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SURFACE VEHICLE RECOMMENDED PRACTICE

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Securing Child Restraint Systems in Motor Vehicles

Foreword—The use of child restraint systems in motor vehicles is required by law in all fifty of the United States. Further, add-on child restraint systems are required by Federal Motor Vehicle Safety Standard No. 213 to be designed to use the vehicle seat belt for attachment to the vehicle and vehicle seat. Accordingly, compatibility between these restraint systems and vehicle seats and seat belts is necessary for their proper functioning and performance. To promote proper installation of child restraint systems in motor vehicles, it is important that manufacturers of both child restraint systems and vehicles design them to conform to this SAE Recommended Practice. Child restraint systems and vehicle seats and seat belts having features that conform to this document are more likely to be compatible with one another.

1. Scope—The scope of this SAE Recommended Practice is to promote compatibility between child restraint systems and vehicle seats and seat belts. Design guidelines are provided to vehicle manufacturers for certain characteristics of seats and seat belts, and to child restraint system (CRS) manufacturers for corresponding CRS features so that each can be made more compatible with the other.

The Child Restraint System Accommodation Fixture, shown in Figure 1, is used to represent a CRS to the designers of both the vehicle interior and the CRS for evaluation of each product for compatibility with the other. The features of the accommodation fixture are described as each is used. A CRS accommodation template of transparent plastic, not shown, represents the side of the accommodation fixture for use in approximating its installed position on design drawings.

2. References

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J1369—Anchorage Provisions for Installation of Child Restraint Tether Straps in Rear Seating Positions

SAE 870324—Performance Evaluation of Child Restraints Relative to Vehicle Lap-Belt Anchorage Location, Weber, K. and Radovich, V. G.

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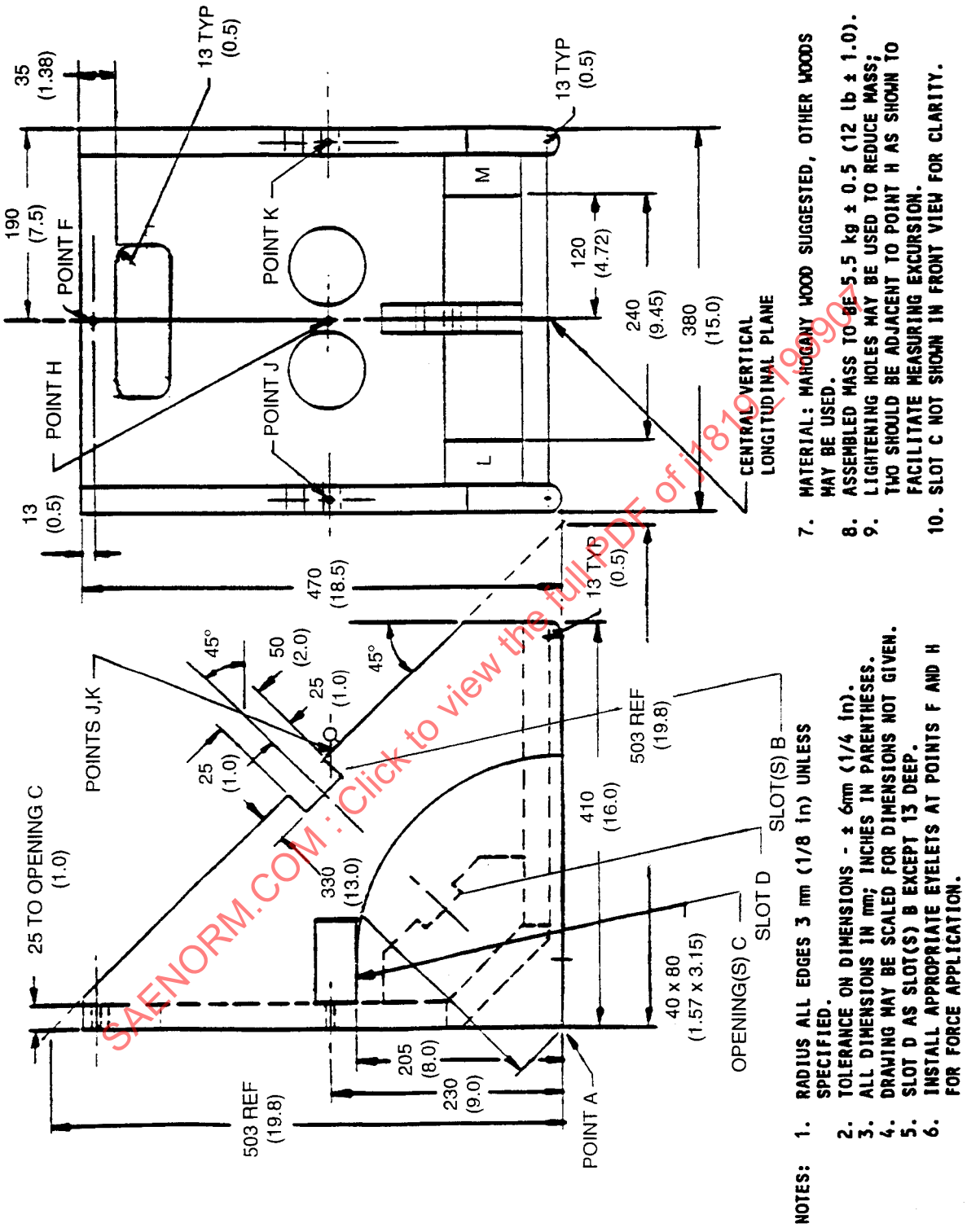

NOTES:
1. RADIUS ALL EDGES 3 mm (1/8 in) UNLESS SPECIFIED.
2. TOLERANCE ON DIMENSIONS - ± 6mm (1/4 in).
3. ALL DIMENSIONS IN mm; INCHES IN PARENTHESES.
4. DRAWING MAY BE SCALED FOR DIMENSIONS NOT GIVEN.
5. SLOT D AS SLOT(S) B EXCEPT 13 DEEP.
6. INSTALL APPROPRIATE EYELETS AT POINTS F AND H FOR FORCE APPLICATION.
7. MATERIAL: MAHOGANY WOOD SUGGESTED, OTHER WOODS MAY BE USED.
8. ASSEMBLED MASS TO BE 5.5 kg ± 0.5 (12 lb ± 1.0).
9. LIGHTENING HOLES MAY BE USED TO REDUCE MASS; TWO SHOULD BE ADJACENT TO POINT H AS SHOWN TO FACILITATE MEASURING EXCURSION.
10. SLOT C NOT SHOWN IN FRONT VIEW FOR CLARITY.

FIGURE 1—ACCOMMODATION FIXTURE

2.1.2 FEDERAL PUBLICATIONS—Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

FMVSS 208—Occupant Crash Protection
FMVSS 209—Seat Belt Assemblies
FMVSS 210—Seat Belt Anchorages
FMVSS 213—Child Restraint Systems
K. Weber and J. W. Melvin, "Dynamic Testing of Innovative Solutions to Child Occupant Protection Problems," Contract No. DTNH22-82-C-07176
Ziegler, P. N. and Morris, J., "Compatibility of Child Safety Seats with Seat Belts in 1984 Model Passenger Vehicles," Washington, D.C., NHTSA, Office of Driver and Pedestrian Research, April 1984

3. ***The Vehicle Seats—***A child restraint system is located and restrained in the vehicle by the seat surfaces and the lap belt or lap portion of the seat belt. Cushion shape, stiffness, and location relative to the lap belt contact points are characteristics significant to child restraint system installation and performance. They are evaluated by first locating the accommodation fixture on the seat so that its central vertical longitudinal plane is coincident with that of the seating position within ±25 mm (1.0 in), and then securing it with the lap belt or lap belt portion of the seat belt passed about the belt path through slots B. Because of the variety and variability of the materials and manufacturing methods used in vehicle seat construction, it is recommended that for the following evaluations, a cotton muslin cloth or sheet be placed on the seat back and cushion before the accommodation fixture is installed on the seat, and that three trials be conducted for each evaluation, each beginning with the installation of the accommodation fixture.

Adjustable seats are placed in the mid-position, or alternately, at the position recommended by the manufacturer when the seat is used with child restraints. Adjustable seat backs are placed at the manufacturer's design position, and seat belt tension, measured in the belt between the two slots B, is adjusted to 60 N ± 5 N (13.5 lbf ± 1.0 lbf) for these evaluations.

To assure compatibility between the vehicle seat and child restraint systems, the vehicle seat cushion shall meet the requirements of 3.1 and 3.2.

3.1 **Seat Cushion Shape—**The shape of the seat cushion shall be such that not less than 85% of the area of the bottom surface (including the edges of the side members) of the accommodation fixture, when the area is projected perpendicularly from that surface, falls upon the surface of the seat cushion.

3.2 **Seat Cushion Stiffness—**The stiffness of the seat cushion shall be such that the angular deflection of the accommodation fixture is not more than 12 degrees when a force of 155 N ± 5 N (35 lbf ± 1 lbf) is applied horizontally (±5 degrees) forward at point F (Figure 1).

4. ***The Vehicle Seat Belts—***Seat belt adjustment hardware, supporting trim, webbing length, and the location of the contact points, those points where the seat belt webbing longitudinal centerline makes contact with attachment hardware such as a swivel plate, all influence the installation and performance of a CRS. The relationships of these features to one another, to the seating position, and to the CRS are evaluated with the aid of the accommodation fixture installed on the vehicle seat as in 3.

To assure compatibility between the vehicle seat belts and child restraint systems, the vehicle seat belts shall meet the requirements of 4.1 through 4.6. Where a manufacturer provides a supplementary lap belt for use with child restraints at front seating positions equipped with automatic belt systems, the supplementary belt shall be used for these evaluations.

4.1 **Lap Belt Length—**The length of the lap belt or the lap portion of the seat belt shall be sufficient to pass around the maximum belt length path through slots B of the accommodation fixture when buckled (approximately 1040 mm (41 in)).

4.2 Buckle or Latch Plate Size—The size of the buckle or latch plate which must pass through a CRS shall be such that it passes freely through an opening measuring 40 mm x 80 mm (1.57 in x 3.15 in), such as opening(s) C in the accommodation fixture.

4.3 Minimum Belt Length—The vehicle manufacturer must assure that the seat belt automatic-locking retractor, where employed, will latch when the belt is buckled over a 50th percentile 6-year-old dummy, as required by FMVSS 208. The minimum length belt path through the openings L and M and the slot D in the center reinforcement of the accommodation fixture, approximately 475 mm (19 in) in length, represents that minimum belt length over the 6-year-old dummy.

4.4 Buckle-Latch Plate Assembled Length—To assure buckle accessibility, ease of belt adjustment, and proper adjustable latch plate function, the buckle-latch plate assembled length shall meet the requirement of either 4.4.1 or 4.4.2.

4.4.1 The buckle-latch plate assembled length shall be such that the end of the latch plate is within the circular segment having a radius of 205 mm (8.0 in) and a center at a point 65 mm (2.6 in) to the right of Point A in Figure 1, when viewed from the side and perpendicular to the surface of the fixture.

4.4.2 The buckle-latch plate assembled length shall be such that belt tension is maintained when the accommodation fixture is restrained by the seat belt passed through the openings C and adjusted to a tension of 60 N ± 5 N (13.5 lbf ± 1.0 lbf) measured between the openings C.

4.5 Means for Locking the Lap Belt—To assure that the belt can be and will remain properly adjusted about a CRS, seat belts that incorporate an emergency locking retractor in either the lap belt, the lap portion of a lap/shoulder belt, or in the shoulder portion of a lap/shoulder belt when equipped with a free-sliding latch plate, shall be provided with a means for locking the lap belt or fixing the length of the lap belt or lap portion when used with a CRS.

4.6 Seat Belt Contact Points—To assure that a properly installed CRS is securely restrained by the seat belt and cannot be readily displaced by the installer, the seat belt contact points shall meet the requirement of either 4.6.1 or 4.6.2, and, if applicable, 4.6.3.

The corresponding requirement necessary to overcome the potentially adverse influence of supporting trim such as belt sleeves is indicated for each of the alternative requirements. Support trim designed to position the buckle or latch plate more forward than the plane through point(s) A for occupant accessibility sometimes does not allow the installer to properly tighten the belt about a CRS.

4.6.1 Seat belt contact points and the point at which the centerline of the webbing emerges from adjacent support trim, if any, shall be at or rearward of the point(s) A on both sides of the accommodation fixture.

4.6.2 Seat belt contact points and adjacent belt support trim shall be such that the horizontal forward displacement of the accommodation fixture is not more than 50 mm (2.0 in), measured at point H when a force of 155 N ± 5 N (35 lbf ± 1.0 lbf) is applied horizontally (±5 degrees) forward at point H, and the fixture is restrained by the seat belt passed through the openings C and adjusted to a tension of 60 N ± 5 N (13.5 lbf ± 1.0 lbf), measured between the openings C.

4.6.3 Where seat belt contact points do not lie in the same vertical lateral plane, the horizontal forward displacement of the side of the fixture that is adjacent to the more forward contact point shall be not more than 50 mm (2.0 in) measured at the side of the fixture when a force of 77 N ± 5 N (17 lbf ± 1 lbf) is applied horizontally (±5 degrees) forward at point J or K, as appropriate, and the fixture is restrained by the seat belt passed through the openings C and adjusted to a tension of 60 N ± 5 N (13.5 lbf ± 1.0 lbf), measured between the openings C.