

## Comparison of oil types regarding air release and foam-ing in dry case operation

### Part Two

#### 4 Comparison of the oils in dry case operation

Utilizing the dry case operation as an example for an application with very high re-quirements for the air release capability two different oil types were compared. For the comparison a standard mineral oil, in this case Shell Tellus S2M46, and an optimized synthetic oil, Shell Tellus S4ME46, were chosen. The oils were compared on the drive-line test stand used for the efficiency measurements (s. Figure 3). Thus the layout of the hydraulic circuit (s. Figure 2) and the overall system setup were very similar to a real world application. First some characteristics of the oils will be given. Second the test equipment and procedure as well as the results are described.

#### 4.1 Characteristics of the chosen oil types

Shell Tellus S2M is a zinc-based mineral oil, whereas Tellus S4ME is a zinc-free and ashless synthetic oil with higher efficiency, wear protection, life-time and air release capability. Table 2 summarizes the basic oil properties of the chosen oil types.

Table 2. Physical characteristics of Tellus S2M46 and Tellus S4ME46.

Property	Method	Tellus S2M46	Tellus S4ME46
Viscosity grade	ISO 3448	46	46
Fluid type	DIN 51502 ISO 6743-4	HLP HM	HLP HM
Kinematic viscosity	DIN 51562-1		
at 0°C	mm <sup>2</sup> /s	580	450
at 40°C	mm <sup>2</sup> /s	46	46
at 100°C	mm <sup>2</sup> /s	6,9	7,7
Viscosity index	ISO 2909	98	135
Density at 15°C	kg/m <sup>3</sup>	879	832
Flash point (COC) °C	ISO 2592	230	250
Pour point °C	ISO 3016	-30	-51

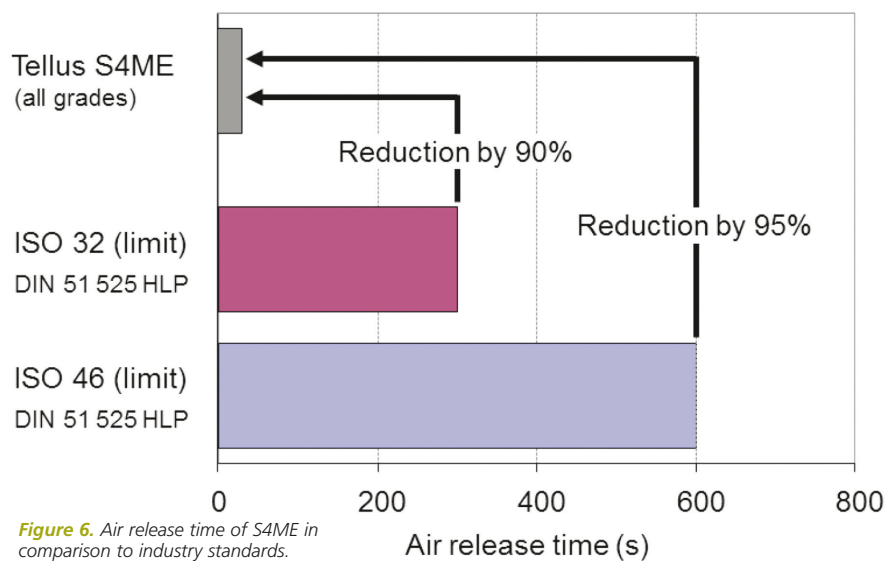


Figure 6. Air release time of S4ME in comparison to industry standards.

Figure 6 shows the air release time of S4ME in comparison to industry standards un-der laboratory conditions. It can be seen, that the time required for air release is re-duced significantly for all viscosity grades. Hence for the dry case operation under real-istic conditions a better air release behaviour can be assumed.

#### 4.2 Test equipment

For the observation and documentation of the oil quality, i.e. the air content of free air, the system was equipped with facilities such as sighting tubes and transparent panes at the tank (s. Figure 7).

The tank was equipped with transparent side panes at the upper side (1) and at the front side (2) where the inlet and the suction pipe were placed. Therefore the oil condi-tion could be observed directly after entering the tank and before leaving the tank through the suction pipe. Four sighting tubes were mounted in the system: in the return pipe from the motor (3), at the outlet of the tank (4), in the return pipe of the cooler (5) and in the suction pipe of the pump (6). The condition of the oil leaving the tank could be observed at (4). At (6) the oil stream that entered the pump could be observed. This oil stream was a mixture of the oil coming from the tank and the returning oil from the cooler which was generally less foamed.