VISHAY SFERNICE MCB RAILWAY

04 / 2018

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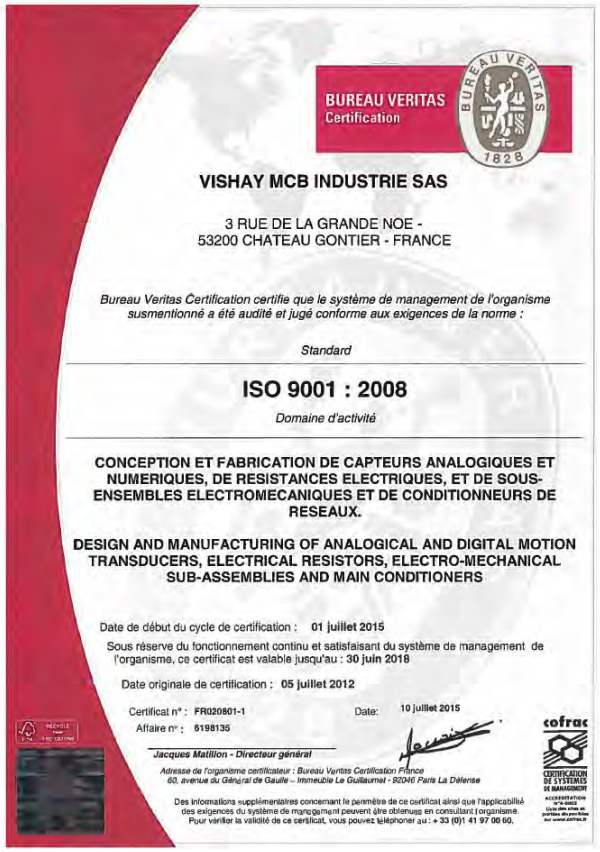
A WORLD OF SOLUTIONS

VISHAY Quality

ISO 9001v2008



BUREAU VERITAS Certification

VISHAY MCB INDUSTRIE SAS

3 RUE DE LA GRANDE NOE -
53200 CHATEAU GONTIER - FRANCE

Bureau Veritas Certification certifie que le système de management de l'organisme susmentionné a été audité et jugé conforme aux exigences de la norme :

Standard

ISO 9001 : 2008

Domaine d'activité

CONCEPTION ET FABRICATION DE CAPTEURS ANALOGIQUES ET NUMERIQUES, DE RESISTANCES ELECTRIQUES, ET DE SOUS-ENSEMBLES ELECTROMECANIQUES ET DE CONDITIONNEURS DE RESEAUX.

DESIGN AND MANUFACTURING OF ANALOGICAL AND DIGITAL MOTION TRANSDUCERS, ELECTRICAL RESISTORS, ELECTRO-MECHANICAL SUB-ASSEMBLIES AND MAIN CONDITIONERS

Date de début du cycle de certification : **01 juillet 2015**

Sous réserve du fonctionnement continu et satisfaisant du système de management de l'organisme, ce certificat est valable jusqu'au : **30 juin 2018**

Date originale de certification : **05 juillet 2012**

Certificat n° : FR020801-1 Date: 10 juillet 2015

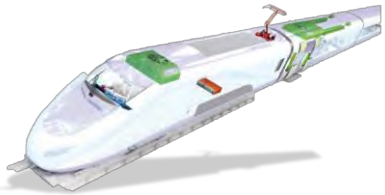
Affaire n° : 5198135

Jacques Matillon - Directeur général

Adresse de l'organisme certificateur : Bureau Veritas Certification France
60, avenue du Général de Gaulle – Immeuble Le Guillaumet - 92046 Paris La Défense

Des informations supplémentaires concernant le périmètre de ce certificat ainsi que l'applicabilité des exigences du système de management peuvent être obtenues en consultant l'organisme. Pour vérifier la validité de ce certificat, vous pouvez téléphoner au : + 33 (0)1 41 97 00 60.

cofrac



IRIS: ISO/TS 22163:2017

IRIS Certification™

BUREAU VERITAS Certification

C E R T I F I C A T E

awarded to

VISHAY MCB Industrie SAS
3, rue de la grande noé
53200, Château-Gontier
France

BUREAU VERITAS CERTIFICATION

confirms, as an IRIS Certification™ approved certification body, that the Management System of the above organization has been assessed and found to be in accordance with the

IRIS Certification™ rules:2017
and based on
ISO/TS 22163:2017

for the activities of Design and Development and Manufacturing
for the scopes of certification: 04 (Power system, drive unit), 19 (Single railway components)
FOR THE PRODUCTS OF ANALOGICAL AND DIGITAL MOTION TRANSDUCERS, ELECTRICAL RESISTORS, ELECTRO-MECHANICAL SUB-ASSEMBLIES AND MAIN CONDITIONERS.

Certificate valid from: 06/04/2018 Certificate valid until: 05/04/2021*

Current date: 05/04/2018
Certificate-Register-No: FRA -IR - 000 1008

* Providing that the subsequent surveillance audits are successful before the validity date of the previous audit.
Certification body address: 67/71 Boulevard du Château, 92200 Neuilly-sur-Seine, France

EN 9100v2009

BUREAU VERITAS Certification

VISHAY MCB INDUSTRIE SAS

3 RUE DE LA GRANDE NOE -
53200 CHATEAU GONTIER - FRANCE

Bureau Veritas Certification certify that the Management System of the above organisation has been audited in accordance with the relevant Aerospace Supplier Quality system Certification Scheme EN 9104-001:2013 and found to be in accordance with the requirements of the management system standard detailed below:

Standard

EN 9100:2009
AS 9100C - JISQ 9100:2009

Scope of certification

DESIGN AND MANUFACTURING OF ANALOGICAL AND DIGITAL MOTION TRANSDUCERS AND ELECTRO-MECHANICAL SUB-ASSEMBLIES

CONCEPTION ET FABRICATION DE CAPTEURS ANALOGIQUES ET NUMERIQUES ET DE SOUS-ENSEMBLES ELECTROMECANIQUES

Certificate Issue Date : 01 July 2015

Subject to the continued satisfactory operation of the organization's Management System, this certificate expires on (Certification Expiry date): **30 June 2018**

Original certification date: 11 July 2012

Certificate : 5198135-Rev0 Date: 10 July 2015

File number : FR020802-1

Jacques Matillon - Managing Director

Bureau Veritas Certification France
60, avenue du Général de Gaulle – 92046 Paris La Défense

Further clarifications regarding the scope of this certificate the applicability of the management system requirements may be obtained by consulting the organization.
To check this certificate validity, please call + 33(0) 1 41 97 00 60.

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TARGET APPLICATION - RAILWAY

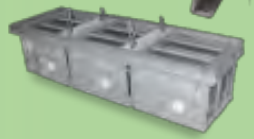
TRACTION

Snubber
Capacitor Precharge Discharge
Crowbar Damping
HVAC Heating
Braking

POWER THICK FILM
Wirewound
Braking Resistors
Heating Resistors

RCEC 400 / 500/ 750 / 850

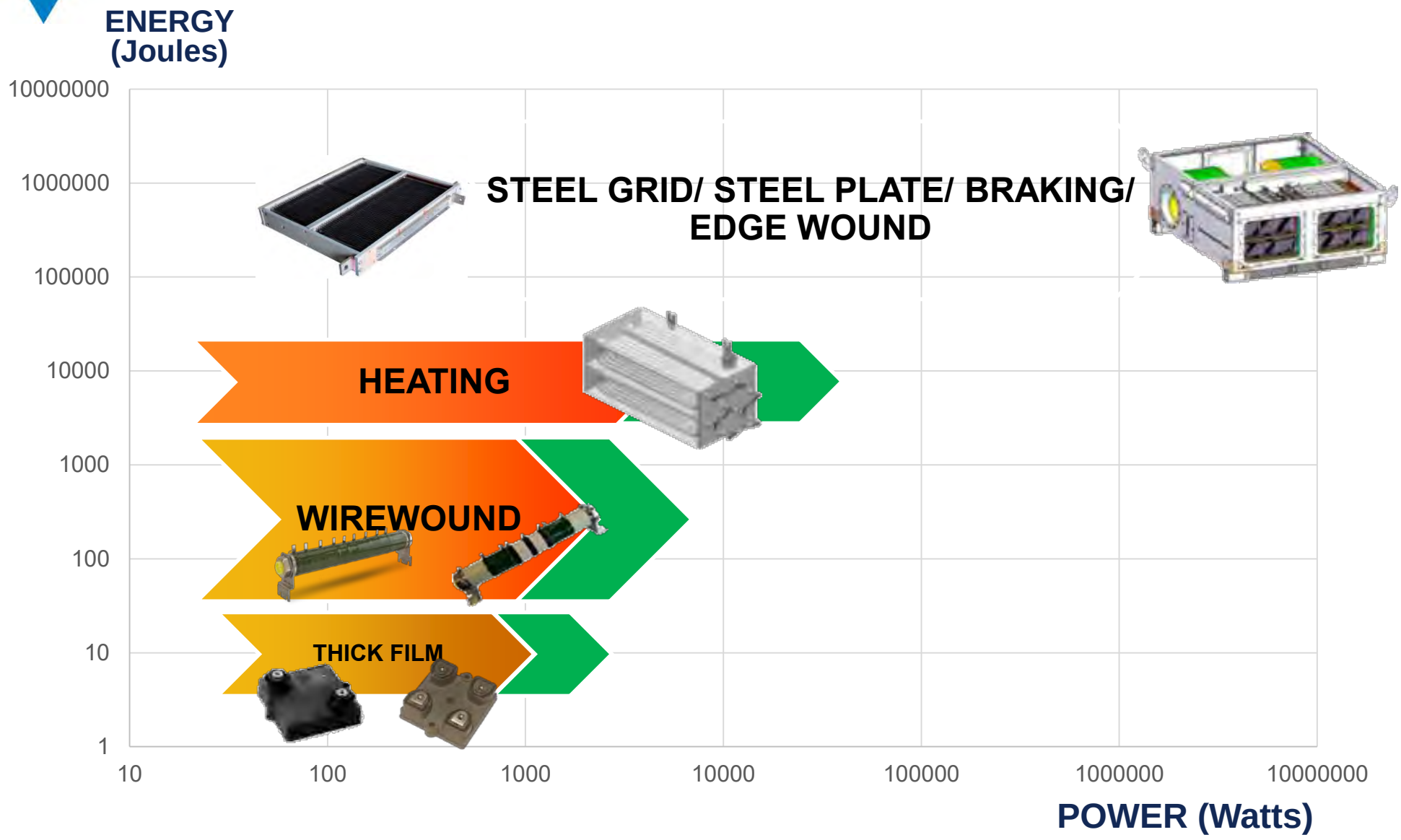
C52T / C64T

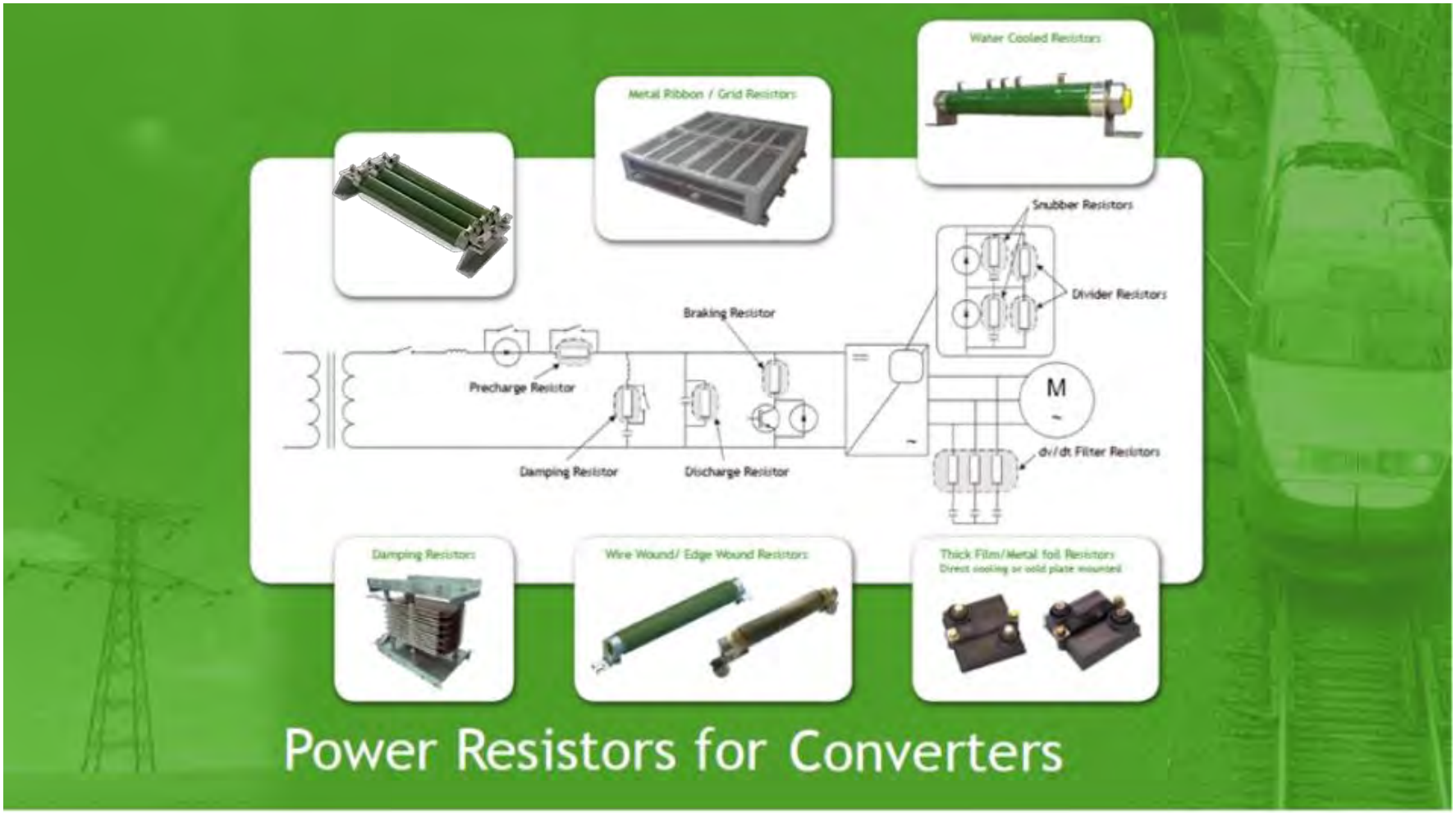


BRAKING

HEATING

POWER RESISTOR TECHNOLOGIES





SFERNICE / MCB OFFER SOLUTIONS FOR ALL APPLICATIONS

RAILWAY - TRANSPORTATION

AEROTHERMS HEATERS

Heating

RW / VNC

RSO / VC

RWST / VN

Main and Auxiliary converters

C64TF NEW / C52TF / C42TF
Precharge

LPS/ RCEC/ RCMC
Snubber Discharge

Braking

BRAKING RESISTORS

NEW

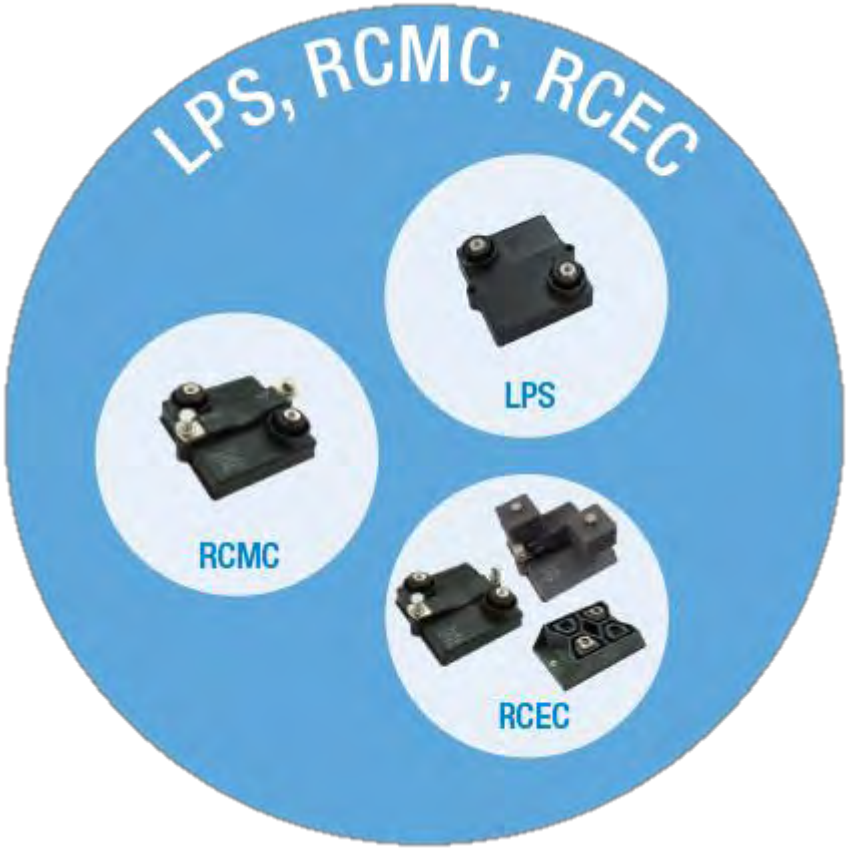
CROWBARS

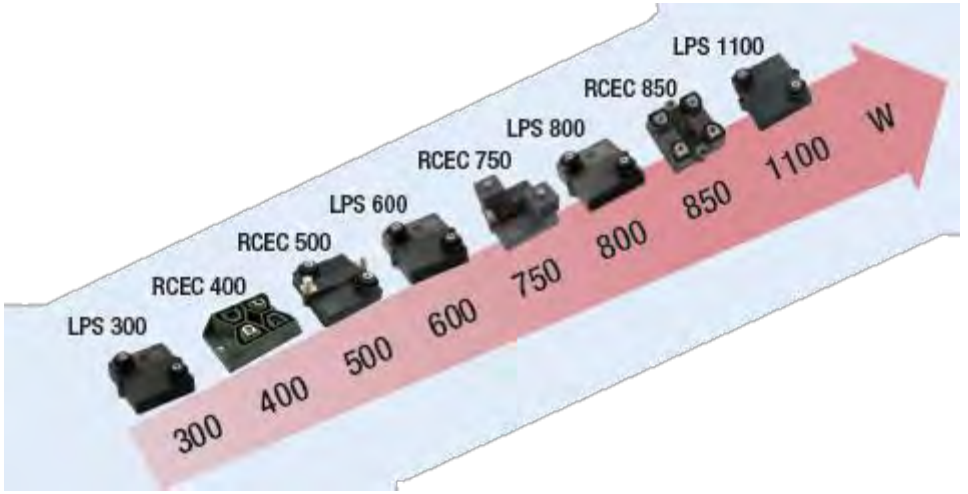
IRIS™ Certification

PLANAR RESISTOR TECHNOLOGY

SFERNICE SOLUTIONS:

- HIGH POWER COMPACT THICK FILM RESISTORS





CUSTOM FRIENDLY

- Specific terminals, (size and diameter M4 - M5)
- Terminals with leads
- Possibility of 2 or 3 resistors in the same case (RCEC 400, RCEC 850)
- Creeping and clearance distances (HV version)
- Assemblies (resistors mounted on heatsink)

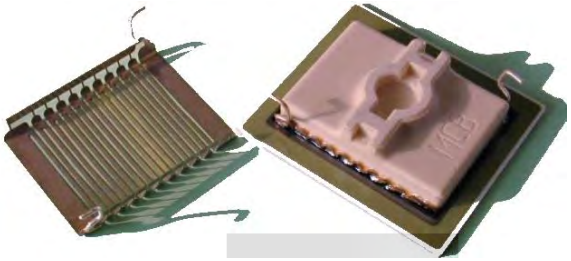
Planar resistors

Technologies

- Film “metal glass” printed onto a ceramic substrate RCEC / LPS
- Metal foil bonded onto a ceramic substrate RCMC

Key Technological Features

- High power density
- Wide ohmic range
- Very low inductivity < 40nH
- High voltage withstand
- Partial discharge free
- Main solution to reduce volume & weight
- Limited external radiation
- Available with several Connections,
- Custom design & delivery of complete Assembly,
- External water or natural cooling (Heatsink surface mount)



Thick-Film Planar resistor RCEC 400

FEATURES

- 400 W @ 75° C Single Value
- 2*180 W @ 75° C Double Value
- Same Footprint than RCEC 500-750 Package
- Configuration with 1,2 or 3 resistors
- M4 Screw terminals
- Electrical Terminal Position on request

- Ohmic Range: 1 Ω – 1 MΩ
- Tolerance: ±10% , ± 5% on request
- Working Voltage: 4000V (between terminals)
- Dielectric Voltage: 6000V rms 50Hz 1min
- Partial Discharge: < 20pC @ 5000V

APPLICATIONS & MARKETS

- HVDC / SVC
- Railway
- Industry
- Snubber
- Discharge
- Balancing

Thick-Film Planar resistor RCEC 500

FEATURES

- 500 W @ 70° C

- Standard Configuration M4 Screw terminals
- Option : M5 Screw terminals

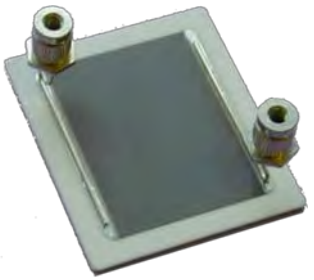
- Ohmic Range: 0,47 Ω – 1 MΩ
- Tolerance: ±10% , ± 5% on request

- Working Voltage: 5000V (between terminals)
- Dielectric Voltage: rms 50Hz 1min

RCEC L	: 6000V
RCEC	: 7000V
RCEC HV	: 12000V

- Partial Discharge

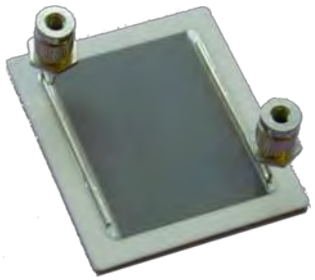
< 500pC @ 7000V
< 10pC @ 5000V
Other values on request



Thick-Film Planar resistor RCEC 750

FEATURES

- 750 W @ 75° C
- Same Package than RCEC 500 excluded double Clamp instead of single
- Standard Configuration M4 Screw terminals
- Option : M5 Screw terminals
- Ohmic Range: 1 Ω – 1 MΩ
- Tolerance: ±10% , ± 5% on request
- Working Voltage: 5000V (between terminals)
- Dielectric Voltage: rms 50Hz 1min
  - RCEC 750 : 7000V
  - RCEC 750 HV : 12000V
- Partial Discharge:
  - < 500pC @ 7000V
  - < 10pC @ 5000V
  - *Other values on request*



Metal Foil Planar resistor RCMC

FEATURES

500 W @ 70° C

Same Package than RCEC 500 excluded double Clamp instead of single

Standard Configuration M4 Screw terminals
Option : M5 Screw terminals

Ohmic Range: 0,56Ω – 18 Ω
Tolerance: ±10%

Working Voltage: 5000V (between terminals)

Dielectric Voltage: rms 50Hz 1min

RCMC 500L	: 5000V
RCMC 500	: 7000V
RCMC 500 HV	: 12000V

Partial Discharge:
On request

NEW PRODUCTS COMING SOON H2 2018

RCEC 850
Thick-Film Planar
Up to 3 resistive elements

NEW

RCEC MW
Thick-Film Planar
Up to 5 resistive elements
Output with leads

NEW

OPTION

- RCEC with thermocouple integrated for monitoring

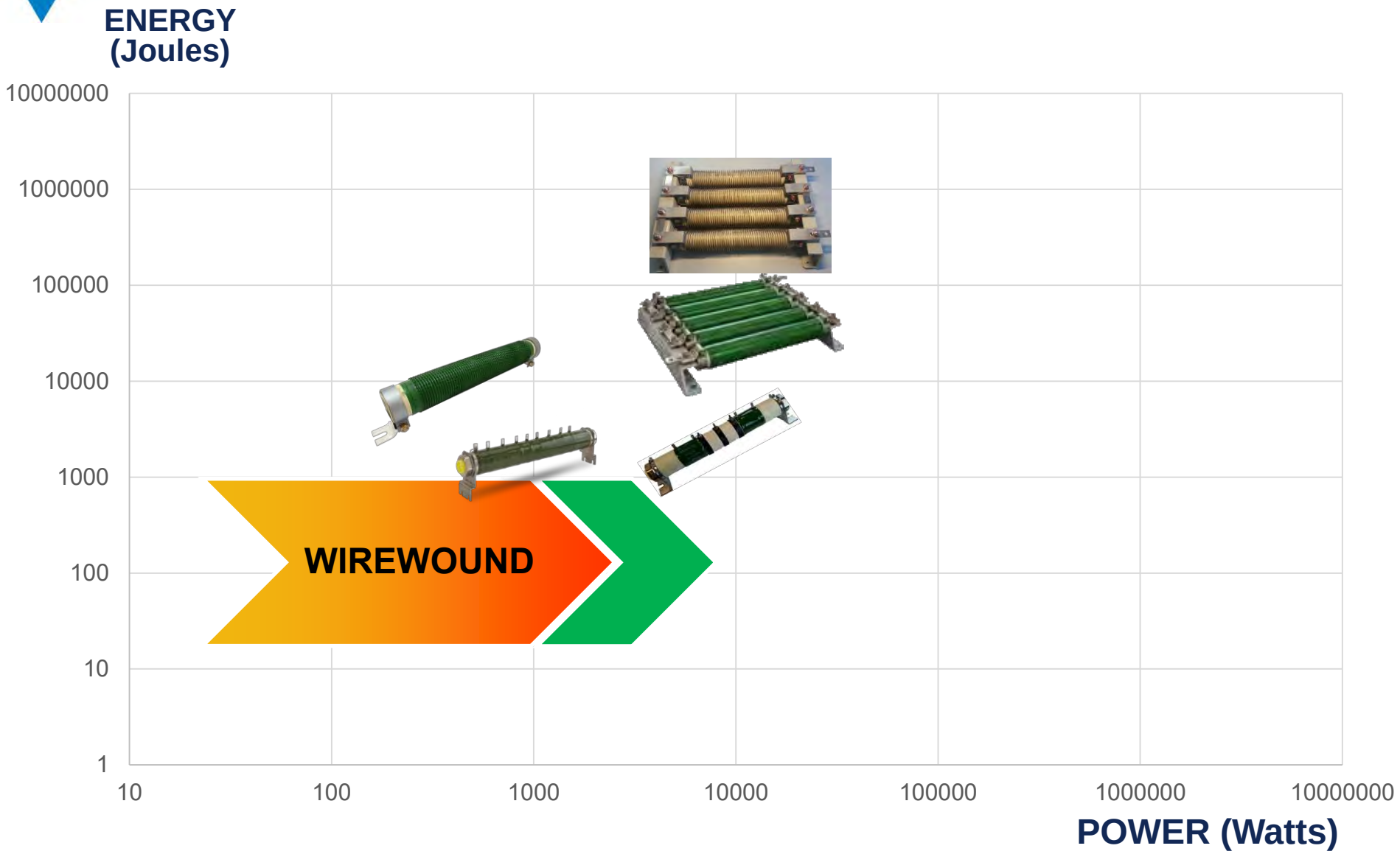
- RCEC with pre applied TIM with phase change material for ready to use (Coming Soon)

Planar resistors assembly

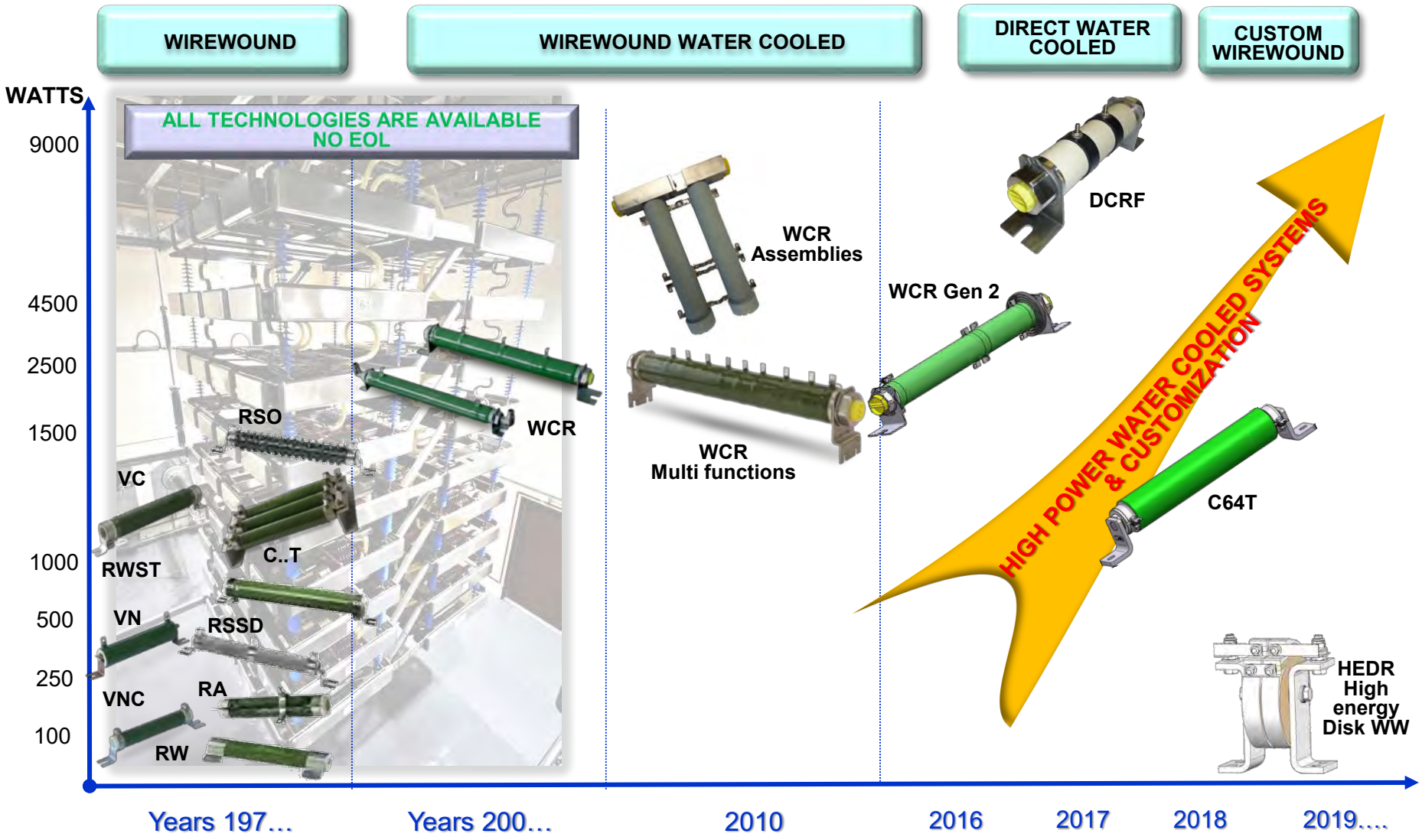
- *Module Assemblies:*
  - *Custom design*
  - *Plug and Play for customer*

  - *Tested in:*
    - *Ohmic value*
    - *Overload*
    - *Partial Discharge*
    - *Leakage*

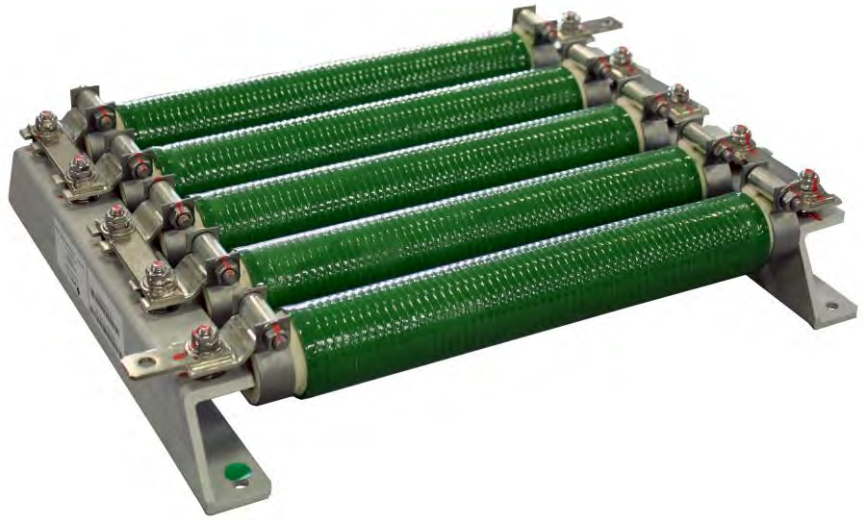
WIREWOUND RESISTOR TECHNOLOGIES



HIGH POWER WIREWOUND RESISTORS ROAD MAP



Wirewound resistors



Technology

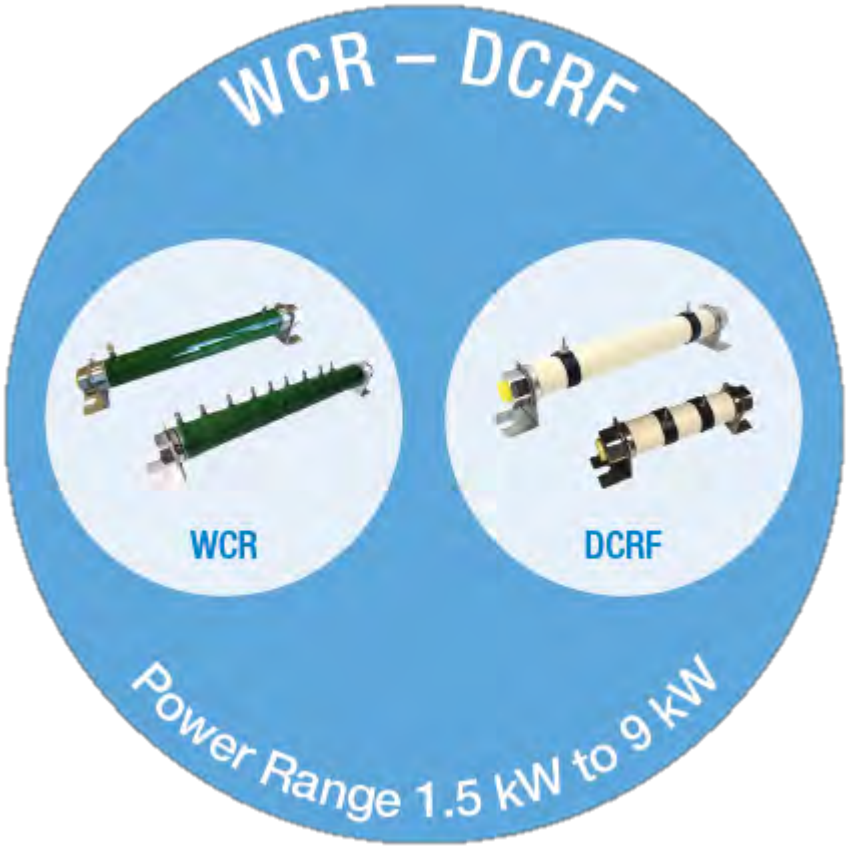
- Wire wrapped around a special ceramic core
- Natural or Direct water cooling
- Vitreous or cement silicon coating

Key Features

- High energy capacity
- High power density for Water cooled(5 Times more than standard Wirewound)
- Wide ohmic range
- Possibility Snubber + balancing on the same tube
- Low inductivity
- Resistant to chemical agents,
- Stand-alone or assembly.
- Custom design & delivery of complete Assembly

SFERNICE SOLUTIONS:

- WCR AND DCRF ULTRA HIGH POWER INTEGRATED RESISTORS



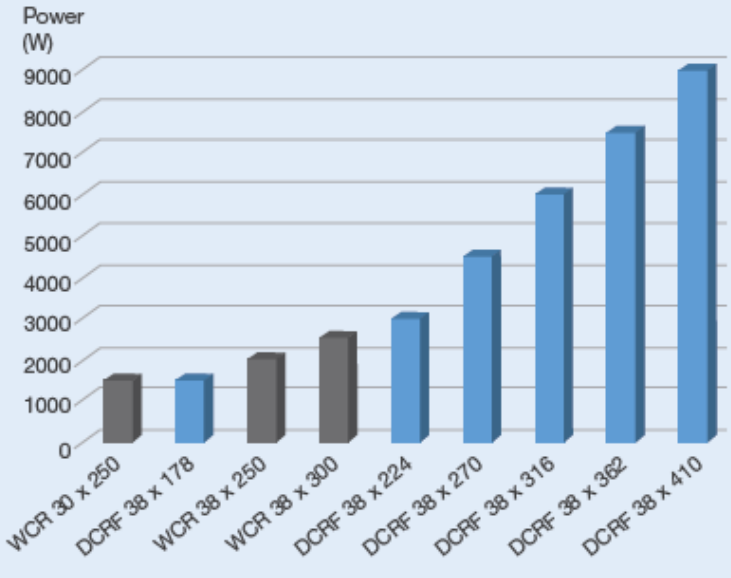
INTEGRATED SOLUTION, NO HEATSINK NEEDED

WCR and DCRF Advantages Over Thick Film Water Cooled Resistors	WCR and DCRF Advantages Over Plastic Box Water Cooled Resistors
• Pulse performance (wirewound technology) • High power dissipation (up to 9 kW) • Overload capability (2 Pn during 60 s) • Multiple resistive element option (low and high ohmic value on the same support) • Safe failure mode (no leakage)	• High power dissipation (up to 9 kW) • Overload capability (2 Pn during 60 s) • Low inductivity option (< 500 nH) • Multiple resistive element option (low and high ohmic value on the same support) • Safe failure mode (no leakage)

WCR and DCRF Advantages Over Standard Wirewound Resistors

- High power dissipation (up to 9 kW)
- Limited external radiation (surface temperature < 120 °C)
- Helps customers gain competitive advantage by reducing equipment size and cost
- Multiple resistive element option (low and high ohmic value on the same support)

PRODUCT PORTFOLIO



SFERNICE OFFER:

- INDIRECT WATER COOLED RESISTOR

VISHAY
www.vishay.com

WCR

Vishay MCB

Water Cooled Wirewound Resistor

FEATURES

- Direct cooling without heat sink
- Better power / volume ratio
- Non-inductive optional
- 1 WCR = 6 wirewound resistors = 5 thick-film resistors
- Up to 6 resistive functions on 1 WCR tube
- 1 single supply for several functions (snubber and divider)
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb RoHS COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS			
GLOBAL MODEL	POWER RATING (1) W	RESISTANCE RANGE Ω	TOLERANCE ± %
WCR 30 x 250	1500	4.7 to 56K	5
WCR 38 x 250	2000	4.7 to 56K	5
WCR 38 x 300	2500	4.7 to 56K	5

Note

(1) Water inlet temperature 60 °C with 40 % glycol, flow rate 5 l/min

SFERNICE OFFERS:

- DIRECT WATER COOLED RESISTOR

VISHAY

www.vishay.com

DCRF

Vishay MCB

Direct Water Cooled Wirewound Resistor

FEATURES

- Direct cooling without heatsink
- Excellent power / volume ratio
- Multi resistive element option
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

APPLICATIONS

- Filter resistor
- Snubber resistor
- Discharge resistor

STANDARD ELECTRICAL SPECIFICATIONS

GLOBAL MODEL	POWER RATING P_n (1) W	RESISTANCE RANGE Ω	TOLERANCE ± %
DCRF 38 x 178	1500	0.56 to 4.7	5, 10 (2)
DCRF 38 x 224	3000	1 to 9.1	5
DCRF 38 x 270	4500	1.5 to 15	5
DCRF 38 x 316	6000	2 to 20	5
DCRF 38 x 362	7500	2.4 to 24	5
DCRF 38 x 410	9000	3 to 27	5

Notes

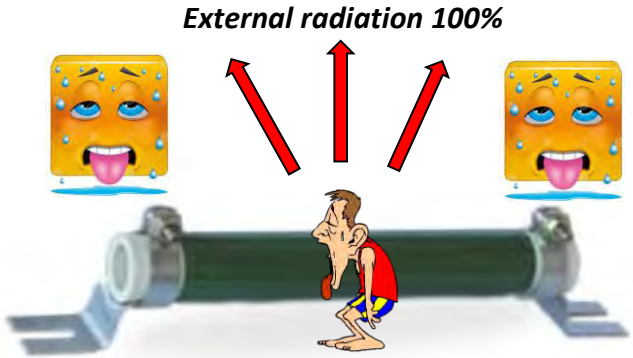
(1) Water inlet temperature 65 °C with 40 % mono ethylene glycol, flow rate 8.33 l/min

(2) 5 for value ≥ 1 Ω, 10 for value < 1 Ω

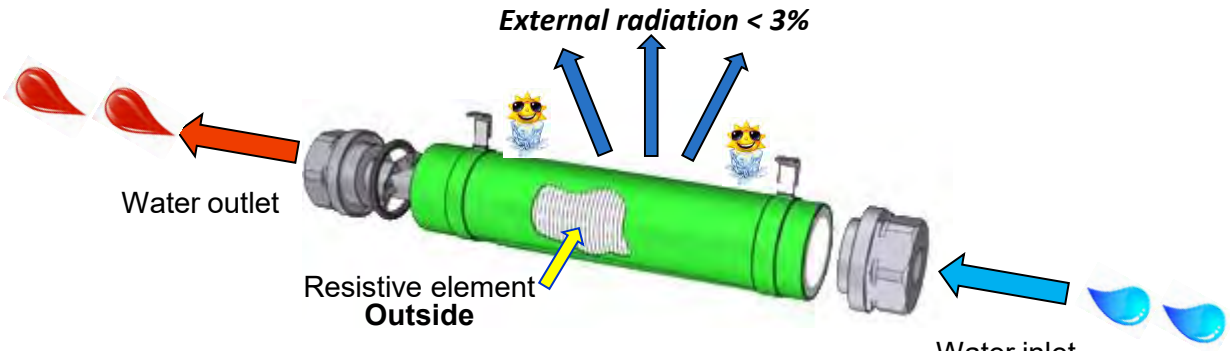
SFERNICE OFFERS:

- OVERALL DIMENSIONS Φ38 – CERAMIC LENGTH ~ 300 MM

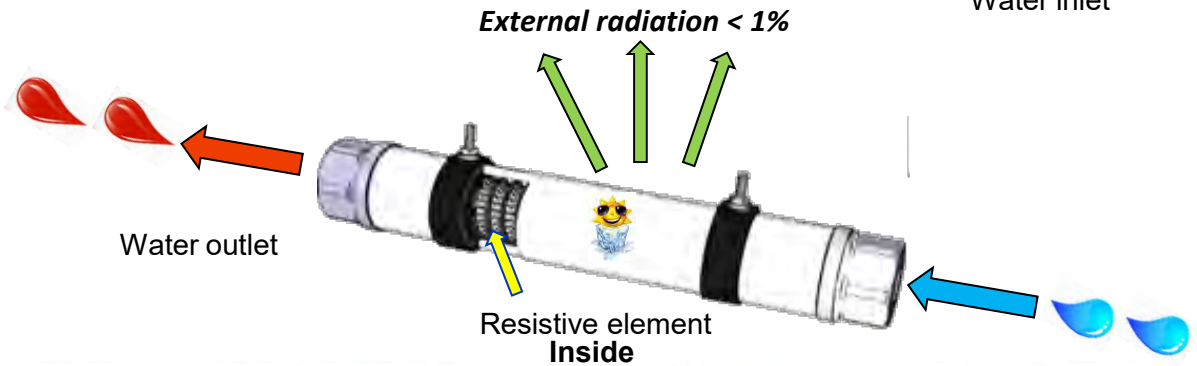
STANDARD WIREWOUND – 600W



WCR – 2500W
INDIRECT WATER COOLED WIREWOUND



DCRF – 6000W
DIRECT WATER COOLED WIREWOUND



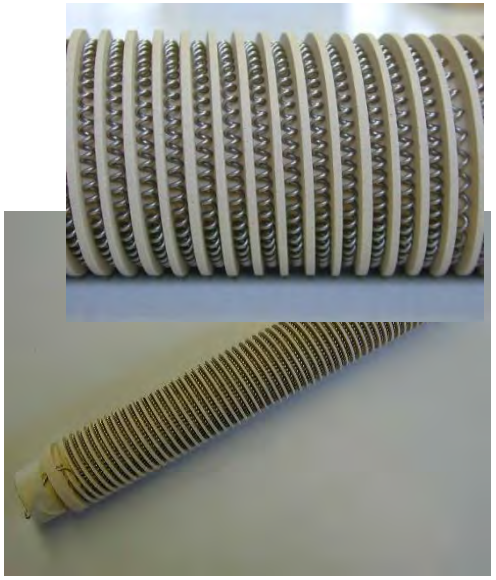
Wirewound resistors C..T
High Energy (Inrush limiting application)

TECHNOLOGY

- Reinforced Wirewound

FEATURES

- High energy absorption and High overload (up to 16 kJ)
- Very High Power Resistor
- 3 sizes : 270 Watt – 480 Watt – 900 Watt
- Special & vitreous coating
- Available in Low inductive design for C52TF= LI Version
- Available with F (Traction) Terminal or N collars

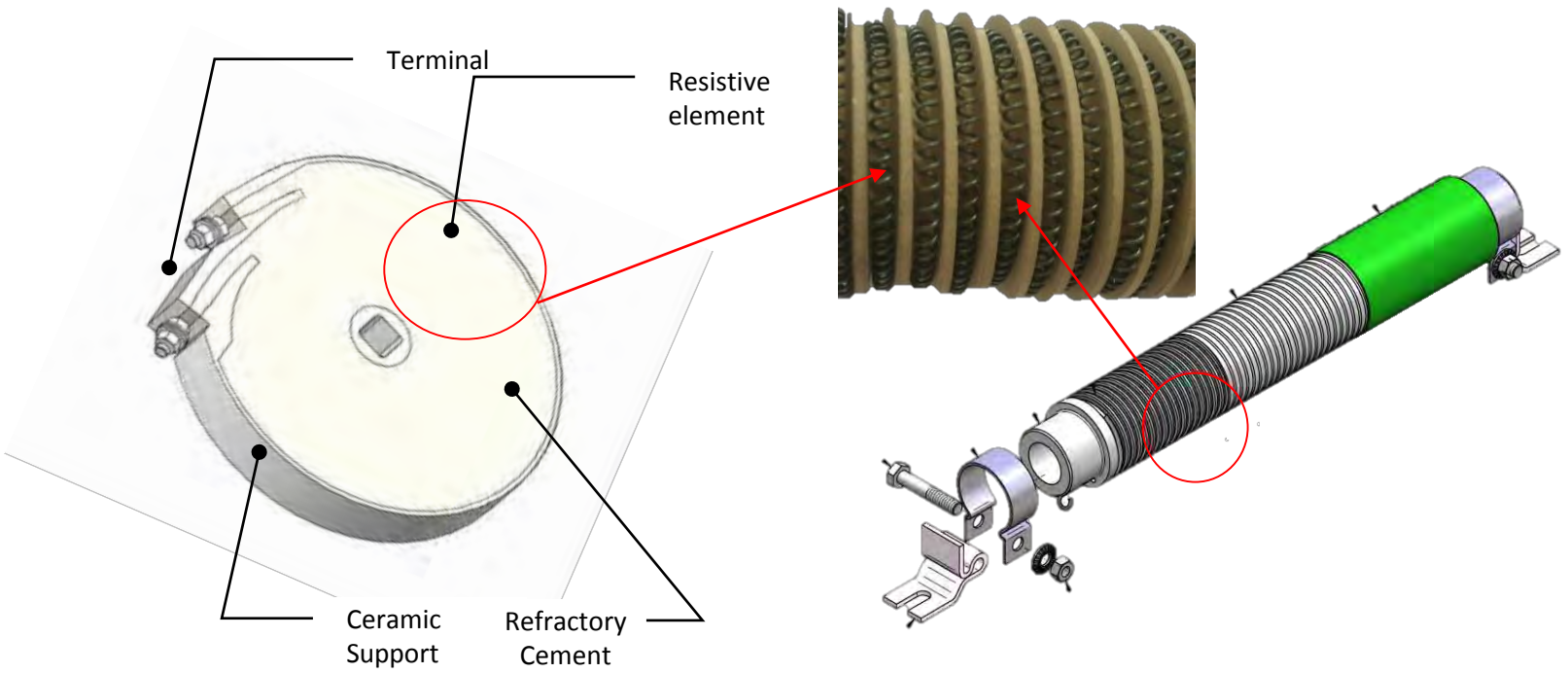


- Precharge or Discharge Filters
- Inrush limiting
- Braking
- Crowbars, Damping
- Snubber, Inverters, converters, snubbers & discharge resistors

NEW DEVELOPMENT COMPACT PRECHARGE WIREWOUND

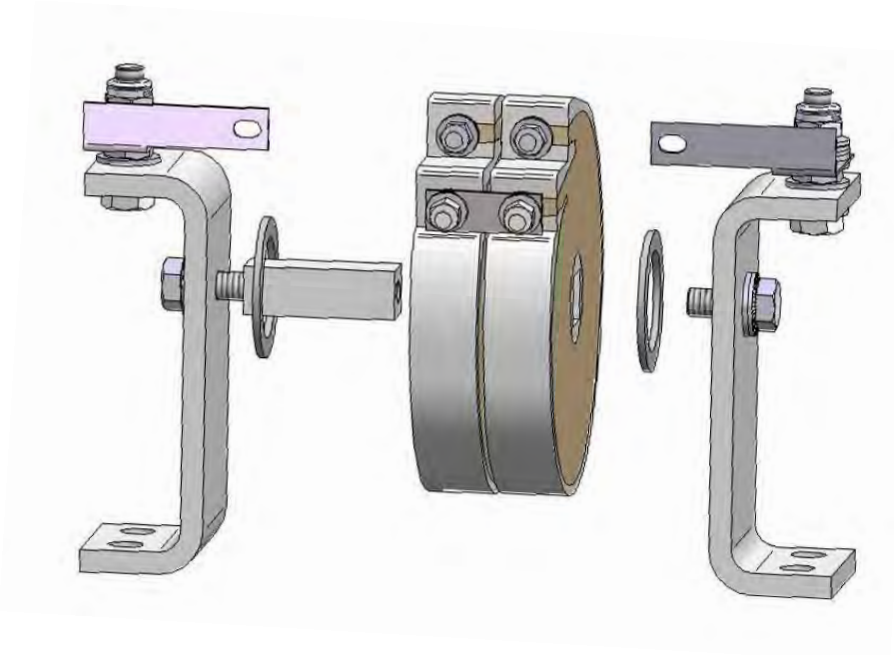
- HEDR DISK RESISTOR

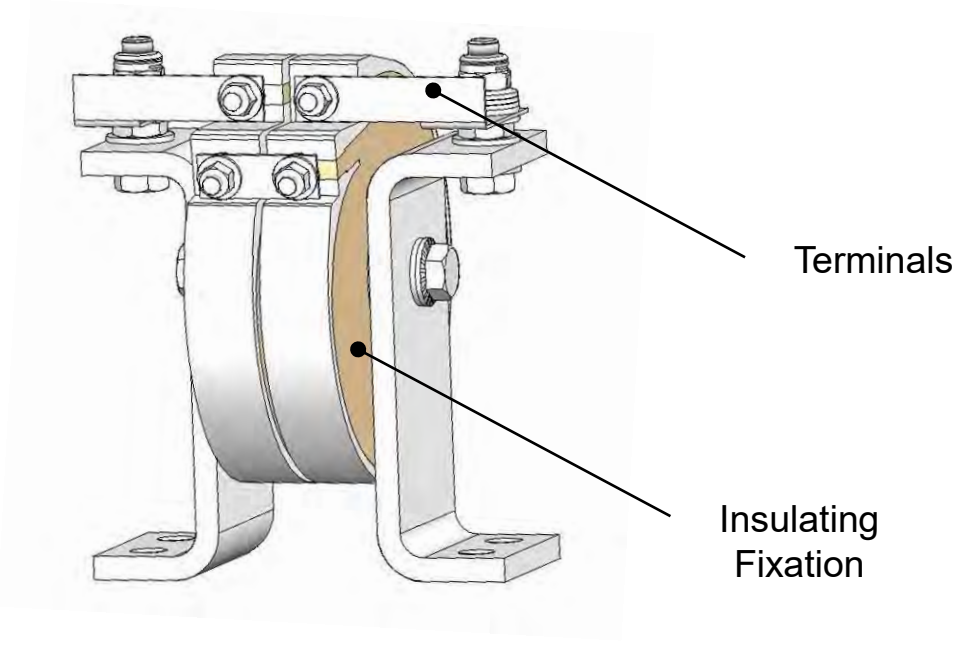
- An HEDR Disk resistor unit consists essentially of two parts:
  - a resistive element wrapped in the form of spring and spiral inward (using our existing technology in our CT series).
  - a refractory cement that serves as a mechanical fixation of the resistive element and energy storage
- In the case of fast transient energy, it is the mass of the wire that absorbs this energy (up to 30KJ)



NEW DEVELOPMENT COMPACT PRECHARGE WIREWOUND

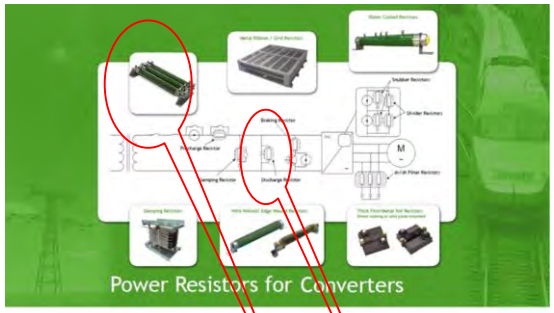
- HEDR DISK RESISTOR

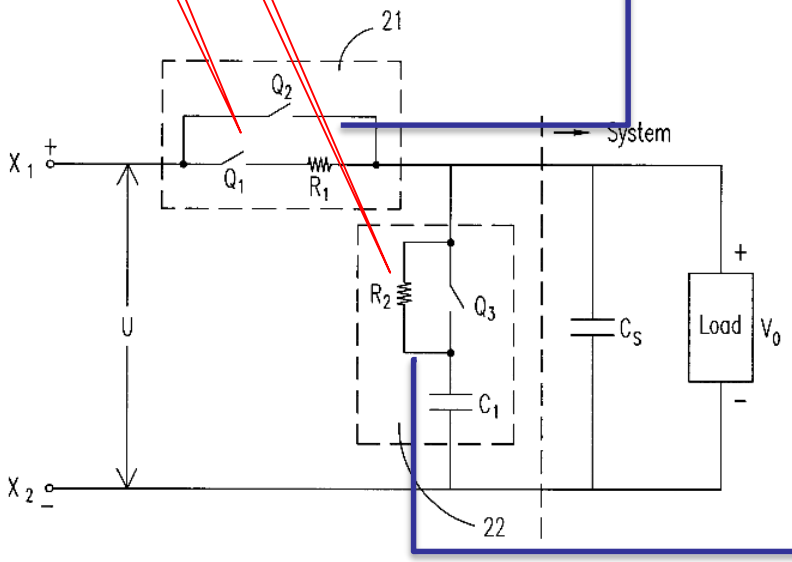




Assembly example

PRECHARGE - DISCHARGE



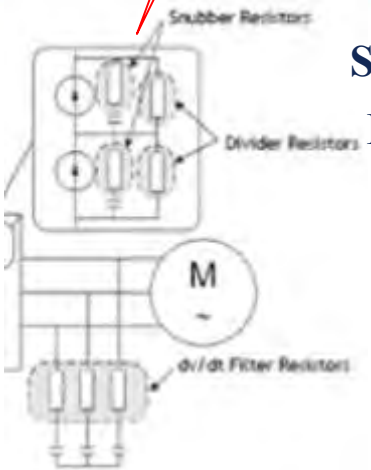


C52T C64T

RCEC

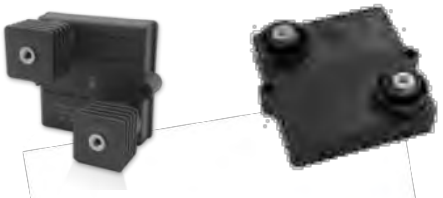
WCR

SNUBBER DIVIDER FILTER



Snubber Divider

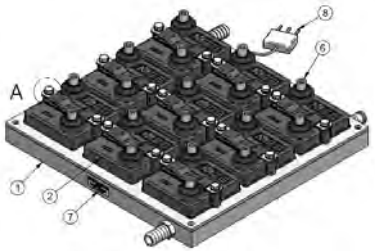
RCEC LPS



WCR

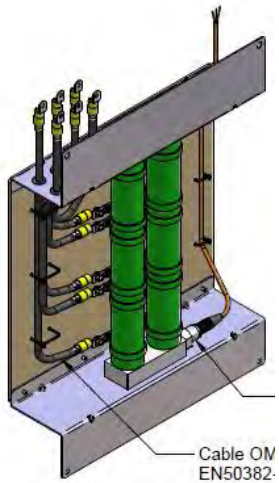
MDCR

RCMC

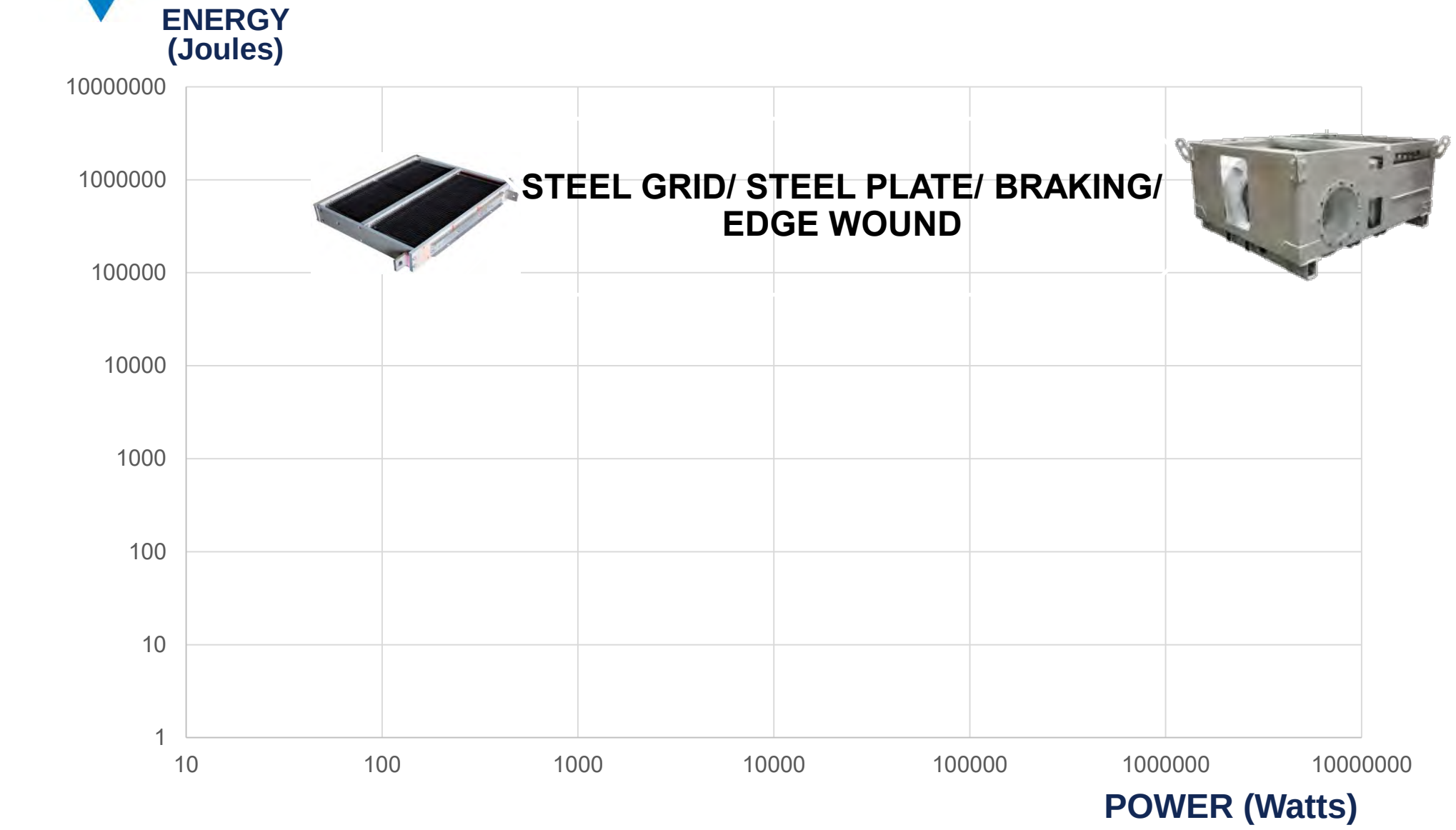


DV/DT Filter

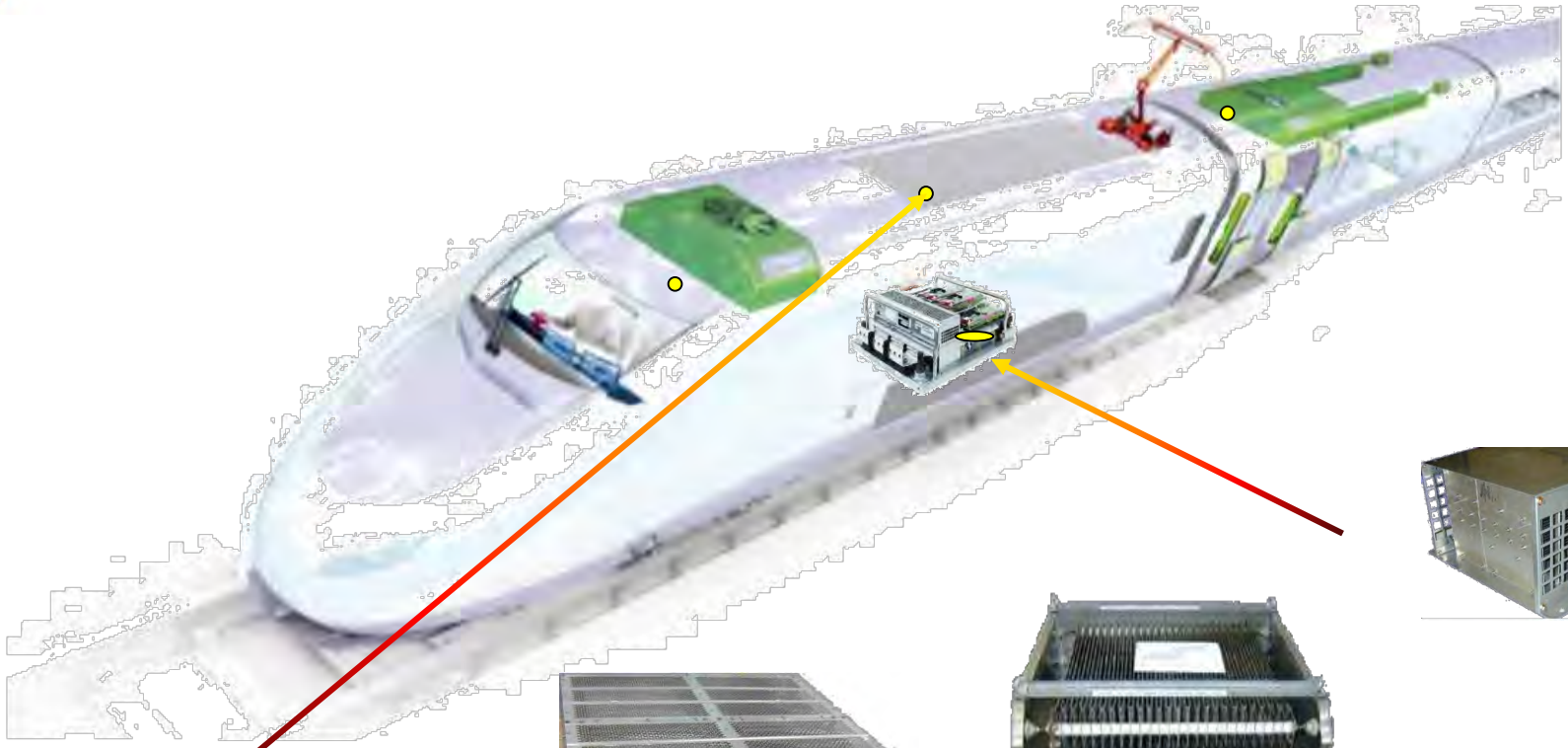
WCR



POWER RESISTOR TECHNOLOGIES



RAILWAY - TRANSPORTATION



Braking

FORCED AIR COOLING
BRAKING RESISTORS

NATURAL COOLING
BRAKING RESISTORS

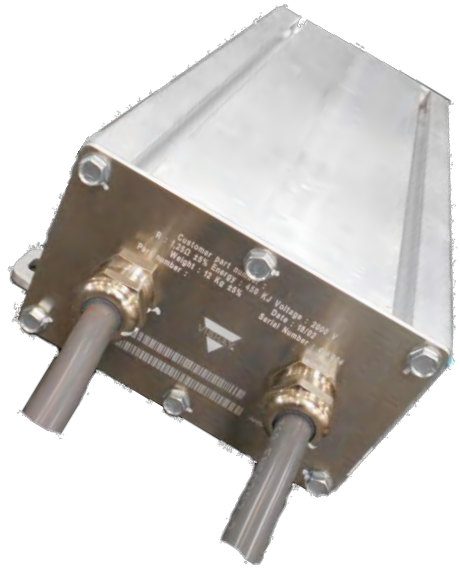
CROWBAR

IRIS™ Certification

INSULATED CROWBAR RESISTORS COMING SOON Q4 2018

- Application
  - Crowbar resistor 1 – 5 Ohms 250 – 500 KJ 2000V

- Main Design Detail
  - Resistor must work in dust and humidity condition
  - Technology Wirewound element in aluminium body (20kg)



NEW

METAL RESISTOR FOLDER METAL SHEET

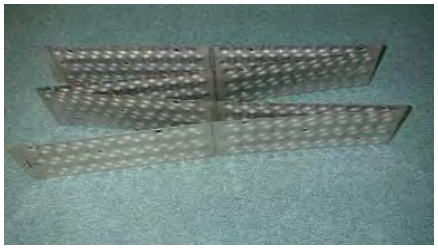
FEATURES

Embossed technology

- Size: - Width : 40mm to 160mm
  - Thickness : 0.4mm to 1.5mm
- Advantage: compactness
- Air forced cooling

Stamped Technology

- Size: - Width : 40mm to 120mm
  - Thickness : 0.4mm to 1.3mm
- Advantage:
  - Modularity
  - Low pressure drop



APPLICATIONS & MARKETS

- Railway braking resistors
- High Speed train « TGV »
- Locos
- Light Railway
- Metros
- Regional Train (maintenance)

METAL RESISTOR

FEATURES

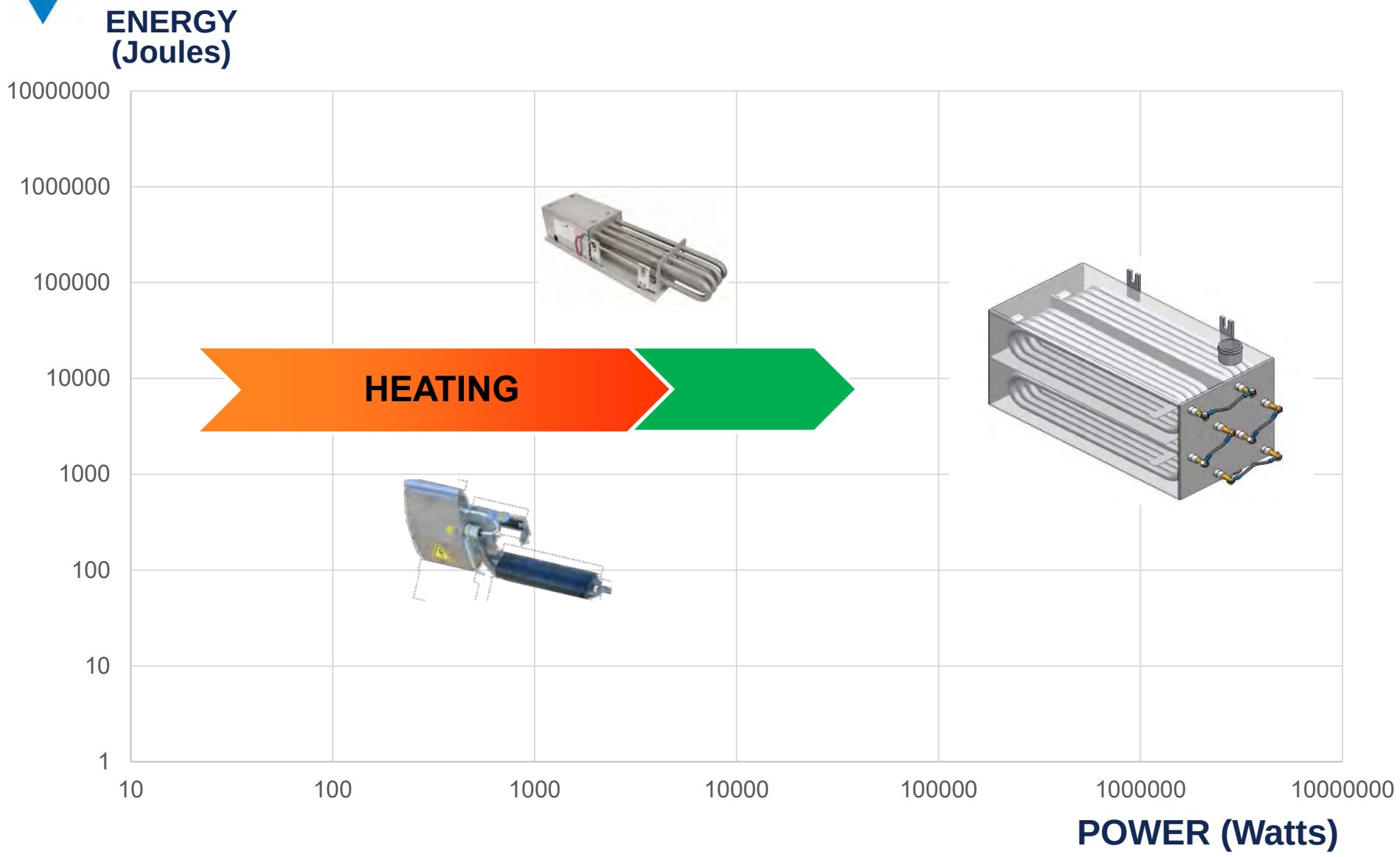
Grid Technology

- Size :
  - Width
    40mm to 250mm
  - Thickness
    1.5mm to 3mm
- Advantage:
  - Low pressure drop
  - High ohmic value

APPLICATIONS & MARKETS

- Braking resistors for Wind Mills
- Slip Grids
- Damping & Crowbars

HEATING RESISTORS TECHNOLOGY



RAILWAY – TRANSPORTATION HEATING SOLUTIONS

Aerotherms

HVAC Cabin Driver Heating Registers

HVAC Passenger car Heating Registers

Auxiliary Air Duct Heaters

Plinth Heaters

IRIS Certification

RAILWAY – TRANSPORTATION HEATING SOLUTIONS

Performances

Power Range :	**from few Watts up to >100 kW.**
Dielectric withstand :	**4 kV on tubes Ø13 mm,** **7 kV on tubes Ø 22 mm**
Large range of resistors size:	
	Diameters : 8,3 ; 10 ; 13 ; 16 & 22 mm **Length : 5,4 m for Ø13 ; 5 m for Ø10 ; 4,6m for Ø8,3 ;**
	Lamellas for Ø8,3 ; Ø10 ; Ø13 ; Ø22 **Spiral fins for Ø13**
Typical application :	**Main Heaters : 80 kW, 60 kW, 34 kW, 25kW…** **Auxiliary Heaters** **Radiators with or without lamellas: plinth, cabin…** **Hot air blower units…** **Liquid cooled braking resistor, 190kj power 50 kW/ 0,2s**

Our expertise and technical know how in different applications (braking and power resistors, heaters, power supplies, sensors…) makes us possible to give customers fast and precise answers.

Selection Guide / Planar thick film

Type	Techno	Key Feature	Capacitor Pre-charge	Capacitor Discharge	Balancing	DC Grading	Chopper	Braking	Crowbar	Filter	Inrush Limiting	Snubber	Pre-heating	Heating
D2TO	Thick Film	25-50 W		x	x									
LTO	Thick Film	30-100 W		x	x									
RTOP / RCEC ISO	Thick Film	100 W		x	x									
LPS 300	Thick Film	300 W		x	x									
RCEC 400	Thick Film	400 W		x	x	x						x		
LPS 600 / RCEC 500	Thick Film	500 W		x	x	x				x		x		
LPS 800 / RCEC 750	Thick Film	750 W		x	x	x				x		x	x	
LPS 1100	Thick Film	1100W		x	x	x								
RCMC	Metal Foil	500 W								x		x		

Selection Guide / Wirewound and others

Type	Techno	Key Feature	Capacitor Pre-charge	Capacitor Discharge	Balancing	DC Grading	Chopper	Braking	Crowbar	Filter	Inrush Limiting	Snubber	Pre-heating	Heating
C..T	Wire-Wound	900 W	x	x			x	x	x		x			
WCR	Wire-Wound	3000 W		x	x	x				x		x		
RSO / VC	Wire-Wound	700W	x						x		x			
RWST / VN	Wire-Wound	600 W		x	x									
VNC	Wire-Wound	320 W		x	x									
EW	Edge Wound	High Energy					x	x	x					
Heating	Stainless steel Tubular							x					x	x
Braking	Embossed	High Power						x						
	Ribbon Stamped	High Power					x	x	x					
	Metal Grid.	High Power					x	x	x	x	x			

STRENGTHS – WEAKNESSES PER TECHNOLOGY

TECHNOLOGY	POWER THICK FILM	POWER METAL	WIREWOUND NATURAL COOLING	REINFORCED WIREWOUND NATURAL COOLING	INDIRECT WATER COOLED	DIRECT WATER COOLED
PRODUCT FAMILY	RCEC RPS LPS	RCMC	RW RWST VN	C..T	WCR	DCRF
						
Low values						
High values						
Tolerance						
Low Inductivity						
TCR						
Power rating						
Overload						
Voltage						
Dielectric						
Partial Discharge						
Damp Humididy						
Ratio Power Volume						
External radiation						

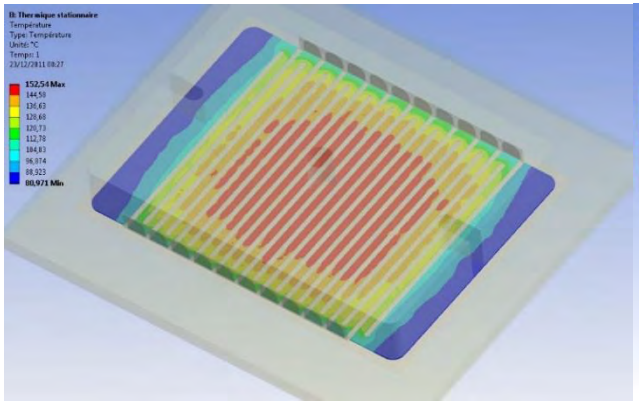
Excellent	
Good	
Medium	
Low	

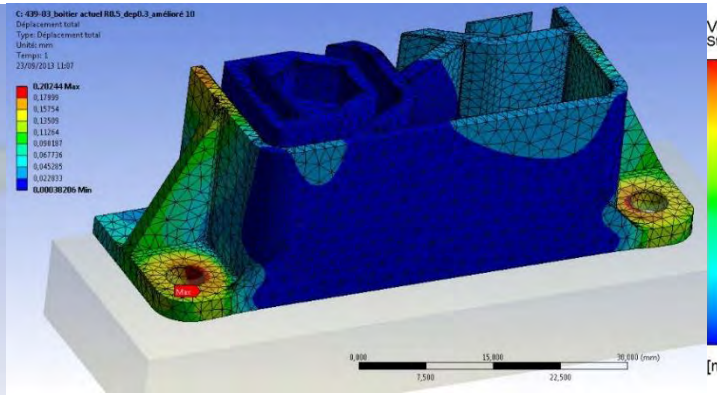
On request	
Non insulated parts	
Not available	

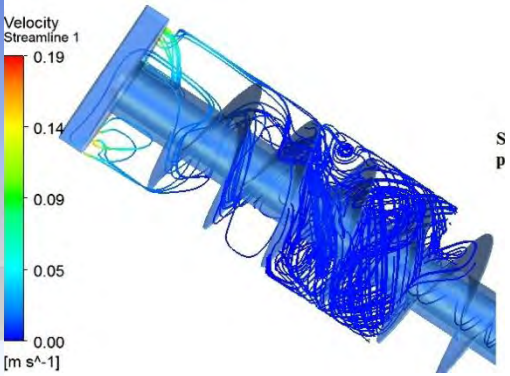
Engineering Tools

- CAD Station : Solid Edge V20
  - 3D/2D, exploded views

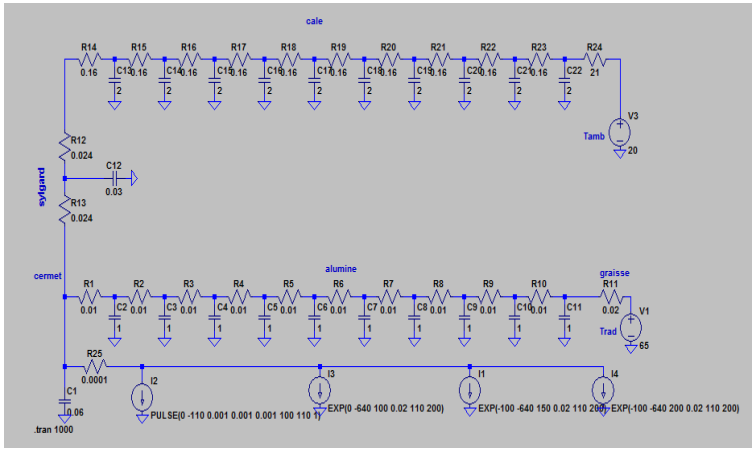
- Engineering Simulation and modeling : ANSYS
  - Structural Mechanics, material resistance, material fatigue
  - Thermal Simulation
  - Fluid Dynamics : currently under evaluation on several applications



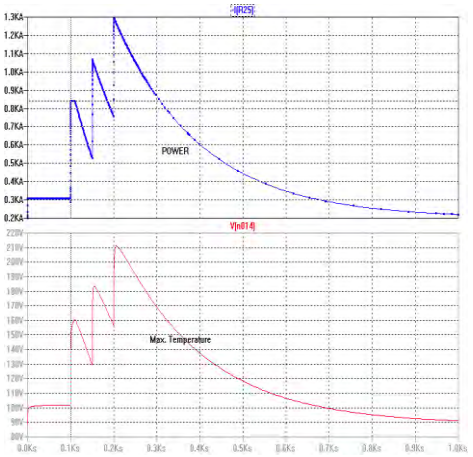




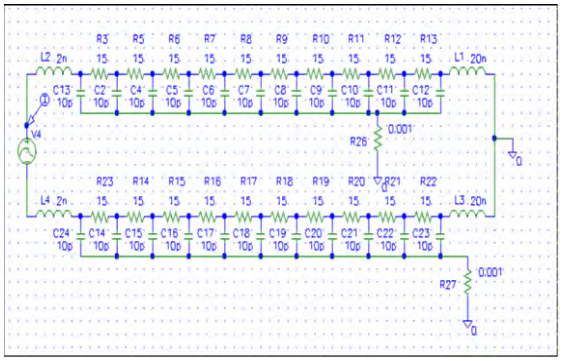
Simulation models



Thermal



Parasitic Capacitance



THANK YOU FOR YOUR ATTENTION