Advancements in Variable Speed Drive Technology for reducing Operational Risk

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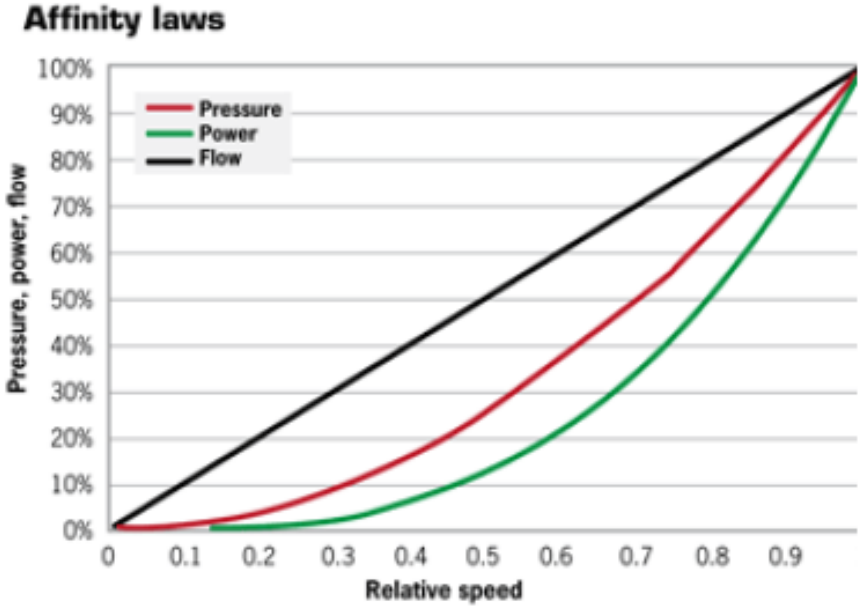
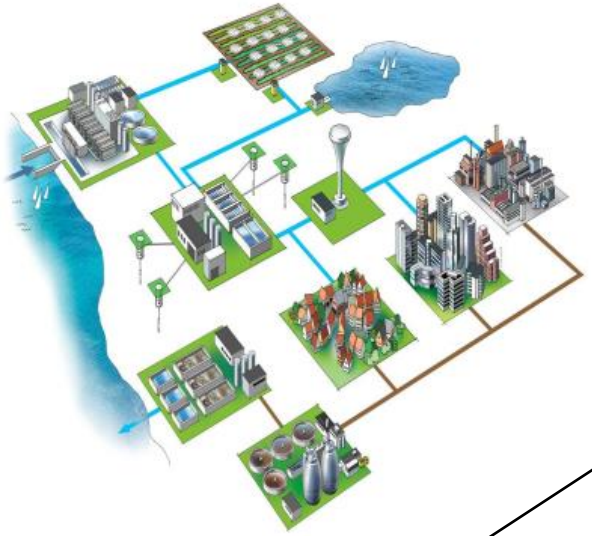
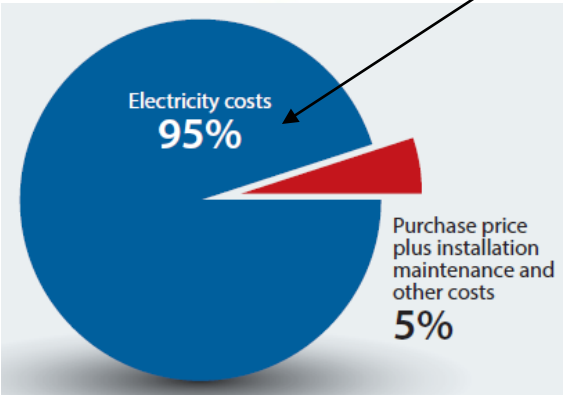
Relationship between Flow, Pressure & Power for Centrifugal Motors



Affinity laws are used in fluid control to express the mathematical relationship between several variables such as pressure, volumetric flow rate, speed, and the power involved in pumps and fans.

Typical VSD Life-Cycle Costs





- Life-Cycle Costs are a key consideration
- LCC = Cic+Cin+Ce+Co+Cn+Cs+Cenv+Cd
  - Cic = initial capital cost
  - Cin = installation & commissioning costs
  - **Ce = energy costs**
  - Co = operating costs
  - **Cm = maintenance costs**
  - Cs = downtime & lost production costs
  - Cenv = environmental costs
  - Cd = de-commissioning & disposal costs
- Two most significant factors:
  - **Energy costs**
  - **Maintenance costs**
- Variable Speed Drive (VSD) / Power Drive System (PDS) design can significantly impact on Life-Cycle Costs

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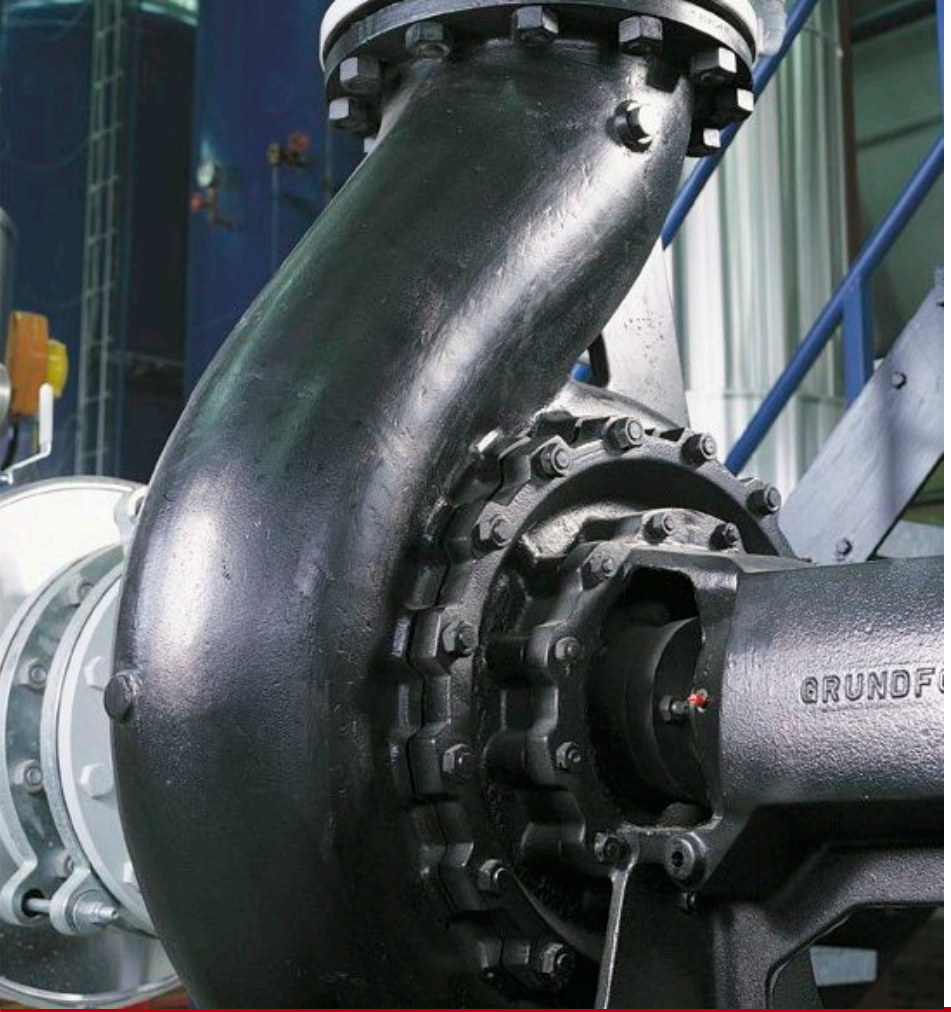


Pump protections

- Flow compensation to reduce pressure when low flow is sufficient
- Motor alternation between two pumps to prevent sticking and ensure even usage
- Dry pump protection detects when pump pressure is lacking and alarms or acts to protect the pump
- No-flow/low-flow compensates the power to the pump
- Pump End of Curve detection
- Short Cycle protection
- Broken Belt function
- **New 5050 CPU**

Intelligent drives

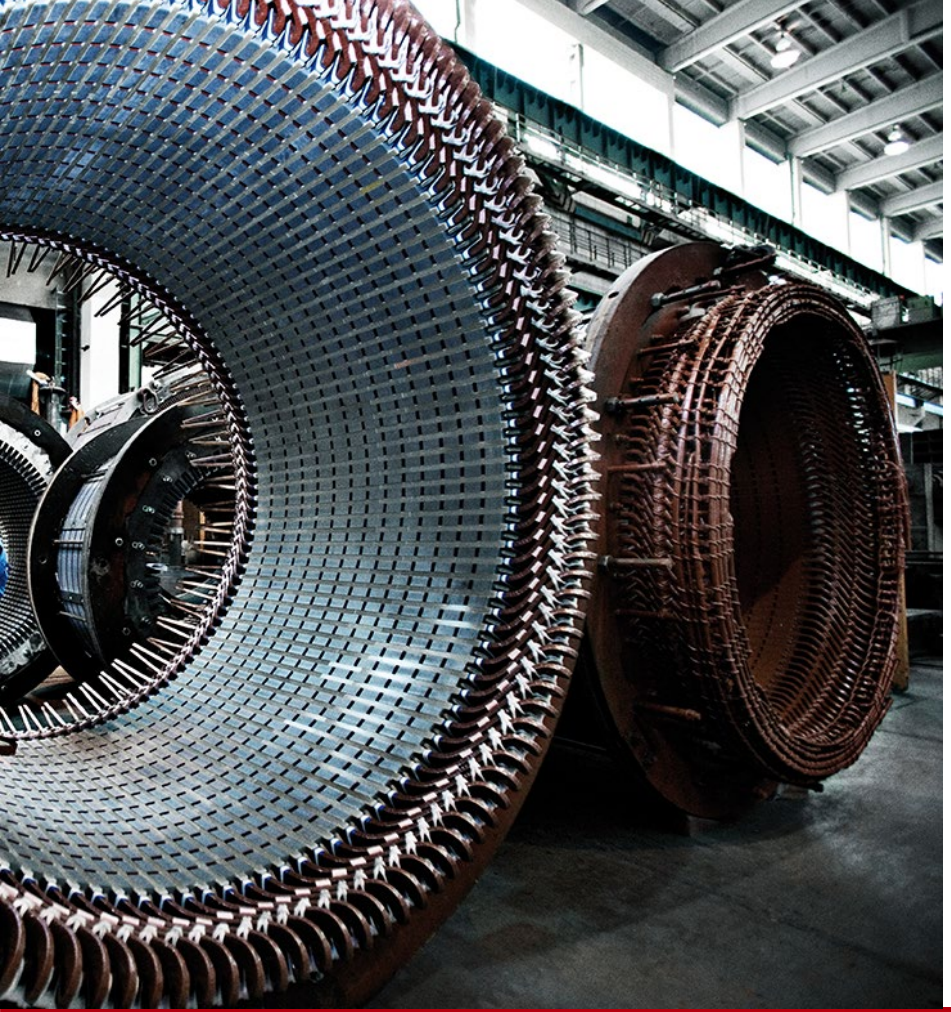
VLT® Condition-based Monitoring

Break-through technology implemented at **drive's level**:

- Stator winding monitoring
- Vibration monitoring
- Load envelope

VLT® features that can be ordered in one "package" as **licensed software** in:

- VLT® AutomationDrive FC 302
- VLT® AQUA Drive FC 202
- (VLT® HVAC Drive FC 102)
- (VLT® Refrigeration Drive FC 103)



Motor stator winding monitoring

- By analyzing the motor current signature, the drive can detect motor winding damage at early stage.
- This function does not require any external sensors.
- The monitoring function triggers an early warning in case the stator winding develops an insulation fault.

Vibration monitoring

- External vibration sensor (4…20 mA).
- Threshold level according to ISO10816.
- The function can be used to detect:
  - unbalance & eccentricity
  - looseness
  - misalignment
  - mechanical resonance
- Drive correlates vibration with motor speed & load.
- Permanent monitoring vs. occasional service checks.

Load envelope

- The function learns the load curve of the application and detects whenever the load moves above or under the baseline level
- The function is useful fault detection in various applications with passive load:
  - Fouling, sanding, broken impeller or wear-out of pumps
  - Clogged filters and leakages in ventilation systems
  - Friction in machines

How does it work?

- Each function (motor winding, vibration and load monitor) is represented by an analogue numeric value.
- Machine learning and edge computing: the drive needs to run a ”baseline measurement” to learn the values of a “normal” operation.
- Two Warning levels (1 and 2) and an Alarm thresholds are created after running the baseline.
- During operation, the actual values are compared to the baseline.

Enforce your **maintenance strategy**

Key customer values:

- Permanent monitoring vs. selective regular checks
- Enable transition from preventive to predictive maintenance
- Cost-effective solution vs external 3rd party complex systems
- Increase uptime of your application
- Suitable for remote locations or hard to access devices

1

Intelligent VLT Drives
Cost-effective solution implemented at drive's level

2

System independence
User interface via LCP102/Fieldbus/MCT10/ Cloud

3

Enforce your Predictive Maintenance strategies
Increase up-time of your application

Key takeaways

Thank you and please visit us at booth 29

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