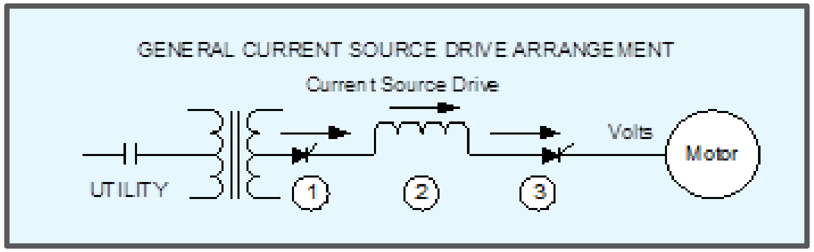
Choosing a Medium Voltage Drive

10 Things to Consider when Selecting a High Quality Medium Voltage Drive

TMEiC

1. Types of Variable Frequency Drives

Issues associated with Current Source Inverters



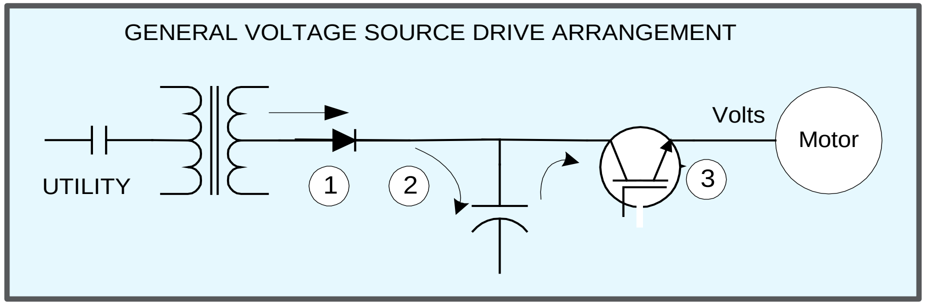
Development of Current Source inverters (LCIs) stopped in the 1990s, because of:

- Low power factor
- High harmonic content
- ***More motor insulation stress*** when used without an isolation input transformer.

Most manufacturers have discontinued this 1980's technology, but some are still marketing LCI drives as "reliable". In fact, other technologies are now more reliable.......

Types of Variable Frequency Drives

Voltage Source Inverter (VSI) Drives



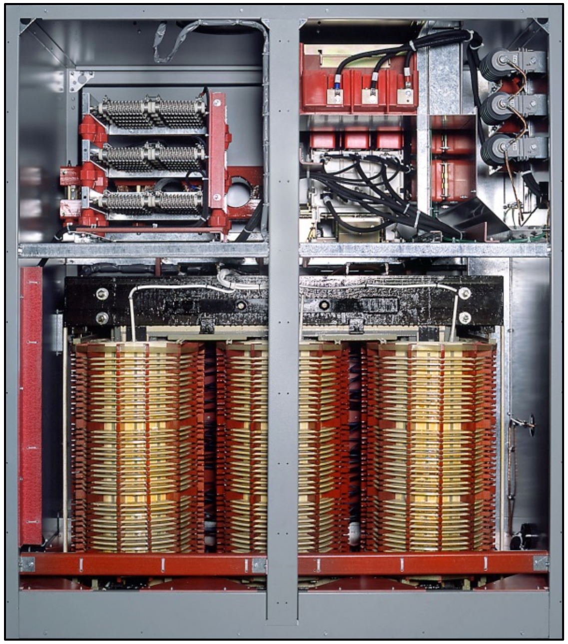
All medium voltage drives designed in the last 10 years are voltage source (VSI) designs.

1. Converters are diode-based, sometimes use active circuits
2. DC bus and capacitors supply the inverter
3. Inverters use pulse width modulation and multi-level output

Most recent drive designs now use IGBTs (Insulated Gate Bipolar Transistors) in the inverters.
This is the same *Topology* used reliably in Low Voltage drives for 20 years. However, using MV components, it became cost effective to take the good LV-VSI and make it even better!

2. Input Isolation Transformer

Input Isolation Transformer – *An electrical shock absorber!*



Some manufacturers try to save cost by eliminating this important component – this exposes the VFD to transients that sometimes cause failures:

- Drives and motors are subject to utility transients from lightning and other equipment switching.
- With no input transformer, drives and motor reliability can suffer as a result;

A motor failure causes lost revenue and the cost of the motor replacement.

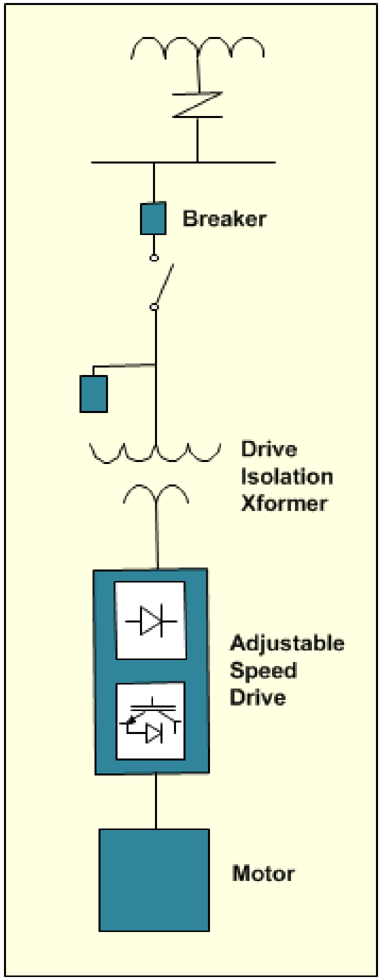
3. Motor Voltage

Utility Input and Motor Voltage. Choose an output voltage that *fits* the power component and switching frequency needs with reliability in mind!

The available voltage on the input of the drive is probably 4,160 Volt, depending on the facility.

- That doesn't mean the motor needs to be 4,160 Volt. Forcing VFD's to meet pre-conceived voltages can cause a reliability problem of itself.
- Leave the selection of motor voltage to the discretion of the drive manufacturer

To prevent issues in the field with compatibility and reliability, it is a good practice to buy the VFD and motor from the same manufacturer.

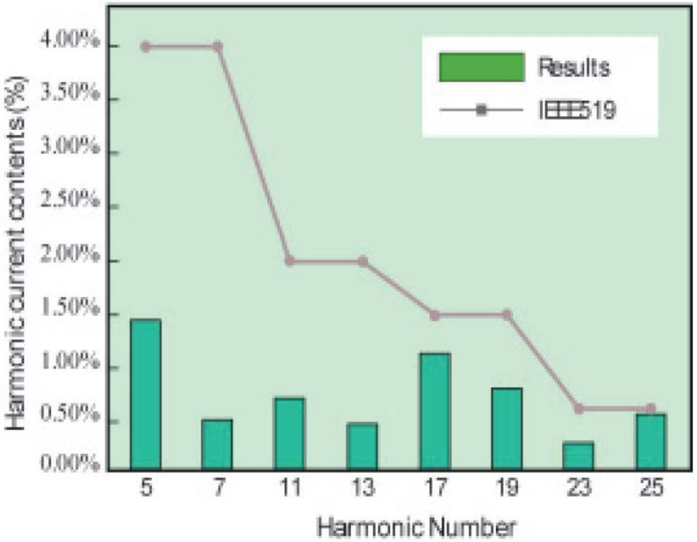


4. Input Harmonics

Require Low Total Harmonic Current Distortion

Outdated variable frequency drives can inject noise into the power grid and cause multiple power problems, with financial penalties.

- The VFD design can minimize harmonics on the Power grid and it is important for the user to understand the impact – each system study yields different results!
- Harmonics can cause legal liability since the noise effects local and neighboring equipment.
- Harmonics on the system will require capital to fix, and may generate financial penalties from the utility.



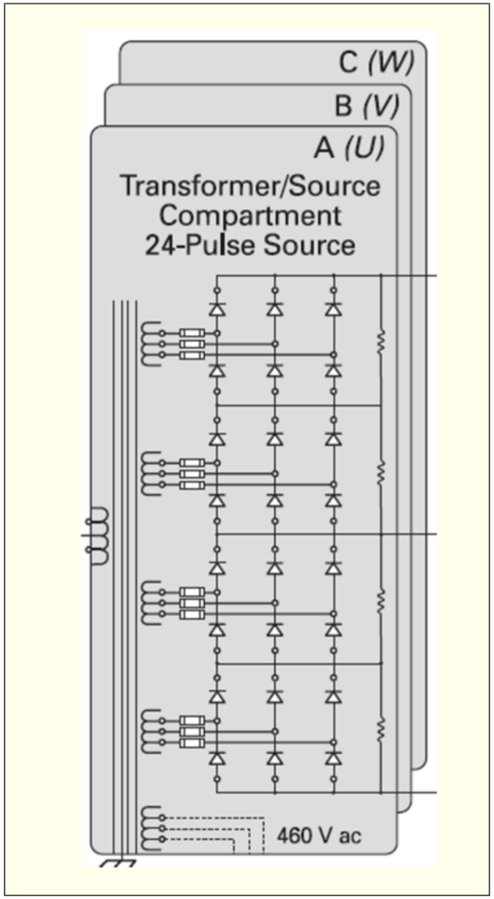
The accepted utility standard for harmonic control in power systems is IEEE 519.

- This requires that the drive input Total Harmonic Current Distortion (THID) be limited to certain levels depending on Utility short circuit levels
- We recommend no more than 5% THID at all operating load levels and all operating speeds, otherwise you take unacceptable risks

5. High Performance Converter

For low THID use a 24-pulse Converter or equivalent

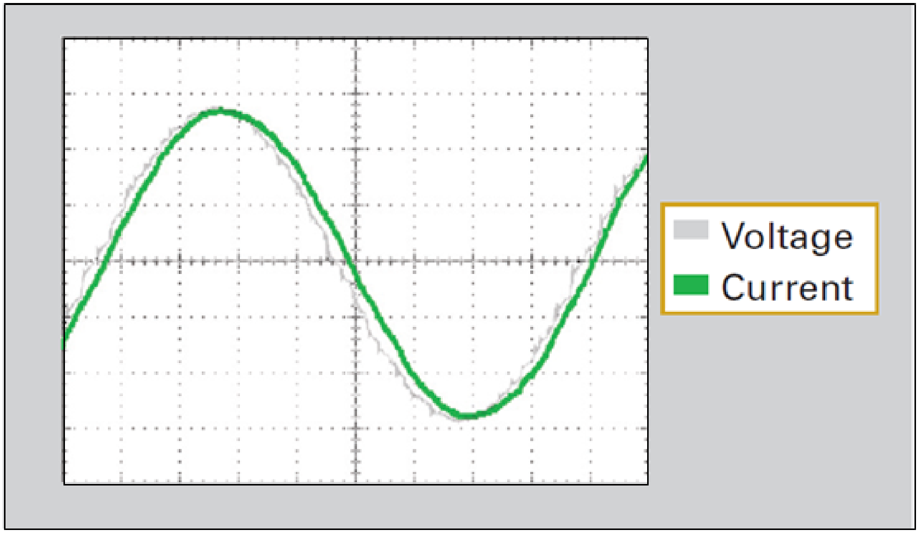
Companies offer 6-pulse, 12-pulse, 18-pulse, or filters to reduce harmonic problems. These may reduce manufacturing costs to achieve a low cost solution, but these savings are on the surface, yet often cause many costly harmonic problems later.



To assure low input harmonic distortion, require either:

- a 24-pulse (or higher) diode converter or
- a properly designed active front end

6. Effects of High Power Factor



Advantages of a Power Factor of 95% or Higher

For similar reasons to previously, require that the “True Power Factor” is 95% or higher at all speeds and all loads above 10 %. (Can be true of a VSI, yet often not for a LCI)

This will prevent:

- Utility penalties
- Problems with voltage drop
- Heating in other components on the utility system

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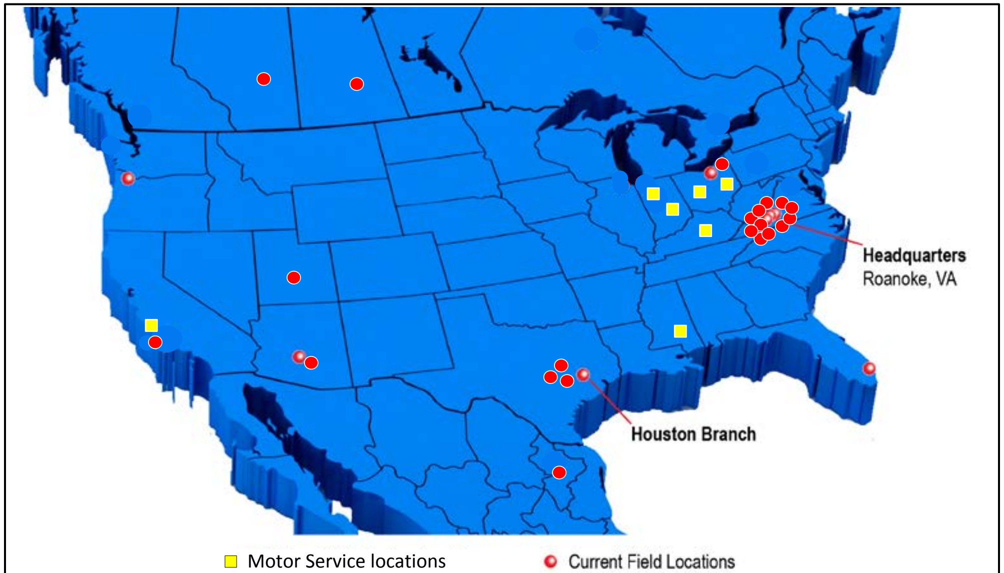
7. Equipment Service

How Many Trained, Full-time Service Engineers?

Find out how many full-time service technicians in the USA are trained and can work on this type drive (not including sales people). To get critical equipment back into operation quickly if trouble arises, field service should provide:



TMEIC VFD & Motor Service Engineer Locations – 37 in the North America

- 24 X 7, all year service
- Should include remote diagnostic service
- When you call, who answers the phone – a tech or a voice mail?

8. Reliability

How do I find the real drive reliability?

All suppliers claim high reliability, often using a theoretical MTBF (Mean Time Between Failure). The only real measurement is continually updated data on the operating fleet of drives.

The Dura-Bilt MV drive has an actual fleet MTBF of over ***15*** years; some TMEIC drives have an MTBF of 30 years, achieved by:

- Conservative, careful design
- Components applied at much lower levels than their ratings
- Coordinated application of the drive to the job

9. The Manufacturer

Who is the Manufacturer?

Ask:
- How long have they been in business?
- How many drives do they have in service?
- What is their reputation?

TMEIC's Fuchu plant near Tokyo, Japan, has 39 years experience building drives and other electrical products

10. Engineering Support

Who will actually provide Application and Engineering Support throughout the project life?

TMEIC's Industrial System Test Lab

- Who provides design, installation, commissioning, & future support?
- Are they experienced and knowledgeable?
- Are they available?
- Are they responsive?
- Are they able to evaluate the entire system and not just the drive?

Last Word

These ten considerations are a good starting point for your MV drive selection, but each application will be different, so….

Plan ahead and make sure that you consider all your options