

2013 Nissan Jatco CVT8 Transmission – NCAT Test Report

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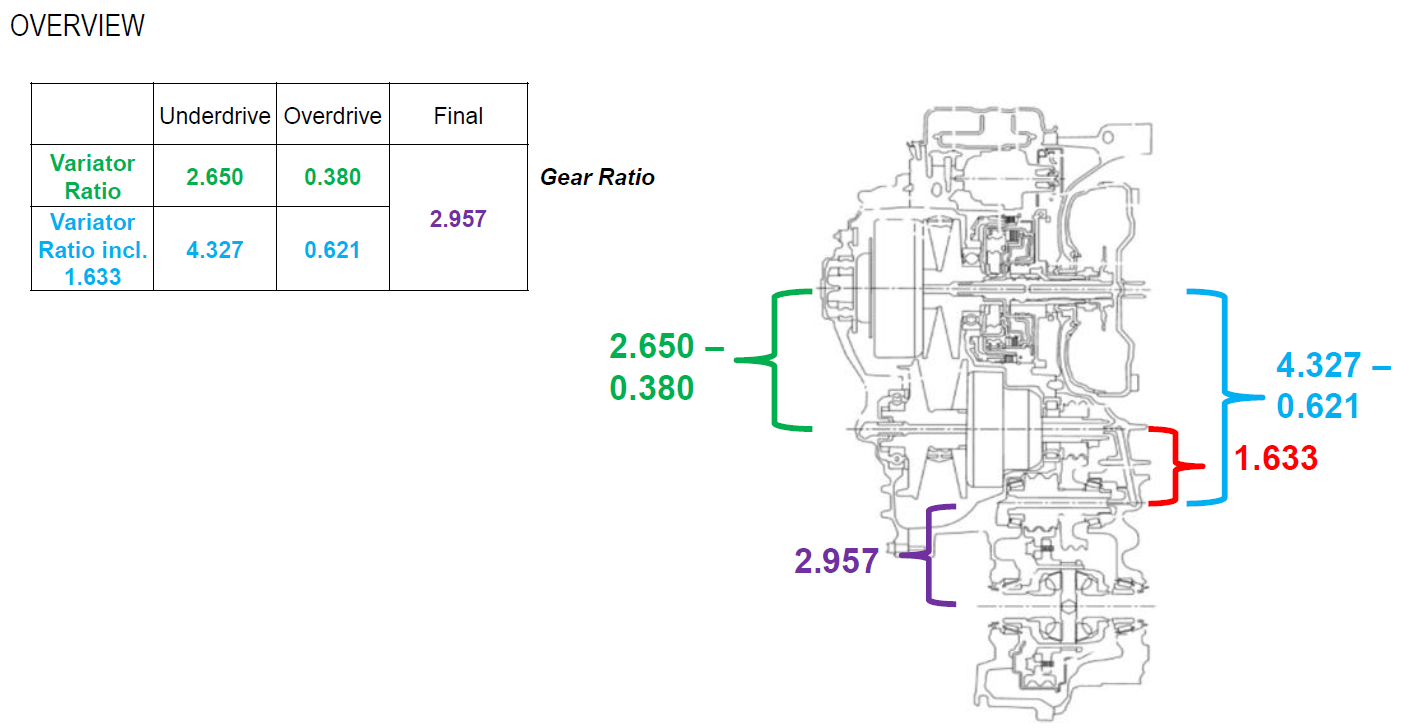
# Purpose of Test

The purpose of this testing is to characterize the performance of a 2013 Nissan Jatco CVT8 transmission to generate efficiency and spin loss data that may be used in the ALPHA (Advanced Light-Duty Powertrain & Hybrid Analysis) model.

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# Test Article

The transmission tested in this project was a Jatco 8-Speed Continuously Variable Automatic Transmission (CVT) with manual shifting mode used in 2013 Nissan Altima 2.5 S vehicles. The ratio spread of this CVT was 7:1 and the specific gear ratios are shown below.



Three CVT8s were utilized in this test program which included the original CVT8 removed from a vehicle along with two spares purchased specifically in support of this test program. The original transmission (CVT#1) was prepped and utilized for the spin loss testing but was damaged during the first runs of loaded efficiency testing due to a pressure sensor fault. The second transmission (CVT#2) was installed in the vehicle to perform a 1200 mile on-road break in but suffered minor damage due to pressure loss when a pressure-tap failed. This transmission remained in the vehicle and after repair, was utilized to conduct the oil pump testing. A third replacement transmission (CVT#3) was purchased to complete the remaining testing, including the loaded efficiency and neutral coasting tests, which were successfully completed after transmission break-in on the test bench.

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# Test Methodology

EPA contracted FEV engine technologies under EPA Contract EP-C-12-014, Work Assignment WA 4-11, to complete benchmarking of the Jatco CVT8 transmission. The benchmarking activities encompassed the following areas:

* Perform a 1200-mile transmission break-in while still in-vehicle following the manufacturer’s recommendations over a combination of city and highway driving
* Gather in-vehicle data with an instrumented transmission to capture pulley, clutch and line pressures
* Conduct loaded efficiency testing on a transmission test stand
* Conduct neutral coast down loss testing on a transmission test stand matching conditions observed in the vehicle
* Measure transmission oil pump efficiency on a test stand
* Conduct spin loss testing on a transmission test stand

In-vehicle testing was performed using a 2013 Nissan Altima 2.5 S as-built from the manufacturer with the original Transmission Control Module (TCM) and production calibration. A spare CVT transmission was instrumented with pressure sensors to capture pulley, clutch and line pressures and installed as replacement for the original CVT. In addition, the vehicle was also driven on a chassis dynamometer at a constant ratio to achieve stable hydraulic operation to represent “steady-state” on the test stand.

The remainder of the testing was performed on a dedicated transmission test stand as shown below in Figure 1. The system pressures recorded during vehicle testing were reproduced on the test stand to reproduce real-world operating conditions. In addition, test points were obtained at elevated system pressures to gain insight into transmission pressure sensitivity.

Further detailed information on the test setup and test methodology, as well as summary results for all the testing, are detailed in the presentation authored by FEV, *3b-* *2013 Nissan Jatco CVT8 Benchmarking Presentation by FEV.pdf*.



**Figure 1: Jatco CVT8 Mounted in FEV’s Test Stand**

# Data Set

The data obtained by FEV are given in the following data files accompanying this document:

* *2013 Nissan Jatco CVT8 Loaded Efficiency Results (FEV)* contains both test stand data and calculated transmission efficiency for six selected gear ratios as a function of input speed and load. The efficiencies were determined at three different transmission oil temperatures (40 °C, 60 °C and 85 °C) with the torque converter clutch locked and were conducted on the third transmission (CVT#3) purchased to complete this testing.
* *2013 Nissan Jatco CVT8 Neutral Coasting Results (FEV)* contains test stand data reporting turning torque (input and output) and CVT ratios during neutral coast down with the torque converter clutch open and were conducted on the third transmission (CVT#3).
* *2013 Nissan Jatco CVT8 Oil Pump Results (FEV)* contains transmission oil pump efficiency and leakage measurements as a function of input speeds ranging from 500 to 5000 rpm in 250 to 500 rpm increments for three different transmission oil temperatures (40 °C, 60 °C and 85 °C). This testing was conducted on the second transmission (CVT#2).
* *2013 Nissan Jatco CVT8 Spin Loss Results (FEV)* contains test stand data reporting turning torque (input torque) and transmission system pressures (drive pulley, driven pulley, forward clutch and line pressures) required to spin the transmission as a function of six selected gear ratios. The testing was conducted on the original transmission (CVT#1) for input speeds ranging from 500 to 5000 rpm in 250 to 500 rpm increments and three transmission oil temperatures (40 °C, 60 °C and 85 °C).

# Results

A summary of the final results are included in FEV’s final report, *3b- 2013 Nissan Jatco CVT8 Benchmarking 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.