NASA SUPPORT LABS
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Customer	Heartland Solutions
Product	Oilsafe-AR
NSL Code #	11-0103
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Test Immersion Corrosion Testing of Metal

Applicable Standard ASTM G31-72 and NACE Standard TM0169-76

Procedure Two mild steel specimens SAE C1020 (area 18.61cm^2 , Density 7.87 g/cm^3) and two 7075-T6 non-clad Aluminum (area 18.54 cm^2 , density 2.80 g/cm^3) specimens are subjected to Immersion Corrosion Testing as outlined in ASTM G31-72 and NACE Standard TM0169-76. The Aluminum and Steel specimens are immersed Into separate containers of the test substance.

Each container held a volume of 1170 g of test solution. The temperature of the Solution was maintained at 55^{o}C for the entire test duration. The test was conducted For a period of 72 hours.

Metal specimens were circular metal coupons having dimensions of 0.3175 cm Thick, 3.175 cm outer diameter and a 0.9525 cm thru centered mounting hole. The alloys have the following composition.

7075-T6 non-clad Aluminum		SAE C1020 Steel	
Al	90.030	Al	0.040
Cr	0.190	C	0.180
Cu	1.480	Cr	0.040
Fe	0.210	Fe	99.260
Mg	2.360	Mn	0.420
Mn	0.040	Mo	0.020
Si	0.070	Ni	0.020
Ti	0.030	P	0.010
V	0.020	S	0.010
Zn	5.570	Si	0.030

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Prior to initial weighing, the coupons were washed with a 50/50 blend of Petroleum ether and methanol and dried at 55°C.

After immersion for the specified time interval the Aluminum specimens were cleaned in a 70% HNO_3 solution and scrubbed with a plastic scouring pad to remove corrosion products.

The mild steel specimens were cleaned in concentrated HCL with 50g/L Tin Chloride and 20g/L Antimony Trichloride and scrubbed with a plastic scouring pad. The specimens were allowed to dry and the weight loss, if any, was noted. The corrosion rate is calculated assuming that all weight loss is due to general corrosion and not to localized corrosion. The corrosion rate expressed as millimeters per year (mmpy) is:

$$\text{mmpy} = \text{wt loss} \times 87.6 \div \text{area} \div \text{time} \div \text{metal density}$$

where weight loss is in mg, area in cm^2 of metal surface exposed and time is hours immersed.

Results **1) SAE 1020 Steel**

Neither sample exhibited discoloration. No pitting was observed.

The corrosion rate based on the 72 hour interval and assuming no localized corrosion is present, averaged 1.21 mm/y.

Table of Results

Specimen #	Immersion Time (hours)	Apparent Corrosion Rate (mm/y)
1	72	0.2604
2	72	0.2805
Avg.	**72**	**0.2704**

2) 7075-T6 non-clad Aluminum

Both samples were found to be severely and evenly corroded, having lost considerable mass. Noticeable gassing was observed on the coupons for the entire 72 hours. No localized pitting was observed.

The corrosion rate, based on the 72 hour interval and assuming no localized corrosion is present, averaged 129.67mm/y.

Table of Results

Specimen #	Immersion Time (hours)	Apparent Corrosion Rate (mm/y)
1	72	1.306
2	72	1.286
Avg.	**72**	**1.296**

Conclusion: The corrosion rate of Heartland Solutions Oilsafe-AR does not exceed 6.25 millimeters per year on SAE C1020 Steel.

The corrosion rate of Heartland Solutions Oilsafe-AR does not exceed 6.25 millimeters per year on 7075-T6 non-clad Aluminum.

Heartland Solutions Oilsafe-AR is deemed Non-Regulated by the Canadian TDG.
Heartland Solutions Oilsafe-AR is deemed Non-Regulated by the US DOT.

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