Recover flare gas to cut costs !

Energy Recovery with Clutch Gearboxes

From Michael Waldburger, Head of Engineering and Test
Renk-Maag GmbH, Winterthur, Switzerland

Introduction

Who is Renk-Maag?

- → A leading manufacturer of high speed, high power and high torque gearboxes and synchronous clutches (SSS-principal)
- → Follow-up company of MAAG-Gear AG, using the world famous MAAG-Technology
- → 100% owned by RENK AG since 2007
- → Located in Winterthur, Switzerland

Introduction

Our world is heating up more and more - with dramatic consequences for us and our planet.

At the moment we are experiencing the first snow-free winter in Central Europe below 1200 m above sea-level.

It is our duty as engineers to do something about it!

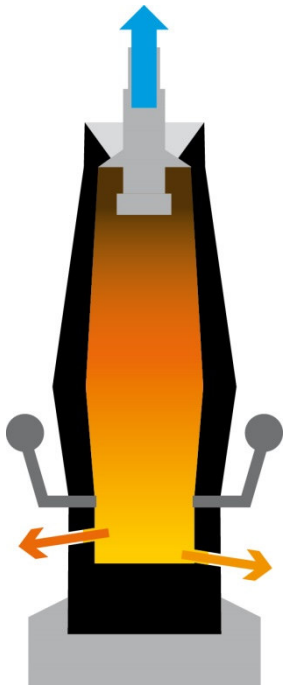
→ RENK-MAAG developed an energy-recovery-gearbox for multiple purposes

→ Within the Gas- and Electric-industry we find many possibilities to recover energy and to be more efficient!

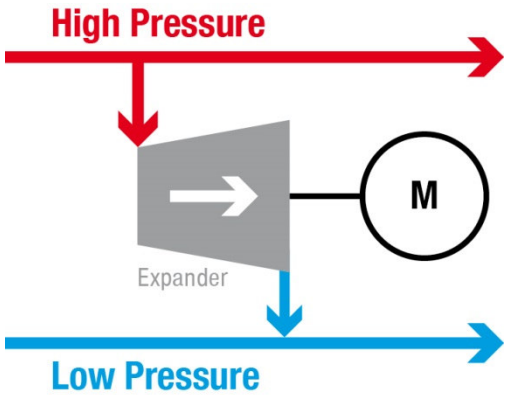
→ In highspeed applications, the HET-vacuum technology can save up to 50% of powerloss in gearboxes!

How to recover flare, waste or pressured gas

Flare Gas



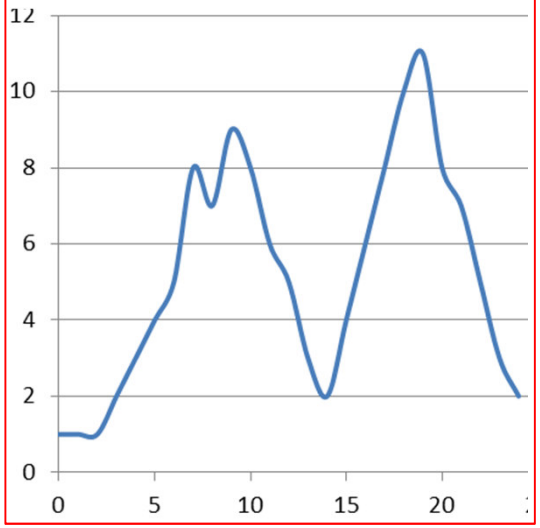
Waste Gas



Pressured Gas or Steam

Challenges to recover energy

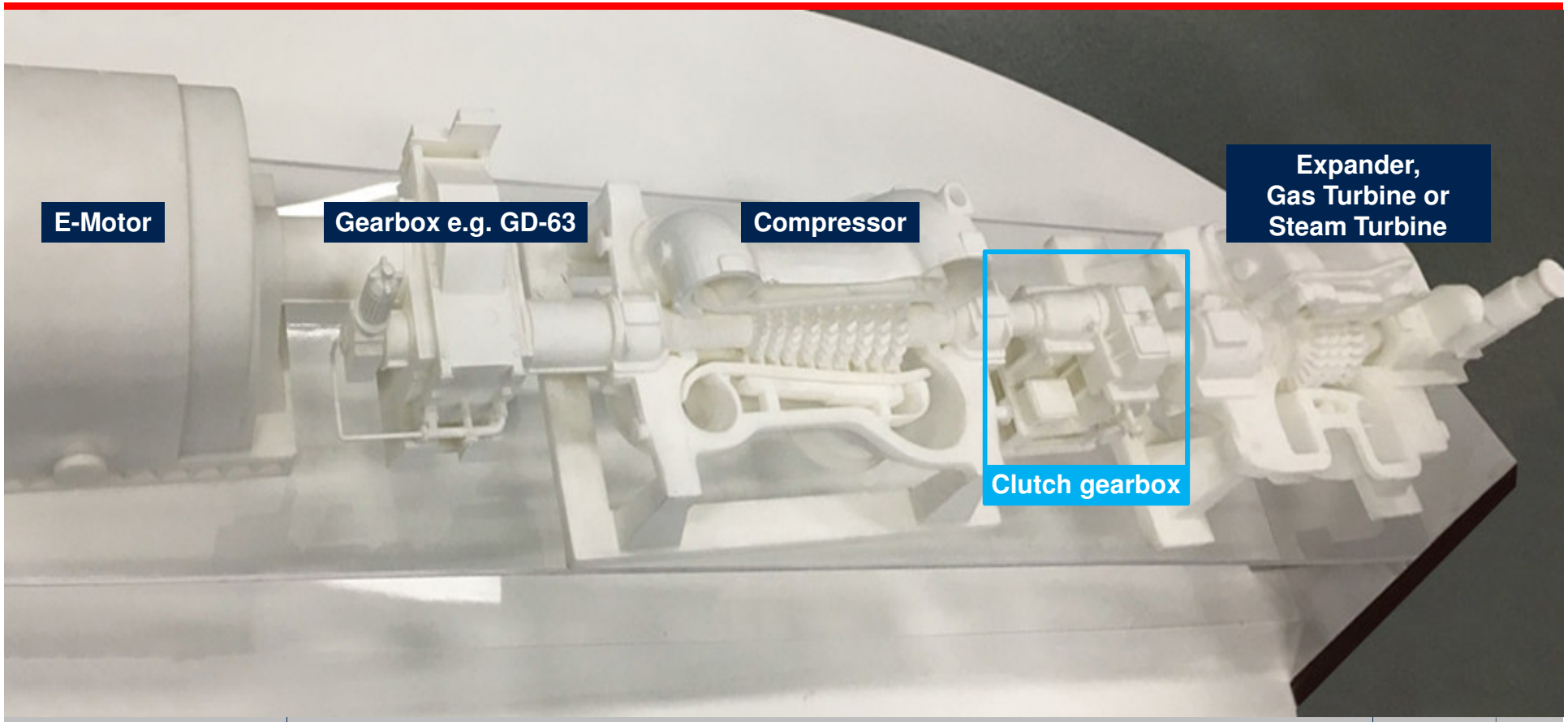
- Fluctuating availability



- Gas contaminated with corrosive residues, such as hydrogen sulfide and others

- Investments

The technical solution



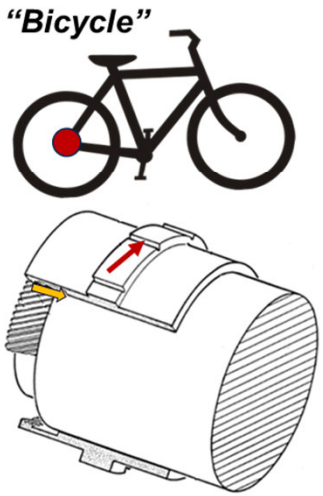
Clutch Gearbox with integrated MS

Function

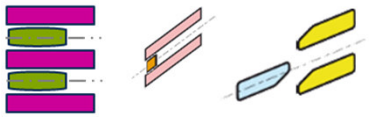
→ Turbo-Gearbox (single- or double helical) combined with our synchronous-clutch type MS

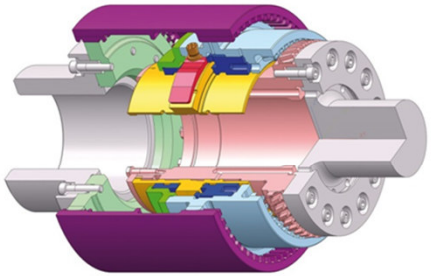
What's inside of a synchronous clutch coupling?

Pawls + Ratchet wheel + Gear tooth system = Synchronous clutch



Spur gears Helical gears





→ Built up to 180 MW

→ Concepts up to 400 MW

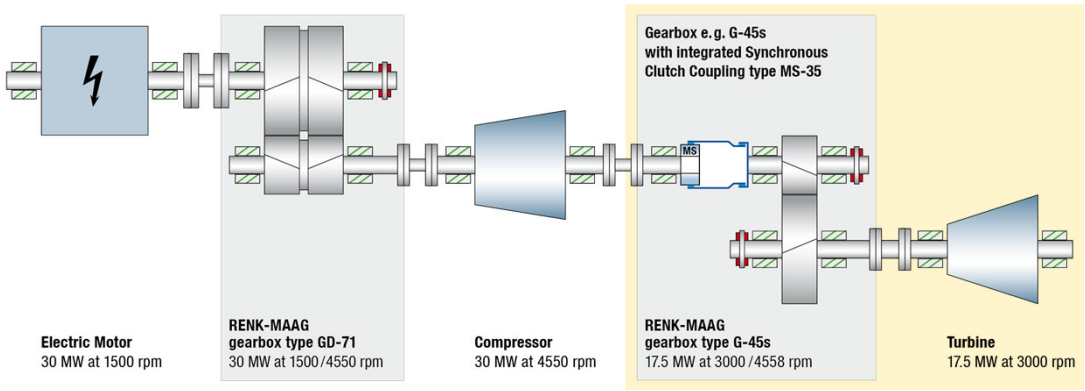
Cost Savings

Annual cost savings e.g. G-45s with integrated MS-35

Example of calculation

Max. Power of gas or steam turbine: 17.5 MW

- Assumed percentage of operation of steam turbine: 50%
- Electricity cost: 0.05 $/kWh
- Annual operation hours of the compressor train: 8’500 hours



Annual cost savings: 8’500 hours x 17’500 kW x 0.05 $/kWh x 50% = USD 3’718’750.–

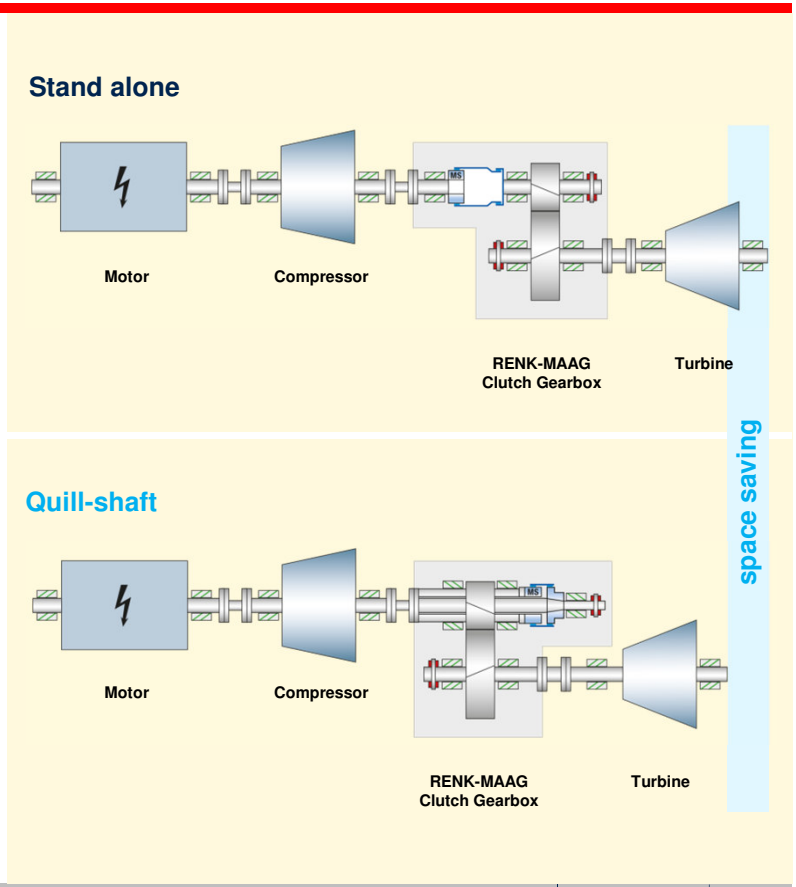
Bearings Axial bearings

Design Versions

Designed using our combined strengths

G — … — S

- Reduction gearbox with MS **on high speed** side
- Quill-shaft arrangement for additional space saving



Design Versions

Designed using our combined strengths

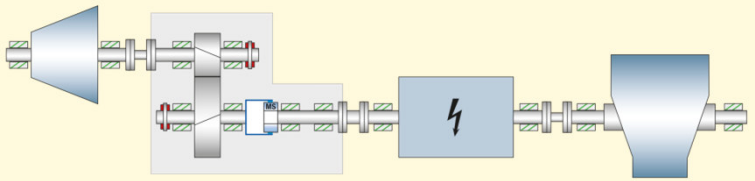
G — … — S

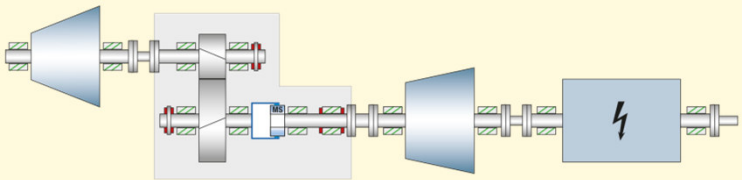
- Increasing gearbox with MS **on low speed** side
- Quill-shaft arrangement for additional space saving
- Proven track record with > 200 units sold

Best reliability and most compact arrangement

Bearings Axial bearings

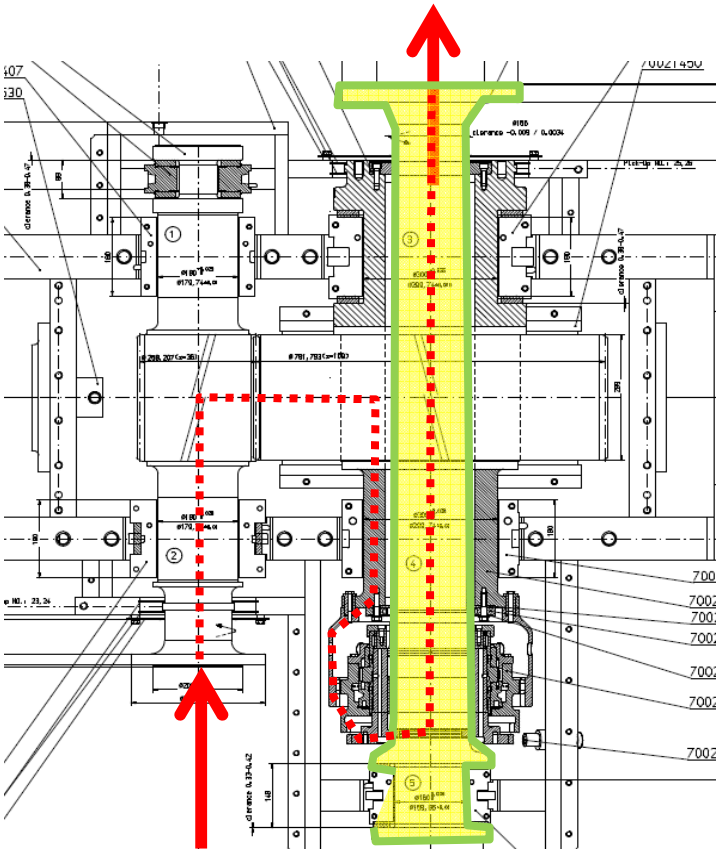
Stand alone





Explanation of version with Quillshaft

Designed, built and delivered



Increasing Clutch Gearbox type G-50s

Gear rated power:	6’500	kW
Low speed side:	1’009	rpm
High speed side:	3’000	rpm
Pitch line velocity:	38	m/s
Gearbox efficiency:	98.7	%
Design code:	AGMA	
Clutch coupling:	MS-39	

Total gearbox weight: 2’335 kg

Installation: between steam turbine and FAN.

Year of manufacture: 2015

Applications and Examples

Applications of the clutch gearbox

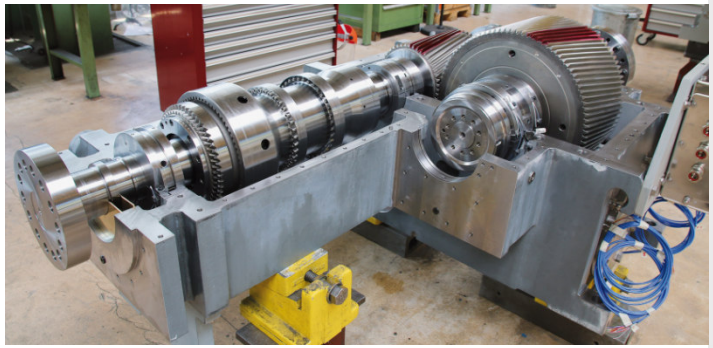
- Compressor train in Steel Plants and Petro-chemical plants
- Blower train
- Peaker gas turbine < 180 MW GT power
- District heating, separation of high pressure from low pressure steam turbine (summer/winter)
- Combined power stations with natural- and bio-gas-turbines
- others

Examples Clutch Gearbox with integrated MS

Designed, built and delivered

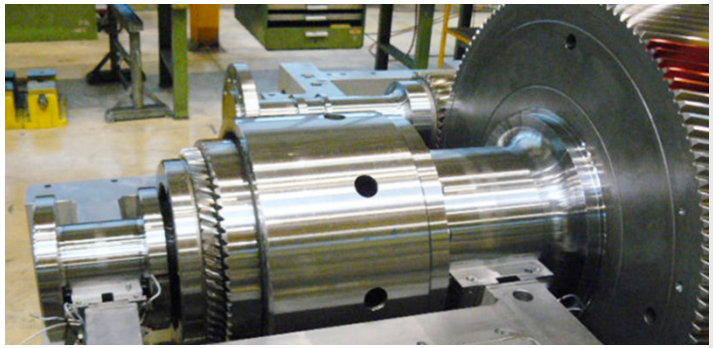
G — 36 — S

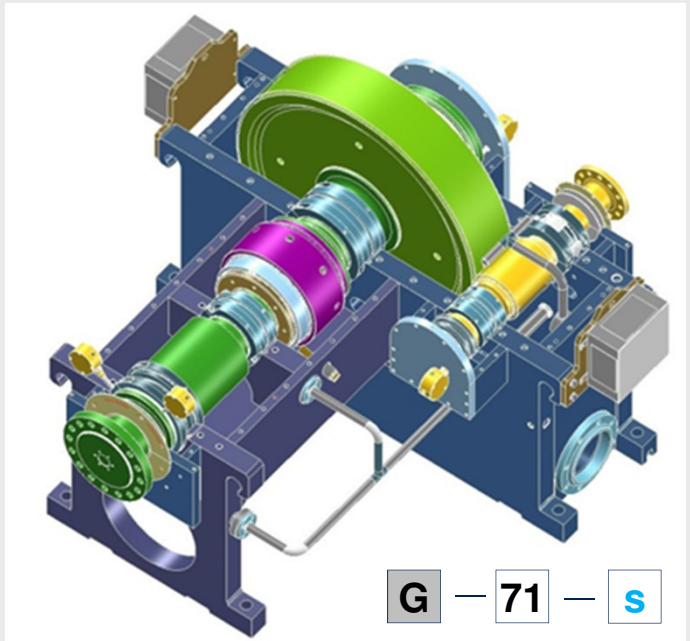
HRT Clutch Gearbox
with integrated MS



G — 71 — S

PRT Clutch Gearbox
with integrated MS





Examples Clutch Gearbox with integrated MS

Designed, built and delivered

Increasing Clutch Gearbox type G-45s

Gear rated power:	14’200	kW
Low speed side:	3’000	rpm
High speed side:	4’583	rpm
Pitch line velocity:	85.4	m/s
Gearbox efficiency:	98.8	%
Design code:	API 613 5th	Ed.
Clutch coupling:	MS-32	

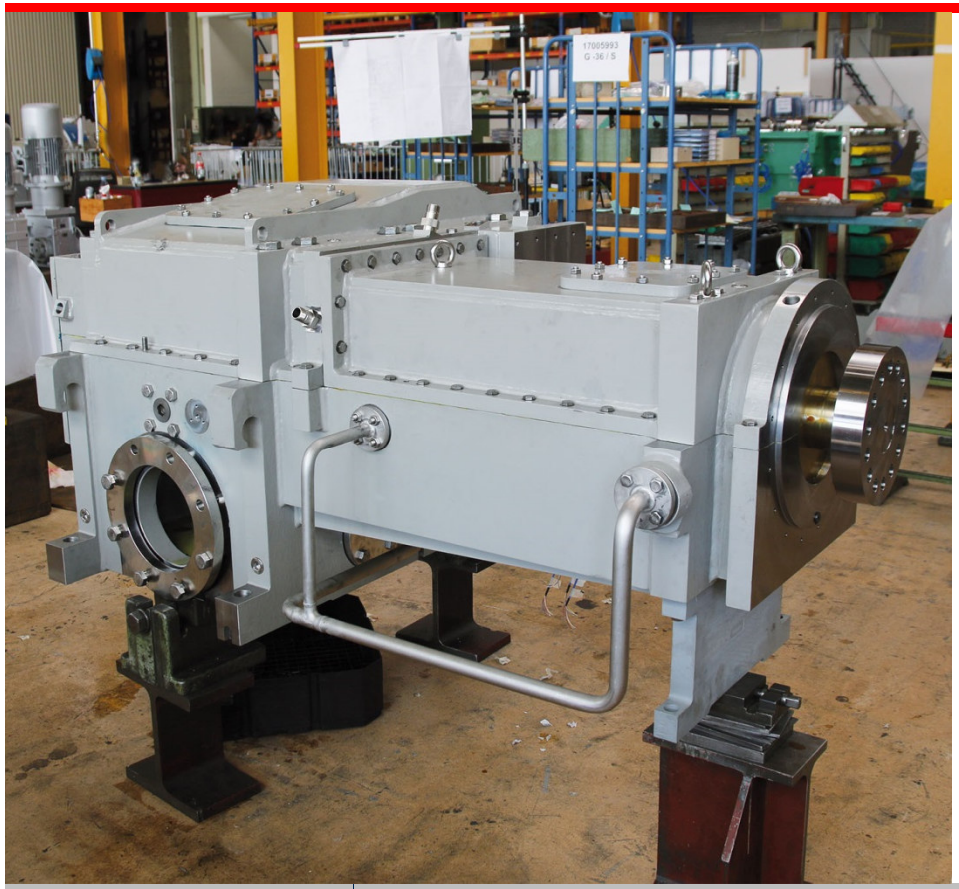
Total gearbox weight: 4’827 kg

Installation: between gas expander and fan in steel works.

Year of manufacture: 2018

Examples Clutch Gearbox with integrated MS

Designed, built and delivered



Increasing Clutch Gearbox type G-36s

Gear rated power:	7’500	kW
Low speed side:	3’000	rpm
High speed side:	5’838	rpm
Pitch line velocity:	74.7	m/s
Gearbox efficiency:	98.8	%
Design code:	API 613 5th	Ed.
Clutch coupling:	MS-26	

Total gearbox weight: 2’672 kg

Installation: between gas expander and fan in steel works.

Year of manufacture: 2018

Examples Clutch Gearbox with integrated MS

Designed, built and delivered

Reducing Clutch gearbox type G-45s

Gear rated power:	4’000	kW
Low speed side:	1’501	rpm
High speed side:	5’600	rpm
Pitch line velocity:	55.8	m/s
Gearbox efficiency:	98.8	%
Design code:	API 613 5th	Ed.
Clutch coupling:	MS-32/Q	

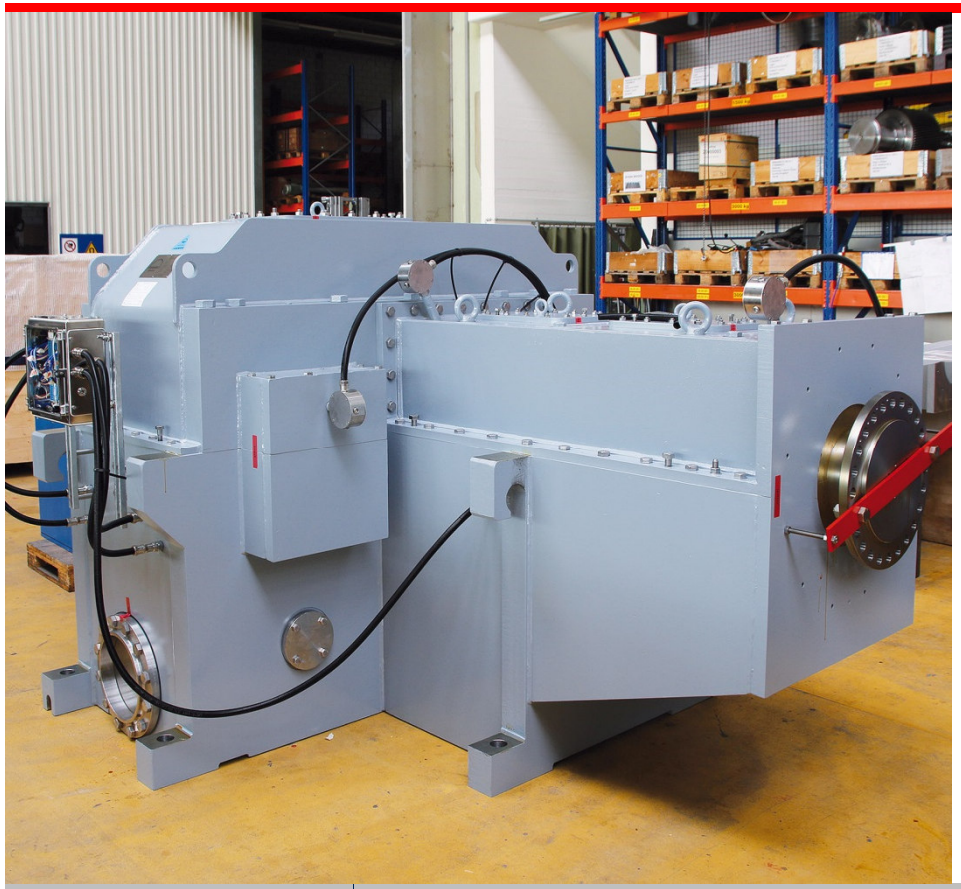
Total gearbox weight: 3’900 kg

Installation: between steam turbine and fan for steel works.

Year of manufacture: 2015

Examples Clutch Gearbox with integrated MS

Designed, built and delivered



Increasing Clutch Gearbox type G-71s

Gear rated power:	10’000	kW
Low speed side:	1’000	rpm
High speed side:	5’550	rpm
Pitch line velocity:	64.2	m/s
Gearbox efficiency:	98.8	%
Design code:	API 613 5th	Ed.
Clutch coupling:	MS-47	

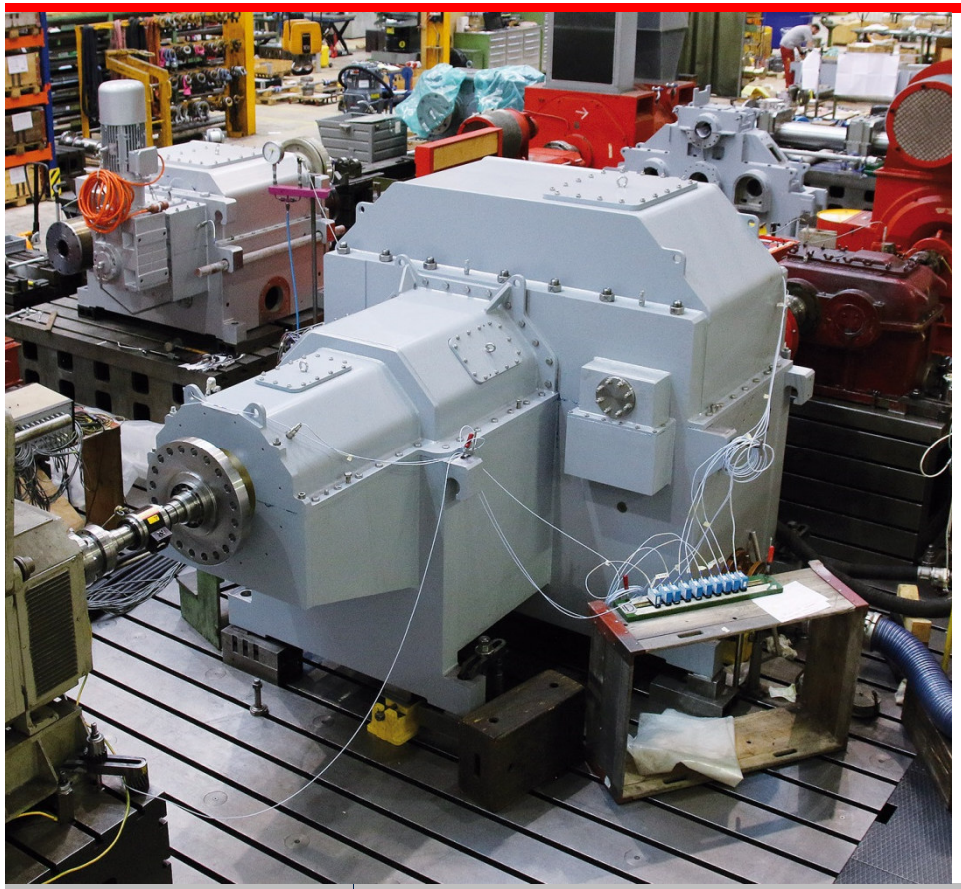
Total gearbox weight: 14’960 kg

Installation: between gas expander and fan in steel works.

Year of manufacture: 2018/2019

Examples Clutch Gearbox with integrated MS

Designed, built and delivered



Increasing Clutch Gearbox type GD-100s

Gear rated power:	19’500	kW
Low speed side:	997	rpm
High speed side:	5’500	rpm
Pitch line velocity:	88.4	m/s
Gearbox efficiency:	99.0	%
Design code:	API 613 5th	Ed.
Clutch coupling:	MS-57-J	left

Total gearbox weight: 29’751 kg

Installation: between steam turbine and integrally geared compressor for steel works

Year of manufacture: 2018

Summary

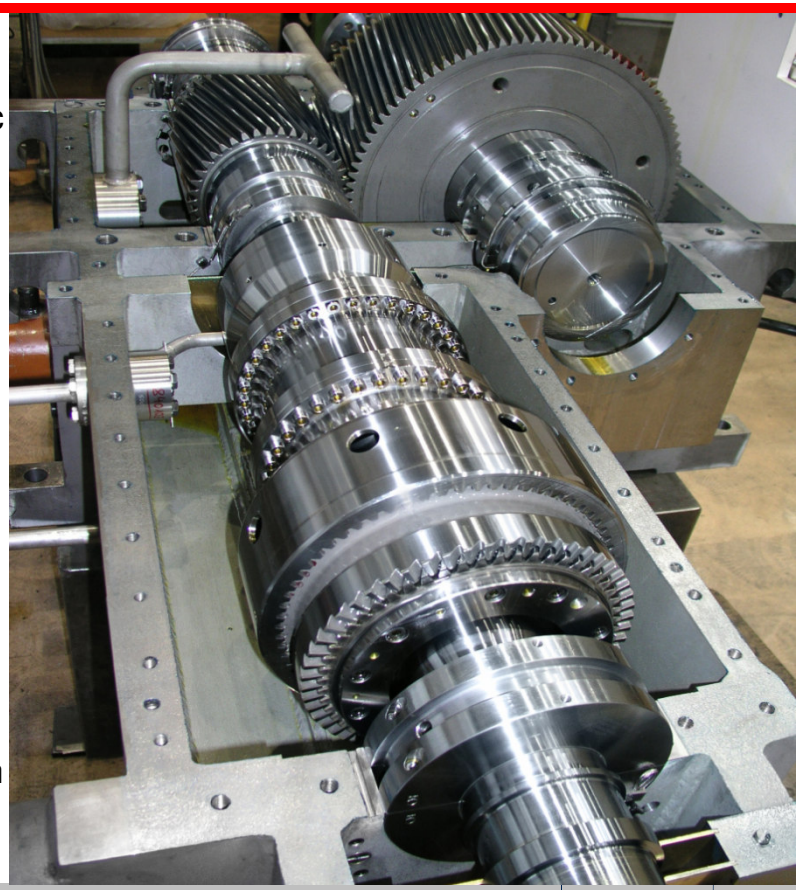
Designed using RENK-MAAGs combined strengths

Benefits

- Innovative train design with combined drivers with fully automatic clutch-in and –out at any speed and time (thanks to mechanical overrunning synchronous clutch)
- Higher efficiency of the plant
- Energy recovery systems – automatically using the full potential of the process (waste heat or pressure recovery)
- Reduced operational costs (OPEX)
- Robust gear-clutch-system with high efficiency and easy instalment

Important Note

- Involve your gearbox manufacturer in a very early conceptual project phase! So you will safe space and have more efficiency in your plant.




Thank you
for your attention!