

Technical Service Bulletin

Date: April 19, 2007

Product Description: AMSOIL Formula 4-Stroke® Marine Oil 10W-40 (WCF)

Subject: SEA-DOO® supercharged personal watercraft (PWC) and sport boats

OBJECTIVE:

Document compatibility of AMSOIL Formula 4-Stroke Marine Oil 10W-40 (product code WCF) for use in personal watercraft (PWC) and sport boats equipped with wet-clutch protected superchargers.

ISSUES:

The recommendation of SEA-DOO to avoid use of synthetic lubricants in supercharged clutch drive mechanisms on 2004-2007 215 hp SEA-DOO 4-TEC™ series engines used in SEA-DOO personal watercraft (PWC) and sport boats.

TECHNICAL DISCUSSION:

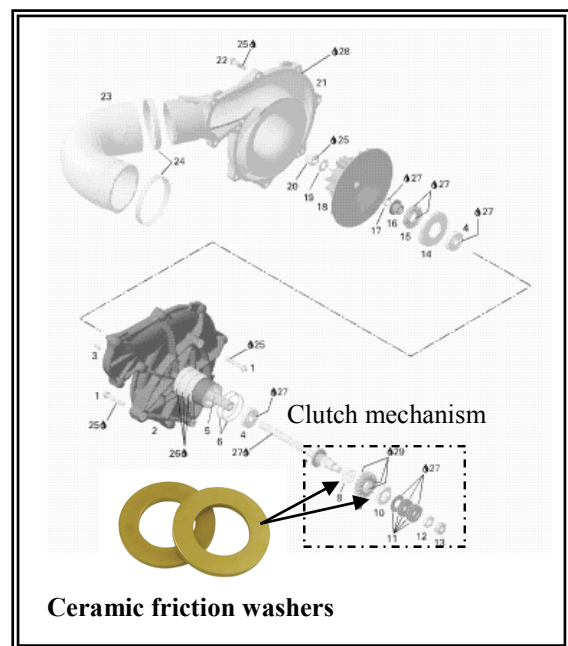
SEA-DOO introduced several PWC and sport boat models equipped with 4-TEC supercharged engines in 2004. A frictional clutch device is incorporated within the engine to provide protection to the supercharger. This clutch consists of two spring-loaded ceramic friction washers which transfer rotation from the engine drive gear to the supercharger drive shaft. The clutch and surrounding support bearings are lubricated with engine oil via oil immersion.

Questions have arisen about the suitability of using certain engine oils in a frictional clutch operation due to competing properties required for a clutch mechanism and a 4-stroke combustion engine. As a result, SEA-DOO cautions owners to select the right engine oil to balance those properties.

SEA-DOO operating manuals and service bulletin #2004-1 dated October 23, 2003 both state, "oils containing friction modifiers should be avoided as their use may result in excessive slippage of the supercharger clutch. This excessive slippage could result in accelerated wear and a significant reduction in clutch life." More critical, as the ceramic friction washers wear, they become more susceptible to fracturing. Should one fracture and shatter,

extensive damage to the supercharger assembly would likely occur. The manuals and bulletin further state that a similar situation could occur if non-mineral-based oils such as SEA-DOO XP-S™ Synthetic 10W-40 (#293-600-039) are used, and SEA-DOO recommends not using any synthetic oil in supercharger-equipped engines. SEA-DOO only recommends mineral-based XP-S 10W-40 (#219-700-346) for this application.

Typical supercharger component break-down



AMSOIL investigated potential concerns about operational performance through testing focused specifically on the wet-clutch frictional properties of the previously mentioned SEA-DOO 4-stroke crankcase lubricants and AMSOIL (WCF).

The test regime utilized was an SAE No.2 universal wet friction test machine operated in accordance with protocol outlined in JASO standard T903:2006 subsection T904:2006. Dynamic friction, static friction and stop time are outlined as the critical criteria for predicting wet-clutch performance.

Submitted By: D.R.A. Reviewed By: D.P. Approval By: A.A. Date: May 11, 2007

Distribution: ___ Internal X All

Page 1 of 2



Technical Service Bulletin

Date: April 19, 2007

Product Description: **AMSOIL Formula 4-Stroke Marine Oil 10W-40 (WCF)**

Subject: **SEA-DOO supercharged personal watercraft (PWC) and sport boats**

The competitive test results for the lubricants are summarized in the table below. Each individual test result was compared with the frictional categories listed within subsection T904 of JASO T903:2006, and summary results were developed based on four frictional categories: MB, MA, MA1 and MA2. Within the standard, category MB represents lubricants with relative higher tendency for slippage in an oil-immersed frictional clutch operation, while category MA2 represents lower relative susceptibility to clutch slippage.

T904 frictional categories and test results

		Slippage Tendency			
		High			Low
JASO T 904:2006 Category		MB	MA	MA1	MA2
Products				XP-S, 10W-40 mineral oil (# 219-700-346)	AMSOIL Formula 4-Stroke Marine Oil, 10W-40, (WCF)
			XP-S, 5W-40 synthetic oil (# 293-600-039)		

The SEA-DOO 4-stroke mineral-based XP-S 10W-40 oil (#219-700-348) recommended by SEA-DOO specifically for this application qualified as a JASO category MA1 product. SEA-DOO 4-stroke synthetic-based XP-S 5W-40 oil (#293-600-039) results showed less resistance to slippage and qualified one category lower at JASO MA. These test results support the position of SEA-DOO to disqualify its own synthetic engine oil for this wet-clutch application.

AMSOIL Formula 4-Stroke Marine Oil (WCF) test results show a full category improvement over SEA-DOO 4-stroke mineral-based XP-S 10W-40 oil (#219-700-348) and a two category improvement over SEA-DOO 4-stroke synthetic-based XP-S 5W-40 oil (#293-600-039). AMSOIL Formula 4-Stroke Marine Oil (WCF) has even better wet-clutch properties than the

mineral-based product recommended by SEA-DOO. Blanket conclusions based on generic categories of lubricants like “synthetic-based” should not be made and are often used as tactics to cause customers to purchase the OEM-branded fluid.

RECOMMENDATION:

AMSOIL confidently recommends owner/operators use AMSOIL Formula 4-Stroke Marine Oil (WCF) for 2004-2007 215 hp SEA-DOO 4-TEC series engines without concern for the clutch slipping or wear-caused damage suggested by SEA-DOO.

AMSOIL Formula 4-Stroke Marine Oil (WCF) does not contain friction modifiers and demonstrates better slippage resistance than SEA-DOO 4-stroke mineral-based XP-S 10W-40 oil (219-700-348) in the SAE No. 2 friction test. It delivers excellent wet-clutch performance in 2004-2007 215 hp SEA-DOO 4-TEC series engines used in SEA-DOO personal watercraft (PWC) and sport boats.

REFERENCES:

1. SEA-DOO watercraft service bulletin # 2004-1 dated October 23, 2003.
2. 2007 SEA-DOO operator’s guide, 4-TEC series, #219-000-474.
3. JASO standard T903:2006 sub text T904:2006.
4. SAE No. 2 Universal wet frictional test machine.

Submitted By: D.R.A. Reviewed By: D.P. Approval By: A.A. Date: May 11, 2007

Distribution: ___ Internal X All