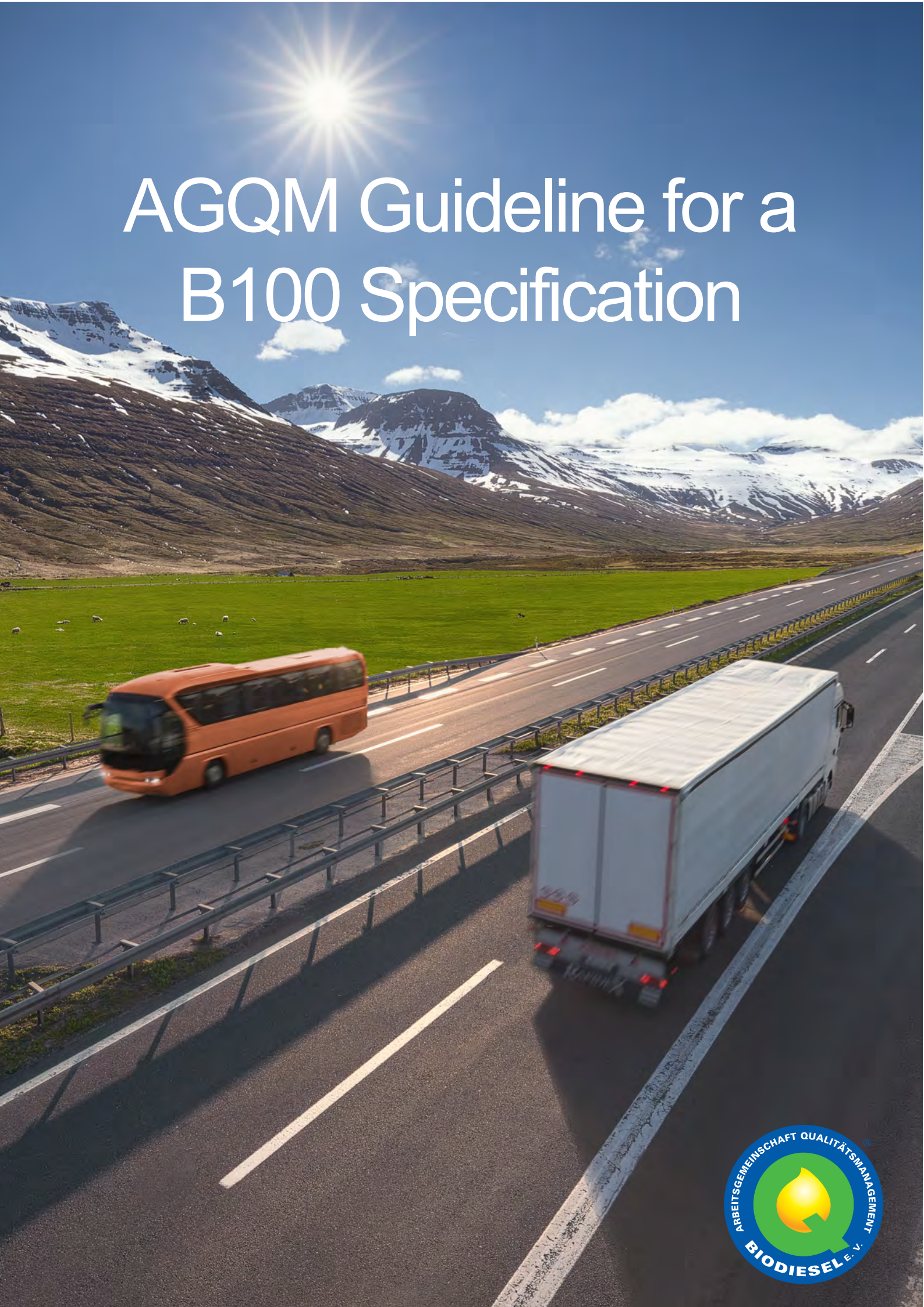
AGQM Guideline for a B100 Specification



BACKGROUND

With the Green Deal and the EU Climate Change Act, the European Union (EU) has committed itself to reducing greenhouse gas emissions by 55 percent by 2030 and to achieving climate neutrality by 2050.

Road transport accounts for about two-thirds of the EU's total transport-related CO_2 emissions. A rapid reduction in this area is therefore particularly important. Consequently, the use of all available options (electromobility, biofuels and other renewable fuels such as synthetic fuels) is necessary to achieve decarbonization of this sector. The use of greenhouse gas-reduced fuels in the existing fleet, and in areas that are difficult to electrify, such as road freight transport, plays an important role.

The increased use of fatty acid methyl esters (FAME - biodiesel) in higher blends or as a pure fuel precisely where liquid fuels cannot be replaced in the short term is to be seen as an essential contribution to overcoming the climate crisis. The Renewable Energy Directive III (RED III) and the revised Fuel Quality Directive (FQD) allow a maximum FAME content of 10 percent by volume (B10) in European diesel together with the use as a pure fuel (B100). In addition, there are standardized fuel qualities with seven percent by volume FAME admixture (B7 - protective grade when B10 is introduced) or 20 or 30 percent by volume (B20/B30 - only for closed fleets).

Currently, various engines and commercial vehicles (trucks, buses, construction vehicles and tractors) are approved for use with B100 or B20/B30 and are listed in a corresponding approval list, which has been published by the associations AGQM (Association Quality Management Biodiesel), MVaK (German Waste-based Biofuels Association), UFOP (Union for the Promotion of Oil and Protein Plants) and VDB (Association of the German Biofuel Industry) (Approval lists).

In addition to the approvals by the manufacturers, the quality of the biodiesel used is a decisive factor when vehicles are operated with B100. Basically, fuels must meet the minimum requirements of the applicable standards. In Europe, EN 14214 defines biodiesel quality, which is usually specified in the product information of the engine and vehicle manufacturers as a requirement for use and warranty.

Due to the continuously stricter emission limits, exhaust gas aftertreatment in vehicles is becoming more and more important. With the introduction of Euro 7 for cars, trucks and buses, in addition to the introduction of new limits (formaldehyd and ammonia) it is planned to also guarantee functionality over the entire life cycle. This places new demands on the exhaust gas aftertreatment system, which can only be met by the consistent use of particularly high-quality fuels. In the case of biodiesel, the focus is set on the ash-forming alkali and alkaline earth metals as well as phosphorus. Although these are already limited in EN 14214, some engine and vehicle manufacturers consider them to be too high if exhausted to be able to guarantee the unrestricted functionality of the exhaust gas aftertreatment over the life cycle of the vehicle when using B100. At the same time, the FAME quality produced in Germany and Austria by biodiesel producers who are AGQM members is demonstrably much better than the standard requires (Biodiesel quality reports).

This guideline is therefore intended to define product properties of FAME for use as a pure fuel (B100) which go beyond the requirements of EN 14214. The defined limit values are intended

on the one hand to ensure the operability of engines and vehicles and in particular of their exhaust gas aftertreatment systems and, on the other hand, to enable a practicable production of this fuel quality at acceptable additional costs. At the same time, taking into account OEM concerns, a basis is created on which engine and vehicle manufacturers can approve their vehicles for use with B100.

REQUIREMENTS FOR BIODIESEL FOR USE AS B100

Note: This guideline is a summary of the experience gained by AGQM and its members to date; it has been prepared with the greatest possible care. Nevertheless, no guarantee can be given for the correctness, completeness and up-to-dateness of the contents provided. For this reason, we exclude any liability in connection with the use of this guideline.

In general, the limit values of EN 14214 must be met when using biodiesel. So far known these limits are sufficient for the use of biodiesel as a blend component. The following recommendations specify additional requirements that should be met when using FAME as a pure fuel in order to guarantee the function of the exhaust gas aftertreatment systems over the entire life cycle. Irrespective of the requirements described, it is strongly recommended to obtain the approval of the respective engine and vehicle manufacturer before using biodiesel and to obtain information about any special maintenance and service requirements that may exist.

Requirements

Biodiesel used as a pure fuel should fulfil the following additional conditions beyond the fulfilment of the requirements of EN 14214:

Parameter	Limit	Standard used
Phosphorus content (P)	max. 2.0 mg/kg	EN 14538
Sodium content (Na)	max. 2.0 mg/kg	EN 14538
Potassium content (K)	max. 2.0 mg/kg	
Calcium content (Ca)	max. 1.0 mg/kg	
Magnesium content (Mg)	max. 1.0 mg/kg	
Sum metals (Na+K+Ca+Mg)	max. 4.0 mg/kg	
Water content	max. 0.030 % (m/m)	EN ISO 129377
Oxidation stability	min. 9 h	EN 15751
Total contamination	max. 20 mg/kg	EN 12662:1998 EN 12662-2:2023
Saturated monoglycerides	max. 1,200 mg/kg	EN 17057
Visual identity	clear and bright	–

EXPLANATION OF THE REQUIREMENTS

Phosphorus content

Phosphorus is found in both vegetable oils and animal fats in the form of phospholipids. Phosphorus is a typical catalyst poison that can irreversibly disrupt the effect of exhaust gas aftertreatment systems. In continuous operation, even low levels of phosphorus can lead to negative long-term effects. In the production of vegetable oil, the phosphorus content is reduced by the process step of degumming, whereas in the production of biodiesel from animal fats, distillation must take place. If phosphoric acid is used in biodiesel production to neutralize the catalyst, residual phosphorus in the biodiesel can also come from this process. However, the phosphoric acid can be removed very well from the biodiesel by means of water washing. The limit value proposed here can only be validly determined with EN 14538, which is yet to be published. The revised standard is expected to be published at the beginning of 2024 and will then contain slight adjustments as well as the precision for the determination of the phosphorus content verified in the interlaboratory study.

Metals content

Sodium and potassium hydroxides as well as methylates are used as catalysts in alkaline production of FAME. Residues of these metals in the fuel can form soaps and lead to filter blockages and deposits in the injection systems. Another important aspect is the possible formation of ash on the surface of particle filters and oxidation catalysts, which can lead to reduced effectiveness and service life of the systems. The alkali metal content in the final product can be reduced by suitable process control.

Alkaline earth metals get into the biodiesel when tap water is used for water washing. Soaps from these metals are more voluminous than alkali metal soaps and can lead to filter blockage and injection pumps sticking. The entry of alkaline earth metals into FAME can be prevented by using deionised water. The limit values proposed can only be validly determined and verified with EN 14538, which is still being published. The revised standard is expected to be published at the beginning of 2024 and will then contain slight adjustments as well as the precision for the determination of the individual metals verified in the interlaboratory study.

Water content

FAME is hygroscopic and can physically dissolve up to 0.150% (m/m) water. The proposed limit is also intended to serve as a precautionary measure when using B100 to minimise the risk of a free water phase that can lead to corrosion and microbial growth.

Oxidation stability

Oxidation stability is a measure of resistance to oxidative processes. The higher limit value for oxidation stability compared to EN 14214 provides a reserve to ensure the application safety of the product. For longer storage times, an even higher oxidation stability can be useful.

Total contamination

The total contamination is a measure of the content of filterable undissolved substances - so-called "rust and dust". The reduced limit value for total contamination compared to EN 14214 creates a reserve that ensures the application safety of the product. At European level, a new method to measure the total contamination in pure FAME has been developed in CEN TC19 WG31 and is expected to be published at the end of 2023 as EN 12662 part 2. In the national foreword of DIN EN 12662:2008, the use of DIN EN 12662:1998 is recommended.

Saturated monoglycerides

Saturated monoglycerides can accumulate in the cold and thus lead to precipitation. Higher concentrations of saturated monoglycerides can therefore lead to a reduction in filterability and even to the risk of filter blockage in vehicles. In 2018, EN 17057 was published as a method for direct determination of the content of saturated monoglycerides. Alternatively, the proportion was calculated via the monoglyceride content and the cloud point (CP). So far, it has not been possible to set a limit for the content of saturated monoglycerides, as a direct correlation and the actual content have not yet been determined. The AGQM recommends not to exceed a content of 1,200 mg/kg for saturated monoglycerides on the basis of independently conducted verifications. EN 14214 is currently being revised. The parameter saturated monoglycerides is to be included in the requirements as a report criterion without a limit value.

Visual identity

”Clear & bright" is a parameter that is easy to determine and has been used successfully for a long time to characterize mineral oil products. Visual inspection can prevent obviously defective products from being accepted and, for example, contaminating incoming tank storage facilities.

All the standards presented are published by Beuth-Verlag and can be obtained there (www.beuth.de/en).

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