BONITRON

Solutions for AC Drives

Marine Drive Applications

Marine Drive Applications

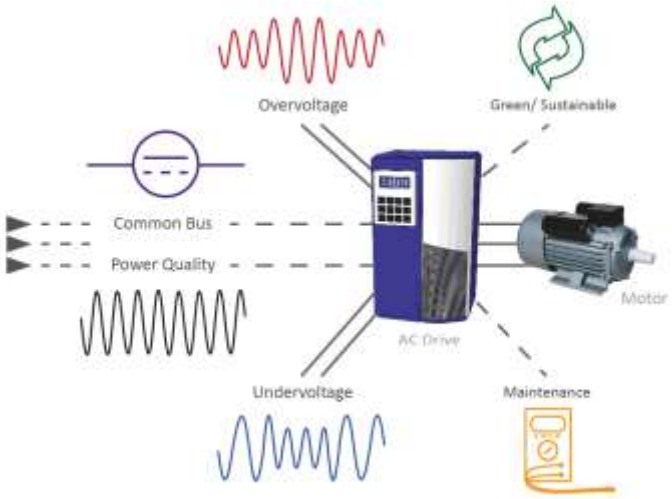
Drive Applications

- Where are drives used?
- What problems are present with drive process?

Bonitron

- Products
  - Overvoltage
  - Common Bus
  - Undervoltage
  - Maintenance
- How can we fix the problems?

Discussion



Marine Drive Applications

Cruise Ships

Voyager, Freedom, & Eagle Class

- 200 – 300 ventilation drives
- 12 – 18 winch drives
- 6 – 8 machine room drives for pumps & fans
- 4 drives for swimming pool filling pumps

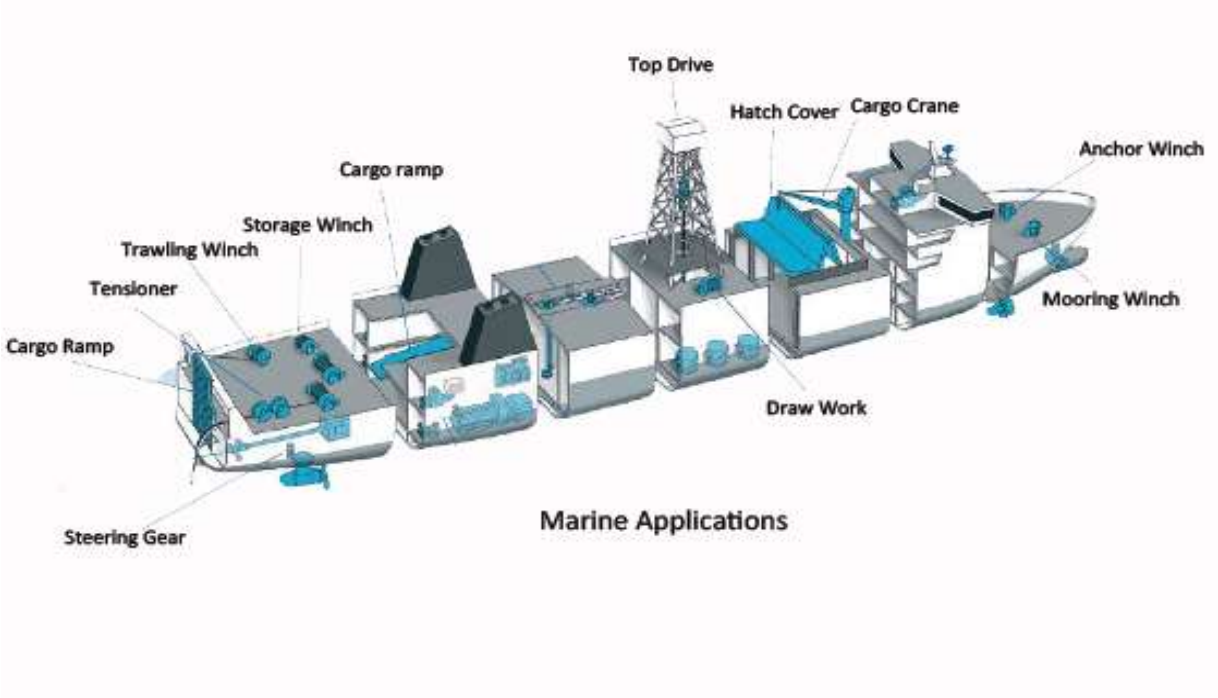
Marine Drive Applications

Ships

- Supply Ships
- Drilling Rigs
- Cruise Ships
- Tankers
- Ferries
- Military
- Barges
- Fishing / Factory

Drive Applications

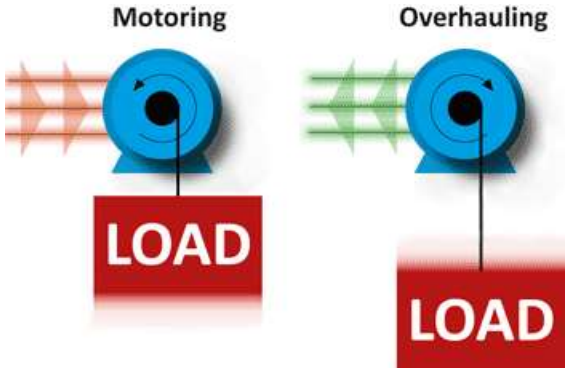
- Fans
- Pumps
- Winches
- Cranes
- Propulsion
- Cargo Ramps
- Deck Lids
- Drilling Rigs
- Conveyors
- Centrifuges
- HVAC



Winches

Typical winch motors are from 15 HP to 75 HP.

Some have multiple motors and drives on one bus.



Anchor Winch

Windlass

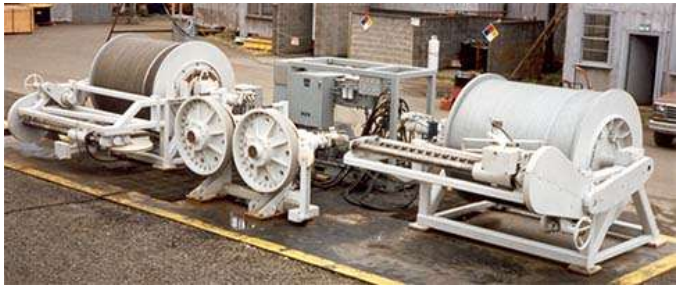
Mooring Winch

Capstan

Winches

Problems

- DC voltage rises when load is lowered (Drive holding back to prevent free fall)
- Overvoltage can cause drive faults or require a drive to slow process to compensate
- Limited space in drive control room. Transistor/resistor generates heat, requiring extra cooling
- Excess DC power generated from braking drives is dissipated in transistor/resistor



Traction Winch System

Recovery Winch

Draw-works & Top Drives




Draw-works

- The faster the draw-works can move, the better
- The drill string is moved rapidly and stopped quickly before hitting the bottom of the hole

Top Drive

- Drill strings can be thousands of feet in length
- It is common for one end of the string to be spinning at a different speed than the other end

Draw-works & Top Drives

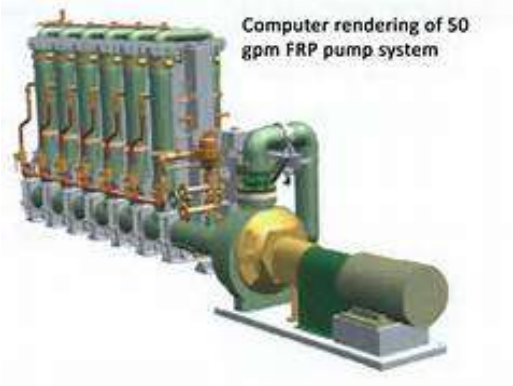
Problems

- Rapid braking of the draw works generates excess DC power, causing the drive to fault or requiring an extended braking period
- Excess DC power generated from braking drives is dissipated in transistor/resistor
- The ends of a drill string can be rotating at different speeds, creating torque on the drill string

Pumps

Ships house many types of pumps, including mud pumps and process cooling pumps.

Pumps may benefit from using a UPD to eliminate nuisance trips which can be frequent on ship power systems.



Pumps

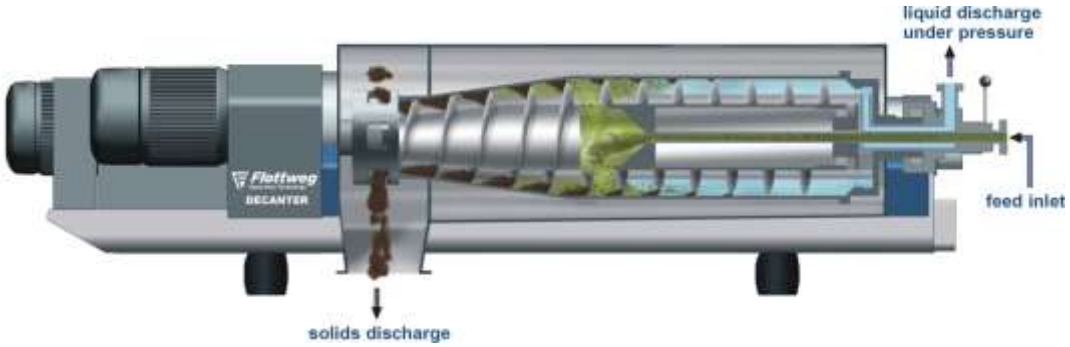
Problems

- Smaller HP pumps require UPDs to eliminate nuisance drive trips which are frequent on ship grid systems
- Cooling is critical to keep propulsion drives running and efficient and prevent drive trips
- Systems with multiple motors and drives require more wiring and components and ships have limited space for extra components

Centrifuges

Centrifuges on ships are generally used in sludge drying or food processing on fishing vessels.

Removing undesirable liquid such as water from useful liquids such as fuel or hydraulic or lube oil is another common marine application of centrifuges.



Centrifuges

Problems

- Can take hours to coast to stop
- Drive speed decreased to slow/stop centrifuge
  - Mechanical energy converted to electrical energy and causes DC voltage to rise
- Electricity created from a stopping centrifuge is dissipated when it can be used to power/start other centrifuges

Propulsion & Thrusters

Diesel-electric propulsion are used on tugboats, offshore/platform vessels, and workboats for dynamic positioning.

Electric motors and drives have a faster response time, allowing for quick changes in direction.

Propulsion & Thrusters

Problems

- Side thrusters stop and change direction quickly, causing DC bus voltage to rise, causing drive trips
- Transistor/Resistor braking generates heat, requiring extra cooling in small drive control room
- Multiple separate thrusters and drives in one system require more wiring and components

Propulsion & Thrusters

AC Drive Propulsion System

Fixed Propellers

- Use Braking Transistors

Bonitron Solutions

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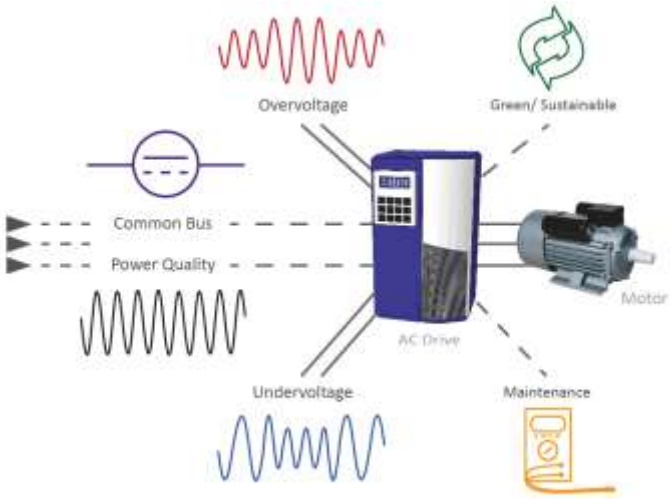
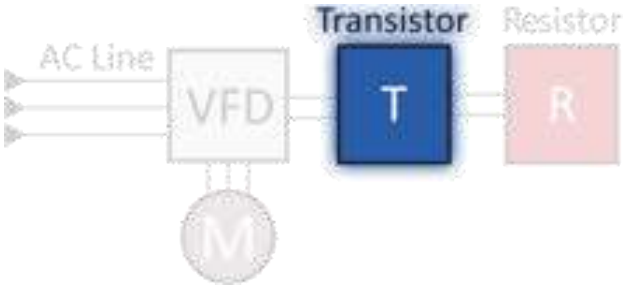
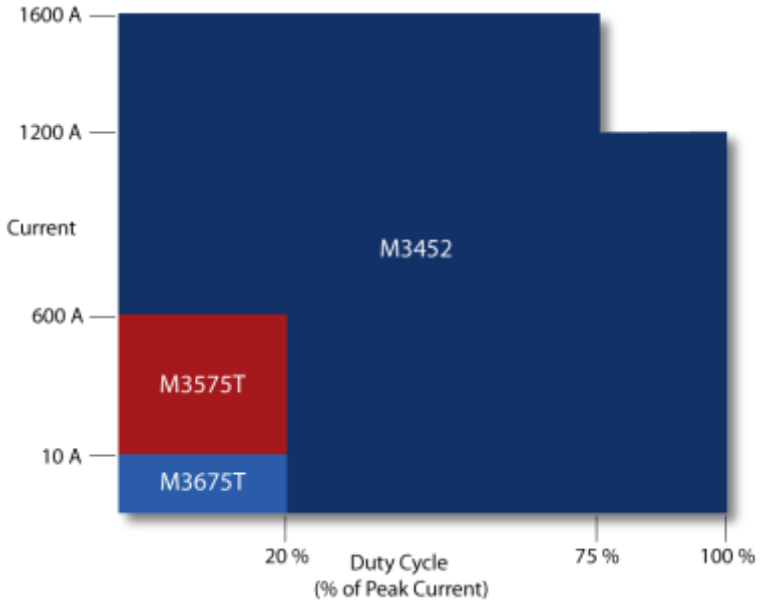


Overvoltage Solutions

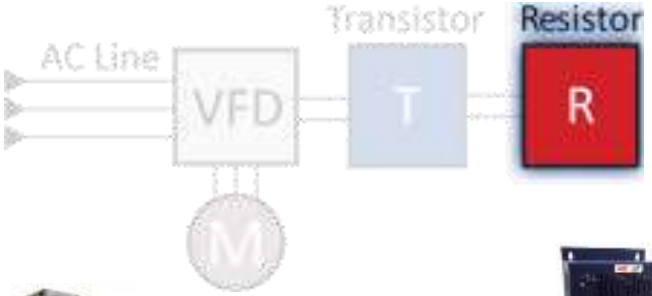
Transistors/Choppers

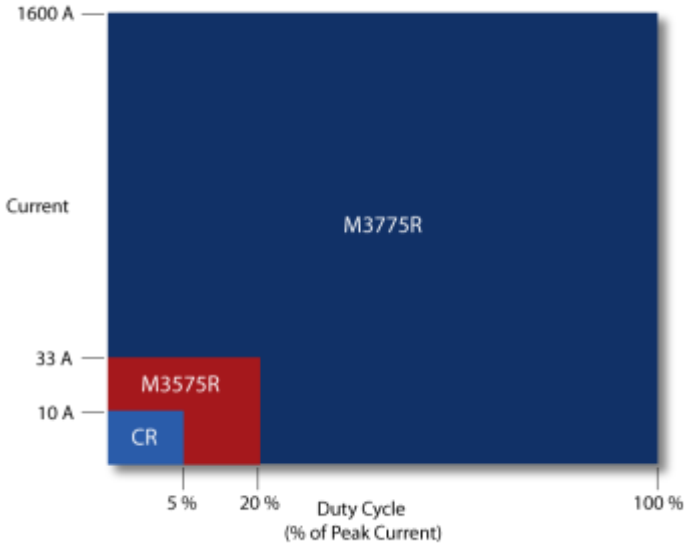




Overvoltage Solutions

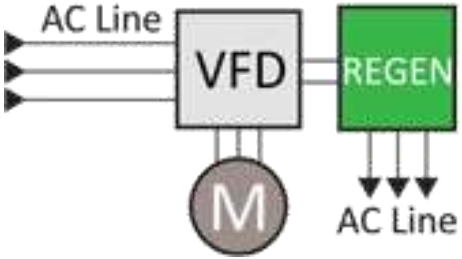
Resistors





Overvoltage Solutions

Line Regen



Great return on investment

- Regenerative energy returned to AC line reduces utility power usage

Product Highlights

- 208 - 600VAC support with 50/60Hz auto select
- 20, 30, 50, 100 Amp units
- 150% overload for 60 seconds
- Digital Display with event and usage logging
- Integrated filtering and transient suppression
- > 99% efficient

Overvoltage Solutions

Transistor / Resistor

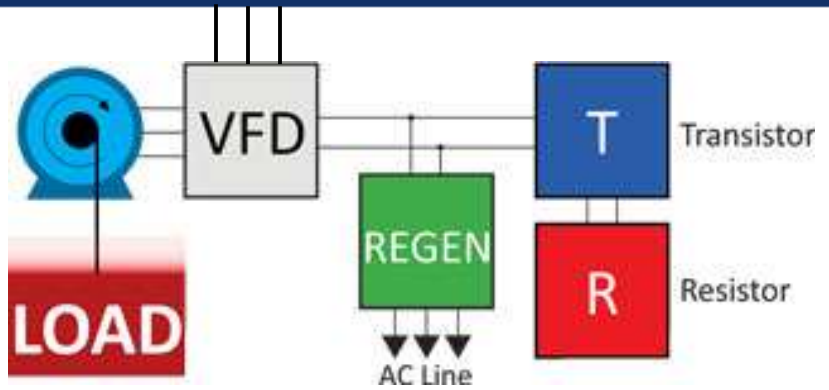
- Heat generated
- Locate outside or adjust cooling
- Added install cost (conduit, wiring, etc)

Line Regen

- Return on Investment
- Simple, low-cost install near drive

Both

- Regen efficiency
- Large Transistor/Resistor for peak or surge power



Regen

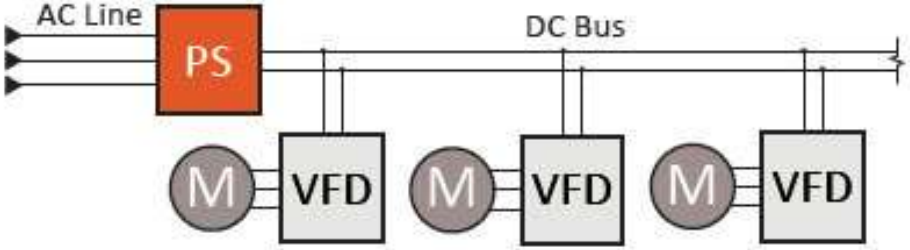
Transistor

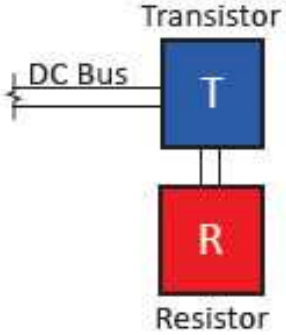
Resistor

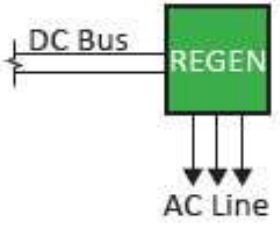
Common Bus Solutions

Common Bus Power Supply

- AC in. DC out
- Drives powered via DC +/-
- Drives share power
- Single or 3-phase AC input



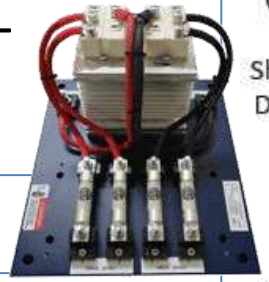


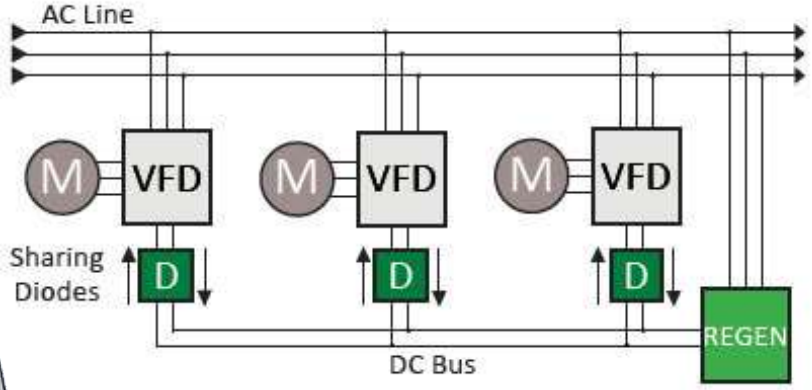


Common Bus Solutions

Sharing Diodes

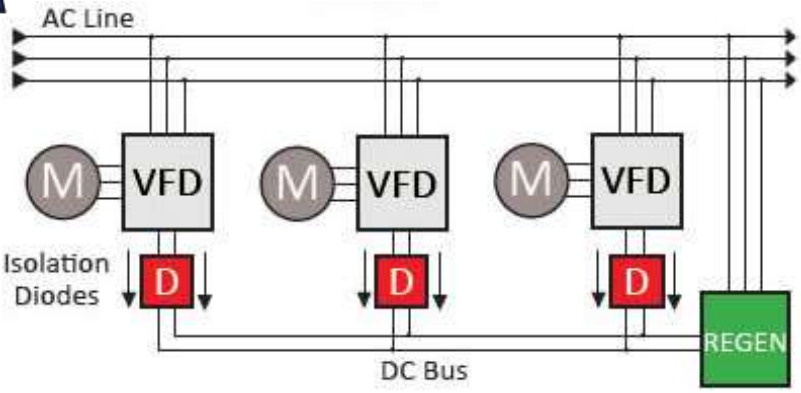
- Drives powered via AC +/-
- Drives share power





Isolation Diodes

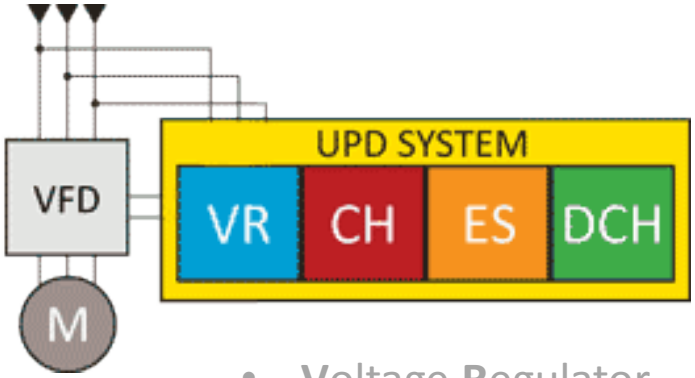
- Drives powered via AC +/-
- Drives isolated. Do not share power



Uninterruptible Power for Drives

UPD

- Critical applications
- Power drive during power sag or outage
- Sold as complete systems with cabinet and disconnects or as components to integrate

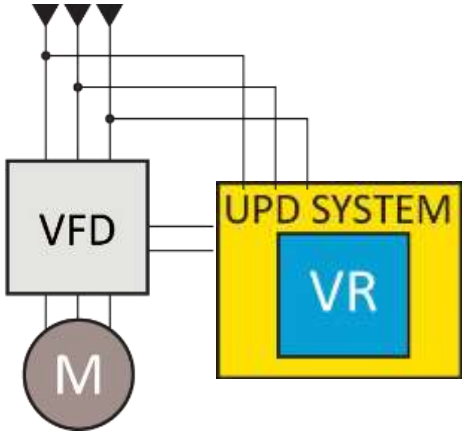


- **V**oltage **R**egulator
- **Ch**arger
- **E**nergy **S**torage
- **Dis**ch**a**rger

Uninterruptible Power for Drives

Sags

- No energy storage necessary
- Provides full-load power for up to 2 seconds for:
  - 50% 3-phase sags
  - 1-phase sag to 0v

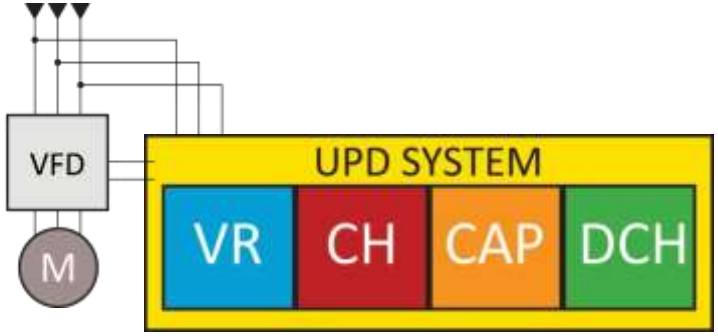


- **V**oltage **R**egulator

Uninterruptible Power for Drives

Short Term Outage

- 2-second,
  100% 3-phase outages
- Electrolytic or ultracapacitor energy storage
- Long lifespan



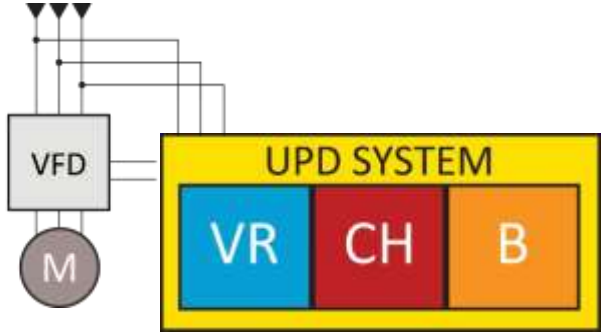
Capacitor Systems

- **V**oltage **R**egulator
- **Ch**arger
- **Cap**acitor
- **Dis**ch**arger**

Uninterruptible Power for Drives

Long Term Outage

- 4-minutes,
  100% 3-phase outages
- Battery energy storage
- Ideal for dark starts or to maintain process before generator starts



Battery Systems

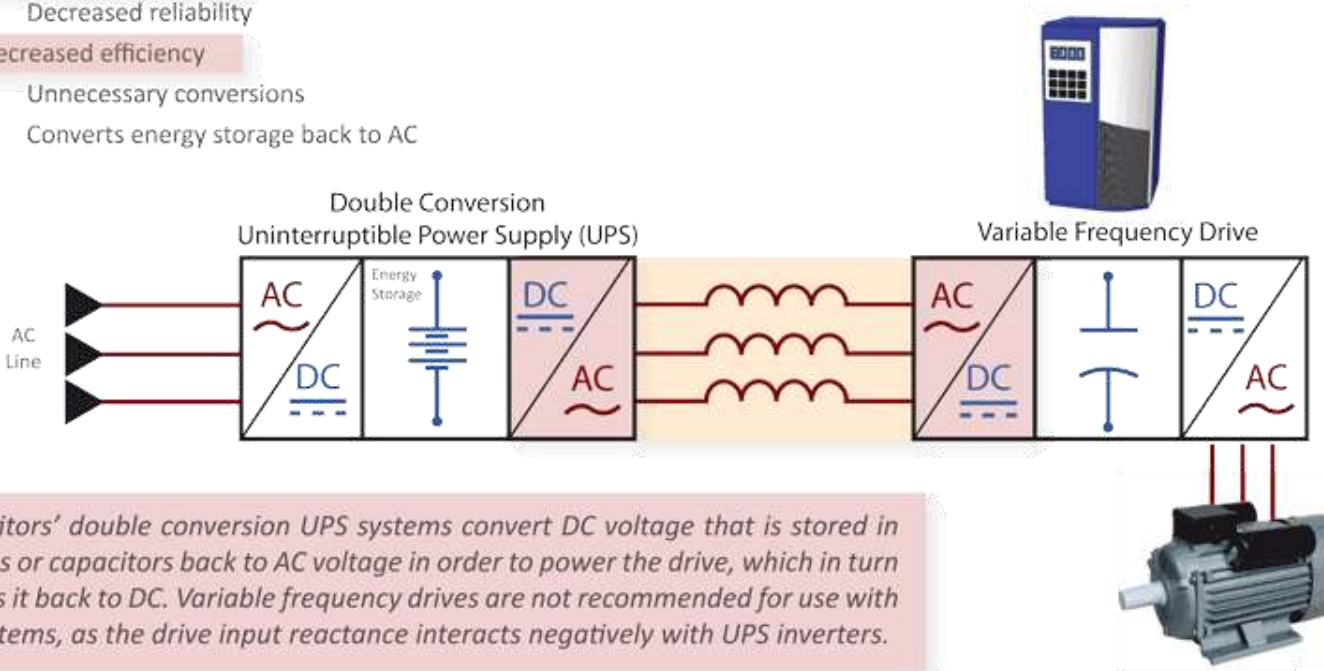
- **V**oltage **R**egulator
- **Ch**arger
- **B**attery

Typical UPS

UPS Disadvantages

In-line UPS Disadvantages

- Series Connection
  - Decreased reliability
- Decreased efficiency
  - Unnecessary conversions
  - Converts energy storage back to AC



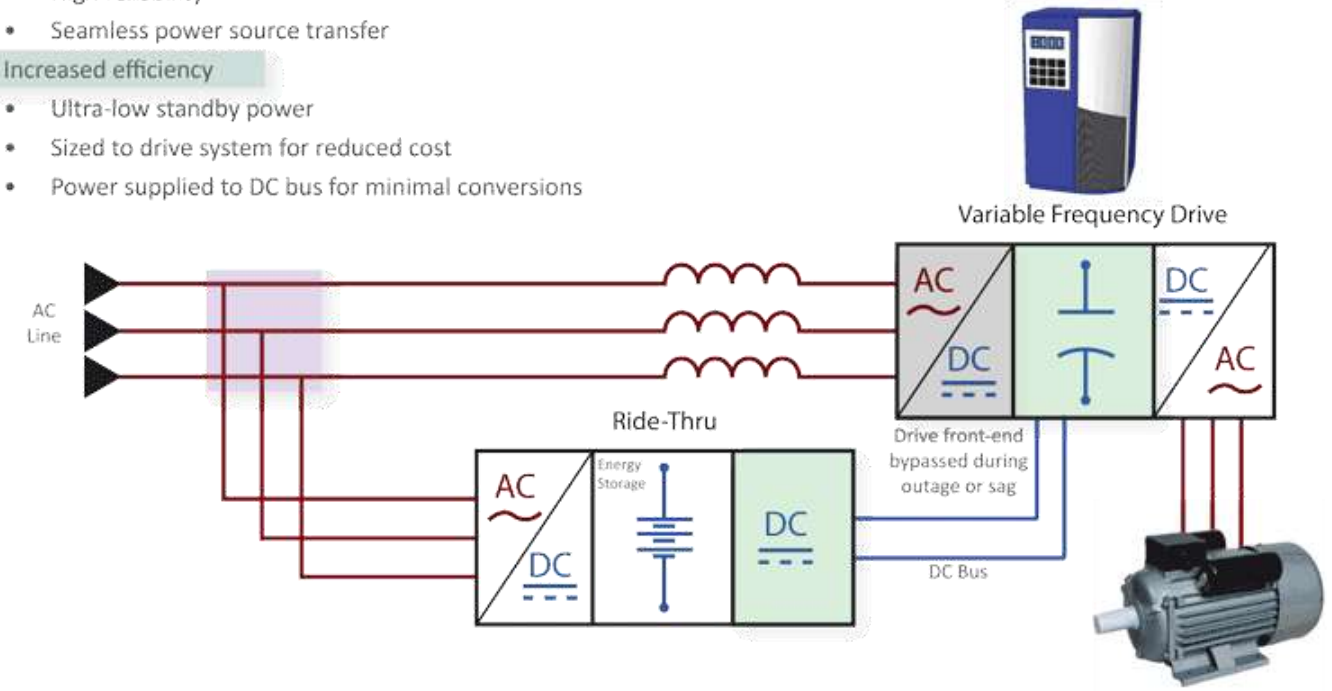
Competitors' double conversion UPS systems convert DC voltage that is stored in batteries or capacitors back to AC voltage in order to power the drive, which in turn converts it back to DC. Variable frequency drives are not recommended for use with UPS Systems, as the drive input reactance interacts negatively with UPS inverters.

Uninterruptible Power for Drives

Bonitron UPD Advantages

- Parallel Connection
  - High reliability
  - Seamless power source transfer
- Increased efficiency
  - Ultra-low standby power
  - Sized to drive system for reduced cost
  - Power supplied to DC bus for minimal conversions

Bonitron UPD Systems power the DC bus of the drive via DC bus connection terminals on the drive. This eliminates an unnecessary and energy wasting DC to AC conversion.



Maintenance Solutions

Capacitor Maintenance

Capacitor Formers

- Form capacitors
- **Test drives left in storage (Drives contain capacitors)**
- Benchtop power supply

Capacitor Testers

- Measure capacitance and ESR to determine when end of life is reached

Discussion

Drive Applications

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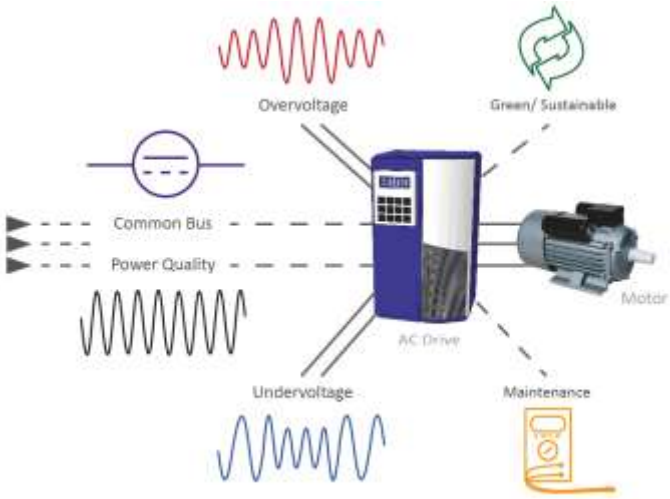

Discussion

Shipboard

Solutions & Applications

- Overvoltage
- Common Bus
- Undervoltage
- Maintenance

Target Customers

- **All Ports**
- **Shipbuilders**
- **OEM Marine**