

TECHNICAL NOTE

NPT12FSC



VARIABLE SPEED COMPRESSORS for Commercial Refrigeration
CASE STUDY · NPT12FSC · R290



cubigel[®]
compressors

by
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NPT12FSC Cubigel Compressors® Variable Speed Drive R290 LBP Compressor



The NPT12FSC is designed for commercial applications and it operates for LBP conditions with R290 refrigerant, at speeds between 1800 and 3600 rpm.

The NPT12FSC offers low energy consumption by adopting electronically-controlled running modes. Its high efficiency mechanics and brush-less electrical motor, along with a system that regulates the speed in accordance with the needs of the system, makes the thermodynamic cycle more efficient, allowing up to a 50% reduction in energy consumption compared to an equivalent standard compressor.

In case of the R290 range, in addition to the enormous energy saving from the intelligent Variable Speed system, it also offers the environmental benefits of using hydrocarbons (R290) as refrigerant.

There is also GLT99FSN model version of the variable speed compressor available for R134a HMBP.

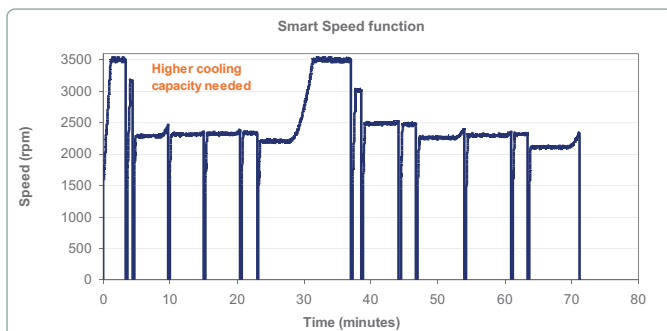
Variable Speed Compressors main advantages and benefits

- Possibility of covering several standard compressor models for different cabinet volumes with just one compressor model.
- Compressor power consumption reduction of 50% in comparison to standard compressors. This energy saving of the total appliance power consumption can be over 40% considering only the compressor.
- Reduces the pull-down time by means of spinning at a higher speed when it is needed.
- Reduces the number of start-ups/stops of the compressor.
- Modifies the speed until the achieving the longest-duty cycle possible.
- Lower Sound Power Level due to the fact that the compressor is usually running at a lower speed than a standard compressor.
- Drop in electronic driver system for automatically self-adapting compressor speed to current thermal load by means of the “Smart Speed” programming option.
- Compatible for electromechanical and electronic thermostats.
- Wider working range in the market:
 - For HMBP: From -25°C to +10°C evaporating temperature
 - For LBP: From -40°C to -10°C evaporating temperature
- Wider operation voltage and maximum ambient temperature

Variable Speed Drive feature

Thanks to its variable speed feature, the NPT12FSC has the possibility of covering several standard fixed speed compressor models for different cabinet volumes.

The variable speed feature, together with the Smart Speed® function, reduces the pull-down or cool down times by means of spinning the NPT12FSC at a higher speed when it is needed.



Example of compressor behavior when higher cooling capacity is needed.

One of the aims of the Smart Speed® function in Cubigel Compressors® variable speed drive models is to achieve the longest duty cycle that the system will allow (up to a maximum of 95%). It is programmed in this way to reduce the number of start-ups/stops of the compressor, since the start-up represents the point of highest power consumption. The driver measures how long the compressor works and how long it is stopped by the thermostat and, based on the results of the automatic calculations performed by the driver, it modifies the speed until the achieving the longest-duty cycle possible.

Thanks to the above mentioned feature, the compressor's speed is optimized so the refrigerant mass flow performed by NPT12FSC is the corresponding one for that specific cooling need. In most cases, this mass flow will be lower than that obtained with a standard model, and so the condensing temperature will be also lower and the thermodynamic cycle will be more efficient.

COP differences between NPT12FSC and R290 LBP standard efficiency compressors (in ASHRAE conditions at -23,3°C evaporating and 55°C condensing temperatures).

NPT12FSC@-23,3/55°C				Standard R290 LBP models			
Model	Speed rpm	Capacity kcal/h	COP (W/W)	Equivalent in standard efficiency			ΔCOP vs std
				Model	kcal/h	(W/W)	
NPT12FSC	1800	300	1,52	NL90FB	290	1,14	33%
	2400	405	1,63	NP12FB	390	1,19	37%
	2700	445	1,62	NP14FB	450	1,19	36%
	3000	485	1,60	NP16FB (*)	514	1,17	37%
	3600	585	1,57	NX18FB (*)	579	1,27	24%

(*) not developed/provisional performance

In this type of compressors, the optimum performance of the mechanics and electrical motor is about 2100 – 2200rpm. This is the speed at which the NPT12FSC performs the highest COP.

Appliance test: Ice cream conservator

The real test in a standard appliance shows the benefits of NPT12FSC compared to the standard efficiency NP14FB com-

pressor. These results are directly connected to the COP values of the compressors and the variable speed drive feature.

Type of cabinet tested: Ice cream conservator

Application Characteristics and Test Conditions	
Internal net volume	340 Liters
Cabinet load	Empty
Ambient temperature / RH in Energy consumption test	25°C / 50%
Average internal temperature during Energy consumption test	-18°C
Ambient temperature / RH in Pull down test	35°C / 50%

In the energy consumption test, the results show 38,5% energy savings with the NPT12FSC vs the standard efficiency R290 compressor NP14FB only by means of charging the compressor in the cabinet. Considering the pull down test according to the table, thanks to the Smart Speed® feature in NPT12FSC, the speed is selected to be the maximum on (3600rpm) and that is why the pull down time is 16% shorter than NP14FB.

Results during pull down test			
	NP14FB	NPT12FSC	Difference
Pull down Time to Average Internal temp equal to -18°C	01:38	01:22	-16,3%

The test shows 38,5% energy consumption savings when using NPT12FSC instead of the equivalent NP14FB.

The energy savings can even be higher considering additional appliance devices like high efficiency fan motors, bigger condenser, low consumption lights and insulation thickness of the cabinet.

Results during energy consumption test			
	NP14FB	NPT12FSC	Difference
Evaporating temperature during energy consumption test	-32,1°C	-31,5°C	+0,6°C
Condensing temperature during energy consumption test	49,5°C	45,1°C	-4,4°C
Duty cycle	51%	73%	+22%
Energy consumption	5,22 kWh/24h	3,31 kWh/24h	-38,5%

