

KD Serises Engines	Coolants and Lubricants Specifications	KOHLER®
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	DATE	MODIFICATIONS	WRITERS	VALIDATION
A	30/03/18	First Edition	E. Le Torc'h	/
A	16/04/18	Revision1: added lube oil approved list	E. Le Torc'h	/
A	04/06/18	Revision2: update this document at the same level than the reference: FluidsAndLubricants-KOspecifications-IND-I-04-2018rev3.docx of 04-06-2018	E. Le Torc'h	/
A	13/06/18	Revision3: add new lube oil on the approved engine oil list (chapter 1.1.5)	E. Le Torc'h	/
A	26/06/18	Revision4: corrected the table1 "oil category" chapter 1.1.1.2 => missing 15W40 lube oil for oil category2 and 2.1	E. Le Torc'h	/
B	19/04/19	Revision1: -Update of the chapter 1.1.1.2 Performance requirements of the quality categories. -Update of chapter 3.1 APPROVAL AND REGISTERING OF LUBRICANTS	E. Le Torc'h	/

This “Coolants and Lubricants Specifications” lists all of KOHLER requirements that a coolant and an engine lube oil needs to full fill for the proper functioning of KD series KOHLER engines. This document lists also all the required data that KOHLER needs to be able qualifying and determining if a coolant or an engine lube oil is suitable for our “Kohler KD Series engines”.

KD series engines:

[K135 engine family:](#)

KD SERIES - K135 RANGE



KD SERIES -K135 RANGE

50 Hz	60 Hz	Engine
800-1100 kVA	800-1000 kWe	KD27V12
1250-1500 kVA	1250-1350 kWe	KD36V16
1650-1800 kVA	1500-1750 kWe	KD45V20

Stand-By power ratings

[K175 engine family:](#)

KD SERIES - K175 RANGE



RATINGS KD62V12 KD83V16 KD103V20

KD SERIES -K175 RANGE

50 Hz	60 Hz	Engine
2000-2750 kVA	2000-2500 kWe	KD62V12
3100-3500 kVA	2800-3250 kWe	KD83V16
3800-4200 kVA	3500-4000 kWe	KD103V20*

Stand-By power ratings

* Coming soon

CHANGES TO THE SPECIFICATION

Only Kohler is authorized to modify this specification. All modifications must be accompanied by a change of Index no.

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1 LUBRICANTS

1.1 ENGINE LUBE OIL

1.1.1 REQUIREMENTS TO BE MEET BY ENGINE OIL

1.1.1.1 QUALITY LEVEL

The approved engine oils are divided into the following Quality Categories:

- **Oil category 1:** Lower quality / mineral based multigrade oils
- **Oil category 2:** Standard quality / Synthetic multigrade oils
- **Oil category 2.1:** Standard quality / Synthetic multigrade oils dedicated for engines with Exhaust aftertreatment system (low SAPS lube oils)
- **Oil category 3:** Highest quality / Synthetic Multigrade oils
- **Oil category 3.1:** Highest quality / Synthetic multigrade oils dedicated for engines with Exhaust aftertreatment system (low SAPS lube oils).

Low SAPS lube oils are dedicated for fuel which content < 15 mg/kg (15ppm) => lube oils with a low sulfur and phosphor content and an ash-forming additive content of $\leq 1\%$.

Do not use Lube oil category 2.1 and 3.1 with a sulfur rate over 15 mg/kg (15 ppm).

Note: Additional engine oil additives are not approved, if they are incorrectly matched with the engine oil they may cause damage.

1.1.1.2 Performance requirements of the Quality categories

Oil Category	Minimum Standards	Recommended viscosity classes		Base oil all have to be compliant to high power turbo charged engines	Factor according to oil category
		Engine Family K135	Engine Family K175		
Oil Category 1	ACEA E5-02 or API CH-4 or DHD-1	SAE 10W-30 SAE 10W-40 SAE 15W-40	Not allowed	Mineral based (Group 1 & 2 Base oils)	1/4
Oil Category 2	ACEA E4 or ACEA E7 or API CI-4 Plus or DHD-1 or JASO DH-1	SAE 5W-30 SAE 10W-30 SAE 10W-40 SAE 15W-40	SAE 5W-40 SAE 10W-40 SAE 15W-40*	Synthetic	1
Oil Category 2.1	ACEA E6 or ACEA E9 or API CJ-4 or JASO DH-2	SAE 5W-30 SAE 10W-30 SAE 10W-40 SAE 15W-40	SAE 5W-40 SAE 10W-40 SAE 15W-40*	Synthetic	1
Oil Category 3 (standard today)	ACEA E4-16 or both ACEA E4 and ACEA E7	SAE 0W-30 SAE 5W-30 SAE 5W-40 SAE 10W-40	SAE 5W-40 SAE 10W-40	Synthetic (Group 3 and/or 4), VI > 155, and long live additives	2
Oil Category 3.1 (standard today)	ACEA E6-12 or both ACEA E6 and ACEA E9 or API CK-4	SAE 0W-30 SAE 5W-30 SAE 5W-40 SAE 10W-40	SAE 5W-40 SAE 10W-40	Synthetic, VI > 155, and long live additives	2

(*) 15W40 possible to use only with engine water preheating system on K175 engine family.

Table 1: Oil category

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This is the minimum required characteristics for a Lube Oil Category 3.

Parameter	Unit	Value Engine oil without exhaust after treatment	Value Engine oil with exhaust after treatment	Method
Visual appearance		clear	clear	Visual
Viscosity at min. Temp.	mm2/s	3500	3500	DIN 51562
Viscosity at operation temp.	mm2/s	10.0– 14,8.0	10.0– 14,8.0	DIN 51562
VI-Index		> 145	> 155	i.A. DIN ISO 2909
Height Temp. High Shear	cP	3.5 – 4.3	3.5 – 4.3	CEC L-36-A-90
Ignition point	°C	> 220	> 220	DIN ISO 2592
Total base number	mg KOH/g	> 12	> 9	DIN ISO 3771
Shear stability	%	10%	10%	ASTM D6278
NOACK (1h at 250°C)	%	max 10%	max 10%	CEC-L-040-93
Ash (Sulphur) max.	g/100g	1.9	0.95	DIN 51575

Table 2: Characteristic requirements for new and aged oil

Note: the lube oil category 3 or 3.1 require a dedicated registration process which is included an official engine run tests with the lube oil that is trying to full fill the category 3 or 3.1 => this is a long and expensive process. Without these engine tests any lube oil with the highest quality will be downgraded to category 2 or 2.1.

1.1.1.3 Use of high sulphur diesel fuel

In any case of Sulfur ratio, it is always to ensure that the TBN (Total Base Number) is >8 mgKOH/g and the soot (SiO) is < 3%.

The following measures must be taken in the case of diesel fuels with a sulfur content above 0.5%:

The lube oil selection is done with a dedicated TBN according to the sulfur ratio (Table3).

-Use of an engine oil with a total base number (TBN) of more than 10 mgKOH/g in case of high sulphur rate (0,5 < sulfur ratio % <1).

-Shortening of oil drain intervals according to "chapter 1.1.3" and lube oil analysis confirmation.

Note: 0,5% of sulfur = 5000 ppm and 1% of sulfur = 10000 ppm

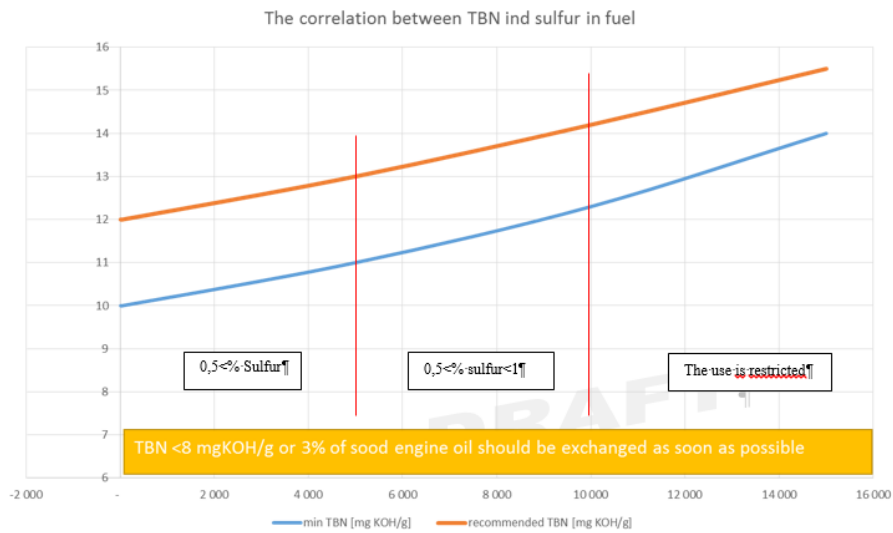


Table 3: TBN curves according to sulphur rate

1.1.2 VISCOSITY GRADE

Monograde lube oil is prohibited for “Project Liberté” engines.

Kohler recommends as mentioned on the chapter 1.1.1.2 the following viscosity grades: SAE 0W-30; 5W-30, 5W-40, 10W-30, 10W-40 and 15W-40 depending on the environmental conditions end the engine models.

Note:

- ✓ SAE 0W-30, 5W-30 and 10W-30 aren't authorized for K175 family.
- ✓ SAE 15W-40 is only authorized for K175 family with pre-heating at cold starts (means water cooling preheating engines).

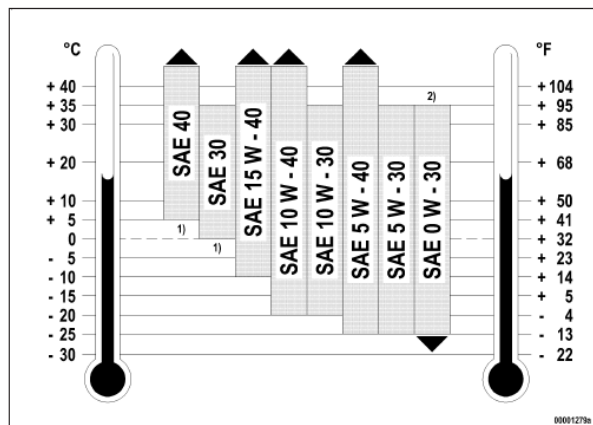


Table 4: Oil viscosity versus temperature

1.1.3 OIL CHANGE INTERVAL

The change intervals are defined as follows:

Basic oil change interval (1) * Factor sulfur content = Change Interval (to be applied on the field)

The basic change interval is defined on dedicated maintenance tables according to the Genset applications (ESP, PRP and COP) and to the engine injection calibration (EO or FO). (1) Taken from the maintenance schedule of the operating manual (OMM).

Note: If there are “difficulty factors” or difficult usage conditions, the oil change interval must be validated through lube oil analysis.

Difficulty factors can be: (Frequent cold starts; environmental influences; operating temperature; dust; high humidity; long standstill times)

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The factor "Sulfur content":

Sulfur content in %	factor "Sulfur content"
0 < sulfur rate < or = 0,5	1 => no change on the maintenance interval
0,5 < sulfur rate < or = 1 Limited to oil category 2 and 3	1/2 => reduced by one half the maintenance schedule interval.
1 < sulfur rate < or = 1,5 Limited to oil category 2 and 3	1/4 => reduced by 4 times the maintenance schedule interval The use of a Sulphur ratio over 1% requires an additional approval from the engine manufacturer to ensure that all the engine options, lube oil selected and maintenance schedule are compliant with this very high Sulphur rate. Specific lube oil need to be used => TBN is >12 mgKOH/g.

1.1.4 OPERATING MONITORING OF ENGINE OIL

In order to check the used oil, it is recommended that regular oil analyses be carried out. Oil samples should be taken and analysed at least once per year and during each oil change and under certain conditions, depending on application and the engine's operating conditions, sampling / analysis should take place more frequently. From the indicated test methods and limit values, it emerges when the result of a single oil sample analysis is to be viewed as abnormal.

KO recommend performing lube oil analysis of used engine lube oil for the following parameters (minimum list).

- Viscosity
- Flashpoint
- Soot
- TBN
- Water
- Oxidation
- Ethylene glycol
- Wear elements (Iron, Chromium, Tin, Aluminium, Nickel, Copper, Lead and Molybdenum)
- Contaminants (Silicon, Potassium, Sodium, Lithium, Antimony, Silver, Titanium, Vanadium, etc....).
- Additives (Calcium, Magnesium, Boron, Zinc, Phosphorus, Barium, Sulphur)
- Diesel fuel rate (dilution).

Example of lube oil analysis:



Example lube oil
analysis

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1.1.5 Approved engine oil

Here under you will find a selection of lube oils suitable for the KD Series engines. The lube oils are classified according 5 columns:

The 5 tables will contain:

- ✓ Brand name
- ✓ Designation
- ✓ SAE viscosity grade
- ✓ Quality specification level (ACEA and API)
- ✓ Kohler Category => important to determine the lube oil exchange interval

Note: the lube oil category 3 or 3.1 require a dedicated registration process which is included an official engine run tests with the lube oil that is trying to full fill the category 3 or 3.1 => this is a long and expensive process. Without these engine tests any lube oil with the highest quality will be downgraded to category 2 or 2.1.

Brands	Designation	SAE	API	ACEA	LH Cat. Proposal	Engine K135	Engine K175
Amsoil	Synthetic Diesel Engine Oil AM3024	5W40	CK-4/ CJ-4/ CI-4 plus	E9/E7	2.1	X	X
	Synthetic Diesel Engine Oil AM3034	5W40	CK-4/ CJ-4/ CI-4 plus	E9/E7	2.1	X	X
Chevron	DELO 400 Multigrade	15W40	CI-4 Plus	E7	2	X	X*
	Texaco URSA premium D	15W40	CI-4/CF	E7	2	X	X*
	DELO 400 LE Synthetic	5W40	CJ-4	E9	2.1	X	X
	Texaco URSA TDX	10W40	CI-4	E7/E4/	2	X	X
	DELO 400 LE Synthetic	5W30	CJ-4	E9/E7/E6	2.1	X	
Fuchs	Titan Truck plus	15W40	CI-4	E7	1	X	
	Titan Unimax Ultra MC	10W40	CI-4	E7	2	X	X
	Titan Cargo	10W30	CJ-4	E9	2.1	X	
	Titan Cargo MC	10W40	CI-4	E7/E4	2	X	X
	Titan Cargo Maxx	10W40	CI-4	E9/E7/E6	2.1	X	X
Gulf	Gulf Superfleet Supreme	15W40	CI-4	E7	1	X	
	Gulf Supreme Duty XLE	15W40	CJ-4	E9/E7	1	X	
	Gulf Superfleet XLD	10W40	CI-4	E7/E4	2	X	X
	Gulf Superfleet XLE	10W40	CI-4	E7/E6	2.1	X	X
KOHLER Genuine Oil	Synthetic Oil for Diesel-Fueled Generator (G-725)	5W40	CK-4/ CJ-4/ CI-4 plus	E9/E7	2.1	X	X

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Brands	Designation	SAE	API	ACEA	LH Cat. Proposal	Engine K135	Engine K175	
Kuwait (Q8)	Q8 T 800	10W40	CI-4/CF	E7	1	X		
	Q8 T 760	10W40	CJ-4/CF	E9	1	X		
	Q8 T 860	10W40	CI-4/CH-4	E7/E4	2	X	X	
	Q8 T 905	10W40	CI-4	E7/E6/E9	2.1	X	X	
	Q8 T 750	15W40	CI-4/CF	E7	1	X		
	Q8 Formula Truck 6800	10W40	CI-4/CH-4	E7/E4	2	X	X	
	Q8 Formula Truck 8500	10W40	CJ-4	E7/E6/E9	2.1	X	X	
Liebherr	Liebherr Motoroil 10W40	10W40	CF	E4	3	X	X	
	Liebherr Motoroil 10W40 low ash	10W40	CF-4, CG-4, CH-4, CI-4	E6/E7/E9	3.1	X	X	
	Liebherr Motoroil 5W30	5W30	CF	E4/E7	3	X		
	Liebherr Motoroil 5W30 low ash	5W30		E6/E7	3.1	X		
Mobil	Mobil Delvac XHP ESP 10W-40 => supersedes the Delvac XHP LE 10W-40	10W40	API CJ-4 ; CI-4 Plus ; CI-4	E9/E7/E6/E4	2.1 (due to field test experiences)	X	X	
SDMO	Genlub Evolution 15W40	15W40	CI-4	E7/E5	2	X	X*	
Shell	Rimula R4X	15w40	CI-4/CH-4	E5/E7	1	X		
	Rimula R5E	10W40	CI-4/CH-4	E5/E7	1	X		
	Rotella T5	15W40	CJ-4/CI-4 plus	E9/E7	1	X		
	Rotella T3	15W40	CJ-4/CI-4 plus	E9/E7	1	X		
	Rimula R5 M (high TBN)	10W40	CI-4/CH-4	E4	2	X	X	
	Rimula R4 L (high TBN)	15W40	CJ-4/CI-4 plus	E9/E7	2.1	X	X*	
	Rotella T5	10W30	CJ-4; SM	E9/E7	2.1	X		
	Rotella T Triple Protection	15W40	CJ-4/CI-4 plus	E9/E7	2.1	X	X*	
	Shell Rotella T5	10W40	CJ-4; SM	E9/E7	2.1	X	X	
	Rimula R6 M	10W40	CF	E7/E4	2.1	X	X	
	Rimula R6 LM	10W40	CI-4/CH-4	E7/E6	2.1	X	X	
	Total	Rubia Works 1000	15W40	CI-4	E7/E5	2	X	X*
		Rubia Works 4000	15W40	CK-4	E9/E7/E5	1	X	
Rubia Works 4000		10W40	CK-4	E9/E7	1	X		
Rubia Tir 8600		10W40	CF	E7/E4/E5	2	X	X	
Rubia Tir 9200 FE		5W30	CF	E7/E4/E5	2	X		
Rubia Works 3000		10W40	CJ-4	E9/E7/E6	2.1	X	X	
Rubia Works 3000 FE		5W30	CJ-4	E9/E7/E6/E4-99	2.1	X		
Rubia Works 2000 (no more produced in 2019)		10W40	CJ-4	E9/E7	2.1	X	X	
Rubia Works 2500 (no more produced in 2019)		10W40	CI-4	E9/E7/E6/E4-99	2.1	X	X	

(*) 15W40 possible to use only with engine water preheating system on K175 engine family.

Table 6: Engine lube oil summary table

2 COOLANTS

2.1 REQUIREMENT TO BE MET BY ENGINE COOLANT

KOHLER engines are tested and approved with SI-OAT-Technology based on Ethylene glycol. These are products that are based BASF Glysantin G40 coolants. It is also possible to use Hybrid technology formulated from BASF Glysantin.G48. The advantage of the G40 is that this coolant can be used 30% longer that G48.

Average change interval with Glysantin G48 = 6000 h or 4 years (to be validated by coolant analysis)

Average change interval with Glysantin G40 = 8000 h or 6 years (to be validated by coolant analysis).

- **Corrosion inhibiting antifreeze (ready mixed or concentrated)** => KOHLER recommend using in priority a ready mixed coolant in order to limit the risk when the operator is preparing the final coolant by mixing concentrate coolant and water. Corrosion inhibitor antifreeze ratio and the water quality are determinant factors
- **Corrosion inhibitors**
This technology of coolant is forbidden on KOHLER engines (KD27V12, KD36V16, KD45V20, KD62V12 and KD83V16) due to insufficient cavitation protection and lower boiling point limit.
- **Fresh water requirements**
Make sure that the water used meets the following requirements:
 - Fully de-ionized water should be used.
 - Corresponds to the 2006 WHO (World Health Organization) guideline for drinking water.

In case of no water analysis or if the end user cannot prove the water quality please switch to deionized water or reversed osmosis water.

Item	Minimum	Maximum
Water hardness		<2.14 mmol/l <12°dH
Ph-Value	6.7	9
Chloride (ions)		< 100 mg/l
Sulfate		< 100 mg/l
Bacteria and toxic constituents		Without
Impurities		Clear and free

Table 5: Example of specification for Fresh water requirements

Caution: If not adequate water is used in refills, it can lead to precipitation of antifreeze product and debris from the water in the circuit coming. A machine failure and expensive repairs are the consequence.

If the cooling circuit becomes dirty, impure water is used or it is mixed with another coolant, the cooling circuit must be replaced as soon as possible.

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2.2 PERMISSIBLE CONCENTRATION FOR ALL THE COOLANT TYPES

KOHLER propose a suitable range of concentration from **40 to 50%**

Note: KOHLER cooling packages are designed with coolant concentration 40%.

2.3 OPERATIONAL MONITORING OF COOLANTS

In order to check the used coolant, it is recommended that periodic coolant analyses be carried out. Coolant samples should be taken and analysed at least once per year and under certain conditions, depending on application and the engine's operating conditions, sampling / analysis should take place more frequently. From the indicated test methods and limit values, it emerges when the result of a single Coolant sample analysis is to be viewed as abnormal.

KOHLER recommends performing coolant analysis of used coolant for the following parameters (minimum list)

Product name				
Lab-No.				
General Information				
Date of sample				
Last fluid exchange				
Added fluid during use		l		
Hours of use		h		
Machinery operating hours		h		
Analyse	Method	Unit		
Optical apparence				
Elements Additives (Ca, Mg, Si, B, P, Ba, S, Na, K)	DIN 51399-1:2012-5	mg/kg		
Elements wear (Fe, Cr, Cu, Sn, Al, Ni, Pb, Mo, Mg, Ti, V)	DIN 51399-1:2012-5	mg/kg		
contamination (Si, Ca, Mg, Zn, Sn, Mo)	DIN 51399-1:2012-5	mg/kg		
Colour	Visual			
Glycol	DIN 51375-1, GC-Headspace, FTIR	%		
corrosion Cu	EN ISO 2160			
corrosion Stahl	ISO 7120			
Bacteria	Dipslide test MERK	count		
Water Hardness	EN ISO 11885	mmol/l		
Nitrate	EN 12014	mg/kg		
Nitrite	EN 12014	mg/kg		
ph-value	EN ISO 10523:2012-04			
Pour Point freezing point	ISO 3016, ASTM 5985	°C		
* compared to fresh fluid n.s. - not specified				

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2.4 FLUSHING AND CLEANING SPECIFICATIONS FOR ENGINE COOLANTS CIRCUITS

Cleaning Agents are not necessary. A mixture of fresh coolant with some biocides such as Grotan WS are suitable. The Following List of Chemicals for cleaning are also suitable, due to their biocidal character.

Example of approved cleaning agents:

Manufacturer	Product name	Concentration for use		Order no.
For coolant systems:				
Kluthe	Hakutex 111 ^{1, 8)}	2% by volume	Liquid	X00065751
	Hakupur 50-706-3 ⁸⁾	2% by volume	Liquid	X00055629
Nalco	Maxi Clean 2 ^{1, 8)}	2% by volume	Liquid	7)
For assemblies:				
Henkel	P3-FD ²⁾	3 to 5% by weight	Powder	7)
	Porodox ²⁾	5 to 10% by weight	Powder	7)
Kluthe	Hakutex 60	100% by volume	Liquid	X00056750 (25kg)
For coolant systems contaminated with bacteria, fungi or yeast (so-called system cleaners):				
Schülke & Mayr GmbH	Grotan WS Plus ⁵⁾	0.15% by volume	Liquid	X00065326 (10kg)
	Grotanol SR1 ⁶⁾	1% by volume	Liquid	X00057297 (10kg) X00057298 (200kg)
Troy Chemical Company	Troyshield SC1 ⁶⁾	1% by volume	Liquid	7)

Table 6: Approved cleaning agents examples

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3 Approval and Registering procedure

All suppliers have to get from KOHLER the approval of the coolants and lubricants proposed to use on KOHLER KD Series engines to keep the warranty and allow the best performance and the reliability of KOHLER engines. The Approval is given for 2 years maximum. The supplier has to renew the approval procedure to extend 2 more years.

Note: any change on the product will lead to cancel the approval:

- Commercial name
- Formular of the product
- Datasheet of the product
- etc..

3.1 APPROVAL AND REGISTERING OF LUBRICANTS.

The supplier has to full fill all lubricants specifications described in the “Coolants and Lubricants Specifications for KD Series Engines” document.

The oil supplier will have to provide to KOHLER the attached “KOHLER diesel engine lube oil registration form” and an official letter of content that clearly states the oil codes and additives, so we can request the additive information at the formulator. We also would need a 5 Litre sample as a reference for the case of warranties.

- ✓ The engine maker and partner of KOHLER expect to launch on Q4 2019 a new registration process. This process will include the study of file “Oil registration form” and all given documents. The process will lead to a registration fee to be paid. I case of need due to complementary investigations for KOHLER and our engine partner all necessary manpower and technical investigations to confirm an additive and the quality of the lube oil will lead to an additional cost:
 - additional administrative work
 - additional technical review
 - official engine test on test bench (mandatory for Cat3 or 3.1)
 - laboratory costs
 - -etc.
- ✓ Note: without official engine run test any lube oil cannot be registered as Cat3 or 3.1
- ✓ The supplier will provide:
 - The official letter.
 - KOHLER diesel engine lube oil registration form
 - Technical data sheet of the selected engine lube oil
 - Safety Data Sheet of the selected engine lube oil
 - Analysis of the selected engine lube oil (new sample)
 - 5 litre sample as a reference
- ✓ After receiving all the requested necessary files, KOHLER will review the data with its engine partner. If the selected engine lube oil is approved, KOHLER will update its internal approved engine lube oil list that we use to give advises to KOHLER dealers about suitable engine lube oil for KD Series engines. KOHLER will give to the supplier its statement about the selected engine lube oil by a letter.
- ✓ Oil registration form:



KOHLER-diesel-engi
ne-lube-oil-Registra


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3.2 APPROVAL AND REGISTERING OF COOLANTS.

The supplier has to full fill all coolant specifications described in the “Coolants and Lubricants Specification for KD Series engines” document. The Supplier will have to prove to KOHLER that the coolant selected by the supplier uses either BASF Glysantin G40 or G48 engine coolant concentrate formula to build its ready-mix coolant.

Note: Others SI-OAT engine coolant base aren’t homologated for the KOHLER KD series engines.

- ✓ The supplier will give an official letter to explain and prove that the selected coolant is made from BASF Glysantin G48 or G40 engine coolant concentrates.
- ✓ The supplier will provide:
 - The official letter.
 - Technical data sheet of the selected coolant
 - Safety Data Sheet of the selected coolant
 - Analysis of the selected coolant (new sample)
- ✓ After receiving all the requested necessary files, KOHLER will review the data with its engine partner. If the selected coolant is approved, KOHLER will update its internal approved coolant list that we use to give advises to KOHLER dealers about suitable coolants for KD Series engines. KOHLER will give to the supplier its statement about the selected coolant.
- ✓ BASF Glysantin engine coolant concentrates => approved products:

Glysantin G40	Glysantin G48
 BASF Glysantin G40	