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METHODS OF TEST FOR FUEL CONSUMPTION OF PASSENGER CARS AND THEIR DERIVATIVES

STANDARDS ASSOCIATION OF AUSTRALIA
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THE FOLLOWING SCIENTIFIC, INDUSTRIAL, CONSUMER AND GOVERNMENTAL organizations and departments were officially represented on the committee entrusted with the preparation of this standard:

Australian Automobile Association

Australian Consumers Association

Australian Federation of Consumer Organizations

Australian Institute of Petroleum Ltd

Automotive and Petroleum Technical Council of Australia

Confederation of Australian Motor Sport

Department of Transport

Federal Chamber of Automotive Industries

Federation of Automotive Products Manufacturers

Society of Automotive Engineers — Australasia

Trade Practices Commission

University of New South Wales

This standard, prepared by Committee CS/27, Fuel Consumption, was approved on behalf of the Council of the Standards Association of Australia on 16 July 1979, and was published on 1 October 1979.

To keep abreast of progress in industry, Australian standards are regularly reviewed. Suggestions for improvements to published standards, addressed to the head office of the Association, are welcomed.

AUSTRALIAN STANDARD

METHODS OF TEST FOR FUEL CONSUMPTION OF PASSENGER CARS AND THEIR DERIVATIVES

AS 2077–1979

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PREFACE

This revision of AS 2077 — 1977 extends the scope of the standard to provide for the testing of diesel-engined vehicles, in addition to those having petrol engines. The revision was prepared by the Association's Committee on Fuel Consumption at the request of the Federal Chamber of Automotive Industries, who wished to apply the standard in their voluntary code for the reduction of passenger car fuel consumption. The standard was initially prepared in response to a request from the Australian Consumers Association, and interest was also shown by the Trade Practices Commission in the standard in relation to the advertising of fuel consumption of cars.

The standard is based on the method of determining fuel consumption used by the United States Environmental Protection Agency, which makes use of the analysis of the exhaust gases to determine the amount of fuel consumed under test. As an alternative, the standard also provides for direct measurement of fuel consumption, as this method has been shown to give results that are compatible with those obtained by exhaust gas analysis.*

In preparing this standard, the main aim has been to provide a basis for comparison of the fuel consumption of different cars. The initial proposal was in part related to the need for a test that could be carried out with simple equipment under service conditions, and this was considered by the committee at some length. However, it was decided that such a test, while useful to the individual motorist-in-relation to his own particular car, would be subject to such variation due to uncontrolled test conditions that it would be of no use in attempting to compare the fuel consumption of different types of car. Furthermore, it was felt that there would be considerable benefit to motorists and the community in general if it were possible to compare fuel consumption data from different sources (such as manufacturers' advertising) that had been derived from a standard method of test. The committee recognized that the results obtained from these tests will only be broadly indicative of the fuel consumption that will be achieved by individual motorists owing to the widely differing conditions of use. It is considered, however, that these tests provide the basis for a valid comparison between cars over the range of conditions experienced by the average motorist.

The requirements of this standard are compatible with those of Australian Design Rule No 27A for vehicle emission control, so that tests to this standard may be carried out on petrol-engined vehicles in conjunction with emission testing under ADR 27A.

The standard expresses fuel consumption in litres per 100 kilometres, this being the unit recommended by the Metric Conversion Board. The term 'kilometres per litre' is also included as a non-preferred alternative, since it is expected that this unit will remain in use for some time.

* See also SIMPSON, Bruce H., 'Improving the Measurement of Chassis Dynamometer Fuel Economy,' IN: SAE paper 750002, Automotive Engineering Congress and Exposition, Detroit, Michigan, February 24–28, 1975.

This standard may require reference to the following standards and documents:

ADR 27A Australian Design Rule 27A — Vehicle Emission Control

ASTM Standards

- D 86 Distillation of Petroleum Products
- D 93 Test for Flash Point by Pensky — Martens Closed Tester
- D 95 Test for Water in Petroleum Products and Bituminous Materials by Distillation
- D 129 Test for Sulfur in Petroleum Products (General Bomb Method)
- D 130 Test for Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test
- D 323 Test for Vapor Pressure of Petroleum Products (Reid Method)
- D 445 Test for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)
- D 482 Test for Ash from Petroleum Products
- D 524 Test for Ramsbottom Carbon Residue of Petroleum Products
- D 974 Test for Neutralization Number by Color-Indicator Titration
- D 976 Calculated Cetane Index of Distillate Fuels
- D 1298 Test for Density, Specific Gravity, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
- D 1319 Test for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption
- D 2699 Test for Knock Characteristics of Motor Fuels by the Research Method

IP Standards for Petroleum and its Products

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FOREWORD

The fuel consumption of a car is not a fixed quantity. It is affected by many factors, the most variable of which are the individual motorist's driving habits which include driving speed, acceleration and braking characteristics, and how well the car is maintained.

Some of the factors affecting the fuel consumption are related to the car, and some are independent of it. The main factors related to the car are—

(a) vehicle size and shape
(b) vehicle mass
(c) engine power
(d) engine capacity
(e) compression ratio
(f) axle ratio
(g) type of transmission
(h) type of tyre
(i) standard of maintenance
(j) accessories fitted and used.

The main factors affecting fuel consumption that are independent of the car are—

(i) speed (both average speed and speed range)
(ii) acceleration and deceleration
(iii) stopping frequency
(iv) trip length
(v) engine starting temperature (hot start or cold start)
(vi) traffic conditions
(vii) temperature
(viii) humidity

(ix) rain
(x) wind
(xi) road surface
(xii) road curvature
(xiii) road gradient
(xiv) altitude.

With so many variables, only a few of which will normally be under the control of the motorist, fuel consumption will vary from time to time. Furthermore, different motorists driving the same type of car are likely to achieve different fuel consumptions. It is therefore very difficult to derive a single value for fuel consumption that an individual motorist would find meaningful in relation to his or her particular circumstances.

However, it is possible to control these variables under test conditions, by means of a chassis dynamometer, which can simulate a number of different driving conditions, within acceptable limits. Results obtained in this way are repeatable, so that the results obtained from different makes or models of car will give a comparison of the relative fuel consumption under the conditions simulated by the test.

The test driving cycles specified in this standard will give comparative fuel consumption figures under conditions typical of city and highway driving. The city driving cycle incorporates cold engine startup, since a significant proportion of city driving consists of short journeys from a cold start. The highway driving cycle incorporates a hot engine startup. It is expected that the values of fuel consumption obtained in these tests may reasonably be achieved by the average motorist under normal conditions.

Finally, it is emphasized again that these tests are primarily intended to provide values for the purpose of comparing the fuel consumption of different cars. If the values obtained are to be interpreted as giving the fuel consumption to be expected from a particular car in every-day use, consideration should be given to conditions that may cause variation from the test value. A guide to the effects of these conditions is given in Appendix G.

SECTION 1. SCOPE, APPLICATION AND DEFINITIONS

1.1 SCOPE. This standard sets out test methods for measuring the fuel consumption of passenger cars and their derivatives under controlled conditions simulating city and highway driving conditions. Measurement of the fuel consumed is made either by analysis of the exhaust gases and evaluation of the amount of carbon in them in terms of the amount of carbon in unburnt fuel, or by direct measurement of the volume, or mass, of fuel consumed, since a comparable degree of accuracy may be obtained by each of these methods.

1.2 APPLICATION. The tests specified are intended for use on vehicles having either four-stroke, spark-ignition, petrol-fuelled internal combustion engines or four-stroke, compression-ignition, diesel-fuelled internal combustion engines. The tests are used to obtain values of fuel consumption for passenger cars and passenger car derivatives, for the purpose of making comparisons between different makes and models. So that the values obtained will be indicative of those to be expected under real-life service conditions, driving cycles are included that represent the driving conditions experienced in city driving and highway driving.

1.3 DEFINITIONS. For the purpose of this standard, the following definitions apply:

1.3.1 Motor vehicle — a passenger car or passenger car derivative as defined in the Australian Design Rules.

1.3.2 Test vehicle — the motor vehicle prepared for test according to this standard.

1.3.3 Fuel system — the combination of fuel tank, fuel pump, fuel lines and carburettor or fuel injection components as appropriate, and including all fuel system vents and fuel evaporative emission control systems if appropriate.

1.3.4 Reference mass — the mass of the vehicle with a full capacity of lubricants, coolant and fuel, but without goods, occupants or options, except those options which are essential to the test, plus a mass of 136 kg.

1.3.5 City cycle — driving pattern described by Appendix A, similar to driving conditions in the city and the suburbs of a large city.

1.3.6 Highway cycle — driving pattern described by Appendix B, similar to driving conditions on a main road in non-urban areas.

1.3.7 Calculated consumption — the fuel consumption during a driving cycle, calculated by one of the methods given in Appendix E.