

Instruction Manual

HAAKE Viscotester 6L/R plus HAAKE Viscotester 7L/R plus

version 1.4

Konformitätserklärung / Declaration of Conformity

075-5001

Produktbezeichnung / Product name

HAAKE Viscotester 7L plus
HAAKE Viscotester 7R plus

Identifikation / Identification

389-0100
390-0100
> Seriennummer 0200304155000

Hersteller / Manufacturer

Thermo Electron (Karlsruhe) GmbH
Dieselstraße 4
D – 76227 Karlsruhe
Germany



Richtlinie / Norm Directive / Standard


2004/108/EG	Richtlinie für elektromagnetische Verträglichkeit Electromagnetic Compatibility Directive
EN 61326-1: 2006	Elektrische Mess-, Steuer-, Regel- und Laborgeräte - EMV-Anforderungen, Teil 1 Allgemeine Anforderungen Electrical equipment for measurement, control and laboratory use EMC-requirements, Part 1 general requirements
2006/95/EG	Niederspannungsrichtlinie Low voltage directive
EN 61010-1: 2001	Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel-, und Laborgeräte - allgemeine Anforderungen Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements

Wir erklären in unserer ausschließlichen Verantwortung, dass das Produkt, auf das sich diese Erklärung bezieht, mit den oben genannten Normen, normativen Dokumenten und den Bestimmungen der genannten Richtlinien übereinstimmt.

Die Prüfprotokolle werden bei Thermo Electron (Karlsruhe) 10 Jahre aufbewahrt.

We declare under our sole responsibility, that this product to which this declaration relates is in conformity with the a.m. standards or other normative documents and is following the provisions of the a.m. directives.

All test certificates will be kept by Thermo Electron (Karlsruhe) for 10 years.

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Unterschrift / Signature Geschäftsleitung/Business Management	Datum/Date	Hersteller/Manufacturer

Konformitätserklärung / Declaration of Conformity

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Key to Symbols

1. Key to Symbols

1.1 Symbols used in this manual

! Warns the user of possible damage to the unit, draws attention to the risk of injury or contains safety notes and warnings.

 Denotes an important remark.

1 Indicates the next operating step to be carried out and...

⇒ ...what happens as a result thereof.

2. Quality Assurance

Dear customer,
Thermo Fisher Scientific implements a **Quality Management System** certified according to ISO 9001:2000. This guarantees the presence of organizational structures which are necessary to ensure that our products are developed, manufactured and managed according to our customers expectations. Internal and external audits are carried out on a regular basis to ensure that our **QMS** is fully functional. We also check our products during the manufacturing process to certify that they are produced according to the specifications as well as to monitor correct functioning and to confirm that they are safe. The results are recorded for future reference.

The “Final Test” label on the product is a sign that this unit has fulfilled all requirements at the time of final manufacturing.

Please inform us if, despite our precautionary measures, you should find any product defects. You can thus help us to avoid such faults in future.

3. Your Contact at Thermo Fisher Scientific

Please get in contact with us or the authorized agent who supplied you with the unit if you have any further questions.

Thermo Fisher Scientific

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D-76227 Karlsruhe, Germany
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Fax +49(0)721 4094-300

support.mc.de@thermofisher.com
www.thermo.com/mc

The following specifications should be given when product enquiries are made:

- **Unit name** printed on the front of the unit and specified on the name plate.
- **Version** of the operating software
- **Serial number** of the unit

Thermo Electron (Karlsruhe) GmbH	Dieselstr. 4 76227 Karlsruhe
TYP	
V/Hz	

Unpacking

4. Unpacking

4.1 Transportation damage?

- Notify carrier (forwarding merchant, railroad, post office) etc,
- Compile a damage report

Before return delivery:

- Inform dealer or manufacturer
(Small problems can often be dealt with on the spot)

4.2 Contents of delivery



HAAKE Viscotester 6L plus

(Order no. 387-0100)
Spindles L1 to L4
Rack
Stand
Case
Spindle Guard
Instruction manual

HAAKE Viscotester 6R plus

(Order no. 388-0100)
Spindles R2 to R7
Rack
Stand
Case
Spindle Guard
Instruction manual

HAAKE Viscotester 7L plus

(Order no. 389-0100)
Spindles L1 to L4
Pt100 sensor
Rack
Stand
Case
Spindle Guard
Instruction manual

HAAKE Viscotester 7R plus

(Order no. 390-0100)
Spindles R2 to R7
Pt100 sensor
Rack
Stand
Case
Spindle Guard
Instruction manual

Unpacking

4.3 Accessories (optional)

HAAKE RheoWin measurement and evaluation software with PC connection cable for:	
HAAKE Viscotester 7L plus	098-5037
HAAKE Viscotester 7R plus	098-5038
Helipath stand to penetrate test fluids with servo-motor	
Helipath stand (230V/50Hz)	222-1380
Helipath stand (115V/60Hz)	222-1386
Mini Printer	999-0118
Low viscosity adapter (UL) incl. spindle	222-1379
Small sample adapter (spindleset is necessary)	222-1378
Set of spindles for HAAKE Viscotester 6/7 L for small sample adapter (222-1378)	222-1397
Set of spindles for HAAKE Viscotester 6/7 R for small sample adapter (222-1378)	222-1387
Set of spindles for HAAKE Viscotester R-Set	222-1396
for R2	222-1655
R3	222-1656
R4	222-1657
R5	222-1658
R6	222-1659
R7	222-1660
and optional spindel R1	222-1395
Set of spindles for HAAKE Viscotester L-Set	222-1398
for L1	222-1661
L2	222-1662
L3	222-1663
L4	222-1664
Pt100 feeler for HAAKE Viscotester 7 plus	222-1701

4.4 Information concerning the CE sign

Thermo Scientific electrical equipment for measurement, control and laboratory use bears the CE marking.

The CE marking attests the compliance of the product with the EC-Directives which are necessary to apply and confirms that the apparatus meets all relevant essential requirements of the directive, the defined relevant protection requirements.

The conformity assessment procedures were performed following a defined methodology according to each applicable directive.

The council decision 93/465/EEC shall be authoritative concerning the modules of the various phases of the conformity assessment procedures and the rules for the affixing and use of the CE marking, which are intended to be used in the technical harmonization directives.

To confirm compliance with the EC-Directive 2004/108/EC Electromagnetic Compatibility (EMC) our product was tested according to the EMC requirements for emission and immunity for electrical equipment for measurement, control and laboratory use.

Compliance with the protection requirements areas (domestic establishments and establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes) and industrial areas is ensured.

Our strict standards regarding operating quality and resulting considerable amount of time and money spent on development and testing reflect our commitment to guarantee the high level of quality of our products even under extreme electromagnetic conditions.

Practice however also shows that even electrical equipment which bears the CE marking such as monitors or analytical instruments can be affected if their manufactures accept an interference (e.g. the flickering of a monitor) as the minimum operating quality under electromagnetic compatibility phenomena. For this reason we recommend you to observe a minimum distance of approx. 1 m from such equipment.

Information concerning the CE sign / WEEE compliance

4.5 WEEE Compliance

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the following symbol:



Thermo Fisher Scientific has contracted with one or more recycling/disposal companies in each EU Member State, and this product should be disposed of or recycled through them. Further information on Thermo Fisher Scientific compliance with these Directives, the recyclers in your country, and information on Thermo Fisher Scientific products which may assist the detection of substances subject to the RoHS Directive are available at www.thermo.com/WEEERoHS

Installation

5. Installation

! The measuring shaft's protective plastic tube should be removed before the instrument is connected.

For stability reasons the viscometer should be placed on a flat laboratory table. The leveling screws should be adjusted until the level which is situated on top of the head indicates that the equipment is leveled.

5.1 Ambient conditions according to EN 61010

- indoors, max. 2000 meters above sea level
- ambient temperature +10 ... 40° C
- relative humidity max. 80%/31°C (→ 50%/40°C)
- excess voltage category II, contamination level 2

5.2 Connecting to the mains

! Only attach this unit to mains sockets with a grounded earth. Compare the local mains voltage with the specifications written on the name plate. Voltage deviations of $\pm 10\%$ are permissible. The socket must be rated as suitable for the total power consumption of the unit.

Safety Notes

6. Safety Notes

These notes are intended to draw your attention to risks which only **YOU** can recognize and avoid or overcome. They are intended to enhance your own safety consciousness.

We have set the highest quality standards for ourselves and this unit during development and production. Every unit meets relevant safety regulations. **The correct unit usage and proper handling is however solely your responsibility.**

The following notes must be observed:

- ! **This instruction manual must be carefully studied! It contains important information on the connection to the local mains supply, correct unit usage and safe handling.**
- ! **Check for transportation damage during unpacking. Get in contact with supplier and/or carrier for settlement of damage claims. Do not try to start up a damaged unit before the damage has been repaired or you have ascertained the effect of the damage.**
- ! **Ensure that this manual is always at hand for every unit operator.**
- ! **Only use this unit solely for the intended application.**
- ! **Repairs, alterations or modifications must only be carried out by specialist personnel. Considerable damage can be caused by improper repairs.
The Thermo Fisher Scientific-service department is at your disposal for repair work.**
- ! **Do not operate the unit with wet or oily hands.**
- ! **Do not expose the unit to spray water or immerse it in water.**
- ! **Do not clean the unit with solvents (fire risk!) – a wet cloth soaked in household detergent is normally sufficient.**

Unit Description

7. Unit Description

The HAAKE Viscotester 6 plus and 7 plus instruments are classic rotational viscometers for the fast determination of viscosity as defined in ISO 2555 and more ASTM standards.

This viscometer works on the same principle as all other rotational viscometers; i.e. a cylinder or a disk is submerged in the substance to be tested and the force which is necessary to overcome the viscosity resistance against the rotation or flow is measured. A spring is connected between the cylinder (or disk/spindle) and the motor shaft which is rotating with a certain speed. The deviation angle of the spindle against the measuring spring is measured electronically; the result is a torque value.

The torque value measured with the viscometer is calculated based on the speed and the geometry of the spindle; the result is a direct reading of the viscosity value in mPas.

For the various applications different spindle types are available. The viscometer with its extensive speed range is a capable instrument for viscosity measurements. Depending on the viscosity the resistance to the movement changes proportionally with the spindle speed or spindle size. The viscometer has been calibrated in such a way that under consideration of the chosen speed and spindle type the result can be read in mPas. The various spindle and speed combinations allow an optimum reading for any measurement within the wide range of the instrument.

For the determination of the rheological properties of a substance the measuring range can already be changed by using a different speed; a change of the spindle is not always necessary. The selection depends on the standard (ISO/ASTM) to be followed.

7.1 Spindles

These accessories are made with maximum precision and ensure accurate measurements according to the instruments specifications as long as the equipment is kept in good working condition.

Functional Elements

8. Functional Elements

8.1 Front



- 1 LCD display
- 2 Panel (see next page)
- 3 Spirit level

Functional Elements

8.1.1 Panel



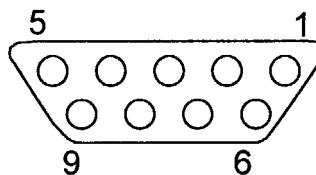
- 4 Start key: starts Auto-Test, switches to parameter mode, starts a measurement.
- 5 Stop key: stops a measurement.
- 6 Enter key: confirms parameter selection.
- 7 Key for parameter selection "down".
- 8 Key for parameter selection "up".

8.1.2 Rear



- 9 Mains switch
- 10 Mains supply socket
- 11 Pt100 (only HAAKE Viscotester 7 plus)
- 12 RS232 interface (only for HAAKE Viscotester 7 plus)

PIN configuration:



- PIN 2: TX (out)
- PIN 3: RX (in)
- PIN 5: GND
- PIN 8: RTS

Operation

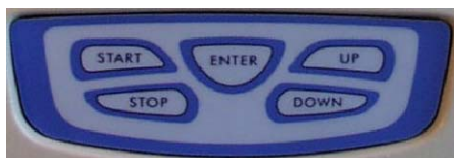
9. Operation

The mains switch is on the rear of the viscometer and can only be activated if the instrument is connected to the mains.

9.1 Selecting language and measuring unit

Switch the equipment "ON". The following message will appear on the viscometer screen for 2 seconds:

```
THERMO SCIENTIFIC
VT 7-L PLUS VX.X      (Version of the Viscotester
                       and the fimware)
GERMAN                 (Language)
```



During the above presentation message, in order to change the measuring units or the language, press <START>. Afterwards press <ENTER> (this should be done within the period of 2 seconds).

Once the user has chosen this option, the equipment is ready to be configured.

The equipment is ready to set-up the language. In order to change the language, the user must press <UP> and <DOWN>, until the desired language appears on the screen, then press <ENTER> to confirm the selection.

Options to choose: ENGLISH, SPANISH, FRENCH, GERMAN, ITALIAN, POLISH, JAPANESE, PORTUGUESE

After pressing <ENTER> to confirm the first selection, the user can change the measuring units. Pressing <UP> and <DOWN> will show the different options for

```
Viscosity:      "mPas" or "cP"
Shear stress:   "Nm-2" or "dyne·cm-2"
Temperature:   "Celsius" or "Fahrenheit"
Print mode:     "Print" or "Computer"
```

Press <ENTER> to confirm it.

Once the user has selected a language and/or a measuring unit, they will appear as default when the equipment is used again.

9.2 Auto Test

The following message will appear on the screen:

```
AUTO TEST?
START-YES STOP-NO
```

With the <Start> switch an Auto Test is initiated; after pressing the <Stop> switch, parameters can be entered.

With the choice of


Operation

START-YES

the following message appears on the screen:

REMOVE SPINDLE
AND PRESS START

The spindle has to be removed from the viscometer and on pressing <Start> the Auto Test will start.

 The Auto-Test has always to be performed without spindle.

Immediately after pressing <Start>, the following message appears:

AUTOTESTING
SPEED: 10 rpm

The speed will increase up to 100 min⁻¹ during the Auto Test. Should there arise any operational problems, they will be displayed on the screen during this test:

AUTO TEST
O.K.

In case of any faults see chapter 9.6.

9.3 Parameter selection on the display

On pressing <Start> the parameters can be chosen from the selection tables (see chap. 10).

9.3.1 Spindle

The first parameter is the spindle (SP), the display for this is in the right top of the screen.

It flashes until the input is completed.

Other spindles (SP) appear on the screen for selection by using the arrow keys. The selection is made by pressing <Enter>.

9.3.2 Speed

The second parameter is the speed; the display for this is left top on the screen.

It flashes until the input is completed.

Other speed stages are displayed for selection by using the arrow keys. The selection is made by pressing <Enter>.

9.3.3 Shear rate

The shear rate is only shown on this display for the special geometries TL 5– TL7 in (1/sec). Not on the other hand for other spindles.

U/min	SP
m Pas	
temp	
range	

Display
Special geometrie TL5–TL7

U/min	SP
m Pas	
1/sec	
N/m2	

Operation

9.4 Inserting the spindle

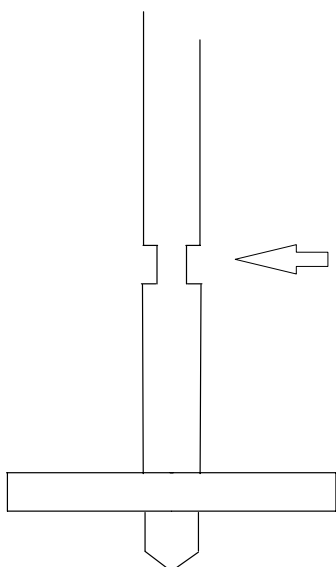
The next message to appear on the screen is:

PRESS START

After insertion of the correct spindle, <Start> has to be pressed and the instrument will start operating.

If the chosen spindle is of a disk type it should be submerged carefully in the substance to avoid bubbles forming under its bottom surface.

To insert the spindle the shaft is slightly raised holding it firmly with one hand. With the other hand the spindle is screwed in.



! This must be done very carefully to make sure that the spindle is not bent.

☞ The spindle and its counterpart with the inner thread should be smooth and clean.

Now the spindle can be immersed in the substance up to the immersion point. The shaft of the instrument should not be knocked against the sides of the container while the spindle is inserted since this could impair the vertical alignment of the spindle.

☞ The spindles L4 and R7 have to be immersed up to the marked zone (narrow spot).

The viscometer is now ready for operation.

Operation

9.5 Starting a measurement

Press <Start> for measurement.

Stable flow conditions is reached quickly and the reading values of the viscometer can be considered correct within a few seconds (depending on the chosen speed and the viscosity of the sample).

If the message "ERROR" appears on the screen and the alarm signal is activated, the maximum %-value of scale has been exceeded. In this case either the speed has to be reduced or a larger spindle should be selected.

If the reading is correct and stable the motor of the instrument can be stopped with the <Stop> -switch. In this case the viscometer will show the last measurement value on the screen.

This Stop-value will change continuously until 0 min^{-1} is reached. This protects the more delicate parts of the instrument from unnecessary shaking which could cause damage.




On pressing <Start> again the viscometer will return quickly to stable readings.

If the speed or the spindle need to be changed, the viscometer will accept the new parameters as soon as they are confirmed with "Enter".

9.6 Display of the substance temperature (HAAKE Viscotester 7 plus only)

The announcement for the temperature, which is sequentially measured during the current measurement is in the middle of the display.

Important Notes

-  The viscosity of a substance is influenced by any change in temperature.
-  If the viscosity reading is not stable the measured substance may be thixotropic or the temperature may not be constant. In the latter case the sample and the spindle should be temperature controlled to get stable readings.
-  The viscosity of substances which are neither Newtonian nor thixotropic change depend on the proportional shear rate (speed). Therefore, viscosity measurements should always be performed with the same spindle and at the same speed.

Operation

9.7 Print mode (HAAKE Viscotester 7 plus only)

To enter the print mode, proceed as described in chapter 9.1. Select "Print" or "Computer" by using the arrow keys. Press <Enter> to confirm it.

9.8 Printing with mini printer (Order No. 999-0118)

Connect the printer to HAAKE Viscotester 7 plus.

If a print out of the data points is to follow, then the "Start" key on HAAKE Viscotester 7 plus should be pressed while the measurement is running.

Operation

9.9 Fault

If the instrument is not fully operational or the Auto Test is not performed correctly the following message appears on the screen:

THIS SYSTEM IS NOT
CORRECTLY ADJUSTED

alternating with:

CALL THE
TECHNICAL SERVICE

At the same time an alarm signal is activated as a warning that the viscometer is not operational.

On pressing <Enter> the Auto Test can be performed again. Prior to a new Auto-Test it should be made sure that there is no spindle inserted and the instrument is correctly leveled.

Should the warning occur again after the new Auto Test, please contact the Thermo Fisher Scientific technical service.

If the instrument is in perfect operating condition, the following message appears:

AUTO TEST
O.K.

If the following messages appear alternately on the screen during a measurement at 200 min^{-1} :

OVER RANGE
SECURITY STOP

CHANGE
RPM/SP

this means that the viscosity of the measured substance is higher than the selected range. A security stop is activated to protect the instrument.

In this case another measuring range should be selected either by reducing the speed (min^{-1}) or choosing a smaller spindle.

Selection Tables

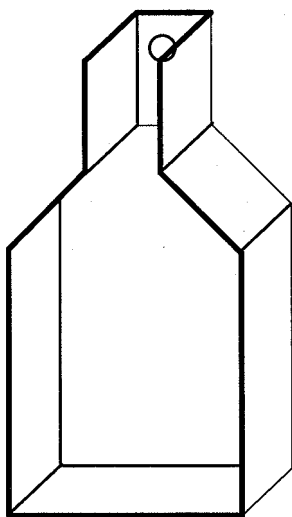
10. Selection Tables (see Appendix)

Valid for all selection tables:

- The tables contain maximum orientative values.
- The minimum recommended reading is 15% of full scale.

10.1 HAAKE Viscotester 6/7 L plus

The model HAAKE Viscotester 6/7L plus has 21 speeds (0,1; 0.2; 0.3; 0.5; 0.6; 1; 1.5; 2; 2.5; 3; 4; 5; 6; 10; 12; 20; 30; 50; 60; 100 and 200 min⁻¹) and is delivered with the standard spindles one to four (see Appendix/Table A1.).



Spindle L1 is used in the lowest viscosity range. With this spindle the use of the supplied spindle guard is indispensable since otherwise the measurement readings would not be correct.

For substances of low viscosity it is advisable to use the accessory Low Viscosity Adapter with the incorporated special spindle (LCP) to obtain a higher accuracy (see Appendix/Table A5.).

The special spindles TL5 to TL7 are used together with the Adapter for Small Samples and are available as an option (see Appendix/Table A2.).

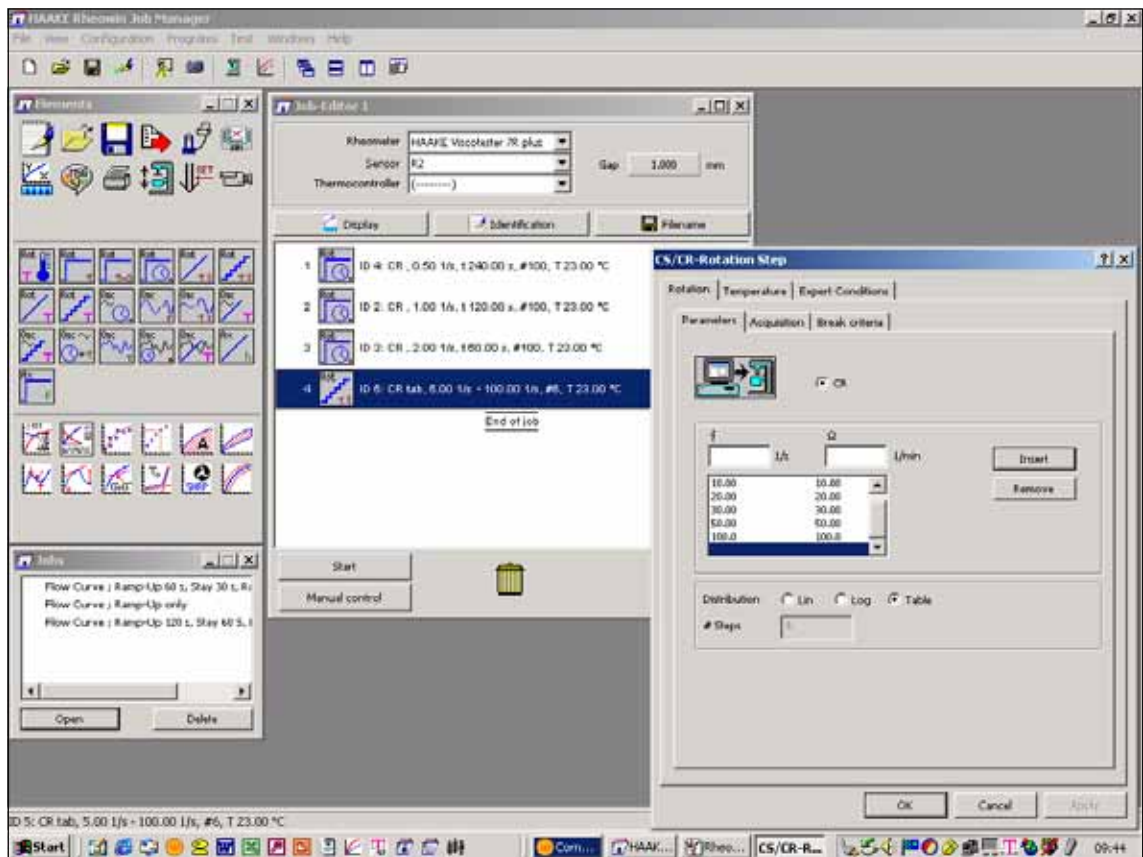
10.2 HAAKE Viscotester 6/7 R plus

The model HAAKE Viscotester 6/7R plus has 21 speeds (0.1; 0.2; 0.3, 0.5, 0.6, 1, 1.5, 2, 2.5, 3, 4, 5, 6, 10, 12, 20, 30, 50, 60, 100 and 200 min⁻¹) and is delivered with the spindles one to seven (see Appendix/Table A3.).

Spindle R1 is used for lower viscosity ranges. Since the instrument is normally operated in a medium viscosity range this spindle is not very frequently used and therefore is not a standard accessory. It is available on request.

The special spindles TR8 to TR11 are used together with the Adapter for Small Samples and are available on request (see Appendix/Table A4.).

11. Control and evaluation software HAAKE RheoWin for HAAKE Viscotester 7 plus



The HAAKE Viscotester 7plus is connected with the PC by connection cable.

With the HAAKE RheoWin software it is possible to control the HAAKE Viscotester 7plus. The software serves to record, save and evaluate the measured values.

Job Manager and a measurement procedure (Job) is derived. At the end of the measurement, the data is saved in a standard RheoWin file (.rwd) and can be evaluated in the RheoWin Data Manager.

Production of a job

The RheoWin Job Manager is opened and a measurement procedure is derived (see fig.):

- Start the RheoWin Job Manager: File/New Job/Create New
- Enter the device parameters [Rheometer (device) and sensor (spindle)]

RheoWin Software

Information on compiling a job

- Only the available 21 speeds (0.1; 0.2; 0.3; 0.5; 0.6; ...200 rpm) are permissible.
- To shorten the measuring time, partition the job according to the speed range.
- Measure rotation time curves at low speeds using longer measuring times (measurement of a complete revolution).
- Measure CR staircases with speeds defined in tables.

If you are using the HAAKE Viscotester 7 and change between manual operation and working with the HAAKE RheoWin measurement and evaluation software, the rotational speed used in manual operation will be saved. If you work with the HAAKE RheoWin software in the meantime, and then change back to manual mode, the rotational speed saved will be used as a presetting.

Calibration

12. Calibration

At regular intervals, the setting and calibration should be tested with Newtonian fluids of a known viscosity (such as HAAKE standard fluids), either in the user's laboratories as a special service provided by the manufacturer or by officially recognized inspection authorities.

Calibration has to be executed at a constant temperature (ISO 2555). Use a beaker with a diameter of between 90mm and 92mm and a height of 115mm and 160mm (e.g. low 600ml beaker).

If a different container is used, correction factors need to be introduced. For the calculation of the correction factor for a certain range, a spindle and a container, a substance with known viscosity must be measured at a defined temperature, with the correct spindle and container. The relation between this measured viscosity and the real viscosity of the substance can be considered as correction factor for measurements of other substances.

Working with the model HAAKE Viscotester 6/7R plus in connection with the spindle R1 might lead to flow turbulences at 100 and 200 min^{-1} . A slight deviation of the displayed value from the real viscosity can be noticed below 85 mPas.

The calibration factors of the instrument are calculated based on the assumption that an infinite "body" (spindle) is immersed with the spindle protection installed. According to specification they are accurate when the measurement is made in a container of more than 70 mm diameter with the spindle centered.

If the model HAAKE Viscotester 6/7L plus is used in smaller containers the viscosity readings are slightly higher with spindle L1 and L2. The calibration for spindle L3 and L4 does not change, i.e. it is independent of the container size provided that the spindle protection is installed.

Flow turbulences might occur with spindle L1 between 60 and 200 min^{-1} if the viscosity of the substance to be measured is less than 15 mPas. Are exact measurements required in this range the use of the Low Viscosity Adapter is recommended.

The results obtained from measurements in small containers and/or without protector can only be considered as comparative measurements and not as real viscosity measurements unless the correction factors are defined and used with every spindle and container.

Technical Specifications

13. Technical Specification

Power supply:

Mains: 100 – 240 V / 50–60 Hz.

Environmental temperature:

from +10°C to 40°C

Relative Humidity:

< 80%

Temperature range: –15°C to 120°C

**Temperature range
temperature sensor** –15°C to 180°C

Speeds :

0.1; 0.2; 0.3; 0.5; 0.6; 1; 1.5; 2; 2.5; 3; 4; 5; 6; 10; 12;
20; 30; 50; 60; 100; 200 rpm

Accuracy: >0.5% of the absolute value

Torque:

L and R differ in the torque range roughly by a factor of 6. The value displayed is measured with a maximum uncertainty of +/- 1% FSD (100%).

Accuracy:

+/- 1% of full scale

Reproducibility:

+/- 0.2% of full scale

Viscosity range:

HAAKE Viscotester 6/7L plus: 3 – 6 000 000 mPas in 84 ranges (21 speeds with 4 spindles) (for low to medium viscosity test fluids)

HAAKE Viscotester 6/7R plus: 20 – 40 000 000 mPas in 126 ranges (21 speeds with 6 spindles) (for medium to higher viscosity test fluids)

Anhang / Appendix / Appendice

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A Auswahltabellen / Selection Tables / Tableau de sélection

**A1. HAAKE Viscotester 6/7L plus:
Standard-Spindeln L1 - L4
Standard Spindles L1 - L4
Mobiles standards L1 - L4**

Spindel-Nr. Spindle no. Mobiles	L1	L2	L3	L4
Drehzahl min ⁻¹ RPM tr min ⁻¹	Viskosität / Viscosity / Viscosité mPa·s			
0,1	$6 \cdot 10^4$	$3 \cdot 10^5$	$1,2 \cdot 10^6$	$6 \cdot 10^6$
0,2	$3 \cdot 10^4$	$1,5 \cdot 10^5$	$6 \cdot 10^5$	$3 \cdot 10^6$
0,3	$2 \cdot 10^4$	$1 \cdot 10^5$	$4 \cdot 10^5$	$2 \cdot 10^6$
0,5	$1,2 \cdot 10^4$	$6 \cdot 10^4$	$2,4 \cdot 10^5$	$1,2 \cdot 10^6$
0,6	$1 \cdot 10^4$	$5 \cdot 10^4$	$2 \cdot 10^5$	$1 \cdot 10^6$
1	$6 \cdot 10^3$	$3 \cdot 10^4$	$1,2 \cdot 10^5$	$6 \cdot 10^5$
1,5	$4 \cdot 10^3$	$2 \cdot 10^4$	$8 \cdot 10^4$	$4 \cdot 10^5$
2	$3 \cdot 10^3$	$1,5 \cdot 10^4$	$6 \cdot 10^4$	$3 \cdot 10^5$
2,5	$2,4 \cdot 10^3$	$1,2 \cdot 10^4$	$4,8 \cdot 10^4$	$2,4 \cdot 10^5$
3	$2 \cdot 10^3$	$1 \cdot 10^4$	$4 \cdot 10^4$	$2 \cdot 10^5$
4	$1,5 \cdot 10^3$	$7,5 \cdot 10^3$	$3 \cdot 10^4$	$1,5 \cdot 10^5$
5	$1,2 \cdot 10^3$	$6 \cdot 10^3$	$2,4 \cdot 10^4$	$1,2 \cdot 10^5$
6	$1 \cdot 10^3$	$5 \cdot 10^3$	$2 \cdot 10^4$	$1 \cdot 10^5$
10	$6 \cdot 10^2$	$3 \cdot 10^3$	$1,2 \cdot 10^4$	$6 \cdot 10^4$
12	$5 \cdot 10^2$	$2,5 \cdot 10^3$	$1 \cdot 10^4$	$5 \cdot 10^4$
20	$3 \cdot 10^2$	$1,5 \cdot 10^3$	$6 \cdot 10^3$	$3 \cdot 10^4$
30	$2 \cdot 10^2$	$1 \cdot 10^3$	$4 \cdot 10^3$	$2 \cdot 10^4$
50	$1,2 \cdot 10^2$	$6 \cdot 10^2$	$2,4 \cdot 10^3$	$1,2 \cdot 10^4$
60	$1 \cdot 10^2$	$5 \cdot 10^2$	$2 \cdot 10^3$	$1 \cdot 10^4$
100	60	$3 \cdot 10^2$	$1,2 \cdot 10^3$	$6 \cdot 10^3$
200	30	$1,5 \cdot 10^2$	$6 \cdot 10^2$	$3 \cdot 10^3$
Schrittweite Increment	1 mPa · s	1 mPa · s	10 mPa · s	10 mPa · s

Anhang / Appendix / Annexe

- A2. HAAKE Viscotester 6/7L plus:
 Sonder-Spindeln TL5 - TL7 zur Verwendung für
 Adapter für kleine Volumina
 Special Spindles TL5 - TL7 for adapters with small volumes
 Mobiles spéciaux TL5 - TL7 pour des adaptateurs pour de petits
 volumes**

Spindel-Nr. Spindle no. Mobiles	TL5	TL6	TL7
Drehzahl min ⁻¹ RPM tr min ⁻¹	Viskosität / Viscosity / Viscosité mPa · s		
0,1	$3 \cdot 10^4$	$3 \cdot 10^5$	$6 \cdot 10^5$
0,2	$1,5 \cdot 10^4$	$1,5 \cdot 10^5$	$3 \cdot 10^5$
0,3	$1 \cdot 10^4$	$1 \cdot 10^5$	$2 \cdot 10^5$
0,5	$6 \cdot 10^3$	$6 \cdot 10^4$	$1,2 \cdot 10^5$
0,6	$5 \cdot 10^3$	$5 \cdot 10^4$	$1 \cdot 10^5$
1	$3 \cdot 10^3$	$3 \cdot 10^4$	$6 \cdot 10^4$
1,5	$2 \cdot 10^3$	$2 \cdot 10^4$	$4 \cdot 10^4$
2	$1,5 \cdot 10^3$	$1,5 \cdot 10^4$	$3 \cdot 10^4$
2,5	$1,2 \cdot 10^3$	$1,2 \cdot 10^4$	$2,4 \cdot 10^4$
3	$1 \cdot 10^3$	$1 \cdot 10^4$	$2 \cdot 10^4$
4	$7,5 \cdot 10^2$	$7,5 \cdot 10^3$	$1,5 \cdot 10^4$
5	$6 \cdot 10^2$	$6 \cdot 10^3$	$1,2 \cdot 10^4$
6	$5 \cdot 10^2$	$5 \cdot 10^3$	$1 \cdot 10^4$
10	$3 \cdot 10^2$	$3 \cdot 10^3$	$6 \cdot 10^3$
12	$2,5 \cdot 10^2$	$2,5 \cdot 10^3$	$5 \cdot 10^3$
20	$1,5 \cdot 10^2$	$1,5 \cdot 10^3$	$3 \cdot 10^3$
30	$1 \cdot 10^2$	$1 \cdot 10^3$	$2 \cdot 10^3$
50	60	$6 \cdot 10^2$	$1,2 \cdot 10^3$
60	50	$5 \cdot 10^2$	$1 \cdot 10^3$
100	30	$3 \cdot 10^2$	$6 \cdot 10^2$
200	15	$1,5 \cdot 10^2$	$3 \cdot 10^2$
Schrittweite Increment	0,1 mPa · s	1 mPa · s	10 mPa · s

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Merkmale der Sonderspindeln Characteristics of Special Spindles Caracteristiques des mobiles spéciaux

Spindel Spindle Mobile	Schergefälle Shear rate Gradient de vitesse (s⁻¹)	Probenvolumen Sample volume Volume d'échantillon (cm³)
TL5	1,32 · Drehzahl (min ⁻¹)	8,0
TL6	0,34 · Drehzahl (min ⁻¹)	10,0
TL7	0,28 · Drehzahl (min ⁻¹)	9,5

Für die Berechnung des Schergefälles wird von Substanzen mit Newtonschem Fließverhalten ausgegangen.

The "Shear Rate" has been calculated assuming the characteristics of Newtonian products.

Le "Gradient de Vitesse" est calculé à la base des caractéristiques des produits Newtonniens.

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**A3. HAAKE Viscotester 6/7R plus:
Standard-Spindeln R1 - R7
Standard Spindles R1 - R7
Mobiles standards R1 - R7**

Spindel-Nr. Spindle no. Mobiles	R1 optional option	R2	R3	R4	R5	R6	R7
Drehzahl min ⁻¹ RPM tr min ⁻¹	Viskosität / Viscosity / Viscosité mPa · s						
0,1	1·10 ⁵	4·10 ⁵	1·10 ⁶	2·10 ⁶	3,9·10 ⁶	1·10 ⁷	4·10 ⁷
0,2	5·10 ⁴	2·10 ⁵	5·10 ⁵	1·10 ⁶	2·10 ⁶	5·10 ⁶	2·10 ⁷
0,3	3,3·10 ⁴	1,3·10 ⁵	3,3·10 ⁵	6,7·10 ⁵	1,3·10 ⁶	3,3·10 ⁶	1,3·10 ⁷
0,5	2·10 ⁴	8·10 ⁴	2·10 ⁵	4·10 ⁵	8·10 ⁵	2·10 ⁶	8·10 ⁶
0,6	1,7·10 ⁴	6,7·10 ⁴	1,7·10 ⁵	3,3·10 ⁵	6,7·10 ⁵	1,6·10 ⁶	6,6·10 ⁶
1	1·10 ⁴	4·10 ⁴	1·10 ⁵	2·10 ⁵	4·10 ⁵	1·10 ⁶	4·10 ⁶
1,5	6,6·10 ³	2,7·10 ⁴	6,7·10 ⁴	1,3·10 ⁵	2,7·10 ⁵	6,7·10 ⁵	2,6·10 ⁶
2	5·10 ³	2·10 ⁴	5·10 ⁴	1·10 ⁵	2·10 ⁵	5·10 ⁵	2·10 ⁶
2,5	4·10 ³	1,6·10 ⁴	4·10 ⁴	8·10 ⁴	1,6·10 ⁵	4·10 ⁵	1,6·10 ⁶
3	3,3·10 ³	1,3·10 ⁴	3,3·10 ⁴	6,7·10 ⁴	1,3·10 ⁵	3,3·10 ⁵	1,3·10 ⁶
4	2,5·10 ³	1·10 ⁴	2,5·10 ⁴	5·10 ⁴	1·10 ⁵	2,5·10 ⁵	1·10 ⁶
5	2·10 ³	8·10 ³	2·10 ⁴	4·10 ⁴	8·10 ⁴	2·10 ⁵	8·10 ⁵
6	1,6·10 ³	6,6·10 ³	1,7·10 ⁴	3,3·10 ⁴	6,7·10 ⁴	1,7·10 ⁵	6,7·10 ⁵
10	1·10 ³	4·10 ³	1·10 ⁴	2·10 ⁴	4·10 ⁴	1·10 ⁵	4·10 ⁵
12	8,3·10 ²	3,3·10 ³	8,3·10 ³	1,7·10 ⁴	3,3·10 ⁴	8,3·10 ⁴	3,3·10 ⁵
20	5·10 ²	2·10 ³	5·10 ³	1·10 ⁴	2·10 ⁴	5·10 ⁴	2·10 ⁵
30	3,3·10 ²	1,3·10 ³	3,3·10 ³	6,6·10 ³	1,3·10 ⁴	3,3·10 ⁴	1,3·10 ⁵
50	2·10 ²	8·10 ²	2·10 ³	4·10 ³	8·10 ³	2·10 ⁴	8·10 ⁴
60	1,7·10 ²	6,6·10 ²	1,6·10 ³	3,3·10 ³	6,6·10 ³	1,6·10 ⁴	6,7·10 ⁴
100	1·10 ²	4·10 ²	1·10 ³	2·10 ³	4·10 ³	1·10 ⁴	4·10 ⁴
200	50	2·10 ²	5·10 ²	1·10 ³	2·10 ³	5·10 ³	2·10 ⁴
Schrittweite Increment	1 mPa · s	1 mPa · s	10 mPa · s	10 mPa · s	10 mPa · s	100 mPa · s	100 mPa · s

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**A4. HAAKE Viscotester 6/7R plus:
Sonder-Spindeln TR8 - TR11 zur Verwendung für
Adapter für kleine Volumina
Special Spindles TR8 - TR11 for adapters with small volumes
Mobiles spéciaux TR8 - TR11 pour des adaptateurs pour de petits
volumes**

Spindel-Nr. Spindle no. Mobiles	TR8	TR9	TR10	TR11
Drehzahl min ⁻¹ RPM tr min ⁻¹	Viskosität / Viscosity / Viscosité mPa · s			
0,1	$5 \cdot 10^5$	$2,5 \cdot 10^6$	$5 \cdot 10^6$	$1 \cdot 10^7$
0,2	$2,5 \cdot 10^5$	$1,3 \cdot 10^6$	$2,5 \cdot 10^6$	$5 \cdot 10^6$
0,3	$1,7 \cdot 10^5$	$8,3 \cdot 10^5$	$1,6 \cdot 10^6$	$3,3 \cdot 10^6$
0,5	$1 \cdot 10^5$	$5 \cdot 10^5$	$1 \cdot 10^6$	$2 \cdot 10^6$
0,6	$8,3 \cdot 10^4$	$4,2 \cdot 10^5$	$8,3 \cdot 10^5$	$1,6 \cdot 10^6$
1	$5 \cdot 10^4$	$2,5 \cdot 10^5$	$5 \cdot 10^5$	$1 \cdot 10^6$
1,5	$3,3 \cdot 10^4$	$1,7 \cdot 10^5$	$3,3 \cdot 10^5$	$6,7 \cdot 10^5$
2	$25 \cdot 10^3$	$1,3 \cdot 10^5$	$2,5 \cdot 10^5$	$5 \cdot 10^5$
2,5	$2 \cdot 10^4$	$1 \cdot 10^5$	$2 \cdot 10^5$	$4 \cdot 10^5$
3	$1,7 \cdot 10^4$	$8,3 \cdot 10^4$	$1,7 \cdot 10^5$	$3,3 \cdot 10^5$
4	$1,3 \cdot 10^4$	$6,3 \cdot 10^4$	$1,3 \cdot 10^5$	$2,5 \cdot 10^5$
5	$1 \cdot 10^4$	$5 \cdot 10^4$	$1 \cdot 10^5$	$2 \cdot 10^5$
6	$8,3 \cdot 10^3$	$4,2 \cdot 10^4$	$8,3 \cdot 10^4$	$1,7 \cdot 10^5$
10	$5 \cdot 10^3$	$2,5 \cdot 10^4$	$5 \cdot 10^4$	$1 \cdot 10^5$
12	$4,2 \cdot 10^3$	$2,1 \cdot 10^4$	$4,2 \cdot 10^4$	$8,3 \cdot 10^4$
20	$2,5 \cdot 10^3$	$1,3 \cdot 10^4$	$2,5 \cdot 10^4$	$5 \cdot 10^4$
30	$1,6 \cdot 10^3$	$8,3 \cdot 10^3$	$1,7 \cdot 10^4$	$3,3 \cdot 10^4$
50	$1 \cdot 10^3$	$5 \cdot 10^3$	$1 \cdot 10^4$	$2 \cdot 10^4$
60	$8,3 \cdot 10^3$	$4,2 \cdot 10^3$	$8,3 \cdot 10^3$	$1,7 \cdot 10^4$
100	$5 \cdot 10^2$	$2,5 \cdot 10^3$	$5 \cdot 10^3$	$1 \cdot 10^4$
200	$2,5 \cdot 10^2$	$1,3 \cdot 10^3$	$2,5 \cdot 10^3$	$5 \cdot 10^3$
Schrittweite Increment	10 mPa · s	100 mPa · s	100 mPa · s	100 mPa · s

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Merkmale der Sonderspindeln Characteristics of Special Spindles Caracteristiques des mobiles spéciaux

Spindel Spindle Mobile	Schergefälle Shear rate Gradient de vitesse (s⁻¹)	Probenvolumen Sample volume Volume d'échantillon (cm³)
TR8	0,93 · Drehzahl min ⁻¹	8,0
TR9	0,34 · Drehzahl min ⁻¹	10,5
TR10	0,28 · Drehzahl min ⁻¹	11,5
TR11	0,25 · Drehzahl min ⁻¹	13,0

Für die Berechnung des Schergefälles wird von Substanzen mit Newtonschem Fließverhalten ausgegangen.

The "Shear Rate" has been calculated assuming the characteristics of Newtonian products.

Le "Gradient de Vitesse" est calculé à la base des caractéristiques des produits Newtonniens.

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**A5. LCP Adapter für dünne Substanzen (mPas)
Auswahlbereiche HAAKE Viscotester 6/7 L und Rplus
LCP Low Viscosity Adapter (mPas)
Selection range HAAKE Viscotester 6/7 L and Rplus
LCP adapteur pour faible viscosité (mPas):
Gamme de sélection HAAKE Viscotester 6/7 L et Rplus**

Volumen des Probenbehälters = 18 cm³

Container sample volume = 18 ml.

Volume d'échantillon du réservoir = 18 ml.

Schergefälle = 1,224 · Drehzahl (min⁻¹)

Shear rate = 1.224 RPM

Gradient de vitesse = 1,2236 tr/min

	VT6/7 L	VT6/7 R
Adapter Adapteur	LCP	LCP
Drehzahl min ⁻¹ RPM tr min ⁻¹	Viskosität / Viscosity / Viscosité mPa · s	
0,1	6000,00	64000,00
0,2	3000,00	32000,00
0,3	2000,00	21333,00
0,5	1200,00	12800,00
0,6	1000,00	10666,00
1	600,00	6400,00
1,5	400,00	4266,00
2	300,00	3200,00
2,5	240,00	2560,00
3	200,00	2133,00
4	150,00	1600,00
5	120,00	1280,00
6	100,00	1066,00
10	60,00	640,00
12	50,00	533,00
20	30,00	320,00
30	20,00	213,00
50	12,00	128,00
60	10,00	106,00
100	6,00	64,00
200	3,00	32,00

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A6. Sonder-Spindeln - Motor-Stativ (Helipath) Special Spindles - Helix Drive (Helipath) Mobiles spéciaux - Helipath

A6.1 Auswahlbereich / Selection Range / Tableau de sélection HAAKE Viscotester 6/7L plus

Spindel-Nr. Spindle no. Mobiles	PA	PB	PC	PD	PE	PF
Drehzahl min ⁻¹ RPM tr/min	Viskosität / Viscosity / Viscosité mPa · s					
∅	48mm	36mm	27mm	20mm	15mm	11mm
0,1	1,9·10 ⁵	3,7·10 ⁵	4,0·10 ⁵	1,9·10 ⁶	4,7·10 ⁶	9,4·10 ⁶
0,2	9,4·10 ⁴	1,9·10 ⁵	4,7·10 ⁵	5,4·10 ⁵	2,2·10 ⁶	4,7·10 ⁶
0,3	6,2·10 ⁴	1,2·10 ⁵	3,1·10 ⁴	6,2·10 ⁵	1,6·10 ⁶	3,1·10 ⁶
0,5	3,7·10 ⁴	7,5·10 ⁴	1,9·10 ⁵	3,7·10 ⁵	9,4·10 ⁵	1,9·10 ⁶
0,6	3,1·10 ⁴	6,2·10 ⁴	1,6·10 ⁴	3,1·10 ⁵	7,8·10 ⁵	1·10 ⁶
1	1,9·10 ⁴	3,7·10 ⁴	9,4·10 ⁴	1,9·10 ⁵	4,7·10 ⁵	9,4·10 ⁵
1,5	1,2·10 ⁴	2,5·10 ⁴	6,2·10 ⁴	1,2·10 ⁵	3,1·10 ⁵	6,2·10 ⁵
2	9,4·10 ⁴	1,9·10 ⁴	4,7·10 ⁴	9,4·10 ⁴	2,3·10 ⁵	4,7·10 ⁵
2,5	7,5·10 ³	1,5·10 ⁴	3,7·10 ⁴	7,5·10 ⁴	1,9·10 ⁵	3,7·10 ⁵
3	6,2·10 ³	1,2·10 ³	3,1·10 ⁴	6,2·10 ⁴	1,6·10 ⁵	3,1·10 ⁵
4	4,7·10 ³	9,4·10 ³	2,3·10 ⁴	4,7·10 ⁴	1,2·10 ⁵	2,3·10 ⁵
5	3,7·10 ³	7,5·10 ³	1,9·10 ⁴	3,7·10 ⁴	9,4·10 ⁴	1,9·10 ⁵
6	3,1·10 ³	6,2·10 ³	1,6·10 ⁴	3,1·10 ⁴	7,8·10 ⁴	1,6·10 ⁵
10	1,9·10 ³	3,7·10 ³	9,4·10 ³	1,9·10 ⁴	4,7·10 ⁴	9,4·10 ⁴
12	1,6·10 ³	3,1·10 ³	7,8·10 ³	1,6·10 ⁴	3,9·10 ⁴	7,8·10 ⁴

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A6.2 Auswahlbereich / Selection Range / Tableau de sélection HAAKE Viscotester 6/7R plus

Spindel-Nr. Spindle no. Mobiles	PA	PB	PC	PD	PE	PF
Drehzahl min ⁻¹ RPM tr/min	Viskosität / Viscosity / Viscosité mPa · s					
∅	48mm	36mm	27mm	20mm	15mm	11mm
0,1	2·10 ⁶	4·10 ⁶	1·10 ⁷	2·10 ⁷	5·10 ⁷	1·10 ⁸
0,2	1·10 ⁶	2·10 ⁶	5·10 ⁶	1·10 ⁷	2,5·10 ⁷	5·10 ⁷
0,3	6,7·10 ⁵	1,3·10 ⁶	3,3·10 ⁶	6,6·10 ⁶	1,7·10 ⁷	3,3·10 ⁷
0,5	4·10 ⁵	8·10 ⁵	2·10 ⁶	4·10 ⁶	1·10 ⁷	2·10 ⁷
0,6	3,3·10 ⁵	6,7·10 ⁵	1,6·10 ⁶	3,3·10 ⁶	8,3·10 ⁶	1,7·10 ⁷
1	2·10 ⁵	4·10 ⁵	1·10 ⁶	2·10 ⁶	5·10 ⁶	1·10 ⁷
1,5	1,3·10 ⁵	2,7·10 ⁵	6,7·10 ⁵	1,3·10 ⁶	3,3·10 ⁶	6,6·10 ⁶
2	1·10 ⁵	2·10 ⁵	5·10 ⁵	1·10 ⁶	2,5·10 ⁶	5·10 ⁶
2,5	8·10 ⁴	1,6·10 ⁵	4·10 ⁵	8·10 ⁵	2·10 ⁶	4·10 ⁶
3	6,6·10 ⁴	1,3·10 ⁵	3,3·10 ⁵	6,7·10 ⁵	1,6·10 ⁶	3,3·10 ⁶
4	5·10 ⁴	1·10 ⁵	25·10 ⁴	5·10 ⁵	1,2·10 ⁶	2,5·10 ⁶
5	4·10 ⁴	8·10 ⁴	2·10 ⁵	4·10 ⁵	1·10 ⁶	2·10 ⁶
6	3,3·10 ⁴	6,7·10 ⁴	1,7·10 ⁵	3,3·10 ⁵	8,3·10 ⁵	1,6·10 ⁶
10	2·10 ⁴	4·10 ⁴	1·10 ⁵	2·10 ⁵	5·10 ⁵	1·10 ⁶
12	1,7·10 ⁴	3,3·10 ⁴	8,3·10 ⁴	1,7·10 ⁵	4,2·10 ⁵	8,3·10 ⁵

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