

# LV COMPENSATION & FILTERING PRODUCTS

## Providing Power Quality and Energy Efficiency

Low (LV) reactive power compensation and harmonic filtering solutions help customers to improve the performance of installations through energy savings and better power quality, enabling end users to save money and reduce the environmental impact of their operations.

GE Vernova offers compensation equipment, a wide range of products and one-off solutions at low voltage levels. Specialists analyse the exact needs of the application and engineer the right solutions for optimal efficiency and economy.

APPLICATIONS	PRODUCTS	CUSTOMER TYPES
Real-time harmonic filtering and reactive power compensation in distorted networks	Active Filters	<ul style="list-style-type: none"><li>• Wind parks</li><li>• Companies with fast variable loads like welding machinery, cranes or lifts</li><li>• Electrical contractors</li></ul>
Reactive power compensation and harmonic filtering in distorted networks	Tuned Harmonic Filter Capacitor Banks (Automatic or Fixed)	<ul style="list-style-type: none"><li>• Buildings with non-linear loads</li><li>• Industries of all kinds</li><li>• Electrical contractors</li></ul>
Reactive power compensation and harmonic filtering in slightly distorted networks	Detuned Harmonic Filter Capacitor Banks (Automatic or Fixed)	<ul style="list-style-type: none"><li>• Buildings with non-linear loads</li><li>• Industries of all kinds</li><li>• Electrical contractors</li></ul>
Reactive power compensation in networks without harmonics	Capacitor Banks Without Reactors (Automatic or Fixed)	<ul style="list-style-type: none"><li>• Buildings of all kinds</li><li>• Industries of all kinds</li><li>• Electrical contractors</li></ul>
Basic components for all types of capacitor banks	Capacitor Units Reactors (Iron-Core) Power Factor Controllers Electronic Discharge Devices	<ul style="list-style-type: none"><li>• LV panelbuilders</li><li>• LV switchboard manufacturers</li><li>• Maintenance companies</li></ul>



### Key Benefits

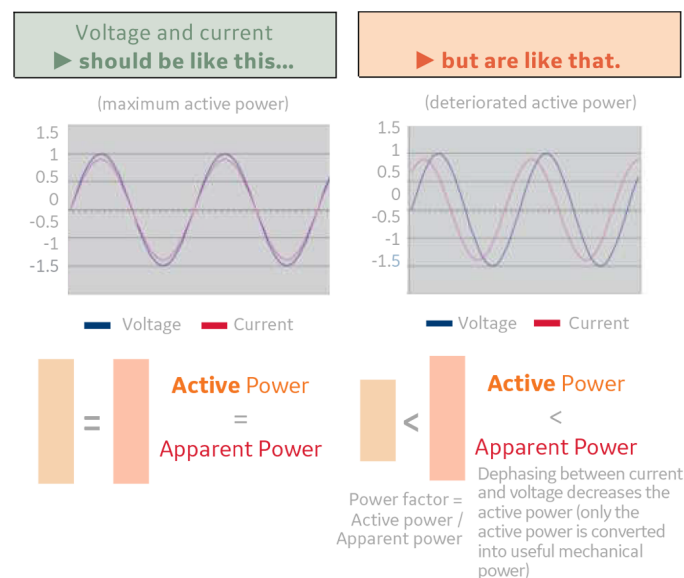
- Reduce harmonics
- Compact solutions
- Lower losses
- Improved power quality
- Cost saving



# Why do we need reactive power compensation and harmonic filtering?

## Reactive Power Compensation

Connected equipment (transformers, motors, air-conditioning, refrigerators, etc.) cause a phase angle between current and voltage. When the current is phase-shifted, it takes more current to deliver the same amount of active power.



### IMPACT OF REACTIVE POWER

- Transmission equipment has to be sized for the apparent power, yet only active power is useful
- Increased losses in the network
- You pay for apparent power but use active power (higher electricity bill)
- Reactive power energy fees to customers with a low power factor installation (example < 0.95)

### WHO

- Power consumers, network operators, electric utilities, power industry, hospitals, offices, public and commercial buildings, factories

### SOLUTION

- The power factor of a facility can be improved by installing capacitor banks

## Harmonic Filtering

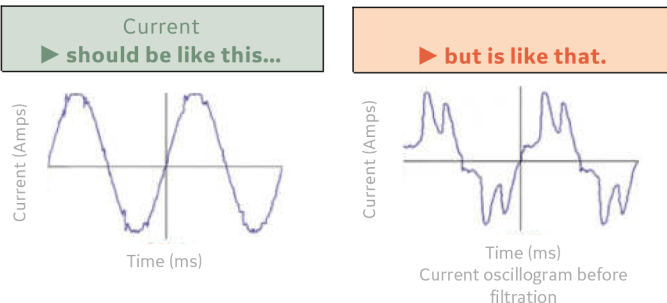
Variable speed drives (process industries, lifts, air conditioning pumps, etc.), uninterruptible power supplies for computers, electronic equipment, etc. distort the current (introduce harmonics).

### IMPACT OF HARMONICS ON TRANSMISSION / DISTRIBUTION EQUIPMENT

- Additional losses (paid for by the end user)
- Heating in power cables
- Audible noise (transformers)
- Penalty fees to customers with a low power factor (example < 0.95)

### IMPACT OF HARMONICS ON EQUIPMENT CONNECTED

- Decreased machinery efficiency
- Costly process shutdowns
- Disturbed electronic equipment (computers, telephones)



### WHO

- Power consumers, network operators, power supplies, power industry

### SOLUTION

- Harmonics can be filtered through a combination of reactors and capacitors (passive filtering) or by injecting the exact opposite of the harmonics detected (active filter) into the network.

## Reactive Power Compensation and Harmonic Filtering Brings

### ECONOMIC BENEFITS

- Saving the costs of reactive power
- Additional savings through reduced active power losses
- Reduction in investment cost

Return on investment is generally below 18 months.

### ENVIRONMENTAL BENEFITS

- Reduced CO<sub>2</sub> emissions
- Customers see environmental benefits through energy savings and more efficient power systems.

By saving millions of tons of CO<sub>2</sub>, power compensation makes an active contribution to protecting the environment.

# N-Series Low Voltage Capacitor Units

## Product Features

Capacitor elements made of metallised polypropylene film are self-healing and dry without impregnation liquid. Each capacitor element is individually protected with patented internal fuse protection.

Capacitors have low losses, and are constructed to be compact size and light in weight. The low voltage power capacitors comply with most national and international standards.

Standard series, for 50 Hz or 60 Hz frequencies, are available for the following voltages: 220, 230, 240, 380, 400, 415, 440, 480, 525, 600, 660 and 690 V.

Other voltages up to 1,000 V are available on request.

## Applications

All kinds of capacitor banks

## Typical Customers

- Panel builders
- LV switchboard manufacturers

## Key Advantages

- Low losses
- Compact size
- Light in weight
- Self-healing
- Easy-to-install components



## Technical Data

Rated voltage	200 V to 1,000 V
Rated frequency	50 Hz or 60 Hz
Insulation level	4 kV rms/12 kV crest
Power losses	≤ 0.5 W/kVar
Continuous overvoltage	1.1 x $U_N$
Continuous overcurrent	1.3 x $I_N$
Mounting arrangement	indoor
Degree of protection	IP42
Temperature class	-40°C to + 55°C
Average 24h:	+ 45°C
Average 1 year:	+ 35°C
Weight	2.5 to 5 kg
Color	RAL7035
Electrical safety	IEC 60831 - 1&2

# L1 and L2-Series Low Voltage Capacitor Units

## Product Features

Capacitor elements made of metallised polypropylene film are self-healing and dry without impregnation liquid. Each capacitor element is individually protected with patented internal fuse protection.

Capacitors come with internal discharge resistors up to 690 V (3 min. 75 V) and terminal boxes (IP42) or without terminal box (IP00). Electronic discharge devices up to 550 V are available.

Standard series, for 50 Hz or 60 Hz frequencies, are available for the following voltages: 220, 230, 240, 380, 400, 415, 440, 480, 525, 600, 660 and 690 V. Other voltages up to 1000 V are available on request.

## Applications

All kinds of capacitor banks

## Typical Customers

- Panel builders
- LV switchboard manufacturers

## Key Advantages

- Easy and robust cable termination
- Internal discharge resistors
- Simple, safe and solid construction
- Self-healing
- Easy-to-install components



## Technical Data

Rated voltage	200 V to 1,000 V
Rated frequency	50 Hz or 60 Hz
Rated power	2.5 to 125 kVAr
Output	3- or 1-phase applications
Capacitance tolerance	- 5 to +10%
Insulation level	4.1 kV I 690 V) or 5 kV I > 690 to 1,000 V)
Continuous overvoltage	$1.1 \times U_N$
Continuous overcurrent	$1.3 \times I_N$
Power losses	$\leq 0.4 \text{ W/kVAr}$ (with discharge resistors)
Mounting arrangement	indoor
Degree of protection	IP00 or IP42
Temperature class	- 40° C as standard (- 5/D on request)
Container	Painted steel container
Weight	2.8 to 25 kg
Color	RAL7035 (light grey)
Electrical safety	IEC 60831 - 1&2



# Fixed Detuned Filter Capacitor Banks

## Product Features

The natural frequency in the resonant circuit formed by the capacitance of the power capacitor and the network inductance may match a harmonic frequency. If there is a harmonic current source for that particular harmonic frequency in the network, the harmonic current of this frequency may reach values as high as 20 times the normal level. The voltage and current waveforms are distorted due to the amplified harmonics caused by the resonance. This leads to further current and voltage distortions.

## Applications

- Compensation of the reactive power in individual, standard-power loads or groups of loads in networks affected by harmonics
- Used to compensate stable reactive power in the networks affected by harmonic
- Usually connected in parallel with the load switching on and off simultaneously with the load

## Typical Customers

- Industries of all kinds
- Contractors

## Key Advantages

- Small and robust construction
- Low losses
- For individual loads
- IN-OUT (passing) cabling



## Technical Data

Rated voltage	230 V to 690 V
Rated frequency	50 Hz or 60 Hz
Rated power DFC 0607 -series	≤ 50 kVAr
Rated power DFL 0611 -series	50 to 100 kVAr
Rated power DFL 0612 -series	100 to 150 kVAr
Tuning frequency	189 Hz or 245 Hz
Insulation level	3 kV
Continuous overvoltage	1.1 x U <sub>N</sub>
Harmonic dimensioning	according to IEC 61000 - 2 - 2
Mounting arrangement	indoor
Degree of protection	IP32
Temperature class	0 °C to + 40 °C
Average 24h:	+ 35 °C
Average 1 year:	+ 25 °C
Dimensions (wxdxh)	DFC 560 × 475 × 660 mm DFL 600 × 600 × 1100 mm or 1200 mm
Weight	DFC ≤ 83 kg, DFL ≤ 200 kg
Colour	RAL7035 (light gray)
Electrical safety	IEC 60289

## Wall Mounted Automatic Capacitor Banks

### Product Features

Automatic capacitor banks are used for centralized power factor correction at the main and sub distribution boards. Power factor correction means that reactive power charges imposed by electricity utilities can be avoided. Automatic capacitor banks consist of steps controlled by a reactive power controller, which ensures that the required reactive power is always connected to the system.

In GE Vernova's wall-mounted automatic capacitor banks, all components (capacitor units, contactors and fuses) are built into a compact steel case. This makes installation easy. Capacitor banks can also be easily extended if necessary. Extension is allowed within the limits of the cabling recommendations.

### Applications

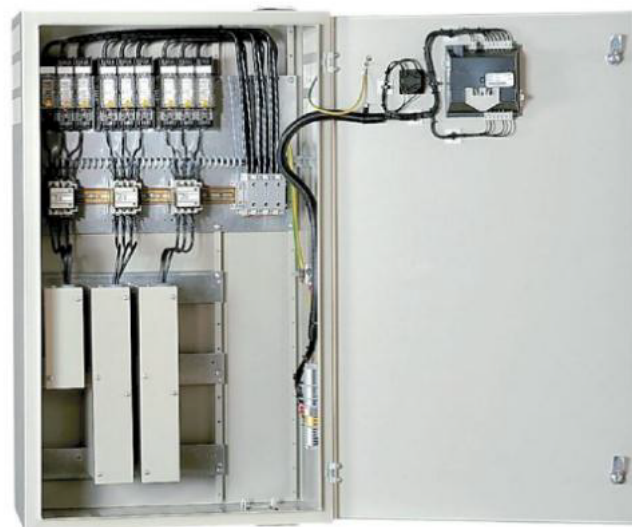
- Reactive power compensation in low voltage networks without harmonics
- Centralized
- Usually connected into the main board or sub board

### Typical Customers

- Small commercial premises
- Small industries of all kinds
- Power utilities
- Contractors

### Key Advantages

- Small space requirement 600 × 300 × 1,000 mm (wxdxh)
- Wide range of cable connections
- Expandability



### Technical Data

Rated voltage	up to 690 V
Rated frequency	50 Hz or 60 Hz
Rated power	15 to 100 kVAr
Number of steps	1 to 5
Capacitance tolerance	-5% /+ 10%
Tuning frequency	-
Insulation level	3 kV
Continuous overvoltage	$1.1 \times U_N$
Continuous overcurrent	$1.3 \times I_N$
Power losses	< 1.3 W
Mounting arrangement	indoor
Degree of protection	IP30
Temperature class	0° C to+ 40° C
Average 24h:	+ 30° C
Average 1 year:	+ 20° C
Dimensions (wxdxh)	600 × 300 × 1000 mm
Weight	45 to 65 kg
Color	RAL7035 (light grey)
Electrical safety	IEC 60831-1&2, EN 60439 -1



# Fixed Detuned Filter Capacitor Banks

## Banks Product Features

GE Vernova's DW-series automatic capacitor banks with blocking reactors are intended for power factor correction in systems where harmonic distortion is present.

The new modular and compact design saves space and is available with options for wall or floor mounting. The DW-series is available in two variants, standard and extendable. The extendable type includes space for fast and easy increase of the output of the c-bank. Reactive power compensation is controlled with the N-6 high performance reactive power controller.

Power factor correction by means of conventional capacitor banks is not possible in systems affected by harmonics. This is because the harmonic currents are amplified in the parallel resonant circuit formed by the capacitor and the network. As a result, current and voltage distortion are further increased.

Wall or floor mounted detuned filter capacitor banks are manufactured for 400 V/50 Hz networks with 141 Hz and 189 Hz tuning frequencies. Other configurations are available to order.

## Applications

- Power factor correction in distorted networks

## Typical Customers

- All kinds of commercial buildings
- Small industries
- Contractors

## Key Advantages

- Compact
- Wall or floor mounting
- Optimized for small steps/outputs



## Technical Data

Rated voltage	up to 690 V
Rated frequency	50 Hz or 60 Hz
Rated power	15 to 75 kVAr
Number of steps	3 to 4
Tuning frequency	189 Hz or 245 Hz
Insulation level	3 kV
Continuous overvoltage	1.1 x U <sub>N</sub>
Harmonic dimensioning	according to IEC 61000 - 2 - 2
Mounting arrangement	indoor, on floor or wall
Degree of protection	IP20C
Temperature class	0° C to+ 40° C
Average 24h:	+ 35° C
Average 1 year:	+ 25° C
Dimensions (wxdxh)	750 × 320 × 1200 mm
Weight	80 to 130 kg
Color	RAL7035 (light grey)
Electrical safety	IEC 60831 - 1&2, EN 60439 - 1

## D-Series Detuned Filter Capacitor Banks

### Product Features

Power transmission and distribution systems are designed to operate with sinusoidal voltage and current having a constant frequency. When non-linear loads – such as thyristor drives and converters – are connected to the system, harmonics are generated, causing voltage and current distortion.

Capacitor capacitance and network inductances may form a parallel resonant circuit, where harmonic currents may be as much as 20 times the normal level. Should the natural frequency of the resonant circuit match an existing harmonic frequency, the current distortion caused by resonance leads to further voltage distortion. Power factor correction by means of conventional capacitors is not possible in systems affected by harmonics.

In systems where harmonics are present, power factor correction should be done with detuned filters. These consist of capacitors and reactors connected in series, capable of compensating reactive power at fundamental frequency without amplifying the harmonics.

### Applications

- Power factor correction in distorted networks
- Centralized compensation
- Used in networks affected by harmonics
- Detuned filter is usually connected into the main board or sub board

### Typical Customers

- Commercial premises of all kinds
- Industries of all kinds
- Contractors

### Key Advantages

- Low losses
- Modular, clear construction
- Extendibility



### Technical Data

Rated voltage	up to 690 V
Rated frequency	50 Hz or 60 Hz
Rated power	45 to 450 kVAr
Number of steps per cubicle	3 to 7
Tuning frequency	189 Hz or 245 Hz (other frequencies on request)
Insulation level	3 kV
Continuous overvoltage	$1.1 \times U_N$
Harmonic dimensioning	according to IEC 61000-2-2
Mounting arrangement	indoor
Degree of protection	IP20C or IP34
Temperature class	0° C to + 40° C
Average 24h:	+ 35° C
Average 1 year:	+ 25° C
Dimensions (wxdxh)	600 × 600 × 1,800 mm
(option height 2000 mm)	800 × 600 × 1,800 mm
(option height 2000 mm)	1,000 × 600 × 1,800 mm
(option height 2000 mm)	1,200 × 600 × 1,800 mm
Weight	180 to 610 kg
Color	RAL7035 (light grey)
Electrical safety	IEC 60831 - 1&2, EN 60439 -1



# Third Harmonic Filter Capacitor Banks

## Product Features

Harmonic filters are usually designed on a case-by-case basis according to the dimensions and assembled from standard components. This ensures the best reactive power compensation and harmonic filtering with reasonable investment costs.

Computers and other loads with SMPS (Switch Mode Power Supply) generate third harmonic current. This causes problems to all loads and networks.

All harmonic currents cause both current and voltage distortion. In addition, third harmonic currents accumulate in the neutral wire, increasing the risk of overloading and causing the magnetic field to have the frequency of 150 Hz or 180 Hz. By filtering the third harmonic out of the network these problems can be eliminated totally.

## Applications

- Improving power quality
- Power factor correction

## Typical Customers

- Commercial premises of all kinds
- Greenhouses
- Contractors

## Key Advantages

- Reduces 3<sup>rd</sup> harmonic current in both phases and neutral
- Patented capacitor/reactor series connection

## Technical Data

Type	3HF50/400-50/150-108/77-0816	3 H F35/400-50/150-127 /116-0816	3HF15/400-50/150-50/44-0812S
Nominal Voltage	400 V	400V	400V
Fundamental frequency	50/60 Hz	50/60 Hz	50/60 Hz
Reactive Power	50 kVAr	35 kVAr	15 kVAr
3 <sup>rd</sup> harmonic current phase/neutral	77/230 A	116/348 A	44/132 A
Mounting arrangement	indoor, on floor	indoor, on floor	indoor, on wall
Degree of protection	IP20C	IP20C	IP20C
Temperature class	0° C to+ 40° C	0° C to+ 40° C	0° C to+ 40° C
Average 24h:	+ 35° C	+ 35° C	+ 35° C
Average 1 year:	+ 25° C	+ 25° C	+ 25° C
Dimensions (w.d.h)	800 × 600 × 1600 mm	800 × 600 × 1600 mm	750 × 320 × 1200 mm
Weight	300 kg	310 kg	130 kg
Color	RAL7035 (light grey)	RAL7035 (light grey)	RAL7035 (light grey)
Electrical safety	IEC 60831-1&2, EN 60439 - 1	IEC 60831- 1&2, EN 60439 - 1	IEC 60831-1&2, EN 60439 -1



## F-Series Harmonic Filter Capacitor Banks

### Product Features

Power transmission and distribution systems are designed for operation with sinusoidal voltage and current waveforms at a constant frequency. However, when non-linear loads – such as thyristor drives, converters and arc furnaces – are connected to the system, excessive harmonic currents are generated, causing both current and voltage distortion.

Harmonic filters can be operated in the same way as automatic capacitor banks: they are controlled by means of a power factor controller according to reactive power requirements.

Harmonic filters are custom designed for each application using standard components. This ensures that the best possible power factor correction and filtering characteristics are achieved with a reasonable investment.

### Applications

- Improving power quality and power factor correction
- Used to filter harmonics
- Usually connected into the main or sub board

### Typical Customers

- Commercial premises of all kinds
- Industries of all kinds
- Contractors

### Key Advantages

- Filter system for 5<sup>th</sup>, 7<sup>th</sup>, 11<sup>th</sup> and 13<sup>th</sup> harmonics controlled by power factor controller
- Reduced harmonics
- Customized for your network
- Improves the quality of the electricity



### Technical Data

Rated voltage	upto 690V
Fundamental frequency	50 Hz or 60 Hz
Filter tuned to	5 <sup>th</sup> , 7 <sup>th</sup> , 11 <sup>th</sup> or 13 <sup>th</sup> order of harmonics
Reactive power per cubicle	60 to 300 kVAr
Insulation level	3 kV
Mounting arrangement	indoor
Degree of protection	IP20C
Temperature class Average 24h: Ave rage 1 year:	0° C to+ 40° C + 35° C + 25° C
Dimensions (wxdxh)	600 × 600 × 2,000 mm 800 × 600 × 2,000 mm
Weight	180 to 500 kg
Color	RAL7035 (light grey)
Electrical safety	IEC 60831 - 1&2, EN 60439 - 1

# MaxSine™ Compact Active Harmonic Filters

## Product Features

- Small size enables customized modular cabinet construction.
- Ethernet connection and web server for monitoring, setting and control
- User interface: PC or optional HMI
- Several languages
- Relay output for run indication
- Standby in case of small load current
- Electronic overload protection
- Auxiliary temperature probe (optional)
- Basic module 100 A line current and 300 A neutral current
- Clock

## Applications

- Improving power quality and power factor correction in real time

## Typical Customers

- Hospitals
- Office buildings
- Companies with fast-changing loads (welding machines, lifts)
- Wind farms
- All users with fast variable loads

## Key Advantages

- Real time filtering and power compensation
- Compact construction
- Improved usability
- Money savings
- Improved power quality

## Technical Data

Rated output	All integer multiples of the below values 200 A, 300 A, 400 A, etc. Phases: Neutral:	<b>MaxSine 100AV6C</b> 100 Arms 60 Arms	<b>MaxSine 100AV6CE</b> 100 Arms 300 Arms
Main voltages		3*208 VAC (-15% ... +10%) 3*400 VAC (-15% ... +10%) 3*480 VAC (-15% ... +10%)	
Degree of protection		IP20	
Enclosure Dimensions (w.d.h) Weight		MaxSine 100AV6C 241 × 400 × 880 mm 57 kg	MaxSine 100AV6CE 241 × 400 × 1129 mm 65 kg
Enclosure material		1 mm sheet iron - colour RAL 7035	
Cooling		Forced air cooled	
Electrical safety		IEC 61800-5-1	



# Power Factor Controllers N-6, N-12 and NC-12

## Product Features

GE Vernova's power factor controllers provide your network with efficient reactive power compensation, measurement and supervision.

## User-friendliness and Condition Monitoring

User-friendliness due to multilingual user interface, clear text and symbol messages, graphics, alarm log and communication. GE Vernova's power factor controller offers advanced condition monitoring for your network as well as for the capacitor bank. The supervision and condition monitoring functions add to the simplified programming with intelligent self-set-up to ensure optimal use of the reactive power compensation system.

## Applications

- Automatic reactive power control of low and medium voltage capacitor banks (tuned, detuned and conventional)

## Typical Customers

- Panel builders
- LV switchboard manufacturers

## Key Advantages

- Optimized user interface for easy operation
- Intelligent stepping algorithm for optimum step utilization and fast response
- All traditional stepping sequences also available
- Quick and simple mounting and wiring
- Insensitive to current transformer polarity
- Monitoring and protection
- User-friendly
- Several language versions
- Robust construction
- Various step programs



## N-6 & N-12

Maximum 6 or 12 capacitor steps
Microprocessor-based technology
C/K auto search
Accuracy class 5%
Ambient temperature 0 to + 60° C
Protection class IP41 at panel and IP20 DIN-rail installation
Measurements; cos $\phi$ P, Q, S, THD(U), U, I, temperature

## NC-12

Maximum 12 capacitor steps
Microprocessor-based technology
C/K auto search
Separate C/K setting for inductive and capacitive side
Accuracy class 2%
Ambient temperature 0 to + 60° C
Protection class IP41 at panel and IP20 DIN-rail installation
Measurements; cos $\phi$ , I <sub>p</sub> , I <sub>q</sub> , I <sub>rms</sub> /I <sub>1</sub> , P, Q, S, THD(U), U, THD(I), I <sub>s</sub> , harmonics
Communication RS485/modbus via optional auxiliaries

For more information, visit  
**[gevernova.com/grid-solutions](https://gevernova.com/grid-solutions)**

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