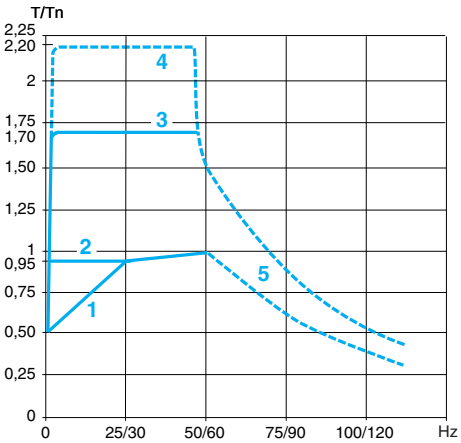
Variable speed drives for asynchronous motors
Altivar 71

Torque characteristics (typical curves)

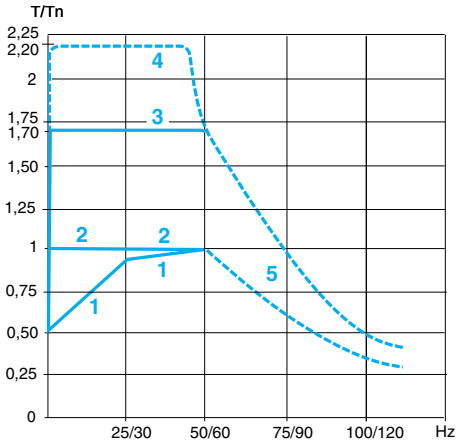
The curves opposite define the available continuous torque and transient overtorque for both force-cooled and self-cooled motors. The only difference is in the ability of the motor to provide a high continuous torque at less than half the nominal speed.



Open loop applications

Open loop applications

1 Self-cooled motor: continuous useful torque *(1)*
2 Force-cooled motor: continuous useful torque
3 Overtorque for 60 s maximum
4 Transient overtorque for 2 s maximum
5 Torque in overspeed at constant power *(2)*



Closed loop applications

Closed loop applications

1 Self-cooled motor: continuous useful torque *(1)*
2 Force-cooled motor: continuous useful torque
3 Overtorque for 60 s maximum
4 Transient overtorque for 2 s maximum
5 Torque in overspeed at constant power *(2)*

Altivar 71 drives are capable of supplying nominal torque continuously at zero speed.

Motor thermal protection

Altivar 71 drives feature thermal protection designed specifically for self-cooled or forced-cooled variable speed motors. The drive calculates the motor thermal state even when it is switched off.

This motor thermal protection is designed for a maximum ambient temperature of 40°C around the motor. If the temperature around the motor exceeds 40°C, thermal protection should be provided directly by thermistor probes (PTC) integrated in the motor. The probes are managed directly by the drive.

(1) For power ratings ≤ 250 W, derating is 20% instead of 50% at very low frequencies.
(2) The motor nominal frequency and the maximum output frequency can be adjusted from 10 to 500 Hz or 1600 Hz, depending on the rating.
Check the mechanical overspeed characteristics of the selected motor with the manufacturer.

Variable speed drives for asynchronous motors
Altivar 71

Special uses

Using Altivar 71 drives with synchronous motors

Altivar 71 drives are also suitable for powering synchronous motors (sinusoidal electromotive force) in open loop mode and are used to achieve performance levels comparable to those associated with an asynchronous motor in sensorless flux vector control.
This drive/motor combination makes it possible to obtain remarkable speed accuracy and maximum torque even at zero speed. The design and construction of synchronous motors are such that they offer enhanced power density and speed dynamics in a compact unit. Drive control for synchronous motors does not cause stalling.

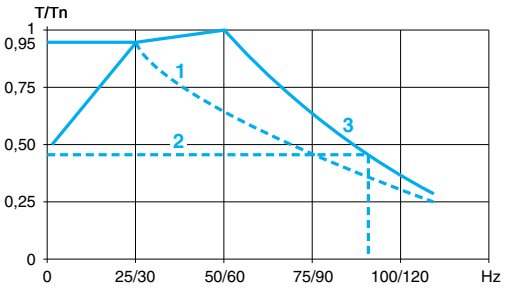
Using special motors at high-speed

These motors are designed for constant torque applications with high frequency ranges. The Altivar 71 drive supports operating frequencies of up to 1600 Hz. By design, this type of motor is more sensitive to overvoltages than a standard motor. Various solutions are available:
- Overvoltage limitation function
- Output filters

The drive's 5-point voltage/frequency control ratio is particularly well-suited as it avoids resonance.

Using a motor at overspeed

The maximum output frequency of the drive can be adjusted from 10 to 1600 Hz for drives rated less than or equal to 37 kW and from 10 to 500 Hz for higher ratings. When using a standardized asynchronous motor at overspeed, check the mechanical overspeed characteristics of the selected motor with the manufacturer.
Above its nominal speed corresponding to a frequency of 50/60 Hz, the motor operates with a decreasing flux, and its torque decreases significantly (see curve opposite).
The application must be able to permit this type of low-torque, high-speed operation.



Using a motor at overspeed

1 Machine torque (degressive torque)
2 Machine torque (low motor torque)
3 Continuous motor torque

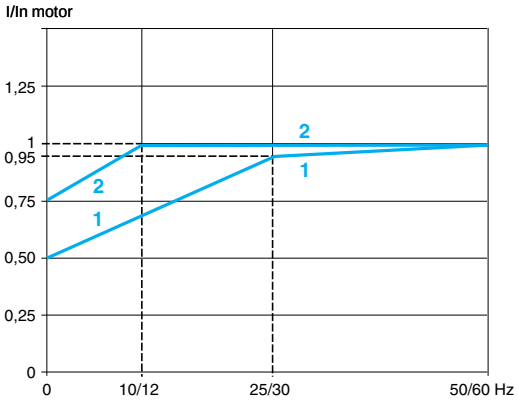
Typical applications: wood-working machinery, broaching machines, high-speed hoisting, etc.

Motor power less than drive power

The Altivar 71 can power any motor which has a rating lower than that for which the drive was designed. This motor/drive combination makes it suitable for applications requiring high, intermittent overtorque.
Typical applications: machines with very high starting torque, grinders, kneaders, etc.

Note: *In this case, it is advisable to over-rate the drive to the next standard power rating immediately above that of the motor.*

Example: Use an 11 kW motor with a 15 kW drive.



Power of a self-cooled motor greater than the drive power

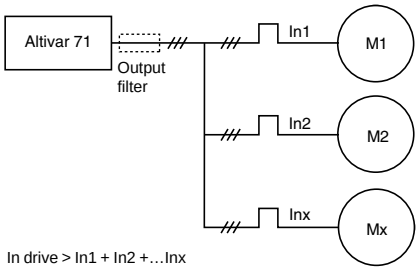
Power of a self-cooled motor greater than the drive power

This motor-drive combination makes it possible to use a self-cooled motor for a greater speed range in continuous operation. The use of a motor with a higher power rating than that of the drive is only possible if the current drawn by this motor is lower than or equal to the nominal drive current.

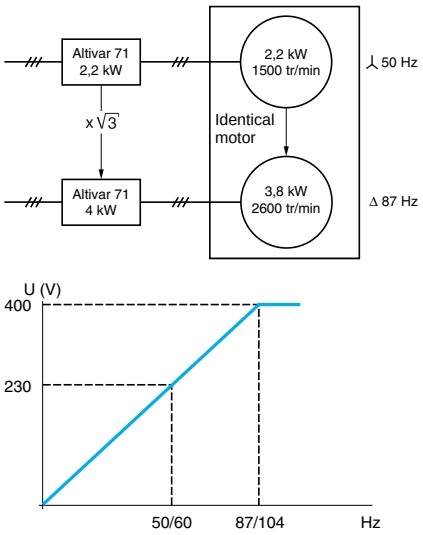
Note: *Limit the motor power to the standard rating immediately above that of the drive.*

Example: On a single machine, the use of a 2.2 kW drive combined with a 3 kW motor means that the machine can operate at its nominal power (2.2 kW) at low speed.
1 Motor power = drive power = 2.2 kW
2 2.2 kW drive combined with a 3 kW motor: greater speed range at 2.2 kW.

Variable speed drives for asynchronous motors
Altivar 71



Connecting motors in parallel



Using a motor at constant torque up to 87/104 Hz

Special uses (continued)

Connecting motors in parallel

The nominal current of the drive must be greater than or equal to the sum of the currents of the motors to be controlled.
In this case, provide external thermal protection for each motor using probes or thermal overload relays. For cable runs over a certain length, taking account of all the tap links, it is advisable either to install an output filter between the drive and the motors or to use the overvoltage limitation function.

If several motors are used in parallel, there are 2 possible scenarios:
- The motors have equal power ratings, in which case the torque characteristics will remain optimized after the drive has been configured
- The motors have different power ratings, in which case the torque characteristics will not be optimized for all the motors

Using a motor at constant torque up to 87/104 Hz

A 400 V, 50 Hz motor in Y connection can be used at constant torque up to 87 Hz if it is in Δ connection.
In this particular case, the initial motor power and the power of the first associated drive are multiplied by √3 (it is therefore important to select a drive with a suitable rating).
Example: A 2.2 kW 50 Hz motor in Y connection supplies 3.8 kW at 87 Hz with a Δ connection.

Note: *Check the overspeed operating characteristics of the motor.*

Using special motors

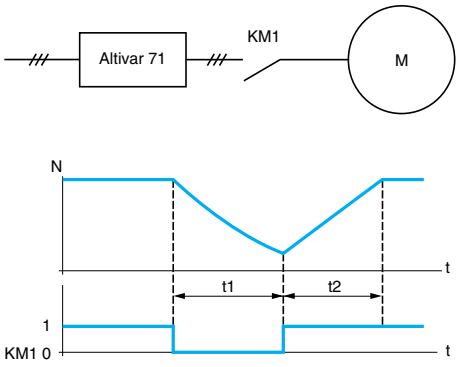
Special brake motors: tapered rotor or flux bypass

The magnetic field releases the brake. This type of operation with the Altivar 71 drive requires application of the voltage/frequency ratio.

Note: *The no-load current may be high, and operation at low speed can only be intermittent.*

Resistive rotor asynchronous motors

Different motor control ratios available on the Altivar 71 drive make it possible to apply specific settings when using high-slip motors.



t1: deceleration without ramp (freewheel)
t2: acceleration with ramp
N: motor speed

Example of loss of output contactor

Special uses (continued)

Switching the motor at the drive output

The drive can be switched when locked or unlocked. If the drive is switched on-the-fly (drive unlocked), the motor is controlled and accelerates until it reaches the reference speed smoothly following the acceleration ramp. This use requires configuration of the automatic catching a spinning load (“catch on the fly”) and the motor phase loss on output cut functions.

Typical applications: loss of safety circuit at drive output, bypass function, switching of motors connected in parallel.
On new installations, it is recommended that the Power Removal safety function is used.

Test on a low power motor or without a motor

In a testing or maintenance environment the drive can be checked without having to switch to a motor with the same rating as the drive (particularly useful in the case of high power drives). This use requires deactivation of the motor phase loss function.