



Quality For Heavy Duty

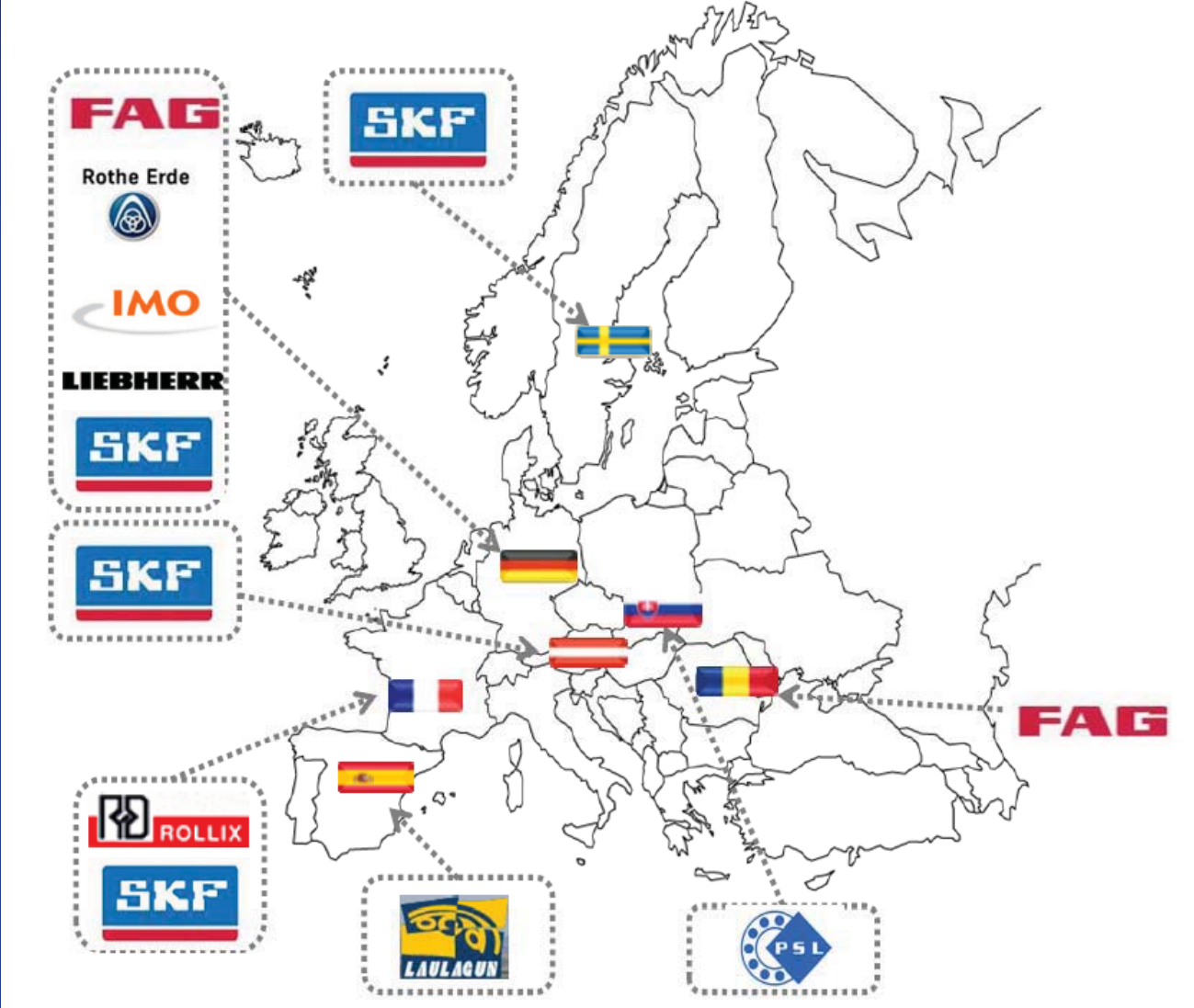
專為重荷載質量的需求

Production Footprint of Wind Turbine Bearing Manufacturers in Europe

歐洲主要的風機軸承製造廠



Quality For Heavy Duty

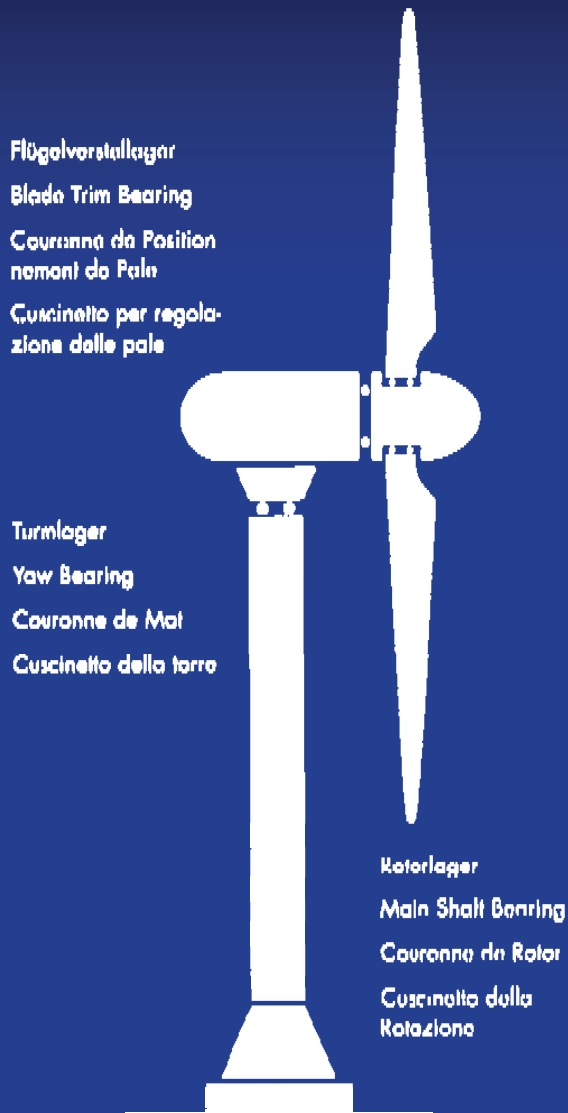


Source: MAKE Consulting - May 2009

風機用軸承 Bearings For Wind Turbines



Quality For Heavy Duty



葉片變槳軸承

- Blade Trim (Pitch) Bearings – they are used to adjust angle of attack the blades in order to regulate speed of the windmill

偏航軸承

- Yaw Bearings – they are used for aligning the whole nacelle to be in direction the rotor blade plane facing the wind

主軸軸承

- Main Shaft Bearings – they are used to arrange the rotor of the wind turbine in the housing of the nacelle

PSL 能生產這三種軸承，整套供應風機使用

PSL is capable to deliver complete bearing packages for wind turbines



PSL 變槳軸承與偏航軸

PSL Blade (Pitch) and Yaw Bearings



Quality For Heavy Duty

- Basically both types of bearings have the similar characteristics

兩種軸承基本上有近似的性質

- PSL delivers single or double row ball bearings with external or internal gearing and a high capacity

PSL供應單、雙列滾珠帶內齒輪或外齒輪的高荷載軸承

- Roller bearing rings are manufactured from the high quality induction hardened steel 42CrMo4

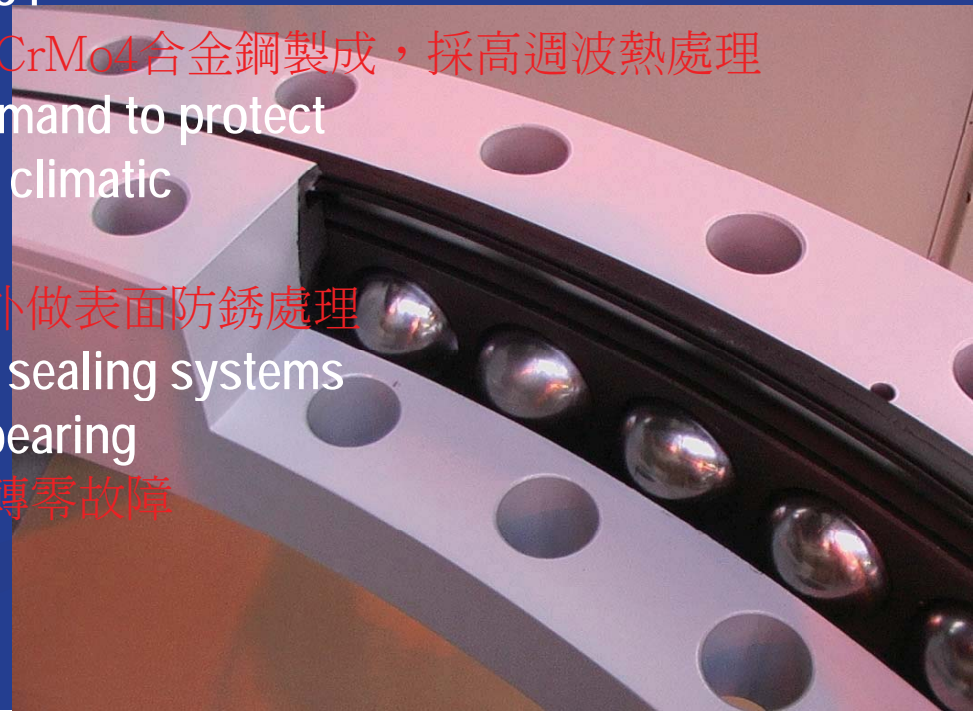
滾珠軸承的內、外環是以高質量的 42CrMo4 合金鋼製成，採高週波熱處理

- Anticorrosion system is applied on demand to protect the surfaces that are exposed to severe climatic conditions

暴露於惡劣氣候環境中的軸承，可另外做表面防銹處理

- Appropriate selection of lubricant and sealing systems to ensure trouble free operation of the bearing

合宜的潤滑和密封系統可確保軸承運轉零故障



PSL 變槳軸承與偏航軸承

PSL Blade (Pitch) and Yaw Bearings

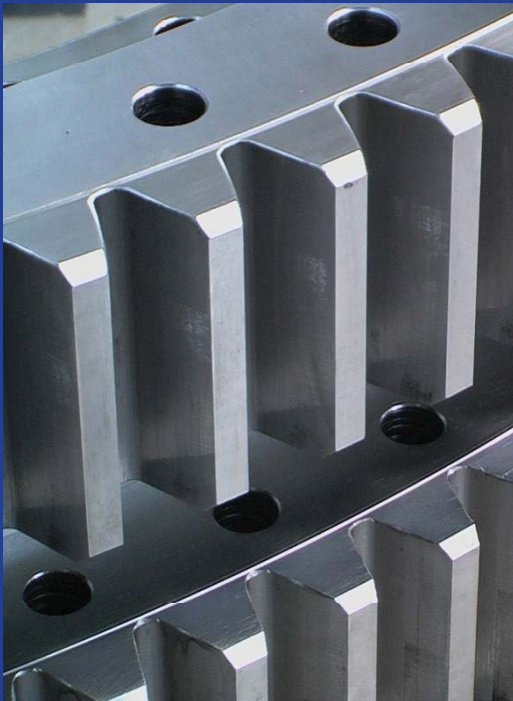


Quality For Heavy Duty

PSL開發製造的葉片(變槳)軸承和偏航軸承，可經由精密調整來符合客戶的需求

- PSL develops and produces blade and yaw slewing bearings which are precisely adjusted to meet needs of our customers

- Outer diameter dimensions up to 4 000 mm
最大外徑可達4米



PSL 的風機主軸軸承

PSL Main Shaft Bearings



Quality For Heavy Duty

- 依照風機的設計概念，可提供不同的軸承組合設計方案
- Various design schemes of the bearing arrangement are used depending on a concept of the wind turbine

- PSL提供廣泛的軸承型式供風機主軸使用，包含單列跟雙列
- PSL delivers wide range of bearing types appropriate for wind turbine main shaft applications which include single and double-row tapered roller bearings, double-row spherical roller bearings as well as cylindrical roller bearings 圓錐滾子軸承，雙列球面滾子軸承(自動調心軸承)，以及圓柱滾子軸承

- Roller bearing rings are manufactured from the high quality case hardening steels which provide a combination of high fatigue strength/high wear-resistance due to the hard surface while the softer core gives the component a high toughness

滾子軸承的內外環是以滲碳熱處理的高級合金鋼製成，這種心部軟而外表堅硬的特性，使軸承具高耐疲勞及高抗磨耗性



PSL 的風機主軸軸承 PSL Main Shaft Bearings



Quality For Heavy Duty

PSL開發製造的風機主軸軸承，可經由精密的調整來符合客戶的需求

- PSL develops and produces main shaft bearings which are precisely adjusted to meet needs of our customers

PSL 軸承的規格型式涵蓋現代化市場的主流需求

- PSL bearing dimensional range includes types matching general requirements of the up to date market

PSL 軸承的設計完全考量到各項複雜的作業荷載

- PSL bearings design fully considers defined complex operation loads

PSL 提供服務支援，最大化設備的效能跟可靠度

- PSL provides a customer support to maximize equipment performance and reliability



PSL 主軸軸承的測試

PSL Testing of Main Shaft Bearings



Quality For Heavy Duty

Dynamic rating
and
life determination
at test bed

額定動荷載、壽命於
測試台上測定

- pair of tapered roller bearings is tested
- axial loading up to 5,000 kN
- rotational speed range from 25 to 40 rpm
- temperature of bearing rings and vibrations are monitored





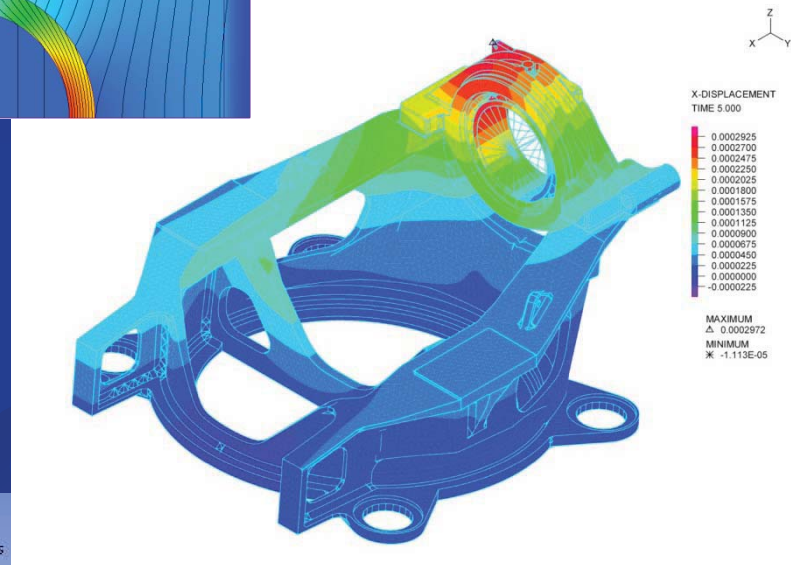
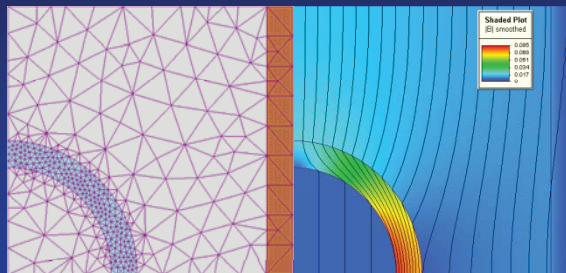
Quality For Heavy Duty

Finite Element Method (FEM)

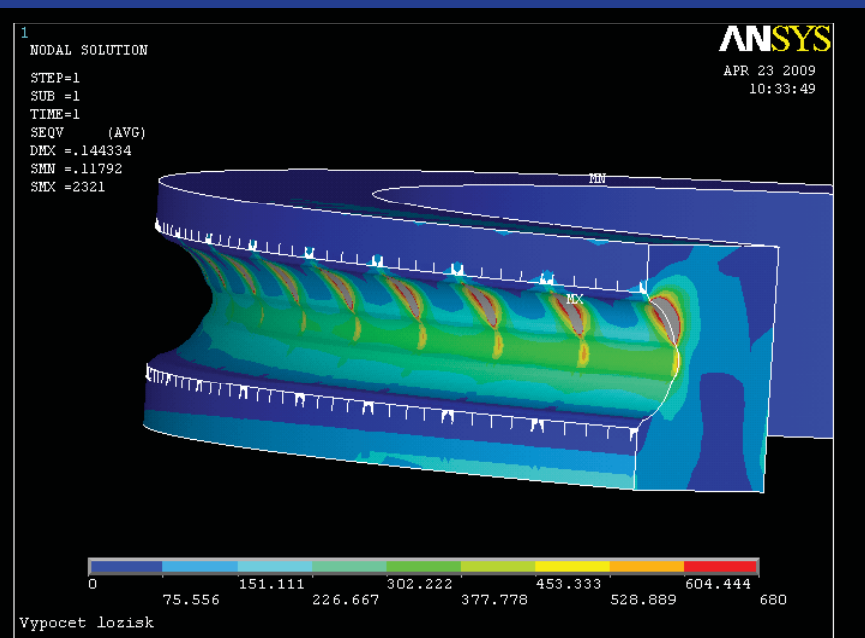
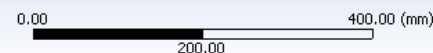
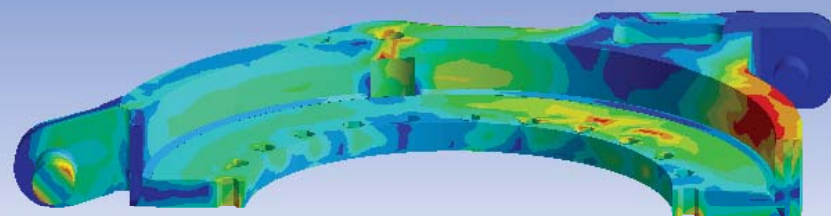
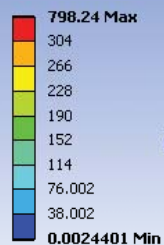
有限元素分析法

PSL 廣泛的應用有限元素數值分析技術，對軸承元件的應力做分析

PSL widely uses FEM numerical technique for stress analyses of bearing components



Equivalent Stress
Type: Equivalent (von-Mises) Stress
Unit: MPa
Time: 2
29. 5. 2009 11:06



Vypocet lozisk

PSL 風機用軸承

PSL Bearings For Wind Turbines



Quality For Heavy Duty

E82



- Main shaft bearings 主軸軸承
- Blade bearings 葉片(變槳)軸承
- Yaw Bearings 偏航軸承



PSL 是德國 ENERCON 及美國 Clipper 兩大風機的主要軸承供應商

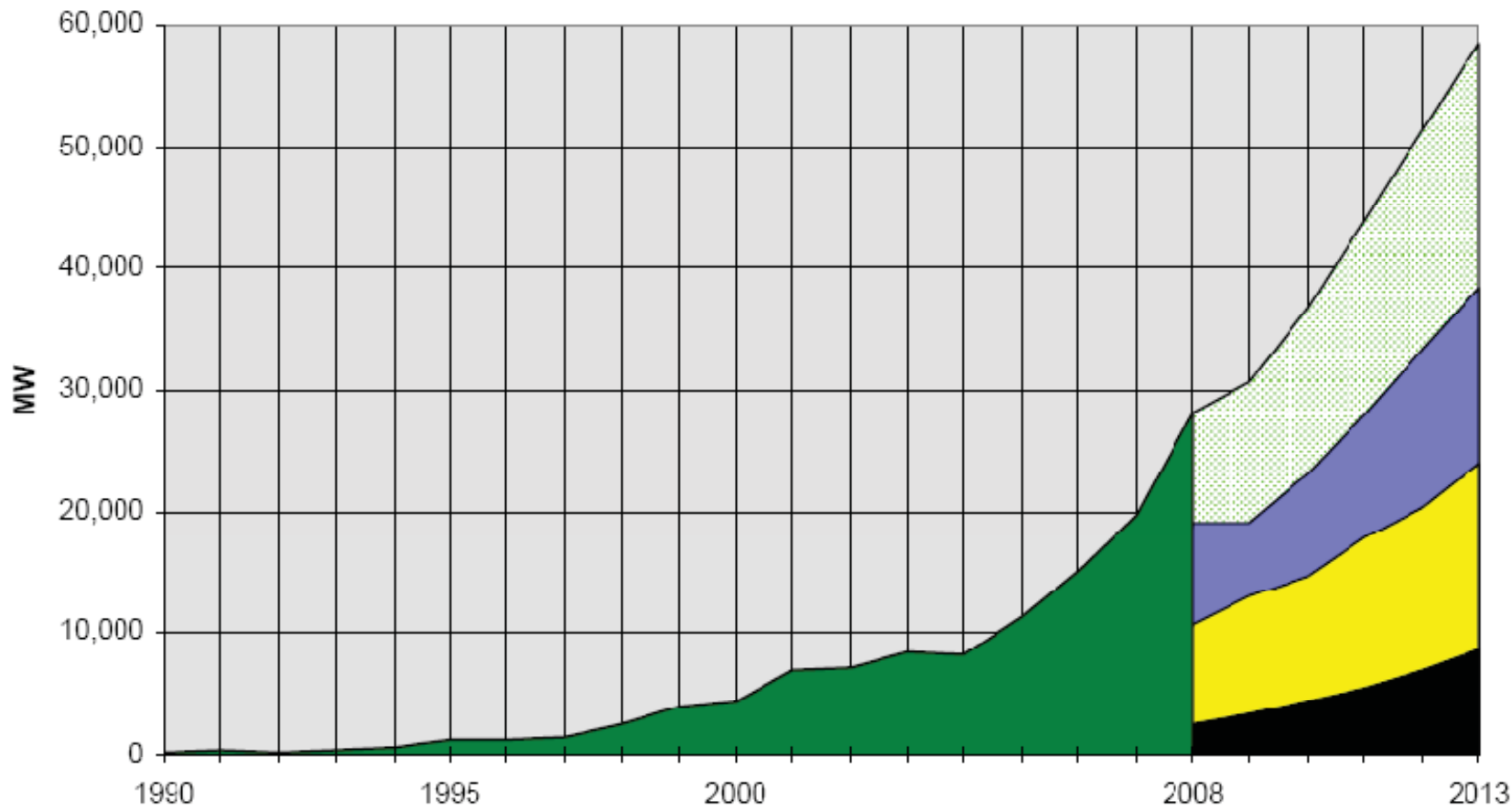
1990 - 2008 實際風能開發 Annual Wind Power Development

Actual 1990 - 2008 & Forecast 2009 -2013

2009 - 2013 風能開發的預估



Quality For Heavy Duty



Source: BTM Consult ApS - March 2009

Legend: Europe (light green), USA (purple), Asia (yellow), Rest of World (black), Existing (green)