SURFACE VEHICLE INFORMATION REPORT

J3081™ OCT2020

Issued 2015-04
Revised 2020-10

Superseding J3081 APR2015

Heavy Vehicle Controls Prioritization and Conflict Resolution

RATIONALE

In conjunction with the standard Five-Year Review, this document has been updated to address industry trends; in particular, the development of pure battery-electric vehicles for commercial vehicle applications.

1. SCOPE

This document is written to address acceleration and deceleration control issues related to heavy-duty trucks and buses greater than 10000 GVW.

1.1 Purpose

Establish criteria and rationale for prioritized response to operator control inputs in order to enable acceptable operation of heavy vehicles, especially in cases where there may be conflicting priorities.

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 +1 724-776-4970 (outside USA), www.sae.org.

SAE J1939 Serial Control and Communications Heavy Duty Vehicle Network - Top Level Document

2.1.2 ISO Publications

Copies of these documents are available online at http://webstore.ansi.org/.

ISO 26262 Road Vehicles - Functional Safety

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 Other Publications

Code of Federal Regulations, 49 CFR, Part 571, Crash Avoidance

Standard No. 105 Hydraulic and Electric Brake Systems

Standard No. 121 Air Brake Systems

Standard No. 124 Accelerator Control Systems

3. TRADITIONAL MECHANICAL CONTROL SYSTEMS

Traditionally operator control of commercial vehicles has been accomplished with a variety of mechanical devices.

1. Accelerator pedal coupled to mechanical governor
2. Brake treadle—pneumatic valve control of brake chambers
3. Engine brakes and drive line retarders
4. Shift selector—typically lever or cable coupling to shift forks
5. Mechanical clutches
6. Steering wheel—geared coupling to steer arms

Care has been taken in the design of these systems to achieve acceptable operation while avoiding the addition of costly redundancy. In general, the goal is to bring the vehicle to a controlled stop, out of harm's way, in the event of failure of a significant control system component. At least in North America, the goal has not been to provide redundancy that would permit mission completion.

For example, in case of a stuck accelerator or governor, the operator can operate the clutch and/or shift to neutral while applying the brakes if necessary. The brake system is split front rear so that complete loss of braking capability is unlikely. The steering system is possibly the most critical control system. It is for this reason that significant effort is put into assuring the robustness and reliability of the mechanical components used within this system.

4. TRANSITION TO ELECTRONIC CONTROL SYSTEMS

As a result of the need to reduce vehicle emissions and to improve vehicle safety, basic mechanical controls are being converted to electronic control or "drive-by-wire" systems.

1. Electronic charging system (voltage regulators)
2. Electronic engine controls
3. Automatic transmission controls
4. Antilock brake systems
5. Traction control systems
6. Vehicle stability systems

7. Hybrid vehicle systems

8. Pure battery-electric vehicle systems

9. Steer by wire systems (future)

As these drive-by-wire systems are being engineered, care is being taken to assure that the new systems perform in a manner at least as acceptable in their operation as the prior mechanical systems. However, there is a need for constant vigilance to assess the performance of advanced control systems that provide features not previously available on commercial vehicles. For example, automatic traction control, electronically controlled transmissions, adaptive cruise control, and hybrid systems technology.

At the same time, the advent of advanced control systems has raised the possibility of enhancing vehicle stability, and in particular, compensating to some extent for operator errors. For example:

1. Antilock systems override engine and driveline retarders to avoid inadvertent lockup of drive wheels.

2. Vehicle controls can respond to service brake inputs preferentially over commands for vehicle acceleration.

3. Adaptive cruise is being extended into automatic collision avoidance.

4. Stability controls can compensate for driver operation at excessive speed or with inappropriate steering angles.

Caution should be taken in developing controls that affect the operation of vehicles to avoid introducing unforeseen consequences. For example:

1. Collision avoidance systems must account for the possibility that the driver may wish to maneuver around an obstacle rather than to perform a maximum performance stop.

2. Overly aggressive stability control systems can result in producing vehicles that are perceived as lacking performance and uncomfortable to drive.

3. Adding technology can increase complexity which can reduce reliability.

5. GENERAL PRIORITIZATION OF SYSTEM CONTROL

General prioritization of system control should be as follows:

1. Steering controls

2. Stability controls system/ABS/ATC

3. Collision avoidance

4. Foundation brake controls

5. Electronic transmission controls

6. Acceleration control

7. Engine brake/drive line retarder systems/regenerative braking systems