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**NLK apparatus EN 459-2
(03.2016)**

1. Unpacking and Installation

Please carefully unpack the apparatus and check for any damages. It is important to immediately detect potential damages caused by transportation. In this case a direct recording of facts is necessary. Therefore please contact the manufacturer.

- Observe technical data for information concerning permissible surrounding conditions.
- Before starting-up, please check your power supply: 230 V - 50 Hz or 115 V - 60 Hz.
- Only licensed temperature probes can be used.

2. Installation and Start-up

Please observe the following succession when installing the apparatus.

ATTENTION - SECURITY ADVICE

***Unslaked lime is etching. The milk of lime is highly alkaline after slaking.
!! Implicitly wear safety glasses and protective gloves !!***

1. Set up the rack and mount cross clamp and Dewar clamp.
2. Mount cross clamp for stirrer motor on the rack and fix stirrer motor.
3. Insert blade stirrer into the stirrer chuck and secure it.
4. Put Dewar flask on rack board and fasten it with the Dewar clamp.
5. Adjust stirrer motor and blade stirrer roughly to the Dewar flask.
6. Tune stirrer motor on the lowest speed and align Dewar flasks with stirrer motor accurately, so that the blade stirrer can rotate freely in the Dewar flask.
7. Put on the lid and align stirrer motor with blade stirrer again so that the blade stirrer can rotate freely. The blade stirrer must not touch the glass and the Dewar must be secured by means of Dewar clamp.
8. Attention: check immersion depth of blade stirrer.
9. Close the lid. Insert temperature sensor and secure it.
10. Connect temperature sensor and observe operating instructions of the temperature measuring device.

3. General Information

Reactivity examination of fine lime while slaking effects via measuring the incipient rise of temperature subject to the duration of reaction (wet slaking curve, NLK).

Basis of apparatus and measuring system is EN 459-2.

Test procedures and measuring methods see Building lime - part 2: Procedure EN 459-2

3.1. Products according to EN 459-2 (Extract of standard ponit 6.6.2)

The apparatus shall consist of the six parts shown in Figure

- 1) Dewar vessel type F9C, Vol. 1000 ml, internal diameter about 77 mm, internal height about 235mm.
- 2) Stirrer motor, (300 – 10) min⁻¹ under load.
- 3) Stand rack and support.
- 4) Blade stirrer made of suitable plastics, see drawing.
- 5) Plastics lid with segment which can be opened, feed opening and bore for the temperature sensor, to fit the Dewar vessel.
- 6) Calibrated thermometer (or comparable electric temperature measuring instrument) 0 °C to 100 °C with an accuracy of 0,5 °C and a high rate of response (adjustment time from 20 °C to 60 °C less than 10 s). The penetration depth shall be about 160 mm from a suitable hole on the top edge of the lid.

Option:

- The following shall be used additionally: a recorder for the temperature measurement.
- weighing and feeding device, made of stainless steel

Stirrer motor Nr. 2

Thermometer Nr. 6

Lid with segment Nr. 5

Dewar vessel F9C Nr. 1

Blade stirrer NLK Nr. 4

Stand and support Nr. 3

3.2. Determination of the water equivalent of the apparatus (extract of standard point 6.6.3)

Determine the water equivalent w by measuring the mixing temperature T_m of an amount of approximately 650 g in the Dewar vessel. Use the apparatus under the same conditions as for a reactivity test.

Fill (450 ± 1) g of water (m_c) of a temperature of $(20 \pm 0,1)$ °C (T_c) into the Dewar vessel. Then add (200 ± 1) g of water (m_h) of a temperature of $(50 \pm 0,1)$ °C (T_h). Run the stirrer at (300 ± 10) min₁. Measure the temperature T_m to $\pm 0,1$ °C after $(5 \pm 0,1)$ min.

$$w = \frac{m_h (T_h - T_m) - m_c (T_m - T_c)}{T_m - T_c} \quad \times 4,19 \quad \text{Joule / Kelvin}$$

where

$T_{m,h,c}$ are temperatures, in degrees Celsius;
 $m_{h,c}$ are masses, in grams;
 w is the water equivalent value, in joules per kelvin.

Alternative

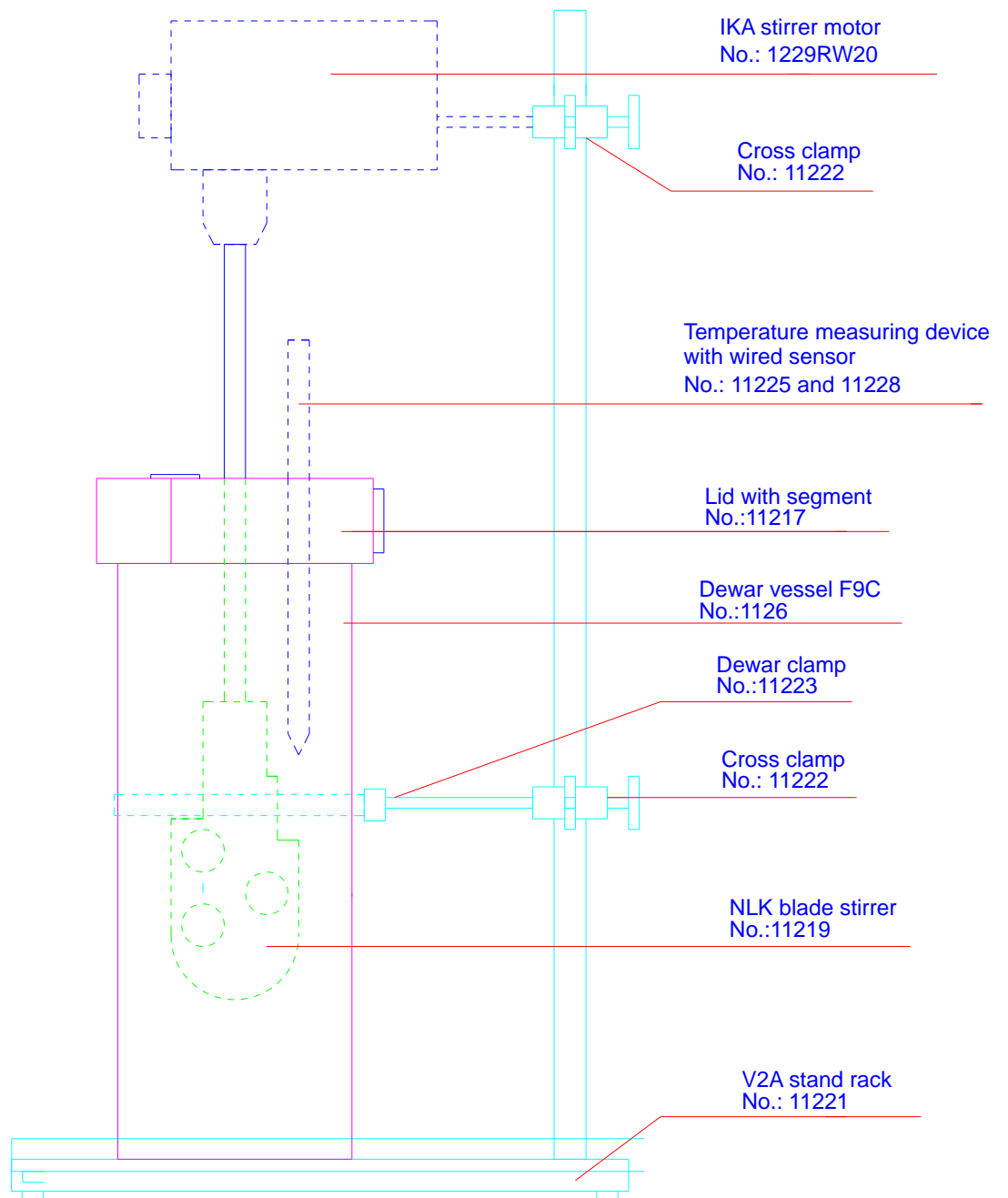
For determination of water equivalent, as well as the entire computation and the automatic operational sequence for the reactivity of the sample (e.g. lime) we recommend the software PDV-NLK3 of the company PDV-Software GmbH to you.

Please have a look at there homepage www.pdv-software.de



NLK assembly with stand rack Type A for wired sensor

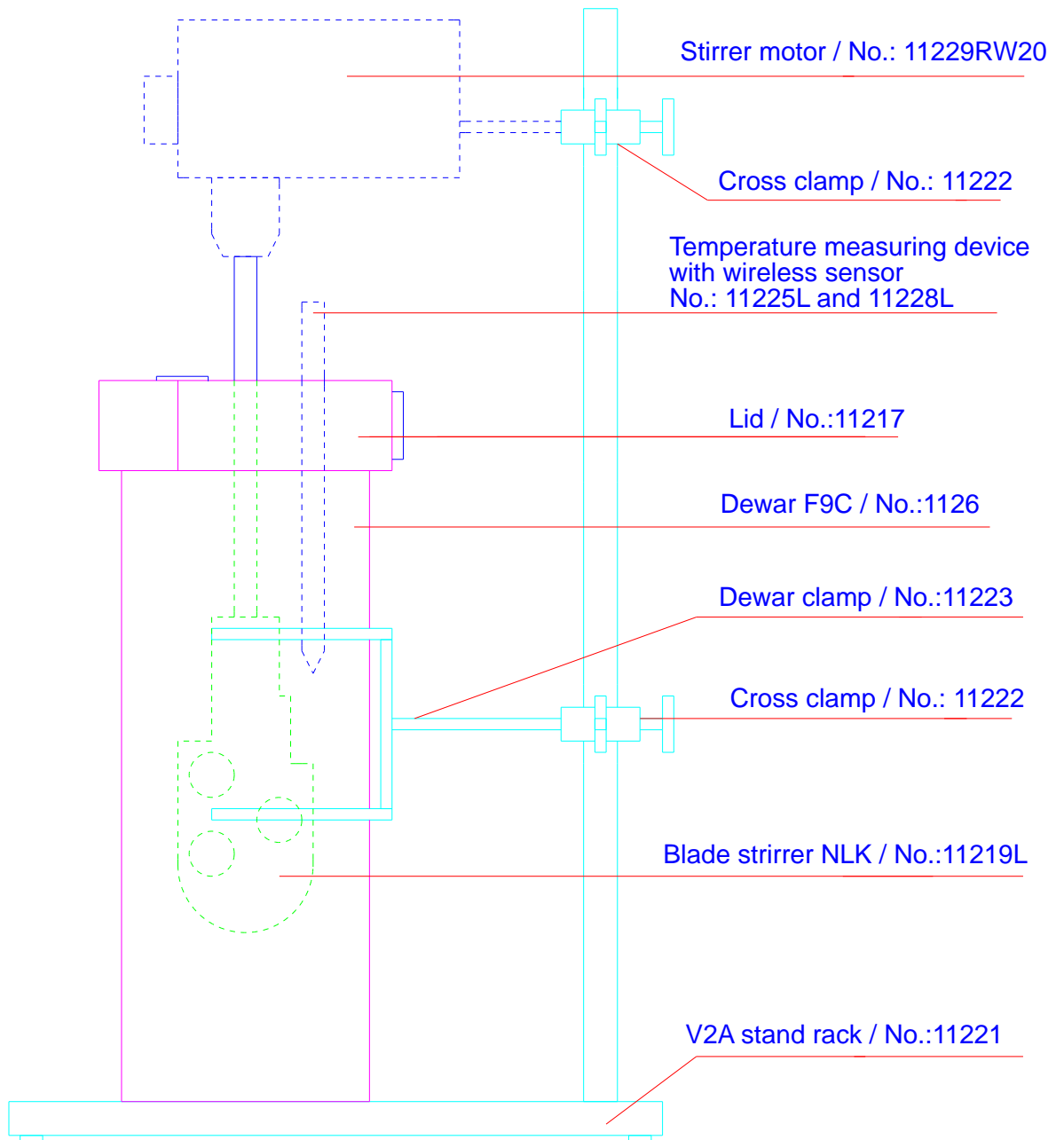
Order No.: 11218 Scope of delivery without data logging and stirrer motor with its clamp.



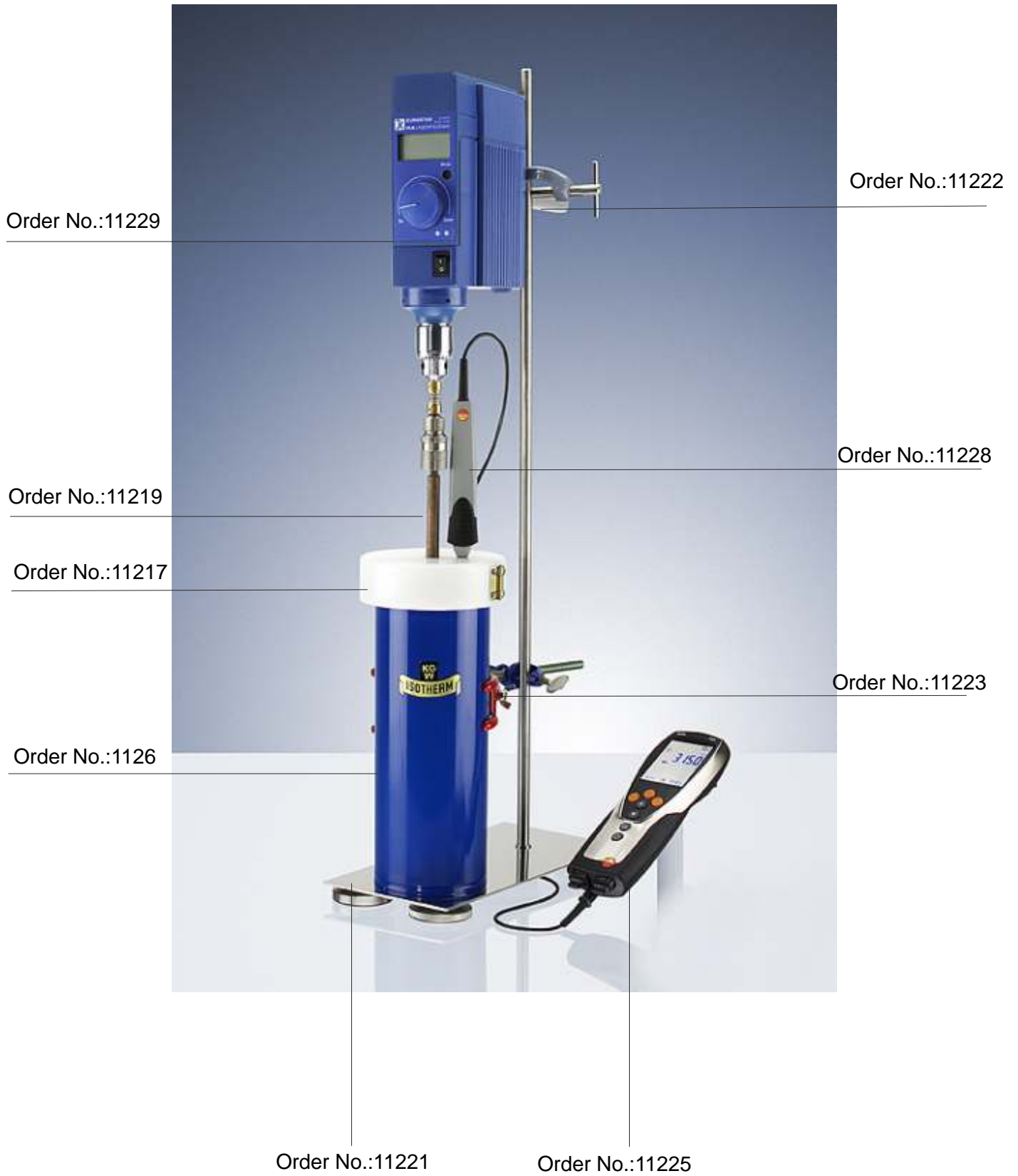


NLK assembly with stand rack Type AL for wireless sensor

Order No.: 11218L Scope of delivery without data logging and stirrer motor with its clamp.



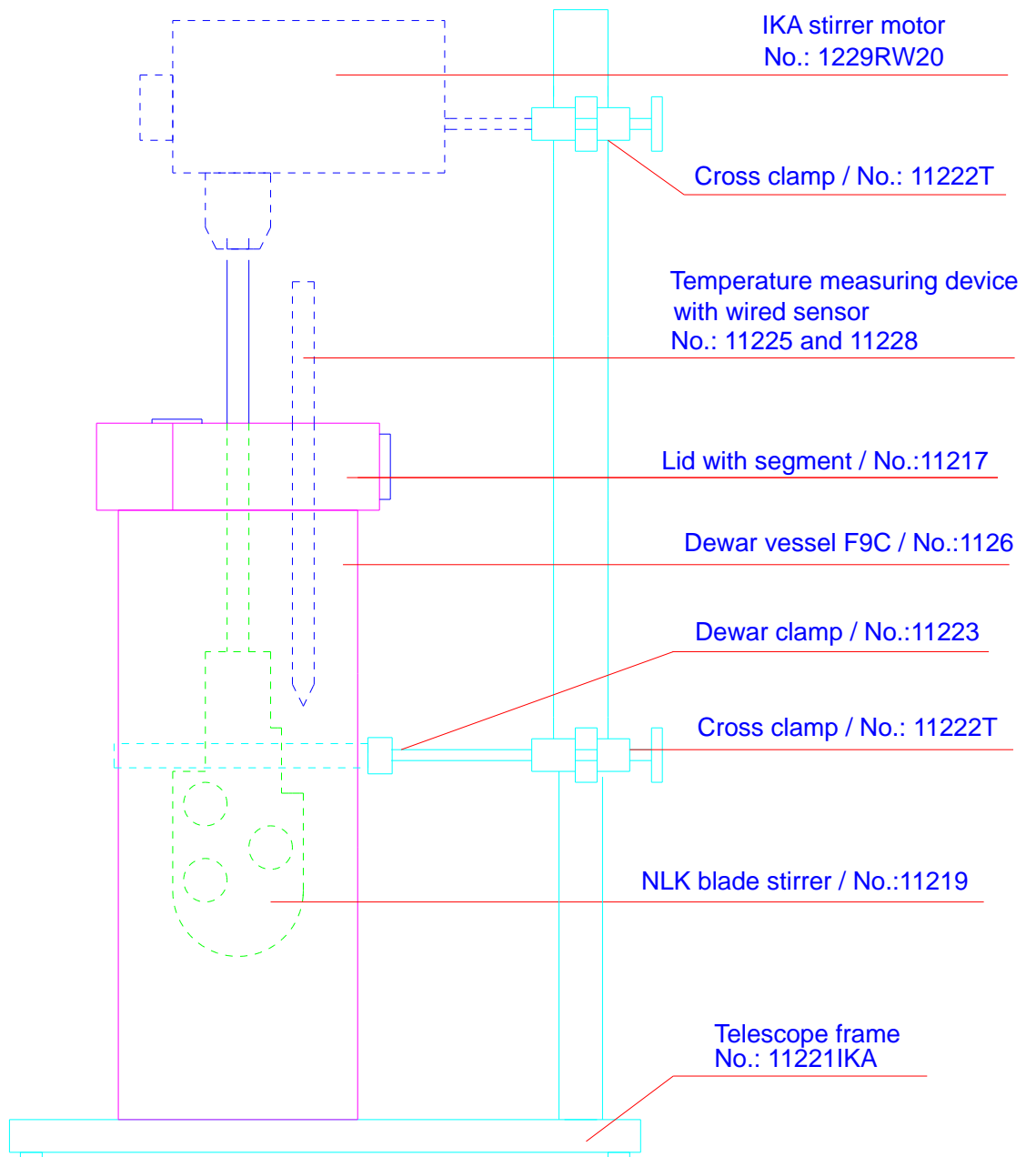
Order Numbers Type A No.: 11218





NLK assembly with telescope frame Type B for wired sensor

Order No.: 11235 Scope of delivery without data logging and stirrer motor with its clamp.



Order numbers Type B No.: 11235



Order No.:
11229RW20

Order No.:11222T

Order No.:11221IKA

Order No.:11228

Order No.:11217

Order No.:11219

Order. No.:11222T

Order No.:11223

Order No.:1126

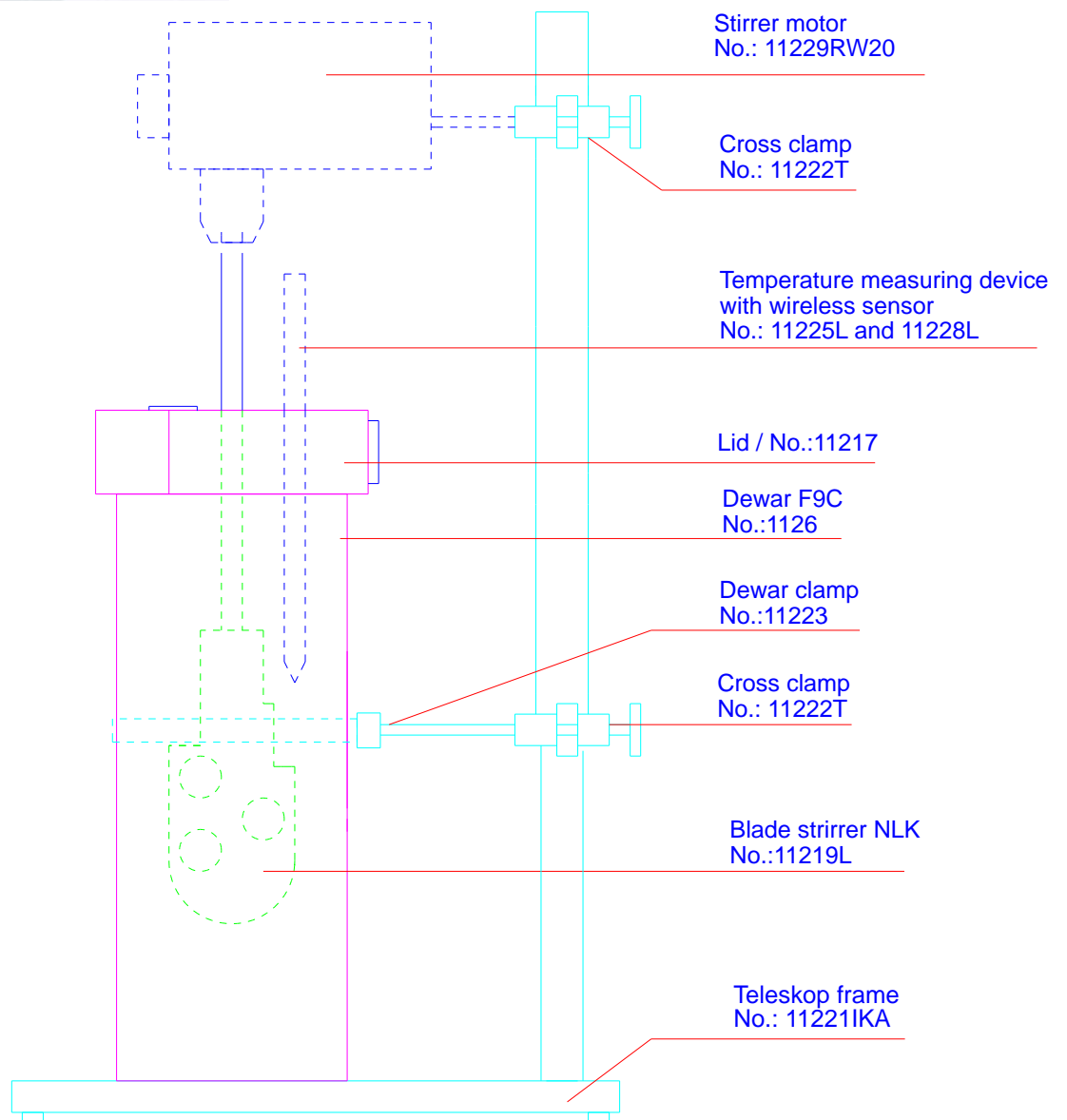
Order No.:11221IKA

Order No.:11225



NLK assembly with stand rack Type BL for wireless sensor

Order No.: 11235L Scope of delivery without data logging and stirrer motor with its clamp.



NLK Assembly with stationary frame type C 3 and three measuring stations



NLK Assembly with stationary frame type C3 for one wired sensor and two wireless sensors with data logging, Dewar flasks, lids, long blade stirrers, Dewar clamps, stirring motors. Appropriate evaluation software when required, is sold by PDV.

One wired sensor is always required on assemblies with multiple measuring stations, if using one or more wireless sensors. Up to three wireless sensors can get applied, afterwards. The data logger itself additionally needs an embedded radio module. In addition, long version of blade stirrer is needed, when using wireless sensors.

NLK Assembly with stationary frame type C for wired and wireless sensors, up to four measuring stations.

Part no. 11218C2, consisting of:

A frame with two Dewar flasks, two lids, two long blade stirrers, two cross clamps and two Dewar clamps (data logging and stirrer motors with their clamps are not included in scope of delivery).

Part no. 11218C3, consisting of:

A frame with three Dewar flasks, three lids, three long blade stirrers, three cross clamps and three Dewar clamps (data logging and stirrer motors with their clamps are not included in scope of delivery).

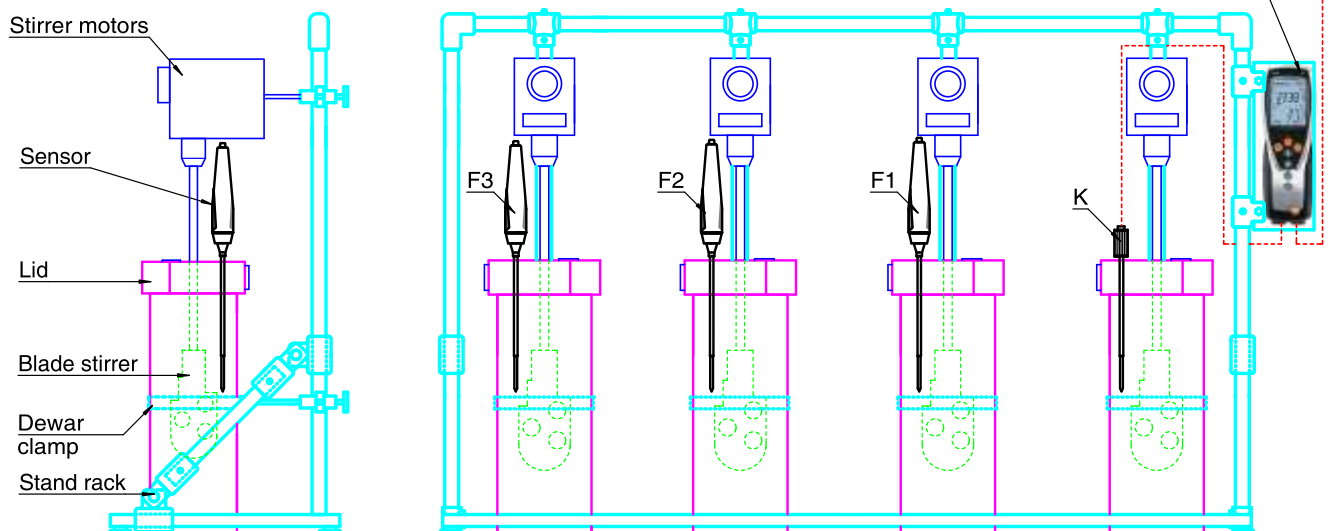
Part no. 11218C4, consisting of:

A frame with four Dewar flasks, four lids, four long blade stirrers, four cross clamps and four Dewar clamps (data logging and stirrer motors with their clamps are not included in scope of delivery).

Construction example with stand rack type C4 data logger with radio module, one wired sensor and three wireless sensors



K = sensor - wired
F1 to F3 = sensor - wireless

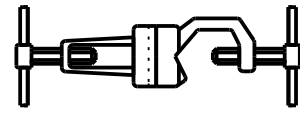


Accessories and spare parts

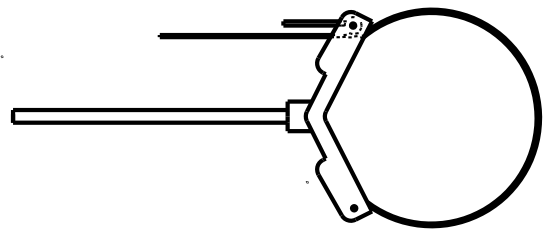
Weighing and feeding device No: 11224



Cross clamp No.: 11222
or 11222T



Dewar clamp No.: 11223

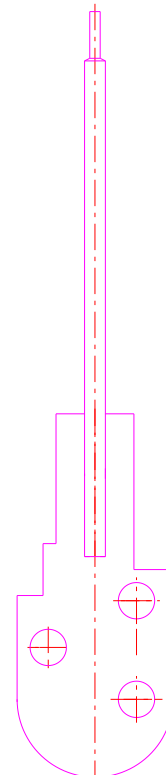
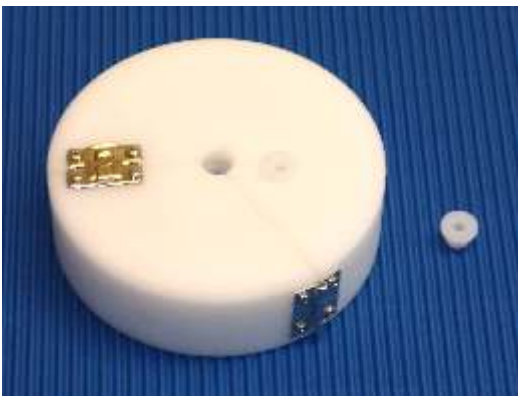


Dewar flask NLK
Typ F9-C No.: 1126



Blade stirrer No: 11219 for wired sensor
Blade stirrer No: 11219L for wireless sensor

Lid with segment No: 11217



Accessories and spare parts

Temperature measuring device for one wired sensor.
Part no.: 11225

Temperature measuring device with radio module for one wired sensor and up to three wireless sensors.
Part no.: 11225L.



Power supply for temperature measuring device.
Part no.: 11225N

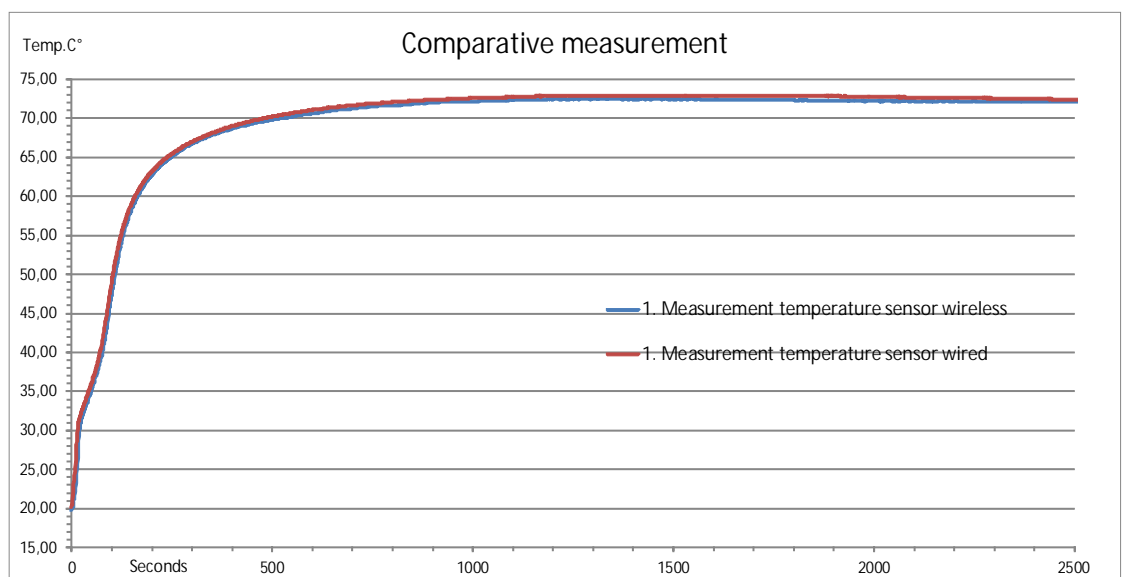
Power supply cannot be used, if PDV software is utilised.



Temperature sensor Typ K wireless No.: 11228L

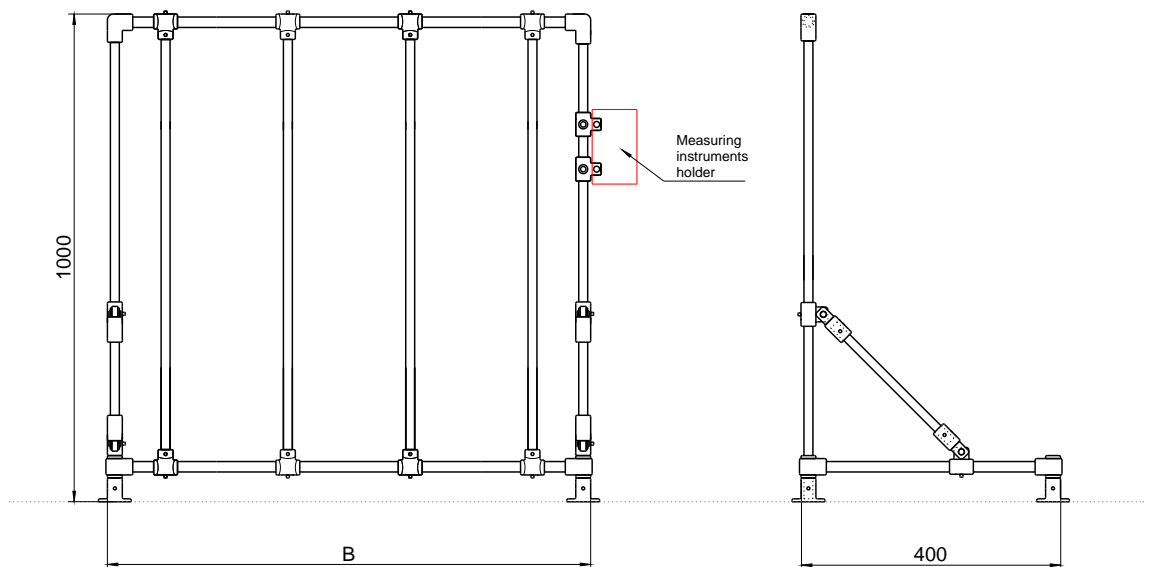


Temperature sensor Pt100 wired No.: 11228



Accessories and spare parts

Stand rack type C for 3 NLK assemblies.



Stand rack for two NLK systems, width B= 600mm, Art. No.: 11221C2
Stand rack for three NLK systems, width B= 900mm, Art. No.: 11221C3
Stand rack for four NLK systems, width B= 1200mm, Art. No.: 11221C4

Article	Part no.
Complete assemblies	
NLK Assembly type A for wired sensor	
Complete assembly with STAND RACK (without temperature-measuring device, stirrer motor/clamp and feeding device as per standard)	11218
NLK Assembly type AL for wireless sensor	
Complete assembly with STAND RACK (without temperature-measuring device, stirrer motor/clamp and feeding device as per standard)	11218L
NLK Assembly type B for wired sensor	
Complete assembly with TELESCOPE FRAME (without temperature-measuring device, stirrer motor/clamp and feeding device as per standard)	11235
NLK Assembly type BL for wireless sensor	
Complete assembly with TELESCOPE FRAME (without temperature-measuring device, stirrer motor/clamp and feeding device as per standard)	11235L
NLK Assembly type C for a wired sensor and wireless sensor(s)	
Complete assemblies with special STAND RACK (without temperature-measuring device, stirrer motor/clamp and feeding device as per standard)	
With 2 x Dewar vessels, Lids and Blade stirres 11219L	11218C2
With 3 x Dewar vessels, Lids and Blade stirres 11219L	11218C3
With 4 x Dewar vessels, Lids and Blade stirres 11219L	11218C4
Accessories	
1. Temperature-measuring device from TESTO	
Testo-Datalogger 735-2	11225
Testo-Datalogger 735-2 with radio module	11225L
Power supply unit	11225N
Temperature sensor - wired	11228
Temperature sensor - wireless	11228L
2. Stirrer motors from IKA	
RW 20 digital (plus clamping, e.g. cross clamp R270)	11229RW 20
Eurostar 40 digital (plus clamping, e.g. cross clamp R270)	11229
Cross clamp R270 for assemblies type B, BL or C	112233
3. Weighing and feeding device as per standard	
	11224
Spare parts	
Special Dewar vessel F9C / NLK	1126
Glass refill for special Dewar, F9A / NLK	1116
Plastic lid with segment	11217
Blade stirrer for wired sensor	11219
Blade stirrer for wireless sensor	11219L
Cross clamp for stand rack (16mm)	11222
Cross clamp for telescope frame (30mm)	11222T
Dewar clamp up to D=170mm	11223
Stand rack	11221
Telescope frame	11221IKA
Stand rack type C2 without accessories (for 2 NLK-assemblies)	11221C2
Stand rack type C3 without accessories (for 3 NLK-assemblies)	11221C3
Stand rack type C4 without accessories (for 4 NLK-assemblies)	11221C4
For NLK-software: please contact the company PDV directly (KGW does not sell this software)	www.pdv-software.de www.nassloeschkurve.de

Software solution for capturing and supporting the analysis process

The company pdv-Software GmbH, Goslar (Germany) has developed pdv-nlk 3 for capturing, storing, and the mathematical analysis of the measured values?



Measurement data acquisition with pdv-nlk 3

Key Features

- Measurement data acquisition with two temperature sensors/transducers
- Analysis according to DIN EN 459-2
- Parameters T_0 , t_{max} , T_{max} , T'_{max} , t_{u80} , T_{u80} , T_{60} , T_{10} , T_{40} , R-value, maximum of turnover rate
- Records values up to four temperature sensors/transducers
- Representation of the characteristic values in the wet slaking curve diagram
- Saving (as an image file) and printing of measurement progress
- Management of measurement data and samples
- Central master data
- Integrated device driver for measurement instrument Testo 735, up to 4 channels simultaneously; other drivers on request
- Calibration of the sensors on two or more points
- Examination of heat loss of the Dewar vessels
- Import and Export of existing raw and end data via CSV interface
- Integration with laboratory information systems (LIS/LIMS) possible

Detailed information about this solution can be found online at www.nasslöschkurve.de/messsoftware-pdv-nlk.

If you are interested in pdv-nlk 3 please consult directly:
pdv-software GmbH
info@pdv-software.de