Sensor systems S 2.869 / 2.870

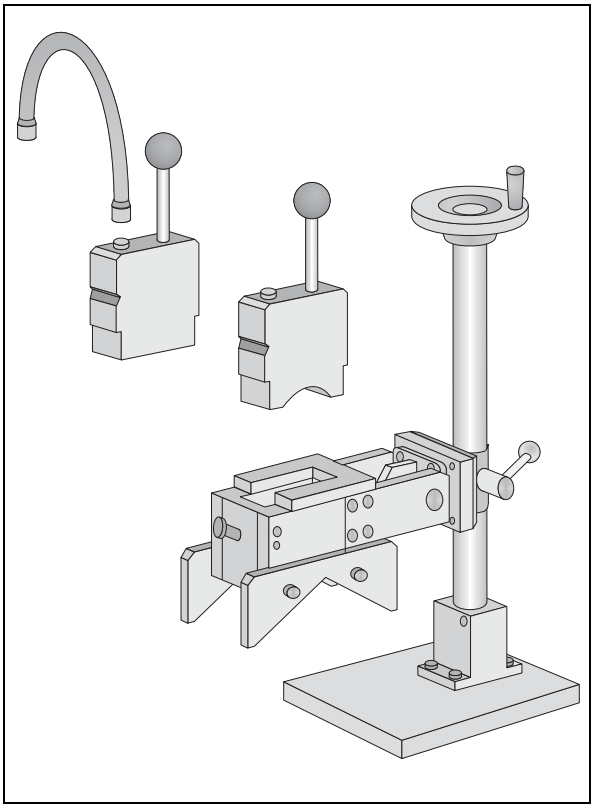

Figure 1: Segment coil yoke LSP 180
with height adjustment,
LMD segment coil and coil cable

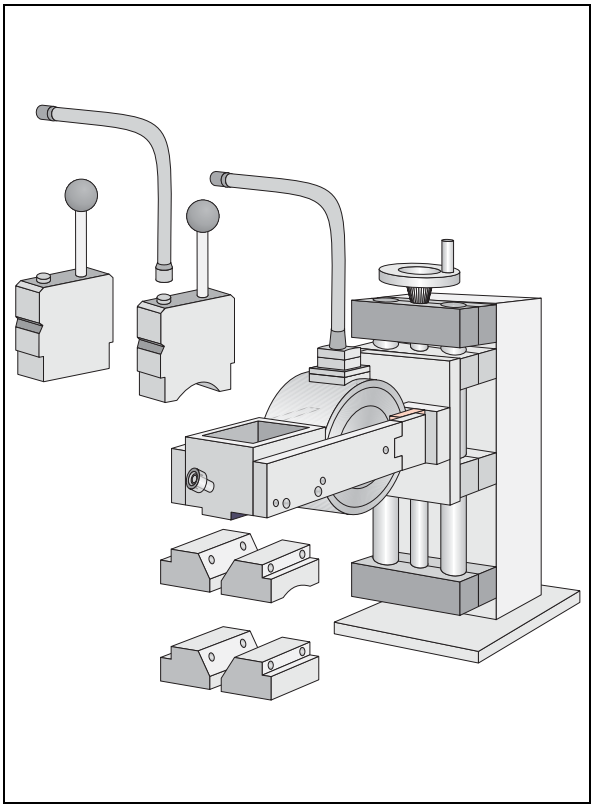

Figure 2: Segment coil yoke LSM 180
with height adjustment,
LMD segment coil

Application

The sensor systems S are used for non-destructive eddy-current testing of the weld seam zone of metallic tubes and pipes with LMD segment coils.

Various sensor systems S with and without DC-magnetization, described in this leaflet, are available.

Test tasks

- Testing non-ferromagnetic test material
- Testing test material with low ferritic components and
- Testing ferromagnetic test material
- Testing round tubes and pipes with concave LMD segment coils and rectangular tubes and pipes with flat LMD segment coils
- Testable material diameter range 10 to 180 mm
- Used directly on the production line, i.e. down-stream of the tube-welding machine
- Testing at all welding speeds

Applications

- The sensor system does not contact the test material, i.e. the guide accuracy of the conveying mechanism is adequately good to ensure constant sensitivity
- The sensor system rolls over the material surface and thus achieves constant test sensitivity

Features for segment coil holder SH 180, segment coil yokes LSP 180 and LSM 180

- ✓ Low-cost systems
- ✓ Diameter range 10 to 180 mm, in special design up to 500 mm
- ✓ Short, compact design
- ✓ Easily interchangeable segment coils
- ✓ Sturdy spindle system for height adjustment
- ✓ Protection of the test coils by means of protective plates (SH 180 and LSP 180) or by interchangeable pole shoes (LSM 180)
- ✓ Partial longitudinal magnetization of the weld seam area (LSP 180 and LSM 180)
- ✓ Coil fixture can be swivelled away upwards
- ✓ Coil holder or coil yoke do not contact test material

Construction

- Sensor system LSP for use on test material with low ferritic components
- Segment coil yoke LSP 180 (2.870.01-2201) with height adjustment
- A special designed LSP 180 with rollers for guiding along the tube is available (2.870.01-2202)
- Linear adjustment unit for height adjustment
- Permanent magnets
- Arm
- Protective plates

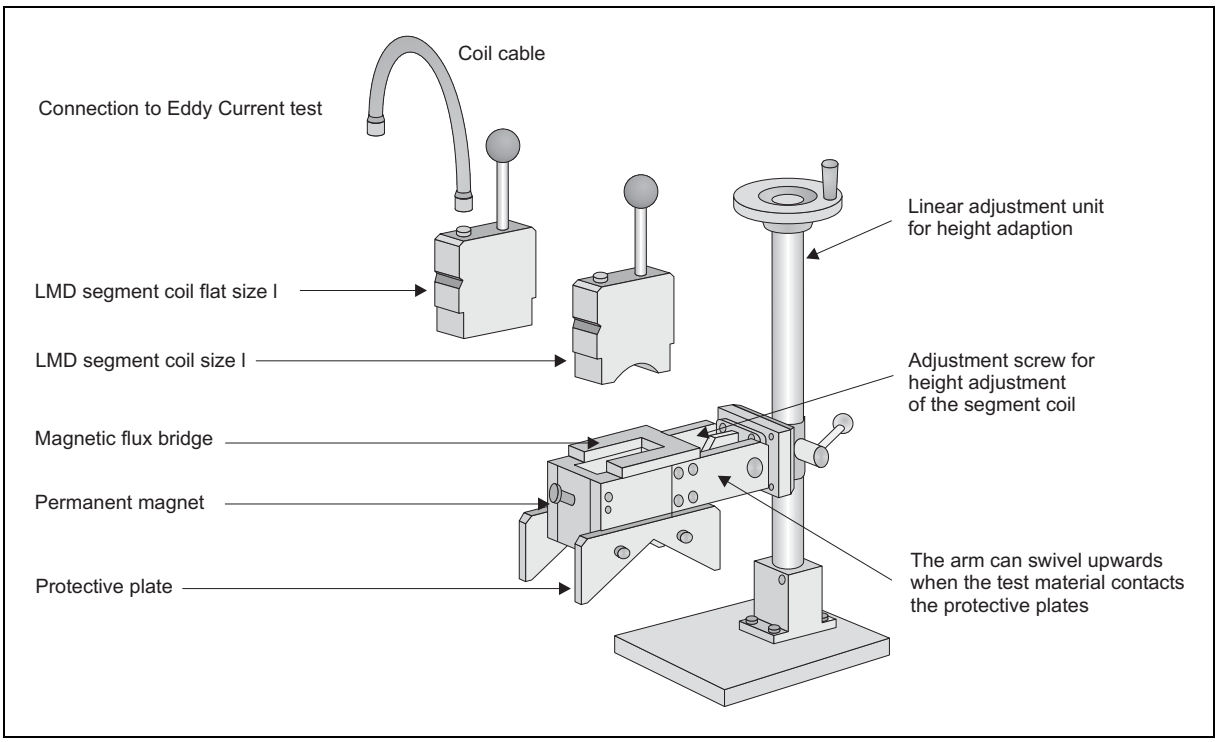

Figure 3: Sensor system S, by way of example of the segment coil yoke LSP 180, 2.870.01-2201

The segment coil yoke LSP 180 covers the tube diameter range 10 to 180 mm.

The coil shaft of the arm accommodates the LMD segment coil size l with the nominal dimensions 11 to 200 mm or the LMD segment coil flat (size l). The clearance “LMD segment coil - material surface” can be set manually so that it is approximately 1 to 2.5 mm* with the linear adjustment unit.

LMD segment coils comprise both a difference winding with a multi-difference-circuit and an absolute winding for the evaluation with a difference and/or an absolute channel.

Since this sensor system is not supported by the test material, good material guidance is required in order to achieve constant test sensitivity. The following guideline value applies: 6 dB sensitivity reduction with 1 mm clearance increase.

Protective plates are mounted on the arm at the entry and exit sides in order to protect the LMD segment coils. V-shaped or flat** protective plates must also be fitted, dependant upon whether a concave or flat LMD segment coil is used.

Segment coil yoke LSP 180 without height adjustment 2.870.02-2201

On this segment coil yoke, the clearance between LMD segment coil and material surface must be set by permanent installation. There is no linear adjustment unit for height adaptions.

Sensor system SH for testing non-ferromagnetic test material

Segment coil holder SH 180 with height adjustment 2.870.01-2301

This segment coil holder has virtually the same de-sign as the segment coil yoke LSP 180*** described above. The differences are as follows:

- no permanent magnets and
- no magnetic flux bridge

Segment coil holder SH 180 without height adjustment 2.870.02-2301

Apart from the height adjustment, it has an identical design to that of the segment coil holder SH 180 with height adjustment.

* Dependent upon diameter tolerance and the guide accuracy
** Option
*** By contrast with the segment coil holder SH 180, the segment coil yoke LSP 180 contains two permanent magnets and a magnetic flux bridge. Otherwise, they have an identical design

If necessary in welding lines, the max. surface temperature of 110 °C. is to be maintained by air cooling (supplied by customer).

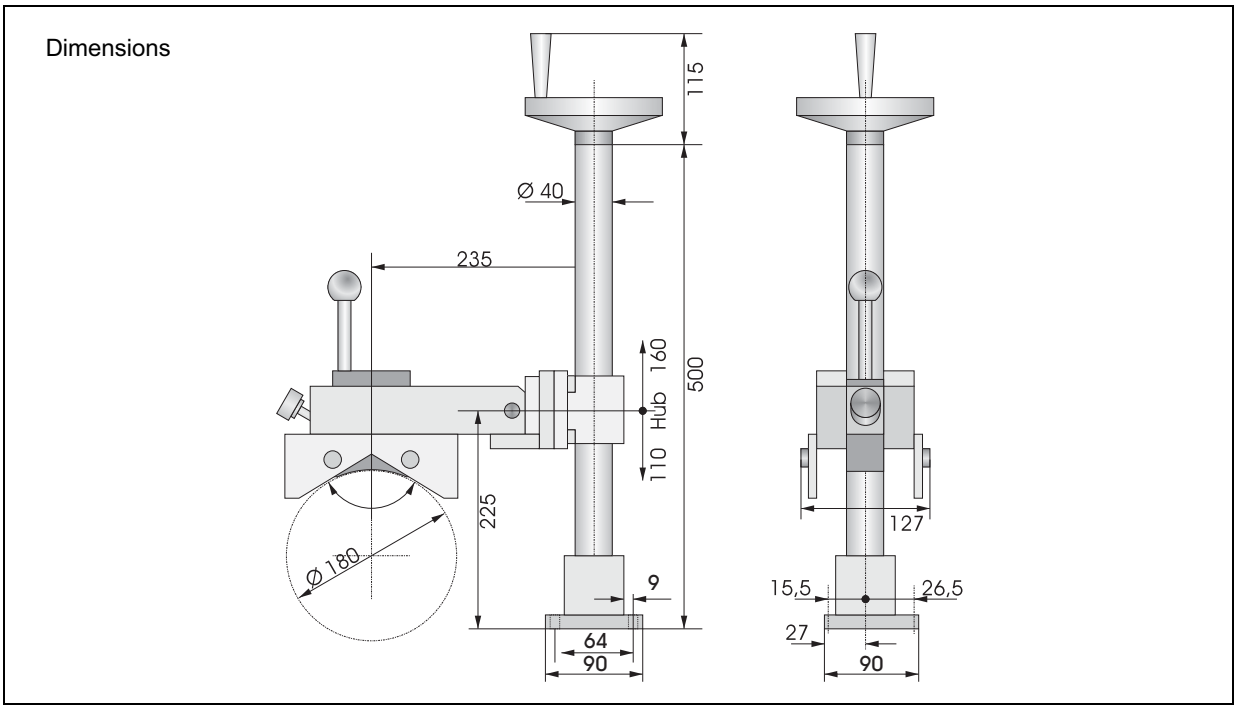

Figure 4: Segment coil holder SH 180 2.870.01-2301 and Segment coil yoke LSP 180 2.870.01-2201 with height adjustment

Sensor system LSM for testing ferromagnetic test material

Segment coil yoke LSM 180

Magnetizing coil powered by:

- Yoke current box with six current values

The essential components of the segment coil yoke LSM 180are:

- Stand
- Adjustment unit
- Arm with magnetizing coil and 1 pair of pole shoes

The segment coil yoke LSM 180 (2.869.01-1201) with height adjustment is designed for the tube diameter range 10 to 180 mm, in special design up to 500 mm (2.869.01-1202). An other designed LSM 180 is equipped with a lift-off-device (2.869.01-1301).

A solid stand supports the adjustment unit. A swivel-ling arm which comprises two magnetizing bars is mounted on the adjustment unit. Whilst the coil shaft and the pole shoes are accommodated at the tip of the arm, its center section bears the magnetizing coils.

The coil shaft of the arm accommodates the LMD segment coil size I or the LMD segment coil, flat, size I with the nominal dimensions 11 to 200 mm. The clearance „LMD segment coil - material surface" can be set manually so that it is approximately 1 to 2.5 mm with the linear adjustment unit*.

* Dependent upon diameter tolerance and the guide accuracy

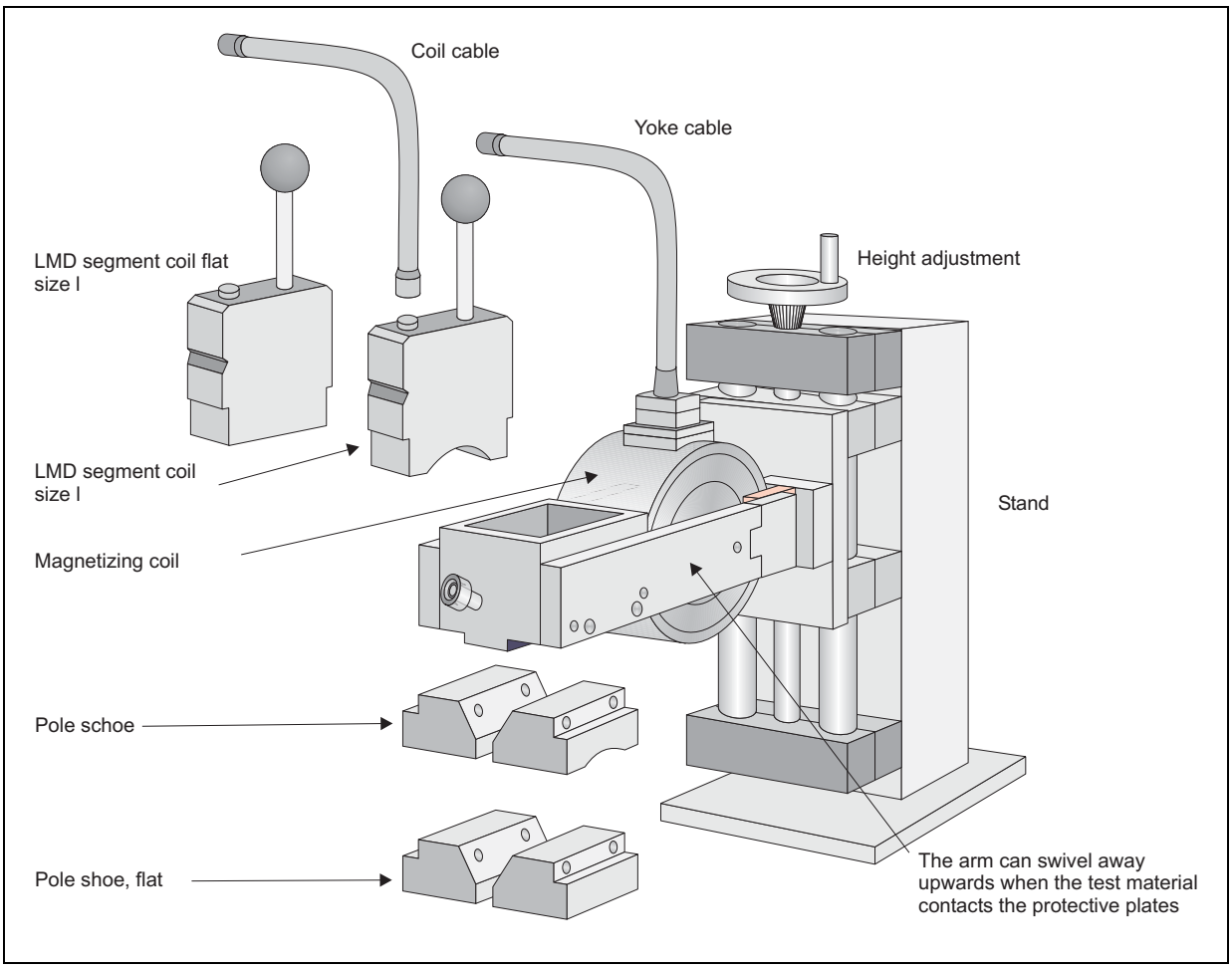

Figure 5: Segment coil yoke LSM 180, 2.869.01-1201

Since this sensor system is not supported by the test material, good material guidance is required in order to achieve constant test sensitivity.

The following guideline value applies:

6 dB sensitivity reduction with 1 mm clearance increase.

Pole shoes must be fitted at the entry and exit sides in order to improve the magnetic flux and to protect the LMD segment coils.

The segment coil and pole shoes suitable for the relevant test diameter must be selected on the basis of table 1 if the applicable requirements are normal.

When selecting, it is compulsory to use segment coils and pole shoes of the same nominal diameter.

In borderline cases, this results in an increase of the air gap of 1.2 mm, starting from the 12 o'clock position through to the limit of the effective area of the coil used.

Segment coils and pole shoes with finer gradings are available for special requirements (see ordering instructions).

Usable for test diameter (mm)	**Nominal diameter of the segment coil and the pole shoes (mm)**
10 to 13	15
13 to 19	20
19 to 25	26
25 to 31	32
30 to 37	38
36 to 43	44
40 to 53	56
51 to 65	68
65 to 80	84
80 to 96	100
96 to 113	116
113 to 137	140
135 to 167	170
158 to 198	200

Table 1

If using segment coils with nominal diameter not shown in table 1, pole shoes with next higher nominal diameter are to be used.

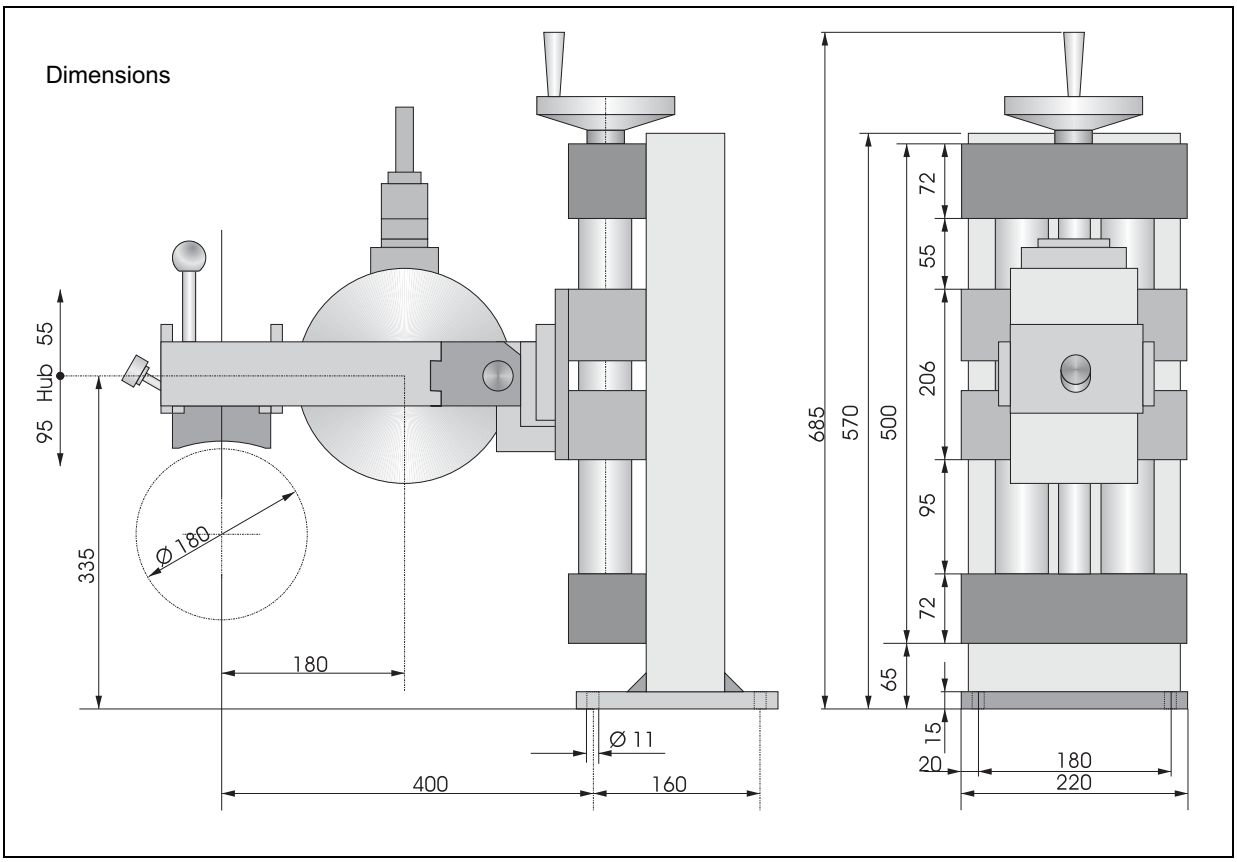

Figure 6: Segment coil yoke LSM 180, 2.869.01-1201 with height adjustment

Segment coil carriage

This sensor system S is a special component which is used to test non-ferromagnetic material in the diameter range 10 to 180 mm.

The components of the “segment coil carriage 2.870.01-1010” are:

- Stand for manual height adjustment
- Swiveling lever arm
- Counterweight
- Coil shaft
- Pair of rollers

The rollers and the coil shaft are mounted on one side and a counterweight is fitted on the other side.

The coil shaft accommodates the LMD segment soils, size I or LMD segment coils, flat, size I, used for weld seam testing.

The support pressure with which the rollers roll over the material surface can be regulated with the aid of the counterweight.

The clearance “test coil - material surface” is preset by rollers and is maintained constant if there is good material guidance and if the material surface condition is good, so as to achieve a constantly high test sensitivity.

The information further above applies to sensitivity fluctuations.

The segment coil carriage ca be swivelled away upwards via the pivot point of the arm or can follow vertical guide inaccuracies upwards.

Its swinging suspension facility on the arm also permits it to follow slight horizontal deviations.

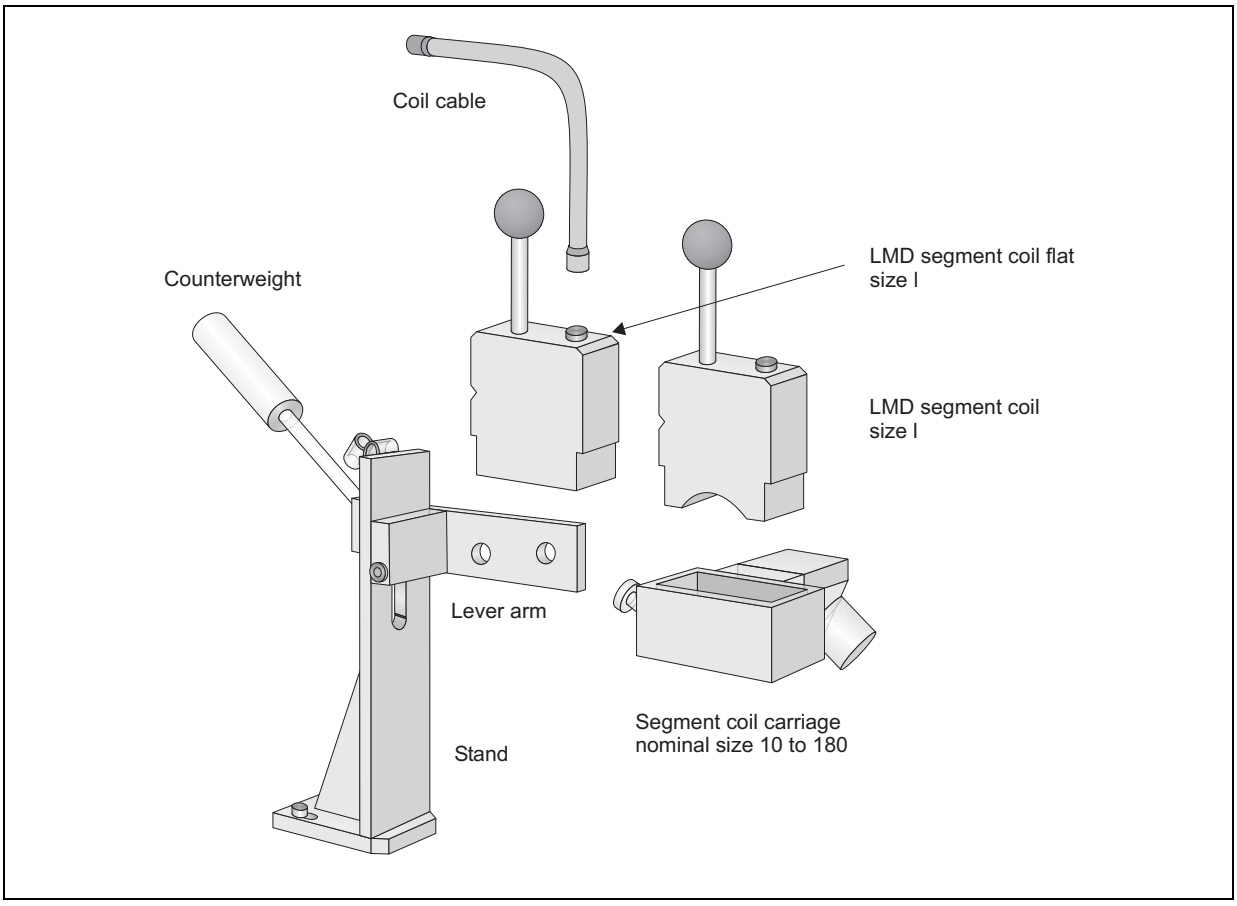

Figure 7: Segment coil carriage 2.870.0-1010 and stand 2.870.0-7001

Segment coil carriage PM

The segment coil carriage PM is used in particular for testing austenitic and ferromagnetic materials in the diameter range 10 to 115 mm.

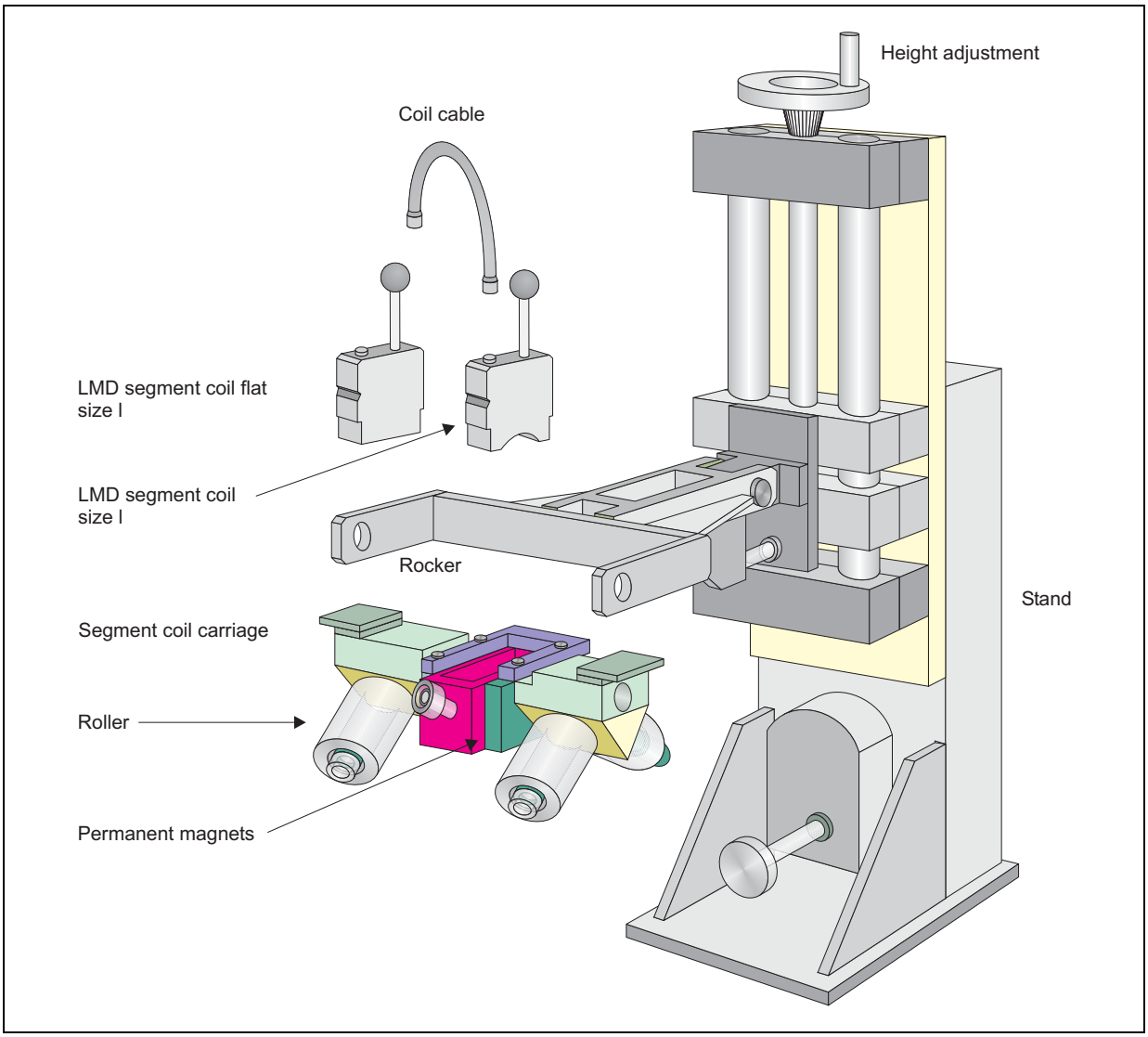

Figure 8: Segment coil carriage PM 2.970.02-2101 with holder 2.870.01-7021

The components of this sensor system are:

- Stand
- Height adjustment
- Rocker
- Segment coil carriage PM
- Permanent magnets
- Rollers
- Coil shaft

The height adjustment facility is mounted on the stand. This bears a rocker which holds the segment coil carriage PM.

The height of the segment coil carriage PM can be adjusted through 180 mm via the spindle of the height-adjustment facility.

The height adjustment facility, rocker and segment coil carriage can be rotated through 180° so that this sensor system can also be positioned against the test material from below.

The segment coil carriage consists of the components:

- Coil shaft
- Holder with permanent magnets
- Rollers

The coil shaft accommodates the segment coil. Its installation position is non-confusable, thanks to a slot at the side. It is locked in position with a locking screw.

Permanent magnets which homogenize the test material are bonded into the holder.

An iron plate ensures a magnetic return path (keeper function).

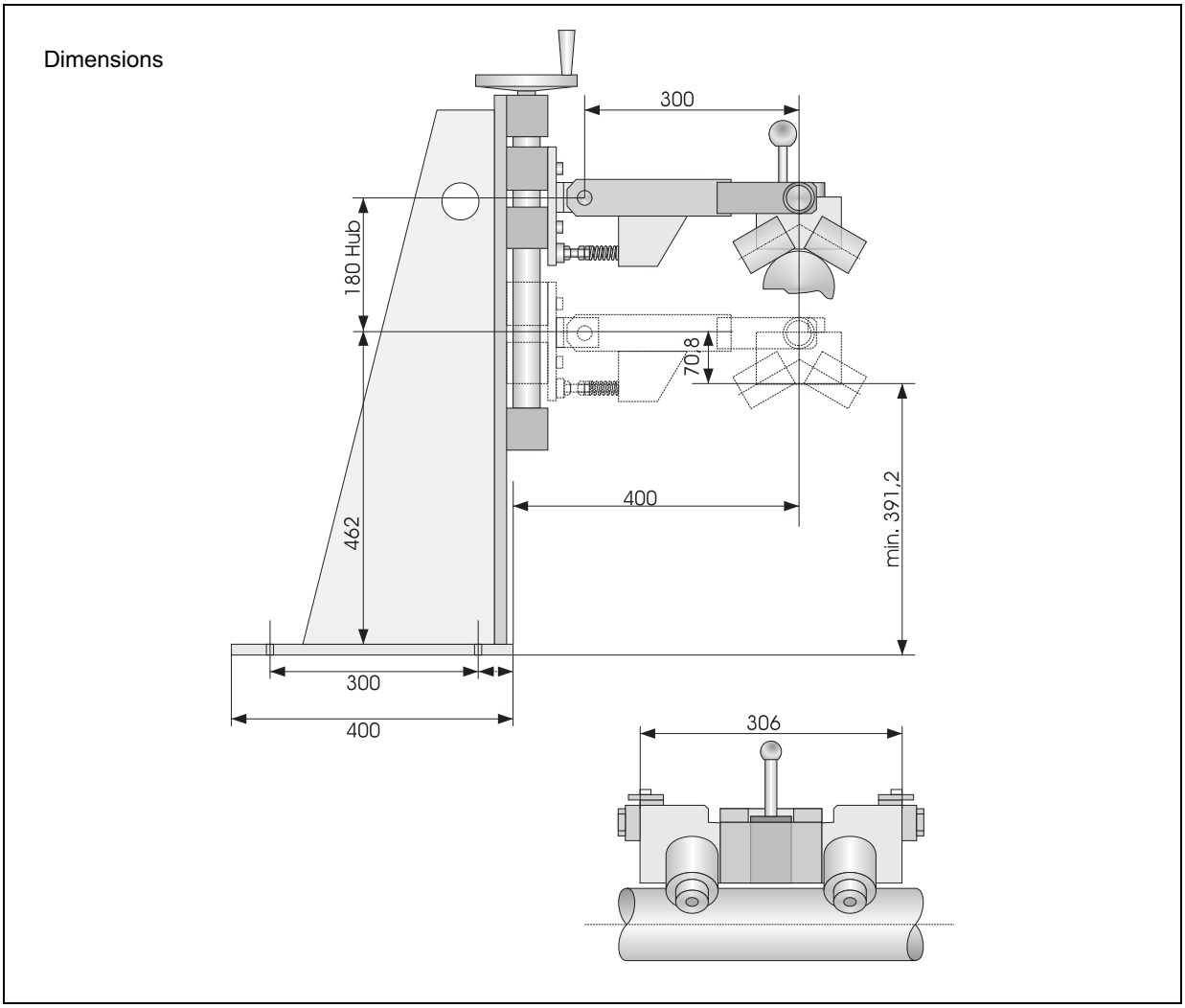

Figure 9: Segment coil carriage PM with holder

The interchangeable rollers are mounted on the holder. They are coated and are positioned with a relative opening angle of 120°.

Their length is designed so that the full diameter range can be tested.

If the roller coating is subject to excessive wear, the rollers must be replaced in order to guarantee an adequate clearance between segment coil and tube surface.

The segment coil carriage PM has two degrees of freedom so that it can follow slight guide inaccuracies.

It can be swivelled away upwards via the pivot point of the rocker and thus also follow vertical movements.

Its swinging suspension on the rocker makes it possible for it to follow slight horizontal movements.

Sensor system M 2.850/51/52 with segment coils

LMD segment coils can be used in these sensor systems which are based upon an electromagnetically operating magnetizing yoke.

Ferromagnetic test material which is magnetized as far as the saturation point for material homogenization is the chief field of application of these sensor systems.

The following general drawings specify the nominal diameter range covered by each of the sensor systems.

Please also refer to the leaflet “Sensor system M 2.850/51/52, Order No. 137 363 3”.

Features on sensor systems M

- ✓ Circular sensor system with encircling magnetizing coil
- ✓ Protective guide nozzles at the entry and exit sides
- ✓ Height adaption via lifting table

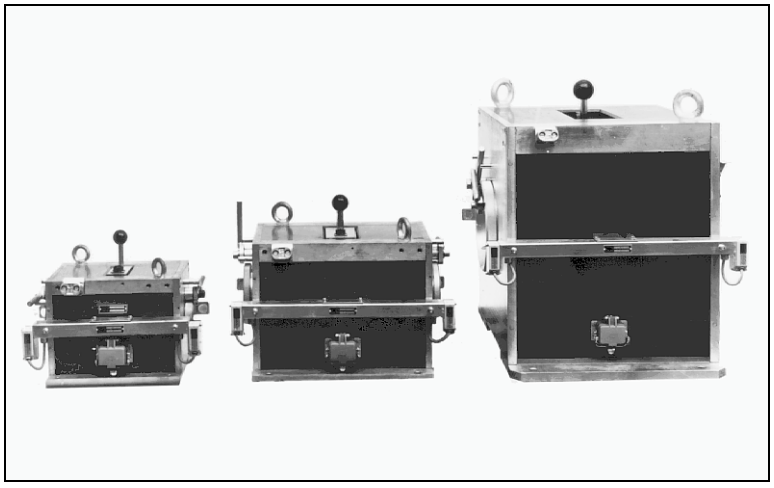

Figure 10: Sensor system M 40, M 90 and M 170

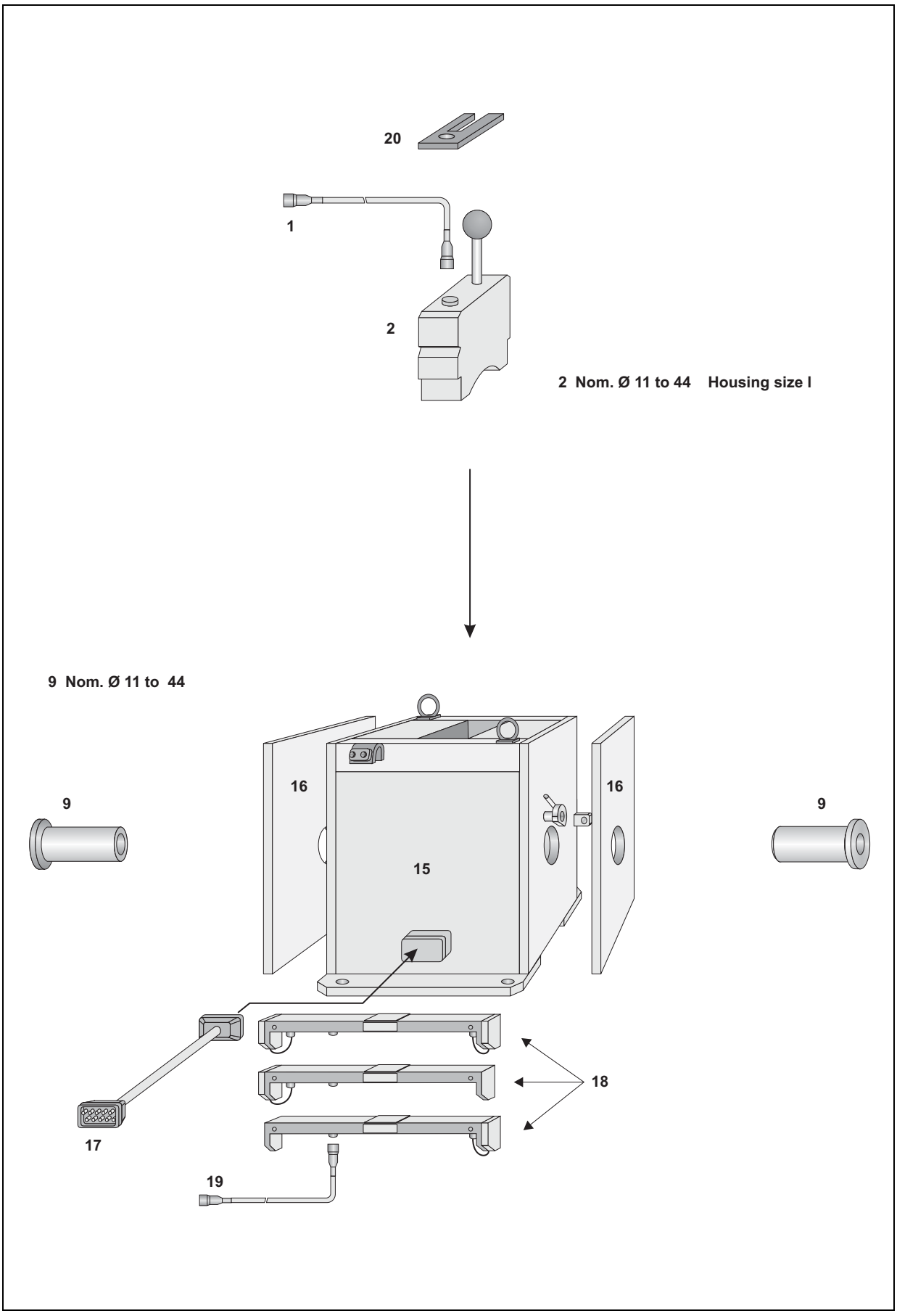

Figure 11: Sensor system M 40

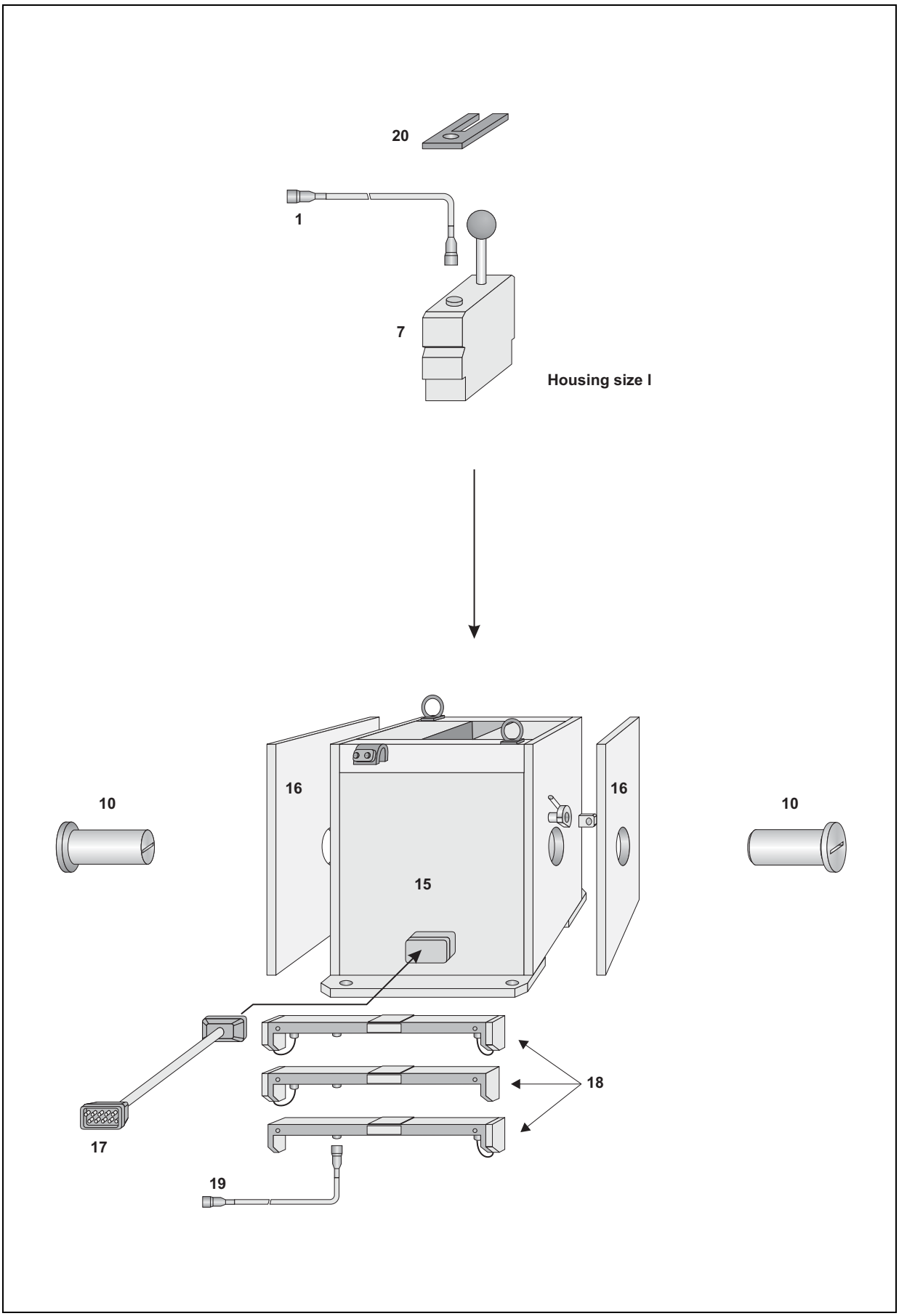

Figure 12: Sensor system M 40, segment coil flat

Position list Sensor system M 40			
Pos.	**Designation**	**Part-No.**	**Mass (kg)**
1	Coil cable 10 m	2.899.51-1110	3.5
2	LMD segment coil size I 11 to 44 mm nominal-Ø	2.893.11-0110 to -0440	
7	LMD segment coil flat size I	2.893.11-9901	
9	Nozzle 11 to 44 mm nominal-Ø	2.850.01-2110 to -2440	1 to 2.5
10	Nozzle flat up to 44 mm diagonal size	2.850.04-2001 to -2100	
15	Magnetizing yoke M 40	2.850.01-1002	55
16	Set of Liquid cooler plates	2.850.01-1901	4
17	Yoke cable 10 m	2.899.11-1210 or 2.899.01-1210	3 3
18	Double test piece sensor or Test piece sensor, left or Test piece sensor, right	2.850.01-6010 2.850.01-6020 2.850.01-6030	2 1.8 1.8
19	Test piece sensor cable 10 m	2.840.01-9901	1.2

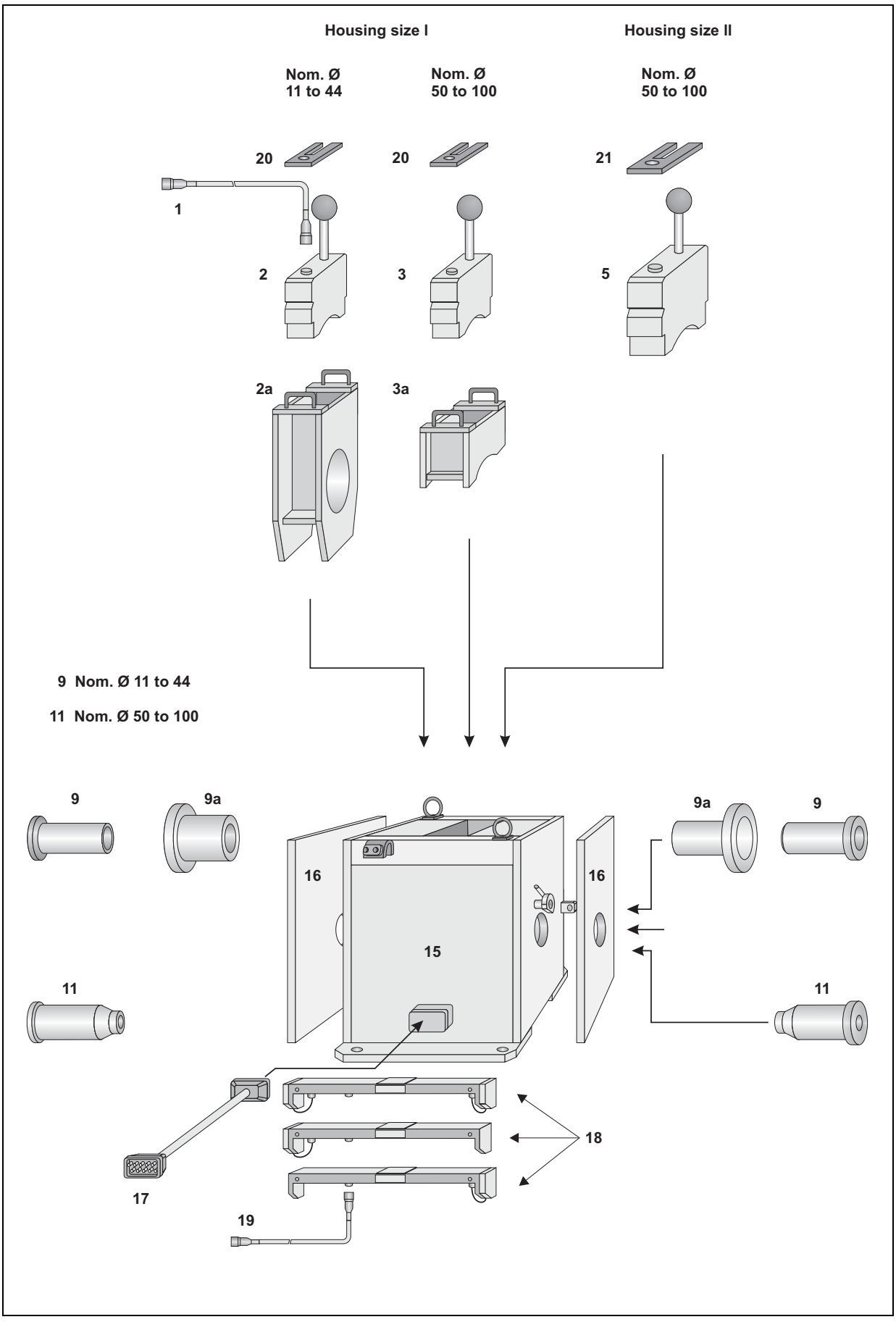

Figure 13: Sensor system M 90

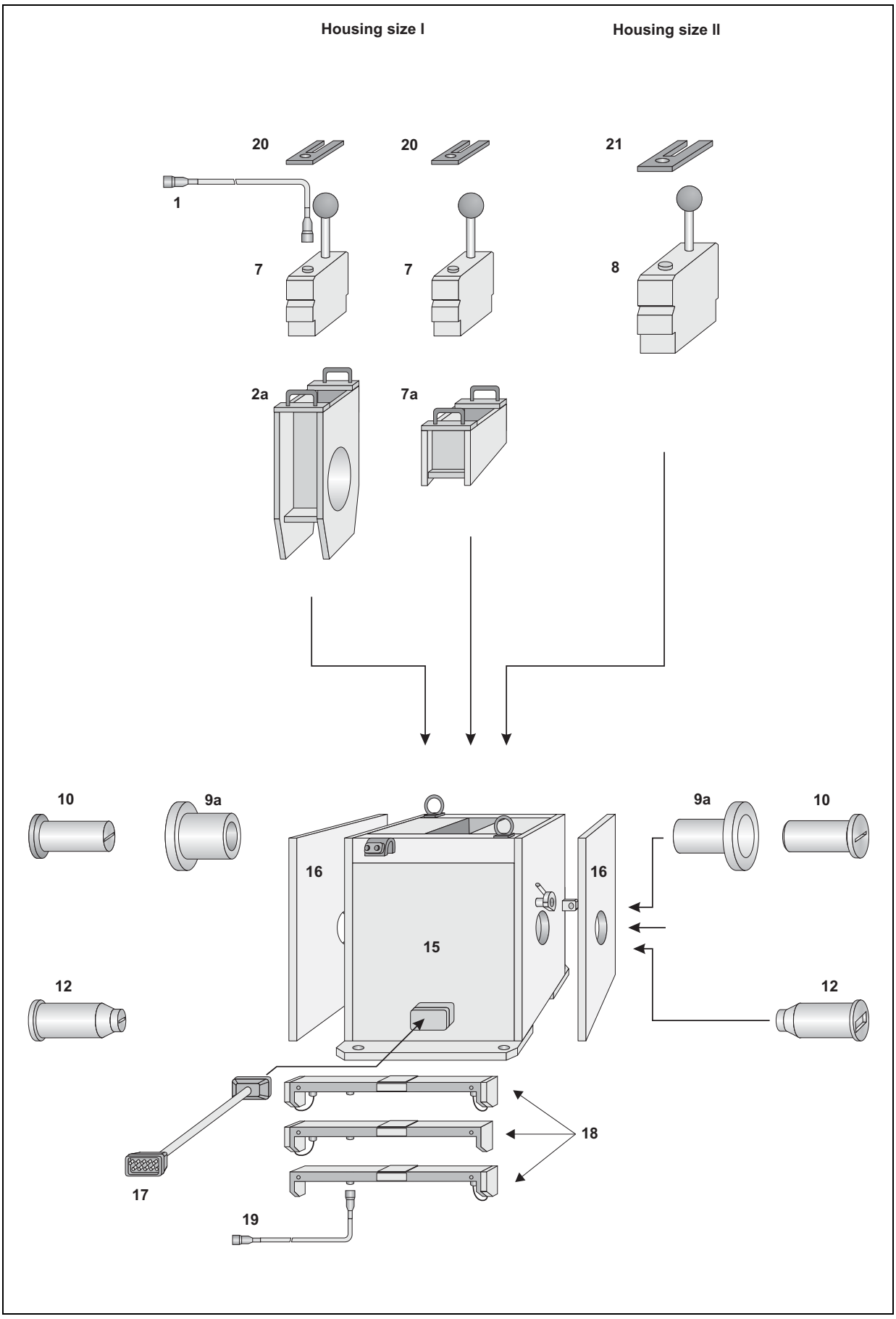

Figure 14: Sensor system M 90, segment coil flat

Position list Sensor system M 90			
Pos.	**Designation**	**Part-No.**	**Mass (kg)**
1	Coil cable 10 m	2.899.51-1110	3.5
2	LMD segment coil size I 11 to 44 mm nominal-Ø	2.893.11-0110 to -0440	
2a	Coil adapter 44	2.852.01-5202	approx. 3
3	LMD segment coil size I 50 to 100 mm nominal-Ø	2.893.11-3050 to -3100	
3a	Segment coil adapter S100	2.851.01-5202	
5	LMD segment coil size II 50 to 100 mm nominal-Ø	2.893.21-3050 to -3100	
7	LMD segment coil flat size I	2.893.11-9901	
7a	Segment coil adapter SF S100 flat	2.851.01-5203	
8	LMD segment coil flat size II	2.893.21-9901/9902	
9	Nozzle 11 to 44 mm nominal-Ø	2.850.01-2110 to -2440	1 to 2.5
9a	Nozzle adapter 44-2	2.851.01-5102	22
10	Nozzle flat up to 44 mm diagonal size	2.850.04-2601 to -2800	
11	Nozzles 50 to 100 mm nominal-Ø	2.851.01-3050 to -3100	3.5 to 12
12	Nozzles flat >44 to 100 mm diagonal size	2.851.04-3601 to -3650	
15	Magnetizing yoke M 90	2.851.02-1002	92
16	Set of Liquid cooler plates	2.851.01-1901	6
17	Yoke cable 10 m	2.899.11-1210 or 2.899.01-1210	3 3
18	Double test piece sensor or Test piece sensor, left or Test piece sensor, right	2.851.01-6010 2.851.01-6020 2.851.01-6030	2 1.8 1.8
19	Test piece sensor cable 10 m	2.840.01-9901	1.2
20	Pressure pad I	2.850.01-5201	
21	Pressure pad II	2.851.01-5201	

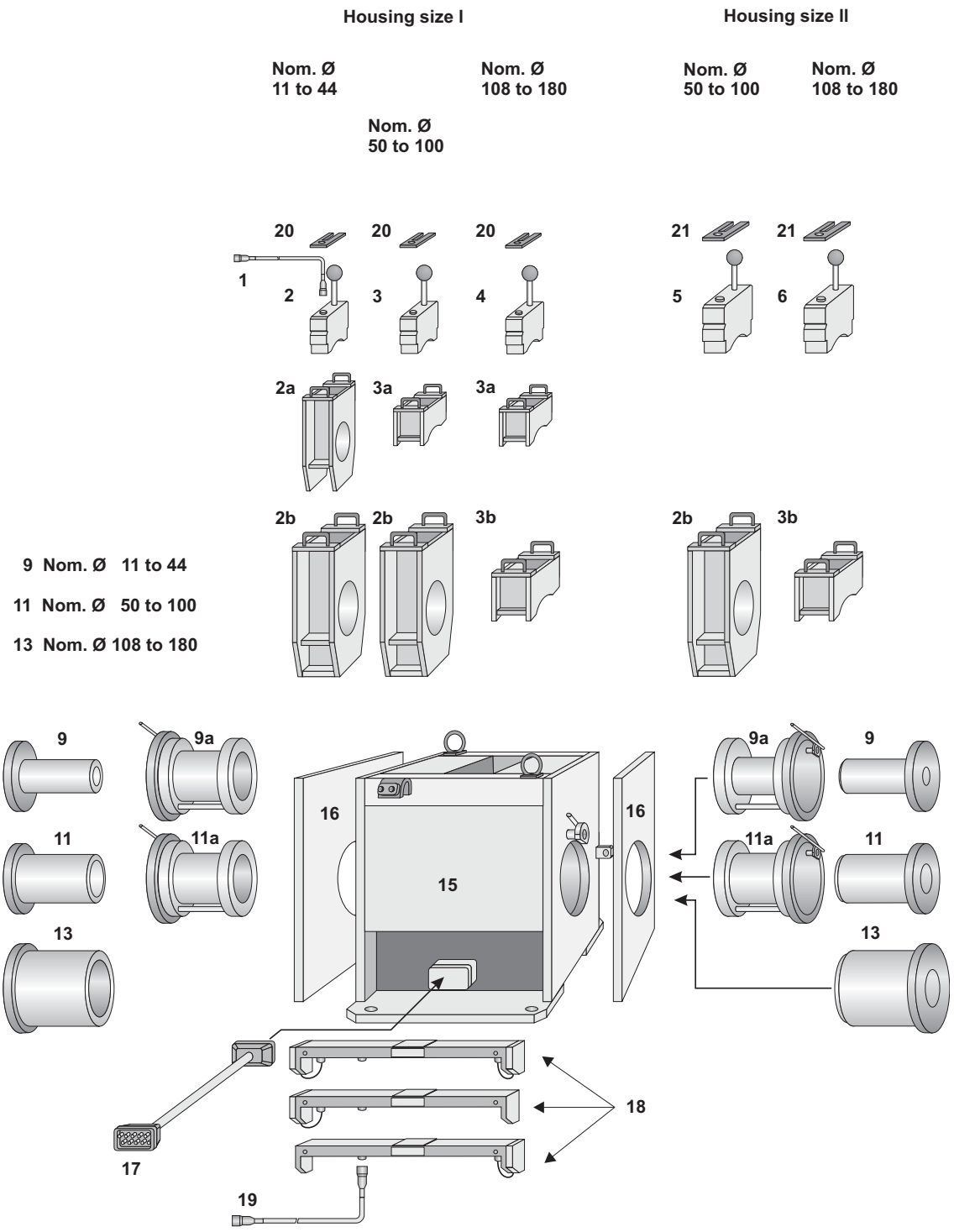

Figure 15: Sensor system M 140 resp. M 170

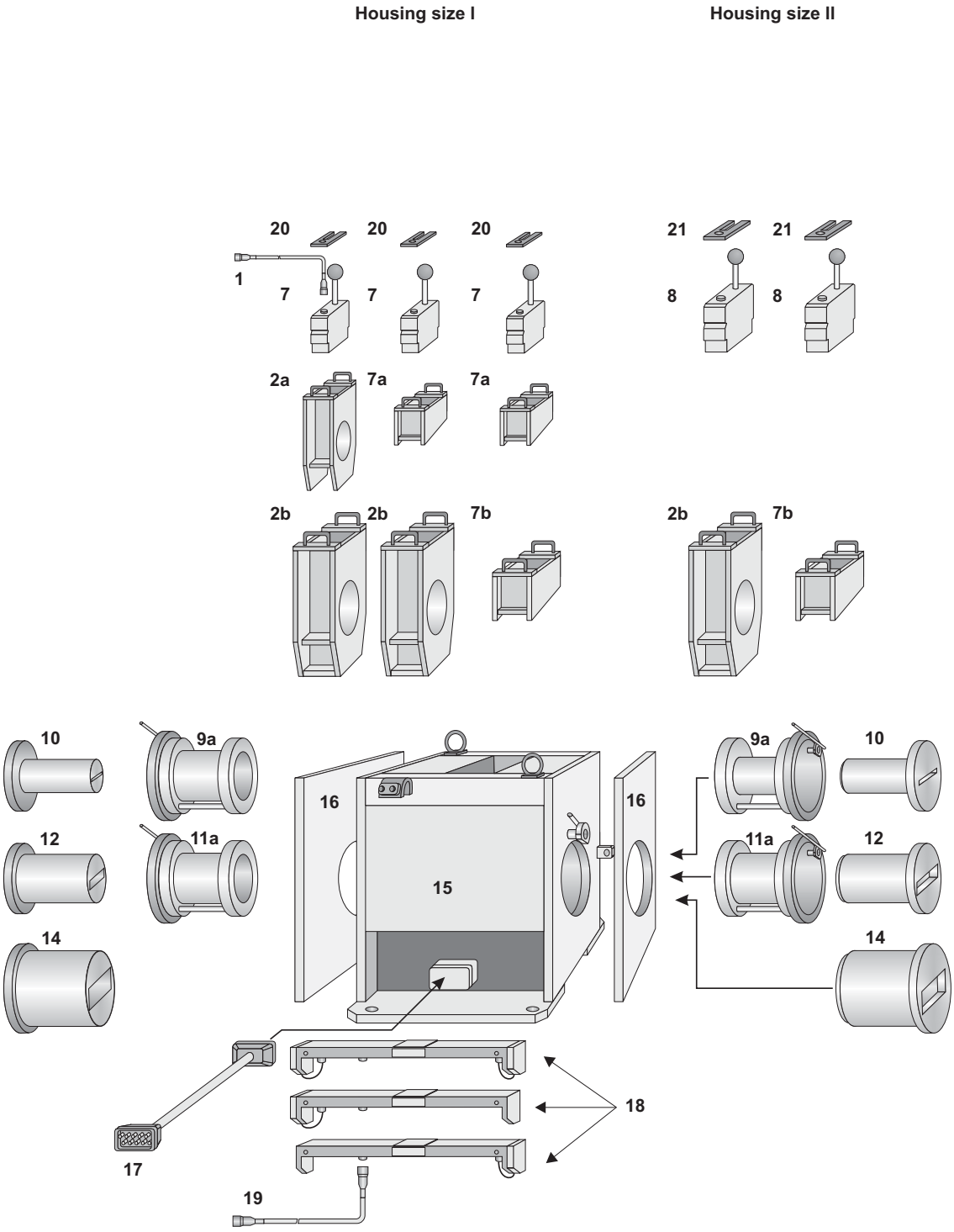

Figure 16: Sensor system M 140 resp. M 170, segment coil flat

Position list Sensor system M 170			
Pos.	**Designation**	**Part-No.**	**Mass (kg)**
1	Coil cable 10 m	2.899.51-1110	3.5
2	LMD segment coil size I 11 to 44 mm nominal-Ø	2.893.11-0110 to -0440	
2a	Coil adapter 44	2.852.01-5202	approx. 3
2b	Coil adapter 100	2.852.01-5203	approx. 8
3	LMD segment coil size I 50 to 100 mm nominal-Ø	2.893.11-3050 to -3100	
3a	Segment coil adapter S100	2.851.01-5202	
3b	Segment coil adapter S180	2.852.01-5204	
4	LMD segment coil size I 108 to 180 mm nominal-Ø	2.893.11-6108 to -6180	
5	LMD segment coil size II 50 to 100 mm nominal-Ø	2.893.21-3050 to -3100	
6	LMD segment coil size II 108 to 180 mm nominal-Ø	2.893.21-6108 to -6180	
7	LMD segment coil flat size I	2.893.11-9001	
7a	Segment coil adapter SF S100 flat	2.851.01-5203	
7b	Segment coil adapter SF S180 flat	2.852.01-5205	
8	LMD segment coil flat size II	2.893.21-9901/9902	
9	Nozzle 11 to 44 mm nominal-Ø	2.850.01-2110 to -2440	1 to 2.5
9a	Nozzle adapter 44-3	2.852.01-5104	12
10	Nozzle flat up to 44 mm diagonal size	2.850.04-2001 to -2100	
11	Nozzles 50 to 100 mm nominal-Ø	2.851.01-3050 to -3100	3.5 to 12
11a	Nozzle adapter 100-2	2.852.01-5105	approx. 12
12	Nozzles flat >44 to 100 mm diagonal size	2.851.04-3001 to -3100	
13	Nozzles 108 to 180 mm nominal-Ø	2.852.01-3108 to -3180	
14	Nozzles flat >100 to 180 mm diagonal size	2.852.04-3651 to -3700	
15	Magnetizing yoke M 170	2.852.01-1001	92
16	Set of Liquid cooler plates	2.852.01-1901	19
17	Yoke cable 10 m	2.899.11-1210 or 2.899.01-1210	3 3
18	Double test piece sensor or Test piece sensor, left or Test piece sensor, right	2.852.01-6010 2.852.01-6020 2.852.01-6030	2 1.8 1.8
19	Test piece sensor cable 10 m	2.840.01-9901	1.2
20	Pressure pad I	2.850.01-5201	
21	Pressure pad II	2.851.01-5201	

Sensor systems H 2.859/60 with segment coils

These sensor systems are used for non-destructive testing of non-ferromagnetic test material in the diameter range 11 to 100 mm.

The general drawings below specify the nominal diameter range covered by each of the sensor systems.

Please also refer to the leaflet “Sensor systems H 2.859/60, Order No. 137 365 0”.

Features on Sensor system H

- ✓ Circular sensor system without magnetization
- ✓ Protective guide nozzles at the entry and exit sides
- ✓ Height adaption via lifting table

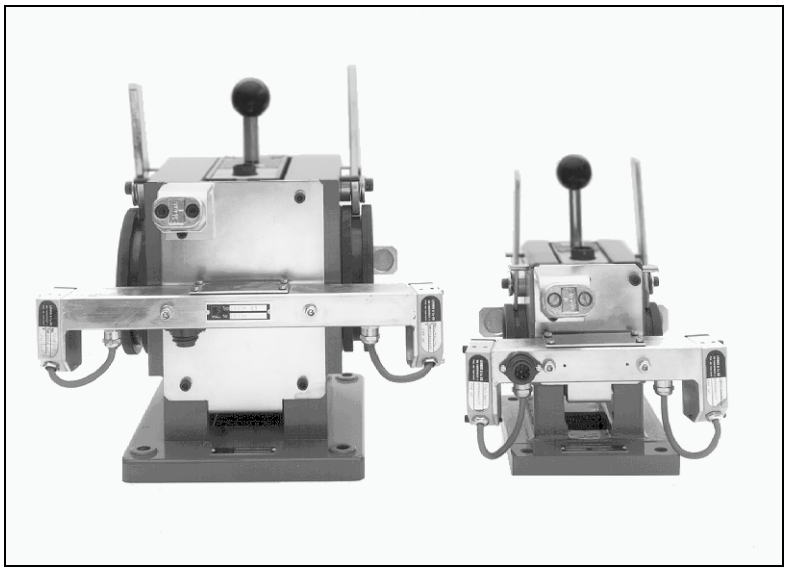

Figure 17: Sensor system H 90 and H 40

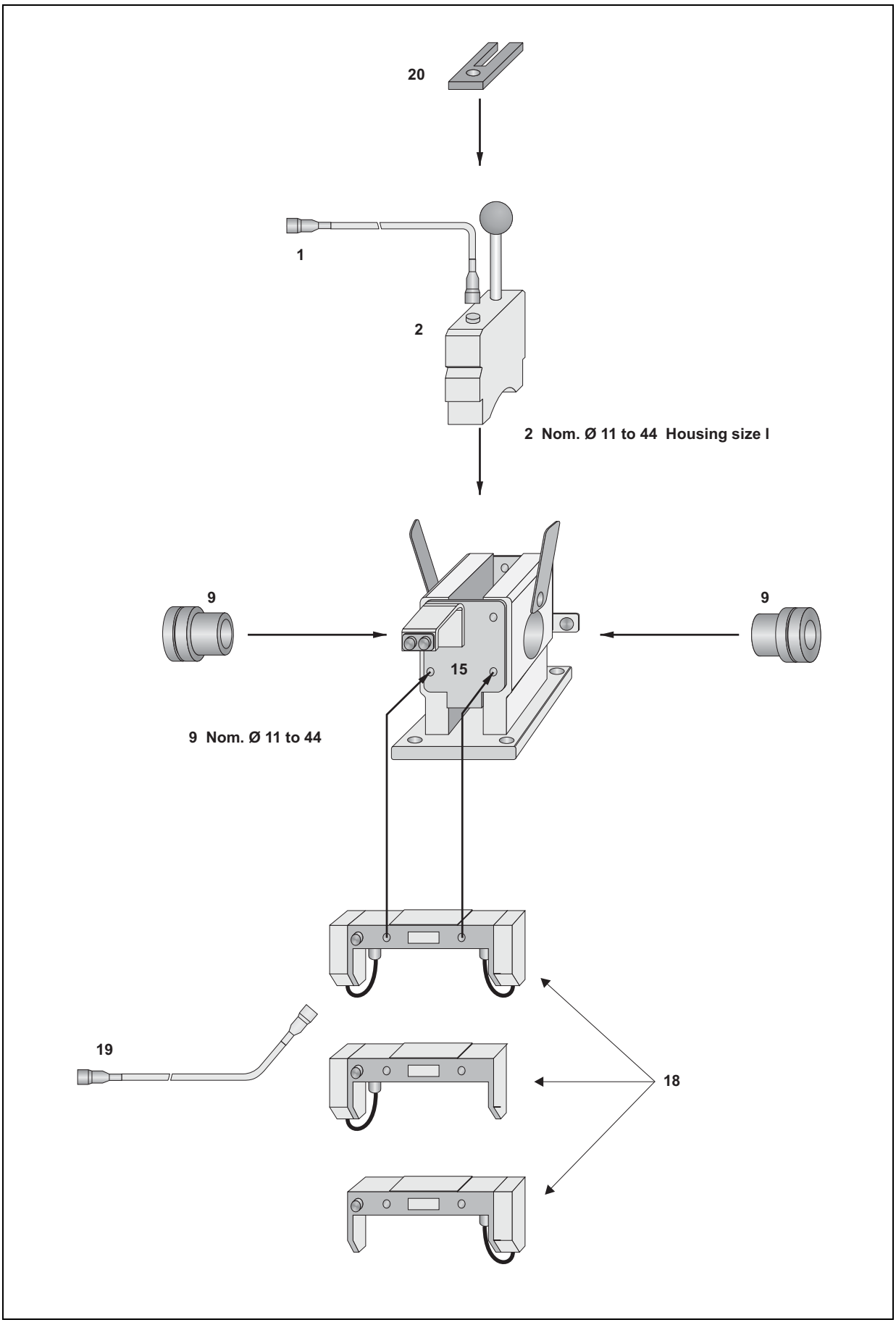

Figure 18: Sensor system H 40

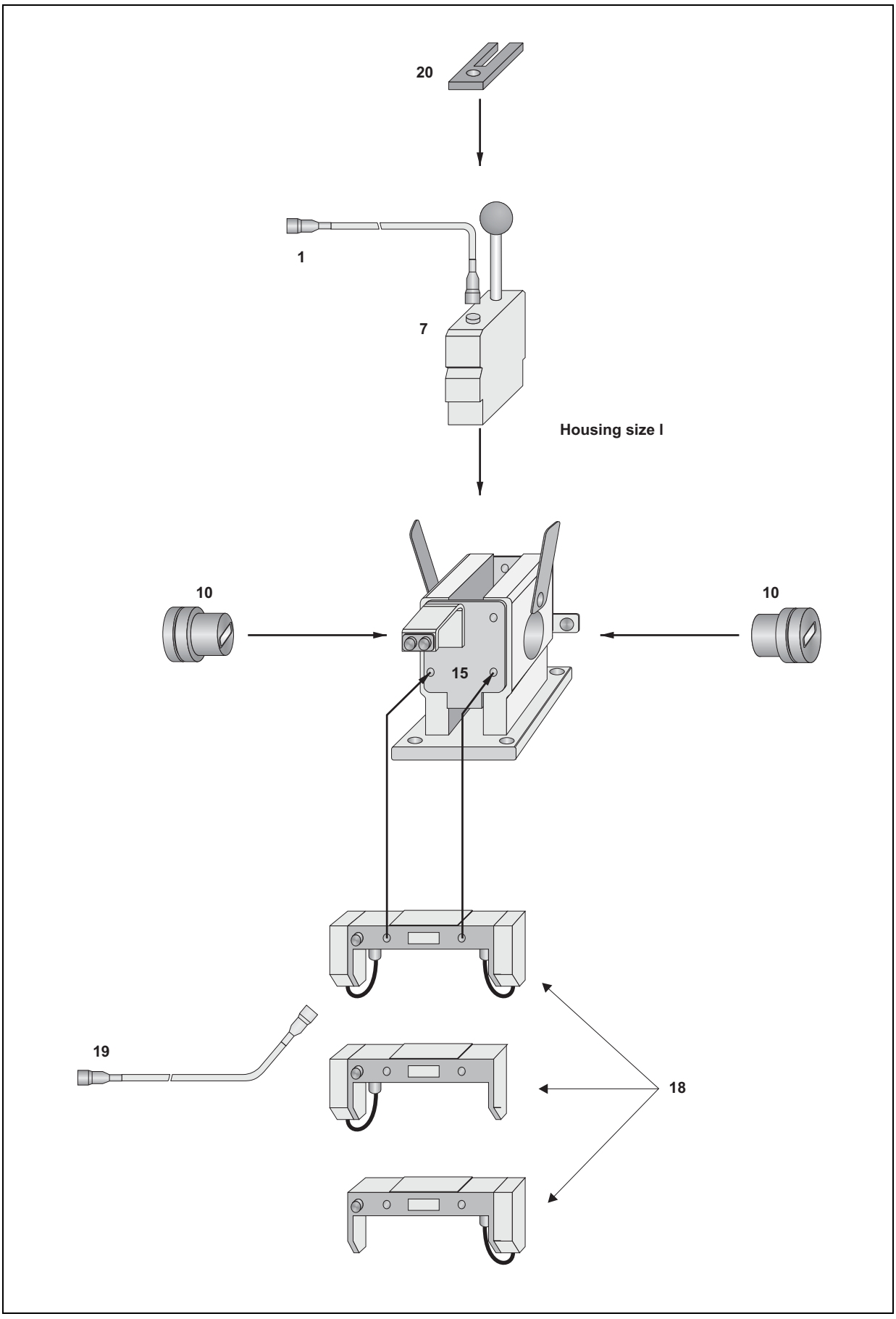

Figure 19: Sensor system H 40, segment coil flat

Position list Coil holder H 40			
Pos.	**Designation**	**Part-No.**	**Mass (kg)**
1	Coil cable 10 m	2.899.51-1110	3.5
2	LMD segment coil size I 11 to 44 mm nominal-Ø	2.893.11-0110 to -0440	
7	LMD segment coil flat size I	2.893.11-9901	
9	Nozzle 11 to 44 mm nominal-Ø	2.859.01-2110 to -2440	1 to 2.5
10	Nozzle flat up to 44 mm diagonal size	2.859.04-2001 to -2100	
15	Coil holder H 40	2.859.02-1001	
18	Double test piece sensor or Test piece sensor, left or Test piece sensor, right	2.859.01-6010 2.859.01-6020 2.859.01-6030	2 1.8 1.8
19	Test piece sensor cable 10 m	2.840.01-9901	1.2
20	Pressure pad I	2.850.01-5201	

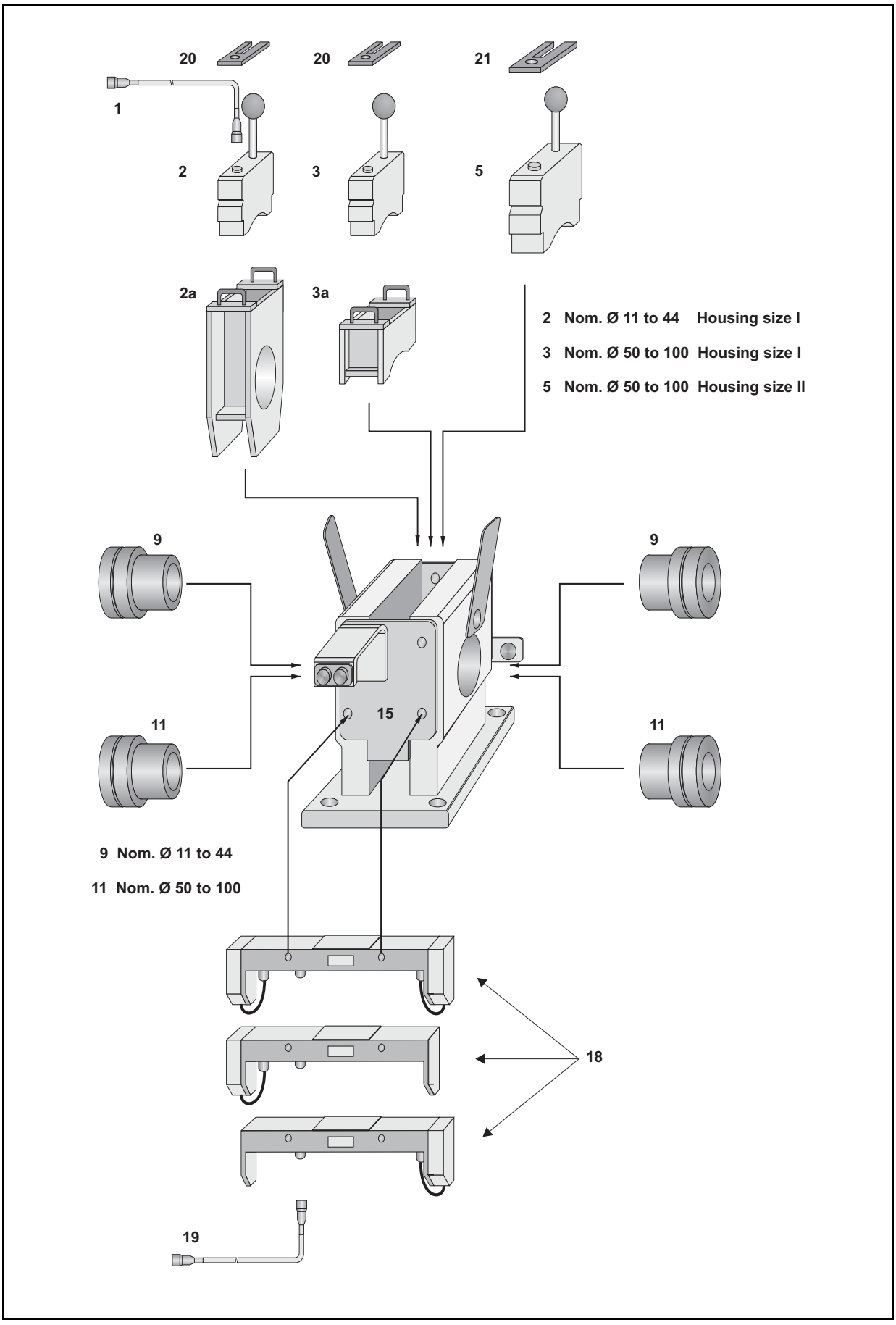

Figure 20: Sensor system H 90

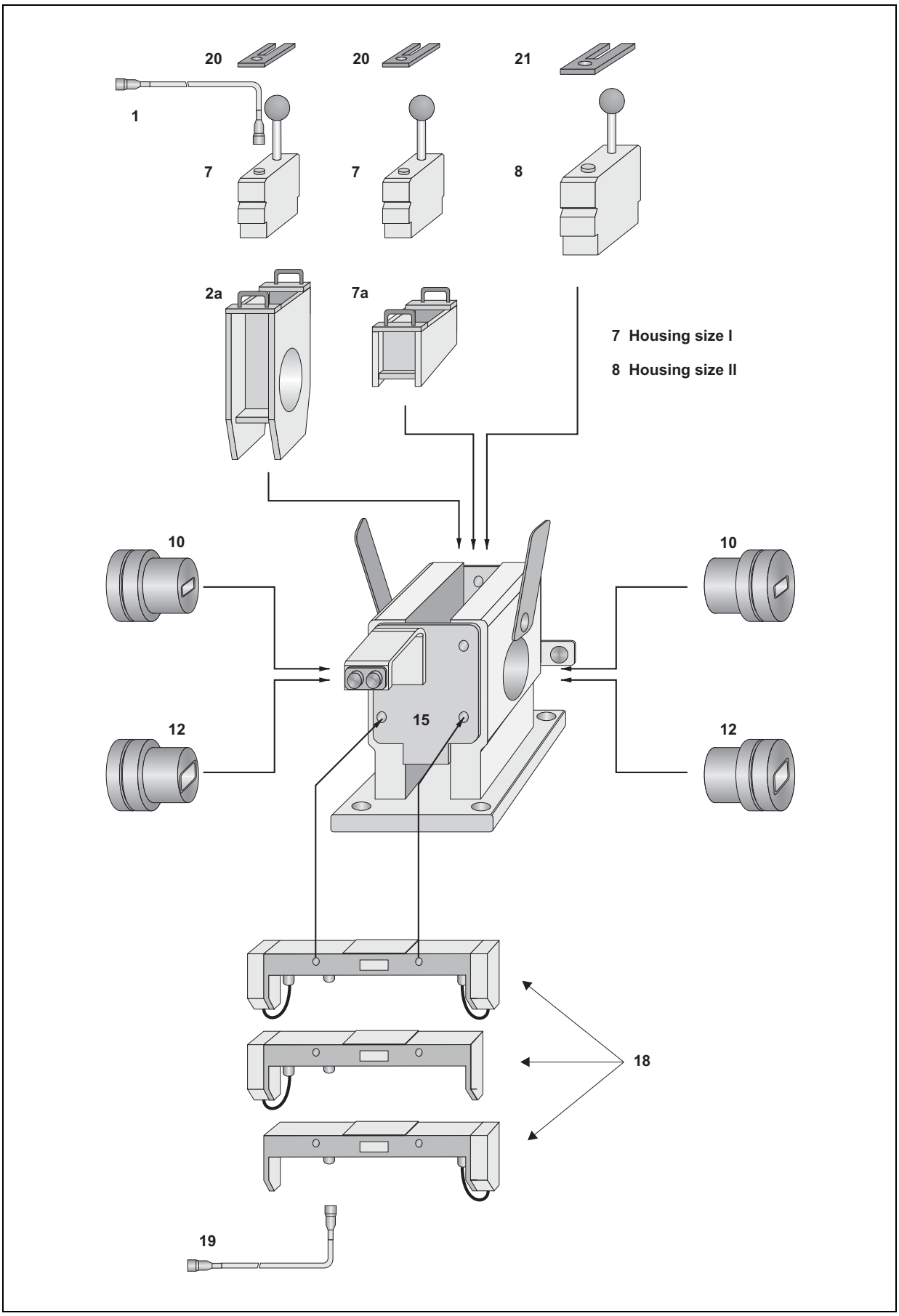

Figure 21: Sensor system H 90, segment coil flat

Position list Coil holder H 90			
Pos.	**Designation**	**Part-No.**	**Mass (kg)**
1	Coil cable 10 m	2.899.51-1110	3.5
2	LMD segment coil size I 11 to 44 mm nominal-Ø	2.893.11-0110 to -0440	
2a	Coil adapter 44	2.852.01-5202	approx. 3
3	LMD segment coil size I 50 to 100 mm nominal-Ø	2.893.11-3050 to -3100	
3a	Segment coil adapter S100	2.851.01-5202	
5	LMD segment coil size II 50 to 44 mm nominal-Ø	2.893.21-3050 to -3100	
7	LMD segment coil flat size I	2.893.11-9901	
7a	Segment coil adapter SF S100 flat	2.851.01-5203	
8	LMD segment coil flat size II	2.893.21-9901/9902	
9	Nozzle 11 to 44 mm nominal-Ø	2.859.01-2110 to -2440	1 to 2.5
10	Nozzle flat up to 44 mm diagonal size	2.859.04-2001 to -2100	
15	Coil holder H 40	2.859.01-1001	
18	Double test piece sensor or Test piece sensor, left or Test piece sensor, right	2.859.01-6010 2.859.01-6020 2.859.01-6030	2 1.8 1.8
19	Test piece sensor cable 10 m	2.840.01-9901	1.2
20	Pressure pad I	2.850.01-5201	
21	Pressure pad II	2.851.01-5201	

Standard components					
	Segment coil holder SH 180		**Segment coil yoke LSP 180**		**Segment coil yoke LSM 180**
Testable material	Nfe - -		NFe (small amount of Fe) Aust. Fe (low compon.)		- Fe Aust.
Nominal-Ø (mm)	10 to 180		10 to 180		10 to 180
Field strength	–		50 kA/m		80 kA/m
Mass (approx.)	with height adjustment	without height adjustment	with height adjustment	without height adjustment	
	9 kg	4,4 kg	10 kg	5,4 kg	65 kg
Ambient temperature	0 to 45 °C				
Enclosure (DIN 40 050)	–				IP 65

Special components		
	Segment coil carriage	**Segment coil carriage PM**
Testable material	NFe	- Aust. Fe (low compon.)
Nominal-Ø (mm)	10 to 180	10 to 115
Field strength	–	48 kA/m
Mass (approx.)	9 kg	11 kg
Ambient temperature	0 to 45 °C	
Enclosure (DIN 40 050)	–	

Sensor systems M and H					
	M 40	**M 90**	**M 140 / M 170**	**H 40**	**H 90**
Testable material	- Fe Aust.	- Fe Aust.	- Fe Aust.	NFe	NFe
Nominal-Ø (mm)	11 to 44	11 to 100	11 to 140/180	11 to 44	11 to 100
Maximum test cross section area which can be magnetized to saturation point	approx. 800 mm^2	approx. 800 mm^2	approx. 800 mm^2	no magnetic field	
Mass (approx.)	55 kg	95 kg	320 kg	9 kg	15 kg
Ambient temperature	0 to 45 °C				

Cable

Yoke cable

Two different yoke cables 10 M are available for magnetization.

- Yoke cable 10 m, 104 485 0
- Yoke cable 10 m with terminal connection on one end, 104 633 0

Intermediate cable

The flexible intermediate cable connects the LMD segment coil to the screened cable.

Intermediate cable	0.7 m	143 036 0
	1.0 m	143 035 1

It is advisable to use this cable if the test location is characterized by cramped installation space and if the less flexible test cable needs to be curved in narrow radii.

Coil cable 10 m, 138 161 0

The 10 m long, screened cable connects the LMD segment coil to the test and evaluation electronics or the test and evaluation electronics to the intermediate cable.

Should you have any special problems please contact:

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