

RENEWABLE ENERGY

WIND ENERGY PRODUCTION

Seals for Wind Mill:

- Base Bearings
- Shaft Bearings
- Blades

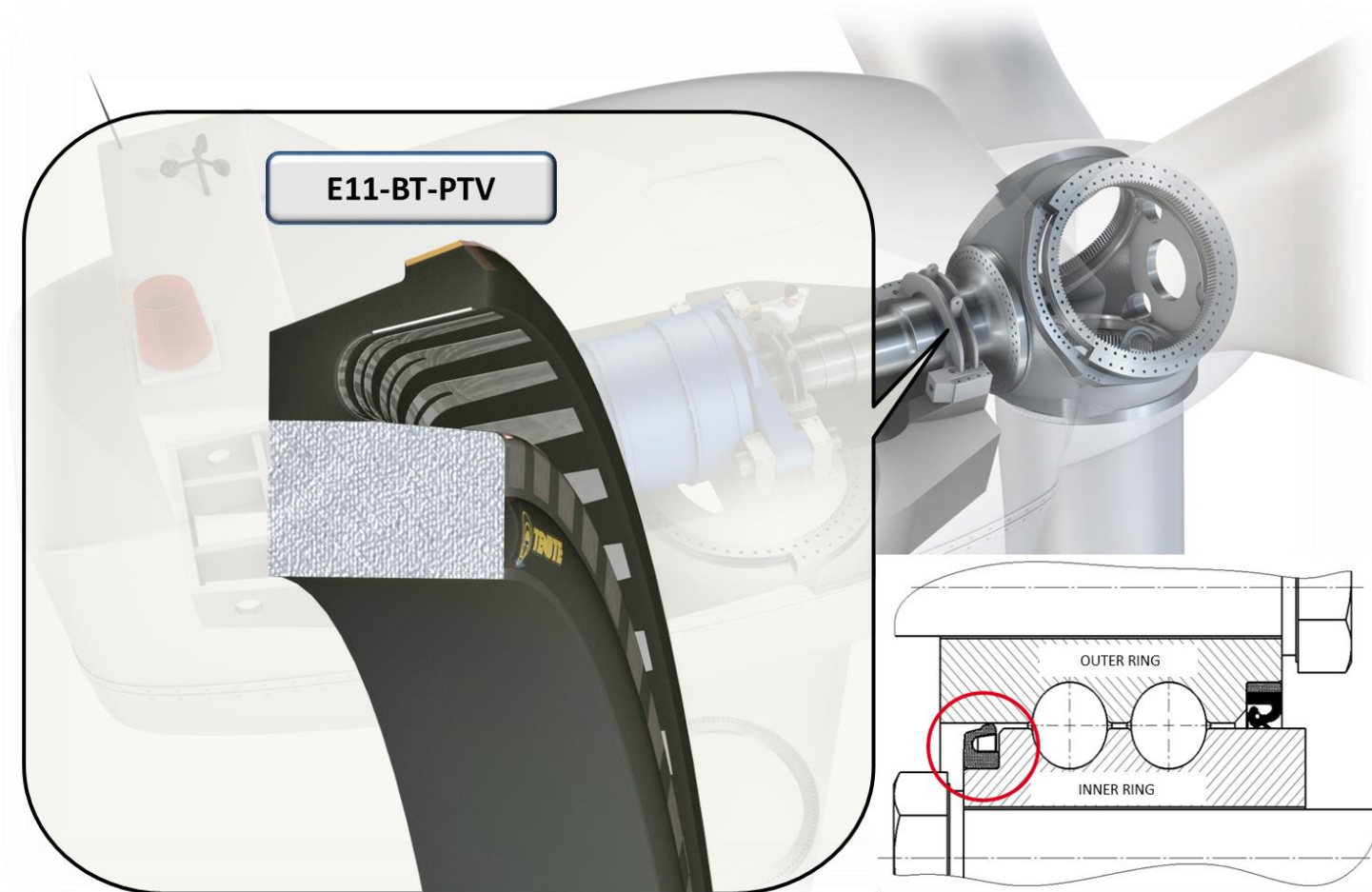
Base Bearing



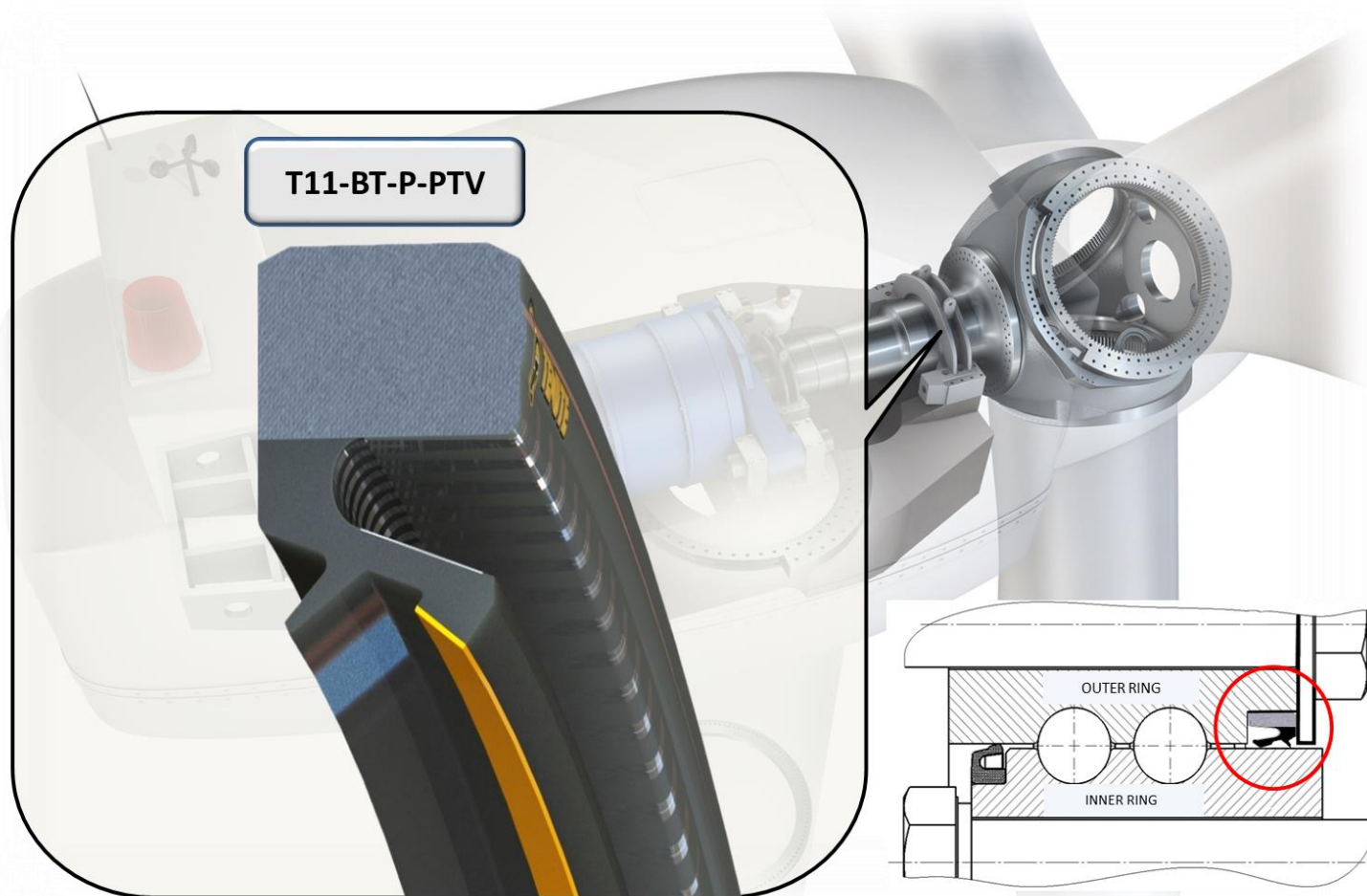
Base Bearing



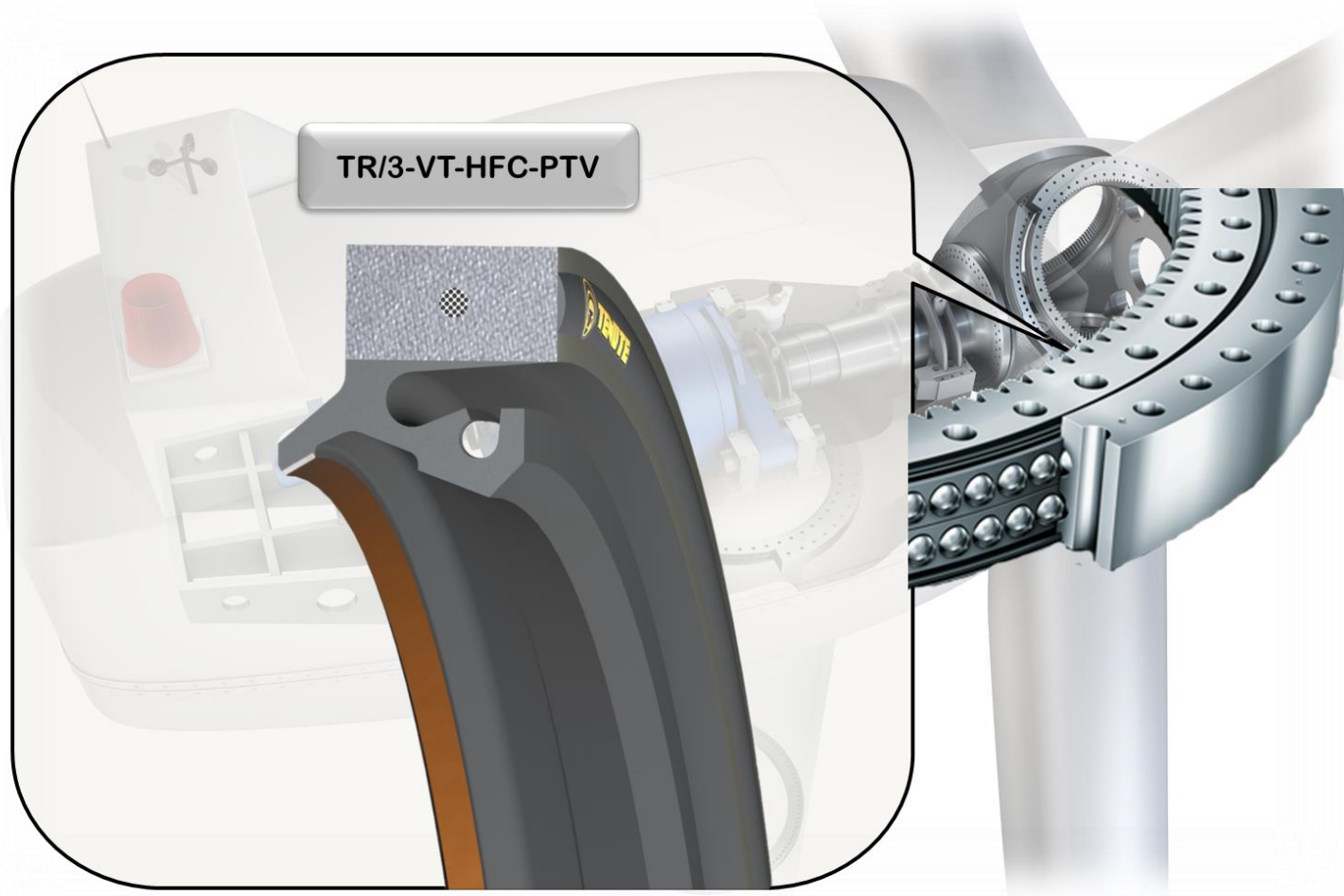
Main Shaft



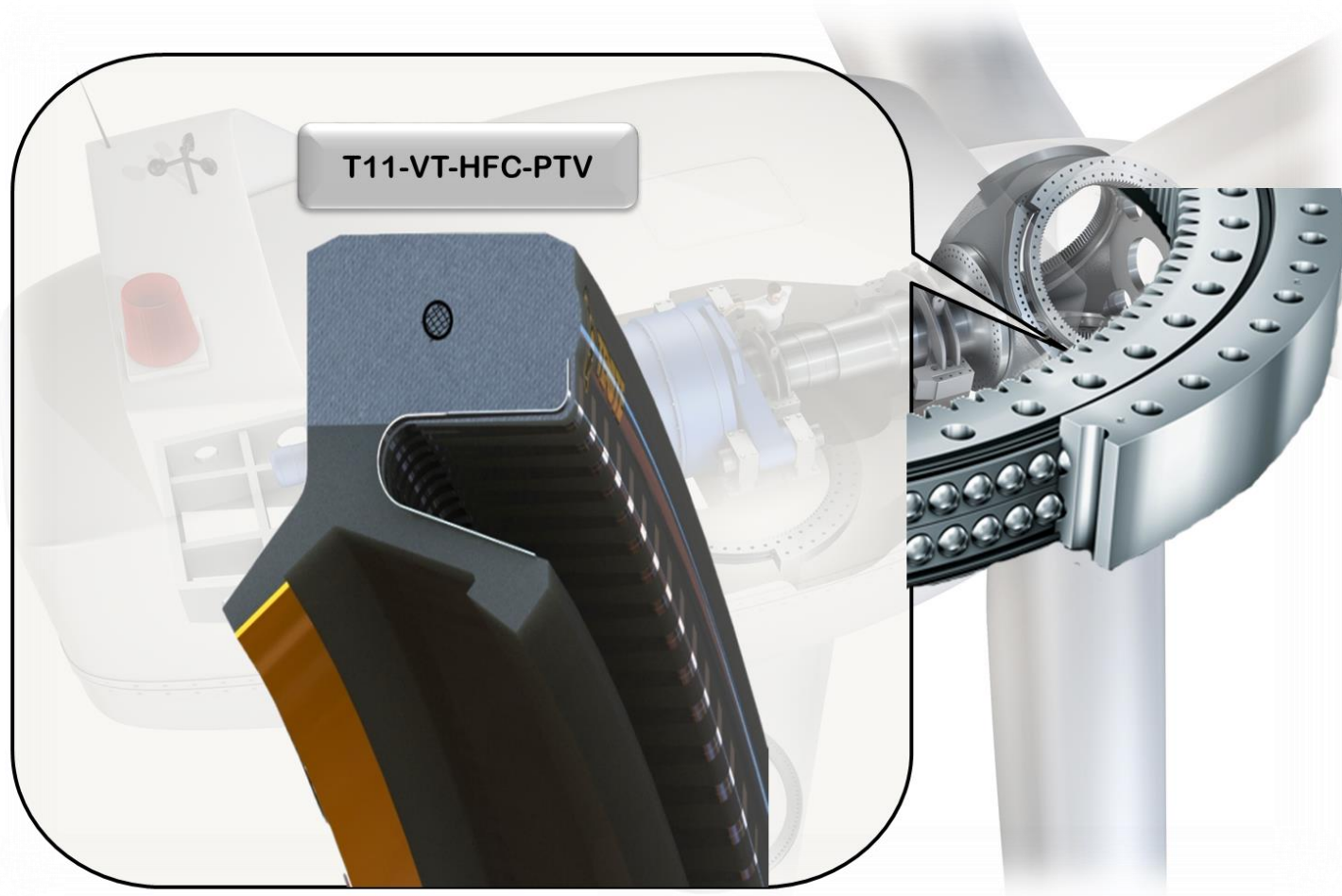
Main Shaft



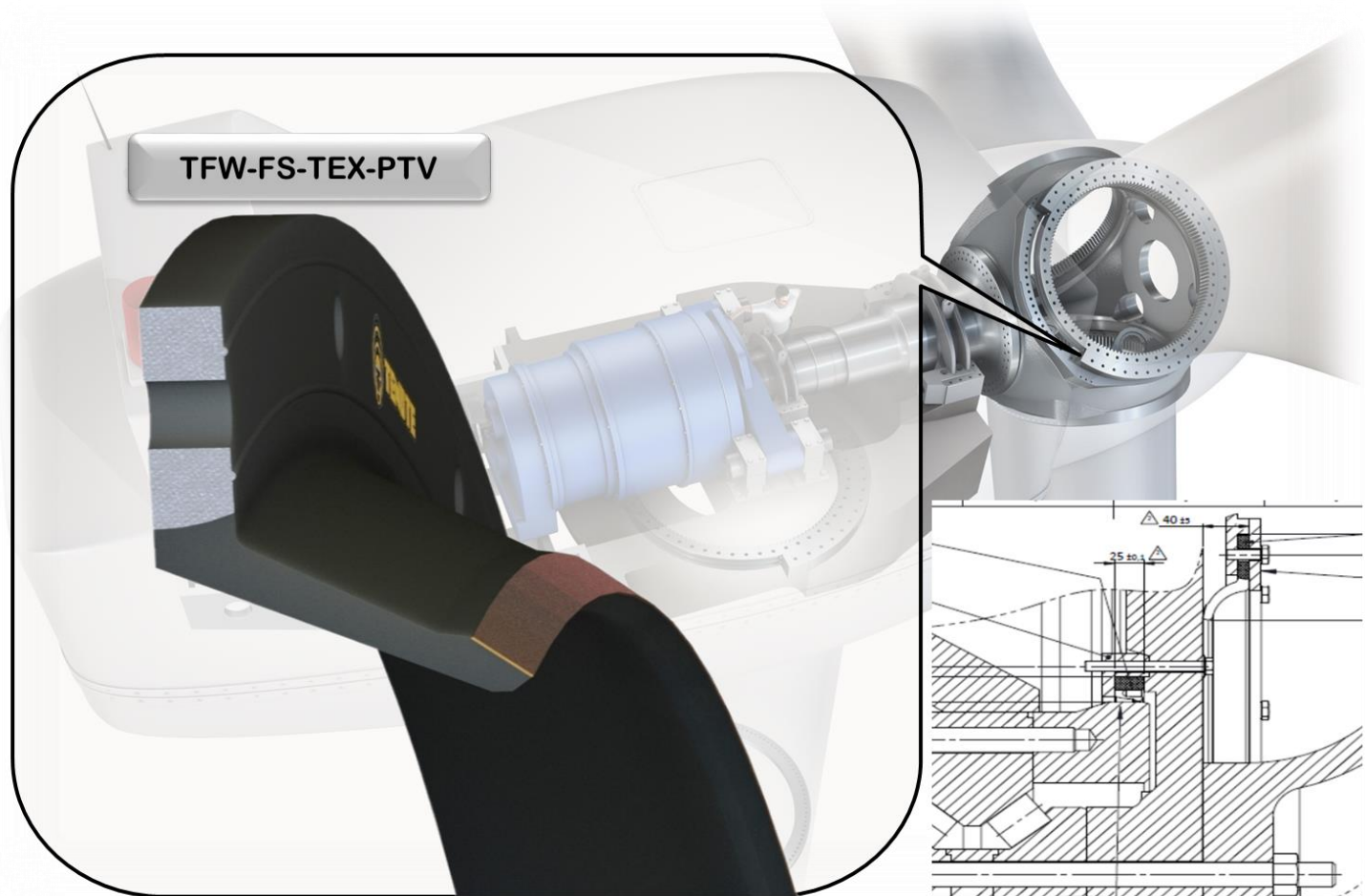
Blade Bearing



Blade Bearing



Blade Bearing



BLUE ENERGY PRODUCTION

Blue Energy

Harnessing the Blue Energy

WaveRoller

A WaveRoller device is a plate anchored on the sea bottom at its base. The back and forth movement of the tidal surge moves the plate, transferring the kinetic energy created to a piston pump.

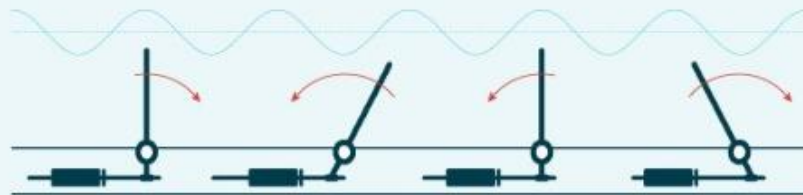
AW-Energy has developed and patented the WaveRoller technology for harnessing the power of the surge phenomenon. The first prototypes were designed and patent applications filed as early as 1999, when Rauno Koivusaari, the original inventor co-operated with Fortum Research during the conceptual phase. Since then the technology has evolved following numerous laboratory tests as well as marine tests conducted in the European Marine Energy Centre (EMEC), Scotland and in Peniche, Portugal.

A series of plates can be used to create an element farm and produce a larger power output. In this kind of element farm a series of piston pumps create a great deal of pressure which is fed into a collection system that then drives hydraulic motor/generator combination(s) to produce electricity.

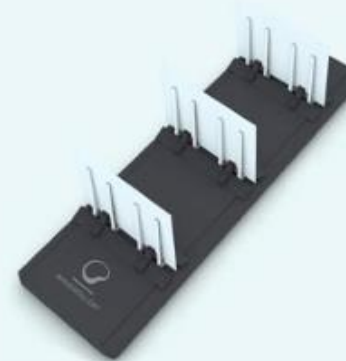
An individual production-sized plate is designed to produce a nominal capacity of up to 600 - 800 kW of electrical power depending on the site. Since the plant construction is modular and there is no natural upper limit to the number of plates that can be used, offering a high level of scalability.

THE WAVEROLLER PRINCIPLE

The phenomenon that WaveRoller utilizes for electricity production is called surge. It is a ubiquitous phenomenon well documented in theoretical wave literature.

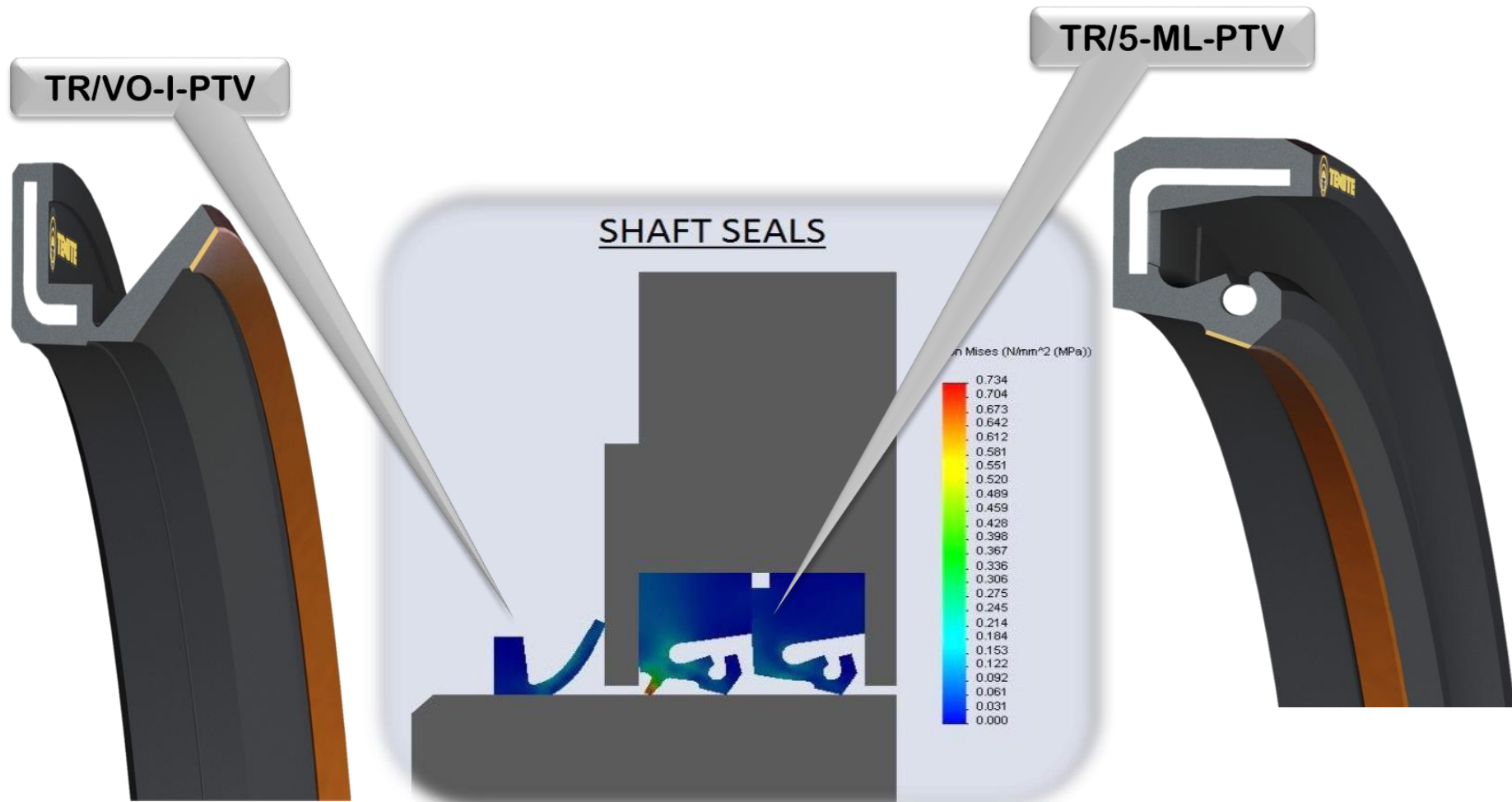


Principle of the oscillating wave surge converter



WaveRoller 3x100 kW prototype

Blue Energy



ENGINEERING

Research and Design
Design Analysis and Approval
Quality Control

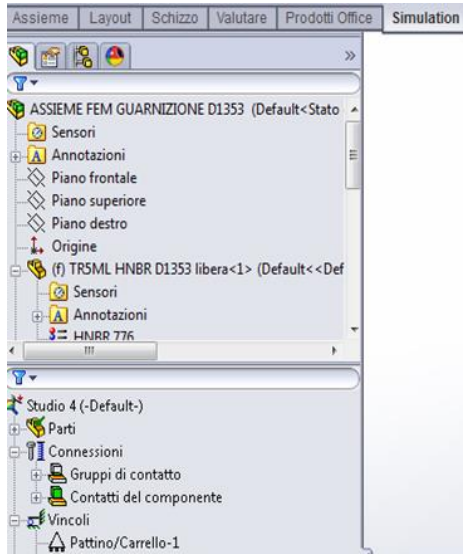
Research – Materials Lab

Our in-house lab creates special materials for the wind energy and marine industries. The lab is equipped to run the following tests:

- Oil compatibility to ASTM standards
- Abrasion resistance
- Compression set
- Rheometric

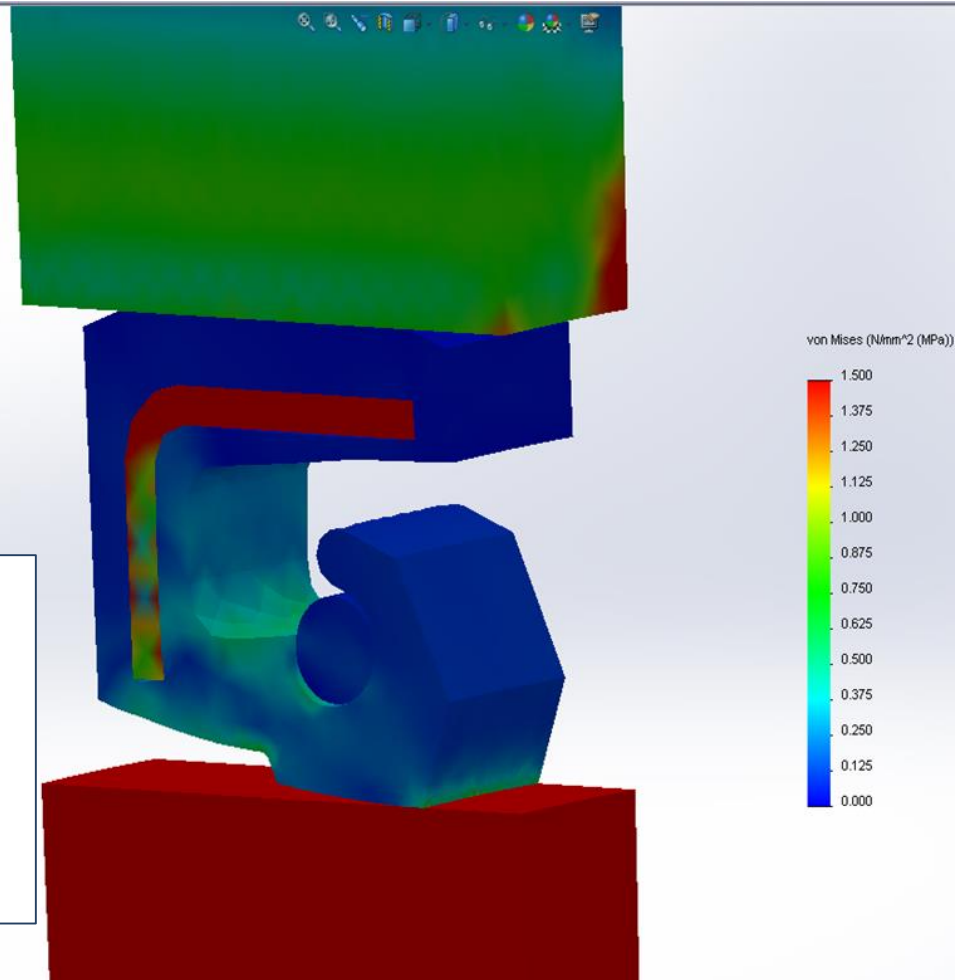
MATERIAL	TEMPERATURE C°	SPRING STANDARD MATERIAL
NBR	-30° +100° (120°)	Carbon Steel
HNBR	-40° +150° (175°)	Carbon Steel
VMQ	-50° +200° (250°)	Carbon Steel
FKM	-20° +200° (250°)	AISI 302

Design Analysis

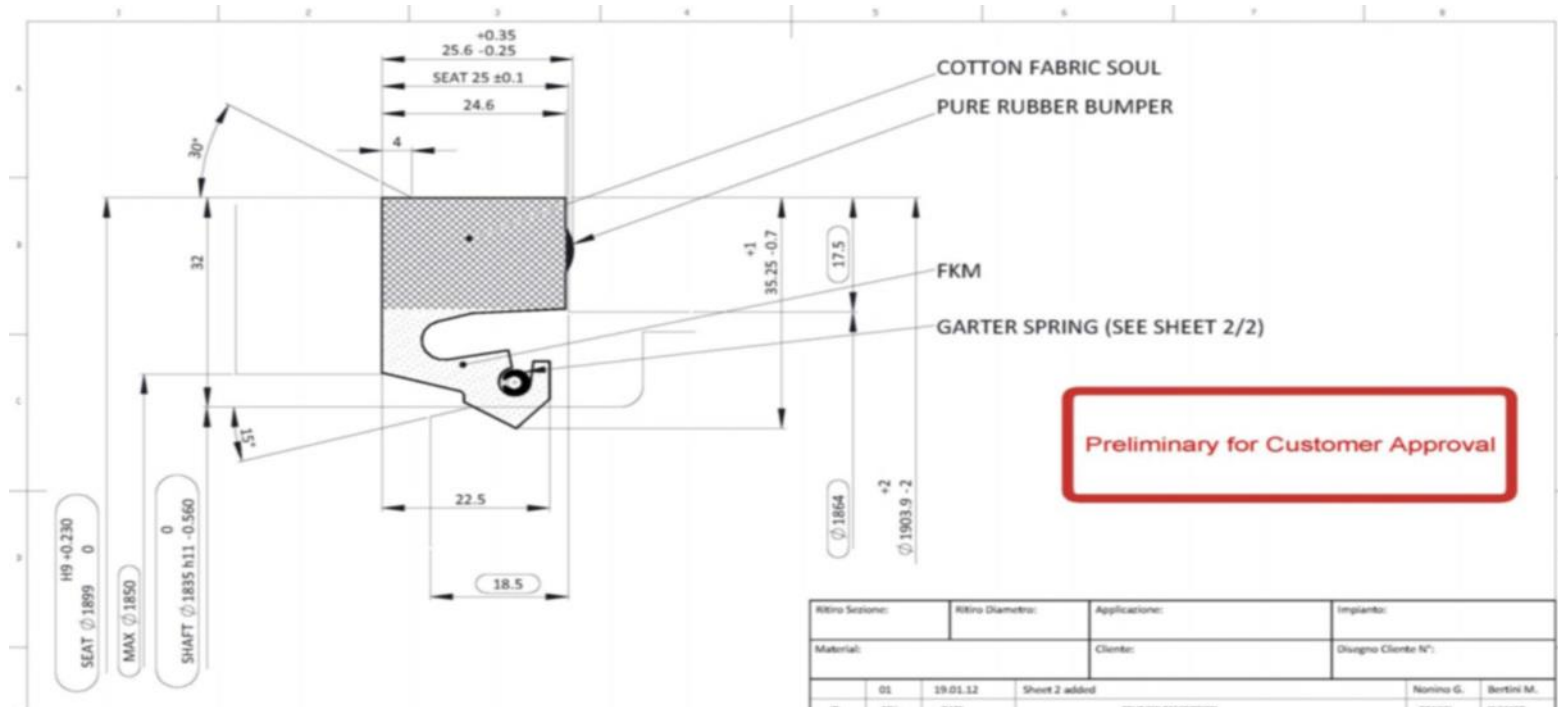


With dimensional data and application requirements, engineering is able to design products that offer greater seal effectiveness.

Use of FEM can simulate expected results.



Design Approval



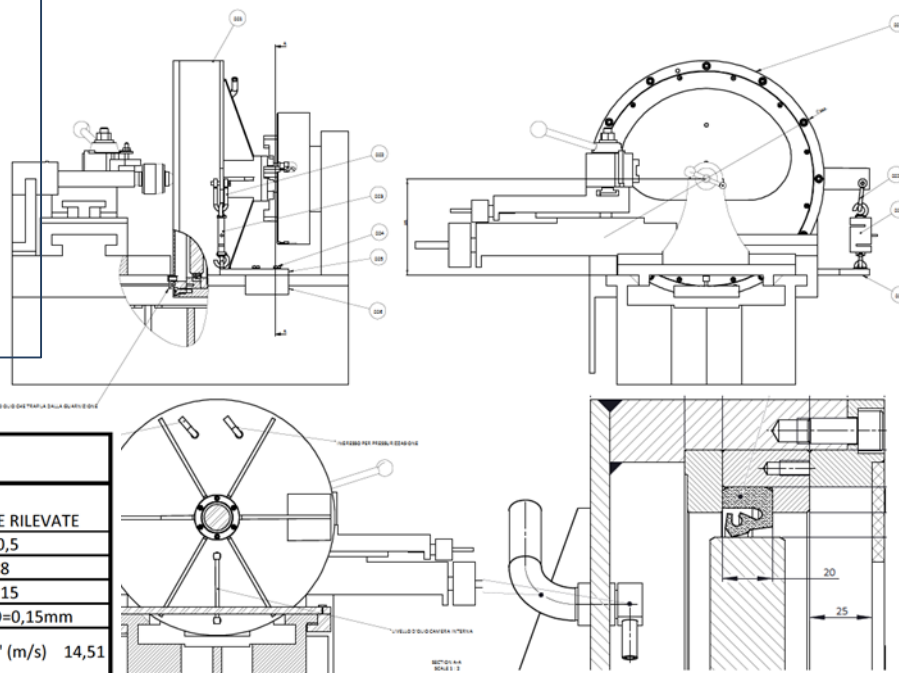
Custom projects are approved through detailed drawings, that are then used for quality control as an exit inspection. Seals are laser etched with data to ensure traceability.

Ritiro Sezione:		Ritiro Diametro:		Applicazione:		Impianto:	
Material:		Clonatore:		Disegno Cliente N°:			
01	19.01.12	Sheet 2 added				Norino G.	Bertini M.
01	REV:	DATE		REVISION DESCRIPTION		DRAWN	CHECKED
Weight kg		General Roughness		General Tolerances		Scale	
				ISO 3302		2:1	
				Title		A3	
				TR/3H			
				$\phi 1835 \times 1899 \times 25$			
				Part Number		N° of Sheets	
				D139300000		2	
						Sheet	
						3	
Approved: Name: Norino G. Date: 11.01.12 Checked: Bertini M. Date: 11.01.12 Approved: Ravanelli R. Date: 11.01.12							
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Quality Control – Seal Testing

Seals are tested and reported on:

- Speed
- Time
- Temperature
- Misalignment
- Torque loss
- Leakage



6° TEST GUARNIZIONI						
CODICE:	TR400021039 (rif.stampo n. 5160)				MISURE RILEVATE	
MISURE NOMINALI:	490x440x22				ØEST. 490,5	
MATERIALE:	gomma = PFK0447 tela=				F	27,8
MOLLA:	Sviluppo 1396 mm.				H	22,15
SMUSSO:						
ECCENTRICITA' RISCONTRATA =0,02mm			SPOSTAMENTO ASSIALE RISCONTRATO=0,15mm			
GIRI AL MINUTO (n°/1')					630	
					VELOCITA' (m/s) 14,51	
	dati partenza	dopo 5"	dopo 10"	dopo 15"	dopo 20"	dopo 30"
TEMPER. SEDE (°C)	62	65	66	68	71	72
TEMPER. ALBERO (°C)	83	85	86	88	90	92
TEMPER. GUARNIZIONE (°C)	75	78	79	80	81	83
FORZA D'ATTRITO CON	70	68	67	66	65	65
PERDIDE D'OLIO (g)						8

NOTE: . Centratrice attrezzatura/guarnizione: pos.1 (2,5 mm)

. Inizio trasduzione

Quality Control – Seal Testing

Our seals are submitted to rigorous quality checks in accordance with ISO standards including:

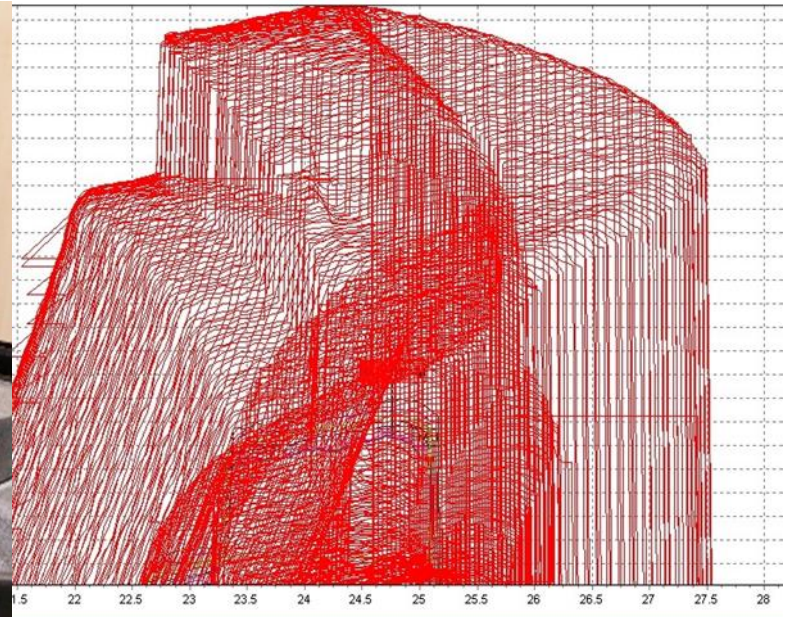
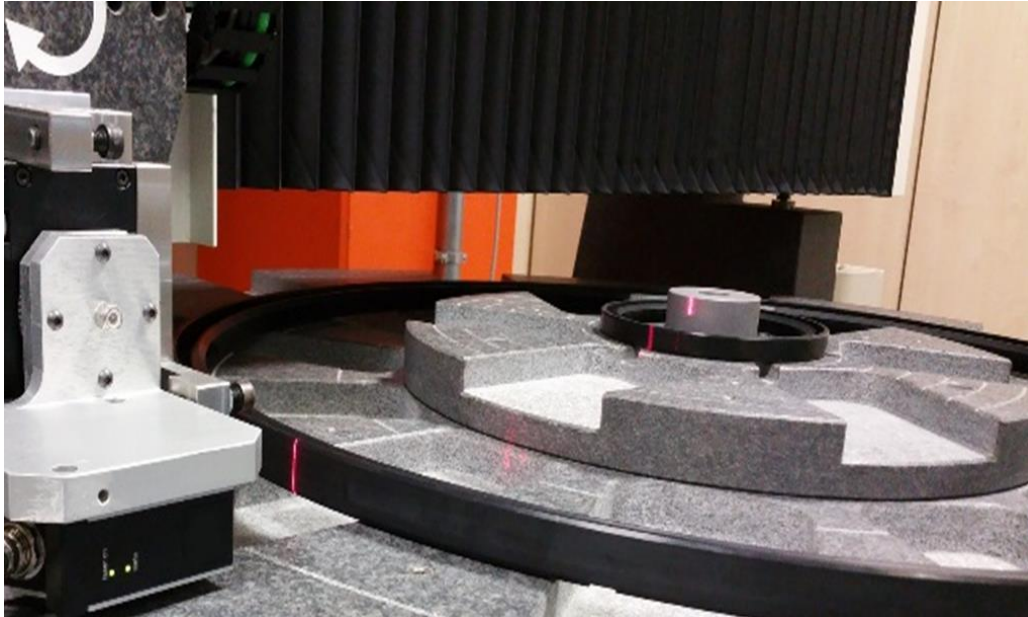
- SPC (Statistic Process Control)
- Six Sigma methods
- Optionally, we can run controls according to Failure Modes and Effect Analysis (FMEA)

Tool R&R				TR5_2 to 10	
				rev.	date
				0	1/3
Part Number	TR500021010		Tool Name	Gauge	
Part Name	TR5/M_PTVHMBR		Tool Number	CAL 01(A8685)	
Characteristic	Width		Tool Type	Digital Caliper	
Nominal	12,2		# of Insp.	# of Trials	# Samples
Total Tolerance	0,4		1	2	10

meas.	operator 1			operator 2			operator 3		
part	1st trial	2nd trial	Range	1st trial	2nd trial	Range	1st trial	2nd trial	Range
1	12,14	12,14	0,00						
2	12,13	12,13	0,00						
3	12,13	12,13	0,00						
4	12,14	12,14	0,00						
5	12,14	12,14	0,00						
6	12,14	12,14	0,00						
7	12,13	12,13	0,00						
8	12,14	12,14	0,00						
9	12,15	12,15	0,00						
10	12,14	12,14	0,00						
Sums	121,38	121,38	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	121,38		RA	0,00		RB	0,00		RC
	242,76	Sum A		0,00	Sum B		0,00	Sum C	
	12,138	X quer A	: 20	0,000	X quer B	: 20	0,000	X quer C	: 20

Calculations	
Max X quer 12,138	Min X quer 12,138
X quer diff 0,000	
R quer = $\frac{RA+RB+RC}{30}$ = 0,000	
Measurement Unit Analysis	
Equipment Variation (E.V.)/Repeatability	
R quer 0,000	K1 4,56
E.V. 0,000	
Reproducibility	
X quer diff 0,0000	K2 3,55
E.V. 0,00	
A.V. 0,000	
Repeatability and Reproducibility	
E.V. 0,000	A.V. 0,000
R & R 0,000	
% R & R 0,00	
Tolerance 0,40	
100 x $\frac{R \& R}{Tolerance}$ = 0,00	
% R & R <= 10: satisfactory	
10 < % R & R <= 30: needs investigation	
% R & R > 30: not acceptable	
Recommendations:	
Gage OK, GRR < 20%	

Quality Control – Polaris



POLITECNICO
DI TORINO

Together with the University of Turin, we have developed a non-touch technology to prevent seals from being damaged during quality control. This Polaris machine can check with an accuracy of:

- $MPE \leq 0,03 \text{ mm} + 1,3 \times 10^{-4} \times D$ on diameter up to 550 mm
- $MPE \leq 1 \times 10^{-4} \times D$ up to 1500 mm



THANK YOU

Questions?

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