Sliding bearings in the conditions of lubrication by contaminated water by solid particles – results of comparative experimental tests

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Water-lubricated journal bearings are frequently applied in marine and hydropower industry due to their advantages over other bearing types. The simplicity is an important advantage. Usually friction losses are small. Water lubricated bearings are environmentally friendly, can operate even without sealings – in ship stern tube bearings or in pumps when lubrication by surrounding, often dirty water with debris takes place.

Experimental tests conducted recently were inspired by a real case when water pump bearings were badly damaged by rapid wear caused by hard, mineral debris contamination after tsunami in Japan. In the literature there is a number of scientific papers referring to this problem. Most of them are theoretical studies focused on hydrodynamic lubrication with lubricant which contains solid particles.

The main concept of the conducted research work was to test group of eight different bearing bush materials (two polymers, two composites, three types of rubbers and PTFE + rubber). Some of them are accepted by classification societies for marine applications, some others are used in pumps of in water turbines. Each sliding couple was made in four different geometry versions (different shape and number of lubrication grooves).

After initial 10 hours long running-in with clean water as a lubricant the test with dirty water was conducted. Each test run takes 60 hours. Bearing specific pressure was 0.64 MPa. Bearings diameter was 65 mm and the shaft speed was 430 rpm. In the test 10 liters of water was contaminated with 5 cm3 of silicon particles (particles concentration 50‰). The contaminated water was changed for times. In the same time similar bearings were tested on a smaller test rig with shaft diameter of 30 mm – to evaluate the problem of bearing scale.

The results are very interesting. Some materials are abrasion resistant in relation to others, bush geometry has also an important role in wear process. The interesting conclusion is that one of the most common application rubber - NBR bush with grooves around full circumference is not at the end of the best sliding couples list.

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