T020179-00-E HEPI Actuator 2 Assembly Oct 24 2002

Directory 1

Pictures of the bellows leak area showing the weld assist inner band.

Directory 2

Here are some more pics of a Hyspan bellows that has many very questionable features. Some areas look like the welding proceeded well but there are areas that appear to have needed quite a lot of filler rod. Or it could have been areas that were welded and then needed to be repaired after it leaked. It would be very hard to tell which was the case.

What can't be shown by a photograph is the waviness of the convolutions. This might not be a problem, but reflects the quality of the part.

What appears to be the resistance weld of the small weld assist band can be seen on the inside of the bellows as shown.

Note the inner weld assist band between the bellows and the large weld assist ring.

Also note the several places where the bellows does not sit flush with the surface by the weld.

Directory 3

Here is some pics of the Ameriflex bellows that Jim Edwards sent overnight after talking to him yesterday evening at 6:30 CDT. I received it this morning at 9:00. This isn't Hyspan.

He has the print and I will contact him today.

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Another problem is that if the Hyspan bellows are that delicate and require such careful installation, how can they be trusted in service over a long period?

The Ameriflex bellows have their weld assist flange made in such a way that any welding on the flange will not stress the bellows to flange joint much. Notice the flair and how nice the weld is.

Soldering to Nitinol

Here is an application note from Indalloy describing an allow they recommend for soft soldering our leaks. This is a possibility to attach the bellows to the plate as well.

Attached are pics of the bellows leak area showing the weld assist inner band.

10/24/2002

jkern@caltech.edu

No2 Leak Area 1.jpg

No2 Leak Area 3.jpg

No2 Leak Area 4.jpg

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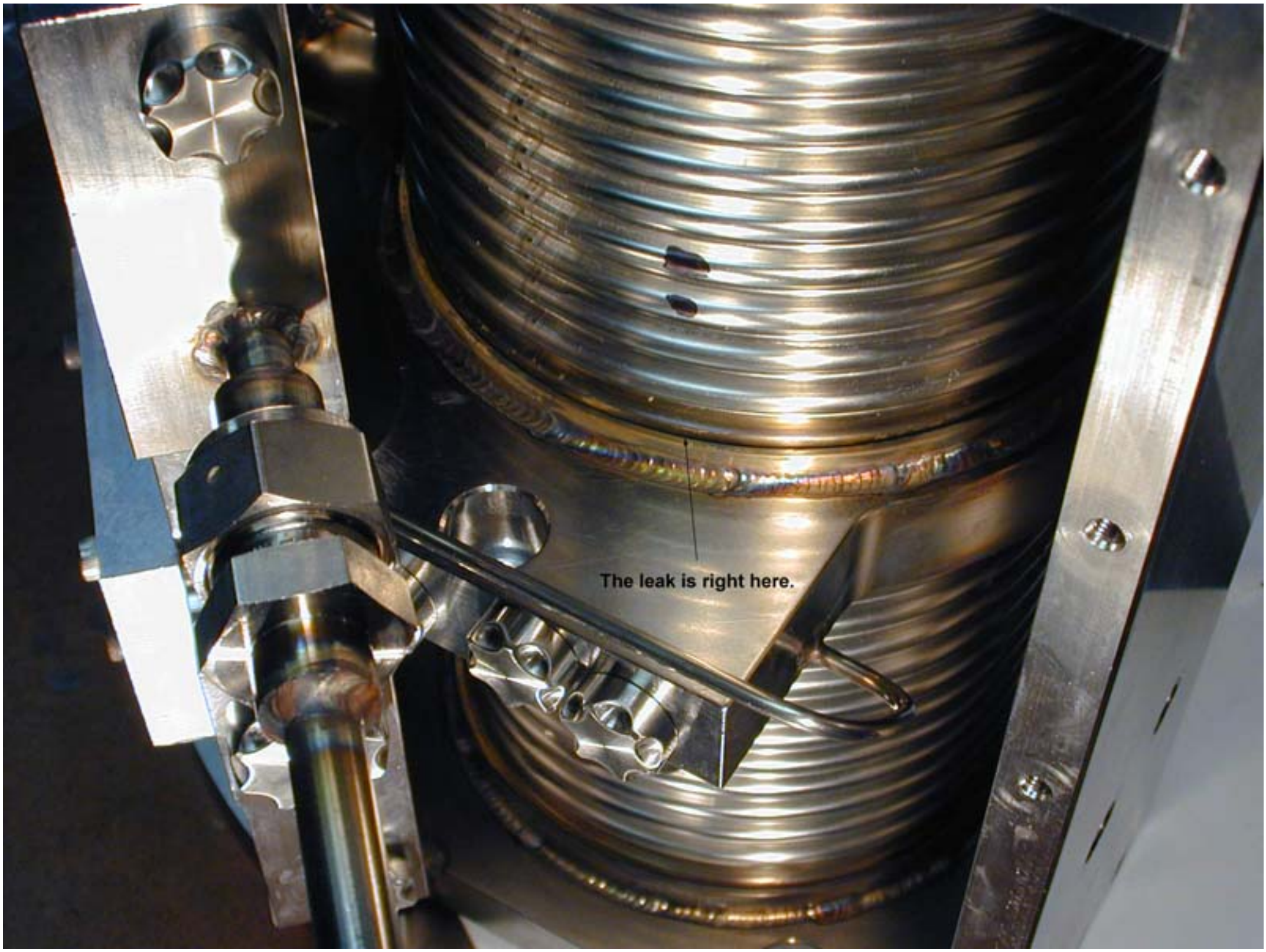

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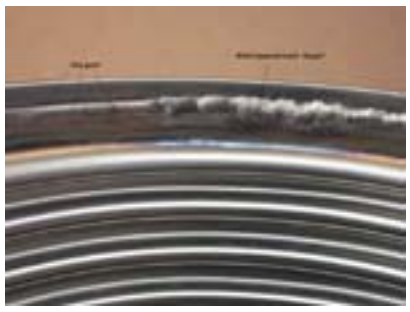
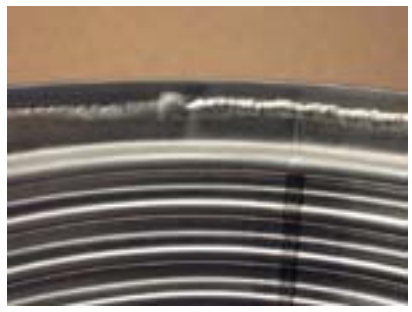
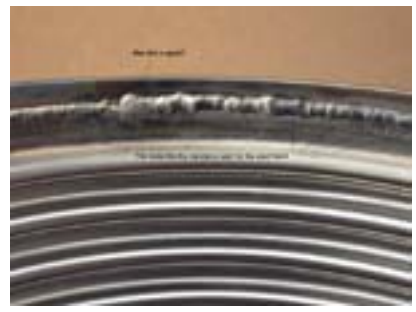


Suspect Weld 1.jpg



Suspect Weld 2.jpg



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Suspect Weld 4.jpg

Suspect Weld 5.jpg

Suspect Weld 6.jpg

Suspect Weld 7.jpg

Suspect Weld 8.jpg

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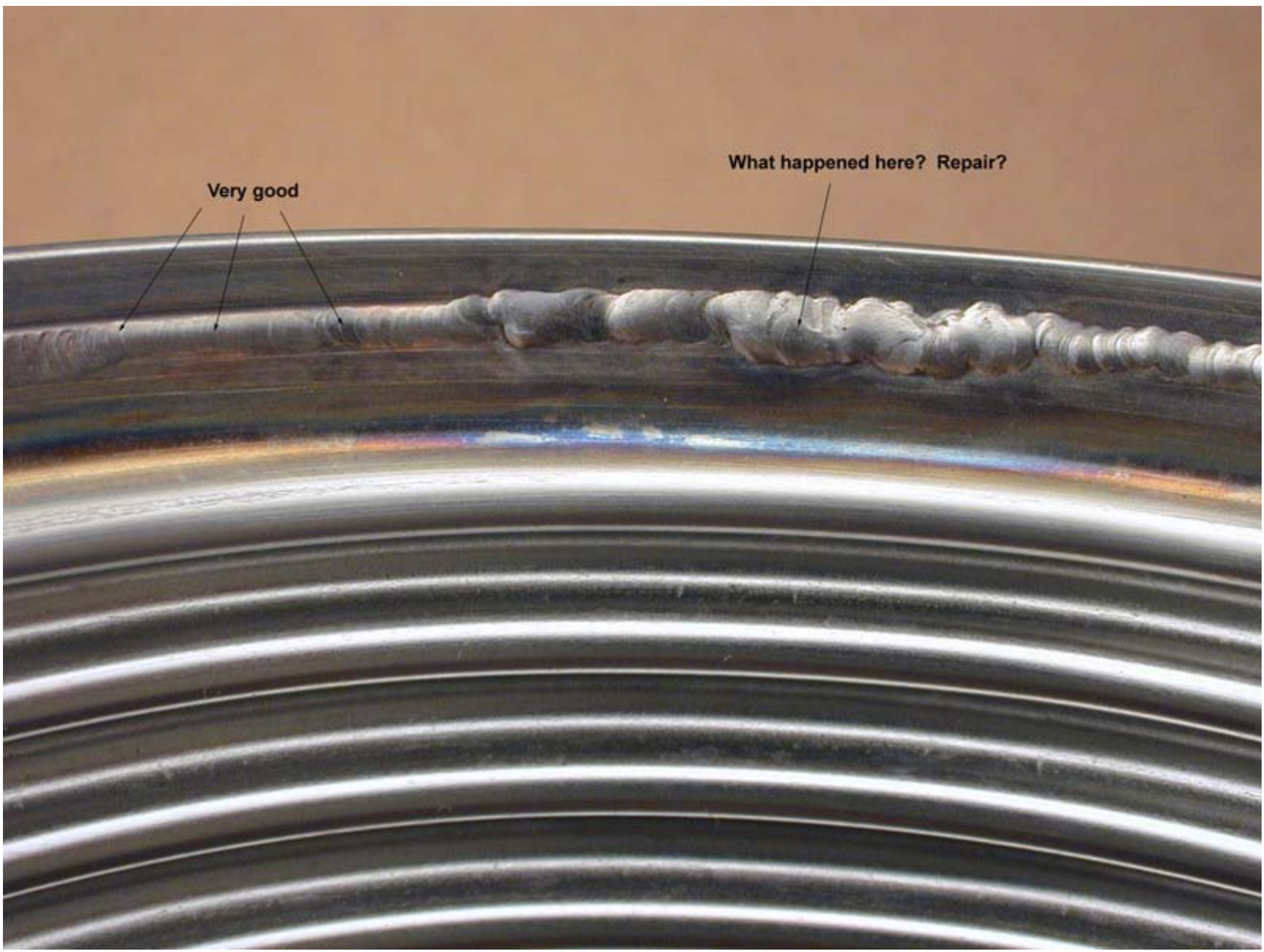

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SOLDERING TO NITINOL

Nitinol (nickel/titanium alloy) has increasingly become a very popular material in the medical industry, largely due to its shape memory characteristics, where it is often used in stents, catheters and other implants. Medical device manufacturers often wish to mechanically bond Nitinol to another metallic material, such as stainless steel, using a solder alloy.

The key to soldering to Nitinol is using an appropriate flux that will effectively reduce both the nickel and titanium surface oxides. Since the devices are used in the human body, it is important that the selected solder alloy has minimum biological activity and the flux residue is completely removed after the soldering operation. Therefore, it is imperative that the selected solder alloy contains no high toxicity metals such as lead, antimony or cadmium.

The tin-silver eutectic solder, 96.5% tin, 3.5% silver (Indalloy #121), is a preferred alloy in that the tensile strength of this solder is high, has a reasonable melting temperature of 221°C, is lead-free, and wets well to Nitinol. The gold-tin eutectic solder, 80% gold, 20% tin, (Indalloy #182), has even higher tensile strength along with a good resistance to peel and with a melting temperature of 280°C can withstand autoclaving temperatures. In using this alloy a nitrogen protective cover gas gave more consistent results and simplified flux removal. The high gold content is also very acceptable for in vivo applications. Although these solder alloys have lower toxicity than common tin-lead solder, it is imperative that the medical manufacturer conduct the necessary tests to insure that the constituents will have no adverse health effects when used in a particular application within the human body.

In wettability tests, it was found that Indalloy Flux #2 provides the best wettability to Nitinol. Soldering temperature should be 25° to 50°C. above the liquidus temperature of the solder. Adequate post soldering cleaning of the flux residue using detergent, water and mechanical scrubbing should be performed to insure that all traces of the flux are removed. Appropriate testing should be done to insure that all traces of the flux have been removed.

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INDALLOY SPECIALTY ALLOYS

Indalloy Number	TEMP Liquidus		TEMP Solidus	Elemental Compostion (% by Mass)	
	°C		°C		
121	221	E	221	**96.5 Sn**	**3.5 Ag**

MECHANICAL PROPERTIES

TEMP Liquidus	TEMP Solidus	Density		Electrical Conductivity ..72µohms-cn	Thermal Conductivity @ 85°C	Thermal Coefficient Expansion @ 20°C	Tensile Strength	Shear Strength	Young's Modulus	Elongation	Brinell Hardness	Latent Heat of Fusion	Specific Heat SOLID	Specific Heat LIQUID	Indalloy Number
°F	°F	lb/in³	gm/cm³	% of IACS	W/cm-°C	PPM/°C	PSI	PSI	PSI x 10⁶	%		J/g	J/g-°C	J/g-°C	
430	430	0.2659	7.36	16	.33	30	5620			73	40				**121**

Lead free high temp solder. Excellent thermal fatigue properties. Not recommended for soldering to gold thicker than 0.5 microns.

NOTES

note 1: Brinell Hardness, 2mm ball, 4kg load
note 2:Modified Brinell hardness, using 100-kg load, 1/2 min.
note 3:Depends on specimen preparation.
note 4:% elongation on 5.65 (sq. root Area) gauge length

Conversions:

Resistivity of IACS / Elec. conductivity %IACS = Resistivity of alloy
ex: 1.72 x 100 / %IACS = micro ohm - cm

Consult with an Indium Technical Representative to discuss your application and receive any updated or corrected alloy information.