Technical details

Construction

Wirewound flat resistors consist of support straps and wiring. As standard version the support strap is from mica. For resistor windings we use round wires from CuNi 44 according to DIN 17471, 46460-1 and 46461 or from NiCr 3020 or CrAl 25 5 according to DIN 17470. We either wind an oxidized wire without gap (type GU) or fix them by non-slip strip cementing (type GZ), even if they increase a little when heated. We surround the resistor installations of our encapsulated flat resistors with quartz sand. Then the wire will not slip and and the heat transfer to the aluminium enclosure is reliable.

Resistance values/ Production tolerance/ Temperature dependency

The resistance values in the column "production range" refer to the standard production program, further values on request. The normal tolerance is ± 10%, restricted tolerance on request.
The resistance value slightly changes in dependency of the winding temperature. The temperature rise at the winding is $\Delta T \approx 300$ K when the rated power is operating continuously. Compared to the cooled off condition you have the following changes of resistance: with wires from CuNi 44 approx. ±1%, from CrAl 25 5 approx. +1% and from NiCr 3020 approx. +10%.

Degrees of protection

Allocation of type series to degrees of protection according to EN 60529 and/or DIN VDE 0470 part 1

Type series	Degree of protection	First characteristic numeral degree of protection against access & against solid foreign objects	Second characteristic numeral degree of protection against water
GU GZ	IP 00	Non-protected – i.e. depending upon integration the user must provide a protection	Non-protected
GLAD GMAD GNAD GPAD	IP 40	Protected against access to hazardous parts with a wire and against solid foreign objects of 1 mm ∅ and greater.	Non-protected
GAAD GBAD GHAD GVAD GWAD	IP 54	Protected against access to hazardous parts with a wire and against dust	Protected against splashing water. Water splashed against the enclosure from any direction shall have no harmful effects
GYAD	IP 67	Protected against access to hazardous parts with a wire and dust-tight	Protected against the effects of temporary immersion in water. Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is temporarily immersed in water under standardized conditions of pressure and time

IP 00

IP 40

IP 54

IP 67

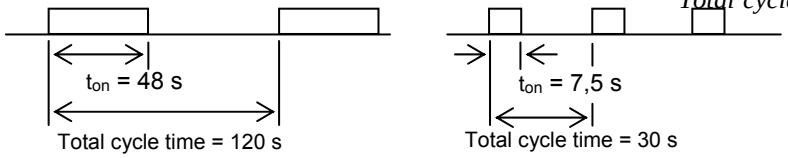
CE

Devices with degrees of protection IP 20 or higher comply with the CE low voltage directive. Power resistors being passive electronical or electrical units are not affected by the specific EMC standards. They do not produce any interfering radiations nor are they affected.

Short time dissipation/ Total cycle time/ Duty cycle factor(DCF)

In many applications resistors are not loaded in continuous but in short time operation. In the following you will find indications, how to calculate the allowable short time dissipation with the help of the duty cycle factor (DCF) and the overload factor (OLF). If the DCF factor is not known, it can be calculated as follows:
:

$$Duty\ cycle\ \ factor(DCF) = \frac{Switch\ on\ time(t_{on})}{Total\ cycle\ time}$$



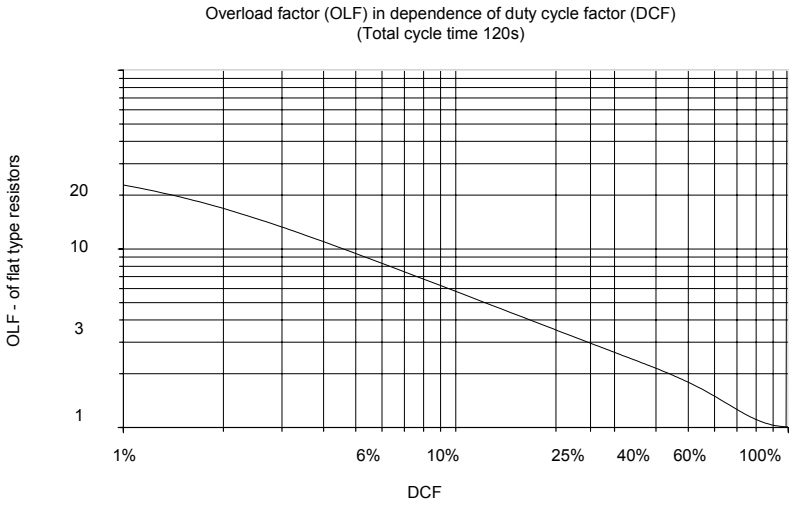
$$DCF_1 = \frac{48s}{120s.} = 0{,}4 = 40\%$$

$$DCF_2 = \frac{7{,}5s}{30s} = 0{,}25 = 25\%$$

Warning: The total cycle time may be maximum 120 s - shorter total cycle times are possible.
The total cycle times for motors are mostly higher than 120 s

Overload factor(OLF)

By comparison of the known DCF-factor with the following diagram or table you can work out the overload factor (OLF) and/or the continuous and the short time dissipation.



DCF	1%	3 %	6%	15%	25%	40%	60%	80%	100%
OLF	22	13	8,2	4,2	3,0	2,2	1,5	1,12	1,0

The continuous and the short time dissipation can be calculated as follows:

$$Short\ time\ dissipation = Continuous\ dissipation \times OLF$$

$$Continuous\ dissipation = \frac{Short\ time\ dissipation}{Overload\ \ factor(OLF)}$$

Calculation example

given:

- Resistor with a short time dissipation of 2,5 kW for 7 s and a total cycle time of 120s

wanted:
continuous dissipation

- The duty cycle factor (DCF) would be 7 s : 120 s x 100% = 6%
- Overload factor (OLF) for 6% DCF, according to table it is 8,2
- The continuous dissipation is 2,5 kW : 8,2 = 305 W;
- You would need a resistor with a continuous dissipation of at least 300W!

Typical power / Continuous dissipation Ventilation / Temperatures

The given typical power values are valid for 100% duty cycle factor (DCF) (continuous dissipation) under the following conditions:

- temperature rise of 200 K at the surface of fixed resistor enclosures (degree of protection> IP00)
- temperature rise of 300 K at the surface of fixed resistor elements (degree of protection IP00).
- maximum ambient temperature 40°C
- unhindered access of cooling air
- unhindered diverting of warmed up air (keep a minimum separation distance of approx. 200 mm to neighbouring components/walls and of approx. 300 mm to components above/ceiling)
- warning: If the ambient temperature is higher than 40°C, you have to lower the continuous dissipation for 4% per 10 K temperature rise!

Since electrical energy is converted into heat, it is inevitable that the enclosure will be heated up, as well as the exhaust air.
The highest temperature at typical power may be maximum 200°C beyond the ambient temperature. Since the cooling of the devices is accomplished by convection or by a heat sink, the above mentioned aspects have absolutely to be considered.

In cases of insufficient cooling or false mounting the resistor or the surrounding construction units could be overheated or ruined.

Air and creepage distances

Air and creepage distances are rated after IEC 664 (DIN EN 0110 part 1) for the overvoltage category III and degree of pollution 3 for grounded three-phase mains supplies up to 3 x 500 V. Testing voltage 2.5 kV AC.

These data are good for all devices that are connected with mains voltage and derived voltages, like for example the intermediate circuit voltage of frequency converters.

Wiring /connections

All our encapsulated resistors in standard version have UL recognized FEP-wires, that are partially also wired on terminals (special wire insulations on request). If the wiring is accomplished by the customer, make sure that use a heat resistant wire is used.

UL-Recognition

All our standard type series have an UL-recognition for the American as well as for the Canadian market. They are recognized according to UL508 with the number E212934, which complies with the recognition according to CSA C22.2 No.14. For further information please check the UL-flyer.
(Please ask for it or visit us at www.frizlen.com)

Excess temperature protection

A version of the excess temperature monitoring particularly suited for long-term overloading is the equipment with a temperature switch with two wires. It releases a signal contact when the set temperature is exceeded. There will not be a disconnection of the resistor.

Contact ratings

Contact ratings of the signal contact:

- 6,3 A / 230 VAC (cos phi = 0,6) resp. 2,0 A / 24 VDC

Mounting

Please consider the mounting indications of the corresponding type series!
You will find these icons in the data sheets:

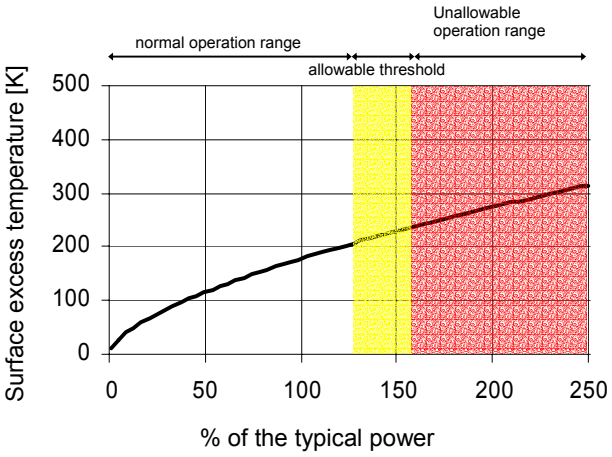
Allowable: On horizonal surfaces

Allowable: On vertical surfaces wires or terminals at the bottom

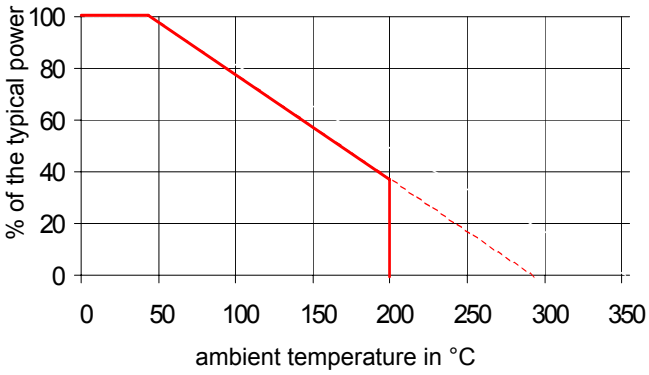
Technical details to type series GAAD. until GYAD.

parameter	symbol	value	unit	conditions
dissipation	P	compare typical power	W	
energy absorption	W	depending on type and resistance value	kJ (kWs)	
rated voltage	U	max. 800	V	DC
rated insulation voltage	U_{ISO}	600	V	AC
testing voltage	$U_{Prüf}$	4000	V	DC
excess temperature at enclosure	ΔT	200 (max. 250)	K	
resistance value	R	compare type	Ω	
tolerance of resistance value		± 10	%	
temperature coefficient	TK	0,00033	1/K	NiCr3020
insulation resistor	R_{ISO}	≥ 100	MΩ	1000 V DC
inductive time constant	τ_{ind}	≤ 3	µs	
thermal time constant	T_{TH}	360	s	free convection

surface excess temperature depending on power

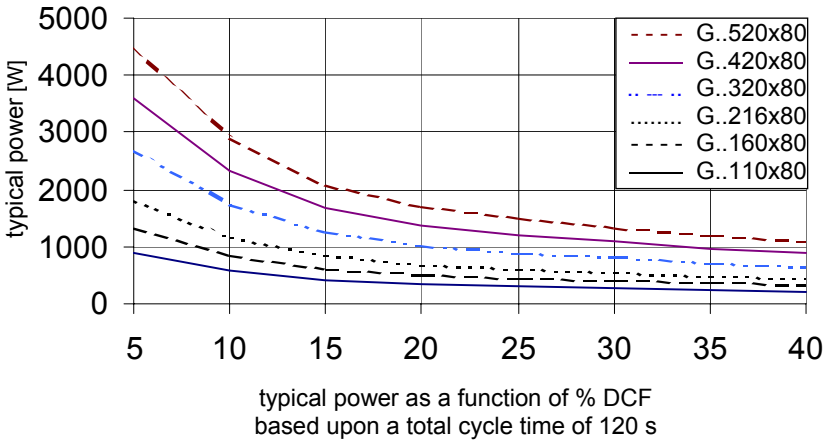


Derating-diagram



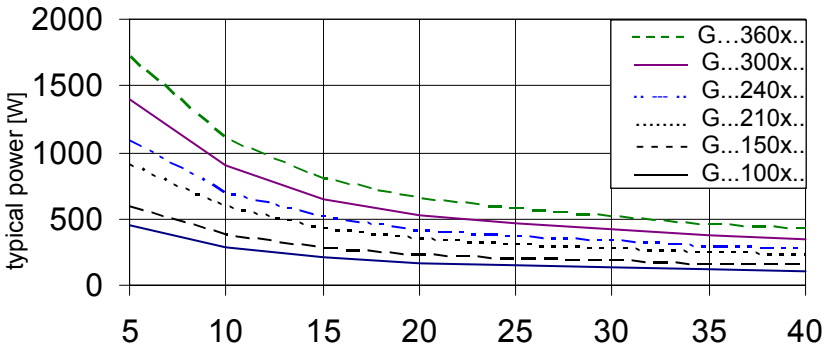
Power ratings in short time operation at an excess temperature of the enclosure of 200K

type series GW.., GY..



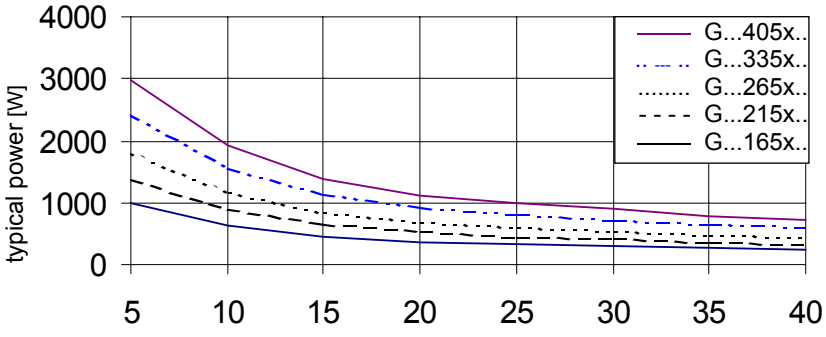
typical power as a function of % DCF
based upon a total cycle time of 120 s

type series GL.., GM..
and GV.., GH..



typical power as a function of % DCF
based upon a total cycle time of 120 s

type series GN.., GP
and GA.., GB



typical power as a function of % DCF
based upon a total cycle time of 120 s