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FLUID COUPLING V/S VFD

Advantages of Fluid coupling over VFD

- ✓ Standard motor could be used with Fluid coupling whereas VFD requires VFD compliant Motors which are costly.
- ✓ Fluid couplings could dampen Torsional vibration and shocks transmitted from Load to Prime mover, thereby extending Equipment life. VFD's do not have this advantage.
- ✓ Fluid coupling does not tamper with the Motor Design parameters while in operation, thereby allowing the Motor to work in its most efficient zone.
- ✓ Motor could be sized according to the demand torque requirement with Fluid coupling, hence resulting in better Power factor.
- ✓ Fluid coupling could be used with HT Motors without any modifications. VFDs are very costly for HT Motors and hence used predominantly with LT Motors.
- ✓ For applications involving frequent start – stops with HT Motor, Fluid couplings are the best option, as it allows HT Motor to run continuously and Equipment could be start-stopped by Fluid coupling. (Since stopping HT motor means you cannot start it immediately due to its cooling time criteria)
- ✓ Fluid couplings are ideal for use in hazardous area where ignition of dust or gas may be a problem since it is non-electrical.

Dis-advantages of VFD

- ✓ Harmonic currents are injected by VFD into Power supply side of the drive and all circuits which causes over heating of wiring or causing devices to trip; thus Filters has to be used with VFD which is an additional cost.
- ✓ VFDs causes motor-bearing damage in High Voltage / High HP Motors due to high frequency current pulses which calls for motor-bearings with high quality insulation.
- ✓ Distance between Motor & VFD should be minimum as possible since long distance induces harmonics and insulation of Motor gets punctured; thus capacitors needs to be added which is an additional cost.
- ✓ Speed reduction in Motor through VFD results in factors such as Thermal stress and Voltage spikes, thereby calling for higher grade of Insulation and de-rating of Motor.
- ✓ Motor manufacturer recommend maximum variation of up to 50% of the base speed, below which Motor needs to be de-rated.
- ✓ Motor efficiency drops with the Motor speed, hence though VFD efficiency is approx. 96%, overall System efficiency with VFD drive drops with the speed reduction.
- ✓ VFD requires Controlled atmosphere (Temperature & Humidity)
- ✓ VFD maintenance cost and skilled manpower cost are high.
- ✓ VFD spares are not easily available in market as they get obsolete very fast.

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VFD are predominantly used in LT Motors which calls for following additional cost:

- ✓ Transformers are required to step down the line voltage from HT to LT.
- ✓ Running current consumed will be more for given Power requirement since voltage is reduced from HT to LT (Power = $\sqrt{3} \times V \times I \times Cos\phi \times \eta$)
- ✓ Cable size needs to be increased (sealed cable) to take care of this extra current for its entire length.
- ✓ Due to high current, required Protection devices needs to be selected for higher ratings.

VFD response time in very long conveyors are not good:

- ✓ E.g. consider a long conveyor of say 12 km with two motors at head & one motor at tail end. All motors are say 500kw. If the conveyor needs to be started in fully loaded condition, the Head motors will get signal immediately to start, whereas there will be a time lag of few minutes for the tail end motor to start because of distance. As a result, till the tail end motor comes in to action, the entire 500kW x 3 = 1500kW load needs to taken by the two head motors of 500kW each. Thus, the two head motors will be overloaded for these few minutes. Whereas in case of Fluid coupling in a similar situation, the fluid couplings connected to the head motors will not connect the motor to conveyor load till the tail end motor comes into action. Thus the head motors are saved from getting damaged.

P.S.: Power loss in case of Variable Speed Fluid coupling varies with Speed for Constant Torque Applications only, hence Cost-Benefit analysis needs to be done with respect to VFD for the given speed range of Equipment in such Constant Torque Applications, while promoting Fluid couplings.