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(R) PASSENGER CAR SIDE DOOR LATCH SYSTEMS—SAE J839 JUN91

SAE Recommended Practice

Report of the Body Engineering Committee, approved November 1962, third revision by the Latch and Hinge Subcommittee July 1982. Completely revised by the SAE Latch and Hinge Subcommittee June 1991. Rationale statement available.

1. Scope—This SAE Recommended Practice establishes minimum performance requirements and test procedures for evaluating and testing passenger car side door latch systems. It is limited to tests that can be conducted on uniform test fixtures and equipment in commercially available laboratory test facilities.

The test procedures and minimum performance requirements outlined in this document are based on currently available engineering data. It is intended that all portions of the document will be periodically reviewed and revised, as additional knowledge regarding vehicle latch performance under impact conditions is developed.

2. References—There are no referenced publications specified herein.

3. Terminology

3.1 Latch—A mechanical device employed to position the door in a closed position relative to the vehicle body with provisions for controlled release (or operation).

3.1.1 Basic latch components (nomenclature) are:

PLATE—The main body or frame for supporting working components, appendages and transmitting or distributing loads to the door structure.

ROTOR (OR BOLT)—The rotating or sliding member of the latch which engages and restrains the latch to the striker.

RATCHET—A member of the latch connected to the rotor to provide an abutment or abutments which, when properly indexed, become engaged with a related pawl to inhibit motion of the rotor in one direction.

PAWL—A member of the latch that can be caused to engage the abutments of the ratchet to inhibit relative motion between the two parts except in one direction.

3.2 Striker—A mechanical device with which the latch engages on the opposing member of the body.

3.3 Fully Latched Position—The attitude that exists between the latch and striker when the door is securely positioned in the fully closed position.

3.4 Secondary Latched Position—The attitude that exists between the latch and striker when the latch holds the door in a position less than fully closed.

NOTE: The secondary latched position may be included in the side door latch, as an added mechanical feature to reduce the possibility of the door opening freely, in the event the door is not closed to the fully latched position. It should be recognized that doors are intended to be in the fully latched position whenever the vehicle is in motion.

4. Basic Requirements

4.1 Longitudinal Load—An automotive door latch and striker assembly, when tested as described under test procedures, must be able to withstand an ultimate longitudinal load of 11 000 N when in the fully latched position (see 5.1) and 4450 N when in the secondary latched position (see 5.2).

4.2 Transverse Load—An automotive door latch and striker assembly, when tested as described under test procedures, must be able to withstand an ultimate transverse load of 8900 N when in the fully latched position (see 5.3) and 4450 N when in the secondary latched position (see 5.4).

4.3 Inertia Load—An automotive door latch, when contained in the door latch system (including the door latch, striker assembly, outside handle, key cylinder, and any connecting mechanisms) and, in the fully latched position, when evaluated by calculation, must remain in the fully latched position when subjected to an inertia load of 30 *g* in any direction. (See Section 6.)

NOTE: Due to the interdependency of the components, it is important that the door latch be analyzed within the confines of

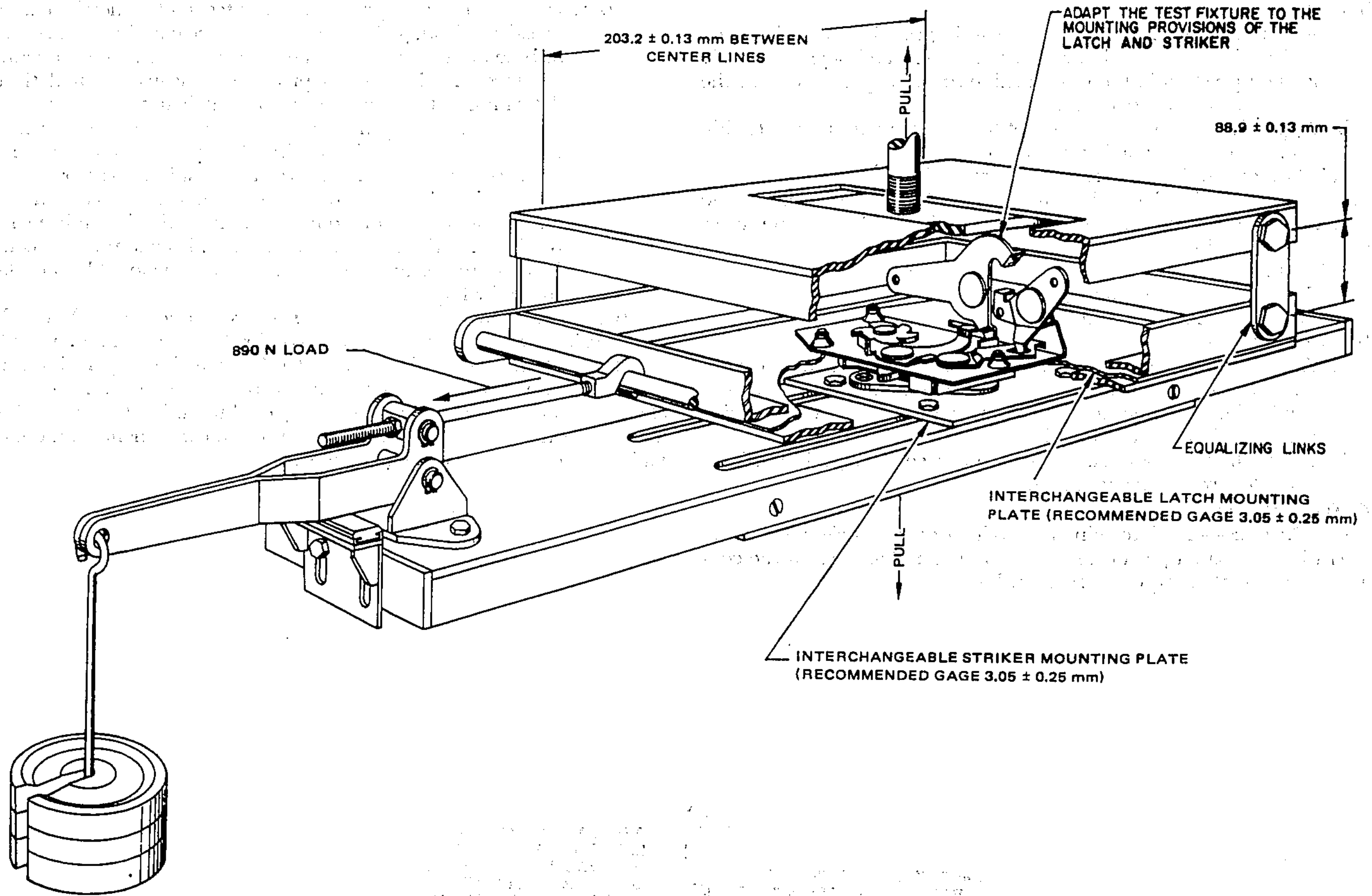


FIGURE 1—DOOR LATCH—STATIC LOAD TEST FIXTURE (LONGITUDINAL LOAD)

the total system and these results considered the basis of acceptance.

5. Static Tests

5.1 Longitudinal Load—Fully Latched Position

5.1.1 Purpose—To determine the ability of the vehicle latch and striker to withstand a test load perpendicular to the face of the latch.

5.1.2 Equipment

a. Tensile testing machine.
b. Static test fixture (see Figure 1).

5.1.3 Operation

a. Attach the test fixture to the mounting provisions of the latch and striker. Align the direction of engagement parallel to the linkage of the fixture. Mount fixture with latch and striker in fully latched position in the test machine so as to apply a load perpendicular to the face of the latch.
b. Locate weights to apply an 890 N load tending to separate the latch and striker in the direction of the door opening.
c. Apply the test load at a rate not to exceed 5 mm/min until failure. Record maximum load.

5.2 Longitudinal Load—Secondary Latched Position

5.2.1 Purpose—To determine the ability of the vehicle latch and striker in the secondary position to withstand a test load perpendicular to the face of the latch.

5.2.2 Equipment

a. Tensile testing machine.
b. Static test fixture (see Figure 1).

5.2.3 Operation

a. Attach the test fixture to the mounting provisions of the latch and striker. Align the direction of engagement parallel to the linkage of the fixture. Mount fixture with latch and striker in secondary latched position in the test machine so as to apply a load perpendicular to the face of the latch.
b. Locate weights to apply an 890 N load tending to separate the latch and striker in the direction of the door opening.
c. Apply the test load at a rate not to exceed 5 mm/min until failure. Record maximum load.
d. The test plate to which the door latch is mounted will have a striker cutout configuration similar to the environment in which the door latch will be mounted on normal vehicle doors.

5.3 Transverse Load—Fully Latched Position

5.3.1 Purpose—To determine the ability of the vehicle latch and striker to withstand the test load in the direction of door opening.

5.3.2 Equipment

a. Tensile testing machine.
b. Static test fixture (see Figure 2).

5.3.3 Operation

a. Adapt the test fixture to the mounting provisions of the latch and striker. Mount fixture with the latch and striker in fully latched position in the test machine so as to apply a load in the direction of door opening.

b. Apply the test load at a rate not to exceed 5 mm/min until failure. Record the maximum load.

5.4 Transverse Load—Secondary Latched Position

5.4.1 Purpose—To determine the ability of the vehicle latch and striker in the secondary position to withstand the test load in the direction of door opening.

5.4.2 Equipment

a. Tensile testing machine.

b. Static test fixture (see Figure 2).

5.4.3 Operation

a. Adapt the test fixture to the mounting provisions of the latch and striker. Mount fixture with the latch and striker in secondary latched position in the test machine so as to apply a load in the direction of door opening.

b. Apply the test load at a rate not to exceed 5 mm/min until failure. Record the maximum load.

6. Inertial Analysis

6.1 Purpose—To determine the ability of the vehicle latch system to resist inertia loading by means of a mathematical analysis of the component parts in their true car relationship.

Note: Due to the complexity of physical testing for inertial characteristics it is judged to be more practical and more accurate to base evaluations on mathematical analysis. The procedure described in this section provides a means for analytically determining the ability of a door latch system to withstand inertia loading. Spring forces are the average of the minimum spring output in the installed position and the minimum spring output in the release position. Friction effects and work to be done are not considered in the calculations. Gravitational pull on components may also be omitted if it tends to restrict unlatching. These omissions from the calculations are permissible because they provide additional factors of safety.

6.2 Calculation Consideration—Each component or subassembly can be calculated for its minimum inertia load resistance in a particular direction. Their combined resistance to the unlatching operation must assure that the door latch system (when properly assembled in the vehicle door) will remain latched when subjected to an inertia load of 30 g in any direction. Figure 3 is an example of the components and combinations of components to be considered.

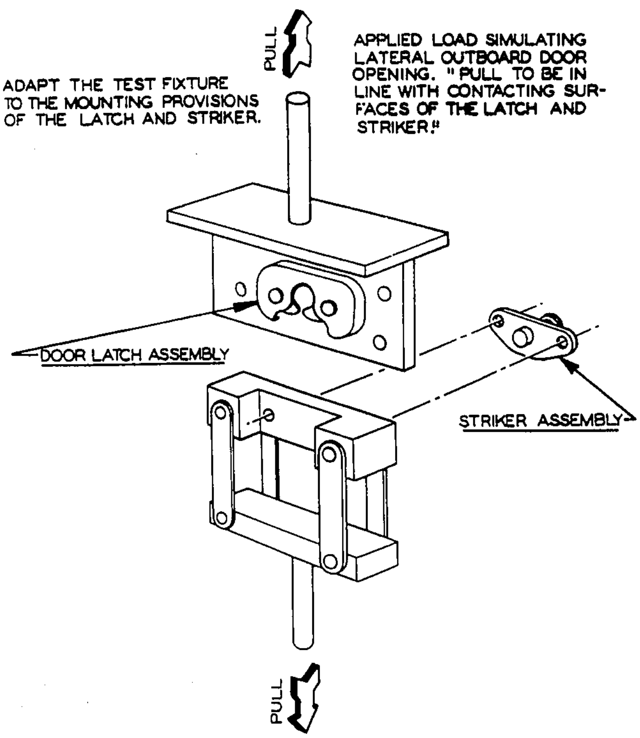
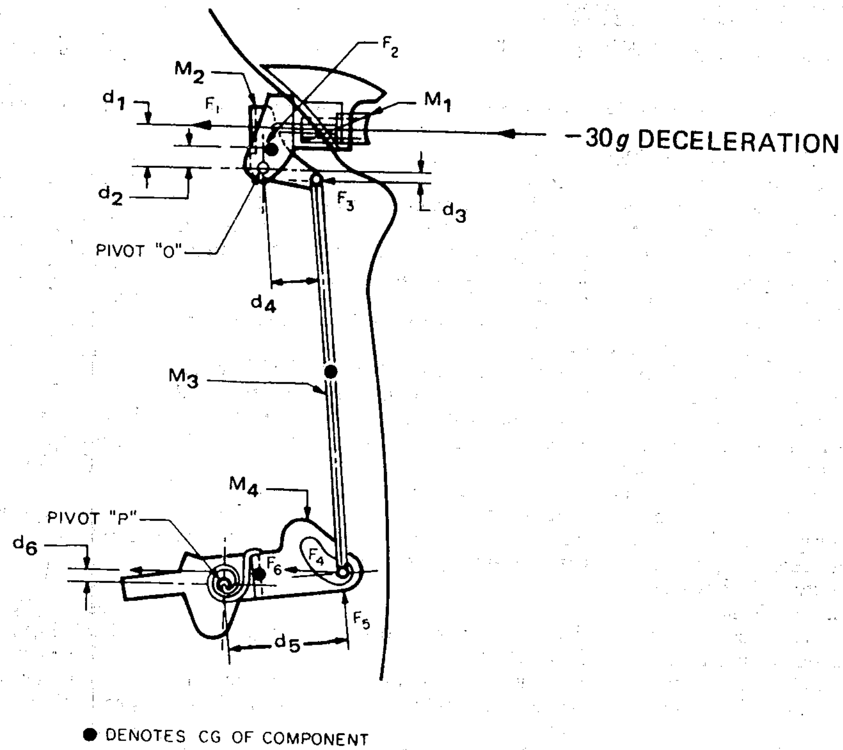


FIGURE 2—DOOR LATCH—STATIC LOAD FIXTURE (LATERAL LOAD)



Given: Door Latch System Subjected to 30 *g* Deceleration
Average Push-Button Spring Output Force = 4.5 N
Pawl Spring Output Torque = 0.45 N·m
$a = 30g\ (m/s^2)$
$F = ma = 30mg = 294.2 * m$

M_1 = 0.0163 kg	d_1 = 31.50 mm
M_2 = 0.0227 kg	d_2 = 10.67 mm
M_3 = 0.0122 kg	d_3 = 4.83 mm
M_4 = 0.0422 kg	d_4 = 31.50 mm
	d_5 = 37.60 mm
	d_6 = 1.91 mm

$F_1 = M_1a$ - (avg. spring output) $= (0.0163 \times 294.2) - 4.5 = 0.30$ N

$F_2 = M_2a = 0.0227 \times 294.2 = 6.68$ N

$F_3 = \frac{M_3a}{2} = (0.0122/2) \times 294.2 = 1.80$ N

$\Sigma M_o = F_1 \times d_1 + F_2d_2 - F_3d_3 = 0.30 \times 31.5 + 6.68 \times 10.67 - 1.80 \times 4.83 = 72.0$ N·mm

$F_5 = \frac{M_o}{d_4} = \frac{72.0}{31.50} = 2.30$ N

$F_6 = M_4a = 0.0422 \times 294.2 = 12.42$ N

ΣM_p = (pawl spring output) $- \left(\frac{F_5 \times d_5 + F_6 \times d_6}{1000}\right) = 0.45 - \left(\frac{2.30 \times 37.60 + 12.42 \times 1.91}{1000}\right) = 0.34$ N·m

EQUATIONS

SYMBOL	DEFINITION
m	Mass
a	Acceleration
g	Gravitational Acceleration
d	Distance to Pivot
F	Force
M	Moment About a Point

METRIC UNITS

SYMBOL	DEFINITION
kg	Kilogram
m/s^2	Meter per second squared
m/s^2	9.806 650 Meter per second squared
mm	Millimeter
N	Newton
N·m	Newton Meter (preferred)
N·mm	(Newton-Millimeter)

FIGURE 3—INERTIA LOADING—SAMPLE CALCULATION