

Surge Protection: ACQ580 (W & WW)

Specification compliance for Surge Protection

When reviewing variable frequency drive (VFD) specifications for water & wastewater (W & WW) applications with the ACQ580 product line in mind; surge protection is commonly required. The ACQ580 product line offers certain surge protection as a standard. However, often additional surge protective devices are required to ensure compliance with engineer provided surge protection specifications. This document is intended to identify the surge protective capabilities of the ACQ580 product and to identify when additional custom surge protection is required to meet common W & WW specification requirements.

Standard ACQ580 surge protection:

The following statement is true for the ACQ580 Series VFD regarding what is offered out of the box for surge protection.

The 580 Series drives use diode bridge rectifiers and four 125 Joule MOVs across the rectifier. This combination gives the drive a surge withstand rating of 4000-volt, 50 joule surge voltage when tested in accordance with ANSI/IEEE C62.41-1991 with the test circuit adjusted for a 1200-amp peak 8x20 μ s short circuit discharge current pulse.

NOTE: The ACQ580 series drive MOV's comply with UL 1449 4th Edition, Type 4

For protection from line-to-line voltage surges for 480 V AC VFDs:

- Three MOVs are connected between each input power line and a common point in a wye configuration.
- Each MOV is rated for:
 - a maximum surge current of 6000 A, based on an 8x20 μ s waveform.
 - a maximum energy absorption in 2 ms of 125 J.

For protection from line-to-ground (common mode) voltage surges for 480 V AC VFDs:

- An additional MOV is connection from the common point of the power line MOVs to earth ground.
- This MOV is rated for:
 - a maximum surge current of 5000 A, based on an 8x20 μ s waveform.
 - a maximum energy absorption in 2 ms of 136 J.

Custom ACQ580 surge protections offered:

The ACQ580 ABB VFD can be quoted and purchased as a custom enclosed VFD panel with additional custom surge protection. As the level of protection increases, the price of the unit will increase, so providing exactly what is required is critical to meet the technical and budget needs for the project.

Custom Surge Arrestors complies with UL 1449 4th Edition, Type 1, is rated for 200kA SCCR and is rated for:

- Max discharge current rating ranging from **45kA to 200kA** per phase based on an 8x20 μ s waveform.
- Voltage Protection Rating (VPR) of **2000 to 3000V** line to line for a three-phase delta system.
- Voltage Protection Rating (VPR) of **1800V** line to ground for a three-phase delta system.

When an SPD is included as part of a custom quotation, it will be included as a plus code (+F262 or +P902). The quotation will include the technical specifics about the SPD that is being included.

Summary of Surge Protections offered:

SCCR rating

Standard Drive:	Unknown
+F262:	200kA
+P902 (Custom):	200kA

Surge withstand rating & voltage protection rating (VPR)

Standard drive:	4000 V Surge Withstand Rating
+F262	3000 VPR (This is in addition to the Standard Drive Protection)
+P902 (Custom):	2000 VPR (This is in addition to the Standard Drive Protection)

UL 1449 4th Edition

Standard drive:	Type 4 only
+F262:	Type 1 and 2
+P902 (Custom):	Type 1 and 2

Max surge current (per phase) & maximum discharge current

Minimum single-pulse surge current withstand rating per phase

Standard drive:	6kA, based on an 8x20 μ s waveform
+F262:	45kA per phase based on an 8x20 μ s waveform.
+P902 (Custom):	160kA per phase based on an 8x20 μ s waveform.
+P902 (Custom):	200kA per phase based on an 8x20 μ s waveform.

Examples of Common Surge Protection Specification Requirements:

Example 1

IEEE C62.41 (formerly IEEE 587) and UL1449

A. Surge protection:

- 1. Metal oxide varistors:*
 - a. Provide protection for the VFD against:*
 - 1) Line transients: 5,000-volt peak minimum.*
 - 2) Line to ground transients: 7,000 peak minimum.*

Analysis: Exception must be taken to the above spec requirement. No known way to comply.

Example 2

Drive shall include surge protection. The surge protective device shall be listed per UL 1449 Fourth Edition (August 2014), Type 1 SPD (In=10kA), 200 kiloAmps (kA) short circuit current rating (SCCR) and have a voltage protection rating (VPR) of 3000Volts per UL 1449.

Analysis: Standard drive meets the SCCR rating and Surge withstand rating but is not a UL 1449 Fourth Edition TYPE 1 SPD. Go with +F262 adder

Example 3

Provide the following internal protective features:

- 1. Transient surge protection.*
- 2. Power transistor VPR rating shall be 1200 Volts, minimum*

Analysis: Standard drive meets Surge withstand rating. Go with Standard Drive

Example 4

A. SPDS: Comply with UL 1449, Type 1

- 1. Include: LED Indicator lights for power and protection status.*
- 2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components*
- 3. Included Form-C contacts rated at 5 A and 250-Vac, one normally open and one normally closed, for remote monitoring of protection status*

B. Peak Surge Current Rating:

The minimum single-pulse surge current withstand rating per phase shall not be less than 200 Ka.

Analysis: Standard drive is not a UL 1449 Fourth Edition TYPE 1 SPD. Standard drive and +F262 adder do not meet Minimum single-pulse surge current withstand rating per phase. Contact ABB for custom +P902 quotation.