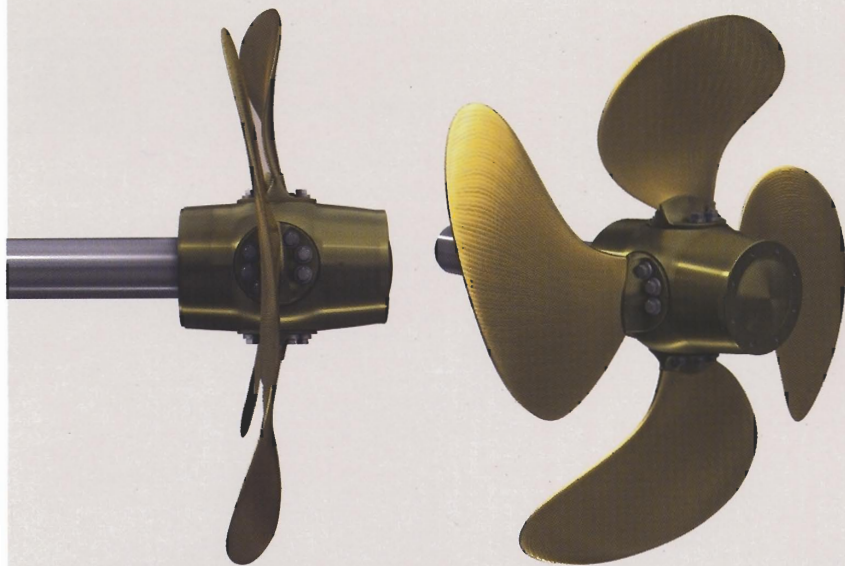


# Controllable Pitch Propeller



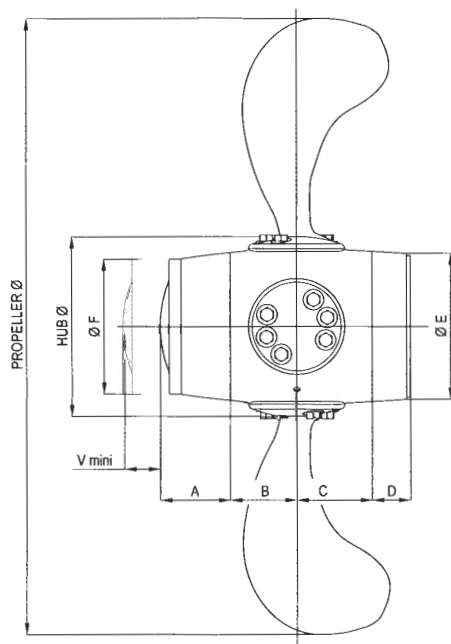




Design simplicity and ruggedness are the main features of the ZF Marine KS family of controllable pitch propellers. The solid hub has large blade port bearings to ensure that high thrust loads and wake-induced, alternating stresses are safely absorbed. This design approach results in reduced maintenance, and subsequently lower through-life costs. A double-blade sealing system further enhances the ecological attractiveness of these propellers.

## Technical data

### Hub



HUB Ø	MAX prop. Dia.	A	B	C	D	Ø E	Ø F	V min
350	1750	137	130	148	75	285	265	70
400	2000	157	149	169	86	326	303	80
450	2250	176	167	190	96	366	341	90
500	2500	196	186	211	107	407	379	100
550	2750	215	204	232	118	448	416	110
600	3000	235	223	253	129	489	454	120
650	3250	254	241	274	139	529	492	130
700	3500	274	260	295	150	570	530	140
760	3800	297	282	320	163	619	575	152
820	4100	321	305	346	176	668	621	164
880	4400	344	327	371	189	717	666	176
940	4700	368	349	396	201	765	712	188
1010	5050	395	375	426	216	822	765	202
1080	5400	423	401	455	231	879	818	216
1150	5750	450	427	485	246	936	871	230
1220	6100	478	453	514	261	993	924	244
1300	6500	509	483	548	279	1059	984	260
1380	6900	540	513	582	296	1124	1045	276
1460	7300	571	542	615	313	1189	1105	292
1550	7750	607	576	653	332	1262	1174	310

## Hub body

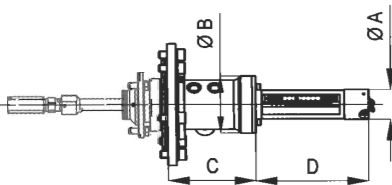
To ensure maximum strength, the hub body is machined from a single, robust, NiBrAl (nickel-bronze- aluminium) casting and is designed to absorb the centrifugal and bending loads that are exerted by the propeller blades. The hub bearing areas are sized using FEM (finite element) technology enabling local stresses to be minimized thereby reducing wear and tear of the bearing surfaces. A strong, cast-steel yoke is centrally located in the hub body with four slots (five slots in the case of a five-bladed propeller) and integrated piston. Sliding blocks are fitted on the blade carrier pins. The hub body also contains blade carriers (counter flanges)

which are bolted to the propeller blade feet. This so-called “pin-slot” mechanism translates the axial motion of the servo piston into pitch rotation of the propeller blades.

## Servo cylinder

The servo cylinder is bolted to the aft face of the hub body and contains a servo piston integrated into the yoke. This has also been generously dimensioned using FEM analysis resulting in a more compact and optimized hub profile.

## OD-box



ODB Model	Ø A	Ø B	C	D	Suitable for hub
ODB 090	65	120	130	190	350
ODB 090	65	120	130	190	400
ODB 110	65	120	150	200	450
ODB 110	65	120	150	200	500
ODB 130	65	120	170	220	550
ODB 130	65	120	170	220	600
ODB 150	65	120	190	240	650
ODB 150	65	120	190	240	700
ODB 170	65	120	210	260	760
ODB 170	65	120	210	260	820
ODB 200	65	120	230	290	880
ODB 200	65	120	230	290	940
ODB 220	85	180	260	310	1010
ODB 220	85	180	260	310	1080
ODB 250	85	180	290	340	1150
ODB 250	85	180	290	340	1220
ODB 280	85	180	320	370	1300
ODB 280	85	180	320	370	1380
ODB 310	85	180	350	400	1460
ODB 310	85	180	350	400	1550





# Commercial Craft Propulsion Systems



# Thruster Systems

ZF Marine HRP has more than 30 years of experience in building azimuth thrusters. The company has designed, produced and commissioned various types of thrusters, for a multitude of applications around the world, bringing

ZF Marine HRP the reputation of a reliable and renowned thruster supplier. All thrusters are developed, designed and produced in house and built in accordance with high quality standards, guaranteeing the reliability of the product.



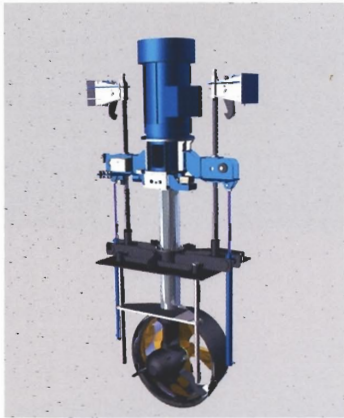
Well mounted steerable azimuth thruster units to be placed below deck



Steerable azimuth thrusters with counter-rotating propellers with guarantee higher efficiency and comfort on board



Deck mounted thruster units placed on deck, with containerised prime mover



Retractable Thrusters mostly used as auxiliary or back up propulsion specially designed for offshore applications like OSVs and PSVs



Shallow Draught Thrusters

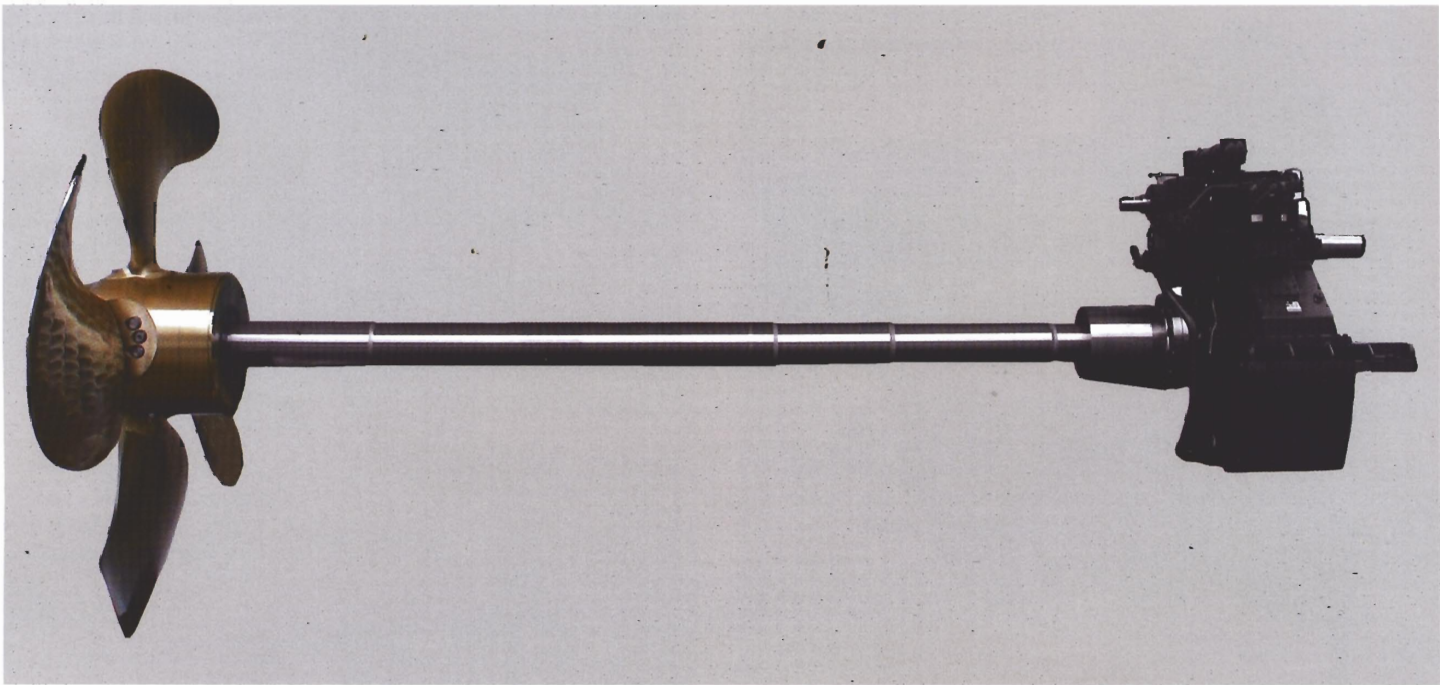


Tunnel thrusters for stern-and bow thruster applications

# CPP and FPP propulsion packages

Turnkey responsibility for the propulsion drive-line offers many benefits, not only during project conception

and system commissioning but also for service support throughout the vessel's life!



These benefits include:

- Optimized design through careful matching of gearbox and propeller to the hull and engine characteristics. ZF Marine's design experts work closely with ship designers, shipbuilders and engine manufacturers during the project phase, construction period and are available for analysis of sea-trial results.
- Standardization of propulsion components results in simple systems, easy maintenance and increased reliability. ZF Marine utilizes their well-proven, KH-type controllable pitch propeller hub design for all applications, from small fast craft up to large product tankers.
- Simplified installation, with no "hidden costs" or unexpected exclusions to the scope of supply.
- ZF Marine service engineers are commissioning experts for propellers, gearboxes and all associated components, hydraulic and electronic systems.

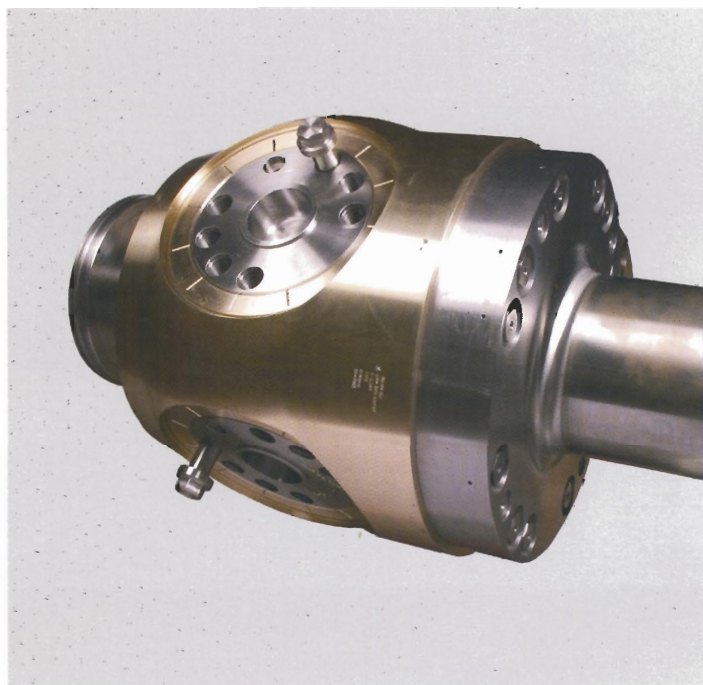
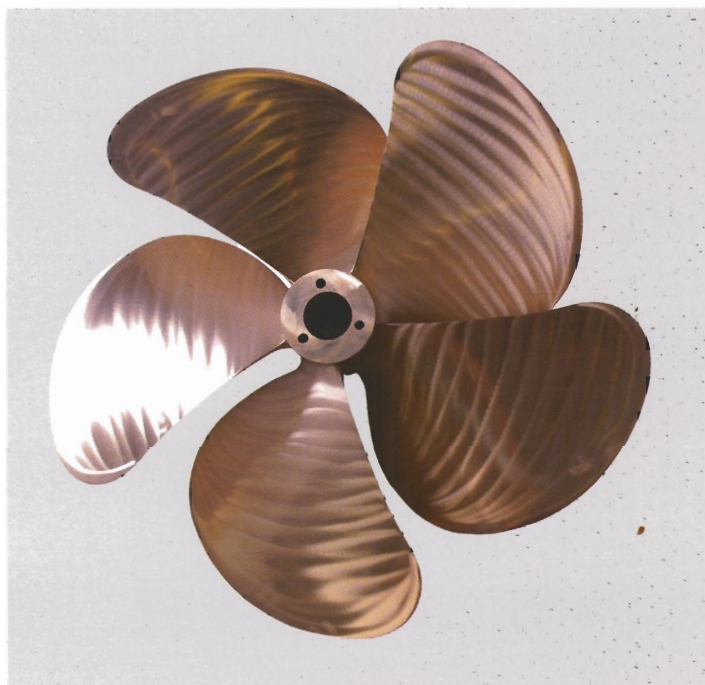


# Controllable Pitch Propellers

Design simplicity and ruggedness are the main features of the ZF Marine KH controllable pitch propeller. The solid hub has large blade port bearings to ensure that the high thrust loads and wake-induced, alternating stresses are safely absorbed. This conservative design approach results

in reduced maintenance, and consequently low through-life costs.

A double-blade sealing system further enhances the ecological attractiveness of these propellers.



## Hub body

To ensure maximum strength, the hub body is formed from a single, robust, nickel-aluminum-bronze casting and is designed to absorb the centrifugal and bending loads that are exerted by the propeller blades. The hub bearing areas are sized using FEM (finite element) technology enabling local stresses to be minimized thereby reducing wear and tear of the bearing surfaces. A strong, cast-steel yoke is centrally located in the hub body with four integral yoke pins (five pins in case of a five-bladed propeller) and piston rod. Bronze sliding blocks, specially shaped to accommodate the largest possible yoke pin eccentricity within the hub confines, are fitted on the yoke pins. The

hub body also contains four slotted blade carriers (counter flanges) which are bolted to the propeller blade feet. This so-called “pin-slot” mechanism translates the axial motion of the servo piston into pitch rotation of the propeller blades.

## Servo cylinder

The servo cylinder is bolted to the aft face of the hub body and contains a servo piston which is connected to the yoke by means of a piston rod. This has also been generously dimensioned using FEM analysis to withstand the maximum hydraulic forces created by the servo system.

# Propulsion Control Systems

ZF Marine propulsion control systems are based on decades of experience in marine control system design and are therefore at the leading edge of marine electronics technology, providing ideal solutions for single engine, multiple engine or multi station installations.

Being a crucial element for vessel and crew safety, ZF Marine control systems incorporate only reliable, well designed components and provide for easy operation and easy maintenance.



Control systems from ZF Marine interface with mechanically or electronically controlled engines, thrusters, transmissions and auxiliary systems. In particular, the electronic control systems for CPP's can be supplied for either constant speed operation or combined mode operation.

Using its own technology gained through the years, interfaces can be made to DP Systems, Autopilot, Single Joystick systems and VCR units. Customized programming is also available for special applications. The number, location (bridge, engine control room or bridge wings) and layout of

the control panels is customized to meet the application and operational constraints.

For thrusters solutions the hydraulic power pack for steering and / or lifting is mounted near the thruster and hooked up by means of hydraulic hoses and piping.

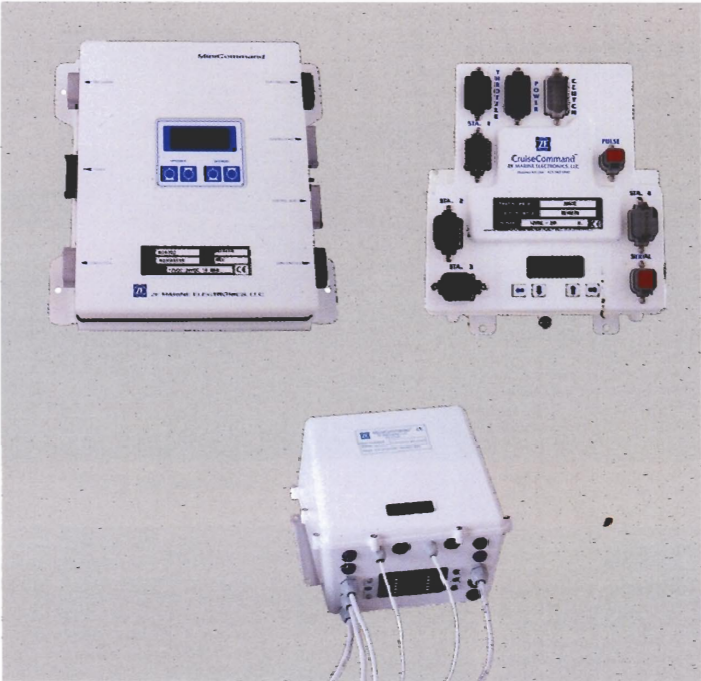
The hydraulic pump is driven by the input shaft of the thruster, or by a constant speed electric motor. The power pack is as a standard provided with filters, clogging indicator, valves, level indicator etc. and fulfils the rules and regulations of any classification society.



ZF Marine manufactures multiple levels of commercial grade propulsion control systems to meet the various needs and requirements of commercial vessel operators. From the most basic tug boat to large double ended Ferries, our state of the art control systems are designed for the harsh engine room environment. Military Vessels and Offshore Supply Vessels, which demand highly sophisticated Dynamic

Positioning systems, are today equipped with ZF Marine propulsion control systems.

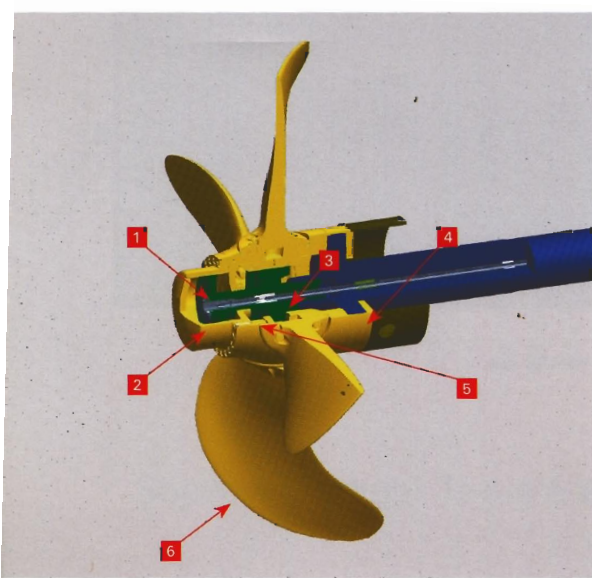
ZF Marine control systems are available for mechanical or electronic engine and transmission applications, and are designed and tested to meet stringent classification society standards.



Standard features

- Plug in Installation
- Push button configuration
- Start interlock
- Multiple Transmission protection functions
- Synchronization
- Warm up mode
- Multiple control station capability with simple station transfer

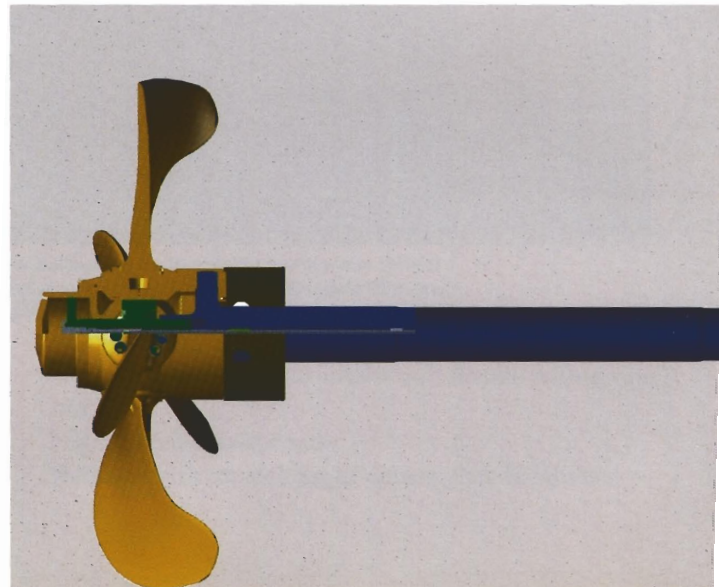
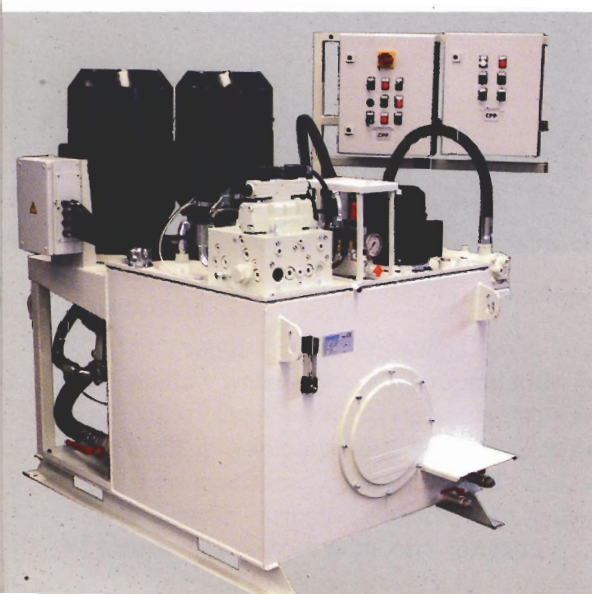
# CPP & Internal Components



## Hub details

- 1 Robust, solid hub with large blade ports
- 2 Servo cylinder for low blade actuating pressure
- 3 Double sealing system for environmental safety
- 4 Hydraulic oil tubes, available with single or double pipe
- 5 Robust, single piece yoke-piston rod arrangement
- 6 Optimized, "wake-adapted" blade design for high efficiency, low noise performance

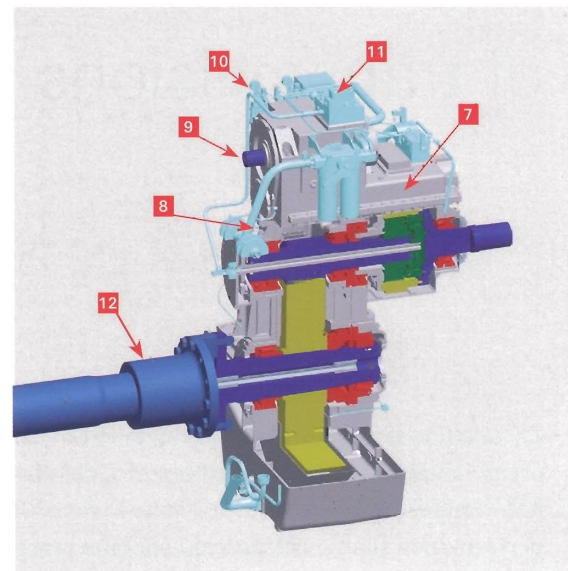
Twin pump hydraulic system with proportional valve



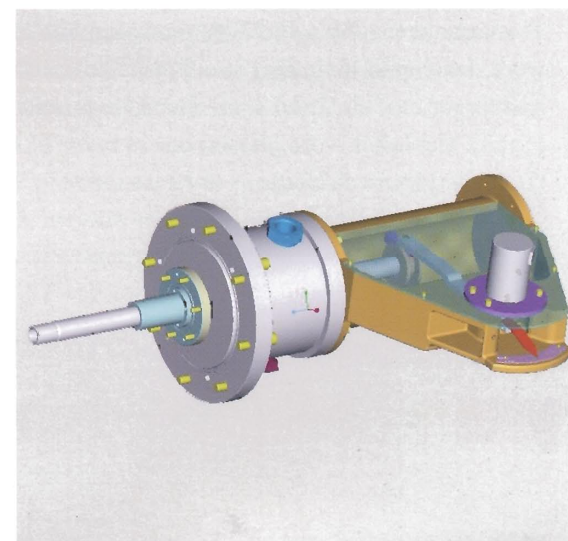
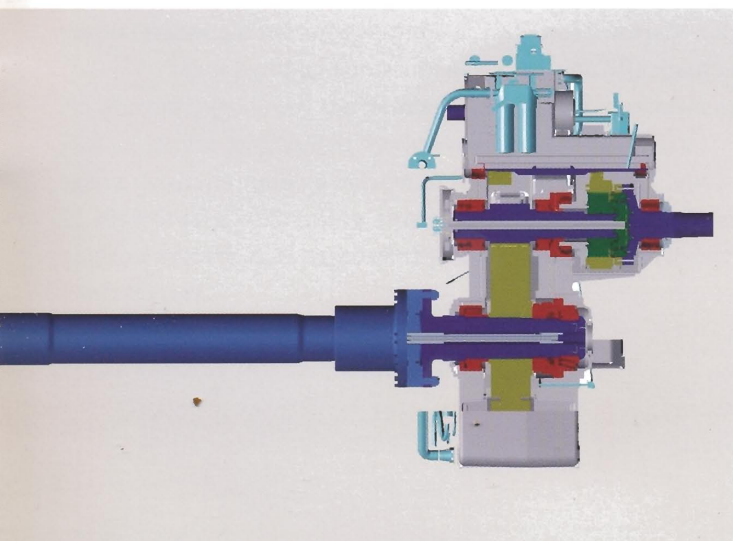


### Transmissions details

- 7 Gearbox with or without disengaging clutch (type NR and NC).
- 8 Integrated hydraulic pump (standby pump loose or fitted on gearbox)
- 9 PTO assembly: Primary and secondary PTO's with or without clutch.
- 10 Centralized and ergonomic alarm and monitoring group.
- 11 Integrated hydraulic control unit.
- 12 Hydraulically fitted flange coupling with integrated drive-up piston.  
SKF-coupling option for plane bearings Gearbox



OD box



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