

Statement of Compliance: OCP Rev2.1

ElectroCool® EC-110 Dielectric Coolant

Engineered Fluids' ElectroCool EC-110 Dielectric Coolant fully complies with the [Open Compute Projects' fluids specifications requirements Revision 2.1 \(2023-08-18\)](#). This document is a reference for Engineered Fluids' ElectroCool (EC-110) typical characteristic values based on our history of quality control testing.

Engineered Fluids can provide a Certificate of Analysis (COA) at the product batch level. Engineered Fluids' Quality Management System is ISO 9001 Certified.

Open Compute Project Fluids Specifications Requirements Rev2.1

Specification	Test method(s)	OCP Minimum Requirements	ElectroCool EC-110
Dielectric Strength, Measured at 1 mm	ASTM D 1816	> 6kV/mm	> 25 kV/mm
Dielectric Constant (Relative permittivity) Measured at: • 5 VAC • 20 GHz and 40 GHz • 20°C and 70°C	There is no method prescribed by OCP Engineered Fluids' testing uses Fabry/Perot Open Resonator @20C	None Described	60 Hz: 2.3 20 GHz: 2.08 40 GHz: 2.08
Loss Tangent	Data must be associated with tests conducted for Dielectric Constant with the referenced properties	None Described	60 Hz: 5.6x10 ⁴ 10 GHz: 5.8x10 ⁴ 20 GHz: 5.8x10 ⁴ 40 GHz: 4.2x10 ⁴
Resistivity	ASTM D1169	≥ 2.00 GΩm	1x10 ⁵ GΩ-m
Maximum Moisture Content for Dielectric Breakdown	ASTM D1533-20	None Described	Moisture Saturation @80 ppm.
Specific Heat Capacity	ASTM E 1269	None Described	2136 J/kg*K @20°C 2174 J/kg*K @30°C 2212 J/kg*K @40°C 2249 J/kg*K @50°C 2287 J/kg*K @60°C 2326 J/kg*K @70°C
Thermal Conductivity	ASTM D 7896	None Described	0.1386 W/m*K @20°C 0.1380 W/m*K @30°C 0.1374 W/m*K @40°C 0.1368 W/m*K @50°C 0.1363 W/m*K @60°C 0.1357 W/m*K @70°C
Density	ISO 12185	None Described	807.3 kg/m3 @20°C 800.6 kg/m3 @30°C 793.9 kg/m3 @40°C 787.2 kg/m3 @50°C 780.5 kg/m3 @60°C 773.8 kg/m3 @70°C

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Specification	Test method(s)	OCP Minimum Requirements	ElectroCool EC-110
Volumetric Expansion	ASTM D 1903	None Described	0.00067/K
Kinematic Viscosity	ASTM D7042 Note 1	None Described	13.82 cSt @20°C 9.78 cSt @30°C 7.25 cSt @40°C 5.58 cSt @50°C 4.44 cSt @60°C 3.62 cSt @70°C
Vapor Pressure	ASTM D2879 (non-volatile fluids)	None Described	0.1 mbar @20°C
Pour Point	ASTM D 97 / ISO 3016	None Described	< -65 °C
Flash Point (Closed Cup)	ASTM D 93 / ISO 2719	≥ 150 °C	160 °C
Fire Point	ASTM D 92 / 2592	None Described	210 °C
Auto ignition Point	DIN 51794 / ASTM E659	≥ 300 °C	340 °C
Sulphur Content	ISO 14596	< 10.0 ppm	0.00 ppm
Acidity	IEC 62021-1 / ASTM 974	≤0.010 mg KOH/g	0.005 mg KOH/g
NSF Nonfood Compounds Certification	NSF certificate	None Described	Yes – Classified HT1 Food Grade in both US and Europe
Odor	Observation	None Described	Odorless
Color	ASTM D 156 / ASTM D1500	None Described	Clear / ASTM 0
Hazard Statements	GHS Classification	None Described	H304: Category 4, H332: Category 1
STOT - single exposure	Safety Data Sheet	None Described	Not Classified
STOT - repeated exposure	Safety Data Sheet	None Described	Not Classified
Biodegradability	OECD 301B / ASTM D5864	None Described	Readily Biodegradable
Oxidation Stability	IEC 61125	None Described	See Note 3
Global Warming Potential (GWP)	IPCC 2007	None Described	0.0
Ozone Depletion Potential	PNNL-16813	None Described	None

Reference Notes:

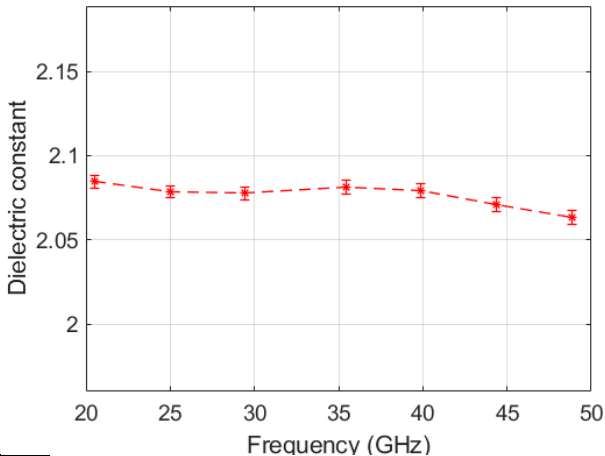
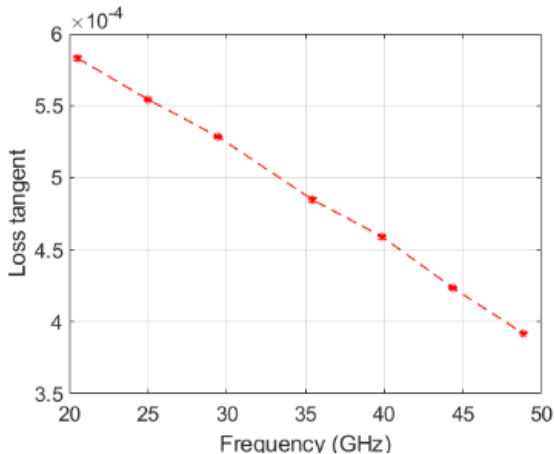
1. ASTM D7042 is used to determine the Dynamic Viscosity, from which the Kinematic Viscosity can be derived.
2. ASTM D156 determines values based on the Saybolt Color Scale (Yellow). EC-110 is clear and is typically tested using the ASTM D1500 Color scale.
3. Oxidation Stability per IEC Test Method 61125 is currently under study

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Extended Characteristics List

ElectroCool EC-110 Dielectric Coolant exceeds all Requirements for Immersion Coolants developed by the Open Compute Project (OCP). Beyond these minimum requirements, ElectroCool EC-110 Dielectric Coolant has been extensively tested and Certified.

These are important characteristics to consider that are not included by OCP.

ELECTRICAL CHARACTERISTICS			
Specification	Test method(s)	OCP Minimum Requirements	ElectroCool EC-110
Conductivity, pS/m	ASTM 2624	None Described	1×10^{-12} (0.001 ps/m)
Electrical Conductivity DC, 20C 60 Hz, 20C 1 KHz, 20C	IEC 61620	None Described	1.10×10^{-14} S/m 1.05×10^{-14} S/m 0.98×10^{-14} S/m
RF Absorption @ 500MHz RF Absorption @ 6GHz	AFC Proprietary	None Described	+0.15 dB 0 dB
Dielectric Constant (Kd) 20-50 GHz	Engineered Fluids' Standard Method		
Loss Tangent (Tan delta) 20-50 GHz	Engineered Fluids' Standard Method		

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Dielectric Breakdown Voltage, Neg. Polarity	ASTM D3300	None Described	205 KV
Gassing Tendency Under Electrical Stress	ASTM D2300	None Described	10 uL/min
HEAT TRANSFER CHARACTERISTICS			
OCP Figure of Merit 1	Calculated @ 25C	Spec Value: >35	41
OCP Figure of Merit 2	Calculated @ 25C	Spec Value: >19	31.9
OCP Figure of Merit 3	Calculated @ 25C	Spec Value: < 1.5 e-02	1.09 e-02
FUNCTIONAL APPLICATION CHARACTERISTICS			
Foaming Test Sequence @24C	EF Proprietary	Not Described	No Foaming with Agitation
Copper Corrosion	ASTM D130	Not Described	1B
Oxidation Resistance	ASTM D2440	Not Described	New Acid Value: 0.01 72 Hour Acid Value 0.01 164 Hour Acid Value 0.04
OPTICAL CHARACTERISTICS			
Refractive Index	ASTM D1218	Industry spec: <1.5	1.41
FLAMMABILITY CHARACTERISTICS			
Fire Propagation in Li-ion Batteries	Southwest Research Institute Nail Test	Not Described	No Fire Propagation Cell to Cell

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PRODUCT PURITY			
Particle Count	ISO 4406	Not Described	17/15/12
PFAS Content, ppb	LC-MS	Not Described	Not detectable
Phosphate Content, ppm	ICP Spec	Not Described	Not detectable
Copper Content, ppm	AA/FE Spec	Not Described	Not detectable (<1ppm)
Chloride Content, ppb	ASTM D878	Not Described	Not detectable
Benzene Content, ppm	GC-MS	Not Described	Not detectable (<1ppm)
Furan Content, ppm	ASTM D5837	Not Described	Not detectable
HEALTH, SAFETY & ENVIRONMENTAL CHARACTERISTICS			
Aquatic Toxicity: Acute and Chronic: minnow, frog, tadpole,	Water Flea: EPA 2021.0	Not Described	LC50>10000 mg/kg
	Ceriodaphnia dubia EPA 2002.0		LC50>10000 mg/kg
	Pimephales promelas, EPA 2002.0		LC50>10000 mg/kg
	Fathead Minnow EPA 2000.0		LC50>10000 mg/kg
	Rainbow Trout: EPA 2019.0		LC50>10000 mg/kg
Biodegradation	ASTM D5864	No industry spec	92%
Biodegradation	OECD 301F	No industry spec	214%
Biodegradation	OECD 301B	No industry spec	71%
SUPPLIER CHARACTERISTICS AND SERVICES			
Supplier Offers Material Compatibility Guarantee	Report	Not Described	Yes
Supplier Offers Free Laboratory Analysis	Report	Not Described	Yes
Supplier Offers Product Collection and Recycling	Report	Not Described	Yes
Supplier has an ISO 9001 Certified Quality System	Report	Not Described	Yes

Need more information? Please contact us at
sales@engineeredfluids.com or +1.725.218.1955

Manufactured
 in the United States

