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Scotland Rotating Wheel Carries Boats between Canals

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A unique wheel-like construction, transfers boats between two canals in Central Scotland, thus connecting a vertical gap of about 32 metres. The wheel measures 35 metres in diameter, with an axle length of 28 metres. It simultaneously lift and lower two 22 metre long caissons which each holds a payload of 300 tonnes, comprising water and up to four boats.

The **Falkirk Wheel**, led by British Waterways, reopens and reconnects the Forth and Clyde Canal, and the Union Canal between Glasgow and Edinburgh.



Artist's impression of the wheel © RMJM

Up until the 1930s, the two canals were linked by a series of 11 locks. However, along with the demise of the canals, the locks fell into disrepair, were filled-in, and have remained unusable. As a result, the idea of connecting the canals via a rotating boat lift was put forward and was originally conceived as a giant Ferris wheel with suspended gondolas. For this design, **SKF** the world's leading bearing solution supplier proposed large, double row, spherical roller bearings and specially designed bearing housings to support the wheel. The final design has, however, evolved over the years of planning into the radical concept that is now a reality.

The new design came from the successful collaboration of several designers led by the **Morrison Bachy Soletanche Joint Venture**. It follows on from the much-acclaimed initial design by Dundee Architects Nicoll Russell Studios and the exemplar designs by Engineers Binnie Black and Veatch.

Situated in a **natural amphitheatre**, the wheel itself is considered to be a form of contemporary sculpture and is endorsed as such by the **Royal Fine Art Commission** for Scotland. It takes the shape of a Celtic-inspired, double headed axe, in which two axe-shaped arms rotate in a continuous circle, 180 degrees at a time. It will simultaneously lift and lower two 22 metre long caissons which each hold a payload of 300 tonnes, comprising of water and up to four boats, and uses a series of synchronous gears to positively keep the caissons in the horizontal plane.

Butterley Engineering, of Ripley, Derbyshire, won the contract to build the wheel and its engineering design consultant, Bennett Associates, of Rotherham, Yorkshire, invited SKF to provide a new bearing solution. To support the wheel, SKF developed a solution which uses a pair of purpose-designed, four metre diameter, three row, slewing bearings, one positioned at either end of the wheel, with outer rings bolted to the support structure and inner rings bolted to the arms. The inner ring of one of the bearings is equipped with gear teeth to transmit the drive to the wheel. The wheel is rotated by **ten hydraulically driven gearboxes**, via the geared slewing bearing. It turns at a rate of around 0.125 rpm, which sees it lift and lower boats at an average rate of 4 metres per minute.

When the caisson and canal watertight doors are closed, a pump system will be brought into action to **equalize the water levels** in the two caissons to establish near perfect balance. The wheel drive system has, of course, been designed to handle a degree of imbalance due to differing water levels in the caissons. However, even allowing for this potential out of balance, the very low friction torque of the SKF antifriction bearings means that a rated torque of only 2972 kNm is required to rotate the wheel.

It is expected that over the coming years, the regenerated network will **attract** increasing numbers of **boaters**, and **visitors** to the area with the waterways acting



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as a catalyst for further economic regeneration and the revitalisation of communities across central Scotland.

Jim Stirling, Director of British Waterways, Scotland: "We always said that the Falkirk Wheel should be something special, we wanted to create something elegant that people would want to come and see. The wheel will be a symbol for Scottish innovation and ingenuity as well as a unique, thrilling experience for visitors." (Source: Minnett Media 2001/2002)

Information & Contact:

SKF Austria AG

Postfach 205

A-4400 Steyr

Phone +43 7252 797-0

Fax +43 7252 797-100



[E-Mail]



[Print]

LINKS

- ▶ **SKF Austria** (<http://www.skf.at>)
- ▶ **SKF Worldwide** (<http://www.skf.com/>)

EMAIL

- ▶ **SKF Austria** (leif.birch-jensen@skf.com)

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