SECTION 903 -- C-DOLLY

1. INTRODUCTION

Subsections 2 to 6, the Appendices, and Figure 1 of this section make up test methods referred to in section 903 of Schedule IV to the Motor Vehicle Safety Regulations, to demonstrate compliance with the requirements of section 903 of Schedule IV of the said Regulations.

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2. DEFINITIONS

In this Section,

"angular displacement" means the angular displacement of the fifth-wheel plate with respect to a transverse line that is

(a) parallel to the horizontal line passing through the centre of the hitching device or hitching devices, and

(b) located on the vertical plane through the surface to which the hitching device or hitching devices of the test rig are attached;

"caster offset" means

(a) in the case of an automotive-type steering mechanism, the longitudinal distance between the centre of tire and the point where the axis of the kingpin on the same side of the C-dolly intersects the surface supporting the C-dolly; and

(b) in the case of a turntable-type steering mechanism, the longitudinal distance between the centre of tire and the turntable axis;

"C-dolly" means a trailer converter dolly that is equipped with a single axle that is self-steering, and a coupling that is so constructed that when the dolly is coupled to a towing trailer, it cannot pivot horizontally with respect to the towing trailer;

"centre of tire" means

(a) in the case of a single tire, any point on the vertical line bisecting the overall width of the tire and intersecting the horizontal axis of the tire; and

(b) in the case of dual tires, any point on the vertical line symmetrically equidistant from the two vertical planes bisecting the overall width of the tires and intersecting the horizontal axis of the tires;

"drawbar" means a structural member of a full trailer, or trailer converter dolly that includes a device for the purpose of coupling to a trailer hitch;

"fifth-wheel" means a coupling device that is mounted on the vehicle chassis and that consists of a skid plate, associated mounting brackets and latching mechanism that couples or connects to a kingpin located on the other vehicle or component, for the purpose of supporting and towing semitrailers;

"test rig" means an apparatus, including fixtures and instrumentation, that is designed to apply forces to a C-dolly and to measure forces and displacements, and that is capable of performing the tests described in this document;

"trailer converter dolly" means a conversion chassis equipped with one or more axles, a lower half of a fifth-wheel coupling and one or two drawbars.

3. VEHICLE PREPARATION

3.1 Examine the C-dolly to ensure that it is in a complete and ready-to-run state of assembly, including tires and hitches.

3.2 Examine the centering force mechanism to ensure that the centering force mechanism is operating in accordance with the manufacturer's recommendations.

3.3 If the C-dolly has a slider fifth-wheel, set the fifth-wheel trunnion centre to a position ahead, but no more than 30 mm ahead, of the centre-line of the C-dolly.

3.4 Activate and deactivate every locking device to ensure free engagement and disengagement, and proper alignment of the axle system when locked.

4. TEST OF STEERING SYSTEM

4.1 Connect the C-dolly to the test rig, in accordance with the manufacturer's recommendation. A typical test rig is shown in Appendix A.

4.2 Connect the centering force mechanism of the C-dolly to an appropriate source of power supply. For a C-dolly equipped with a pressurized pneumatic system for the centering force mechanism, connect the pneumatic system to an air supply line regulated at a pressure of 690 kPa.

4.3 Place frictionless bearings beneath the tires of the C-dolly to eliminate horizontal forces between the tires of the C-dolly and the test platform.

4.4 Apply the service brakes on the C-dolly wheels with maximum application force and maintain the application for the duration of the test.

4.5 Load the C-dolly to its GAWR, by means of a vertical force on the fifth-wheel.

4.6 Apply a steering moment about the turntable axis in the case of a turntable-type steering mechanism, or about the kingpin axes in the case of an automotive-type steering mechanism, until the wheels reach the limit of their angular range. Measure the total steering moment and the average steering angle continuously (or at intervals of 0.5 degree angular displacement of the axle, including measurement of the final displacement).

4.7 Remove the steering moment and measure the average steering angle at that point.

4.8 Repeat 4.6 and 4.7 for a steering moment in the opposite direction.

5. CALCULATION OF EQUIVALENT FORCES FROM STEERING MOMENT

5.1 Record the steering moments measured at a steering angle of one degree in each direction from paragraphs 4.6 and 4.7.

5.2 Calculate the equivalent lateral force by dividing the steering moment obtained in 5.1 by the sum of caster offset and 50 mm.

5.3 Calculate the equivalent longitudinal force by dividing the steering moment obtained in 5.1 by

(a) in the case of an automotive-type steering mechanism, the lateral distance between the centre of tire and the point where the axis of the kingpin on the same side of the C-dolly intersects the surface supporting the dolly; and

(b) in the case of a turntable-type steering mechanism, the lateral distance between the centre of tire and the turntable axis.

6. TEST OF TORSIONAL STIFFNESS

6.1 Connect the C-dolly to the test rig, in accordance with the manufacturer's recommendation.

6.2 Lift the test rig and the C-dolly so that the C-dolly remains level and its tires are free of the ground. Lock the test rig in this position for the duration of the torsional test.

6.3 Apply a torque gradually at the hitch points of the C-dolly about its longitudinal axis until the value of 45,000 N·m is reached. Measure any initial angular displacement due to slack at the hitch points (i.e. the initial angular displacement just before the torque exceeds zero value, see Appendix B). During the application, measure and record the torque at 0.1 degree intervals of angular displacement of the dolly frame.

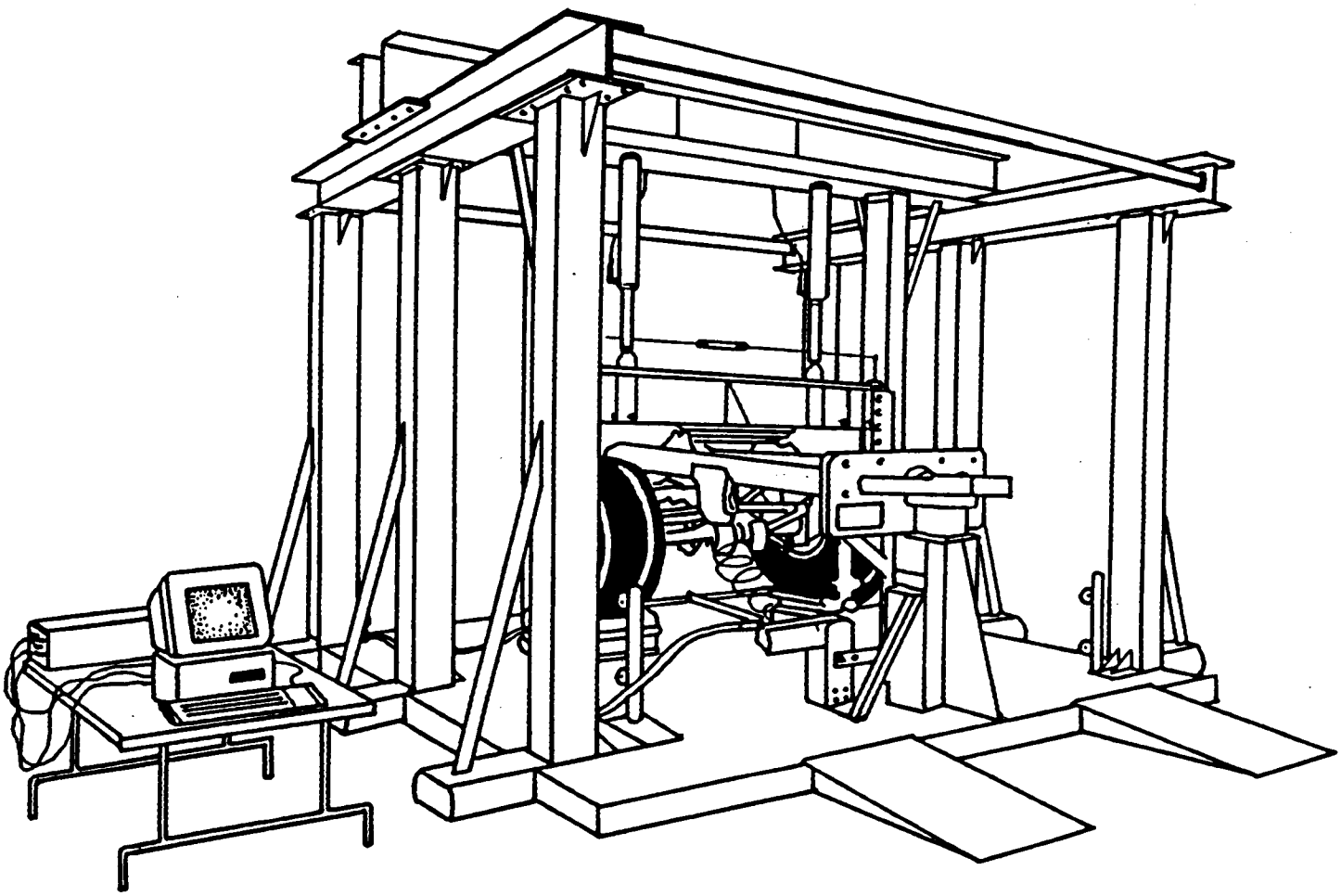
6.4 Calculate the torsional stiffness by dividing the torque of 45,000 N·m by the difference between the angular displacement corresponding to this torque and the initial angular displacement.

6.5 Remove the torsional load and measure any residual angular displacement at that point (see Appendix B).

6.6 Repeat 6.3 to 6.5 for a torsional load of 45,000 N·m in the opposite direction.

Appendix A

The following diagram illustrates a facility for testing a trailer converter dolly equipped with a self-steering mechanism*:



*Ref.: "Technical Analysis and Recommended Practice for the Double-Drawbar Dolly Using Self-Steering Axles", J.H.F. Woodrooffe, P.A. LeBlanc, M. El-Gindy, December, 1989. A study sponsored by Roads and Transportation Association of Canada and National Research Council

Appendix B-1

MEASUREMENT OF RESIDUAL ANGULAR DISPLACEMENT (RESIDUAL DEFORMATION)

For the purpose of this test method, Figure 1 shows the region in which the torsional stiffness curve of a C-dolly must lie. Under Section 903 of the Motor Vehicle Safety Regulations, the torsional stiffness of a C-dolly must be at least 3000 N·m/degree. Also, the residual deformation of the C-dolly, following the application and removal of a torque of 45000 N·m about the longitudinal axis, must not exceed 0.5 degrees. The compliance region is shown by the polygon **ABCDEF** formed by bold lines in Figure 1. The two horizontal lines **BC** and **EF** are the 45,000 N·m torque limits. The vertical lines **AB** and **DE** are the 0.5 degree limits for maximum allowable residual deformation. Points **C** and **F** represent the angular displacement of 15 degrees when the torque of 45,000 N·m is reached. The slope of **CF**, which passes through the origin, represents the minimum torsional stiffness of the C-dolly.

For a C-dolly to comply with the torsional stiffness requirements of CMVSS 903, C-dolly Specifications, any loading and unloading curves (twisting and un-twisting) must fall within the compliance region **ABCDEF**. Theoretically, the loading curve should start at the origin, and the unloading curve may return to the horizontal axis at some point within 0.5 degrees of the origin due to hysteresis and hitch slack. But in practice, even without any hitch slack, there is always some initial non-zero angular displacement due to manufacturing tolerances. For most C-dolly designs which have two separate hitches, this misalignment may, when coupled to a trailer, be as much as 1.5 degrees. To allow for this possible misalignment, the compliance region in Figure 1 extends 1.5 degrees horizontally in both directions. The thin lines, which are parallel to **DC** and **AF** and cutting the horizontal axis at 2 degrees, represent the limits for the compliance region when both initial angular displacement and residual deformation are considered.

Therefore, if an initial angular displacement is present in a torsional test, the centre of the compliance polygon should be shifted to the point of initial angular displacement in order to measure the actual residual deformations. In other words, the residual deformation must be measured relative to the point of initial angular

displacement. The C-dolly is considered as non-compliant if an initial angular displacement exceeding 1.5 degrees, or a residual deformation exceeding 0.5 degrees is measured. For practical purpose, the limit of 1.5 degrees for initial angular displacement applies to all C-dollies regardless of the design of hitching device.

Torsional Stiffness Requirements
9100 kg GAWR C-Dolly

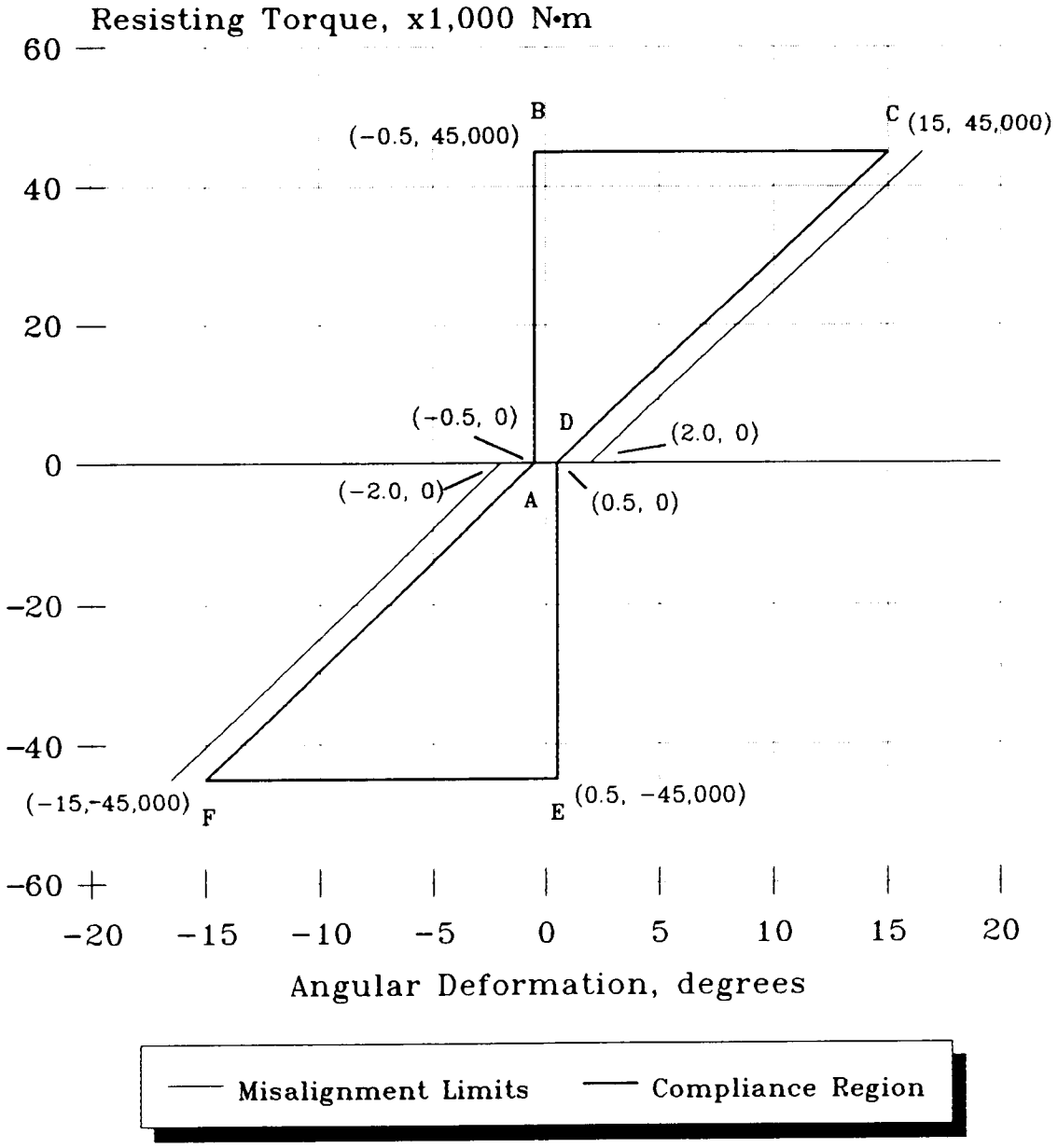


Figure 1