



All moving parts of the Pont Jacques Chaban-Delmas are subject to extremely high loads



The winches need a grease with very high viscosity

SMOOTH OPERATOR

Different parts of movable bridges demand different lubricants; environment must also be considered in the choice

Wherever moving parts have to function smoothly under high loads, reliable lubrication is vital, and this applies in particular to the lubrication of movable structures, notably lifting bridges. The moving parts of these bridges are not only subject to extreme mechanical stresses, but are frequently exposed to humidity and – when they are in locations close to the sea – they have to cope with an aggressive saline atmosphere. High-performance lubricants are required to meet the specific challenges.

Movable bridges are defined by the requirement that specific components have capable of being easily moved whenever required. In the case of a lifting bridge in particular, the movable components are subject to high mechanical stresses, which place particular demands on the lubricants. The reliable lubrication of moving components is essential in order to protect installations against failure, especially in such large scale structures. Decisive factors in choosing lubricants are their anti-wear properties, corrosion-protection, high resistance to pressure and water, suitability for the respective environment and operating temperatures, as well as the required intervals between relubrication, and ease of operation. Disregarding these criteria can lead to expensive operational failures. Experienced tribology experts can actively assist bridge designers and owners in this process, right from the planning stage to the actual building.

One recent challenge for specialist Klüber Lubrication was the lubrication of the numerous friction points on the Pont Jacques-Chaban-Delmas. This huge lifting bridge connects the two banks of the Garonne river in Bordeaux, France; it is 433m long and has a main span of 117m, which is designed to be lifted in order to allow the passage of large vessels. The bridge takes about 11 minutes to reach its fully raised height of 53m, and in this process, the lifting mechanism of the bridge works like a giant elevator: counterweights in the form of four metal bars with a total weight of 2,694t move up and down inside the towers, reaching up 77m. The counterweights are connected to the middle span of the bridge by sets of cables running over 4m-diameter pulleys which are mounted on the top of the towers. In the base of the towers, the cables are wound on drums. The control centre for operating the motors and winches is situated on one river bank.

All moving parts in this mechanism are subject to extremely high loads and so the lubrication must be reliable and failure-proof. Since some of the friction points are hard to access, relubrication intervals were to be made as long as possible. Moreover, as Bordeaux is near the Atlantic coast, the air is rich in salt, which not only has a corroding effect, it can cause lubricants to deteriorate rapidly. Another demand by the client was that only a small number of different lubricants should be specified, in order to reduce the risk of products getting mixed up, and to make purchasing and storage easier. Construction of the bridge was carried out by GTM, part of the Vinci Group. The study of the lubricant requirements was carried out by NFM Technologies in liaison with specialist Klüber Lubrication.

Following an analysis of the system, Klüber Lubrication recommended three speciality lubricants offering the characteristics needed to satisfy the individual requirements of the numerous friction points involved.

The bearings of the cable drums and the winches require a grease with a very high viscosity, that is higher than 1,000mm²/s. Klüberlub BE 41-1501 is a special grease for rolling bearings running slowly under heavy loads. It is based on a highly viscous mineral oil (ISO VG 1500), lithium special soap and has extremely effective extreme pressure/anti-wear additives. To protect components in the event of insufficient lubricant supply and to ensure emergency lubrication, it contains MoS₂ (molybdenum di-sulphide) and graphite as solid lubricants.

Due to the proximity of the site to the Atlantic Ocean, the corrosive effect of salt had to be taken into account by the tribologists. Klüberplex AG 11-462 was specifically developed for marine applications and hence is able to cope with a salty atmosphere. It is a brushable adhesive white operating and priming lubricant containing an aluminium complex soap, mineral oil and white solid lubricant particles. Klüberplex AG 11-462 is resistant to high loads and offers very good corrosion protection also when exposed to sea water.

It offers very good adhesion and elevated wear protection also at low temperatures due to specially selected solid lubricants and additives. As the lubricant is white, the need for cleaning the area of application is reduced. Klüberplex AG 11-462 offers versatile uses, for example in gear rim and pinion drives, bearings and so on. The couplings, joints, locking mechanisms and guideways of the lifting middle section are also lubricated with Klüberplex AG 11-462.

For the gearboxes involved, Klübersynth GH 6-320, a synthetic high-temperature gear oil based on polyglycol was specified. This lubricant offers high resistance to scuffing and micropitting as well as very good wear protection to prevent premature bearing failure. Thanks to the excellent ageing and oxidation resistance of its synthetic base oil, Klübersynth GH 6-320 attains a much longer service life than mineral oil-based lubricants, leading to longer service intervals.

The optimised friction behaviour of the polyglycol base oil reduces power loss and improves gear efficiency. Its excellent viscosity-temperature behaviour supports the formation of a sufficient lubricant film also at elevated or high temperatures. Klübersynth GH 6-320 has a wide service temperature range