

C100 series Automatic Power Factor Correction



Automatic Capacitor Bank Assembly



4, 6 Unit Assemblies

- 10 to 600 kVAR
- 208 to 600 Volts
- Nema : Type 1 & 12



6 to 12 Units Assemblies

- 400 to 1200 kVAR
- 208 to 600 Volts
- Nema Type – 1,2,3R,12, 4X

The Reactive Power Solution

The Gentec C100 Automatic capacitor banks are used for central power factor correction at main and group distribution boards. Power factor correction means that reactive power charges levied by electricity suppliers can be avoided. The C100 Automatic capacitor banks consist of stages controlled by a reactive power regulator, which ensures that the required capacitor power is always connected to the system.

In C100 Capacitors floor and wall-mounted automatic capacitor bank, all components (capacitor units, contactors, controller and fuses) are built into a compact steel enclosure. This makes installation easy, and capacitor banks can also be easily planned for in the cabling recommendations.

The C100 4, 6 & 12 Units assemblies are available in free standing or wall mounted configuration. When power ratings in excess of 240 kVAR in 4 Unit, 600 kVAR in 6 Units and 1200 kVAR in 12 units are required, cubicle type automatic capacitor banks are used.

Important: When selecting compensation for a system which contains a harmonic generating load, check that the automatic capacitor bank is suitable for the purpose. In systems where harmonics are present, compensation should be by means of a capacitor bank with Anti-resonant reactors (de-tuned filter) or a harmonic filter (tuned filter).

Automatically Switched 50 to 1200 kvar

The indoor automatically switched Type C100 Capacitor is a durable, self-supporting, steel structured assembly which permits automatic control of power factor correction. This field tested bank is UL and CSA Approved and meets the Electrical Code requirements for protection and safety of the customer and equipment. The C100 banks are intended for indoor or outdoor applications on 240, 480 and 600 volts, 3 phase 3 or 4 wire systems. Equipment is suitable for operation in ambient temperatures up to +40 degrees C. Type C100 banks incorporate the dry self-healing technology of the DSHI capacitor with the dependable switching service of the previous liquid filled equipment to provide the ultimate in power factor correction at an affordable price. The product value is further enhanced by competent support from the company representatives, who offer maintenance, initial operating instructions and explain to the user, the function of the bank features.

The automatic control system is designed to insert or remove kvar in predetermined steps as required by the load. Fluctuating loads are tracked using a current signal from a current transformer which monitors the total system load and a voltage signal from a potential transformer mounted in the capacitor bank. The controller continually monitors the reactive power being drawn from the utility system and automatically switches capacitors on or off as required. The automatic system prevents over-correction at light load conditions and supplies essential kvar as the load increases to reduce voltage drop and improve the power factor of the system.

Due to the absence of fluid, the new dry C100 design is smaller and lighter and is supplied in more versatile enclosures than previous designs. Drip trays are now eliminated as there is no leakage hazard and capacitors are environmentally safe. The dry self-healing capacitor cells are packed in vermiculite insulation and housed in steel casings which results in a capacitor bank which offers virtually low fire hazard. Internal fuses isolate defective cells.

The UL and CSA approved C100 banks are available in larger kvar ratings per enclosure than the previous designs. Steps are protected by 200 Ka HRC current limiting fusing and are equipped with current limiting devices to reduce inrush currents produced by back-to-back switching. This gives longer life by supplying a bank that is less likely to fail. The increased kvar supplied in smaller enclosures reduces installation, shipping, handling and initial purchase price thereby providing substantial savings to the user.

IN OPTION:

A GFI 120 V. breaker can be supplied on all C100 banks to provide high protection level against the person. This breaker would go out if the control source becomes short circuited.



TECHNICAL DATA

Automatic power factor control systems are designed to meet all UL and CSA requirements for power factor improvements in the average industrial plant. Equipment consists of a 4, 6, 12 unit metal enclosure which houses the required quantity of 3 phase capacitor units, fuses, contactors, reactors, controller, control components and wiring.

Housings : The C100 bank enclosure is a 4, 6, 12 units free standing metal NEMA rated housing. The housing is supplied with vented doors to allow for ventilation and cooling of the control components. Banks which exceed the 4, 6, 12 unit limitations would have factory supplied control wiring between separate housings or can be supplied with individual power connections to each housing.

Power cables are connected to the cubicle at the upper right hand side. The income termination is made to two 600 MCM solderless cable lugs provided on each phase.

Fusing Protection :

Cables feeding the C100 capacitor bank must be protected by an over-current device as per Code regulations. The capacitor bank termination lugs are mounted on copper bus having an ampacity rating the same as or greater than that of the termination lugs. Lugs and bus are insulated from the housing by 600 volt stand-off insulators. Current limiting type HRC fuses having a 200,000 ampere fault interrupting capacity are provided on the bus prior to cable derating to protect the wiring to each phase of each individual capacitor step. To provide additional protection the control circuitry is fused on both the primary and the secondary of the control transformer.

Current limiting Devices :

In an automatic switched bank, capacitors are installed in close proximity to each other. Without current damping devices between capacitors, the inrush currents created by back-to-back switching can cause undue stress on the capacitor dielectric and also contactor pitting leading to premature failure. All C100 switched banks are provided with current damping device to smooth the initial high current spikes created by the switching operation. The addition of this damping device provides longer component life and less maintenance down time.

Contactors :

The contactors used in C100 banks are specifically selected for capacitor switching duty providing durability and reliable switching. The contactors are sized base on the Kvar and voltage rating values.



Capacitors : C100 capacitor equipments use the dry self-healing type DSHI Capacitor as described for the individual kVAR steps. internally fused and are self-healing. The dielectric consists of metalized polypropylene film. Cells are protected from moisture and foreign matter by thermosetting resin and a plastic case. Individual cells are packed in vermiculite and housed in a

steel casing to provide a rugged durable product. The 240, 480 and 600 volt DSHI capacitors have their cells internally connected in delta. The 750 volt construction design is internally wye connected.

Controller :

For this applications Gentec inc uses the Nokian N12 or NC12 capacitor controller. This controller regulates power factor correction by means of VAR sensing. As the power factor deviates from unity the reactive power is measured by means of a current transformer mounted on the line side of the system load and a potential transformer contained within the capacitor enclosure. Capacitor steps are added or subtracted as required. Care should be taken when selecting individual step sizes to avoid kvar ratings below the minimum switching level of the controller .

The N12 or NC12 controller is available in 12 step designs. A target $\cos \phi$ PF override is supplied to provide a means of maintaining the power factor over the range 0.90 to 0.85 lagging. The standard controller is provided with capacitive load, inductive load and step indicating lights. Adjustable CK settings are used to set calculated levels for addition or removal of capacitor steps.

This controller is supplied with inductive load, capacitive load indication and step indication. Front Key board allows manual override to check individual capacitor steps. Step switching is provided with programmable, time delays for individual steps. In the event of a power failure (over 30 milli secs.) all connected steps are switched off by a built-in loss of voltage feature and reconnected step by step after a time delay.



N6 - N12



NC12

Control Transformer:

A control transformer is mounted in the first group bank housing to provide sensing to the control circuit. This transformer is connected across "A" and "C" phases on the line termination bus to ensure proper phasing. The customer mounted current must be installed in the "B" phase or else proper phase rotation of the potential leads must be observed. The CT must be installed on the line side of the system load and voltage and current must be at same potential reference of the transformer. Capacitor assembly to monitor the total load current to be corrected.

The automatically switched power factor correction system shall be type C100 or approved equal suitable for use on a 600V (or 240, 480) 3 phase, 60 Hz, 3 wire (or 4 wire) system. It shall meet the requirements of current UL and CSA standards and the Electrical Code.

The capacitor bank will be designed for indoor installation and for operation in ambient temperatures up to 40°C. Enclosures provided will be indoor or outdoor rated for floor mounting complete with proper ventilation and lockable doors. A means will be provided to quickly and easily replace faulty capacitor units in the field.

The capacitor bank will be factory wired and assembled complete, ready for setting in place and connection to the power system and to the 2 wire signal from a remotely mounted current transformer.



4 Unit Assembly
Wall mounting



6 Unit Assembly
Floor mounting

1. Operation shall be by means of an electronic controller with the following features :
 - auto/manual control
 - variable operating time settings.

- Indicators for number of stages energized and the switching direction
 - loss of voltage element
 - six or twelve step switching with provision for steps to handle added kvar as the load grows.
2. Contactor with current limiting device will be supplied in each step to limit inrush currents during switching operations.
 3. Fuses will be installed to protect the cable leads feeding each capacitor step.
 4. Switching shall be by means of contactors specifically rated for capacitor switching duty to ensure long life and trouble free performance.
 5. Bank operation shall be readily detected by means of LED display installed on the front of the housing on the controller.
 6. Capacitors will be the dry, self-healing type DSHI with no free fluid and extended foil construction to minimize losses and prevent loss of capacitance due to premature tab failure. Each capacitor will be fitted with discharge resistors to reduce the residual voltage to 50 volts crest in less than 1 min. from de-energizing. Units will be individual design to allow easy changeout.
 7. Direct heat transfer supplied on each internal cells fuses



The following information should be supplied at the order entry stage to ensure the most economical bank with the highest degree of correction is supplied :

1. Characteristics of the load to be corrected i.e. amps, voltage, power factor.
2. KVA rating and percent impedance of the transformer supplying the load to be corrected.
3. Special Filter Devices equipment on system e.g. D.C./ A.C. drives, variable freq. drives, etc.
4. CT ratio to be confirmed..