TOSHIBA

Questions to ask your vendor when purchasing a medium voltage drive

Topologies of medium voltage drives vary greatly between manufacturers. These differences are complex and allow a drive manufacturer's representative many opportunities to confuse a prospective client with claims that its product is better or superior due to these differences. Most drives that are sold in industry may work for an application, but different topologies may require additional purchases increasing cost of ownership. The following questions asked by the purchaser to a drive vendor can help the purchaser cut through the "marketing hype" and identify the important issues:

Disconnect Switch?

Ask if the drive includes a method to lock-out and tag for safe access for maintenance or troubleshooting. Drives should include interlock keys that prevent access to high voltage areas until the disconnect switch is open. If the disconnect switch is not included, it becomes the burden of the purchaser to add equipment and coordinate with the existing and new installation.

Toshiba's main disconnect is mechanically interlocked to help ensure safe isolation of high voltage sections of the drive for personnel safety.

Fuses?

How is the drive protected? Are fuses used in the design to prevent fire and explosion? When properly designed, fuses are not nuisance items that need constant replacement as they provide an important back up protection when electronic protection means fail. Fuses provide a current limit when a power device shorts the internal transformer secondary. When fuses are not present, the transformer windings are at risk of distortion from magnetic forces during a failure event.

Toshiba's drive input disconnect section has fuses and input contactors as a form of protection. Fuses are sized according to horsepower and kV rating. The secondary sides of all Toshiba transformers are fused to help prevent transformer damage in the event of power circuit failure.

Input vacuum contactor?

Just like a fuse and possibly faster, a vacuum contactor properly interlocked with a drive as part of the drive design will interrupt a fault in process and possibly prevent fire and explosion.

Toshiba's input disconnect section utilizes Toshiba manufactured vacuum contactors with either a 400Amp or 720Amp rated configuration as part of the drive's input controller.

Toshiba International Corporation
Social Infrastructure Group – Motors & Drives Division
13131 West Little York Road, Houston, Texas 77041
Phone: (800) 231-1412 Facsimile: (713) 896-5238
www.toshiba.com/tic

Secondary sources of power?

Does the drive need a secondary source of power for cooling fans or control system? If needed, it becomes important for the purchaser to properly label the equipment as this secondary power source complicates the process for safe removal of all power sources since second and maybe even third locks and tags could be required. It is not always simple or inexpensive to find these power sources and have them wired to the drive, so this should be part of the cost calculation when evaluating a drive bid.

Control and cooling fan power is derived internally in Toshiba drives, thus eliminating the need for secondary power sources. Toshiba drives internally develop secondary 480V power from the tertiary winding on the transformer secondary. 120V secondary power is developed through potential transformers connected to incoming power. The need for bringing in separate power sources is removed from the equation because 480V, coming from the transformer, supplies the cooling fan power and 120V, from the potential transformers, supplies the control board.

How big is the drive? Will it fit? Will we need additional equipment?

Many drives in bid quotations may require extra equipment not clearly shown on the quotation such as external input transformers or reactors, harmonic filters, output reactors, etc. It is important to ensure these items are part of the bid under evaluation.

Toshiba's transformers and output rectors are integrated into and are part of the drive enclosure. Dimensions listed are a true equipment footprint. However if maintenance bypass or Sync-transfer is utilized, this will add to the overall size.

Is drive capable of running on an existing power system? Is a study necessary?

Many drives in bids quotations have small print in quotations, specifications or manuals indicating power line quality and impedance needs to be evaluated. Drives that are sensitive to power quality or impedance utilize active front-end technology. Such drives may not start or run if power quality is not up to a particular standard. In the event this occurs, the cost to fix the background harmonics can exceed the drive initial cost and the cost burden of the fix would likely be on the purchaser because of the fine print in the quotation. In addition these drives will often not run on backup generators without a lot of additional equipment, so it is important to ask if the drive is compatible with any type of power feed.

Toshiba standard NEMA 1 rated drive is a 24-pulse phase-shifting input section that meets IEEE 519 2014 standard. Drives without phase-shifting transformers may not meet IEEE 519 harmonic standards without any additional filtering.

Toshiba International Corporation
Social Infrastructure Group – Motors & Drives Division
13131 West Little York Road, Houston, Texas 77041
Phone: (800) 231-1412 Facsimile: (713) 896-5238
www.toshiba.com/tic

Will application of power to the drive flicker the lights? What inrush is expected?

Many drive topologies use an integral transformer and drives are sold for application where the power line is very soft. The drive is purchased to remove the motor inrush and prevent the power line from collapsing during starting of the motor. A transformer has similar inrush characteristics to an induction motor but only a shorter time. This inrush can cause relays to drop out and the lights to flicker. Some drives that do not use transformers have harmonic filters with capacitors that may have a high inrush and other problematic issues that need to be considered.

Toshiba medium voltage drive offerings are equipped with a standard pre-charge circuit that limits the current inrush during initial energization of the transformer, thus reducing droop or sag on the power source.

Are standard cables acceptable to connect the drive and motor?

Some drive topologies elevate the phase to phase or phase to ground voltage which makes it unacceptable for existing or standard cables that would normally be used to connect a system.

Toshiba's medium voltage drives do not require special cabling and can utilize standard 5kV cabling.

Is an existing or standard motor insulation acceptable for use on the drive?

Drive topologies that elevate phase to phase or phase to ground voltages may damage a motor depending upon the motor insulation and other factors, so it is important to confirm that the motor will not be damaged by the drive. It should be a concern to the purchaser if a bid or quote states that special cables are required (perhaps indicating elevated phase to phase or phase to ground voltage) but that same bid does not indicate any special considerations needed for the motor.

Toshiba recommends the motor insulation to be inverter-duty per NEMA MG1, Section IV, Part 31.

Will the drive cause additional bearing shaft currents?

Some motors do not have insulated bearings, so it is important to ask if the drive will elevate bearing voltage to the existing motor.

Due to the multi-level output design of Toshiba medium voltage drives, we closely mimic the true sinewave incoming power, thus providing a smooth waveform for the motor.

Toshiba International Corporation
Social Infrastructure Group – Motors & Drives Division
13131 West Little York Road, Houston, Texas 77041
Phone: (800) 231-1412 Facsimile: (713) 896-5238
www.toshiba.com/tic

How often will parts need to be replaced? What are the lifecycle costs compared to the purchase price?

Maintenance is the overall largest cost for medium voltage drives. Maintenance includes preventive maintenance carried out at predetermined intervals to reduce probabilities of failure as well as parts replacement due to actual failure. Component quality is a factor in determining the required and recommended frequency of parts replacement. Shorter replacement cycles and numerous replacement of components over the life of the equipment greatly increases the overall cost of ownership. As an example, replacement of electrolytic capacitors over 20 years can cost more than the initial purchase price of the drive – just in parts and service alone.

Toshiba's recommended replacement schedule and drive design greatly reduce overall lifecycle equipment cost. Use of high quality components leads to longer component life, reduced replacement schedule and overall lower lifetime maintenance cost.

Toshiba's use of oil-filled capacitors with a 20-year life expectancy means no expected lifecycle capacitor cost for 20 years. Cooling fans and circuit boards have a 7-year recommended replacement cycle for Toshiba, while some manufacturers recommend cooling fan replacement every 4 years and circuit boards every 5 years.

Sync Transfer:

Who will be supplying the software for contactor sequencing?

The controls and sequencing associated with Sync-Xfer function should be provided by the drive manufacturer, not a third party. Drive manufacturer should be responsible for successful sync-transfer. There can be cost and coordination issues associated with any third-party software needed for sync transfer.

Toshiba supplies a complete Sync-Xfer system that includes drive, contactors and all controls. System is factory tested prior to shipment and customer has the option for witness testing in Houston.

Is the output reactor used for Sync-Xfer integrated into the drive enclosure?

Consider costs associated with the output reactor when it is not integrated into the drive cabinet (e.g.: if located outside the drive what are cost for cabling, concrete slab for support, wall perforation for cabling between drive and reactor).

Toshiba's Sync-Xfer output reactors are integrated within the drive enclosure up to 9,000HP. Above 9,000HP an additional cabinet required for 4160V drives. Cabinet dimensions for the 6600V are increased above 3,500HP, so no additional cabinet is required.

Toshiba International Corporation
Social Infrastructure Group – Motors & Drives Division
13131 West Little York Road, Houston, Texas 77041
Phone: (800) 231-1412 Facsimile: (713) 896-5238
www.toshiba.com/tic