



SURFACE VEHICLE RECOMMENDED PRACTICE

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Motor Vehicle Seating Manual

RATIONALE

Technical content contained in this document was last revised by the SAE Body Engineering Committee in August 1976. Minor editorial reversions were made in February 1980. No subsequent changes were made to this document since February 1980. The SAE Human Accomodation and Design Devices Standards Committee in 2014 determined that the 1980 version of SAE J782 contained useful historical seat terminology and technology which was not dynamic in nature and therefore stabilized this document.

Two sections in the SAE J782 document have been revised and integrated into two different SAE standards. These sections are 7.1.1, Free Seat Contour, and 7, Seat Spring Assembly Test Methods. The updated content appears in the following SAE Recommended Practices:

SAE J2732 Motor Vehicle Seat Dimensions

SAE J2896 Motor Vehicle Seat Comfort Performance Measures

STABILIZED NOTICE

This document has been declared "Stabilized" by the SAE Human Accomodation and Design Devices 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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1. Scope

2. References

2.1 Applicable Publications—The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated the latest revision of SAE publications shall apply.

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

SAE J826b JAN74—Devices for Use in Defining and Measuring Vehicle Seating Accommodation

SAE J879b JUL68—Motor Vehicle Seating Systems

SAE J1010 FEB73—Emission Control Hose

2.1.2 ASTM PUBLICATIONS—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D2406

ASTM D1692 MVSS 302

ASTM D1229—Test Method for Rubber Property—Compression Set at Low Temperatures

3. Motor Vehicle Seats

3.1 Front Seats—The motor vehicle seat is a structure engineered to seat the driver and passengers comfortably for short, as well as extended, periods of time with a minimum of fatigue. It must position the occupants at their proper locations to assure the desired:

- a. Proximity of driver to steering wheel, brake pedal, accelerator pedal, and instrument panel controls
- b. Head and leg room
- c. Field of vision

In addition, modern automotive seating requires an appealing appearance as well as versatility such as folding for entrance or egress. Today's seating may encompass such things as reclining seat backs, swivel seats, arm rests, lumbar supports, and head restraints of add-on or built-in variety. Some of the typical front seats available today are shown in Figure 1 (A-G).

3.2 Rear Seats—The rear seats may take many different shapes; the most basic seats are the four-door, two-door, and station wagon second and third seats.

In general, four-door and two-door seats are supported by the floor pan and are not adjustable. Seats may be side facing, front facing, or rear facing. Most station wagon seats fold to give a level loading area. A number of typical rear seats are shown in Figure 2 (A-C).

4. Seat Adjusters

4.1 Definition—A seat adjuster is a device which, when suitably anchored to the vehicle structure, supports the seat frame assembly and provides adjustments by manual or power actuating assemblies.

4.2 Purpose—The purpose of a seat adjuster is to enable the driver to readily adjust the seat position to suit his individual requirements.

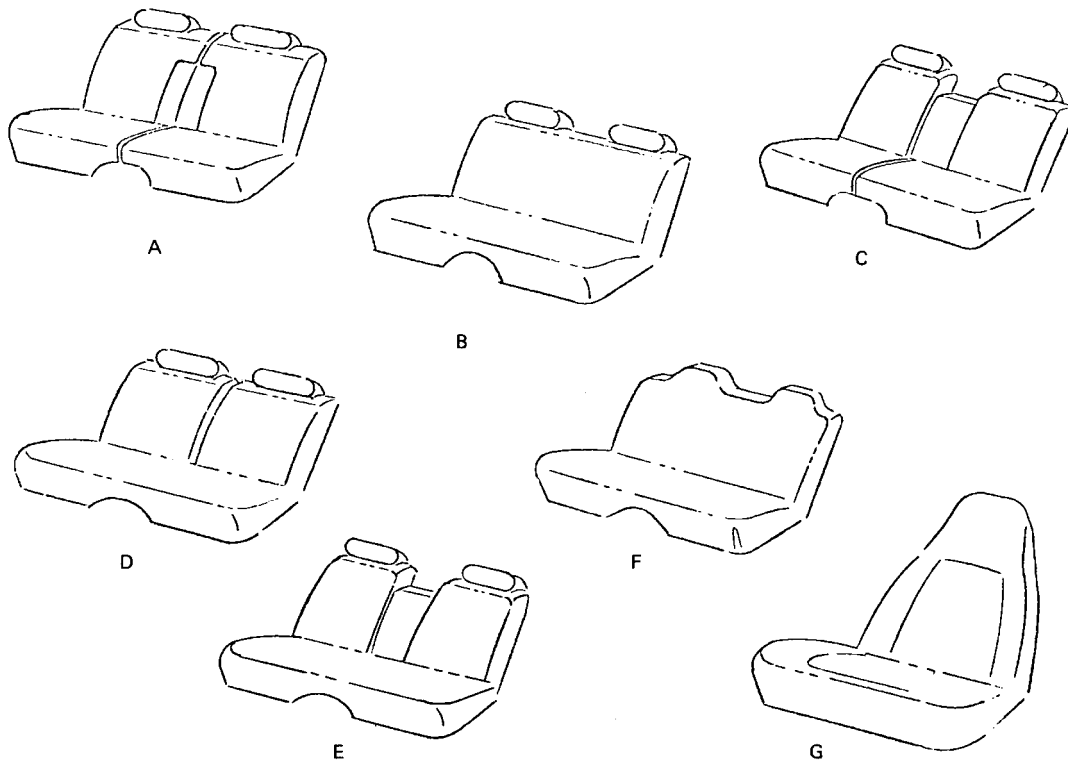


FIGURE 1—TYPICAL FRONT SEATS (A) 50/50 BENCH WITH ARM RESTS (B) FOUR-DOOR BENCH (C) 60/40 BENCH WITH A CENTER ARM REST (D) TWO-DOOR BENCH (E) TWO-DOOR OR FOUR-DOOR BENCH WITH CENTER ARM REST (F) FOUR-DOOR BENCH WITH INTEGRAL HEAD RESTRAINT (G) BUCKET SEAT WITH INTEGRAL HEAD RESTRAINT

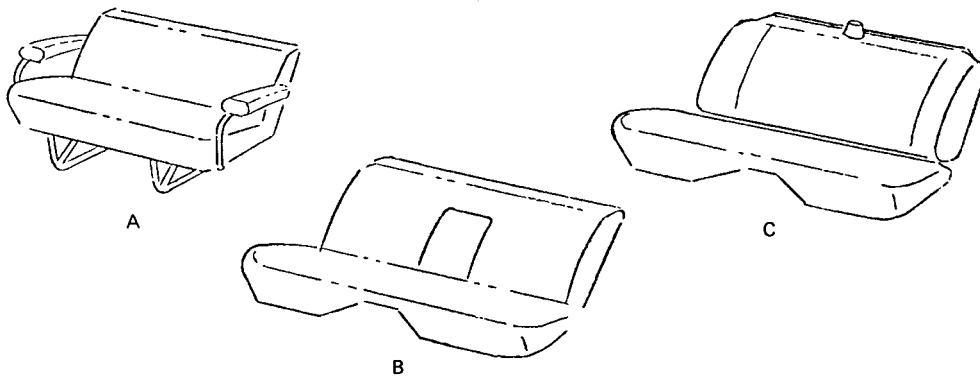


FIGURE 2—TYPICAL REAR SEATS (A) VAN TYPE PASSENGER SEAT
(B) TYPICAL PASSENGER CAR REAR SEAT (C) FOLDING BACK
SEAT FOR SUBURBANS AND SPECIAL SPACE PACKAGE VEHICLES

4.3 Design Requirements

- 4.3.1 The usual adjustment range fore and aft is between 3 1/2 (90 mm) and 6 in (152 mm), in increments of about 1/2 (13 mm)—5/8 in (16 mm), or an infinite number of positions as in the case of the power-operated adjuster.
- 4.3.2 The usual range of maximum vertical adjustments is between 1 1/4 (30 mm) and 2 1/2 in (65 mm), in increments of about 1/4 in (6 mm) or an infinite number of positions as in the case of the power-operated adjuster.
- 4.3.3 The usual range of angular adjustment is between 5 deg = (0.087 rad) and 10 deg = (0.174 rad) from the horizontal plane, in increments of about 1/2 deg = (0.009 rad) or an infinite number of positions as in the case of the power-operated adjuster.
- 4.3.4 The adjuster should provide a safe locking device which should not fail under normal operation. Impact loadings should also be considered.
- 4.3.5 It should operate with minimum effort.

4.4 Typical Types of Adjusters

- 4.4.1 A two-way straight adjuster, providing level fore-and-aft movement of the seat (Figure 3).
- 4.4.2 A two-way inclined straight adjuster combining the elevation with forward movement of the seat (Figure 4).
- 4.4.3 A two-way curved adjuster combining forward tilt and elevation with forward movement of the seat (Figure 5 and 6).

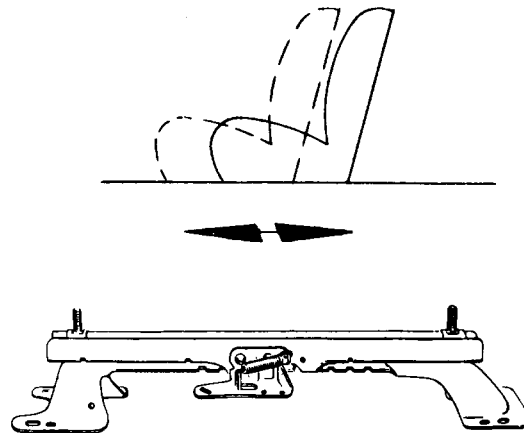


FIGURE 3—TWO-WAY STRAIGHT ADJUSTER

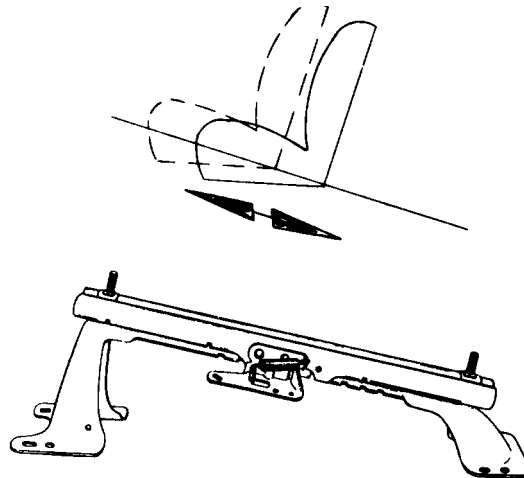


FIGURE 4—TWO-WAY INCLINED STRAIGHT ADJUSTER

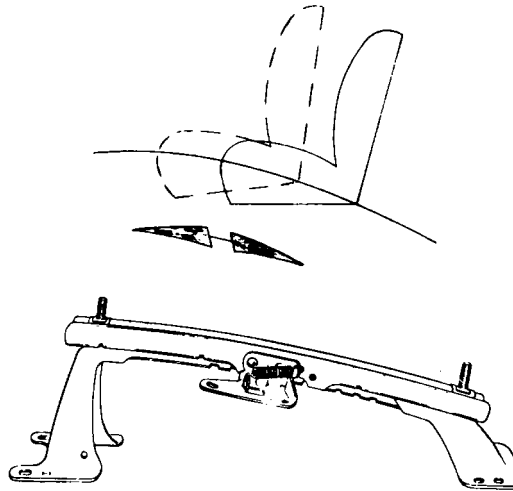


FIGURE 5—TWO-WAY CURVED ADJUSTER

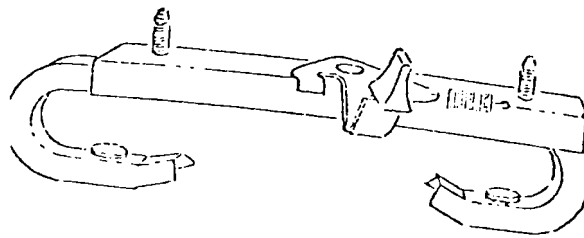


FIGURE 6—TWO-WAY CURVED ADJUSTER

- 4.4.4 A four-way elevating adjuster consisting of a mechanism for independently raising the seat in addition to the fore-and-aft movement of the basic type adjusters. (See Figures 3 - 5.) The vertical elevation is sometimes combined with a movement tilting the seat forward as it is raised (Figure 6).
- 4.4.5 A multipositioning adjuster provides the seat with angular tilting and elevating as well as any combination of these and the normal fore-and-aft movements (Figure 7).

The coordination of the movements between the right-hand and the left-hand seat adjusters may be accomplished by torque bars, cables, seat frame, or some other mechanical interlocking device so that whatever motion is imparted to one side of the seat is transmitted to the opposite side.

4.5 Methods of Test

4.5.1 GENERAL REQUIREMENTS

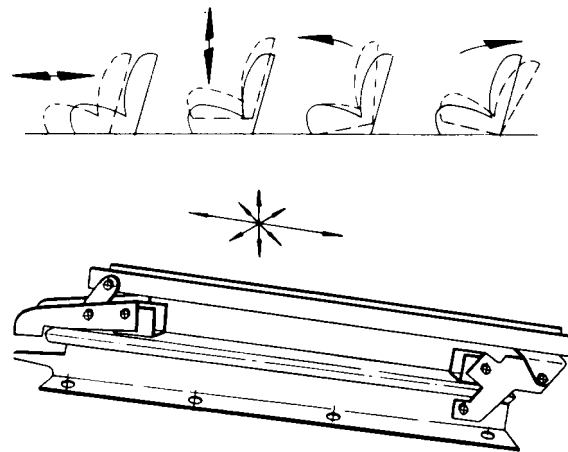


FIGURE 7—SIX-WAY ADJUSTER

4.5.1.1 Manual Seat Adjusters—The seat adjuster mechanism must be capable of giving trouble-free operation throughout the design range of travel. The locking mechanism should operate with the application of no more than 15 lb (67 N) horizontally and 25 lb (111 N) vertically to release. Adequate structural strength must be provided to sustain vertical and lateral loading. Ease of operation is essential and forces required to operate the seat should not exceed 80 lb (356 N) in the rearward direction and 45 lb (200 N) in the forward direction.

4.5.1.2 Power Seat Adjusters—Power seat adjusters, in addition to the requirements in Section 4.3, should be capable of traveling in the fore-and-aft direction at the rate of 0.4 in (10 mm)/s—1.5 in (40 mm)/s with a load of 600 lb (2669 N) (bench seat) and 325 lb (1446 N) (bucket seat) while capable of raising 700 lb (3114 N) (bench) and 350 lb (1557 N) (bucket) through one cycle without impairment.

4.5.2 OPERATION TEST

4.5.2.1 Manual Seat Adjusters—For this test, the seat adjuster is mounted in car position with a seat frame or equivalent structure and loaded to 156 lb (71 kg) per passenger, properly distributed, in addition to the normal weight of the seat. A mechanism to cycle the seat adjuster between the extremes of its travel must be provided. The locking mechanism may be activated if desired. The seat is operated 5000—10 000 cycles with periodic inspection for wear during the cycling test. The periodic inspection normally consists of an examination of the wearing surfaces and measurements of the force required to move the adjusters and the locking mechanism control. A suggested procedure for conducting this test is shown in Figure 8.

4.5.2.2 Power Seat Adjusters—Power seat adjusters are normally set up and loaded in a manner similar to the manual seat adjusters and operated through the extremes of travel on a cyclic basis, such as forward, up, rearward, and down for 5000—10 000 cycles. Time delays are ordinarily required between each change of direction of motion in the cycle to prevent the overheating of the drive mechanism. Periodically during this test, the adjuster is examined for wear and operating characteristics, such as the time of cycling, power requirements, etc. Measurement of power is ordinarily a good indication of the wear characteristics in testing a power seat adjuster.

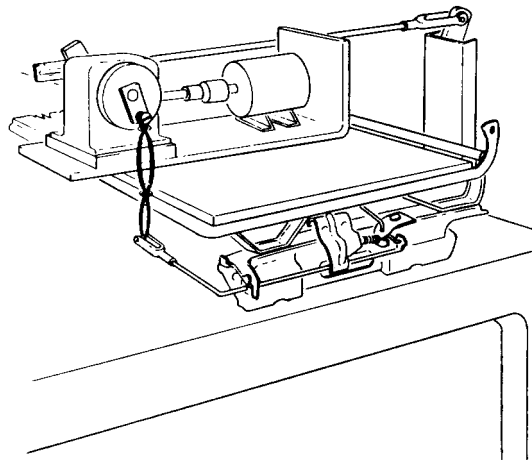


FIGURE 8—OPERATION TEST OF SEAT ADJUSTER

4.5.3 STATIC TEST

4.5.3.1 Manual and Power Seat Adjuster—Static tests on seat adjusters are normally of the proof load type. Adjusters are not required to be operable after proof loading, but must have no separation of mating parts, per SAE J879b (July, 1968). These tests require that the seat adjuster withstand the test loading in any adjustable position. Typical seat adjuster tests are:

- a. **Vertical Loading**—A vertical load of 500 lb (2224 N) per passenger is applied to seat frame. Indicators installed to determine the relative movement of the seat adjuster to the base under this load application. See Figure 9.
- b. **Occupant (Rearward) and Inertia Loading**—As outlined in SAE J879b. See Figure 9.
- c. **Lateral Loading**—A lateral load of 100 lb (445 N) is applied midway between the seat frame attachments, and corresponding measurements are taken at the seat frame attachment relative to the base. The load is applied first to the left and then to the right, giving the total displacement on the indicators. Typical setup is shown in Figure 10. This test is conducted with no vertical load on the seat frame.
- d. **Fore-and-Aft Chocking Load**—A load of 100 lb (445 N) is applied in both the fore-and-aft direction at the center of the seat frame, and measurements of the fore-and-aft movement of the seat adjuster slide are made relative to the base. Deflections for this loading should be a minimum to avoid noise and chuck problems. A typical setup for this test is shown in Figure 11.

4.5.4 OTHER MISCELLANEOUS TESTS—Other tests are conducted for specific studies on seat adjusters. However, these tests are not ordinarily performed in all instances. It is sometimes desirable to study the brinelling characteristics of the rollers or balls by subjecting the seat to a vibration test.

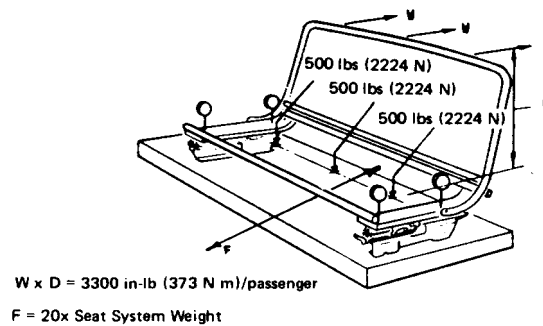


FIGURE 9—STATIC VERTICAL LOAD TEST OF SEAT ADJUSTER

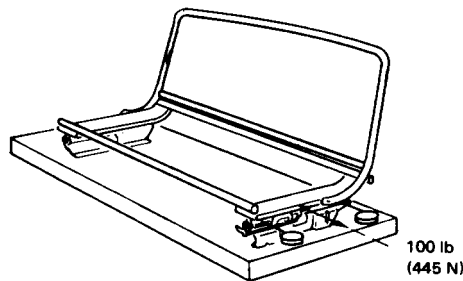


FIGURE 10—STATIC LATERAL LOAD TEST OF SEAT ADJUSTER

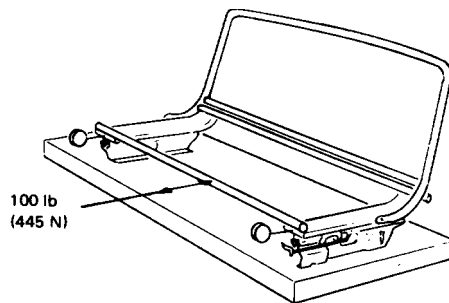


FIGURE 11—STATIC FORE AND AFT CHUCKING TEST OF SEAT ADJUSTER

5. Motor Vehicle Seat Frames

5.1 Definition—The term seat frame refers to the structural portion of a seat assembly. The seat frame may be constructed with springs attached to the structural frame or may support padding such as urethane foam, which can be applied or molded onto the frame.

5.2 Purpose—The purpose of the seat frame is to provide shape and support for the cushioning members and trim covers.

It provides an attachment to the vehicle structure and maintains the occupant in the proper seating attitude.

5.3 Structural Classification—The frames are generally classified structurally as follows:

- a. Tubular
- b. Stamped or rolled sections
- c. Wire or sheet metal assemblies
- d. Combinations of a, b, and c
- e. Fiberboard
- f. Reinforced plastics
- g. Wood

5.4 Design Requirements

- 5.4.1 Structurally, the seat frame should be strong enough to withstand the design load requirements without excessive permanent set. The load requirements vary with the number of passengers and vehicle use.
- 5.4.2 The seat frame is constructed to provide a means of attaching trim, ornamentation accessories, and possibly occupant restraint systems.
- 5.4.3 Forward and rearward facing seats having folding seat backs must be provided with a latching mechanism that meets the requirements of SAE J879b (July, 1968).

5.5 Methods of Test—Seats are subjected to a variety of tests. Tests must be performed as outlined in SAE J879b (July, 1968).

In addition, other tests for fatigue strength of springs and frames, frame parallelogramming, cushion and back permanent set, and spring damping are sometimes performed for specific investigations.

5.6 Typical Types of Seat Frames

5.6.1 FRONT SEAT SPRING AND FRAME ASSEMBLIES

- 5.6.1.1 Two-door full width cushion spring assembly—folding split backs designed for full volume foam pads (Figure 12).
- 5.6.1.2 Four-door full width cushion—full width back. Both components are designed for full volume foam pads (Figure 13).
- 5.6.1.3 Individual cushion and back designed for full volume foam pads (Figure 14).

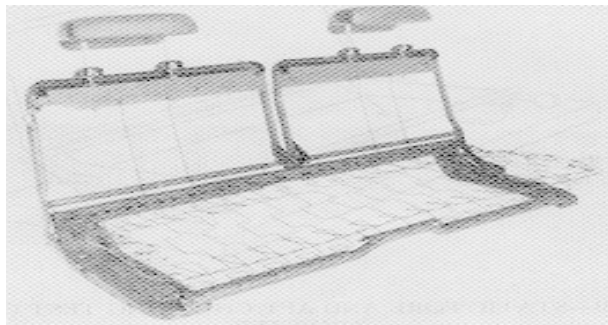


FIGURE 12—



FIGURE 13—

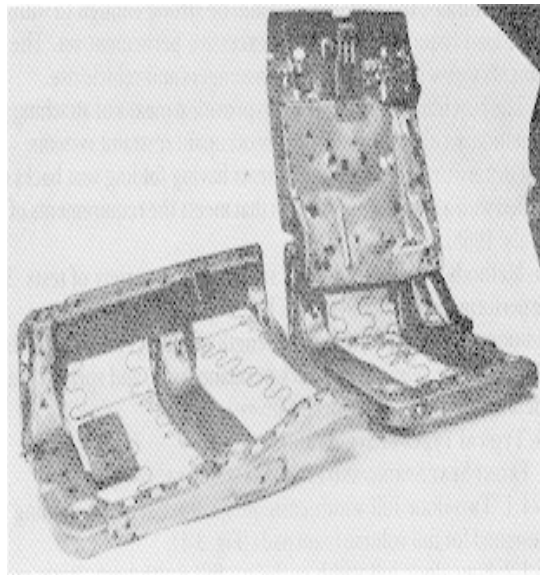


FIGURE 14—

5.6.1.4 Bucket type cushion and back designed for full volume foam pads with integral head restraints (Figure 15).

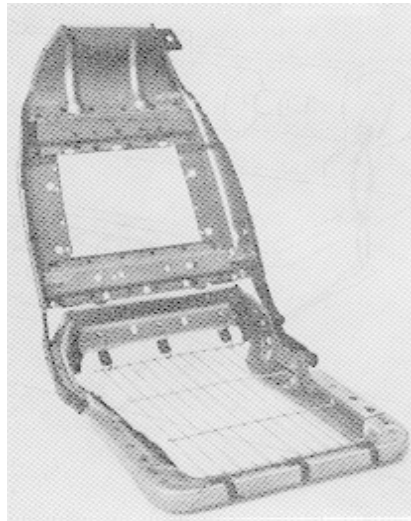


FIGURE 15—

5.6.1.5 Bucket type cushion and back. Back frame molded integral with foam pad (Figure 16).

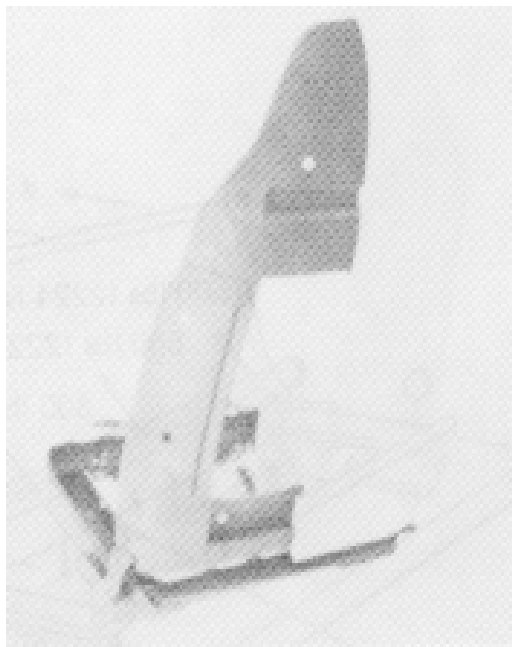


FIGURE 16—

5.6.1.6 Truck bucket seat (Figure 17).

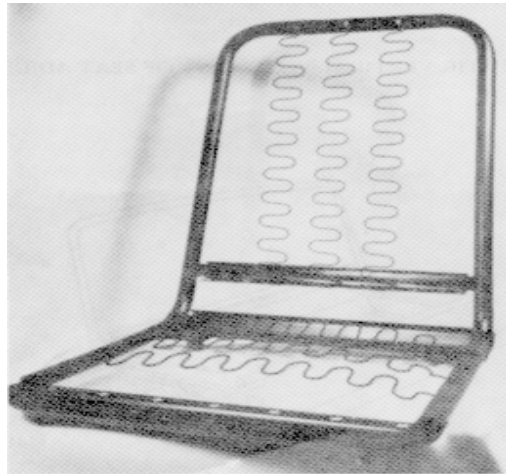


FIGURE 17—

5.6.2 REAR SEAT SPRING AND FRAME ASSEMBLIES

5.6.2.1 Full width cushion spring—full width back spring (Figure 18).

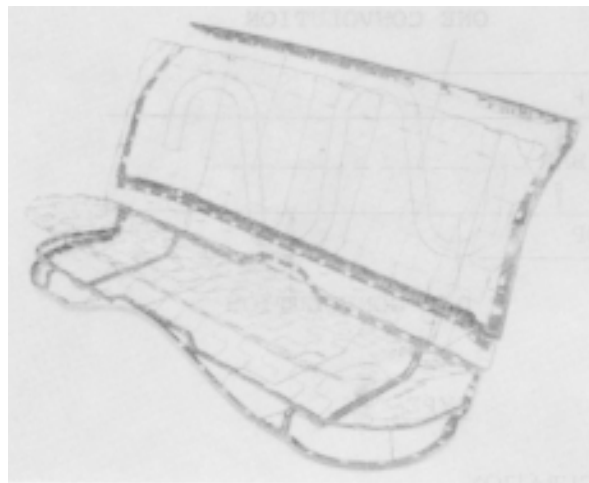


FIGURE 18—

5.6.2.2 Full width cushion frame—full width back fiberboard frame—both designed for full volume foam pads (Figure 19).

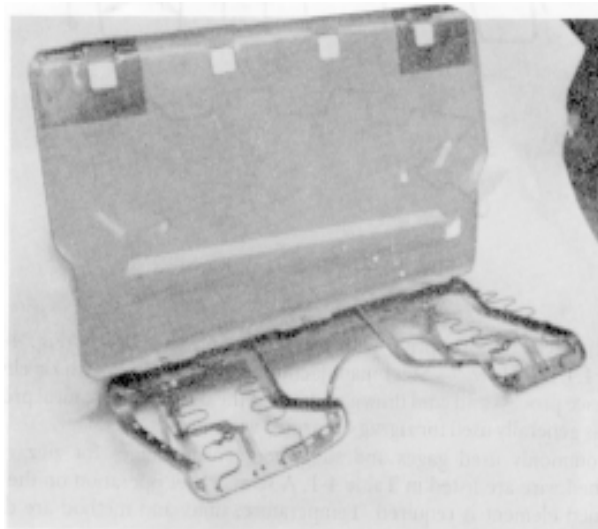


FIGURE 19—

5.6.2.3 Second seat cushion with folding cargo panel back frame (Figure 20).

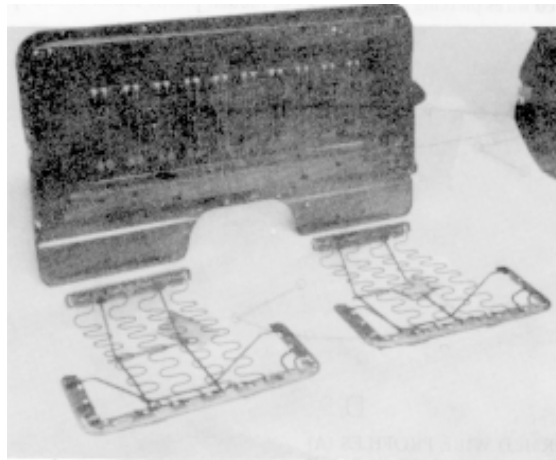


FIGURE 20—

5.6.2.4 Van type passenger bench seat spring assembly (Figure 21).

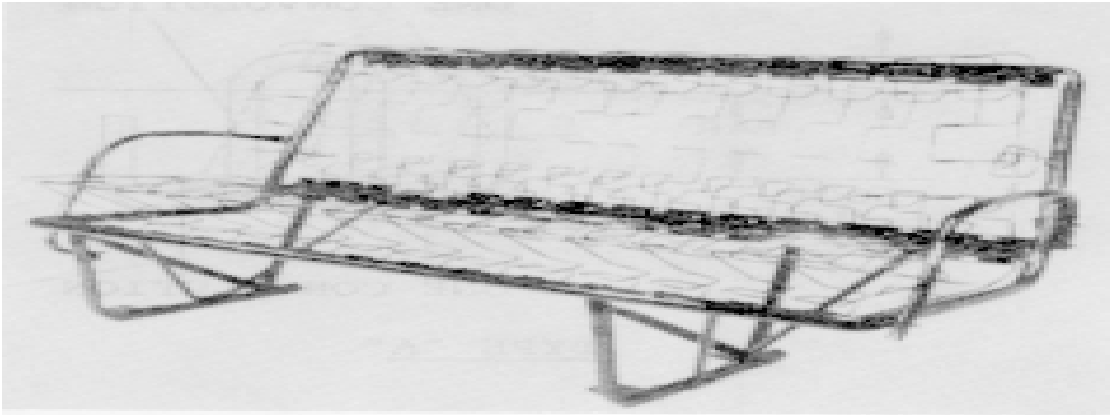


FIGURE 21—

6. Seat Spring Assemblies

6.1 Definition—A seat spring assembly is that part of a seat which distributes the load of the occupant to a seat frame or substructure mounted on or within a seat frame or other structural member.

6.2 Purpose—The purpose of the seat spring assembly is to absorb shock and vibration and support the occupant with a maximum of comfort and safety.

6.3 Design Requirements—Seat cushion and back spring assemblies are designed within the limitations of the body. This accounts for the many variations and combinations. The basic requirements of a good seat spring assembly are as follows:

- a. It should support the occupant.
- b. It should provide comfortable pressure distribution.
- c. It should have acceptable service life and minimum set.
- d. It should be noiseless.
- e. It should have good dampening characteristics to absorb shock and vibrations.
- f. The outside edges of the spring assembly should provide sufficient support to hold the occupant and maintain the trim contour.

6.4 Spring Element Types

6.4.1 ZIGZAG AND FORMED WIRE TYPE SPRING ELEMENTS

6.4.1.1 Definitions and Terms—The zigzag and formed wire spring element provides a load-supporting span by being formed (two-dimensionally) into a ribbon-like flat pattern which is anchored at or near each end. Spring action results from the twist of the torsion bars and the flexing of the radii joining them. Additional springing results from crowning the ribbon element, high near the middle. However, the most pronounced spring action is created when bends are placed in the surface near the front (and sometimes rear).

- a. **Zigzag Springs**—The wire is formed into a pattern of constant width having parallel bars connected by constant radii which are alternating. Common terms to define sections of the spring are:
 1. **Convolution**—The distance from any one point on the spring to the next corresponding or exact same point in the series of formations making up the spring (Figure 22).
 2. **Bar**—The center, or straight portion, of the formation making up the spring (Figure 22).
 3. **Loop**—The outer, curved portion of the formation making up the spring (Figure 22).