## NUFLUX

# NUFLUX<sup>™</sup> technology: Blend procedure and guidelines





1

## NUFLUX<sup>™</sup> technology: Blend procedure and guidelines

### **BEFORE YOU BEGIN**

Review Evonik's Oil Additives "Storage and Handling Brochure," which establishes guidelines for the proper storing and dispensing of VISCOBASE<sup>®</sup> and VISCOPLEX<sup>®</sup> products.

Review safety documentation. If you do not have safety data sheets, please contact us:

Telephone No.	+1-215-706-0843
Toll Free No.	+1-888-876-4629
Regulatory Specialist	+1-215-706-5800
Or for emergencies;	
Or for emergencies; CHEMTREC	1-800-424-9300

At a minimum, we recommend that employees wear appropriate personal protective equipment (PPE), including lab coat, gloves, safety glasses, and safety shoes when blending industrial gear oils based on NUFLUX<sup>™</sup> technology. Additional PPE may be required during the handling of hot materials.

Follow proper kettle cleaning procedures to eliminate/minimize product contamination. If the kettle has an available lid, it should be in place during the filtration operation (Step 9 in this procedure) and should also be in place during the transfer of filtered material to the drums (Step 13 in this procedure).



### **BLEND PROCEDURE (A) USING HIGH-SHEAR MIXERS**

1	Transfer the desired amount of NEXBASE® 3080 base oil to the kettle	
2	Begin agitation and heat to a temperature of 60°C (140°F)	
3	Transfer the desired amount of VISCOBASE® 5-220 to the blend kettle	Preheat VISCOBASE <sup>®</sup> 5-220 to a minimum temperature of 45°C (113°F) and a maximum of 80°C (176°F). The target is 60°C (140°F). At this temperature the product viscosity is low enough for transfer. See "product handling" section for more information on viscosity temperature profile.
4	Continue agitation and watch for high torque and/or motor overheating	The viscosity will increase quickly once the VISCOBASE® is added.
5	Transfer the desired amount of VISCOPLEX® 1-180 to the blend kettle	Preheat VISCOPLEX® 1-180 to a minimum temperature of 45°C (113°F) and a maximum of 80°C (176°F). The target is 60°C (140°F). See product handling section for more information on viscosity temperature profile.
6	Transfer the desired amount of HiTEC <sup>®</sup> 307, Afton's industrial gear oil additive package, to the blend kettle	If desired, HiTEC <sup>®</sup> 307 can also be preheated. Afton recommends a maximum handling temperature of 65°C (150°F). Contact Afton for additional details.
7	Maintain a blend temperature of 60°C for 2 hours	
8	Test the sample for kinematic viscosity at 40°C	Viscosity should be within 10% of viscosity grade reported target.
9	Filter the blend such that an ISO cleanliness of at least X/15/12 is achieved (A 3-micron beta 1000 filter has been useful for meeting this ISO cleanliness requirement. Your situation may vary.)	If possible, we recommend to preheat the filter unit to 60°C (140°F) and/or make sure the blend is at 60°C.
10	Remove an appropriate amount of the blend as a sampling for incorporation of the defoamer	Typically (5 to 20 liters) 1-5 gallons. Be careful to not introduce contamination at this point.
11	Add the desired amount of VISCOPLEX® 14-520 defoamer to the sampling taken from the blend kettle and agitate vigorously	

### **BLEND PROCEDURE (A) USING HIGH-SHEAR MIXERS CONTINUED...**

- **12** Return the sampling, now containing defoamer, to the blend kettle and maintain agitation at a blend temperature of 60°C for an additional hour (60 minutes).
- **13** Transfer the blend from the kettle to clean, particulate-free, epoxy-lined steel drums. Ensure that appropriate measures are taken to avoid particulate contamination during transfer.
- 14 Conduct additional testing, as described in the "Product Performance" section

### **BLEND PROCEDURE (B) USING FILTRATION CARTRIDGE**

1	Add all components (including defoamer) to the kettle
2	Heat to 50°C and begin mixing with paddle/prop impeller agitation
3	Mix for 2 hours or until desired viscosity is reached
4	Recirculate the entire batch through filtration equipment for at least four (4) full turnovers.
5	Transfer to clean drums

\*This filtration cartridge equipment can be used to re-incorporate the defoamer in aged gear oil samples.

Pre-cleaned drums are available.

The duration of this filtration will vary depending on the equipment and filters used. Please contact your filter supplier for additional support.

### **PRODUCT PERFORMANCE: TYPICAL DATA OF NUFLUX™ GEAR OIL**

Contact your Evonik representative for additional information.

Property	Method	NUFLUX™ ISO VG 320
Kinematic viscosity @ 40°C	ASTM D445	320 cSt
Kinematic viscosity @ 100°C	ASTM D445	37 cSt
Viscosity Index	ASTM D2270	165
Density @ 15°C	ASTM D4052	0.89 g/cm³
Flash Point, COC	ASTM D92	> 220°C
Pour Point	ASTM D97	-36°C
Elemental analysis	ASTM D5185	Report



## PHYSICAL PROPERTIES

OF BLEND COMP	PONENTS			
VISCOBASE <sup>®</sup> 5-220				VISCOPLEX <sup>®</sup> 14-520
Temperature, °C	Temperature, °F	Density, g/cm³	Density, Ibs/gal	Density @ 15°C = 0.93 g/cm <sup>3</sup>
40	104	0.924	7.715	Kinematic viscosity @ 40°C = 17.5 cSt
60	140	0.912	7.610	
80	176	0.899	7.506	
100	212	0.887	7.402	
	•		-	
Temperature, °C	Temperature, °F	Kinemati	c viscosity, cSt	
40	104		12000	
60	140		3290	
80	176		1150	
100	212		480	
VISCOPLEX <sup>®</sup> 1-180				
Temperature, °C	Temperature, °F	Density, g/cm³	Density, Ibs/gal	
40	104	0.894	7.46	
60	140	0.882	7.35	
80	176	0.869	7.25	
100	212	0.856	7.14	
	<b>.</b> .			
Temperature, °C	Temperature, °F	Kinematic viscosity, cSt		
40	104		3400	
		1325		
60	140		1323	
60 80	140 176		603	

	ONENTS			
VISCOBASE <sup>®</sup> 5-220				VISCOPLEX <sup>®</sup> 14-520
Temperature, °C	Temperature, °F	Density, g/cm³	Density, Ibs/gal	Density @ 15°C = 0.93 g/cm <sup>3</sup>
40	104	0.924	7.715	Kinematic viscosity @ 40°C = 17.5 cSt
60	140	0.912	7.610	
80	176	0.899	7.506	
100	212	0.887	7.402	
Temperature, °C	Temperature, °F	Kinemati	c viscosity, cSt	
40	104		12000	
60	140		3290	
80	176		1150	
100	212	480		
		:		
VISCOPLEX <sup>®</sup> 1-180		:		
VISCOPLEX® 1-180		:	:	
VISCOPLEX° 1-180 Temperature, °C	Temperature, °F	Density, g/cm³	Density, Ibs/gal	
VISCOPLEX° 1-180 Temperature, °C 40	Temperature, °F 104	Density, g/cm <sup>3</sup> 0.894	Density, Ibs/gal 7.46	
VISCOPLEX* 1-180 Temperature, °C 40 60	<b>Temperature,</b> ° <b>F</b> 104 140	Density, g/cm <sup>3</sup> 0.894 0.882	Density, Ibs/gal 7.46 7.35	
VISCOPLEX* 1-180 Temperature, °C 40 60 80	Temperature,           °F           104           140           176	Density, g/cm <sup>3</sup> 0.894 0.882 0.869	Density, Ibs/gal 7.46 7.35 7.25	
VISCOPLEX* 1-180 Temperature, °C 40 60 80 100	Temperature,         °F           104         140           176         212	Density, g/cm <sup>3</sup> 0.894 0.882 0.869 0.856	Density, Ibs/gal 7.46 7.35 7.25 7.14	
VISCOPLEX* 1-180 Temperature, °C 40 60 80 100	Temperature,         °F         104         140         176         212	Density, g/cm <sup>3</sup> 0.894 0.882 0.869 0.856	Density, Ibs/gal 7.46 7.35 7.25 7.14	
VISCOPLEX* 1-180 Temperature, °C 40 60 80 100 Temperature, °C	Temperature,         °F         104         140         176         212         Temperature,         °F	Density, g/cm <sup>3</sup> 0.894 0.882 0.869 0.856 Kinemati	Density, Ibs/gal 7.46 7.35 7.25 7.14 c viscosity, cSt	
VISCOPLEX° 1-180 Temperature, °C 40 60 80 100 Temperature, °C 40	Temperature,         °F         104         140         140         212         Temperature,         °F         104	Density, g/cm <sup>3</sup> 0.894 0.882 0.869 0.856 Kinemati	Density, Ibs/gal 7.46 7.35 7.25 7.14 c viscosity, cSt 3400	
VISCOPLEX° 1-180 Temperature, °C 40 60 80 100 Temperature, °C 40 60 60	Temperature,       °F         104         104         140         176         212         Temperature,         °F         104         176         176         176         176         176         176         176         176         176         176         176         176         104         140	Density, g/cm <sup>3</sup> 0.894 0.882 0.869 0.856 Kinemati	Density, Ibs/gal 7.46 7.35 7.25 7.14 c viscosity, cSt 3400 1325	
VISCOPLEX* 1-180 Temperature, °C 40 60 80 100 Temperature, °C 40 60 80	Temperature,         °F         104         140         140         212         Temperature,         °F         104         176         212         Temperature,         °F         104         176         176         176	Density, g/cm <sup>3</sup> 0.894 0.882 0.869 0.856 Kinemati	Density, Ibs/gal 7.46 7.35 7.25 7.14 c viscosity, cSt 3400 1325 603	

ISCOBASE <sup>®</sup> 5-220				
				VISCOPLEX <sup>®</sup> 14-520
Temperature, °C	Temperature, °F	Density, g/cm³	Density, Ibs/gal	Density @ 15°C = 0.93 g/cm <sup>3</sup>
40	104	0.924	7.715	Kinematic viscosity @ 40°C = 17.5 cSt
60	140	0.912	7.610	
80	176	0.899	7.506	
100	212	0.887	7.402	
Temperature, °C	Temperature, °F	Kinemati	c viscosity, cSt	
40	104		12000	
60	140		3290	
80	176		1150	
100	212		480	
/ISCOPLEX® 1-180				
Temperature, °C	Temperature, °F	Density, g/cm³	Density, Ibs/gal	
Temperature, °C 40	Temperature, °F 104	Density, g/cm <sup>3</sup> 0.894	Density, Ibs/gal 7.46	
Temperature,           °C           40           60	Temperature,         °F           104         140	Density, g/cm <sup>3</sup> 0.894 0.882	Density, Ibs/gal 7.46 7.35	
Temperature,           °C           40           60           80	Temperature,         °F           104         140           176         176	Density, g/cm <sup>3</sup> 0.894 0.882 0.869	Density, Ibs/gal 7.46 7.35 7.25	
Temperature,           °C           40           60           80           100	Temperature,         °F           104         140           176         212	Density, g/cm <sup>3</sup> 0.894 0.882 0.869 0.856	Density, Ibs/gal 7.46 7.35 7.25 7.14	
Temperature,         °C           40         60           80         100	Temperature,         °F           104         140           176         212	Density, g/cm <sup>3</sup> 0.894 0.882 0.869 0.856	Density, Ibs/gal 7.46 7.35 7.25 7.14	
Temperature,         °C           40         60           80         100           Temperature,         °C	Temperature,         °F           104         104           140         140           176         212           Temperature, °F         °F	Density, g/cm <sup>3</sup> 0.894 0.882 0.869 0.856 Kinemati	Density, Ibs/gal 7.46 7.35 7.25 7.14 c viscosity, cSt	
Temperature,         °C           40         60           80         100           Temperature,         °C           40         40	Temperature,         °F         104         140         140         212         Temperature,         °F         104	Density, g/cm <sup>3</sup> 0.894 0.882 0.869 0.856 Kinemati	Density, Ibs/gal 7.46 7.35 7.25 7.14 c viscosity, cSt 3400	
Temperature,         °C           40         60           80         100           Temperature,         °C           40         60	Temperature,         °F         104         140         140         212         Temperature,         °F         104         140         140         140         140         140         140         140         140         140         140	Density, g/cm <sup>3</sup> 0.894 0.882 0.869 0.856 Kinemati	Density, lbs/gal 7.46 7.35 7.25 7.14 c viscosity, cSt 3400 1325	
Temperature,         °C           40         60           80         100           Temperature,         °C           40         60           80         80	Temperature,         °F         104         140         140         212         Temperature,         °F         104         176         104         176         104         104         104         104         104         176	Density, g/cm <sup>3</sup> 0.894 0.882 0.869 0.856 Kinemati	Density, Ibs/gal 7.46 7.35 7.25 7.14 c viscosity, cSt 3400 1325 603	

OF BLEND COMP	ONENTS			
VISCOBASE <sup>®</sup> 5-220				VISCOPLEX <sup>®</sup> 14-520
Temperature, °C	Temperature, °F	Density, g/cm³	Density, Ibs/gal	Density @ 15°C = 0.93 g/cm <sup>3</sup>
40	104	0.924	7.715	Kinematic viscosity @ 40°C = 17.5 cSt
60	140	0.912	7.610	
80	176	0.899	7.506	
100	212	0.887	7.402	
Temperature, °C	Temperature, °F	Kinemati	c viscosity, cSt	
40	104		12000	
60	140		3290	
80	176		1150	
100	212		480	
		:	:	
Temperature, °C	Temperature, °F	Density, g/cm³	Density, Ibs/gal	
40	104	0.894	7.46	
60	140	0.882	7.35	
80	176	0.869	7.25	
100	212	0.856	7.14	
Temperature, °C	Temperature, °F	Kinematic viscosity, cSt		
40	104		3400	
60	140		1325	
	17/	603		
80	176		603	

This information and all further technical advice is based on our present knowledge and experience. However, it implies no liability or other legal responsibility on our part, including with regard to existing third party intellectual property rights, especially patent rights. In particular, no warranty, whether express or implied, or guarantee of product properties in the legal sense is intended or implied. We reserve the right to make any changes according to technological progress or further developments. The customer is not released from the obligation to conduct careful inspection and testing of incoming goods. Performance of the product described herein should be verified by testing, which should be carried out only by qualified experts and is the sole responsibility of the customer. Reference to trade names used by other companies is neither a recommendation, nor does it imply that similar products could not be used.

VISCOBASE<sup>®</sup>, VISCOPLEX<sup>®</sup> and NUFLUX<sup>™</sup> are registered trademarks of Evonik Resource Efficiency GmbH. HiTEC<sup>®</sup> is a trademark of Afton Chemical Corporation. NEXBASE<sup>®</sup> is a registered trademark of Neste Corporation. ©10/2017 EVONIK INDUSTRIES AG – v3

EUROPE, AFRICA, MIDEAST Evonik Resource Efficiency GmbH Kirschenallee 64293 Darmstadt Germany

phone +49 6151-1809 fax +49 6151 18-4100

oil-additives@evonik.com www.evonik.com/oil-additives

### AMERICAS

Evonik Oil Additives USA, Inc. 723 Electronic Drive Horsham, PA 19044-4050 USA

PHONE +1 215 706-5800 FAX +1 215 706-5801 TOLL-FREE +1 888 876-4629

### ASIA PACIFIC

Evonik Oil Additives Asia Pacific Pte. Ltd. 3 International Business Park 07-18 Nordic European Centre Singapore 609927

PHONE +65 6809-6666 FAX +65 6809-6707

