



# gentec

## GENERAL

Type DSHI low voltage power capacitors are manufactured using the latest "state-of-the-art" technology for dry metalized film power capacitors. The absence of any free dielectric fluid means no risk of leakage and eliminates the need for additional drip trays to conform to Code installation requirements. The self healing characteristics combine with the internal fuse in the capacitor elements or cells located within the steel enclosure eliminates the need for separate fusing. The light weight and compact design provides easy handling and installation.

## CONSTRUCTION

Elements: the DSHI capacitor consists of a number of capacitor elements or cells connected to provide the required three phase output. These cells are wound from metalized polypropylene film. After winding, the cell ends are zinc sprayed to provide the best electrical contact between the turns of the winding, and connection copper buss. The winding is then placed in a thermoplastic resin case following which polyurethane resin is added and allowed to harden. The finished cells are then arranged for the required three phase output and mounted in a steel housing.

### Housings:

This housing is constructed from steel and consists of a box type case with mounting flanges at the bottom part and a removable cover. Discharge resistors and solderless terminals are included in this design.

Two design are available ( L & N series) shipped complete and ready for installation in the average industrial plant. This design are supplied with general purpose enclosure to contain all live parts.

### Finish :

All type DSHI dry self healing capacitors are given two coats of an attractive light beige powder epoxy paint.

## FEATURES

**Lower Operating Losses :** The use of only low loss polypropylene film for the dielectric in the DSHI capacitor results in average losses of 0.4 watts per kVAR for an operating cost saving of 50 percent over previous designs using the paper-film mixed dielectric system.

### Environmentally Safe :

Although the elements used in the DSHI capacitor are treated with silicon oil there is no free liquid. Hence in the extremely unlikely even of an element rupture there is no risk of leakage or pollution.

### Self healing Protecting:

In earlier design DSHI capacitors have been tested with elements purposely shorted by a nail passed through the cell. Testing has proven that the impedance of the cell materials and connections will limit the fault current to allow internal isolation and self healing of the fault. This process is accomplished in 10 micro seconds. Each time a capacitor self heals metal deposits around the puncture are vaporized or blown back to develop an open circuit at the point where the plate shorted. The self healing operation is faster than the reaction time of a fuse.

Field applications show that voltage spikes can cause insulation deterioration and a hole to be developed. In this type of a fault the internal arcing through the hole becomes progressive as more ionized air is developed by the arc. This low current fault does not produce a solid short allowing the cell to self heal. As a result, end of life protection was developed in the forms of pressure sensitive interrupters and end of life fusing.

Heat is the major factor in the breakdown of insulation. The Nokian capacitor supplied by Gentec is provided with a special patented direct heat transfer to remove the core heat developed by the fuse protection. This device removes the heat directly from the from the cell core to provide cooler film for increased dielectric strength. *This feature is only in the Nokian designs which is offered by Gentec.*

Consequently, all low voltage assemblies include current limiting HRC fusing capacitors installed. Note, fusing is intended for short circuit protection of cables and not for unit case rupture protection as was the case on the previous liquid filled designs. Unlike the liquid filled design, the dry cells would self heal prior to the fuse seeing a fault condition within a capacitor unit. The internal fuses provide a secondary protection.

### Easy to installation:

The DSHI capacitor is both smaller and lighter than previous liquid filled designs which makes it easier to handle and install. In addition, as a result of its compact size the DSHI is available in larger ratings than previously possible. For example, at 600 volts the DSHI is available in single unit sizes up to 100 kVAR which weighs only 20 kg (44 lbs.), being less than the previous 60 kVAR liquid filled design. This will result in considerable savings for larger installations.

## Operating Limitations

**Temperature:** The DSHI capacitor is designed to operate over an ambient temperature range of -40 degrees C to + 40 degrees C.

Housed equipments, either natural or force ventilated, are usually designed for 46 degrees C maximum ambient temperature. Where the user provides housing for DSHI capacitor units, spacing and ventilation recommendations should be obtained.

### Ventilation:

Racks or enclosures for all assemblies should provide proper spacing and mounting of the individual units to insure natural air circulation. For cooling, dead air space or any obstruction or covering that will reduce the natural flow of air between the units should be avoided.

**Overvoltage:** The maximum permissible operating voltage is 110 percent of the nameplate voltage (RMS including harmonics). All power capacitors are suitable for continuous operation at this voltage.

**Overcurrent :** The maximum permissible operating current is 135 percent of the rated nameplate current (including harmonics). All low voltage dry capacitors are suitable for continuous operation at this current.

**Frequency :** The low voltage dry capacitor is designed for operation at 60 Hz at nominal nameplate voltage and current.

**Discharge resistors :** All power capacitors are equipped with discharge resistors as a safety feature to discharge the capacitor when de-energized. For 1000 volts and below, the residual voltage is reduced to 50 volts crest in less than one minute after the unit has been disconnected from the circuit. For units above 1000 volts, the residual voltage is reduced to 50 volts crest in less than 5 minutes.

**Re-Rating kvar :**

Capacitor units are designed to produce rated kvar when operated at rated frequency and voltage). They may be operated at lower than rated voltage or frequency with kVAR values derated.

**Example :**

When using a 60 Hertz capacitor on a 50 Hertz system the resulting kvar is :

$$\frac{50}{60} \times \text{rated kvar at 60 Hz}$$

When using 480 volt capacitors on a 460 volt system the resulting kvar is :

$$\left(\frac{460}{480}\right)^2 \times \text{rated kvar}$$



DSH self healing dry type low voltage capacitors have been manufactured since 1980. Today Gentec / Nokian Capacitors manufacture low voltage units having rated voltages from 200V to 1000V for both frequencies 50Hz and 60Hz. For example, we have the following applications:

- Delta or star connected 3-phase units to be used for power factor correction in all kind of capacitor banks including detuned and tuned filters
- 1-phase units to be used e.g. in heating installations

- Capacitors units for special applications are available (contact Gentec factory)

In the design and manufacturing of the new cool type capacitor unit (L- and N-series) the latest knowledge in raw materials and processing has been utilised. While choosing raw materials and manufacturing processes the quality of the end product has been the first priority. As a proof of our continuous commitment to quality, Gentec was awarded the Quality Certificate ISO 9001-2000 in December 2001 which is followed-up with twice yearly audits. Capacitor units have been type tested according to UL and CSA .

Because the high temperature of the plastic insulation material is known to lead to its premature aging, one of the main targets in the design of the new cool type capacitor unit was to find a construction having a low temperature rise which has been reached by the following means:

- Losses of the elements have been minimized using by mean of winding design and using short solid copper terminals.
- Losses of the wiring have been minimized using solid copper bus bars and thick copper wires with low current density for internal connection in the capacitor unit
- Elements assembled in the steel container using a spacer to separate elements from each other.
- The split design of the container allows much better cooling due to 40% increase in the cooling surface.

Safety has also been an important guideline in the design. The main safety features being:

- The capacitor is completely encased in the steel container.

The capacitor unit has been provided with three level protection comprised of self healing cells individually fused elements and non-flammable filling around the elements in larger capacitor units which displaces oxygen and absorbs energy in failure situations with the heat transfer package.

The new arrangement of the terminals allows easy connection and the design of the discharge resistors (discharge time to 50V is less than 60s) allows the capacitor units to be easily used in automatically controlled capacitor banks.

**LOW VOLTAGE POWER CAPACITORS:**

Low voltage power capacitors are manufactured using the latest methods. Capacitor elements of metallized polypropylene film are self-healing and dry without impregnation liquid. Each capacitor element is individually protected with patented internal protection.

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