



# Fluids and Lubricants Specifications

Fluids and Lubricants Specifications for Series 1800

A001062/03E



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# 1 Preface

## 1.1 General information

These Fluids and Lubricants Specifications contain general instructions for the proper and safe operation of your product from the manufacturer MTU.

### Definition of MTU

MTU refers to Rolls-Royce Power Systems AG and MTU Friedrichshafen GmbH or an affiliated company pursuant to Section §15 AktG (German Stock Corporation Act) or a controlled company (joint venture).

### Used symbols and means of representation

The following instructions are highlighted in the text and must be observed:

#### Important

This field contains product information which is important or useful for the user. It refers to instructions, work and activities that have to be observed to prevent damage or destruction to the material.

### Note:

A note provides special instructions that must be observed when performing a task.

### Fluids and lubricants

The operational life, operational reliability and function of the drive units are largely dependent on the fluids and lubricants employed. The correct selection and treatment of these fluids and lubricants are therefore extremely important. This publication specifies which fluids and lubricants are to be used.

Test standard	Designation
DIN	Deutsches Institut für Normung (Federal German Standards Institute)
EN	Europäische Normung (European Standards)
ISO	International standard
ASTM	American Society for Testing and Materials
IP	Institute of Petroleum
DVGW	Deutscher Verein des Gas- und Wasserfaches e.V. (German Gas and Water Industry Association)

Table 1: Test standards for fluids and lubricants

### Applicability of this publication

The Fluids and Lubricants Specifications will be amended or supplemented as necessary. Before using them, make sure you have the latest version. The latest version is also available at:

[www.mtu-solutions.com](http://www.mtu-solutions.com) (Valid for Series 1800 PowerPack® only).

If you have any questions, your MTU contact person will be happy to help you.

The Fluids and Lubricants Specifications are applicable to PowerPacks® with Series 1800 engines compliant with emission specifications

- Euro 3
- EU stage 3A / EPA Tier 3 (with diesel particulate filter but without SCR aftertreatment systems)
- EU Stage 3B

## Warranty

Use of the approved fluids and lubricants, either under the brand name or in accordance with the specifications given in this publication, constitutes part of the warranty conditions.

The supplier of the fluids and lubricants is responsible for the worldwide standard quality of the named products.

### Important

Fluids and lubricants for drive units may be considered hazardous materials. Certain regulations must be obeyed when handling, storing and disposing of these substances.

These regulations are contained in the manufacturers' instructions, statutory regulations and technical guidelines valid in the individual countries. Great differences can apply from country to country and a generally valid guide to applicable regulations for fluids and lubricants is therefore not possible within this publication.

Users of the products named in these specifications are therefore obliged to inform themselves of the locally valid regulations. MTU accepts no liability whatsoever for improper or illegal use of the fluids and lubricants which it has approved.

## Preservation

All information on preservation, represervation and depreservation including the approved preservatives is available in the Preservation and Represervation Specifications (publication number A001070/...). The latest version is also available at:

[www.mtu-solutions.com](http://www.mtu-solutions.com)

## 2 Lubricants for Four-Cycle Engines

### 2.1 Lubricants

#### Engine oils

##### Important

Dispose of used fluids and lubricants in accordance with local regulations.

#### Selection of viscosity grades

Selection of the viscosity grade is based primarily on the ambient temperature at which the engine is to be started and operated. If the relevant performance criteria are observed the engines can be operated both with single-grade and multi-grade oils, depending on the application. Standard values for the temperature limits in each viscosity grade are shown in Chart 1.

If the prevailing temperature is too low, the engine oil must be preheated.

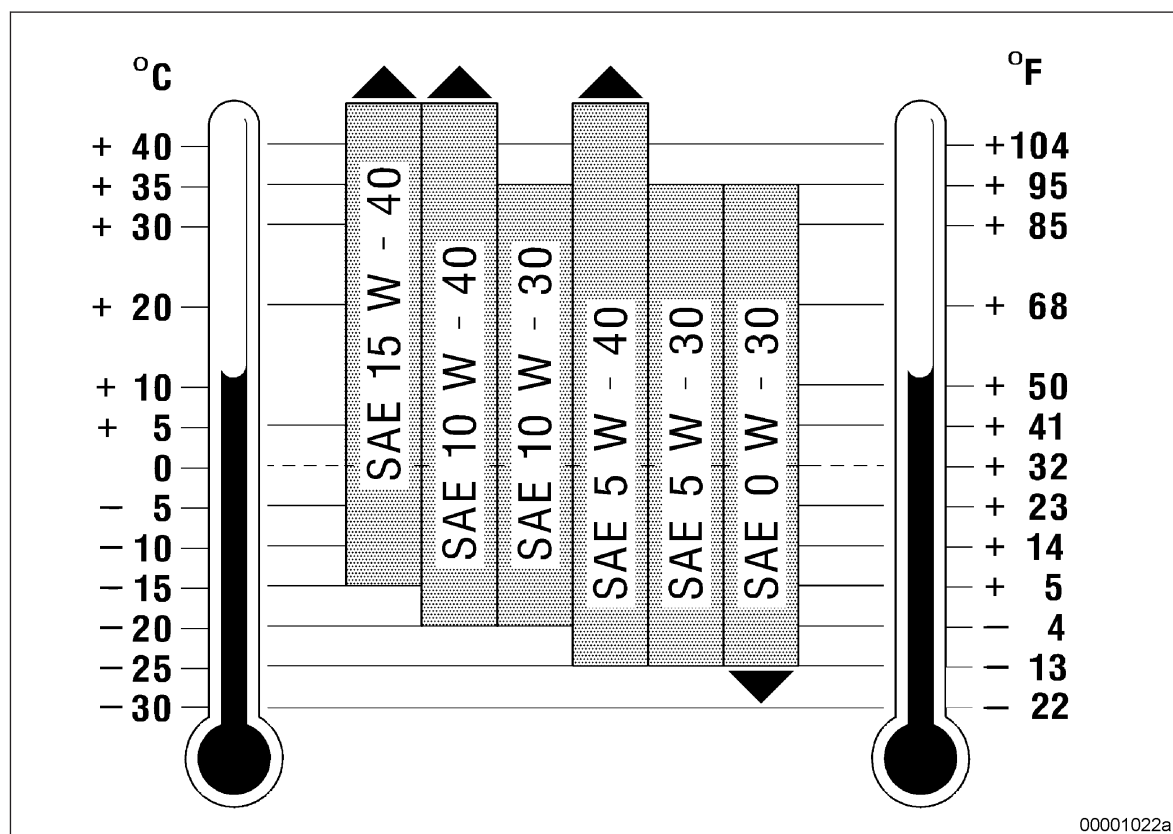


Chart 1

## Engine oils for Series 6H 1800 engines

### Important

For engine model 6H 1800, only engine oils in accordance with Chapter 5.2 (→ Page 20) may be used. For engines equipped with diesel particulate filter, only "Low SPAsh oils" in accordance with Chapter 5.3 (→ Page 21) may be used!

The oil change interval is 1000 operating hours or max. 1 year under the condition that approved fuels as per Chapter 4 (→ Page 14) are used.

If fuels which have not been approved are used, shorter oil change intervals are to be expected. Prior to using non-approved fuels, contact MTU to determine the applicable oil change intervals. Operating the engines with biodiesel/FAME acc. to EN14214:2010-04 involves reduced oil change intervals, see Chapter 4 (→ Page 14).

## Mixing engine oils

### Important

Mixing different engine oils is strictly prohibited!  
Topping up engine oil with a different oil brand than currently used in the engine is also strictly prohibited!

Changing to another oil grade can be done together with an oil change. The remaining oil quantity in the engine oil system is not critical in this regard.

## Transmission oils for rail vehicles with ZF transmissions

### (Abstract from the ZF List of Lubricants TE-ML16, Edition 01.10.2008)

The ZF Lists of Lubricants are updated every three months on 01.01., 01.04., 01.07. and 01.10.. Before using them, make sure you have the latest version. The latest version is also available at:

<http://www.zf.com/Corporate/en> menu item Products & Services / Service Portfolio / Service Center / Lubricants & Steel / List of Lubricants / Please choose your Language / TE-ML 16.

Product groups automatic transmissions for rail vehicles	Lubricant classes for service fills <sup>(1)</sup> transmissions with/out/with ZF-Intarder
ASRail	
• 12 AS 2303. 12 AS 2703. 12 AS 3103. 16 AS2 603	16K / 16P
Ecomat	
• HP 500 R, HP 590 R, HP 600 R	16L / 16M / 16N
• HP 502 R, HP 592 R, HP 602 R	Automatic Transmission Fluid (ATF) <sup>(2)</sup>
Ecomat	
• HP902 R	16N
EcoLife (up to 105 °C)	16Q

<sup>(1)</sup> = Approved commercial products (see Chapter 5), oil change intervals and low temperature limits (specified below).

<sup>(2)</sup> = Particularly recommended: The fully synthetic ATF ZF-Ecofluid A PLUS was developed specifically for use in Ecomat transmissions. This combination of a synthetic base oil with a specially balanced additive package delivers superlative oxidation stability and consistent friction characteristics. The viscosity level is ideally suited to this transmission and this factor, combined with resistance to scuffing and pitting, assures the unit of extremely valuable protection and a correspondingly long service life for its bearings and gears. Another positive feature of ZF-Ecofluid A PLUS is its flat viscosity characteristics curve which makes it particularly well suited to operation in cold as well as in hot climatic zones .

Follow the instructions for greasing points in the manual.

### Important

Additives of any kind added later to the oil change the oil in a manner that is unpredictable, and they are therefore not permitted. ZF accepts no liability whatsoever for any damage resulting from the use of such additives.

### Oil change intervals for ASRail transmissions:

Lubricant classes <sup>(1)</sup>	Oil change interval [km / years] <sup>(2,3)</sup>
16K	300,000 km / every 2 years
16P	360,000 km / every 3 years

<sup>(1)</sup> = Pay attention to approved trade products and lubricant classes.

<sup>(2)</sup> = Oil change required, depending on what occurs first.

<sup>(3)</sup> = After consultation with the product support department of ZF Friedrichshafen AG, Special Drive Technology, and after an oil analysis has been made (after agreed mileages), longer oil change intervals can be applied to some reference transmissions. The procedure for taking oil samples is described in the respective Service Information.

### Oil and filter change intervals for Ecomat transmissions HP 500 R, HP 590 R, HP 600 R, HP 502 R, HP592 R, HP 602 R for rail vehicles:

Lubricant classes <sup>(1)</sup>	Oil and filter change interval [km / years] <sup>(2,3)</sup>
16L	60,000 km / every 2 years
16M	120,000 km / every 2 years
16N	150,000 km / every 3 years

<sup>(1)</sup> = Pay attention to approved trade products and lubricant classes.

<sup>(2)</sup> = Oil change required, depending on what occurs first.

<sup>(3)</sup> = After consultation with the product support department of ZF Friedrichshafen AG, Special Drive Technology, and after an oil analysis has been made (after agreed mileages), longer oil change intervals can be applied to some reference transmissions. The procedure for taking oil samples is described in the respective Service Information.

### Oil and filter change intervals for Ecomat transmissions HP 902 R for rail vehicles:

Lubricant classes <sup>(1)</sup>	Oil and filter change interval [km / years] <sup>(2,3)</sup>
16N	120,000 km / every 3 years

<sup>(1)</sup> = Pay attention to approved trade products and lubricant classes.

<sup>(2)</sup> = Oil change required, depending on what occurs first.

<sup>(3)</sup> = After consultation with the product support department of ZF Friedrichshafen AG, Special Drive Technology, and after an oil analysis has been made (after agreed mileages), longer oil change intervals can be applied to some reference transmissions. The procedure for taking oil samples is described in the respective Service Information.

### Oil and filter change intervals for EcoLife transmissions for rail vehicles:

Lubricant classes <sup>(1)</sup>	Oil and filter change interval [km / years] <sup>(2,3)</sup>
16Q	180,000 km / every 3 years

<sup>(1)</sup> = Pay attention to approved trade products and lubricant classes.

<sup>(2)</sup> = Oil change required, depending on what occurs first.



<sup>(3)</sup> = After consultation with the product support department of ZF Friedrichshafen AG, Special Drive Technology, and after an oil analysis has been made (after agreed mileages), longer oil change intervals can be applied to some reference transmissions. The procedure for taking oil samples is described in the respective Service Information.

**The above oil change intervals only apply to complete fills. If oil is changed to another class of lubricants, the following oil and filter change intervals apply :**

Changing class of lubricant from	Oil and filter change interval [km / years] <sup>(1)</sup>
16L => 16M	90,000 km / every 2 years
16L => 16N	120,000 km / every 2 years
16M => 16N	150,000 km / every 3 years

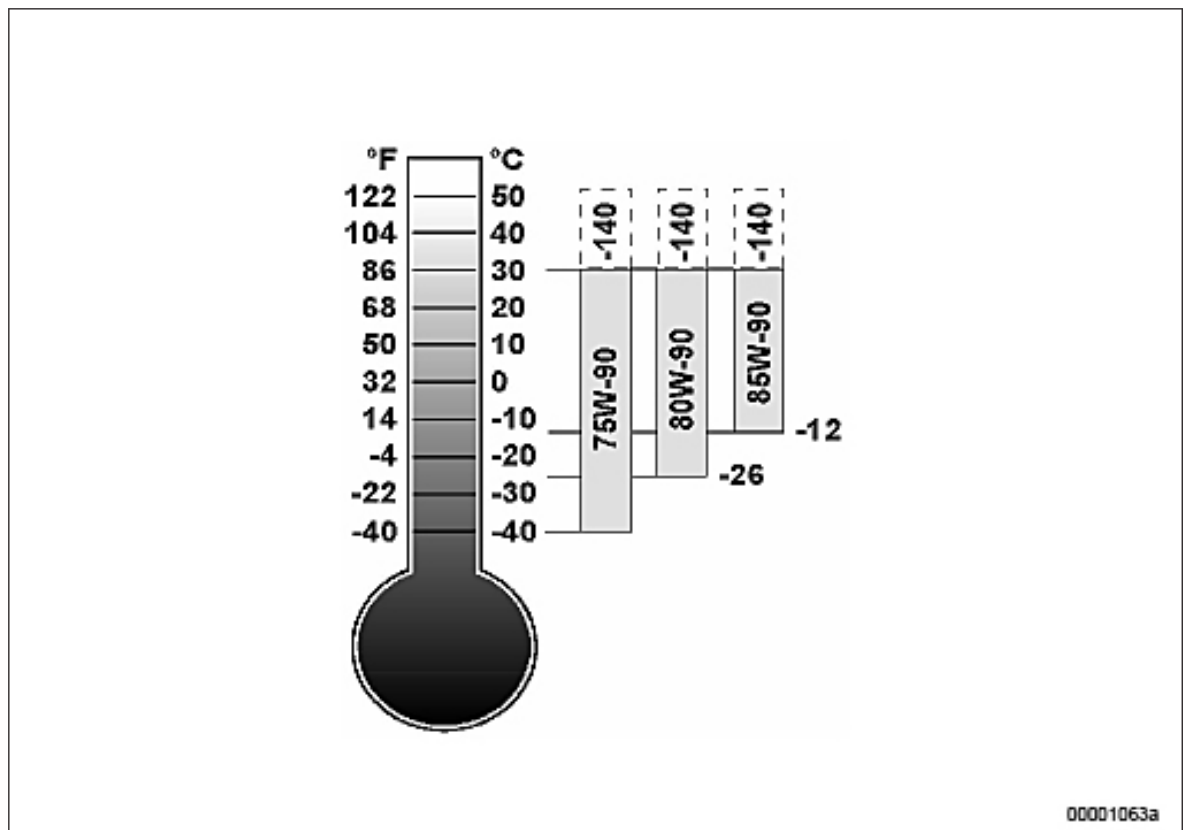
<sup>(1)</sup> = Oil change required, depending on what occurs first.

### Application areas of lubricants

The following illustration shows application areas of the various SAE classes in relation to the ambient temperatures to be expected.

The oils have a bottom limit of max. dynamic viscosity (Brookfield) of 150,000 mPas, which roughly corresponds to the viscosity limit at low temperatures.

The upper limit is determined by the load in the transmission and the appearing temperature level during operation. It can be assumed that high ambient temperatures will also result in higher oil sump temperatures. For detailed information on the low temperature behavior of the specific product see at the safety data sheet of the supplier.



**The user must observe the low temperature limits!**

Lubricant classes	Viscosity grades	Use at oil sump temperature as over
16K / 16L / 16M / 16N / 16P / 16Q	75W-80 / 75W-85 / 75W-90 / 75W-110 / 75W-140 / ATF	- 40 °C

## Power transmission oils for Voith Turbo transmissions T 211 re.4 + KB190

### Abstract from Voith documentation "Transmission oils for Voith Turbo transmissions 120.00059000 Version 1 and Repair instructions 120.00068341 Version 3

Voith publications are continuously updated. Before using them, make sure you have the latest version. The latest version is also available at:

"www.Voithturbo.com" menu item Products & Applications / Rail / Hydrodynamic drives / Publications / Data sheet (Title) - (Market Division / Product Group) Hydrodynamic Drives / Transmission oils for turbo transmissions

## Oil and filter change intervals for Voith Turbo transmissions T 211 re4 + KB190

Oil and filter change interval based on running hours <sup>(1)</sup>	Oil and filter change intervals based on mileage (km)
5,000	300,000

<sup>(1)</sup> = Running hours are accumulated operating hours at speeds of more than 1 km/h.

## Use at low temperatures

The approved transmission oils allow cold starts at temperatures down to -20 °C.

Special measures must be taken if temperatures are lower.

## Oil filtration

Ensure oil filtration to purity class 15/11 as per ISO 4406 when filling the transmission with oil. For appropriate filter units please contact Voith Turbo.

The maximum quantity of foreign particles in 100 ml oil for this purity class is:

- Particles >5µm: 32,000 (class 15)
- Particles >15µm: 2,000 (class 11)

## Oil and filter replacement intervals for Voith transmission unit DIWA 884.5 / SWG

Oil and filter change intervals based on diesel engine operating hours	Oil and filter change intervals based on mileage (km)
4,000	120,000

## Hydraulic system

Important
The oil change interval for the hydraulic system is 4000 operating hours / max. 2 years!

The approved engine oils specified in Chapter 5 must be used.

# 3 Coolants

## 3.1 Coolants

### Coolant – Definition

Coolant	= Coolant additive (concentrate) + freshwater in the specified mixing ratio ready for use in the engine.
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Table 2:

### Requirements

Coolants must be prepared from suitable fresh water and a coolant additive approved by MTU. Prepare the coolant outside the PowerPack®!

The corrosion-inhibiting effect of coolant is only ensured with the coolant circuit fully filled. This means that the engine must be preserved when coolant was drained off and refilling is not planned. For the preservation procedure, refer to the Preservation and Represervation Specifications A001070/.. of the engine.

The entire cooling system must be free of zinc components. This also applies to coolant supply and return/drain lines as well as to storage bins.

Important
Mixing of different coolant additives and supplementary additives is prohibited!

The quantity of coolant remaining in the PowerPack coolant circuit during a coolant change is not critical.

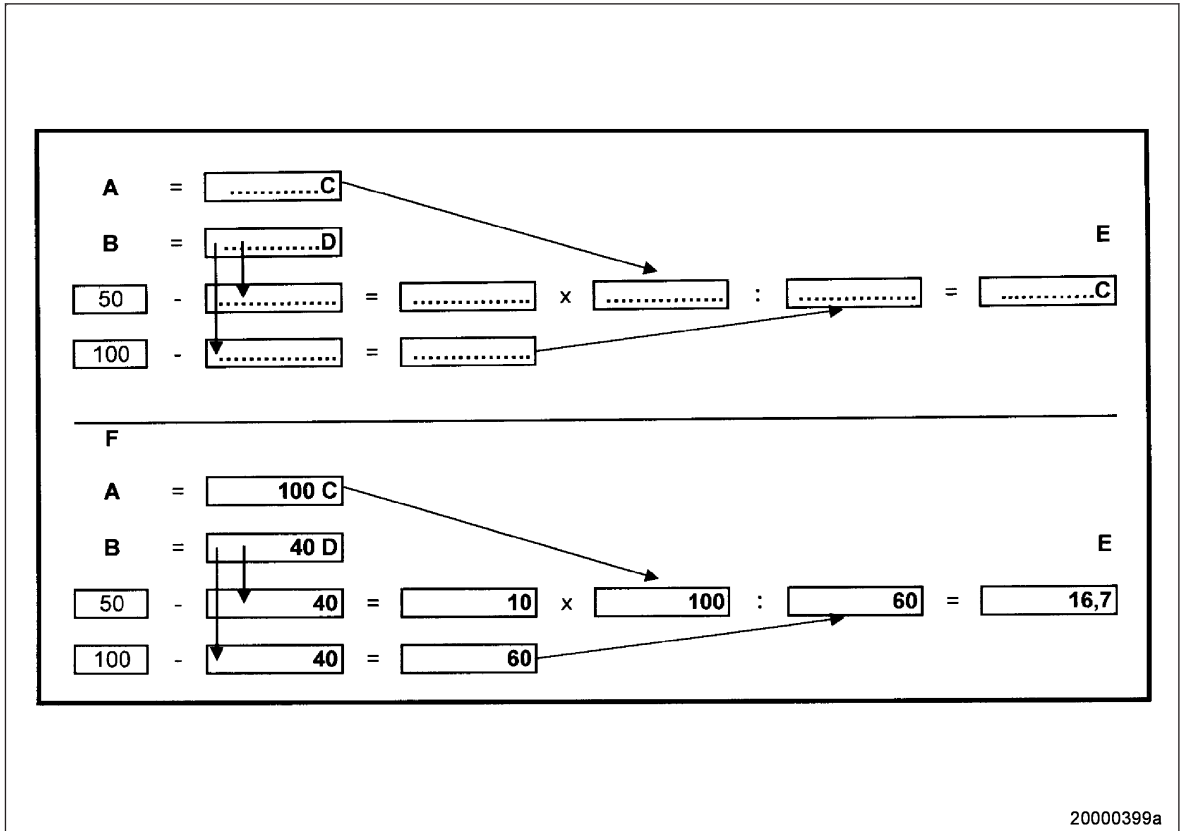
To prevent cooling system damage:

- For initial filling, a corrosion-inhibiting antifreeze concentration of 50% by volume must be ensured.
- For topping up coolant (after a coolant loss) or when the corrosion-inhibiting antifreeze concentration falls below 40% by volume, a concentration of 50% by volume must be established in the cooling system.
- A corrosion-inhibiting antifreeze concentration lower than 40% by volume is inadmissible to avoid the reduction of corrosion protection.
- Never exceed an antifreeze concentration of 55% by volume Use corrosion-inhibiting antifreeze. Concentrations in excess of this reduce antifreeze protection and heat dissipation.

### Coolant mixing ratio

Antifreeze protection to °C	-27	-32	-37	-42
Water % by vol.	60	55	50	45
Corrosion-inhibiting antifreeze % by vol.	40	45	50	55

## Calculation of the corrosion-inhibiting antifreeze quantity for refill



20000399a

A Coolant capacity (total)  
B Measured concentration

C Liters  
D Percent by volume

E Refill quantity of corrosion-inhibiting antifreeze (This quantity must be drained off if the coolant level is within the specifications!)

F Calculation example

## Freshwater

Only clean, clear water with values in accordance with those in the following table must be used for preparing the coolant. If the limit values for the water are not achieved, its hardness or mineral content can be decreased by adding demineralized water.

	min.	max.
Total earth alkalines <sup>1)</sup> (Water hardness)	0 mmol/l 0°d	2.7 mmol/l 15°d
pH value at 20 °C	6.5	8.0
Chloride ions		100 mg/l
Sulphate ions		100 mg/l
Anions total		200 mg/l
Bacteria, fungi, yeasts	are not permitted!	

<sup>1)</sup> Common designations for water hardness in various countries:

1 mmol/l = 5.6°d = 100 mg/kg CaCO<sub>3</sub>

- 1°d = 17.9 mg/kg CaCO<sub>3</sub>, USA hardness
- 1°d = 1.79° French hardness
- 1°d = 1.25° English hardness

## Operational checks

Inspection of the freshwater and continuous monitoring of the coolant are essential for trouble-free Power-Pack operation. MTU recommends to check the freshwater and coolant quality every six months and whenever the system is to be filled. This can be done with the MTU Test Kit. The MTU Test Kit contains all necessary equipment and chemical substances, instructions with the procedures of the analyses to be conducted and the relevant limit values.

The following tests can be conducted with the MTU test kit:

- Determination of total hardness (°d)
- pH value
- Chloride content of freshwater
- Antifreeze (corrosion-inhibiting) concentration

Orders for fresh water and coolant analysis may be placed with MTU. Samples of min. 0.25 l must be supplied.

## Limit values for coolants

pH value when using – Corrosion inhibitor / antifreeze	Min. 7.0	Max. 9.0
Silicon – Valid for coolants containing Si	Min. 25 mg/l	

## Coolant concentrates – Storage capability

Storage capability is specified for a storage temperature of max. 30 °C.

Corrosion-inhibiting antifreeze	Approx. 3 years	Observe manufacturer's specifications
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# 4 Liquid Fuels

## 4.1 Fuels

### Diesel fuels

#### Selecting a suitable diesel fuel

The quality of the fuel is very important for satisfactory engine performance, long engine service life and acceptable exhaust emission levels.

In order to achieve optimum engine performance and satisfactory service life for the entire fuel and injection system, the limit values for water, total contamination and particle distribution must be complied with in the vehicle tank for all approved fuel qualities.

#### Limit values for water and total contamination

		Test method		Limit values
		ASTM	ISO	
Proportion of water	max.	D6304	EN 12937	200 mg/kg
Total contamination	max.	D6217	EN 12662	24 mg/kg
Particle distribution for fuel in tanks	max.		ISO 4406	ISO classes 18/17/14

It is strictly recommended to integrate an additional filtering system in the fuel system.

#### Important

The use of fuels which have not been approved may lead to considerable deviations from the specified engine power and to severe engine damage.  
Consult MTU before using non-approved fuels!

#### Important

If fuels which have not been approved are used, shorter oil change intervals are to be expected. Prior to using non-approved fuels, contact MTU to determine the applicable oil change intervals. Operating the engines with biodiesel/FAME acc. to EN14214:2010-04 involves reduced oil change intervals, see "Engine oil and servicing" (→ Page 15).

#### Important

Dispose of used fluids and lubricants in accordance with local regulations.

### Requirements

Commercially available diesel fuels meeting the following specifications are approved for use:

#### Distillate fuels

	Diesel fuel acc. to DIN EN 590:2010-05	ASTM D975-11 Grade 2-D	
		S15	S500
Up to EU Stage 3A / EPA Tier 3	Approval issued	Approval issued	Approval issued
From EU Stage 3B / EPA Tier 4i	Approval issued	Approval issued	Approval issued

### Biodiesel

The standardized general term "FAME" (Fatty Acid Methyl Ester) is used here to designate biodiesel fuels.

### Important

The basic configuration of the PowerPack® is not equipped with a fuel system suitable for FAME. Before using biodiesel (FAME) fuels or diesel fuels with a FAME content exceeding the limit values of DIN EN 590:2010-05, the fuel system of the PowerPack® must be modified! Consultation with MTU is mandatory!

### Important

The use of diesel fuels with a FAME content acc. to DIN EN 590:2010-05 does not present a problem. This fuel has no influence on the oil change intervals.  
Consult MTU if the FAME content is higher.

## Approval and engine / PowerPack® requirements for the operation with FAME

Engine/Series	Approval/requirements
PowerPack® 6H 1800 P	Only with special equipment
Engine 6H 1800	Approved as from series production

### Fuel (FAME)

- The fuel must comply with DIN EN 14214:2010-04. Operation with fuels of lower quality can lead to damage and malfunctions.
- Either FAME or diesel fuel may be used. The various mixtures of FAME and normal diesel fuel which may occur in the vehicle tank as a result, present no problem.

### Engine oil and servicing

- A certain amount of fuel always finds its way into the engine oil via the pistons and cylinders. Its high boiling point means that FAME does not evaporate but remains in the engine oil in its entirety. Under certain conditions chemical reactions may take place between FAME and the engine oil. This can lead to engine damage.
- For this reason, engine oil and filter change intervals must be shortened for operation both with pure FAME and with FAME-diesel mixtures.
- For Series 460/1800, special equipment is available which facilitates an increase in the engine oil change intervals for operation with 100% FAME. For this application, the engines must be fitted with special equipment, i.e. special unit pumps and a fuel prefilter with heated water separator.

Engine version	Engine oil change interval
Engines not fitted with special equipment for operation with FAME.	Reduction of the engine oil change interval to 300 operating hours.
Engines with special equipment: <ul style="list-style-type: none"><li>• Special unit pump</li><li>• Fuel prefilter with heated water separator</li></ul>	Reduction of the engine oil change interval to 500 operating hours.

### Important

The relevant engine oil change and filter replacement intervals must be complied with without fail!  
Exceeding the engine oil change intervals can cause engine damage!

- Operation with 100% FAME requires shortened fuel filter change intervals. A new fuel filter must be fitted each time the engine oil is changed.
- Fuel and engine oil must be changed approximately 25 operating hours after conversion to FAME due to the danger of blockage caused by loosened deposits (FAME has a pronounced cleaning effect).
- Over longer periods, fuel filter service life may be reduced as a result of old residues being carried into the filter from the fuel system. A special, approved fuel prefilter can be installed as an improvement.

### Engine power and engine standstill

- Due to its calorific value, operation with 100% FAME involves a reduction of approx.8% to 10% in engine power. This leads to a corresponding increase in fuel consumption as compared to operation with diesel fuel. Engine power corrections are not permissible.
- Prior to any extended period out of operation, the fuel system must be flushed out in order to prevent congestion. For flushing, the engine must be operated for at least 30 minutes on diesel fuel (without FAME).

### General notes

- We can make no comment with regard to the level of FAME resistance of the fuel system, which is not part of our scope of supply.
- FAME is an extremely effective solvent. Any contact with paint, for example, must therefore be avoided.
- The characteristic smell of FAME exhaust, especially during long periods of idling, may be perceived as unpleasant. The nuisance caused by smell can be reduced by an oxidation catalyst which may be installed by the vehicle / equipment manufacturers at their own risk.

#### Important

Our company accepts no responsibility for and provides no warranty in respect of any fault or damage connected in any way with the use of FAME of a lower quality or resulting from noncompliance with our specifications on operation using FAME. All resultant irregularities and consequential damage lie outside our responsibility.

### Vegetable oils as an alternative to diesel fuel

#### Important

The use of pure vegetable oils as an alternative to diesel fuel or FAME is strictly prohibited due to the absence of standardization and to negative experience (engine damage caused by coking, deposits in the combustion chambers and oil sludge)!

### Low-sulfur diesel fuels

Sulfur is contained in chemically bound form in crude oil and is therefore present in fuel at varying levels.

A sulfur content of max. 50 mg/kg or 10 mg/kg (depending on category) has been a European Union requirement since Jan. 1, 2005. The term "sulfur-free" is used here to designate diesel fuels with a sulfur content of max. 10 mg/kg. Low-sulfur diesel fuels (max. 50 mg/kg) are to be recommended for environmental reasons. In order to avoid problems with wear, lubricity additives, among other things, are added by the manufacturer.

### Diesel fuels in winter operation

At low outdoor temperatures, the diesel fuel's fluidity can be inadequate on account of paraffin precipitation.

In order to prevent operational problems (e.g. clogged filters) during the winter months, diesel fuel with suitable cold-flow characteristics should be used.

### Flow improvers

Flow improvers cannot prevent paraffin precipitation but they do influence the size of the crystals and allow the diesel fuel to pass through the filter.

The effectiveness of the flow improvers is not guaranteed for every fuel.

Certainty is only assured after laboratory analyses of the filtering capability.

Required quantities and mixing procedures must be carried out according to the manufacturer's instructions.



## Microorganisms in fuel

Bacterial attack and sludge formation may occur in the fuel under unfavorable conditions. In such cases, the fuel must be treated with biocides in accordance with the manufacturer's specifications. Overconcentration must always be avoided.

For prophylactic use, the appropriate concentration must be identified in consultation with the relevant manufacturer.

## Approved biocides

Manufacturer	Brand name	Concentration for use
Schülke und Mayr 22840 Norderstedt Tel. +49 (0) 40/52100-00 Fax. +49 (0) 40/52100-244	Grota MAR 71	0.5 l / ton

## 4.2 NO<sub>x</sub> reducing agent AUS 32 for SCR after-treatment systems

### **General information**

SCR (Selective Catalytic Reduction) catalysts can be used for NO<sub>x</sub> emission reduction. The reducing agent (urea solution with an urea concentration of 32.5 %) in such catalysts reduces the nitrogen oxide emissions.

To ensure efficient operation of the exhaust gas after-treatment system, compliance of the reducing agent with the quality requirements stipulated in DIN 70070 / ISO 222 41-1 is mandatory.

In Europe, this reducing agent is often offered under the brand name “AdBlue”.

The test methods to determine the quality and characteristics of the reducing agent are specified in the standards DIN 70071 / ISO 222 41-2.

### **Storage of reducing agent**

For instructions on storage, packing and transport, refer to the ISO 222 41-3 standard . The instructions of the manufacturer must be observed.

The reducing agent crystallizes at -11 °C.

Avoid direct sunlight because it promotes the occurrence of microorganisms and the decomposition of the reducing agent.

# 5 Approved Fluids and Lubricants

## 5.1 General information

### **Fluids and lubricants for hydrostatic drive systems (fans, generator drive)**

Only approved engine oils as listed below may be used as operating fluids in the hydraulic system.

#### **Engine oils**

For details and special features, see chapter 2 (→ Page 6).

## 5.2 Multi-grade oils acc. to MB specifications 228.5

### **Approved engine oils**

For approved engine oils, refer to the MB Fluids and Lubricants list at:

[http://bevo.mercedes-benz.com/bevolistenmain.php?navigation\\_path=bevolisten&blatt=228.5&content\\_action=show](http://bevo.mercedes-benz.com/bevolistenmain.php?navigation_path=bevolisten&blatt=228.5&content_action=show)

Open sheet 228.5 at the website.

## 5.3 Multi-grade Low SPAsh oils acc. to MB specifications 228.51

### **Approved engine oils**

For approved engine oils, refer to the MB Fluids and Lubricants list at:

[http://bevo.mercedes-benz.com/bevolistenmain.php?navigation\\_path=bevolisten&blatt=228.51&content\\_action=show](http://bevo.mercedes-benz.com/bevolistenmain.php?navigation_path=bevolisten&blatt=228.51&content_action=show)

Open sheet 228.51 at the website.

## 5.4 Fluids and lubricants for ZF transmissions

Mechanical manual shift transmissions from ZF Co. Friedrichshafen:

The current, permissible fluids and lubricants for ZF transmissions can be downloaded free-of-charge from the following Internet address:

[http://www.zf.com/corporate/de/products/services/servicecenter/lubricants\\_steel/lubricants\\_steel.html](http://www.zf.com/corporate/de/products/services/servicecenter/lubricants_steel/lubricants_steel.html) / Schmierstofflisten / Sprache auswählen / TE-ML16

### Lubricant class 16K - Transmission oil of viscosity class: SAE 75W-80 (base oil partly synthetic, synthetic, suitable for intarders)

Manufacturer	Product name
Baywa AG, München/D	Tectrol Syntogear MA 7580
Fuchs Petrolub AG, Mannheim/D	Fuchs Titan Cytrac MAN Synth 75W-80

### Lubricant class 16L (ATF)

Manufacturer	Product name
Addinol Lube Oil GmbH, Leuna/D	Addinol ATF D II E
American AGIP Company, Cabot/USA	AGIP HD Synthetic Blend
Amsoil, Superior/USA	Amsoil 206 Synthetic
ARAL AG, Bochum/D	ARAL Getriebeöl ATF E-S
AVIA Mineralöl-AG, München/D	AVIA Fluid ATF 92 S
Bucher AG Langenthal, Langenthal/CH	ATF TP Motorex ATF II Synthetic
Castrol International, Pangbourne Reading/GB	Castrol Import Multivehicle ATF
Cepsa Lubricants S.A., Madrid/E	Cepsa ATF 3000 S
Chevron Texaco Global Lubricants, San Ramon/USA	Caltex Synthetic ATF Heavy Duty Chevron Automatic Tansmission Fluid Mercon V Chevron Multi-Vehicle ATF Chevron Synthetic ATF Heavy Duty Texaco Havoline ATF Mercon V Texaco Havoline Multi-Vehicle ATF Texaco Synthetic ATF Heavy Duty
Chevron Texaco, Ghent/B	Texamatic S
Comercial Importadora S.A. DE C.V., Santa Fe/MEX	Multi ATF Para Todas Las Marcas
Comp. Brasil. d. Petro.Ipiranga, Rio de Janero/BR	Isamatic Mercon V
ENI S.p.A.Refining & Marketing Division, Rome/I	ATF II E
Fuchs Petrolub AG, Mannheim/D	Esso ATF LT 71141 Mobil 1 Synthetic ATF Mobil ATF SHC
Exxon Mobil Corp., Fairfax, Virginia/USA	Titan ATF 5000 SL
Ginouves Georges SA, La Farlede/F	York 886
Grupa Lotos SA, Gdansk/PL	Lotos ATF Super III G
Huiles Berliet S.A., Saint Priest/F	RTO Starmatic S2

Manufacturer	Product name
Kuwait Petroleum R&T B.V., Europoort RT/NL	Q8 Auto 14 Synthetic Q8 Auto 15 ED
LLK Finland OY, Hamina/FIN	Teboil Fluid ES-Max
Lubricant Oil Com. Sinopec, Beijing/CN	GW ATF-III LD
Lubricantes Venoco Intern. C.A., Guacara/YV	Venoco ATF Multi -Vehiculo (75W)
Lubrication Engineers, Inc., Fort Worth, Texas/USA	1150 Trans-AII EHP Automatic Transmission Fluid
Maziva Zagreb D:O.O., Zagreb/HR	INA ATF Ekstra
Mol-Lub Kft., Almásfüzitő/H	Mol ATF Synt
Neste Markkinointi Oy, Espoo/Fin	Neste ATF-2
New Process AG, Tübach/CH	ATF Synth
OMV Refining & Marketing GmbH, Wien/A	OMV ATF Z2 OMV ATF-S
Orlen Oil SP. Z.O.O., Krakow/PL	Hipol ATF IIE
Pakelo Motor Oil S.R.L., San Bonifacio (VR)/I	Pakelo ATF DXIII HTS Pakelo Auxon III Pakelo DX Fluid II TS
Panolin AG, Madetswil/CH	Panolin ATF Synth
Petro-Canada Lubricants, Mississauga/CDN	Heavy Duty Synthetic Blend ATF Mercon V ATF H-36007
Petronas Lubricants Intern., Kuala Lumpur/MAL	Tutela Truck ATF 90
Raloy Lubricantes S.A. DE C.V., Tianguistenco/MEX	Transfluid Synthetic M-5
Ravensberger Schmierstoffvertrieb GmbH, Werther/D	Ravenol Dexron II E Ravenol Dexron III H
Repsol YPF Lubricantes y Especialidades, Madrid/E	Matic Sintetico Repsol Matic III
S.A.E.L., Madrid/E	Gulf ATF Synt
Shell International Petroleum Comp. LTD., London/GB	Shell Donax TV Shell Donax TX
SRS Schmierstoff Vertrieb GmbH, Salzbergen/D	SRS Violin ATF Dexron S
Statoil Lubricants, Stockholm/S	Syntomatic Transway S DX II Transway S DX III F
Suomi Petrooli OY, Hamina/F	Teboil Fluid ES-Max
Tedex Production SP.Z.O.O.Tomaszwo Mazowiecki/PL	Tedex ATF III Tedex ATF Synthetic
Total Lubrifiants S.A., Paris/F	Elfmatic G2 SYN Elfmatic G3 SYN Total Fluide SYN FE Total Fluide XLD FE Total Fluidematic SYN
Valvoline Europe, Dordrecht/NL	Valvoline Synpower ATF
Wameco, Zanica (BG)/I	Helifluid 9600 TS
Warren Oil CO., Dunn, North Carolina/USA	Multi-Vehicle Synthetic Blend ATF

### Lubricant class 16M (ATF)

Manufacturer	Product name
ARAL AG, Bochum/D	ARAL ATF LTF
BP International, Pangbourne, Reading/GB	BP Autran LTF BP Autran SYN 295
Castrol International, Pangbourne, Reading/GB	Castrol Transmax Z Castrol Transynd
Kompressol-Oel Verkaufs GmbH, Köln/D	Kompressol-Dexron Synth LTF

### Lubricant class 16N (synthetic ATF)

Manufacturer	Product name
Petronas Lubricants Intern., Kuala Lumpur/MAL	Tutel Truck ATF 120
Shell International Petroleum Comp. LTD., London/GB	Shell Donax TZ
ZF Friedrichshafen AG, Friedrichshafen/D	ZF-Ecofluid A Plus

### Lubricant class 16P - Transmission oil of viscosity class: SAE 75W-80 (base oil synthetical, suitable for intarders)

Manufacturer	Product name
Castrol International, Pangbourne Reading/GB	Castrol Syntrans Max 75W-80
ZF Friedrichshafen AG, Friedrichshafen/D	ZF-Ecofluid M

### Lubricant class 16Q

Manufacturer	Product name
ZF Friedrichshafen AG, Friedrichshafen/D	ZF-Ecofluid Life



## 5.5 Fluids and lubricants for Voith transmissions T 211.re.4 + KB190 (General List of Lubricants 120-00059010\_EN, Edition 14 dated 2019-04-10)

Voith hydrodynamic transmissions:

Before using them, make sure the fluids and lubricants listed below are still approved. The latest version is available at: [www.voith.com/brochures/2255](http://www.voith.com/brochures/2255)

### Important

Use Voith approved transmission oils only when filling the turbo transmission. The use of other oil grades and blends or contaminated oils is prohibited.  
No liability whatsoever will be accepted if oils for which Voith has not granted approval are used in the turbo transmission.

### Approved power transmission oils for Voith turbo transmissions T 211 re.4 + KB190

Manufacturer	Product name	Index	Suitable for low temperatures <sup>4)</sup> down to
Addinol	SGL 18	1	-25 °C
ARAL	ARAL Degol BG 32		-20 °C
BASF	Emgard HF EAL 801-32	1, 4, 5	-40 °C
Caltex	Torque Fluid 32	2	-25 °C
Castrol	Castrol Alpha VT 32	1	-25 °C
	Castrol Hyspin HL-XP 32	2	-25 °C
Chevron Texaco	Textran V 32	2	-25 °C
Exxon Mobil	Mobilfluid 125	2	-20 °C
Finke	Aviaticon ML 32 SG	1	-25 °C
Fuchs-Europe	Renofluid TF 1500	1	-25 °C
INA Maziva	INA Fluid V 32	2	-25 °C
	INA Fluid VT 32	1	-25 °C
Q8	Q8 Auto R 26	2	-25 °C
Shell	Shell Tegula V 32	1	-25 °C
SRS	SRS Wiolan HF 32 DB	1	-25 °C
	SRS Wiolan HF 32 synth	3	-40 °C
Total	Total Azolla VTR 32		-20 °C
Voith Turbo s,r,l.	Turbo Transmission Fluid	1	-25 °C
	Turbo Transmission Fluid Synth	3	-40 °C

Table 3:

Explanation of the Index column:

1. Increased thermal-oxidation resistance
2. Oil is not suitable for all electronically-controlled turbo transmissions except for T 211...
3. Especially increased thermal-oxidation resistance (synthetic oil)
4. Rapidly biodegradable, comprises renewable raw materials, granted EU Ecolabel
5. Only for use with electrostatically optimized fine filter element (order no. H90.934913) not suitable for S 211 re.2

## 5.6 Fluids and lubricants for Voith transmission unit DIWA 884.5 / SWG

Voith transmission unit DIWA DIWA8845 / SWG:

Before using them, make sure the fluids and lubricants listed below are still approved. Call the service phone number (+49) (0)7321-37-4181 at Voith Turbo for confirmation.

### Approved fluids and lubricants for Voith transmission unit DIWA 884.5 / SWG

Manufacturer	Product name
American Agip	HD Synthetic Blend ATF (H-36381)
Aral AG	Getriebeöl ATF E-S
Avia Mineralöl AG	AVIA Fluid ATF 92 S
Bantleon Ulm	Avia Fluid ATF 92 S
BP plc	Autran LTFBP Autran Syn 295 (G-36746)
Bucher + Cie AG	Motorex ATF IIE Synthetic
Castrol Ltd.	Castrol Transmax Z Castrol Transmax Long Life Castrol TranSynd (G-34010)
Cepsa Lubricantes S.A.	CEPSA ATF SYNTHETIC Cepsa ATF 3000 S
Chevron Texaco Global Lubricants	Caltex Synthetic ATF HD (G-36048) Chevron Synthetic ATF HD (G-36048) Texaco Synthetic ATF HD (G-36048) Texamatic S
Cognis GmbH	EMGARD ATF 2801
Deutsche Pentosin Werke GmbH	Pentosin ATF1
ENI S.p.A.	Agip ATF II E
Exxon Mobil Corporation, Fairfax, Virginia, USA	Esso ATF LT 71141 Mobil ATF LT 71141 Mobil Delvac Synthetic ATF
Fabrika Maziva FAM A.D. Krusevac, Serbia	ATF DIIIIH
FL Group	Tutela Truck ATF 90
Fuchs Europe Schmierstoffe GmbH	Fuchs Titan ATF 5000 SL Fuchs Titan ATF 5005
Fuchs Lubricants Co.	Sintofluid III MTA (H-36310)
Ginouves Georges SA	Ginouves York 886
Kuwait Petroleum	Q8 Auto 14 Synthetic Q8 Auto 15 ED
Leprince + Siveke GmbH, Herford	Leprinxol Multi Fluid S
LOTOS OIL	LOTOS ATF SUPER IIIIG
Maziva - Zagreb d.o.o.	INA ATF Ekstra
Mol Hungarian Oil and Gas Co.	Mol ATF Synt Mol ATF Synt 3H
Neste Lubricants Ltd.	ATF-S II (E-25112)
New Process AG	ATF Synth
OMV AG	OMV ATF-S
Optimum Oils Ltd	Optisyn ATF (E-25112)

Manufacturer	Product name
Pakelo Motor Oil S.r.L	Pakelo Auxon II E (G-34011) Pakelo V Liquid BLU S (G-34011)
Panolin AG	Panolin ATF Synth
Paz Lubricants & Chemicals	PAZ Power ATF
Petro Canada Lubricants	Petro-Canada Heavy Duty Synthetic Blend ATF
Rafineria Nafty Jedlicze S. A.	Hipol ATF II E
Ravensberger Schmierstoffvertrieb	Ravenol Dexron II E Ravenol Dexron III H
Repsol YPF Lubricantes y Especialidades, S.A.	Repsol Matic Sintetico Repsol Matic III
Shell International Petroleum Company	Shell Donax TV = Shell Spirax S6 ATF VM Shell Donax TX = Shell Spirax S4 ATF HDX Shell ATF XS
Slovnaft JS Co	Madit Automatic II E
SRS Schmierstoff Vertrieb GmbH	Wintershall ATF Dexron S
Statoil Lubricants	Statoil Syntomatic Statoil Transway S DX II Statoil Transway S DX III F
Suomen Petrooli Oy	Teboil Fluid ES-MAX (E25112)
TEDEX Productions Sp.z o.o.	Tedex ATF Synthetic
Total Lubrifiants S.A.	Elfmatic G2 SYN (E-25112) Finamatic S 6726 Gulf ATF Synthetic Total Fluide SYN FE Total Fluide XLD FE
Unil Deutschland GmbH, Bremen	Unil Matic S
Valvoline Int. Europe	Valvoline Synpower ATF
Veedol International Ltd.	Veedol ATF Unitrans Z

## 5.7 Coolant additives

For details and special information, see chapter 3 "Coolants"(→ Page 11)

Special arrangements presently in effect remain valid.

Important
Mixing of different coolant additives and supplementary additives is prohibited!
Important
Before changing from a corrosion-inhibiting antifreeze concentrate containing silicon to a silicon-free corrosion-inhibiting antifreeze concentrate, flush the coolant circuit with freshwater! Before changing from a silicon-free corrosion-inhibiting antifreeze concentrate to a corrosion-inhibiting antifreeze concentrate containing silicon, flush the coolant circuit with freshwater!

### Corrosion-inhibiting antifreeze concentrates (containing silicon)

Manufacturer	Brand name	Runtime Hours / Years	Comments
MTU Friedrichshafen GmbH	Coolant AH 100	- / 3	
Tognum America	Power Cool Universal	- / 3	
	Power Cool Off Highway	- / 3	
Aral AG	Aral Antifreeze Extra	- / 3	
BASF AG	Glysantin G 05	- / 3	
	Glysantin G 48	- / 3	
Castrol Ltd.	Castrol Antifreeze NF	- / 3	
	Castrol Radicool NF	- / 3	
Clariant GmbH	Genantin Super	- / 3	
Fuchs Petrolub AG	Fuchs Maintain Fricofin	- / 3	
Ginouves Georges S.A.	York 716	- / 3	
Krafft S.A.	Krafft Refrigerante ACU 2300	- / 3	
Maziva - Zagreb d.o.o.	INA Antifriz AI Super	- / 3	
MOL-LUB Ltd.	EVOX Extra G48 Antifreeze concentrate	- / 3	
The Valvoline Company	Zerex G 05	- / 3	
	Zerex G 48	- / 3	
Total	Glacelf MDX	- / 3	

### Corrosion-inhibiting antifreeze concentrates (silicon-free)

Manufacturer	Brand name	Runtime Hours / Years	Comments
Aral AG	Aral Antifreeze Silikatfrei	- / 3	
BASF AG	Glysantin G 30	- / 3	
CCI	L 415	- / 3	
CCI Manufacturing IL Corporation	C 521	- / 3	
Fuchs Petrolub AG	Maintain Fricofin G 12 Plus	- / 3	

TIM-ID: 000.003943 - 003

Manufacturer	Brand name	Runtime Hours / Years	Comments
Old World Industries	Final Charge Global Extended Life Coolant	- / 3	
The Valvoline Company	Zerex G 30	- / 3	

### Corrosion-inhibiting antifreezes: ready-mix

Manufacturer	Brand name	Runtime Hours / Years	Comments
Tognum America	Power Cool Off-Highway 50/50	- / 3	containing silicon
	Power Cool Universal 50/50	- / 3	containing silicon
Castrol Ltd.	Castrol Radicool NF Premix (45%)	- / 3	containing silicon
Old World Industries	Final Charge Global Extended Life Prediluted Coolant (50/50)	- / 3	silicon-free
The Valvoline Company	Zerex G05 50/50 Mix	- / 3	containing silicon
Total	Total CoolElf MDX -37	- / 3	containing silicon

# 6 Preservation / Depreservation

## 6.1 Preservation, re-preservation and de-preservation of PowerPacks®

### **Note**

For information on preservation, re-preservation and de-preservation of PowerPacks® refer to the Preservation and Re-preservation Specifications, MTU publication No. A001070/.. .

# 7 Flushing and Cleaning Specifications for Engine Coolant Circuits

## 7.1 General information

In the course of time, sludge deposits from aging coolant additives can accumulate in the coolant circuits. Reduced cooling capacity, clogged vent lines and drain points and dirty coolant level sight glasses can result.

Below-standard water quality or incorrect coolant preparation can also heavily contaminate the system.

If such conditions occur, the coolant circuit is to be flushed out with fresh water, repeatedly if necessary.

If these flushing sequences are insufficient or if the system is too heavily contaminated, the coolant circuit and all affected assemblies must be cleaned.

Only clean, fresh water (no river or sea water) must be used for flushing.

Only products approved by MTU or corresponding products (→ Page 32) at the specified concentrations may be used for cleaning. The specified cleaning procedure is to be complied with.

Immediately after flushing or cleaning, fill the coolant circuits with treated engine coolant as stipulated in these Fluids and Lubricants Specifications (→ Page 11). Otherwise there is a danger of corrosion!

### Important

Fluids and lubricants (e.g. treated engine coolant), used flushing water, cleaning agents and cleaning solutions can be hazardous materials. Certain regulations must be obeyed when handling, storing and disposing of these substances.

These regulations are contained in the manufacturer's instructions, statutory requirements and technical guidelines valid in the individual countries. Considerable differences can apply from country to country so that no generally valid statement on the applicable regulations for fluids and lubricants etc. can be made in this publication.

Users of the products named in these specifications are therefore obliged to inform themselves of the locally valid regulations. MTU accepts no responsibility whatsoever for improper or illegal use of the fluids and lubricants / cleaning agents which it has approved.

### Important

Scrap oil heat exchangers from engines with bearing or piston seizures or friction damage!

## Test equipment, auxiliary materials and fluids and lubricants

MTU test kit or electric pH value measuring instrument

- Freshwater
- Prepared engine coolant
- Superheated steam
- Compressed air

## 7.2 Approved cleaning agents

Manufacturer	Product name	Working concentration		Order no.
<b>For coolant systems:</b>				
Kluthe	Hakutex 111 <sup>1, 5)</sup>	2% by volume	Liquid	X00065751
	Decorrdal 20-1 <sup>8)</sup>	10% by volume	Liquid	<sup>7)</sup>
	Hakupur 50-706-3 <sup>4)</sup>	2% by volume	Liquid	X00055629
<b>For assemblies:</b>				
Henkel	Bonderite C-AK FD <sup>2)</sup>	1 to 10% by weight	Powder	<sup>7)</sup>
	Bonderite C-MC 11120 <sup>3)</sup>	2 to 10% by weight	Powder	<sup>7)</sup>
Kluthe	Hakutex 60 MTU	100% by volume	Liquid	X00070585 (25 kg)
<b>For coolant systems contaminated with bacteria, fungi or yeast (so-called system cleaners):</b>				
Schülke & Mayr GmbH	Grotan WS Plus <sup>5)</sup>	0.15% by volume	Liquid	X00065326 (10 kg)
	Grotanol SR2 <sup>6)</sup>	0.5% by volume	Liquid	X00069827 (10 kg)

Table 4:

<sup>1)</sup> For light lime deposits, light corrosion

<sup>2)</sup> For greasy lime deposits

<sup>3)</sup> Preferred for heavy lime deposits

<sup>4)</sup> Not suitable for galvanized surfaces

<sup>5)</sup> Bacteria contamination up to  $10^4$

<sup>6)</sup> Bacteria contamination up to  $> 10^4$ , contamination with fungi and yeast

<sup>7)</sup> Not stocked by MTU

<sup>8)</sup> With serious corrosion; not permitted for aluminum materials

### Important information

The technical data sheets and safety data sheets of the product must be observed!

The cleaning agents are available world-wide through the branches of the manufacturers or their trading partners.



## 7.3 Engine coolant circuits - Flushing

1. Drain engine coolant.
2. Measure pH-value of the fresh water using the MTU test kit or electric pH-value measuring device.
3. Fill coolant circuit with fresh water.

### Important information

Never pour cold water into a hot engine!

4. Preheat, start and run engine until warm.
5. Run engine for approx. 30 minutes at increased speed.
6. Take flush-water sample at engine-coolant-sample extraction cock.
7. Shut down engine.
8. Drain flush water.
9. Measure pH value of flush-water sample using the MTU test kit or electric pH value measuring device and compare with the pH value of the fresh water.
  - a) pH value difference  $< 1$ : Fill system with treated coolant and start engine.
  - b) pH value difference  $> 1$ : Fill system with fresh flush water and repeat flushing process.
  - c) If the pH value difference is still  $> 1$  after 4 to 5 flushing operations: The coolant circuit must be cleaned, see (→ Page 34). The assemblies may also have to be cleaned, see (→ Page 35).

### Important information

Refer to the engine operating instructions for additional information.

## 7.4 Engine coolant circuits – Cleaning

1. Mix cleaner to the specified concentration with freshwater. Use warm freshwater (45 °C) if the engine is warm.
2. Cleaning agents for coolant circuits are prepared in warm freshwater as a concentrated solution, see (→ Page 32).
3. In the case of powdered products, stir until the cleaning agent is completely dissolved and without sediment.
4. Pour solution together with freshwater into coolant circuit.
5. Start engine and run until warm.
6. Select temperature and duration of residence time according to the specifications of the technical data sheets of the manufacturer.
7. Shut down engine.
8. Drain off cleaning agents and flush the engine coolant circuit with fresh water.
9. Take flush-water sample at engine-coolant-sample extraction cock.
10. Measure pH value of flush-water sample using the MTU test kit or electric pH value measuring device and compare with the pH value of the freshwater.
  - a) pH value difference < 1: Fill system with treated coolant and start engine.
  - b) pH value difference > 1: Clean assemblies, see (→ Page 35).

### Important

Refer to the engine operating instructions for additional information.

## 7.5 Assemblies – Cleaning

1. Remove, disassemble and clean assemblies that are exposed to heavy sludge deposits e.g. expansion tanks, preheating units, heat exchangers (coolant cooler, oil heat-exchanger, charge-air cooler, charge-air preheater, fuel preheater etc.) and lower sections of pipework.
2. Before cleaning, examine degree of contamination on water sides.
3. If greasy lime deposits are found, first degrease the water side.
4. Deposits in charge-air coolers caused by oil mist can be removed using Kluthe Hakutex 60.
5. Remove hard lime deposits with a decalcifying product. In the event of stubborn lime deposits, if necessary a 10% inhibited hydrochloric acid solution may have to be used.
6. Dissolve deposits on and in heat-exchanger elements in a heated cleaning bath. Observe the manufacturer's specifications and use only approved detergents in the permissible concentration, see (→ Page 32)

### Important information

Deposits on the oil side can also be dissolved in a kerosene bath.  
The dwell time in the cleaning bath depends on the type and degree of contamination, as well as the temperature and activity of the bath.

7. Clean individual components such as housings, covers, pipes, sight glasses, heat-exchanger elements with superheated steam, a nylon brush (soft) and a powerful water jet.

### Important information

In order to avoid damage:  
Do not use hard or sharp-edged tools (steel brushes, scrapers, etc.) (oxide protective layer).  
Do not set the pressure of the water jet too high (may damage cooler fins, for example).

8. After cleaning, blow through the heat exchanger elements with low-pressure steam in the direction opposite to operational flow, rinse with clear water (until pH-value difference is  $< 1$ ) and blow dry with compressed or hot air.
9. Check that all components are in perfect condition, repair or replace as necessary.
10. Flush oil and engine coolant sides of heat-exchanger elements with corrosion-inhibiting oil. This step may be omitted if the heat exchanger is installed and taken into service immediately after cleaning.
11. After installing all assemblies, flush engine coolant circuit once, see (→ Page 33).
12. Check coolant system for leaks during initial operation of engine.

### Important information

For further information, see the Maintenance Manual for the engine in question.

## 7.6 Coolant circuits contaminated with bacteria, fungi or yeast

### **System cleaning**

The system cleaner must flow a sufficiently long time through the complete cooling system to ensure effective cleaning and disinfection.

Therefore, the predefined amount of the approved system cleaner must be added to the contaminated coolant in the system, see (→ Page 32). Use a circulating pump to provide continuous mixture flow through the coolant system for at least 24 hours or max. 48 hours.

### **Flushing**

When the coolant and system cleaner have been drained, the cooling circuit must be flushed with fresh water. Flushing must be carried out until no more contaminants are visible and the flushing liquid has the same pH-value as the fresh water used (max. pH-value difference < 1).

### **Refill**

Before refilling the circuit, make sure the system is free of contaminants.

Refill must be performed directly after flushing to avoid the risk of corrosion!

# 8 Appendix

## 8.1 Revision overview from version A001062/02 to A001062/03

### General

This publication is only applicable to Series 1800 PowerPacks®.

For information on the other MTU engine series and MTU-DD Series S60, please refer to the MTU Fluids and Lubricants Specifications, publication no. A001061/.. .

### Modifications

Seq. No.	Page	Subject	Action	Action
0	(→ Page 0 )	Copyright	Updated	New Corporate Design
1	(→ Page 4)	General	Revised	Table Important, New Corporate Design
2	(→ Page 6)	Lubricants	Revised	Table Important, New Corporate Design
3	(→ Page 11)	Coolant	Revised	Table Important, New Corporate Design
4	(→ Page 14)	Fuels	Revised	Table Important, New Corporate Design
5	(→ Page 18)	NOx reducing agent AUS 32 for SCR after-treatment systems	Revised	New version
6	(→ Page 28)	Coolant additives	Revised	New Corporate Design
7	(→ Page 30)	Preservation, re-preservation and de-preservation of PowerPacks®	Revised	New version
8	(→ Page 33)	Engine coolant circuits - Flushing	Revised	Chapter replaced
9	(→ Page 34)	Engine coolant circuits - Cleaning	Revised	Chapter replaced
10	(→ Page 35)	Assemblies - Cleaning	Revised	Chapter replaced
11	(→ Page 36)	Coolant circuits contaminated with bacteria, fungi or yeast	Revised	New version