

**GM Coolant Recycling Evaluation
D-4340 Hot Surface Comparison Data Explanation
Represented in this Chart are:**

ASTM method D4340 is a “Standard Test Method for Corrosion of Cast Aluminum Alloys in Engine Coolants Under Heat-Rejecting Conditions.” Basically, this test attempts to simulate aluminum heat transfer corrosion in automobiles except under accelerated conditions (275° F and 28 psi for one week). In the test before after weight is taken of the aluminum test specimen and the test result is the weight change per centimeter² of the aluminum puck per week.

In the GM Evaluation-D4340 chart the different test numbers represent samples of coolant that were analyzed which can also involve more than one method of recycling for some of the recyclers. In this case, Glyclean has two processes and each one recycled two samples. Butler also had two processes but one of the processes only recycled one sample which is the high result--this was the result of their high capacity recycling unit. The other processes only had one recycling process which recycled one or two samples of coolant. From these test results we can see that KFM, Bad Ethyl and one processes of Butler passes this hot-surface aluminum corrosion test. Activ did not pass according to this chart. However, this is only one test in a group of test that must be passed. **One point of interest is that KFM's recycled coolant performs better in this test than GM's “Virgin Antifreeze”.**

Represented in this chart are:

GLYCLEAN -- two processes, and one each recycled two samples
BUTLER -- two processes, one process recycled only one sample
OTHERS -- only one process, which recycled one or two samples of coolant

From these test results we can see that KFM, Bad Ethyl and one Butler processor passed this hot-surface aluminum corrosion test. Activ did not pass according to this chart. However, this is only one test in a group of tests that must be passed. One point of interest in that KFM'S recycled coolant performs better in this test than GM's “virgin antifreeze.” Another item to mention is that all the D-4340 testing is complete and there will be no additions to this chart.

GM Evaluation - Corrosion And Performance Data

The following is a summary of test data obtained by a leading independent laboratory for the GM on-site engine coolant recycling evaluation. The finished coolant produced by the KFM Coolant Purification System (CPS) satisfies the requirements of General Motors.

Physical/Chemical Requirements: ¹	ASTM Test Method	GM 1825M	Test Results	
			Pall #1	Pall #2
Specific Gravity, 60/60 °F	D1122	1.065 min	1.08	1.08
Freezing Point °F	D1177	-34 min.	-34.4	-34.3
Boiling Point, °F	D1120	226 min.	226	226
Effect on automotive finish	D1822	no effect	none	none
Ash content, wt. %	D1119	2.5 max.	1.04	1.04
pH	D1287	7.5 - 11.0	10.2	10.2
Reserve Alkalinity, ml	D1121	report	5.5	5.6
Chlorides, mg/L	D3634	25 max.	<4	<4
R.A., % loss after 1000 hours	D1121	25% max.	NDA	NDA
Performance Requirements:				
Corrosion in glassware	D1384			
Copper		10	0	0
Solder		20	-0.3	0
Brass		10	-0.3	-0.3
Steel		10	0	0
Cast Iron		10	0	0
Aluminum		20	-0.3	0.3
Simulated Service Test	D2570			
Copper		10	-5	-5
Solder		40	0	0
Brass		20	-5.3	-5.3
Steel		20	0	0
Cast Iron		20	0	0
Aluminum		40	-2	-2
Heat Transfer Corrosion	D4340	1	<0.1	0.3
Foaming, volume (ml)/break	D1881	50/5	47/1	32/1
Cavitation Erosion	D2809	8@300	9	9
Glycol Composition by GC	NA	No Req.		
Ethylene glycol, wt. %		...	49	48.8
Diethylene glycol, wt. %		...	2.5	2.6
Propylene glycol, wt. %		...	<0.5	<0.5

¹ Per D4656 prediluted specifications.

GM Evaluation - Coolant Properties Before and After KFM Coolant Purification System (CPS)

Chemical Properties:	Before CPS	After CPS	Reinhibited #1	Reinhibited #2
Contaminants				
Chloride (Cl)	64	28	17	28
Sulfate (SO ₂)	290	6	82	100
Formic Acid	780	0	0	0
Glycolic Acid	1,800	28	15	0
Acetate	21	0	0	0
Calcium, mg/L	0	1	0	1
Magnesium, mg/L	0	0	0	0
Corrosion Metals				
Aluminum, mg/L	3	0	3	3
Copper, mg/L	7	0	0	0
Iron, mg/L	0	0	1	2
Lead, mg/L	28	0	0	0
Zinc, mg/L	0	0	0	0
Inhibitors				
Boron, mg/L	516	0	0	0
Molybdenum, mg/L	249	1	181	149
Phosphorus, mg/L	990	28	2,612	2,421
Potassium, mg/L	1,203	52	4,474	5,315
Silicon, mg/L	20	7	86	92
Sodium, mg/L	3,014	7	318	380
Nitrate (NO ₃), mg/L	760	27	450	450
Nitrite (NO ₂), mg/L	35	14	14	0
General Properties:				
pH	8.37	8.46	10.38	10.38
Freezing Point, °F	-60	-36	-34	-34
Glycol, wt. %	58	52	50	50
Reserve Alkalinity, ml	7.5	0.3	6.4	6.3
Conductivity, µS/cm	1,879	21	2,769	2,810
TDS (calculated), mg/L	7,500	200	8,300	8,000
TDS (209B), mg/L	16,638	110	11,362	10,703
TSS, mg/L	1,318	90	356	419
Visual	brown-green	clear/colorless	bright green	bright green