

SCA Guidance Note for the use of Inverters or Variable Speed Drives in powered smoke ventilation systems

The technology and use of inverters or variable speed drives (VSDs) in building services has become increasingly complex and common place in building services including use in smoke ventilation systems. Smoke ventilation systems are life safety systems where the first consideration is reliable operation with appropriate standby, backup and changeover as necessary to meet the design requirement. The thrust of development in building services has been for increased efficiency in order to meet higher regulatory standards for energy use in buildings. This guidance note is intended to help designers, specifiers, approval and regulatory bodies satisfy themselves that the control systems and strategies proposed and installed are appropriate for the specific application.

Smoke ventilation systems are often dual purpose operating in ventilation mode and fire mode. Traditionally the VSD was bypassed in fire mode with a physical electrical bypass to ensure that the fan could run to destruction as tested to EN12101-3. In recent time with improvements in hardware and software most VSD manufacturers have developed VSDs with a “fire mode” that selectively switches off protection features and introduces fault overrides to increase the availability of the drive. The meaning of “fire mode” in relation to VSDs was not defined so GAMBICA have issued a guide to express the opinions of what constitutes “fire mode”. The GAMBICA Technical Guide “Fire mode in variable speed drives” should be read in conjunction with the following guidance.

Smoke ventilation systems using VSDs should meet the following requirements

- I. One dedicated VSD should be supplied for each smoke ventilation fan
- II. Failure of one fan or VSD should not affect the operation of other duty fans or standby fans.
- III. Where there is no VSD ‘Fire Mode’, as described in the [GAMBICA Technical Guide “Fire mode in variable speed drives”](#), then a physical electrical bypass of the VSD is required.
- IV. The particular selection of smoke fan and VSD must be compatible and suitable for operation in smoke ventilation mode. There are 3 options in EN12101-3 as follows:
 - a. Fan running with VSD which is bypassed during a fire leaving the fan DOL.
 - b. Fan running with VSD where both the fan and the VSD have been tested to EN12101-3 and can therefore operate on the VSD during fire.
 - c. Fan running with VSD where only the fan has been tested to EN12101-3 but has the motor de-rated by 20% and a sinusoidal filter installed after the VSD.
- V. Under emergency conditions, a fan running with a VSD should only be used at the maximum speed/frequency to which it has been tested and certified to EN 12101-3.
- VI. The designer must be satisfied that the smoke ventilation system will operate continuously and reliably under emergency conditions including trips, faults, power outages and power changeovers in the finished building.
- VII. The changeover to standby fans must meet the performance and timing requirements that are appropriate to the specific design case.
- VIII. If there is no physical electrical bypass the selected VSD must be configured to and be capable of handling faults generated during duty standby power changeover to maintain operation.
- IX. The number of restarts following any individual fault condition on an individual VSD should be limited to suit the specific design case.