

VARIABLE FREQUENCY DRIVES

The course starts at a basic level and builds, avoiding the need for any technical prerequisite, other than the desire to increase your knowledge and understanding of variable speed drives.

Learn proper design recommendations to ensure that your equipment is as energy efficient and safe as possible. Discover the best practices for frequency drives in HVAC, pumping, and facility applications. Whether in facility maintenance, chilled water systems, waste water systems or manufacturing, this course unlocks the secrets of VFDs to maintain your equipment.

In the hands-on lab portion you will use scopemeters to see how improper designs can lead to motor deterioration and other problems. You will program and troubleshoot newly upgraded equipment that includes Allen-Bradley Powerflex4 and ABB ACS-350 variable frequency flux vector drives. Learn to manipulate external drive control wiring.

Gain troubleshooting skills by deciphering fault diagnostics and correcting problems.

CLASS FORMAT:

Lab + classroom

The participant is able to “learn-by-doing” in the course; this knowledge can be transferred to the workplace.

STANDARD SIZE CLASS:

NTT recommends a class of no more than 12 participants for the best results

NTT PROVIDES:

- 3 days (24 contact hours) of on-site instruction
- Textbooks and lab manuals
- Classroom consumables
- Completion certificates
- Shipping and instructor fees and travel expenses

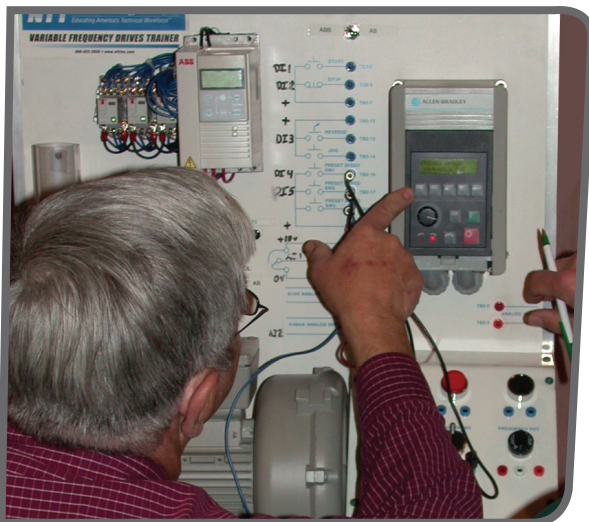
CLIENT TO PROVIDES:

- Classroom, with easy access, of 750 square feet or greater
- Projection screen, white board and/or flip chart(s)
- Preferred power supply for the training equipment is one 20-amp circuit or two 15-amp circuits at 120 vac
- A dock facility or a forklift to unload the training equipment
- Pallet jack to move the crates around after they have been unloaded
- Please place the equipment in the training room for the NTT instructor to test and setup prior to class start.

SHIPPING:

1 crate at 900 lbs

- 2 crates @ 54"x33"x53"



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COURSE AGENDA

INTRODUCTION

MOTOR/DRIVE/CONTROL SYSTEM DESIGN AND OVERVIEW

- Advantages/disadvantages and effects of adjusting motor speed
- Identify and compare systems to adjust motor speed, torque and position control
 - Mechanical drives
 - Hydraulic drives
 - Eddy current
 - Rotating DC
 - Solid-state DC
 - Solid-state AC (VFD)
- Building blocks of a motor/drive system
- Advantages/disadvantages of three-phase AC motor/drive systems, DC motor/drive systems and single-phase AC motor systems
- Operating costs (maintenance, process, efficiency, space requirements)
- Technological capabilities (functionality, future expansion, communication, integration to other systems)
- Operational reliability (impacts on existing equipment, code regulations, environmental conditions, replacement availability, power distribution reliability)
- Application characteristics (torque, speed, control, process requirements)

POWER TRANSMISSION, RELATIONSHIP AND FORMULAS

- Efficiency
- Torque
- Inertia
- Horsepower/power factor
- Electrical demand

MAINTENANCE RECOMMENDATIONS AND SPECIAL CONSIDERATIONS

- Power factor
- Line notching
- Harmonics
- Isolation transformer/reactors
- Operator interfaces
- Bypass systems

AC INDUCTION MOTORS

- Motor construction
- Torque production
- Speed, pole, frequency relationship
- Types of AC motors

OPERATING ON VARIABLE FREQUENCY

- Volts to hertz
- Constant voltage mode
- Sensorless vector
- Flux vector

VARIABLE SPEED DRIVES

- Current Source Inverter (CSI)
- Variable Voltage Input Inverter (VVI)
- Pulse-Width Modulation (PWM/Transistor/IGBT)

MOTOR SPECIFICATIONS: MATCHING MOTOR FOR VARIABLE SPEED DRIVE OPERATION—MGI

OPERATION, SET UP AND MAINTENANCE OF VSD

- Typical faults
- Causes
- Fixes

SELECTION AND APPLICATION FOR DRIVES

- Load matching
- Bypass considerations
- Motor nameplate information

ENCLOSURE SIZING FOR HEAT DISSIPATION

- Heat calculations
- Energy saving opportunities
- Facility operating problems
- Variable torque operations
- Fans
- Pumps
- Payback/return on investment calculations

VARIABLE FREQUENCY DRIVES



The advantage of using Variable Frequency Drives (VFDs) is their energy saving potential. Students calculate the enormous energy savings using data from live measurements, and plot the data to show the energy savings VFDs offer over standard HVAC speed control designs.