

Motor selection guide



1. Introduction

As you know it probably, there exists several types of electrical motors and therefore several technologies are available to make variable speed regulation. This guide is aimed at describing them and at helping you to differentiate the various solutions which exist today and more particularly, those most usually used. To know DC motors, asynchronous motors (in other words induction motors) and finally brushless servomotors.

It should be stressed that there is a wide range of applications that can be equally well met by more than one motor type, and the choice will tend to be dictated by customer preference, previous experience or compatibility with existing equipment.



2. Technology “typical range” performances comparison

Motor	Asynchronous			DC motor		Brushless	
Drive type *	O.L. V/F	O.L. vector	C.L.	O.L.	C.L.	O.L.	C.L.
Speed regulation	1-5%	0.1-0.5%	0.01-0.05%	2-3%	0.01-1%	≥ 1%	0.01-1%
Speed loop response	1-2Hz	1-10Hz	20-100Hz	10-20Hz	0.5-2Hz	Up to 20Hz	300Hz
Torque accuracy	10-20%	2-10%	0.5-1%	2-5%	2-5%	-	10-30%
Torque response	5-10Hz	75-200Hz	200-1000Hz	10-20Hz	20-100Hz	-	
Positionning	No	No	Yes	No	No	No	Yes
Robust	Yes			Moderate		Yes	
Space	Moderate			Large		Small	
Maintenance	Maintenance free			Periodic maintenance		Maintenance free	
Efficiency	Moderate			Moderate		High	High
Motor cost	Low			Moderate		Moderate	High
Drive cost	Low			Low		Low	High
Inertia	High			High		Very low	
Forced ventilation	Needed at low speed			Yes		No	

(*) O.L. and C.L. for **Open Loop** and **Closed Loop**

Performance varies widely between drive manufacturers

- Speed regulation is dependent upon speed feedback device used
- Open loop regulation is motor dependent
- Response rates are rarely published and can be misleading.



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3. Case study

We are going to take an example and to determine the most adapted motorisation by visualising on the performances table the most adapted possibilities and choices.

We have chosen the conveyor because it is a quite simple system and it is commonly used in many industries and a wide variety of related conveying machines are available, different as regards principle of operation, including chain conveyors, belt conveyors, screw conveyors, vibrating conveyors... A conveyor system is a common piece of mechanical handling equipment that moves materials from one location to another. A conveyor can also be made up of several series of motorisations in the case of very long distance to travel.



The customer needs are the following :

1. Basic speed regulation
2. Very compact system
3. As there are several motorisations, the customer looks for saving energy
4. The competitive market impose also a cost pressure

By highlighting the table of performances, we see that at the beginning all the motor types can satisfy the application, but quickly as the needs are more precise, one technology brings out.

Indeed we can see that the brushless solution without sensor is the most adapted to the customer's needs.

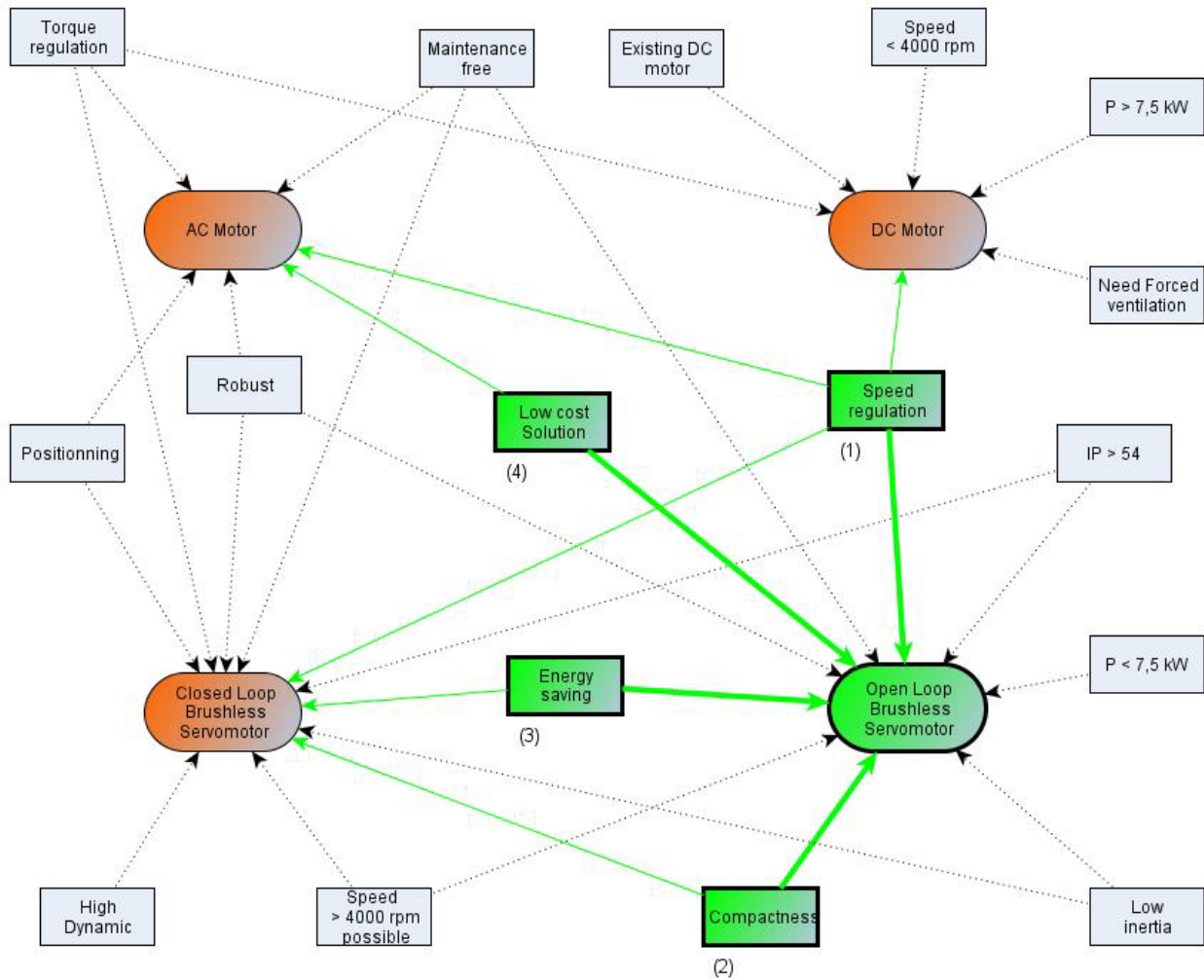


Motor	Asynchronous			DC motor		Brushless	
	O.L V/F	O.L. vector	C.L.	O.L.	C.L.	O.L.	C.L.
(1) Speed regulation	1-5%	0.1-0.5%	0.01-0.05%	2-3%	0.01-1%	> 1 %	0.01-1%
Speed loop response	1-2Hz	1-10Hz	20-100Hz	10-20Hz	0.5-2Hz	Up to 20Hz	1-300 Hz
Torque accuracy	10-20%	2-10%	0.5-1%	2-5%	2-5%	-	10-30%
Torque response	5-10Hz	75-200Hz	200-1000Hz	10-20Hz	20-100Hz	-	
Positionning	No	No	Yes	No	No	No	Yes
Robust	Yes			Moderate		Yes	
(2) Space	Moderate			Large		Very small	
Maintenance	Maintenance free			Periodic maintenance		Maintenance free	
(3) Efficiency	Moderate			Moderate		High	High
(4) Motor cost	Low			Moderate		Moderate	High
(4) Drive cost	Low			Low		Low	High
Inertia	High			High		Very low	
Forced ventilation	Needed at low speed			Yes		No	

Another way makes it possible to see which is the most adapted solution :

The diagram of choice below illustrates the possibilities which are offered to us according to the requirements of the application.

We see that only one technology follows naturally from the customer needs.



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