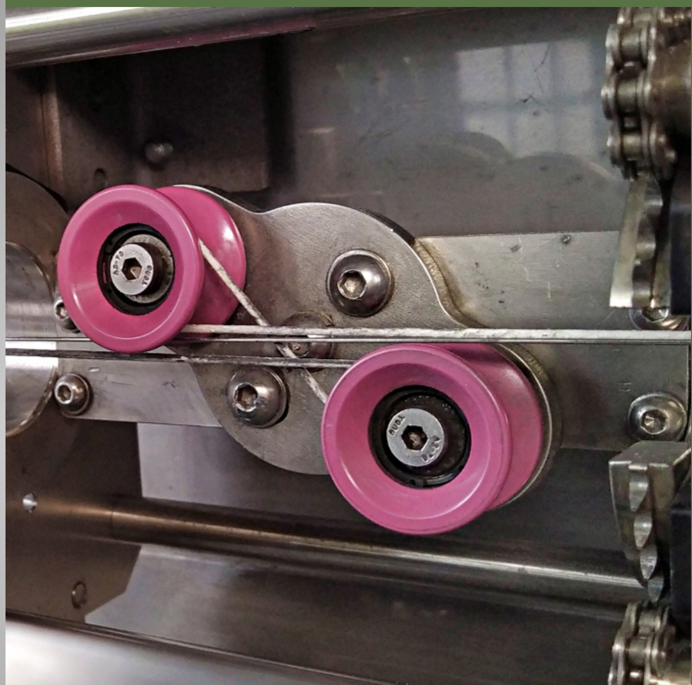
Boockmann
Engineering GmbH

2024



Labtech

Made in Germany

www.boockmann.com

HELILUB®

HELICORD®

Table of Contents

I. Labtech

1 Device for Determination of the Static Coefficient of Friction of Wire or Cable Surfaces

Basic Considerations

Both in the laboratory and in production, a quick evaluation of sliding properties of wire or cable surfaces is often needed. The static coefficient of friction (µ) can be used as a first indication.
Boockmann's compact device for measuring the static coefficient of friction provides a quick and easy measurement and thus allows fast judgement of production conditions and parameters.

Measurement Principle

Condition I: $F_H < F_R$

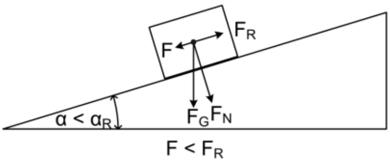


Fig. 43

Condition II: $F_H \geq F_R$

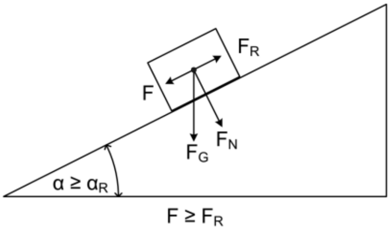


Fig. 44

F_N = Normal force
F_H = Downhill slope force
F_G = Gravitational force (sliding plate)
F_R = Friction force
µ = Coefficient of friction

$$\mu = \frac{F_R}{F_N}$$

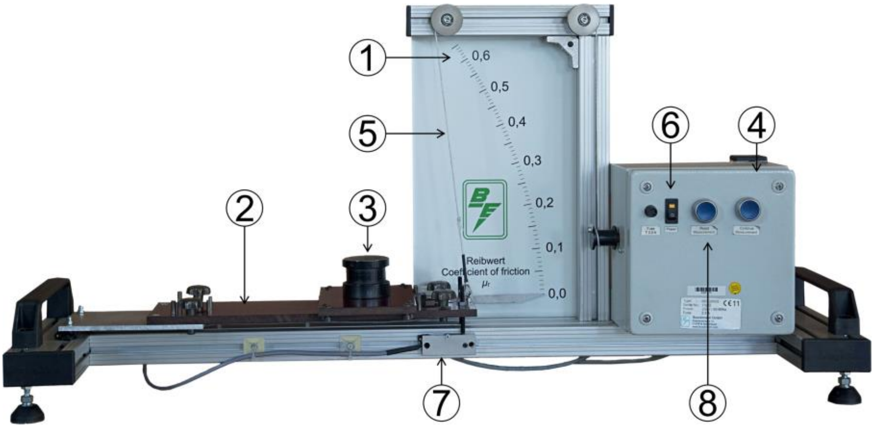
For the condition $F_H = F_R$, the friction force is determined by increasing the angle β until the sliding plate starts moving (Condition II).

Measurement

After the wire or cable is positioned correctly and the measurement is started, the inclination plate (2) moves upwards and stops automatically when the sliding plate (3) starts moving (picture 11). The coefficient of friction µ ($\mu = \tan\beta$) can be read on the scale (1)

A minimum of 5 measurements is made, and the arithmetical average of μ is calculated.

Equipment and Technical Data



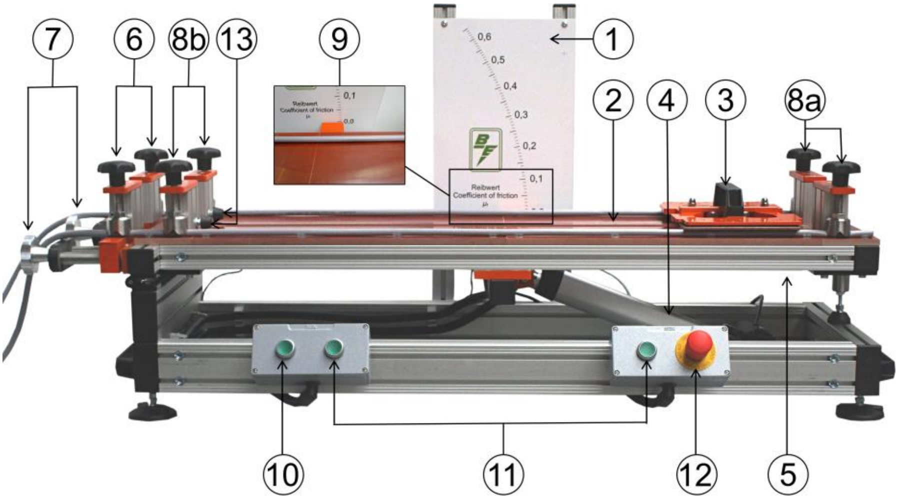
Picture 10: Device for wire

Legend:

1 - Scale
2 - Inclination plate
3 - Sliding plate with a weight
4 - Control Box
5 - Rope
6 - Main switch
7 - Micro switch
8 - Reset measurement button

Device for		wire	cable
Recommended wire diameter		0.10 to 2.5 mm	8 to 30 mm
Mains voltage		115 to 230 V AC	100 - 240 V AC - 50/60 Hz (one phase) (Land dependent)
Fuse		T 2.5 A	T 4 A
Total power consumption (W)		~ 50	Max. 120
Operating environment	Temperatures	+10°C to +45°C	+10 to +45
	Relative air humidity	5 to 70 % at 25 °C, not condensing	5 to 70 % at 25 °C, not condensing
	Air pressure (hPa)	860 to 1080	860 to 1080
Storage and transport temperature (°C)		- 20 to +60	- 20 to +60
Measurement (W x H x D)		1010 x 500 x 310 mm	1388 x 639 x 705
Weight		~ 10 kg	~50
Measuring range		0.0 to 0.6	0.0 to 0.6
Accuracy		± 0.01	± 0.01

Table 22



Picture 11: Device for cable

Legend:

1 – Scale
2 – Inclination plate
3 – Sliding plate with a weight
4 – Lift drive
5 – Contact switch (under the inclination plate)
6 – Tensioner with cable/wire pinch
7 – Handle to straighten the cable/wire
8 a,b – Cable/wire pinch of the inclination plate
9 – Pointer to read the value of the coefficient of friction
10 – Button to start/continue the measurement
11 – Buttons to reset the measurement
12 – Emergency button
13 – Stops of the inclination plate

2 Test Unit for Determination of Hydrocarbons on Wire Surfaces

Hydrocarbons (CH) can influence the surface properties of wire and its processing considerably. Therefore the knowledge of type and amount of organics on the wire surface, either contamination or functional coating, is important for wire manufacturers, processors and industrial end-users for quality assurance.

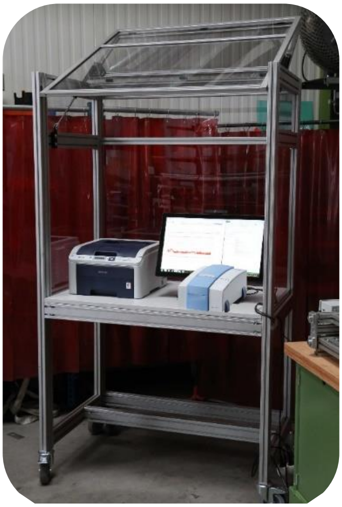
More simple infrared measurement systems applied in the wire industry work with a fixed wavelength and only allow the quantitative determination of a specific hydrocarbon based on the calibration set in the factory.

In contrast, the test unit presented here records the full spectrum in the MIR range

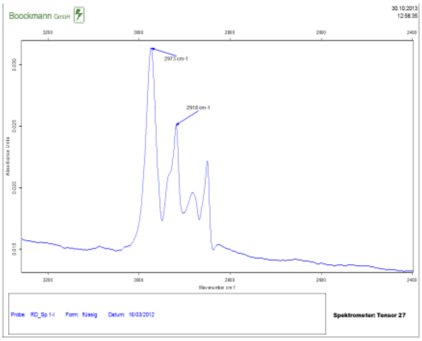
- either in the transmitted light through a cuvette containing the measuring solution

- or optionally by an „ATR“ unit in total reflection at the wire itself or by a wipe on a suitable CH-free medium.

Amount and type of pure hydrocarbons on wire surfaces can be determined by suitable computer-assisted analysis. The determination of mixtures of CH or additions of inorganic components is limited.



Picture 12: Enclosure, IR spectrometer, computer for evaluation and color laser printer



IR spectrum: CH absorption used for evaluation

Two configuration data sets with the associated calibration curves for the IR spectrometer are delivered with the CH test unit for quality-ensuring determination of the amount of known hydrocarbons. They enable even non-professionals to successfully operate the machine by following an easy-to-understand measuring instruction.
The CH test unit converts the determined concentration of the solvent on the basis of the entered data and provides results in terms of the amount of lubricant per square meter of the wire surface.

The test unit provides the following additional features like for example:

- extension of the library of IR spectra included in the delivery
- setup of customized libraries
- computer-supported substance identification by comparing spectra (with references created before) in the libraries
- method setup for substance specific quantification
- diverse functions for spectra editing and evaluation

Included in the delivery of the test unit are:

- work table with dust cover (with ventilation hook-up)
- FTIR spectrometer (measuring range for wave numbers of 375 – 7.500 cm^{-1}) with
- transmission unit with holder for cuvettes
- 10 mm quarz cuvettes set
- 5 ml pipette
- test tube holder
- 200 test tubes
- configuration data sets to determine the amount of specific hydrocarbons
- optional: ATR-unit
- computer with Windows operating system and pre-installed software for spectra evaluation
- spectra library with organic substances frequently used in welding wire manufacturing
- measuring standards (BE standard 151, BE standard 154, BE standard 156) for quantitative and qualitative determination of substances
- color laser printer
- analytical scales
- dosage pipette

3 Digital Microscope for Wire Surface Examination

Task

Surface damages on wire, such as

- roughness from rod or strip
- scratches from pulley flanges
- scratches from precision winding
- micro cracks due to too high deformation ratio or slippage of the wire on capstan rolls

are generated in different steps of the production process.

In order to avoid this and systematically improve the wire surface quality, raw material quality and process conditions, especially of drawing and rolling, must be adjusted. To do so, it is necessary to examine and evaluate the wire surface carefully in each production step.

Solution

The digital microscope provides, at reasonable cost, the possibility to visually inspect the wire surface on sample pieces or directly on spools (figure 48). Comparing the surface after different stages of production, ideally the particular process during which a specific type of surface damage is generated, can be verified.

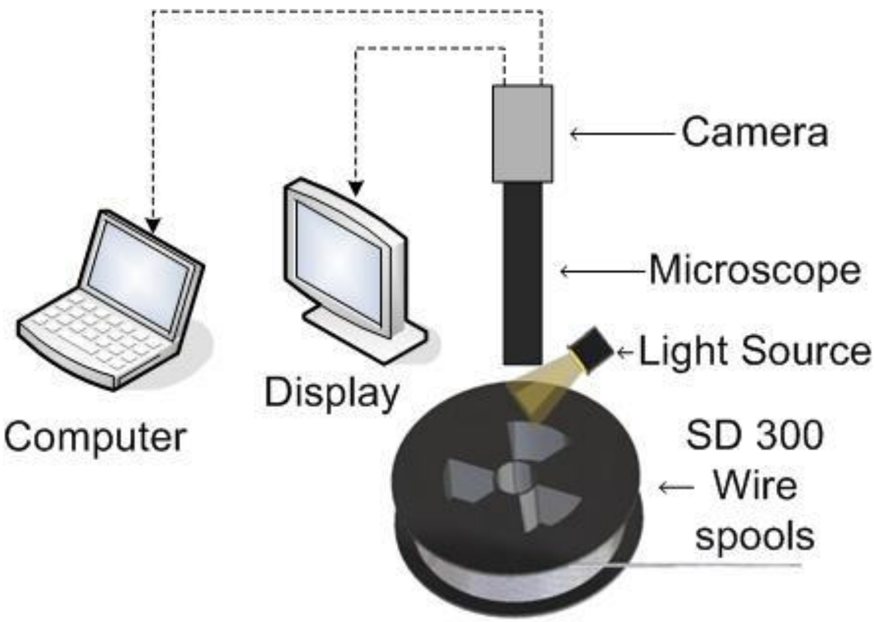


Fig. 45: Schematic

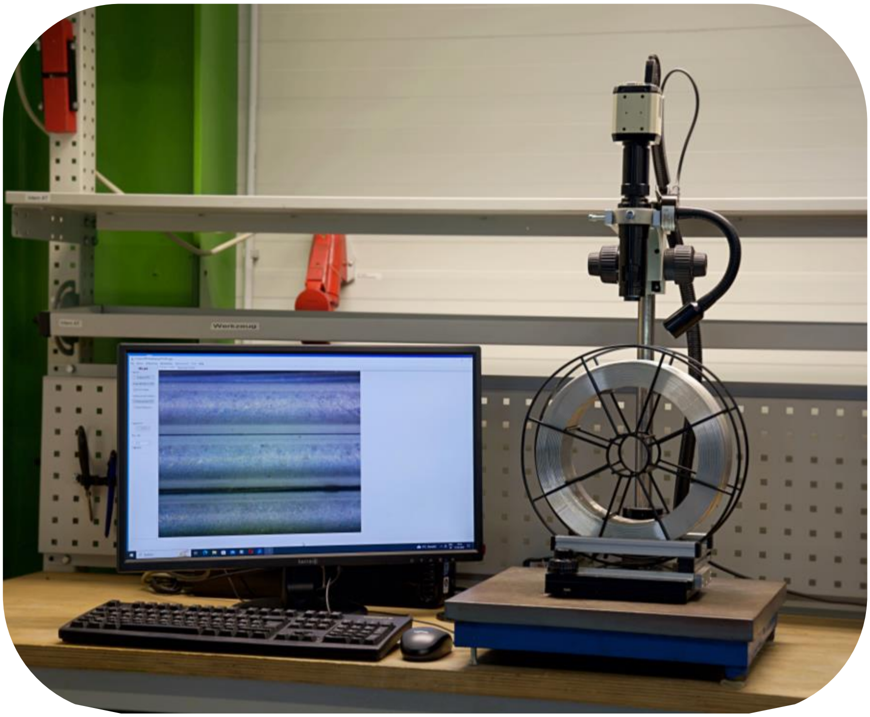


Fig. 48 Setup

The digital microscope setup consists of

- Reflected-light microscope with 11-fold optical zoom
- 15" XGA color monitor
- Object table with stand column

- Precision xy-cross table with additional holders for
    a. wire spools (up to dimension of SD 300, see fig.: 48) and
    b. wire segments Ø 0.5 to 3 mm and 200 mm length; 360° observation by wire rotation around its longitudinal axis
- LED ring light for vertical lighting
- LED spot light (2.3 W) for inclined lighting
- High resolution camera with direct and USB video output

and comes with a CD with basic PC software that allows storing individual pictures and short videos.

Options

- Two additional lenses providing magnifications 90x - 1,000x (about 45 mm focal distance) and 22x - 250x (about 180 mm focal distance) available. [Remark: The higher the focal distance, the higher is the depth of sharpness.]
- Software for enhancement of depth of sharpness
- PC or notebook with Microsoft Windows operating system

Technical Data

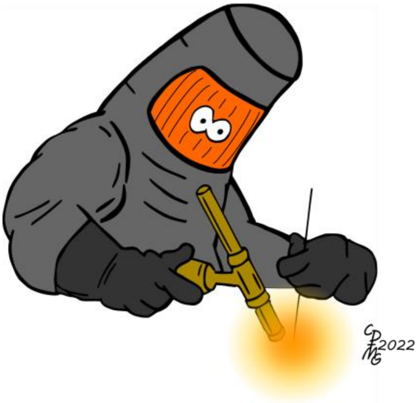
Microscope		
Magnification (with respect to a 15" monitor)		45× to 500×
Focal distance (microscope to object) (mm)		90
Video Camera		
Resolution	Direct video output (pixel)	1,024 × 768 (XGA)
	USB output to PC (pixel)	1,600 × 1,200 (UXGA)
Power supply		100 - 240 V / 50 – 60 Hz (P + N), max. 1.0 A
Monitor		
Screen size (inch)		15
Resolution (pixel)		1,024 × 768
Power supply		100 - 240 V / 50 – 60 Hz (P + N + PE), max 1.5 A
Object table		
Lateral dimensions (mm)		400 × 400
Height of stand column (mm)		about 560
Precision xy-cross table		
Lateral dimensions (mm)		180 × 155
Lateral working range (mm)		65 × 76

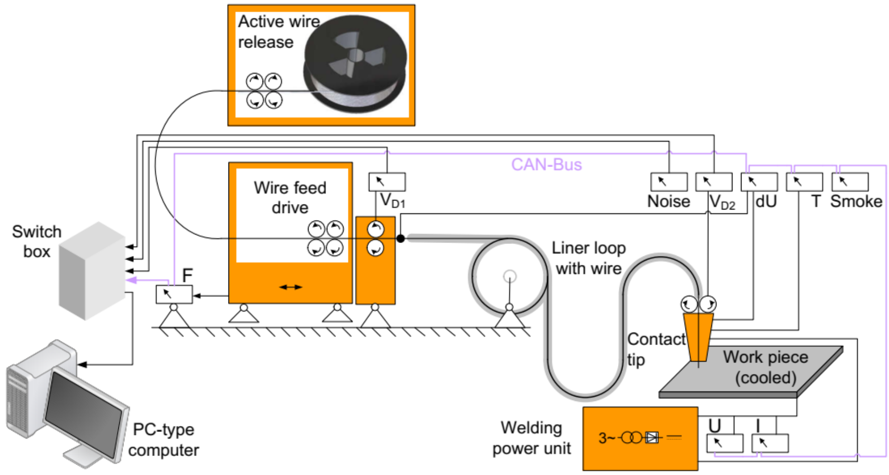
Table 19

4 Welding Test Unit

Picture13

The welding wire test unit allows the objective assessment of welding wire properties by operator-independent experimental welds under controlled and repeatable conditions. That provides information on systematic further development and quality assurance. During welding, measurements like feedability and voltage loss in the contact tip are recorded. The moving work piece allows long-time tests, so that variations in wire surface quality regarding particles, roughness and consistency as well as performance in the contact tip and contact tip wear can be detected.





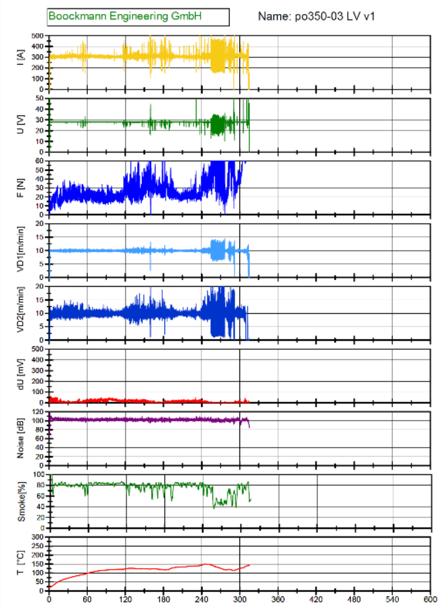
Picture 14

The following measurements are recorded by the computer of the welding test unit and displayed as a chart on the screen:

- feeding force (F)
- welding current (I)
- welding voltage (U)
- voltage loss in the contact tip (dU)
- noise level during welding
- temperature curve of the contact tip (T)
- wire speed after wire feed (VD1)
- wire speed before contact tip (VD2)
- smoke density

The chart shows measurement curves of a customary stainless steel welding wire in need of improvement. The simultaneous fluctuations of the feeding force and the welding current curve show micro-arcs and welds in the contact tip. They finally lead to complete fusing of the wire with the contact tip and interruption of the measurement. The high and very irregular voltage loss probably is caused by contamination of the wire surface.
The voltage loss of a good copper-plated wire is less than 25 mV, that of a good blank normal steel wire less than 100 mV.

Testing curves (flux-cored stainless steel welding wire with a diameter of 1.2 mm):



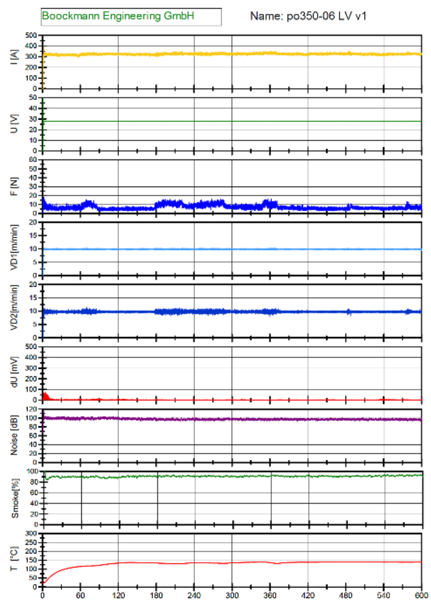


Fig. 46: Commercially available prod

Fig. 47: Wire from a) after welding wire finishing with HELICORD®

Further properties

- The welding current can be set up to 500 A during permanent operation.
- Measuring data are recorded at up to 1 kS/s and an analog digital converter resolution of up to 12 bit.
- The welding speed can be set up to 1,000 mm/min.
- The operator is guided through the measurement by HMI.
- The measurement report can be printed by the color laser printer included in the delivery.

Boockmann Engineering GmbH

Eckartspfad 6
97708 Bad Bocklet / OT Steinach
Germany

info@helicord.de