

Heart Valve Programs  
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To Whom It May Concern:

As Shiley no longer manufactures or markets heart valves and the Pfizer Heart Valve Programs have no safety information related to the current types of MRI machines in use and their effect on Shiley heart valves, the Pfizer Heart Valve Programs cannot make a recommendation as to whether any specific medical procedure such as an MRI should or should not be performed.

The struts and flanges of the Bjork-Shiley mechanical valves are made of a material known as HAYNES Alloy 25. Attached is a two-page description of this material distributed by Haynes International, Inc.

You may wish to contact the manufacturer of the MRI machine to obtain additional safety information.

Pfizer Heart Valve Programs  
Pfizer Inc

Enclosure

## HAYNES® alloy 25

### CHEMISTRY: Weight %

Co	Ni	Fe	Cr	W	Mn	Si	C
51*	10	3*	20	15	1.5	0.4*	0.10
* As Balance				*Maximum			

### ALLOY DESCRIPTION:

HAYNES alloy 25 (also known as alloy L-605) is a solid-solution-strengthened superalloy with outstanding high-temperature strength, good oxidation resistance to 1800°F (980°C), and very good resistance to gaseous sulfidation. It is widely used in established aircraft gas turbine engines for fabricated components, for bolts and races in bearings, and for various industrial applications. In modern gas turbine engines, alloy 25 has been largely replaced by newer materials, such as HAYNES alloy 188 and HAYNES 230™ alloy (ask for document H-3135), which possess improved properties. For sulfidizing environments, the newer material, H-160™ alloy, can provide even better performance than this alloy. Alloy 25 may be cold- or hot-formed by various techniques, and is readily weldable by most standard methods.

### PHYSICAL PROPERTIES:

	Temp., °F	British Units	Temp., °C	Metric Units
Density	Room	0.330 lb/in <sup>3</sup>	Room	9.14 g/cm <sup>3</sup>
Melting Range	2425-2570		1330-1410	
Thermal Conductivity	800	120 BTU-in/ft <sup>2</sup> -hr-°F	400	16.6 W/m-K
	1000	135 BTU-in/ft <sup>2</sup> -hr-°F	600	20.7 W/m-K
	1200	150 BTU-in/ft <sup>2</sup> -hr-°F	700	22.6 W/m-K
	1400	165 BTU-in/ft <sup>2</sup> -hr-°F	800	24.7 W/m-K
	1600	182 BTU-in/ft <sup>2</sup> -hr-°F	900	26.9 W/m-K
	1800	200 BTU-in/ft <sup>2</sup> -hr-°F	1000	29.2 W/m-K
Mean Coefficient of Thermal Expansion	70-800	7.8 μin/in-°F	20-500	14.3 μm/m-°C
	70-1000	8.0 μin/in-°F	20-600	14.6 μm/m-°C
	70-1200	8.2 μin/in-°F	20-700	15.1 μm/m-°C
	70-1400	8.6 μin/in-°F	20-800	15.8 μm/m-°C
	70-1600	9.1 μin/in-°F	20-900	16.5 μm/m-°C
	70-1800	9.4 μin/in-°F	20-1000	17.0 μm/m-°C
Electrical Resistivity	400	37.6 μohm-in	200	95.6 μohm-cm
	800	39.1 μohm-in	400	98.5 μohm-cm
	1000	40.4 μohm-in	600	104.3 μohm-cm
	1200	41.8 μohm-in	700	106.6 μohm-cm
	1400	42.3 μohm-in	800	107.8 μohm-cm
	1600	40.6 μohm-in	900	101.1 μohm-cm
	1800	37.7 μohm-in	1000	95.0 μohm-cm

### HEAT TREATMENT (AMS 5537 - Sheet and Strip):

2225°F (1220°C)/Bright Anneal

# HAYNES® alloy 25

## DYNAMIC MODULUS OF ELASTICITY:

Temp., °F	10 <sup>4</sup> psi	Temp., °C	GPa	Temp., °F	10 <sup>4</sup> psi	Temp., °C	GPa
70	32.6	20	225	1200	25.8	700	174
400	31.0	200	214	1400	24.3	800	163
800	28.3	400	197	1600	22.8	900	154
1000	26.9	600	181	1800	21.4	1000	146

## TYPICAL TENSILE PROPERTIES, SHEET (AMS 5537):

Test Temperature		Ultimate Tensile Strength		0.2% Yield Strength		Elongation
°F	°C	Ksi	MPa	Ksi	MPa	In 2 in (51mm)
ROOM	ROOM	146	1005	69	475	51
1000	540	112	770	48	330	60
1200	650	108	745	48	330	60
1400	760	93	640	41	285	42
1600	870	60	415	36	250	45
1800	980	34	235	18	125	36
2000	1095	23	160	11	76	48

## TYPICAL STRESS-RUPTURE STRENGTH, SHEET (AMS 5537):

Test Temperature		Approximate Initial Stress, Ksi (MPa) to Produce Rupture in:					
°F	°C	10 Hours		100 Hours		1000 Hours	
1200	650	82.0	(565)	69.0	(475)	57.0	(395)
1300	705	64.0	(440)	50.0	(345)	38.0	(260)
1400	760	47.0	(325)	36.0	(250)	26.0	(180)
1500	815	34.0	(235)	24.7	(170)	18.1	(125)
1600	870	24.0	(165)	17.5	(120)	12.0	(83)
1700	925	17.3	(120)	11.8	(81)	7.2	(50)
1800	980	11.8	(81)	7.2	(50)	4.0	(28)

## PROPERTIES DATA:

The data and information in this publication are based upon work conducted principally by Haynes International, Inc. and occasionally supplemented by information from the open literature, and are believed to be reliable. However, we do not make any warranty or assume any legal liability or responsibility for its accuracy, completeness or usefulness. We also make no warranty of results to be obtained for any particular use of the information herein contained. Material safety data sheets are available from Haynes International, Inc.

• HAYNES, HR-160, and 230 are trademarks of Haynes International, Inc.

## AVAILABLE FORMS: (Routine Production)

Sheet & Strip	- 0.012 to 0.187" (0.30 to 4.75 mm)
Plate	- 0.1875 to 2.0" (4.76 to 50.8 mm)
Bar	- 0.250-5.0" (6.3 to 127.0 mm) dia.
Billet	- 4.0-12.0" (101.6 to 304.8 mm) dia.
Wire	- 0.035 to 0.187" (0.89 to 4.75 mm) dia.
Pipe	- 1/4" sched. to 8" sched. welded
Tube	- 1/2" O.D. to 8" O.D. welded