Directive 94/20/EC of the European Parliament and of the Council of 30 May 1994 relating to the mechanical coupling devices of motor vehicles and their trailers and their attachment to those vehicles (repealed)

LIST OF ANNEXES

ANNEX VI

TESTING OF MECHANICAL COUPLING DEVICES

4. SPECIFIC TESTING REQUIREMENTS

4.1. **Coupling balls and towing brackets**

4.1.1. The mechanical coupling devices of coupling balls may be of the following types:

— one-piece coupling balls including devices with non-interchangeable detachable balls (see Figure 20),

— coupling balls, comprising a number of parts which can be dismantled (see Figures 21, 22, 23),

— towing brackets (see Figure 24).

4.1.2. The basic test is an endurance test with an alternating test force. The test specimen is the coupling ball, the ball neck and the mountings necessary for attaching to the vehicle. The coupling ball and towing brackets must be rigidly mounted to a test rig, capable of producing alternating forces, in the actual position in which it is intended for use.

4.1.3. The positions of the fixing points for attaching the coupling ball and towing brackets are specified by the vehicle manufacturer (see Annex VII, Section 1.2).

4.1.4. The devices submitted to the test shall be provided with all design details which may have an influence on the strength criteria (for example electrical socket plate, any marking, etc.). The test periphery ends at the anchorage points or fitting points. The geometric location of the coupling ball and the fixing points of the coupling device related to the reference line shall be provided by the vehicle manufacturer and shall be shown in the test report. All relative positions of the anchorage points with respect to the reference line, for which the towing vehicle manufacturer shall provide all the necessary information to the towing device manufacturer, shall be repeated on the test bed.

4.1.5. The assembly mounted on the test bed shall be subjected to a test on an alternating stress tensible testing machine (for example on a resonance pulser).

The test load shall be an alternating force and must be applied to the coupling ball at an angle of $15^{o} \pm 1^{o}$ as shown in Figure 17 and/or Figure 18.

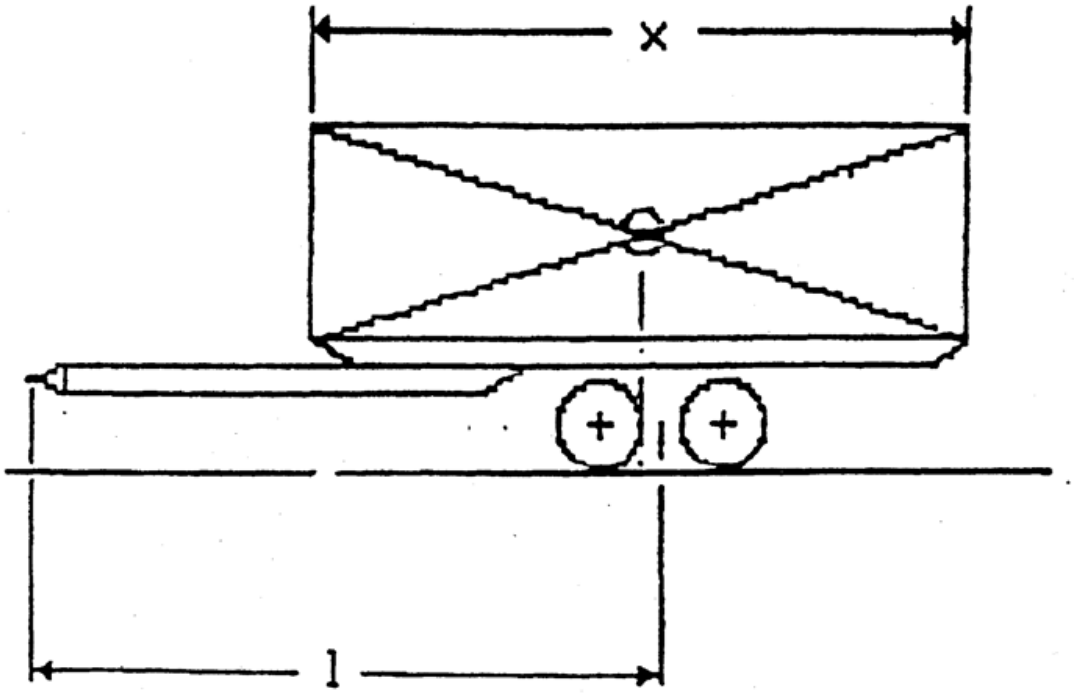
If the ball centre is above that line parallel to the reference line as shown in Figure 19 which contains the highest of the nearest fixing points, the test has to be carried out with an anlge $\alpha = -15^{o} \pm 1^{o}$ (see Figure 17). If the ball centre is below that line parallel to the reference line as shown in Figure 19 which contains the highest of the nearest fixing points, the test has to be carried out with an angle $\alpha = + 15^{o} \pm 1^{o}$ (see Figure 18).

This angle is chosen in order to take account of the vertical static and dynamic load. This test method is only applicable to a permitted static load of not more than

$$S = \frac{120 \cdot D}{g}$$

If a static load above $120 \cdot D$ is requested, the test angle should be increased to 20^{o}. The dynamic test must be performed with the following test force:

$F_{hs\ res} = \pm 0{,}6\ D$



MODEL

(maximum format: A4 (210 × 297 mm))

EEC TYPE-APPROVAL CERTIFICATE

Stamp of Administration

Comunication concerning the

— type-approval (1),

— extension of type-approval (1),

— refusal of type-approval (1),

— withdrawal of type approval (1),

of a type of a vehicle with regard to Directive 94/20/EC.

Type-approval number: .....

Reason for extension: .....

Section I

0. GENERAL

0.1. Make (trade name of manufacturer): .....

0.2. Type and general commercial description(s): .....

.....

0.3. Means of identification of type if marked on the vehicle (2): .....

0.3.1. Location of that marking: .....

0.4. Category of vehicle (3): .....

0.5. Name and address of manufacturer: .....

.....

0.8. Name(s) and address(es) of assembly plants: .....

.....

Section II

1. Additional information (where applicable): see Appendix I

2. Technical service responsible for carrying out the tests: .....

.....

3. Date of test report: .....

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(1) Delete where not applicable.

(2) If the means of identification of type contains characters not relevant to describe the vehicle, component or separate technical unit types covered by this type-approval certificate such characters shall be represented in the documentation by the symbol '?' (e.g. ABC??123??).

(3) As defined in Annex IIA to Directive 92/53/EEC.

4. Number of test report: .....

5. Remarks (if any): see Appendix I

6. Place: .....

7. Date: .....

8. Signature: .....

9. The index to the information package lodged with the competent authority that has granted type approval, which may be obtained on request, is attached.

INFORMATION DOCUMENT No .....

pursuant to Annex I to Council Directive 70/156/EEC relating to EEC type-approval of a vehicle with respect to the fitting of mechanical coupling devices (94/20/EC)

The following information, if applicable, must be supplied in triplicate and include a list of contents. Any drawings must be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, must show sufficient detail.

If the systems, components or separate technical units have electronic controls, information concerning their performance must be supplied.

0. GENERAL

0.1. Make (trade name of manufacturer): .....

.....

0.2. Type and commercial description(s): .....

0.3. Means of identification of type, if marked on the vehicle [b]: .....

.....

0.3.1. Location of that marking: .....

0.4. Category of vehicle (see Annex II to Directive 70/156/EEC): .....

0.5. Name and address of manufacturer: .....

.....

0.8. Address(es) of assembly plant(s): .....

.....

1. GENERAL CONSTRUCTION CHARACTERISTICS OF THE VEHICLE

1.1. Photographs and/or drawings of a representative vehicle: .....

1.4. Chassis (if any) (overall drawing): .....

1.5. Material used for the side-members [d]: .....

2. MASSES AND DIMENSIONS [e] (in kg and mm) (refer to drawing where applicable)

2.2. **In the case of tractive units**

2.2.1. Fifth wheel lead (maximum and minimum) [g]: .....

2.2.2. Maximum height of the fifth wheel (standardized) [h]: .....

2.4.2. *For chassis with bodywork*

2.4.2.5. Rear overhang [n]: .....

The item numbers and footnotes used in this information document correspond ot those set out in Annex I to Directive 70/156/EEC, as last amended by Directive 92/53/EEC.
Items not relevant for the purpose of this Directive are omitted.

4.1.6. The test procedure is applicable to the different types of coupling devices (see Section 4.1.1) as follows:

4.1.6.1. one-piece coupling balls including devices with non-interchangeable detachable balls (see Figure 20).

The strength test for the devices shown in Figure 20 shall be carried out according to the requirements of Section 4.1.5;

4.1.6.2. coupling balls, comprising parts which can be dismantled.

The following categories are defined:

— towing bracket and ball (see Figure 21),
— towing bracket and ball on integral support (see Figure 22),
— towing bracket and ball (see Figure 23),
— towing bracket without ball (see Figure 24).

The strength test for the devices shown in Figures 21 to 23 shall be carried out according to the requirements of Section 4.1.5. Dimensions e and f with a manufacturing tolerance of ± 5 mm, shall be shown in the test report.

The test of the towing bracket (see Figure 24) shall be carried out with a mounted ball (on support). Account will be taken only of the results to the towing bracket between the fixing points and the mounting surface of the ball support.

The dimensions e and f are to be specified by the coupling device manufacturer.

4.1.6.3. Coupling devices with variable dimensions e and f for demountable and interchangeable coupling balls.

4.1.6.3.1. The strength tests for such towing brackets (shown in Figure 25) shall be carried out to the requirements of Section 4.1.5.

4.1.6.3.2. If a worst case configuration can be defined by agreement between the manufacturer and the Technical Service, the testing of this one configuration alone shall be sufficient. Otherwise, several ball positions shall be tested in a simplified test programme according to Section 4.1.6.3.3.

4.1.6.3.3. In a simplified test programme, the value for f shall be between a defined value of f_{min} and a value of f_{max} which does not exceed 100 mm. The ball shall be at a distance ($e_{max)}$ of 130 mm from the support. To cover all possible positions of the ball, in the field given by the horizontal distance from the mounting surface and the vertical range of f (f_{min} to $f_{max)}$, two devices are to be tested:

— one with a ball in top (f_{max},), and
— one with a ball in low ($f_{min)}$ position.

If the field of possible ball positions is divided by the line parallel reference line (see Figure 25c), the test angles are:

— α for the ball above, and + α for the ball below that reference line (compare Figure 19).

(a) f_{max} below line parallel reference line test angles: + α

(b) f_{min} above line parallel reference line test angles: -α

(c) f_{max} above line parallel reference line

f_{min} below line parallel reference line

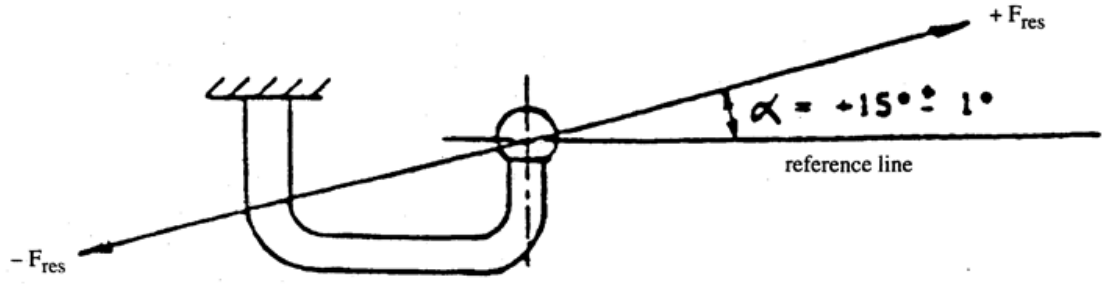
test angles: + α and - α

4.2. COUPLING HEADS

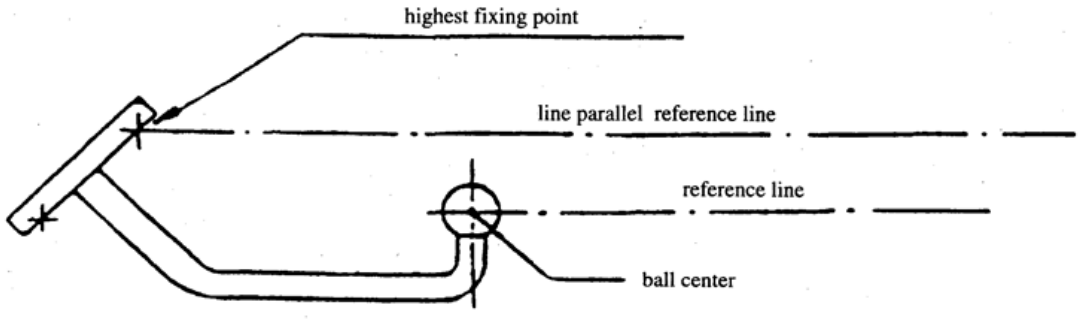
4.2.1. The basic test is an endurance test with an alternating test force and a static test (lifting test) on each test specimen.

4.2.2. The dynamic test must be performed with a Class A coupling ball of appropriate strength. On the test rig the ball coupling and coupling ball must be arranged as instructed by the manufacturer and in a way corresponding to their attachment in a vehicle. There should be no possibility of extra forces in addition to the test force acting on the specimen. The test force must be applied along a line passing through the centre of the ball and inclined downwards to the rear at 15^{o} (see Figure 26). An endurance test must be performed on a test specimen with the following test force:

$F_{hs\ res\ w} = 0{,}6\ D$



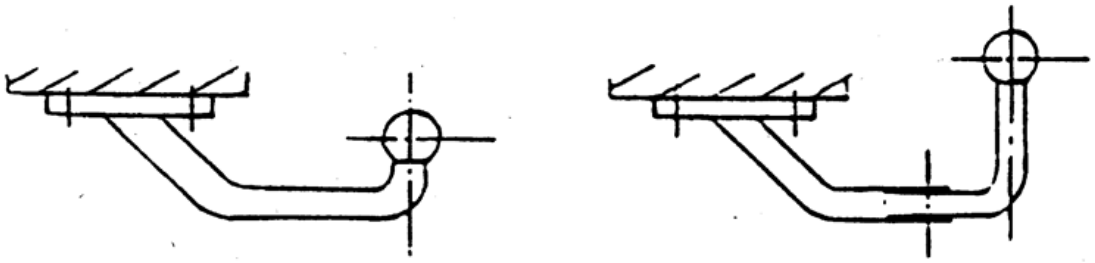
4.2.3. A static lifting test must also be performed. The coupling ball used for the test must have a diameter of



in order to represent a worn coupling ball. The lifting force F_A must be increased smoothly and quickly to a value of

$g\left(c + \frac{S}{1\,000}\right)$

and be held for 10 seconds (see Figure 27). The coupling head shall not separate from the ball or exhibit any permanent distortion which could have an adverse effect on its functional capability.



4.3. **Drawbar couplings and draw beams**

4.3.1. An endurance test must be performed on a test specimen. The coupling device must be equipped with all the fixings needed to attach it to the vehicle. Any intermediate devices fitted between the drawbar couplings and the vehicle frame (i. e. drawbeams) must be tested with the same forces as the coupling. When testing drawbeams intended for standard drawbar couplings, the vertical load shall be applied at a longitudinal distance from the vertical plane of the fixing points that is equal to the position of the corresponding standard coupling.

4.3.2. *Drawbar couplings for hinged drawbars (S=0)*

The dynamic tests must be performed with a horizontal alternating force of $F_{hw} = 0,6$ D acting in a line parallel to the ground and in the longitudinal median plane of the towing vehicle passing through the centre of the coupling pin.

4.3.3. *Drawbar couplings for use with centre-axle trailers (S > 0).*

4.3.3.1. *Centre-axle trailer masses up to and including 3,5 tonnes*

Drawbar couplings for use with centre-axle trailers up to and including a mass of 3,5 tonnes must be tested in the same way as coupling balls and towing brackets described in Section 4.1 of this Annex.

4.3.3.2. *Centre-axle trailer masses exceeding 3,5 tonnes*

The test loads are applied to the specimen in the horizontal and vertical directions in an asynchronous endurance test. The horizontal line of action must be parallel to the ground in the longitudinal median plane of the towing vehicle and pass through the centre of the coupling pin. The vertical line of action must be perpendicular to the ground in the longitudinal median plane of the towing vehicle and pass through the centre of the coupling pin (see Figure 28).

The fixing arrangements for the drawbar coupling and the drawbar eye on the test bed shall be those intended for its attachment to the vehicle in accordance with the manufacturer's fitting instructions.

The following test loads shall be applied to the coupling point

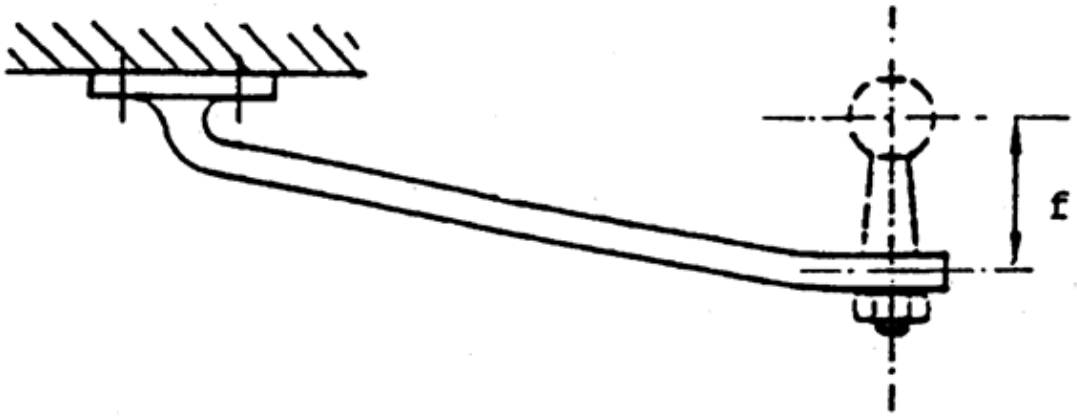
Test load	Mean value (kN)	Amplitude (kN)
Horizontal load	0	± 0,6 D
Vertical load	$\frac{g \cdot s}{1000}$	± 0,6 V

The test force is the geometrical sum of the vertical and the horizontal components. This can be achieved by the test bed configuration shown in Figure 28. The vertical and the horizontal components shall be sinusoidal in shape and shall be applied asynchronously, where the

difference of their frequencies shall be between 1 and 3 %, so that resulting test forces in all directions are created.

4.3.4. *Static test on coupling pin locking device*

With drawbar couplings it is also necessary to test the closure and any locking devices by means of a static force of 0,25 D acting in the direction of opening. The test must not cause the closure to open and it must not cause any damage. A test force of 0,1 D is sufficient in the case of cylindrical coupling pins.



4.4. **Drawbar eyes**

4.4.1. Drawbar eyes must be subjected to the same dynamic testing as drawbar couplings. Drawbar eyes used solely for trailers having hinged drawbars allowing free vertical movement must be subjected to an alternating load as described in Section 4.3.2. Drawbar eyes also intended for use on centre-axle trailers must be tested in the same way as ball couplings (Section 4.2) for trailer masses C up to and including 3,5 tonnes and in the same way as drawbar couplings (Section 4.3.3.2) for centre-axle trailer with a mass C exceeding 3,5 tonnes.

4.4.2. The testing of drawbar eyes must be conducted in such a manner that the alternating load also acts on the parts used for attaching the drawbar eye to the drawbar. All flexible intermediate components must be clamped.

4.5. **Drawbars**

4.5.1. Drawbars shall be tested in the same way as drawbar eyes (see Section 4.4). The technical service may waive an endurance test if the simple design of a component makes a theoretical check of its strength possible. The design loads for the theoretical verification of the drawbar of centre-axle trailers with a mass C of up to and including 3,5 tonnes shall be taken from ISO 7641/1 (1983). The design loads for the theoretical verification of drawbars for centre-axle trailers having a mass C over 3,5 tonnes must be calculated as follows:

$$F_{sp} = \frac{g \times S}{1\,000} + V$$

where the force amplitude V is that given in Annex I, Section 2.1.19.

The permissible stresses based on the design load for trailers having a total mass C over 3,5 tonnes shall be in accordance with paragraph 5.3 of ISO 7641/1. For bent drawbars (e. g. swan neck) and for drawbars of full trailers, the horizontal force component $F_{hp} = 1{,}0 \times D$ shall be taken into consideration.

4.5.2. For drawbars for full trailers with free movement in the vertical plane, in addition to the endurance test or theorectical verification of strength, the resistance to buckling must be verified either by a theoretical calculation with a design load of 3,0 D or by a buckling test with a design load of 3,0 × D. The permissible stresses in case of calculation shall be in accordance with paragraph 5.3 of ISO 7641/1.

4.5.3. In the case of steered axles, the resistance to bending must be verified by theoretical calculations or by a bending test. A horizontal lateral static force must be applied in the centre of the coupling point. The magnitude of this force must be chosen so that a moment of 0,6 x A_V × g (kNm) is exerted about the front axle centre. The permissible stresses shall be in accordance with paragraph 5.3 of ISO 7641/1.

4.6. **Fifth wheel couplings**

4.6.1. The basic strength tests are a dynamic test and a static test (lifting test). Fifth wheel couplings intended for the positive steering of semi-trailers must be subject to an additional static test (bending test). For the purpose of the tests the fifth wheel coupling must be equipped with all the fixings needed to attach it to the vehicle. The method of mounting must be indentical to that employed subsequently on the vehicle itself.

4.6.2. *Static tests*

4.6.2.1. Standard fifth wheel couplings designed for a steering wedge or similar device for the positive steering of semi-trailers (see Annex V, Section 7.9) must be tested for adequate strength by means of a static bending test within the working range of the steering device with the simultaneous application of fifth wheel load. The maximum permitted fifth wheel load U must be applied vertically on the coupling in its operating position by means of a rigid plate of sufficient size to cover the coupling completely.

The resultant of the applied load must pass through the centre of the horizontal joint of the fifth wheel coupling.

Simultaneously, a horizontal lateral force, representing the force needed for positive steering of the semi-trailer, must be applied to the flanks of the guide for the coupling pin. The magnitude of this force and the direction in which it acts must be chosen so that a moment of 0,75 m X D is exerted about the centre of the coupling pin. The moment should be applied by means of a force acting on a lever arm 0,5 m long. Permanent (plastic) distortion up to 0,5 % of all nominal dimensions is permitted. There must be no cracking.

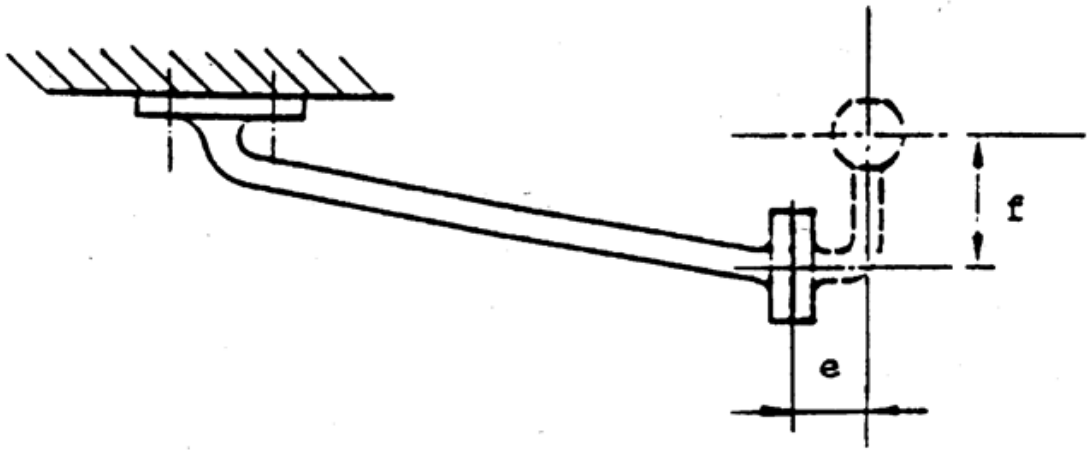
4.6.2.2. A static lifting test must be performed on all fifth wheel couplings. Up to a lifting force of $F_A = g \cdot U$ there must be no major permanent bending of the coupling plate over more than 0,2 % of its width.

In the case of Class G 50 standard fifth wheel couplings and comparable couplings for the same coupling pin diameter there must be no separation of the coupling pin from the coupling with a lifting force of

$FA = g \cdot 2{,}5 \cdot U.$

The force should be applied by means of a lever bearing on the coupling plate at one end and being raised at the other end at a distance of 1,0 to 1,5 m from the centre of the coupling pin (see Figure 29).

The lever arm must be at 90^o to the direction of entry of the coupling pin into the coupling. If the worst case is obvious, this worst case has to be tested. If the worst case is not easy to determine, the technical service shall decide which side to test. No second test shall be required.



4.6.3. *Dynamcic test*

The fifth wheel coupling must be subjected to alternating stress on a test rig (asynchronous dynamic test) with horizontal alternating and vertical pulsating forces acting simultaneously.

4.6.3.1. In the case of fifth wheel couplings not intended for the positive steering of semi-trailers the following forces must be used:

Horizontal:	$F_{hw} = \pm 0{,}6 \cdot D$
Vertical:	$F_{sO} = g \cdot 1{,}2 \cdot U$ $F_{sU} = g \cdot 0{,}4 \cdot U$

These two forces must be applied in the longitudinal median plane of the vehicle with $F_{sO,U}$ passing through the centre of the joint of the coupling.

The vertical force $F_{sO,U}$ alternates between the limits

$+ 1{,}2 \cdot U$ and $+ 0{,}4 \cdot U$

and the horizontal force between

$+ 0{,}6 \cdot D$ and $- 0{,}6 \cdot D$.

4.6.3.2. In the case of fifth wheel couplings intended for the positive steering of semi-trailers the following forces must be used:

Horizontal:	$F_{hw} = \pm 0{,}675 \cdot D$
Vertical:	$F_{sO,U}$ as in Section 4.6.3.1

The lines of action of the forces are shown in Section 4.6.3.1.

4.6.3.3. For the dynamic test of fifth wheel couplings, a suitable lubricating material shall be placed between the coupling plate and the trailer plate so that a maxium friction coefficient of $\mu = 0{,}15$ is assured.

4.7. **Mounting plates for fifth wheel couplings**

The dynamic test for fifth wheel couplings described in Section 4.6.3 and the static tests described in Section 4.6.2 must be applied appropriately to mounting plates. With mounting plates it is sufficient to perform the lifting test on one side only. The test must be based on the maximum assigned installation height for the coupling, the maximum assigned width and the miminum assigned length of the mounting plate design. It is not necessary to carry out this test if the mounting plate is narrower and/or longer and the total height lower, but otherwise identical to a design which has already undergone this test.

4.8. **Fifth wheel coupling pins of semi-trailers**

4.8.1. A dynamic test with alternating stress must be performed on a specimen on a test rig. The testing of the coupling pin must not be combined with the testing of the fifth wheel coupling. The test must be conducted so that the load is also applied to the fixings needed for attaching the coupling pin to the semi-trailer.

4.8.2. A dynamic test with a horizontal load of $F_{hw} = \pm 0{,}6 \cdot D$ must be applied to the coupling pin in the operating position.

The line of action of the force must pass through the centre of the smallest diameter of the cylindrical part of the coupling pin having a diameter of 50,8 mm for Class H 50 (see Annex V, Figure 16).