



SURFACE VEHICLE INFORMATION REPORT

J2601™-2

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Fueling Protocol for Gaseous Hydrogen Powered Heavy Duty Vehicles

RATIONALE

When SAE J2601-2 was first published in 2014, there was not a published standard fueling protocol or adopted method for fueling hydrogen powered heavy duty transit buses and heavy duty vehicles. The original intent of this document was to establish the safety limits and performance requirements for 35 MPa hydrogen dispensing systems for refueling transit buses and heavy duty vehicles.

However, as the market developed, additional fueling protocols have been published in the SAE J2601 context (for example: CHSS Capacity Category D), and other protocols are being developed as part of SAE J2601-5 and other standards. The users of SAE J2601-2 should consider using protocols developed as the result of recent efforts, as they match current technology capabilities and reflect lessons learned in the field. SAE J2601-2 should only be utilized at non-public access hydrogen stations where the vehicles being fueled are known and appropriate administrative controls are enforced.

Users of SAE J2601-2 are also advised that SAE J2601 may contain requirements and considerations that should be applied to fueling protocols developed under SAE J2601-2. It is the responsibility of the fueling protocol developer to ensure that the resulting protocol can be used under all operating conditions for all vehicles and CHSS configurations.

STABILIZED NOTICE

This document has been declared "STABILIZED" by SAE Fuel Cell Standards Committee and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

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Documents

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FOREWORD

The intent of this document is to provide guidance for performance oriented dispenser standards for safe fueling of hydrogen powered transit buses and heavy duty vehicles.

1. SCOPE

The purpose of this document is to provide performance requirements for hydrogen dispensing systems used for fueling 35 MPa heavy duty hydrogen transit buses and vehicles (other pressures are optional).

This document establishes the boundary conditions for safe heavy duty hydrogen surface vehicle fueling, such as safety limits and performance requirements for gaseous hydrogen fuel dispensers used to fuel hydrogen transit buses. For fueling light-duty vehicles SAE J2601 should be used.

SAE J2601-2 is a performance based protocol document that also provides guidance to fueling system builders, manufacturers of gaseous hydrogen powered heavy duty transit buses, and operators of the hydrogen powered vehicle fleet(s).

This fueling protocol is suitable for heavy duty vehicles with a combined vehicle CHSS capacity larger than 10 kilograms aiming to support all practical capacities of transit buses. It is non-prescriptive in how to achieve a full fill or 100% state of charge (SOC) in the vehicle tank storage system.

This document is an independent document from SAE J2601 "Fueling Protocols for Light Duty Gaseous Hydrogen Surface Vehicles" and should be used separately.

The fueling limits shown in this document are harmonized with the fueling assumptions used for on-board fuel systems, as provided by gaseous hydrogen transit bus manufacturers.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J1939	Serial Control and Communications Heavy Duty Vehicle Network – Top Level Document
SAE J2574	Fuel Cell Vehicle Terminology
SAE J2578	Recommended Practice for General Fuel Cell Vehicle Safety
SAE J2579	Standard for Fuel Systems in Fuel Cell and Other Hydrogen Vehicles
SAE J2600	Compressed Hydrogen Surface Vehicle Fueling Connection Devices
SAE J2601	Fueling Protocols for Light Duty Gaseous Hydrogen Surface Vehicles
SAE J2719	Hydrogen Fuel Quality for Fuel Cell Vehicles
SAE J2760	Pressure Terminology Used in Fuel Cells and Other Hydrogen Vehicle Applications
SAE J2799	Hydrogen Surface Vehicle to Station Communications Hardware and Software

2.1.2 ISO Publications

Available from American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036, Tel: 212-642-4900, www.ansi.org.

ISO 14687-2	Hydrogen Fuel - Product Specifications
ISO 13849-1	Safety - Related Parts of Control Systems
ISO 17268:2012	Gaseous Hydrogen Land Vehicle Refuelling Connection Devices
ISO 19078	Gas Cylinders - Inspection of the Cylinder Installation, and Requalification of High Pressure Cylinders for the On-Board Storage of Natural Gas as a Fuel for Automotive Vehicles
ISO/DIS 20100	Gaseous Hydrogen - Fuelling Stations

2.1.3 CSA Publications

Available from CSA International, 178 Rexdale Boulevard, Toronto, Ontario, Canada M9W 1R3, Tel: 416-747-4000, www.csa-international.org.

CSA B51-09 Boiler, Pressure Vessel, and Pressure Piping Code

ANSI/CSA CHMC 1-2014 Test Methods for Evaluating Material Compatibility in Compressed Hydrogen Applications - Metals

CSA HGV 2- 2014 Hydrogen Fuel System Containers (to be published March 2014)

CSA HGV 3.1 – 2013 Fuel system components for compressed hydrogen gas powered vehicles

ANSI/CSA HGV 4.1-2013 Standard for Hydrogen Dispensing Systems

ANSI/CSA HGV 4.2-2013 Standard for Hoses for Compressed Hydrogen fuel Stations, Dispensers and Vehicle fuel Systems

ANSI/CSA HGV 4.4-2013 Standard for Breakaway Devices for Compressed Hydrogen Dispensing Hoses and Systems

ANSI/CSA HGV 4.5-2013 Standard for Priority and Sequencing Equipment for Hydrogen Vehicle Fueling

ANSI/CSA HGV 4.6-2013 Manually Operated Valves for use in Gaseous Hydrogen Vehicle Fueling Stations

ANSI/CSA HGV 4.7-2013 Automatic Valves for use in Gaseous Hydrogen Vehicle Fueling Stations

ANSI/CSA HGV 4.8-2012 Hydrogen Gas Vehicle Fueling Station Compressor Guidelines

ANSI/CSA HGV 4.10-2012 Standard for Fittings for Compressed Hydrogen gas and Hydrogen Rich gas Mixtures

ANSI/HPRD 1-2013 Thermally activated pressure relief devices for compressed hydrogen vehicle fuel containers

2.1.4 ISA Publications

Available from the International Society of Automation, 67 T.W. Alexander Drive, PO Box 12277, Research Triangle Park, NC 27709, Tel: (919) 549-8411, www.isa.org.

ANSI/ISA-75.02.01-2008 Control Valve Capacity Test Procedures

2.1.5 European Commission Publications

EC79 Regulation (EC) No 79/2009 of the European Parliament and of the Council of 14 January 2009 on type-approval of hydrogen-powered motor vehicles, and amending Directive 2007/46/EC – Available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:035:0032:0046:EN:PDF> or <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009R0079:EN:NOT>

2.1.6 US DOT Publications

FMCSA-RRT-07-020 Guidelines for Use of Hydrogen Fuel in Commercial Vehicles – Available at: <http://www.fmcsa.dot.gov/facts-research/research-technology/report/guidelines-h2-fuel-in-cmvs-nov2007.pdf>

3. ABBREVIATIONS AND SYMBOLS

3.1 Abbreviations

ASOV	Automatic Shut Off Valve
CHSS	Compressed Hydrogen Storage System (on board vehicle)
ESDS	Emergency Shut Down System
FS	Fueling Station
FSP	Full Storage Pressure
H2	Hydrogen gas
HSV	Hydrogen Surface Vehicle
HDHSV	Heavy Duty Hydrogen Surface Vehicle
LDHSV	Light Duty Hydrogen Surface Vehicle
MAWP	Maximum Allowable Working Pressure (dispenser system)
NIST	National Institute of Standards and Technology
NWP	Nominal Working Pressure (same as SP)
PRD	Pressure Relief Device (thermally activated gas release device in vehicle fuel system)
PRV	Pressure Relief Valve (mechanical valve in fueling station; over-pressure protection)
SAE	Society of Automotive Engineers
SOC	State of Charge
SP	Service Pressure, (same as NWP)
VFA	Vehicle Fueling Appliance

3.2 Symbols

P	Pressure
T	Temperature
ρ	Density
t	Time