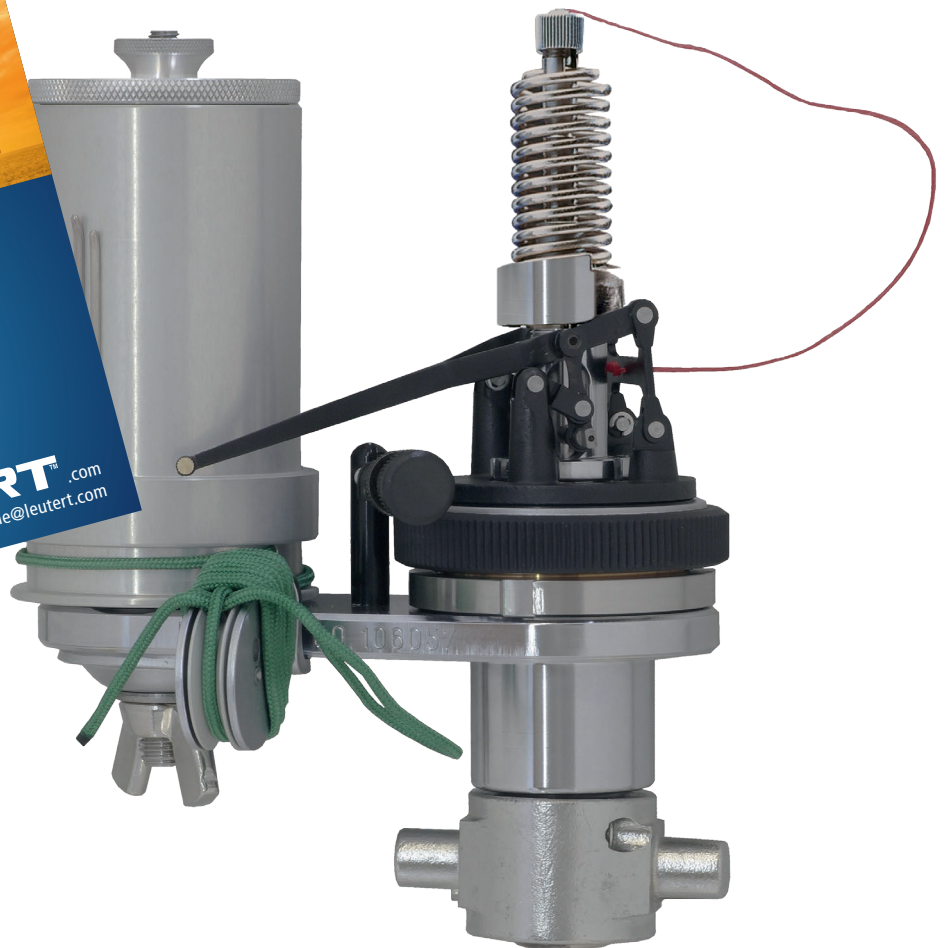


Engine Indicator Type 50 Type 30

Operating Instructions



Engine Indicator

The mechanical engine indicators type 50 and type 30 measure dynamic pressures. They are especially designed to analyze large two and four stroke Diesel engines.

Introduction

This operating manual provides instructions on how to use this product correctly, effectively and safely for the intended purpose. Please read all instructions, notes on danger and warning attentively. Please follow all safety instructions and precautionary notes in order to avoid damage to people or property during operation. LEUTERT can not be held responsible for damage or injury resulting from improper product use, incorrect operation or lack of maintenance.

This operating manual is directed to technically trained personnel. In case of doubt regarding safety or operational aspects, please do not hesitate to contact LEUTERT for assistance. Should you notice a faulty description or depiction or if you would like to suggest points for improvement, we are looking forward to hearing from you.

Please keep the operating manual near the product to have it available if needed. Make sure that the manual is protected from dirt and moisture.

Explanation of symbols:



DANGER

indicates a hazardous situation which, if not avoided, will result in death or serious injury.



WARNING

indicates a hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



NOTICE

is used to address practices not related to personal injury.

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1 The Engine Indicator

1.1 General Description

The LEUTERT engine indicator is used to draw a single graph of the dynamic pressures in a combustion engine cylinder against the cylinder volume. This so called a P-V curve or indicator diagram can be used to diagnose problems such as leaking valves or incorrect timing. The LEUTERT indicators can be used for any reciprocating engine.

To operate the indicator a sheet of paper is wrapped around the drum. The indicator is mounted to the cylinder head of the engine to be measured. The engine needs to be equipped with an indicator valve to do so.

The indicator cord may be pulled manually to rotate the indicator drum. The drum is returned by an incorporated spring. Alternatively the cord may be connected to the cam shaft of the engine so that the drum rotates backwards and forwards with the motion of the piston. If connected to the cam shaft, the circumference of the graph indicates the power of the cylinder.

A pen arm is linked to a spring bellow that is connected through a pipe to a valve in the cylinder head. The pressure in the cylinder head moves the pen along the axis of the drum to complete the pressure volume graph.

The sectional drawing of the indicator shows that the bottom part is mounted in the drum support by means of a slotted nut. Depending on the expected maximum pressure, two types of bottom parts are available: One bottom part for the piston rod 1/5 and one for the piston rod 1/10.

The upper part consists of the recording mechanism, the piston rod and the ring nut. The recording pencil of the indicator type 50 is interchangeable. To be able to measure higher pressure, the LEUTERT Indicators can be equipped with a smaller piston size. Corresponding to smaller piston size, higher pressure ranges can be indicated with the same spring.

The spring is a double-coiled, easily interchangeable tension spring. All springs are precisely calibrated and marked with the spring number corresponding to the max. pressure rating. When selecting springs, note that the highest frequency of natural vibration can be obtained by using the largest piston possible with appropriately strong spring.

Every single device is being tested and calibrated according to our ISO 9001 quality standards and will be supplied with a calibration certificate proving the accuracy of the device.

1.2 Technical Specifications of the Indicators

1.2.1 Indicator Type 50

This indicator is especially designed to analyze large two stroke Diesel engines.

Max. Pressure	:	300 bar
Measuring range	:	see spring table
Engine range	:	up to 300 rpm or max. $dp/dt = 9 \times 10^3$ bar/sec
Diagram height / length	:	max. 50 mm / 80 mm
Drum diameter	:	50 mm
Paper size	:	180 mm x 65 mm
Dimensions	:	165 mm x 130 mm x 90 mm
Weight	:	1.5 kg without wooden box 4.4 kg with wooden box
Standard connection	:	W 27 x 1/10"

1.2.2 Indicator Type 30^{*)}

This indicator is especially designed to analyze large two and four stroke Diesel engines.

Max. Pressure	:	250 bar
Measuring range	:	see spring table
Engine range	:	up to $n = 1,000$ rpm or max. $dp/dt = 18 \times 10^3$ bar/sec
Diagram height / length	:	max. 30 mm / 60 mm
Drum diameter	:	40 mm
Paper size	:	145 mm x 45 mm
Dimensions	:	120 mm x 105 mm x 85 mm
Weight	:	1.1 kg without wooden box 4.0 kg with wooden box
Standard connection	:	W 27 x 1/10"

^{*)} Discontinued product. No availability of spare parts. Availability of complete units while stock last.

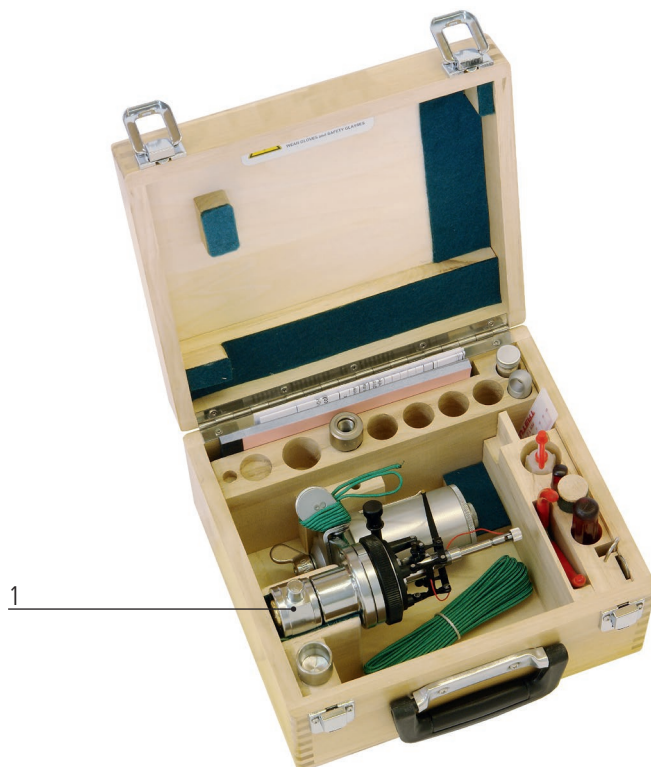


NOTICE

The applicability of the indicators not only depends on the speed of the engine, but also on the pressure change rates.

2 Assembly Drawing and Inventory

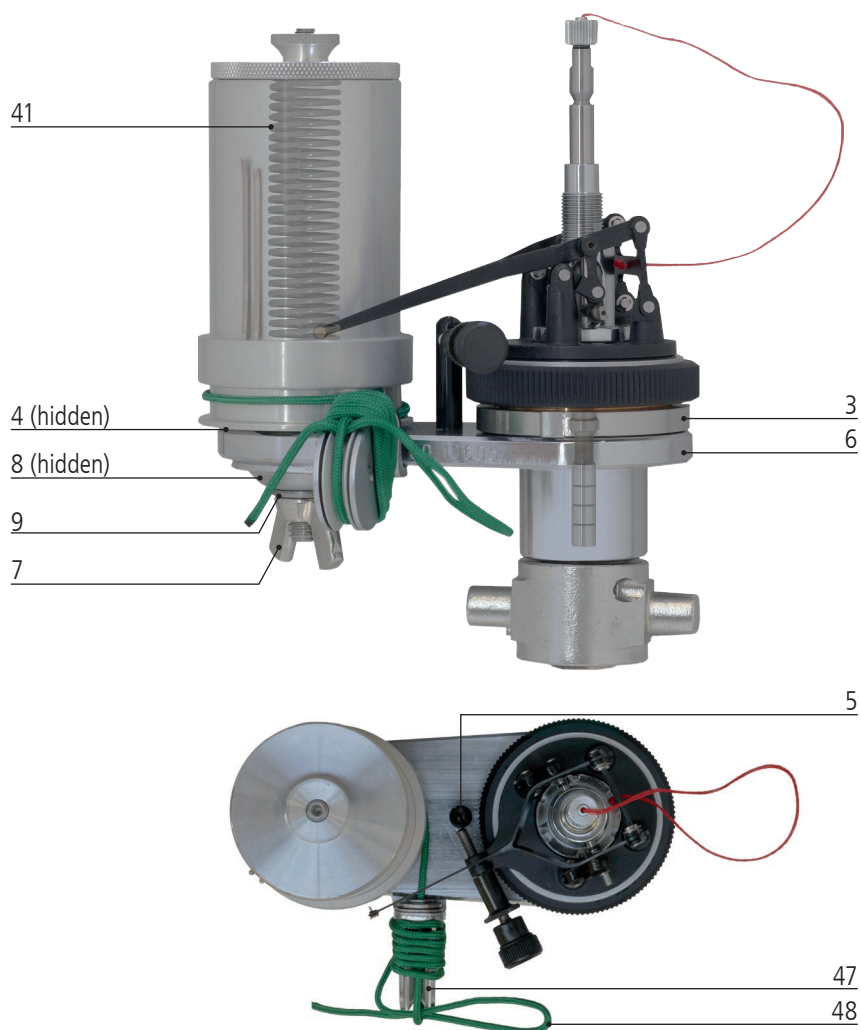
Item	Description	Part-No.		
		Type 50 Piston 1/10	Type 50 Piston 1/5	Type 30 ^{*)} Piston 1/5
1	Indicator complete with accessories, without spring & measuring scale	4656.00.00000	4663.00.00000	4611.00.00000



^{*)} Discontinued product. No availability of spare parts. Availability of complete units while stock last.

2.1 The Indicator

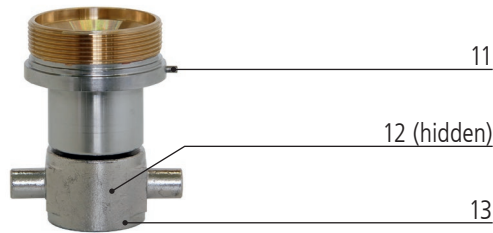
Item	Description	Part-No.		
		Type 50 Piston 1/10	Type 50 Piston 1/5	Type 30*) Piston 1/5
2	Indicator	4656.11.00000	4663.11.00000	4611.11.00000
3	Slotted nut	4651.11.03002	4651.11.03002	4611.11.03002
4	Stop screw	4651.11.03003	4651.11.03003	N.A.
5	Stop column	4651.11.03004	4651.11.03004	4611.11.03003
6	Drum support	4651.11.03005	4651.11.03005	4611.11.03004
7	Wing nut	MUTTERM10.05300	MUTTERM10.05300	MUTTERM10.05300
8	Nut M10	MUTTERM10.05200	MUTTERM10.05200	MUTTERM10.05200
9	Washer 10,5	USCHEID10.07000	USCHEID10.07000	USCHEID10.07000
41	Drum spring	4651.11.01003	4651.11.01003	4611.11.01002
47	Guide roll	4661.11.02000	4661.11.02000	4611.11.02000
48	Indicator cord	4651.98.00004	4651.98.00004	4651.98.00004



*) Discontinued product. No availability of spare parts. Availability of complete units while stock last.

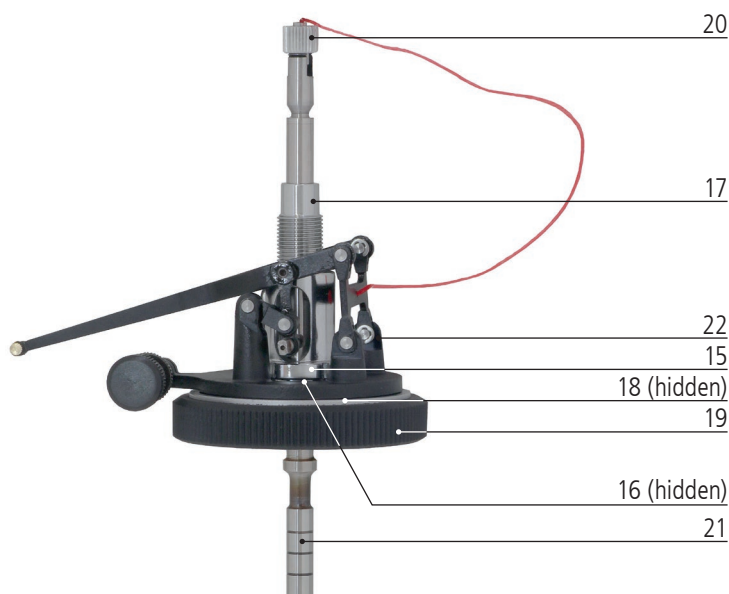
2.1.1 The Bottom Part, complete

Item	Description	Part-No.		
		Type 50 Piston 1/10	Type 50 Piston 1/5	Type 30 ^{*)} Piston 1/5
10	Bottom part, complete	4651.11.03100	4651.11.03200	4611.11.03100
11	Straight pin	ZSTIFTD02.25600	ZSTIFTD02.25600	ZSTIFTD02.25600
12	Wedge	4651.11.03102	4651.11.03102	4651.11.03102
13	Coupling nut	4651.11.03103	4651.11.03103	4651.11.03103



2.1.2 The Upper Part, complete

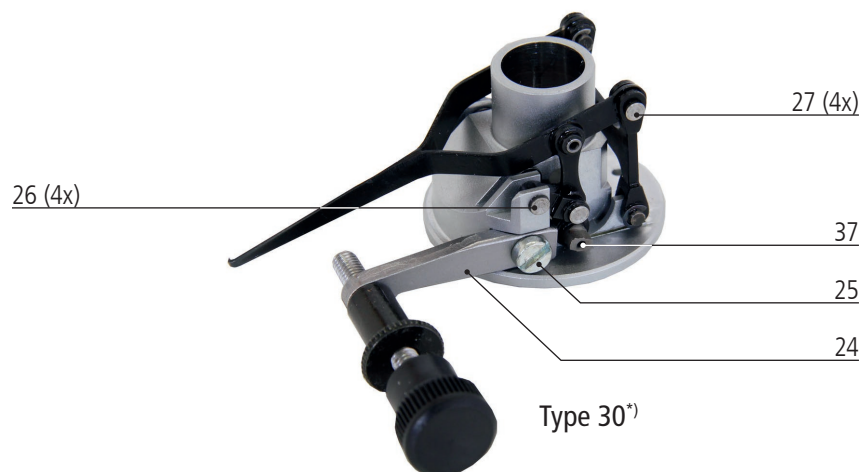
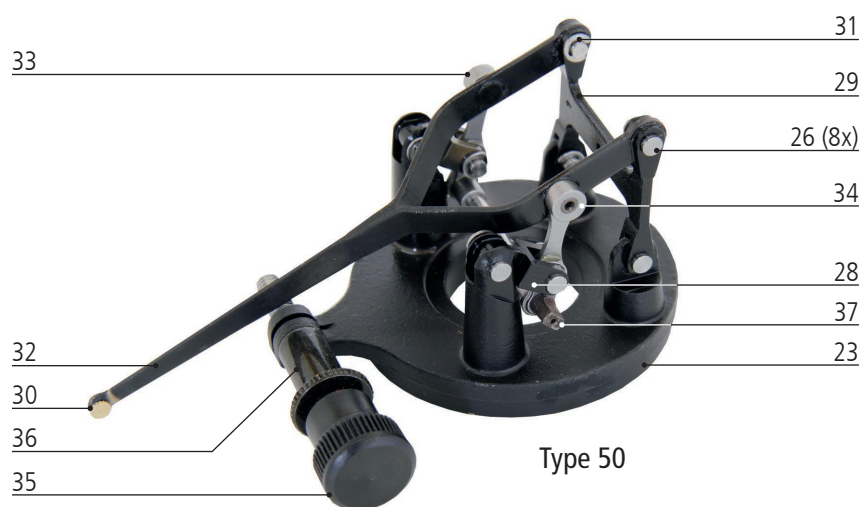
Item	Description	Part-No.		
		Type 50 Piston 1/10	Type 50 Piston 1/5	Type 30 ^{*)} Piston 1/5
14	Upper part, complete	4656.11.10000	4651.11.10000	4611.11.10000
15	Turning ring lock screw	4651.11.10001	4651.11.10001	4611.11.10001
16	Elastic washer	4651.11.10002	4651.11.10002	N.A.
17	Spring support	4651.11.10006	4651.11.10006	4611.11.10401
18	Headless stud	4651.11.10009	4651.11.10009	4611.11.10403
19	Ring nut	4651.11.10100	4651.11.10100	4611.11.10100
20	Spring cap	4651.11.10300	4651.11.10300	4611.11.10300
21	Piston rod c/w piston	4656.11.10100	4651.11.10200	4611.11.10200
22	Recording mechanism	4651.11.11000	4651.11.11000	4611.11.12000



^{*)} Discontinued product. No availability of spare parts. Availability of complete units while stock last.

2.1.3 The Recording Mechanism

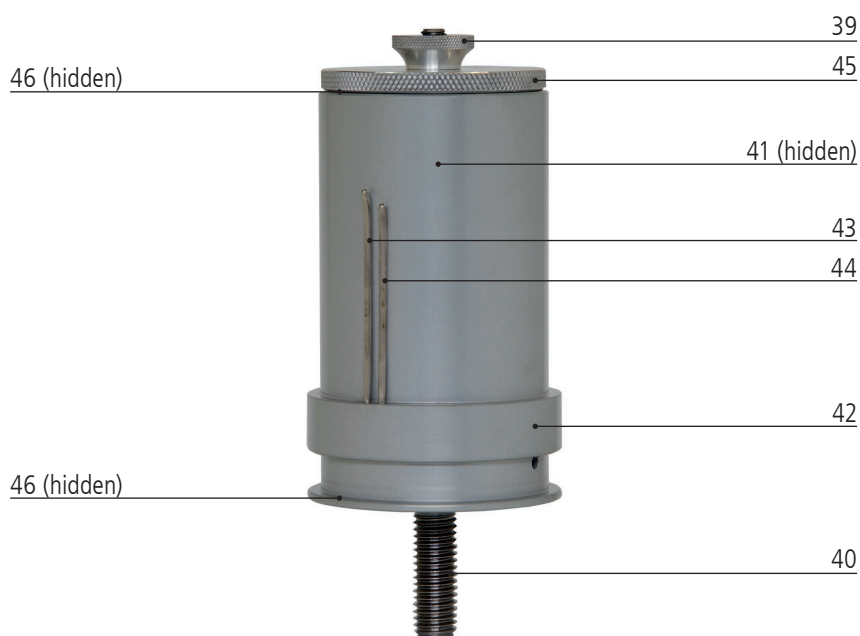
Item	Description	Part-No.		
		Type 50 Piston 1/10	Type 50 Piston 1/5	Type 30*) Piston 1/5
22	Recording mechanism	4651.11.11000	4651.11.11000	4611.11.12000
23	Turning ring	4651.11.11001	4651.11.11001	4611.11.12001
24	Support arm	N.A.	N.A.	4611.11.10005
25	Cap screw	N.A.	N.A.	4611.11.10008
26	Link bolt	4651.11.11003	4651.11.11003	4611.11.12002
27	Link bolt, short	N.A.	N.A.	4611.11.12003
28	Counter link	4651.11.11005	4651.11.11005	4611.11.12004
29	Swing lever	4651.11.11007	4651.11.11007	4611.11.12006
30	Tube incl. 5 recording pencils	4651.98.00200	4651.98.00200	N.A.
31	Retaining ring	SEEG-SRS.103200	SEEG-SRS.103200	SEEG-SRS.103500
32	Recording lever	4651.11.11100	4651.11.11100	4611.11.12101
33	Coupling link, left	4651.11.11200	4651.11.11200	4611.11.12200
34	Coupling link, right	4651.11.11300	4651.11.11300	4611.11.12300
35	Knurled handle	4651.11.11400	4651.11.11400	4651.11.11400
36	Knurled nut	4651.11.11009	4651.11.11009	4651.11.11009
37	Coupling pin	4651.11.10008	4651.11.10008	4611.11.10009



*) Discontinued product. No availability of spare parts. Availability of complete units while stock last.

2.1.4 The Drum, complete

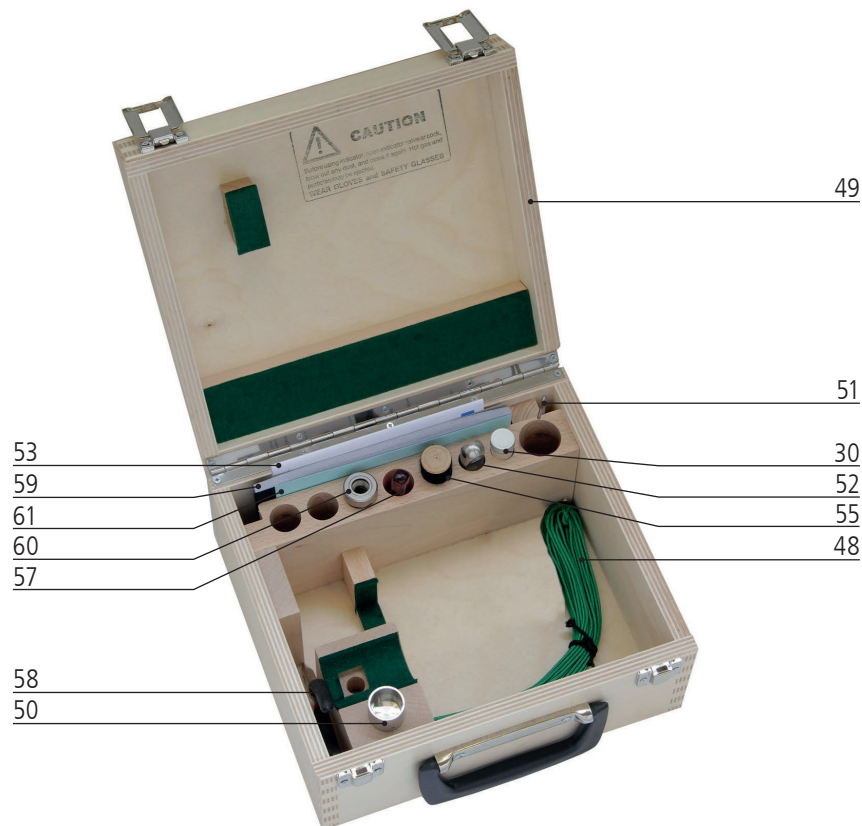
Item	Description	Part-No.		
		Type 50 Piston 1/10	Type 50 Piston 1/5	Type 30 ^{*)} Piston 1/5
38	Drum, complete	4661.11.01000	4661.11.01000	4611.11.01000
39	Drum knob	4651.11.01001	4651.11.01001	4651.11.01001
40	Drum axle	4651.11.01002	4651.11.01002	4611.11.01001
41	Drum spring	4651.11.01003	4651.11.01003	4611.11.01002
42	Drum cylinder	4661.11.01101	4661.11.01101	4611.11.01101
43	Paperclamp, long	4651.11.01102	4651.11.01102	4611.11.01102
44	Paperclamp, short	4651.11.01103	4651.11.01103	4611.11.01103
45	Drum cover	4661.11.01201	4661.11.01201	4611.11.01201
46	Cylindrical pin	KBSTIFD03.03300	KBSTIFD03.03300	KBSTIFD03.03300



^{*)} Discontinued product. No availability of spare parts. Availability of complete units while stock last.

2.2 Tools and Accessories

Item	Description	Part-No.		
		Type 50 Piston 1/10	Type 50 Piston 1/5	Type 30*) Piston 1/5
49	Accessories box	4651.98.03100	4651.98.03100	4611.98.01100
50	Stand for instrument	4631.98.01001	4631.98.01001	4631.98.01001
51	Cord tightening hook	4651.98.00001	4651.98.00001	4651.98.00001
52	Hollow spanner	4651.98.00002	4651.98.00002	4651.98.00002
53	Operating instructions, engl.	4651.98.00020	4651.98.00020	4651.98.00020
30	Tube incl. 5 recording pencils	4651.98.00200	4651.98.00200	N.A.
55	Cylinder cleaner	4651.98.02300	4651.98.02200	4651.98.02200
56	Washer (optional)	4651.99.00004	4651.99.00004	N.A.
57	Screw driver	9000.00.3931800	9000.00.3931800	9000.00.3931800
58	Flat plier (optional)	9000.00.3940700	9000.00.3940700	9000.00.3940700
59	Block indicator paper	4651.98.00003	4651.98.00003	4611.98.00001
48	Indicator cord (optional)	4651.98.00004	4651.98.00004	4651.98.00004
60	Indicator spring	view spring table	view spring table	view spring table
61	Measuring scale	view spring table	view spring table	view spring table



*) Discontinued product. No availability of spare parts. Availability of complete units while stock last.

3 The Indicator Spring

3.1 Indicator Type 50

Piston	Piston Ø	Scale	Max. Pressure	Spring-No.	Part-No.
1/10	6.41 mm	0.35 mm/bar	140 bar	50 / 14 bar	4651.71.14000
1/10	6.41 mm	0.30 mm/bar	160 bar	50 / 16 bar	4651.71.15000
1/10	6.41 mm	0.25 mm/bar	200 bar	50 / 20 bar	4651.71.16000
1/10	6.41 mm	0.20 mm/bar	250 bar	50 / 25 bar	4651.71.17000
1/10	6.41 mm	0.15 mm/bar	300 bar	50 / 30 bar	4651.71.18000



3.2 Indicator Type 30

Piston	Piston Ø	Scale	Max. Pressure	Spring-No.	Part-No.
1/5	9.06 mm	0.20 mm/bar	150 bar	30 / 30 bar	4611.71.14000
1/5	9.06 mm	0.16 mm/bar	200 bar	30 / 40 bar	4611.71.16000
1/5	9.06 mm	0.12 mm/bar	250 bar	30 / 50 bar	4611.71.17000



4 Operating Procedure

Remove the upper part from the bottom part by turning the ring nut.

Lubricate the operative surfaces of the bottom part, piston rod and piston rod guide with top-quality, non-viscous cylinder oil.



CAUTION

Take care not to damage the recording mechanism while removing the upper part. Slightest damage may lead to substantial recording errors.

The links must never be disassembled and should always be sufficiently lubricated with cylinder oil.

Do not bend the piston rod while removing the upper part as the piston may seize.

Reconnect the upper part to the bottom part.



CAUTION: Make sure that the seat of spring support and the corresponding seat of the bottom part are absolutely clean before inserting the upper part.

When inserting the upper part, do not tighten the ring nut fully at first. Use the knurled handle to move the recording levers until the pencil touches the drum, then tighten the ring nut in this position firmly by hand (do not use tools).

If the recording pencil is pressed on the drum too hard, faulty diagrams will result. If the ring nut is slackened, the recording lever can be turned and arrested in any desired position.

Make sure that the indicator is designed for the pressure of the engine to be measured.



WARNING: Check the maximum pressure of the indicator spring. If the spring is designed for lower pressures the recording mechanism of the Indicator will be damaged.

Wrap a sheet of indicator paper around the drum. The indicator is now ready to record the first cylinder.



WARNING

Put on suitable gloves as the instrument will get very hot during operation.

The usage of safety glasses is required when operating the indicator as hot gas and particles may be ejected from the engine.

Blow through the connection line before mounting the indicator to prevent wrong indication of the engine pressure by any condensed water, oil or soot deposits in the connection line.



DANGER: The valve ejects hot gas under high pressure. Danger of sparks and burning!

Close the indicator valve.

Pull the cord to draw the atmospheric pressure line.

If necessary, the atmospheric pressure line of the diagram can be raised by placing one or more washers (must be ordered separately) on the spring support before mounting the spring.

Screw the indicator onto the indicator valve.



WARNING: Use the hollow spanner only to screw the indicator on or off the indicator valve. Hammering on the extensions of the connecting nut will damage the nut. As a result of these damages the nut might break apart under the influence of the high pressure and the indicator may be propelled through the engine room with great speed.

The indicator should be mounted preferably near to the engine cylinder to be tested. If the indicator connections are arranged at the side of the engine cylinder, the indicator will be in a horizontal position. This will not effect the functionality of the indicator. In some cases extension tubes are required to fit the indicator.

Open the indicator valve fully.



WARNING: Danger of injury during the measuring procedure caused by moving parts such as indicator spring, piston rod, drum cylinder and recording lever.

Pull the indicator cord.

Close the indicator valve.

Remove the indicator cord from the drum and verify the result. The procedure can be repeated.



CAUTION: If testing internal combustion engines, piston and piston rod of the indicator should be lubricated periodically after 10 to 15 diagrams.

After verification of the indicator diagram it is very important to note all necessary data on the diagram, such as piston size of the indicator, spring number, engine number etc.

After every operation the indicator must be thoroughly cleaned, oiled and replaced in its box. The instrument should be cleaned with a lint-free rag, the cylinder only with the cylinder cleaner stored in the box. The sliding surfaces of the cylinder and piston rod guide should be lubricated with top-quality, non-viscous cylinder oil (oil bottle stored in the box).

The links of the recording mechanism, and the drum bearings should also be lubricated occasionally with the same oil after removing the drum cover.

Carbon deposits on the piston or cylinder should never be scratched off, but always be removed by washing them with benzene or petroleum.

5 Changing the Spring

Remove spring cap at the upper end of the piston rod. Unscrew the spring. Place the new spring over the piston rod so that the small ball on the spring engages with the corresponding slot of the piston rod, and firmly tighten the spring by hand only, and replace, and tighten the spring cap also firmly by hand (do not use tools).

6 Changing the Piston Rod



CAUTION: The recording mechanism must be handled with extreme care; slightest damage may lead to substantial recording errors. The links must never be disassembled and should always be sufficiently lubricated with cylinder oil.

To exchange the piston rod, the upper part has to be removed by unscrewing the ring nut as described on page 12.

Unscrew the spring cap and remove the coupling pin by gripping its flat head with the small accessory pliers.

The piston rod can now be removed from the upper part.

When inserting the new piston rod, make sure that the coupling pin is inserted into the link with the larger bore and into that side of the piston rod which is marked by a punched spot.

Digital Pressure Indicator DPI

The Digital Pressure Indicator DPI can be seen as the electronic equivalent of our range of mechanical indicators with all advantages of an electronic device and a very convincing price-performance ratio.

Indicator / Features	DPI	Type 50	MSI-3
Software based power/MIP calculation	✓	○ ¹⁾	–
Analyzing Software	✓	–	–
Electronic data transfer and sharing	✓	–	–
P-Max	✓	✓	✓
PV-Plot	✓	✓	–
P-comp	✓	✓	–
DP (Derivative plot)	✓	–	–
RPM	✓	–	–
Suitable for 2- and 4-stroke engines	✓	✓ ²⁾	✓

¹⁾ Using Planimeter with manual calculation, and engines fitted with an indicator drum drive

²⁾ Choose correct indicator type according to RPM range