



# Specifications and characteristics of electrical fluids

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## Electric mobility – fluid requirements

Fluids applied in electric mobility shall share following minimum requirements:

- Low electric conductivity
  - To avoid short circuit occurring (presence of bare conductors)
- High breakdown voltage
  - To avoid damages from incidental discharges
- Minimally electrostatic dissipative
  - To avoid static sparking
- High thermal conductivity
  - To support cooling of electric devices
- Low viscosity
  - Better pumpability and less energy loss in systems

Standard for EV charging  
and discharging infrastructure

IEC 63110

# Electric fluids– physical properties



Parameter	Unit	Standard	Mineral oil	PAO	Grp. III	Ester
Heat capacity $c_p$ [100 °C]	J / kg * K	ASTM D7896	1860	2200	1900	2170
Thermal conductivity*	W / m * K	ASTM D7896	0.125	0.15	0.13	0.13
Breakdown voltage*	kV	IEC 60156	60	55	49	70
Electric conductivity*	pS/m	ASTM D 2624	10	30	50	> 200
Rel. Permittivity*	-	IEC 60247	2.2	2.1	2.0	3.0
Water content*	ppm	ASTM D6304	< 100	< 50	< 50	< 500

\* Tested at RT; values to be seen as showcase for noted base fluids

- Ester show interesting thermal properties compared to mineral oil and synthetic HC
- Though ester tolerate higher amounts of water their electrical properties are excellent

# Electric fluids– material compatibilities



Parameter	Unit	Standard	Mineral oil	PAO	Grp. III	Ester
Kinem. Viscosity[40°C]	J / kg * K	ASTM D445	7	5	12	8
Density*	g/cm <sup>3</sup>	ASTM D7896	0.84	0.80	0.84	0.92
Flash point	°C	ISO 2592	130	155	198	180
Compatibility with						
Plastic compounds	-	ISO 1817	+	+	+	+
Elastomers	%	ISO 6072	+	+ / -	+ / -	+ / -

- Focusing on efficient heat transport, esters combine:
  - low viscosity
  - low safety risk due to better (higher) flash point
- Material compatibility needs thorough evaluation as synthetic hydro-carbons tend to shrink & esters tend to swell

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**Thank you for your attention**

**Q&A**

