



Standard Developments for Electric Vehicle Fluids and Natural Gas-Hydrogen Blends for Motor Vehicles

California Bureau of Automotive Repair

BAR Advisory Panel

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Overview of Presentation

- Introduce ASTM committees
- Current Standard Development for EV Coolants D15.26
- Natural Gas and Natural Gas-Hydrogen Blends D03.02
 - Impact Hydrogen Blended with Natural Gas
 - NCWM Handbook 130
- SAE EV Lubricants SAE TC3
- Future Concerns

Scope of D03.02 Subcommittee on Specifications and Classifications of Gaseous Fuels

D03.02 Responsible for developing and maintaining standard specifications for gaseous fuels. Interfaces with relevant ASTM D03 subcommittees on issues related to gaseous fuel specifications. Supports the development of practices, guides, and test methods needed for gaseous fuel specifications.

Scope of D15.26 Subcommittee on Specifications and Classifications of Gaseous Fuels

D15.26 Responsible for developing and maintaining standard specifications for electric vehicle coolants. Interfaces with relevant ASTM D15 subcommittees on issues related to electric vehicle coolant specifications. Supports the development of practices, guides, and test methods needed for electric vehicle coolant specifications.

ASTM D02 Coordinating Subcommittee CS 97 on Fluids for Electrified Vehicles and Drive Systems

Proposed Scope:

The promotion of knowledge related to, all fluids utilized in electrified vehicles and drive systems. To maintain liaison with other industry groups, both within and outside of ASTM, in their work on such fluids. Work will include the collection, dissemination, and standardization of the research on fluids for electrified vehicles and drive systems.

D02.97 liaisons

- ASTM Committees:
 - D02 Petroleum Products, Liquid Fuels, and Lubricants;
 - D15 Engine Coolants and Related Fluids;
 - D27 Electrical Insulating Liquids and Gases ,
- SAE International Fuels and Lubricants TC 3 Driveline and Chassis Lubrication
- STLE - Society of Tribologists and Lubrication Engineers www.stle.org
- NCWM – National Conference on Weights and Measures
 - FALS Fuels, Automotive Products, Lubricants Subcommittee
- CRC Coordinating Research Council
- NLGI National Lubricating Grease Institute
- IFC International Fluids Consortium
- DIN Deutsches Institut für Normung, [German National Standards]
- SwRI AFEV Advanced Fluids for Electrified Vehicles Consortium.

Need for EV Coolants

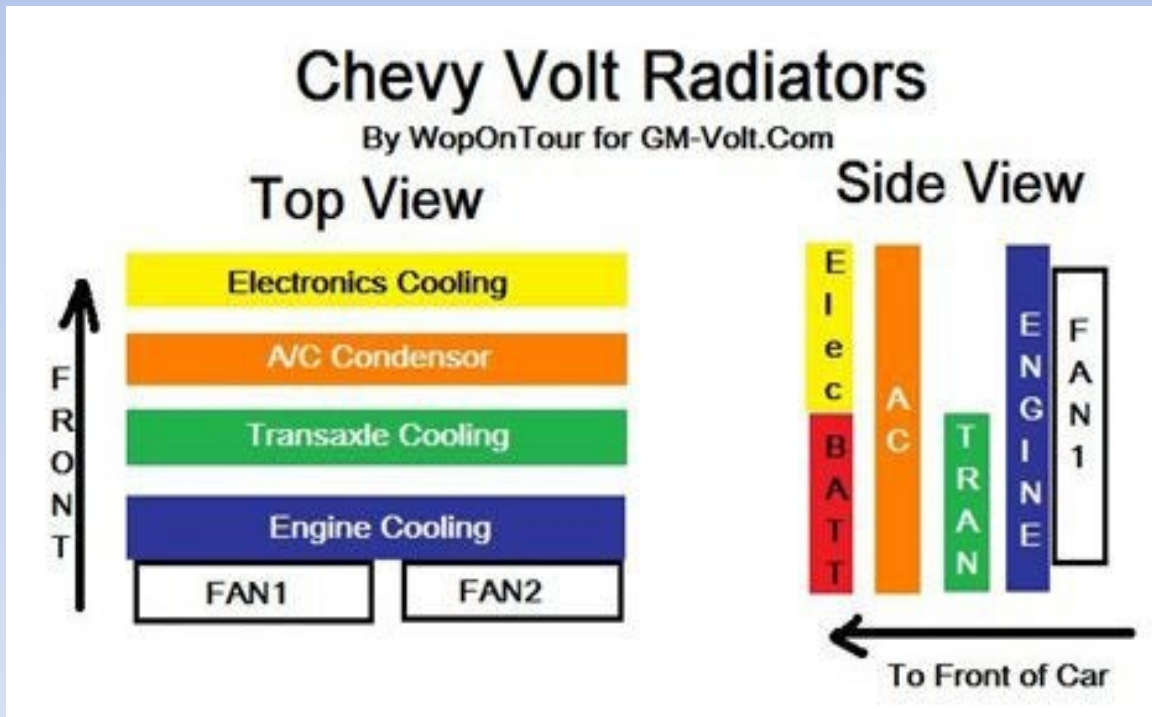
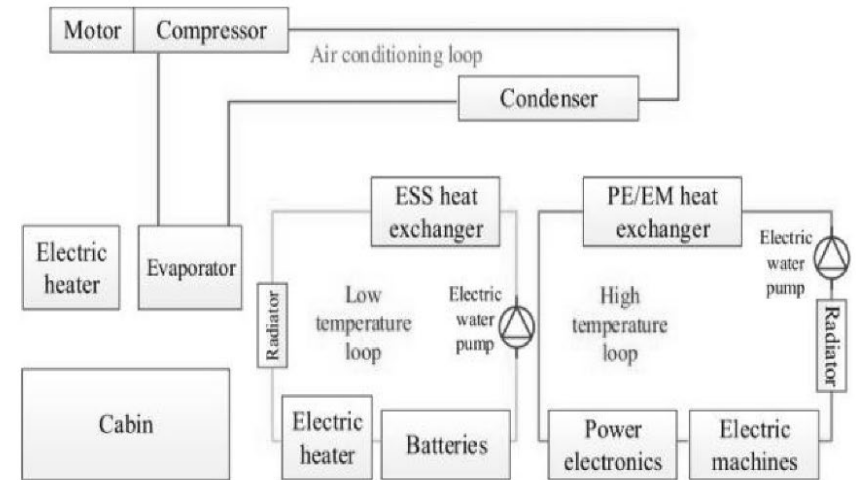


Fig. 1

From: Thermal Management of Electrified Propulsion System for Low-Carbon Vehicles



Schematic of a thermal management system for electric vehicle [5]

ASTM D15.26 EV Coolants

- Glycol Based Coolants
 - Fuel Cell Vehicle; Ion exchange resins to remove contaminants
 - Low Electrically Conductive Non-ionic corrosion inhibitors
 - Traditional Additives Formulations
- Waterless Coolants
 - High Dielectric Fluids
 - High Temperature Fluids
 - Lubricant and Coolant (Common Sump)

Additional D15.26 Work

- Developing Test Methods for EV Coolants
 - Corrosion Tests for New Material Compositions
 - Elastomer Compatibility
 - Electrical Conductivity
 - Flash Point and Flame Point Testing
 - Non-Motor Vehicle Applications

ASTM D03 Gaseous Fuels

- A 2009 discussion led to a 12-year effort to create a natural gas fuel quality standard
- Brought together Stakeholders OEMs, fuel providers, gas utilities, testing laboratories, and regulators
- Development of a method to determine antiknocks properties: Methane Number Calculated MNc D8221
- Identified Additional Test Methods Needed

ASTM D8080-21

Specification for Compressed Natural Gas (CNG) and Liquefied Natural Gas (LNG) Used as a Motor Vehicle Fuel

- Defines the criteria for compressed natural gas (CNG), liquefied natural gas (LNG), or biogas when used as a fuel for internal combustion engines in motor vehicles.
- Established two performance grades MNc 65 and MNc 75
- Three levels of Sulfur needed for odorization's requirements (mercaptans)
- Limits hydrogen to 0.3 % by volume

California PUC and Hydrogen Blending into Natural Gas Supply

- Senate Bill No. 1369 requires CPUC to add green hydrogen as part of California's renewable energy portfolio
- Current consideration 5% hydrogen with a potential increase to 30 %
- Current CNG vehicle fuel specifications limit hydrogen to 0.03%

Hydrogen Impacts on Engine Performance

- Engine Knock – Increased knock with increasing hydrogen
 - RON Methane >120; H₂ ~63; Gasoline 90 - 100
 - A new scale Methane Number Methane = 100 Hydrogen = 0 has been developed. (MWM has been updated to MNc)
- Engine Power – Lower density means Lower Energy Content Heating Value Wobbe Index -
- Engine Durability – Hydrogen impact on components due to hydrogen embrittlement

H2 Blending

Impacts of MNc, LHV, and Wobbe

MNc 75 min. or 65 min.				LHV, MJ/m3 33.2 MJ/m3 min.				Wobbe (HHV), (MJ/m3) 46-53 MJ/m3			
H2 (%)	Nat Gas	CNG	Low MNc Nat Gas	H2 (%)	Nat Gas	CNG	Low MNc Nat Gas	H2 (%)	Nat Gas	CNG	Low MNc Nat Gas
0	80	92	71	0	37.66	36.01	38.81	0	51.24	49.83	51.41
1	80	92	71	1	37.39	35.76	38.53	1	51.11	49.71	51.28
2	80	90	71	2	37.12	35.51	38.25	2	50.98	49.59	51.14
5	78	87	70	5	36.32	34.75	37.41	5	50.59	49.23	50.74
10	75	83	68	10	34.97	33.49	36.01	10	49.94	48.63	50.07
15	72	78	65	15	33.63	32.23	34.60	15	49.28	48.02	49.40
20	68	74	62	20	32.29	30.97	33.20	20	48.63	47.42	48.72
25	65	70	59	25	30.94	29.70	31.80	25	47.97	46.82	48.05
30	62	66	56	30	29.60	28.44	30.40	30	47.31	46.22	47.37

ASTM D8487-23

Standard Specification For Natural Gas, Hydrogen Blends For Use As A Motor Vehicle Fuel

- Minimizing impacts on fuel parameters led to a 10% by Volume blend
- Building on D8080 success this process was only a 2-year effort
- As demand for more hydrogen to be blended into natural gas there will be an increased amount of hydrogen allowed
- Test methods are being modified to allow for high hydrogen concentrations

NIST -National Conference on Weights and Measures(NCWM) Handbook 130 Fuel Quality

- Proposal to amend NIST HB 130 B. Uniform Regulation for the Method of Sale of Commodities
- Replacing SAE J1616 and SAE J2699 with ASTM D8080 “Standard Specification for Compressed Natural Gas (CNG) and Liquefied Natural Gas (LNG) Used as a Motor Vehicle Fuel.”
- Add ASTM D8487 “Standard Specification for Natural Gas, Hydrogen Blends for Use as a Motor Vehicle Fuel.”.
- Add labeling of grades to the method of sale



SAE TC 3 Driveline and Chassis Lubrication

EV Lubricants

- SAE J3200 Specification for Fluid for Automotive Electrified Drivetrains
 - Electrical Properties
 - Heat Transfer Properties
 - Copper Corrosion and Conductive Deposit Properties
 - Oxidation Properties
 - Material Compatibility Properties
 - High-Speed Aeration Properties
 - New Wear Concerns

Future Concerns

- Updating California Codes and Regulations for New Specifications; Fuels, Lubricants, and Coolants
- Education for Auto Repair Facilities on new Fluids Requirements
- Building Codes Impacting EV and Alternative Fueled Vehicles Repair Facilities

Questions and Answers



Thank You

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