



SAE International Presents

“Profiling Electric Drivetrain Fluid Characteristics’ Tests”

SAE J3200™

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Agenda

Background – Who and Why?

Topics evaluated

Final characteristics considered

What is next for J3200?

Background



EV technology is evolving quickly. However, it is still in its infancy and companies are working diligently to develop fluids with minimal information on the broader scale.



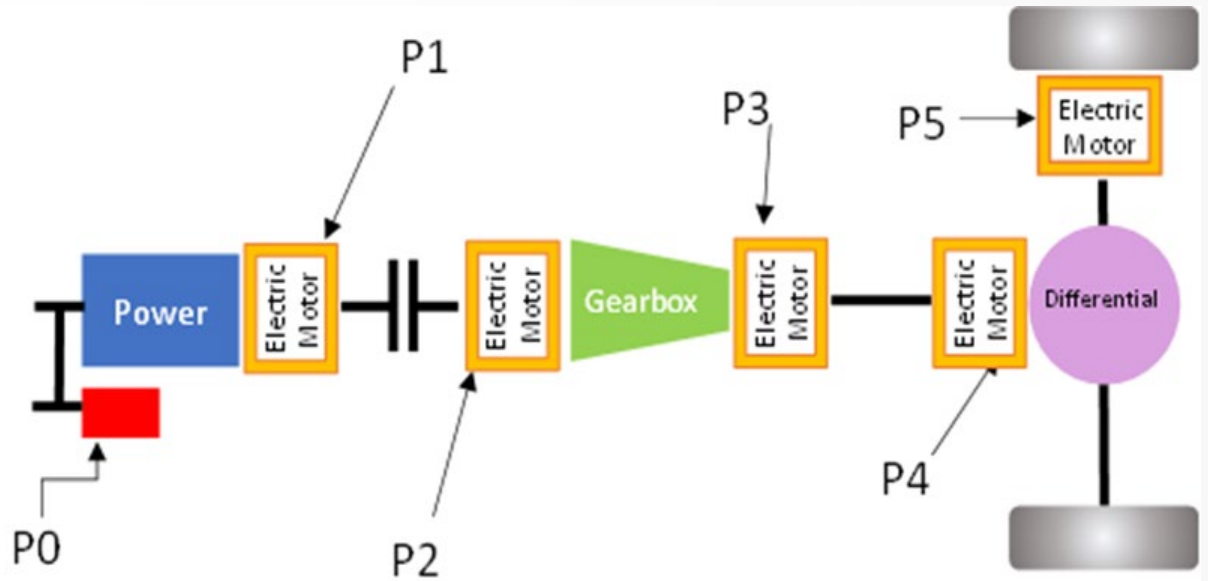
OEM's keep information close as the market is competitive.



However, a broader guideline and ultimate classification must be determined in order to assist this industry to be successful. SAE International has stepped up to that call.

Potential BEV and P/HEV Systems

- ▶ The electric motor windings can produce temperatures well above those found in corresponding ICE vehicle power-drivetrains or axles.
- ▶ Direct cooling of the windings by the lubricant is advantageous in keeping the motor cool and thereby improving vehicle efficiency and therefore range.
- ▶ Lubricants under these conditions may require greater oxidation stability than their conventional counterparts.
- ▶ The heightened importance of cooling the electric motor necessitates understanding these characteristics.



Lubricants and Fluids Required



Power-Drivetrain Fluids

Provide lubrication for the gearbox.
Assist with cooling for the motor.



Grease

Wheel bearings
Chassis



Engine Oil

Motor for HEV




Coolant

Direct cooled batteries
Immersion cooled batteries

SAE International - SAE J3200™- Electric and Hybrid Powertrain Fluids

- ▶ SAE Technical Committee 3
 - ▶ Committee Mission
 - ▶ Formed EV team in 2019
 - ▶ SAE J3200™- Electric and Hybrid Powertrain Fluids
- ▶ Goal for EV
 - ▶ Considered various materials to evaluate.
 - ▶ Agreed to focus “initially” on power-drivetrain fluids
- ▶ Step 1 – Recommendations and Guideline J3200 for power-drivetrain Fluids
- ▶ Step 2 – Add other needed tests and other EV fluids and lubricants such as greases.
- ▶ Step 3 – J3200 EV Classification





Power- Drivetrain Fluid Conditions

The electric motor is powered in the fluid. If the electrical conductivity of the lubricant is too high, then it could provide a potential path for leakage current to the housing and thereby create a shock hazard.

The motor windings are made of insulated copper wire held in place by various polymeric materials. Shorting of the windings either through deterioration of the insulation or corrosion of the copper wire would lead to an irreversible failure.

The lubricant must provide assured corrosion protection under a wide variety of conditions and not damage the insulation or other new polymeric materials contained within the motor to maintain its structural integrity.



SAE EV
Team
Areas of
Concern

- Electrical Properties
- Heat Transfer Characteristics
- Corrosion
- Material Compatibility
- Oxidation
- High Speed Aeration
- New Wear Concerns

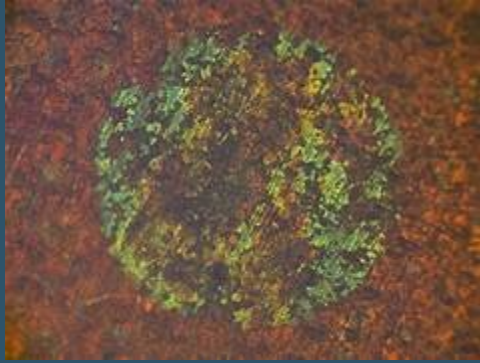


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Areas of
Concern

Electrical Properties and Heat Transfer Characteristics

Areas of Concern

- ▶ Thermal conductivity and specific heat.
- ▶ Electrical conductivity, breakdown and dissipation.



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Areas of
Concern

Corrosion

Areas of Concern

- ▶ Copper Corrosion / Depletion
- ▶ Conductive Deposits



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Areas of
Concern

Oxidation and Material Compatibility

Areas of Concern

- ▶ High temperature degradation of the fluid
- ▶ PA6, PA46, PA66, PPS, epoxy ester, phenolic molding compound, cyanoacrylate adhesive,
- ▶ Polypropylene (PP), polyethylene terephthalate polyester (PET), Plastic PBT.
- ▶ Flexible materials: polyester braided fabric, aramid polymer paper, Insulating paper

Wear Trepidations



- ▶ Electric pitting must be addressed in greases.
- ▶ Only one test exists for shear/wear consideration.
- ▶ Looking to this SWRI/STLE Consortium to add more value to the future specification.



What is Happening Now?

- ▶ SAE J3200™ proposal completed, ballot sessions beginning.
 - ▶ Two instruments have been taken into consideration at ASTM within Subcommittee 9.
 - ▶ Test method currently written.
 - ▶ Interlaboratory Study (ILS) will follow as protocol to develop precision.
 - ▶ Tests are written as US Army MILSPEC/FTM and awaiting approval.
 - ▶ Other proposals are currently in process for other specification groups globally.
- ▶ Potential SAE J3200™ phase II
 - ▶ Will need more input to refine and add tests to current slate.
 - ▶ Add other EV lubricants and fluids.

Thank you for your kind attention!



SAE J3200™