

# Resilient gear design for deep ice drilling systems

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This presentation addresses the requirements and design considerations for an open and pressure-tolerant cycloidal gearbox. Electric motors often require reduction gears to achieve sufficient torque at the output shaft at comparably low speeds. Conventional gearbox designs feature closed compartments with static and dynamic seals to contain the oil or grease required for bearings and the teeth of gear wheels. The application of gears in ice drills in liquid filled bore holes is challenged by temperatures down to -50°C and cyclic loads of hydrostatic pressure up to 250 bar. To cope with these conditions especially for dynamic sealing of rotating shafts only special PTFE seals of limited availability and high price can be used. Furthermore these seals cannot be stretched for installation in grooves and therefore require a more complex embodiment design of the housing. This often results in a higher number of individual parts and additional static seals, all of which must function flawlessly, otherwise endangering the whole system. An alternative gear design is proposed that radically shifts the focus from durability causing complexity towards simplicity and ease of maintenance. As drilling fluid unfortunately is more a solvent than lubrication the tribological requirements of the contact of the working surfaces has to be considered. In contrast to the sliding contact of conventional toothed gearwheels, cycloid gears feature only rolling motion for the contact of its main components, rendering it applicable to an unsealed open housing and direct contact to drill liquid.

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