Schneider Electric

Solutions

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Energy Efficiency

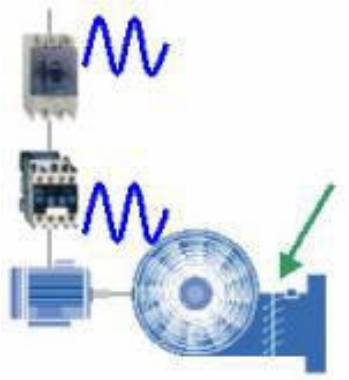
Application: Pumps & Fans Control (Industry/Infrastructure)

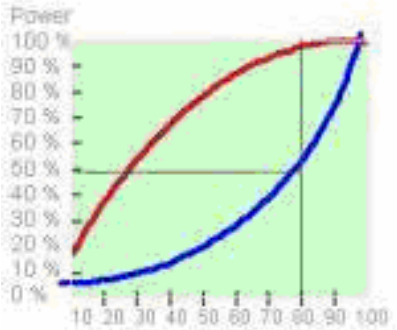
Pains & drivers

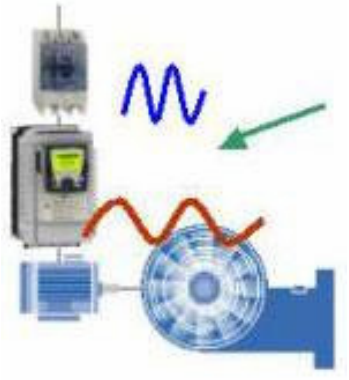
- **In Industry, 70% of electrical consumption is used to turn motors. Of these motors, 33% of them control pump or fan applications.**
- Most pump and fan applications are driven by a DOL solution of SoftStarter. This means that the motor runs at full speed and the flow variation is obtained. The energy consumption falls very little when the flow decreases. At 80% of the nominal flow, the energy consumption remains at 95%. The potential for saving on the installed base is huge.
- The CEMEP association has made a simulation for the European market. The use of Drive in such applications could save 900 M Euro/year as well as 4 Million tons of CO2/year.

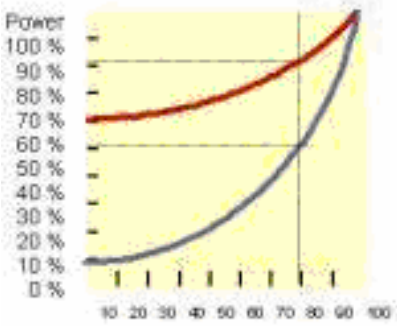
How can a customer manage energy more efficiently?

- To save energy you must:
  - drive the motor with a frequency inverter instead of a contactor or Soft Start
  - remove the restriction device (valve or damper)
- The AC Inverter allows you to adjust the speed of the Pump or the Fan, and therefore the Flow
- **The result is huge savings compared to conventional solutions:**
  - **up to 50% for Fan** , return on investment for the drive is within one year
  - **up to 30 % for a Pump** , return on investment within 2 years









Solutions or architectures used in the application

A) Solution without Drive

The motor turns at a fixed speed according to the network frequency and the number of poles.

Example: 3600 Rpm for 60 Hz Motor 2 poles

The only way to adjust the Flow is a restriction device (damper) which generates losses.

B) Energy Saving Solution with Drive

The Drive, which is also called a frequency inverter, lets you vary the frequency and therefore the motor speed.

The Flow is directly proportional to the speed.

The damper or valve is no longer required.

C) Energy Consumption with and without Drive

Example for Fan Application
Outlet damper
Variable speed drive
50% of energy saving at 80% of the nominal flow

Example for Pump Application
Control valve
Drive
30% of energy saving at 80% of the nominal flow

Variable speed drives for asynchronous motors

Type of machine		Simple machines		Pumps and fans (Building (HVAC) *(1)*
				
Power range for 50…60 Hz (kW) supply		**0.18…2.2**	**0.18…15**	**0.75…75**
	Single phase 100…120 V (kW)	0.18…0.75	–	–
	Single phase 200…240 V (kW)	0.18…2.2	0.18…2.2	–
	Three phase 200…230 V (kW)	0.18…2.2	–	–
	Three phase 200…240 V (kW)	–	0.18…15	0.75…30
	Three phase 380…480 V (kW)	–	–	0.75…75
	Three phase 380…500 V (kW)	–	0.37…15	–
	Three phase 525…600 V (kW)	–	0.75…15	–
Drive	Output frequency	0.5…200 Hz	0.5…500 Hz	0.5…200 Hz
	Type of control Asynchronous motor	Sensorless flux vector control		Sensorless flux vector control, voltage/frequency ratio (2 points), energy saving ratio
	Synchronous motor	–		–
	Transient overtorque	150…170% of the nominal motor torque	180% of the nominal motor torque for 2 seconds	110% of the nominal motor torque
Functions				
Number of functions		26	50	50
Number of preset speeds		4	16	7
Number of I/O	Analog inputs	1	3	2
	Logic inputs	4	6	3
	Analog outputs	–	1	1
	Logic outputs	1	–	–
	Relay outputs	1	2	2
Communication	Embedded	–	Modbus and CANopen	Modbus
	Available as an option	–	Ethernet TCP/IP, DeviceNet, Fipio, Profibus DP	LonWorks, METASYS N2, APOGEE FLN, BACnet
Cards (available as an option)		–	–	–
Standards and certifications		IEC/EN 61800-5-1, IEC/EN 61800-3 (environments 1 and 2)		
		EN 55011: Group 1, class A and class B CE, UL, CSA, C-Tick, N998	EN 55011: Group 1, class A and class B with option card, CE, UL, CSA, C-Tick, N998	EN 55011: Group 1, class A and class B with option card, CE, UL, CSA, C-Tick, NOM 117
References		**ATV 11**	**ATV 31**	**ATV 21**
Pages		2/14 to 2/17	2/112 to 2/115	2/48 and 2/49

(1) Heating Ventilation Air Conditioning

Pumps and fans (Industry)	**Complex machines**
	  
0.37…630	**0.37…500**
–	–
0.37…5.5	0.37…5.5
–	–
0.75…90	0.37…75
0.75…630	0.75…500
–	–
–	–
0,5…1000 Hz up to 37 kW, 0.5…500 Hz from 45 to 630 kW	1…1600 Hz up to 37 kW, 1…500 Hz from 45 to 500 kW
Sensorless flux vector control, voltage/frequency ratio (2 or 5 points), energy saving ratio	Flux vector control with or without sensor, voltage/frequency ratio (2 or 5 points), ENA System
–	Vector control without speed feedback
120…130% of the nominal motor torque for 60 seconds	220% of the nominal motor torque for 2 seconds 170% for 60 seconds
> 100	> 150
8	16
2…4	2…4
6…20	6…20
1…3	1…3
0…8	0…8
2…4	2…4
Modbus and CANopen	
Ethernet TCP/IP, Fipio, Modbus Plus, INTERBUS, Profibus DP, Modbus/Uni-Telway, DeviceNet, LONWORKS, METASYS N2, APOGEE FLN, BACnet	Ethernet TCP/IP, Fipio, Modbus Plus, INTERBUS, Profibus DP, Modbus/Uni-Telway, DeviceNet
I/O extension cards, “Controller Inside” programmable card, multi-pump cards	Encoder interface cards, I/O extension cards, “Controller Inside” programmable card
IEC/EN 61800-5-1, IEC/EN 61800-3 (environments 1 and 2, C1 to C3), EN 55011, IEC/EN 61000-4-2/4-3/4-4/4-5/4-6/4-11 CE, UL, CSA, DNV, C-Tick, NOM 117, GOST	
ATV 61	**ATV 71**
2/172 to 2/175	2/360 to 2/363