

**SKF®**

# SKF LWSS

## Light Weight Sealing System for Wind turbine applications

Presented by Hans-Jürgen Liesegang /Key Account Manager/Renewable Energy  
Presented to Forum Windenergietage 2018 Linstow  
November 2018



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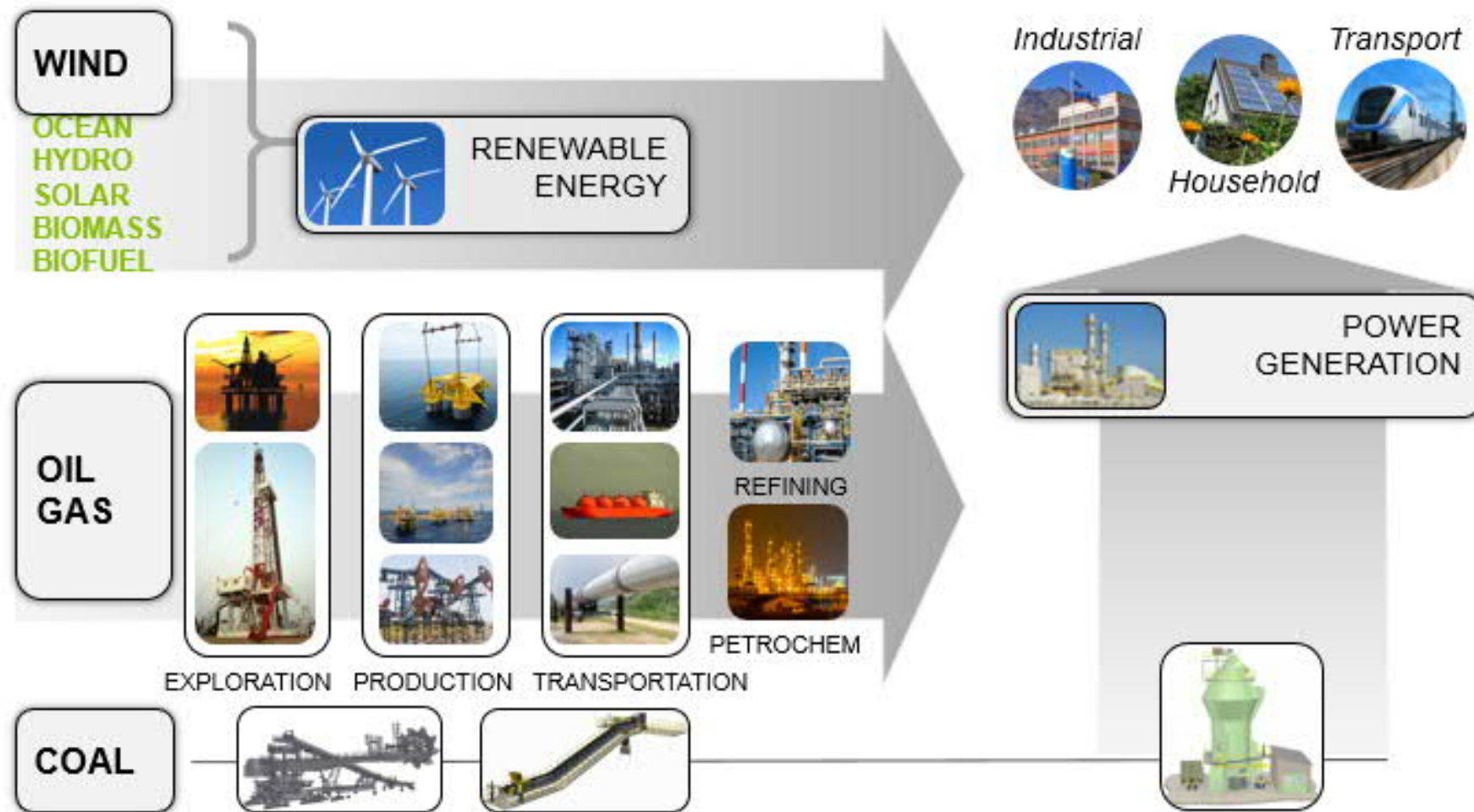
# SKF and the Energy Industry

2018-xx-xx



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# Energy is an important business area for SKF







## SKF and Wind Energy



Wind O&M





Turbines with  
gearbox

Hybrid Turbines

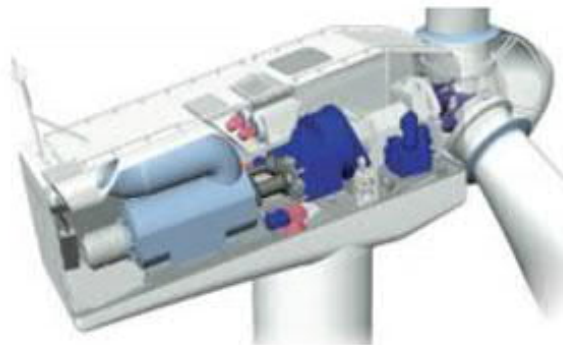
Gearless Turbines  
(Direct Drive)

Generator speeds [rpm]

1200 – 1800

150 - 400

12-30



# SKF offers to the wind industry



SKF high-capacity CRB and  
SKF high-capacity separable CRB

SKF Wind Farm  
Management Conference



SKF Remote Diagnostic  
Services



SKF High Endurance  
Slewing Bearings



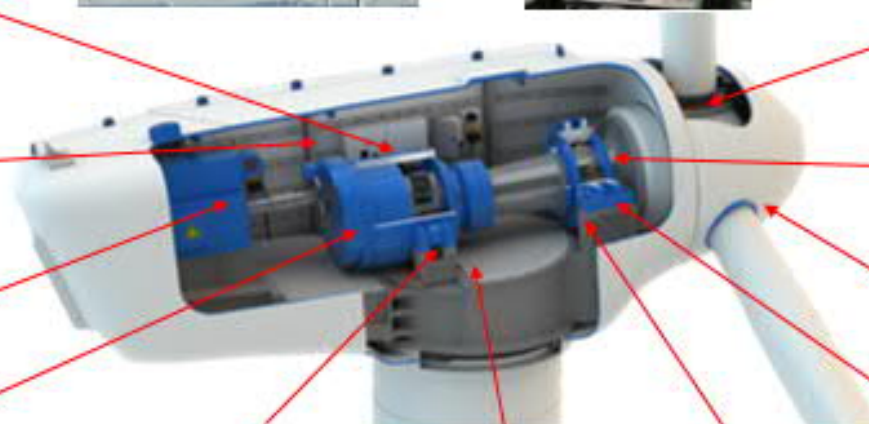
SKF Nautilus



SKF roller bearings  
for wind turbine main  
shafts



SKF WindCon



SKF XL Hybrid  
bearings



Black oxide-  
coated bearings



Automatic centralized  
lubrication kits



SKF Spare part  
management programme



HRS –  
Polyurethane seal



Axial excluder  
seal GR06



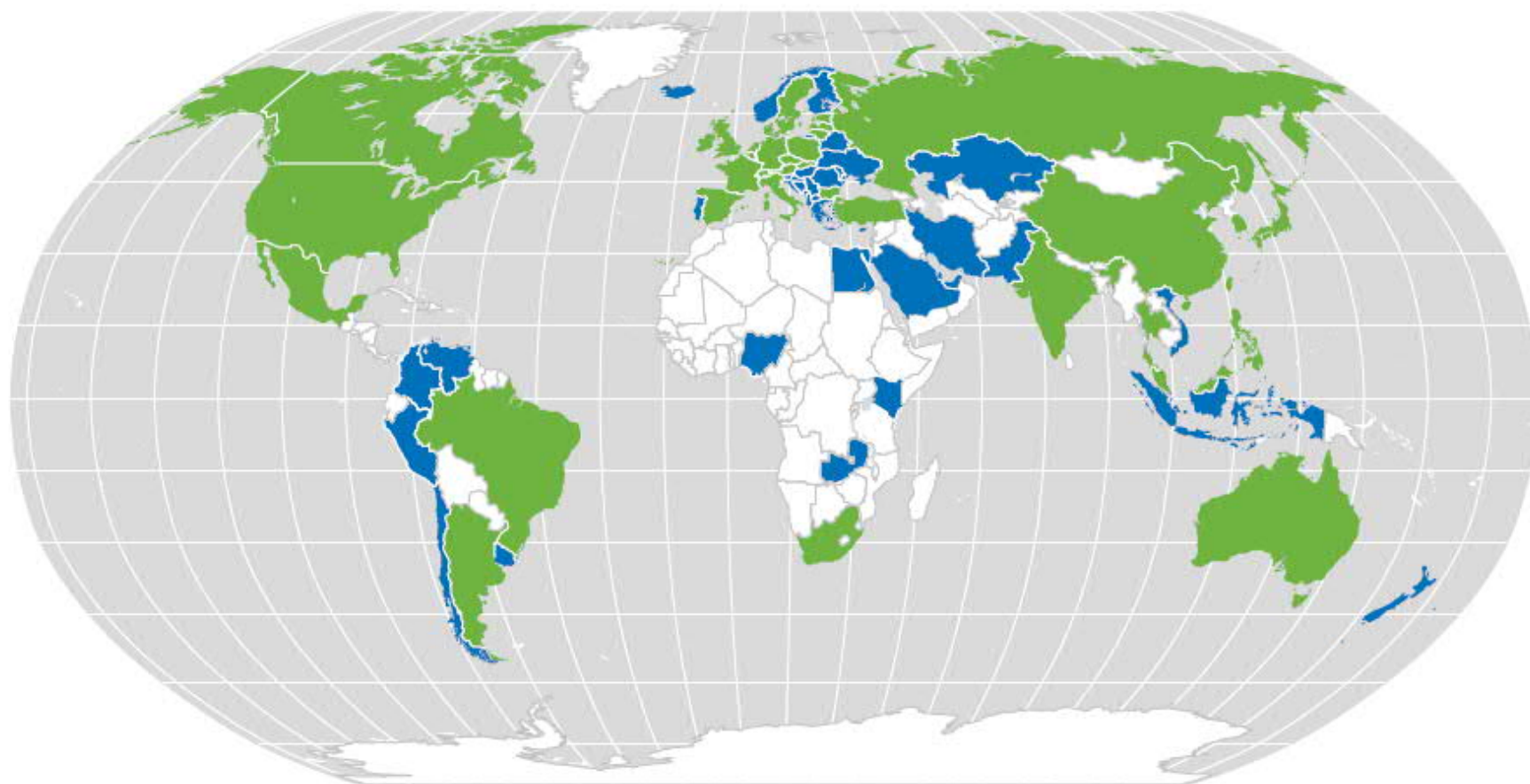
LGBB 2 grease



■ Countries with SKF seals moulding and/or machining facilities, engineering, sales and customer service units

■ Countries with SKF sales, engineering and customer services units

□ In most of the countries in white SKF is represented through authorized distributors/dealers





# Quick facts

LWSS – *Light Weight Sealing System* for Senvion 6.2M152



Project Start 2013

SoP 07/2018

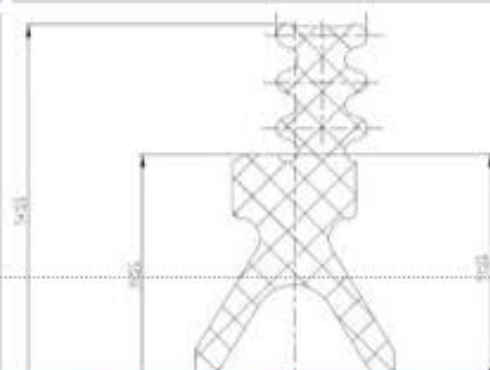
Seal carrier + seal  
for main bearing  
 housings

Seal diameter

Ø 1772 mm &  
Ø 1398 mm

Status: Series delivery

32 wind turbines for  
Trianel



Hans-Jürgen Liesegang

Business Development Manager  
& KAM Erneuerbare Energien



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„Keep grease inside“

„Keep dirt & water outside“



# Customer need

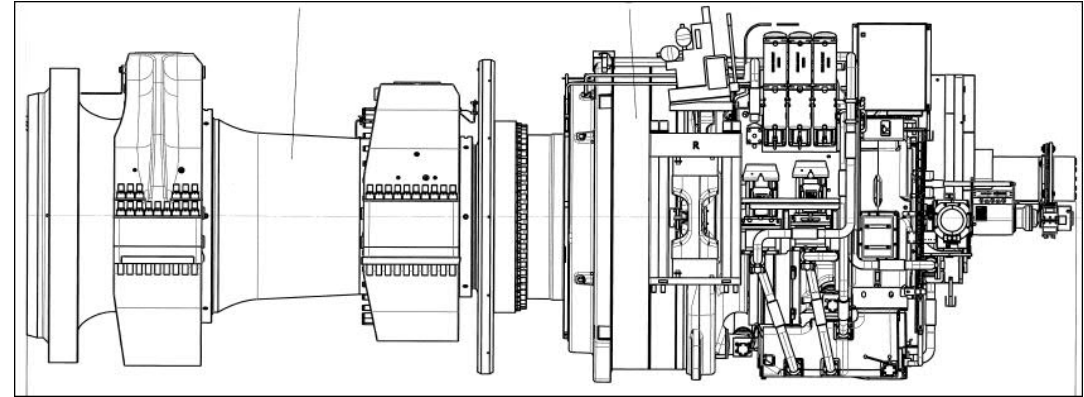
Customer Senvion (Germany) was looking for a new improved Sealing system for the upcoming Wind-Turbine 6.2M-152  
->(predecessor 6.2M-126 with cast labyrinth rings + V-Rings)

„...pollution by dust etc. coming out of nacelle should be less than today and grease-leakages should be less than with the current labyrinth system...” ( Carsten Eusterbarkey,R&D Senvion )

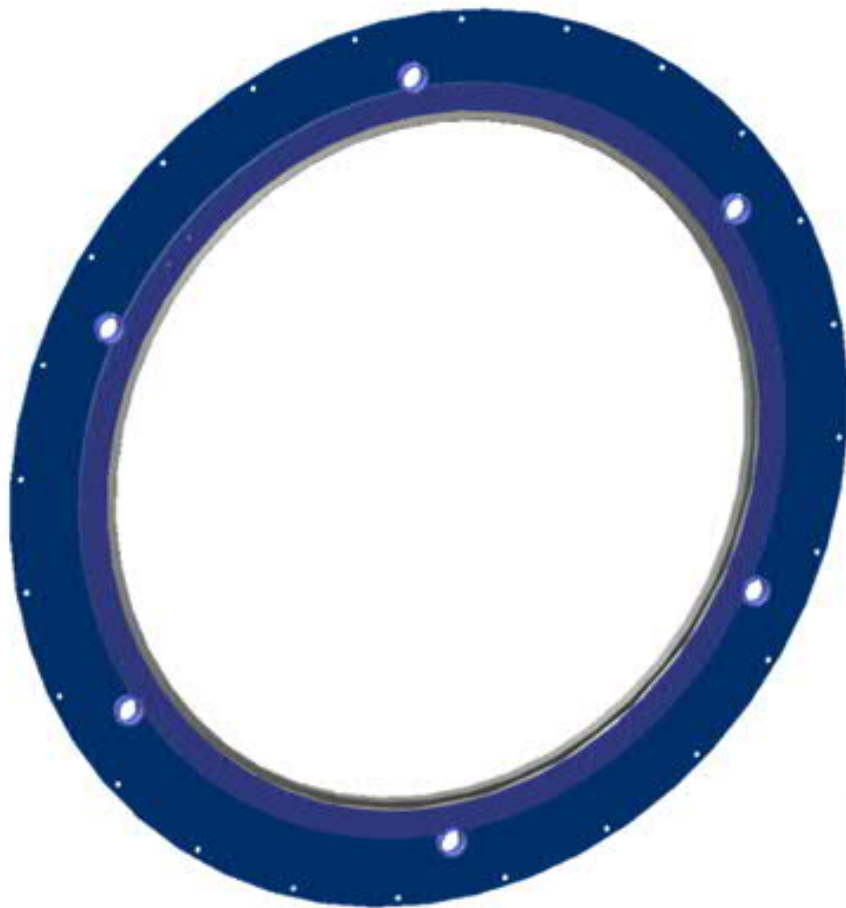


## Further requirements:

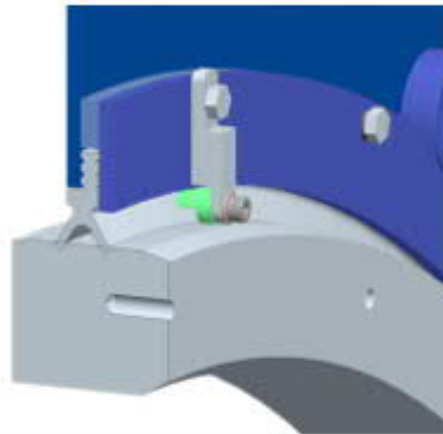
- robust
- reliable
- easy to change/ replace seal
- better inspection of bearing raceways
- dismountable in nacelle (weight reduction)



# SKF proposal

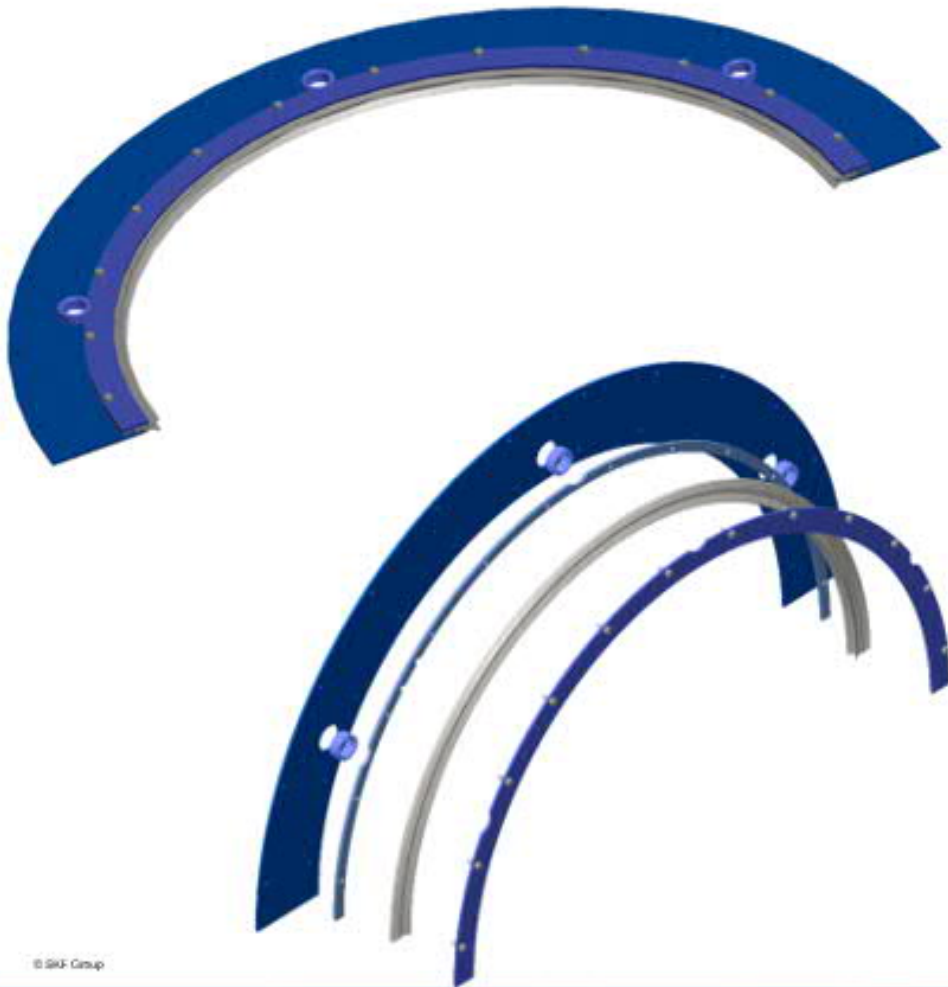


- Replace cast Labyrinth rings with sheet metal sealing carrier → evolution design form one piece sheet metal carrier + radial shaft lip seal (Bild eno)
- simplified design to reduce mounting complexity and manufacturing cost
- All parts bolt up – no welding or metal-cutting operation necessary
- New extruded seal design based on two lip design



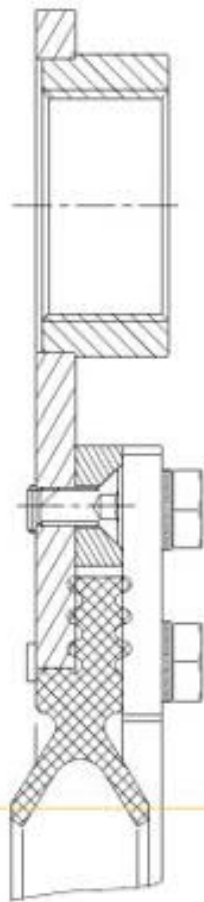


# Sealing carrier design



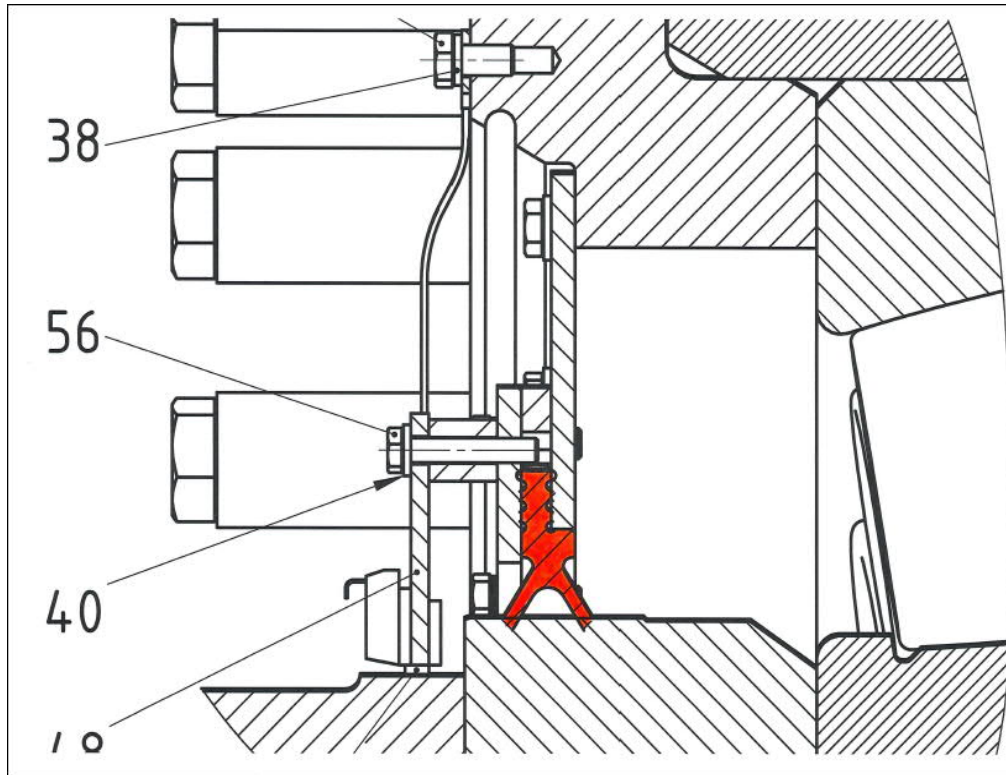
- Sealing carrier delivered pre-assembled
- Split halves for easier mounting / dismounting
- Sheet metal parts not welded – assembly is bolted
- Seal can be easily replaced
- Additional features – like grease outlets etc. - can be implemented

# Sealing carrier design

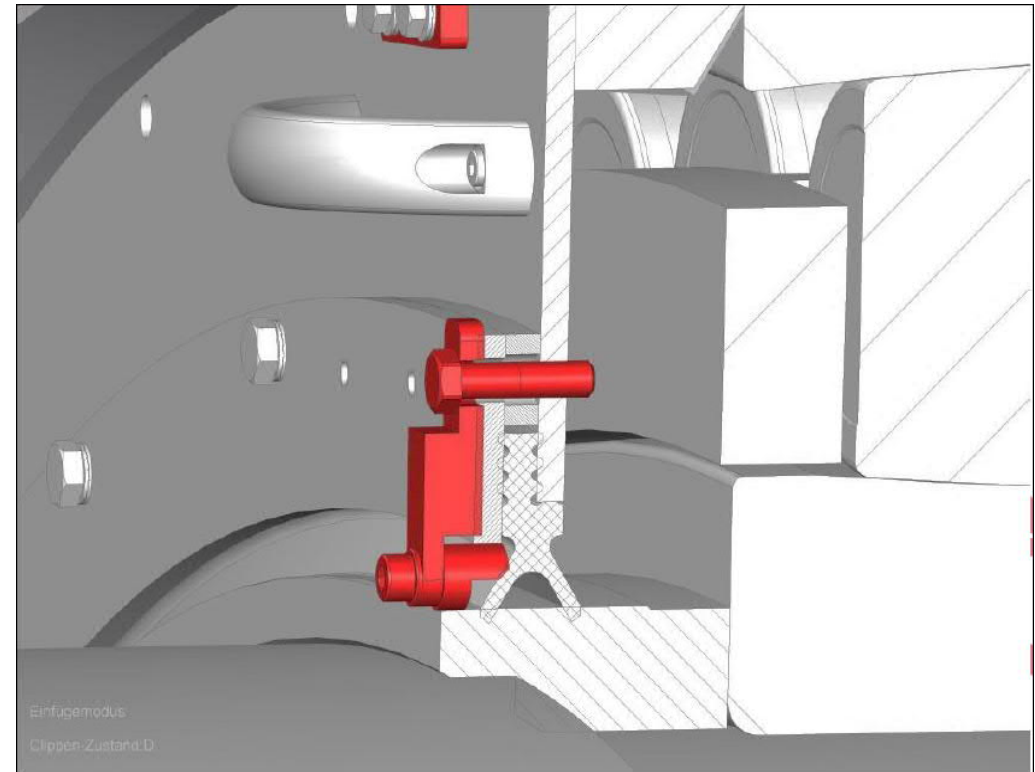


- All parts laser cut from 8 mm to 10 mm steel plates
  - Main carrier 180° - horizontal split (leakage and cost reduction)
  - Clamping rings etc. segmented
  - Metal parts (S355 MC) ZnNi galvanized (10 µm – dipping bath)
  - Corrosion protection 1000 h acc. To DIN EN ISO 9227 (salt spray tests)
  - Fittings for inspection / endoscopy, air filter and grease outlets (defined grease flow / grease level acc. to operating conditions)
- Only one relevant centering diameter for seal positioning
- Positioning of assembled sealing carrier will be aligned to shaft during installation
- Position of seal main carrier is fixed in housing during first mounting at customer
- Biggest single piece weighs max. 40 kg

## Complete sealing-carrier with a mounted LWSS-HNBR-Rubber-Seal

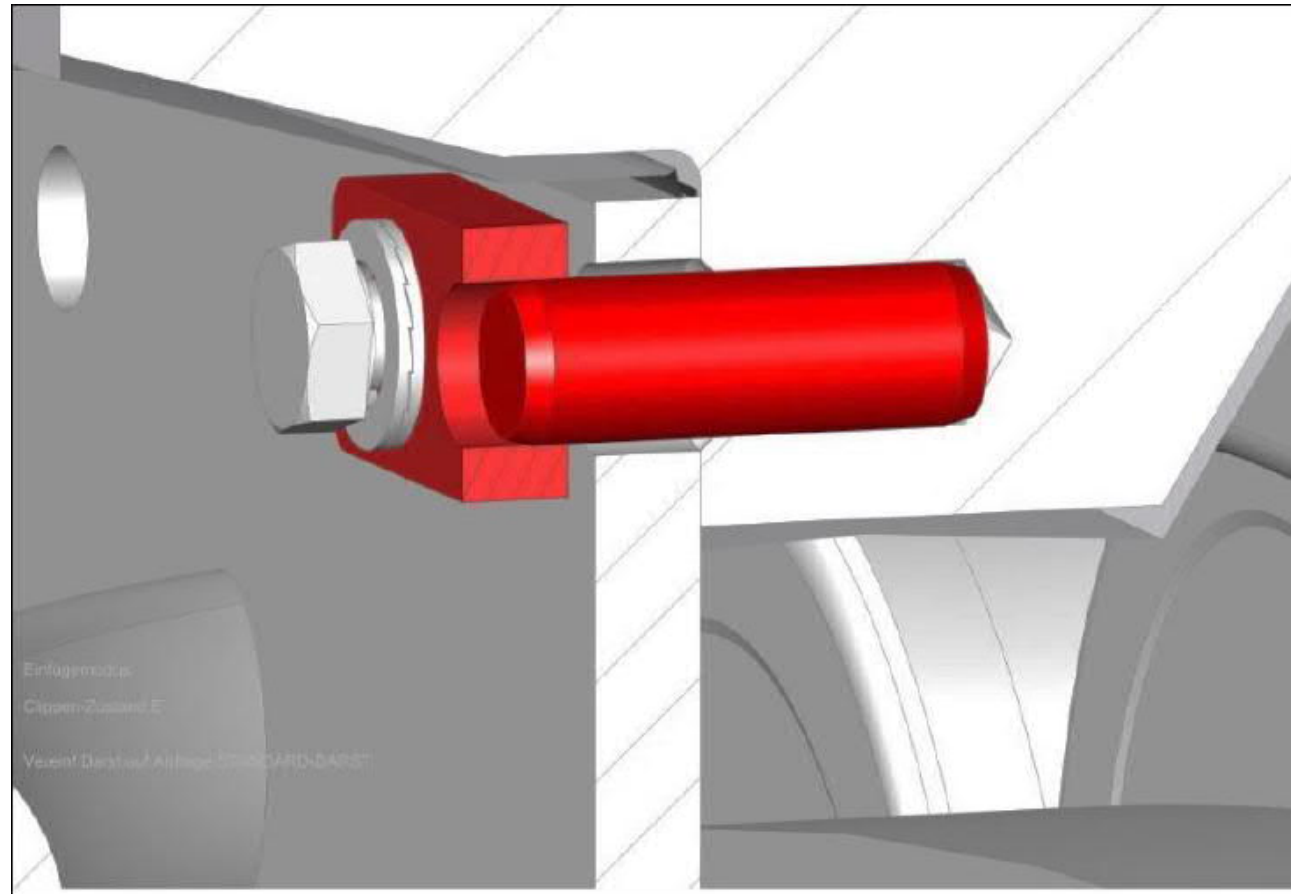


Senvion-Design as an example



SKF-Mounting-tool for a simplified centering of the seal to the shaft

## Freezing of the sealing-carrier-position with a simplified fitting-pin & fitting-sheet





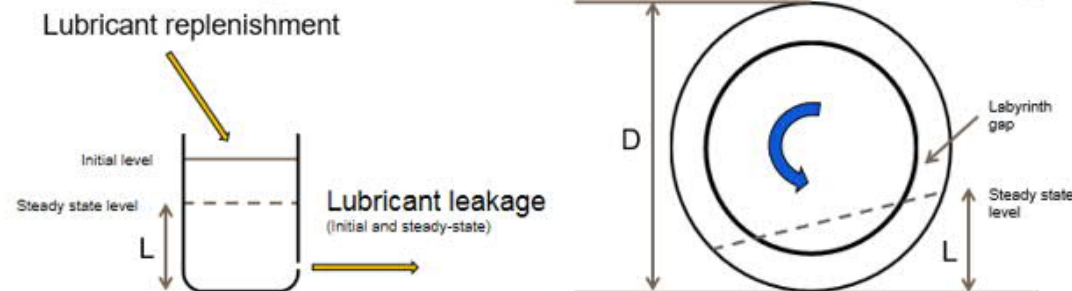
# Field testing

- Prototype in operation since Q3/2014
- Several inspections and seal replacement since then
- Customer feedback very positive: performance of seal is better than expected – only small leakage as expected
- Higher grease filling degree in bearing – bearing raceways in excellent conditions
- After 2 years of operations some issues with leakage occurred - caused by high degree of grease filling in housing  
→ change of initial filling degree for housing for series and change of run in process
- Further customers interest – field test started 09/2018

# Summary

- 1.) Main benefit: combination of effective contact seal and proper designed grease flow (filling degree, outlet size and positioning) increases bearing performance and service lifetime.

## Sufficient steady-state level is necessary for migration



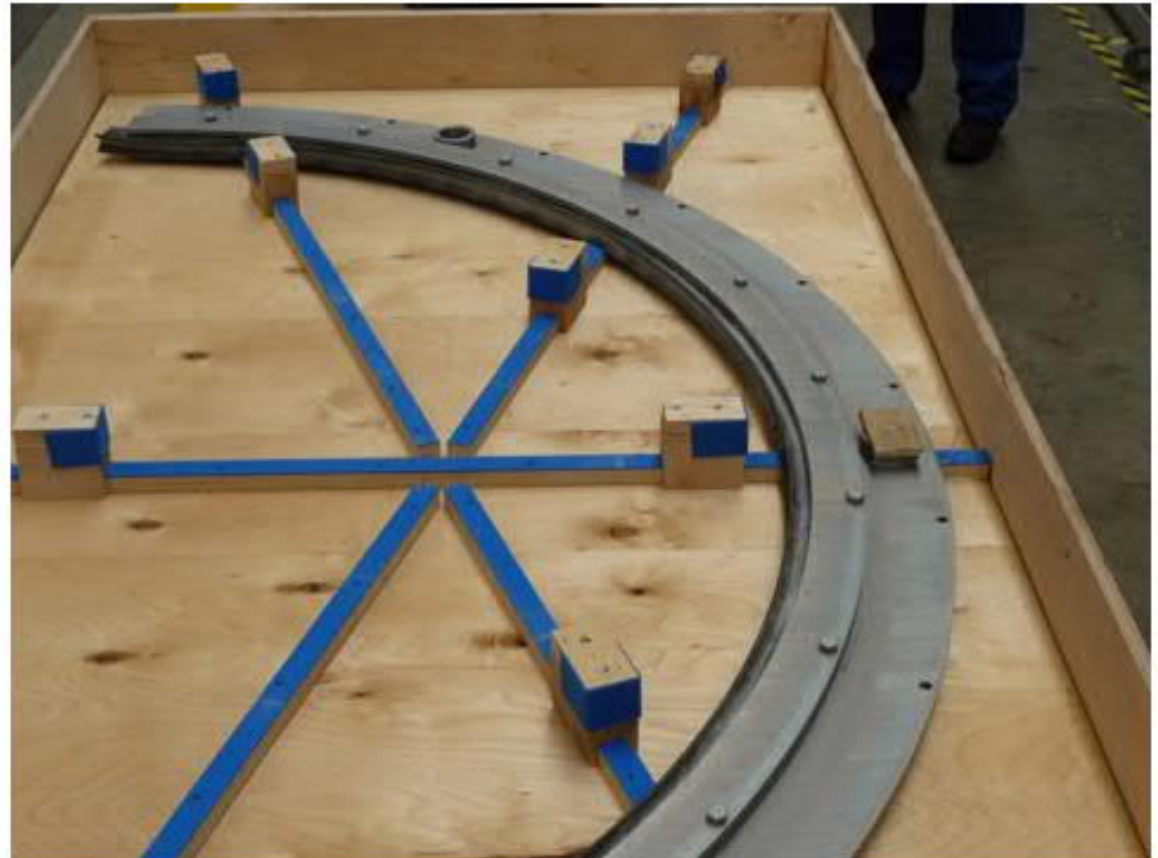
- The steady-state level  $L$  is the major driver for how much lubricant (grease/oil) is re-entered into the bearing. Due to hydrostatic pressure, a high level " $L$ " forces more grease back into the bearing than what a low " $L$ " does.
- The steady-state level  $L$  is a function of the grease replenishment flow in relation to the lubricant leakage flow through the labyrinth gap [volume per time], the grease NLGI number [stiffness], the grease oil bleeding ability and the housing shape.

# Summary

2.) Main benefit : It is easy possible to take out the „old bleed-to-death“-grease after 5 years.

The background is the technical request to replace the grease  
in the bearing & bearing-housing (free-spaces)  
in 5 years .Based on that request SKF calculates the re-greasing-volumes for the pump-systems.

## Prototype mounting – Senvion 6.2M152



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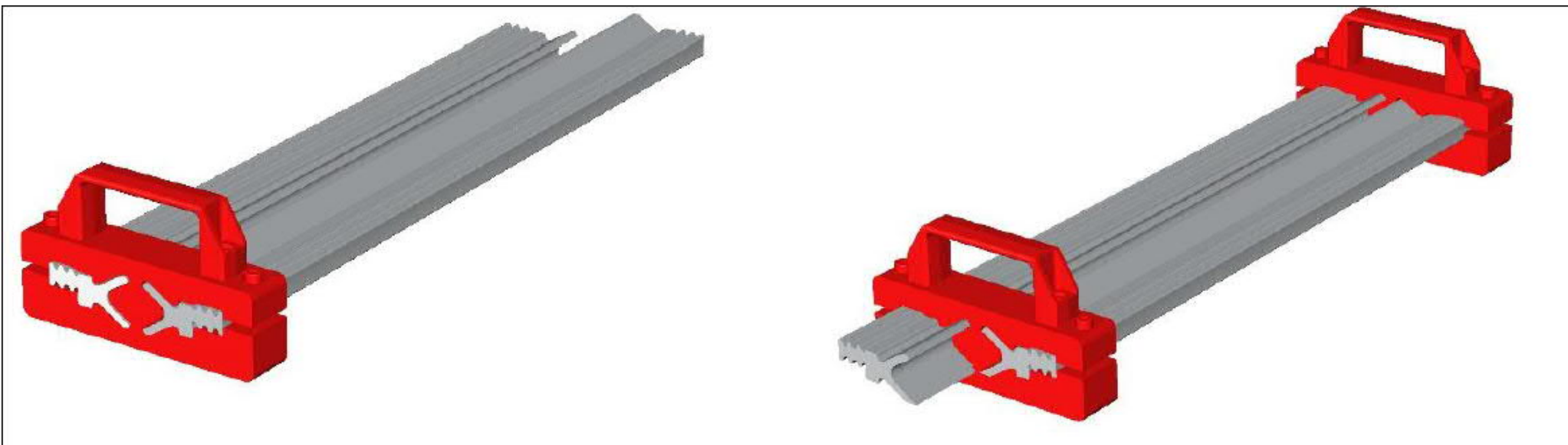
## Prototype mounting – Senvion 6.2M152



## Prototype mounting – Senvion 6.2M152



## Seal – replacement tools



## Seal – replacement tools





## Seal cutting



## Seal replacement



## Seal replacement





## Seal replacement





## Seal replacement



Vielen Dank für Ihre  
Aufmerksamkeit  
Fragen....?