



Friction Coefficient of Window Regulator Tube

1 Scope

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. To determine the friction coefficient of window-regulator tube, which affects the performance of glass guidance system. The information is used in Computer Aided Engineering (CAE) model to predict the performance of glass guidance system.

1.2 Foreword. Not applicable.

1.3 Applicability. This procedure applies to all cable-drive regulator system.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

None

3 Resources

3.1 Facilities. Not applicable.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment.

3.2.1 Fixed rigid fixture that can support a cable conduit with a 100 mm radius.

3.2.2 Weights.

3.3 Test Vehicle/Test Piece. Production intent cable conduit and production intent cable with product intent cable end fittings.

3.4 Test Time. Not applicable.

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Not applicable.

4 Procedure

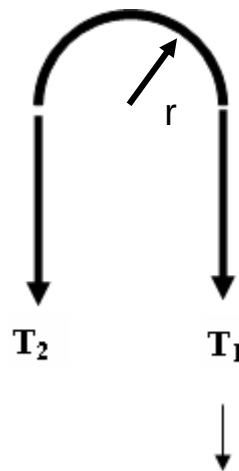
4.1 Preparation. Not applicable.

4.2 Conditions.

4.2.1 Environmental Conditions. Conduct tests at ambient conditions $22\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.3 Instructions.



Where:

T_1 = Hanging weight 1

T_2 = Hanging weight 2

r = Radius of cable conduit in fixture = 100 mm

Figure 1: Cable Conduit and Weight Setup

4.3.1 Mount the tube/cable subassembly in a fixed rigid fixture with a contact angle of 180 degrees. Remain equal length for both ends. The radius in the bend in the conduit shall be 100 mm.

4.3.2 Hang equal weight to each end of cable. Record the weight (T_2) as shown in Figure 1.

4.3.3 Gradually increase weight to one (1) end of cable until the cable begins to move. Record the final weight (T_1).

4.3.4 Substitute T_1 , T_2 into 5.1 Equation 1 and calculate the friction coefficient u_t .

4.3.5 Change the balance weight (T_2), and repeat 4.3.2 through 4.3.4 for another four (4) estimates.

4.3.6 Average the five (5) estimates.

5 Data

5.1 Calculations. The friction coefficient of the tube is estimated per Equation 1.

$$u_t = \frac{1 - \frac{T_1}{T_2}}{1 + \frac{T_1}{T_2}} \quad \text{Equation 1}$$

Where:

T_1 = Hanging weight 1

T_2 = Hanging weight 2

u_t = Friction coefficient of conduit