APPLICATION PROFILE

Pauwels SLIM® transformers lead the way to wind-power in France

Pauwels SLIM® transformers, with DuPont™ NOMEX® thermal protection, are specially designed for installation in restricted spaces. They are playing a role in France's bid to boost the use of wind-power.

France was a late starter in building wind farms, but is now forcing the pace. Only 25 MW generating capacity was installed between 1991 and 1996; then, between 1996 and 2002, annual growth averaged 80% and in 2003 alone about 100 MW were added. Two French developers, Mistral Energie and InnoVent, are showing the way for further growth, using Pauwels SLIM® transformers.

In December 2001 Mistral Energie, one of France's most active investors in wind-energy, installed a Pauwels transformer of classic design, with cellulose paper insulation and with mineral-oil dielectric, in a Vestas V52 wind-turbine at the Port-Saint-Louis-du-Rhône wind-farm on France's Mediterranean coast. Due to the dimensions of this conventional transformer, it had to be located in a separate concrete chamber at the foot of the turbine tower.

Some 18 months later, with the support of Vestas, Mistral Energie redesigned the V52 installation so that the high-voltage equipment could be integrated in the base of the tower, eliminating the cost of the concrete chamber and reducing the cost of cabling and installation work.

To fit the transformer in the tower, Mistral Energie chose Pauwels' recently developed SLIM® model, created by combining Pauwels' advanced transformer design capabilities with DuPont's in-depth knowledge and experience in thermal insulation technology using DuPont™ NOMEX® paper.

Insulated with NOMEX®, the Pauwels SLIM® offers economic and technical advantages.

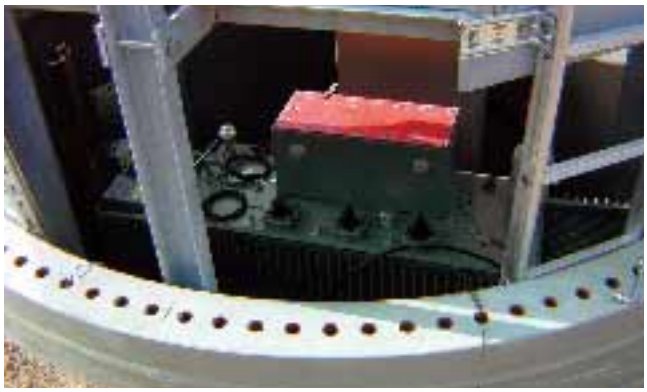
- The insulation's high-temperature resistance improves the transformer's reliability.
- Greater overload potential provides longer operational life.
- NOMEX® thermal protection combined with the use of silicone oil as dielectric makes these transformers' compact dimensions possible. They can be installed and removed through the door at the foot of the tower.
- Reduced no-load losses compared to alternative technologies.
- Use of silicone liquid as dielectric ensures good fire resistance and it is environmentally friendly.

Michel Schmerber, technical director of the Port-Saint-Louis-du-Rhône wind-farm, adds: "This transformer is in a hermetically sealed tank, so that no dust or dirt gets deposited on the coils. It does not need routine maintenance, as do air-cooled, dry-type transformers."

Mistral Energie's 1000 kW Vestas V52 wind-turbine in construction at Port-Saint-Louis-du-Rhône. With the help of NOMEX® thermal protection, the size of the Pauwels SLIM® transformer was reduced, so that it could be installed in the tower.

DuPont™
NOMEX®

Another French wind-farm developer is InnoVent. In November 2003 this company erected two Enercon wind-turbines, the first Enercon turbines sold in France, of 2000 kW each at Chépy, near Abbeville. Pauwels SLIM® transformers were installed in both. M. Grégoire Verhaeghe, director of InnoVent, noted that this wind-farm is close to the villages of Chépy and Feuquières-en-Vimeu, so the Enercon design's low noise level weighed heavily in their favour. Total investment for the Chépy wind-farm was about € 4 million. Commenting on the choice of Pauwels SLIM® transformers, M. Verhaeghe points out that their small dimensions allow them to be put in and removed from the tower through the door. "This saved us the cost of a separate building for them. They also have the advantage of developing little heat, so we don't need to install cooling fans, as air convection in the tower creates sufficient cooling."



Reduced dimensions of the Pauwels SLIM® transformer allowed it to be installed in a very limited space at the foot of Mistral Energie's 1000 kW wind-tower at Port-Saint-Louis-du-Rhône.

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Technical specifications:
Pauwels SLIM® hermetically sealed step-up transformers, with NOMEX® thermal protection and silicone liquid dielectric.

1. Port-Saint-Louis-du-Rhône	
Power (kVA)	1000
Tension (V)	20000 / 690
No-load losses (W)	1400
Load losses at 75° C (W)	7400
Load losses at 125° C (W)	8500
Dimensions (mm):	
• Length	2150
• Width	590
• Height	1590

2. Chépy	
Power (kVA)	2000
Tension (V)	20000 / 690
No-load losses (W	2100
Load losses at 75° C (W)	16700
Load losses at 125° C (W)	18500
Dimensions (mm):	
• Length	2210
• Width	770
• Height	2040

Pauwels SLIM® transformers are installed in Enercon E66/20_70 wind-turbines at Chépy, northern France. The transformers' reduced dimensions meant that they could be housed at the foot of the tower, thus saving the cost of separate buildings to house them.

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