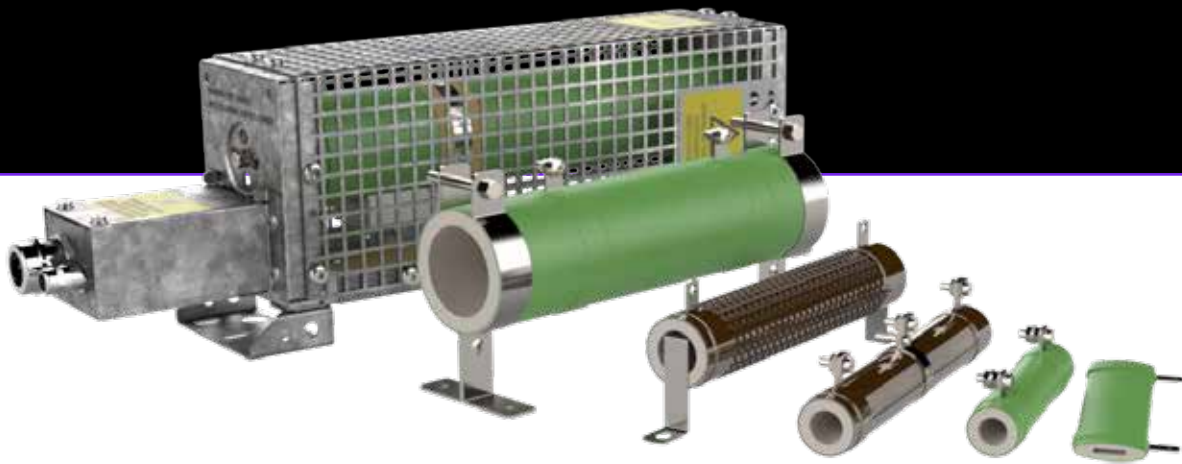




# DANOTHERM™



## Wirewound resistors

- Vitreous Enamelled and Cement Coated
- Round and Oval Shaped
- Sigma Modular Wirewound Brake Resistors
  
- 15–5000W
- Solder, Screw or Fast-on terminals
- Different styles of mounting brackets
- Open type IP00 and Sigma IP20
- Increased creepage distance for high voltage applications
- Optional Live terminals (only oval shaped types)
- Wide ohm range

# Round shape Wirewound resistors

Size	P <sub>nom</sub> @25°C T =350°C	Critical voltage*	Insulation voltage**	Critical resistance*	R <sub>min</sub>			R <sub>max</sub>				Preferred	Profile
					□RF □RI	□RV	□BF □BV	□RF	□RV	□RI	□BF □BV		
					±15%	±10%		±10%					
□ to be G or Z	W	Vrms	Vrms	kΩ	mΩ	Ω	mΩ	kΩ	kΩ	Ω	Ω		
□RF 10/44	17	270	1000	4.2	56	0.8	-	8	1.8	22	-	P	1
□RF 10/55	22	430	1000	8.4	100	0.6	-	12	2.7	33	-		1
□RF 10/63	25	550	1000	12	100	0.6	-	18	3.9	47	-	P	1
□RF 12/51	24	370	1000	5.7	47	1	-	12	3.3	39	-		1
□RF 12/63	30	550	1000	10	56	1	-	22	4.7	56	-	P	1
□RF 12/76	36	750	1000	15	82	1	-	27	5.6	68	-		1
□RF 12/102	48	1200	1000	30	82	1	-	47	8.2	120	-	P	1
□RF 13/51	28	370	1200	4.8	56	1	-	18	3.6	47	-	P	1
□RF 13/63	32	550	1200	9.4	56	1	-	22	5.6	47	-	P	1
□RF 13/100	52	1100	1200	23	82	1	-	47	10	120	-	P	1
□RF 15/51	30	370	1200	4.5	56	1	68	18	3.3	47	3		1
□RF 15/63	38	550	1200	7.9	56	1	100	27	5.6	56	6	P	1
□RF 15/76	45	750	1200	12	82	1	150	33	6.8	68	8		1
□RF 15/100	60	1100	1200	20	82	1	220	58	12	120	12	P	1
□RF 20/50	40	360	1200	3.2	56	0.3	33	22	4.7	47	4		1
□RF 20/75	60	730	1200	8.8	100	0.3	75	47	10	100	8		1
□RF 20/100	78	1100	1200	15	220	0.3	120	56	15	150	12	P	1
□RF 20/140	100	1700	1200	28	220	0.3	180	82	22	220	22	P	1
□RF 20/165	120	2100	1200	36	220	0.5	220	100	27	280	27	P	1
□RF 20/267	200	3600	1200	64	220	1	390	150	47	470	47	P	1
□RF 24/165	150	2100	1200	29	220	1	180	100	33	270	27	P	1
□RF 30/75	85	730	1200	6.2	120	1	39	39	15	120	12		1
□RF 30/100	110	1100	1200	11	180	1	68	56	22	180	18	P	1;3
□RF 30/133	150	1600	1200	17	270	1	100	78	33	220	27	P	1;3
□RF 30/152	170	1900	1200	21	330	1	120	82	39	270	33	P	1
□RF 30/165	185	2100	1200	23	330	1	150	100	42	330	39		1;3
□RF 30/200	225	2600	1200	30	390	1	150	120	47	420	42	P	1
□RF 30/215	245	2900	1200	34	470	1	180	150	56	470	47		1;3
□RF 30/250	275	3400	1200	42	560	1	220	150	68	560	56		1;3
□RF 30/265	300	3600	1200	43	560	1	220	180	68	560	68	P	1;3
□RF 30/330	375	4600	3000	56	680	1	270	180	82	750	75	P	1;3
ZRF 45/370	600	5200	2400	45	1000	-	-	100	-	-	-		1
ZRF 55/100	180	800	3000	3.5	150	1	120	47	-	180	7	P	1
ZRF 55/150	250	1200	3000	5.7	300	1	270	56	-	270	14	P	1
ZRF 55/215	330	1900	3000	10	560	1	560	75	-	330	23	P	1
ZRF 55/290	450	2700	3000	16	820	1	680	100	-	470	35	P	1
ZRF 55/300	450	2800	3000	17	1000	1	820	100	-	470	35		1
ZRF 55/390	600	3700	3000	22	1200	1.2	1000	150	-	620	50	P	1
ZRF 55/400	600	3800	3000	24	1200	1.5	1000	150	-	620	50		1
ZRF 55/490	800	4700	3000	27	1500	1.5	1200	180	-	750	65	P	1
ZRF 55/500	800	4800	3000	28	1500	2.2	1200	180	-	750	65		1
ZRF 55/590	1000	5700	3000	32	1500	2.2	1500	200	-	1000	80	P	1

Table 1

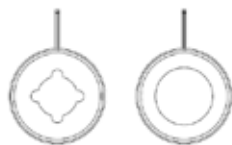
\* Critical voltage and Critical resistance are related to Ohm's law. Their product results in the nominal power. If one or both values are exceeded, the power must be de-rated.

\*\* Insulation voltage is the maximum voltage with standard creepage distance from terminal to mounting bracket. Higher values are possible on request.

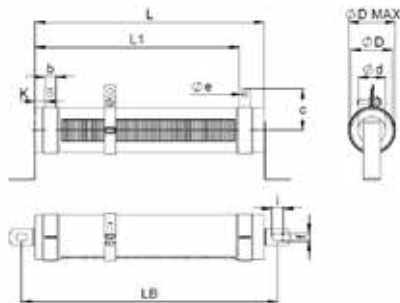
# Mechanical dimensions round shape resistors

Size	D	L	Ltol	d	D max	b L,S/A	e	c	K min	L1±1 L,S/A	LB	fxi	Mass
□ to be G or Z	mmØ	mm	± mm	mmØ	mmØ	mm	mm	mm	mm	mm	mm	mm	g
□RF 10/44	10	44	1	6	13	4.8/6.3	3.2	19	5	32.3/30.8	58	3.2X6	11
□RF 10/55	10	55	1	6	13	4.8/6.3	3.2	19	5	43.1/41.6	69	3.2X6	14
□RF 10/63	10	63	1	6	13	4.8/6.3	3.2	19	5	50.9/49.4	77	3.2X6	15
□RF 12/51	12	51	1	5.5	16	4.8/6.3	3.2	16.5/21	5	39.2/37.7	65	3.2X6	19
□RF 12/63	12	63	1	5.5	16	4.8/6.3	3.2	16.5/21	5	50.9/49.4	77	3.2X6	22
□RF 12/76	12	76	1	5.5	16	4.8/6.3	3.2	16.5/21	5	63.7/62.2	90	3.2X6	26
□RF 12/102	12	102	1	5.5	16	4.8/6.3	3.2	16.5/21	5	89.2/87.7	116	3.2X6	34
□RF 13/51	13	51	1	8.3	17	4.8/6.3	3.2	15.5/20	6	38.2/36.7	-	-	20
□RF 13/63	13	63	1	5.5	17	4.8/6.3	3.2	15.5/20	6	49.4/48.4	-	-	24
□RF 13/100	13	100	1	5.5	17	4.8/6.3	3.2	15.5/20	6	86.2/84.7	-	-	40
□RF 15/51	15	51	1	10	19	4.8/8	3.2	22	6	38.2/35	65	4.2X8	22
□RF 15/63	15	63	1	10	19	4.8/8	3.2	22	6	49.4/46.7	77	4.2X8	26
□RF 15/76	15	76	1	10	19	4.8/8	3.2	22	6	62.7/59.5	90	4.2X8	30
□RF 15/100	15	100	1	10	19	4.8/8	3.2	22	6	86.2/83	114	4.2X8	40
□RF 20/50	20	50	1	12	24	4.8/8	3.2	22/25	6	37.2/34	66	5.5X8	40
□RF 20/75	20	75	1	12	24	4.8/8	3.2	22/25	6	61.7/58.5	91	5.5X8	55
□RF 20/100	20	100	1	12	24	8	4.2	22/25	6	83	116	5.5X8	70
□RF 20/140	20	140	1	12	24	8	4.2	22/25	6	122.2	156	5.5X8	100
□RF 20/165	20	165	1	12	24	8	4.2	22/25	6	146.7	181	5.5X8	115
□RF 20/267	20	267	1	12	24	8	4.2	22/25	6	246.7	283	5.5X8	190
□RF 24/165	24	165	1	15	24	8	4.2	23	6	146.7	181	5.5X8	155
□RF 30/75	30	75	1	20	34	8	4.2	30	6	58.5	93	5.5X8	105
□RF 30/100	30	100	1	20	34	8	4.2	30	6	83	118	5.5X8	135
□RF 30/133	30	133	1	20	34	8	4.2	30	6	115.3	151	5.5X8	175
□RF 30/152	30	152	1	20	34	8	4.2	30	6	134	170	5.5X8	200
□RF 30/165	30	165	1	20	34	8	4.2	30	6	146.7	183	5.5X8	220
□RF 30/200	30	200	1	20	34	8	4.2	30	6	181	218	5.5X8	265
□RF 30/215	30	215	1	20	34	8	4.2	30	6	195.7	233	5.5X8	285
□RF 30/250	30	250	1	20	34	8	4.2	30	6	230	268	5.5X8	320
□RF 30/265	30	265	1	20	34	8	4.2	30	6	244.7	283	5.5X8	350
□RF 30/330	30	330	1	20	34	8	4.2	30	15	301	348	5.5X8	440
ZRF 45/370	45	370	1	30	50	10	5.2	39	12	341.6	-	-	950
ZRF 55/100	55	100	1	42	60	10	5.2	43.5	15	72	124	5.5X8	260
ZRF 55/150	55	150	1	42	60	10	5.2	43.5	15	111.2	175	5.5X8	355
ZRF 55/215	55	210	1	42	60	10	5.2	43.5	15	179.8	236	5.5X8	525
ZRF 55/290	55	290	1	42	60	10	5.2	43.5	15	258.2	317	5.5X8	725
ZRF 55/300	55	300	1	42	60	10	5.2	43.5	15	268	327	5.5X8	740
ZRF 55/390	55	390	1	42	60	10	5.2	43.5	15	356.2	418	5.5X8	940
ZRF 55/400	55	400	1	42	60	10	5.2	43.5	15	366	428	5.5X8	960
ZRF 55/490	55	490	1	42	60	10	5.2	43.5	15	454.2	517	5.5X8	1200
ZRF 55/500	55	500	1	42	60	10	5.2	43.5	15	464	527	5.5X8	1230
ZRF 55/590	55	590	1	42	60	10	5.2	43.5	15	553	618	5.5X8	1450

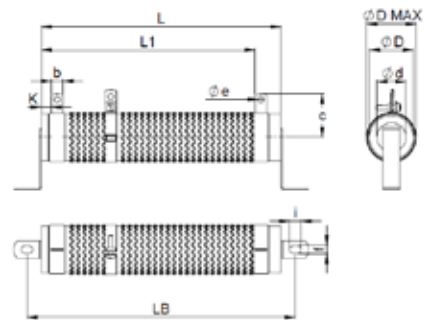
Table 2



Profile 3 Profile 1



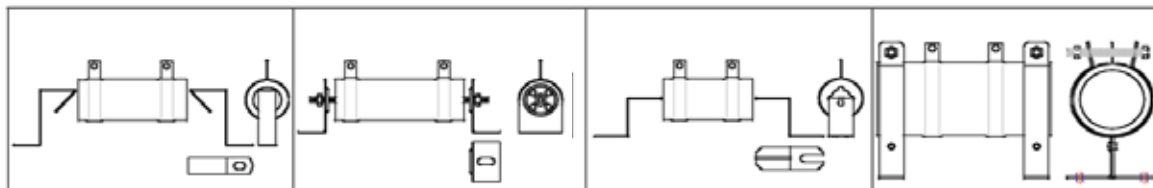
GRV/ZRV GRF/ZRF



GBV/ZBV GBF/ZBF

## Mounting brackets for Round shape resistors

Diameter	Profile No. 1	Profile No. 1	Profile No. 3	-
10mmØ:	R101			
12mmØ	R101			
15mmØ:	R102			
20mmØ:	R103	R701/Length		
24mmØ:	R104			
30mmØ:	R105	R702/Length	R107	
55mmØ:		R703/Length		R901



Mounting brackets for Wirewound resistors need to be ordered separately.

Table 3

## Variants Round shape Wirewound resistors

### Resistor types:

#### GRF/ZRF:

fixed resistors for ac and dc current. Standard tolerance of  $\pm 10\%$  and 5% on request. Can be fitted with mounting feet and intermediate bands if required.

#### GRV/ZRV:

resistor with one or more variable connection band.

#### GRI/ZRI:

induction low resistors by double winding (Ayrton-Perry)

#### GBF/ZBF:

corrugated winding for high pulse load and low Ohm values. The corrugated wire functions as fins, increasing the active surface area. As a rule of thumb, the nominal power increases by some 20%. Also available in variable band types (GBV/ZBV)

### Specifications:

All-welded construction.

Tolerance:

$R > 1$  :  $\pm 5\%$  or 10 % (see table1)

Power rating: Based on 25°C and horizontal mounting.

Temperature Range: -50°C – 250°C

Temperature coefficient:

Low ohm: 200 (400ppm)/°.

Medium-high ohm: <100ppm/°.

Dielectric voltage:

Based on indicated creepage distance ('k' in table 2) from terminals to mounting bracket. 5mm: 1000V; 6mm: 1200V.

Other values than indicated are possible.

Overload:

General: 10 X in 5 seconds.

### Remarks:

Nominal power rating; for corrugated wire types (ZBF/GBF) allow 20% higher power.

Induction low types should be de-rated by 25%.

Standard insulation voltage levels, higher levels on request.

### Materials:

#### Core:

Diameter 10-30 mm:

- Steatite C221

- Porcelain C110, only certain types.

Diameter 45mm:

- Porcelain C410

Diameter: 55mm:

- Corderite C520

Steatite C221 is the optimal choice of ceramic bases material for temperatures below 350 -400°C. It has high mechanical strength and excellent DC stability. If higher temperatures can be expected porcelain C110 can be used. For our large resistor types, corderite C520 are used due to its very high stability to temperature changes.

#### Terminals:

FeNi42 ; has an equivalent temperature expansion coefficient like Steatite. FeNi42 can be soldered when it is clean from oxidation and is relatively stainless.

#### Wire:

Low Ohm value

CuNi10 (T.C: 400ppm)/

CuNi23Mn (T.C: 200ppm)

Medium Ohm value:

CuNi44 (T.C. < 80ppm)

High Ohm value:

NiCr8020; CrAlFe, (T.C. <100ppm)

#### Coating:

Vitreous Enamel, excellent protection to thin wires. All Vitreous Enamelled Resistors meet the IEC 68-2-3 Ca. 56 days. Vitreous enamel can only be used on Steatite. AlPO4 is the best choice regarding high pulse load capability and high temperature stability.

Thermal models are available.

Each resistor can be provided with data sheets including an individual thermal model for simulating temperature rises during load.

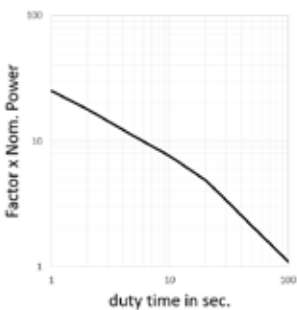
# Oval shape Wirewound resistors

Size	P <sub>nom</sub> @ 25°C T = 350°C	Critical voltage*	Insulation voltage	Critical resistance*	R <sub>min</sub>				R <sub>max</sub>		
					ZFF	ZFI	GFF	GFI	ZFF/GFF	ZFV/GFV	ZFI/GFI
□ to be G or Z	W	V <sub>rms</sub>	V <sub>rms</sub>	kΩ	mΩ	mΩ	Ω	Ω	kΩ	kΩ	Ω
□FF 20/50	30	360	1000	4.3	56	-	1	-	5.6	-	47
□FF 20/80	50	810	1000	13	75	-	1	-	12	-	82
□FF 20/90	55	960	1000	16	100	-	1	-	12	-	100
□FF 20/100	60	1100	1000	20	120	-	1	-	15	-	120
□FF 20/120	70	1400	1000	28	150	-	1	-	18	-	150
□FF 27/50(-M)	40	360	1200	3.2	56	56	1	1	6.8	3.3	47
□FF 27/80(-M)	60	810	1200	10	68	68	1	1	15	6.8	100
□FF 27/90(-M)	65	960	1200	14	82	82	1	1	18	8.2	120
□FF 27/100(-M)	70	1100	1200	17	100	100	1	1	22	10	150
□FF 27/120(-M)	90	1400	1200	21	120	120	1	1	27	12	220
□FF 27/153(-M)	110	1900	1200	32	150	150	1	1	33	15	270
ZFF 45/150(-M)	180	1900	1200	20	150	-	1	-	47	-	270
ZFF 45/200(-M)	225	2600	1200	30	180	-	1	-	68	-	330
ZFF 45/250(-M)	280	3400	1200	41	220	-	1	-	100	-	470
ZFF 78/100(-M)	180	800	3000	3.5	150	-	1	-	4.7	-	180
ZFF 78/140(-M)	250	1200	3000	5.7	300	-	1	-	5.6	-	270
ZFF 78/210(-M)	330	1900	3000	10	560	-	1	-	7.5	-	330
ZFF 78/290(-M)	450	2700	3000	16	820	-	1	-	10	-	470
ZFF 78/390(-M)	600	3700	3000	22	1200	-	1.2	-	15	-	620
ZFF 78/490(-M)	800	4700	3000	27	1500	-	1.5	-	18	-	750

\* Critical voltage and Critical resistance are related to Ohm's law. Their product results in the nominal power. If one or both values are exceeded, the power must be de-rated. Table 4

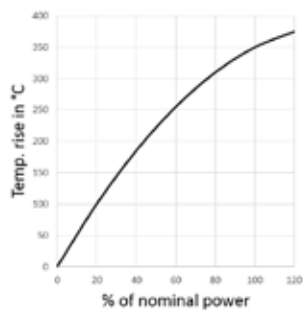
## Overload Capability

Wirewound resistors can be overloaded during certain time several times their nominal power rating. Underneath curve shows the overload capability in percentage of the nominal power for pulse loads at given duration with a cycle time of 120 seconds.



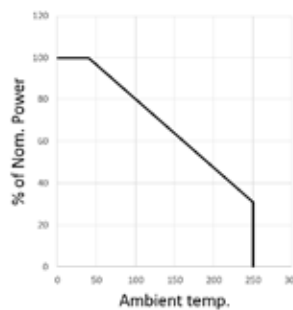
## Temperature rise at constant load.

The maximum surface temperature rise is 350°C. Underneath curve shows the relation between power and surface temperature. For very dynamic power loads we suggest our Cement Coated wirewound resistors.



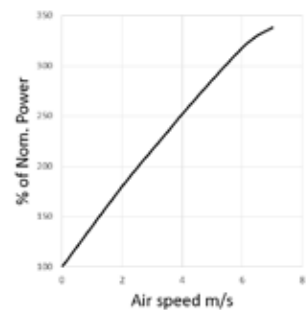
## Elevated ambient temperatures

The admissible maximum power dissipation must be de-rated to prevent over-heating. De-rating is done linearly from 25°C to 350°C at 100% nominal power to 0. Underneath curve shows the relation between ambient temperature and max power dissipation.

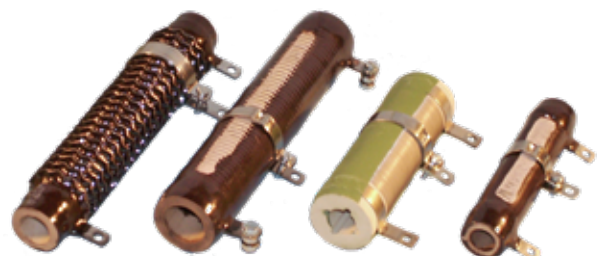


## Forced air cooling

Forced air increases the ability to expel heat into the ambient air. Underneath curve shows the relation between airspeed and maximum admissible power dissipation.



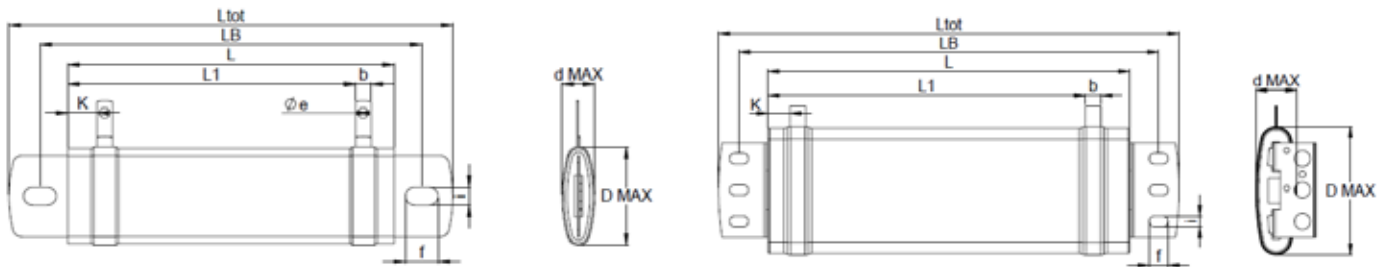
- Nomenclature
- ZB F 30/330 S 000 8R KT
  - Thermal drift **T** = 100ppm/K
  - Resistance tolerance **J** = 5%, **K** = 10%
  - Ohmic value (16R = 16; 5k6 = 5.6k)
  - Drawing No. (omitted when standard)
  - **S**: Screw (order separate in bag) / **L**: Tinned / **A**: Fast-On
  - Length of resistor ceramic in mm
  - Diameter of resistor ceramic in mm
  - **F**: Fixed resistor / **I**: Low induction / **V**: Adjustable
  - **R**: Normal wire / **B**: Corrugated flat wire
  - **G**: Vitreous Enamelled / **Z**: Cement coated



# Mechanical dimensions Oval shape Wirewound resistors

Size	D max	d max	L	L Tol.	L1 ± 1 L1. S/A	Lb	Ltot	k min	b L1. S/A	e	f x i	Mass typ.
□ to be G or Z	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	g
□FF 20/50	23	9.5	50	1	38.2/36.7	67	86	5	4.8/6.3	3.2	7.4mmø	22
□FF 20/80	23	9.5	80	1.6	67.6/66.1	97	116	5	4.8/6.3	3.2	7.4mmø	32
□FF 20/90	23	9.5	90	1.8	77.4/75.9	107	126	5	4.8/6.3	3.2	7.4mmø	35
□FF 20/100	23	9.5	100	2	87.2/85.7	117	136	5	4.8/6.3	3.2	7.4mmø	40
□FF 20/120	23	9.5	120	2.4	106.8/105.3	137	156	5	4.8/6.3	3.2	7.4mmø	45
□FF 27/50	30	10	50	1	37.2/35.7	67	86	6	4.8/6.3	3.2	7.4mmø	30
□FF 27/80	30	10	80	1.6	66.6/65.1	97	116	6	4.8/6.3	3.2	7.4mmø	45
□FF 27/90	30	10	90	1.8	76.4/74.9	107	126	6	4.8/6.3	3.2	7.4mmø	48
□FF 27/100	30	10	100	2	86.2/84.7	117	136	6	4.8/6.3	3.2	7.4mmø	55
□FF 27/120	30	10	120	2.4	105.8/104.3	137	156	6	4.8/6.3	3.2	7.4mmø	65
□FF 27/153	30	10	153	3.1	138.1/136.6	170	189	6	4.8/6.3	3.2	7.4mmø	75
ZFF 45/150	48	12	150	3	136	170	190	6	8	4.2	6.5x10	155
ZFF 45/200	48	12	200	4	185	220	240	6	8	4.2	6.5x10	200
ZFF 45/250	48	12	250	5	234	270	290	6	8	4.2	6.5x10	250
ZFF 78/100	81	25	100	2	72	137	164	15	10	5.3	6.5x12	260
ZFF 78/140	81	25	140	2.8	111	177	204	15	10	5.3	6.5x12	355
ZFF 78/210	81	25	210	4.2	178	247	274	15	10	5.3	6.5x12	525
ZFF 78/290	81	25	290	5.8	258	327	354	15	10	5.3	6.5x12	725
ZFF 78/390	81	25	390	7.8	356	427	454	15	10	5.3	6.5x12	940
ZFF 78/490	81	25	490	9.8	454	527	554	15	10	5.3	6.5x12	1200

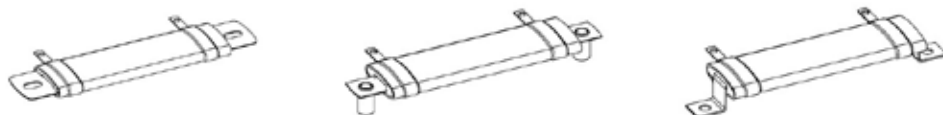
Table 5



size 20/27/45 with optional bracket

size 78 with optional bracket

## Mounting brackets for Oval shape resistors



Tube width	Bracket No.	Bracket No.	Bracket No.
20mm	R123	R120	R122
27mm	R123	R120	R122
45mm	R124	-	-
78mm	P36804*	-	P36802*

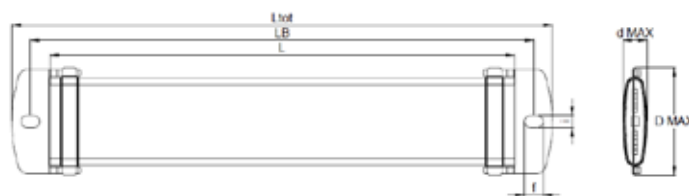
Table 6

Mounting brackets for Wirewound resistors need to be ordered separately.  
\* pre-fitted by factory

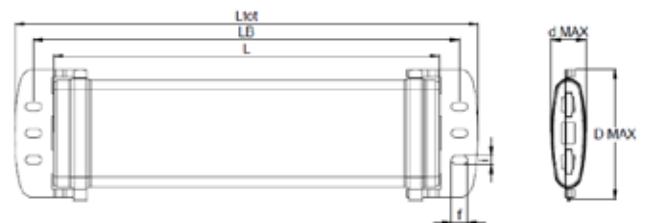
# M-type Oval shape wirewound resistors with live terminals.

Size	D max	d max	L	L tol.	Lb	L <sub>tot</sub>	f x i	Mass typ.
□ to be G or Z	mm	mm	mm	mm	mm	mm	mm	g
□FF 27/50-M	38	10	50	1	67	86	5.5x10	30
□FF 27/80-M	38	10	80	1.6	97	116	5.5x10	45
□FF 27/90-M	38	10	90	1.8	107	126	5.5x10	48
□FF 27/100-M	38	10	100	2	117	136	5.5x10	55
□FF 27/120-M	38	10	120	2.4	137	156	5.5x10	65
□FF 27/153-M	38	10	153	3.1	169	188	5.5x10	75
ZFF 45/150-M	59	12	150	3	170	190	6.5x10	155
ZFF 45/200-M	59	12	200	4	220	240	6.5x10	200
ZFF 45/250-M	59	12	250	5	270	290	6.5x10	250
ZFF 78/100-M	96	25	100	1.8	128	156	6.5x12	260
ZFF 78/140-M	96	25	140	2.5	168	196	6.5x12	355
ZFF 78/210-M	96	25	210	4.2	238	266	6.5x12	525
ZFF 78/290-M	96	25	290	5	318	346	6.5x12	725
ZFF 78/390-M	96	25	390	5.5	418	446	6.5x12	940
ZFF 78/490-M	96	25	490	6.8	518	546	6.5x12	1200

Table 7



size 20/27/45 -M



size 78 -M

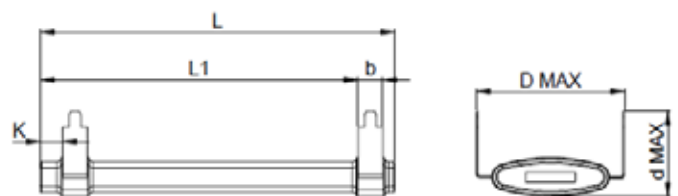
### Custom designed resistors and assemblies

are available on request. Details like wire configuration, creepage distance and inductance can be specified by the customer. The choice between more than 50 sizes guarantee our customer that the best resistor configuration can be found within our program. Special lengths are very well possible.

### Standard, 'Turtles' and 'M-types':

Oval Shaped Vitreous Enamelled or Cement Coated Resistors can be supplied in various types: A 'Turtle' style, having 4 soldering legs to stand on, ideally suited for mounting on PCB's with good mechanical stability. 'Turtles' are offered in 27mm types and all standard lengths.

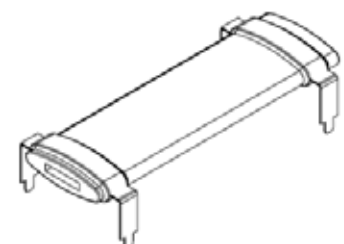
Contact our sales department or email: danotherm@danotherm.dk for special configurations.



size 27 'Turtle'

- Nomenclature**
- ZFF** - Fixed resistor / **I**: Low induction / **V**: Adjustable
  - 45/200** - Length of resistor ceramic in mm
  - S** - Screw (order separate in bag) / **L**: Tinned / **A**: Fast-On
  - 000** - Drawing No. (omitted when standard)
  - 30R** - Ohmic value (16R = 16; 5k6 = 5.6k)
  - KT** - Thermal drift **T** = 100ppm/K
  - Resistance tolerance **J** = 5%, **K** = 10%

'Turtles' are ideally suited for PCB mounting.

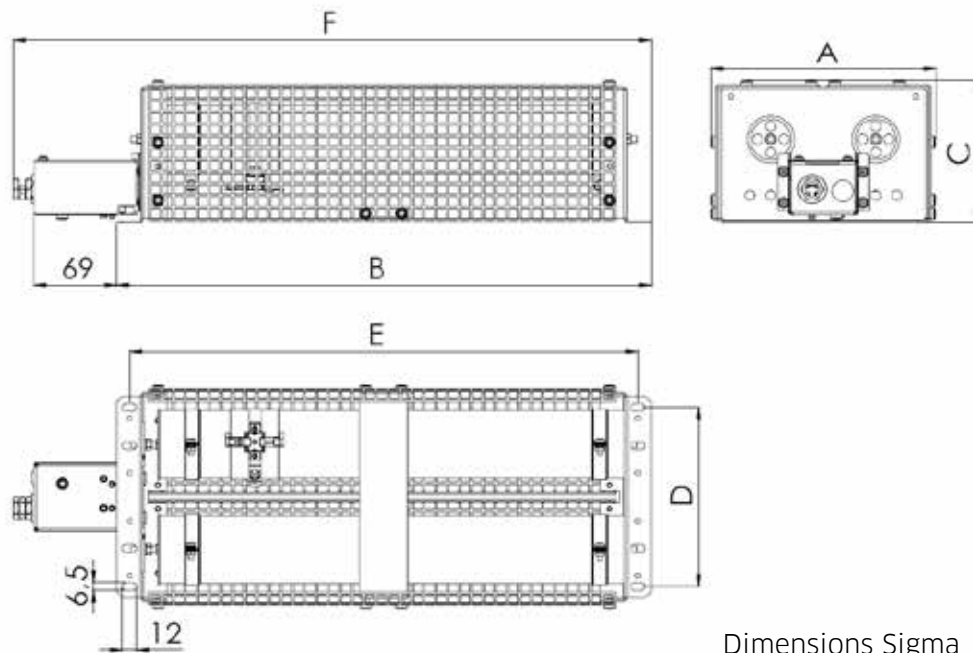


# SIGMA-Modular Wirewound brake resistors

Type	Mass	Ohmic range	number of resistors	P <sub>nom</sub>	Pulse load *	Width (A)	Length (B)	Height (C)	Mount. holes (D)	Mount. holes (E)
□ to be connection type	kg	Ω - kΩ		W	kW	mm	mm	mm	mm	mm
ZRF 55 / 100 0□1	1.1	0.15 - 47	1	180	1,25	89	160	115	64	135
ZRF 55 / 150 0□1	1.2	0.3 - 56	1	250	1,70	89	210	115	64	186
ZRF 55 / 150 0□2	2		2	500	3,40	176	210	115	150	186
ZRF 55 / 150 0□3	3.2		3	750	5,00	265	210	115	240	186
ZRF 55 / 150 0□4	3.8		4	800	5,80	176	210	230	150	186
ZRF 55 / 150 0□6	5.7		6	1200	8,70	265	210	230	240	186
ZRF 55 / 220 0□1	2.1	0.56 - 75	1	330	2.6	89	270	115	64	246
ZRF 55 / 220 0□2	2.9		2	650	5,20	176	270	115	150	246
ZRF 55 / 220 0□3	4.1		3	1000	7,80	265	270	115	240	246
ZRF 55 / 220 0□4	5		4	1100	8,60	176	270	230	150	246
ZRF 55 / 220 0□6	7.2		6	1500	12,50	265	270	230	240	246
ZRF 55 / 300 0□1	2.2	01 - 100	1	450	3,60	89	350	115	64	326
ZRF 55 / 300 0□2	3.5		2	900	7,20	176	350	115	150	326
ZRF 55 / 300 0□3	5.1		3	1300	10,80	265	350	115	240	326
ZRF 55 / 300 0□4	6.3		4	1500	12,00	176	350	230	150	326
ZRF 55 / 300 0□6	9		6	2200	18,00	265	350	230	240	326
ZRF 55 / 400 0□1	2.4	1.2 - 150	1	600	4,80	89	450	115	64	426
ZRF 55 / 400 0□2	4.2		2	1200	9,60	176	450	115	150	426
ZRF 55 / 400 0□3	5.6		3	1800	14,40	265	450	115	240	426
ZRF 55 / 400 0□4	7.6		4	2000	16,00	176	450	230	150	426
ZRF 55 / 400 0□6	11		6	3000	24,00	265	450	230	240	426
ZRF 55 / 500 0□1	3	1.5 - 180	1	800	5,80	89	550	115	64	526
ZRF 55 / 500 0□2	4.6		2	1600	11,60	176	550	115	150	526
ZRF 55 / 500 0□3	7.2		3	2400	17,40	265	550	115	240	526
ZRF 55 / 500 0□4	8.9		4	2600	19,00	176	550	230	150	526
ZRF 55 / 500 0□6	13.2		6	3800	28,50	265	550	230	240	526
ZRF 55 / 600 0□1	3.5	1.5 - 200	1	1000	7,00	89	650	115	64	626
ZRF 55 / 600 0□2	5.8		2	2000	14,00	176	650	115	150	626
ZRF 55 / 600 0□3	7.6		3	3000	21,00	265	650	115	240	626
ZRF 55 / 600 0□4	10.4		4	3200	22,50	176	650	230	150	626
ZRF 55 / 600 0□6	15		6	5000	34,00	265	650	230	240	626

Table 8

\* Pulse load is defined with a 10% on-time and cycle time of 120s



Dimensions Sigma



# SIGMA connection types

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□ to be number of tubes



03□  
400V Phoenix connector 0.25-4mm2

05□  
400V Phoenix connector 0.25-4mm2 connection  
box IP20



06□  
main + thermal switch  
400V Phoenix connector 0.25-4mm2  
connection box IP20

07□  
Phoenix G10/2, AWG 20-6,  
800V connection box IP20



08□  
Phoenix G10/2, AWG 20-6, 800V (main)  
Phoenix connector 0.25-4mm2 (TS)  
connection box IP20

A08□  
Phoenix G10/2, AWG 20-6, 800V (main) Phoenix con-  
nector 0.25-4mm2 (TS)  
connection box IP20, UL approved

# Sigma Wirewound brake resistors UL approved

Type	P <sub>nom</sub>	Max. Surface temp @ 40°C	1s/120s	5s/120s	10s/120s	40s/120s	Ohmic range
	W	°C	kW	kW	kW	kW	Ω - kΩ
ZRF 55/300 OA81	430	375	8	4.8	3.5	1.2	1.0 - 0.4
ZRF 55/400 OA81	575	375	12	6	4.5	1.6	1.5 - 0.9
ZRF 55/500 OA81	725	375	18	8	6	2	2.2 - 1.2
ZRF 55/600 OA81	875	375	22	10	7	2.6	2.5 - 1.5
ZRF 55/400 OA82	900	375	24	12	9	2.7	3.0 - 1.8
ZRF 55/500 OA82	1130	375	36	16	12	3.3	4.0 - 2.2
ZRF 55/600 OA82	1365	375	44	20	14	3.9	5.5 - 3.0
ZRF 55/500 OA83	1545	375	54	24	18	4.5	6.5 - 3.6
ZRF 55/600 OA83	1860	375	66	30	21	5.5	6.8 - 4.5
ZRF 55/500 OA84	2060	375	72	32	24	6	2.0 - 4.8
ZRF 55/600 OA84	2480	375	88	40	28	9.5	2.8 - 6.2
ZRF 55/500 OA86	3065	375	105	56	36	9	3.3 - 6.8
ZRF 55/600 OA86	3690	375	130	60	52	11	3.5 - 10
ZRF 55/500 OA89	4030	375	160	70	54	12	1.5 - 6.8
ZRF 55/600 OA89	4855	375	180	85	60	14	1.8 - 10

Table 9

Each **SIGMA-MODULE** is supplied with resistor element corresponding to the actual load and according to the mechanical sizes shown in the table. The resistor modules consist of fully welded, wire wound ceramic resistors, which is a well-known and proven technology. The base material is corderite, which is a ceramic with a very high resistance to temperature changes. The wire is coated with aluminium phosphate to protect the wire and conduct the heat on to the ceramic core. The modules are fitted with a protection grid complying with IP20, with a ceramic housing connector in an open or closed connector box.

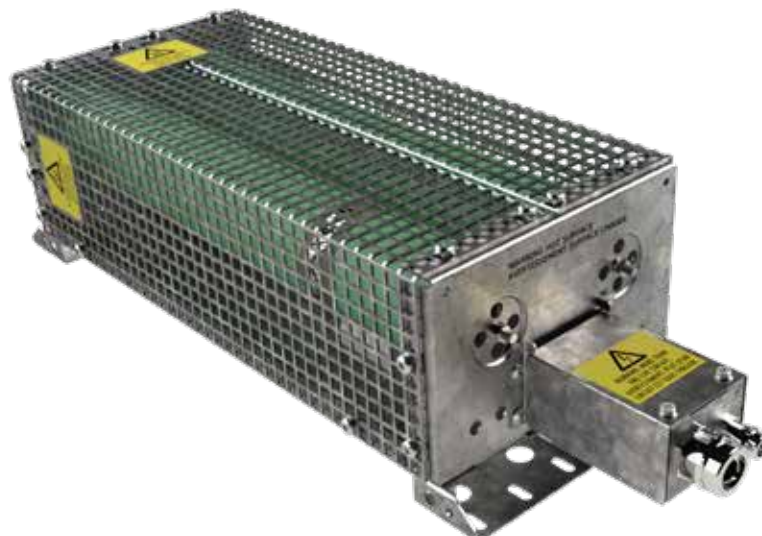
**Resistor material:**

- Ceramic Core:
- 20-30 mm Ø Steatite C221
- 55 mm Ø Corderite
- Resistor Wire: CrAlFe / CrNi / CuNi
- Terminal resistors: FeNi42
- Mounting Bracket: Steel, hot galvanized 1,5mm
- Protection grating: Steel, hot galvanized 1,5mm, perforated
- Module connectors: Porcelain

**Thermostats (optional)**

The thermostat, which surveys the temperature of the resistor element, is equipped with a NC switch for warning if the resistor is over loaded. It is mounted on the lower side on one or more resistor elements and has directly thermal contact. The standard switching temperature is 260°C. Other (lower) temperatures are possible. The switch is specified to 250/380VAC, 10/5A. The thermostat is insulated from the resistor via a ceramic housing.

The resistor elements have a nominal power from 100W and upward and are particularly suitable for pulse loads of 10 - 20 time or more compared to the nominal load. Danotherm has developed thermal models corresponding to all resistor types and resistor values. By using these models it is possible to simulate the temperature rise in the resistor wire for all possible load situations. Danotherm offers its assistance to customers to find the optimum solution for any situation.



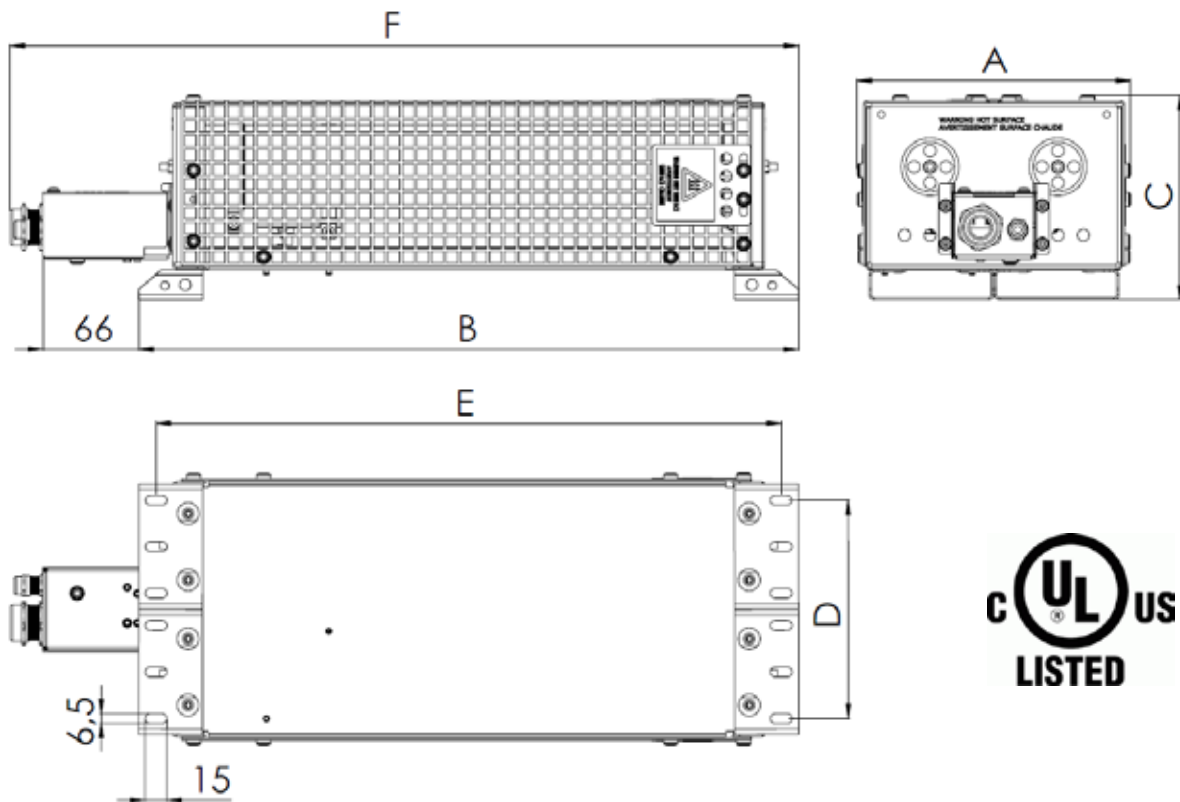
Sigma UL ZRF 55/600 OA82

# Mechanical dimensions Sigma UL approved

Type	A ± 2	B1 ± 2	C ± 2	D ± 1	E ± 3	F ± 3	Mass
	mm	mm	mm	mm	mm	mm	kg
ZRF 55/300 OA81	97	350	142	64	326	435	2.5
ZRF 55/400 OA81	97	450	142	64	426	535	3
ZRF 55/500 OA81	97	550	142	64	526	635	3.5
ZRF 55/600 OA81	97	650	142	64	626	735	4
ZRF 55/400 OA82	188	450	142	150	426	535	5
ZRF 55/500 OA82	188	550	142	150	526	635	5.5
ZRF 55/600 OA82	188	650	142	150	626	735	6.5
ZRF 55/500 OA83	279	550	142	240	526	635	7.8
ZRF 55/600 OA83	279	650	142	240	626	735	8.5
ZRF 55/500 OA84	188	550	252	150	526	635	9.5
ZRF 55/600 OA84	188	650	252	150	626	735	11
ZRF 55/500 OA86	274	550	252	240	526	635	14
ZRF 55/600 OA86	274	650	252	240	626	735	15
ZRF 55/500 OA89	274	550	342	240	526	635	17
ZRF 55/600 OA89	274	650	342	240	626	735	18

Table 10

## Dimensions Sigma UL



- Nomenclature**
- ZRF 55/400 033 000 8R0 KT
- Thermal drift **T** = 100ppm/K
  - Resistance tolerance **J** = 5%, **K** = 10%
  - Ohmic value (16R = 16; 5k6 = 5.6k)
  - Drawing No. (omitted when standard)
  - Number of resistor elements; 1 / 2 / 3 / 4 / 6
  - Connection box style; 03 / 05 / 06 / 07 / 08 / A08
  - Length of resistor protection grating in mm
  - Diameter of resistor ceramic in mm
  - **KASSE ZRF**: for other types consult Danotherm



KASSE ZRF 55/220 081 30R KT

## Overview of the ALPHA resistor family (IP00-IP65)



Power: 60-410W	Power: 85W - 1.7kW	Power: 410W - 12kW	Power: 445W-15kW	Power: 860W-25kW
	9-150kJ @5s	25-550kJ @5s	80kJ-2.5MJ @5s	6.4kJ-1.1MJ @5s
- Applications	- Applications	- Applications	- Applications	- Applications
Charge / Discharge	High Pulse load	High Pulse load	High Pulse load	Short recovery time
Brake	Brake	Brake	Brake	Brake
Filter	Filter	Filter	Medium voltage	Filter
Charge / Discharge	Charge / High Pulse	Charge / High Pulse	Charge / High Pulse	High Pulse

## Other resistor types from Danotherm (IP00-IP65)



Multi purpose	Outdoor & Marine	Filter	Medium & HV	Filter & load
Power: 100W-5kW	Power: 1-500kW	Power: 4-200kW	Power: 500W->	Power: 5kW-1MW
Ceramic wirewound	Steel tube	Wirewound	Steel grid	Steel tube

Official Danotherm dealer



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