

SAE J2982 Riding Range Test Procedure for On-Highway Electric Motorcycles



September 20, 2022

The Need For ZEM Range Determination

- A standard, repeatable test to determine the range of zero emissions motorcycles (ZEM) is needed
 - Allows comparison across multiple ZEM models
 - Establishes a testing standard for manufacturers to follow
 - Allows for ZEM regulation and incentives based on range
 - Improves consumer confidence in ZEMs
- Several range procedures are currently used globally, leading to uncertainty in the ZEM market

SAE J2982

- Developed specifically for determining range of on-highway electric motorcycles with top speed ≥ 26 mph (41.8 kph)
 - Originally adopted in 2013
 - Currently being updated
 - Expected completion in late 2022
 - Will include regenerative braking
- [J2982 201306: Riding Range Test Procedure for On-Highway Electric Motorcycles - SAE International](#)

 SURFACE VEHICLE RECOMMENDED PRACTICE	SAE J2982 JUN2013
	Issued 2013-06
Riding Range Test Procedure for On-Highway Electric Motorcycles	

RATIONALE

This Recommended Practice has been developed to provide a reasonable and consistent basis for manufacturers of on-highway electric motorcycles to inform prospective owners of the riding range that can be expected under specified operating conditions.

FOREWORD

This Recommended Practice establishes a chassis dynamometer-based procedure for measuring the riding range of on-highway electric motorcycles under several different operating conditions. A "City" range test is specified to determine riding range during "stop-and-go" operation. Constant speed tests at 55 mph and 70 mph are specified to determine riding range during uncongested highway operation at two different cruising speeds. A "Highway Commuting" range calculation procedure is specified to determine riding range in urban areas when operation consists of 50% stop-and-go operation and 50% operation on urban freeways under levels of congestion that allow for quasi-steady speeds of 55 to 70 mph.

INTRODUCTION

Since model year 1972, the U.S. Environmental Protection Agency (EPA) has specified the use of the Urban Dynamometer Driving Schedule (UDDS) to determine compliance with exhaust emission standards for passenger cars and light-duty trucks. Beginning in model year 1978, the UDDS was also the driving cycle specified to determine the "city" fuel economy used to determine compliance with the Corporate Average Fuel Economy Standards for passenger cars. Also beginning in model year 1978, the UDDS was the driving schedule specified for testing exhaust emissions from highway motorcycles with engines >169 cubic centimeters (cc) displacement. (A modified version of the driving cycle with reduced speeds was specified for motorcycles <170 cc.) More recently, the UDDS has been specified as the driving cycle used to determine the "Urban All-Electric Range" of an electric car, which is used to determine the level of credit a manufacturer receives under California and federal standards requiring compliance to be based on the fleet average emissions of vehicles meeting various emissions standards. (The federal procedure for measuring the range of an electric vehicle, which is in 40CFR86.1770-99, is a copy of the procedure initially developed by the California Air Resources Board.)

The primary provisions of the "Urban All-Electric Range" test procedure are a specified "cold soak" period prior to the start of the test during which the battery is charged, followed by operation over repeated Urban Dynamometer Driving Schedules until the vehicle is no longer able to maintain its initial speed-time profile. (Testing is terminated for vehicles that cannot keep up with the required speed-time profile when fully charged or when their maximum speed falls below 95 percent of the maximum speed initially achieved on the UDDS.) Alternatively, the test is terminated when a warning light indicates that it is not safe to continue.

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SAE Standard Development Process

- SAE standards are developed by a committee of subject matter experts
- Draft standards must be voted on before receiving final approval
- Standards are revised periodically based on user feedback



Source: <https://www.sae.org/standards/development>

SAE J2982 Test Procedures

- Consists of a city test and a constant speed test
- City test based on the U.S. EPA Urban Dynamometer Driving Schedule (UDDS)
- Constant speed tests vary based on ZEM top speed
 - 55mph and 70mph test
 - ZEMs not capable of 55mph do not perform constant speed tests

FOREWARD OF DRAFT SAE J2982-2022

This SAE Recommended Practice establishes a chassis dynamometer-based procedure for measuring the riding range of on-highway electric motorcycles under several different operating conditions. A “city” range test is specified to determine riding range during “stop-and-go” operation. Constant speed tests at 55 mph and 70 mph are specified to determine riding range during uncongested highway operation at two different cruising speeds. A “highway commuting” range calculation procedure is specified to determine riding range in urban areas when operation consists of 50% stop-and-go operation and 50% operation on urban freeways under levels of congestion that allow for quasi-steady speeds of 55 to 70 mph. This also establishes a recommended practice for deriving dynamometer coefficients for electric vehicles incapable of disengaging the motor for the “coast-down” portions of the test.

SAE J2982 Dyno Parameters

- Dynamometer Coefficients are set in accordance with U.S EPA regulations (*40 CFR 86.529-98*)
 - Road load force and inertia weight determination
 - Based on a series of real-world coastdown runs
- For ZEMs incapable of complete motor disengagement, alternatives to coastdown method are prescribed
- Allows for accurate Dynamometer Coefficient settings unique to ZEMs vs internal combustion motorcycles

SAE J2982 Range Reporting

- Range can be reported as: City Range, Constant Speed Range, and Highway Commuting Range
 - City Range and Constant Speed Range are based solely on their respective test cycles
- Highway Commuting Range is an average of the city test and constant speed test results
 - Only applicable to ZEMs capable of at least 55mph top speed
- WMTC can be used in-lieu of UDDS for vehicles capable of maintaining a top speed of 55mph for 10min

Recommendations

1. Develop a standardized test procedure for ZEM range determination that can be used globally
2. Use the 2022 revision of SAE J2982 as a basis for development
 - Potential changes to SAE J2982
 - Emphasize WMTC drive cycle over UDDS
 - Use terminology consistent with other UN GTR documents
 - Account for regional differences in typical ZEM usage