which is a significant improvement over a PREN of 27.2 for BioDur 316LS. BioDur 734's higher PREN value is mainly attributed to the higher chromium and nitrogen content over that of BioDur 316LS.

PITTING RESISTANCE EQUIVALENT NUMBERS FOR BIODUR ALLOYS

ALLOY	PREN VALUE
BioDur 316LS	27.2
BioDur 734	33.4
BioDur 108	38.8

IMPORTANT NOTE: The following 4-level rating scale is intended for comparative purposes only. Corrosion testing is recommended; factors which affect corrosion resistance include temperature, concentration, pH, impurities, aeration, velocity, crevices, deposits, metallurgical condition, stress, surface finish, and dissimilar metal contact.

Nitric Acid	Excellent	**Sulfuric Acid**	Moderate
Phosphoric Acid	Moderate	**Acetic Acid**	Good
Salt Spray (NaCl)	Excellent	**Sour Oil/Gas**	Moderate
Humidity	Excellent		

Physical properties

PROPERTY	English Units	Metric Units
DENSITY	0.2800 lb/in^3	—
MEAN COEFFICIENT OF THERMAL EXPANSION	9.20 x 10^{-6} in/in/°F	—

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Magnetic properties

MAGNETIC PERMEABILITY	< 1.0200 μ

Typical mechanical properties

ALLOY	CONDITION	COLD WORK	0.2% YIELD STRENGTH		ULTIMATE TENSILE STRENGTH		ELONGATION	REDUCTION OF AREA
		%	ksi	MPa	ksi	MPa	%	%
BioDur 734	Annealed	—	65	448	122	841	39	58
	Cold worked	5	85	586	124	855	32	66
	Cold worked	35	128	883	170	1172	18	48
BioDur 316LS	Annealed	—	38	248	85	568	57	88
	Cold worked	5	56	386	88	607	—	73
	Cold worked	35	115	793	125	862	18	72
BioDur 108	Annealed	—	85	586	135	931	52	75
	Cold worked	10	114	786	154	1062	37	73
	Cold worked	40	225	1551	251	1731	12	59

Heat treatment

Annealing	Annealing is accomplished by heating in the range of 1922/2102°F (1050/1150°C). Typically, the alloy is annealed at the lower end of this range to preserve the fine grain size that is required by customers who have used this alloy for medical applications.
Hardening	This alloy cannot be hardened by heat treatment. It must be hardened by cold working.

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Workability

Machinability	BioDur 734 stainless has a machinability rating that is approximately 30% of AISI 1212. Slow to moderate speeds, moderate feeds, and rigid tools should be considered; tools must be kept sharp. Chips tend to be tough and stringy. Chip curlers or breakers are helpful. Use a sulfurized cutting fluid, preferably of the chlorinated type. The following typical feeds and speeds should be considered as starting points when developing machining parameters for a special job.

Typical feeds and speeds

The feeds and speeds in the following charts are conservative recommendations for initial setup.
Higher feeds and speeds may be attainable depending on machining environment.

TURNING — SINGLE-POINT AND BOX TOOLS

DEPTH OF CUT, IN	HIGH-SPEED TOOLS			CARBIDE TOOLS (INSERTS)			
	SPEED, FPM	FEED, IPR	TOOL MATERIAL	SPEED, FPM		FEED, IPR	TOOL MATERIAL
				UNCOATED	COATED		
.150	55	.015	M-2	250	300	.015	C-6
.025	70	.007	T-15	300	350	.007	C-7

TURNING — CUT-OFF AND FORM TOOLS

SPEED, FPM	FEED, IPR							TOOL MATERIAL	
	CUT-OFF TOOL WIDTH, IN			FORM TOOL WIDTH, IN				HIGH-SPEED TOOLS	CARBIDE TOOLS
	1/16	*1/8*	*1/4*	*1/2*	*1*	*1-1/2*	*2*		
40	.001	.001	.0015	.0015	.001	.0007	.0007	T-15	—
140	.004	.0055	.0045	.004	.003	.002	.002	—	C-6

ROUGH REAMING

HIGH-SPEED TOOLS		CARBIDE TOOLS		FEED, IPR, REAMER DIAMETER, IN					
SPEED, FPM	TOOL MATERIAL	SPEED, FPM	TOOL MATERIAL	*1/8*	*1/4*	*1/2*	*1*	*1-1/2*	*2*
60	M-7	—	—	.003	.005	.008	.012	.015	.018
—	—	80	C-2	.003	.005	.008	.012	.015	.018

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DRILLING — HIGH-SPEED TOOLS									
SPEED, FPM	FEED, IPR								TOOL MATERIAL
	NOMINAL HOLE DIAMETER, IN								
	1/16	1/8	1/4	1/2	3/4	1	1-1/2	2	
45–50	.001	.002	.004	.007	.010	.012	.015	.018	T-15, M-42

DIE THREADING — HIGH-SPEED TOOLS				
SPEED, FPM				TOOL MATERIAL
7 OR LESS, TPI	8 TO 15, TPI	16 TO 24, TPI	25 AND UP, TPI	
4–8	6–10	8–12	10–15	T-15, M-42

MILLING — END PERIPHERAL												
DEPTH OF CUT, IN	HIGH-SPEED TOOLS						CARBIDE TOOLS					
	SPEED, FPM	FEED, IN PER TOOTH				TOOL MATERIAL	SPEED, FPM	FEED, IPT				TOOL MATERIAL
		CUTTER DIAMETER, IN						CUTTER DIAMETER, IN PER TOOTH				
		1/4	1/2	3/4	1-2			1/4	1/2	3/4	1-2	
.050	65	.001	.002	.003	.004	M-2, M-7	245	.001	.002	.003	.005	C-2

TAPPING — HIGH-SPEED TOOLS	
SPEED, FPM	TOOL MATERIAL
12–25	M-1, M-7, M-10

BROACHING — HIGH-SPEED TOOLS		
SPEED, FPM	CHIP LOAD, IN PER TOOTH	TOOL MATERIAL
10	.003	M-2, M-7

When using carbide tools, surface speed feet/minute (SFPM) can be increased between 2 and 3 times over the high-speed suggestions. Feeds can be increased between 50 and 100%

Figures used for all metal removal operations covered are average. On certain work, the nature of the part may require adjustment of speeds and feeds. Each job has to be developed for best production results with optimum tool life. Speeds and/or feeds should be increased or decreased in small steps.

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Other information

Technical information	Properties of an Essentially Nickel-Free Stainless Alloy for Medical Implants BioDur 316LS Datasheet BioDur 108 Datasheet

For additional information, please contact your nearest sales office:
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