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Lower maintenance costs and failure rate in wind turbine generators are possible

Wind farm owners and mayor Wind Turbine Generators (WGT) manufacturers have actually realised about the importance of reducing maintenance costs, as well as to decrease failure rates due to mechanical wear, in order to achieve the results expected.

Wind Turbine Generators (WGT) up to 2.5 MW were developed by using technologies and mechanical components based on theoretical calculations. A few successful endurance tests, brief operation experiences, and thousands of reports and marketing actions, entailed to new engineering projects in order to design bigger and more powerful WTGs. It was a needing of the market and governments worldwide, due to a lack of alternative energy sources. Renewable energy – and particularly wind energy – is absolutely indeed to become the mayor source of power generation in short future. Yes, it is. Nowadays, companies involved in this market have to face off lower efficiency than expected and a longer return of investment than state-of-the-art reports assured time ago.

Multi megawatt WTGs new developments try to take this into account. Wind farm owners and mayor WTG manufacturers have actually realised about the importance of reducing maintenance costs, as well as to decrease failure rates due to mechanical wear, in order to achieve the results expected. Furthermore, the trends in the wind energy market – such as offshore WTGs – increase the rotor dimensions and extend life-cycle. These facts join to government reductions of public subsidies, lead to an immediate increasing of price/Kilowatt. World population cannot afford it; therefore it's absolutely mandatory to optimize the wind energy production as well as inherent costs of unexpected lack of energy generation or too expensive maintenance operations in Wind Turbines.

Meanwhile WTG dynamic operation, there are six main mechanical parts inside which suffers compression stresses that cause millions of micro movements between physical components. These parts are pitch gear, pitch bearing, main bearing, gearboxes, yaw gear, yaw bearing and generator bearings. Heavy loads, environmental factors, vibrations and corrosion, cause wearing even to the highest quality mechanical components. It implies as essential a proper and better lubrication, in order to avoid more than 35% of the failures which still happens nowadays due to mechanical breakdowns of these components. In particular, gearboxes are so sensitive to breakdowns that – also due to other factors – new designs of WTGs have been developed under the concept of direct drive, that is, without gearboxes.

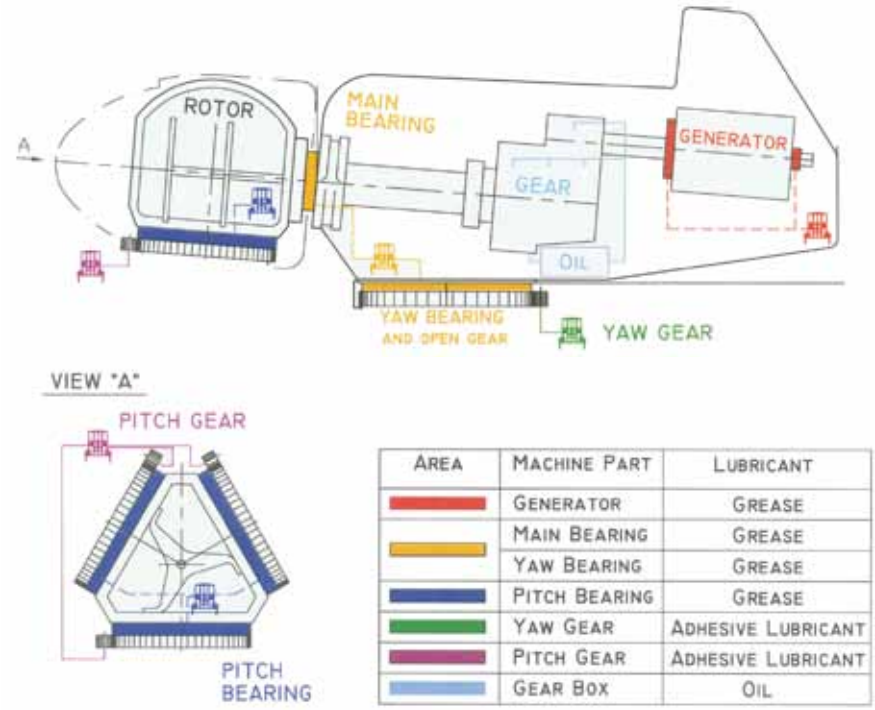
Lubrication

In order to achieve the best performance of any WTG, it is essential to trust the lubrication methods and systems to specialised companies. Best decision implies to install automatic lubrication systems for those weak parts of WTGs. Latest developments also allow to perform this task manually, by using a grease pump and external devices, to deliver a prescribed volume of lubricant to pitch (or yaw) bearings at the same time through every lube point, meanwhile pitch system is activated. This way grease is better distributed inside the bearing, overpressure is avoided, and as consequence the sealing does not suffer any damage. The key of this new development is to balance the operating pressure and the grease flow to every lube point of the bearing under any environmental condition, and to allow the maintenance operator a permanent monitoring of this task. This method might be acceptable for small or medium size WTGs with no automatic systems installed.

It must not be forgotten that lubricant is the main actor at this performance. Grease physical properties and weaknesses – if any – should be analysed before designing every automatic lubrication system. Pump-stations, metering devices, instrumentation and interconnection accessories are not enough by themselves. The behaviour of each system must be studied and tested in advance, as well as lifetime calculation, lubrication cycles, physical and environmental conditions inside each WTG model. These factors join to integration, accessibility for maintenance staff, electrical monitoring, and in-house installation of lubrication systems, will determine the right – or not – grease supply at pitch, rotor, yaw and generator bearings and gears. As consequence, it will directly affect to the failure rate, maintenance cost, loss of energy generation and

definitively it will set if the theoretical return of investment is feasible.

Another important consideration about operation and maintenance companies is the qualification and specific training of the technical staff. It is supposed a complete knowledge about electrical, mechanical, hydraulics and structural components of the WTG to maintain. I wonder what about lubrication systems and tools. Grease equipment knowledge must belong to the skills of maintenance operators. Investing in training is always profitable.



AREA	MACHINE PART	LUBRICANT
	GENERATOR	GREASE
	MAIN BEARING	GREASE
	YAW BEARING	GREASE
	PITCH BEARING	GREASE
	YAW GEAR	ADHESIVE LUBRICANT
	PITCH GEAR	ADHESIVE LUBRICANT
	GEAR BOX	OIL

Breakthrough solutions

If you keep doing the same, why do you expect different results? The target of cost reduction should not imply lower quality. Moreover, better quality does not only imply the right products, but it also needs outstanding design of the lubrication processes, tasks and systems. That is the key.

It implies to study the lubrication needs of the bearing or gear from its design. Common mistakes come from inherit the lubrication systems from a WTG model by adapting it to a similar one. Just the modification of the lubricant might require modifying the entire lubrication system. First of all it is mandatory to define the lubricant to be used, mode of control desired, frequency of lubrication cycles according to operation requirements, volume of grease injected, recovering of waste grease and the layout of lubrication points. Engineers specialised in lubrication system for WTG will be able to determine the most suitable technical system, and to develop a first draft. Depending on the lifetime expected, resources available in the WTG, corrosion issues and integration, the appropriate products can be chosen. Later on, it is necessary to perform operation and endurance tests under working conditions. To complete the process, logistic and installation instructions must be taken into account. Labelling, pre-assembly, protection devices and right packaging are as important as the design of the system, due to serial manufacturing of WTGs requires plug-and-play subcomponents to complete the installation of the automatic lubrication systems. Technicians in charge of erection and commissioning in every wind farm should receive proper training and instructions about how lube systems work, and how to fix eventual problems which might happen during the start up. Last but not least, the maintenance company contracted should receive training and components information, directly from the designer of lube systems.

Next steps

Wind energy market is nowadays focused on Offshore WTGs, mainly under the concept of direct drive. The huge (and expensive) resources necessary for maintain operations and repairing tasks, implies to suit automatic lubrication systems into every bearing and gear to protect them from the wearing. In fact, it is expected a tendency of unify lube systems as long as it becomes technically possible. The design and deliveries of lubrication systems – not only the products – must be guaranteed by expertise companies.

Technical systems for automatic lubrication, products improvements, as well as specific tools and devices for transferring grease, are currently being developed to offer a solution to the powerful new WTGs to come. Retrofits of lubrication systems for onshore WTGs are going to be installed within next years, mainly for yaw drives and generators