



## TEST REQUIREMENTS FOR CARAVAN AND CAR TRAILER WHEELS

# E S 3.10

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*SPECIFICATION D'ESSAI DES ROUES DE REMORQUES LEGERES ET CARAVANES*  
PRÜFVERFAHREN FÜR WOHNWAGEN - UND PKW-ANHÄNGER - RÄDER

### 1 - SCOPE

1.1 This specification defines the minimum fatigue test requirements for caravan and car trailer steel wheels.

### 2 - WHEEL DEFINITION

#### W H E E L

2.1 Typically an assembly of a rim and a centre member commonly known as a disc or spider.

#### R I M

2.2 Supporting member for the tyre or tyre and tube assembly.

#### CENTRE MEMBER ( DISC OR SPIDER )

2.3 The connection between the hub mounting face and the rim centre line.

### 3 - COMPONENT VALIDATION

3.1 The only fully processed wheel assemblies which are representative of production parts intended for the caravan or car trailer.

3.2 Separate new wheels must be used for each test.

### 4 - DYNAMIC CORNERING FATIGUE TEST

#### EQUIPMENT

4.1 The test machine shall be one with a rotatable device having means to impart a constant bending moment to the wheel disc or spider.  
See fig. 1 and 3, sheet 4 and 6.

#### PROCEDURE

4.2 The rim of the wheel shall be clamped with equal and sufficient clamping forces to ensure the test wheel position is maintained during test without localised distortion of the rim.

4.3 A rigid load arm shaft and adaptor assembly shall be attached to the mounting face of the wheel, using studs or bolts in good condition and being representative of those used on the vehicle. These wheel nuts or bolts shall be torqued at the beginning of the test to a value recommended by the vehicle manufacturer.

4.4 The loading system should be capable of maintaining the specific bending moment to within  $\pm 2.5 \%$ .

Main changes compared to the last issue:

In chapter 9: K factor 2.0 instead of 2.25 – in chapter 10: requirement 1000 km instead of 350000 cycles.

## 5 - TEST REQUIREMENT AND FAILURE IDENTIFICATION

5.1 The failure criteria are:

- \* The inability of the wheel to sustain the charge
- \* A fatigue crack penetrating through a section of the wheel.

5.2 Cracks are to be determined by means of a commercial crack detection method.

5.3 Bolting up face cracks are permissible at 100.000 cycles provided that the cracks have not propagated through the material thickness.

5.4 Off torque values of fixing nuts and/or bolts are to be checked at completion of test. If resultant has fallen below 50 % of initial torque applied, the wheel shall be deemed to have failed.

## 6 - BENDING MOMENT DETERMINATION

$$M = 2 \cdot F_v \cdot g (\mu \cdot R_{dyn} + d) \quad [Nm]$$

where:

|                              |   |
|------------------------------|---|
| <b>M</b> [Nm]                | = bending moment  |
| <b>F<sub>v</sub></b> [Kg]    | = max. static wheel load  |
| <b>g</b> [m/s <sup>2</sup> ] | = 9.81 (constant of gravity)  |
| <b>μ</b> [-]                 | = 0.9 (coefficient of friction)   |
| <b>R<sub>dyn</sub></b> [m]   | = dynamic loaded radius defined as the circumference divided by 2π of the largest tyre to be used on the wheel, as specified by the vehicle or wheel manufacturer |
| <b>d</b> [m]                 | = inset   |

Minimum No. of Load Cycles for Steel Wheels:

75 % M max -->  $2.0 \cdot 10^4$  cycles

50 % M max -->  $2.33 \cdot 10^5$  cycles.

## 7 - DYNAMIC RADIAL FATIGUE TEST

### EQUIPMENT

7.1 The test machine will have driven rotatable drum of 1700 mm diameter minimum which presents a surface wider than the loaded test tyre section width. See fig. 2, sheet 5.

**8 - PROCEDURE**

- 8.1 The tyre selected for this wheel must be representative of the tyre specified by the caravan or car trailer manufacturer for the wheel.  
The recommended cold inflation pressure of the test tyre is 4.6 Kg/cm<sup>2</sup> which during test is to be maintained within 10 %.
- 8.2 Wheel fixing nuts or bolts to be torqued at the beginning of the test to a value recommended by the caravan or trailer manufacturer.
- 8.3 The loading system should be capable of maintaining the specified load within  $\pm 2.5$  %.

**9 - TEST LOAD DETERMINATION**

The test load is determined as follows:

$$F_r = F_v \cdot K \quad [N]$$

where:

$F_r$  [N] = Radial Load

$F_v$  [N] = Rated tyre load as specified by the vehicle or wheel manufacturer

$K$  [-] = Overload factor 2.0

**10 - TEST REQUIREMENTS AND FAILURE IDENTIFICATION****10.1 TEST REQUIREMENTS**

All test wheel assemblies must withstand a total of 1.000 kilometres

**10.2 FAILURE IDENTIFICATION**

10.2.1 Inability of wheel to sustain load

10.2.2 Inability of wheel to sustain tyre pressure

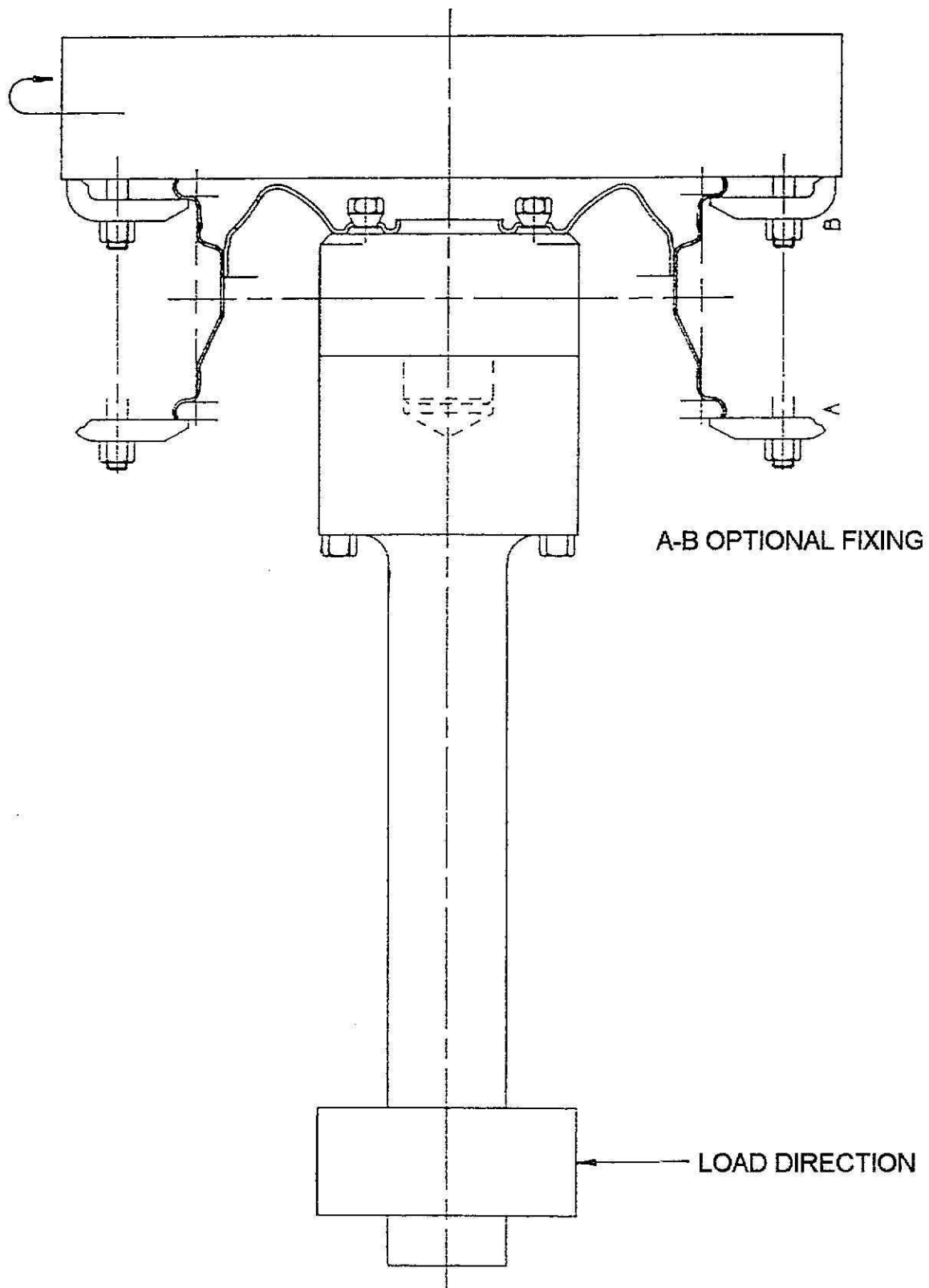


Figure 1 - DISC BENDING TEST

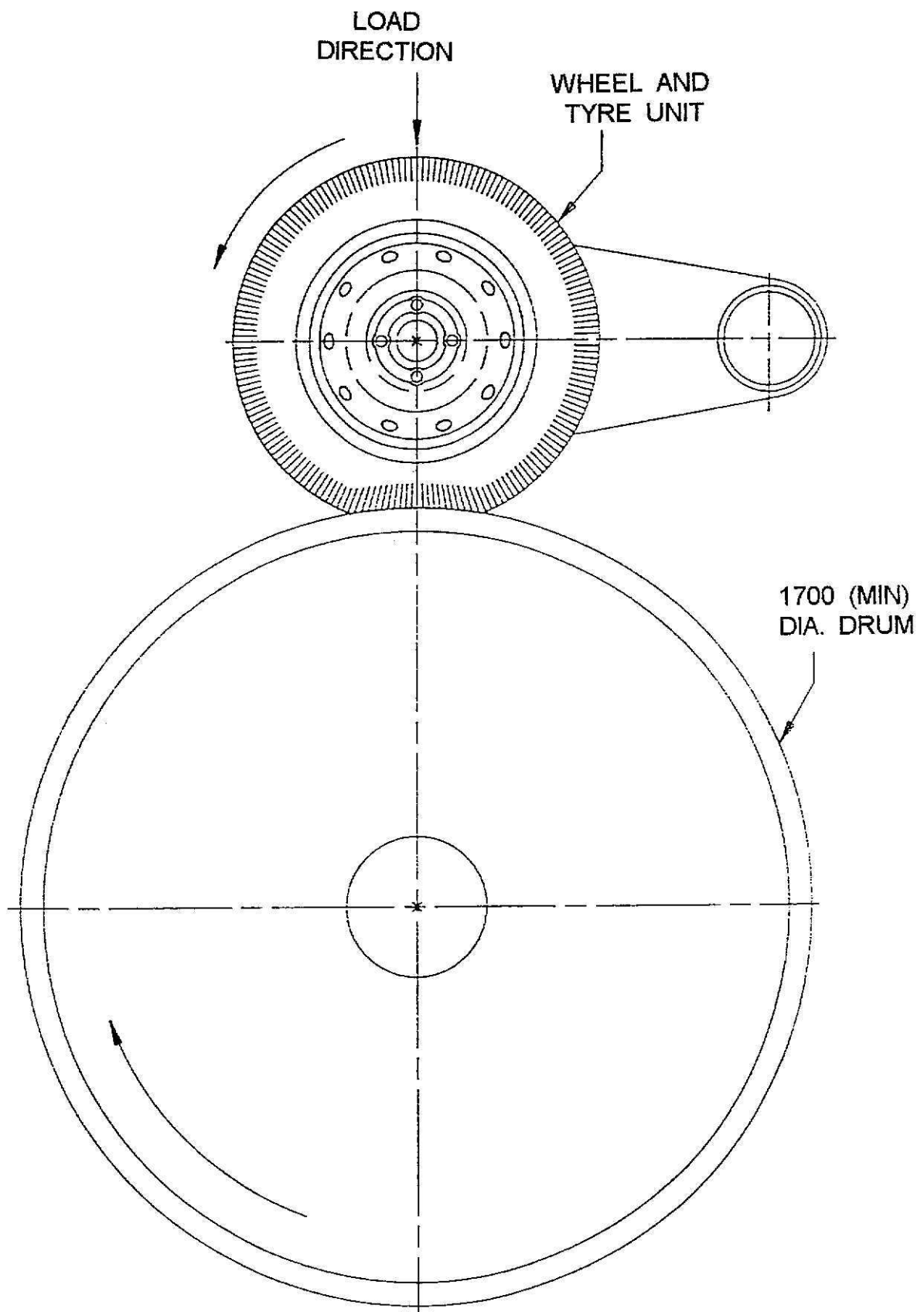


Figure 2 - DYNAMIC RADIAL FATIGUE TEST

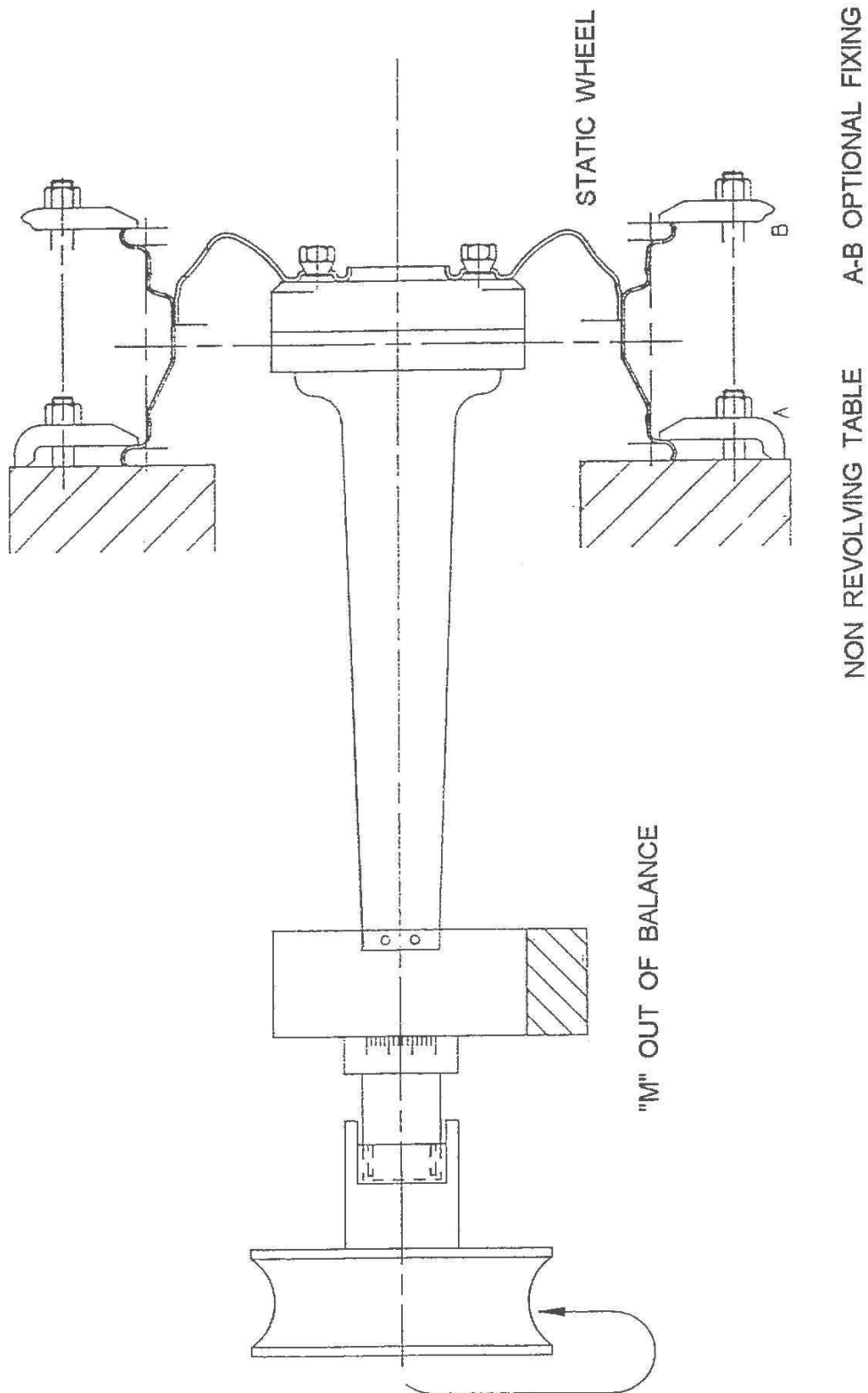


Figure 3 - UNBALANCE TYPE DISC BENDING MACHINE