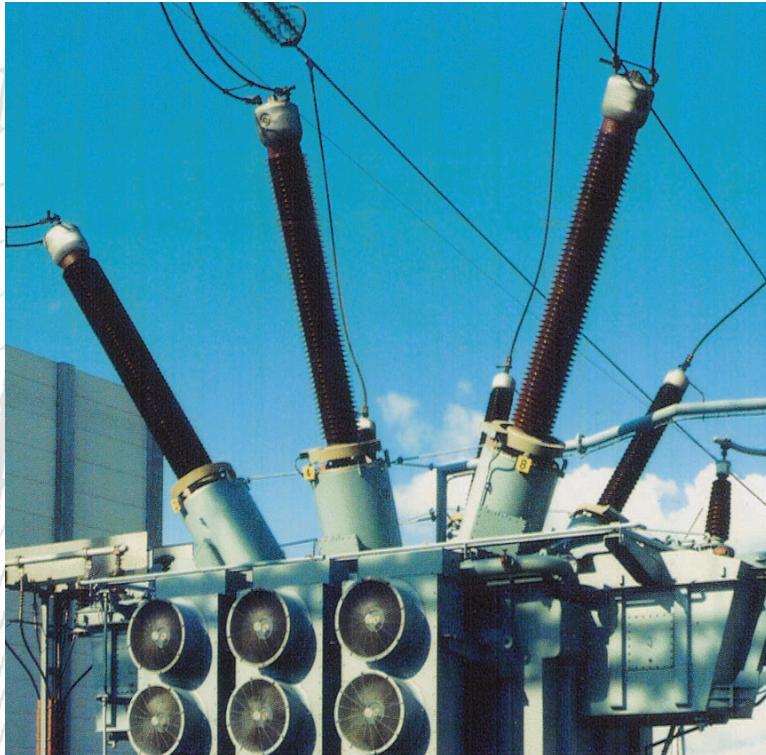


Transformer Bushings

Type COT 125 ... COT 1050

24 kV to 245 kV
up to 3150 A
IEC 137



TRENCH

Main
Menu



Features

If you need any transformer bushing proven in operation conditions around the world, Trench has it !

- experience in bushing manufacture for more than 80 years
- capacitive fine graded oil-paper insulation with long term experience
- computer optimized electrical field distribution
- proven high electrical withstand against transient or impulse stresses
- excellent long term stability due to extremely low partial discharge and power loss factor
- oil immersed part covered by epoxy resin tube providing high impact resistance
- electrode embedded in the epoxy resin tube
 - avoids external shielding
 - reduces distance to ground
- porcelain cemented into flange provides higher mechanical strength than level II of IEC 137
- available with porcelain or composite insulator on air side
- inclination in service up to 40° from vertical; for COT 125 and COT 170 even horizontal operation possible
- horizontal transport for all types possible
- $\tan \delta$ and PD-values more than twice as good as requested by IEC 137
- current rating can easily be increased up to 1250A by exchanging the cable bolt with a removable split conductor on existing bushing

To preserve our environment the free oil volume in COT-bushings is minimized

(see table page 14)

Certified ISO 9001



Transformer Bushings Type
COT 1050 and COT 125



Main
Menu



Design

1 Terminal

Terminal (Al or Cu) for connection of overhead lines or bus bars and arcing horns. Our design provides a maintenance free termination and ensures that the connection will not become loose in service.

2 Assembly

The whole bushing is tightened together by the central tube or conductor.

3 Head

Al-casted head with oil expansion chamber and oil level indicator. The chamber is hermetically sealed against atmosphere.

4 Oil filling

COT bushings are filled with dried, degassed insulating mineral oil.

5 Insulator

Porcelain Insulator made of high grade electrotechnical porcelain according to IEC 815. The insulator is connected to the mounting flange using Portland cement and sealed with o-ring gasket. Instead of porcelain a composite insulator is also available.

6 Active part

The active part is made of oil-impregnated wide band paper with layers of aluminium foil to control the electrical field radially and axially. Depending on the current rating, the paper and foil are wound on either a central tube or a solid conductor.

7 Flange

Mounting flange with integrated test tap made of corrosion free aluminium alloy, machined to ensure an excellent seal between the bushing and the transformer.

8 CT-Pocket

If current transformers are required on the bushing, the ground sleeve can be extended.

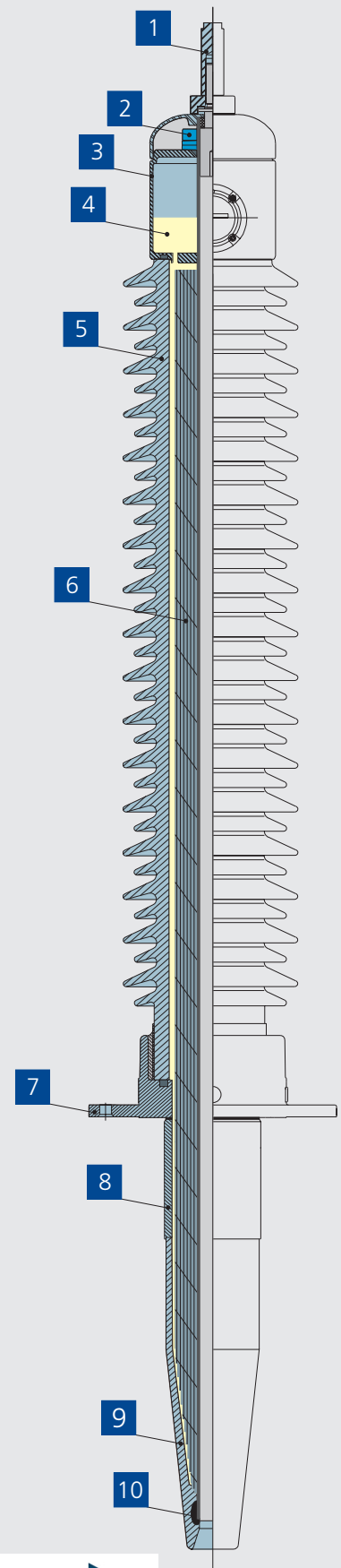
9 Oil side end

The insulator on the oil side is made of an epoxy resin tube. It is designed to stay installed during the in-tank drying process of the transformer and can withstand temperatures up to 130°C.

10 End-shielding

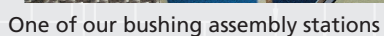
For voltages starting with 52 kV a special aluminium electrode is cast into the end of the epoxy resin tube. This end shielding controls the electrical field strength in this area to ground.

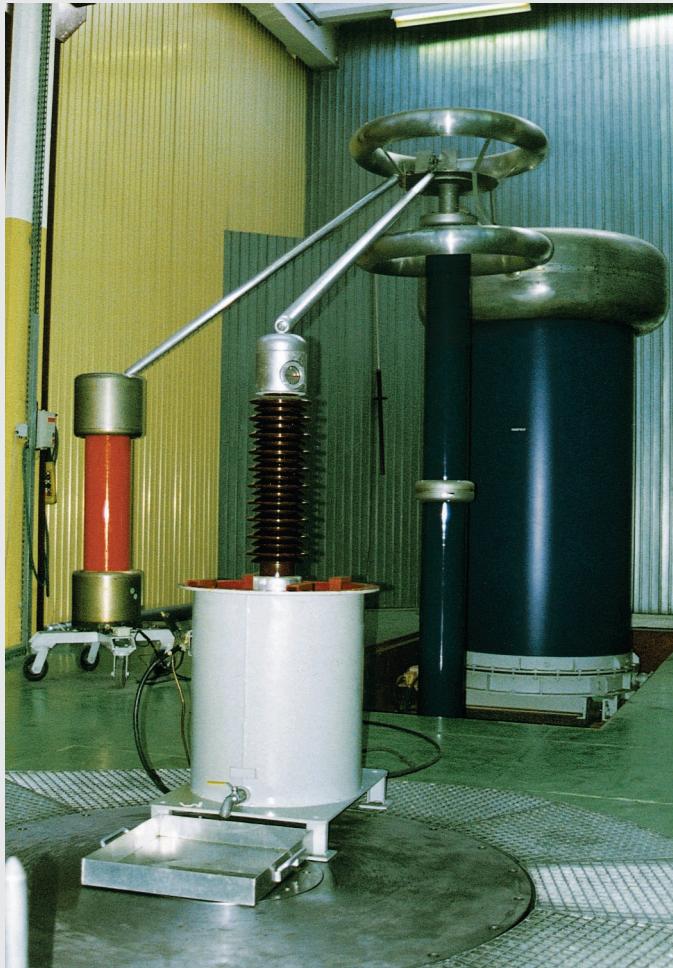
Cut view general design



Main
Menu



0 °
0 mm



Power frequency voltage withstand test including PD-measurement



Epoxy resin insulator with embedded electrode



Main
Menu



Type COT 125 ... 450

	01	02	03	04	05	06	07	08	09	10	11	12	13
No.	Type	Rated voltage U_r	Rated phase to earth voltage $U_r/\sqrt{3}$	Test voltage 60sec.	Impulse voltage 1,2/50µs	Rated current I_r	Connection to transformer	cable: cross section Cu-cond.: diameter	L4 see fig.3	AD Arcing distance (min.)	Standard creepage distance (min.)	Mass approx.	Cantilever test load (min.)
		kV	kV	kV	kV	A		mm ² mm	mm	mm	mm	kg	N
01	COT 125	24	14	50	125	800	cable	400		235	600	22	2000
02						1000	cable ¹⁾	400				22	2000
03						1250	rem. Cu-cond. ²⁾	35				28	2000
04						1600	fixed Cu-cond.	-				29	2000
05						2500	fixed Cu-cond.	-				32	2000
06						3150	fixed Cu-cond.	-				36	3150
07	COT 170	36	21	70	170	800	cable	400		340	900	30	2000
08						1000	cable ¹⁾	400				30	2000
09						1250	rem. Cu-cond. ²⁾	35				37	2000
10						1600	fixed Cu-cond.	-				43	2000
11						2500	fixed Cu-cond.	-				48	2000
12						3150	fixed Cu-cond.	-				52	3150
13	COT 250	52	30	95	250	800	cable	400	Standard: 0, 300, 500	475	1300	26	2000
14						1000	cable ¹⁾	400				26	2000
15						1250	rem. Cu-cond. ²⁾	35				35	2000
16						1600	fixed Cu-cond.	-				36	2000
17						2500	fixed Cu-cond.	-				54	3150
18						3150	fixed Cu-cond.	-				75	4000
19	COT 325	72,5	42	140	325	800	cable	400		600	1820	31	2000
20						1000	cable ¹⁾	400				31	2000
21						1250	rem. Cu-cond. ²⁾	35				40	2000
22						1600	fixed Cu-cond.	-				44	2000
23						2500	fixed Cu-cond.	-				62	3150
24						3150	fixed Cu-cond.	-				88	4000
25	COT 450	100	58	185	450	800	cable	400		830	2540	40	2000
26						1000	cable ¹⁾	400				40	2000
27						1250	rem. Cu-cond. ²⁾	35				52	2000
28						1600	fixed Cu-cond.	-				56	2000
29						2500	fixed Cu-cond.	-				80	3150
30						3150	fixed Cu-cond.	-				106	4000

Comments related to columns 1...31:

02,04,05: Rated and test voltages acc. to IEC 137

07: ¹⁾ Class F insulated

²⁾ Removable solid rod copper conductor connection system see page 14...17

09: Extension for current transformer. Other extensions on request.



06	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Rated current I_r	L	L1	L2	L3	L6	L7	D	D1	D2	D3	D4	D5	D6	D7 min.	øt	n	e	see fig.
A	mm																	
800	761	140	621	452	80	60	80	82	184	240	210	190	30	40	24	4	12	19
1000	761	140	621	452	80	60	80	82	184	240	210	190	30	40	24	4	12	19
1250	761	140	621	-	80	60	80	82	184	240	210	190	30	-	24	4	12	20
1600	729	140	589	-	125	60	80	82	184	240	210	190	40	-	24	4	12	21
2500	729	140	589	-	125	60	80	82	184	240	210	190	40	-	24	4	12	21
3150	729	140	589	-	125	60	80	82	184	240	210	190	40	-	24	4	12	21
800	895	169	726	557	80	60	80	82	184	240	210	190	30	40	24	4	12	19
1000	895	169	726	557	80	60	80	82	184	240	210	190	30	40	24	4	12	19
1250	895	169	726	-	80	60	80	82	184	240	210	190	30	-	24	4	12	20
1600	863	169	694	-	125	60	80	82	184	240	210	190	40	-	24	4	12	21
2500	863	169	694	-	125	60	80	82	184	240	210	190	40	-	24	4	12	21
3150	863	169	694	-	125	60	80	82	184	240	210	190	40	-	24	4	12	21
800	1090	140	950	760	80	100	100	110	185	225	200	170	30	35	16	6	14	22
1000	1090	140	950	760	80	100	100	110	185	225	200	170	30	35	16	6	14	22
1250	1090	140	950	-	80	100	100	110	185	225	200	170	30	-	16	6	14	23
1600	1135	140	995	-	125	100	100	110	185	225	200	170	40	-	16	6	14	24
2500	1095	140	955	-	125	100	120	135	200	240	228	170	60	-	22	6	16	25
3150	1105	140	965	-	125	110	130	200	290	335	242	170	60	-	16	12	16	26
800	1210	175	1035	845	80	100	100	110	185	225	210	170	30	35	16	6	14	22
1000	1210	175	1035	845	80	100	100	110	185	225	210	170	30	35	16	6	14	22
1250	1210	175	1035	-	80	100	100	110	185	225	210	170	30	-	16	6	14	23
1600	1255	175	1080	-	125	100	100	110	185	225	210	170	40	-	16	6	14	24
2500	1275	175	1100	-	125	100	120	135	200	240	228	170	60	-	22	6	16	25
3150	1285	175	1110	-	125	110	130	200	290	335	242	170	60	-	16	12	16	26
800	1503	230	1273	1085	80	100	100	110	185	225	210	170	30	35	16	6	14	22
1000	1503	230	1273	1085	80	100	100	110	185	225	210	170	30	35	16	6	14	22
1250	1503	230	1273	-	80	100	100	110	185	225	210	170	30	-	16	6	14	23
1600	1548	230	1318	-	125	100	100	110	185	225	210	170	40	-	16	6	14	24
2500	1543	230	1313	-	125	100	120	135	200	240	228	170	60	-	22	6	16	25
3150	1553	230	1323	-	125	110	130	200	290	335	242	170	60	-	16	12	16	26

10,11: Brown glazed porcelain, other colours and other creepage distances upon request

13: According to IEC 137 level II or better.

14,15:

L1 and L depends on L4. The values in the table are valid for L4=0mm. If L4>0mm add L4 to L1 and L.

22,23,27,30: Other dimensions on request



Type COT 550 ... 1050

	01	02	03	04	05	06	07	08	09	10	11	12	13
No.	Type	Rated voltage U_r	Rated phase to earth voltage $U_r/\sqrt{3}$	Test voltage 60sec.	Impulse voltage 1,2/50 μ s	Rated current I_r	Connection to transformer	cable: cross section Cu-cond.: diameter	L4 see fig.3	AD Arcing distance (min.)	Standard creepage distance (min.)	Mass approx.	Cantilever test load (min.)
		kV	kV	kV	kV	A		mm ² mm	mm	mm	mm	kg	N
31	COT 550	123	71	230	550	800	cable	400		1050	3075	62	3150
32						1000	cable ¹⁾	500				62	3150
33						1250	rem.Cu-cond. ²⁾	35				74	3150
34						1600	fixed Cu-cond.	-				79	3150
35						2500	fixed Cu-cond.	-				165	4000
36						3150	fixed Cu-cond.	-				173	4000
37	COT 650	145	84	275	650	800	cable	400		1250	3625	81	3150
38						1000	cable ¹⁾	500				81	3150
39						1250	rem.Cu-cond. ²⁾	35				98	3150
40						1600	fixed Cu-cond.	-				101	3150
41						2500	fixed Cu-cond.	-				190	4000
42						3150	fixed Cu-cond.	-				198	4000
43	COT 750	170	98	325	750	800	cable	400		1460	4250	92	4000
44						1000	cable ¹⁾	500				92	4000
45						1250	rem.Cu-cond. ²⁾	35				111	4000
46						1600	fixed Cu-cond.	-				117	4000
47						2500	fixed Cu-cond.	-				215	5000
48						3150	fixed Cu-cond.	-				223	5000
49	COT 1050	245	142	460	1050	800	cable	400		2150	6125	236	4000
50						1000	cable ¹⁾	500				236	4000
51						1250	rem.Cu-cond. ²⁾	38				266	4000
52						1600	fixed Cu-cond.	-				285	4000
53						2500	fixed Cu-cond.	-				328	5000
54						3150	fixed Cu-cond.	-				332	5000

Comments related to columns 1...31:

02,04,05: Rated and test voltages acc. to IEC 137

07: ¹⁾ Class F insulated

²⁾ Removable solid rod copper conductor connection system see page 14...17

09: Extension for current transformer. Other extensions on request.

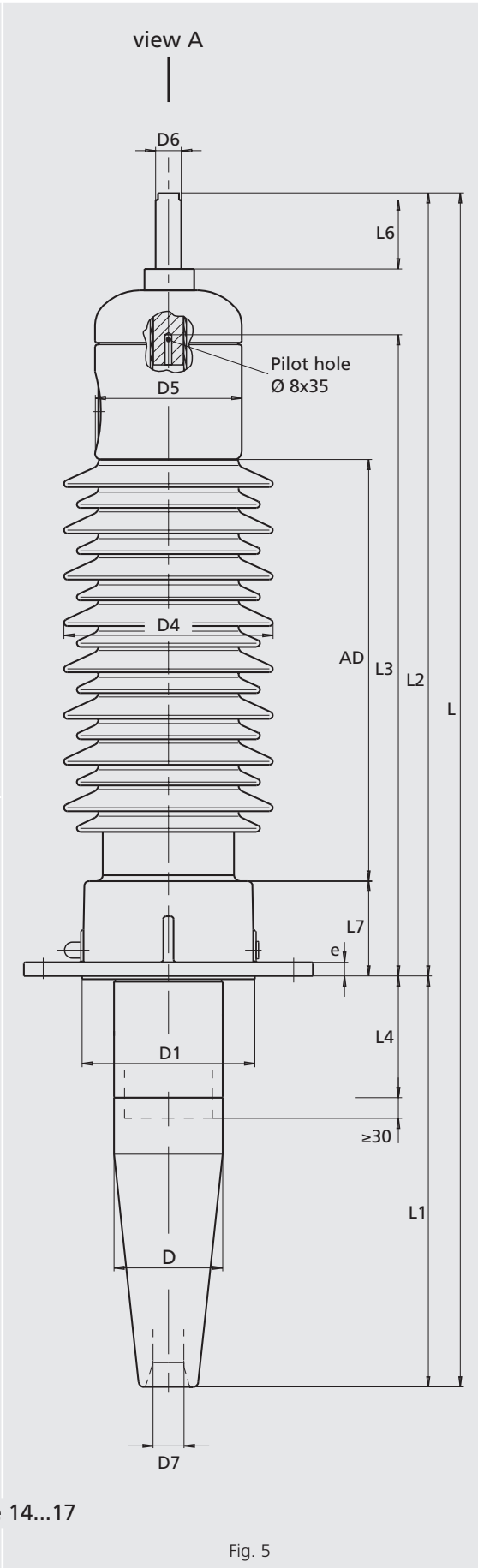
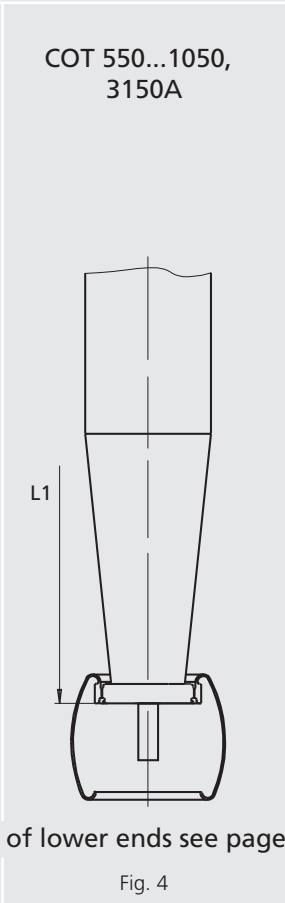
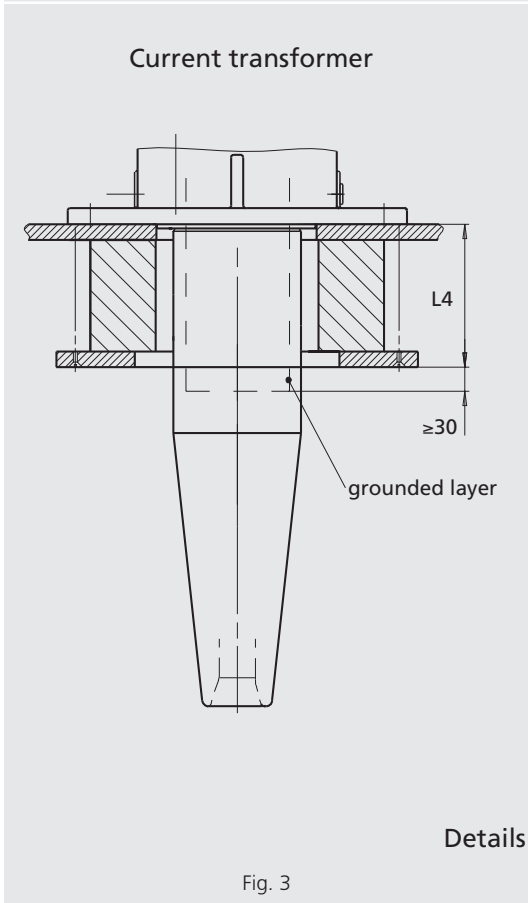
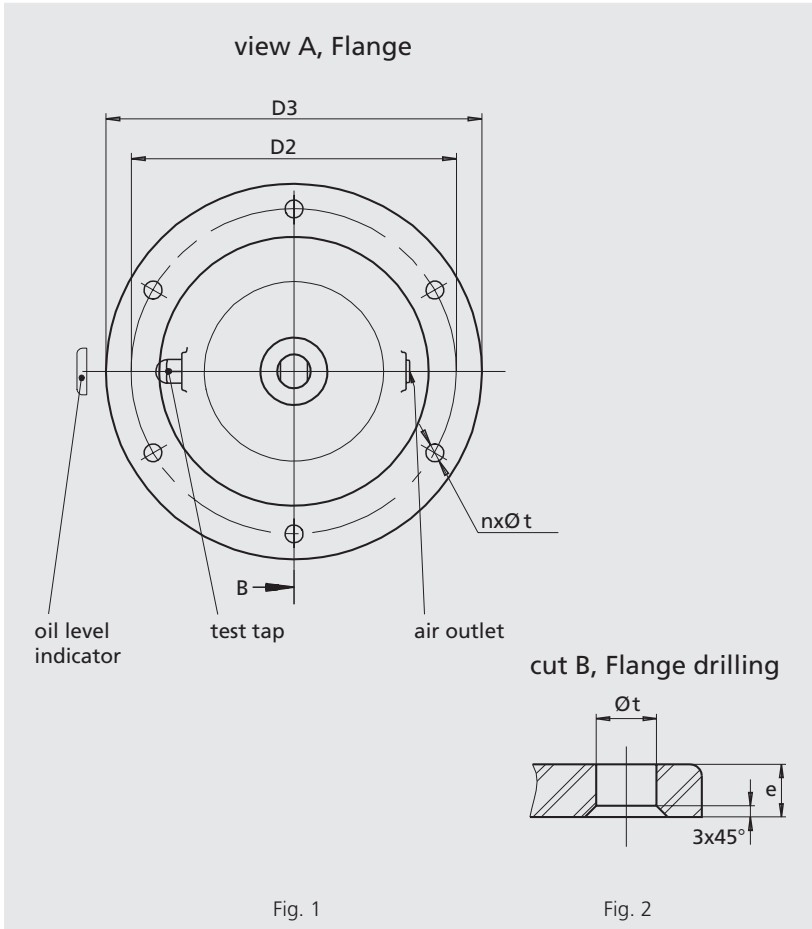


06	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Rated current I _r	L	L1	L2	L3	L6	L7	D	D1	D2	D3	D4	D5	D6	D7 min.	øt	n	e	see fig.
A	mm																	
800	1805	310	1495	1306	80	110	120	175	250	290	231	170	30	35	16	8	15	27
1000	1805	310	1495	1306	80	110	120	175	250	290	231	170	30	35	16	8	15	27
1250	1805	310	1495	-	80	110	120	175	250	290	231	170	30	-	16	8	15	28
1600	1850	310	1540	-	125	110	120	175	250	290	231	170	40	-	16	8	15	29
2500	2089	310	1779	-	125	195	175	200	290	335	295	300	60	-	20	12	20	30
3150	2089	310	1779	-	125	195	175	315	400	450	295	300	60	-	22	12	22	31
800	2055	360	1695	1506	80	110	130	200	290	335	242	170	30	35	16	12	16	27
1000	2055	360	1695	1506	80	110	130	200	290	335	242	170	30	35	16	12	16	27
1250	2055	360	1695	-	80	110	130	200	290	335	242	170	30	-	16	12	16	28
1600	2100	360	1740	-	125	110	130	200	290	335	242	170	40	-	16	12	16	29
2500	2339	360	1979	-	125	195	175	200	290	335	295	300	60	-	20	12	20	30
3150	2339	360	1979	-	125	195	175	315	400	450	295	300	60	-	22	12	22	31
800	2325	420	1905	1716	80	110	130	200	290	335	242	170	30	35	16	12	16	27
1000	2325	420	1905	1716	80	110	130	200	290	335	242	170	30	35	16	12	16	27
1250	2325	420	1905	-	80	110	130	200	290	335	242	170	30	-	16	12	16	28
1600	2370	420	1950	-	125	110	130	200	290	335	242	170	40	-	16	12	16	29
2500	2609	420	2189	-	125	195	175	200	290	335	295	300	60	-	20	12	20	30
3150	2609	420	2189	-	125	195	175	315	400	450	295	300	60	-	22	12	22	31
800	3518	684	2834	2500	80	195	175	315	400	450	295	300	30	40	22	12	22	32
1000	3518	684	2834	2500	80	195	175	315	400	450	295	300	30	40	22	12	22	32
1250	3518	684	2834	-	80	195	175	315	400	450	295	300	30	-	22	12	22	33
1600	3563	684	2879	-	125	195	175	315	400	450	295	300	40	-	22	12	22	34
2500	3563	684	2879	-	125	195	200	315	400	450	340	300	60	-	22	12	22	35
3150	3444	565	2879	-	125	195	200	315	400	450	340	300	60	-	22	12	22	36

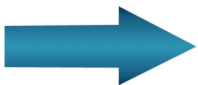
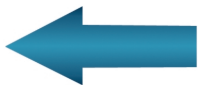
10,11: Brown glazed porcelain, other colours and other creepage distances upon request
13: According to IEC 137 level II or better.

14,15: L1 and L depends on L4. The values in the table are valid for L4=0mm. If L4>0mm add L4 to L1 and L.
22,23,27,30: Other dimensions on request





Details of lower ends see page 14...17



Oil level indicator
COT 125, COT 170

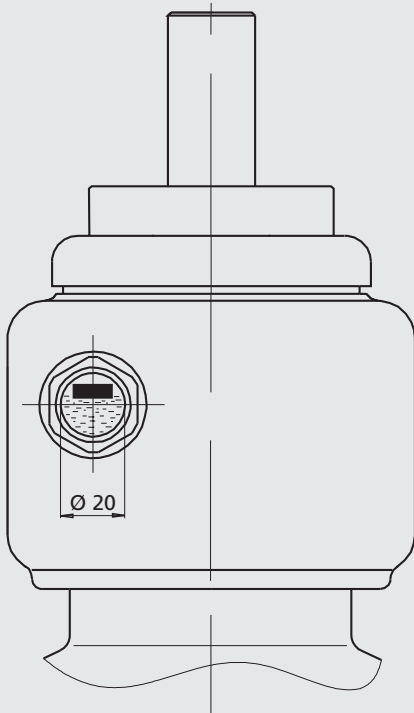


Fig. 6

Oil level indicator
COT 250 ... COT 1050

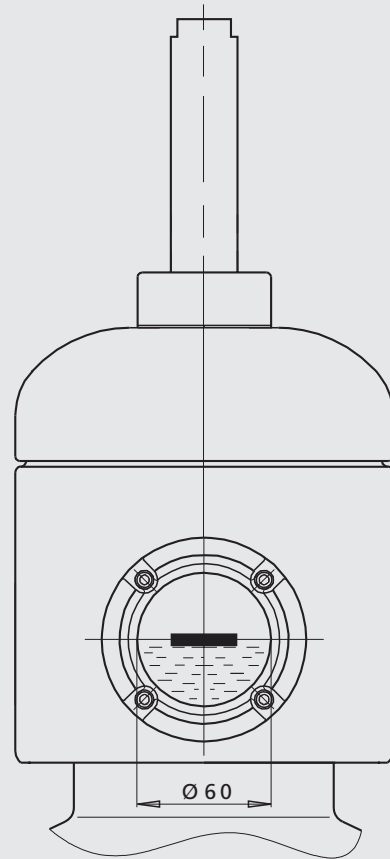


Fig. 7

Test tap 2 kV

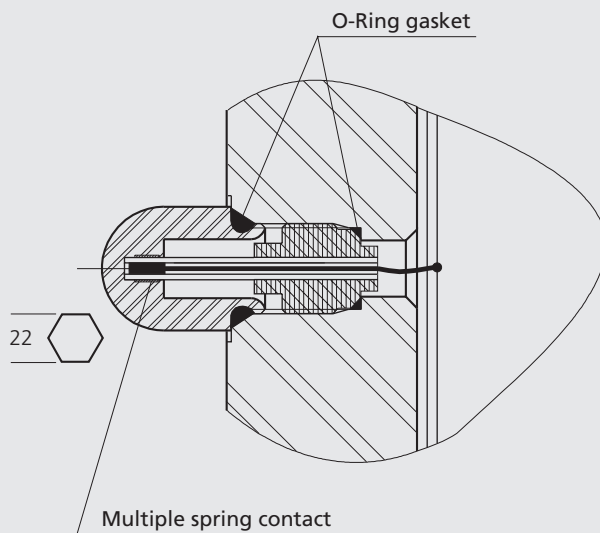


Fig. 8

Air escape screw for turret
COT 250 ... COT 1050

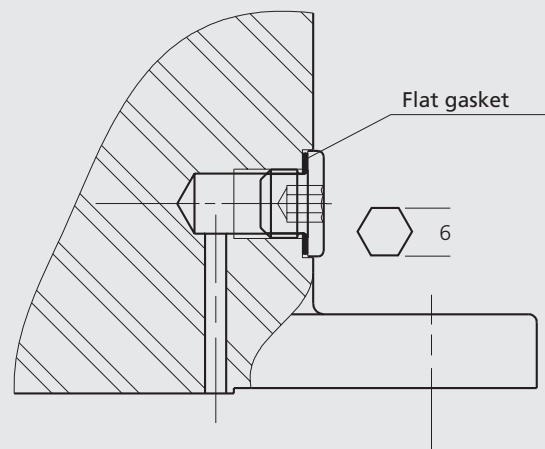


Fig. 9



Magnetic oil level indicator

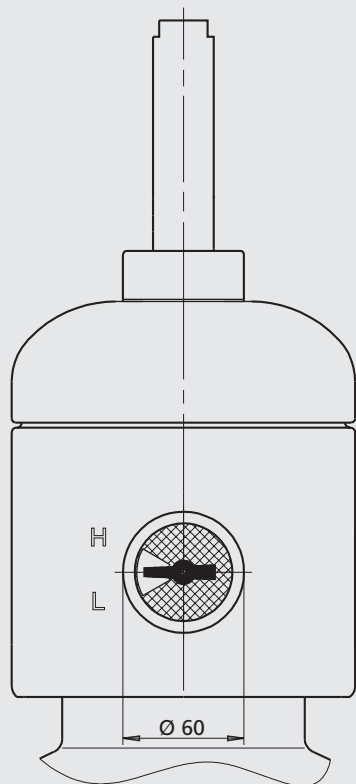


Fig. 10

Arcing horns

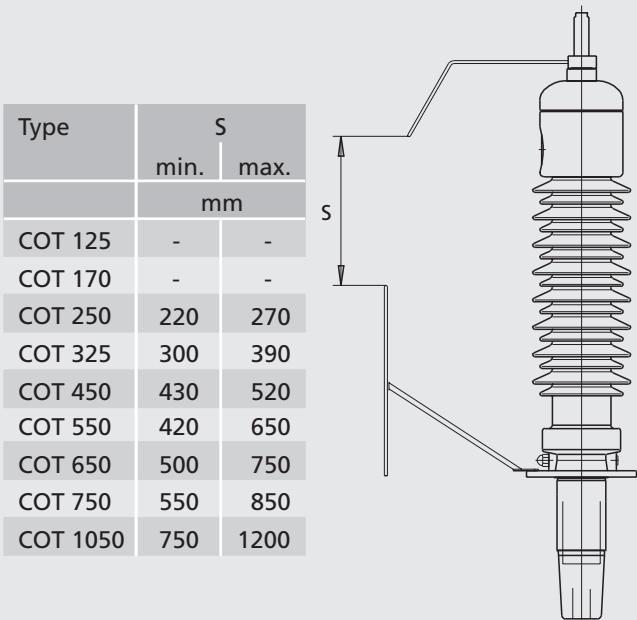


Fig. 11

Voltage tap according to ANSI/IEEE Type A
COT 250 ... COT 1050

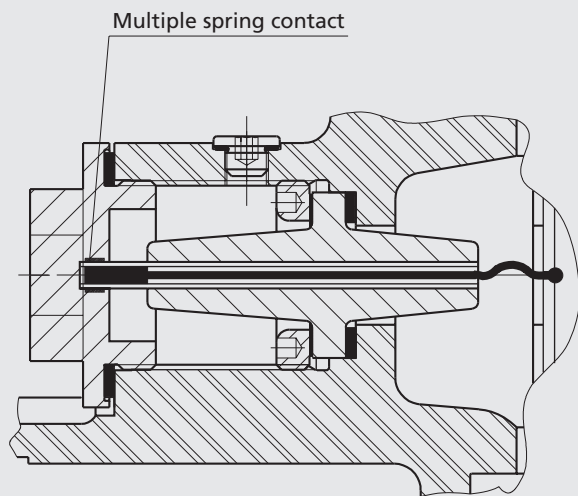


Fig. 12

Oil sampling device

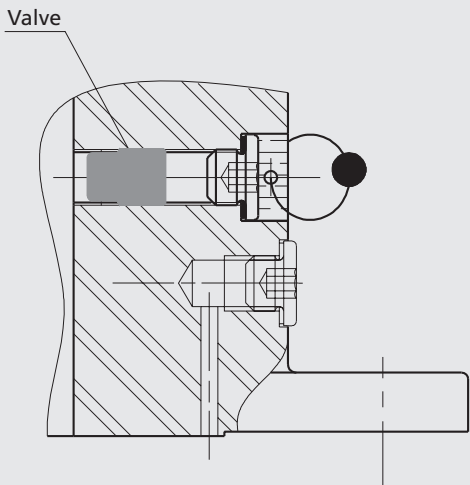
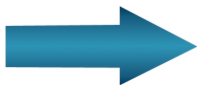
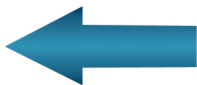
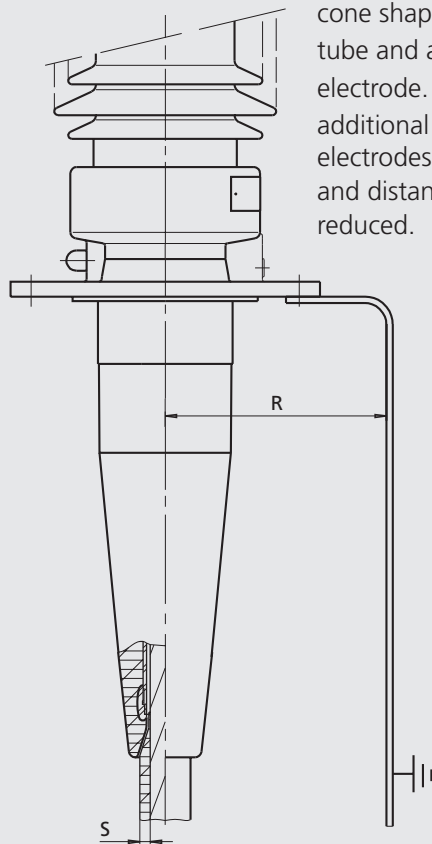


Fig. 13



Embedded Electrode



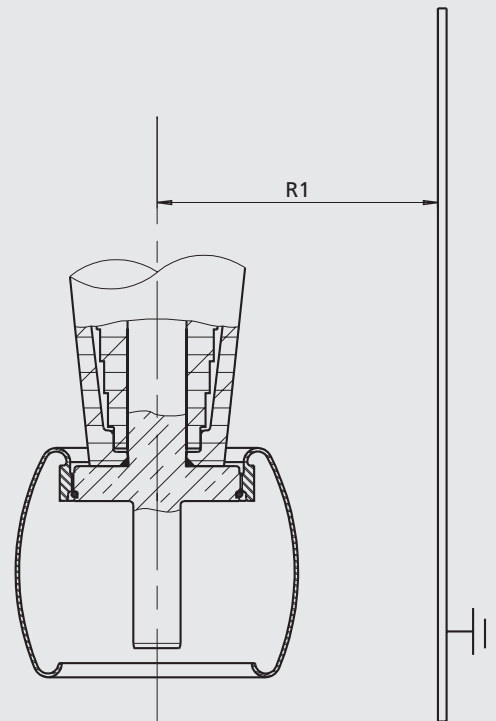
These bushings are equipped on the lower end with a cone shaped epoxy resin tube and an embedded electrode. Therefore additional barriers or electrodes may be omitted and distance to ground is reduced.

Oil conditions:

Mineral oil with less than 10ppm watercontent and dielectric strength higher than 60kV (acc. to IEC 156).

Fig. 14

External Shielding

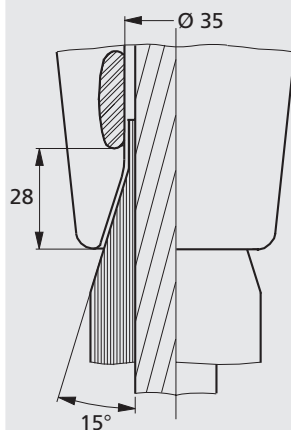


Bushings for higher currents may have an external shielding. Distance to ground has to be increased.

Fig. 15

Draw lead insulation

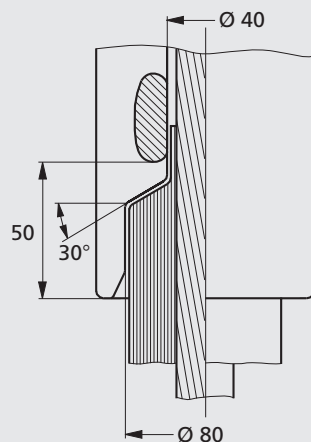
COT 550...750



with draw lead

Fig. 16

COT 1050



with draw lead

Fig. 17

Cable insulation and distance to grounded parts

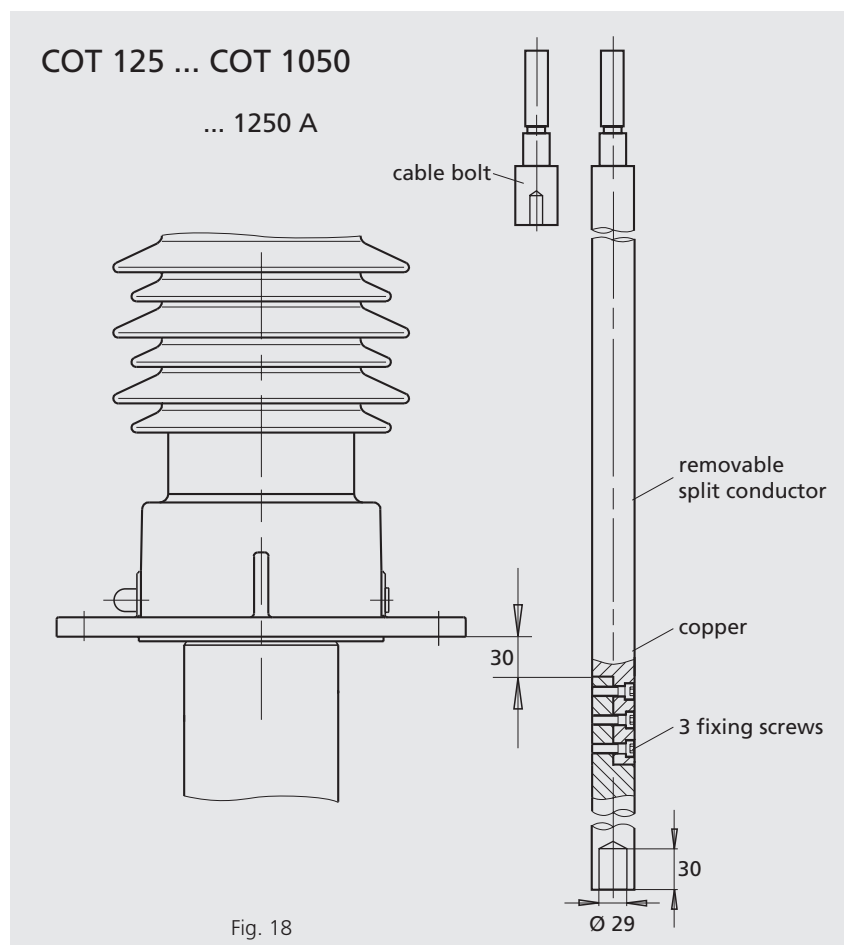
Type	min. insulation thickness S	min. distance to grounded parts	
		R	R1
		mm	
COT 125	5	65	-
COT 170	5	75	-
COT 250	10	85	-
COT 325	10	120	-
COT 450	12	135	-
COT 550	12	145	250
COT 650	15	180	275
COT 750	15	225	300
COT 1050	20	300	375



Main Menu



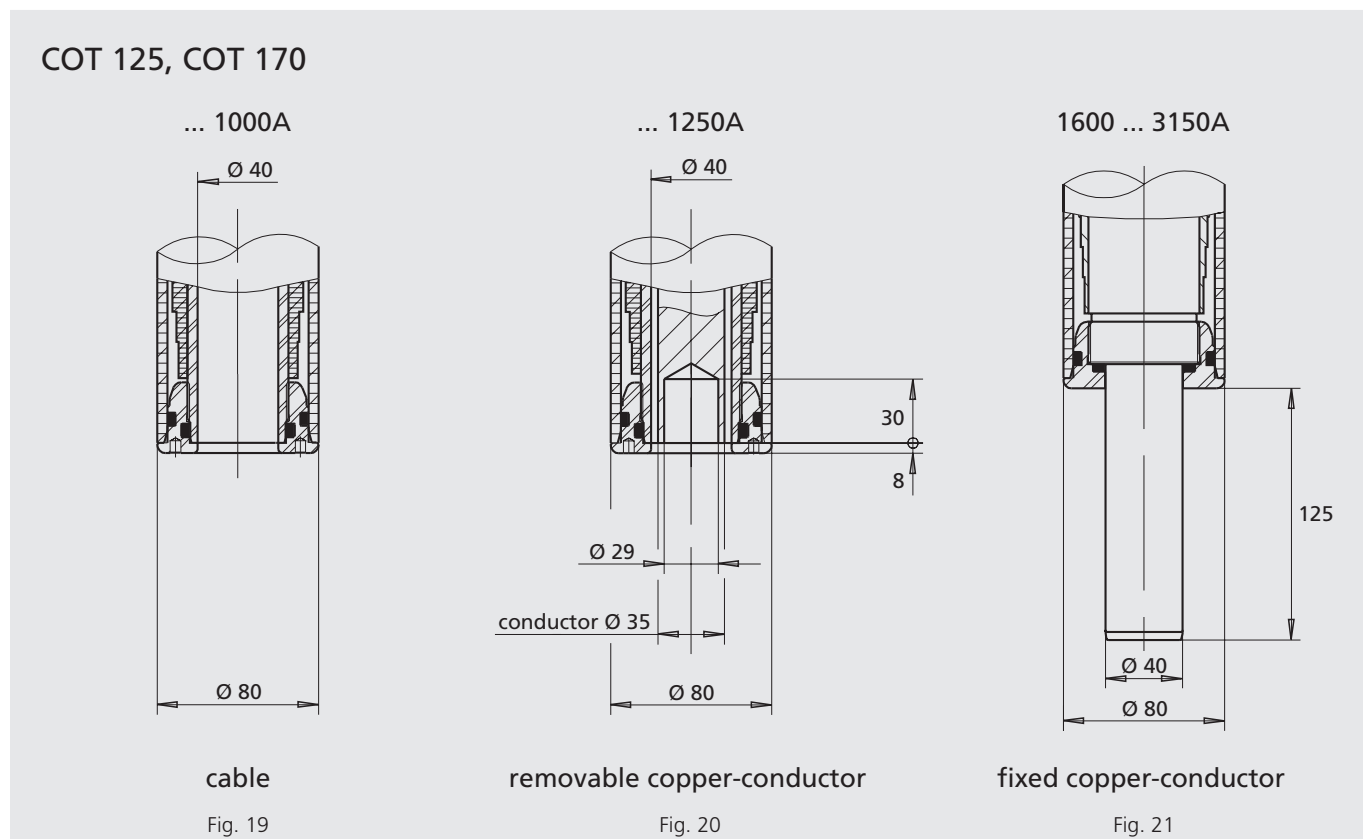
Removable split conductor



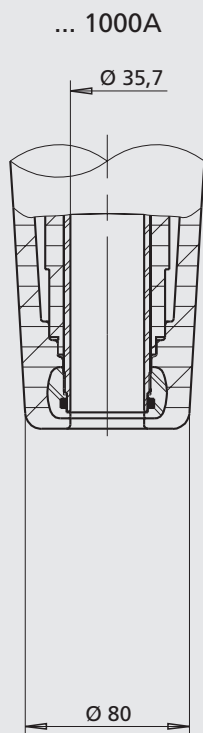
Free oil volumes

Type	volume l
COT 125	2,6
COT 170	2,8
COT 250	2,7
COT 325	2,5
COT 450	2,5
COT 550	3,8
COT 650	4,7
COT 750	5,0
COT 1050	19,0

Oil side end

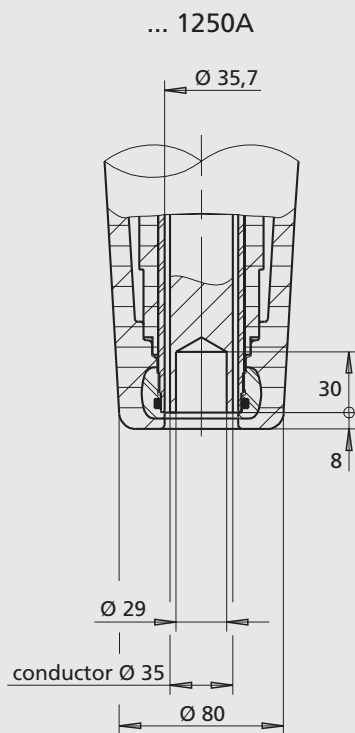


COT 250 ... COT 450



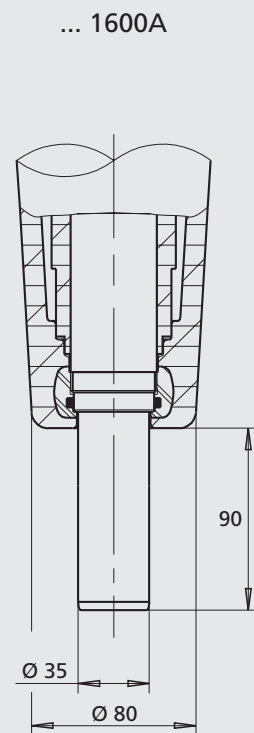
cable

Fig. 22



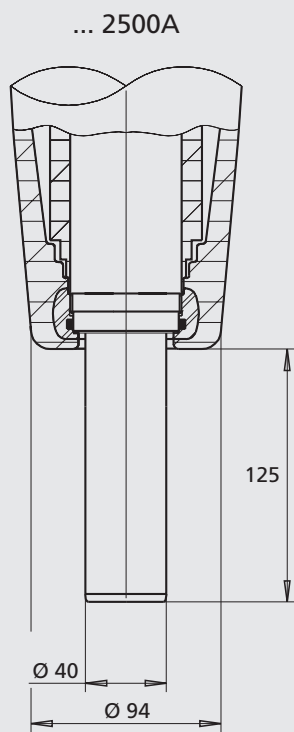
removable copper-conductor

Fig. 23



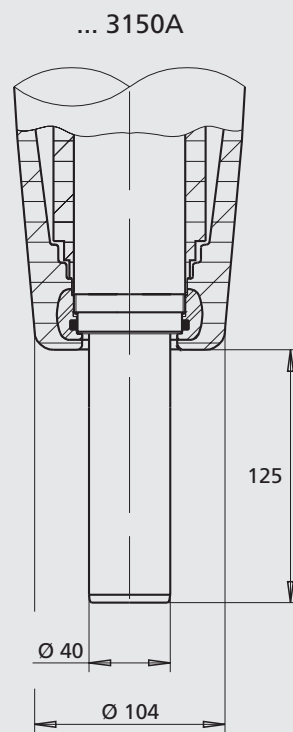
fixed copper-conductor

Fig. 24



fixed copper-conductor

Fig. 25



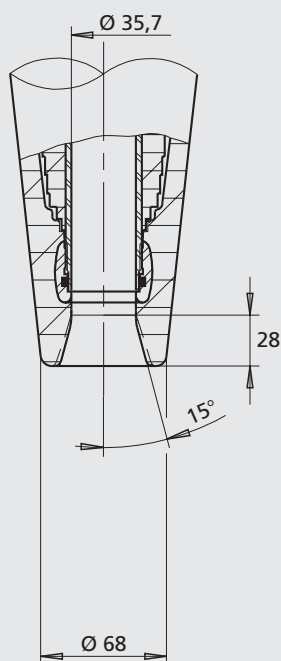
fixed copper-conductor

Fig. 26



COT 550 ... COT 750

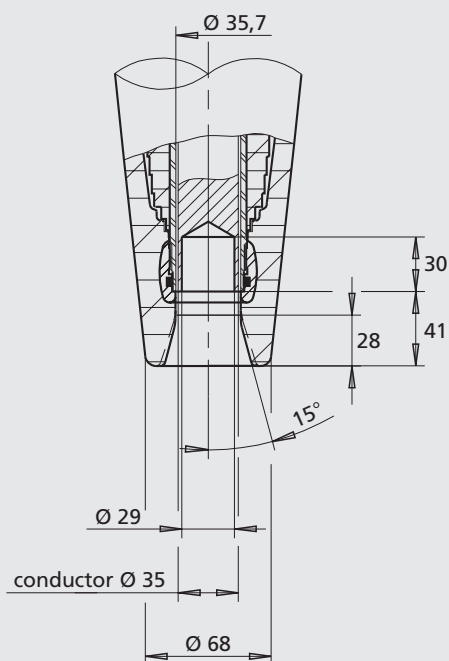
... 1000A



cable

Fig. 27

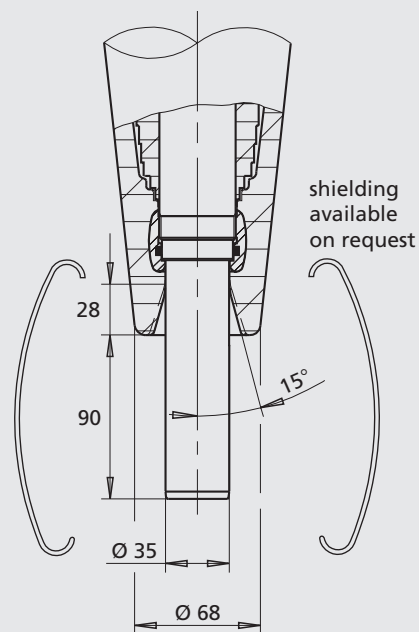
... 1250A



removable copper-conductor

Fig. 28

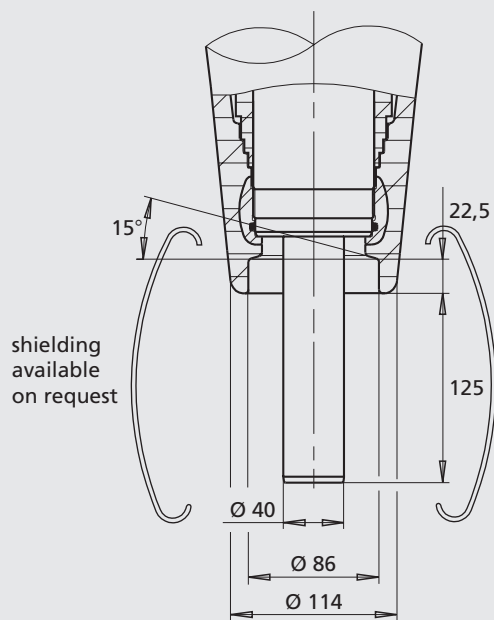
... 1600A



fixed copper-conductor

Fig. 29

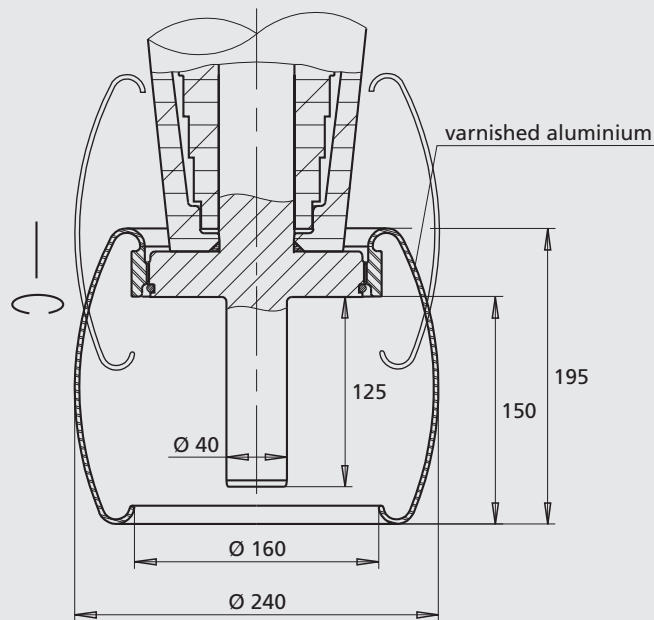
2500A



fixed copper-conductor

Fig. 30

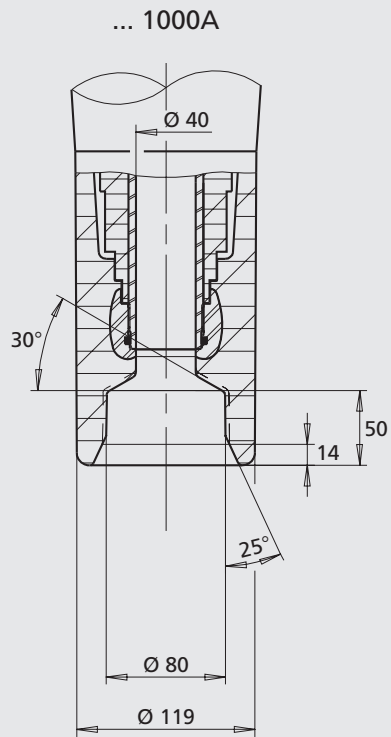
3150A



fixed copper-conductor with shielding

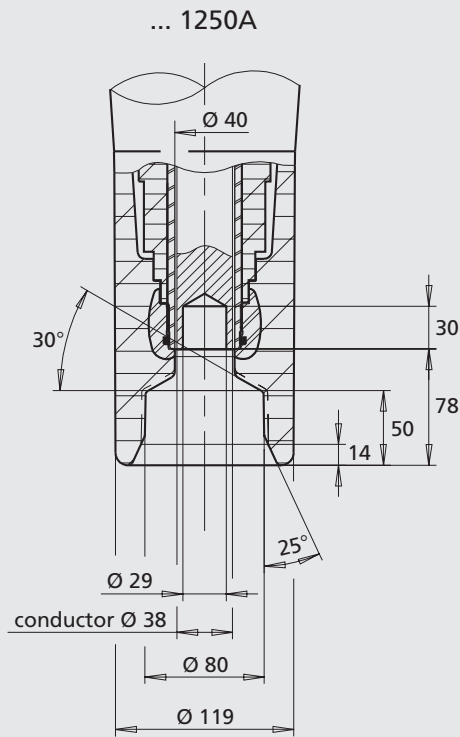
Fig. 31





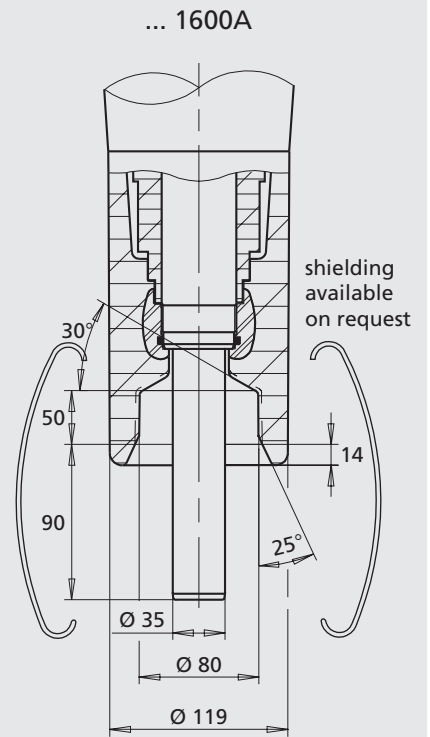
cable

Fig. 32



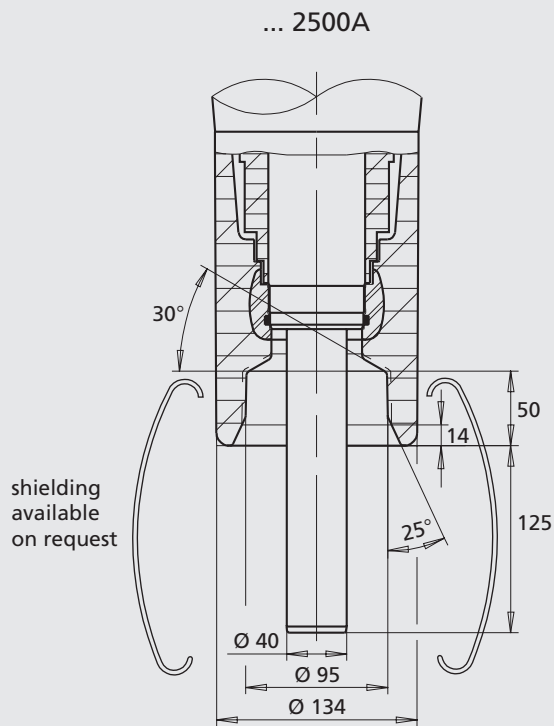
removable copper-conductor

Fig. 33



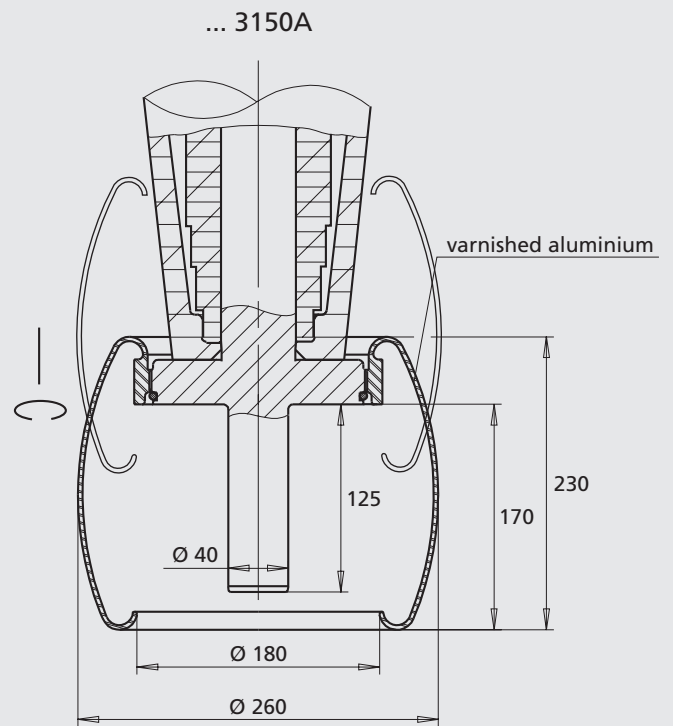
fixed copper-conductor

Fig. 34



fixed copper-conductor

Fig. 35



fixed copper-conductor with shielding

Fig. 36





TRENCH

Product Range

Bushings for

- Power Transformers
up to 765 kV, 3150 A
(>245 kV see separate
brochure E 322.90)
- High Current Application
up to 36 kV, 25000 A
- Transformer to SF6
connection up to 550 kV
- Gas-Insulated Switchgear
(GIS) up to 800 kV, 6000 A
- Generators
up to 36 kV, 45000 A
- Railways
- Buildings
up to 244 kV, 3000 A

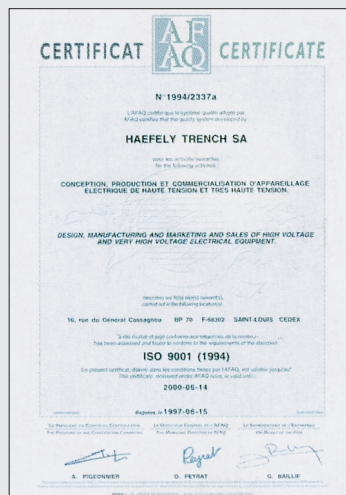
Bushings according to all main
standards as:

IEC
ANSI (see separate brochure
E 322.72)
BS
UTE

Bushings according to
customer's special specification

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At Trench quality is a way of
life. Trench quality assurance
complies with the most
stringent standard of ISO
9001. Certified by AFAQ
since 1994.



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