BS 6380:2012+A1:2016

BSI Standards Publication

# Guide to low temperature properties and cold weather use of diesel fuels and gas oils

bsi.

## Publishing and copyright information



Published by BSI Standards Limited 2016

ISBN 978 0 580 93583 1

ICS 75.160.20

The following BSI references relate to the work on this standard:
Committee reference PTI/2
Drafts for comment 12/30259259 DC; 16/30338657 DC

## Publication history

First published July 1983
Second edition May 1997
Third (present) edition, July 2012

## Amendments issued since publication

| Date | Text affected |
|---|---|
| July 2016 | A1, see Foreword |

# Contents



**List of figures**



**Summary of pages**

This document comprises a front cover, an inside front cover, pages i to ii, pages 1 to 10, an inside back cover and a back cover.

# Foreword

## Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 July 2012. It was prepared by Technical Committee PTI/2, *Liquid fuels*. A list of organizations represented on this committee can be obtained on request to its secretary.

## Supersession

BS 6380:2012+A1:2016 supersedes BS 6380:2012, which is withdrawn.

## Information about this document

This British Standard has been prepared as a guide because it does not set out to cover the subject completely, but is intended to help individual users of the fuels covered, who will probably require other expert guidance in applying some of the recommendations. Some further guidance material is listed in the bibliography. This British Standard has been prepared in support of the automotive diesel specification BS EN 590 and the fuel oil specification BS 2869, but also refers to British Standards that cover in detail the storage of fuel oils.

Text introduced or altered by Amendment No. 1 is indicated in the text by tags [A1⟩ ⟨A1]. Minor editorial changes are not tagged.

BS 6380:2012 was a full revision of the standard, and introduced the following principal changes:

- changes in seasonality dates. Seasonality dates are now specified in the relevant British Standards, BS 2869 for fuel oil for agricultural, domestic and industrial engines and burners, and BS EN 590 for automotive road fuel;
- a change to the cold filter plugging point test method reference to align with that currently specified in BS EN 590;
- to reflect that, as a measure to reduce greenhouse gas emissions (see The Renewable Transport Fuel Obligations Order [1]), Fatty Acid Methyl Ester (FAME) is now permitted as a component as specified with a consequent possible effect on additive addition, low-temperature solids deposition and an increased propensity for microbiological proliferation.

## Hazard warnings

**WARNING.** This British Standard calls for the use of substances and/or procedures that can be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

## Use of this document

As a guide, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification or a code of practice and claims of compliance cannot be made to it.

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

## Presentational conventions

The guidance in this standard is presented in roman (i.e. upright) type. Any recommendations are expressed in sentences in which the principal auxiliary verb is "should".

*Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.*

## Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

**Compliance with a British Standard cannot confer immunity from legal obligations.**

Particular attention is drawn to the following specific regulations:

- Hydrocarbon Oil Duties Act 1979 (as amended) [2].
- HM Revenue and Customs Notice 179 [3].

*This page deliberately left blank*

# Introduction

These guidelines are intended to help users of fuels conforming to BS EN 590 and class A2 and class D of BS 2869:2010+A1 to understand the problems that might be encountered in very severe winters and to help overcome them. Kerosene does not normally present problems at low temperatures, but, where suppliers have blended Fatty Acid Methyl Ester (FAME) into kerosenes for heating/cooking applications and cold weather problems ensue, this Guide can provide useful advice. Users have found that it is not always possible to avoid fuel flow problems during extreme weather conditions. Such problems can arise because of:

a) inappropriate fuel quality for certain weather conditions encountered, e.g. summer grade fuel being in use out of season;

b) fuel systems on vehicles or burner plant that through their design give rise to sensitivity to blockage by precipitated wax;

c) the possibility of biogenic precipitates during extended exposure of fuels to sub-zero temperatures (see *Report 9/09 – Guidelines for Handling and Blending FAME* [4]);

d) fuel storage systems that are badly sited and poorly maintained;

e) fuel storage systems that are inadequately heated or protected against loss of heat, bearing in mind their conditions of service;

f) freezing of free water accumulated through the condensation of damp air entering the storage tank as fuel is withdrawn;

g) microbiological contamination that can block filters and gauze strainers. Although this is not, of itself, a low-temperature phenomenon, any entrained water from microbial metabolic process can freeze in lines and filters. (See *Guidelines for the investigation of the microbial content of petroleum fuels and for the implementation of avoidance and remedial strategies* [5].)

# 1 Scope

This British Standard gives guidance on the low temperature properties and cold weather use of diesel fuel conforming to BS EN 590 and gas oils conforming to class A2 and class D of BS 2869:2010+A1.

This British Standard does not address the use of 100% FAME as an automotive fuel or a heating fuel, such as that specified in BS EN 14214.

Clause **3** and Clause **4** give details of the fuel classes and their low temperature properties. Clause **5** to Clause **8** give recommendations for fuel quality and treatment, the cold weather use of bulk handling and storage systems, cold weather operation of diesel-engined vehicles and mobile automotive plant and remedial measures for fuel starvation in oil-fired burner systems.

# 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 799-5, *Oil burning equipment – Part 5: Carbon steel oil storage tanks – Specification*

BS 2869:2010+A1:2011, *Fuel oils for agricultural, domestic and industrial engines and boilers – Specification*

BS 5410-1, *Code of practice for oil firing – Part 1: Installations up to 45 kW output capacity for space heating and hot water supply purposes*

BS 5410-2, *Code of practice for oil firing – Part 2: Installations of 45 kW and above output capacity for space heating, hot water and steam supply services*

BS 5410-3, *Code of practice for oil firing – Part 3: Installations for furnaces, kilns, ovens and other industrial purposes*

BS EN 590, *Automotive fuels – Diesel – Requirements and test methods*

# 3 Classes of fuels

Three classes of middle distillate fuel are specified in British Standards; automotive diesel fuel is specified in BS EN 590 and a diesel fuel and two classes of gas oil are specified in BS 2869. Their primary uses are as follows.

a) BS EN 590

BS EN 590 fuel is for use in diesel-engined vehicles operating on the public highway. It is manufactured and handled as a separate grade and is dispensed either from service station tanks directly into the vehicle tank or alternatively handled by fleet users who have their own bulk storage. BS EN 590 fuel is undyed and unmarked.

b) BS 2869:2010+A1, class A2

BS 2869:2010+A1, class A2 fuel is a "sulfur-free" grade which is primarily intended for use in non-road mobile machinery which operates off the public highway, e.g. airport refuellers, agricultural tractors, forestry tractors. Users normally carry their own bulk stocks in tanks or barrels. Class A2 fuel is normally dyed red and contains a chemical marker, in accordance with HM Revenue and Customs requirements (see Hydrocarbon Oil Duties Act 1979 [2] and HM Revenue and Customs Notice 179 [3]).

c) BS 2869:2010+A1, class D

BS 2869:2010+A1, class D fuel is intended for use in stationary applications such as generating plant, for oil burners in domestic, commercial and lower thermally rated industrial heating plants, and in some industrial gas turbines. Users normally have their own bulk storage. It is dyed and marked in accordance with HM Revenue and Customs requirements (see Hydrocarbon Oil Duties Act 1979 [2] and HM Revenue and Customs Notice 179 [3]).

*NOTE In the UK, it can be common industry practice to "dual-grade" the two grades of marked and dyed gas oil in BS 2869, whereby the marketed product incorporates the most stringent requirements of both grades. Such a product is usually described as "BS 2869: Classes A2/D".*

These three classes of fuel might be stored, handled and used in conditions sufficiently different to markedly affect their low temperature performance. Automotive diesel fuel is usually stored underground at service stations and is therefore protected from the worst of the weather, but most user storage for all three classes is in above-ground storage, usually unprotected from the elements. Where the fuel offtake is small, the pipework is typically of a narrow bore and therefore more subject to blockage in very cold weather. The design position of filter boxes and the length and diameter of pipework exposed need to be carefully considered to minimize the potential for problems in extreme cold weather.

# 4 Low temperature properties of BS EN 590 and BS 2869:2010+A1, class A2 and class D fuels

## 4.1 Fuel properties

These fuels consist of a wide range of hydrocarbons with boiling points predominantly between about 180 °C and 380 °C. They may also contain FAME as a biogenic component as permitted in BS EN 590 and BS 2869. As the fuel is cooled progressively, there comes a point at which the heavier paraffinic hydrocarbons, i.e. the waxes, begin to separate and appear as a cloud in the fuel. Further cooling brings more of the hydrocarbons out of solution and the waxes will begin to agglomerate to form a visual haziness or cloudiness, (see BS EN 23015 for the quantitative assessment of "cloud point"), although the fuel is still fluid and can be used in practice.

If cooling is continued, more wax is precipitated and a point is reached where there is sufficient wax present to form a mat on filters which is thick enough to impede the flow of fuel. With winter grade fuels, this can occur when the fuel temperature drops to –15 °C or below for automotive diesel to BS EN 590 or to –12 °C or below for BS 2869:2010+A1, class A2 and class D fuels. When an engine or heating system is operated under these conditions, the agglomerated wax will compact on the fine mesh filters, causing severe restriction of fuel flow or even complete blockage. In severe cases, narrow diameter pipework might also become blocked, particularly at bends or unions.

## 4.2 Test method

The temperature down to which a fuel remains usable in normal equipment is estimated in the laboratory by the Cold Filter Plugging Point (CFPP) test described in BS EN 116. In this test, a fuel sample is cooled progressively and drawn through a fine mesh filter every 1 °C using a vacuum. The CFPP is the temperature at which the fuel, when cooled under the prescribed conditions, requires more than 60 seconds for more than 20 mL to pass through the filter. While the test-mesh aperture width of 45 µm is coarser than that of many filters used, particularly for auto diesel fuel handling systems, it was chosen because, in conjunction with other test parameters, it affords good correlation with diesel engine filter performance (see CEC Report No. P-171-82 [6] [1)]).

## 4.3 Seasonality requirements

Fuel oils for agricultural, domestic and industrial engines and boilers should conform to BS 2869 for seasonality requirements.

Diesel should conform to BS EN 590 for seasonality requirements.

## 4.4 Fuel production processes

The winter design temperature for all these middle distillate fuels is a compromise reconciling a number of factors, for example:

a) an acceptable degree of risk in operation;

b) the sensitivity of some fuel handling systems to component types and location;

c) the practicality of maintaining required fuel supply levels without entailing unacceptable costs or upset to refinery product balances.

[1)] This report is out of print but can be obtained on request to CEC. See Bibliography for details.

The cold weather properties of middle distillate fuels are achieved during manufacture, often by the use of additives. They ensure that the precipitated wax particles are small and will pass through a gauze filter down to the operating temperature.

Given that a significant improvement in cold weather quality levels of middle distillate fuels is not practicable without reducing fuel availability, some precautions are described in Clause **5** to Clause **8** which can help to alleviate or prevent problems which could occur at temperatures below the operability temperature of the fuels.

# 5 Fuel quality and treatment

## 5.1 Seasonality dates

Fuel suppliers should ensure that all deliveries of class A2 and class D fuels from main terminals to third party users are to winter quality by the dates specified in BS 2869, and that deliveries of BS EN 590 fuel are to winter quality by the dates specified in the relevant Annex to BS EN 590. Recipients and users of such fuels are advised to ensure that the fuels conform to the appropriate British Standard to ensure that these dates are met. This, in addition, ensures that the composition of the fuel is regulated, critically that the composition of any bio-component in the form of FAME has the safeguards contained in BS EN 14214, particularly with regard to low temperature operability and fuel stability.

## 5.2 Fuel treatment

Some improvement in low temperature performance of middle distillate fuels is possible by fuel treatment, but the degree of improvement will be variable. In a very cold spell, with sustained temperatures below the operating temperature of the fuels, there is no practical way, except by fuel heating, by which winter quality fuel can be guaranteed to behave satisfactorily. The forms of fuel treatment available to the user are detailed in **5.3** and **5.4** [A1] *Text deleted* [A1]. [A1] Kerosene should not be added to fuel intended for use in diesel engines, as it can cause serious damage to the engine and emissions control systems. [A1] Petrol addition introduces a significant safety hazard and the practice is strongly discouraged (see **5.5**).

It is important, however, to stress that many winter problems are due to accumulated water freezing in lines and storage tanks. In such cases, the remedial measures outlined in **7.3** are effective.

## 5.3 Additive treatment

A range of proprietary after-market additives is available from a number of suppliers who claim between 5 °C and 10 °C lowering of the CFPP. The benefit obtained can be useful particularly where a proportion of summer grade fuel might be present, but these benefits cannot be guaranteed and the following points should be noted.

a) Most fuel suppliers use an additive to achieve the lower CFPP in winter to increase the fuel volume available from their refinery and this might have exhausted the sensitivity and response of the fuel to further additive treatment. Response can only be checked by laboratory tests.

b) Additional additive treatment might cause problems of haze and water suspension.

c) Provided laboratory tests have indicated the fuel still has residual response to after-market additive treatment, the additive should be mixed into the fuel (which should be above the cloud point and free of already

precipitated wax) to give a homogeneous blend. The additive should be of the diluted type recommended for secondary treatment and should be a clear, free-flowing solution at the time of use. If the additive is not adequately mixed into the fuel, the risk exists that little or no increased operability will be achieved and that the undispersed additive could increase the filterability problem.

### 5.4 Kerosene addition

〉A1〈 Kerosene addition can be a reliable way to increase the low temperature performance of some fuels. The addition of up to 25% (v/v) (i.e. by volume) of kerosene gives approximately 5 °C of additional protection. Kerosene should be added to the fuel before any wax has separated, preferably at a fuel temperature of no less than 5 °C above the cloud point (if known). Added kerosene might not be able to redissolve separated wax. The kerosene/gas oil mixture should be thoroughly mixed to give a homogeneous blend.

The use of kerosene dilution should, however, be regarded as a purely temporary measure. Kerosene should not be applied to any fuel intended for use in compression ignition engines, i.e. fuels conforming to BS EN 590 for on-road application and BS 2869:2010+A1:2011, Class A2 for non-road mobile machinery and Class D middle distillate for use in internal combustion engines. Addition of kerosene to fuel intended for use in diesel engines can cause serious damage to the engine and emissions control systems.

*NOTE When adding kerosene to fuel, attention is drawn to the fiscal regulations referred to in the Foreword (see Hydrocarbon Oil Duties Act 1979 [2] and HM Revenue and Customs Notice 179 [3]).* 〈A1〉

For kerosene addition to be fully effective, associated pipework should be drained and filled with blended fuel.

### 5.5 Petrol addition

Whilst some engine and vehicle manufacturers permit the addition of petrol to vehicle tanks in severe weather, such action introduces a significant safety hazard and the practice is strongly discouraged. Petrol can give rise to concentrations of explosive vapours in vehicle tanks, maybe days or weeks after the addition of the petrol has been made, i.e. when the incident is forgotten. Modern high pressure common-rail and unit fuel injection systems could also be damaged by the injection of petrol to diesel or gas oil due to reduced fuel lubricity and increased cavitation risk.

**WARNING.** Do not add petrol to diesel fuel storage tanks. Do not add petrol to gas oil used for heating or process applications.

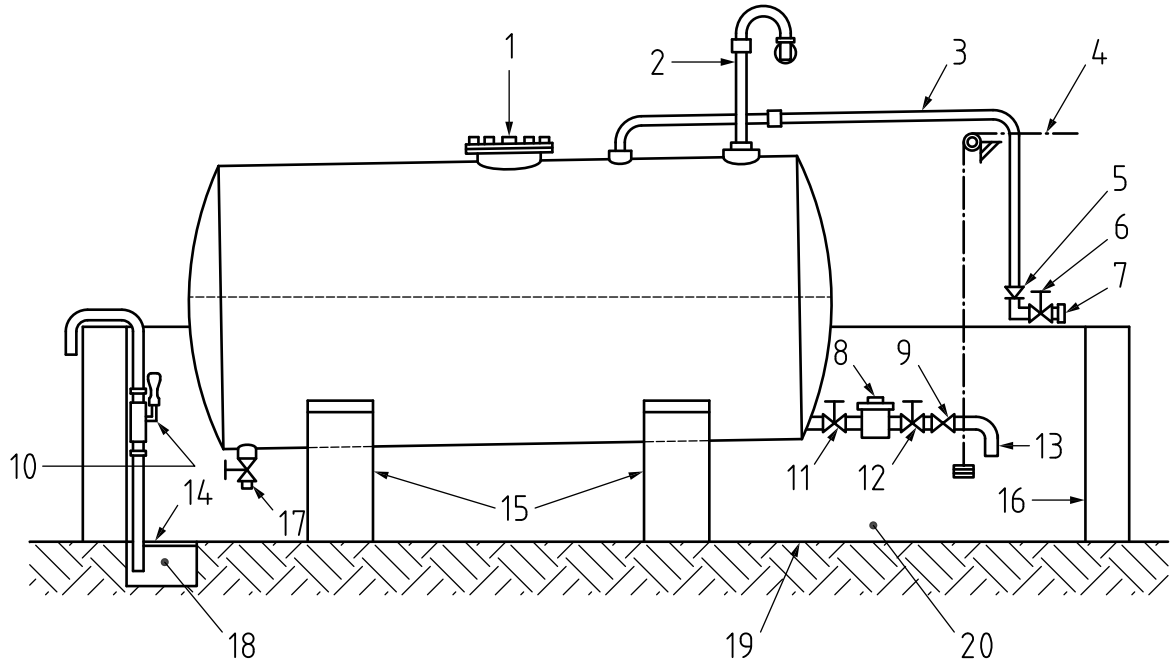
## 6 Bulk handling and storage systems

### 6.1 Recommendations for good design and installation of bulk storage systems

These recommendations apply to the storage system for any of the three classes of fuel described in Clause **3**.

The design of above-ground tank facilities should conform to BS 799-5, BS 5410-1 or BS 5410-2. Figure 1 shows a suitable design for a cylindrical horizontal tank which is the most common type for all but the smallest installations. Figure 2 shows a suitable design for a small domestic fuel storage tank and indicates the desirable design features to prevent low temperature problems.

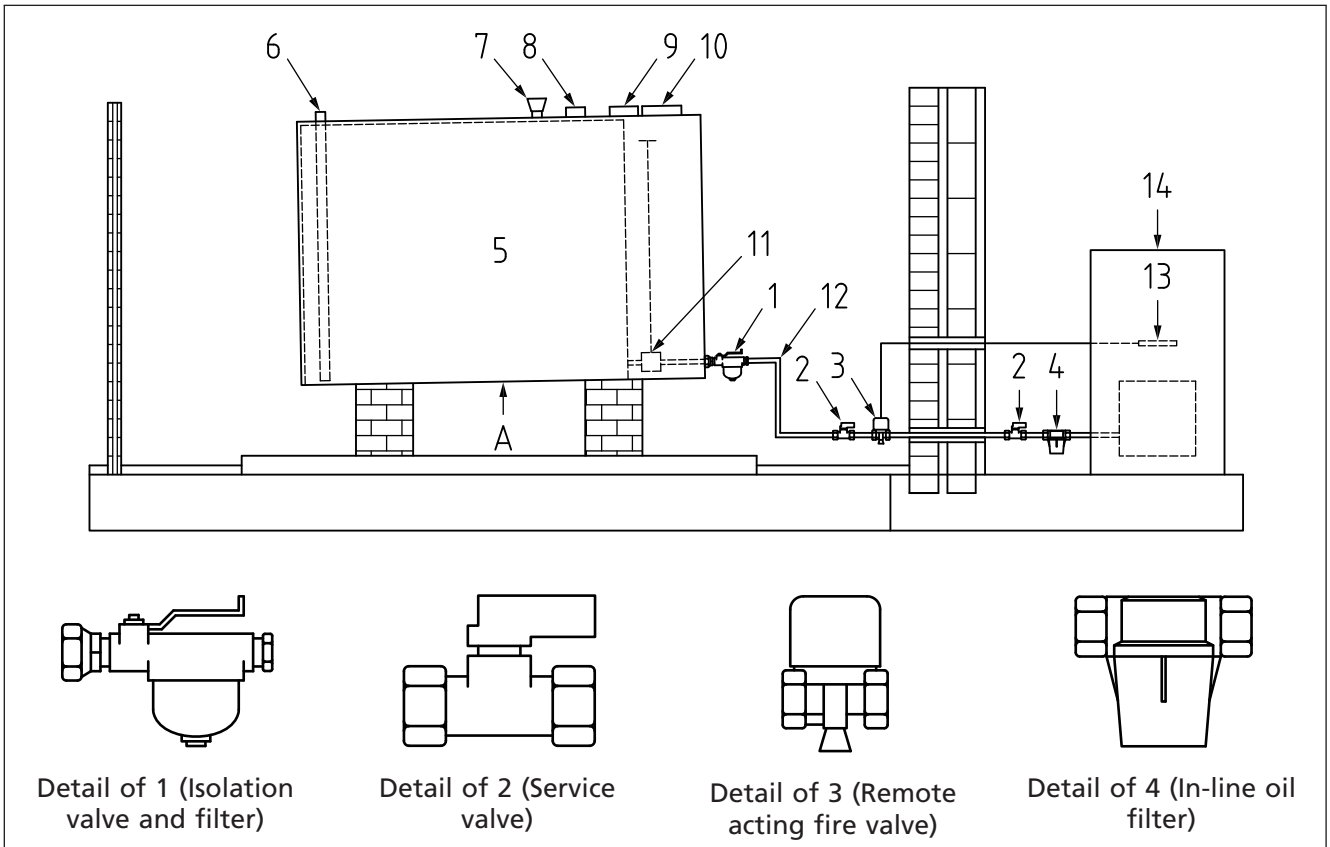
Figure 1 **Suitable design for a cylindrical horizontal tank**




**Key**

| | | | |
|---|---|---|---|
| 1 | Manhole | 11 | Isolation valve |
| 2 | Vent pipe | 12 | Service valve |
| 3 | Extended fill pipe | 13 | Oil supply pipe |
| 4 | Fire valve wire | 14 | Grating |
| 5 | Non-return valve | 15 | Piers |
| 6 | Isolation valve | 16 | Bundwall |
| 7 | Fill point with screw cap and chain | 17 | Drain valve |
| 8 | Filter | 18 | Sump |
| 9 | Fire valve | 19 | Bund sealant |
| 10 | Semi-rotary pump | 20 | Catch pit |

Figure 2 **Suitable design for a small domestic fuel storage tank**




**Key**

| | | | |
|---|---|---|---|
| 1 | Isolation valve and filter | 9 | Vent/overflow |
| 2 | Service valve | 10 | Bund inspection hatch |
| 3 | Remote acting fire valve | 11 | Internal isolation valve |
| 4 | In-line oil filter | 12 | Oil supply pipe |
| 5 | Integrally bunded tank | 13 | Fire valve sensor |
| 6 | Sludge socket and pipe | 14 | Boiler |
| 7 | Contents gauge | A | Inclination of 20 mm per metre length of tank |
| 8 | Fill connection point | | |

The basic principles for good design are as follows.

a) Locate the storage tank in a sheltered position protected from the direct force of the wind.

b) Ensure that pipe runs have a steady fall with no unnecessary changes in diameter and no sharp bends or low points where water might collect.

c) In locations regularly experiencing unusually severe weather conditions and where essential services have to be maintained, lag the exposed pipework, filter housings and valves using a suitable water-and-oil-proof material.

d) Provide facilities for collection and removal of condensed water arising from the ingress of damp air into the tank as fuel is withdrawn. This is achieved by erecting the tank with a slight rake and with a drain valve at the lower end. Check storage regularly for water, especially before the onset of winter. In the case of underground storage, water should be drawn off by a dip tube.

e) Filters fitted near to the tank should be coarse strainers and need to be in a protected location. Fine filters to protect pumps, filters or burners should

only be located near the equipment they protect and should be in a sheltered spot, preferably in a building. For more detailed advice on design see BS 799-5, BS 5410-1 or BS 5410-2.

f) Copper and galvanized pipe-work and fittings should be avoided, as should any fitting or gasket containing copper or zinc which comes into contact with the fuel, particularly where the fuel is to be used in a diesel engine.

g) Ensure all seals and metal components are compatible with FAME blends.

### 6.2 Precautions for cold weather

No minimum storage temperature is specified in BS EN 590 or in BS 2869:2010+A1 for class A2 or class D, but in situations where particularly low temperatures are anticipated, or where it is vital for the equipment to operate, e.g. stand-by generators or snow ploughs, heating and lagging of tanks and pipework should be considered.

Heating equipment should provide a minimum storage and handling temperature between 0 °C and 5 °C in accordance with the requirements of BS 5410-1, BS 5410-2 and BS 5410-3. Alternatively, for less critical uses, if cold weather is anticipated, it might be sufficient to arrange for temporary protection of the fuel tank and lines using non-absorbent flame resistant materials. However, doing this after the fuel has cooled only delays warming up when the weather improves. Temporary protection can be provided by a waterproof tarpaulin erected over the fuel lines and held by wooden battens so as to provide an insulating air layer. Fuel filters and gauzes should be cleaned and replaced immediately prior to the first delivery of winter grade fuel. Any water in the storage tank should be drained off.

It is important to ensure that, as far as is practicable, all stocks of summer grade fuel remaining in user storage are run down before the first delivery of winter quality fuel.

## 7 Diesel-engined vehicles

### 7.1 General

The British Technical Council of the Motor and Petroleum Industries has published advice on design of low-pressure diesel fuel systems for vehicles and how to deal with problems that do arise (see *Diesel Fuel Systems for Low Temperature Operations* [7]).

To reduce the possibility of vehicle operating problems when cold weather is forecast, some precautionary steps are listed in **7.2**. Before undertaking any work that involves a modification to the vehicle's equipment, the manufacturer should be consulted and the user should be satisfied that the work does not invalidate any warranty.

A1 *NOTE PD CEN/TR 16884 provides further detailed information on vehicle fuel system design and diesel properties impacting low temperature operability.* A1

### 7.2 Cold winter weather precautions

A1 When cold weather is forecast, the following precautions should be taken.

a) Ensure that all stocks of fuel are of winter quality.

b) Drain and refill with fresh engine oil prior to the onset of winter. Check that it is fluid before starting.

c) Park vehicles under cover when not in use.

d) Before commencing a journey in cold conditions, ensure that the systems are at operating temperatures by allowing a period of idling with reduced cooling air flow.

e) Cold winds increase the rate of cooling of fuel in unlagged tanks and consideration should be given to fitting a water-and-oil-proofed lagged cover.

*NOTE Also, on wet surfaces, the forced evaporation of water reduces the temperature to below ambient. Although this is most likely to happen at temperatures above freezing under certain conditions, this effect can also be observed on surfaces coated with snow and frost.* A1

### 7.3 Remedial measures for diesel vehicle fuel starvation caused by wax or other low-temperature precipitates

The following remedial measures should be taken to counteract diesel fuel starvation caused by wax or other low-temperature precipitates.

a) Fit a new filter element.

b) Drain and clean water separators.

c) After start-up, an extended idling period with the cooling air flow restricted can be beneficial.

d) Clear ice or wax blockage by warming the fuel lines with hot water, hot air, etc.

**WARNING.** Do not warm fuel lines with a naked flame.

e) Warm and drain the fuel tank into containers and refill with clear and bright fuel from a stock at higher temperature.

*NOTE It is advisable to keep a can of suitable fuel in a warm convenient place for this purpose.*

f) Once flow has been established and the engine compartment is warm, the fuel returning to the tank will help warm up the bulk, if a fuel spill-back system is fitted.

## 8 Remedial measures for fuel starvation in oil-fired burner systems

The position of the blockage should be identified and steps taken to remove the wax by application of gentle heat. Clear ice or wax blockage by warming the fuel lines with hot water, hot air, etc.

**WARNING.** Do not warm fuel lines with a naked flame.

The problem can be compounded in the smaller type of installation by the low flow rates needed and the narrow-bore piping permitted in such installations. Any insoluble particulate matter, including biogenic material, collects in filtration under conditions of use. If the condition persists, consideration should be given to the addition of trace heating to assist fuel flow.

It is highly unlikely that biogenic precipitates will occur with fuels manufactured to British Standards, which mandate the use of FAME to BS EN 14214. However, if precipitates do occur, it is vital that all filter elements are removed, cleaned and replaced, or renewed, to assist oil flow.

# Bibliography

**Standards publications**

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS EN 116, *Diesel and domestic heating fuels – Determination of cold filter plugging point*

BS EN 23015, *Petroleum products – Determination of cloud point*

BS EN 14214, A1 *Liquid petroleum products – Fatty acid methyl esters (FAME) for use in diesel engines and heating applications – Requirements and test methods* A1

A1 BS EN 16329, *Diesel and domestic heating fuels – Determination of cold filter plugging point – Linear cooling bath method* A1

**Other publications**

[1] GREAT BRITAIN. The Renewable Transport Fuel Obligations Order 2007. London: The Stationery Office.

[2] GREAT BRITAIN. Hydrocarbon Oil Duties Act 1979 (Chapter 5). London: The Stationery Office.

[3] HM REVENUE AND CUSTOMS. Notice 179: Motor and heating fuels: General information and accounting for Excise Duty and VAT. HMRC, 2011.

[4] THE OIL COMPANIES' EUROPEAN ASSOCIATION FOR ENVIRONMENT, HEALTH AND SAFETY IN REFINING AND DISTRIBUTION (CONCAWE). *Report 9/09 – Guidelines for Handling and Blending FAME.* Brussels: CONCAWE, 2009. [2)]

[5] ENERGY INSTITUTE. *Guidelines for the investigation of the microbial content of petroleum fuels and for the implementation of avoidance and remedial strategies.* London: The Energy Institute, 2008. ISBN 978 0 85293 524 8.

[6] CEC. The Co-ordinating European Council for the Development of Performance Tests for Lubricants and Engine Fuels. *Low temperature operability of diesels: CEC Report No. P-171-82.* [3)]

A1 *Text deleted* A1

[7] THE BTC TESTING ADVISORY GROUP. *Diesel Fuel Systems for Low Temperature Operations*. Desford: British Technical Council, 1979.

**Further reading**

A1 *Text deleted* A1

PD CEN/TR 15367-1, *Petroleum Product – Guide for good housekeeping – Part 1: Automotive diesel fuels*

A1 PD CEN/TR 16884, *Automotive fuels – Diesel fuel – Cold operability testing and fuel performance correlation* A1

[2)] Available from www.concawe.org.

[3)] This report is out of print but a copy is available on request to CEC. CEC Secretariat, PO Box 6475, Earl Shilton, Leicester, LE9 9ZB.

*This page deliberately left blank*

# British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

## About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

## Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

## Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

## Copyright in BSI publications

All the content in BSI publications, including British Standards, is the property of and copyrighted by BSI or some person or entity that owns copyright in the information used (such as the international standardization bodies) and has formally licensed such information to BSI for commercial publication and use.

Save for the provisions below, you may not transfer, share or disseminate any portion of the standard to any other person. You may not adapt, distribute, commercially exploit, or publicly display the standard or any portion thereof in any manner whatsoever without BSI's prior written consent.

## Storing and using standards

Standards purchased in soft copy format:

- A British Standard purchased in soft copy format is licensed to a sole named user for personal or internal company use only.
- The standard may be stored on more than 1 device provided that it is accessible by the sole named user only and that only 1 copy is accessed at any one time.
- A single paper copy may be printed for personal or internal company use only.

Standards purchased in hard copy format:

- A British Standard purchased in hard copy format is for personal or internal company use only.
- It may not be further reproduced – in any format – to create an additional copy. This includes scanning of the document.

If you need more than 1 copy of the document, or if you wish to share the document on an internal network, you can save money by choosing a subscription product (see 'Subscriptions').

## Reproducing extracts

For permission to reproduce content from BSI publications contact the BSI Copyright & Licensing team.

## Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

**PLUS** is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email subscriptions@bsigroup.com.

## Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

## Useful Contacts

**Customer Services**
**Tel:** +44 345 086 9001
**Email (orders):** orders@bsigroup.com
**Email (enquiries):** cservices@bsigroup.com

**Subscriptions**
**Tel:** +44 345 086 9001
**Email:** subscriptions@bsigroup.com

**Knowledge Centre**
**Tel:** +44 20 8996 7004
**Email:** knowledgecentre@bsigroup.com

**Copyright & Licensing**
**Tel:** +44 20 8996 7070
**Email:** copyright@bsigroup.com

**BSI Group Headquarters**

389 Chiswick High Road London W4 4AL UK

bsi.