

## Rheometers

Sentmanat extensional rheometer  
(SER) for HAAKE MARS Rheometers

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## Keywords

HAAKE MARS Rheometers, controlled temperature chamber (CTC), TM-CR-O450 temperature chamber, extensional rheology, solid tensile testing

The SER3 fixture is available for Thermo Scientific™ HAAKE™ MARS™ Rheometers in combination with a suitable temperature chamber (CTC) for HAAKE MARS 40 & 60 Rheometers or TM-CR-O450 for HAAKE MARS iQ Rheometers. This fixture transforms the (rotational) shear rheometer into an extensional rheometer for films and fibers (Figure 1). For technical specifications, please see Table 1.

The measuring principle of the SER3 fixture, developed by Dr. Martin Sentmanat of Xpansion Instruments, is based on two counter rotating windup drums, which are applying an extensional deformation to an attached specimen.

With the SER3 fixture, a uniform uniaxial extensional deformation of the sample is achieved. For sample specifications, please see Table 2. In addition to the measurement of the apparent (transient) extensional viscosity, the SER3 fixture can be used for solids tensile testing, tear, and peel testing, as well as friction testing.



Figure 1:  
SER3 tool with TM-CR-O450 temperature chamber for HAAKE MARS iQ Series.

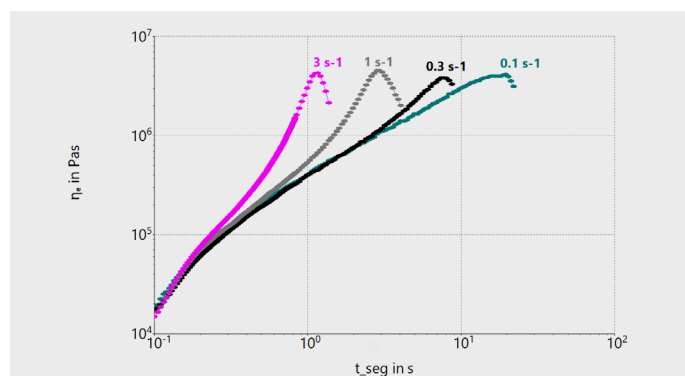
The two drums are removable for easy cleaning or exchange. Different drums are available on request. The operating temperatures of the SER3 fixture covers a range from 0 °C to 315 °C. The combination of convection and radiation heating in the CTC or TM-CR-O450 temperature chambers enables fast temperature changes and guarantees an even temperature distribution around the sample. During sample loading the CTC can be moved into a closed parking position, where the test temperature is maintained.<sup>1</sup> The half-shells of the TM-CR-O450 can be opened in a wide angle (> 90°) for easy accessibility and convenient sample loading.<sup>2</sup> The SER3 fixture is fully integrated in the HAAKE RheoWin™ Measuring and Evaluation Software.

Max. recommended Hencky strain rate	20 s <sup>-1</sup>
Max. Hencky strain per drum revolution	4
Operating temperature	0 °C – 315 °C
Wind-up drum diameter	10.31 mm
Stretch zone gage length	12.72 mm

Table 1: SER3 fixture specifications.

Measurements can be made in both, controlled extensional rate, and controlled tensile stress mode. The extensional properties of the sample are calculated automatically and presented directly in the software.

Figure 2 shows the results of measurements on a High Impact Polystyrene (HIPS) performed with a HAAKE MARS iQ Air Rheometer and the SER3 fixture. All tests were performed at 150 °C. Depending on the extensional strain rate, strain hardening occurs at different times.



**Figure 2: Apparent extensional viscosity as a function of time for HIPS measured at 150 °C at different extensional strain rates.**

Min. shear viscosity in extension mode	10,000 Pas
Sample mass	5 mg – 200 mg
Recommended sample width	1 mm – 12.7 mm
Recommended sample thickness	0.05 mm – 1 mm

**Table 2: Sample specifications.**

### References

1. C. Küchenmeister-Lehrheuer, F. Meyer, Controlled Test Chamber (CTC) for HAAKE MARS Rheometers, Thermo Fisher Scientific Product information P057
2. C. Küchenmeister-Lehrheuer, F. Meyer, Temperature chamber for HAAKE MARS iQ Rheometer series, Thermo Fisher Scientific Data Sheet D038

### Ordering information

Description	Cat. No
<b>For HAAKE MARS iQ Rheometer Series</b>	
SER3 including adapter with “Connect Assist” for HAAKE MARS iQ Rheometer Series with temperature chamber TM-CR-O450	222-2418
Universal lower holder for Pt100 temperature sensor	222-2531
<b>HAAKE MARS 40 &amp; 60 Rheometers</b>	
SER3 including adapter with “Connect Assist” for HAAKE MARS 40 & 60 Rheometers with temperature chamber CTC	222-2176
Triangular base plate with lower holder and Pt100 sensor as accessory for SER tool	603-1205

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**HAAKE MARS iQ Rheometer with SER3 tool and TM-CR-O450 temperature chamber.**