Table of contents **Edition D**

1. General information about resistance welding

"Electrical resistance welding" is a welding process in which the welding is carried out by heating and applying pressure to the parts to be connected. There are the following procedures for resistance welding:

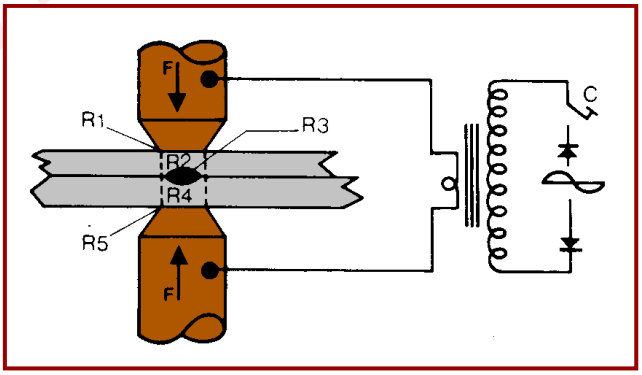
- **spot welding,**
- **projection welding,**
- **seam welding,**
- **butt welding.**

Spot welding:

The parts to be welded are located between two electrodes, which are connected to the secondary side of the transformer and acting with an electrode force of F on the parts to be welded. The electrodes are made of a material that has high electrical and thermal conductivity and good mechanical properties. Electrodes for resistance welding have the task of transferring all specialty sizes of welding parts. The electrode is the tool of resistance welding, and the same principle applies here as anywhere else in the manufacturing technology:

Permanent production success can be achieved only with the best tools!

At the closing of the contact C, the flow through the Joule effect leads to a warming of the resistance between the electrode tips.
R1 and R5 are contact resistances between the active part of the electrode tip and the parts to be welded. R2 and R4 are the resistors of the parts to be welded (a fictional cylinder whose diameter is equal to the diameter of the active part of the electrode and the amount of which corresponds to the strength of the parts). R3 is the resistance between the parts. These resistance values are different and vary in function of the force F. The biggest opposition is R3, and R1 and R5 are the smallest resistances. Through the continuity, the metal in the resistors R2, R3, and R4 is heated and melted in the vicinity of the resistor R3 and forms a weld spot. By setting up the electrodes is hot solidified molten core. Minor warming through resistors R1 and R5 will be absorbed mostly by the electrodes, which are cooled by circulating water.



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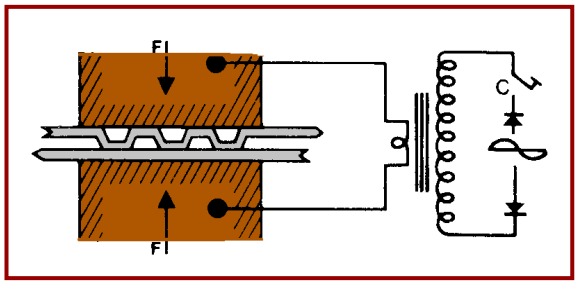
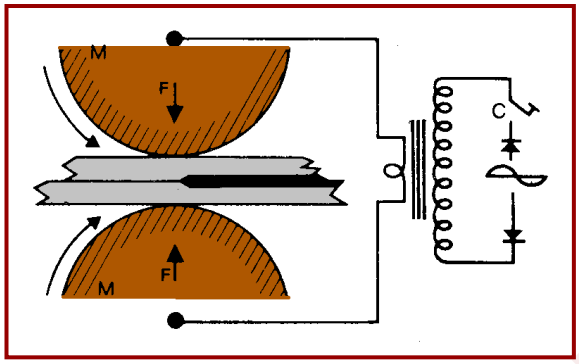


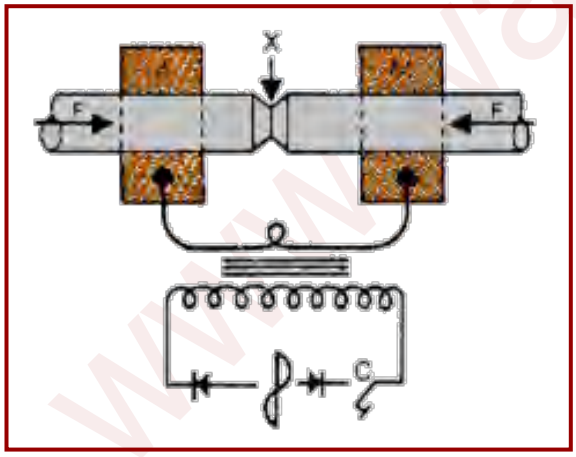
Projection welding:

The principle of projection welding is basically spot welding. The difference is that a proportion of the parts to be welded must undergo the welding process before one or more "hump" can be applied, allowing the secondary flows. The parts of these "humps" are welded at the closure of the contact.



Seam welding:

Also, the welding with the roller electrode is almost the same as the spot welding. In this process, the electrodes have the shape of discs or rings. To get multiple welds, the rollers are driven. Depending on the speed of the rollers, a continuous and watertight weld or welds can be achieved with small or large intervals (spot welding with the roll seam electrode).



Butt welding:

The parts are clamped between two Jaws M. To weld by resistance, press the parts together first and then allow the welding current through. By constantly reversing, the material is heated and welded in a doughy state under crushing pressure. A bead is at the welding spot.

Flash butt welding:

This procedure differs from the resistance welding due to the nature of the warming of the weld. The welded parts clamped in the jaws have no electrical contact. You can flow the current through a resistor to the ignition of the thyristors. Then the welding parts go to each other, until combustion takes place. After sufficient warming, the compression pressure takes place.

2. Parameters for resistance welding

Benchmarks for **spot welding** of **steel sheets** with max. 0.3% C

Sheet thickness (Thinner sheet metal)	Electrode			Electrode force	Current time 1 cycle = 20ms	Welding current	Minimum lenses - Ø	Minimum spot distance
mm	(d_1)mm	(d_2)mm	(r)mm	daN	cycles	kA	(d)mm	(a_1)mm
0,5	12,5	5	50	150	5	6	3,5	10
0,8	12,5	6	75	220	7	10	4,5	16
1,0	12,5	6	75	300	9	12	4,7	20
1,25	12,5	6	75	370	10	13	5,2	25
1,5	12,5	6	75	440	12	14	5,4	30
1,75	12,5	6	75	510	14	15	6,2	32
2,0	19	6	75	580	16	16	6,4	35
2,25	19	8	75	650	20	17	6,6	38
2,5	19	8	75	720	24	18	6,8	42
2,75	19	8	75	790	26	19	7,0	46
3,0	19	8	75	850	30	20	7,2	50
3,5	19	8	75	900	50	21	7,4	54
4,0	25	12	90	950	60	22	8,2	58
4,5	25	12	90	1.000	65	23	8,6	62
5,0	25	12	90	1.300	75	24	9,0	66
5,5	25	12	90	1.700	85	25	9,4	70
6,0	25	12	90	2.000	95	26	9,8	74

Benchmarks for **spot welding** of **galvanized steel sheets**

Sheet thickness (Thinner sheet metal)	Electrode			Electrode force	Current time 1 cycle = 20ms	Welding current	Minimum lenses - Ø	Minimum spot distance
mm	(d_1)mm	(d_2)mm	(r)mm	daN	cycles	kA	(d)mm	(a_1)mm
0,5	12,5	5	50	140	7	9	3,8	10
0,8	12,5	6	75	200	9	11	4,5	16
1,0	12,5	6	75	270	11	14	4,8	20
1,25	12,5	6	75	330	12	15	5,2	25
1,5	12,5	6	75	400	14	17	5,4	30
1,75	12,5	6	75	450	16	18	6,2	32
2,0	19	6	75	500	20	19	6,4	35
2,25	19	8	75	580	22	20	6,6	38
2,5	19	8	75	650	26	21	6,8	42
2,75	19	8	75	720	28	22	7,0	46
3,0	19	8	75	780	30	23	7,2	50
3,5	19	8	75	820	54	24	7,4	54
4,0	25	12	90	860	64	25	8,2	58
4,5	25	12	90	900	69	26	8,6	62
5,0	25	12	90	940	79	27	9,0	66
5,5	25	12	90	980	89	28	9,4	70
6,0	25	12	90	1.020	99	29	9,8	74

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Benchmarks for **spot welding** of **stainless chromium-nickel sheet steel**

Sheet thickness (Thinner sheet metal)	Electrode			Electrode force	Current time 1 cycle = 20ms	Impulse	Welding current	Minimum lenses - Ø	Minimum spot distance
mm	(d_1)mm	(d_2)mm	(r)mm	daN	cycles	quantity	kA	(d)mm	(a_1)mm
0,25	12,5	4	50	100	2	-	2,5	3,5	6
0,50	12,5	5	50	200	3	-	4,0	4,5	8
0,75	12,5	5	75	300	4	-	6,0	4,7	13
0,75 *	12,5	5	75	300	2	2	6,0	5,2	13
1,00	12,5	6	75	450	5	-	7,0	5,4	16
1,00 *	12,5	6	75	450	3	2	7,0	6,2	16
1,50	19	8	75	650	8	-	10	6,4	25
1,50 *	19	8	75	650	4	2	10	6,6	25
2,00	19	8	90	900	12	-	13	6,8	32
2,00 *	19	8	90	900	4	3	13	7,0	32
2,50	19	10	90	1.200	14	-	15	7,2	35
2,50 *	19	10	90	1.200	5	3	15	7,4	35
3,00	19	10	90	1.500	18	-	17	8,2	50
3,00 *	19	10	90	1.500	6	3	17	8,6	50

* multi-pulse welding

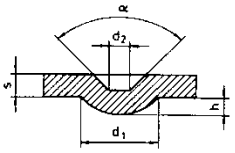
Benchmarks for **spot welding** of **aluminum**

Sheet thickness (Thinner sheet metal)	Electrode			Electrode force	Current time 1 cycle = 20ms	Welding current	Minimum lenses - Ø	Minimum point distance
mm	(d_1)mm	(d_2)mm	(r)mm	daN	cycles	kA / DC	(d)mm	(a_1)mm
0,5	12,5	5	75	170	3	18	3,5	10
0,8	12,5	6	75	180	3	24	4,5	16
1,0	12,5	6	75	190	3	30	4,7	20
1,25	12,5	6	75	200	3	32	5,2	25
1,5	12,5	6	75	210	3	35	5,4	30
1,75	12,5	6	75	240	5	38	6,2	32
2,0	19	6	90	260	5	40	6,4	35
2,25	19	8	90	300	6	45	6,6	38
2,5	19	8	90	320	6	49	6,8	42
2,75	19	8	90	340	7	54	7,0	46
3,0	19	8	90	360	7	58	7,2	50
3,5	19	8	90	400	8	65	7,4	54
4,0	25	12	90	450	10	70	8,2	58
4,5	25	12	90	500	10	76	8,6	62
5,0	25	12	90	550	11	85	9,0	66
5,5	25	12	90	600	11	98	9,4	70
6,0	25	12	90	650	12	110	9,8	74

Minimum lenses-Ø: $d_L \approx 5\sqrt{s}$

suitable test measuring devices and test tools from page 92

Benchmarks for **projection welding** of **sheet steel** with max. 0.3% C

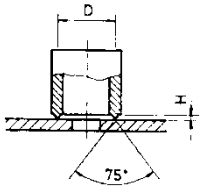


The benchmarks refer to one hump, if there are several humps,
a factor of 0.8 can usually be used.

For the electrode force, the table value must be multiplied by the number of humps.

Sheet thickness (Thinner sheet metal) (s) mm	Hump - Ø (d_1) mm	Hump height (h) mm	Stamp - Ø (d_2) mm	Stamp angle (α)°	Electrode force daN	Current time 1 cycle = 20ms cycles	Impulse quantity	Welding current kA
0,5	2,0	0,5	0,5	60	80	4	-	3 - 5
0,75	2,5	0,6	0,6	60	120	6	-	4 - 6
1,0	3,0	0,7	0,7	60	180	8	-	5 - 7
1,5	3,6	0,8	0,9	70	250	10	-	7 - 10
2,0	4,0	1,0	1,0	70	400	14	-	9 - 12
2,5	4,5	1,1	1,1	70	500	18	-	10 - 14
3,0	5,0	1,3	1,2	80	650	24	-	11 - 15
3,5	5,5	1,4	1,4	80	800	17	2	12 - 16
4,0	6,0	1,5	1,5	80	950	20	2	13 - 17
4,5	6,5	1,6	1,6	90	1.100	18	3	14 - 18
5,0	7,0	1,6	1,7	90	1.250	22	3	15 - 19
5,5	7,5	1,9	1,8	90	1.400	18	4	16 - 20
6,0	8,0	2,0	2,0	90	1.550	22	4	17 - 22

Benchmarks for **ring projection welding** on **low-alloy sheet steel**



Setting values for steel ring stamps with a point angle of 75°

Ring hump - Ø (D) mm	Ring hump height (H) mm	Electrode force daN	Current time 1 cycle = 20ms cycles	Welding current kA
5,0	0,7	750	2	15
7,5	0,8	1.000	2,5	21
10,0	0,9	1.250	3	26
12,5	1,1	1.600	3,5	33
15,0	1,2	2.000	4	40
17,5	1,3	2.500	4,5	50
20,0	1,4	3.000	5	60
22,5	1,5	3.300	5,5	65
25,0	1,6	3.750	6	70
27,5	1,7	4.100	6,5	75
30,0	1,8	4.400	7	80
32,5	1,9	4.700	7,5	85
35,0	2,0	5.050	8	90
37,5	2,1	5.400	8,5	95
40,0	2,2	5.700	9	100

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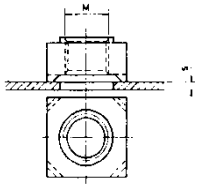
Benchmarks for **projection welding** of **welding nuts low-alloy sheet steel**

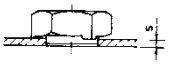


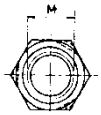
Setting values for **square welding nuts according to DIN 928**

Welding nut (M) size	Sheet thickness (s) mm	Electrode force daN	Current time 1 cycle = 20ms cycles	Welding current kA	Extrusion force min. kN	Torque min. 1) u. 2) Nm
M4	0,75 - 1,50	200	3	7,0	2,67 - 5,17	27 - 31
M5	0,75 - 2,00	250	4	9,0	4,60 - 5,47	51 - 54
M6	0,75 - 2,50	300	5	10,0	4,52 - 10,48	55 - 66
M8	1,00 - 3,00	400	6	15,0	8,58 - 19,02	162 -180
M10	1,25 - 4,00	450	10	12,0	11,30 - 20,68	-
M12	1,00 - 2,50	500	13	17,0	12,39 - 27,85	-
M14	1,50 - 3,00	600	16	19,0	21,66 - 36,17	-

1) With sheet metal thicknesses up to and including 1, 25 mm, the removal torque can only be determined up to maximum of M6 due to the low rigidity of the sheets.

2) The determination of the removal torque is limited to a maximum of M8 due to the effort required for manual testing.





Setting values for **Hexagon welding nuts according to DIN 929**

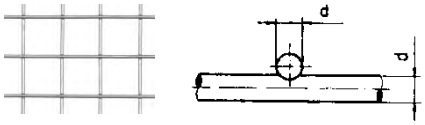
Welding nut (M) size	Sheet thickness (s) mm	Electrode force daN	Current time 1 cycle = 20ms cycles	Welding current kA	Extrusion force min. kN	Torque min. 1) Nm
M3	0,75 - 1,00	80	2	5,0	0,74 - 0,86	6 - 7
M4	0,75 - 1,50	100	3	6,0	1,35 - 1,65	13 - 16
M5	0,75 - 2,00	150	4	8,0	2,16 - 4,53	19 - 29
M6	1,00 - 2,50	200	4	10,0	3,26 - 5,81	24 - 34
M8	1,00 - 3,00	300	5	14,0	3,38 - 5,79	58 - 65
M10	1,25 - 4,00	350	7	16,0	5,97 - 15,5	112 - 133
M12	1,50 - 6,00	400	10	15,0	5,39 - 16,1	-
M14	3,00 - 6,00	450	12	18,0	10,6 - 15,5	-
M16	3,00 - 6,00	500	14	19,0	16,2 - 18,2	-

1) The determination of the removal torque is limited to a maximum of M10 due to the effort for manual testing.

Electrodes for welding nuts from page 31

Suitable test equipment (torque wrench) from page 95

Benchmarks for the **cross wire welding** of **low-alloy steel wire**
with max. 0.2% C wire rod, cold-drawn, bright



Setting values for single crossing, **penetration depth 15%**

Wire - Ø (d) mm	Electrode force daN	Current time 1 cycle = 20ms cycles	Welding current kA	Shear force kN
3	60	9	1,9	4,3
4	150	12	3,1	8,2
5	180	16	3,6	9,5
6	240	18	4,3	15,5
8	375	25	6,2	23,0
9	450	30	7,2	28,0
10	560	35	8,1	31,0
11	635	42	9,3	43,5
12	750	48	10,1	53,5

Setting values for single crossing, **penetration depth 30%**

Wire - Ø (d) mm	Electrode force daN	Current time 1 cycle = 20ms cycles	Welding current kA	Shear force kN
3	120	9	2,7	5,1
4	210	12	4,6	9,5
5	300	16	5,5	12,0
6	370	18	6,5	18,0
8	660	25	9,3	27,7
9	870	30	11,0	36,5
10	1.050	35	12,1	38,5
11	1.320	42	13,8	51,3
12	1.480	48	15,2	59,0

Setting values for single crossing, **penetration depth 50%**

Wire - Ø (d) mm	Electrode force daN	Current time 1 cycle = 20ms cycles	Welding current kA	Shear force kN
3	160	9	3,4	5,6
4	320	12	5,8	10,2
5	360	16	6,2	11,5
6	520	18	8,3	18,8
8	910	25	11,0	29,5
9	1.240	30	13,5	38,0
10	1.500	35	15,0	41,0
11	2.020	42	17,4	54,0
12	2.350	48	20,5	64,0

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Benchmarks for **seam welding** of **sheet steel** with max. 0.3% C
Sealing seams welded with current program

Sheet thickness (Thinner sheet metal) (s) mm	Electrode roll (d) mm	(R) mm	Welding speed (v) m/min	Electrode force daN	Current time 1 cycle = 20ms cycles	Break time cycles	Welding current kA
0,25	3,0	50	2,0	180	1	1	8,0
0,5	3,0	50	2,0	240	2	1	10,0
0,75	3,5	50	2,0	300	2	2	12,0
1,0	4,0	75	1,8	400	3	3	15,0
1,25	4,5	75	1,7	450	4	4	16,0
1,5	5,0	75	1,6	520	4	5	17,0
2,0	5,5	75	1,5	600	6	6	19,0
2,5	6,0	100	1,4	700	7	7	20,0
3,0	6,5	100	1,1	800	9	8	21,0

Benchmarks for **seam welding** of **stainless chrome-nickel sheet steel**
Sealing seams welded with current program

Sheet thickness (Thinner sheet metal) (s) mm	Electrode roll (d) mm	(R) mm	Welding speed (v) m/min	Electrode force daN	Current time 1 cycle = 20ms cycles	Break time cycles	Welding current kA
0,25	3,5	50	1,5	250	2	2	6,0
0,5	4,0	50	1,4	300	2	2	8,0
0,75	4,5	50	1,3	400	2	2	10,0
1,0	5,0	75	1,2	500	3	3	12,0
1,25	5,5	75	1,2	600	4	3	13,0
1,5	6,0	75	1,0	800	4	4	15,0
2,0	6,5	75	1,0	1.000	4	5	16,0
2,5	7,0	75	1,0	1.200	5	5	17,0
3,0	8,0	100	0,9	1.500	6	7	18,0

Benchmarks for **seam welding** of **aluminum and aluminum alloys**
Sealing seams welded with current program

Sheet thickness (Thinner sheet metal) (s) mm	Electrode roll (d) mm	(R) mm	Welding speed (v) m/min	Electrode force daN	Current time 1 cycle = 20ms cycles	Break time cycles	Welding current kA / DC
0,25	-	50	1,2	250	1	1	21,0
0,5	-	50	1,0	280	1	2	25,0
0,75	-	50	1,0	300	2	3	30,0
1,0	-	75	0,9	350	2	3	32,0
1,25	-	75	0,8	400	2	4	35,0
1,5	-	75	0,7	450	3	5	40,0
2,0	-	75	0,6	500	3	6	42,0
2,5	-	100	0,6	550	4	6	52,0

3. Electrode materials

Materials for electrodes and conductive parts of resistance welding equipment according to DIN 44759
Composition and properties Benchmarks

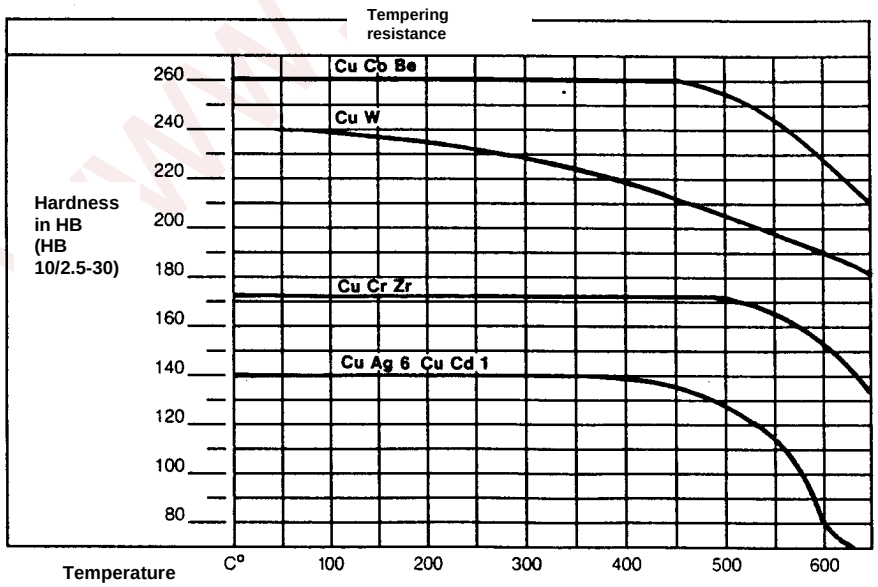
Designation	Class DIN44759	Material No. (DIN)	Material No. (DIN EN)	Typical analysis %	Hardness HB	Tensile strength N/mm²	Softening temperature [1] °C	Conductivity m/Ω x mm²
E-Cu	A1/1	2.0060	CW004A	Cu 99,5-98	80	390	200	57
CuAg0,1P	A1/4	2.1191	CW016A	Cu 99,95; Ag 0,1	90	300	350	57
CuCr	A2/1	2.1291	CW105C	Cu 99,5; Cr 0,5	125	530	475	45
CuCrZr H328 [2]	A2/2	2.1293	CW106C	Cu 99,12; Cr 0,8; Zr 0,08	160	500-600	500	43
CuCoBe H100 [3]	A3/1	2.1285	CW103C	Cu 97,5; Co 1,0; Ni 1,0; Be 0,5	260	720-820	475	25

[1] The softening temperature is the temperature up to which a material can be briefly heated without a drop in hardness occurring (measured after cooling at room temperature).

[2] Warm hardened copper alloy with high hardness and strength with high electrical conductivity.

[3] Hardened copper alloy with high thermal conductivity good hardness and heat resistance, good tempering resistance.

Graphic progression of the tempering resistance of the electrode materials



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4. Stock list for semi-finished materials

Brass (MS58) CuZn39Pb3 / Material No. 2.0401 - CW616N

● round		■ square		▬ flat		⬣ hexagon	
mm Ø	kg/m	mm	kg/m	mm	kg/m	mm	kg/m
10	0,67	10 x 10	0,85	15 x 10	1,30	SW 10	0,74
12	0,96	12 x 12	1,22	20 x 10	1,70	SW 12	1,06
15	1,50	15 x 15	1,91	20 x 15	2,55	SW 14	1,44
18	2,16	18 x 18	2,76	25 x 10	2,13	SW 17	2,13
20	2,67	20 x 20	3,40	25 x 15	3,19	SW 19	2,66
22	3,23	22 x 22	4,11	25 x 20	4,30	SW 22	3,56
25	4,16	25 x 25	5,31	30 x 10	2,55	SW 24	4,24
28	5,23	30 x 30	7,65	30 x 15	3,83	SW 27	5,37
30	6,00	40 x 40	13,60	30 x 20	5,10	SW 30	6,62
32	6,84	50 x 50	21,25	40 x 10	3,40	SW 32	7,54
35	8,19	60 x 60	30,60	40 x 15	5,10	SW 36	9,54
40	10,69	70 x 70	41,65	40 x 20	6,80	SW 41	12,37
45	13,51			40 x 30	10,20	SW 46	15,38
50	16,68			50 x 10	4,25	SW 50	18,40
55	20,18			50 x 20	8,50	SW 55	22,27
60	24,02			50 x 30	12,75		
65	29,19			60 x 10	5,10		
70	32,70			60 x 20	10,20		
75	37,55			60 x 30	15,30		
80	42,73			80 x 20	13,60		
85	48,23			80 x 40	27,20		
90	54,08			100 x 10	8,50		
100	66,76			100 x 20	17,00		
120	96,08						
150	150,13						
200	266,90						
drawn up to 70mm Ø > 70mm Ø pressed		pulled		pulled		pulled	

Stock list for semi-finished materials

H-328 CuCrZr / Material No. 2.1293 - CW106C

round		square		flat		flat		hexagon		slices	
mm Ø	kg/m	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m	mm Ø	kg/ slice
5	0,18	4 x 4	0,14	15 x 10	1,34	* 80 x 25	17,80	SW 10	0,77	172 x 16	3,35
6	0,25	8 x 8	0,57	20 x 10	1,78	* 80 x 30	21,30	SW 12	1,12	190 x 16	4,10
8	0,45	10 x 10	0,89	20 x 15	2,67	* 80 x 40	28,50	SW 14	1,51	200 x 10	2,80
10	0,70	12,5 x 12,5	1,30	25 x 5	1,11	* 80 x 50	35,60	SW 17	2,23	200 x 16	4,54
12	1,01	15 x 15	2,00	25 x 10	2,33	* 80 x 60	42,72	SW 19	2,78	200 x 20	5,60
12,5	1,09	16 x 16	2,28	25 x 15	3,34	85 x 3	2,27	SW 22	3,73	200 x 30	8,40
12,7	1,12	18 x 18	2,88	25 x 20	4,45	*100 x 10	8,90	SW 24	4,44	200 x 35	9,92
13	1,18	20 x 20	3,56	30 x 8	2,14	*100 x 12	10,68	SW 27	5,62	212 x 16	5,03
14	1,37	22 x 22	4,31	30 x 10	2,67	*100 x 15	13,35	SW 28	6,04	220 x 16	5,55
15	1,58	25 x 25	5,56	30 x 15	4,00	*100 x 20	17,80	SW 32	7,90	220 x 18	6,16
16	1,79	30 x 30	8,00	30 x 20	5,35	*100 x 30	26,70	SW 36	9,99	230 x 16	5,92
18	2,27	32 x 32	9,10	30 x 25	6,67	*100 x 40	35,60			250 x 10	4,38
19	2,53	36 x 36	11,55	35 x 20	6,23	*100 x 50	44,50			250 x 12	5,25
20	2,80	40 x 40	14,25	35 x 25	7,80	*120 x 30	32,10			250 x 12,7	5,60
22	3,39	42 x 42	15,70	38 x 25	8,46	*120 x 40	42,70			250 x 16	7,00
24	4,03	45 x 45	18,02	40 x 6	2,14	*120 x 60	64,08			250 x 20	8,83
25	4,38	50 x 50	22,25	40 x 10	3,56	*130 x 20	23,20			270 x 18	9,30
28	5,48	60 x 60	32,05	40 x 15	5,35	*150 x 10	13,35			270 x 20	10,20
30	6,30	70 x 70	43,60	40 x 20	7,10	*150 x 15	20,02			280 x 12	6,59
32	7,20	80 x 80	56,96	40 x 25	8,90	*150 x 25	33,20			300 x 12	7,56
35	8,60	100 x 100	89,00	40 x 30	10,70	*150 x 50	67,50			300 x 16	10,20
38	10,10	130 x 130	150,40	50 x 10	4,45	*150 x 75	100,00			300 x 20	12,60
40	11,20			50 x 15	6,70	*200 x 30	53,40			300 x 22	13,86
42	12,34			50 x 20	8,90	*200 x 40	71,20			310 x 10	6,10
45	14,20			50 x 25	11,10	*200 x 50	89,00			315 x 10	6,94
50	17,50			50 x 30	13,40	*200 x 60	106,80			320 x 18	12,90
52	18,93			50 x 35	15,58	*200 x 80	142,40				
55	21,20			60 x 6	3,20	*200 x 100	178,00				
60	25,17			60 x 10	5,35	*200 x 120	213,60				
65	29,52			60 x 15	8,00	*210 x 36	67,30				
70	34,25			60 x 20	10,70	*245 x 70	152,60				
75	39,32			60 x 25	13,40	*258 x 56	128,60				
80	44,74			60 x 30	16,05	*400 x 30	106,80				
85	50,50			*60 x 45	24,00	*400 x 40	142,40				
90	56,63			70 x 15	9,35	*400 x 50	178,00				
95	56,60			*70 x 20	12,50	*400 x 60	213,60				
100	69,90			*70 x 30	18,70	*500 x 30	133,50				
110	84,50			80 x 8	5,70	*500 x 40	178,00				
120	100,70			80 x 10	7,12	*500 x 50	222,50				
130	118,10			*80 x 20	14,25						
150	157,20										
160	179,00										
180	226,40										
200	280,00										
210	308,10										
drawn up to 50mm Ø according to DIN 1756, material group II; > 50mm Ø pressed or forced		up to 40mm square pulled according to DIN 1761, material group II; > 40mm Ø square pressed or forged		drawn according to DIN 1759 * pressed or forged				dragged to DIN 1763, material group II.		for roller electrodes DIN 44754, cured.	

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Stock list of semi-finished materials

H-100 CuCoBe / Material No. 2.1285 - CW103C

● round		■ square		▬ flat		▬ flat		⬢ hexagon		⬤ slices	
mm Ø	kg/m	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m	mm Ø	kg/ slice
6	0,25	6 x 6	0,32	20 x 10	1,78	100 x 15	13,35	SW 14	1,51	110 x 20	1,69
8	0,45	10 x 10	0,89	20 x 15	2,67	100 x 20	17,80	SW 19	2,78	200 x 10	2,80
10	0,70	13 x 13	1,30	25 x 15	3,34	100 x 30	26,70	SW 22	3,73	200 x 16	4,54
12	1,01	16 x 16	2,28	25 x 20	4,45	100 x 50*	44,50	SW 24	4,44	220 x 18	6,16
12,5	1,09	20 x 20	3,56	30 x 10	2,67	120 x 60*	64,08	SW 27	5,62	220 x 20	6,78
13	1,18	25 x 25	5,56	30 x 15	4,00	150 x 50*	67,50	SW 32	7,90	225 x 20	7,10
14	1,37	30 x 30	8,00	30 x 20	5,35	150 x 85*	113,89	SW 36	9,99	250 x 12,7	5,60
15	1,58	32 x 32	9,10	30 x 25	6,67	240 x 70*	150,07			250 x 16	7,00
16	1,79	35 x 35	10,50	35 x 20	6,23	250 x 65*	145,16			250 x 20	8,83
18	2,27	40 x 40	14,25	38 x 25	8,46	250 x 80*	178,66			300 x 20	12,60
19	2,53	50 x 50	22,25	40 x 10	3,56	250 x 100*	223,33			320 x 16	11,48
20	2,80	60 x 60	32,05	40 x 15	5,35	250 x 120*	267,99				
22	3,39	70 x 70	43,60	40 x 20	7,10	305 x 65*	177,09				
25	4,38	80 x 80	56,96	40 x 25	8,90	305 x 85*	231,58				
28	5,48	100 x 100	89,00	40 x 30	10,70						
30	6,30			50 x 10	4,45						
32	7,20			50 x 15	6,70						
35	8,60			50 x 20	8,90						
40	11,20			50 x 25	11,10						
45	14,20			50 x 30	13,40						
51	18,17			50 x 40	17,80						
57	22,70			60 x 15	8,00						
60	25,17			60 x 10	5,34						
65	29,50			60 x 20	10,70						
70	34,25			60 x 25	13,40						
75	39,30			60 x 30	16,05						
80	44,74			70 x 20	12,50						
90	56,63			70 x 30	18,70						
95	63,10			80 x 20	14,25						
100	69,90			80 x 25	17,80						
120	100,70			80 x 30	21,30						
130	118,10			* 80 x 40	28,50						
150	157,20			* 80 x 60	42,72						
160	179,00										
200	280,00										
250	437,00										
drawn up to 50mm Ø according to DIN 1756, material group II; > 50mm Ø forged and pre-turned Ø-tolerance +0,5mm		up to 40mm square pulled according to DIN 1761, material group II; > 40mm Ø square pressed or forged		drawn according to DIN 1759, material group II * raw forged				dragged to DIN 1763, material group II.		for roller electrodes DIN 44754, cured.	

5. Sintered metals – high melting materials

In powder metallurgy, the shaping of metals is not achieved by melting, solidification and subsequent machining and metal powders are mixed, placed by pressing into the desired shape, and sintered. Sintering-a heating below the melting point-can be understood as a diffusion-controlled process in which the contact surfaces of the powder particles to grain boundaries forming.

In this way, you can, for example of tungsten perfectly in combination with the advantageous properties such as excellent electrical conductivity of copper the special qualities.
Tungsten sintered metals are characterized by:

- high pressure resistance and hot hardness
- good electrical conductivity
- low wear, fireproof
- long service life

Composition and properties Benchmarks

Sintered metal	Material	Composition %	Hardness HV	Tensile strength N/mm²	Melting point °C [1)]	Conductivity m/Ω x mm²
H10W3	Tungsten Copper	W 72 / Cu 28	170	390	1083	29
H20W3	Tungsten Copper	W 76 / Cu 24	200	440	1083	22
H30W3	Tungsten Copper	W 78 / Cu 22	230	490	1083	15
H100W	Tungsten	W 100	450	340	3410	19
H100M	Molybdenum	Mo 100	150	550	2610	19
TZM	Titanium Zircon Molybdenum	Ti 0,5;Zr 0,08; C 0,02; Mo 99,4	240	690	2610	15

[1)] In case of composite metals temperature of low melting component

Excerpt of delivery forms sintered metals

Rods 200 and 300mm long / polished

● round	mm Ø	2	3	4	5	6	8	10	12	15	20	25	30	50
■ square	mm	4x4	6x6	10x10	12x12	15x15	20x20	25x25	30x30					
▬ flat	mm	10x4	10x5	10x6	10x15	10x20	10x30	10x40	12x20	12x30	20x30	20x40		

Other rod lengths and dimensions available on request

Electrodes for micro resistance welding machines see from page 41

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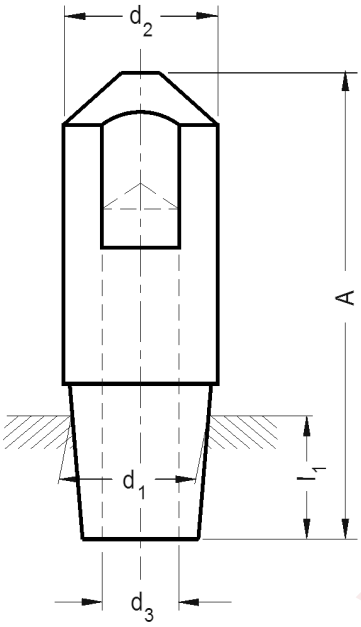
6. Standard - spot welding electrodes

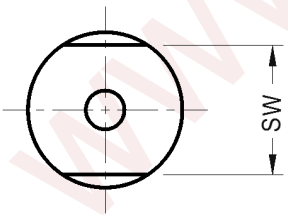
Order example / Assignment / Electrode cone

All standard spot welding electrodes are made of CuCrZr.

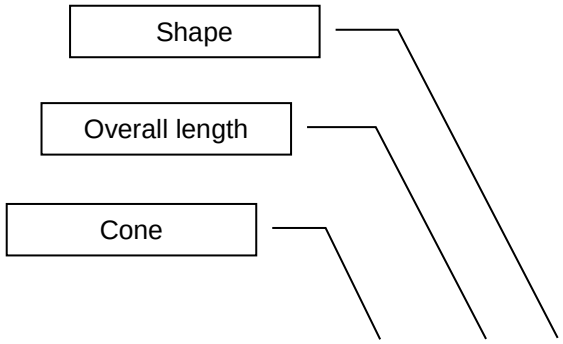
The seat and main dimensions are indicated in the table below.

All dimensions in mm.





Cone	Ø d_1	Ø d_2	Ø d_3	l_1	SW
1 : 10 / A1	**8,9**	12,5	6	10	8
1 : 10 / A2	**11,8**	12,5	8	14	11
1 : 10 / A3	**17,8**	19	10	20	17
1 : 10 / A4	**24,5**	25	14	31,5	22
1 : 10 / Kuka old	**10,5**	6-Kt	6,5	12	12
1 : 10	**15,75**	16	8,5	18	13
1 : 20 / Mk1	**12,065**	12,5	8	14	11
1 : 20 / Mk2	**17,780**	19	10	22	17
1 : 20 / Mk3	**23,825**	25	14	30	22

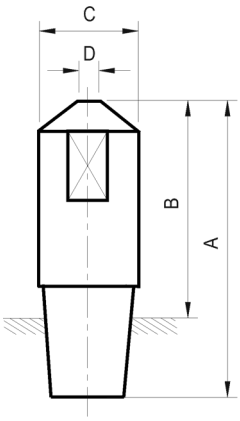


Designation example: **Mk1 x 34 - Z**

We supply spot welding electrodes in various basic designs and specials designs!

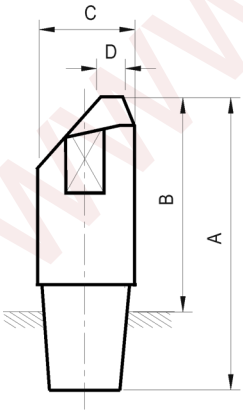
Standard - spot welding electrodes

Electrode centrically-straight



Designation	A	B	Ø C	Ø D	SW	Article-No.
A1 x 25 - Z	25	15	12,5	5	11	40-040-002
A1 x 34 - Z	34	24	12,5	5	11	40-040-004
A2 x 34 - Z	34	20	12,5	5	11	40-040-022
A2 x 45 - Z	45	31	12,5	5	11	40-040-026
A2 x 55 - Z	55	41	12,5	5	11	40-040-028
A2 x 75 - Z	75	61	12,5	5	11	40-040-032
A3 x 45 - Z	45	25	18	6	17	40-040-040
A3 x 60 - Z	60	40	18	6	17	40-040-048
A3 x 70 - Z	70	50	18	6	17	40-040-052
A3 x 95 - Z	95	75	18	6	17	40-040-060
Mk1 x 34 - Z	34	20	12,5	5	11	40-050-061
Mk1 x 45 - Z	45	31	12,5	5	11	40-050-063
Mk1 x 60 - Z	60	46	12,5	5	11	40-050-071
Mk1 x 75 - Z	75	61	12,5	5	11	40-050-072
Mk1 x 85 - Z	85	71	12,5	5	11	40-050-073
Mk1 x 100 - Z	100	86	12,5	5	11	40-050-074
Mk2 x 40 - Z	40	18	19	6	17	40-050-076
Mk2 x 50 - Z	50	28	19	6	17	40-050-077
Mk2 x 60 - Z	60	38	19	6	17	40-050-079
Mk2 x 75 - Z	75	53	19	6	17	40-050-081
Mk2 x 100 - Z	100	78	19	6	17	40-050-087
Mk3 x 65 - Z	65	34	25	8	22	40-050-171
Mk3 x 100 - Z	100	69	25	8	22	40-050-172

Electrode eccentric-straight



Designation	A	B	Ø C	Ø D	SW	Article-No.
A1 x 25 - E	25	15	12,5	5	11	40-040-070
A1 x 34 - E	34	24	12,5	5	11	40-040-072
A2 x 34 - E	34	20	12,5	5	11	40-040-080
A2 x 45 - E	45	31	12,5	5	11	40-040-082
A2 x 55 - E	55	41	12,5	5	11	40-040-086
A2 x 75 - E	75	61	12,5	5	11	40-040-090
A3 x 45 - E	45	25	18	6	17	40-040-100
A3 x 60 - E	60	40	18	6	17	40-040-106
A3 x 70 - E	70	50	18	6	17	40-040-112
Mk1 x 34 - E	34	20	12,5	5	11	40-050-098
Mk1 x 45 - E	45	31	12,5	5	11	40-050-102
Mk1 x 60 - E	60	46	12,5	5	11	40-050-106
Mk1 x 75 - E	75	61	12,5	5	11	40-050-092
Mk1 x 85 - E	85	71	12,5	5	11	40-050-095
Mk2 x 50 - E	50	28	19	6	17	40-050-115
Mk2 x 60 - E	60	38	19	6	17	40-050-117
Mk2 x 75 - E	75	53	19	6	17	40-050-119
Mk2 x 100 - E	100	78	19	6	17	40-050-122
Mk3 x 65 - E	65	34	25	8	22	40-050-175
Mk3 x 100 - E	100	69	25	8	22	40-050-176

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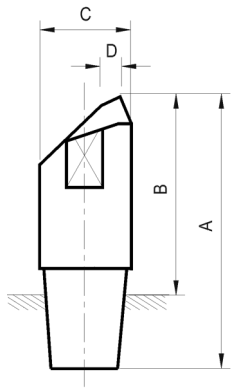
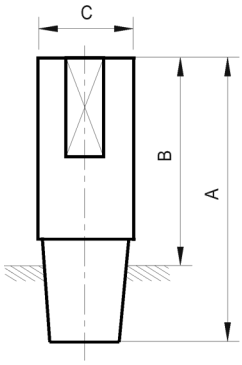
Standard - spot welding electrodes

Electrode eccentric-inclined



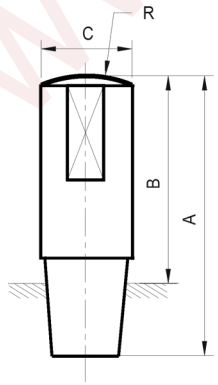
Designation	A	B	Ø C	Ø D	SW	Article-No.
A1 x 25 - S	25	15	12,5	5	11	40-040-126
A2 x 34 - S	34	20	12,5	5	11	40-040-144
A2 x 55 - S	55	41	12,5	5	11	40-040-148
A3 x 45 - S	45	25	18	6	17	40-040-156
A3 x 60 - S	60	40	18	6	17	40-040-160
A3 x 70 - S	70	50	18	6	17	40-040-164
Mk1 x 34 - S	34	20	12,5	5	11	40-050-701
Mk1 x 45 - S	45	31	12,5	5	11	40-050-702
Mk2 x 47 - S	47	25	18	5	17	40-051-114
Mk2 x 50 - S	50	28	19	5	17	40-051-115
Mk2 x 60 - S	60	38	19	5	17	40-051-117
Mk3 x 60 - S	60	29	25	8	22	40-050-710

Electrode flat



Designation	A	B	Ø C	SW	Article-No.
A1 x 25 - F	25	15	12,5	11	40-040-180
A1 x 34 - F	34	24	12,5	11	40-040-182
A2 x 34 - F	34	20	16	14	40-040-192
A2 x 55 - F	56	41	16	14	40-040-196
A3 x 45 - F	45	25	19	17	40-040-210
A3 x 60 - F	60	40	19	17	40-040-220
Mk1 x 34 - F	34	20	12,5	11	40-050-132
Mk1 x 45 - F	45	31	12,5	11	40-050-134
Mk1 x 60 - F	60	46	12,5	11	40-050-138
Mk1 x 75 - F	75	61	12,5	11	40-050-144
Mk2 x 50 - F	50	28	19	17	40-050-152
Mk2 x 60 - F	60	38	19	17	40-050-155
Mk2 x 75 - F	75	53	19	17	40-050-157
Mk2 x 100 - F	100	78	19	17	40-050-159
Mk3 x 65 - F	65	35	25	22	40-050-181
Mk3 x 100 - F	100	70	25	22	40-050-182

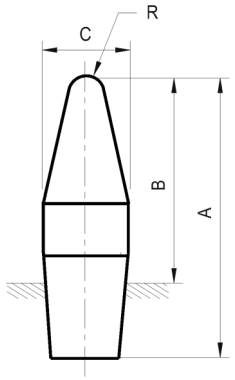
Electrode flat-crowned



Designation	A	B	Ø C	R	SW	Article-No.
A2 x 34 - FB	34	20	12,5	40	11	40-040-385
A2 x 45 - FB	45	31	12,5	40	11	40-040-386
A2 x 75 - FB	75	61	12,5	40	11	40-040-387
A3 x 45 - FB	45	25	18	75	17	40-040-390
A3 x 70 - FB	70	50	18	75	17	40-040-391
Mk1 x 34 - FB	34	20	12,5	40	11	40-050-205
Mk1 x 45 - FB	45	31	12,5	40	11	40-050-206
Mk1 x 75 - FB	75	61	12,5	40	11	40-050-207
Mk1 x 100 - FB	100	86	12,5	40	11	40-050-208
Mk2 x 50 - FB	50	30	18	75	17	40-050-210
Mk2 x 70 - FB	70	50	18	75	17	40-050-211
Mk2 x 100 - FB	100	80	18	75	17	40-050-212
Mk3 x 65 - FB	65	35	25	75	22	40-050-185

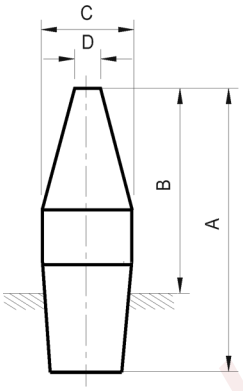
Standard - spot welding electrodes

Electrode conically crowned



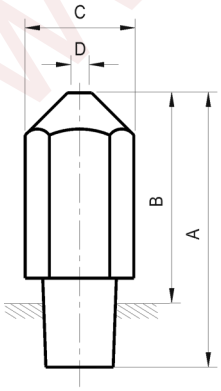
Designation	A	B	Ø C	R	SW	Article-No.
A1 x 25 - KE	25	15	10	3	9	40-040-282
A2 x 45 - KE	45	31	12,5	4	-	40-040-291
A2 x 55 - KE	55	41	12,5	4	-	40-040-292
A2 x 75 - KE	75	61	12,5	4	-	40-040-293
K1:10 x 35 - KE	35	23	6-kt.	2	12	40-045-004
K1:10 x 40 - KE	40	28	6-kt.	2	12	40-045-006
Mk1 x 45 - KE	45	31	12,5	4	-	40-050-032
Mk1 x 60 - KE	60	46	12,5	4	-	40-050-034
Mk1 x 75 - KE	75	61	12,5	4	-	40-050-036
Mk2 x 50 - KE	50	28	18	6	-	40-050-039
Mk2 x 60 - KE	60	38	18	6	-	40-050-041
Mk2 x 75 - KE	75	53	18	6	-	40-050-043
Mk2 x 100 - KE	100	78	18	6	-	40-050-045
Mk3 x 75 - KE	75	45	25	8	-	40-050-048

Electrode conically centrically-straight



Designation	A	B	Ø C	Ø D	Article-No.
Mk1 x 40 - KEZ	40	26	12,5	5	40-050-443
Mk1 x 45 - KEZ	45	31	12,5	5	40-050-444
Mk1 x 50 - KEZ	50	36	12,5	5	40-050-445
Mk1 x 55 - KEZ	55	41	12,5	5	40-050-446
Mk1 x 60 - KEZ	60	46	12,5	5	40-050-447
Mk1 x 70 - KEZ	70	56	12,5	5	40-050-448
Mk2 x 50 - KEZ	50	28	18	6	40-050-020
Mk2 x 60 - KEZ	60	38	18	6	40-050-022
Mk2 x 75 - KEZ	75	53	18	6	40-050-024
Mk2 x 100 - KEZ	100	78	18	6	40-050-026

Electrode 6-Kant centrically-straight



Designation	A	B	C	Ø D	Article-No.
K1:10 x 35 - Z	35	23	SW 12	5	40-045-025
K1:10 x 50 - Z	50	28	SW 12	5	40-045-030
Mk1 x 45 - Z	45	31	SW 14	5	40-045-042
Mk1 x 60 - Z	60	46	SW 14	5	40-045-044
Mk1 x 80 - Z	80	66	SW 14	5	40-045-045
Mk2 x 65 - Z	65	43	SW 22	6	40-045-048
Mk2 x 75 - Z	75	53	SW 22	6	40-045-050
Mk2 x 100 - Z	100	78	SW 22	6	40-045-055

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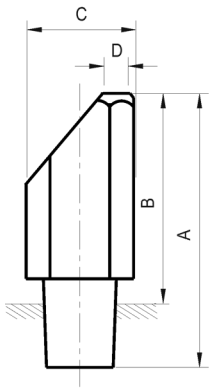
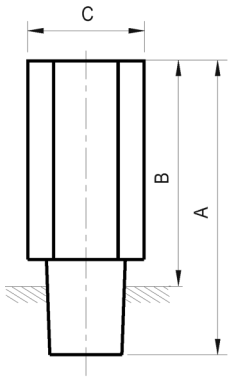
Standard - spot welding electrodes

Electrode 6-Kant eccentric-straight



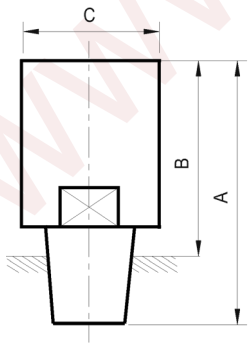
Designation	A	B	C	Ø D	Article-No.
K1:10 x 35 - E	35	23	SW 12	5	40-045-062
K1:10 x 50 - E	50	28	SW 12	5	40-045-064
Mk1 x 45 - E	45	31	SW 14	5	40-045-070
Mk1 x 60 - E	60	46	SW 14	5	40-045-075
Mk2 x 65 - E	65	43	SW 22	6	40-045-080
Mk2 x 95 - E	95	73	SW 22	6	40-045-085

Electrode 6-Kant flat



Designation	A	B	C	Article-No.
A1 x 30 - F	30	20	SW 10	40-040-170
A1 x 40 - F	40	30	SW 10	40-040-172
A1 x 50 - F	50	40	SW 10	40-040-176
K1:10 x 35 - F	35	23	SW 12	40-045-092
K1:10 x 50 - F	50	28	SW 12	40-045-094
Mk1 x 45 - F	45	31	SW 14	40-045-102
Mk1 x 60 - F	60	46	SW 14	40-045-105
Mk2 x 65 - F	65	43	SW 22	40-045-110
Mk2 x 75 - F	75	53	SW 22	40-045-114
Mk2 x 100 - F	100	78	SW 22	40-045-116

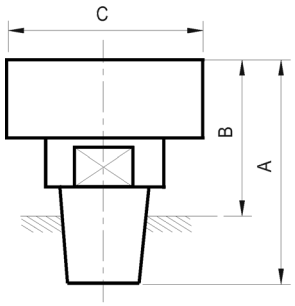
Electrode - plate CuCrZr



Designation	A	B	Ø C	SW	Article-No.
A1 x 34 - F/25Ø	34	24	25	22	40-040-186
A2 x 34 - F/25Ø	34	20	25	22	40-040-200
A3 x 45 - F/25Ø	45	33	25	22	40-040-216
A3 x 55 - F/25Ø	55	43	25	22	40-040-217
Mk1 x 34 - F/25Ø	34	20	25	22	40-050-162
Mk2 x 55 - F/25Ø	55	33	25	22	40-050-167
Mk2 x 70 - F/25Ø	70	48	25	22	40-050-169
Mk2 x 85 - F/30Ø	85	63	30	22	40-052-360
Mk2 x 85 - F/35Ø	85	63	35	24	40-052-370
Mk2 x 60 - F/45Ø	60	38	45	22	40-035-418
Mk2 x 60 - F/60Ø	60	38	60	22	40-035-425

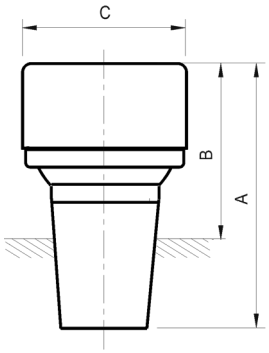
Standard - spot welding electrodes

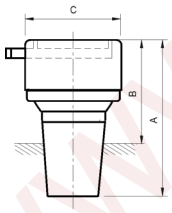
Electrode - plate - special CuCoBe



Designation	A	B	Ø C	SW	Article-No.
Mk2 x 60 - F/25Ø	60	38	25	22	40-035-450
Mk2 x 60 - F/30Ø	60	38	30	22	40-035-451
Mk2 x 60 - F/35Ø	60	38	35	22	40-035-452
Mk2 x 60 - F/40Ø	60	38	40	22	40-035-453
Mk2 x 60 - F/45Ø	60	38	45	22	40-035-454
Mk2 x 60 - F/50Ø	60	38	50	22	40-035-455
Mk3 x 75 - F/35Ø	75	40	35	22	40-035-460
Mk3 x 75 - F/40Ø	75	40	40	22	40-035-461
Mk3 x 75 - F/45Ø	75	40	45	22	40-035-462
Mk3 x 75 - F/50Ø	75	40	50	22	40-035-463
Mk3 x 75 - F/55Ø	75	40	55	22	40-035-464
Mk3 x 75 - F/60Ø	75	40	60	22	40-035-465

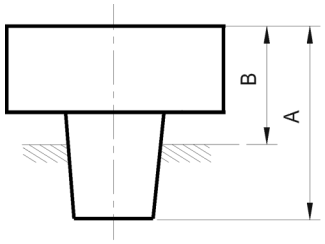
Electrode - ball / swinging





Designation	A	B	Ø C	SW	Article-No.
A1 x 40 - K-m/Ø22	40	30	22	11	40-040-226
A1 x 40 - K-m/Ø30	40	30	30	11	40-040-227
A2 x 43 - K-m/Ø22	43	29	22	11	40-040-230
A2 x 43 - K-m/Ø30	43	29	30	11	40-040-234
A3 x 55 - K-m/Ø22	55	35	22	14	40-040-242
A3 x 55 - K-m/Ø30	55	35	30	16	40-040-244
A3 x 55 - K-o/Ø30	55	35	30	16	40-040-246
Mk1 x 43 - K-o/Ø22	43	29	22	11	40-050-262
Mk1 x 43 - K-m/Ø30	43	29	30	11	40-045-168
Mk2 x 55 - K-o/Ø22	55	35	22	14	40-045-167
Mk2 x 55 - K-m/Ø22	55	35	22	14	40-045-169
Mk2 x 55 - K-o/Ø30	55	35	30	16	40-045-170
Mk2 x 55 - K-m/Ø30	55	35	30	16	40-045-173
o: without through-drilled cooling hole / m: with through-drilled cooling hole					
Mk1 x 43 - KF/Ø22	43	33	22	11	40-050-264
Mk2 x 55 - KF/Ø30	55	35	30	16	40-045-175
KF: with forming gas connection, for spot welding of stainless steel without annealing					

Electrode - bar CuCrZr



Designation	A	B	Electrode surface	Article-No.
Mk2 x 50 - B 20/40	50	28	20 x 40	40-050-362
Mk2 x 50 - B 20/50	50	28	20 x 50	40-050-364
Mk2 x 50 - B 20/60	50	28	20 x 60	40-050-366
Mk2 x 50 - B 20/70	50	28	20 x 70	40-050-368
Mk2 x 50 - B 20/80	50	28	20 x 80	40-050-370
Mk2 x 50 - B 20/100	50	28	20 x 100	40-050-372

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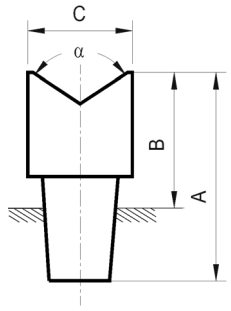
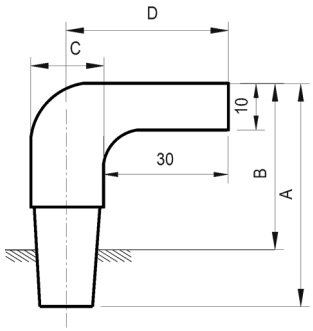
Standard - spot welding electrodes

Electrode - prism shape



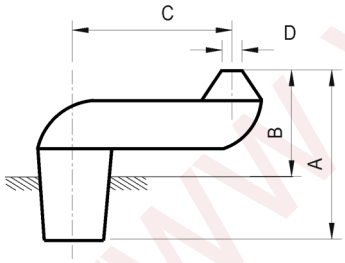
Designation	A	B	C	α	Article-No.
A1 x 25 - P	25	15	15x15	120°	40-050-375
A2 x 34 - P	34	20	20x20	120°	40-050-378
A3 x 45 - P	45	25	25x25	120°	40-050-380
A3 x 50 - P	50	30	Ø 50	140°	40-050-382
Mk1 x 34 - P	34	20	20x20	120°	40-050-385
Mk2 x 52 - P	52	30	25x25	120°	40-050-388
Mk2 x 50 - P	50	28	Ø 50	140°	40-050-390
Mk3 x 65 - P	65	35	30x30	120°	40-050-392

Electrode - angle-flat



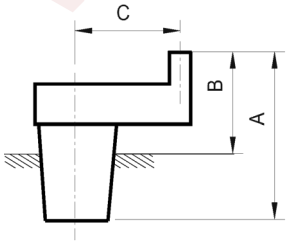
Designation	A	B	Ø C	D	Article-No.
A3 x 50/30 - SG	50	30	18	39	40-040-375
Mk2 x 52/30 - SG	52	30	18	39	40-050-240

Electrode - angle shape



Designation	A	B	C	Ø D	Article-No.
Mk1 x 50/45 - GW	50	36	45	10	40-050-275
Mk2 x 50/45 - GW	50	30	45	10	40-050-276

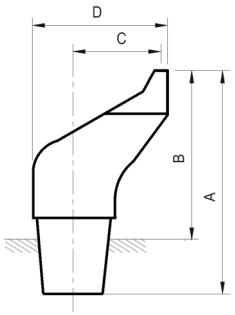
Electrode - angle shape



Designation	Type	A	B	C	Article-No.
Mk1 x 36 - GW	Area 5x5	36	22	18	40-050-241
Mk1 x 36 - GW	Cone Ø8	36	22	18	40-050-242
Mk2 x 46 - GW	Area 10x20	46	25	20	40-050-244

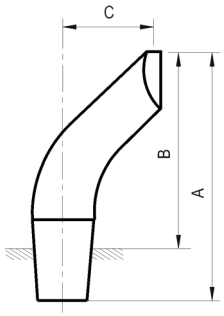
Standard - spot welding electrodes

Electrode - cranked



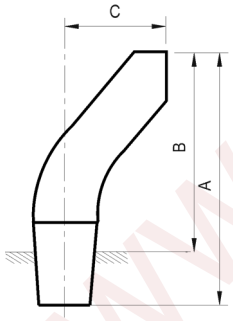
Designation	Type	A	B	C	D	Article-No.
K1:10 x 35/22 - G	WN 32933-05	35	23	10	22	40-045-121
A3 x 75/35 - G	WN 32935-05/A3	75	53	22	35	40-040-380
Mk1 x 45/30 - G	WN 32934-05	45	31	20	30	40-045-123
Mk2 x 75/35 - G	WN 32935-05	75	53	22	35	40-045-124

Electrode - cranked



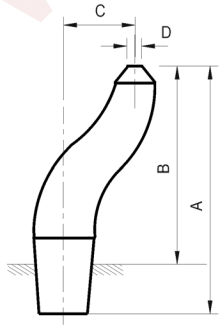
Designation	Type	A	B	C	Article-No.
A2 x 55/15 - G	7F35	55	41	15	40-040-362
A3 x 70/25 - G	E2-41 / 8F50	70	48	25	40-040-382
Mk1 x 55/15 - G	E1-41 / 1F35	55	41	15	40-050-219
Mk2 x 70/25 - G	2F50	70	48	25	40-050-224
Mk2 x 70/25 - G	E2-41	70	48	25	40-050-225
Mk2 x 80/45 - G	E2-41	80	58	45	40-050-226

Electrode - cranked, flat



Designation	Type	A	B	C	Article-No.
A2x55/18-G/flat	E1-42 / 1:10=12	55	41	18,5	40-040-364
A3x70/30-G/flat	E2-42 / 1:10=12	70	48	30	40-040-384
Mk1x55/18-G/flat	E1-42 / Mk1	55	41	18,5	40-050-221
Mk2x70/30-G/flat	E2-42 / Mk2	70	48	30	40-050-227

Electrode, bended centrically-straight



Designation	A	B	C	D	Article-No.
A2 x 95/25 - SG/Z	95	81	25	5	40-040-256
A3 x 95/25 - SG/Z	95	75	25	6	40-040-261
Mk1 x 95/25 - SG/Z	95	81	25	5	40-050-246
Mk2 x 95/25 - SG/Z	95	73	25	6	40-050-256

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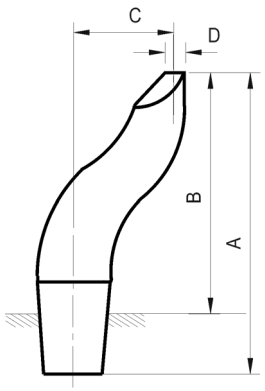
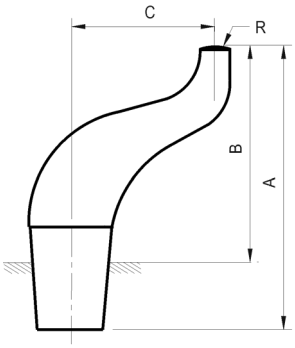
Standard – spot welding electrodes

Electrode, bended eccentric-straight



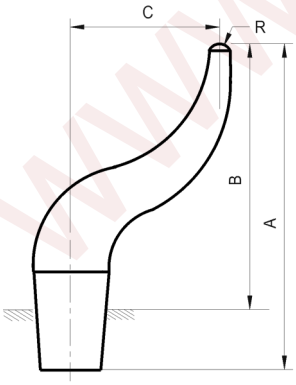
Designation	A	B	C	D	Article-No.
A2 x 95/25 - SG/E	95	81	25	5	40-040-257
A3 x 95/25 - SG/E	95	75	25	6	40-040-262
Mk1 x 95/25 - SG/E	95	81	25	5	40-050-243
Mk2 x 95/25 - SG/E	95	73	25	6	40-050-252

Electrode, bended crowned



Designation	A	B	C	R	Article-No.
A3 x 102/50 - SG	102	82	50	75	40-040-266
Mk2 x 102/50 - SG	102	80	50	75	40-050-249
Mk2 x 115/48 - SG	115	93	48	75	40-050-253
Mk3 x 115/48 - SG	115	84	48	75	40-050-254

Electrode, bended conically-crowned



Designation	A	B	C	R	Article-No.
A2 x 110/40 - SG	110	96	40	5	40-040-253
A3 x 125/45 - SG	125	105	45	5	40-040-268
Mk1 x 110/40 - SG	110	96	40	5	40-050-245
Mk2 x 125/45 - SG	125	103	45	5	40-050-251

Other sizes and lengths available on request!

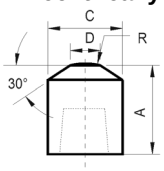
Angle electrode holders see from page 46

7. Electrode caps - standard

Material CuCrZr according to DIN 44750 / DIN ISO 5821

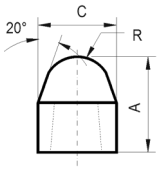
Type / Outer-Diameter:	**E17** / 13Ø	**E20** / 16Ø	**E22** / 20Ø
Inner cone=Ø:	1:10=10Ø	1:10=12Ø	1:10=15Ø
Electrode-force max.:	400 daN	630 daN	1.000 daN

Form A centrically-straight



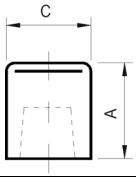
Designation	A	Ø C	Ø D	R	Article-No.
17-A-hard centr.	17	13	5	32	40-055-012
20-A-hard centr.	20	16	6	40	40-055-022
22-A-hard centr.	22	20	8	50	40-055-222

Form B crowned



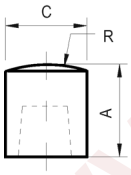
Designation	A	Ø C	R	-	Article-No.
17-B-hard crowned	17	13	5	-	40-055-032
20-B-hard crowned	20	16	6	-	40-055-042
22-B-hard crowned	22	20	8	-	40-055-224

Form C flat



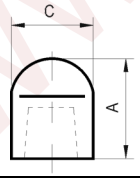
Designation	A	Ø C	-	-	Article-No.
17-C-hard flat	17	13	-	-	40-055-056
20-C-hard flat	20	16	-	-	40-055-060
22-C-hard flat	22	20	-	-	40-055-226

Form D flat-crowned



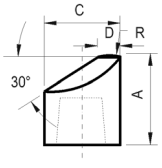
Designation	A	Ø C	R	-	Article-No.
17-D-hard flat/crowned	17	13	32	-	40-055-072
20-D-hard flat/crowned	20	16	40	-	40-055-079
22-D-hard flat/crowned	22	20	50	-	40-055-228

Form E round



Designation	A	Ø C	-	-	Article-No.
17-E-hard round	17	13	-	-	40-055-130
20-E-hard round	20	16	-	-	40-055-132
20/22-E-hard round	22	16	-	special length	40-055-133
22-E-hard round	22	20	-	-	40-055-230

Form F eccentric-straight



Designation	A	Ø C	Ø D	R	Article-No.
17-F-hard ecc/str.	17	13	5	32	40-055-096
20-F-hard ecc/str.	20	16	6	40	40-055-112
22-F-hard ecc/str.	22	20	8	50	40-055-232

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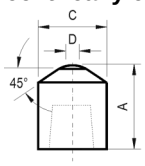
8. Electrode caps - special

Material CuCrZr

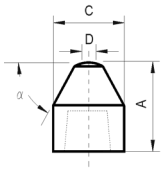
Type / Outer-Diameter:	**E17** / 13Ø	**E20** / 16Ø	**E22** / 20Ø
Inner cone=Ø:	1:10=10Ø	1:10=12Ø	1:10=15Ø
Electrode-force max.:	400 daN	630 daN	1.000 daN

Form A **centrically-crowned**



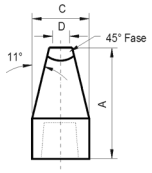
Designation	A	Ø C	Ø D	-	Article-No.
17-A-hard centr./str. – crow.	17	13	5	-	40-055-015
20-A-hard centr./str. – crow.	20	16	6		40-055-025

Form B **crowned-pointed**



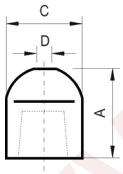
Designation	A	Ø C	Ø D	α	Article-No.
17-B-hard crowned-pointed	17	13	4	60°	40-055-038
20-B-hard crowned-pointed	20	16	6	66,5°	40-055-046
20-B-hard crowned-pointed	20	16	8	66,5°	40-055-048

Form B **crowned**



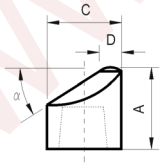
Designation	A	Ø C	Ø D	-	Article-No.
17/29-B-hard crowned	29	13	5	-	40-055-036

Form E **round-flat**



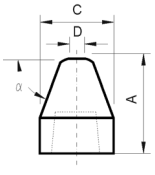
Designation	A	Ø C	Ø D	Article-No.
20/16-E-hard round - centr./flat	16,5	16	6	40-055-142

Form F **eccentric-crowned**



Designation	A	Ø C	Ø D	α	Article-No.
17-F-hard ecc/str. – crow.	17	13	5	40°	40-055-116
20-F-hard ecc/str. – crow.	20	16	6	35°	40-055-118

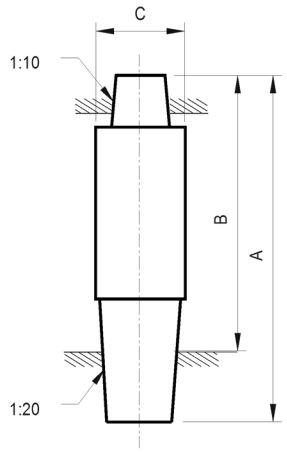
Form G **crowned**



Designation	A	Ø C	Ø D	α	Article-No.
17-G-hard crowned	17	13	5	75°	40-055-034
20-G-hard crowned	20	16	6	75°	40-055-044
22-G-hard crowned	22	20	8	67,5°	40-055-234

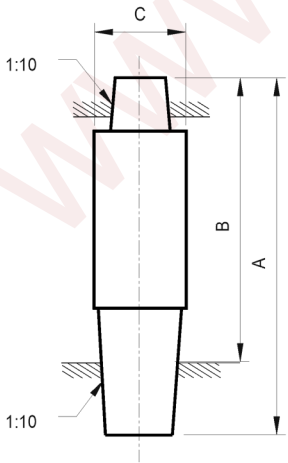
9. Electrode shafts

Electrode shaft
Cone Mk (1:20)
CuCrZr



Designation	Type	A	B	Ø C	Article-No.
Mk1 x 33,5 / E17	16-0	33,5	21,5	12,5	40-060-160
Mk1 x 43,5 / E17	16-1	43,5	31,5	12,5	40-060-161
Mk1 x 53,5 / E17	16-2	53,5	41,5	12,5	40-060-162
Mk1 x 63,5 / E17	16-3	63,5	51,5	12,5	40-060-163
Mk1 x 73,5 / E17	16-4	73,5	61,5	12,5	40-060-164
Mk1 x 83,5 / E17	16-5	83,5	71,5	12,5	40-060-165
Mk1 x 93,5 / E17	16-6	93,5	81,5	12,5	40-060-166
Mk1 x 103,5 / E17	16-7	103,5	91,5	12,5	40-060-167
Mk2 x 36 / E20	19-0	36	18	18	40-060-190
Mk2 x 46 / E20	19-1	46	28	18	40-060-191
Mk2 x 56 / E20	19-2	56	38	18	40-060-192
Mk2 x 66 / E20	19-3	66	48	18	40-060-193
Mk2 x 76 / E20	19-4	76	58	18	40-060-194
Mk2 x 86 / E20	19-5	86	68	18	40-060-195
Mk2 x 96 / E20	19-6	96	78	18	40-060-196
Mk2 x 106 / E20	19-7	106	88	18	40-060-197
Mk2 x 57 / E22	20-1	57	39	20	40-060-201
Mk2 x 67 / E22	20-2	67	49	20	40-060-202
Mk2 x 77 / E22	20-3	77	59	20	40-060-203
Mk2 x 87 / E22	20-4	87	69	20	40-060-204
Mk2 x 97 / E22	20-5	97	79	20	40-060-205
Mk2 x 107 / E22	20-6	107	89	20	40-060-206
Mk2 x 117 / E22	20-7	117	99	20	40-060-207

Electrode shaft - special
Cone (1:10)
CuCrZr



Designation	Type	A	B	Ø C	Article-No.
1:10=12 x 33,5 / E17	15-0	33,5	21,5	12,5	40-060-150
1:10=12 x 43,5 / E17	15-1	43,5	31,5	12,5	40-060-151
1:10=12 x 53,5 / E17	15-2	53,5	41,5	12,5	40-060-152
1:10=12 x 63,5 / E17	15-3	63,5	51,5	12,5	40-060-153
1:10=12 x 73,5 / E17	15-4	73,5	61,5	12,5	40-060-154
1:10=12 x 83,5 / E17	15-5	83,5	71,5	12,5	40-060-155
1:10=12 x 93,5 / E17	15-6	93,5	81,5	12,5	40-060-156
1:10=12 x 103,5 / E17	15-7	103,5	91,5	12,5	40-060-157
1:10=15,75 x 36 / E20	18-0	36	18	16	40-060-180
1:10=15,75 x 46 / E20	18-1	46	28	16	40-060-181
1:10=15,75 x 56 / E20	18-2	56	38	16	40-060-182
1:10=15,75 x 66 / E20	18-3	66	48	16	40-060-183
1:10=15,75 x 76 / E20	18-4	76	58	16	40-060-184
1:10=15,75 x 86 / E20	18-5	86	68	16	40-060-185
1:10=15,75 x 96 / E20	18-6	96	78	16	40-060-186
1:10=15,75 x 106 / E20	18-7	106	88	16	40-060-187

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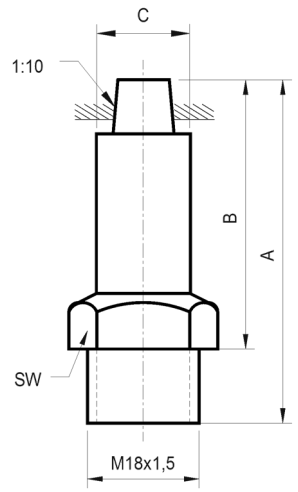
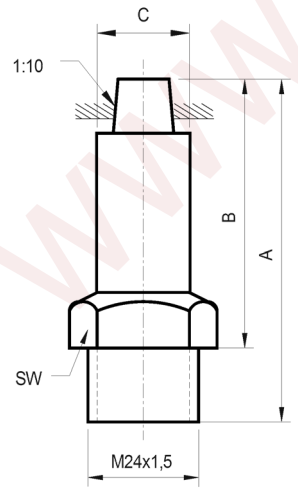
Electrode shafts - special

Electrode shaft with threaded M18x1,5 CuCrZr



Designation	A	B	Ø C	SW	Article-No.
M18x1,5 x 43,5 / E17	43,5	28,5	13	24	40-060-502
M18x1,5 x 53,5 / E17	53,5	38,5	13	24	40-060-504
M18x1,5 x 63,5 / E17	63,5	48,5	13	24	40-060-506
M18x1,5 x 73,5 / E17	73,5	58,5	13	24	40-060-508
M18x1,5 x 83,5 / E17	83,5	68,5	13	24	40-060-510
M18x1,5 x 48 / E20	48	33	18	24	40-060-522
M18x1,5 x 58 / E20	58	43	18	24	40-060-524
M18x1,5 x 68 / E20	68	53	18	24	40-060-526
M18x1,5 x 78 / E20	78	63	18	24	40-060-528
M18x1,5 x 88 / E20	88	73	18	24	40-060-530
M18x1,5 x 98 / E20	98	83	18	24	40-060-532
M18x1,5 x 108 / E20	108	93	18	24	40-060-534
M18x1,5 x 50 / E22	50	35	20	24	40-060-542
M18x1,5 x 60 / E22	60	45	20	24	40-060-544
M18x1,5 x 70 / E22	70	55	20	24	40-060-546
M18x1,5 x 80 / E22	80	65	20	24	40-060-548
M18x1,5 x 90 / E22	90	75	20	24	40-060-550
M18x1,5 x 100 / E22	100	85	20	24	40-060-552
M18x1,5 x 110 / E22	110	95	20	24	40-060-554

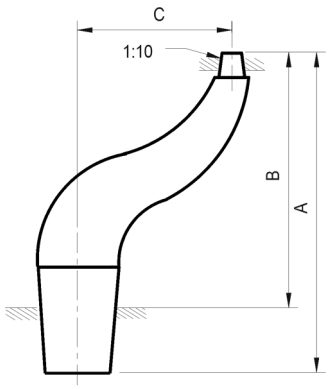
Electrode shaft with threaded M24x1,5 CuCrZr



Designation	A	B	Ø C	SW	Article-No.
M24x1,5 x 43,5 / E17	43,5	28,5	13	30	40-060-702
M24x1,5 x 53,5 / E17	53,5	38,5	13	30	40-060-704
M24x1,5 x 63,5 / E17	63,5	48,5	13	30	40-060-706
M24x1,5 x 73,5 / E17	73,5	58,5	13	30	40-060-708
M24x1,5 x 83,5 / E17	83,5	68,5	13	30	40-060-710
M24x1,5 x 48 / E20	48	33	18	30	40-060-722
M24x1,5 x 58 / E20	58	43	18	30	40-060-724
M24x1,5 x 68 / E20	68	53	18	30	40-060-726
M24x1,5 x 78 / E20	78	63	18	30	40-060-728
M24x1,5 x 88 / E20	88	73	18	30	40-060-730
M24x1,5 x 98 / E20	98	83	18	30	40-060-732
M24x1,5 x 108 / E20	108	93	18	30	40-060-734
M24x1,5 x 50 / E22	50	35	20	30	40-060-742
M24x1,5 x 60 / E22	60	45	20	30	40-060-744
M24x1,5 x 70 / E22	70	55	20	30	40-060-746
M24x1,5 x 80 / E22	80	65	20	30	40-060-748
M24x1,5 x 90 / E22	90	75	20	30	40-060-750
M24x1,5 x 100 / E22	100	85	20	30	40-060-752
M24x1,5 x 110 / E22	110	95	20	30	40-060-754

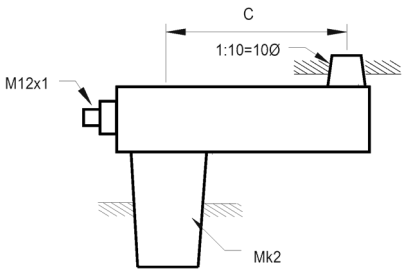
Electrode shafts - special

Electrode shaft, bended



Designation	A	B	C	Ø	SW	Article-No.
Mk2 x 110/40-SG/E17	110	90	40	19	17	40-050-258
Mk3 x 110/40-SG/E20	110	80	40	25	22	40-050-259

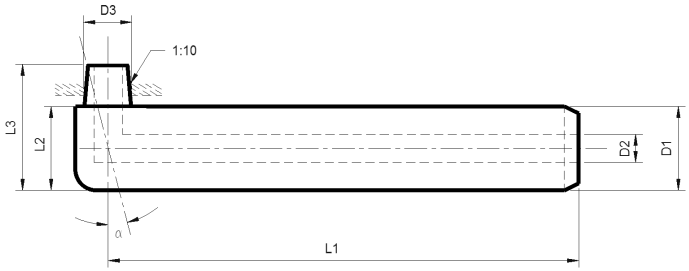
Electrode shaft, boom

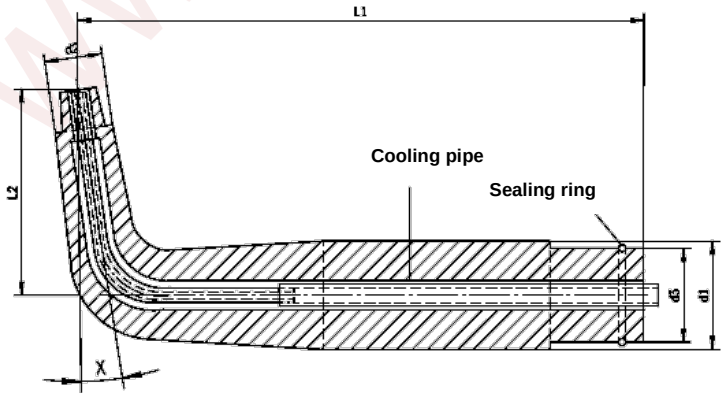


Designation	Type	C	Height with cap	cap	Article-No.
Mk2x50Ausl-AB/E17	E2-31/E17	50	35	E17	40-050-292
Mk2x70Ausl-AB/E17	E2-37/E17	70	35	E17	40-050-293
With additional water connection at the back					

Electrode shaft with braze cone or bent straight or inclined in CuCrZr

Examples





Made according to drawing or sample

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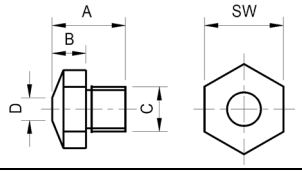
10. Screw electrodes

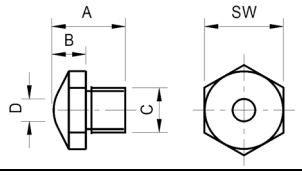
Material CuCrZr

Shape A centrically-straight



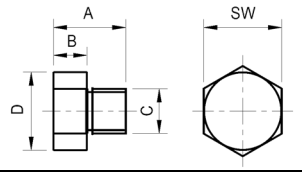
Designation	A	B	C	Ø D	SW	Article-No.
M8 x 19 - Z_SW10	19	10	M8	6	10	40-055-710
M8 x 19 - Z_SW12	19	10	M8	6	12	40-055-712
M8 x 19 - Z_SW14	19	10	M8	6	14	40-055-714

Shape B crowned



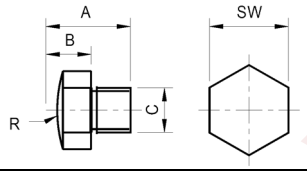
Designation	A	B	C	Ø D	SW	Article-No.
M8 x 19 - B_SW10	19	10	M8	4	10	40-055-730
M8 x 19 - B_SW14	19	10	M8	4	14	40-055-734

Shape C flat



Designation	A	B	C	Ø D	SW	Article-No.
M8 x 19 - F_SW10	19	10	M8	10	10	40-055-750
M8 x 19 - F_SW14	19	10	M8	14	14	40-055-754
M8 x 19 - F_SW24	19	10	M8	24	24	40-055-760
M10 x 19 - F_SW14	19	10	M10	14	14	40-055-762

Shape D flat/crowned



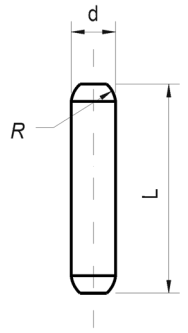
Designation	A	B	C	R	SW	Article-No.
M8 x 19 - FB_SW10	19	10	M8	40	10	40-055-770
M8 x 19 - FB_SW12	19	10	M8	40	12	40-055-772
M8 x 19 - FB_SW14	19	10	M8	40	14	40-055-774

11. Ceramic - standard parts

Welding centering pins made of high-performance ceramics, polished quality, high-strength and impact-resistant.
Zirconium oxide, color: blue, flexural strength: 1.300 MPa, compressive strength: 3.000 MPa,
Impact strength: 12 MPa $m^{1/2}$, Vickers hardness: 1.150 $HV_{0,5}$, resistance to temperature changes: ΔT 280°C

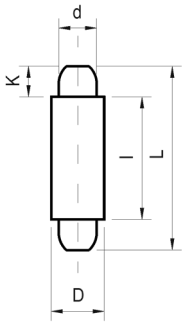
Ceramic centering pins with 40 x tool life compared to steel pins.

Welding centering pin



Nut size	Ø d_{h8}	L $_{+/-0,3}$	R	Article-No.
M4	3,2	24	2	40-105-101
M5	4,1	26	3	40-105-102
M6	4,9	30	4	40-105-103
M8	6,6	32	5	40-105-104
M10	8,3	35	6	40-105-105
M12	10,1	43	7	40-105-106

Welding centering pin with heel



Nut size	Ø d_{h8}	Ø D_{h8}	L $_{+/-0,3}$	L$_{+/-0,3}$	K	Article-No.
M4	3,2	5,8	18	24	3,2	40-105-107
M5	4,1	6,8	18	26	3,9	40-105-108
M6	4,9	7,8	20	30	4,7	40-105-109
M8	6,6	10,3	20	32	6,2	40-105-110
M10	8,3	12,3	20	35	7,5	40-105-111
M12	10,1	14,6	25	43	9,0	40-105-112

Special shapes according to your drawing specifications!

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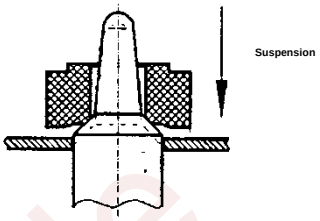
12. Electrodes for welding nuts

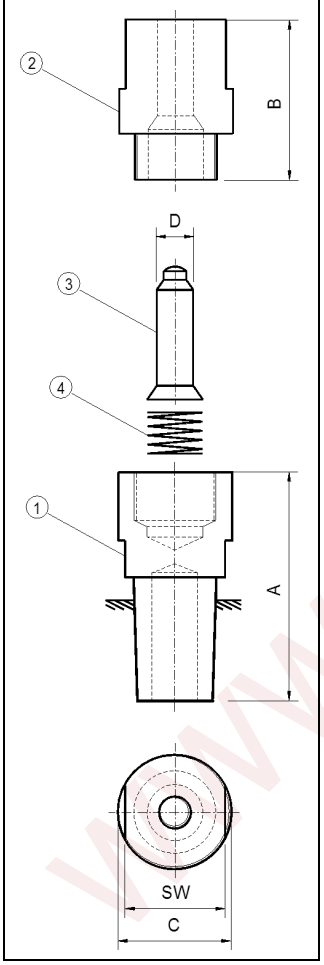


„simple model“

With ceramic welding centering pin

- precise centering of the weld nut over phase
- with spring-loaded **centering pin made of high-performance ceramic** (zirconium oxide)
- high-strength and impact-resistant, polished quality
- centering pin Ø adapted to weld nut according to DIN928 and 929
- two-piece electrode, top electrode as exchangeable electrode

Electrode for weld nuts



Nut / Cone	Part	Designation	Ø D	A	B	Ø C	SW	Article-No.
M4 / Mk2 ES 22-04-	00	complete electrode	5,9	70	50	20	17	40-052-410
	01	electrode lower part	-	50	-	20	17	40-052-411
	02	electrode upper part	-	-	35	20	17	40-052-412
	03	centering pin	5,9	-	-	-	-	40-105-133
	04	compression spring	-	-	-	-	-	40-100-960
M5 / Mk2 ES 22-05-	00	complete electrode	6,9	70	50	20	17	40-052-420
	01	electrode lower part	-	50	-	20	17	40-052-421
	02	electrode upper part	-	-	35	20	17	40-052-422
	03	centering pin	6,9	-	-	-	-	40-105-134
	04	compression spring	-	-	-	-	-	40-100-960
M6 / Mk2 ES 22-06-	00	complete electrode	7,9	70	50	25	22	40-052-430
	01	electrode lower part	-	50	-	25	22	40-052-431
	02	electrode upper part	-	-	35	25	22	40-052-432
	03	centering pin	7,9	-	-	-	-	40-105-135
	04	compression spring	-	-	-	-	-	40-100-951
M8 / Mk2 ES 22-08-	00	complete electrode	10,4	70	50	28	24	40-052-440
	01	electrode lower part	-	50	-	28	24	40-052-441
	02	electrode upper part	-	-	35	28	24	40-052-442
	03	centering pin	10,4	-	-	-	-	40-105-136
	04	compression spring	-	-	-	-	-	40-100-951

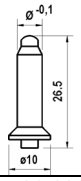
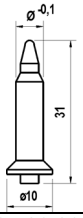
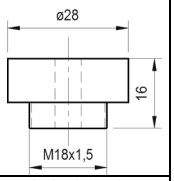
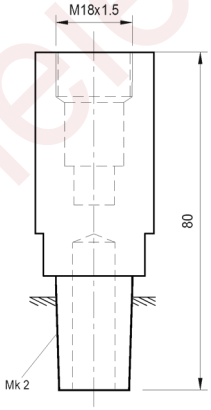
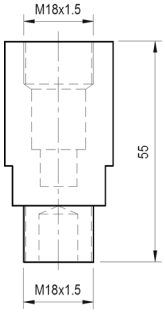
Electrodes for welding nuts M3 - M14

for sheet metal hole-Ø 4,5 to 16,8

- welding centering pins **made of high performance ceramic**
- precise centering of the weld nut over phase
- **short centering pin (s)** for manual insertion, **long centering pin (l)** for automated feeding
- electrode with compressed air connection for blowing out scale and weld spatter

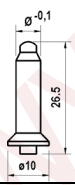
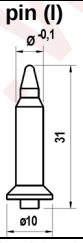
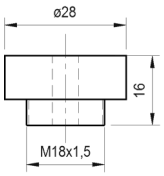
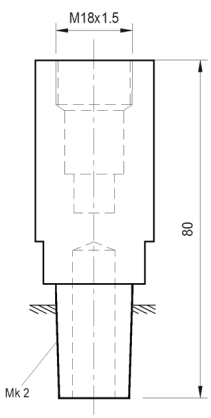
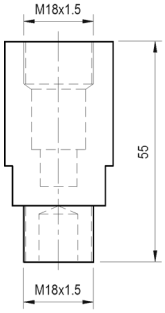
Ceramic welding centering pins for nut size M4

Order example for complete electrode: Mk2_M4_6,0_k

sheet metal hole Ø	short pin (s) 	long pin (l) 	electrode upper part CuCoBe 	compression spring  	electrode lower part with air connection Cone Mk2 	electrode lower part with air connection Thread M18x1,5 
				40-100-970	40-052-980	40-052-982
4,5	40-106-000	40-106-060	40-052-610			
4,6	40-106-001	40-106-061	40-052-611			
4,7	40-106-002	40-106-062	40-052-612			
4,8	40-106-003	40-106-063	40-052-613			
4,9	40-106-004	40-106-064	40-052-614			
5,0	40-106-005	40-106-065	40-052-615			
5,1	40-106-006	40-106-066	40-052-616			
5,2	40-106-007	40-106-067	40-052-617			
5,3	40-106-008	40-106-068	40-052-618			
5,4	40-106-009	40-106-069	40-052-619			
5,5	40-106-010	40-106-070	40-052-620			
5,6	40-106-011	40-106-071	40-052-621			
5,7	40-106-012	40-106-072	40-052-622			
5,8	40-106-013	40-106-073	40-052-623			
5,9	40-106-014	40-106-074	40-052-624			
6,0 *	**40-106-015**	**40-106-075**	**40-052-625**	**quick plug-connection** 1/8"a - 6mm 40-132-216	(Cone A3/1:10=18 40-052-985)	

Ceramic welding centering pins for nut size M5

Order example for complete electrode: Mk2_M5_7,0_k

sheet metal hole Ø	short pin (s) 	long pin (l) 	electrode upper part CuCoBe 	compression spring  	electrode lower part with air connection Cone Mk2 	electrode lower part with air connection Thread M18x1,5 
				40-100-970	40-052-980	40-052-982
5,5	40-106-100	40-106-160	40-052-620			
5,6	40-106-101	40-106-161	40-052-621			
5,7	40-106-102	40-106-162	40-052-622			
5,8	40-106-103	40-106-163	40-052-623			
5,9	40-106-104	40-106-164	40-052-624			
6,0	40-106-105	40-106-165	40-052-625			
6,1	40-106-106	40-106-166	40-052-626			
6,2	40-106-107	40-106-167	40-052-627			
6,3	40-106-108	40-106-168	40-052-628			
6,4	40-106-109	40-106-169	40-052-629			
6,5	40-106-110	40-106-170	40-052-630			
6,6	40-106-111	40-106-171	40-052-631			
6,7	40-106-112	40-106-172	40-052-632			
6,8	40-106-113	40-106-173	40-052-633			
6,9	40-106-114	40-106-174	40-052-634			
7,0 *	**40-106-115**	**40-106-175**	**40-052-635**	**quick plug-connection** 1/8"a - 6mm 40-132-216	(Cone A3/1:10=18 40-052-985)	

*** standard sheet metal hole Ø**

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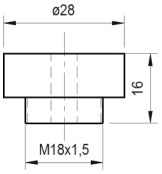
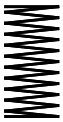
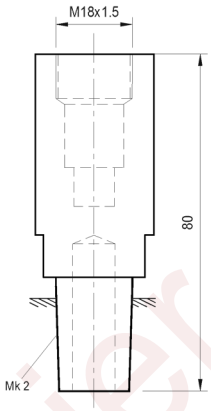
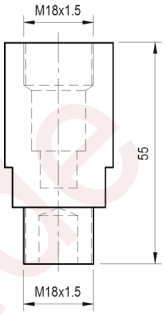
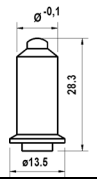
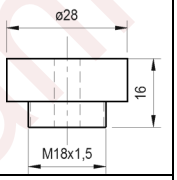
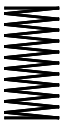
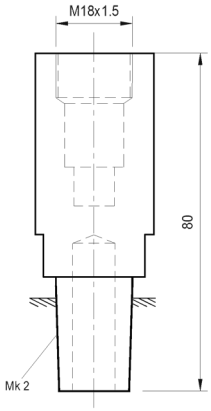
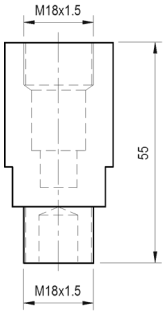
Ceramic welding centering pins for nut size M6

Order example for complete electrode: Mk2_M6_8,0_k

sheet metal hole Ø	short pin (s)	long pin (l)	electrode upper part CuCoBe	compression spring	electrode lower part with air connection Cone Mk2	electrode lower part with air connection Thread M18x1,5
				40-100-970 	40-052-980 	40-052-982 
6,5	40-106-200	40-106-260	40-052-630			
6,6	40-106-201	40-106-261	40-052-631			
6,7	40-106-202	40-106-262	40-052-632			
6,8	40-106-203	40-106-263	40-052-633			
6,9	40-106-204	40-106-264	40-052-634			
7,0	40-106-205	40-106-265	40-052-635			
7,1	40-106-206	40-106-266	40-052-636			
7,2	40-106-207	40-106-267	40-052-637			
7,3	40-106-208	40-106-268	40-052-638			
7,4	40-106-209	40-106-269	40-052-639			
7,5	40-106-210	40-106-270	40-052-640			
7,6	40-106-211	40-106-271	40-052-641			
7,7	40-106-212	40-106-272	40-052-642	quick plug-connection 1/8“a - 6mm		
7,8	40-106-213	40-106-273	40-052-643			
7,9	40-106-214	40-106-274	40-052-644			
8,0 *	**40-106-215**	**40-106-275**	**40-052-645**			
8,1	40-106-216	40-106-276	40-052-646			
8,2	40-106-217	40-106-277	40-052-647			
8,3	40-106-218	40-106-278	40-052-648	40-132-216	(Cone A3/1:10=18 40-052-985)	
8,4	40-106-219	40-106-279	40-052-649			
8,5	40-106-220	40-106-280	40-052-650			

Ceramic welding centering pins for nut size M8

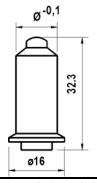
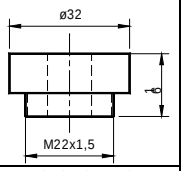
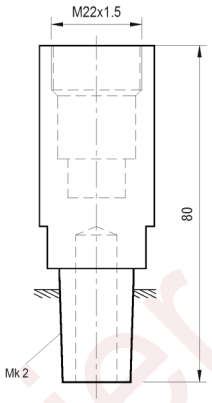
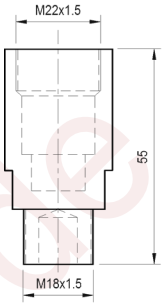
Order example for complete electrode: Mk2_M8_10,5_k

sheet metal hole Ø	short pin (s)	long pin (l)	electrode upper part CuCoBe	compression spring	electrode lower part with air connection Cone Mk2	electrode lower part with air connection Thread M18x1,5
				40-100-970 	40-052-980 	40-052-982 
8,5	40-106-300	40-106-360	40-052-650			
8,6	40-106-301	40-106-361	40-052-651			
8,7	40-106-302	40-106-362	40-052-652			
8,8	40-106-303	40-106-363	40-052-653			
8,9	40-106-304	40-106-364	40-052-654			
9,0	40-106-305	40-106-365	40-052-655			
9,1	40-106-306	40-106-366	40-052-656			
9,2	40-106-307	40-106-367	40-052-657			
9,3	40-106-308	40-106-368	40-052-658			
9,4	40-106-309	40-106-369	40-052-659			
9,5	40-106-310	40-106-370	40-052-660			
9,6	40-106-311	40-106-371	40-052-661			
9,7	40-106-312	40-106-372	40-052-662			
9,8	40-106-313	40-106-373	40-052-663			
9,9	40-106-314	40-106-374	40-052-664			
10,0	40-106-315	40-106-375	40-052-665			
10,1	40-106-316	40-106-376	40-052-666	quick plug-connection 1/8“a - 6mm		
10,2	40-106-317	40-106-377	40-052-667			
10,3	40-106-318	40-106-378	40-052-668			
10,4	40-106-319	40-106-379	40-052-669			
10,5 *	**40-106-320**	**40-106-380**	**40-052-670**			
10,6	40-106-321	40-106-381	40-052-671			
10,7	40-106-322	40-106-382	40-052-672			
10,8	40-106-323	40-106-383	40-052-673	40-132-216	(Cone A3/1:10=18 40-052-985)	
10,9	40-106-324	40-106-384	40-052-674			
11,0	40-106-325	40-106-385	40-052-675			

*** standard sheet metal hole Ø**

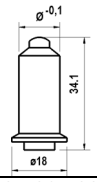
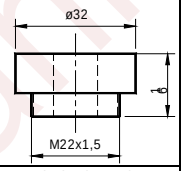
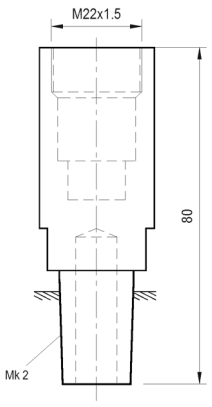
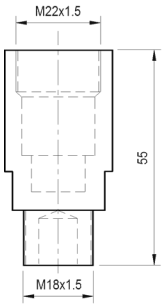
Ceramic welding centering pins for nut size M10

Order example for complete electrode: Mk2_M10_12,5_k

sheet metal hole Ø	short pin (s)	long pin (l)	electrode upper part CuCoBe	compression spring	electrode lower part with air connection Cone Mk2	electrode lower part with air connection Thread M18x1,5
				40-100-985 	40-052-990 	40-052-992 
11,0	40-106-400	40-106-460	40-052-750			
11,1	40-106-401	40-106-461	40-052-751			
11,2	40-106-402	40-106-462	40-052-752			
11,3	40-106-403	40-106-463	40-052-753			
11,4	40-106-404	40-106-464	40-052-754			
11,5	40-106-405	40-106-465	40-052-755			
11,6	40-106-406	40-106-466	40-052-756			
11,7	40-106-407	40-106-467	40-052-757			
11,8	40-106-408	40-106-468	40-052-758			
11,9	40-106-409	40-106-469	40-052-759			
12,0	40-106-410	40-106-470	40-052-760			
12,1	40-106-411	40-106-471	40-052-761			
12,2	40-106-412	40-106-472	40-052-762			
12,3	40-106-413	40-106-473	40-052-763			
12,4	40-106-414	40-106-474	40-052-764			
12,5 *	**40-106-415**	**40-106-475**	**40-052-765**	**quick plug-connection** 1/8"a - 6mm  40-132-216	(Cone A3/1:10=18 40-052-995)	
12,6	40-106-416	40-106-476	40-052-766			
12,7	40-106-417	40-106-477	40-052-767			
12,8	40-106-418	40-106-478	40-052-768			
12,9	40-106-419	40-106-479	40-052-769			
13,0	40-106-420	40-106-480	40-052-770			

Ceramic welding centering pins for nut size M12

Order example for complete electrode: Mk2_M12_14,8_k

sheet metal hole Ø	short pin (s)	long pin (l)	electrode upper part CuCoBe	compression spring	electrode lower part with air connection Cone Mk2	electrode lower part with air connection Thread M18x1,5
				40-100-985 	40-052-990 	40-052-992 
13,0	40-106-500	40-106-560	40-052-770			
13,1	40-106-501	40-106-561	40-052-771			
13,2	40-106-502	40-106-562	40-052-772			
13,3	40-106-503	40-106-563	40-052-773			
13,4	40-106-504	40-106-564	40-052-774			
13,5	40-106-505	40-106-565	40-052-775			
13,6	40-106-506	40-106-566	40-052-776			
13,7	40-106-507	40-106-567	40-052-777			
13,8	40-106-508	40-106-568	40-052-778			
13,9	40-106-509	40-106-569	40-052-779			
14,0	40-106-510	40-106-570	40-052-780			
14,1	40-106-511	40-106-571	40-052-781			
14,2	40-106-512	40-106-572	40-052-782			
14,3	40-106-513	40-106-573	40-052-783			
14,4	40-106-514	40-106-574	40-052-784			
14,5	40-106-515	40-106-575	40-052-785			
14,6	40-106-516	40-106-576	40-052-786			
14,7	40-106-517	40-106-577	40-052-787			
14,8 *	**40-106-518**	**40-106-578**	**40-052-788**	**quick plug-connection** 1/8"a - 6mm  40-132-216	(Cone A3/1:10=18 40-052-995)	
14,9	40-106-519	40-106-579	40-052-789			
15,0	40-106-520	40-106-580	40-052-790			

*** standard sheet metal hole Ø**

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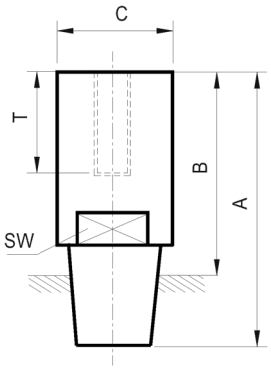
Complete electrodes for welding nuts M3 - M 14 / standard sheet metal hole-Ø

Nut size	Sheet metal hole-Ø	Cone/Thread	Centering pin	Designation	Article-No.
M3	4,5	Mk2	short **(s)**	Mk2_M3_4,5_k	40-053-915
		Mk2	long/flange **(l/f)**	Mk2_M3_4,5_l/B	40-053-975
		M18x1,5	short **(s)**	M18x1,5_M3_4,5_k	40-054-915
		M18x1,5	long/flange **(l/f)**	M18x1,5_M3_4,5_l/B	40-054-975
		A3 (1:10=18)	short **(s)**	A3_M3_4,5_k	40-056-915
		A3 (1:10=18)	long/flange **(l/f)**	A3_M3_4,5_l/B	40-056-975
M4	6,0	Mk2	short **(s)**	Mk2_M4_6,0_k	40-053-015
		Mk2	long/flange **(l/f)**	Mk2_M4_6,0_l/B	40-053-075
		M18x1,5	short **(s)**	M18x1,5_M4_6,0_k	40-054-015
		M18x1,5	long/flange **(l/f)**	M18x1,5_M4_6,0_l/B	40-054-075
		A3 (1:10=18)	short **(s)**	A3_M4_6,0_k	40-056-015
		A3 (1:10=18)	long/flange **(l/f)**	A3_M4_6,0_l/B	40-056-075
M5	7,0	Mk2	short **(s)**	Mk2_M5_7,0_k	40-053-115
		Mk2	long/flange **(l/f)**	Mk2_M5_7,0_l/B	40-053-175
		M18x1,5	short **(s)**	M18x1,5_M5_7,0_k	40-054-115
		M18x1,5	long/flange **(l/f)**	M18x1,5_M5_7,0_l/B	40-054-175
		A3 (1:10=18)	short **(s)**	A3_M5_7,0_k	40-056-115
		A3 (1:10=18)	long/flange **(l/f)**	A3_M5_7,0_l/B	40-056-175
M6	8,0	Mk2	short **(s)**	Mk2_M6_8,0_k	40-053-215
		Mk2	long/flange **(l/f)**	Mk2_M6_8,0_l/B	40-053-275
		M18x1,5	short **(s)**	M18x1,5_M6_8,0_k	40-054-215
		M18x1,5	long/flange **(l/f)**	M18x1,5_M6_8,0_l/B	40-054-275
		A3 (1:10=18)	short **(s)**	A3_M6_8,0_k	40-056-215
		A3 (1:10=18)	long/flange **(l/f)**	A3_M6_8,0_l/B	40-056-275
M8	10,5	Mk2	short **(s)**	Mk2_M8_10,5_k	40-053-320
		Mk2	long/flange **(l/f)**	Mk2_M8_10,5_l/B	40-053-380
		M18x1,5	short **(s)**	M18x1,5_M8_10,5_k	40-054-320
		M18x1,5	long/flange **(l/f)**	M18x1,5_M8_10,5_l/B	40-054-380
		A3 (1:10=18)	short **(s)**	A3_M8_10,5_k	40-056-320
		A3 (1:10=18)	long/flange **(l/f)**	A3_M8_10,5_l/B	40-056-380
M10	12,5	Mk2	short **(s)**	Mk2_M10_12,5_k	40-053-415
		Mk2	long/flange **(l/f)**	Mk2_M10_12,5_l/B	40-053-475
		M18x1,5	short **(s)**	M18x1,5_M10_12,5_k	40-054-415
		M18x1,5	long/flange **(l/f)**	M18x1,5_M10_12,5_l/B	40-054-475
		A3 (1:10=18)	short **(s)**	A3_M10_12,5_k	40-056-415
		A3 (1:10=18)	long/flange **(l/f)**	A3_M10_12,5_l/B	40-056-475
M12	14,8	Mk2	short **(s)**	Mk2_M12_14,8_k	40-053-518
		Mk2	long/flange **(l/f)**	Mk2_M12_14,8_l/B	40-053-578
		M18x1,5	short **(s)**	M18x1,5_M12_14,8_k	40-054-518
		M18x1,5	long/flange **(l/f)**	M18x1,5_M12_14,8_l/B	40-054-578
		A3 (1:10=18)	short **(s)**	A3_M12_14,8_k	40-056-518
		A3 (1:10=18)	long/flange **(l/f)**	A3_M12_14,8_l/B	40-056-578
M14	16,8	Mk2	short **(s)**	Mk2_M14_16,8_k	40-053-618
		Mk2	long/flange **(l/f)**	Mk2_M14_16,8_l/B	40-053-678
		M18x1,5	short **(s)**	M18x1,5_M14_16,8_k	40-054-618
		M18x1,5	long/flange **(l/f)**	M18x1,5_M14_16,8_l/B	40-054-678
		A3 (1:10=18)	short **(s)**	A3_M14_16,8_k	40-056-618
		A3 (1:10=18)	long/flange **(l/f)**	A3_M14_16,8_l/B	40-056-678

13. Electrodes for welding screws

For welding of screws and bolts

Electrodes for welding screws made of CuCoBe, insulation made of hard fabric + VA pipe total wall thickness 1,5mm

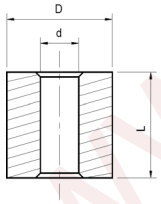


Designation	A	B	Ø C	T	SW	Article-No.
Mk2x70-Ø19 / **M5 - 30**	70	48	19	30	17	40-052-822
Mk2x70-Ø19 / **M6 - 35**	70	48	19	35	17	40-052-832
Mk2x80-Ø19 / **M6 - 45**	80	58	19	45	17	40-052-834
Mk2x70-Ø25 / **M8 - 35**	70	48	25	35	22	40-052-842
Mk2x80-Ø25 / **M8 - 45**	80	58	25	45	22	40-052-844
Mk2x85-Ø25 / **M10 - 40**	85	63	25	40	22	40-052-852
Mk2x85-Ø25 / **M10 - 50**	85	63	25	50	22	40-052-854
Mk2x85-Ø25 / **M12 - 40**	85	63	25	40	22	40-052-862
Mk2x85-Ø25 / **M12 - 50**	85	63	25	50	22	40-052-864
Mk2x100-Ø30 / **M14 - 50**	100	78	30	50	24	40-052-874
Mk2x100-Ø35 / **M16 - 50**	100	78	35	50	27	40-052-884

Welding centering sleeves made of high-performance ceramics, thermal shock resistant, extremely wear-resistant

silicon nitride, color: gray, flexural strength: 750 MPa, compressive strength: 2.500 MPa, impact strength: 6,7 MPa m ^{½}, Vickers hardness: 1.650 HV $_{0,5}$, temperature resistance: ΔT 550°C

Welding centering sleeve

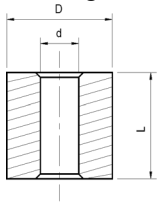


Bolt size	Ø $d^{+0,2}_{+0,05}$	Ø D_{h8}	$L_{+/-0,3}$	Article-No.
M4	4	12	12	40-105-141
M5	5	12	12	40-105-142
M6	6	12	12	40-105-143
M8	8	18	12	40-105-144
M10	10	18	12	40-105-145
M12	12	18	12	40-105-146

Welding centering sleeve standard ceramic Z-111

zirconium oxide, color: yellow, flexural strength: 700 MPa, compressive strength: 2.500 MPa, impact strength: 7,0 MPa m ^{½}, Vickers hardness: 1.200 HV $_{0,5}$, temperature resistance: ΔT 250°C

Welding centering sleeve



Bolt size	Ø $d^{+0,2}_{+0,05}$	Ø D_{h8}	$L_{+/-0,3}$	Article-No.
M4	4	12	12	40-105-149
M5	5	12	12	40-105-152
M6	6	12	12	40-105-153
M8	8	18	12	40-105-154
M10	10	18	12	40-105-155
M12	12	18	12	40-105-156

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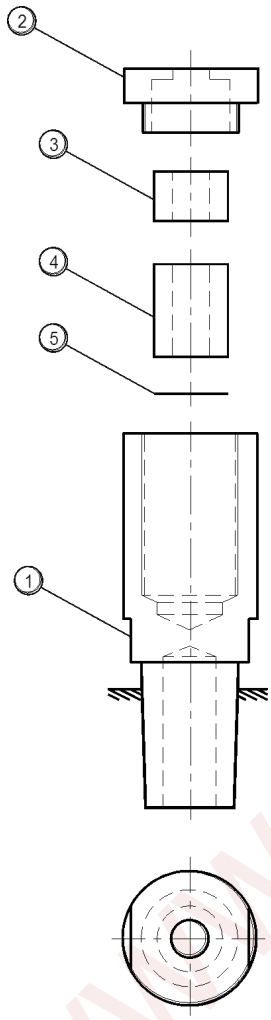
Electrodes for welding screws

Electrode for welding screws with ceramic centering sleeve

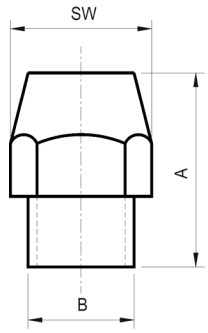


Bolt size / Cone	Part	Designation	Article-No.
M4 - 45 / Mk2	00	complete electrode M4	40-052-910
	01	electrode lower part Mk2x80 / M18x1,5	40-052-980
	02	electrode upper part M4 / M18x1,5	40-052-916
	03	ceramic centering sleeve M4 / Ø12x12	40-105-141
	04	insulating tube Ø13,8/7,0 x 21	40-105-090
	05	O-ring	10-530-416
M5 - 45 / Mk2	00	complete electrode M5	40-052-920
	01	electrode lower part Mk2x80 / M18x1,5	40-052-980
	02	electrode upper part M5 / M18x1,5	40-052-926
	03	ceramic centering sleeve M5 / Ø12x12	40-105-142
	04	insulating tube Ø13,8/7,0 x 21	40-105-090
	05	O-ring	10-530-416
M6 - 45 / Mk2	00	complete electrode M6	40-052-930
	01	electrode lower part Mk2x80 / M18x1,5	40-052-980
	02	electrode upper part M6 / M18x1,5	40-052-936
	03	ceramic centering sleeve M6 / Ø12x12	40-105-143
	04	insulating tube Ø13,8/7,0 x 21	40-105-090
	05	O-ring	10-530-416
M8 - 45 / Mk2	00	complete electrode M8	40-052-940
	01	electrode lower part Mk2x80 / M22x1,5	40-052-990
	02	electrode upper part M8 / M22x1,5	40-052-946
	03	ceramic centering sleeve M8 / Ø18x12	40-105-144
	04	insulating tube Ø17,8/13,0 x 21	40-105-091
	05	O-ring	10-530-423
M10 - 45 / Mk2	00	complete electrode M10	40-052-950
	01	electrode lower part Mk2x80 / M22x1,5	40-052-990
	02	electrode upper part M10 / M22x1,5	40-052-956
	03	ceramic center. sleeve M10/ Ø18x12	40-105-145
	04	insulating tube Ø17,8/13,0 x 21	40-105-091
	05	O-ring	10-530-423
M12 - 45 / Mk2	00	complete electrode M12	40-052-960
	01	electrode lower part Mk2x80 / M22x1,5	40-052-990
	02	electrode upper part M12 / M22x1,5	40-052-966
	03	ceramic center. sleeve M12 / Ø18x12	40-105-146
	04	insulating tube Ø17,8/13,0 x 21	40-105-091
	05	O-ring	10-530-423

Other sizes, cones or threads available on request!

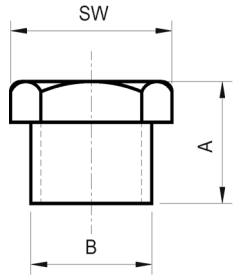
14. Electrode holder, Cu-sealing washers

Electrode-holder (brass)



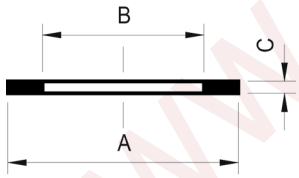
Designation	Type	A	B	SW	Article-No.
A1 x 35	WN 127130	35	M16x1,5	19	40-070-009
A2 x 35	"	35	M16x1,5	19	40-070-010
K1:10=10,5 x 35	"	35	M16x1,5	19	40-070-011
Mk1 x 35 / 16	"	35	M16x1,5	19	40-070-012
Mk1 x 35 / 18	"	35	M18x1,5	24	40-070-013
Mk1 x 42 / 24	"	42	M24x1,5	30	40-070-025
Mk2 x 42	"	42	M24x1,5	30	40-070-026

Electrode-holder (brass)



Designation	Type	A	B	SW	Article-No.
A1 x 16	WN 127131	16	M16x1,5	19	40-070-051
A2 x 16	"	16	M16x1,5	19	40-070-052
K1:10=10,5 x 16	"	16	M16x1,5	19	40-070-053
Mk1 x 16 / 16	"	16	M16x1,5	19	40-070-054
Mk1 x 18 / 18	"	18	M18x1,5	24	40-070-055
Mk1 x 24 / 24	"	24	M24x1,5	30	40-070-056
Mk2 x 20	"	20	M22x1,5	24	40-070-046
Mk2 x 24	"	24	M24x1,5	30	40-070-057

Cu - sealing washers



Designation	Type	Ø A	Ø B	C	Article-No.
11 x 8 x 1	WN 31451	11	8	1	40-080-011
18 x 13 x 2	"	18	13	2	40-080-018
22 x 16,2 x 2,5	"	22	16,2	2,5	40-080-022
23 x 18,2 x 2,5	"	23	18,2	2,5	40-080-024
30 x 18,2 x 3	"	30	18,2	3	40-080-030
30 x 22,2 x 3	"	30	22,2	3	40-080-032
34 x 24,2 x 3	"	34	24,2	3	40-080-035

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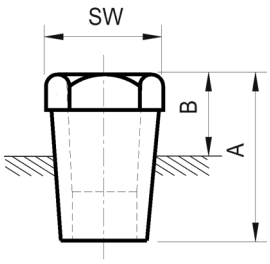
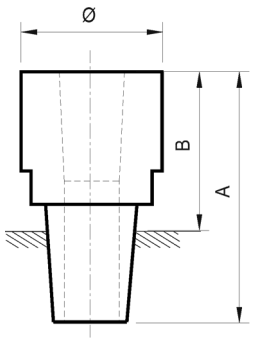
15. Reducing cone / electrode extension

Reducing cone (brass)



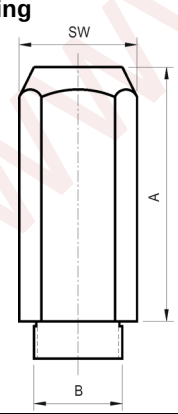
Designation	A	B	SW	Article-No.
A3 - A2 x 32	32	12	19	40-075-008
A3 - A2 x 45	45	25	19	40-075-012
A3 - Mk1 x 40	40	20	19	40-075-017
Mk2 - A2 x 32	32	10	19	40-075-022
Mk2 - Mk1 x 32	32	10	19	40-075-032
Mk2 - Mk1 x 45	45	23	19	40-075-040
Mk2 - Mk1 x 65	65	50	19	40-075-037
Mk3 - A3 x 50	50	20	27	40-075-056
Mk3 - Mk1 x 55	55	20	27	40-075-043
Mk3 - Mk2 x 50	50	20	27	40-075-047
Mk3 - Mk2 x 100	100	70	27	40-075-048

Electrode extension cone - cone (brass)



Designation	A	B	Ø	SW	Article-No.
A3 - A3 x 65	65	45	30	27	40-075-280
A3 - A3 x 100	100	80	30	27	40-075-285
Mk2 - Mk2 x 65	65	42	30	27	40-075-260
Mk2 - Mk2 x 100	100	78	30	27	40-075-265

Extended electrode uptake thread - cone (brass) with O-ring



Designation	Cone	A	B	SW	Article-No.
V1/75	Mk1	75	M24x1,5	32	40-075-320
V2/75	Mk2	75	M24x1,5	32	40-075-340
V2/95	Mk2	95	M32x1,5	41	40-075-360
V3/100	Mk3	100	M32x1,5	41	40-075-380

Other sizes and lengths available on request!

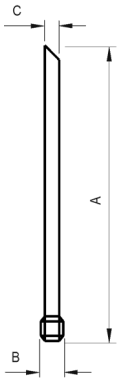
16. Cooling tubes

Copper- or brass- tube

When ordering please specify a length of up to 1,5m

Material	Size	Outer-Ø	Inner-Ø	Article-No.
Copper	4 x 0,5	4,0	3,0	40-092-040
Copper	5 x 0,5	5,0	4,0	40-092-050
Copper	6 x 1	6,0	4,0	40-092-061
Copper	8 x 1	8,0	6,0	40-092-081
Copper	10 x 1	10,0	8,0	40-092-101
Brass	5 x 0,5	5,0	4,0	40-092-150
Brass	6 x 1	6,0	4,0	40-092-161
Brass	8 x 1	8,0	6,0	40-092-181
Brass	10 x 1	10,0	8,0	40-092-201

Cooling tube (brass) with soldering thread



Designation	A	B	C	Article-No.
M8 x 55	55	M8x1,25	Ø5 x 0,5	40-085-010
M8 x 65	65	M8x1,25	Ø5 x 0,5	40-085-020
M8 x 75	75	M8x1,25	Ø5 x 0,5	40-085-025
M8 x 85	85	M8x1,25	Ø5 x 0,5	40-085-030
M8 x 100	100	M8x1,25	Ø5 x 0,5	40-085-032
M8 x 125	125	M8x1,25	Ø5 x 0,5	40-085-034
M8 x 150	150	M8x1,25	Ø5 x 0,5	40-085-035
M8 x 200	200	M8x1,25	Ø5 x 0,5	40-085-040

Cooling tube (brass or copper)

Designation	A	B	C	Article-No.	
M6x0,75 x A / Ms	20mm in 5mm increments	M6x0,75	Ø6 x 1	40-085-300	**When ordering please specify length A in mm.**
M6x0,75 x A / Cu		M6x0,75	Ø6 x 1	40-085-350	
M8x0,75 x A / Ms		M8x0,75	Ø8 x 1	40-085-400	
M8x0,75 x A / Cu		M8x0,75	Ø8 x 1	40-085-450	
M8x1 x A / Ms		M8x1	Ø8 x 1	40-085-500	
M8x1 x A / Cu		M8x1	Ø8 x 1	40-085-550	

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17. Electrodes for micro resistance welding machines

Electrode classes:

- electrodes class 0
  Hard-drawn from electrolytic copper (E-Cu),
  for welding aluminum and light metal alloys.

- electrodes class 2
  Made of copper-chromium-zircon (CuCrZr),
  for welding steel, stainless steel, brass, nickel alloys and bronze.

- electrodes class 3
  Made of copper-cobalt-beryllium (CuCoBe),
  for welding high-alloy steel, NiCr alloys and Monel.

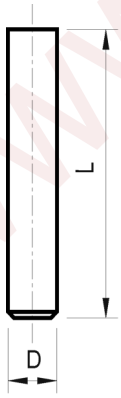
- electrodes class 6
  Made of tungsten-copper 80/20 (WCu),
  for welding non-ferrous metals with a high copper proportion.

- electrodes class 7
  Made of tungsten 100% (W),
  for welding copper and silver, resistance brazing and hot riveting.

- electrode class 8 (Mo) and 8.1 (TZM)
  Made of molybdenum
  for welding copper, stranded copper wire and silver.

Classes 6 - 8.1 are soldered into copper carriers.

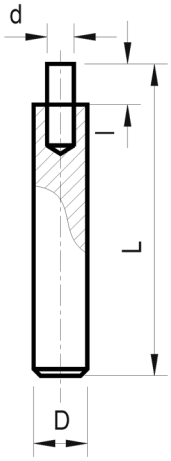
Round electrodes, cylindrical



Class	Material	Ø D	L	Article-No.
0	E-Cu	3	40	40-098-001
2	CuCrZr	3	40	40-098-002
0	E-Cu	4	30	40-098-010
2	CuCrZr	4	30	40-098-011
0	E-Cu	6	50	40-098-020
2	CuCrZr	6	50	40-098-021
3	CuCoBe	6	50	40-098-022
0	E-Cu	10	75	40-098-030
2	CuCrZr	10	75	40-098-031
3	CuCoBe	10	75	40-098-032

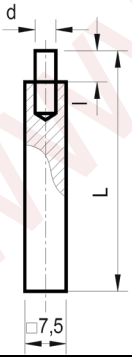
Electrodes for micro resistance welding machines

Round electrodes, cylindrical with soldered inserts



Class	Insert	ØD	Ø d	L	l	Article-No.
6	WCu	3	2	40	3	40-098-060
7	W	3	2	40	3	40-098-061
8	Mo	3	2	40	3	40-098-062
6	WCu	4	2	30	5	40-098-070
7	W	4	2	30	5	40-098-071
8	Mo	4	2	30	5	40-098-072
6	WCu	6	3	50	5	40-098-080
6	WCu	6	4	50	5	40-098-081
7	W	6	2	50	5	40-098-082
7	W	6	3	50	5	40-098-083
7	W	6	4	50	5	40-098-084
8	Mo	6	2	50	5	40-098-085
8	Mo	6	3	50	5	40-098-086
8	Mo	6	4	50	5	40-098-087
8.1	TZM	6	4	50	5	40-098-088
6	WCu	10	6	75	6	40-098-100
7	W	10	3	75	6	40-098-101
7	W	10	4	75	6	40-098-102
7	W	10	6	75	6	40-098-103
8	Mo	10	3	75	6	40-098-104
8	Mo	10	4	75	6	40-098-105
8	Mo	10	6	75	6	40-098-106
8.1	TZM	10	6	75	6	40-098-107

Square electrodes with soldered inserts



Class	Insert	Square	Ø d	L	l	Article-No.
6	WCu	7,5 x 7,5	6	55	10	40-098-150
7	W	7,5 x 7,5	6	55	10	40-098-151
8	Mo	7,5 x 7,5	6	55	10	40-098-152
8.1	TZM	7,5 x 7,5	6	55	10	40-098-153

Special electrodes available on request!

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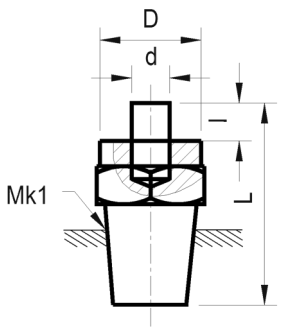
Electrodes for micro resistance welding machines

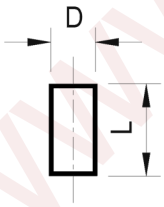
Electrodes Mk1x34 / Insert Ød with soldered inserts



Class	Insert	Ø D	Ø d	L	l	Article-No.
6	WCu	14	3	34	6	40-098-301
6	WCu	14	4	34	6	40-098-302
6	WCu	14	5	34	6	40-098-303
6	WCu	14	6	34	6	40-098-304
6	WCu	14	8	34	6	40-098-305
6	WCu	14	10	34	6	40-098-306
7	W	14	3	34	6	40-098-331
7	W	14	4	34	6	40-098-332
7	W	14	5	34	6	40-098-333
7	W	14	6	34	6	40-098-334
7	W	14	8	34	6	40-098-335
7	W	14	10	34	6	40-098-336
8	Mo	14	3	34	6	40-098-361
8	Mo	14	4	34	6	40-098-362
8	Mo	14	5	34	6	40-098-363
8	Mo	14	6	34	6	40-098-364
8	Mo	14	8	34	6	40-098-365
8	Mo	14	10	34	6	40-098-366

Other sizes and cones available on request!

Sintered metal polished inserts

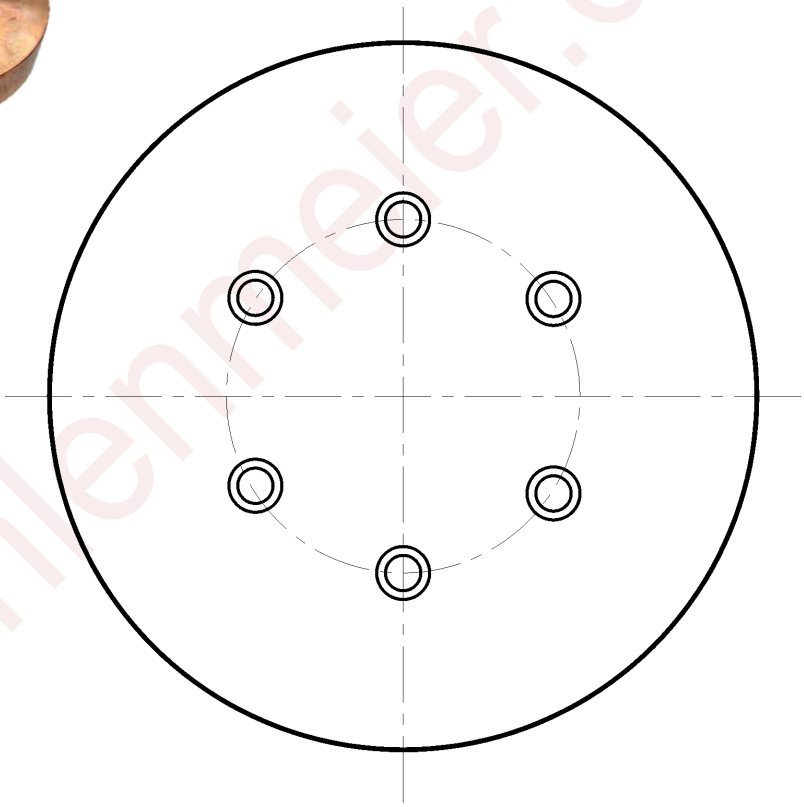


Class	Material	Ø D	L	Article-No.
7	W	3	20	40-098-805
7	W	4	20	40-098-815
7	W	5	20	40-098-825
7	W	6	20	40-098-835
7	W	8	20	40-098-845
7	W	10	20	40-098-855
7	W	12	20	40-098-865
7	W	15	20	40-098-875
8	Mo	3	20	40-098-905
8	Mo	4	20	40-098-915
8	Mo	5	20	40-098-925
8	Mo	6	20	40-098-935
8	Mo	8	20	40-098-945
8	Mo	10	20	40-098-955
8	Mo	12	20	40-098-965
8	Mo	15	20	40-098-975

Other sizes and materials available on request!

18. Roller electrodes

Roller electrodes for welding rollers are manufactured according to customer's drawings.
Diameter range: Ø90 to Ø300mm
Materials: CuCrZr and CuCoBe



Standard roller electrodes

Machine type	Drawing-No.	Dimensions	Position	Article-No.
PMS 11-4, 11-6	11_1.11798.0	Ø125 x 20mm	length ways below	40-045-205
	11_1.11022.0	Ø160 x 25mm	across top across below length ways above	40-045-210
PMS 14-4, 14-6	Z_72.12307.0	Ø140 x 20mm	length ways below	40-045-215
	Z_72.11442.0	Ø224 x 25mm	across top across below length ways above	40-045-220

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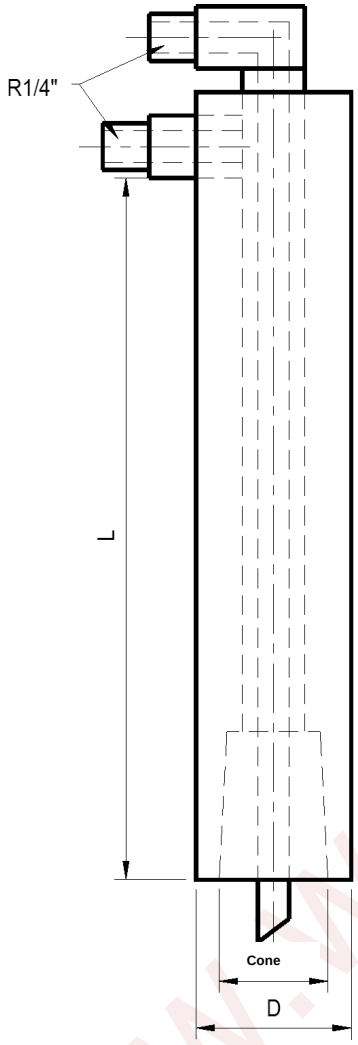
19. Electrode holders

E-holder standard (brass)



Reducing piece 1/4“i - M12x1a: Article.-No. 40-130-080
Reducing piece 1/4“i - M16x1,5a: Article.-No. 40-130-085

Designation	Ø	L	Cone	Article-No.
E12/6/50	12	50	A1	31-752-001
E12/6/70	12	70	A1	31-752-002
E12/6/125	12	125	A1	31-752-005
E12/6/190	12	190	A1	31-752-006
E16/1/32	16	32	Mk1	31-161-032
E16/1/140	16	140	Mk1	31-161-140
E20/1/50	20	50	Mk1	31-202-050
E20/1/105	20	105	Mk1	31-202-105
E20/1/162	20	162	Mk1	31-202-162
E20/1/185	20	185	Mk1	31-202-185
E25/1/50	25	50	Mk1	31-252-051
E25/1/180	25	180	Mk1	31-252-182
E25/2/50	25	50	Mk2	31-252-050
E25/2/63	25	63	Mk2	31-252-063
E25/2/130	25	130	Mk2	31-252-130
E25/2/180	25	180	Mk2	31-252-180
E25/2/300	25	300	Mk2	31-252-300
E25/2/430	25	430	Mk2	31-252-430
E30/2/75	30	75	Mk2	31-302-075
E30/2/170	30	170	Mk2	31-302-170
E30/2/240	30	240	Mk2	31-302-240
E30/2/400	30	400	Mk2	31-302-400
E35/3/105	35	105	Mk3	31-353-105
E35/3/170	35	170	Mk3	31-353-170
E35/3/250	35	250	Mk3	31-353-250
E35/3/350	35	350	Mk3	31-353-350

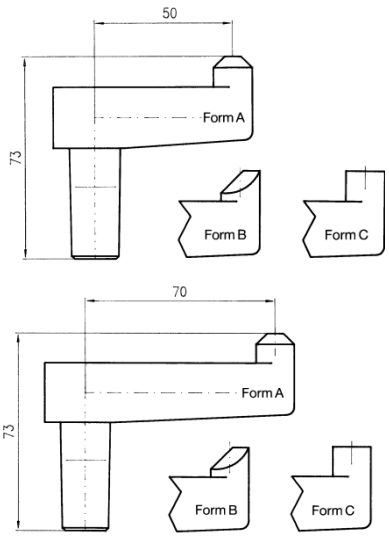
For other sizes, please always specify when ordering!

- Diameter **D** in mm
- Length **L** in mm
- Recording **cone or thread size**

Tubing connector pieces and tubing’s from page 75

20. Angle electrode holders

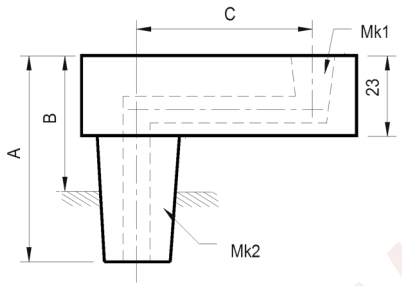
Electrode - cantilever



Designation	Type	Height	Spot-Ø	E-Cap	Article-No.
Mk2x50Ausl-AB	E2-31/A	30	5	-	40-050-271
Mk2x50Ausl-AB	E2-31/B	30	5	-	40-050-278
Mk2x50Ausl-AB	E2-31/C	30	14	-	40-050-285
Mk2x50Ausl-AB	E2-31/E17	35	-	E17	40-050-292
Mk2x70Ausl-AB	E2-37/A	30	5	-	40-050-272
Mk2x70Ausl-AB	E2-37/B	30	5	-	40-050-279
Mk2x70Ausl-AB	E2-37/C	30	14	-	40-050-286
Mk2x70Ausl-AB	E2-37/E17	35	-	E17	40-050-293
Ausl=(cantilever form)					

With additional water connection at the back.

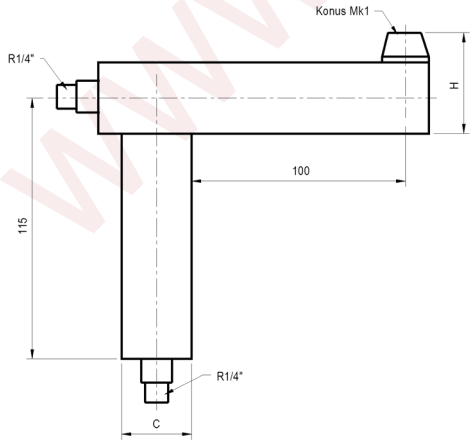
E-holder - cantilever (brass)



Designation	A	B	C	Article-No.
Mk2-Mk1 Ausl.50	50	28	50	40-070-750
Mk2-Mk1 Ausl.70	50	28	70	40-070-770
Mk2-Mk1 Ausl.110	50	28	110	40-070-775
Ausl=(cantilever form)				

Without additional water connection.

Angle electrode holder standard (brass)



Designation	Ø C	H	max. E-Force	Article-No.
25 WE 100 G	25	41	280 daN	34-527-173
25 WE 100 S	25	34	280 daN	34-527-175
30 WE 100 G	30	46	300 daN	34-527-177
30 WE 100 S	30	39	300 daN	34-527-178

G=gerade (straight); S=schräg, (inclined, 30°)
WE=Winkelelektrode (Angle electrode)

Spare parts:

1) Electrode Mk1	40-070-304
2) Cu-sealing washer 23x18,2x2,5	40-080-024
3) Cooling tube M6x0,75 x 40 / Ms (brass)	40-085-300

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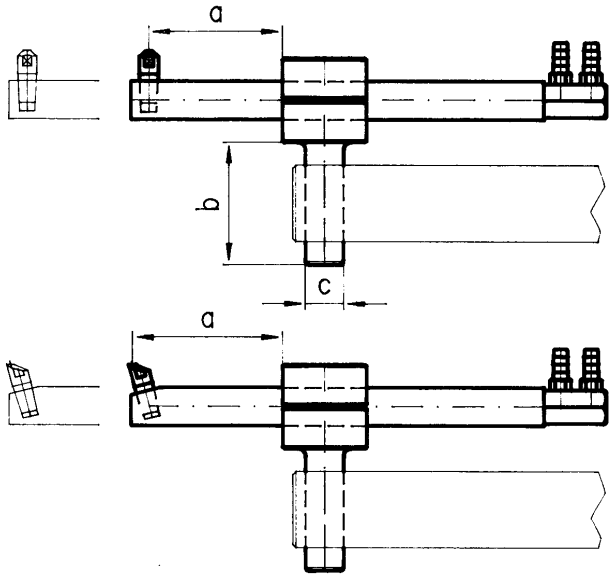
Angle electrode holders

Movable electrode holders



Type: 1

Electrode straight
1.1 Electrode holder horizontal Ø25 cone Mk1
1.2 Electrode holder horizontal Ø30 cone Mk2

Type: 2

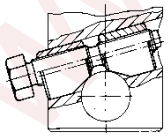
Electrode inclined
2.1 Electrode holder horizontal Ø25 cone Mk1
2.2 Electrode holder horizontal Ø30 cone Mk2

Please always specify when ordering!

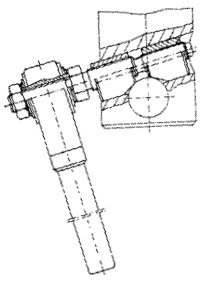
- Type
- Length **a** in mm
- Length **b** in mm
- Diameter **c** in mm
- Electrode holder diameter
- Recording **cone**

21. Clamping pieces

Clamping piece - double (brass)



Clamping piece with ratchet



Ø mm	Length	for machine type	Article-No.
12	20	A 3111; A3112; A3136	32-513-513
16	20	SF 8; SF/SL 102;104	32-516-273
20	24	PMS 10-4 / -6/T 16kVA	32-520-243
25	14	SF/SL 16; 25; 202; 204; 206	32-513-083
25	20	PL 40/63; PMS 10-4 / -6	32-525-693
30	25	PL 80/100; PMS 11-4 / -6	32-524-003
35	35	PMS 12-5; 14-4 / -6; 16-4 / -6	32-524-343

Ø mm	Length	for machine type	Article-No.
25	20	PL 40/63; PMS 10-4 /-6	32-531-473
30	25	PL 80/100; PMS 11-4 / -6	32-531-483
35	35	PMS 12-5; 14-4 / -6; 16-4 / -6	32-531-493

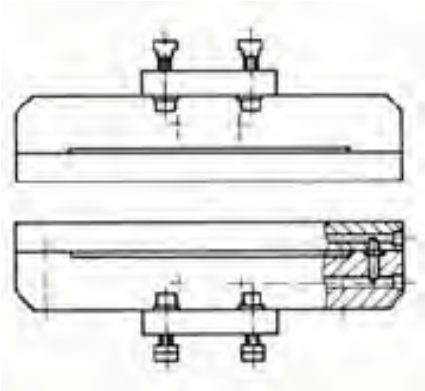
22. Bar-, pendulum- and vice electrodes

Pendulum electrode holder water-cooled

Bar electrode holder water-cooled

Designation	Recording	Electrode surface	Article-No.
20 PE 85	Ø 20	85 x 20	40-050-505
25 PE 85	Ø 25	85 x 20	40-050-510
2 PE 85	Cone Mk2	85 x 20	40-050-525
3 PE 85	Cone Mk3	85 x 20	40-050-535
20 BE 100	Ø 20	100 x 20	40-050-315
25 BE 100	Ø 25	100 x 20	40-050-320
30 BE 100	Ø 30	100 x 20	40-050-325
35 BE 100	Ø 35	100 x 20	40-050-330

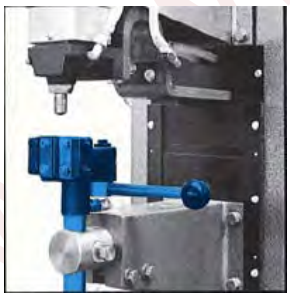
Bar electrodes for projection welding machines



Please always specify when ordering:

- T-slot size and spacing
- Size of the clamping plate
- Bar size

Vice electrode



Designation	Recording	Clamping range	Article-No.
16 ES 8	Ø 16	3 - 8 mm	31-913-000
20 ES 8	Ø 20	3 - 8 mm	31-913-001
25 ES 15	Ø 25	5 - 15 mm	31-913-002
30 ES 15	Ø 30	5 - 15 mm	31-913-003
35 ES 25	Ø 35	8 - 25 mm	31-913-004

For welding on bolts, threaded pins, etc. through current carrying clamping

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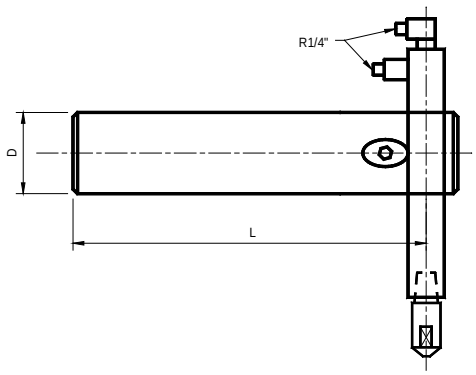
23. Electrode arms for spot welding machines

Suitable for DALEX - spot welding machines
made of brass

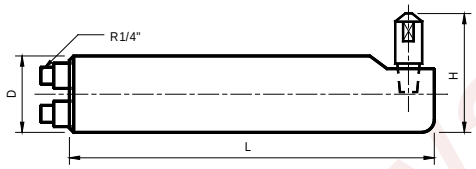
Electrode arm



Diameter, Length	with E-holder	for machine type	Article-No.
only E-holder water-cooled:			
Ø32, 300mm lg.	E16/1/140	SF 8; SF/SL 102/104	31-160-001
Ø45, 500mm lg.	E25/1/180	SF/SL 16/202	31-250-001
Ø45, 700mm lg.	E25/1/180	SF/SL 16/202	31-250-002
Ø60, 550mm lg.	E25/2/180	PL 40/63	31-250-101
Ø60, 750mm lg.	E25/2/180	PL 40/63	31-250-102
Ø70, 650mm lg.	E30/2/240	PL 80/100	31-300-001
E-arm and E-holder water-cooled:			
Ø45, 500mm lg.	E25/2/180	SF/SL 25/204/206	31-250-005
Ø45, 700mm lg.	E25/2/180	SF/SL 25/204/206	31-250-006

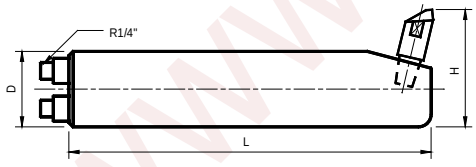
Electrode arm straight or inclined by exchanging the clamping piece with the E-holder.

Pipe arm, straight



Diameter, Length	Cone	H	for machine type	Article-No.
Ø32, 300mm lg.	Mk 1	50	SF8; SF/SL 102;104	31-160-031
Ø45, 500mm lg.	Mk 2	70	SF/SL 16/25/202-206	31-250-031
Ø45, 700mm lg.	Mk 2	70	SF/SL 16/25/202-206	31-250-032
Ø60, 550mm lg.	Mk 2	80	PL 40/63	31-250-131
Ø60, 750mm lg.	Mk 2	80	PL 40/63	31-250-132
Ø70, 650mm lg.	Mk 2	85	PL 80/100	31-300-031

Pipe arm, inclined



Diameter, Length	Cone	H	for machine type	Article-No.
Ø32, 300mm lg.	Mk 1	48	SF8; SF/SL 102;104	31-160-061
Ø45, 500mm lg.	Mk 2	64	SF/SL 16/25/202-206	31-250-061
Ø45, 700mm lg.	Mk 2	64	SF/SL 16/25/202-206	31-250-062
Ø60, 550mm lg.	Mk 2	80	PL 40/63	31-250-161
Ø60, 750mm lg.	Mk 2	80	PL 40/63	31-250-162
Ø70, 650mm lg.	Mk 2	85	PL 80/100	31-300-061

For other sizes, please always specify when ordering!

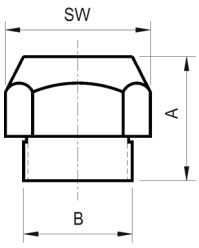
- Diameter **D** in mm
- Length **L** in mm
- **Electrode-holder**
- Tube arms, **cone or thread size**

24. Flange-mounted electrode holder

Flange-mounted electrode holder standard (brass)

Cone	Slot spacing	Square	Thread	Article-No.
Mk2	63	41x41	M24x1,5	35-365-085
Mk2	126	45x45	M32x1,5	35-365-093
Mk3	63	45x45	M32x1,5	35-365-090
Mk3	126	45x45	M32x1,5	35-365-095

Electrode holder with O-ring (brass)



Size	B	A	SW	Article-No.
Mk1 x 17	M18x1,5	17	SW24	35-365-105
Mk1 x 22	M24x1,5	22	SW32	35-365-110
Mk2 x 22	M24x1,5	22	SW32	35-365-115
A3 x 22	M24x1,5	22	SW32	35-365-116
Mk2 x 23	M32x1,5	23	SW41	35-365-120
Mk3 x 33	M32x1,5	33	SW41	35-365-125

T-slot nuts, DIN 508

Size	a	e	h	k	Article-No.
M6 x 8	7,7	13	10	6	35-365-050
M8 x 10	9,7	15	12	6	35-365-055
M8 x 12	11,7	18	14	7	35-365-059
M10 x 12	11,7	18	14	7	35-365-060
M8 x 14	13,7	22	16	8	35-365-063
M10 x 14	13,7	22	16	8	35-365-064
M12 x 14	13,7	22	16	8	35-365-065

25. Bottom clamping plate, attachable

Bottom clamping plate, attachable

Arm-Ø	Table size	T-slot	for machine type	Article-No.
45	100x100	8 / 63	PMS 10-4/T, 10-6/T	35-365-150
60	100x130	10 / 63	PMS 10-4 / -6	35-365-155
60	130x130	10 / 63	PMS 11-4 / -6	35-365-160
75	150x150	10 / 63	PMS 12-5; 14-4 / -6	35-365-165
90	200x200	14 / 126	PMS 16-4 / -6	35-365-170

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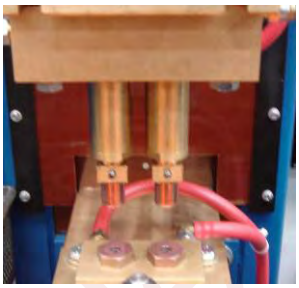
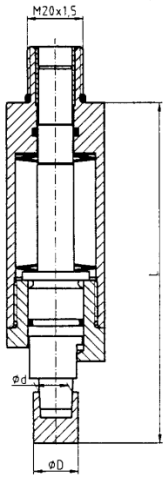
26. Compensation electrode holder



Application area
For welding galvanized sheet metals, for welding tools, for multiple spot welding (projection welding). Tools that are used on welding presses are given the desired compensation by the compensating electrode for the different wear and tear of the electrode material or the different heights of the components.
The greater the desired welding pressure, the smaller the possible one compensation path. The compensation path is between **6.6 and 1.8mm.**

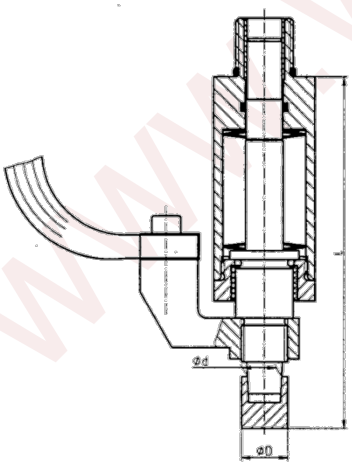
Outer-Ø 35mm · Mount thread M20x1,5 / 20mmlg. · SW32

Compensation electrode holder with silver-plated contact plates



Designation	E-force	X	d	D	L	Article-No.
AE-200-17	200 daN	22	10	13	119	40-070-710
AE-200-20	200 daN	22	12	16	121	40-070-711
AE-200-22	200 daN	22	15	20	123	40-070-712
AE-400-17	400 daN	24	10	13	119	40-070-716
AE-400-20	400 daN	24	12	16	121	40-070-717
AE-400-22	400 daN	24	15	20	123	40-070-718
AE-600-17	600 daN	24	10	13	119	40-070-722
AE-600-20	600 daN	24	12	16	121	40-070-723
AE-600-22	600 daN	24	15	20	123	40-070-724

Compensation electrode holder with current strap and secondary connection



X=number of disc springs / Article-No. 40-070-701
Note data:
200daN=11x2fold (22); 400daN=8x3fold (24);
600daN=6x4fold (24); 900daN=5x5fold (25)
Power band / Article.-No.: 40-070-706

Designation	E-force	X	d	D	L	Article-No.
AE-200-17-S	200 daN	22	10	13	119	40-070-730
AE-200-20-S	200 daN	22	12	16	121	40-070-731
AE-200-22-S	200 daN	22	15	20	123	40-070-732
AE-400-17-S	400 daN	24	10	13	119	40-070-736
AE-400-20-S	400 daN	24	12	16	121	40-070-737
AE-400-22-S	400 daN	24	15	20	123	40-070-738
AE-600-17-S	600 daN	24	10	13	119	40-070-742
AE-600-20-S	600 daN	24	12	16	121	40-070-743
AE-600-22-S	600 daN	24	15	20	123	40-070-744
AE-900-22-S	900 daN	25	15	20	123	40-070-745

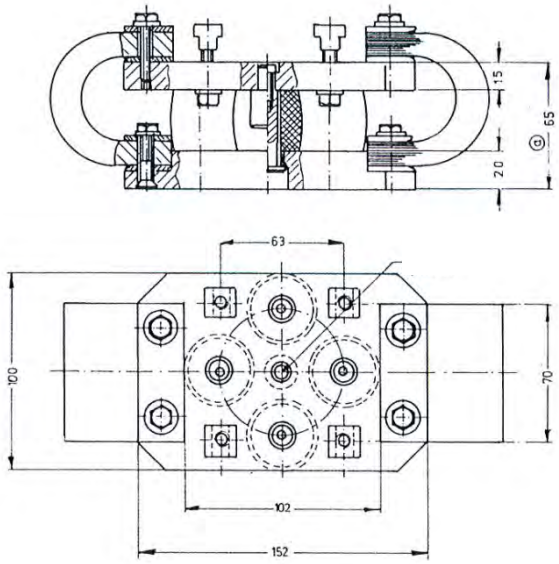
Suitable electrode caps see page 24 + 25

Pressure compensation for projection welding

700 - 1800daN

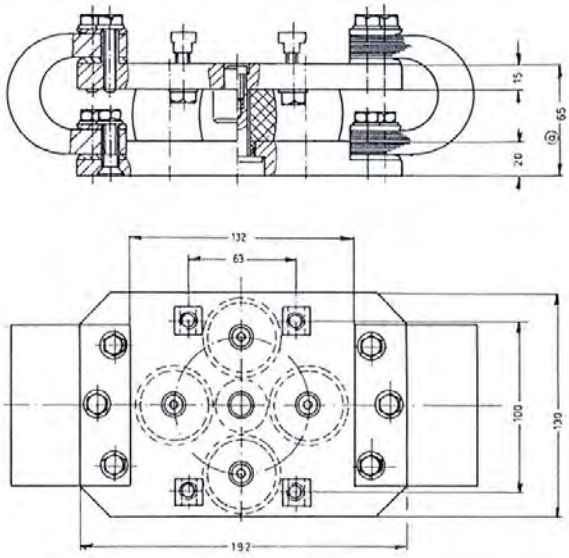
To compensate for workpiece tolerances, rubber springs ensure optimal repositioning, the side current straps serve to improve current distribution.

Electrode force max. 700daN,
T-slot spacing 63mm



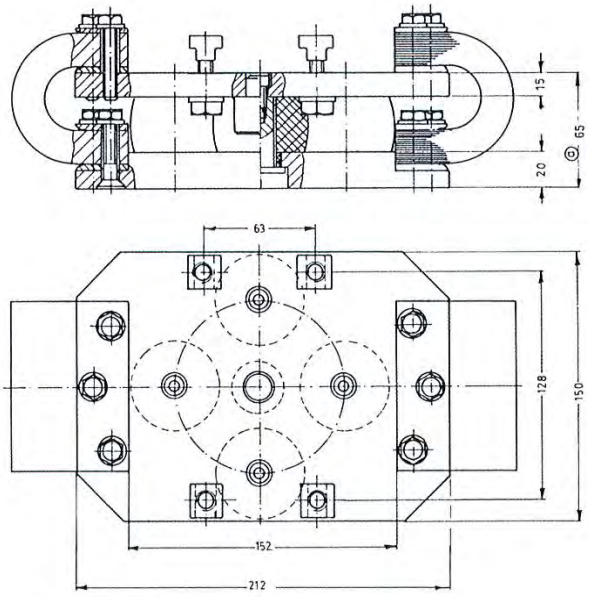
Z_10.52545.3 Article-No. 32-525-453

Electrode force max. 1200daN,
T-slot spacing 63mm



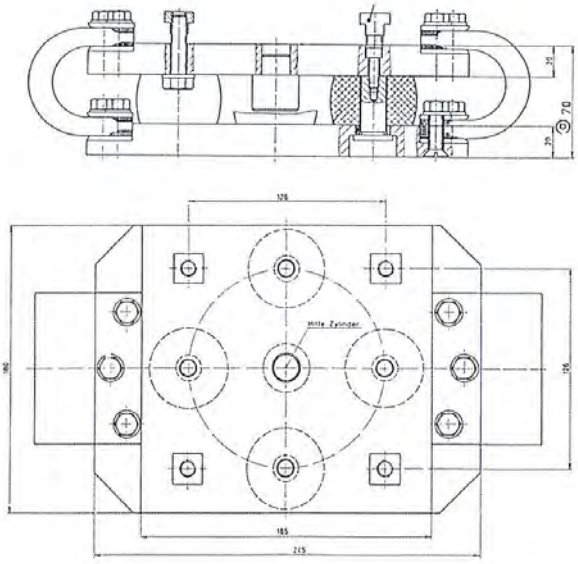
Z_10.52546.3 Article-No. 32-525-463

Electrode force max. 1800daN,
T-slot spacing 63mm



Z_10.52531.3 Article-No. 32-525-313

Electrode force max. 1800daN,
T-slot spacing 126mm



Z_10.53108.3 Article-No. 32-531-083

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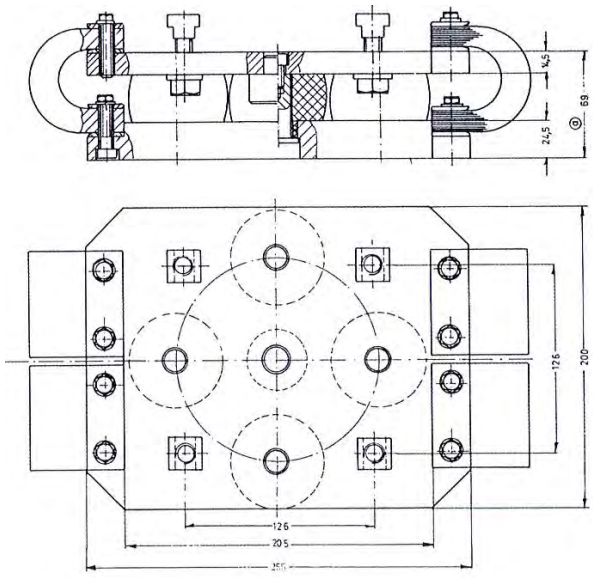
Pressure compensation for projection welding

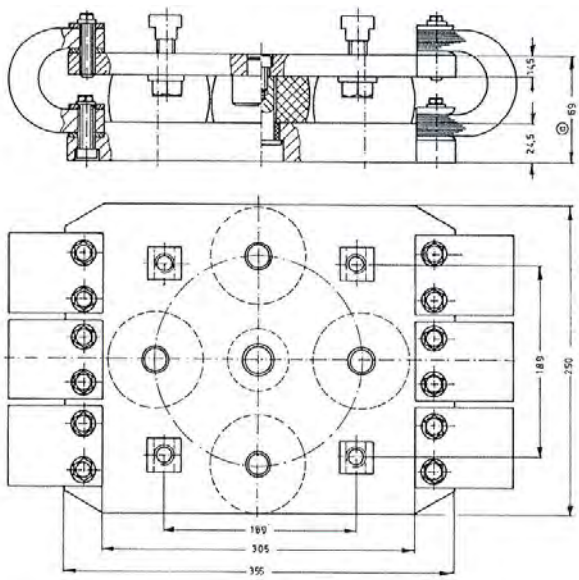
3000 - 6000daN

Electrode force max. 3000daN,
T- slot spacing 126mm



Z_10.52547.3 Article-No. 32-525-473

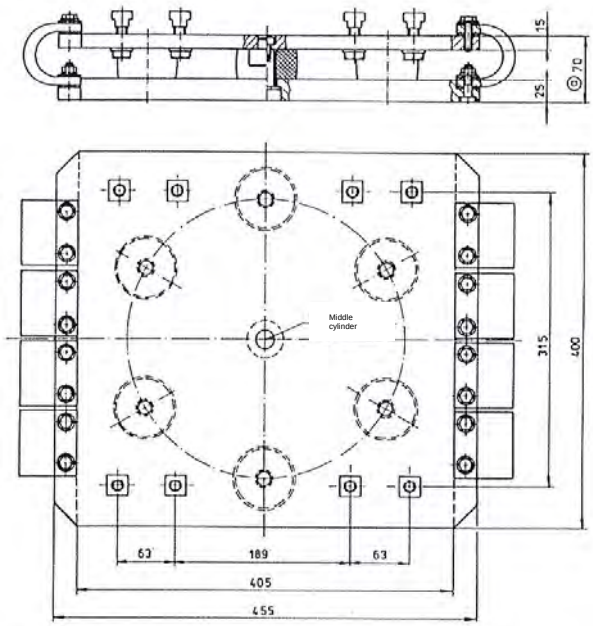
Electrode force max. 4000daN,
T- slot spacing 189mm



Z_10.52635.3 Article-No. 32-526-353

Electrode force max. 6000daN,
T- slot spacing 126mm

Z_10.53028.3 Article-No. 32-530-283



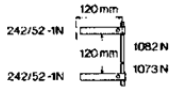
When ordering please specify!

- Machine type
- Electrode force
- Dimensions of the clamping plate
- T-slot spacing and size

27. Electrode arms for spot welding guns

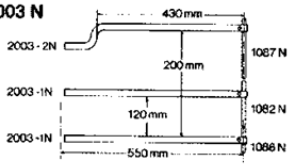
Suitable for DALEX body spot welding guns
From drawn hard copper or solid copper-chromium alloy. 20x20mm square electrode arms torsion and bending arm.

242/52 N O-242-1K O-242-1 KuE U-242-1K U-242-1 KuE

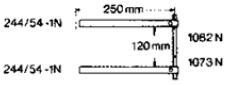


V 20 / 6 / 120 S

2003 N

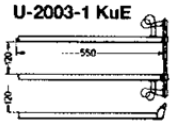


244/54 N O-244/54-1K O-244/54-1KuE U-244/54-1K U-244/54-1KuE



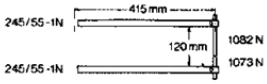
V 20 / 6 / 250 S

O-2003-1 K O-2003-1 KuE U-2003-1 K U-2003-1 KuE



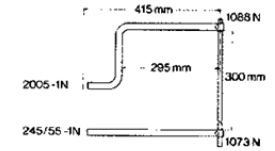
V 20 / 6 / 550 S

245/55 N O-245/55-1K O-245/55-1KuE U-245/55-1K U-245/55-1KuE

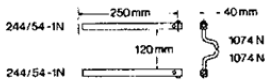


V 20 / 6 / 415 S

2005 N 2005 K 2005 KuE

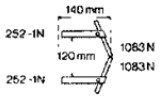


244/1074 N O-244/1074 KuE U-244/1074 KuE

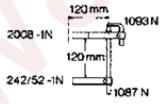


2006 N

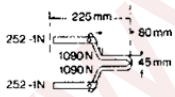
252 N 252 K 252 KuE



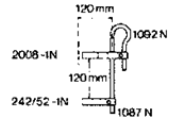
2008 N 2008 K 2008 KuE



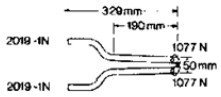
252/1090 N 252/1090 KuE



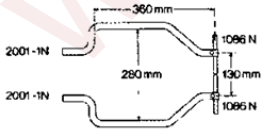
2008/1092 N 2008/1092 KuE



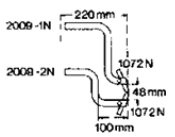
2019 N



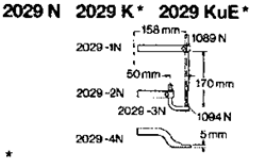
2001 N 2001 K 2001 KuE



2009 N 2009 K 2009 KuE

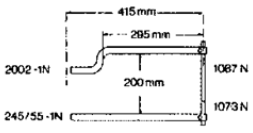


2029 N 2029 K* 2029 KuE*

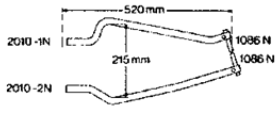


* Only two parts

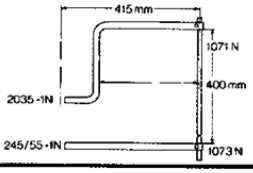
2002 N 2002 K 2002 KuE



2010 N



2035 N 2035 K 2035 KuE



Versions

Electrode sleeves for spot welding tongs **N** **A 3111 / A 3112**

Electrode sleeves for spot welding tongs **K** **A 3139/** A 3119K/A 3193-

Version A
made of drawn electrolyte hard copper or drawn copper-chromium alloy, completely water-cooled including spot electrode

Electrode sleeves for spot welding tongs **KuE** **A 3139/** A 3119K/A 3193-

Version B
made of drawn electrolyte hard copper or drawn copper-chromium alloy, only electrode arms water-cooled, spot electrode not cooled

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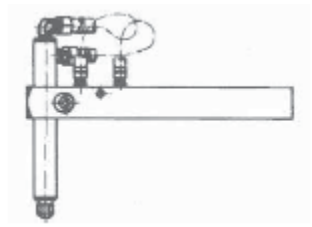
Electrode arms for spot welding guns

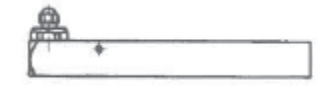
Suitable for DALEX X - spot welding guns
From drawn hard copper or solid copper-chromium alloy. Square electrode arms torsion and bending arm.

E-arm, up-straight



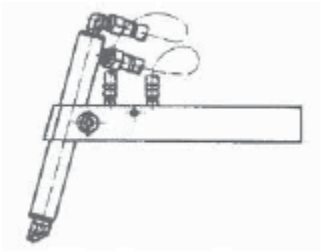
Tongs	170 mm	350 mm	500 mm	650 mm	800 mm
3218 3228 3238	D30/20/170g - Mk1 **22-763-105**	D30/20/350g - Mk1 **22-763-106**	D30/20/500g - Mk1 **22-763-107**	D30/20/650g - Mk1 **22-763-108**	-
3329	D34/25/170g - Mk2 **22-765-105**	D34/25/350g - Mk2 **22-765-106**	D34/25/500g - Mk2 **22-765-107**	D34/25/650g - Mk2 **22-765-108**	D34/25/800g - Mk2 **22-765-109**
3328-6	E34/25/170g - Mk2 **22-765-305**	E34/25/350g - Mk2 **22-765-306**	E34/25/500g - Mk2 **22-765-307**	E34/25/650g - Mk2 **22-765-308**	E34/25/800g - Mk2 **22-765-309**
3427 3526 3528	D45/25/170g - Mk2 **22-764-105**	D45/25/350g - Mk2 **22-764-106**	D45/25/500g - Mk2 **22-764-107**	D45/25/650g - Mk2 **22-764-108**	D45/25/800g - Mk2 **22-764-109**

E-arm, down-straight



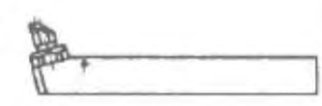
Tongs	170 mm	350 mm	500 mm	650 mm	800 mm
3218 3228 3238	D30/1/170g - Mk1 **22-763-205**	D30/1/350g - Mk1 **22-763-206**	D30/1/500g - Mk1 **22-763-207**	D30/1/650g - Mk1 **22-763-208**	-
3329	D34/2/170g - Mk2 **22-765-405**	D34/2/350g - Mk2 **22-765-406**	D34/2/500g - Mk2 **22-765-407**	D34/2/650g - Mk2 **22-765-408**	D34/2/800g - Mk2 **22-765-409**
3328-6	E34/2/170g - Mk2 **22-765-205**	E34/2/350g - Mk2 **22-765-206**	E34/2/500g - Mk2 **22-765-207**	E34/2/650g - Mk2 **22-765-208**	E34/2/800g - Mk2 **22-765-209**
3427 3526 3528	D45/2/170g - Mk2 **22-764-205**	D45/2/350g - Mk2 **22-764-206**	D45/2/500g - Mk2 **22-764-207**	D45/2/650g - Mk2 **22-764-208**	D45/2/800g - Mk2 **22-764-209**

E-arm, up-sloping



Tongs	170 mm	350 mm	500 mm	650 mm	800 mm
3218 3228 3238	D30/20/170s - Mk1 **22-763-155**	D30/20/350s - Mk1 **22-763-156**	D30/20/500s - Mk1 **22-763-157**	D30/20/650s - Mk1 **22-763-158**	-
3329	-	D34/25/350s - Mk2 **22-765-156**	D34/25/500s - Mk2 **22-765-157**	D34/25/650s - Mk2 **22-765-158**	D34/25/800s - Mk2 **22-765-159**
3328-6	-	E34/25/350s - Mk2 **22-765-356**	E34/25/500s - Mk2 **22-765-357**	E34/25/650s - Mk2 **22-765-358**	E34/25/800s - Mk2 **22-765-359**
3427 3526 3528	-	D45/25/350s - Mk2 **22-764-156**	D45/25/500s - Mk2 **22-764-157**	D45/25/650s - Mk2 **22-764-158**	D45/25/800s - Mk2 **22-764-159**

E-arm, down-sloping

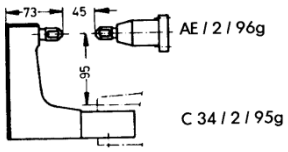


Tongs	170 mm	350 mm	500 mm	650 mm	800 mm
3218 3228 3238	D30/1/170s - Mk1 **22-763-255**	D30/1/350s - Mk1 **22-763-256**	D30/1/500s - Mk1 **22-763-257**	D30/1/650s - Mk1 **22-763-258**	-
3329	D34/2/170s - Mk2 **22-765-455**	D34/2/350s - Mk2 **22-765-456**	D34/2/500s - Mk2 **22-765-457**	D34/2/650s - Mk2 **22-765-458**	D34/2/800s - Mk2 **22-765-459**
3328-6	E34/2/170s - Mk2 **22-765-255**	E34/2/350s - Mk2 **22-765-256**	E34/2/500s - Mk2 **22-765-257**	E34/2/650s - Mk2 **22-765-258**	E34/2/800s - Mk2 **22-765-259**
3427 3526 3528	D45/2/170s - Mk2 **22-764-255**	D45/2/350s - Mk2 **22-764-256**	D45/2/500s - Mk2 **22-764-257**	D45/2/650s - Mk2 **22-764-258**	D45/2/800s - Mk2 **22-764-259**

Electrode arms for spot welding guns

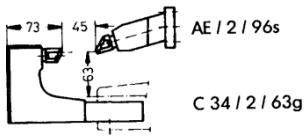
Suitable for DALEX C - spot welding guns

Extension 95mm, Mk2



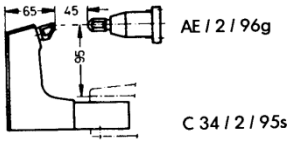
Tongs	Designation	PS / WS	Article-No.
3346 + 3349 / SS	AE/2/96g	0 / 45	22-751-001
3346 + 3349 / SS	C 34/2/95g	0 / 45	22-766-106
3348 / DS	AE/2/96g	60 / 10	22-751-001
3348 / DS	C-DS 34/2/95g	60 / 10	22-766-206

Extension 63mm, Mk2



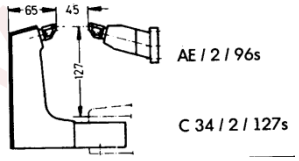
Tongs	Designation	PS / WS	Article-No.
3346 + 3349 / SS	AE/2/96s	0 / 45	22-751-002
3346 + 3349 / SS	C 34/2/63g	0 / 45	22-766-105
3348 / DS	AE/2/96s	60 / 10	22-751-002
3348 / DS	C-DS 34/2/63g	60 / 10	22-766-205

Extension 95mm, Mk2



Tongs	Designation	PS / WS	Article-No.
3346 + 3349 / SS	AE/2/96g	0 / 45	22-751-001
3346 + 3349 / SS	C 34/2/95s	0 / 45	22-766-156
3348 / DS	AE/2/96g	60 / 10	22-751-001
3348 / DS	C-DS 34/2/95s	60 / 10	22-766-256

Extension 127mm, Mk2



Tongs	Designation	PS / WS	Article-No.
3346 + 3349 / SS	AE/2/96s	0 / 45	22-751-002
3346 + 3349 / SS	C 34/2/127s	0 / 45	22-766-157
3348 / DS	AE/2/96s	60 / 10	22-751-002
3348 / DS	C-DS 34/2/127s	60 / 10	22-766-257

Drawings each with single stroke

SS = single stroke; DS = double stroke; PS = pre-stroke; WS = working stroke

Special electrode arms available on request!

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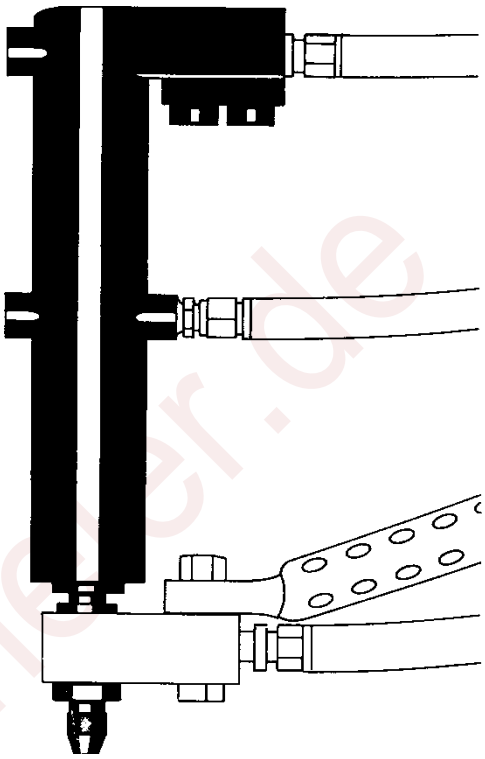
28. Welding cylinders



Variants

Cylinder types	**Type**
• foot flange	00-09
• side flange	10-19
• floor joint	20-29
• bottom pivot	30-39
• cylinder head side joint	40-49
• bottom plate	50-59
• pivot pin	60-69

Piston rod	**Type**
• round, not secured against twisting	L-N
• flattened, secured against twisting	W-Z

Force connections	**Type**
• inner cone	00-09
• internal thread	10-19
• external thread	20-29
• knurled thumb screw	30-39

Cylinder 2-stage pressurized **Type: 20**

Piston-Ø	**max. electrode forces at 10 bar**
38 mm	200 daN = 2,0 kN
44 mm	280 daN = 2,8 kN
58 mm	500 daN = 5,0 kN
70 mm	720 daN = 7,2 kN
80 mm	950 daN = 9,5 kN
90 mm	1.200 daN = 12,0 kN

Cylinder 3-stage pressurized **Type: 21**

Piston-Ø	**max. electrode forces at 10 bar**
38 mm	280 daN = 2,8 kN
44 mm	380 daN = 3,8 kN
58 mm	720 daN = 7,2 kN
70 mm	1.040 daN = 10,4 kN
80 mm	1.400 daN = 14,0 kN
90 mm	1.800 daN = 18,0 kN

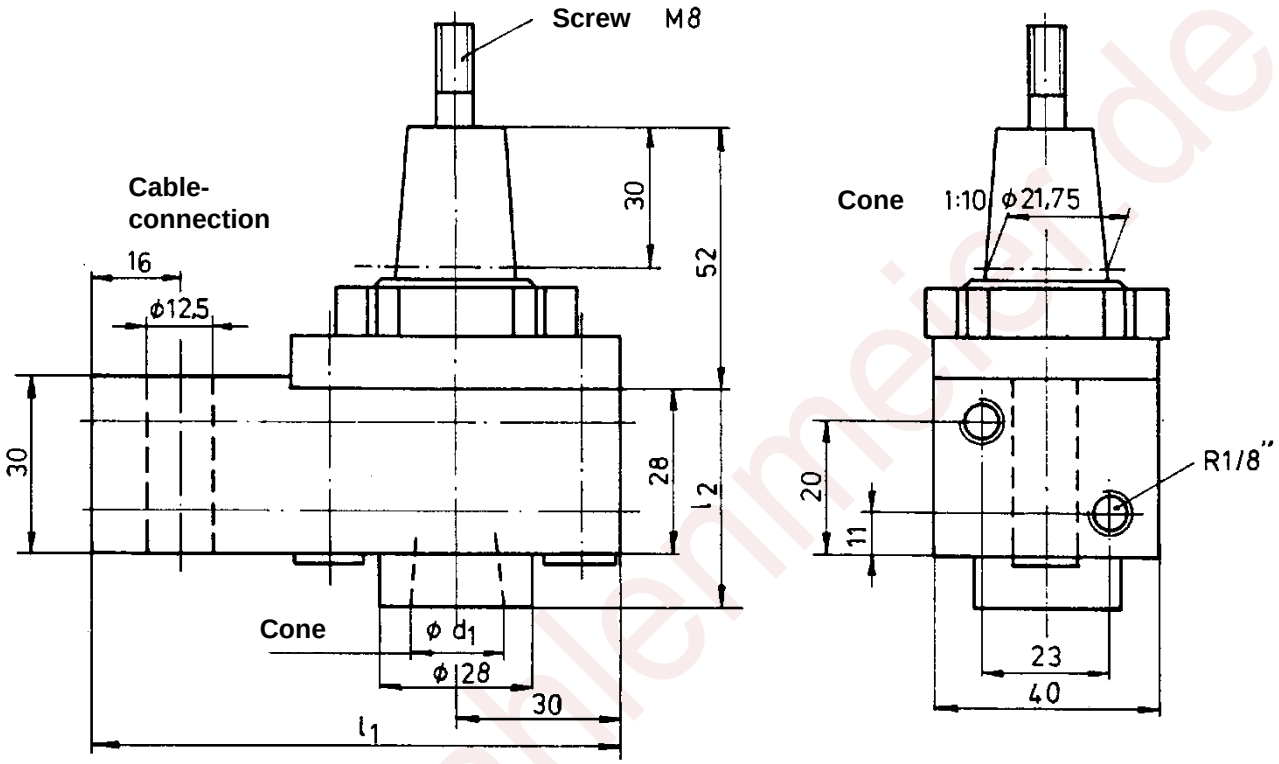
Single strokes
Working stroke 36, 50, 65, 80, 100, 130, 150mm

Double strokes
Pre-stroke+working stroke 50+30, 60+20, 70+30, 80+20, 90+40, 100+30 and 110+40mm

Piston rod and cylinder jacket are fully isolated from each other. The starting pressure is 0.8 bar.

If necessary, request detailed documents.

29. Electrode holders for welding cylinder



Type	Cylinder piston-Ø	l_1
29.010.*	38	95
29.011.*	44	95
29.012.*	58	110
29.013.*	70	110
29.014.*	80	120
29.015.*	90	120

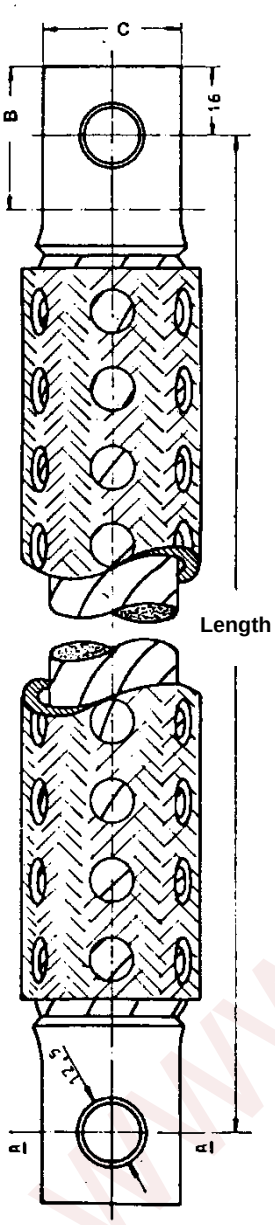
* Type	Cone	d_1	l_2
01	1:10	9,8	39
02	1:10	12,7	39
03	1:10	15,5	39
04	1:10	19,0	50
05	1:10	12,0	39
06	1:10	15,75	39
07	1:10	17,75	50
08	Mk1	12,065	39
09	Mk2	17,781	50
10	1:10	21,75	50

* Code for pickup cone

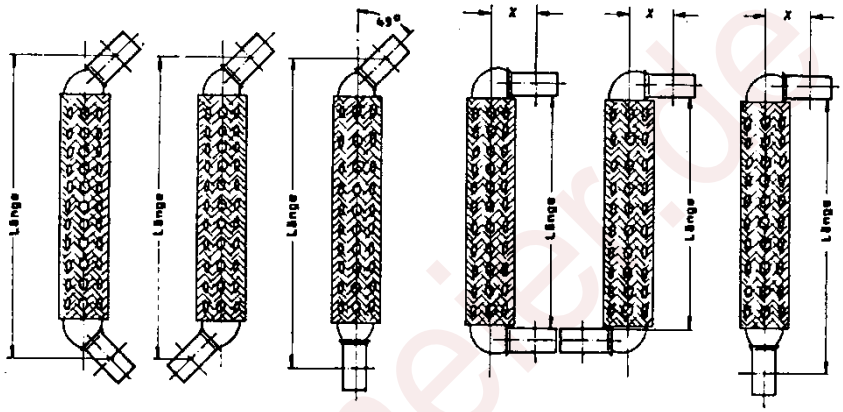
30. Secondary welding cable

Connection cable (air-cooled), ROWA
With perforated or non-perforated hose
Single wire-Ø 0,15mm

Form A



B C D E F G

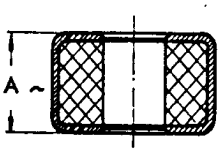


Cross section	Dimension A	Dimension B	Dimension C	Dimension X	Ø-outer
200²	*ca. 11	32	32	-	ca. 36
250²	ca. 13	32	32	-	ca. 36
300²	ca. 13,5	32	32	ca. 50	ca. 38
400²	ca. 18	32	32	ca. 53	ca. 40
500²	ca. 21,5	32	32	ca. 56	ca. 43
600²	ca. 24,5	40	32	-	ca. 47
750²	ca. 24,5	40	38	-	ca. 54
850²	ca. 27	40	38	-	ca. 62

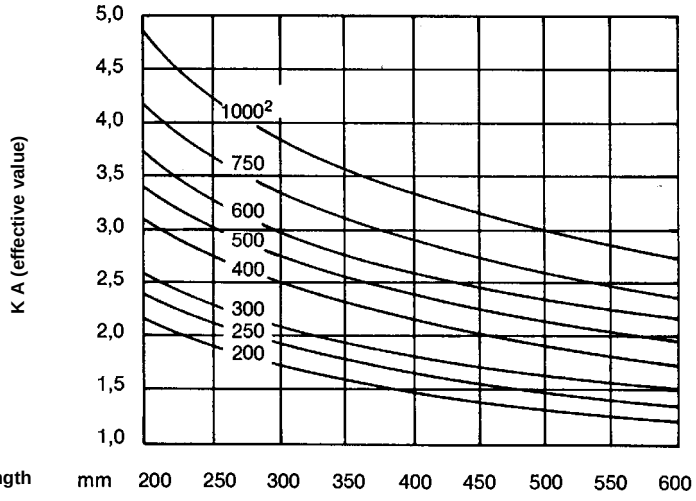
*ca. = circa

Length: from 150 until about 5000mm, in steps of 25mm, measured from center hole to center hole.

Cross section in section A-A

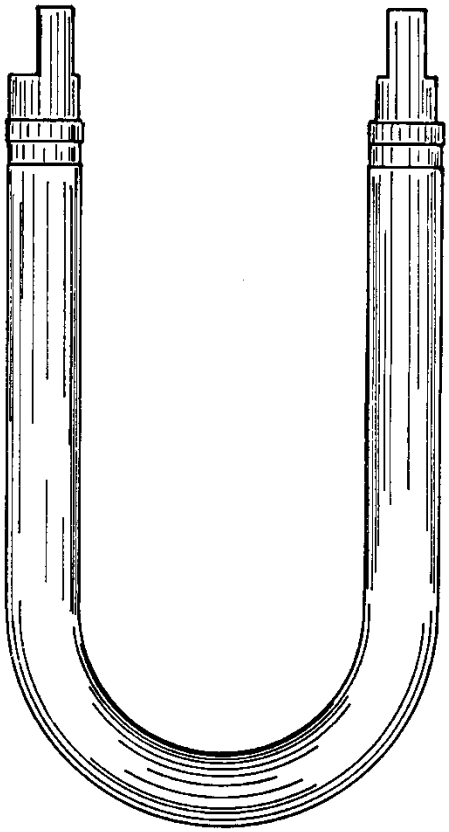


Load table for air-cooled welding cables

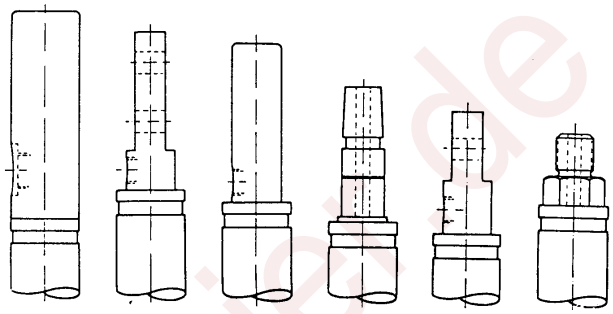


Secondary welding cable

Single conductor welding cable (water-cooled), ROWA
Single wire-Ø 0,15mm



Form A - F



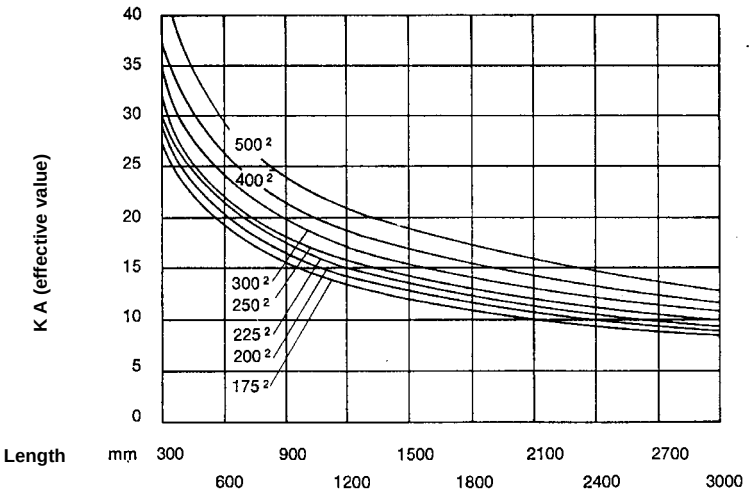
Cross section	Ø-outer
150²	ca. 32
175²	ca. 35
200²	ca. 35
225²	ca. 38
250²	ca. 38
300²	ca. 42
400²	ca. 44
500²	ca. 51

Min. bending radius ap. 5x outer diameter.

Length as specified.
Other connectors according to drawing or pattern.

Water connection: thread ¼“

Load table for water-cooled welding cable



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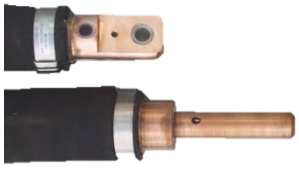
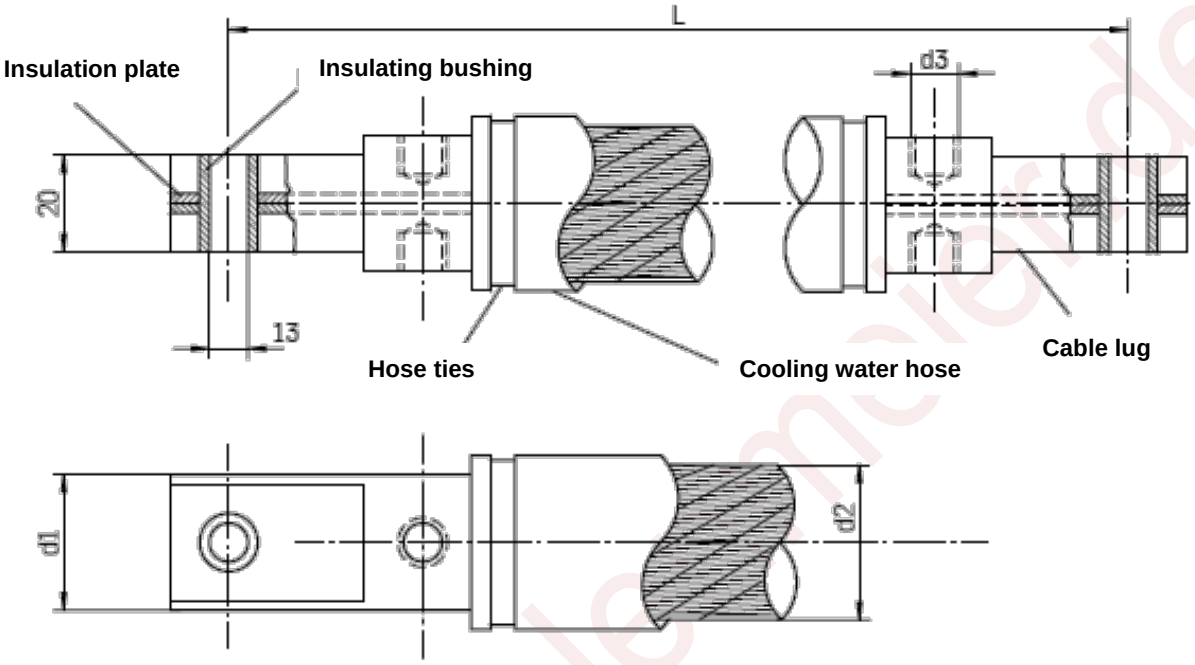
Secondary welding cable



Double conductor welding cable, coaxial (water-cooled), ROWA
Single wire-Ø 0,15mm



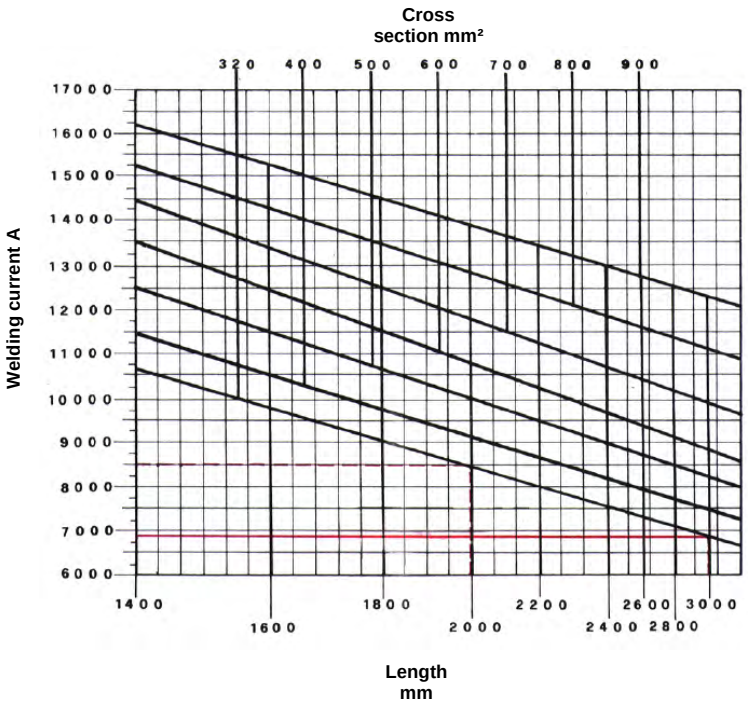
Cross section	Ø-outer
2x160²	ap. 52
2x200²	ap. 56
2x250²	ap. 60
2x300²	ap. 66
2x350²	ap. 66
2x400²	ap. 72
2x425²	ap. 72
2x450²	ap. 72

Min. bending radius ap. 5x outer diameter.

Length as specified.
Other connectors according to drawing or pattern.

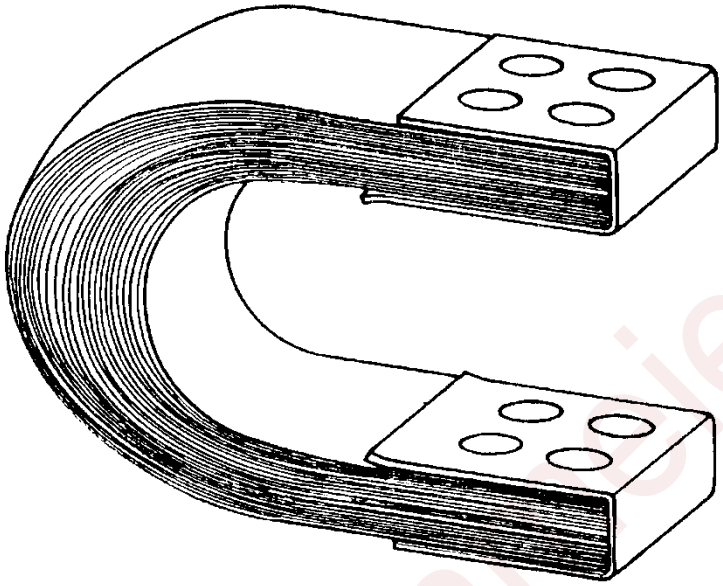
Water connection: thread ¼“

Load table for water-cooled welding cable



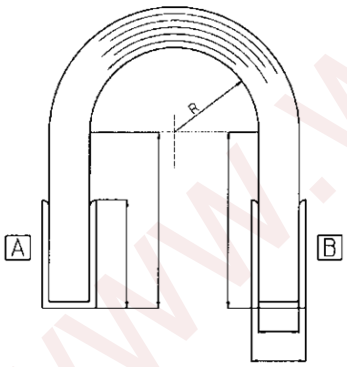
31. Current tapes / lamella shunts / current springs

Available in all possible designs and dimensions according to drawings or samples.



Lamella shunts are available in all possible versions and dimensions according to customer drawings. To order a lamella shunt, if a drawing or sample is not available, the following dimensions are required (please enter the dimensions in the form and tick the drilling pattern accordingly.

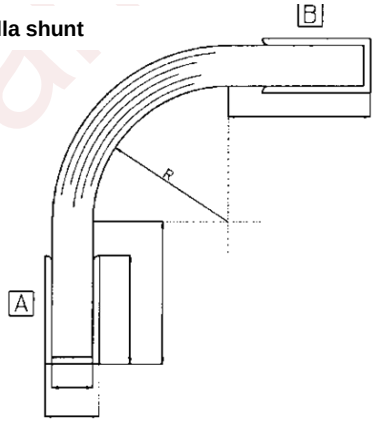
180° Lamella shunt



Shortest shunt mm

Longest shunt mm

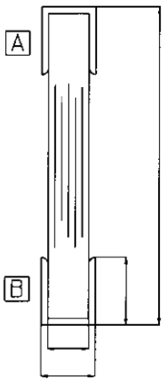
90° Lamella shunt

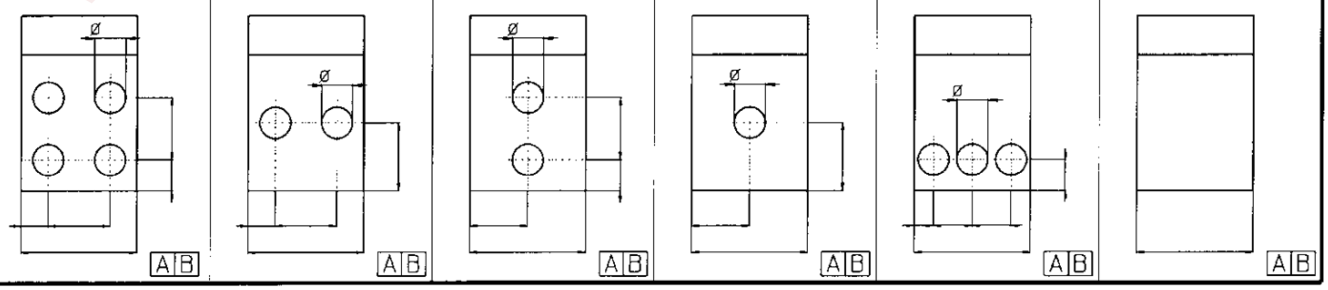


Shortest shunt mm

Longest shunt mm

Straight Lamella shunt





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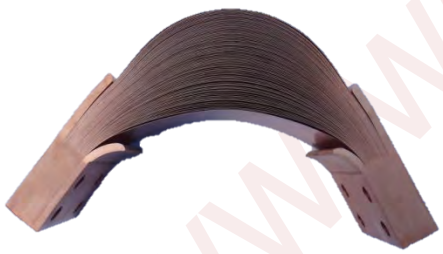
Standard - current tapes

Standard current tapes / current springs for spot welding guns
0,1mm Cu-slats

Type of tongs	Drawing-No.	Article-No.
A3111, A3112	3111-6/55014.0	32-380-820
A3119, A3139	A3119/95714.3	32-380-830
3218, 3228-4, 3238-4	3218/51579.3	32-380-840
3326-4, 3328-4, 3329	3326-3/51068.3	32-380-850
3328-6	3328-6/52932.3	32-380-860
3528-4	3528/51282.3	32-380-870
3346-4, 3348-4, 3349-4	3346-3/51624.3	32-380-880

Standard current tapes / current springs for spot- and projection welding machines
current tapes, above / 180° / 0,1mm Cu-slats



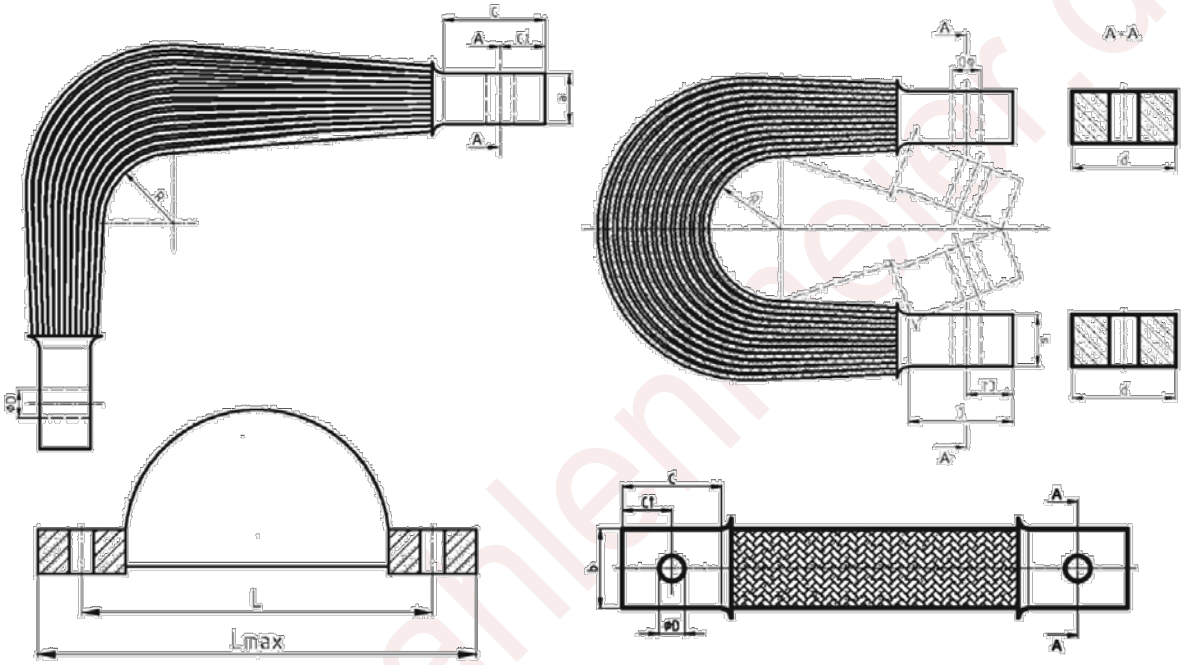
Machine type	Drawing-No.	stroke	Article-No.
K6/P1	300-16.58/U1	36	40-255-083
K15/P	300-16.19/U1	30	40-255-108
PPN 28	246834	60	40-182-383
PPN 53	246837	65	40-182-386
PPN 83, 103, 153	246855	100	40-182-388
PPN 253	246844	100	40-182-390
SL/SF 16, 25	SL16.51309.3	-	32-380-016
SL/SF 202, 204, 206	SL202.50000.0	-	32-380-020
PL 40, 63	PL40_2.52689.3	76	32-380-040
PL 80, 100	PL80_2.52695.3	96	32-380-080
PMS 10-4/T, 10-6/T	10_1.51055.3	70	32-380-110
PMS 10-2	10_2.51871.3	70	32-380-171
PMS 10-4, 10-6	10_4.52396.3	70	32-380-115
PMS 11-1, 11-2, 11-3, 14-1	11_1.51592.3	100	32-380-121
PMS 11-4, 11-6, 34-4	11_4.52423.3	118	32-380-123
PMS 14-4, 14-6	14_4.52440.3	120	32-380-144
PMS 16-4, 16-6	16_4.52460.3	134	32-380-460
PMS 12-5, 12-6	12_5.53267.3	100	32-380-126
PMS 32-5, 32-6	32_5.53245.3	100	32-380-132
PMS 34-1	34_1.51641.3	100	32-380-141
PMS 36-5, 36-6	36_5.53165.3	120	32-380-136

Other standard current tapes on request!

32. Flat braided shunts, high flexible

Current tapes, mass and grounding tapes, highly flexible, air-cooled, solder-free, pressed design.

Flat braided shunts are extremely flexible connections made from highly flexible round stranded wire with a diameter of 0.07 to 0.1 mm. At the ends, seamless contact sleeves are pressed on without soldering under high pressure. Tin-plated or silver-plated connections are also possible on request. We manufacture shunts with connection widths of 10-200mm and cross-sections of 16-6000mm². The flat braided shunts enable the transmission of very high currents.



Longest outer tape: _____ mm

Total cross-section: _____ mm²

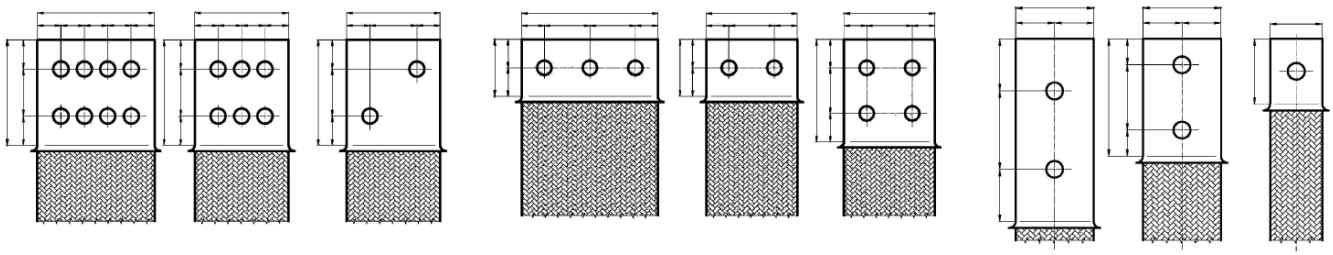
Shortest inner tape: _____ mm

Designation / No.: _____

Single layer cross-section: _____ mm²

required quantity: _____

Examples of connection variants:



We manufacture any special execution according to samples or drawings!
For an order please enter the required dimensions and values in this drawing!

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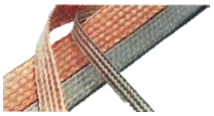
E-Cu - fabric tape, high flexible

In accordance with DIN 46444



Cross section mm²	Dimensions width x thickness mm	Single wire-Ø mm	Weight kg/1000m	Article-No.
4	8,2 x 1,0	0,07	40	50-182-801
5	9,8 x 1,2	0,07	53	50-182-803
6	10,0 x 1,3	0,07	60	50-182-805
8	12,3 x 1,5	0,07	80	50-182-807
10	14,0 x 1,5	0,07	100	50-182-809
16	17,5 x 2,0	0,1	160	50-182-811
25	22,0 x 2,5	0,1	250	50-182-813
35	30,0 x 2,5	0,1	350	50-182-815
50	33,0 x 3,2	0,1	500	50-182-817
70	45,0 x 3,5	0,1	700	50-182-819
95	50,0 x 4,0	0,1	950	50-182-821
120	60,0 x 4,0	0,1	1200	50-182-823
140	60,0 x 4,5	0,1	1400	50-182-825
150	65,0 x 5,0	0,1	1500	50-182-827
168	70,0 x 5,0	0,1	1680	50-182-829
185	75,0 x 5,0	0,1	1850	50-182-831
240	80,0 x 6,5	0,1	2400	50-182-833
250	80,0 x 7,0	0,1	2500	50-182-835
300	90,0 x 7,0	0,1	3000	50-182-837
400	100,0 x 8,5	0,1	4000	50-182-839

E-Cu – round strands, high flexible

In accordance with DIN 46438

Cross section mm²	outer-Ø mm	Single wire-Ø mm	Weight kg/100m	Article-No.
25	7,5	0,1	25	50-182-863
35	9,0	0,1	35	50-182-864
50	11,0	0,1	50	50-182-865
70	13,0	0,1	70	50-182-866
95	15,0	0,1	105	50-182-867
120	17,0	0,1	132	50-182-868
150	19,0	0,1	162	50-182-869
185	21,0	0,1	196	50-182-870
240	23,5	0,1	250	50-182-871
300	27,5	0,1	315	50-182-872

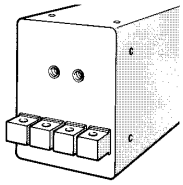
33. Resistance welding transformers

We supply welding transformers for resistance welding technology from 10 - 800kVA in different designs according to DIN 44766.

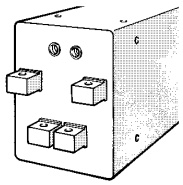
Alternating current, medium frequency and 3-phase direct current transformers

Connection diagrams:

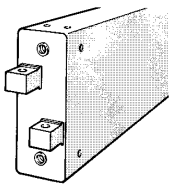
Built-in - Welding transformers ET



A

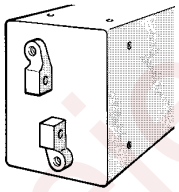


B

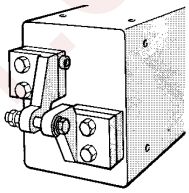


B/2

Hanging - Welding transformers HT

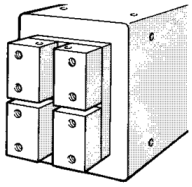


C

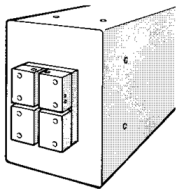


D

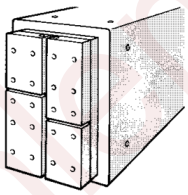
Machine - Welding transformers MT



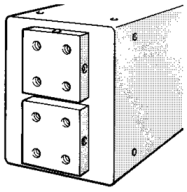
E



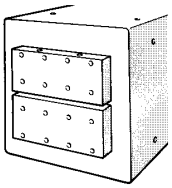
F



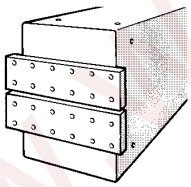
G



9

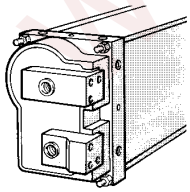


10

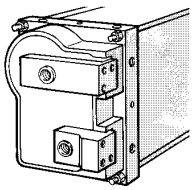


11

Tongs - Welding transformers ZT



H



J

Options:

- with step switch
- with thermal switch
- with secondary current measuring coil

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Resistance welding transformers in medium frequency technology

Designs and performance classes, transformers of the HWT 2000 series

80-90 kVA

Type	Rated power at 20%ED kVA	Voltage-sec. V	Diode count Piece	Weight kg	Article-No.
HWT 2108-6,3	80	6,3	2	17	50-221-228
HWT 2109-8,3	90	8,3	2	17	50-221-229

180 kVA

Type	Rated power at 20%ED kVA	Voltage-sec. V	Diode count Piece	Weight kg	Article-No.
HWT 2118-9,0	180	9,0	4	27	50-221-236
HWT 2118-10,2	180	10,2	4	27	50-221-240
HWT 2118-8+10,2	180	8,0 + 10,2	6	30	50-221-241

250-300 kVA

Type	Rated power at 20%ED kVA	Voltage-sec. V	Diode count Piece	Weight kg	Article-No.
HWT 2125-11,8	250	11,8	4	33	50-221-242
HWT 2125-10,2+11,8	250	10,2 + 11,8	6	36	50-221-243
HWT 2125-13,2	250	13,2	4	33	50-221-244
HWT 2125-10,2+13,2	250	10,2 + 13,2	6	36	50-221-245
HWT 2130-16,0	300	16,0	4	33	50-221-250

500 kVA-700kVA

Type	Rated power at 20%ED kVA	Voltage-sec. V	Diode count Piece	Weight kg	Article-No.
HWT 2150-11,8	500	11,8	6	55	50-221-252
HWT 2170-8,5+9,4	700	8,5 + 9,4	12	85	50-221-255
HWT 2170-10,7+11,8	700	10,7 + 11,8	12	85	50-221-256

Terminal box in aluminum for 80-90 kVA MF transformers — Article no. 50-221-259
Terminal box in aluminum for 180-300 kVA MF transformers — Article no. 50-221-266

Other MF transformers in various designs up to 1000 kVA on request!

34. Insulation bushes / -tubes / -pins / -plates / Dowel pins

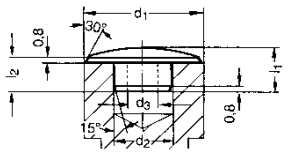
Standard insulating bushes ISO 7931 / DIN 44763 for isolating cylinder screws according to DIN 912 type A

Article-No.	40-105-014	40-105-015	40-105-017	40-105-002	40-105-003	40-105-004	40-105-005
Size	**M4**	**M5**	**M6-special**	**M6**	**M8**	**M10**	**M12**
Ø D_1	14,0	15,0	17,2	21,5	24,6	27,6	30,6
Ø d_1	8,5	9,5	10,5	10,5	13,0	15,0	17,0
T	4,5	5,5	6,5	6,5	9,3	10,5	12,8
Ø D	12,8	13,8	15,0	20,0	22,0	24,2	26,3
Ø d_2	7,3	8,3	9,5	9,5	11,6	14,2	16,2
t_1	7,8	9,3	12,0	12,0	14,0	16,0	18,2
H	12,8	14,3	17,0	17,0	19,0	21,0	23,2
Ø D_2	8,0	9,5	10,9	10,9	15,0	17,0	18,9

Insulating protection caps

Made of elastic plastic, impact and oil resistant.

insulating protection caps for DIN 912 cylinder screws



Size	Nominal size for screws according to DIN 912	Article-No.
SW3	M4	40-105-018
SW4	M5	40-105-019
SW5	M6	40-105-020
SW6	M8	40-105-021
SW8	M10	40-105-022
SW10	M12	40-105-023

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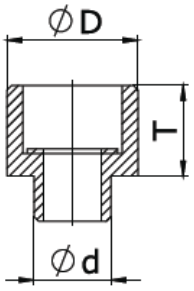
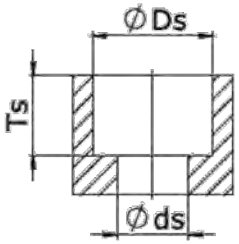
Insulating bushes - special

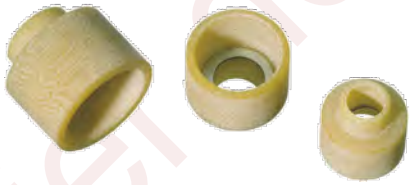
Form B

Special insulating bushes for isolating cylinder screws according to DIN 912
small design, high compressive strength

Compressive strength: 600N/mm² - up to max. 180°C temperature loadable





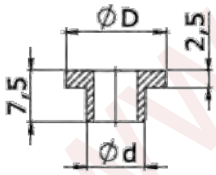


Article-No.	40-105-093	40-105-094	40-105-095	40-105-096	40-105-097	40-105-098
Size	**M4**	**M5**	**M6**	**M8**	**M10**	**M12**
Ø D	10,0	13,0	14,5	17,5	20,5	22,5
Ø d	6,5	7,5	8,5	10,5	12,5	14,5
T	7,0	9,0	10,0	12,0	14,0	16,0
Ø Ds	11,0	14,0	18,0	20,0	24,0	26,0
Ø ds	7,0	8,0	9,0	11,0	13,0	15,0
Ts	7,0	9,0	10,0	12,0	14,0	16,0

Insulating bushes - special

Form C

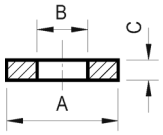
Insulating bushes without collar



Size	Ø d	Ø D	Article-No.
M4	6,5	9,0	40-105-083
M5	7,5	10,0	40-105-084
M6	8,5	13,0	40-105-085
M8	10,5	16,0	40-105-086
M10	12,5	20,0	40-105-087
M12	14,5	22,0	40-105-088

Insulating washers

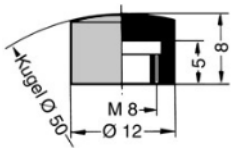
Insulating washers of HGW hard fabric



Size	Ø A	Ø B	C	Article-No.
M5	12,5	5,3	3	40-105-041
M6	16,0	6,5	4	40-105-042
M8	21,0	8,4	4	40-105-043
M10	23,0	10,5	4	40-105-044
M12	25,0	13,0	5	40-105-045

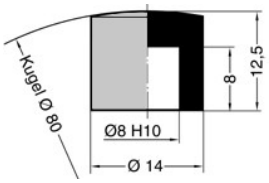
Insulating cap

Insulating cap M8 DIN 44765



Scope of application:	Article-No.
This standard applies to insulating caps for insulating screws with an M8 thread in the secondary circuit of resistance welding equipment.	40-105-024

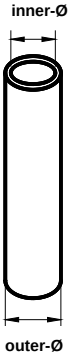
Insulating cap Form C



Scope of application:	Article-No.
see above, but to be plugged on, Ø8H10	40-105-026

Insulating tubes

Hard fabric insulating tubes
HGW 2375.4

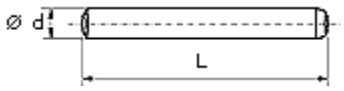


When ordering please specify the length max. 1,2m

Size	Outer-Ø	Inner-Ø	Article-No.
8 x 1	8,0	6,0	40-105-052
10 x 0,9	10,0	8,2	40-105-054
10 x 1	10,0	8,0	40-105-056
12 x 0,9	12,0	10,2	40-105-058
12 x 1	12,0	10,0	40-105-060
14 x 1	14,0	12,0	40-105-062
15 x 1,2	15,0	12,5	40-105-064
16 x 1	16,0	14,0	40-105-066
25 x 1,5	25,0	22,0	40-105-068

Insulating pins

Insulating pins of POM DIN 44764



POM
high strength; impact resistant; melting point at 175°C

Ø d	Length	Article-No.
6,0	30	40-105-030
	40	40-105-031
	50	40-105-032
8,0	30	40-105-033
	40	40-105-034
	55	40-105-035
10,0	50	40-105-036
12,0	60	40-105-038

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Insulating rods

Insulating rods made of POM
Resistant up to 100°C

Ø	Length	Article-No.
5	1000mm	40-105-220
6	1000mm	40-105-221
8	1000mm	40-105-222
10	1000mm	40-105-223
12	1000mm	40-105-224
15	1000mm	40-105-225
20	1000mm	40-105-226
25	1000mm	40-105-227
30	1000mm	40-105-228
40	1000mm	40-105-229
50	1000mm	40-105-230
60	1000mm	40-105-231
70	1000mm	40-105-232
80	1000mm	40-105-233
90	1000mm	40-105-234
100	1000mm	40-105-235
120	1000mm	40-105-236
150	1000mm	40-105-238

Hard fabric insulating rods
HGW 2088, resistant up to 120°C

Ø	Length	Article-No.
10	1000mm	40-105-248
15	1000mm	40-105-249
20	1000mm	40-105-250
25	1000mm	40-105-251
30	1000mm	40-105-252
40	1000mm	40-105-253
50	1000mm	40-105-254
60	1000mm	40-105-255
70	1000mm	40-105-256
80	1000mm	40-105-257
90	1000mm	40-105-258
100	1000mm	40-105-259

Insulating plates

Insulating plates made of hard paper HP 2061, resistant up to 120°C

Thickness	Dimensions	Article-No.
0,5	300 x 200 x 0,5mm	40-105-260
1	300 x 200 x 1,0mm	40-105-261
2	300 x 200 x 2,0mm	40-105-262
3	300 x 200 x 3,0mm	40-105-263
4	300 x 200 x 4,0mm	40-105-264
5	300 x 200 x 5,0mm	40-105-265
6	300 x 200 x 6,0mm	40-105-266
8	300 x 200 x 8,0mm	40-105-268
10	300 x 200 x 10,0mm	40-105-270
12	300 x 200 x 12,0mm	40-105-271
15	300 x 200 x 15,0mm	40-105-272
20	300 x 200 x 20,0mm	40-105-273
25	300 x 200 x 25,0mm	40-105-274
30	300 x 200 x 30,0mm	40-105-275
40	300 x 200 x 40,0mm	40-105-276
50	300 x 200 x 50,0mm	40-105-277

Hard fabric insulating plates HGW 2372.1, resistant up to 130°C

Thickness	Dimensions	Article-No.
0,5	300 x 200 x 0,5mm	40-105-280
1	300 x 200 x 1,0mm	40-105-281
2	300 x 200 x 2,0mm	40-105-282
3	300 x 200 x 3,0mm	40-105-283
4	300 x 200 x 4,0mm	40-105-284
5	300 x 200 x 5,0mm	40-105-285
6	300 x 200 x 6,0mm	40-105-286
8	300 x 200 x 8,0mm	40-105-288
10	300 x 200 x 10,0mm	40-105-290
12	300 x 200 x 12,0mm	40-105-291
15	300 x 200 x 15,0mm	40-105-292
20	300 x 200 x 20,0mm	40-105-293
25	300 x 200 x 25,0mm	40-105-294
30	300 x 200 x 30,0mm	40-105-295
35	300 x 200 x 35,0mm	40-105-296
40	300 x 200 x 40,0mm	40-105-297

Other dimensions on request!

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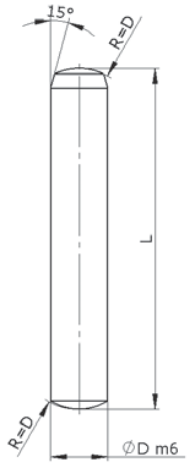
Dowel pins - ceramic

Dowel pins according to DIN 6325
made of high-performance ceramic Z-101
zirconia

Tolerance ØD m6

Color:	white
Bending strength:	1.000 MPa
Compressive strength:	3.000 MPa
Impact strength:	8,0 MPa $m^{1/2}$
Vickers hardness:	1.300 $HV_{0,5}$
Thermal shock resistance:	ΔT 270°C



Ø D	Length	Article-No.
1,5	5	40-105-683
2,0	6	40-105-689
	12	40-105-693
3,0	10	40-105-702
	14	40-105-704
	20	40-105-707
	28	40-105-709
4,0	10	40-105-722
	16	40-105-725
	20	40-105-727
	32	40-105-730
5,0	16	40-105-745
	20	40-105-747
	24	40-105-748
	28	40-105-749
	32	40-105-750
	36	40-105-751
6,0	14	40-105-764
	20	40-105-767
	24	40-105-768
	28	40-105-769
	32	40-105-770
	40	40-105-772
	50	40-105-774
	60	40-105-775
8,0	20	40-105-797
	24	40-105-798
	32	40-105-800
	40	40-105-802
	50	40-105-804
	60	40-105-805
	70	40-105-806
10,0	24	40-105-818
	32	40-105-820
	40	40-105-822
	50	40-105-824
	60	40-105-825
	70	40-105-826
	90	40-105-828
12,0	28	40-105-840
	40	40-105-842
	60	40-105-845
14,0	40	40-105-862

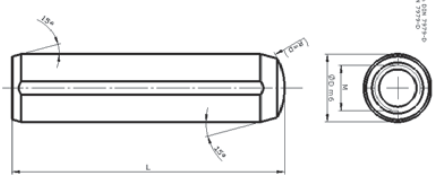
Other sizes on request!

Pull dowel pins - ceramic, with inner thread

Dowel pins according to DIN 7979-D
made of high-performance ceramic Z-101
zirconia

Tolerance ØD m6

Color:	white
Bending strength:	1.000 MPa
Compressive strength:	3.000 MPa
Impact strength:	8,0 MPa $m^{½}$
Vickers hardness:	1.300 $HV_{0,5}$
Thermal shock resistance:	ΔT 270°C



Ø / Thread	Length	Article-No.
6,0 / M4	14	40-105-924
	20	40-105-927
	24	40-105-928
	32	40-105-930
	40	40-105-932
	50	40-105-934
	60	40-105-935
8,0 / M5	20	40-105-947
	32	40-105-950
	40	40-105-952
	50	40-105-954
	60	40-105-955
	70	40-105-956
10,0 / M6	24	40-105-968
	32	40-105-970
	40	40-105-972
	50	40-105-974
	60	40-105-975
	70	40-105-976
	90	40-105-978
12,0 / M6	28	40-105-979
	40	40-105-982
	60	40-105-985
14,0 / M8	40	40-105-992

Other sizes on request!

Ceramic positioning pins – composite solutions
according to drawings

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35. Hose fittings and hoses

Threaded connectors / double nipples
B with inner cone
(Brass)

Thread A - Thread B	Length	SW	Article-No.
R 1/4“ - R 1/4“	26	14	40-138-981
R 1/8“ - M12x1 / DN 6	23	14	40-130-010
R 1/4“ - M12x1 / DN 6	28	14	40-130-011
R 1/4“ - M16x1,5 / DN 10	28	19	40-130-012
R 3/8“ - M16x1,5 / DN 10	28	19	40-130-013
R 1/2“ - M22x1,5 / DN 12	34	24	40-130-014
M12x1 - M12x1 / DN 6	28	14	40-130-015
M14x1 - M12x1 / DN 6	28	14	40-130-016

Elbow screw nipples 90° + 45°
B with inner cone
(Brass)

Thread A - Thread B	Angle	SW	Article-No.
R 1/8“ - M12x1 / DN 6	90°	10	40-130-120
R 1/4“ - M12x1 / DN 6	90°	13	40-130-122
R 1/4" - M16x1,5 / DN 10	90°	14	40-130-125
R 1/8“ - M12x1 / DN 6	45°	10	40-130-130
R 1/4“ - M12x1 / DN6	45°	13	40-130-132
R 1/4“ - M16x1,5 / DN 10	45°	14	40-130-135

Union nut + sealing cone
(Brass)

Designation	Thread/ Connection	SW	Article-No.
Union nut	M12x1 / Ø9,2	14	40-130-316
Union nut	1/4“ / Ø9,5	17	40-130-317
Sealing cone	for hose inner-Ø 8 mm		40-130-319
Union nut	1/4“ / Ø10,2	17	40-130-322
Sealing cone	for hose inner -Ø 9 mm		40-130-325
Union nut	3/8“ / Ø12,5	19	40-130-326
Sealing cone	for hose inner -Ø 9 mm		40-130-329
Union nut	1/2“ / Ø15,3	27	40-130-332
Sealing cone	for hose inner -Ø 13 mm		40-130-335

Hose connector with external thread

Thread – hose size	Length	SW	Article-No.
G 1/8“a - 9 mmØi	35	14	40-130-336
G 1/4“a - 9 mmØi	35	17	40-130-337
G 3/8“a - 9 mmØi	50	17	40-135-729
G 1/2“a - 9 mmØi	60	22	40-135-759
G 1/2“a - 13 mmØi	60	22	40-135-763
G 3/4“a - 19 mmØi	60	32	40-135-692
G 1“a - 25 mmØi	70	36	40-135-695

Hose connector with internal thread

Thread – hose size	Length	SW	Article-No.
G 1/8“i - 8 mmØi	31	12	40-136-648
G 1/4“i - 9 mmØi	33	17	40-136-660
G 3/8“i - 9 mmØi	33	19	40-136-675
G 3/8“i - 13 mmØi	40	19	40-136-679
G 1/2“i - 9 mmØi	36	24	40-136-685
G 1/2“i - 13 mmØi	43	24	40-136-690

Hose fittings and hoses

PVC fabric hose, crystal clear

Inner-Ø x wall thickness	Outer-Ø	Max. pressure	Article-No.
6 x 3,0	12	23 bar	40-125-106
8 x 3,0	14	22 bar	40-125-107
9 x 3,0	15	19 bar	40-125-108
13 x 3,5	20	13 bar	40-125-111
19 x 4,0	27	12 bar	40-125-114
25 x 4,5	34	9 bar	40-125-115

Textile fabric hose, PZA

Inner-Ø x wall thickness	Outer-Ø	Max. pressure	Article-No.
PZA 5 / 4,5 x 2,5	9,5	10 bar	40-125-028
PZA 6 / 5,5 x 2,5	10,5	10 bar	40-125-030
PZA 8 / 7,5 x 2,5	12,5	10 bar	40-125-032
PZA 10 / 9,0 x 2,5	14,0	10 bar	40-125-034

2-ear clamps, galvanized

Clamping range-Ø in mm	Tape width	*PU	Article-No.
05-07	6	25 St.	40-140-107
07-09	7	25 St.	40-140-109
09-11	7	25 St.	40-140-111
11-13	7	25 St.	40-140-113
13-15	7,5	25 St.	40-140-115
15-17	8	25 St.	40-140-117

*packaging unit

1-ear clamps stepless, stainless steel

Clamping range -Ø in mm	Tape width	PU	Article-No.
8,8-10,5	5	25 St.	40-140-130
9,6-11,3	5	25 St.	40-140-131
10,8-13,3	7	25 St.	40-140-133
12,8-15,3	7	25 St.	40-140-135
15,0-17,5	7	25 St.	40-140-137

Clamping tongs

Designation	Article-No.
Clamping tongs – with side cutting edge Mounting help for ear clamps	40-140-195

Stainless steel hose clamps

Clamping range -Ø in mm	Tape width	Article-No.
08-12	7,5	40-140-005
08-16	9	40-140-010
12-22	9	40-140-015
16-27	9	40-140-020
20-32	9	40-140-025
25-40	12	40-140-045
35-50	12	40-140-050
50-70	12	40-140-055

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Hose connectors and hoses

Hose connection for plug-in hose

Plug-in hose connector straight
Brass

Hose size / Thread	SW	Article-No.
DN 6 - M12x1	14	40-130-350
DN 10 - M16x1,5	19	40-130-352
DN 12 - M22x1,5	27	40-130-354
DN 16 - M26x1,5	32	40-130-356

Plug-in hose connector - 45° angled
Brass

Hose size / Thread	SW	Article-No.
DN 6 - M12x1	14	40-130-370
DN 10 - M16x1,5	19	40-130-372
DN 12 - M22x1,5	27	40-130-374

Plug-in hose connector - 90° angled
Brass

Hose size / Thread	SW	Article-No.
DN 6 - M12x1	14	40-130-360
DN 10 - M16x1,5	19	40-130-362
DN 12 - M22x1,5	27	40-130-364

Plug-in hose 837BM
For temperature range -40/+100°C.
Abrasion, oil and weather resistant.
Outer layer made of synthetic rubber.

Size	Color	Inner Ø	Outer Ø	Max. pressure	Article-No.
DN 6 - 1/4“	black	6,3	12,7	24 bar	40-125-204
DN 10 - 3/8“	black	9,5	15,9	20 bar	40-125-206
DN 12 - 1/2“	black	12,7	19,8	20 bar	40-125-208
DN 16 - 5/8“	black	15,9	23,0	20 bar	40-125-210
DN 6 - 1/4“	red	6,3	12,7	24 bar	40-125-224
DN 10 - 3/8“	red	9,5	15,9	20 bar	40-125-226
DN 12 - 1/2“	red	12,7	19,8	20 bar	40-125-228
DN 6 - 1/4“	blue	6,3	12,7	24 bar	40-125-244
DN 10 - 3/8“	blue	9,5	15,9	20 bar	40-125-246
DN 12 - 1/2“	blue	12,7	19,8	20 bar	40-125-248
DN 6 - 1/4“	green	6,3	12,7	24 bar	40-125-264
DN 10 - 3/8“	green	9,5	15,9	20 bar	40-125-266
DN 12 - 1/2“	green	12,7	19,8	20 bar	40-125-268

High-impedance plug-in hose
for thyristor power parts

DN 6 - 1/4“	black	6,3	12,3	24 bar	40-125-100

36. Quick release couplings

Couplings „one-way shut-off“
Type 21 „mini“

Coupling with external thread
Brass

Connection	Type	NW	Ø	SW	Article-No.
G 1/8“	21	5	16	14	40-133-200
G 1/4“	21	5	16	17	40-133-204
G 3/8“	21	5	16	19	40-133-208

Coupling with internal thread
Brass

Connection	Type	NW	Ø	SW	Article-No.
G 1/8“	21	5	16	14	40-133-210
G 1/4“	21	5	16	17	40-133-214
G 3/8“	21	5	16	19	40-133-218

Coupling with hose connection
Brass

Connection	Type	NW	Ø	SW	Article-No.
6 mm	21	5	16	14	40-133-226
8 mm	21	5	16	14	40-133-228
9 mm	21	5	16	14	40-133-229
DN 6 / Steckschl.	21	5	16	14	40-133-231

Plug-in nozzle with hose connection
Brass

Connection	Type	NW	Length	Article-No.
6 mm	21	5	32	40-133-306
8 mm	21	5	32	40-133-308
9 mm	21	5	32	40-133-309
DN 6 / nozzle	21	5	32	40-133-305

Plug-in nipple with external thread
Brass

Connection	Type	NW	SW	Article-No.
G 1/8“	21	5	14	40-133-310
G 1/4“	21	5	17	40-133-314

Plug-in nipple with internal thread
Brass

Connection	Type	NW	SW	Article-No.
G 1/8“	21	5	14	40-133-321
G 1/4“	21	5	17	40-133-324

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Quick release couplings

Couplings „one-way shut-off“
Type 26

Coupling with external thread
Brass

Connection	Type	NW	Ø	SW	Article-No.
G 1/8“	26	7,2	27	22	40-133-003
G 1/4“	26	7,2	27	22	40-133-004
G 3/8“	26	7,2	27	22	40-133-008
G 1/2“	26	7,2	27	22	40-133-012

Coupling with internal thread
Brass

Connection	Type	NW	Ø	SW	Article-No.
G 1/4“	26	7,2	27	22	40-133-024
G 3/8“	26	7,2	27	22	40-133-028
G 1/2“	26	7,2	27	22	40-133-032

Coupling with hose connection
Brass

Connection	Type	NW	Ø	SW	Article-No.
9 mm	26	7,2	27	22	40-133-039
13 mm	26	7,2	27	22	40-133-043
DN 6	26	7,2	27	22	40-133-044
DN 10	26	7,2	27	22	40-133-045

Plug-in nozzle with hose connection
Brass

Connection	Type	NW	Length	Article-No.
6 mm	26	7,2	45	40-133-056
8 mm	26	7,2	45	40-133-058
9 mm	26	7,2	45	40-133-059
10 mm	26	7,2	48	40-133-060
13 mm	26	7,2	48	40-133-063
DN 6	26	7,2	43	40-133-064
DN 10	26	7,2	46	40-133-065

Plug-in nipple with external thread
Brass

Connection	Type	NW	SW	Article-No.
G 1/8“	26	7,2	14	40-133-070
G 1/4“	26	7,2	17	40-133-074
G 3/8“	26	7,2	19	40-133-078
G 1/2“	26	7,2	22	40-133-082

Plug-in nipple with internal thread
Brass

Connection	Type	NW	SW	Article-No.
G 1/8“	26	7,2	14	40-133-090
G 1/4“	26	7,2	17	40-133-094
G 3/8“	26	7,2	19	40-133-098
G 1/2“	26	7,2	22	40-133-102

Quick release couplings

Couplings „double shut-off“

Closing coupling
Brass

Connection	Type	NW	Ø	SW	Article-No.
G 1/4“ inner	72	6,0	28,5	19	40-132-804
G 3/8“ inner	73	7,5	35,0	22	40-132-806
G 1/2“ inner	74	11,0	44,5	27	on request

Closing nipple
Brass

Connection	Type	NW	SW	Article-No.
G 1/4“ inner	72	6,0	19	40-132-822
G 3/8“ inner	73	7,5	22	40-132-824
G 1/2“ inner	74	11,0	27	on request

Attention: Only couplings and plugs of the same type fit together!

Marking rings, red/blue

Color	Inner Ø	PU	Article-No.
red	1/4"	10 pcs.	40-133-360
blue	1/4“	10 pcs.	40-133-361

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37. Brass fittings

Double nipple with inner cone

Thread A - Thread B	Length	SW	Article-No.
G 1/8“a - G 1/8“a	21	14	40-135-818
G 1/8“a - G 1/4“a	23	17	40-135-823
G 1/4“a - G 1/4“a	23	17	40-135-830
G 1/4“a - G 3/8“a	27	19	40-135-840
G 1/4“a - G 1/2“a	27	24	40-135-850
G 3/8“a - G 3/8“a	27	19	40-135-855
G 3/8“a - G 1/2“a	28	24	40-135-865
G 1/2“a - G 1/2“a	30	24	40-135-870
G 1/2“a - G 3/4“a	36	32	40-135-875
G 3/4“a - G 3/4“a	40	32	40-135-885
G 3/4“a - G 1“a	42	36	40-135-890
G 1“a - G 1“a	42	36	40-135-895

Reducing nipple

Thread a - Thread i	Length	SW	Article-No.
G 1/4“a - G 1/8“i	9	14	40-136-100
G 3/8“a - G 1/8“i	9	19	40-136-110
G 3/8“a - G 1/4“i	9	19	40-136-105
G 1/2“a - G 1/4“i	14	22	40-136-120
G 1/2“a - G 3/8“i	14	22	40-136-125
G 3/4“a - G 1/4“i	12	27	40-136-130
G 3/4“a - G 3/8“i	12	27	40-136-135
G 3/4“a - G 1/2“i	12	27	40-136-140
G 1“a - G 1/2“i	14	34	40-136-150
G 1“a - G 3/4“i	14	34	40-136-160
G 1 1/4“a - G 1/2“i	15	42	40-136-170
G 1 1/4“a - G 3/4“i	15	42	40-136-180
G 1 1/4“a - G 1“i	15	42	40-136-190

Reducer

Thread i - Thread a	Length	SW	Article-No.
G 1/4“i - M 12x1a	26	17	40-130-080
G 1/4“i - M 16x1,5a	26	17	40-130-085
G 1/8“i - G 1/8“a	21	14	40-136-202
G 1/4“i - G 1/8“a	26	17	40-136-206
G 1/4“i - G 1/4“a	28	17	40-136-208
G 3/8“i - G 1/4“a	29	19	40-136-212
G 1/2“i - G 3/8“a	32	24	40-136-218
G 3/4“i - G 1/2“a	31	32	40-136-230

Angle 90° - 2 x internal thread

Size	Ø	Article-No.
G 1/8“i	14	40-136-520
G 1/4“i	17	40-136-525
G 3/8“i	22	40-136-530
G 1/2“i	24	40-136-535
G 3/4“i	30	40-136-540
G 1“i	38	40-136-545

Brass fittings

Angle 90° - external thread / internal thread

Size	Ø	Article-No.
G 1/4“i - a	17	40-136-633
G 3/8“i - a	22	40-136-634
G 1/2“i - a	24	40-136-635
G 3/4“i - a	30	40-136-636
G 1“i - a	38	40-136-637

T-piece - 3 x internal thread

Size	Ø	Article-No.
G 1/8“i	14	40-136-570
G 1/4“i	17	40-136-575
G 3/8“i	22	40-136-580
G 1/2“i	24	40-136-585
G 3/4“i	30	40-136-590
G 1“i	38	40-136-591

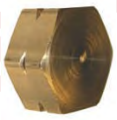
Angle 90° - 2 x external thread with inner cone

Size	SW	Article-No.
G 1/8“a	10	40-136-600
G 1/4“a	11	40-136-604
G 3/8“a	15	40-136-608
G 1/2"a	18	40-136-612

T-piece - 3 x external thread, with inner cone

Size	SW	Article-No.
G 1/4“a	13	40-136-622
G 3/8“a	14	40-136-624
G 1/2“a	17	40-136-626

Closing caps with internal thread



Size	L	SW	Article-No.
G 1/8“i	9,5	13	40-136-800
M12x1i	14	14	40-136-802
G 1/4“i	12	17	40-136-804
M16x1,5i	19	19	40-136-806
G 3/8“i	12	19	40-136-808
G 1/2“i	15	24	40-136-812
G 3/4“i	15	30	40-136-816
G 1“i	15	36	40-136-825

Screw plug – with hexagon socket

Size	Ø	L	SW - Inner	Article-No.
R 1/8“	14	11	5	40-136-885
R 1/4“	18	15	7	40-136-886
R 3/8“	22	15	8	40-136-888
R 1/2“	26	18	10	40-136-889
R 3/4“	32	20	13	40-136-890
R 1“	39	21	17	40-136-891

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Brass fittings

Plug – with hexagon socket

Size	L	SW - Inner	Article-No.
R 1/8“	5	5	40-130-753
R 1/4“	8	7	40-130-757
R 3/8“	10	8	40-130-759

Sleeves / round

Size	L	Ø	Article-No.
G 1/8“ / round	16	15	40-136-900
G 1/4“ / round	24	18	40-136-904
G 3/8“ / round	24	23	40-136-908
G 1/2“ / round	32	28	40-136-912
G 3/4“ / round	34	34	40-136-916
G 1“ / round	32	42	40-136-920

Sleeves / hexagonal (hx)

Size	L	SW	Article-No.
G 1/8“ / 6-hx.	22	14	40-136-960
G 1/4“ / 6-hx.	26	17	40-136-970
G 3/8“ / 6-hx.	26	22	40-136-980
G 1/2“ / 6-hx.	30	27	40-136-985
G 3/4“ / 6-hx.	36	32	40-136-990
G 1“ / 6-hx.	40	41	40-136-995

PVC-Seals

Size	Dimension	VE	Article-No.
G 1/8“	(13x10,0øx1,5mm)	50 pcs.	40-132-013
G 1/4“	(18x13,2øx2,0mm)	50 pcs.	40-132-018
G 3/8“	(22x17,0øx2,0mm)	50 pcs.	40-132-022
G 1/2“	(28x21,0øx2,0mm)	50 pcs.	40-132-028
G 3/4“	(33x26,5øx2,0mm)	50 pcs.	40-132-033

38. Ball valves

Small ball valves - 314

Connection	L	DN	SW	Article-No.
G 1/4“ i - a	55	10	19	40-132-051
G 1/4“ i	47	10	19	40-132-041
G 3/8“ i	50	10	22	40-132-042
G 1/2“ i	52	15	24	40-132-043
G 3/4“ i	57	20	32	on request
G 1“ i	68	25	41	on request

Ball valves with lever handle - 10

Connection	L	DN	SW	Article-No.
G 1/4“ i	47	10	19	40-132-100
G 3/8“ i	50	10	22	40-132-101
G 1/2“ i	64	15	27	40-132-102
G 3/4“ i	74	20	32	40-132-103
G 1“ i	88	25	41	40-132-104
G 1 1/4“ i	101	32	49	on request
G 1 1/2“ i	105	40	55	on request

39. Other accessories

Flow control

Type	Article-No.
2-circuit-battery	40-135-202
3-circuit-battery	40-135-203
4-circuit-battery	40-135-204
5-circuit-battery	40-135-205
6-circuit-battery	40-135-206
7-circuit-battery	40-135-207

Up to 16 measuring and control circuits possible, adjustable forward and reverse.

Spare parts	Article-No.
Measuring housing complete with hose connection Ø10	40-135-210
Valve with housing connection	40-135-211
Valve with hose connection Ø10	40-135-212

Quartz water filter

Flow monitor and temperature sensor, electronic

Vibration damper for elastic mounting of the welding machines, without anchoring to the ground

All-metal vibration damper with height adjustment screw + anti-slip plate

Type-thread / total machine weight	Static load	Natural frequency	Max. dynamic load	Article-No.
V43 H - M12 / up to 1t	0,5-2,5 kN	25-30 Hz	12,5 kN	35-365-025
SP 43 - M16 / up to 1t	0,5-2,5 kN	25-30 Hz	12,5 kN	35-365-030
V 44 H - M16 / over 1t	2,0-30 kN	25-30 Hz	70,0 kN	35-365-035

Other parts

Combination maintenance unit

Connection: G1/2“
Control range: 0,5 - 6 bar
Flow: 1400 l/min

With protective basket, holder and hand drain valve.

Article-No. 40-135-630

Special pneumatic air oil

Viscosity at +40°C: ca. 43 mm²/s
Density at 15°C: ca. 0,87 g/cm³
Flash point: 225 °C

Can 500ml
Article-No. 32-405-095

Electrode grease - contact fix

Viscosity at +40°C: ca. 90 mm²/s
Density at 15°C: ca. 0,93 g/cm³
Flash point: 200 °C

Can 250g
Article-No. 40-100-432

Anti-corrosion agent - VARIDOS 1+1
It is a tested, anodic and cathodic protection agent for closed water systems.

pH value: 8,7 ±0,2
Density at 20°C: ca. 1,16 g/cm³
Freezing point: -10 °C

Application:
1-2 kg VARIDOS 1+1 per 100 liters of cooling water, renew the concentrate every year.

Special grease for roller heads

CEPLATTYN

Can 1kg
Article-No. 40-100-437

Container 2kg
Article-No. 40-190-010

Safety marking
Prohibited for people with pacemakers

Sticker Ø 50mm
Article-No. 90-810-205

Sticker Ø100mm
Article-No. 90-810-210

Safety marking
Strong magnetic field

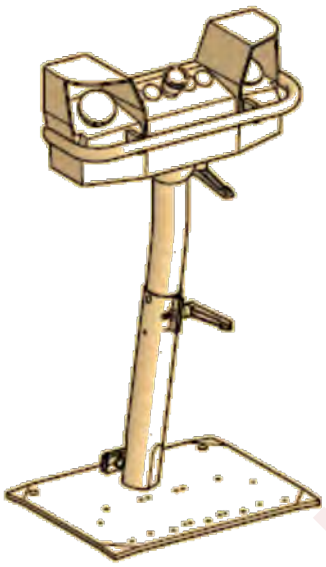
Sticker 50mm
Article-No. 90-810-215

Other parts

Foot switch 1-fold, for single stroke
with accident protection hood
Article-No. 40-175-120

Foot switch 1-fold, for single stroke
with pressure point (for „powerless placement“)
with accident protection hood
Article-No. 40-175-133

Foot switch 2-fold, for double stroke
with accident protection hood
left grid / right button
Article-No. 40-175-126



Stand start desk
for two-hand safety start

1 power circuit
Article-No. 40-235-025

2 power circuits
Article-No. 40-235-026

Two-hand safety start
24VAC/DC
(suitable for press safety)
Article-No. 40-235-015

Foot switch with connection cable and plug:

Foot switch for single stroke

Description	Article-No.
Foot switch, 1-fold	40-175-140
Foot switch, 1-fold with pressure point	40-175-141
Foot switch, 2-fold, Power I + Power II	40-175-150
Foot switch, 2-fold, Power I + Power II, with pressure point	40-175-151

Foot switch for double stroke

Description	Article-No.
Foot switch, 2-fold	40-175-142
Foot switch, 2-fold with pressure point	40-175-143
Foot switch, 3-fold, Power I - pre-stroke - Power II	40-175-152
Foot switch, 3-fold, Power I - pre-stroke - Power II, with 2x pressure points	40-175-153

or special versions on request!

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40. Electrode cutters

Electrode file
Article-No. 40-100-181

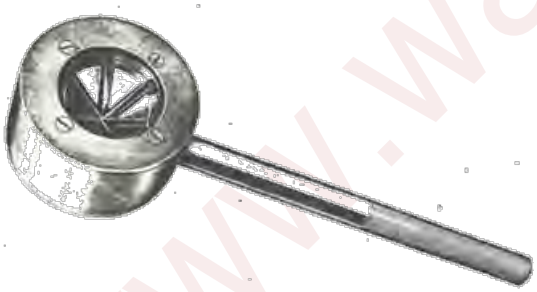
Electrode sharpener
for electrodes 10mmØ **Article-No. 60-017-552**
for electrodes 12mmØ **Article-No. 60-017-554**

Electrode shape: round

Electrode re-twisting device-hand
Electrode sharpener

120° cutting on both sides
Height 12mm
Cutting blades not replaceable

Article-No. 40-100-012



Electrode re-twisting device-hand

Type: F A V O R I T

For quickly re-tightening spot welding electrodes. Under normal contact pressure, the FAVORIT is turned by hand in the cutting direction, using the principle of a ratchet.

Type 1
90° cutting on both sides, height 25mm, for electrodes up to 20mmØ
Article-No. 40-100-010

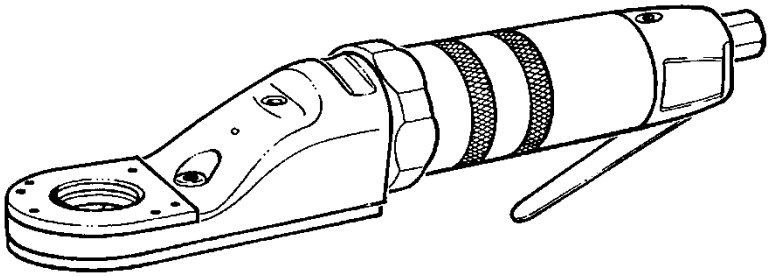
Set of replacement knives 90°
Article-No. 40-100-015

Type 2
120° cutting on both sides, height 25mm, for electrodes up to 30mmØ
Article-No. 40-100-011

Set of replacement knives 120°
Article-No. 40-100-016

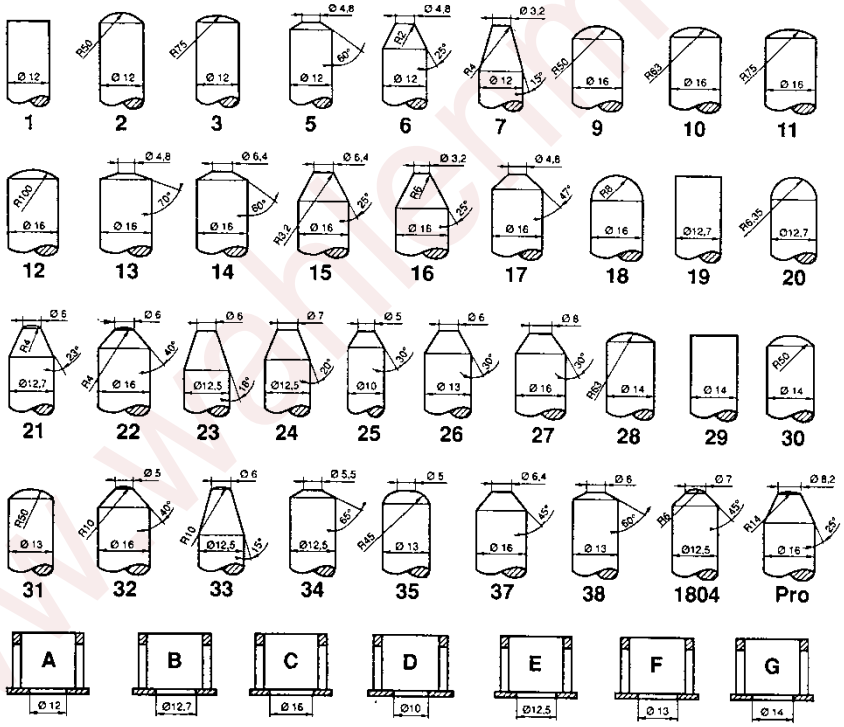
Pneumatic electrode cutters

Unilateral editing of electrodes and electrode caps in the installed state.



Type	EDV 16
Electrode-Ø	10 - 16 mm
Rotational speed	1500 rpm
Weight	1,6 kg
Flat head height	19 mm
Article-No.	**40-100-055**

Cutting tools for Type: EDV16 / H-1000



To recut the electrodes shown, cutting blades are inserted into the corresponding sleeves (marked with letters).

All knives and sleeves can also be ordered individually. However, they can only be used as a set consisting of a knife and sleeve.

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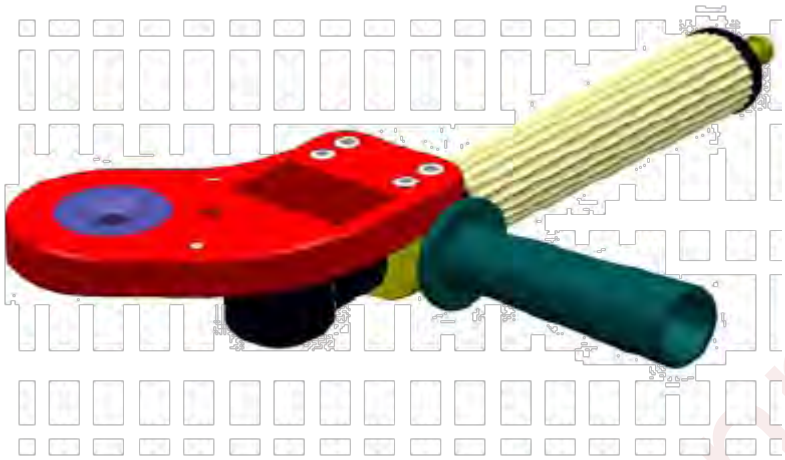
Pneumatic electrode cutters

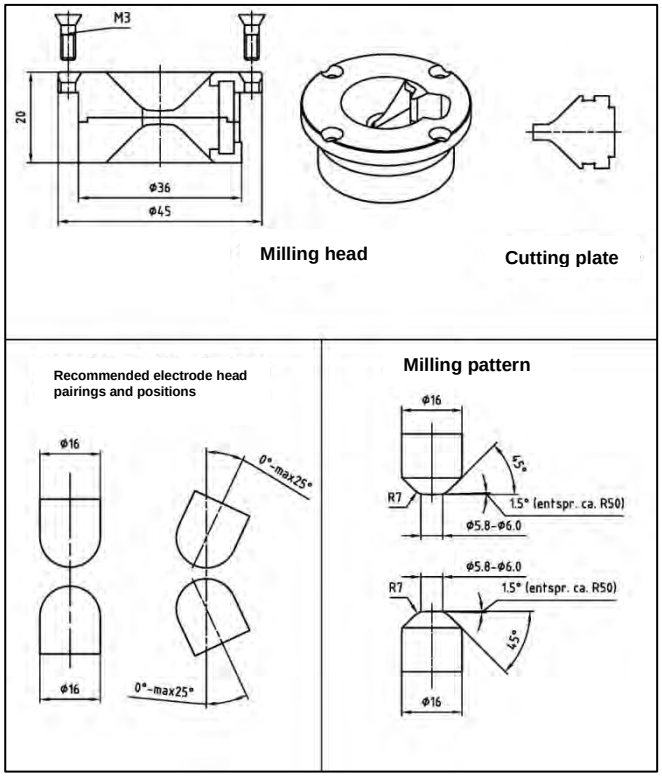
Electrode cap cutter manual 2400
This hand-held electrode cap cutter is specially designed for the mechanical finishing of electrode caps on hand-held transformer welding guns and cable welding guns. By using an exchangeable milling head, it is possible to machine rotationally symmetrical electrode caps of different diameters and geometries on **both sides** at the same time.



Type	2400.000.10
Torque	90 Nm
Rotational speed	170 rpm
Operating pressure	5,5 - 6,3 bar
Air consumption	190 l/min
Recommended e-force	130 daN
Noise level	73 dB(A)
Weight	2,5 kg
Flat head height	20 mm
Article-No.	**40-100-120**

Electrode cap cutter manual 2400
Delivery does not include milling head and cutting plate.

Milling head - screw cap with cutting plate
is designed for appropriate electrode pairing.



Stationary electrode cap cutters

Stationary electrode cap cutter 3000 for robot welding guns
Stationary electrode cap cutters are used for the mechanical finishing of electrode caps. The cap cutter is attached to the floor in the robot welding system using an infinitely height-adjustable stand. By using an exchangeable milling head, it is possible to machine any rotationally symmetrical cap shape.

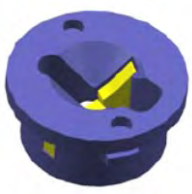
Type	3000 - standard
Connection voltage	3x400 V / 50 Hz
Nominal power	0,7 kW
Nominal speed	280 rpm
Control voltage	24 V DC
Compressed air connection	4 - 6 bar
Recommended E-force	120 daN cap-Ø13 150 daN cap-Ø16 170 daN cap-Ø20
Start milling time	2 x 1,5 sec.
Normal milling time	0,8 - 1,5 sec.
Article-No.	**40-100-130**

Standard equipment

- Cutter base body with electric drive
- Rotary movement query
- Standard milling head with cutting plate
- Electrical control box for controlling the drive
- Pneumatic equipment for chip removal system
- Chip removal system for safe removal of chips from the milling area
- Height adjustable stand

Optional:

- Different construction variants of the milling cutter position (horizontal, 180° vertical, 90° vertical, 0° vertical)
- Test sensor for welding cap surface (optical sensor)
- Test sensor for the electrode force (force sensor)
- Test sensor for the welding current (current sensor)
- Automatic cap changer



Milling head - screw cap with cutting plate
is designed for appropriate electrode pairing.

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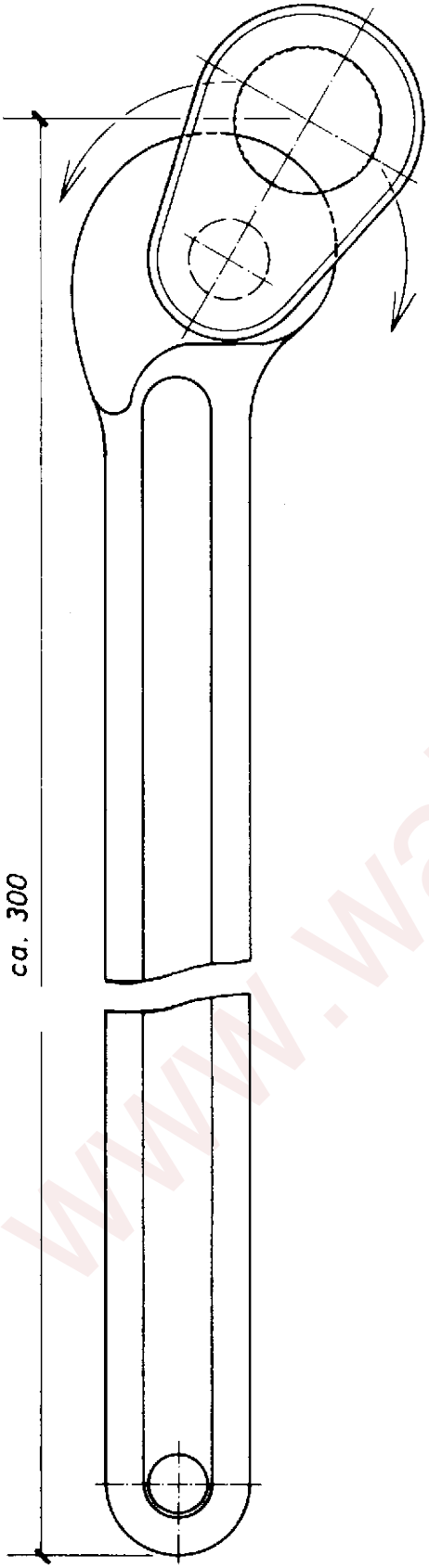
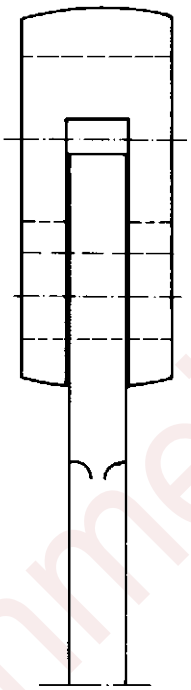
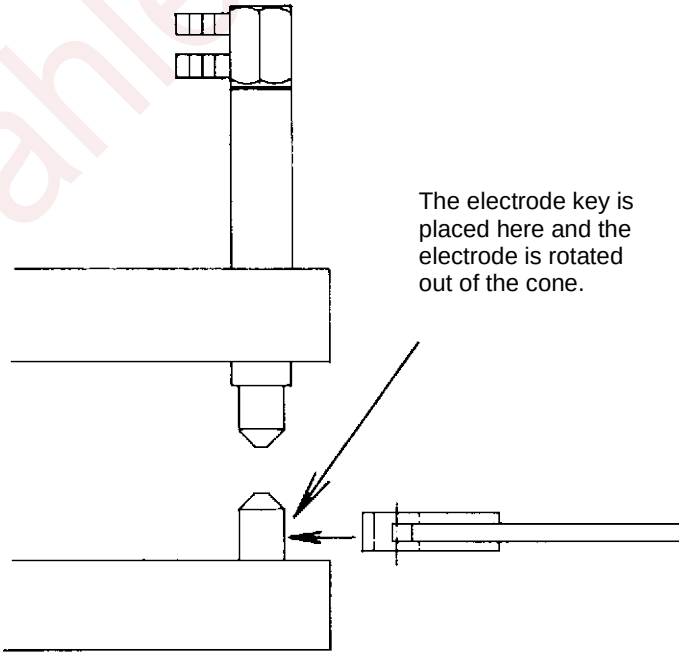
41. Electrode wrench





Key width = 10 mm

Article-No.: 40-100-410

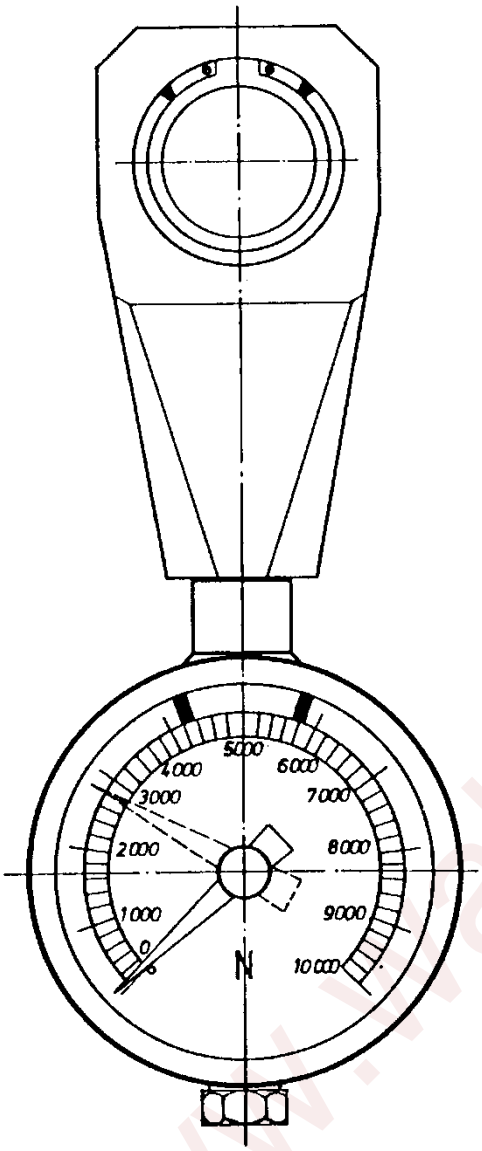


The electrode key is placed here and the electrode is rotated out of the cone.

For electrodes up to 20 Ø

42. Electrode force- and current measuring devices

Hydraulic force measuring devices



Version for the following measuring ranges:

Force measuring range until:	Article-No.
600 daN	40-100-020
1.000 daN	40-100-021
1.600 daN	40-100-022
3.150 daN	40-100-023
5.000 daN	40-100-024

For measuring electrode force under operating conditions

- with insulated electrode support (no need to switch off the welding current)
- pressure gauge with damped pointer and drag pointer
- high accuracy of ± 100 N from 1000 N nominal force
- required electrode stroke min. 20mm
- complete with bag

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Mobile measuring device for resistance welding systems 1600-S
Current and force measurement

This instrument ensures the quality of your production and the proper function of the welding machine. Ideal use to set up or sampling.

For measuring welding current and electrode force

It is suitable for measuring:
- alternating current machines (AC),
- three-phase direct current (DC) machines
- medium frequency machines (DC)
- capacitor welding machines (CD)

Technical features 1600-S (51-041-041)

- switchable suppression time (measured value suppression)
- measured value memory (saves the last 10 measurements)
- Display of the current measurement curve via oscilloscope
- Display of the force measurement curve via oscilloscope
- including transport case, independent battery operation
- including current measuring belt 270mmØ
- RS-232 data interface

Options

- serial connection cable (51-041-015)
- force measuring head up to 200daN
- force measuring head up to 2,000daN
- force measuring head up to 10,000daN

Display

equal- and alternating current: current, current time and flow angle

Electrode force: maximum, initial and final welding force

Measuring ranges

Current: 2,0 - 20 - 200kA eff. (RMS)
2,8 - 28 - 280kA peak
2,8 - 28 - 280kA direct current (DC)

Current time: in periods (AC) 0,5-99,5 per.
in ms (DC) 1-1000ms

Electrode force: up to 10.000daN
(depending on force measuring head)

up to 200daN (51-041-044)
up to 2.000daN (51-041-046)
(flat version)

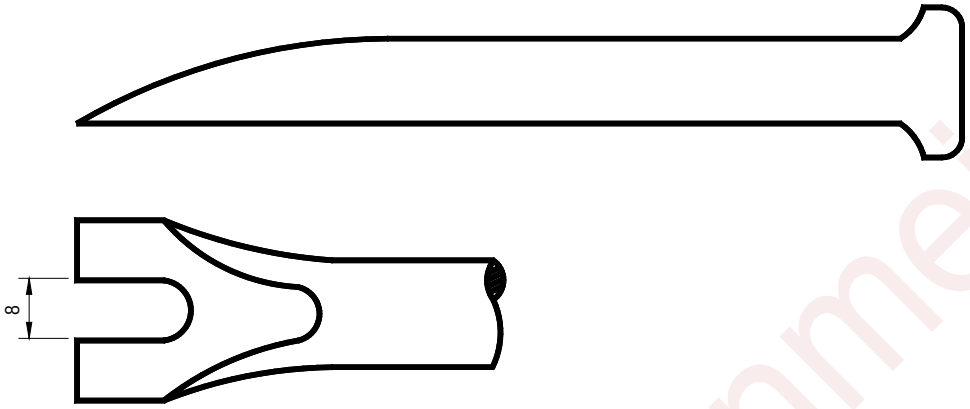
up to 1.200daN (51-041-047)
(with reduced diameter)

up to 10.000daN (51-041-048)

43. Testing equipment for spot welded joints

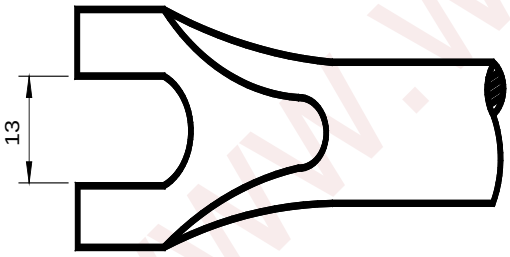
Workshop attempt to assess resistance spot welded joints:

Workshop proceedings of the chisel trying have proven itself as among others. Doing mostly single or series spot welding in simple testers or directly on the object without capturing a certain reading are claimed to fracture. The type of fraction and size of the welding slug cut off are criteria for assessing the loading capacity of the coupling.



Test chisel for spot diameter up to 8 mm 318 - ROWA

Article-No. 40-100-318



Test chisel for point diameter up to 13 mm 319 - ROWA

Article-No. 40-100-319

According to DVS 2916 testing of spot welded joints!

Testing equipment

Torque wrench, electronic
with replaceable insertion tool

Type 1: IZO-D
The IZO-D torque wrench combines the accuracy and is easily work by modern electronic rotary - moment work with a **tangible signal**, when the set torque value is reached. The intense noticeable sensors directly capture the correct measurement of your hand.

- Stainless steel housing with shockproof, shatterproof display
- Handle made of non-slip glass fiber nylon with integrated Santoprene soft grip
- Measuring ranges programmable in Nm, Lbf.ft and Lbf.in
- 2 scroll buttons for quick and easy operation
- Protection against accidental adjustment of the measuring range
- Programming of the torque with set point and +/- tolerance
- Error limit +/- 2%
- Quick battery change
- Power save function, automatic shutdown in sleep mode after 60 seconds
- Dust and splash proof
- Display of low battery charge
- Automatic zero point check when switching on
- Data and set point storage when changing batteries

Reversible ratchet head and 3 AA batteries included.

Torque wrench, electronic, with storage

Type 2: IZO-DM
- Storage of up to 1.100 measured values
- RS 232 interface

Incl. Data transfer kit with IZO software and cable,
for torque wrench type IZO-DM with storage
IZO-M-DOC

Type 1:	Type 2: with storage	Measuring range Nm	Insertion Dimension mm	Ratchet head size
IZO-D-30 40-100-601	**IZO-DM-30** 40-100-606	3-30	9x12	1/4"
IZO-D-135 40-100-602	**IZO-DM-135** 40-100-607	7-135	9x12	3/8“
IZO-D-200 40-100-603	**IZO-DM-200** 40-100-608	20-200	14x18	1/2"
IZO-D-340 40-100-604	**IZO-DM-340** 40-100-609	34-340	14x18	1/2"

Testing equipment

Socket equipment for torque wrench

	Size	Insertion Dimension (mm)	Article-No.
 **Ratchet head**	1/4"	9x12	40-100-615
	3/8“	9x12	40-100-616
	1/2"	14x18	40-100-617

	Size	Article-No.		Size	Article-No.
 **mouth** **Insertion Dimension 9x12mm**	SW 7	40-100-620	 **mouth** **Insertion Dimension 14x18mm**	SW 13	40-100-635
	SW 8	40-100-621		SW 14	40-100-636
	SW 9	40-100-622		SW 15	40-100-637
	SW 10	40-100-623		SW 17	40-100-639
	SW 11	40-100-624		SW 18	40-100-640
	SW 13	40-100-625		SW 19	40-100-641
	SW 14	40-100-626		SW 22	40-100-643
	SW 15	40-100-627			
	SW 16	40-100-628			
	SW 17	40-100-629			
	SW 18	40-100-630			
	SW 19	40-100-631			

	Size	Article-No.		Size	Article-No.
 **ring** **Insertion Dimension 9x12mm**	SW 7	40-100-650	 **ring** **Insertion Dimension 14x18mm**	SW 13	40-100-665
	SW 8	40-100-651		SW 14	40-100-666
	SW 10	40-100-653		SW 15	40-100-667
	SW 11	40-100-654		SW 17	40-100-669
	SW 12	40-100-655		SW 19	40-100-671
	SW 13	40-100-656		SW 22	40-100-673
	SW 14	40-100-657			
	SW 15	40-100-658			
	SW 17	40-100-660			
	SW 19	40-100-662			

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44. Feeding devices

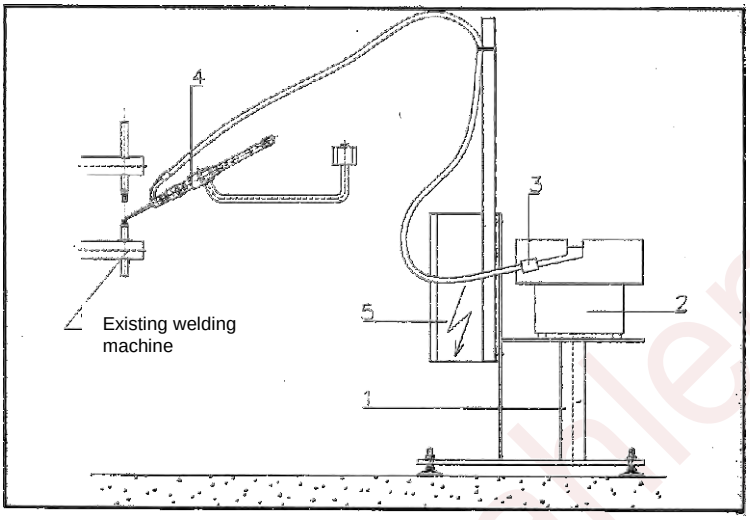
Weld nut feed SMZ / weld screw feed SSZ

A proven system for quick and precise positioning of weld nuts and bolts. The nuts or screws are positioned mechanically and pneumatically quickly on the workpiece, directly under the welding machine.

Weld nuts are fed onto an on-site centering pin in the lower electrode, optionally also possible with integrated position orientation.

Welding screws are placed linearly, vertically downwards into the component or holder of the lower electrode using a setting head.

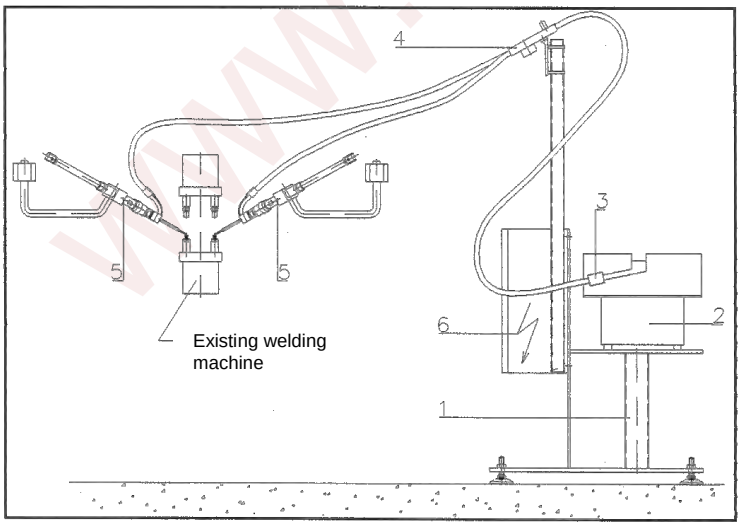
Single feed:



Version / Features:

- Reduction of time required by over 50%
- Avoidance of potential sources of error by placing the nut or screw in front without tiring
- Easy adaptation to your individual needs up to full automation
- Cost-effective alternative to robot systems
- Electrical coupling possible via various bus systems
- Optionally with position orientation for square weld nuts
- Optionally with soundproof noise protection hood for vibratory conveyors
- Optionally with automatic storage bunker for longer refill intervals
- Optionally pluggable and mobile version

Double feed:



Double feed operating modes:

- Both insertion devices work independently on two separate welding machines
- Both insertion devices work on a welding machine

Regardless of the operating mode, each place can be switched off individually.

45. Precision spot welders

For spot welding metal foils, screen mesh, thin sheets in precision mechanics and electrical engineering

Welding machine (AC):

designed for connecting fine spot welding devices

Functions:

- Digital 2-time thyristor control,
  Operating modes: single point and seam,
  Half-wave operation for SZ and SAZ
- Integrated welding transformer 4/15kVA
- Secondary connections can be plugged in
- Integrated Schuko socket 230V/50Hz
  for connecting a cooling device
- Main switch and connection cable
- Connection: 400V50Hz, fuse: 16A

ROWA 2Z1P / 800A
Article-No. 22-505-100

ROWA 2Z1P / 2000A
Article-No. 22-505-101

Micro tongs:

Technical features:

- robust aluminum housing Air-cooled or water-cooled version
- Electrode force adjustment via adjusting screw
- CuCrZr electrodes

Technical data:

	Micro tongs	Micro tongs, water-cooled
Electrode force	6 - 25N	6 - 25N
Electrode spacing	6mm	6mm
Electrode-Ø	5mm	5mm
Power	150Ws	150Ws
Weight	330g	450g
Cable cross section	25mm²	25mm²
Cable length	2000mm	2000mm
Dimension (WxHxL)	25x48x132mm	30x48x132mm
Article-No.	**40-281-635**	**40-281-640**
Spare electrodes	Ø5/M5x60mm	Ø5/M5x60mm
Article-No.	**40-281-642**	**40-281-642**

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Precision spot welders

Micro pointer:

Technical features:

- high-quality plastic housing
- Electrode force adjustment via adjusting screw
- CuCrZr electrodes

Technical data:

	Micro welding ROWA 020	Micro welding ROWA 021	Micro welding ROWA 032
Electrode force	4 - 14N	4 - 14N	4 - 14N
Electrode-Ø	3mm	4mm	4mm
Power	150Ws	150Ws	150Ws
Weight	195g	195g	380g
Cable cross section	16mm²	16mm²	35mm²
Cable length	2000mm	2000mm	2000mm
Dimension (WxHxL)	25x50x75mm	25x50x75mm	25x43x120mm
Article-No.	**40-281-646**	**40-281-647**	**40-281-665**
Spare electrodes	Ø3/M3x35mm	Ø4x37mm	Ø4x60mm
Article-No.	**40-281-652**	**40-281-656**	**40-281-662**

Micro hand welding roller:

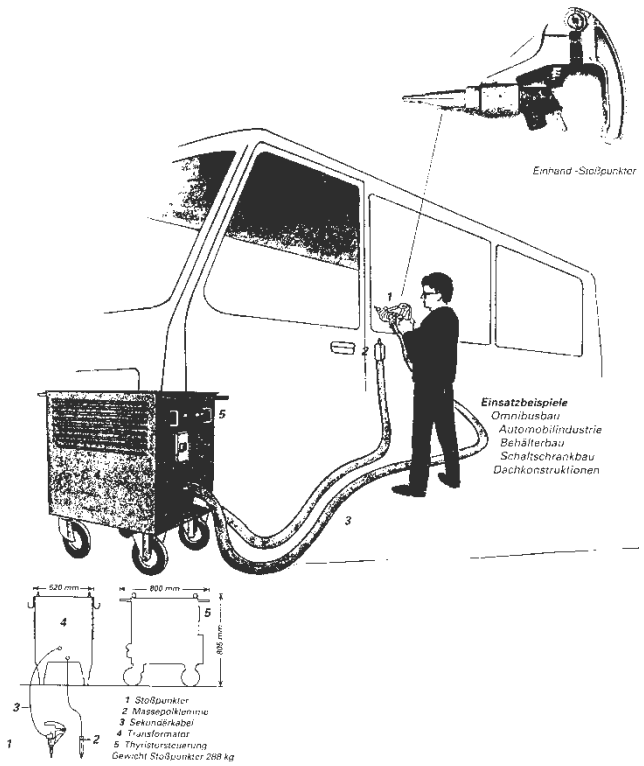
Technical features:

- robust aluminum housing
- Plain bearings for power transmission
- CuCrZr electrode roll

Technical data:

	Micro roller seam welding head, water-cooled	
Electrode roll Ø	50mm	
Effective area	1mm / 2mm	
Power	up to 1kA	
Cone	Mk1	
Weight	ca. 1,4kg	
Cable cross section	25mm²	
Cable length	3000mm	
Article-No.	**40-281-610**	
Spare electrode roll	Ø50mm/1mm	Ø50mm/2mm
Article-No.	**40-281-625**	**40-281-626**

46. Push welder PP6



Mobile Push welder system
With built-in water cooler, cable set, PP6, pole clamp and welding control.

Rated power	100kVA at 50%ED
Connection voltage	400V/50Hz
Protection	125A
Secondary short circuit current max.	13,0kA
With cable cross section	200mm²
With cable distance	200mm
With cable length	3000mm

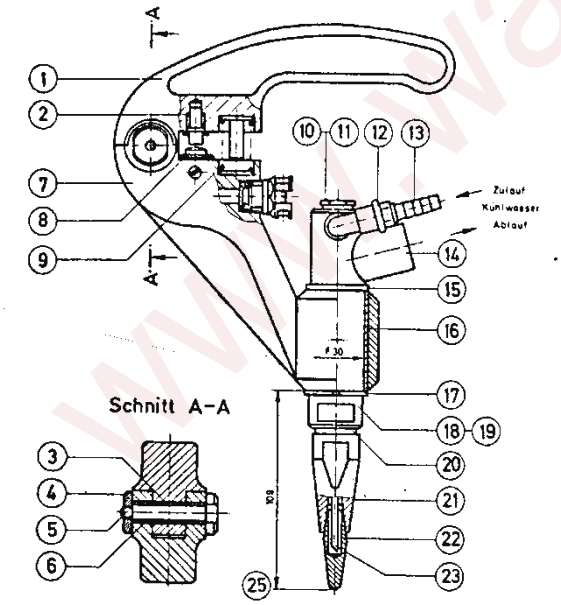
Article-No. 40-275-250

Push welder PP6
Short version, Mk1, water cooled,
Cable connection M18x1,5
Article-No. 40-275-120

Pole clamp
water cooled,
Cable connection M18x1,5
Article-No. 40-275-140

Other versions available on request!

Spare parts PP6



Part-No.	Designation	Zg.-No.	Article-No.
1	Handle	3230.00-02	40-275-001
2	Compression spring, small	3229.00-11	40-275-002
	Pressure bolt	3230.00-09	40-275-028
	Bridge	3230.00-08	40-275-029
3	Bearing bushing, middle	3230.00-07	40-275-003
4	Nut	3230.00-04	40-275-004
5	Axle bolts	3230.00-03	40-275-005
6	Bearing bushing, side (2pcs)	3230.00-06	40-275-006
7	Basic body	3230.00-01	40-275-007
8	Push buttons	Ø16	40-275-008
9	Compression spring, small	3229-00-10	40-275-009
10	Screw plug	¼“	40-136-886
11	Seal PVC	¼“	40-132-018
12-13	Water connection ¼“	see from page 75	
14	Cable connection M18x1,5	3230.01-03	40-275-014
15	Cu sealing washer 34x24,2x3	WN-31451	40-080-035
16	Plain bearings 30x34x20 (2pcs)	3230.00-05	40-275-016
17	Retaining ring	30x1,5	40-275-017
19	Shaft short ø30x75mmlg.	3230.01-01	40-275-019
	Shaft long ø30x320mmlg.	3230.03-01	40-275-020
20	Cu sealing washer 23x18,2x2,5	WN-31451	40-080-024
21	Electrode holder	3230.01-02	40-275-021
22	Electrode Mk1	see from page 15	
23	Cooling water pipe-short 160mmlg.	3230.02	40-275-023
	Cooling water pipe-long 405mmlg.	3230.04	40-275-026
	Hole screw ¼“	3230.01-06	40-275-027

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47. Spot welding guns

Standard spot welding guns for body repairs

7900 - 7903P hand operated
Projection 125 to 500mm

Type	Rated power at 20% kVA	Electrode force max. daN	Weight kg	Article-No.
7900	2,0	120	10,5	60-017-900
7902 P	2,5	120	11,0	60-017-902
7903 P	6	120	12,0	60-017-903

A 3111 - A 3119 hand operated
Projection 120 to 415mm

Type	Rated power at 20% kVA	Electrode force max. daN	Weight kg	Article-No.
A 3111	2,4	180	10,5	22-108-791
A 3112	2,4	180	10,5	22-110-791
A 3119	8	180	12,2	22-140-791

A 3139 pneumatically operated
Projection 120 to 415mm

Type	Rated power at 20% kVA	Electrode force max. daN	Weight kg	Article-No.
A 3139 S2 with hanging bracket	8	300	15,5	22-164-780
A 3139 S3	8	300	15,5	22-164-785

Standard spot welding guns for industrial sheet metal processing

X-Clamps 16 - 63kVA pneumatically operated
Projection 170 to 800mm

Type	Rated power at 20% kVA	Electrode force max. daN	Weight kg	Article-No.
3238-4	16	270	38,0	22-202-000
3228-4	16	270	38,0	22-203-000
3329	25	440	46,5	22-205-020
3328-6	25	600	51,5	22-205-001
3528-4	63	730	98,0	22-208-010

C-Clamps 22 - 35kVA pneumatically operated

Type	Rated power at 20% kVA	Electrode force max. daN	Weight kg	Article-No.
3346-4	22	360	40,5	22-280-000
3349-4	35	360	59,0	22-280-020

Suitable electrode arms see from page 54

48. Spring balancers

Features of use:

- perfect ergonomics in the workplace
- workflows become more fluid and safer
- excellent recovery and compensation behavior
- the ideal helpers in assembly and production

Spring balancers / Cable extension 2000 mm

Type	Load capacity	Own weight	Article-No.
D 4/5	3 - 5 kg	2,9 kg	23-601-405
D 4/7	4,5 - 7 kg	3,1 kg	23-601-407
D 4/10	6 - 10 kg	3,2 kg	23-601-410
D 4/14	9 - 14 kg	3,4 kg	23-601-414
D 4/17	13 - 17 kg	3,6 kg	23-601-417
D 4/21	16 - 21 kg	3,8 kg	23-601-421

Spring balancers / Cable extension 2000 mm

Type	Load capacity	Own weight	Article-No.
D 5/30	21 - 30 kg	16,3 kg	23-601-530
D 5/45	31 - 45 kg	18,0 kg	23-601-545
D 5/60	46 - 60 kg	18,4 kg	23-601-560
D 5/75	61 - 75 kg	19,8 kg	23-601-575
D 5/90	76 - 90 kg	20,8 kg	23-601-590
D 5/100	91 - 100 kg	21,0 kg	23-601-600

Spring balancers / Cable extension 3000 mm / with 2 springs

Type	Load capacity	Own weight	Article-No.
D 6/115	100 - 115 kg	42 kg	23-601-615
D 6/130	115 - 130 kg	44 kg	23-601-630
D 6/140	130 - 140 kg	46 kg	23-601-640
D 6/150	140 - 150 kg	48 kg	23-601-650

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49. Spot welding machines

Standard spot welding machines
Simple machine program for trade and light industrial use

Series SF 100 -200
Rocker arm, foot operated

Type	Rated power at 20% kVA	Electrode force max. daN	Unloading stepless mm	Article-No.
SF 102	8	220	130-300	11-101-102
SF 104	12	220	130-300	11-101-104
SF 202	20	360	130-500	11-101-130
SF 204	30	360	130-500	11-101-150
SF 206	50	360	130-500	11-101-155

- with 1-time synchronous welding control, digital current and time setting
- main switch and 3m connection cable

Series SL 100 -200
Rocker arm,
pneumatically operated

Type	Rated power at 20% kVA	Electrode force max. daN	Unloading stepless mm	Article-No.
SL 102	8	360	130-300	11-101-103
SL 104	12	360	130-300	11-101-105
SL 202	20	420	130-500	11-101-202
SL 204	30	420	130-500	11-101-204
SL 206	50	420	130-500	11-101-206

- with 5-time synchronous welding control, digital current and time setting
- 2 welding programs
- main switch and 3m connection cable

Series PL
Parallel stroke,
pneumatically operated

Type	Rated power at 20% kVA	Electrode force max. daN	Unloading stepless mm	Article-No.
PL 40_EH	40	100-600	250-550	11-101-210
PL 63_EH	63	100-600	250-550	11-101-260
PL 80_EH	80	100-600	350-650	11-101-310
PL 100_EH	100	100-600	350-650	11-101-360

- with 5-time synchronous welding control, digital current and time setting
- 8 welding programs
- main switch

Additional special options on request!

For electrode holders and electrode arms see page 45

50. Water chiller

Water chiller IK-V (fully-hermetic)

for ambient temperatures up to 42°C

IK-V 07 and IK-V1.4/T

IK-V 07 to IK-V4/T

Compact devices for indoor installation with 0.9kW to 4.3kW cooling capacity, in stainless steel housing. Our devices are equipped with an electronic thermostat and digital display.
The working range of these devices is at water flow temperatures between 10°C and 25°C.

Water-circulating cooling device IK-V 13

Inside view IK-V2 to IK-V5

IK-V2 to IK-V70

Systems for indoor and outdoor installation from 2,3 to 81,5kW cooling power. Systems of this size incorporate decades of experience in refrigeration engineering and modern production methods and set standards in economics and reliability.
Fine tuning of cooling power and pump performance ensures a high degree of trouble-free operation.

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Technical Data

Compact devices

Type			IK-V 07/A	IK-V 07/B	IK-V 1.4/T	IK-V 2/T	IK-V 3/T	IK-V 4/T	IK-V 1.4
Refrigerant			R 134a	R 134a	R 134a	R 134a	R 134a	R 134a	R 134a
Nominal output		kcal/h*	750	750	1.300	1.720	2.300	3.700	1.500
Nominal output		kw*	0,9	0,9	1,5	2,0	2,7	4,3	1,8
Pump type			LNY 2841	NPY-2051	NPY-2051	NPY-2051	NPY-2051	NPY-2051	NPY-2051
Pump output		kW	0,12	0,25	0,25	0,25	0,25	0,25	0,25
Flow rate at 2bar		l/min	5	12	12	12	12	12	12
Basin capacity		ltr.	6	6	15	15	15	15	40
Pipe connection			DN 10	DN 10	DN 10	DN 10	DN 10	DN 10	DN 10
Connected power		kW	0,7	0,8	1,0	1,3	1,6	2,2	1,1
Rated voltage		V/Hz	1x230/N/PE/50	1x230/N/PE/50	1x230/N/PE/50	1x230/N/PE/50	3x400/N/PE/50	3x400/N/PE/50	1x230/N/PE/50
Control voltage		V	230 AC	230 AC	230 AC	230 AC	24 AC	24 AC	230 AC
Maximum current		A	5,5	6,8	8,0	9,9	3,9	4,9	8,2
Dimensions	lenght	mm	565	565	750	750	750	750	1000
.	width	mm	440	440	450	450	450	450	440
.	height	mm	345	345	500	500	500	500	500
Weight ca.		kg	42	42	85	85	85	85	85

Systems up to 81,5kW

Type			IK-V 2	IK-V 3	IK-V 5	IK-V 7	IK-V 9	IK-V 13	IK-V 18
Refrigerant			R 134a	R 134a	R 134a	R 134a	R 134a	R 134a	R 134a
Nominal output		kcal/h*	2.000	3.200	5.200	7.800	9.750	13.000	18.000
Nominal output		kW*	2,3	3,7	6,1	9,1	11,3	15,1	20,9
Pump type			CM 1-4	CM 1-4	CM 1-4	CM 1-6	CM 1-6	CM 3-6	CM 3-6
Pump output		kW	0,46	0,46	0,46	0,46	0,46	0,65	0,65
Basin capacity		ltr.	87	87	87	140	140	300	300
Pipe connection			R 3/4"	R 3/4"	R 3/4"	R 3/4"	R 3/4"	R 1"	R 1"
Connected power		kW	1,73	2,53	2,93	4,45	4,80	8,10	10,20
Rated voltage		V/Hz	1x230/N/PE/50	3x400/N/PE/50	3x400/N/PE/50	3x400/N/PE/50	3x400/N/PE/50	3x400/N/PE/50	3x400/N/PE/50
Control voltage		V	230 AC	24 AC	24 AC	24 AC	24 AC	24 AC	24 AC
Maximum current		A	10,8	5,5	6,5	8,0	10,1	16,6	20,6
Dimensions	lenght	Mm	730	730	730	860	860	1470	1470
.	width	Mm	675	675	675	760	760	730	730
.	height	Mm	1165	1165	1165	1370	1370	1560	1560
Weight ca.		Kg	148	152	165	205	220	420	465

Type			IK-V 23	IK-V 28	IK-V 34	IK-V 40	IK-V 50	IK-V 60	IK-V 70
Refrigerant			R 134a	R 134a	R 134a	R 134a	R 134a	R 134a	R 134a
Nominal output		kcal/h*	23.800	28.000	34.000	40.000	50.000	60.000	70.000
Nominal output		kW*	27,7	32,5	39,5	46,5	58,2	70,0	81,5
Pump type			CM 3-6	CM 10-3	CM 10-3	CM 10-3	CM 10-3	CM 15-2	CM 15-2
Pump output		kW	0,65	2,2	2,2	2,2	2,2	2,2	2,2
Basin capacity		ltr.	500	500	500	500	500	500	500
Pipe connection			R 1"	R 1 1/4"	R 1 1/4"	R 1 1/2"	R 1 1/2"	R 1 1/2"	R 1 1/2"
Connected power		kW	13,30	17,40	17,40	21,00	26,90	31,60	31,60
Rated voltage		V/Hz	3x400/N/PE/50	3x400/N/PE/50	3x400/N/PE/50	3x400/N/PE/50	3x400/N/PE/50	3x400/N/PE/50	3x400/N/PE/50
Control voltage		V	24 AC	24 AC	24 AC	24 AC	24 AC	24 AC	24 AC
Maximum current		A	25,7	32,3	32,3	43,7	53,1	62,5	62,5
Dimensions	lenght	mm	1670	1670	1910	1910	1910	2460	2460
.	width	mm	930	930	1130	1130	1130	1380	1380
.	height	mm	1790	1790	1900	1900	2050	2050	2050
Weight ca.		kg	540	620	780	850	1.100	1.300	1.600

Scope of delivery:
Completely wired and piped refrigeration system with insulated tank and pump. All switching, control and monitoring devices comply with the ISO standard, UVV, VGB, VDE and CE. The temperature is controlled by a digital thermostat with a temperature display. The machine is delivered ready for connection and filled with environmentally friendly CFC-free refrigerant.
Paint: blue, similar to RAL 5012 structure, (compact devices in stainless steel design).

* The mentioned cooling capacity refers to an ambient temperature of +32°C, the water inlet temperature is +15°C.
If the water inlet temperature is lower, the cooling capacity decrease about 3% per °C.

Our systems can also be equipped with special options, e.g. special pumps, special paint finishes, stainless steel design, liquid circuit for aggressive media, systems with special voltages, temperature control devices and much more...

For difficult conditions with ambient temperatures above 42°C, our IK-H series systems with semi-hermetic motor compressors should be used.

51. Services

Advice and Sale
- DALEX welding machines
- HARMS+WENDE welding controls
- Accessories and components for resistance welding technology
- Carrying out welding tests
- Showroom with current welding machines and welding controls
- Updated used machines

Design and manufacturing
- Special welding systems
- Welding equipment
- Standard and special electrodes

Commissioning
- Assembly and commissioning at the destination

Maintenance and repair
- Maintenance and service work on all resistance welding systems
- Repair in our service department

Machine overhaul
- Overhaul and modernization of all resistance welding systems
- Revision of the mechanical, pneumatic and electrical components
- Conversion to modern welding control in 50Hz, 3-phase direct current, low-frequency technology or medium-frequency technology

Spare parts
- Various wear and tear and spare parts from stock
- Delivery possible within 24 hours

Training
- Resistance welding training in your company
- Theory and practical training course
- Welding process optimization on all resistance welding systems

For all resistance welding equipment, standard and special systems from various manufacturers, even an older model year!

Service - Hotline Tel: +49 (0) 7151 33377

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Resistance welding training in your company

We offer you practical training for resistance welding in your company, specifically tailored to your products with your welding machines.

Theoretical part:

The theory lecture consists of two blocks (ca. 2 x 1.5 hours).

Block I Basics and use cases

1. Basics of AC/DC technology in resistance welding
2. Basics of medium frequency technology (1000 Hz)
3. Function and use cases about resistance welding systems
4. Function and use cases about welding controls

Block II Quality assurance in resistance welding

5. Quality assurance in resistance welding
6. Interference variables during resistance welding
7. Test methods in resistance welding
8. Control and monitoring functions on resistance welding systems

Practical part:

The practical part is based on the existing resistance welding machines and welding controls in your company (max. 2 days).

9. Internship on a variety of welding machines and welding guns
   including welding process optimization on your systems

The number of participants is limited to a maximum of 8 people!

After completing the course you will receive a participant certificate.

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