

VARIABLE FREQUENCY DRIVES

DESIGN GUIDELINES

1. Summary:
 - a. This section provides guidelines and standards for Variable Frequency Drives.
2. General
 - a. Provide one drive for each motor being controlled. This does not include “fan-walls”.
 - b. Review with WUSM OFMD the use of VFD’s on pumps and HVAC equipment prior to design.
 - c. Drive to include the following features:
 - Nema type 1 enclosure or upgraded to NEMA 3R/4 where required due to harsh environmental conditions.
 - Exterior drives should be avoided.
 - Units shall have automatic high temperature shut down at and above 50°C where serving non critical spaces.
 - Custom enclosure (ABB BCR) is preferred. Where space is an issue, vertical style VFD enclosure can be used (ABB VCR),
 - Variable torque
 - Three contactor manual bypass or two contactor bypass w/maintenance safety switch.
 - 100KAIC rating minimum (To be determined by electrical engineer).
 - Control Operators (door mounted): Hand-OFF-Auto selector switch, Manual speed control.
 - VFD control panel shall include LCD display to indicate operating mode and alarms, Enable LED, Drive and Bypass LED and Motor Run LED.
 - Line reactors: A 3% line reactor minimum required installed on all drives.
 - VFD Fault Contact.
 - VFD Run Contact.
 - Fire/Freeze stat contact to shutdown fans from fire alarm or building automation system.
 - Unit shall be designed for easy fan replacement without removal of other components.
 - Drives shall be provided with a 3-year factory warranty.
 - d. Communications: All VFD to be used with external system within a multidrop LAN configuration. Interface shall allow all parameter settings of VFD to be programmed via

BAS control. Provide capability for VFD to retain these settings within the nonvolatile memory. Provide a communications card (N2, Bacnet, ModBus or similar) with the VFD.

- e. Remote mounted variable frequency drives shall be interlocked to its respective auxiliary contacts on the disconnect switch. Coordinate with Temperature Controls Contractor.
 - f. Control/communications wiring shall not be installed in the same conduit, raceway or wire-trough as power wiring.
 - g. Load and Line power wiring shall not be installed in the same conduit, raceway or wire-trough.
3. Location
- a. Ambient temperature.
 - b. Ventilated space.
 - c. Provide cooling capacity for VFD heat load.
 - d. Remote mounted variable frequency drives shall be interlocked to its respective auxiliary contacts on the disconnect switch. Coordinate with Temperature Controls Contractor.
 - e. Control wiring shall not be installed in same conduit with power wiring.
 - f. Label and provide appropriate Signage.
 - g. Not inside any equipment being served.
 - h. With-in sight, so not to have additional disconnects.
 - i. Unit shall be protected during construction from construction dust and debris.
 - j. Do not install in public spaces (ex. Parking garages) where public could access drives. If installed in public space, provide protection around drive that is lockable.
 - k. Location coordination with animal research, lab equipment, etc.
4. Equipment Manufacturer provided VFD's – Coordinate the following:
- a. Location
 - b. Manual bypass (if required)
 - c. Unit-mounted or remote
5. DDC Controls
- a. BACnet card to expose all BACnet points to BAS.
 - b. All overloads shall provide "alarm" to the BAS vs shutting down.
 - c. BAS points to be monitored:
 - Start/Stop
 - Speed command.
 - Hertz
 - Voltage
 - Status

6. Related Sections:
 - a. AHUs
 - b. RTUs
 - c. Pumps
 - d. Fans
 - e. Cooling Towers
 - f. Enclosed Motor Controllers
 - g. Enclosed Switches And Circuit Breakers
 - h. Motors
 - i. DDC Controls

EQUIPMENT and PRODUCT REQUIREMENTS

1. VFD's
 - a. Approved Manufacturers:
 - ABB (Preferred)
 - Toshiba
 - Yasakawa preferred for small fractional horsepower equipment (i.e. small fan coil units).
2. Manual bypass
 - a. Speed limitation needs to be verified so as not to over pressurize ductwork or piping systems when unit is operated in bypass.
 - b. Speed limitation for pumps without triple-duty valves.
3. Enclosure Style
 - a. Use custom enclosure (ABB BCR).
 - b. Vertical style (ABB VCR) enclosure are only allowed for space considerations and must be approved by WUSM Engineering.
 - c. NEMA-1
 - d. Unit shall be designed for easy internal cooling fan replacement without removing of other electronic boards, etc.

END OF SECTION

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