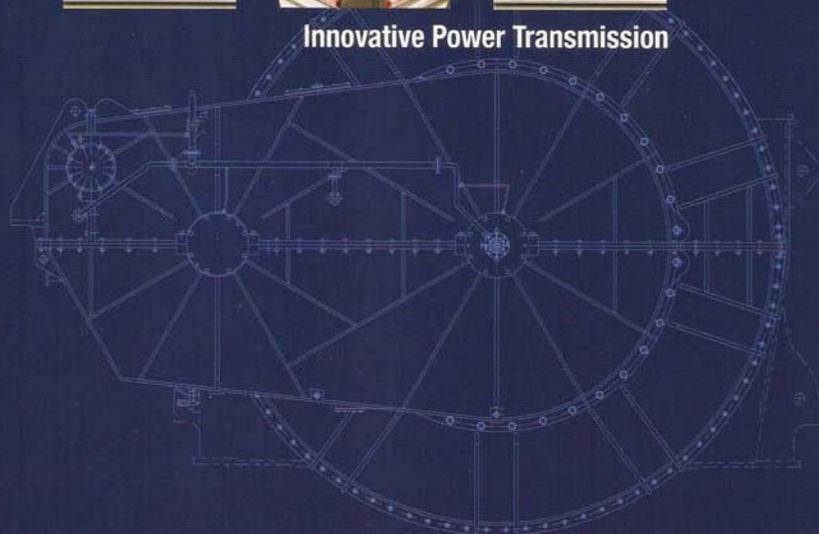




### Innovative Power Transmission



# Shaft Generator Drives

GCR and RCF: Most efficient PTO systems for controllable and fixed pitch propeller 2-stroke application

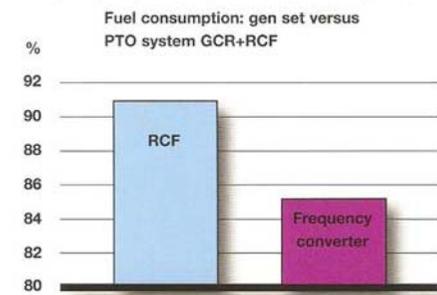
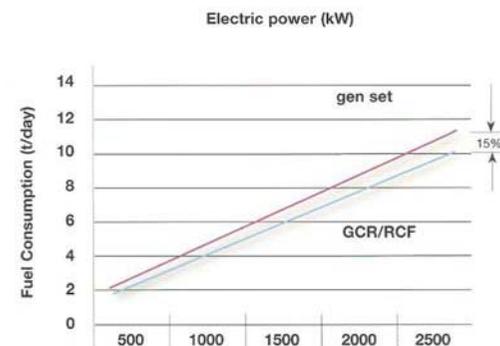
on board. Forget your gen sets.

RENK front-end shaft generator systems type GCR (Gear Constant Ratio) and RCF (RENK Constant Frequency) were developed in order to optimise the overall operating economy while generating electric power. Up to 15% higher efficiency is granted using RENK PTO instead of gen sets.

A long list of references shows the success of the front-end gear systems running for ten thousands of operating hours nearly without wear or maintenance needed. Typically, maintaining expenses are less than 10 man hours per year plus two filter-inserts. No skilled personnel is necessary. RENK RCF and GCR follow the rule "fit and forget". Thus, even if neglecting any savings by higher efficiency compared to a typical gen set installation, the front end system—even called "crankshaft gear"—offers a tremendous benefit.

Considering the steady increase in fuel oil prices during the recent period, shaft generating of power becomes more and more attractive.

Running PTO – driven alternators on FPP systems, there are two options to stabilize the frequency; RENK Constant Frequency or electronic converters instead. The efficiency of RENK's most reliable mechanic system is unbeatable.

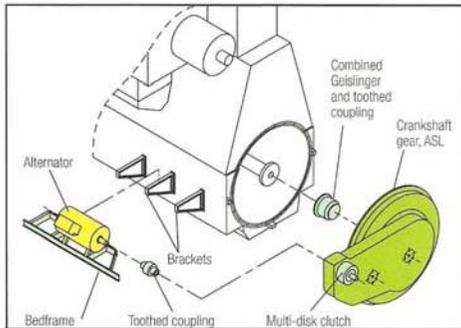


Frequency converter versus RCF  
RENK Constant Frequency - total efficiency





The two basic PTO systems GCR and GCR+RCF are mounted on the front end side of the 2-stroke main engine. With both types, the generator can be installed either in front or aside of the engine. Actually, in most cases the generator is mounted side by side with the engine. The GCR is equipped with a multi-disk clutch, allowing engaging or disengaging of the generator.

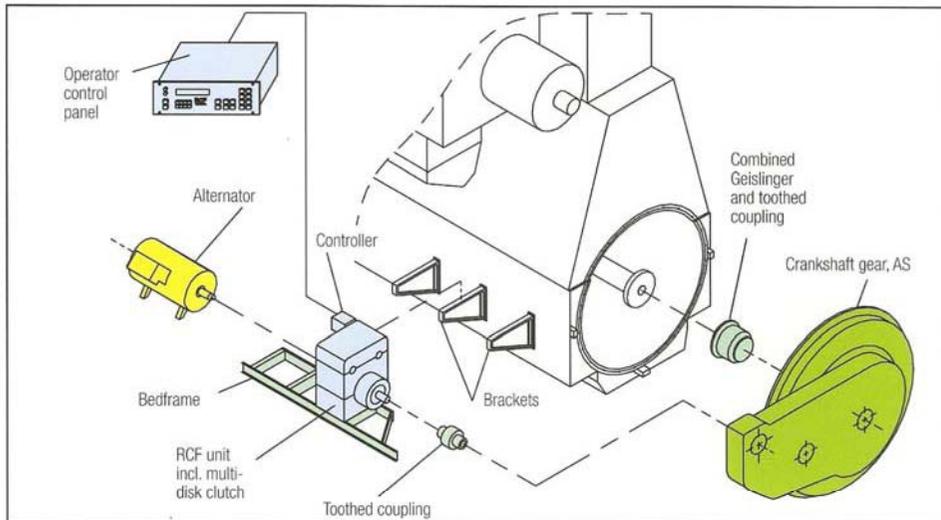


BW III arrangement, GCR

The GCR is a most reliable step-up gear system used with controllable pitch propeller application providing constant speed without RCF.

The RCF is an option to be added onto the GCR system. It consists of an epicyclic gear with a hydrostatic superposition drive. Hereby it is possible to generate electric power with constant electrical frequency at variable engine speed. No frequency converter is needed even if operating the vessel with fixed pitch propeller.

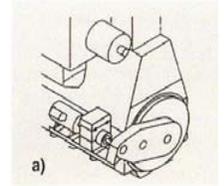
Slightly higher investment cost is paid back by additional space for cargo transportation due to the compact design of the system as well as significant savings on fuel and maintenance.



BW III arrangement, RCF

Alternative types and layouts of shaft generators	Design	Seating	Total efficiency (%)
1	BW I/GCR	on engine (vertical generator)	92
2	BW II/GCR	on tanktop	92
3	BW III/GCR	on engine	92
4	BW IV/GCR	on tanktop	92
5a	BW I/RCF	on engine (vertical generator)	88-91
6a	BW II/RCF	on tanktop (vertical generator)	88-91
7a	BW III/RCF	on engine	88-91
8a	BW IV/RCF	on tanktop	88-91

2600 kW. Designs for most types of two-stroke engine do exist.



Standard design comprises a crankshaft gear BW III at the forward end of the engine (crankshaft/front-end gear) laterally attached RCF gear and generator.

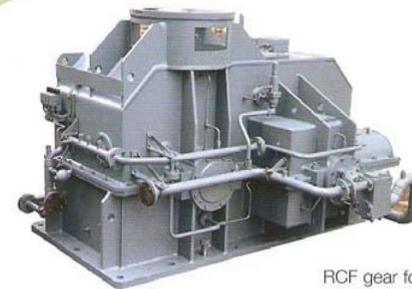
The RCF is intended to be used with fixed pitch propeller plants. Within the range varying from 70% to 105% of engine's nominal speed, constant frequency is provided by the generator.



RCF unit with generator mounted on frame (sketch a)

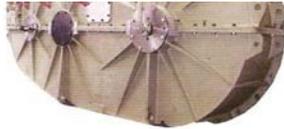
The basic version of the RCF is combined with the typical front-end type gear as per figure a). Arrangement is known as the so-called "BW III/RC" version.

Various options as per b) and c) but also combined with tunnel gear (d) are available.



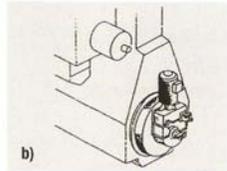
RCF gear for vertical arrangement of the generator (see sketch b)

## Most flexibility for ship yard and operators needs

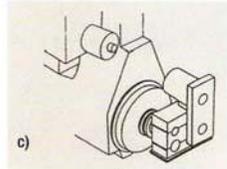


RENK

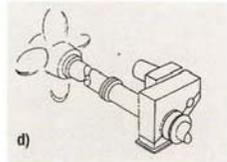
## Benefits of front-end PTO, optionally fitted with RENK Constant Frequency



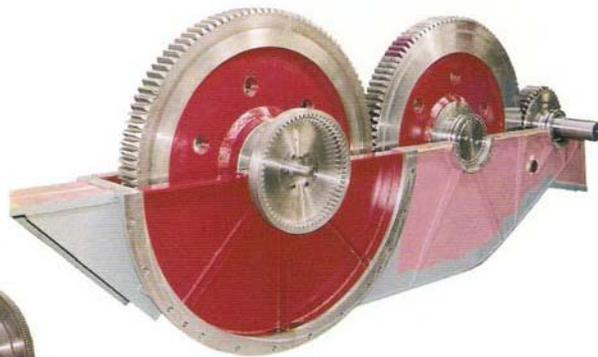
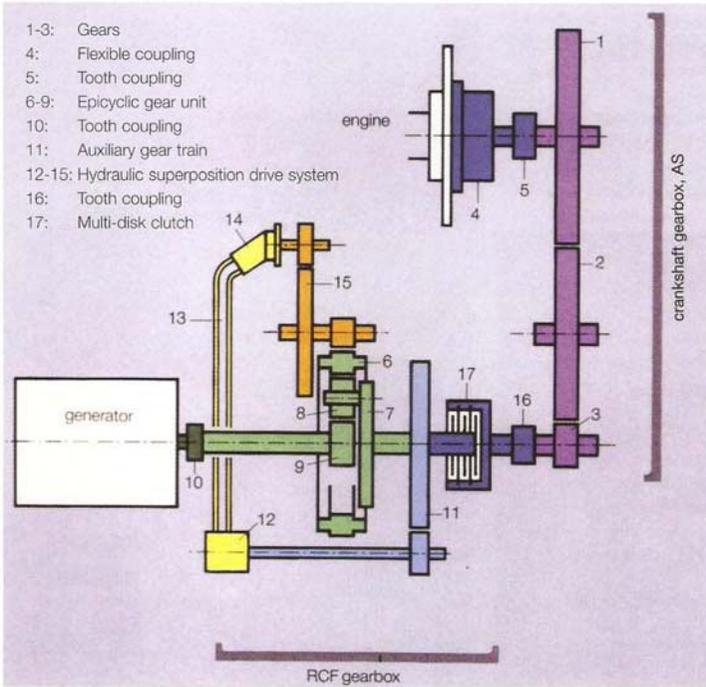
b) Gear flanged to the forward end of the engine, with the generator vertically arranged



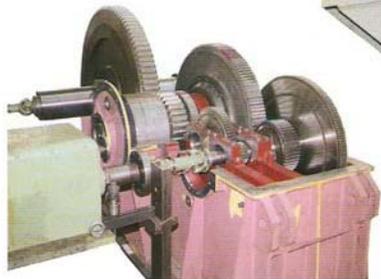
c) Separately mounted gear at the forward end of the engine, with the generator axially arranged on top of the gear.



d) Tunnel gear over the propeller shaft to drive the RCF gear and the generator, both on separate foundation.



GCR crankshaft gear



### From a yard point of view:

#### Alignment

- System is build onto and supported by the engine: No need for alignment
- Propeller shaft aligned without any thought about PTO interface
- No interference with ship structure
- No interference with the propeller shaft
- Interface with engine organised between engine supplier and RENK
- No need for yard involvement

#### Foundation

- No connection between ship-structure and PTO
- Frame/Brackets carrying the system are part of PTO/engine supply
- Assembling of PTO and engine possible before lifting into the vessel - lifting inside the hull within one turn

#### Oil-Supply/Cooling

- GCR lubricated/cooled by the main engine's circuit,
- RCF features own independent control-oil and lubricating system
- No cooling ducts required like when using electronic frequency converters

#### Fuel oil system

- No additional fuel-oil supply needed
- No additional exhaust gas system needed

### Benefits from an operators point of view:

#### Servicing/Maintenance

- Working on/pulling off the propeller shaft does not interfere with the PTO e.g. like with a tunnel gear
- Maximum 10% of maintenance compared to gen set installation
- No skilled personnel needed
- No major overhaul
- designed for vessel's life-time

#### Emergency capabilities

- Generator can be declutched for end of operation but also in case of a failure just by pushing a button
- Special device exists for disengaging the whole front end gear from the engine

#### Less space for installation

- Compact design and side by side arrangement with the main engine contribute to a space saving configuration and improved payload

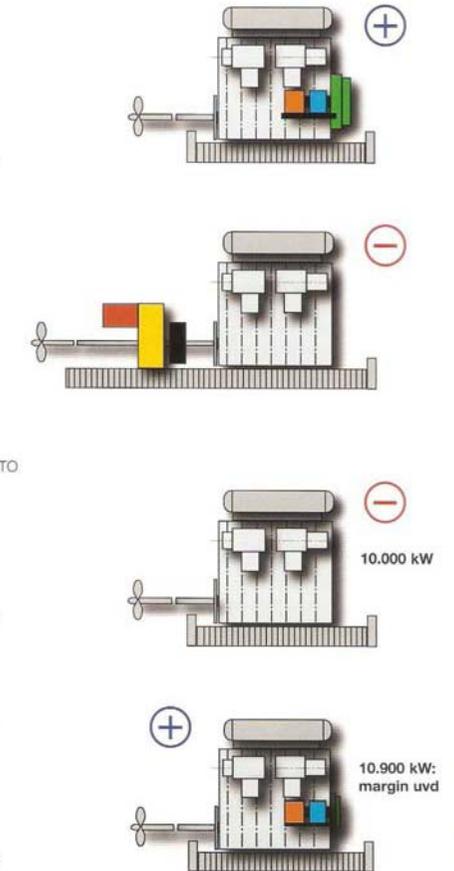
#### Power reserve utilised

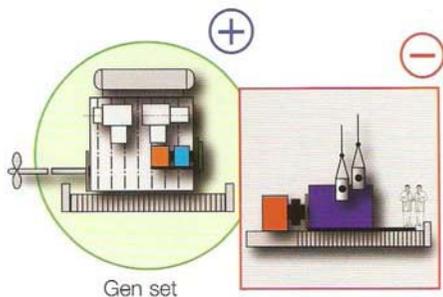
- Margin in rating of the main engine may be utilised by the activated PTO

#### Efficiency

- Higher efficiency regardless if comparing with gen sets or other PTOs with frequency converter systems
- Less expensive Heavy Fuel Oil used for power generation

Generator  
RCF  
Crankshaft gear





PTO's of front end type feature a lot of advantages from the yard's point of view with regards to installation, alignment and supply lines. From the operators point of view front end types feature minimised operation and maintenance cost. Lifetime is unlimited, no major overhaul is schedule, necessary skills for maintenance are on the lowest level. These benefits apply while comparing with other type of PTO e. g. tunnel installation as well as comparing with gen sets.

Using the RCF as an option on the front end type, constant frequency is provided without the need for extensive and sensitiv frequency converters requiring space, cooling ducts and fans. GCR and RCF stands for highest efficiency while using less expensive heavy fuel oil.



**No extra cost for foundation and exhaust gas pipe**

RCF gear and generator are supported by brackets attached to the main engine casing and do not require their own foundation

# RENK GCR and GCR + RCF Shaft Generator Drives



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