

2013 General Motors 6T40 Transmission Mapping - NCAT Test Report

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**NCAT – National Center for Advanced Technology**

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# Purpose of Test

The purpose of this testing is to characterize the performance of a 2013 General Motors 6T40 transmission, in particular to generate efficiency and spin loss data that may be used in the ALPHA (Advanced Light-Duty Powertrain & Hybrid Analysis) model.

# Test Article

The transmission used in this project was a GM 6T40 FWD 6-speed automatic transmission removed from a 2013 Chevrolet Malibu 2.5L, VIN 1G11B5SA2DF147935.

# Test Methodology

EPA contracted FEV engine technologies under EPA contract EP-C-12-014 to complete benchmarking of the GM 6T40 transmission. The benchmarking activities encompassed areas:

* Perform vehicle break-in following the manufacturer’s recommendations over a combination of city and highway driving
* Gathering in-vehicle data to create upshift and downshift maps
* Conduct loaded efficiency testing on a transmission test stand
* Conduct spin loss testing on a transmission test stand
* Measure torque converter efficiency

The test setup, test methodology, and summary results are detailed in the accompanying final report authored by FEV, *3b- 2013 GM 6T40 Final Transmission Testing Report by FEV.pdf*.

# Data Set

The data obtained by FEV are given in the four accompanying data files:

* *4a- 2013 GM 6T40 Loaded Efficiency Results (FEV) – Test Data Set.xlsx* details efficiency in each gear as a function of input speed and load. Efficiencies are given at two different transmission oil temperatures (37 °C and 93 °C) and at 10 bar line pressure.
* *4b- 2013 GM 6T40 Shiftmap Data (FEV) – Test Data Set.xlsx* contains the points used to construct the transmission shift maps for both the upshifts and downshifts. These points are given as a function of vehicle speed and ECU-reported pedal position.
* *4c- 2013 GM 6T40 Spin Loss Results (FEV) – Test Data Set.xlsx* contains spin losses in each gear as a function of input speed. Efficiencies are given at two different transmission oil temperatures (37°C and 93°C) and at two different line pressures (5 bar and 10 bar).
* *4d- 2013 GM 6T40 Torque Converter Test Results (FEV) – Test Data Set.xlsx* contains torque converter torque ratios (and associated K factors) as a function of speed ratio.

# Results

A summary of the results is included in FEV’s final report, *3b- 2013 GM 6T40 Final Transmission Testing Report by FEV.pdf*. Additional detailed results are included in the associated presentation, *3c- 2013* *GM 6T40 Final Transmission Testing Report Presentation by FEV.pdf*.

# Discussion and Data Usage

In general, the transmission data produced in this testing are robust and can be used for any purpose. The benchmarking results from this testing were provided to the ALPHA model to perform full vehicle simulations over several drive cycles and vehicle road loads. Additional details pertaining to this modeling and the results obtained are described in the attached SAE paper *SAE 2015-01-1140 Benchmarking and Modeling a Conventional Mid-Size Car.pdf.* [1]

# References

[1] Newman, K., Kargul, J., and Barba, D., “*Benchmarking and Modeling of a Conventional Mid-Size Car Using ALPHA*,” SAE Technical Paper 2015-01-1140, 2015, doi:10-4271/2015-01-1140.