SURFACE VEHICLE RECOMMENDED PRACTICE

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Seat Belt Comfort, Fit, and Convenience - Truck and Bus

RATIONALE

This revision incorporates information from FMVSS 208, corrects errors and updates references to the final Department of Transportation (DOT) document designation and title.

1. SCOPE

This SAE Recommended Practice provides design, test, and performance guidelines on the comfort, fit, and convenience for active restraint systems for heavy trucks and multipurpose passenger vehicle applications over 10 000 lbs gross vehicle weight rating (GVWR). The information pertains to the forward facing seating positions.

1.1 Purpose

The purpose of this document is to provide the engineer with general reference considerations for the design of active restraint systems that are comfortable and convenient to use for heavy truck and multipurpose passenger vehicle applications. The intent of this practice is to present a logical process by which the engineer and designer may evaluate restraint system designs, regarding comfort, fit, and convenience.

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 J826 Devices for Use in Defining and Measuring Vehicle Seating Accommodation

SAE J833 Human Physical Dimensions

SAE J1516 Accommodation Tool Reference Point

SAE J1522 Truck Driver Stomach Position

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

2.1.2 Government Publications

Federal Motor Vehicle Safety Standards (FMVSS) are available from the Superintendent of Documents, U.S. Government Printing Office, Mail Stop: SSOP, Washington, DC 20402-9320.

FMVSS 101 Controls and Displays

FMVSS 105 Hydraulic Brake Systems

FMVSS 121 Air Brake Systems

FMVSS 208 Occupant Crash Protection

FMVSS 209 Seat Belt Assemblies

FMVSS 210 Seat Belt Assembly Anchorages

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 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 J140 Seat Belt Hardware Test Procedure

SAE J339 Seat Belt Assembly Webbing Abrasion Test Procedure

SAE J383 Motor Vehicle Seat Belt Anchorages - Design Recommendation

SAE J384 Motor Vehicle Seat Belt Anchorages - Test Procedure

SAE J385 Motor Vehicle Seat Belt Anchorages - Performance Requirements

SAE J800 Motor Vehicle Seat Belt Assembly Installation

2.2.2 Other Publications

HS-801 277 Sources and Remedies for Restraint Systems' Discomfort and Inconvenience

DOT-HS-805-597 Comfort and Convenience Specifications for Safety Belts: Shoulder Belt Fit, Pressure and Pull Out Forces

DOT-HS-803-887 An Examination of the Comfort and Convenience of 1979 Safety Belt Systems

3. DEFINITIONS

3.1 ACCOMMODATION TOOL REFERENCE POINT

A two-dimensional side view line which defines a horizontal reference point as a function of H-point height to which stomach contours can be located in vehicle space. Three different lines are provided to accommodate truck driver populations with male/female ratios of 50/50, 75/25, and 90/10 to 95/5 (SAE J1516 and SAE J1522).

3.2 ACTIVE RESTRAINT BELT SYSTEM

A belt system that requires action (i.e., donning/doffing) by the vehicle occupant.

3.3 ADJUSTMENT HARDWARE

All hardware designed to adjust the length of the seat belt assembly to fit the user, including such hardware that may be integral with a buckle, attachment hardware, or retractor.

3.4 ANCHORAGE

The final point of attachment for transferring seat belt assembly loads to the vehicle structure.

3.5 ATTACHMENT HARDWARE

All hardware designed for securing the webbing of a seat belt assembly to a motor vehicle at the anchorage.

3.6 AUTOMATIC LOCKING RETRACTOR (ALR)

A retractor incorporating adjustment by means of a positive self-locking mechanism which is capable when locked of withstanding restraint forces.

3.7 BUCKLE

A quick-release mechanism which fastens a person in a seat belt assembly.

3.8 D-RING

A load-bearing device, through which safety belt webbing passes, which controls belt routing and support for the occupant's upper torso.

3.9 DOFFING

The act of removing and storing a seat belt assembly from the occupant.

3.10 DONNING

The act of positioning a seat belt assembly on the occupant.

3.11 EGRESS

The act of exiting (a vehicle).

3.12 EMERGENCY LOCKING RETRACTOR (ELR)

A retractor incorporating adjustment hardware by means of a locking mechanism that is activated by vehicle acceleration, webbing movement relative to the vehicle, or other automatic action during an emergency, and is capable, when locked, of withstanding restraint forces.

3.13 H-POINT

The H-point is the pivot center of the torso and thigh on the two- or three-dimensional devices used in defining and measuring vehicle seating accommodation (see SAE J826).

3.14 HARDWARE

Any metal or rigid plastic part of the seat belt assembly.

3.15 INGRESS

The act of entering (a vehicle).

3.16 INTERMEDIATE CONNECTING POINT (ICP)

A seat belt attachment point which may be located on the seat upper structure to provide additional comfort and convenience with some seat belt systems which use tether belts (see 5.8.)

3.17 LATCH PLATE (Tongue)

Metal part of the latch which is usually connected to the webbing and inserts into the buckle end of the seat belt assembly.

3.18 PELVIC RESTRAINT

A seat belt assembly, or portion thereof, intended to restrain movement of the pelvis.

3.19 RETRACTOR

A device for storing part or all of the webbing of the seat belt assembly.

3.20 SEAT BELT ASSEMBLY

Any strap, webbing, or similar device designed to secure a person in a motor vehicle with the intention of mitigating the results of a collision, including all buckles and other fasteners and all hardware designed for installing the assembly in a motor vehicle.

3.21 Seating Reference Point (SRP)

The manufacturer's design reference point is a unique design H-point which:

a. Establishes the rearmost normal design driving or riding position of each designated seating position, which includes consideration of all modes of adjustment, horizontal, vertical, and tilt, in a vehicle

b. Has X, Y, Z coordinates established relative to the designed vehicle structure

c. Simulates the position of the pivot center of the human torso and thigh

d. Is the reference point employed to position the two-dimensional drafting template with the 95th percentile leg described in SAE J826

3.22 SEAT SYSTEM

The structure necessary to accommodate a person in a designated seating position. Such structure may include, but is not limited to, cushions, headrests, adjustment devices for height, tilt and fore and aft location, mounts, supports, and suspension system.

3.23 STRAP

Nonwoven material used in a seat belt assembly in place of webbing.

3.24 TETHER BELT

Any strap, belt, or device (webbing, wire cable, solid line, etc.) that aids in the transfer of the seat and seat belt loads to the anchorage.

3.25 TYPE I SEAT BELT ASSEMBLY

A lap belt for pelvic restraint.

3.26 TYPE II SEAT BELT ASSEMBLY

A combination of pelvic and upper torso restraints.

3.27 UPPER TORSO RESTRAINT

A portion of a seat belt assembly intended to restrain movement of the chest and shoulder regions.

3.28 WEBBING

A narrow fabric woven with continuous filling yarns and finished salvages.

3.29 WEBBING TENSION RELIEVING DEVICE

A mechanism designed for relieving or eliminating shoulder restraint tension.

4. SEAT BELT ASSEMBLY REQUIREMENTS

4.1 The vehicle shall, at each designated seating position, have either a Type I or a Type II seat belt assembly that conforms to FMVSS 209. Type II seat belt assemblies are preferred for forward facing, outboard seating positions.

4.2 All Type I and Type II belt assemblies mounted in the forward facing outboard seating positions shall utilize either an emergency locking or an automatic locking retractor. Single retractor Type II systems or the upper torso portion of two retractor Type II systems shall utilize an emergency locking retractor. Emergency locking retractors should also be selected to minimize undesirable lockup and cinching during rough ride conditions. Automatic locking retractors should also be the anti-cinching type.

4.3 An automatic locking retractor used at a front outboard seating position that has some type of suspension system for the seat, shall be attached to the seat structure that moves as the suspension system functions.

4.4 Adjustment

The seat belt system should accommodate the truck driver stomach of the anticipated driver population mix as defined in SAE J1522.

One method of complying with this requirement will be considered met if the seat belt assembly can be properly fitted to an adult male using the 95th percentile values from SAE J833 located in the vehicle with its H-point on a horizontal line through the accommodation tool reference point (SAE J1516), and with the whole of the truck driver stomach contour (SAE J1522) encompassed within the manikin stomach outline. The manikin torso angle is to be at the design nominal position and the seat in the rearmost-position. (The objective of the compliance statement is to get a test that can be performed with the currently available manikin, i.e., without the need for an all new SAE/Teamsters manikin.) See attached sketch, Figure 1.

Specialty vehicles intended to be operated by personnel wearing heavy clothing (i.e. fire fighters, hazmat crews, etc…) should provide belt length sufficient to accommodate the extra bulk of the heavy clothing and protective gear.

4.4.1 A seat belt assembly installed in any designated seating position other than the outboard forward facing seating position shall adjust either by an automatic locking retractor, emergency locking retractor, or manual adjusting device that conforms to FMVSS 209.

4.5 Extension

The upper torso portion of the seat belt system shall provide sufficient extension capability to allow all drivers (5th percentile female to 95th percentile male values from SAE J833) while wearing the restraint system to:

a. Reach and operate all controls and displays as required by FMVSS 101, 105, 121, and 208

b. Make the full range of steering wheel movement in a manner that will not adversely affect the driver's ability to maintain control of the vehicle during normal and evasive maneuvers

Specialty vehicles intended to be operated by personnel wearing heavy clothing (i.e. fire fighters, hazmat crews, etc.) should provide belt length sufficient to accommodate the extra bulk of the heavy clothing and protective gear.

4.6 Latch Mechanism

A seat belt assembly shall have a latch mechanism:

a. Whose components are accessible to a seated occupant in both the stowed and operational positions

b. That releases both the upper torso restraint and the lap belt simultaneously, if the assembly has a lap belt and an upper torso restraint that require unlatching for release of the occupant

c. That releases at a single point by push button action

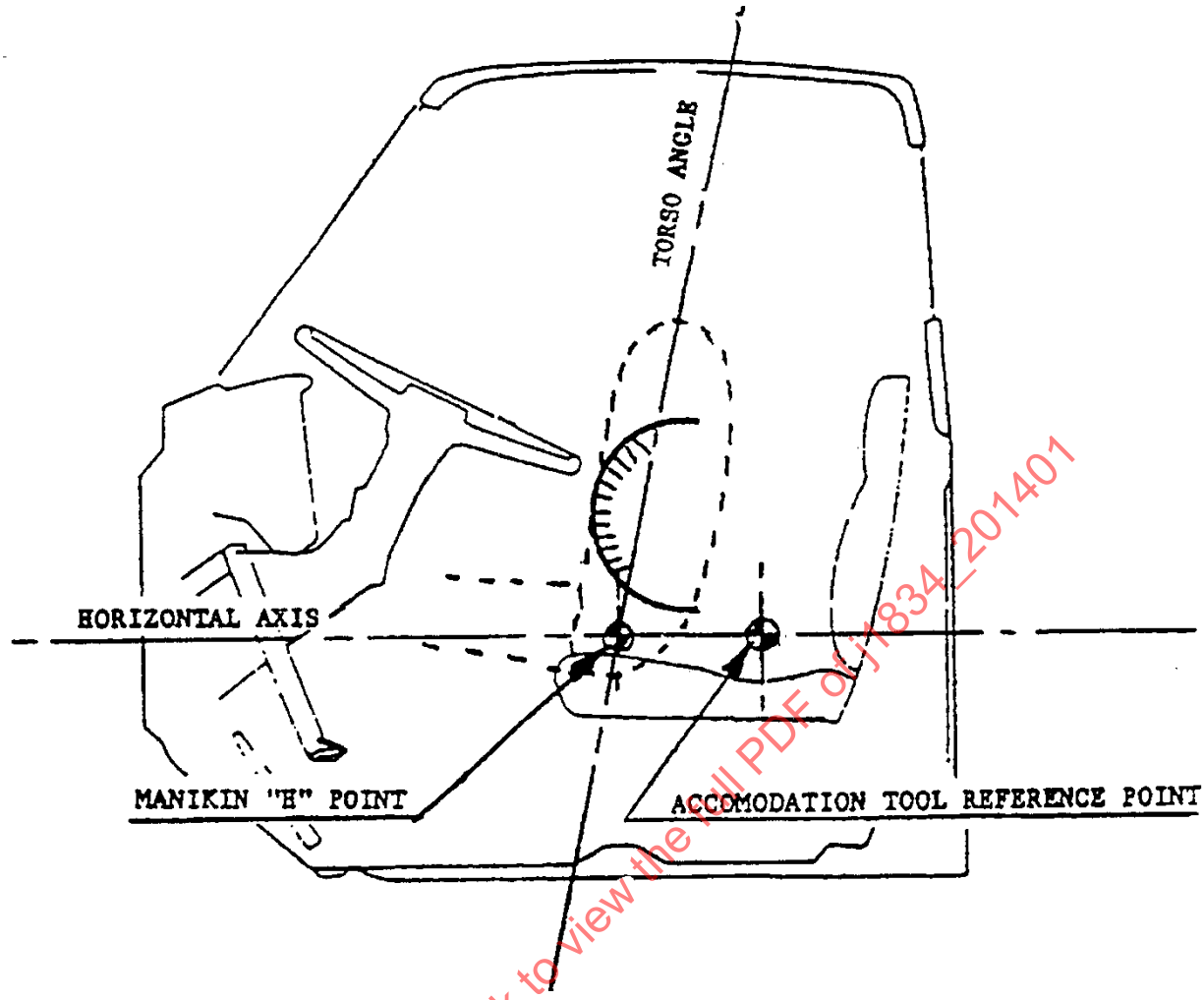

FIGURE 1 - STOMACH CONTOUR