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Test Report of FMVSS No. 201 Free-Motion Headform (49 CFR 572 Subpart L) Used in Headform Test of ECE Reg. 43

A series of free-motion headform (FMH) tests was conducted on polycarbonate plastic samples to provide data for GRSG in considering the U.S. headform as an alternative impact device in the headform impact test of plastic panes contained in the ECE Regulation 43. The FMH is a Hybrid III head, weighing 4.5 kg (10 lbs.), modified for use as a free-motion impactor. The headform was instrumented with a triaxial accelerometer array located at the center of gravity. The accelerometers used were Endevco's model 7264-2000 units. Headform acceleration data was collected as a function of time in accordance with SAE Recommended Practice J211.

Twenty-four polycarbonate samples were purchased from a regional plastic supplier. The samples were cut by the supplier to a length of 1100 mm and a width of 500 mm. Twelve pieces had a nominal thickness of 4.76 mm (3/16") and twelve had a thickness of 6.35 mm (1/4"). The test support frame used was supplied by the Visteon Glass Plant in Nashville, TN.

Test Setup

The polycarbonate samples were kept in an environmentally controlled lab at least 4 hours prior to testing. The exact temperature and humidity were not recorded. The protective plastic covering was removed from individual polycarbonate pieces and then cleaned with a mild cleaning solution. The test piece was then fixed between the upper and lower halves of the support frame and secured by applying a torque of 30 Nm to the bolts. The geometric center of each piece was found and the area of impact was ensured to be within 40 mm of this center in accordance to ECE 43.

It was determined that the direction of force imparted on the headform by the test piece should be at the

center of the forehead, just above the bridge of the nose. After positioning the impactor perpendicular to the plane of the test piece, it could be seen that contact would be made by other features on the face of the headform during dynamic testing. To avoid interference, the impactor was rotated 5 degrees backwards (See figure 1). Subsequent trial testing revealed that this shallow angle allowed for the rebounding headform to strike the impactor fixture, causing damage to the fixture and accelerometer data cables. Therefore, the impactor was rotated an additional 16 degrees (see figure 1).

Figure 1 -- Impact Angle of 21 degrees

Although the headform did not rebound into the impactor, a plastic shroud was positioned around the test piece to prevent the headform from bouncing away and stretching the data cables. As a result, the headform struck the test piece multiple times after the initial impact.

Equivalent impact velocities for drop heights of 1.5 m and 3.0 m were computed to be 5.42 m/s (12.1 mph) and 7.67 m/s (17.2 mph) respectively. Table 1 list the test configurations and computed HIC values (36 and 15 ms).

Table 1 **B** HIC Values for Rigid Plastic Glazing

Test No.	Impact Speed/Equiv. Drop Height	Thickness	HIC (36 ms)	HIC (15 ms)	Comments
RGP3_01	17.26 MPH/ 3.0 Meters	3/16 "	872	872	
RGP3_02	17.41 MPH/ 3.0 Meters	3/16 "	817	817	
RGP3_03	17.32 MPH/ 3.0 Meters	3/16 "	839	839	
RGP3_04	17.07 MPH/ 3.0 Meters	3/16 "	918	918	
RGP3_05	16.92 MPH/ 3.0 Meters	3/16 "	918	918	
RGP3_06	16.82 MPH/ 3.0 Meters	3/16 "	884	884	
RGP3_07	17.12 MPH/ 3.0 Meters	1/4 "	893	893	
RGP3_08	17.14 MPH/ 3.0 Meters	1/4 "	876	876	
RGP3_09	17.17 MPH/ 3.0 Meters	1/4 "	849	849	
RGP3_10	17.01 MPH/ 3.0 Meters	1/4 "	873	873	
RGP3_11a	16.41 MPH/ 3.0 Meters	1/4 "	780	780	Table was not anchored to floor correctly
RGP3_11b	17.04 MPH/ 3.0 Meters	1/4 "	924	924	Used same plastic piece as previous test
RGP3_11c	17.02 MPH/ 3.0 Meters	1/4 "	959	959	Used same plastic piece as previous test
RGP3_12	16.86 MPH/ 3.0 Meters	1/4 "	845	845	
RGP15_01	12.15 MPH/ 1.5 Meters	3/16 "	288	288	
RGP15_02	11.81 MPH/ 1.5 Meters	3/16 "	291	291	
RGP15_03	11.71 MPH/ 1.5 Meters	3/16 "	298	298	
RGP15_04	11.84 MPH/ 1.5 Meters	3/16 "	303	303	
RGP15_05	11.96 MPH/ 1.5 Meters	3/16 "	297	297	
RGP15_06	11.72 MPH/ 1.5 Meters	3/16 "	326	326	
RGP15_07	11.75 MPH/ 1.5 Meters	1/4 "	310	310	
RGP15_08	12.03 MPH/ 1.5 Meters	1/4 "	319	319	
RGP15_09	12.11 MPH/ 1.5 Meters	1/4 "	279	279	
RGP15_10	12.09 MPH/ 1.5 Meters	1/4 "	291	291	
RGP15_11	12.03 MPH/ 1.5 Meters	1/4 "	290	290	
RGP15_12	12.18 MPH/ 1.5 Meters	1/4 "	313	313	
RGP15_13	16.80 MPH/ 3.0 Meters	1/4 "	885	885	Used same plastic piece as previous test