# APPLICATION GUIDELINE #33

## (Issues with VFD's in Motor Control Centers)



The following is a summary of issues regarding mounting VFD's (Variable Frequency Drives) into MCC's (Motor Control Centers). There is no question that MCC's do serve a good purpose in reducing space and neatly packaging a variety of electrical related equipment into one line-up, which also feeds everything off a common bus network. However, depending on a mill's overall interest, this may not be the solution to follow for the installation of every VFD within the mill.

### Issues with Mounting VFD's in MCC's include:

1) Longer Distances to motors
   - Distances to motors often increase when MCC's are used, which may require the use of a dv/dt filter, when otherwise if the drive is mounted closer to the motor's location may not require an output filter.
   - If it is determined that if a dv/dt filter is needed, whether the drive is mounted in an MCC or a custom enclosure, it is strongly recommended that the filter be mounted externally due to the fact that the filter creates a significant amount of heat.

2) The better 'Load Specific' harmonic mitigation methods are not simple to accomplish when VFD's are mounted inside MCC sections. The power cables would have to be run from the MCC mounted disconnect to an externally mounted 'isolation transformer', 'multiple winding transformer' or "Mirus Lineator' (due to their large dimensions), and then you would have to cable back to the drive mounted in the MCC, then cable back out to the motor.
   - Multi-pulse options would be even more complicated because two (2) separate and independent phase shifted feeds from a dual (multi) secondary isolation transformer would have to be run back to the MCC, and more room in the MCC would be required for the larger sized 12 or 18 pulse drive.
   - Input Line Reactor: Recommended for all installations, are your most economical line of defense against harmonics. Input impedance minimizes harmonic distortion on the power system plus helps improve reliability of the drive. It is therefore very good practice to install input reactors with a minimum 5% impedance on all drives. However, adding this to an MCC creates another source of heat generation to be concerned about.

3) Heat generation from VFD's
   - Especially as you get into larger HP units. It can be assumed that drives produce between 113-130 BTU/HP per hour. This heat needs to be removed from the MCC with a specially designed enclosure with appropriately sized cooling provisions if you expect to get rated life from the multiple electronic devices used in the construction of modern VFD's (IGBT's, Diodes, SCR's, Capacitors)

4) Space Constraints
   - MCC's makes it difficult to make adjustments or changes to equipment mounted within.
   - The larger the drive rating, the more of an issue spacing becomes.
   - Isolated by-pass schemes for critical applications are more difficult to accomplish in MCC's due to space constraints. Two of the three contactors in the isolated bypass scheme need to be mechanically interlocked. A custom drive build-up can be sized appropriately to house all the needed equipment in one enclosure including the main disconnect or Circuit Breaker, input line reactor, CPT and other control devices.



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5) Electrical Noise Issues
   - Running control wiring and power wires through a common MCC wireway may cause the drive to be more susceptible to RFI and EMI noise concerns. All drive manufactures insist that power wiring (both input and output) and control wiring be run in separate, metal conduits.

In Summary, there are obvious conveniences and advantages of packaging VFD's in MCC's, however a drive buildup in a custom enclosure should not be so quickly overlooked, especially if improved harmonic mitigation options, more spacing for custom requirements, lower enclosure temperature, and less opportunity for noise issues are desired.

## Toshiba's S5 Micro Series Drive Dimensions

| S5 - 575V | | | | | | |
|---|---|---|---|---|---|---|
| Hp | Amps | Model Number | H | W | D | Weight |
| 1 | 2.1 | VFS5-5020UPH | 8.5 | 7.3 | 6.4 | 7.7 |
| 2 | 3.0 | VFS5-5030UPH | 8.5 | 7.3 | 6.4 | 7.7 |
| 3 | 4 | VFS5-5040UPH | 8.5 | 7.3 | 6.4 | 7.7 |
| 5 | 6.1 | VFS5-5060UPH | 11.8 | 8.3 | 6.8 | 15.4 |
| 10 | 12 | VFS5-5120UPH | 11.8 | 8.3 | 6.8 | 15.4 |
| 15 | 17 | VFS5-5160UPH | 15.4 | 9.6 | 7.6 | 24.3 |
| 20 | 22 | VFS5-5220UPH | 15.4 | 9.6 | 7.6 | 24.3 |
| 25 | 27 | VFS5-5270UPH | 15.4 | 9.6 | 7.6 | 24.3 |

## Toshiba's G7/H7 Series Drive Dimensions

| G7/H7-600V | | | | | | |
|---|---|---|---|---|---|---|
| Hp | Amps | Model Number | H | W | D | Weight |
| 1 | 2.1 | VT130G(H)7U6015 | 8.5 | 7.3 | 7.33 | 13 |
| 2 | 3.1 | VT130G(H)7U6025 | 8.5 | 7.3 | 7.33 | 13 |
| 3 | 4.1 | VT130G(H)7U6035 | 8.5 | 7.3 | 7.33 | 13 |
| 5 | 6.1 | VT130G(H)7U6060 | 8.5 | 7.3 | 7.33 | 13 |
| 7.5 | 9 | VT130G(H)7U6080 | 8.5 | 7.3 | 7.33 | 13 |
| 10 | 11 | VT130G(H)7U6120 | 8.5 | 7.3 | 7.33 | 13 |
| 15 | 17 | VT130G(H)7U6160 | 8.5 | 7.3 | 7.33 | 13 |
| 20 | 22 | VT130G(H)7U6220 | 23.6 | 17.4 | 11.5 | 67 |
| 25 | 27 | VT130G(H)7U6270 | 23.3 | 17.4 | 11.5 | 110 |
| 30 | 32 | VT130G(H)7U6330* | 36.5 | 19.3 | 13.6 | 110 |
| 40 | 41 | VT130G(H)7U6400* | 36.5 | 19.3 | 13.6 | 111 |
| 50 | 52 | VT130G(H)7U6500* | 36.5 | 19.3 | 13.6 | 190 |
| 60 | 62 | VT130G(H)7U6600* | 36.5 | 19.3 | 13.6 | 196 |
| 75 | 77 | VT130G(H)7U6750* | 36.5 | 19.3 | 13.6 | 200 |
| 100 | 100 | VT130G(H)7U610K* | 57 | 19.3 | 13.2 | 302 |
| 125 | 125 | VT130G(H)7U612K* | 57 | 19.3 | 13.2 | 304 |
| 150 | 150 | VT130G(H)7U615K* | 59.9 | 25.9 | 14.5 | 310 |
| 200 | 200 | VT130G(H)7U620K* | 59.9 | 25.9 | 14.5 | 440 |
| 250 | 250 | VT130G(H)7U625K* | 59.9 | 25.9 | 14.5 | 448 |

Note: Larger drive ratings are available in floor mounted stand alone enclosures, they're construction does not allow them to be mounted inside MCC's or other types of custom enclosures.