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ELECTRONIC RESPONSE TIME MEASUREMENT

1. INTRODUCTION

1.1 This circular is applicable to Total Trailer Brake Systems and to Control System Sub-Assemblies, for trailers over 4.5 tonnes ATM.

1.2 Australian Design Rule 38/05 – Trailer Brake Systems (ADR 38/05) sets a maximum electronic response time for trailers equipped with an electric Control Line. This must not exceed 0.4 seconds (refer clause 7.1.4), when measured in accordance with clause 16.5, at any brake actuator of any Axle Group on the trailer.

1.3 In summary, for a test to clause 16.5 (electronic response time measurement):

(a) the trailer Supply Line and energy storage devices are charged to 1.0 E (650 kPa) prior to testing (refer clause 16.5.1);

(b) no additional energy is added to the trailer Supply Line during testing (refer clause 16.5.1);

(c) an electronic simulator is used to produce a digital demand signal in the electric Control Line, which is equivalent to a linear pneumatic pressure increase from 0.0 to 650 kPa in 0.2 ± 0.01 seconds (refer clauses 16.5.2 and 16.5.3); and

(d) the electronic response time is taken from no later than when the signal produced by the simulator exceeds the equivalent of 0.1 E (65 kPa), to when the pressure in the least favoured brake actuator reaches 75 per cent of its asymptotic value (refer clause 16.5.4).

1.4 The purpose of this circular is to provide further detail and explanation of acceptable test methods, including examples, to demonstrate that a trailer brake system meets the maximum electronic response time requirement in the ADR.

2. ACCEPTABLE TEST METHODS

2.1 A digital demand signal in the electric Control Line will be considered equivalent, for the purpose of electronic response time measurement, to that specified in clause 16.5.3 of the ADR, if the following condition is met throughout the test:

$$P_E \leq 65 + \left[\left(\frac{650}{0.19}\right) \times t\right]$$

where:

P_E is the equivalent pneumatic pressure to the calculated digital demand signal in the electric Control Line at time t, in kPa; and

t is the time elapsed since the commencement of the electronic response time measurement, in seconds.

2.2 The asymptotic value shall be taken to be the final pressure reached or approached in the least favoured actuator for an electric Control Signal equivalent to at least 1.0 E (650 kPa), and a Supply Line energy level of 1.0 E (650 kPa).

2.3 The least favoured actuator is the actuator with the longest (i.e. worst case) response time.

2.4 Figure 1 shows an example of a suitable digital demand signal, and a compliant pressure response in a brake actuator.

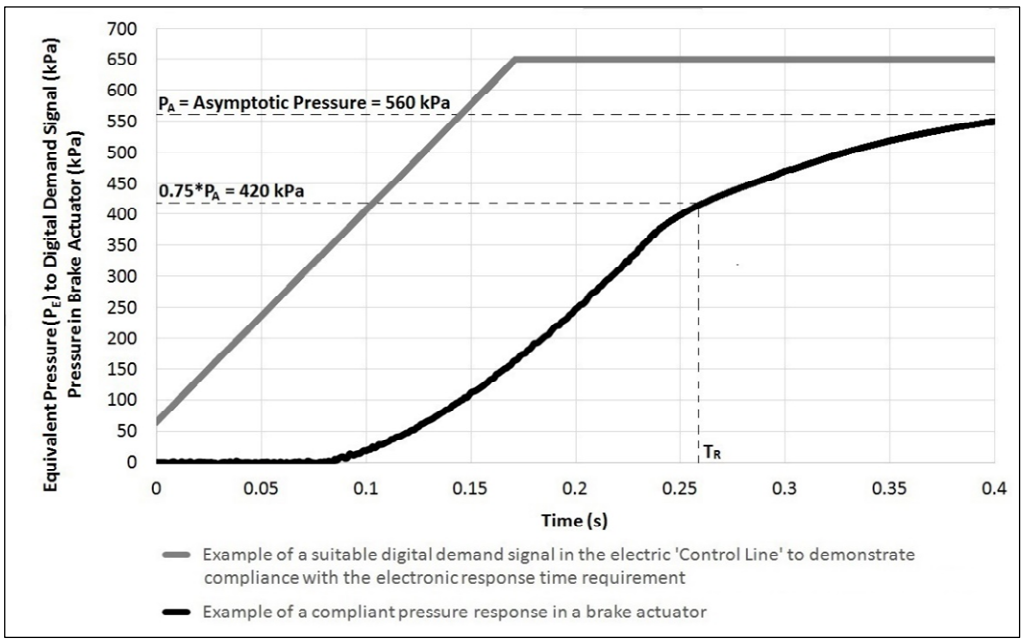

Figure 1: An example of a suitable digital demand signal in the electric Control Line, and a compliant pressure response in a brake actuator

In this example, the digital demand signal in the electric Control Line exactly matches the maximum permitted by clause 16.5.3, up until the digital equivalent of 1.0 E (650 kPa) is reached. The response time (T_R), taken from when the signal produced by the simulator exceeds the equivalent of 0.1 E (65 kPa), to when the pressure in the actuator reaches 75 per cent of its asymptotic value (0.75 × P_A = 420 kPa), is 0.26 seconds.

2.5 Figure 2 shows another example of a suitable digital demand signal, and a compliant pressure response in a brake actuator.

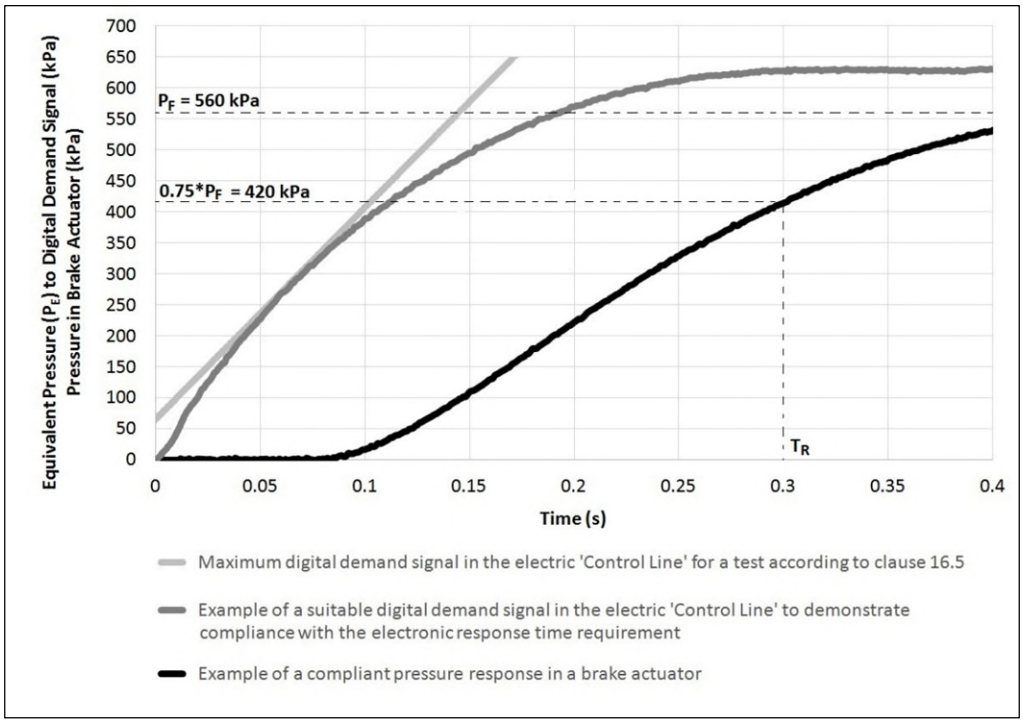

Figure 2: Another example of a suitable digital demand signal in the electric Control Line, and a compliant pressure response in a brake actuator

In this example, the digital demand signal in the electric Control Line does not exceed the maximum specified in clause 16.5.3, throughout the response time measurement. To ensure this, the response time (T_R = 0.3 seconds) is taken from when the signal produced by the simulator initially rises, to when the pressure in the actuator reaches 75 per cent of its final value (0.75 × P_F = 420 kPa) for an electric Control Signal equivalent to 650 kPa (1.0 E)[1].

[1] This may be determined from the Control System ratios at each axle for an electric Control Signal input equivalent to 650 kPa (1.0 E) and a Supply Line energy level of 650 kPa (1.0 E).