

APPENDIX A
LPR STANDARD OPERATING PROCEDURE

LPR Corrosion Study Standard Operation Procedure

Alloys: AA356.2, A36, AA6061-T6, CDA 360, AZ91C-T6

Project: NCHRP, 404-0355-03

June 14, 2005

1.0 Pre-Test Preparation:

1.1 Glass cleaning:

- Acid-clean glass beakers and graduated cylinder with 1:1 HCl
 - Rinse all surfaces very well
 - Dump waste acid in waste acid vessel for disposal
 - If solution becomes quite coloured, then repeat
- Rinse flasks well with tap water
- Rinse with reverse osmosis de-ionized water >4 times
- Inspect glassware

1.2 Electrode holder cleaning:

- Wash electrode holder under tap with soap and water, rubbing gently with cloth
- Rinse well with tap water and then alcohol
- Visually inspect for cleanliness

1.3 Electrode cleaning:

- Sandpaper clean electrodes on drill press (wet for magnesium sample)
 - Use separate sandpaper (600 grit) for each sample, avoid cross-contamination of metals
 - Thread 32tpi holder shaft into sample then put other end of threaded shaft into drill press
 - At high speed gently pinch paper between thumb and fingers around sample and slide up and down exposing all fresh metal and evenly abrading sample, press paper flat onto end of electrode
 - Stop when all previous corrosion product is removed
 - Repeat pinching of sample with paper towel while spinning sample to remove any other debris
- Rinse off with alcohol and gloved finger rub, flush threaded hole, then blow-dry
- Maintain cleanliness of samples at all times by avoiding touching them with bare hands to avoid depositing oil, or contacting them with dirty surfaces
- Store in closed clean petri dish
- Weigh samples when dry and measure dimensions

2.0 Performance of LPR Test:

2.1 Sample cell assembly:

- Measure solution into graduated cylinder to nearest ml.
 - Initially rinse graduated cylinder with a very small amount (~15 ml) of test solution and discard
 - Shake flask as dry as possible
 - 1% and 10% tests require a 750 ml solution; full strength solutions require 500 ml
- Pour solution into test beaker; CDA 360 full strength requires waisted beaker to increase solution height
- Put clean rubber washer on electrode holder and screw electrode on firmly so to form a seal
- Order electrodes in sample cell, left to right: electrode 1 on holder A, 2 on B, and 3 on C, or as necessary and record
- For 15 minute reading times of 1% and 10% solutions immerse assembled tops into solution at 16 minute intervals, noting initial immersion time. For 3 minute reading of 100% solution, immerse 4 minutes apart
- Plug leads hanging from the test stand into the probe holders, A on left, B centre, C right

2.2 Data acquisition:

- Prepare data sheets from template, update solution, date, and test number
- After assembly and immersion of final cell, take potential reading of first cell
 - Instrument
 - Plug and screw lead from MS1500L into test stand plug above sample
 - Turn MS1500L on (slide switch on bottom left to the right)
 - Push ENTER key to enter the electrode selection menu
 - Push arrow keys to move to required electrode (specifies alloy, corrosion/potential, duration)
 - Push ENTER to select
 - Push arrow key to select MAKE MEASUREMENT
 - Verify info in window is correct
 - Push ENTER again to start
 - Almost instantly a POT value will appear in window, push ENTER to save and record on worksheet
- Note temperature and observations
- Repeat for each cell, 16 minutes apart and after 72-hour corrosion reading (4 minutes and 24 hours for 100%)

-Take corrosion measurements 3, 6, 24, 48, and 72 hours after initial immersion (1, 3, 6, 24 hours for 100%)

Instrument

- Turn on
 - Push ENTER key to enter the electrode selection menu
 - Push arrow keys to move to required electrode
 - Push ENTER to select
 - Push arrow key to select MAKE MEASUREMENT
 - Verify info in window is correct
 - Push ENTER again to start
 - After 15 minutes, a MPY value appears in window, push ENTER to save, record value on worksheet
- Repeat measurement process on each cell, 16 minutes apart
- Take potential reading for each cell after 72-hour corrosion reading (24 hours for 100%)

3.0 Completion of Test:

- Take photos of any unusual phenomena
- Remove samples from solution, confirm ordering of electrodes
- Individually ultrasonic clean each alloy sample in a beaker of Alconox solution (~1 hr)
- Rub samples with paper towel, rinse with alcohol, flush tapped hole, blow dry, and weigh
- If necessary, submit for visual examination
- Upload data from MS1500L data logger to PC
- Complete hand-notated table filled during test, transfer to digital Excel copy and save to folder for that test



Figure A-1 – General View of LPR Test Arrangement with Meter Affixed to Brass (CDA 360) Samples

APPENDIX B
CORROSION TEST WORKSHEET AND SUMMARY

Table B-1 – NCHRP Corrosion Test Worksheet and Summary

NCHRP Corrosion Test Work Sheet and Summary

Project:

Solution: # [redacted]
 Concentration: % [redacted]
 Soln Volume: ml [redacted]
 Start Date:
 End Date: 3-Jan-00

Test #

Test coupon alloy	UNS No.	Probe ID corr.	pot.	Mass after cleaning, pretest (g)	Immersion time	1.0 hr potential (mV)	3 hr corr (mpy)	6 hr corr (mpy)	24 hr corr (mpy)	48 hr corr (mpy)	72 hr corr (mpy)	72 hr potential (mV)	Mass after test and US cleaning (g)	Mass change (g)	Coupon order	Probe Length (in)	Probe Dia. (in)	Approx. Probe Area (in ²)	Metal Density g/cc	MPY
AA 356.2	A03562	1	2	1 2 3	0:00	1:04	3:00	6:00	0:00	0:00	0:00	0:15	1 2 3	0.0000 0.0000 0.0000	A B C	1.606 1.608 1.606	0.235 0.238 0.239	1.229 1.247 1.251	2.68 2.68 2.68	0.00 0.00 0.00
A36	K02600	3	4	1 2 3	0:16	1:20	3:16	6:16	0:16	0:16	0:16	0:31	1 2 3	0.0000 0.0000 0.0000	A B C	1.778 1.784 1.782	0.232 0.234 0.233	1.338 1.354 1.347	7.60 7.60 7.60	0.00 0.00 0.00
AA 6061-T6	A96061	5	6	1 2 3	0:32	1:36	3:32	6:32	0:32	0:32	0:32	0:47	1 2 3	0.0000 0.0000 0.0000	A B C	1.743 1.745 1.742	0.232 0.231 0.230	1.313 1.308 1.300	2.70 2.70 2.70	0.00 0.00 0.00
CDA 360	C36000	7	8	1 2 3	0:48	1:52	3:48	6:48	0:48	0:48	0:48	1:03	1 2 3	0.0000 0.0000 0.0000	A B C	3.251 3.248 3.244	0.239 0.239 0.239	2.486 2.484 2.481	8.49 8.49 8.49	0.00 0.00 0.00
Mg AZ91C	M11914	9	10	1 2 3	1:04	2:08	4:04	7:04	1:04	1:04	1:04	1:19	1 2 3	0.0000 0.0000 0.0000	A B C	2.065 2.060 1.952	0.340 0.342 0.340	2.297 2.305 2.176	1.81 1.81 1.81	0.00 0.00 0.00

Observations:

A = Reference B = Test C = Auxiliary

0 Hr

1 Hr

6 Hr

24 Hr

48 Hr

72 Hr





APPENDIX C
CORROSION RATE DATA SUMMARIES

Table C-1 – Corrosion Rate Data Summary for AA356.2 Cast Aluminum Alloy

Corrosion Rate Data Summary - A356.2, Cast Aluminum Alloy

Soln		Corr MPY														
		2	3	6	10	13	17	20	21	26	29	32	37	40	41	42
Conc %	Time Hr	NaCl + OMB	NaCl + OMB	NaCl	NaCl + P	CaCl ₂	CaCl ₂ + OMB	CaCl ₂ + C, A	CaCl ₂ + OMB	MgCl ₂	MgCl ₂ + OMB, TEA	MgCl ₂ + OMB	Blended Chloride	CMA	CMAK	KA
100	1	55.45	73.3	81.68	9.36	3	14.31	64.6	73.13	67.73	58.61	0.09	0	0.04	61.4	74.61
	3	28.95	73.45	79.23	16.23	2.85	30.21	57.47	75.13	72.42	54.26	0.19	0.18	0.06	72.55	78.95
	6	23.71	72.4	81.54	41.64	1.46	30.89	79.57	77.28	78.93	52.04	0.21	56.97	0.05	77	83.5
	24	52.52	68.58	78.59	43.61	0.97	35.16	73.85	76.24	81.05	44.3	0.27	38.45	0.04	83.61	84.58
	AVE	40.16	71.93	80.26	27.71	2.07	27.64	68.87	75.45	75.03	52.30	0.19	23.90	0.05	73.64	80.41
	MAX	55.45	73.45	81.68	43.61	3.00	35.16	79.57	77.28	81.05	58.61	0.27	56.97	0.06	83.61	84.58
	MIN	23.71	68.58	78.59	9.36	0.97	14.31	57.47	73.13	67.73	44.30	0.09	0.00	0.04	61.40	74.61
	STDEV	16.15	2.28	1.58	17.47	1.01	9.15	9.79	1.78	6.10	5.99	0.07	28.51	0.01	9.34	4.57
	RSD	40%	3%	2%	63%	49%	33%	14%	2%	8%	11%	39%	119%	20%	13%	6%
	10	3	16.14	7.73	17.27	5.44	15.99	56.28	127	44.95	6.43	0.16	22.14	24.3	0.07	37.28
6		13.02	6.47	16.28	3.9	16.63	57.98	100.93	43.98	12.74	0.42	42.44	26.51	0.09	37.69	49.23
24		14.47	3.68	14.29	1.54	35.1	63.57	53.52	37.58	32.09	0.75	52.48	28.03	0.03	37.03	42.87
48		12.03	4.2	11.14	0.13	43.98	59.9	51.83	36.09	38.31	0.34	52.09	26.9	0.05	35.83	37.36
72		11.66	4.82	12.49	0.03	48.14	56.93	62.05	35.24	39.97	0.50	52.32	24.69	0.01	35.24	35.41
AVE		13.46	5.38	14.29	2.21	31.97	58.93	79.07	39.57	25.91	0.43	44.29	26.09	0.05	36.61	42.99
MAX		16.14	7.73	17.27	5.44	48.14	63.57	127.00	44.95	39.97	0.75	52.48	28.03	0.09	37.69	50.09
MIN		11.66	3.68	11.14	0.03	15.99	56.28	51.83	35.24	6.43	0.16	22.14	24.30	0.01	35.24	35.41
STDEV		1.85	1.68	2.55	2.39	15.05	2.93	33.39	4.56	15.35	0.22	13.10	1.56	0.03	1.03	6.68
RSD		14%	31%	18%	108%	47%	5%	42%	12%	59%	50%	30%	6%	63%	3%	16%
1	3	0.48	0.04	0.09	3.34	0	0.02	25.63	0	0.33	0.01	0.05	0.01	0.05	0.02	0.01
	6	1.05	0.04	0.49	0.37	0	0.01	7.02	0.02	0.34	0.02	0.13	0	0.01	0	0
	24	0.01	0.05	0.31	0.08	0	0	2.64	0.04	0.07	0.02	0.01	0.01	0	0	0.02
	48	0.06	0.11	0.21	0.09	0.06	0.03	0.62	0.01	0.01	0.11	0.5	0.01	0.01	0.01	0.02
	72	0.16	0.05	0.34	0.50	0.18	0.01	0.45	0.03	0.00	0.64	0.36	0.02	0.00	0.01	0.04
	AVE	0.35	0.06	0.29	0.88	0.05	0.01	7.27	0.02	0.15	0.16	0.21	0.01	0.01	0.01	0.02
	MAX	1.05	0.11	0.49	3.34	0.18	0.03	25.63	0.04	0.34	0.64	0.50	0.02	0.05	0.02	0.04
	MIN	0.01	0.04	0.09	0.08	0.00	0.00	0.45	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
	STDEV	0.43	0.03	0.15	1.39	0.08	0.01	10.60	0.02	0.17	0.27	0.21	0.01	0.02	0.01	0.01
	RSD	122%	51%	52%	159%	163%	81%	146%	79%	114%	170%	101%	71%	148%	105%	82%



Table C-2 – Corrosion Rate Data Summary for A36 Structural Steel

Corrosion Rate Data Summary - A36, Structural Steel

Soln		Corr MPY														
Conc %	Time Hr	2	3	6	10	13	17	20	21	26	29	32	37	40	41	42
		NaCl + OMB	NaCl + OMB	NaCl	NaCl + P	CaCl ₂	CaCl ₂ + OMB	CaCl ₂ + C, A	CaCl ₂ + OMB	MgCl ₂	MgCl ₂ + OMB, TEA	MgCl ₂ + OMB	Blended Chloride	CMA	CMAK	KA
100	1	0	1.64	2.09	3.28	0.58	2.7	2.19	6.85	2.56	2.19	0.76	4.43	0.05	0.01	0
	3	0.05	1.22	1.64	2.41	0.56	1.96	1.92	7.78	2.27	1.94	0.69	3.44	0.13	0	0
	6	0.01	1.06	1.5	2.08	0.54	1.1	1.52	17.57	1.32	1.59	0.62	2.56	0.01	0.01	0
	24	32.94	0.94	1.12	0.52	0.36	0.45	0.82	4.03	0.15	0.86	0.38	0.17	0.03	0.22	0
	AVE	8.25	1.22	1.59	2.07	0.51	1.55	1.61	9.06	1.58	1.65	0.61	2.65	0.06	0.06	0.00
	MAX	32.94	1.64	2.09	3.28	0.58	2.70	2.19	17.57	2.56	2.19	0.76	4.43	0.13	0.22	0.00
	MIN	0.00	0.94	1.12	0.52	0.36	0.45	0.82	4.03	0.15	0.86	0.38	0.17	0.01	0.00	0.00
	STDEV	16.46	0.31	0.40	1.15	0.10	0.98	0.60	5.89	1.09	0.58	0.17	1.82	0.05	0.11	0.00
	RSD	200%	25%	25%	56%	20%	63%	37%	65%	69%	35%	27%	69%	96%	178%	0%
	10	3	5.2	1.31	4.99	3.54	14.35	9.08	2.6	1.43	1.43	1.95	0.01	1.83	0.01	0.01
6	4	1.06	4.94	3.51	9	9.12	2.62	1.3	4.68	1.54	0.03	1.62	0.05	0.01	0.04	
24	3.73	0.72	2.11	1.95	6.11	3.2	4.62	3.2	3.82	1.59	0.01	1.38	1.98	0	0.12	
48	3.27	0.65	1.7	0.205	4.63	1	2.19	4.34	3.91	2.27	0.01	1.22	1.65	0.01	0	
72	4.39	0.50	2.50	2.67	2.80	1.25	2.00	4.63	4.21	3.55	0.05	1.30	2.37	1.74	0.01	
AVE	4.12	0.85	3.25	2.38	7.38	4.73	2.81	2.98	3.61	2.18	0.02	1.47	1.21	0.35	0.04	
MAX	5.20	1.31	4.99	3.54	14.35	9.12	4.62	4.63	4.68	3.55	0.05	1.83	2.37	1.74	0.12	
MIN	3.27	0.50	1.70	0.21	2.80	1.00	2.00	1.30	1.43	1.54	0.01	1.22	0.01	0.00	0.00	
STDEV	0.73	0.33	1.59	1.38	4.51	4.08	1.05	1.57	1.26	0.82	0.02	0.25	1.11	0.77	0.05	
RSD	18%	39%	49%	58%	61%	86%	37%	53%	35%	38%	81%	17%	91%	219%	137%	
1	3	2.34	5.38	3.51	6.69	3.46	1.65	1.45	1.22	4.65	76.51	0.01	3.25	0.08	0.03	0.03
	6	0.91	3.83	3.24	6.94	4.06	2.09	1.72	0.75	1.06	2.26	0.04	3.36	0.12	0.02	0.05
	24	2.37	0.69	3.13	2.47	3.62	1.69	1.63	1.66	2.88	2.24	6.75	2.23	1.79	0.01	0.01
	48	4.3	0.73	4.48	2.74	4.2	1.85	1.69	1.04	2.82	2.27	0.83	2.28	1.61	0.02	0.03
	72	6.35	0.43	3.73	2.81	3.81	3.08	1.84	1.37	2.28	1.51	1.30	4.52	1.79	0.02	0.04
	AVE	3.25	2.21	3.62	4.33	3.83	2.07	1.67	1.21	2.74	16.96	1.79	3.13	1.08	0.02	0.03
	MAX	6.35	5.38	4.48	6.94	4.20	3.08	1.84	1.66	4.65	76.51	6.75	4.52	1.79	0.03	0.05
	MIN	0.91	0.43	3.13	2.47	3.46	1.65	1.45	0.75	1.06	1.51	0.01	2.23	0.08	0.01	0.01
	STDEV	2.11	2.26	0.54	2.27	0.30	0.59	0.14	0.34	1.29	33.29	2.83	0.94	0.90	0.01	0.01
	RSD	65%	102%	15%	53%	8%	28%	9%	28%	47%	196%	158%	30%	83%	35%	46%

Table C-3 – Corrosion Rate Data Summary for AA6061-T6 Wrought Aluminum Alloy

Corrosion Rate Data Summary - AA6061-T6, Wrought Aluminum Alloy

Soln		Corr MPY														
		2	3	6	10	13	17	20	21	26	29	32	37	40	41	42
Conc %	Time Hr	NaCl + OMB	NaCl + OMB	NaCl	NaCl + P	CaCl ₂	CaCl ₂ + OMB	CaCl ₂ + C, A	CaCl ₂ + OMB	MgCl ₂	MgCl ₂ + OMB, TEA	MgCl ₂ + OMB	Blended Chloride	CMA	CMAK	KA
100	1	56.65	75.55	71.52	78.95	4.93	68.82	62.97	104.16	59.94	47.57	55.11	59.46	12.76	74.35	76.44
	3	41.49	73.07	72.1	79.53	2.44	65.17	56.11	90.43	67.37	42.95	48.36	60.16	11.47	84.03	82.19
	6	74.35	71.99	80.06	81.66	1.13	66.13	59.66	103.24	79.46	41.27	43.77	58.78	10.05	78.33	79.04
	24	74.13	71.1	82.2	88.64	0.56	64.81	75.63	81.7	81.07	37.29	33.49	65.09	11.85	44.7	46.91
	AVE	61.66	72.93	76.47	82.20	2.27	66.23	63.59	94.88	71.96	42.27	45.18	60.87	11.53	70.35	71.15
	MAX	74.35	75.55	82.20	88.64	4.93	68.82	75.63	104.16	81.07	47.57	55.11	65.09	12.76	84.03	82.19
	MIN	41.49	71.10	71.52	78.95	0.56	64.81	56.11	81.70	59.94	37.29	33.49	58.78	10.05	44.70	46.91
	STDEV	15.80	1.92	5.46	4.45	1.94	1.81	8.50	10.79	10.08	4.26	9.08	2.87	1.13	17.56	16.33
	RSD	26%	3%	7%	5%	86%	3%	13%	11%	14%	10%	20%	5%	10%	25%	23%
	10	3	31.24	3.4	50.23	36.32	13.11	47.15	20.41	41.52	29.31	8.94	6.64	28.43	0.01	41.32
6		27.42	3.03	46.36	37.17	10.88	48.33	21.46	42.26	35.61	6.9	42.48	30.27	0.04	41.57	36.45
24		21.49	3.53	42.77	38.07	13.02	58.43	26.27	37.57	42.62	5.33	47.51	30.54	0.1	40.13	34.45
48		17.78	7.63	38.9	37.96	43.73	55.14	28.96	36.94	49.38	5.73	52.31	30.09	0.05	39.08	31.21
72		14.98	11.30	37.61	37.95	45.02	52.08	28.45	36.91	52.48	6.48	64.36	29.04	0.04	38.60	33.27
AVE		22.58	5.78	43.17	37.49	25.15	52.23	25.11	39.04	41.88	6.68	42.66	29.67	0.05	40.14	34.40
MAX		31.24	11.30	50.23	38.07	45.02	58.43	28.96	42.26	52.48	8.94	64.36	30.54	0.10	41.57	36.63
MIN		14.98	3.03	37.61	36.32	10.88	47.15	20.41	36.91	29.31	5.33	6.64	28.43	0.01	38.60	31.21
STDEV		6.72	3.61	5.23	0.75	17.58	4.69	3.96	2.63	9.57	1.41	21.71	0.90	0.03	1.32	2.27
RSD		30%	63%	12%	2%	70%	9%	16%	7%	23%	21%	51%	3%	68%	3%	7%
1	3	0.1	0.07	0.75	0.06	1.94	0.04	1.17	0	0.29	0.02	0.09	0.06	0.01	0.02	0.05
	6	0.73	0.04	2.82	0.03	0.87	0.03	1.16	0	0.5	0.15	0.05	0.03	0	0.04	0
	24	0.05	0.01	0.74	0.13	0.24	0	0.29	0	0.1	0.03	0.06	0.01	0.01	0	0.01
	48	0.26	0.13	0	0.46	0.18	0.06	0.19	0.01	0.04	0.02	0.12	0.31	0	0	0.02
	72	0.09	0.13	0.02	0.02	0.04	0.00	0.42	0.03	0.00	0.34	0.24	0.06	0.01	0.02	0.03
	AVE	0.25	0.08	0.87	0.14	0.65	0.03	0.65	0.01	0.19	0.11	0.11	0.09	0.01	0.02	0.02
	MAX	0.73	0.13	2.82	0.46	1.94	0.06	1.17	0.03	0.50	0.34	0.24	0.31	0.01	0.04	0.05
	MIN	0.05	0.01	0.00	0.02	0.04	0.00	0.19	0.00	0.00	0.02	0.05	0.01	0.00	0.00	0.00
	STDEV	0.28	0.05	1.15	0.18	0.79	0.03	0.48	0.01	0.21	0.14	0.08	0.12	0.01	0.02	0.02
	RSD	115%	71%	133%	131%	120%	100%	74%	163%	112%	124%	68%	130%	91%	105%	87%

Table C-4 – Corrosion Rate Data Summary for CDA 360 Free Machining Brass

Corrosion Rate Data Summary - CDA36000, Free Machining Brass

Soln		Corr MPY														
Conc %	Time Hr	2	3	6	10	13	17	20	21	26	29	32	37	40	41	42
		NaCl + OMB	NaCl + OMB	NaCl	NaCl + P	CaCl ₂	CaCl ₂ + OMB	CaCl ₂ + C, A	CaCl ₂ + OMB	MgCl ₂	MgCl ₂ + OMB, TEA	MgCl ₂ + OMB	Blended Chloride	CMA	CMAK	KA
100	1	22.74	12.26	3.69	2.32	0.7	0.5	1.53	48.15	0.12	0	1.87	0.5	6.66	77.15	76.47
	3	16.09	8.23	3.73	3.68	2.97	0.68	1.65	35.79	1.05	0.33	1.45	0.38	10.2	83.6	69.04
	6	12.75	1.73	3.81	3.7	3.2	2.91	0.28	26.3	1.24	0.33	0.54	0.16	17.75	90.63	46.65
	24	1.38	0.55	3.8	3.86	1.79	7.89	0.46	15.07	0.5	0.13	0	0.03	1.2	90.89	22.98
	AVE	13.24	5.69	3.76	3.39	2.17	3.00	0.98	31.33	0.73	0.20	0.97	0.27	8.95	85.57	53.79
	MAX	22.74	12.26	3.81	3.86	3.20	7.89	1.65	48.15	1.24	0.33	1.87	0.50	17.75	90.89	76.47
	MIN	1.38	0.55	3.69	2.32	0.70	0.50	0.28	15.07	0.12	0.00	0.00	0.03	1.20	77.15	22.98
	STDEV	8.93	5.53	0.06	0.72	1.16	3.44	0.71	14.05	0.51	0.16	0.85	0.21	6.94	6.55	24.13
	RSD	67%	97%	2%	21%	53%	115%	72%	45%	70%	82%	88%	79%	77%	8%	45%
	10	3	0.17	0.28	15.7	41.55	24.54	10	2.31	2.32	15.31	0.26	23.27	2.24	38.59	83.01
6		0.2	0.23	20.92	46.07	26.1	11.76	13.77	2.17	16.63	0.26	25.75	1.93	50.23	100.32	44.3
24		0.11	0.09	38.78	57.52	28.11	0.06	25.72	0.48	26.46	0.06	34.4	1.28	72	109.53	111.17
48		0.13	0.01	31.38	49.88	29.35	0.17	27.11	0.13	36.65	0.01	38.52	1.58	82.07	105.65	107.94
72		0.16	0.02	27.67	42.93	13.30	0.14	33.51	0.33	39.43	0.46	39.85	1.94	83.88	89.21	105.39
AVE		0.15	0.13	26.89	47.59	24.28	4.43	20.48	1.09	26.90	0.21	32.36	1.79	65.35	97.54	81.54
MAX		0.20	0.28	38.78	57.52	29.35	11.76	33.51	2.32	39.43	0.46	39.85	2.24	83.88	109.53	111.17
MIN		0.11	0.01	15.70	41.55	13.30	0.06	2.31	0.13	15.31	0.01	23.27	1.28	38.59	83.01	38.92
STDEV		0.04	0.12	8.99	6.41	6.41	5.92	12.41	1.07	11.09	0.18	7.49	0.37	20.07	11.16	36.56
RSD		23%	98%	33%	13%	26%	134%	61%	98%	41%	86%	23%	21%	31%	11%	45%
1	3	10.1	1.35	15.45	1.44	0.41	10.15	1.48	0.44	0.05	2.35	0.13	0.89	0.16	0.24	0.02
	6	2.89	1.29	7.45	1.38	0.57	1.39	1.76	0.57	0.02	6.29	0.02	0.87	0.16	0.22	0.02
	24	0.81	0.09	2.1	1.35	2.95	0.08	1.11	0.34	0.2	0.52	0.09	0.95	0.2	0.06	0.03
	48	0.19	0.11	2.26	1.63	20.82	0.22	0.76	0.59	0.25	2.82	0.07	0.55	0.26	23.21	3.08
	72	0.38	0.03	2.71	1.24	32.43	0.32	1.08	0.11	0.29	7.71	0.12	0.36	0.24	45.37	12.30
	AVE	2.87	0.57	5.99	1.41	11.44	2.43	1.24	0.41	0.16	3.94	0.09	0.72	0.20	13.82	3.09
	MAX	10.10	1.35	15.45	1.63	32.43	10.15	1.76	0.59	0.29	7.71	0.13	0.95	0.26	45.37	12.30
	MIN	0.19	0.03	15.45	1.24	0.41	0.08	0.76	0.11	0.02	0.52	0.02	0.36	0.16	0.06	0.02
	STDEV	4.18	0.68	15.45	0.14	14.50	4.35	0.39	0.20	0.12	2.97	0.04	0.26	0.05	20.26	5.32
	RSD	145%	119%	258%	10%	127%	179%	31%	48%	75%	75%	51%	35%	22%	147%	172%



Table C-5 – Corrosion Rate Data Summary for AZ91C-T6 Magnesium Alloy

Corrosion Rate Data Summary - Alloy AZ91C, Magnesium Alloy

Soln		Corr MPY														
Conc %	Time Hr	2	3	6	10	13	17	20	21	26	29	32	37	40	41	42
		NaCl + OMB	NaCl + OMB	NaCl	NaCl + P	CaCl ₂	CaCl ₂ + OMB	CaCl ₂ + C, A	CaCl ₂ + OMB	MgCl ₂	MgCl ₂ + OMB, TEA	MgCl ₂ + OMB	Blended Chloride	CMA	CMAK	KA
100	1	4.56	OVER	57.15	36.02	133.26	OVER	OVER	OVER	20.97	73.78	32.47	17.35	81.71	18.22	42.92
	3	3.22	OVER	27.04	23.21	51.55	OVER	OVER	OVER	137.5	OVER	90.45	22.39	63.92	12.72	37.09
	6	2.57	142.69	21.54	16.52	49.34	OVER	91.55	OVER	OVER	88.65	OVER	24.54	34.47	12.54	29.94
	24	11.21	76.91	7.77	8.24	32.55	OVER	46.32	124.38	OVER	148.07	123.19	19.95	10.57	12.59	15.59
	AVE	5.39	109.80	28.38	21.00	66.68	na	68.94	124.38	79.24	103.50	82.04	21.06	47.67	14.02	31.39
	MAX	11.21	142.69	57.15	36.02	133.26	0.00	91.55	124.38	137.50	148.07	123.19	24.54	81.71	18.22	42.92
	MIN	2.57	76.91	7.77	8.24	32.55	0.00	46.32	124.38	20.97	73.78	32.47	17.35	10.57	12.54	15.59
	STDEV	3.97	46.51	20.83	11.74	45.19	na	31.98	na	82.40	39.31	45.94	3.10	31.48	2.80	11.79
	RSD	74%	42%	73%	56%	68%	na	46%	na	104%	38%	56%	15%	66%	20%	38%
	10	3	89.64	OVER	OVER	5.95	86.99	88.45	18.41	OVER	58.61	75.93	22	15.12	10.76	8.68
6		33.55	78.05	OVER	7.11	26.35	80.9	22.07	OVER	82.37	61.9	9.98	4.67	7.44	4.97	8.81
24		41.34	16.31	73.18	24.99	33.1	46.55	20.29	32.85	65	47.94	15.37	1.56	3.26	3.91	2.47
48		41.95	103.18	98.98	5.15	37.51	49.91	18.74	36.48	50.51	60.29	63.98	8.53	3.01	3.71	1.32
72		37.00	121.42	63.50	7.11	30.67	48.31	9.63	21.63	24.06	56.25	73.58	5.89	2.84	3.63	3.31
AVE		48.70	79.74	78.55	10.06	42.92	62.82	17.83	30.32	56.11	60.46	36.98	7.15	5.46	4.98	5.10
MAX		89.64	121.42	98.98	24.99	86.99	88.45	22.07	36.48	82.37	75.93	73.58	15.12	10.76	8.68	9.57
MIN		33.55	16.31	63.50	5.15	26.35	46.55	9.63	21.63	24.06	47.94	9.98	1.56	2.84	3.63	1.32
STDEV		23.14	45.87	18.34	8.39	24.96	20.16	4.81	7.74	21.41	10.20	29.53	5.11	3.53	2.14	3.81
RSD		48%	58%	23%	83%	58%	32%	27%	26%	38%	17%	80%	71%	65%	43%	75%
1	3	4.57	3.12	2.69	2.77	23.34	9.73	10.76	16.74	2.24	7.28	13.88	0.41	1.39	1.27	1.13
	6	1.25	3.03	0.37	2.25	26.78	11.69	3.86	5.45	1.35	7.33	25.48	5.61	1.01	1.04	1.16
	24	0.22	2.01	1.26	2.1	17.11	7.13	8.02	12.68	0.32	0.07	4.91	1.5	0.36	1.27	0.54
	48	1.74	3.68	0.98	4.12	19.47	5.73	12.23	2.07	2.05	5.6	7.08	8.02	0.33	1.33	0.6
	72	6.46	3.65	0.81	1.31	11.01	5.05	9.14	3.09	0.66	6.55	12.66	1.49	0.25	1.28	0.41
	AVE	2.85	3.10	1.22	2.51	19.54	7.87	8.80	8.01	1.32	5.37	12.80	3.41	0.67	1.24	0.77
	MAX	6.46	3.68	2.69	4.12	26.78	11.69	12.23	16.74	2.24	7.33	25.48	8.02	1.39	1.33	1.16
	MIN	0.22	2.01	0.37	1.31	11.01	5.05	3.86	2.07	0.32	0.07	4.91	0.41	0.25	1.04	0.41
STDEV	2.58	0.68	0.88	1.04	6.03	2.79	3.19	6.40	0.84	3.04	8.01	3.26	0.51	0.11	0.35	
RSD	91%	22%	72%	41%	31%	35%	36%	80%	63%	57%	63%	96%	76%	9%	46%	

Table C-6 – Estimate of Corrosion Rates by Area under Corrosion Rate vs. Time Curve (Integration) for AA356.2 Cast Aluminum Alloy

Estimate of Corrosion Rates by Area Under Corrosion Rate vs. Time Curve (Integration)

A356.2, Cast Aluminum Alloy

		Trapezoidal Area														Average
		2	3	6	10	13	17	20	21	26	29	32	37	40	41	
		NaCl + OMB	NaCl + OMB	NaCl	NaCl + P	CaCl ₂	CaCl ₂ + OMB	CaCl ₂ + C, A	CaCl ₂ + OMB	MgCl ₂	MgCl ₂ + OMB, TEA	MgCl ₂ + OMB	Blended Chloride	CMA	CMAK	KA
100%	Total Area	84.40	146.75	160.91	25.59	5.85	44.52	122.07	148.26	140.15	112.87	0.28	0.18	0.10	133.95	153.56
	Total Area	78.99	218.78	241.16	86.81	6.47	91.65	205.56	228.62	227.03	159.45	0.60	85.73	0.17	224.33	243.68
	Total Area	686.07	1268.82	1441.17	767.25	21.87	594.45	1380.78	1381.68	1439.82	867.06	4.32	858.78	0.81	1445.49	1512.72
	Total Area/24	849.46	1634.35	1843.24	879.65	34.19	730.62	1708.41	1758.56	1807.00	1139.38	5.20	944.69	1.08	1803.77	1909.96
10%	Total Area	35.39	68.10	76.80	36.65	1.42	30.44	71.18	73.27	75.29	47.47	0.22	39.36	0.04	75.16	79.58
	Total Area	43.74	21.30	50.33	14.01	48.93	171.39	341.90	133.40	28.76	0.87	96.87	76.22	0.24	112.46	148.98
	Total Area	247.41	91.35	275.13	48.96	465.57	1093.95	1390.05	734.04	403.47	10.53	854.28	490.86	1.08	672.48	828.90
	Total Area/72	318.00	94.56	305.16	20.04	948.96	1481.64	1264.20	884.04	844.80	13.08	1254.84	659.16	0.96	874.32	962.76
1%	Total Area	284.28	108.24	283.56	1.92	1105.44	1401.96	1366.56	855.96	939.36	10.08	1252.92	619.08	0.72	852.84	873.24
	Total Area	893.43	315.45	914.18	84.93	2568.90	4148.94	4362.71	2607.44	2216.39	34.56	3458.91	1845.32	3.00	2512.10	2813.88
	Total Area/72	12.41	4.38	12.70	1.18	35.68	57.62	60.59	36.21	30.78	0.48	48.04	25.63	0.04	34.89	39.08
	Total Area/72	2.30	0.12	0.87	5.57	0.00	0.05	48.98	0.03	1.01	0.05	0.27	0.02	0.09	0.03	0.02
0.1%	Total Area	9.54	0.81	7.20	4.05	0.00	0.09	86.94	0.54	3.69	0.36	1.26	0.09	0.09	0.00	0.18
	Total Area	0.84	1.92	6.24	2.04	0.72	0.36	39.12	0.60	0.96	1.56	6.12	0.24	0.12	0.12	0.48
	Total Area	2.64	1.92	6.60	7.08	2.88	0.48	12.84	0.48	0.12	9.00	10.32	0.36	0.12	0.24	0.72
	Total Area/72	15.32	4.77	20.91	18.74	3.60	0.98	187.88	1.65	5.78	10.97	17.97	0.71	0.42	0.39	1.40
0.01%	Total Area	0.21	0.07	0.29	0.26	0.05	0.01	2.61	0.02	0.08	0.15	0.25	0.01	0.01	0.01	0.02
	Total Area/72															0.27



Table C-7 – Estimate of Corrosion Rates by Area under Corrosion Rate vs. Time Curve (Integration) for A36 Structural Steel

Estimate of Corrosion Rates by Area Under Corrosion Rate vs. Time Curve (Integration)

A36, Structural Steel

		Trapezoidal Area														Average
		2	3	6	10	13	17	20	21	26	29	32	37	40	41	
		NaCl + OMB	NaCl + OMB	NaCl	NaCl + P	CaCl ₂	CaCl ₂ + OMB	CaCl ₂ + C, A	CaCl ₂ + OMB	MgCl ₂	MgCl ₂ + OMB, TEA	MgCl ₂ + OMB	Blended Chloride	CMA	CMAK	KA
100%	Total Area	0.05	2.86	3.73	5.69	1.14	4.66	4.11	14.63	4.83	4.13	1.45	7.87	0.18	0.01	0.00
	Total Area	0.09	3.42	4.71	6.74	1.65	4.59	5.16	38.03	5.39	5.30	1.97	9.00	0.21	0.02	0.00
	Total Area	296.55	18.00	23.58	23.40	8.10	13.95	21.06	194.40	13.23	22.05	9.00	24.57	0.36	2.07	0.00
	Total Area/24	296.69	24.28	32.02	35.83	10.89	23.20	30.33	247.06	23.45	31.48	12.42	41.44	0.75	2.10	0.00
10%	Total Area/24	12.36	1.01	1.33	1.49	0.45	0.97	1.26	10.29	0.98	1.31	0.52	1.73	0.03	0.09	0.00
	Total Area	13.80	3.56	14.90	10.58	35.03	27.30	7.83	4.10	9.17	5.24	0.06	5.18	0.09	0.03	0.08
	Total Area	69.57	16.02	63.45	49.14	135.99	110.88	65.16	40.50	76.50	28.17	0.36	27.00	18.27	0.09	1.44
	Total Area/72	84.00	16.44	45.72	25.86	128.88	50.40	81.72	90.48	92.76	46.32	0.24	31.20	43.56	0.12	1.44
1%	Total Area/72	91.92	13.80	50.40	34.50	89.16	27.00	50.28	107.64	97.44	69.84	0.72	30.24	48.24	21.00	0.12
	Total Area	259.29	49.82	174.47	120.08	389.06	215.58	204.99	242.72	275.87	149.57	1.38	93.62	110.16	21.24	3.08
	Total Area	3.60	0.69	2.42	1.67	5.40	2.99	2.85	3.37	3.83	2.08	0.02	1.30	1.53	0.30	0.04
	Total Area/72	4.88	13.82	10.13	20.45	11.28	5.61	4.76	2.96	8.57	118.16	0.08	9.92	0.30	0.08	0.12
1%	Total Area	29.52	40.68	57.33	84.69	69.12	34.02	30.15	21.69	35.46	40.50	61.11	50.31	17.19	0.27	0.54
	Total Area	80.04	17.04	91.32	62.52	93.84	42.48	39.84	32.40	68.40	54.12	90.96	54.12	40.80	0.36	0.48
	Total Area	127.80	13.92	98.52	66.60	96.12	59.16	42.36	28.92	61.20	45.36	25.56	81.60	40.80	0.48	0.84
	Total Area/72	242.24	85.46	257.30	234.26	270.36	141.27	117.11	85.97	173.63	258.14	177.71	195.95	99.09	1.19	1.98
		3.36	1.19	3.57	3.25	3.76	1.96	1.63	1.19	2.41	3.59	2.47	2.72	1.38	0.02	0.03

Table C-8 – Estimate of Corrosion Rates by Area under Corrosion Rate vs. Time Curve (Integration) for AA6061-T6 Wrought Aluminum Alloy

Estimate of Corrosion Rates by Area Under Corrosion Rate vs. Time Curve (Integration)

AA6061, Wrought Aluminum Alloy

		Trapezoidal Area														Average
		2	3	6	10	13	17	20	21	26	29	32	37	40	41	
		NaCl + OMB	NaCl + OMB	NaCl	NaCl + P	CaCl ₂	CaCl ₂ + OMB	CaCl ₂ + C, A	CaCl ₂ + OMB	MgCl ₂	MgCl ₂ + OMB, TEA	MgCl ₂ + OMB	Blended Chloride	CMA	CMAK	KA
100%	Total Area	98.14	148.62	143.62	158.48	7.37	133.99	119.08	194.59	127.31	90.52	103.47	119.62	24.23	158.38	158.63
	Total Area/24	173.76	217.59	228.24	241.79	5.36	196.95	173.66	290.51	220.25	126.33	138.20	178.41	32.28	243.54	241.85
	Total Area	1336.32	1287.81	1460.34	1532.70	15.21	1178.46	1217.61	1664.46	1444.77	707.04	695.34	1114.83	197.10	1107.27	1133.55
	Total Area/24	1608.22	1654.02	1832.20	1932.97	27.94	1509.40	1510.35	2149.56	1792.33	923.89	937.01	1412.86	253.61	1509.19	1534.03
10%	Total Area	87.99	9.65	144.89	110.24	35.99	143.22	62.81	125.67	97.38	23.76	73.68	88.05	0.08	124.34	109.62
	Total Area/72	440.19	59.04	802.17	677.16	215.10	960.84	429.57	718.47	704.07	110.07	809.91	547.29	1.26	735.30	638.10
	Total Area	471.24	133.92	980.04	912.36	681.00	1362.84	662.76	894.12	1104.00	132.72	1197.84	727.56	1.80	950.52	787.92
	Total Area/72	393.12	227.16	918.12	910.92	1065.00	1286.64	688.92	886.20	1222.32	146.52	1400.04	709.56	1.08	932.16	773.76
1	Total Area	1392.54	429.77	2845.22	2610.68	1997.09	3753.54	1844.06	2624.46	3127.77	413.07	3481.47	2072.46	4.22	2742.32	2309.40
	Total Area/72	19.34	5.97	39.52	36.26	27.74	52.13	25.61	36.45	43.44	5.74	48.35	28.78	0.06	38.09	32.08
	Total Area	1.25	0.17	5.36	0.14	4.22	0.11	3.50	0.00	1.19	0.26	0.21	0.14	0.02	0.09	0.08
	Total Area/72	7.02	0.45	32.04	1.44	9.99	0.27	13.05	0.00	5.40	1.62	0.99	0.36	0.09	0.36	0.09
1	Total Area	3.72	1.68	8.88	7.08	5.04	0.72	5.76	0.12	1.68	0.60	2.16	3.84	0.12	0.00	0.36
	Total Area	4.20	3.12	0.24	5.76	2.64	0.72	7.32	0.48	0.48	4.32	4.32	4.44	0.12	0.24	0.60
	Total Area	16.19	5.42	46.52	14.42	21.89	1.82	29.63	0.60	8.75	6.80	7.68	8.78	0.35	0.69	1.13
	Total Area/72	0.22	0.08	0.65	0.20	0.30	0.03	0.41	0.01	0.12	0.09	0.11	0.12	0.00	0.01	0.02



Table C-9 – Estimate of Corrosion Rates by Area under Corrosion Rate vs. Time Curve (Integration) for CDA 360 Free Machining Brass

Estimate of Corrosion Rates by Area Under Corrosion Rate vs. Time Curve (Integration)

CDA36000, Free Machining Brass

		Trapezoidal Area														Average	
		2	3	6	10	13	17	20	21	26	29	32	37	40	41		42
		NaCl + OMB	NaCl + OMB	NaCl	NaCl + P	CaCl ₂	CaCl ₂ + OMB	CaCl ₂ + C, A	CaCl ₂ + OMB	MgCl ₂	MgCl ₂ + OMB, TEA	MgCl ₂ + OMB	Blended Chloride	CMA	CMAK	KA	
100%	Total Area	38.83	20.49	7.42	6.00	3.67	1.18	3.18	83.94	1.17	0.33	3.32	0.88	16.86	160.75	145.51	
	Total Area/24	43.26	14.94	11.31	11.07	9.26	5.39	2.90	93.14	3.44	0.99	2.99	0.81	41.93	261.35	173.54	
	Total Area/72	127.17	20.52	68.49	68.04	44.91	97.20	6.66	372.33	15.66	4.14	4.86	1.71	170.55	1633.68	626.67	
	Total Area/24	209.26	55.95	87.22	85.11	57.84	103.77	12.74	549.41	20.27	5.46	11.17	3.40	229.34	2055.78	945.72	
		8.72	2.33	3.63	3.55	2.41	4.32	0.53	22.89	0.84	0.23	0.47	0.14	9.56	85.66	39.40	12.31
10%	Total Area	0.56	0.77	54.93	131.43	75.96	32.64	24.12	6.74	47.91	0.78	73.53	6.26	133.23	275.00	124.83	
	Total Area/24	2.79	2.88	537.30	932.31	487.89	106.38	355.41	23.85	387.81	2.88	541.35	28.89	1100.07	1888.65	1399.23	
	Total Area/72	2.88	1.20	841.92	1288.80	689.52	2.76	633.96	7.32	757.32	0.84	875.04	34.32	1848.84	2582.16	2629.32	
	Total Area/24	3.48	0.36	708.60	1113.72	511.80	3.72	727.44	5.52	912.96	5.64	940.44	42.24	1991.40	2338.32	2559.96	
		9.71	5.21	2142.75	3466.26	1765.17	145.50	1740.93	43.43	2106.00	10.14	2430.36	111.71	5073.54	7084.13	6713.34	30.38
		0.13	0.07	29.76	48.14	24.52	2.02	24.18	0.60	29.25	0.14	33.76	1.55	70.47	98.39	93.24	
1%	Total Area	19.49	3.96	34.35	4.23	1.47	17.31	4.86	1.52	0.11	12.96	0.23	2.64	0.48	0.69	0.06	
	Total Area/24	33.30	12.42	85.95	24.57	31.68	13.23	25.83	8.19	1.98	61.29	0.99	16.38	3.24	2.52	0.45	
	Total Area/72	12.00	2.40	52.32	35.76	285.24	3.60	22.44	11.16	5.40	40.08	1.92	18.00	5.52	279.24	37.32	
	Total Area/24	6.84	1.68	59.64	34.44	639.00	6.48	22.08	8.40	6.48	126.36	2.28	10.92	6.00	822.96	184.56	
		71.63	20.46	232.26	99.00	957.39	40.62	75.21	29.27	13.97	240.69	5.42	47.94	15.24	1105.41	222.39	
		0.99	0.28	3.23	1.38	13.30	0.56	1.04	0.41	0.19	3.34	0.08	0.67	0.21	15.35	3.09	2.94



Table C-10 – Estimate of Corrosion Rates by Area under Corrosion Rate vs. Time Curve (Integration) for AZ91C-T6 Magnesium Alloy

Estimate of Corrosion Rates by Area Under Corrosion Rate vs. Time Curve (Integration)

AZ91C, Magnesium Alloy

		Trapezoidal Area														Average	
		2	3	6	10	13	17	20	21	26	29	32	37	40	41		42
		NaCl + OMB	NaCl + OMB	NaCl	NaCl + P	CaCl ₂	CaCl ₂ + OMB	CaCl ₂ + C, A	CaCl ₂ + OMB	MgCl ₂	MgCl ₂ + OMB, TEA	MgCl ₂ + OMB	Blended Chloride	CMA	CMAK	KA	
100%	Total Area >	7.78	400.00	84.19	59.23	184.81	400.00	400.00	400.00	158.47	273.78	122.92	39.74	145.63	30.94	80.01	
	Total Area/24 >	8.69	514.04	72.87	59.60	151.34	600.00	437.33	600.00	506.25	432.98	435.68	70.40	147.59	37.89	100.55	
		124.02	1976.40	263.79	222.84	737.01	3600.00	1240.83	2919.42	3600.00	2130.48	2908.71	400.41	405.36	226.17	409.77	
		140.49	2890.44	420.85	341.67	1073.16	4600.00	2078.16	3919.42	4264.72	2837.24	3467.31	510.55	698.58	295.00	590.33	
		5.85	120.43	17.54	14.24	44.71	191.67	86.59	163.31	177.70	118.22	144.47	21.27	29.11	12.29	24.60	78.13
10%	Total Area >	184.79	417.08	600.00	19.59	170.01	254.03	60.72	600.00	211.47	206.75	47.97	29.69	27.30	20.48	27.57	
	Total Area/72 >	674.01	849.24	2458.62	288.90	535.05	1147.05	381.24	2095.65	1326.33	988.56	228.15	56.07	96.30	79.92	101.52	
		999.48	1433.88	2065.92	361.68	847.32	1157.52	468.36	831.96	1386.12	1298.76	952.20	121.08	75.24	91.44	45.48	
		947.40	2695.20	1949.76	147.12	818.16	1178.64	340.44	697.32	894.84	1398.48	1650.72	173.04	70.20	88.08	55.56	
		2805.68	5395.40	7074.30	817.29	2370.54	3737.24	1250.76	4224.93	3818.76	3892.55	2879.04	379.88	269.04	279.92	230.13	36.51
1%	Total Area >	38.97	74.94	98.25	11.35	32.92	51.91	17.37	58.68	53.04	54.06	39.99	5.28	3.74	3.89	3.20	
	Total Area/72 >	8.73	9.23	4.59	7.53	75.18	32.13	21.93	33.29	5.39	21.92	59.04	9.03	3.60	3.47	3.44	
		13.23	45.36	14.67	39.15	395.01	169.38	106.92	163.17	15.03	66.60	273.51	63.99	12.33	20.79	15.30	
		23.52	68.28	26.88	74.64	438.96	154.32	243.00	177.00	28.44	68.04	143.88	114.24	8.28	31.20	13.68	
		98.40	87.96	21.48	65.16	365.76	129.36	256.44	61.92	32.52	145.80	236.88	114.12	6.96	31.32	12.12	
		143.88	210.83	67.62	186.48	1274.91	485.19	628.29	435.38	81.38	302.36	713.31	301.38	31.17	86.78	44.54	
		2.00	2.93	0.94	2.59	17.71	6.74	8.73	6.05	1.13	4.20	9.91	4.19	0.43	1.21	0.62	4.62

* note: values >200mpy are set to 200mpy minimum for the area calculation



APPENDIX D
COMPARISON OF CORROSION RATES BY LPR
VS. WEIGHT LOSS

Table D-1 – AA356.2 Cast Aluminum Alloy

AA356.2						
Conc	Sol'n	Corrosion Rate		Weight Loss		
		LPR	WL	MPY		
100%	2	40.2	0.67	0.68	0.67	0.66
100%	3	71.9	6.24	6.08	6.66	5.97
100%	6	80.3	3.34	2.7	3.33	3.98
100%	10	27.7	11.53	2.03	9.99	22.57
100%	13	2.1	5.36	6.76	5.99	3.32
100%	17	27.6	-0.44	0	-0.67	-0.66
100%	20	68.9	4.45	4.05	3.33	5.97
100%	21	75.4	1.56	1.35	0.67	2.66
100%	26	75	3.34	3.38	3.33	3.32
100%	29	52.3	4.45	3.38	4.66	5.31
100%	32	0.2	4.02	5.4	3.33	3.32
100%	37	23.9	3.34	2.7	4	3.32
100%	40	0	2.45	2.03	2.66	2.66
100%	41	73.6	0.23	0.68	0	0
100%	42	80.4	2.90	4.05	1.33	3.32
10%	2	13.5	0.14	0.22	0	0.21
10%	3	5.4	n/a	Not Available		
10%	6	14.3	22.68	51.84	10.88	5.33
10%	10	2.2	0.64	0.65	0.21	1.07
10%	13	32	-0.71	-0.43	-0.43	-1.28
10%	17	58.9	-0.22	-0.22	-0.43	0
10%	20	79.1	3.67	2.4	4.3	4.3
10%	21	39.6	-5.97	-4.79	-6.66	-6.45
10%	26	25.9	-2.66	-2.4	-2.79	-2.8
10%	29	0.4	1.68	1.32	1.96	1.75
10%	32	44.3	0.37	0.22	0.44	0.44
10%	37	26.1	1.24	0.67	1.31	1.75
10%	40	0.1	0.81	0.89	0.66	0.88
10%	41	36.6	0.81	0.67	1.1	0.66
10%	42	43	1.11	0.45	1.11	1.77
1%	2	0.4	-0.22	-0.22	0	-0.43
1%	3	0.1	14.51	3.2	16.85	23.47
1%	6	0.3	0.28	0.21	0.64	0
1%	10	0.9	0.64	0	0.64	1.28
1%	13	0	0.00	0	0	0
1%	17	0	-1.36	-0.65	-0.64	-2.78
1%	20	7.3	-1.94	-1.74	-0.86	-3.23
1%	21	0	-0.29	0	-0.86	0
1%	26	0.2	-0.72	-0.65	-0.21	-1.29
1%	29	0.2	0.80	0.44	1.09	0.87
1%	32	0.2	0.58	0.22	1.31	0.22
1%	37	0	0.96	0.67	0.66	1.54
1%	40	0	0.88	0.89	0.44	1.32
1%	41	0	0.22	0	0.44	0.22
1%	42	0	0.08	0.23	0	0

Table D-2 – A36 Structural Steel

A36						
Conc	Sol'n	Corrosion Rate			MPY	
		LPR	WL			
100%	2	8.3	3.40	1.97	4.32	3.91
100%	3	1.2	3.91	3.28	3.89	4.56
100%	6	1.6	2.68	1.75	2.16	4.13
100%	10	2.1	1.67	1.53	1.3	2.17
100%	13	0.5	2.75	3.06	3.03	2.17
100%	17	1.6	1.74	1.31	1.95	1.96
100%	20	1.6	3.55	3.5	3.46	3.69
100%	21	9.1	3.84	4.16	4.11	3.26
100%	26	1.6	3.04	3.28	2.59	3.26
100%	29	1.6	1.82	2.41	1.95	1.09
100%	32	0.6	0.94	1.09	0.43	1.3
100%	37	2.7	2.32	1.97	2.59	2.39
100%	40	0.1	1.53	1.75	0	2.83
100%	41	0.1	2.39	2.19	2.16	2.83
100%	42	0	-1.09	-1.31	-0.22	-1.74
10%	2	4.1	2.38	1.99	2.4	2.76
10%	3	0.8	n/a	Not Available		
10%	6	3.2	6.27	6.93	4.67	7.21
10%	10	2.4	2.41	2.55	2.26	2.41
10%	13	7.4	3.16	3.12	3.18	3.18
10%	17	4.7	1.84	1.28	2.47	1.77
10%	20	2.8	4.53	3.55	4.8	5.24
10%	21	3	-0.28	-0.07	-0.78	0
10%	26	3.6	-1.16	-1.84	-0.85	-0.78
10%	29	2.2	3.34	3.16	3.35	3.5
10%	32	0	3.51	3.45	3.57	3.5
10%	37	1.5	2.65	2.44	2.57	2.93
10%	40	1.2	1.55	1.37	1.57	1.71
10%	41	0.4	1.62	2.37	0.93	1.57
10%	42	0	2.17	2.04	2.31	2.17
1%	2	3.3	1.98	1.91	1.91	2.12
1%	3	2.2	1.63	1.77	1.48	1.63
1%	6	3.6	3.37	3.04	4.1	2.97
1%	10	4.3	4.81	4.81	4.67	4.95
1%	13	3.8	3.92	3.76	3.89	4.1
1%	17	2.1	-1.04	-0.43	-1.55	-1.13
1%	20	1.7	2.17	1.99	11.8	-7.29
1%	21	1.2	1.96	1.35	2.12	2.41
1%	26	2.7	0.28	0.57	0.14	0.14
1%	29	17	3.15	3.23	3	3.21
1%	32	1.8	3.34	3.38	2.85	3.79
1%	37	3.1	3.24	3.02	3.07	3.64
1%	40	1.1	2.76	2.44	2.85	3
1%	41	0	2.67	2.95	2.28	2.79
1%	42	0	3.82	3.94	3.67	3.84

Table D-3 – AA6061-T6 Wrought Aluminum Alloy

AA6061						
Conc	Sol'n	Corrosion Rate		MPY		
		LPR	WL			
100%	2	61.7	2.51	4.39	3.15	0
100%	3	72.9	10.08	11.3	10.08	8.87
100%	6	76.5	2.32	1.26	3.15	2.54
100%	10	82.2	5.26	2.51	7.56	5.7
100%	13	2.3	11.14	10.04	11.97	11.41
100%	17	66.2	-0.21	-0.63	-0.63	0.63
100%	20	63.6	6.73	6.28	7.56	6.34
100%	21	94.9	6.09	6.91	5.67	5.7
100%	26	72	5.47	5.02	5.04	6.34
100%	29	42.3	5.47	2.51	5.67	8.24
100%	32	45.2	2.73	4.39	1.89	1.9
100%	37	60.9	6.09	8.16	5.04	5.07
100%	40	11.5	-0.01	1.26	1.89	-3.17
100%	41	70.4	7.36	9.42	5.04	7.61
100%	42	71.1	-6.73	-3.14	-8.19	-8.87
10%	2	22.6	0.47	0.4	0.4	0.6
10%	3	5.8	n/a	Not Available		
10%	6	43.2	60.79	82.12	25.36	74.88
10%	10	37.5	2.35	3.02	2.01	2.01
10%	13	25.2	-0.74	-0.81	-0.8	-0.6
10%	17	52.2	1.55	1.82	1.41	1.42
10%	20	25.1	6.36	6.5	6.49	6.09
10%	21	39	-17.86	-21.52	-17.24	-14.83
10%	26	41.9	-7.44	-7.11	-8.72	-6.5
10%	29	6.7	3.28	2.67	3.69	3.49
10%	32	42.7	0.48	0.41	0.41	0.62
10%	37	29.7	2.96	2.69	3.3	2.89
10%	40	0	1.86	2.28	1.24	2.06
10%	41	40.1	1.03	0.83	1.03	1.24
10%	42	34.4	4.49	4.19	5.04	4.23
1%	2	0.2	0.20	0.6	0	0
1%	3	0.1	0.87	1.61	0	1.01
1%	6	0.9	2.89	2.62	4.23	1.81
1%	10	0.1	1.27	3.02	0.4	0.4
1%	13	0.7	-1.01	-3.64	0.2	0.4
1%	17	0	-7.41	-6.87	-7.27	-8.09
1%	20	0.6	0.20	1.83	0	-1.22
1%	21	0	0.54	0.41	0.81	0.41
1%	26	0.2	-2.77	-3.05	-4.46	-0.81
1%	29	0.1	2.46	2.26	2.05	3.08
1%	32	0.1	1.30	1.23	1.64	1.03
1%	37	0.1	0.97	1.04	1.03	0.83
1%	40	0	1.51	1.04	2.06	1.44
1%	41	0	2.27	1.66	2.68	2.48
1%	42	0	1.05	1.26	1.05	0.85

Table D-4 – CDA 360 Free Machining Brass

CDA360						
Conc	Sol'n	Corrosion Rate		1.16	1.79	1.8
		LPR	WL			
100%	2	13.2	1.58	1.16	1.79	1.8
100%	3	5.7	1.44	1.69	1.27	1.37
100%	6	3.8	2.36	2.11	2.32	2.64
100%	10	3.4	2.11	2	1.9	2.43
100%	13	2.2	0.84	1.05	0.74	0.74
100%	17	3	1.16	1.16	1.69	0.63
100%	20	1	1.45	1.27	1.27	1.8
100%	21	31.3	0.32	0.53	0.11	0.32
100%	26	0.7	0.92	0.74	1.06	0.95
100%	29	0.2	-1.09	-0.95	-1.27	-1.06
100%	32	1	-1.86	-2.21	-2.43	-0.95
100%	37	0.3	0.32	0.32	0.53	0.11
100%	40	9	-0.53	0.21	0	-1.8
100%	41	85.6	0.21	0.11	0.32	0.21
100%	42	53.8	-0.21	-0.53	-0.42	0.32
10%	2	0.2	0.35	0.45	0.31	0.28
10%	3	0.1	n/a	Not Available		
10%	6	26.9	1.98	1.21	4.32	0.41
10%	10	47.6	0.80	0.72	0.38	1.31
10%	13	24.3	0.39	0.41	0.45	0.31
10%	17	4.4	0.95	1	0.62	1.24
10%	20	20.5	4.33	4.07	4.42	4.49
10%	21	1.1	-0.93	-1.28	-0.69	-0.83
10%	26	26.9	-0.81	-0.66	-0.9	-0.86
10%	29	0.2	0.08	0.21	-0.31	0.35
10%	32	32.4	0.00	0	-0.03	0.03
10%	37	1.8	1.62	1.46	1.71	1.68
10%	40	65.4	0.31	0.14	0.42	0.38
10%	41	97.5	0.08	0.1	0.07	0.07
10%	42	81.5	-0.28	-0.35	-0.25	-0.25
1%	2	2.9	0.56	0.55	0.59	0.55
1%	3	0.6	0.48	0.55	0.48	0.41
1%	6	6	3.96	1.73	7.22	2.94
1%	10	1.4	0.26	0.24	0.48	0.07
1%	13	11.4	1.00	0.89	1.24	0.86
1%	17	2.4	0.02	-0.17	0	0.24
1%	20	1.2	-0.81	-0.48	-1.11	-0.83
1%	21	0.4	-0.05	-0.03	-0.14	0.03
1%	26	0.2	0.35	0.28	0.35	0.41
1%	29	3.9	0.81	0.73	0.83	0.87
1%	32	0.1	0.15	0.1	0.17	0.17
1%	37	0.7	0.34	0.35	0.31	0.35
1%	40	0.2	0.23	0.21	0.21	0.28
1%	41	13.8	0.24	0.31	0.21	0.21
1%	42	3.1	-0.01	0	-0.04	0

Table D-5 – AZ91C-T6 Magnesium Alloy

AZ91C						
Conc	Sol'n	Corrosion Rate		MPY		
		LPR	WL			
100%	2	5.4	12.12	6.96	9.07	20.34
100%	3	109.8	531.43	501.56	540.74	551.98
100%	6	28.4	8.86	11.45	7.08	8.06
100%	10	21	13.41	11.78	15.46	12.99
100%	13	66.7	16.50	16.59	16.53	16.38
100%	17	#DIV/0	300.19	134.36	349.82	416.39
100%	20	68.9	47.11	52.99	44.26	44.07
100%	21	124.4	24.83	26.76	24	23.73
100%	26	79.2	306.61	265.5	350.36	303.96
100%	29	103.5	143.68	137.54	144.43	149.08
100%	32	82	70.18	63.7	58.13	88.7
100%	37	21.1	0.89	2.14	0.53	0
100%	40	47.7	76.20	78.15	73.06	77.4
100%	41	14	13.44	10.17	25.06	5.08
100%	42	31.4	15.26	24.62	5.33	15.82
10%	2	48.7	11.75	12.84	13.32	9.1
10%	3	79.7	n/a	Not Available		
10%	6	78.6	10.80	11.68	13.49	7.24
10%	10	10.1	13.27	13.62	14.51	11.68
10%	13	42.9	4.48	2.73	4.81	5.9
10%	17	62.8	35.98	31.22	40.22	36.49
10%	20	17.8	24.72	22	25.36	26.8
10%	21	30.3	-5.79	-2.35	-7.22	-7.81
10%	26	56.1	-4.70	-1.01	-6.89	-6.21
10%	29	60.5	57.80	64.82	50.5	58.08
10%	32	37	1.85	2.74	1.54	1.27
10%	37	7.2	8.84	5.6	9.53	11.4
10%	40	5.5	-21.23	-19.59	-24.25	-19.86
10%	41	5	5.07	3.15	4.33	7.72
10%	42	5.1	10.36	6.96	12.62	11.49
1%	2	2.8	6.53	1.12	8.18	10.28
1%	3	3.1	4.17	4.25	3.59	4.67
1%	6	1.2	3.66	3.09	4.85	3.05
1%	10	2.5	1.03	0.77	2.15	0.18
1%	13	19.5	2.29	2.09	2.09	2.7
1%	17	7.9	-25.23	-24.78	-22.2	-28.72
1%	20	8.8	-0.41	2.52	-2.86	-0.89
1%	21	8	2.17	1.01	3.19	2.31
1%	26	1.3	4.27	3.19	5.88	3.73
1%	29	5.4	8.60	6.84	9.55	9.41
1%	32	12.8	-2.26	-3.76	-0.85	-2.17
1%	37	3.4	5.33	5.6	4.33	6.07
1%	40	0.7	3.26	2.45	3.29	4.05
1%	41	1.2	2.55	1.75	2.77	3.13
1%	42	0.8	3.51	3.03	3.56	3.95

