51 Door latches and retention components

Refer to: R11 02-S1

51.1 Effective date and Scope:

51.1.1 As for the category symbols M1 and N1, the new vehicle types as of 2008/1/1 and all vehicle types as of 2010/1/1, shall comply with this regulation.

51.1.2 The applicants applying for low volume safety approval could exempt from regulation of “door latches and retention components” except child-only vehicle.

51.1.3 Applying for vehicle-by-vehicle low volume safety approval, the vehicle could exempt from regulation of “door latches and retention components”.

51.2 Door latches and retention components shall according to suitable types and range of principle are as below：

51.2.1 designation of the vehicle type by the manufacturer;

51.2.2 the type of latch;

51.2.3 the type of door retention component;

51.2.4 the way in which the latches and door retention components are fitted to and retained by the structure of the vehicle;

51.2.5 type of sliding doors;

51.3 General specification:

51.3.1 Each latch shall have a fully latched position; for hinged doors, an intermediate latched position shall also be provided.

51.3.2 A sliding door which has no intermediate latched position shall automatically move away from the latch to a partially-opened position if the door has not reached the fully latched position, the partially opened position shall be readily apparent to occupants of the vehicle.

51.3.3 Latches shall be designed in such a way as to prevent the doors opening accidentally.

51.3.4 The retention components of hinge-mounted side doors, other than folding doors, fitted to the sides of vehicles, shall be mounted at the forward edge in the direction of travel. In the case of double doors, this requirement shall apply to the door wing, which opens first; the other wing shall be capable of being bolted.

51.3.5 The means of attachment of the sample to the test fixture shall be adequate to prevent failure to the attachment.

51.3.6 The means of attachment of the sample to the test fixture shall be the same as or be equivalent to the means used in normal production for attaching components to the vehicle.

51.3.7 Continuous recordings of applied load may be made during all tests. This does not include the 890 N weight load on latches during longitudinal loading.

51.3.8 The tensile force shall be applied at a rate not to exceed 5 mm per minute until the required test load is reached.

51.4 Specifications concerning latches:

51.4.1 Longitudinal load: The latch and striker assembly shall be capable of withstanding a longitudinal load of 4,440 N in the intermediate latched position and 11,110 N in the fully latched position (see Fig 2).

51.4.1.1 Secondary latching

51.4.1.1.1 The tensile force shall be in line with the contacting surfaces of the latch and striker.

51.4.1.1.2 The tensile force shall stress the latch and striker in the vehicle longitudinal direction.

51.4.1.1.3 The latch and striker shall be engaged in the secondary latched position.

51.4.1.1.4 A weight of 890 N shall be applied to the latch, to load the latch and striker in the vehicle-transverse, door-opening direction.

51.4.1.2 Full latching

51.4.1.2.1 The tensile force shall be in line with the contacting surfaces of the latch and striker.

51.4.1.2.2 The tensile force shall stress the latch and striker in the vehicle longitudinal direction.

51.4.1.2.3 The latch and striker shall be engaged in the fully latched position.

51.4.1.2.4 A weight of 890 N shall be applied to the latch, to load the latch and striker in the vehicle-transverse, door-opening direction.

51.4.2 Transverse load: The latch and striker assembly shall be capable of withstanding a transverse load of 4,440 N in the intermediate latched position, and 8,890 N in the fully latched position (see Fig 3).

51.4.2.1 Transverse load, secondary latching:

51.4.2.1.1 The tensile force shall be in line with the contacting surfaces of the latch and striker.

51.4.2.1.2 This tensile force shall stress the latch and striker in a direction that is approximately horizontal and transverse to the vehicle in the door-opening direction.

51.4.2.1.3 The latch and striker shall be engaged in the secondary latched position.

51.4.2.2 Transverse load, full latching:

51.4.2.2.1 The tensile force shall be in line with the contacting surfaces of the latch and striker.

51.4.2.2.2 This tensile force, when applied, shall stress the latch and striker in the vehicle-transverse, door-opening direction.

51.4.2.2.3 The latch and striker shall be engaged in the fully latched position.

51.4.2.3 Resistance of latches to acceleration-Impact test:

51.4.2.3.1 Inertia loads: The latch shall not move from the fully latched position when an acceleration of 30 g is applied in both directions longitudinally and transversally to the latch, including its actuating mechanism, with the locking mechanism disengaged.

51.4.2.3.2 The resistance of door locks to inertia loads may be determined either by dynamic or by analytical means. In the case of a dynamic test, the test vehicle itself or the simulated structure shall be secured to a chassis with the door lock system in the fully latched position. An acceleration of 30-36 g, shall be applied to the chassis for a period of at least

30 milliseconds in a forward direction in parallel to the vehicle longitudinal axis as well as in a direction of the door opening that is perpendicular to the above described first direction.

51.5 Specification for a set of retention components (hinge) for each door:

The set of retention components for each door shall be capable of supporting the door and withstanding a longitudinal load of 11,110 N and a transverse load of 8,890 N in both directions (see Fig 1).

51.5.1 Longitudinal load:

51.5.1.1 The set of retention components for one door shall be positioned on the test fixture in the closed-door attitude.

51.5.1.2 Full-length (piano) hinge: The hinge is positioned on the test fixture which shall have adequate dimensions to enable the hinge to be fitted along all its length to satisfy the following requirements:

51.5.1.2.1 The line of application of tensile force shall bisect at right angles the engaged portion of the hinge pin.

51.5.1.2.2 The tensile force, when applied, shall stress the hinge system approximately in the vehicle longitudinal direction.

51.5.1.3 Multiple hinges: The hinge assemblies shall be positioned on the test fixture to satisfy the following requirements:

51.5.1.3.1 The hinge pins shall be in a straight line, so that the prescribed longitudinal load is perpendicular to the axis of the hinge pivots, situated in a plane passing through that axis;

51.5.1.3.2 The distance between further ends of adjacent hinges shall be 406 mm. For the case in which the 406 mm dimension cannot be complied with, the hinges shall be arranged in such a way that the distance between the nearest parts of two adjacent hinges shall be at least 100 mm.

51.5.1.3.3 A line joining the mid-points of the engaged portions of the two outermost hinge pins shall be bisected at right angles by the line of application of tensile force.

51.5.1.3.4 The tensile force, when applied, will stress the set of hinges approximately in the vehicle-longitudinal direction.

51.5.2 Transverse load:

51.5.2.1 The set of hinges shall be positioned on the test fixture in the closed-door attitude.

51.5.2.2 Full-length (piano) hinge: The hinge is positioned on the test fixture which shall have adequate dimensions to enable the hinge to be fitted along all its length to satisfy the following requirements:

51.5.2.2.1 The engaged length of the hinge pin shall be bisected at the right angles by the line of application of the tensile force.

51.5.2.2.2 The hinge assembly shall be stressed approximately in the vehicle transverse direction.

51.5.2.3 Multiple hinges: The hinge assemblies shall be positioned on the test fixture to satisfy the following requirements:

51.5.2.3.1 The hinge pins shall be in a straight line, so that the prescribed transverse load is perpendicular to the plane defined by the longitudinal load and the axis of the pivots, and situated in a plane passing through the axis.

51.5.2.3.2 The distance between further ends of adjacent hinges shall be 406 mm. For the case in which the 406-mm dimension cannot be complied with, the hinges shall be arranged in such a way that the distance between the nearest parts of two adjacent hinges shall be at least 100 mm.

51.5.2.3.3 A line joining the mid-points of the engaged portions of the two outermost hinge pins shall be bisected at right angles by the line of application of tensile force.

51.5.2.3.4 The tensile force, when applied, will stress the set of hinges approximately in the vehicle-transverse direction.

51.6 Sliding-doors:

For sliding doors the track and slide combination or other supporting means shall not separate when an outward transverse load of 8,890 N is applied to the load-bearing members at the opposite edges of the door (17.8 kN total). The test may be performed either in the vehicle or with the door retention components in a bench test fixture.

51.7 Equivalent test methods:

51.7.1 Equivalent non-destructive test methods are permitted, provided that the results referred to in paragraphs (1)~(4) above of the Regulation can be obtained either entirely by means of the substitute test or by calculation from the results of the substitute test.

For above-mentioned paragraph 51.6.3.3 enduring acceleration-impact test， an example of calculation is consult in Figure 4.

51.7.2 If a method other than that described in paragraphs 51.3 and 51.4 above is used, its equivalence shall be demonstrated.

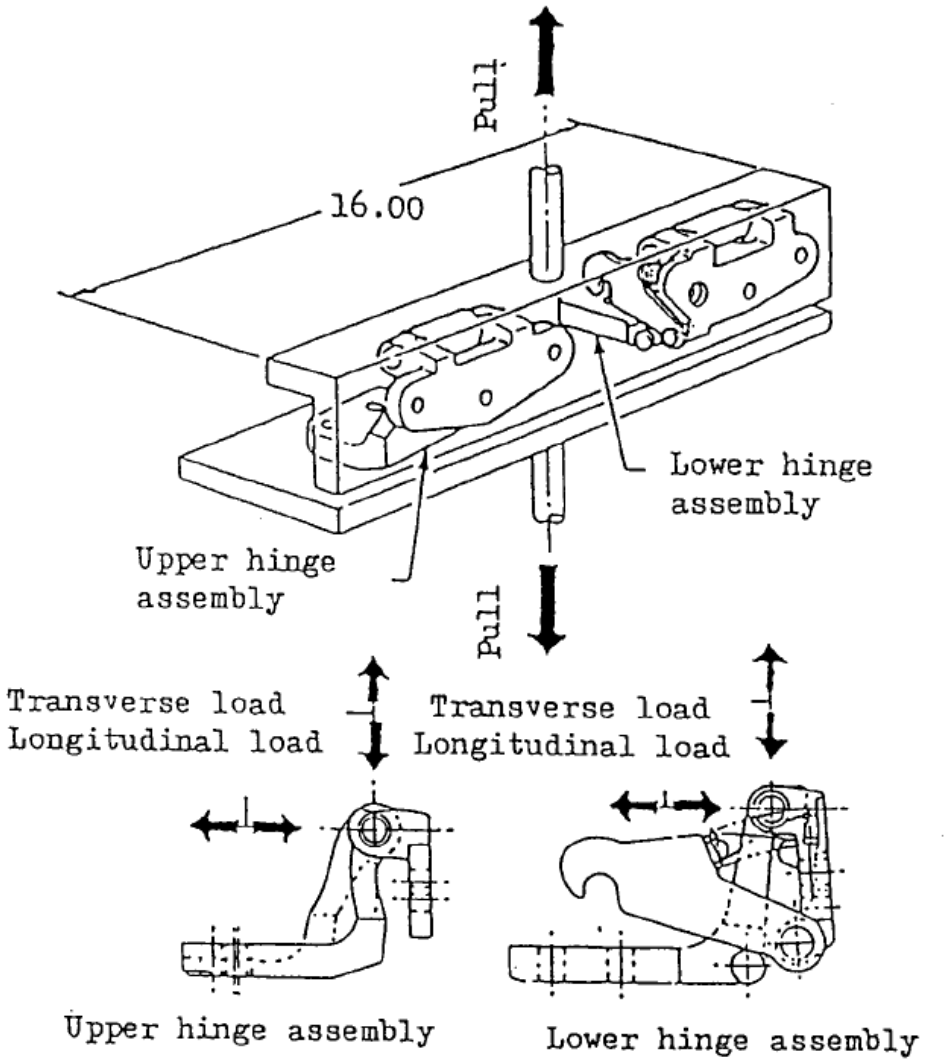


Fig 1. Door retention components-static load fixture (transverse load)

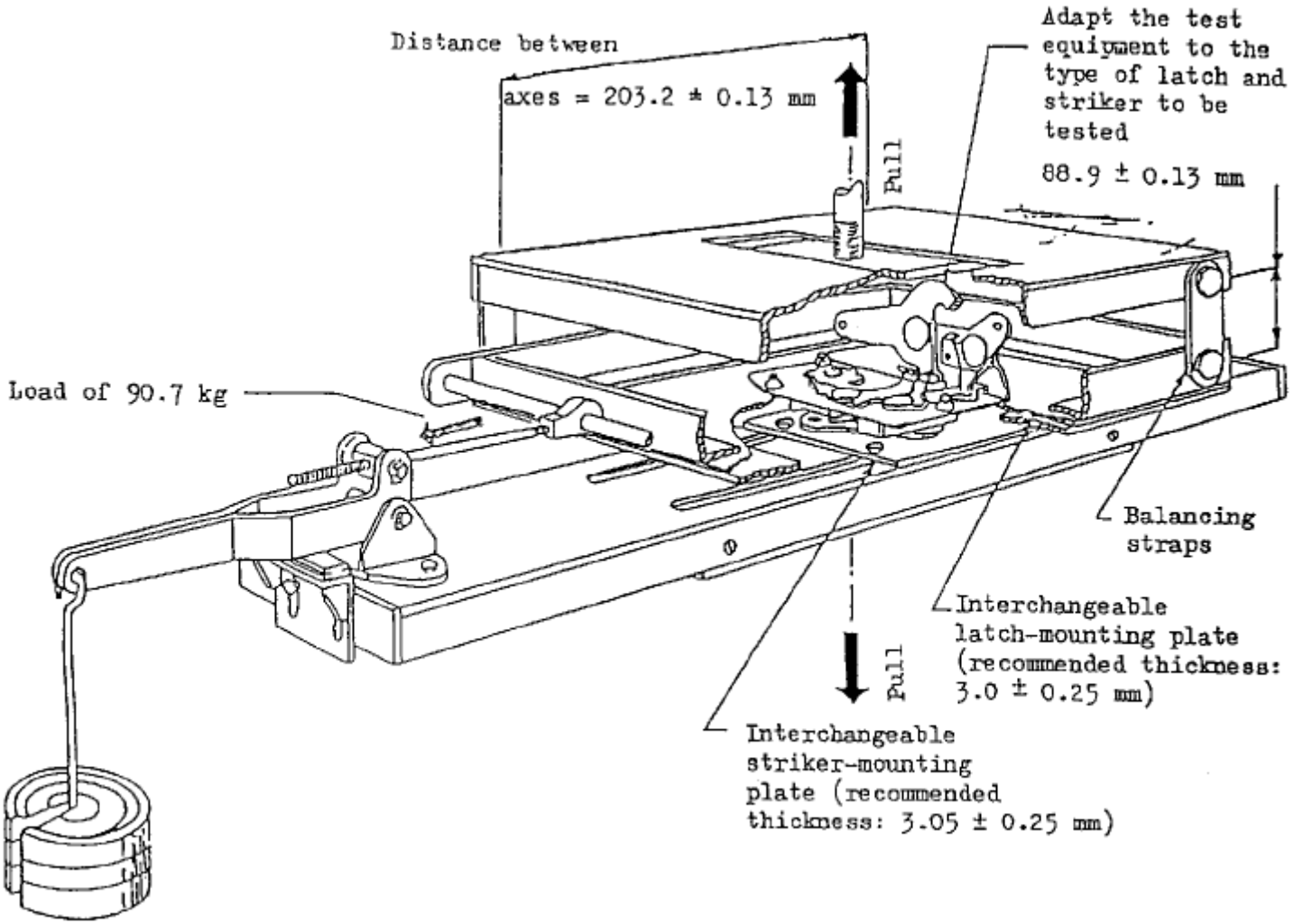


Fig 2. Door latch – static load (Longitudinal load)

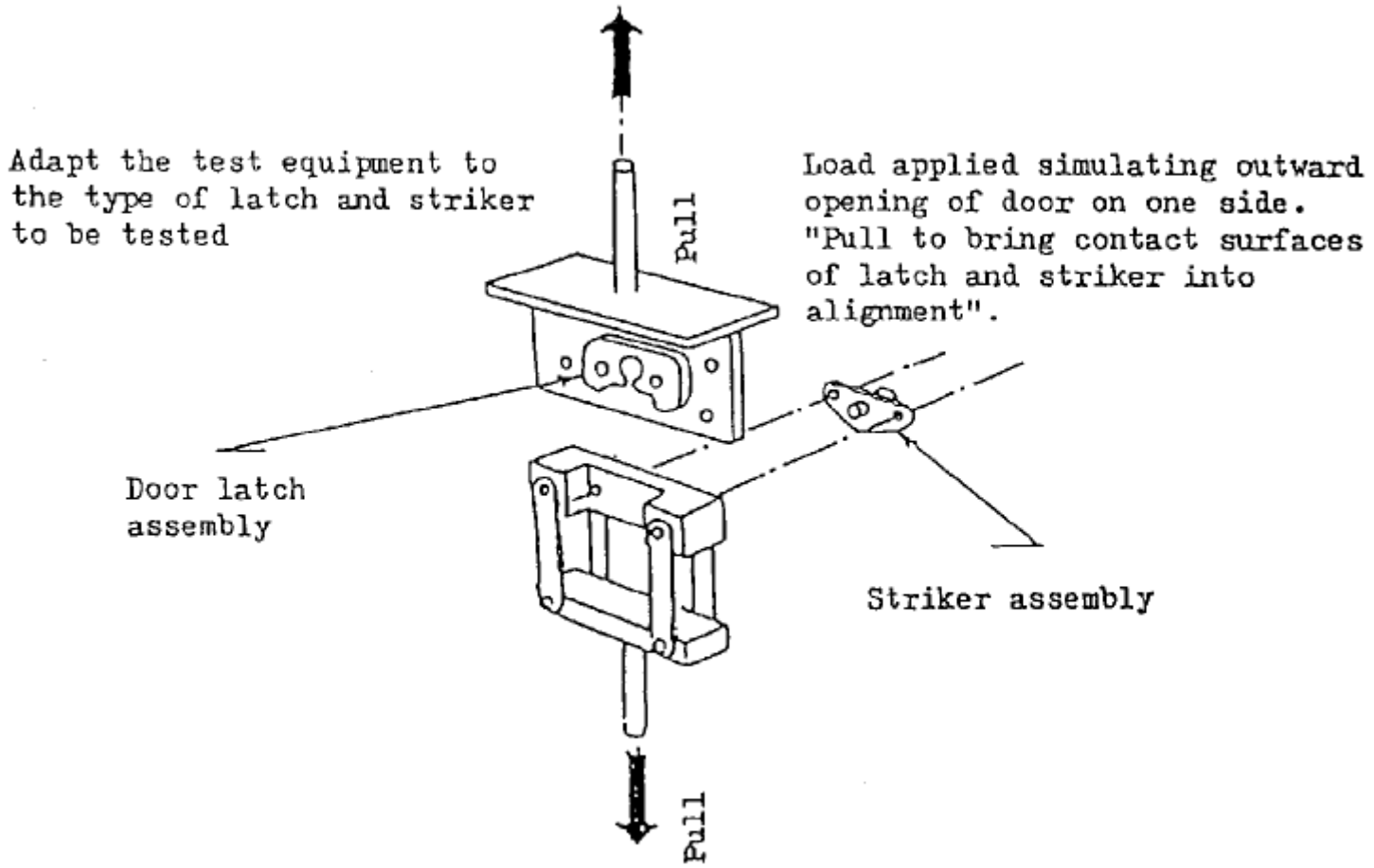


Fig 3. Door latch – static load (Transverse load)

W_2 = 0.023 kg

d_1 = 31.5 mm

d_2 = 10.67 mm

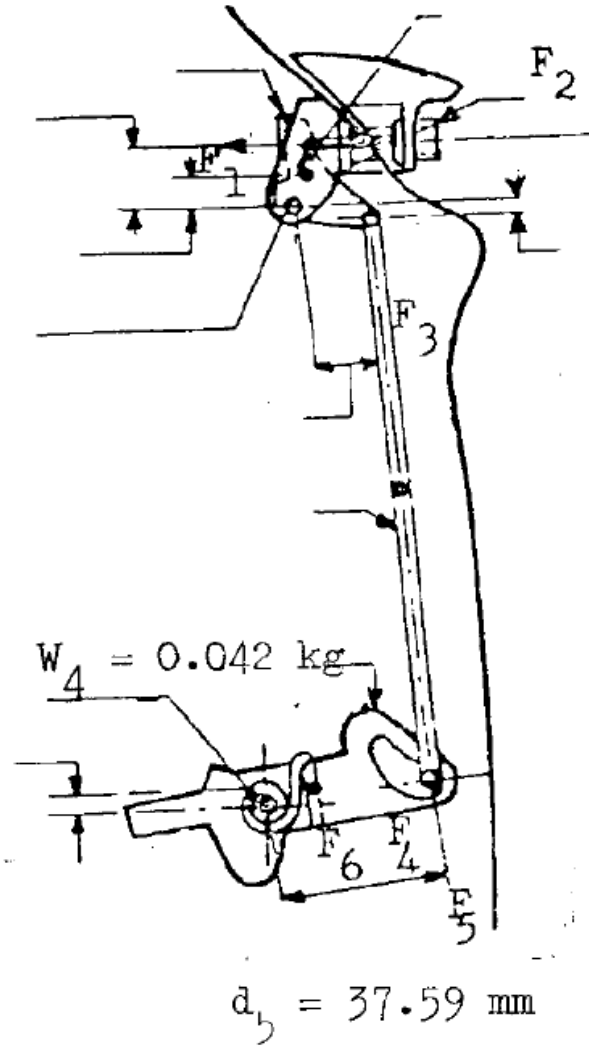
Pin "O"

d_4 = 31.5 mm

W_3 = 0.012 kg

Pin "P"

d_6 = 1.90 mm



W_1 = 0.016 kg
Deceleration 30 g

d_3 = 4.83 mm

Centre of gravity of component

d_5 = 37.59 mm

Given:

A door latch system subjected to a deceleration of 30 g,

$$F = M_a = \frac{W}{g}a = \frac{W}{g}30g = 30W$$

$F_1 = W_1 \times 30$ – Average load at knob spring = (0.016 kg x 30) – 0.454 kg = 0.036 kg

$F_2 = W_2 \times 30 = 0.023$ kg x 30 = 0.68 kg

$$F_3 = \frac{W_3}{2} \times 30 = \frac{0.012kg}{2} \times 30 = 0.184kg$$

Σ Mo = $F_1 \times d_1 + F_2 \times d_2 - F_3 \times d_3$

= 0.036 kg x 31.5 mm + 0.68 kg x 10.67 mm – 0.184 kg x 4.83 mm

= 7.51 mmkg

$$F_5 = \frac{M_O}{d_4} = \frac{7.51}{31.5} = 0.238kg$$

$F_6 = W_4 \times 30 = 0.042 \times 30 = 1.265$ kg

Σ Mp = Load on bolt spring – ($F_5d_5 + F_6d_6$)

= 45.62 mmkg – (0.238 x 37.59 + 1.265 x 1.9)

= 45.62 mmkg – 11.36 mmkg

= 34.26 mmkg

Fig 4. Resistance to the effects of inertial - example of calculation