



Power Capacitors

Capacitors for Power Electronics

Vishay Electronic GmbH

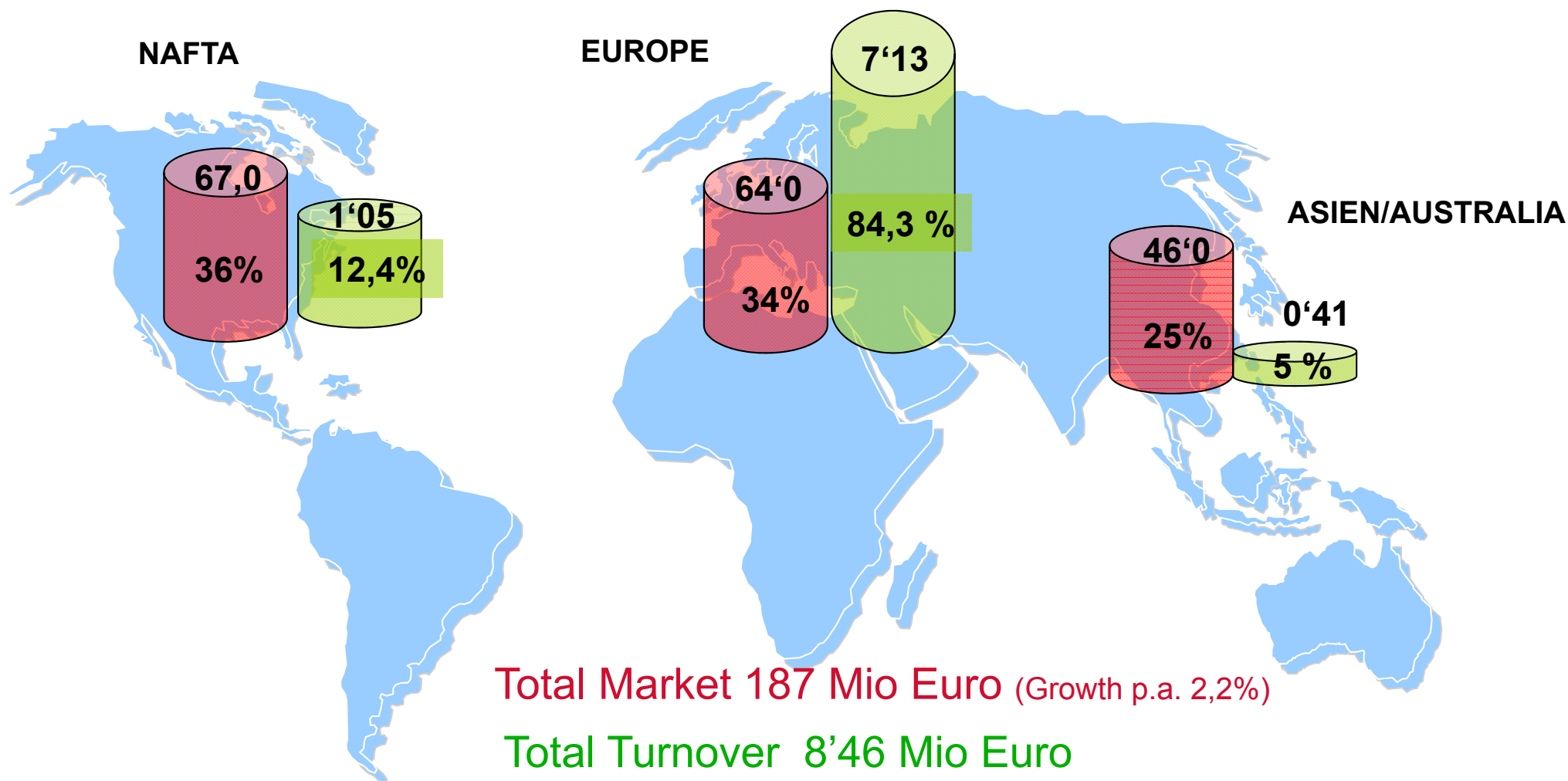
Landshut/Germany

Oktober 2001

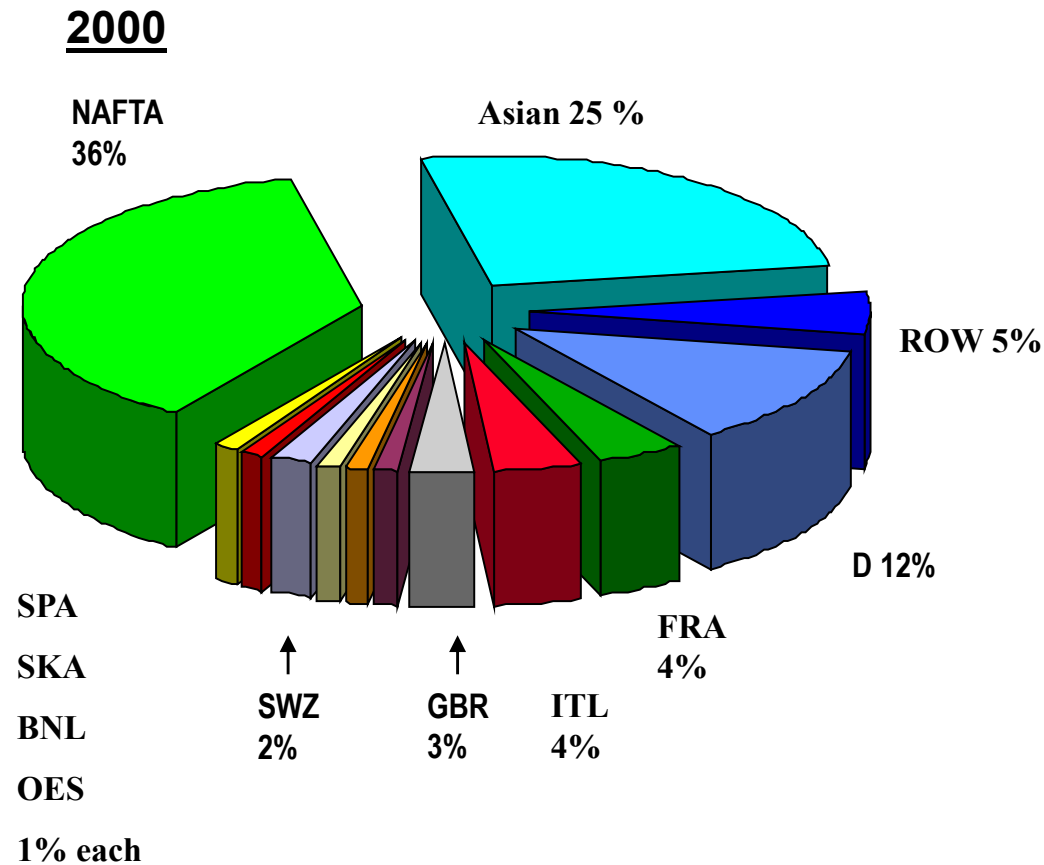
Business Profile PEC

Business Environment	Market 2000	64 Mio Euro (Europe) 187 Mio Euro (World)
	Major Competitors	EPCOS, AVX/TPC, Electronicon, ICAR, Montena Ducati, GE, General Atomics
	Major Customers	Siemens, Bombardier, Alstom, Ansaldo
Position	Sales 2000	8,46 Mio Euro
	Competitive Ranking	No. 3 Europe
	Market Share	13,2 % (Europe) 4,5 % (World)
Strategy	General	Increase market share by product innovation Permanent improvement of cost situation (ratio)
	Market Focus	Europe, Expansion NAFTA and Asia/Australia

Market and Turnover 2000 worldwide



Relevant Market by Countries



Market (Mio Euro)

	2000	grow %p.a.	2005
D	23	0,2	23,5
FKR	7,7	0,0	7,7
ITL	6,7	0,0	6,7
GBR	5,6	1,0	6,1
SPA	1,8	1,0	1,9
SCA	2,6	0,0	2,6
BNL	2,6	0,0	2,6
CH	3,1	-2,0	2,8
OES	1,3	1,5	1,4
Rest Europe	21	1,0	22
Europe	64	0,6	66
NAFTA	66,5	1,9	73
Asian	46	2,4	50
ROW	10,5	1,0	11
Total	187	1,3	200

Top Ten Customers (global)

Customer	Sales 2000	MA
Bombardier	2'778	60%
Ansaldobreda	0'686	60%
Vishay (USA)	0'536	100%
Siemens	0'358	15%
ABB Utility (Schweden)	0'334	80%
Vishay (France)	0'284	100%
KMT Tekniikka (Finland)	0'248	100%
Transtechnik	0'245	80%
SEW Eurodrive	0'172	40%
Schroeter	0'169	100%

Werte in Mio Euro

Vishay market placement

- ❑ Technically competent partner for all application
- ❑ Widest product range for power capacitors
- ❑ Full supplier for all capacitor technologies
- ❑ Highest flexibility in mech. designs, also for low quantities
- ❑ Shortest sampling and delivery time
- ❑ Cost and performance oriented products
- ❑ Most customer oriented innovations

Standard Capacitor Program

- ▶ Lamp and Motor capacitors
- ▶ Low voltage power capacitors and plants with power-factor controllers
- ▶ Furnace capacitors for mains and medium frequencies
- ▶ High-voltage capacitors
- ▶ Capacitors for power electronics

Lamp and motor capacitors



Description

motor capacitors

- ↙ 1-60 μ F, 240-450 V
according EN 60252

lamp capacitors

- ↙ 2-60 μ F 250V 1*-20 μ F 420/480 V
according EN 61048, EN 61049

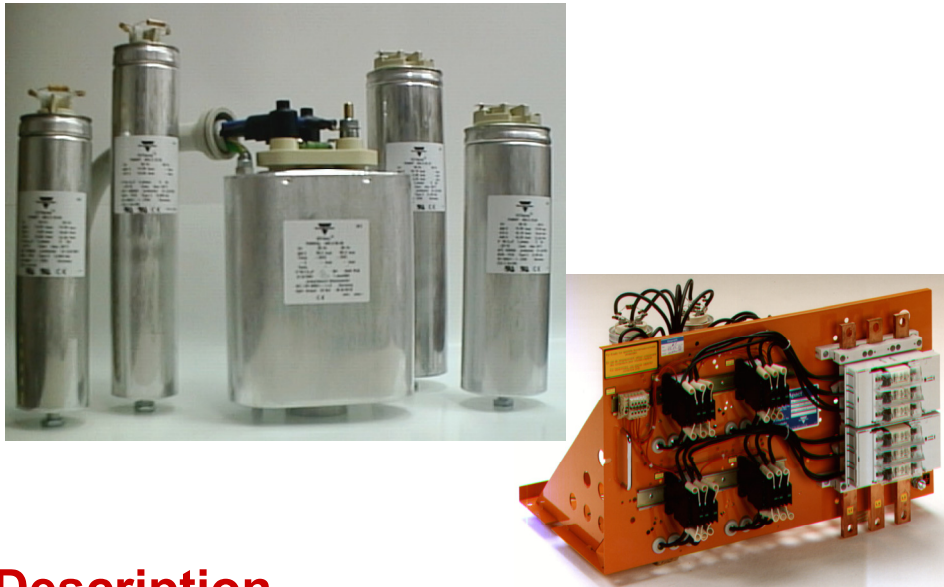
Applications

- ↙ motor operating capacitors which generate the necessary phase displacement for motors supplied from the single-phase system.
- ↙ discharge lamp capacitors used in parallel or series circuits for reactive power compensation

Features

- ↙ with or without $\textcircled{\text{FP}}$ or $\textcircled{\text{FPU}}$
- ↙ extremely long operating life
- ↙ very wide temperature range: in certain product from -40°C to + 100°C
- ↙ approved by: VDE, CERTIF, IMQ

Low-voltage power capacitors and plants with power-factor controllers



Description

- ✦ voltage range 230 to 1000 V 50/60Hz, output 2.5 up to 56.2 kvar for can types, up to 500 kvar per unit with special filter capacitors
- ✦ systems from 12.5 to 800 kvar and higher in various steps
- ✦ according to IEC 60831/1+2 and 2 EN60831/1+2

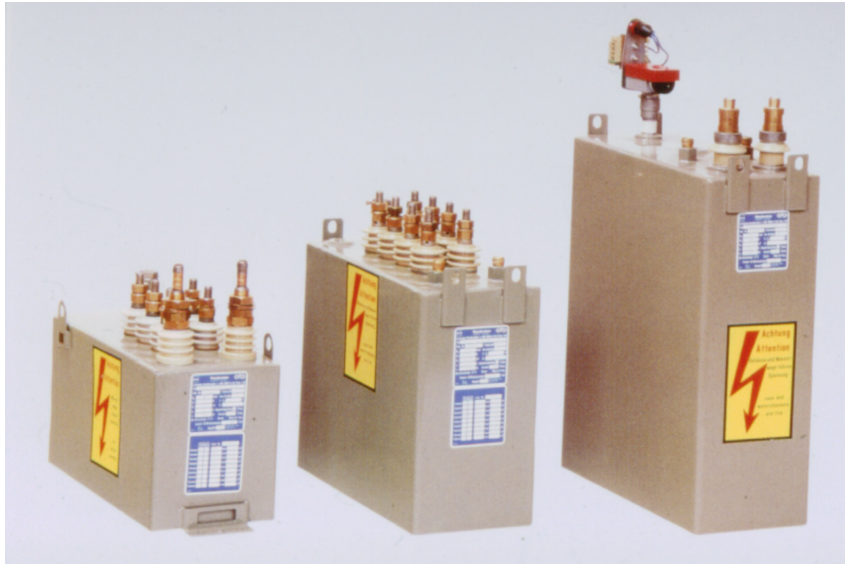
Application

- ✦ individual and group fixed compensation
- ✦ controlled central compensation
- ✦ filter circuits for mains systems with harmonics

Features

- ✦ low-loss, self-healing MKP technology
- ✦ biologically degradable, vegetable-based impregnating agent, alternatively gas-filled
- ✦ burstproof confirmed by UL and ULc
- ✦ absolutely stable switching, due to high current-surge load rating
- ✦ adaptable to suit clients' specification
- ✦ long life expectancy with high stable capacitance values

Furnace capacitors for mains and medium frequencies



Application

- ↙ static power capacitors for inductive heating
- ↙ plant compensation

Types of cooling

- ↙ natural cooling via air circulation
- ↙ forced-air fan cooling
- ↙ water cooling

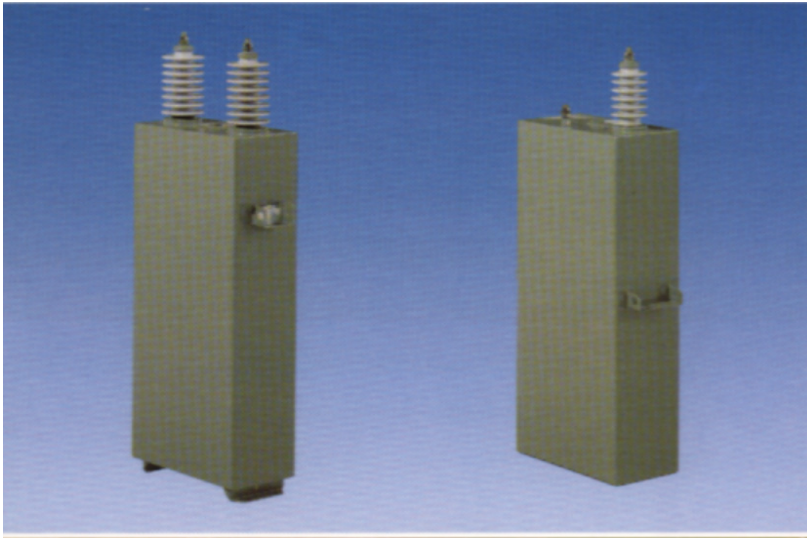
Description

- ↙ mains frequency
220-3000 V, up to 800 kvar per unit
- ↙ medium frequency
50-3000 V, 100-200,000 Hz up to 7,500 kvar per unit

Features

- ↙ compact construction
- ↙ tailor-made design to customer's needs
- ↙ can operate in extreme ambient conditions
- ↙ easy to integrate into overall system concept

High-voltage capacitors



Description

- ✦ individual capacitors from 660 V to 24 kV, up to 1000 kvar
- ✦ bank installations up to 500 kV, any output
- ✦ standards IEC 60871-1, IEC 143

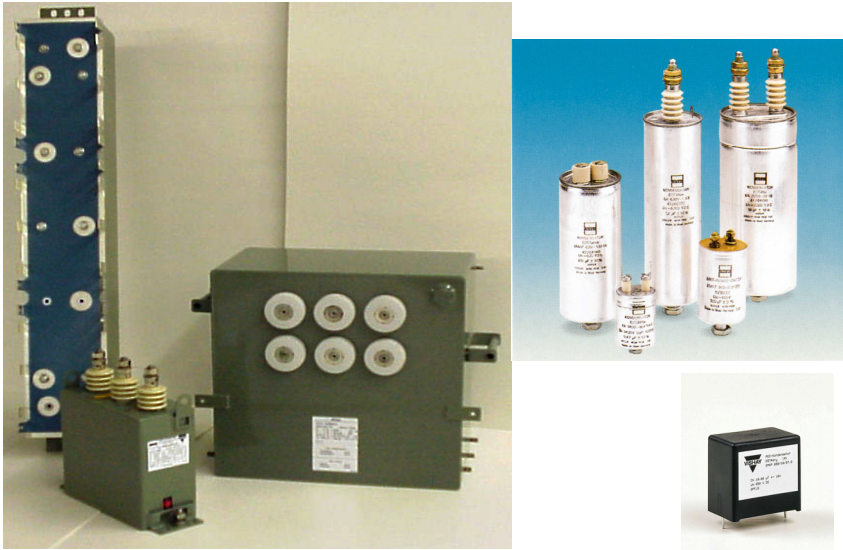
Application

- ✦ individual and group compensation
- ✦ fixed and controlled central compensation
- ✦ overvoltage protection and RC circuits
- ✦ filter circuits for mains systems with harmonics
- ✦ filter circuits for SVC (static var compensation)
- ✦ filter circuits for HVDC transmission
- ✦ series capacitors for power systems

Features

- ✦ voltage and output rating can be matched precisely to client's specifications
- ✦ element fuses for high operating reliability
- ✦ flexible plant design, using racks of our own construction
- ✦ Vishay's own unbalance protection

Capacitors for power electronics



Description

- ✦ DC capacitors up to 10 kV, to 20mF, to 600 A with dry technology
- ✦ DC capacitors up to 100 kV per unit oilfilled
- ✦ AC capacitors up to 24 kV per unit oilfilled
- ✦ standard IEC 61071, customer specifications

Application

- ✦ converters for traction and drives
- ✦ UPS
- ✦ clamping and snubber capacitors for GTO's and IGBT's
- ✦ AC/DC filters,
- ✦ DC supply equipment for radio and TV stations
- ✦ pulsed energy e.g. in laser systems

Features

- ✦ all rectangular capacitors are designed on customers specification
- ✦ dry technology, with segment metallized polypropylene foil
- ✦ shock and vibration proofed



Innovations PEC

High Voltage DC-Capacitors (SH) up to 75 kVDC

Low Inductive DC-Capacitors for Traction and Industrial Converters

HV-DC Capacitors



Description

- ⚡ Voltage range up to 75.000 VDC
- ⚡ Impulse discharge current >200 k A
- ⚡ Energy up to 130kWs
- ⚡ Temperature range - 40°C through +60 °C

Applications

- ⚡ HVDC Transmission
- ⚡ HV testing equipment
- ⚡ Impulse discharge
- ⚡ Medical equipment

Features

- ⚡ High ripple current capacity
- ⚡ Highest impulse discharge currents
- ⚡ Dielectric selfhealing , non polarized
- ⚡ Low dissipation factor
- ⚡ Low inductance
- ⚡ Stabil against shock and vibration

Low inductive DC Capacitors for AC drives



Description

- ⚡ Voltage range up to 2500 VDC/ 550 VAC
- ⚡ Capacitance up to 250 μ F
- ⚡ Ripple Current capacity 100 A
- ⚡ Inductance < 30 nH
- ⚡ Temperature range - 40°C through 85 °C

Application

- ⚡ DC Link in low power industry and traction drives
- ⚡ Impulse discharge capacitor (welding equipment)
- ⚡ Voltage converters
- ⚡ Uninterruptible power supplies
- ⚡ Replacement for aluminium electrolytics (lower capacitance but higher currents)

Features

- ⚡ High ripple current capacity
- ⚡ Dielectric selfhealing , non polarized
- ⚡ Low dissipation factor
- ⚡ Low inductance
- ⚡ Stabil against shock and vibration