HALO™ Rollover Occupant Protection System – ISO 3471-2008 Test Report

Safety Engineering International submitted the HALO™ to be tested under the ISO 3471:2008 standard, which specifies the performance requirements for metallic rollover protective structures (ROPS).

The test was conducted by Friedman Research Corporation.

www.FriedmanResearch.com

HALO Rollover Occupant Protection System

ISO 3471-2008 Test Report: Ford F350 Dual Cab

1508-B Ferguson Lane, Austin, TX 78754 TEL: 512.247.2277 FAX: 512.727.5504
81 David Love Place #216, Goleta, CA 93117 TEL: 805.683.1300 FAX: 805.880.8889

F-350 HALO: ISO 3471-2008 Test Report Date: August 13, 2021

Vehicle

Type: Light duty truck

Manufacturer: Ford

Model Number: F350 crew cab

ROPS

Manufacturer: Safety Engineering International: High Attenuation Load Offset (HALO)

Information supplied by manufacturer.

Location of DLV: Orthogonal projection of 95th %ile male Hybrid III ATD in driver seat

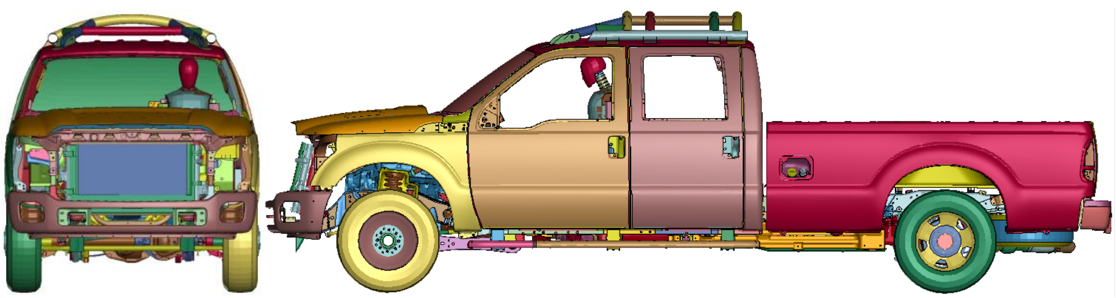

Figure 1. Pre-test image

Test Results and Criteria

Lateral Loading	**Attained**	**Min required**	**Max allowed**
Max force	23400 N	9818 N	
Absorbed energy	750 J	709.5 J	
Max displacement	51.3 mm		250 mm
Vertical Loading			
Maximum force	32300 N	32100 N	
Max displacement	2.5 mm		117 mm
Longitudinal Loading			
Maximum force	10400 N	7909 N	
Max displacement	10.1 mm		450 mm

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Temperature and Materials

The test was performed with ROPS and machine frame members soaked to 20 deg C (material properties defined at ambient temperatures)

The Charpy V-notch impact strength requirements for ROPS structural metallic members were tested on a specimen of size 10 mm x 10 mm. The absorbed energy was 40 J at -40 deg C[1]

Nut property class: 8

Bolt property class: 8.8

[1]https://www.ssab.com/api/sitecore/Datasheet/GetDocument?productId=77213F04FD5D440080457225B1E273FD&language=en

Force-deflection curve for loading test

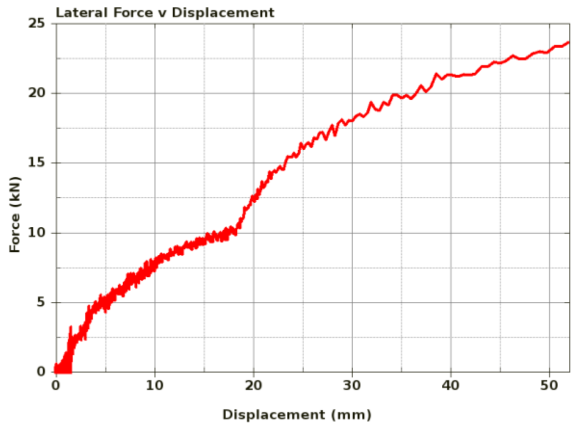

Figure 2. Lateral Force v Displacement

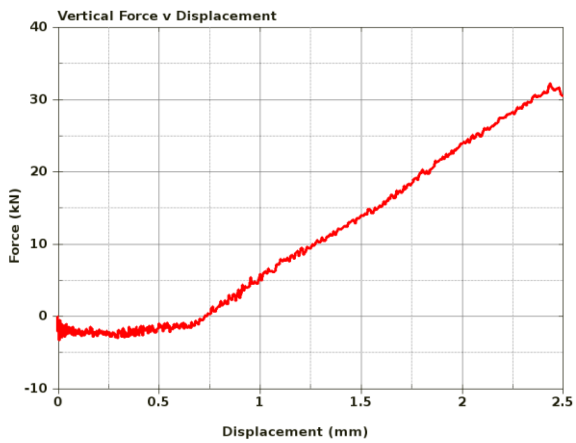

Figure 3. Vertical Force v Displacement

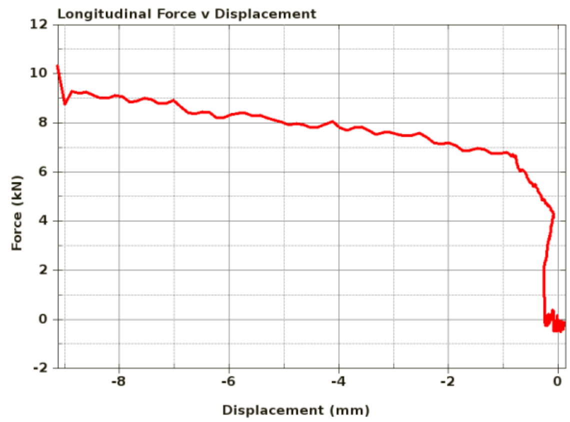

Figure 4. Longitudinal Force v Displacement

Photo of specimen

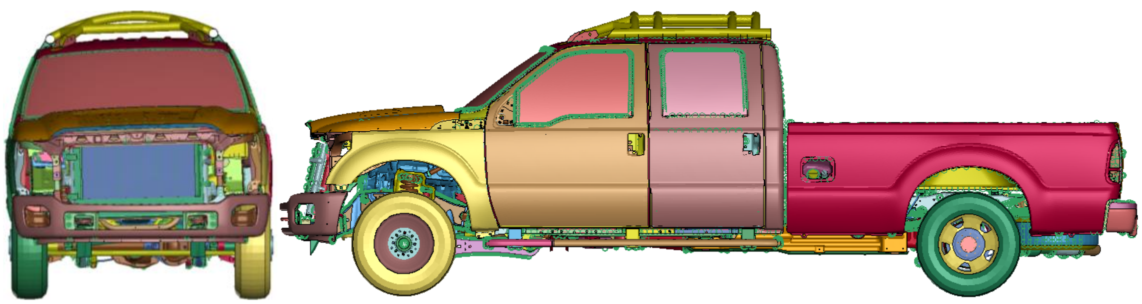

Figure 5. Post-Test Image

Attestation statement

The minimum performance requirements of ISO 3471:2008 were met in this test for a maximum machine mass of 2727 kg. Use of the Finite Element method is an accepted means for demonstrating compliance and performance of structures under static and dynamic loading environments to protect occupants.[2,3,4,5]

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[2] Federal Aviation Administration, AC 20-146A – Methodology for Dynamic Seat Certification by Analysis for Use in Parts 23, 25, 27, and 29 Airplanes and Rotorcraft, June 29, 2018
[3] European Standard, prEN 16303, Road restraint systems – Validation and verification process for the use of virtual testing in crash testing against vehicle restraint system, 2018
[4] Ray et al., NCHRP 22-24, Web-Only Document 179: Procedures for verification and validation of computer simulations used for roadside safety applications, March 2010
[5] Euro NCAP, Pedestrian Human Model Certification, Technical Bulletin 24, 2017