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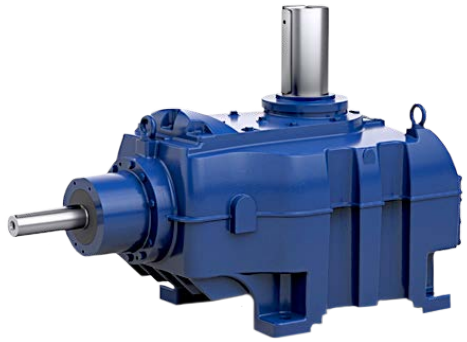
“ACC GEARBOX DURABILITY”

- STARTING TORQUES
- SEALING & LUBRICATION



Kris Herijgers 13 Sept. 2022

KRIS HERIJGERS

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- **Product Manager Industrial gearboxes @ Sumitomo Drive Technologies**
- **+20.000 Cooling Technolgy installations in the field**
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- **https://emeia.sumitomodrive.com/en-de/page/hansen-industrial-gearboxes-brand**

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01

STARTING TORQUES

ACC FAN DRIVE = FREQUENT STARTS AND STOPS …

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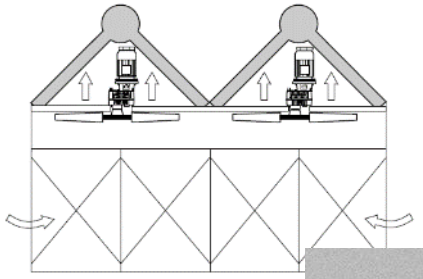
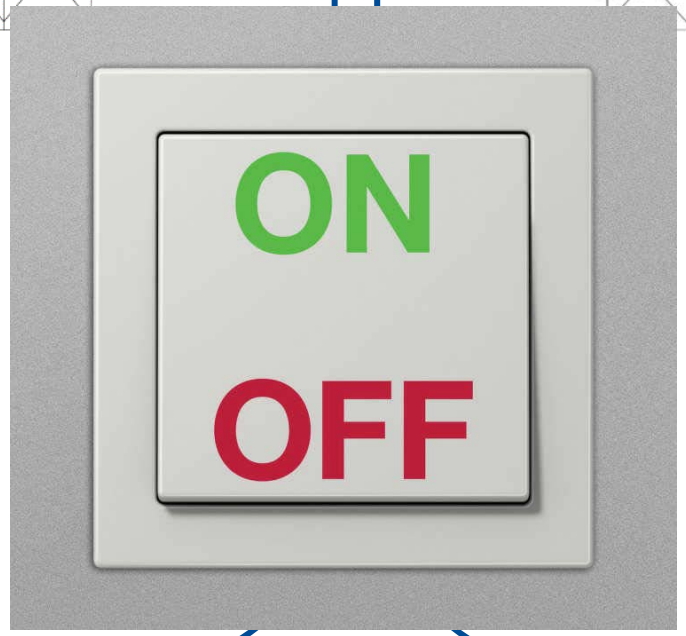
Parallel gearbox

FORCED DRAFT AIR COOLED CONDENSERS

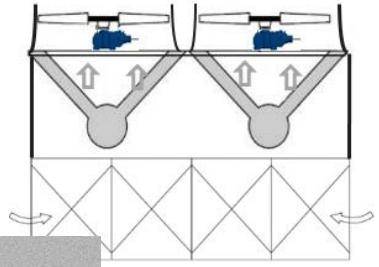


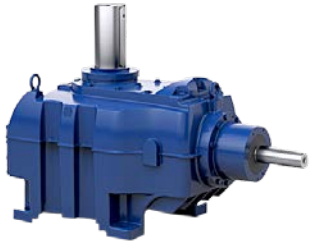
Hansen M4ACC



Right-angle gearbox

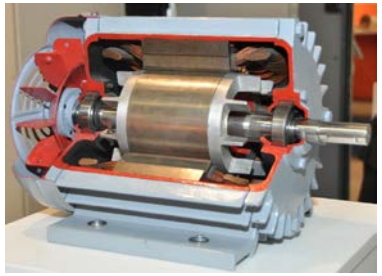
INDUCED DRAFT FOR AIR COOLED CONDENSERS
(new design)

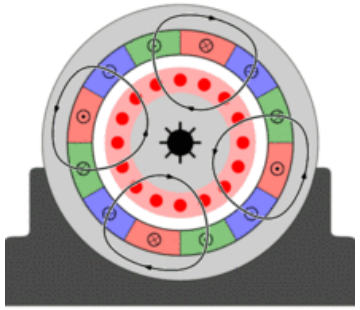




Hansen M5CT

MOTOR TORQUE PEAKS DURING STARTUP CYCLE….





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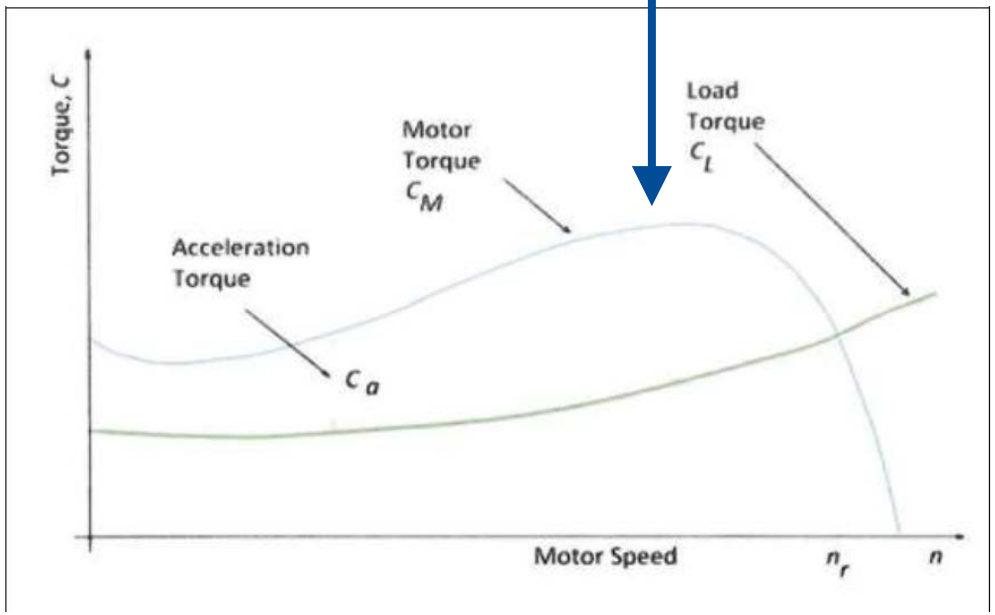
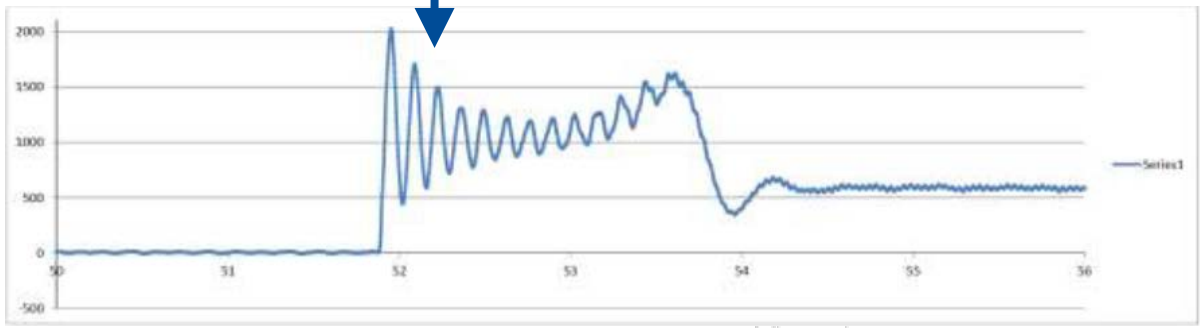
3 x NOMINAL TORQUE of the motor or even higher

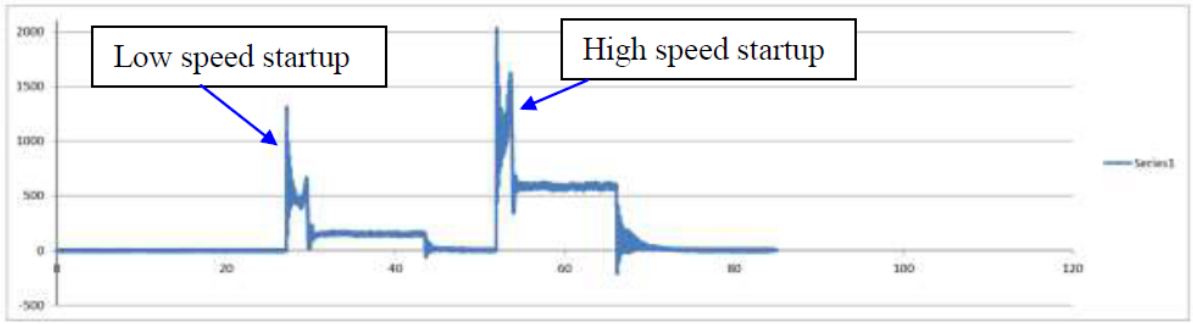


Motor Torque/speed curve

Additionally, motor creates a sinusoidal TRANSIENT TORQUE

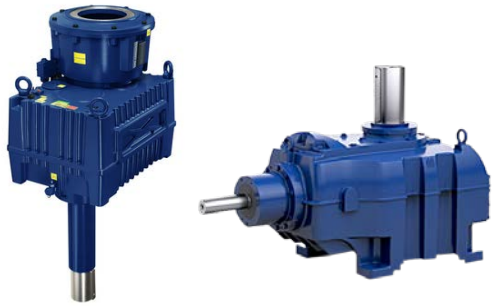


Detail of High speed start torque evolution, measured on Gearbox shaft



Torque measurements on gearbox input shaft with low and high speed startup

GEARBOX SELECTION



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During : Nominal operation + **START-UP** !

SOPHISTICATED CALCULATION TOOLS are necessary !

1. **Max Torque** → Enhanced gear microgeometry
2. **Total starting time** → Gear Lifetime ‘Minor’s sum’ cumulative fatigue analysis

Required calculation INPUT parameters:

1. The full load cycle during start up
   - ✓ Motor starting method [DOL / VFD]
   - ✓ Motor curve: starting peak Torque incl. the transient torque [kNm]
2. Total required starting time (sum of all starting cycles) [h]

GEAR DESIGN

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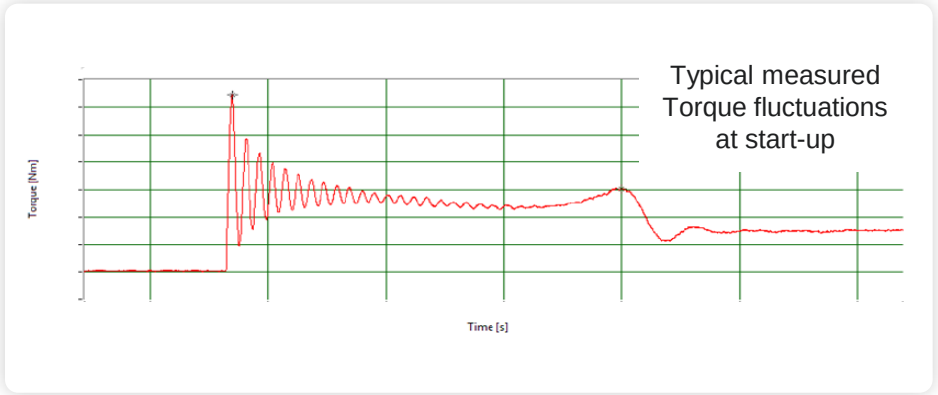
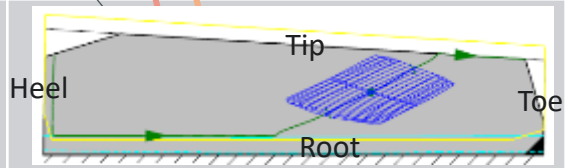
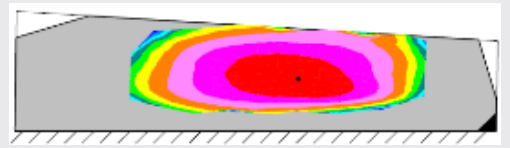
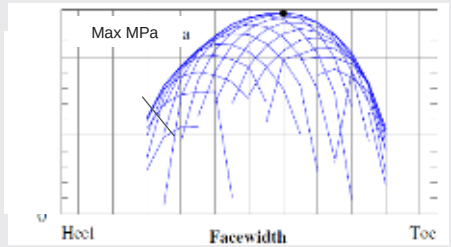
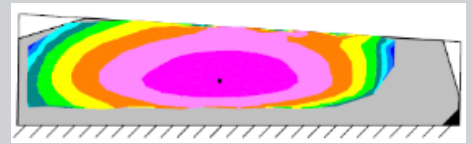
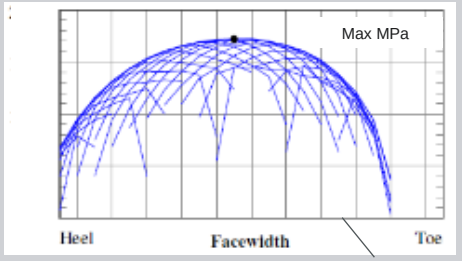
OPTIMIZED GEAR MICROGEOMETRY is needed to withstand many torque fluctuations



Well balanced load distribution under nominal + start up operation !

Load condition	Gear micro geometry
No load	
Nominal operation	 
Start-up operation	 

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02

MAINTENANCE FRIENDLY GEARBOX SEALING AND LUBRICATION

SEALING : MAKE USE OF CENTRIFUGAL EFFECT

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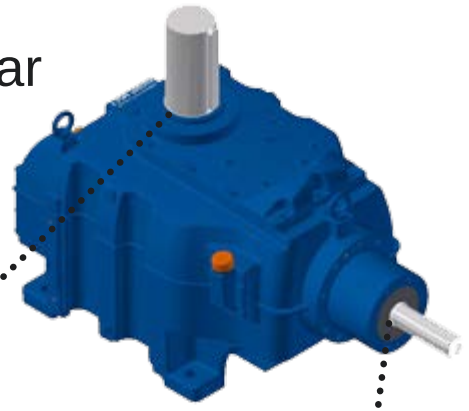
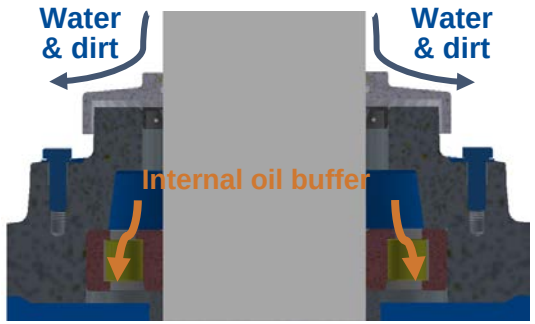
- Sealing function: keep oil in and dirt out!
- Design: No grease + centrifugal effect + no wear
- Maintenance-free



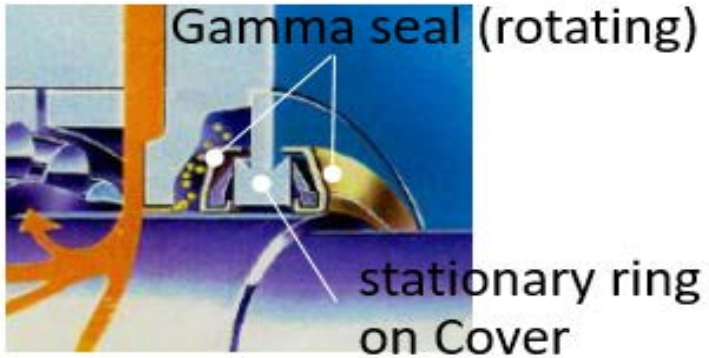
Based on centrifugal force on The rotating parts, a slinger effect will be generated, removing all water & dirt

OIL SEAL HOOD



Flexible lips will lift off during operation (maintenance free!) At standstill, the lips close and ensure additional sealing.

OIL LOCK



LUBRICATION : AVOID GREASE & PIPING ON THE OUTSIDE

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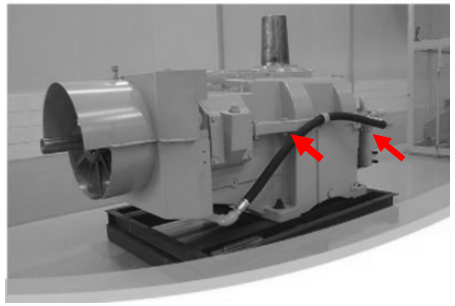
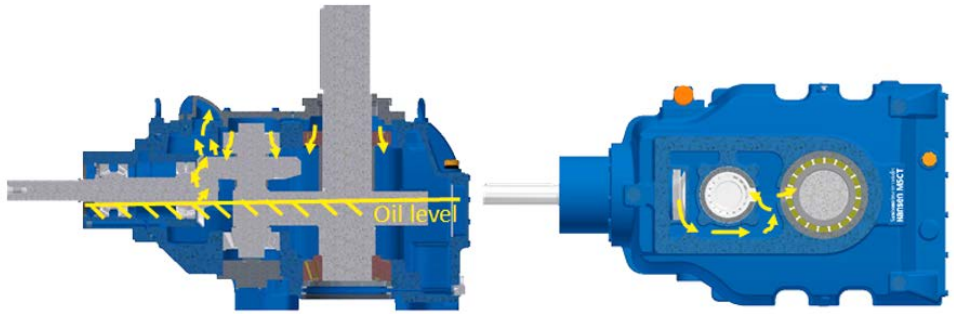
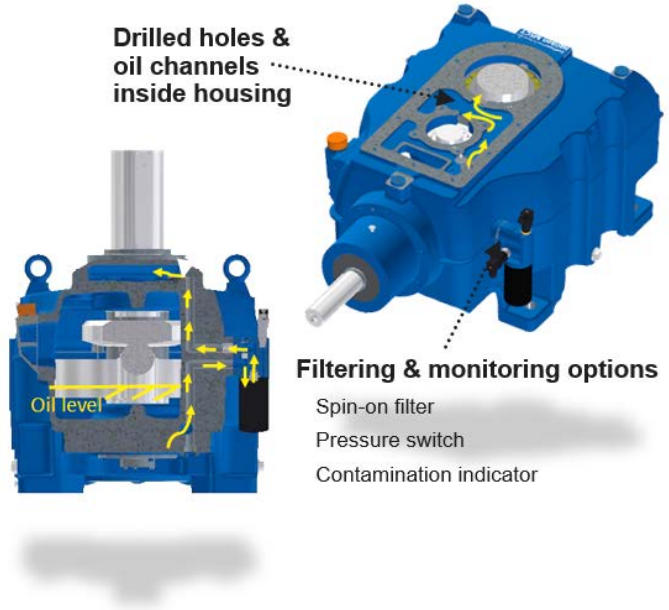


- All bearings and gears oil lubricated (no grease).
- Oil distribution via internal drilled pipes or via the design of the casting.
  - Splash or pump lubrication
- Easy to install without damaging + Leakage risk reduction.

SPLASH lubrication	PUMP lubrication
 Splash principle via 'oil slinger disc' on the input shaft Simple & safe lubrication without monitoring instruments (e.g. no cabling needed)	

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THANK YOU

FOR YOUR ATTENTION