Change Supplement

Electrical Installation Requirements for Rotary Air Compressors with Variable Speed Drives (VSD)

About This Supplement

The electrical installation data provided in this publication supplements the data in the INSTALLATION section of your Operation and Maintenance manual or Product Information Manual.

This change supplement applies only to models with VSD. Nirvana models beginning with "IRN" and R-Series models ending with "n" or "ne" are affected.

Electrical Safety – General Warnings

The voltage used in the compressor can cause a dangerous electrical shock or burns, and could kill you. Be careful when you:

- do work with the VSD
- do work adjacent to the VSD in the compressor enclosure
- do work on electrical components in the compressors enclosure.

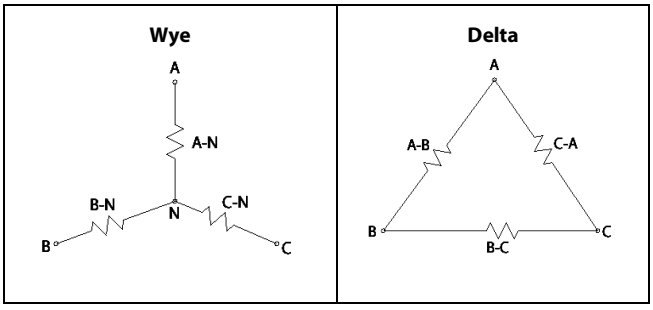
Make sure that:

- Approved personnel install, do the initial start procedures, do the troubleshooting procedures, and do the maintenance on the compressor.
- All personnel read all safety data included:
  - in this manual
  - in the safety information manual
  - on the compressor
  - in all the operation instructions
- You disconnect the primary input power before you open the compressor enclosure doors.
- You use the correct personal protective equipment when the compressor enclosure doors are open and when you examine internal electrical components.

Primary Input Power Supply

The primary input power for the compressor can come from different transformer sources and configurations. The most typical sources and configurations are a wye secondary and a delta secondary.

Figure 1: Wye and Delta Configurations

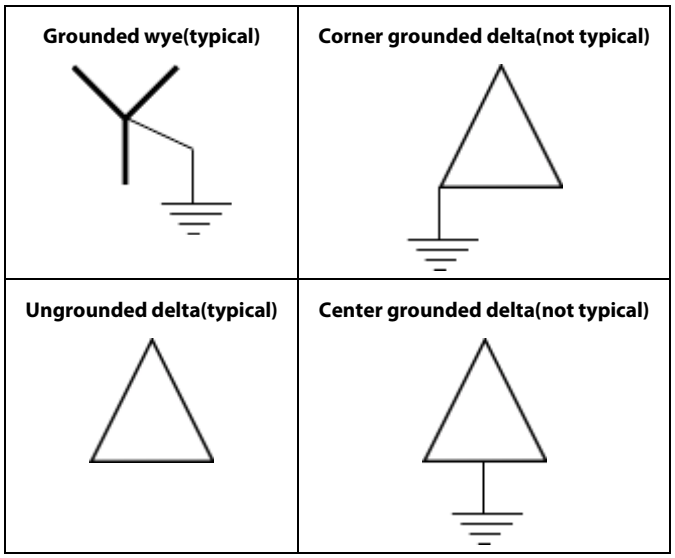


How to Ground

In most conditions, you must ground a wye system. Refer to local electrical codes. When you ground a wye system, the voltage to ground becomes stable and controlled. This prevents a system from damage by conditions that cause high voltage to ground. It is typical to ground the neutral (center) point of a wye source.

It is not necessary to ground a delta system. If you do ground a delta system, ground one phase. You can also ground the center tap on one phase.

Figure 2: Wye and Delta Grounding



Refer to local electrical codes for grounding the compressor to a permanent protective ground connection. The compressor electrical enclosure contains an electrical power ground terminal that has the identification of "PE". The typical primary input power is a four-wire connection with three power wires and a ground wire. Connect the ground wire to the ground terminal.

NOTICE

If there are only three power wires and no ground wire, connect the ground terminal to a correct building ground. Do not let the enclosure frame float without an electrical connection to a power ground source.

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How to Find Which System Is Used

NOTICE

Use a multimeter to measure the voltage. All voltage indications can change plus or minus 10%.

In a grounded wye connected 480-volt network:

- Each phase to ground (neutral) voltage is approximately 277 volts (480/sqrt3).
- 277 volts is a nominal indication for 480-volt systems.
- Other voltage indications are possible for 380, 415, 440 and 575-volt systems. See Table 1 on page 2.
- The phase-to-phase voltage is the same as the primary supply voltage (575, 480, 460, 440, 415, or 380 volts).

NOTICE

You must disconnect the VSD's two electro-magnetic compatibility (EMC) filters in a wye network that has a high resistance neutral connection more than 30 ohms. See "Disconnecting the VSD's Electro-magnetic Compatibility (EMC) Filters" on page 3.

In an ungrounded delta connected network:

- The network can be capacitively grounded.
- Stray capacitances can be connected between each phase conductor to ground.
- All phase voltages to ground are approximately 277 volts for a 480-volt network. These indications can vary greatly because of the capacitive ground.
- The phase-to-phase voltage is the same as the primary supply voltage (575, 480, 440, or 380 volts).

The primary function of an ungrounded delta network is to let uninterrupted power occur during a ground fault. At this time, the ungrounded network is referenced to ground. The primary circuit breaker opens only when two phases are connected to ground. Thus, it is possible to have one of the three phases of an ungrounded delta network connected to ground or the network be ungrounded at the time of compressor installation, but have a grounded phase at a future time.

NOTICE

You must disconnect the VSD's two electro-magnetic compatibility (EMC) filters in a delta network that is not grounded. If you do not do this, damage will occur to the filter and to the VSD. This voids the factory warranties. See "Disconnecting the VSD's Electro-magnetic Compatibility (EMC) Filters" on page 3.

In a grounded delta connected network:

- Only two phases to ground have a voltage, while the third phase has zero volts. The phase with zero volts is grounded.
- The two ungrounded phase voltages are the same as the primary supply (480 volts to ground for a 480-volt system).
- The phase-to-phase voltage is the same as the primary supply voltage (480, 440, or 380 volts).

NOTICE

With all compressors that have a variable speed drive for the primary drive, connect the ground to the L2 input of the compressor. If you do not obey this procedure, the compressor may not operate.

NOTICE

If you find a grounded phase during installation, it is important to know if the grounded phase is intentional (grounded) or accidental (ungrounded with a ground fault condition present).

Table 1: Input Voltage Rating

Nominal Voltage Rating (VAC)	380-460
Phase	3
Hertz	50/60
Min./Max. Voltage Tolerance (%) 400-460 V	± 10
380 V	+10, -6
Min. /Max. Voltage Imbalance Between Phases (%)	3
Min./Max. Frequency Tolerance (%)	± 5

NOTICE

Ratings that do not fall in these limits can cause damage to the compressor and make all factory warranties void.

High Voltage Conditions and Secondary Protection

A compressor with a variable speed drive contains metal oxide varistors (MOV). The MOV prevent damage to the VSD from typical high voltage conditions. Very high voltage conditions can cause damage to the MOV and the VSD. These are examples of very high voltage conditions:

- lightning storms
- switching of power factor capacitors
- welders
- thyristors

If there are very high voltage conditions, you must add secondary protection to prevent damage to the compressor.

NOTICE

Damage to the MOV shows that the compressor was exposed to very high voltage conditions.
Damage to the MOV because of very high voltage makes the factory warranty and the extended contract warranty void.

Power Factor Compensation Capacitors

Power factor compensation capacitors are not necessary for a compressor that contains a variable speed drive. Nevertheless, if you connect the compressor to a system that includes compensation capacitors, obey these instructions:

- Do not connect a high-power capacitor to the power line while the compressor is connected to the primary power. High voltage conditions can open the compressor protection circuits or they can cause damage to the compressor.
- If you increase or decrease the capacitor load gradually when the compressor is connected to the power line, make sure the connection steps are sufficiently low not to cause voltage transients that can open the compressor protection circuits or cause damage to the compressor.
- Check that the power factor compensation unit is correct for use in systems with AC drives. The compensation unit must typically have a blocking reactor or harmonic filter.
- Do not connect any devices to the output of the AC drive in the compressor.

NOTICE

If you do not obey the electrical installation instructions, the factory warranty and any extended contract warranty is void.

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Disconnecting the VSD's Electro-magnetic Compatibility (EMC) Filters

On some types of electrical power systems, you must disconnect the internal electro-magnetic compatibility (EMC) filters. If you do not do this, the electrical power system is connected to ground potential through the EMC filter capacitors. This can cause a dangerous situation and it can cause damage to the variable speed drive. See figures 3 and 4 for the location of the two jumpers that you must remove to disable the EMC filters.

Disconnect the two EMC filters if the electrical power system is:

- ungrounded (floating)
- a high-resistance ground system (greater than 30 ohms)
- a corner- grounded delta system

WARNING

Do not try to install or remove the EMC filters and jumpers while power is applied to the compressors input terminals.

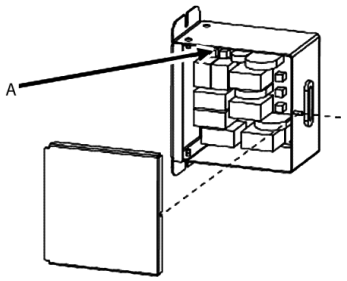
NOTICE

If you disconnect the internal EMC filters, the variable speed drive does not agree to the European requirements for electro-magnetic compatibility. If you operate the compressor without the EMC filters, the compressor can cause unwanted interference with electronic devices. You can continue to operate the compressor without the EMC filters only if electro-magnetic compatibility is not necessary in your area.

NOTICE

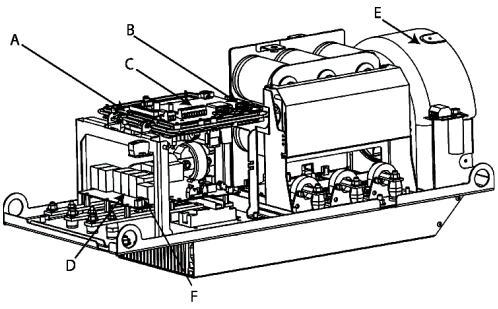
You must remove the two jumpers. One jumper is in the MOV/EMC metal box at the bottom of the compressor. The other jumper is on the printed circuit board (PCB) found on the input buss bars to the drive.

Figure 3: Location of First Jumper



A – First jumper

Figure 4: Location of Second Jumper



A – Power interface board (located underneath)
B – DC Bus sensing board
C – Control board
D – EMC board
E – Cooling fan
F – Second jumper

Power Supplied By Dedicated Transformer or Generator

High Impedance Power Source

The compressor can operate in industrial electrical networks that have a short-circuit power 15 times greater than the rated power of the drive (line impedance less than seven percent). Make sure that the network is correct if you operate the compressor on a generator set or on a dedicated transformer.

We recommend that you open the link that connects the electro-magnetic compatibility filter capacitors to the ground point if the installation ha > the following characteristics:

- the distribution power network has no connection to ground and
- the short-circuit current at the drive connection point and its rated current has a ratio lower than 30

Low Impedance Power Source

The variable speed drive can experience low impedance if the installation has the following characteristics:

- the compressor is installed near to the medium voltage/low voltage (MV/LV) power supply transformer, and
- a bank of power factor correction capacitors are connected in parallel at the secondary side of the transformer

The risk of a high voltage surge at the equipment terminals is high in the condition that the voltage decrease > at the primary side of the transformer.

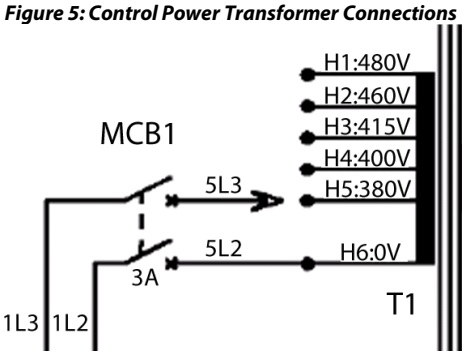
Example of line impedance calculation in percent

For a compressor with a rated input current of 100 amps and a line power supply with short-circuit current capacity of 5000 amps, the line impedance is two percent (100 A/5000 A).

Control Power Transformer Connections

The control circuit transformer has different voltage primary taps for different power line voltage levels. Make sure that the taps are set for the correct applied voltage before you start the compressor.

Figure 5: Control Power Transformer Connections



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