

TEST FUEL FORMULATIONS

Application

This test method describes the formulations required for preparing various test fuels. These test fuel blends are used to determine permeation and fuel compatibility of various materials used in automotive fuel systems. These fuels do not contain the additive packages (detergents, antioxidants, lubricity modifiers, etc.) found in most commercial fuels. Their use in engineering testing protocols should take this into consideration.

Nomenclature and Terminology

Fuel Designation Format

X[Y#(Y₂#)]Z where X = Base fuel
Y = Oxygenate
= Volume percent of oxygenate
Y₂ = Second oxygenate
Z = Impurity

Base Fuel (X)

A = reference fuel A (100 % iso-octane)
B = reference fuel B (70 % iso-octane, 30 % toluene)
C = reference fuel C (50 % iso-octane, 50 % toluene)
D = reference fuel D (60 % iso-octane, 40 % toluene)
E = reference fuel E (100 % toluene)
F = reference fuel F (diesel fuel, Grade #2, 100 %)
G = reference fuel G (fuel D 85 %, anhydrous denatured ethanol 15 %)
H = reference fuel H (fuel C 85 %, anhydrous denatured ethanol 15 %)
I = reference fuel I (fuel C 85 % anhydrous methanol 15 %)
K = reference fuel K (fuel C 15 %, anhydrous methanol 85 %)

These reference fuels are described in ASTM D 471/ISO 1817. The fuel typically used for materials testing has been reference fuel C.

Date	Action	Revisions
2001 01 31	Revised	Editorial – no technical change A. Cockman
2000 06 13	Revised	Deleted MTBE and updated J. Lott
1997 11 21	Activated	J. Spencer

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Oxygenate and Alternative Fuels (Y)

Several oxygenates (alcohols and ethers) are in use or have been identified as potential candidates for use in reformulated gasolines. The most common include:

M = methanol

E = ethanol

EE = ethyl tertiary butyl ether

TE = tertiary amyl methyl ether

Higher molecular weight alcohols (isopropyl and t-butyl) and ethers (diisopropyl and ethyl t-amyl) may find some usage.

Alcohol based alternative fuels will consist of blends of ethanol (0 - 83 %) or methanol (0 - 85 %) and with a hydrocarbon mixture such as unleaded gasoline (15 - 30 %).

Impurity (Z)

P = auto-oxidized fuel

A = aggressive

Preparation of 'auto-oxidized' fuel is described in ISO 4639-3 annex A.

Examples:

$X[Y\#]Z = C[M25]A =$

75 % aggressive reference fuel C
+ 25 % aggressive methanol

$X[Y\#(Y_2\#)]Z = C[M25(ME15)] =$

60 % fuel C + 25 % methanol +
15 % methyl tertiary butyl ether

$X[Y\#(Y_2\#)(Y_3\#)]A = C[M3(E5)(EE7)]A =$

85 % aggressive reference fuel C
+ 3 % aggressive methanol + 5 %
aggressive ethanol + 7 % ethyl
tertiary butyl ether

Aggressive Mixtures**Aggressive Water:**

1.0 l of distilled water

0.990 g NaCl (600 PPM Cl^-)

0.888 g Na_2SO_4 (600 PPM SO_4^{2-})

0.828 g $NaHCO_3$ (600 PPM HCO_3^-)