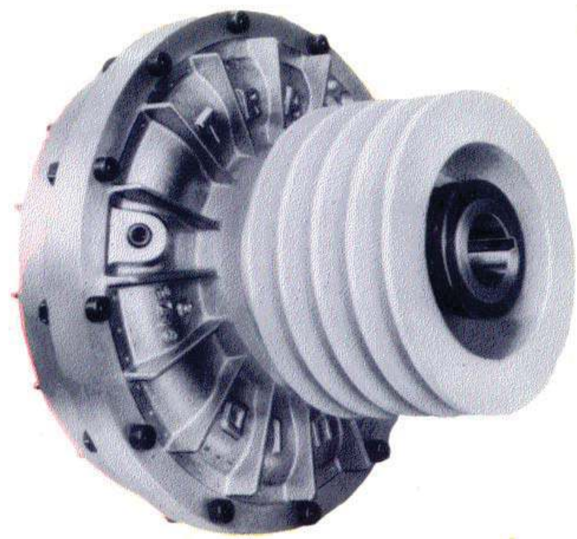
XI. FLUID COUPLING 13 KRG



1. DESCRIPTION

The TRANSFLUID coupling (K series) is a constant filling type comprising three main elements :

- Driving impeller (pump) mounted on the input shaft.
- Driven impeller (turbine) mounted on the output shaft.
- Cover, flanged to the output impeller, with an oil-tight seal
  The first two elements can work both as pump and/or turbine.

2. OPERATING CONDITIONS

The TRANSFLUID coupling is a hydrokinetic transmission. The impellers perform like a centrifugal pump and a hydraulic turbine. With an input drive to the pump (e.g. electric motor or Diesel engine) kinetic energy is imparted to the oil in the coupling. The oil moves by centrifugal force across the blades of the turbine towards the outside of the coupling.

This absorbs the kynetic energy and develops a torque which ,is always equal to input torque thus causing rotation of the output shaft. The wear is practically zero since there are no mechanical connections.

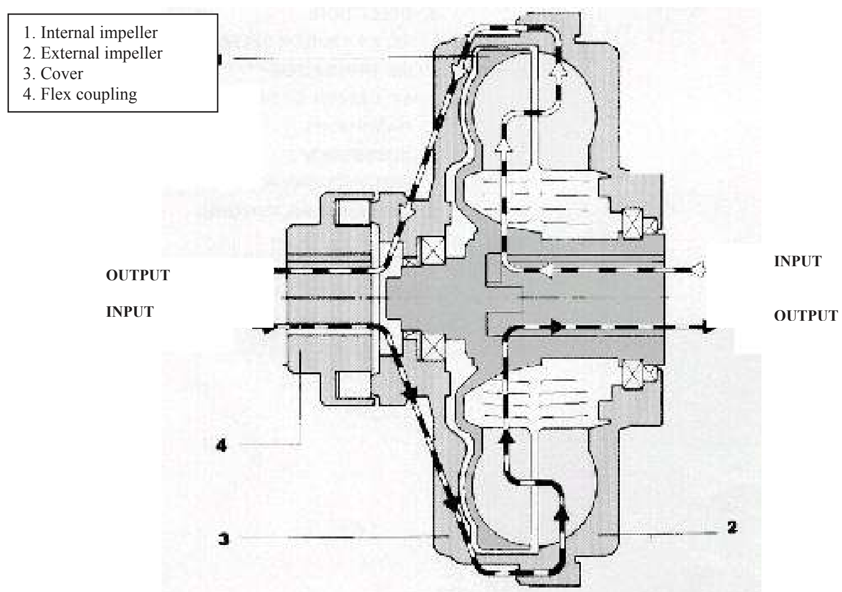
The efficiency is influenced only by the speed differency (slip) between pump and turbine.

- The slip is essential to the functioning of the coupling: there could not be torque transmission without slip! The formula for slip, from which the power loss can be deduced is as follows:

  - Slip % = (((Input speed – Out speed) / Input speed)) X 100

- In normal conditions (standard duty) the slip can vary from 1,5% (large power) to 6% (small power). The TRANSFLUID couplings follow the laws of ail centrifugal machines:

- Transmitted torque is proportional to the square of input speed;
- Transmitted power is proportional to the cube of input speed;
- Transmitted power is proportional to the fifth power of circuit outside diameter.



2.1. TRANSFLUID coupling fitted on electric motors

The fluid coupling is mainly fitted on triphase squirrel-cage motors which supply maximum torque at 85% of rated speed. With direct-on-line starting, these motors absorb approx. 6 times nominal current. The result is an increase of: motor temperature, prime costs (specially with frequent starts) and the overcoming of limits imposed on many plants by suppliers of electrical energy.

To avoid these inconveniences, some people substitute direct starting with other methods.

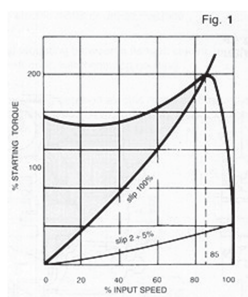
The most usual method is star-delta starting (YΔ) that reduces by about 1/3 the absorbed current and torque required by direct starting.

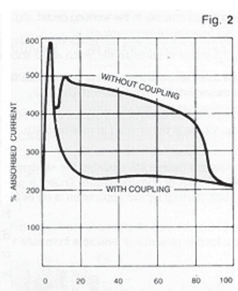
This method does not eliminate high current peaks during the initial commutation phase, and with high inertia machines it is necessary to select an oversized motor to deal with the long acceleration period during starting. With the inclusion of a TRANSFLUID coupling the motor starts on very low load with only an instantaneous current peak at switch-on (see fig. 2).

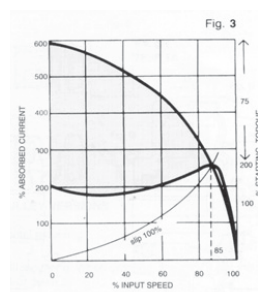
At start all the torque is available to accelerate the motor and the driving impeller. In this phase there is 100% slip until the motor reaches the maximum torque point (200% of nominal torque). Then the driven member speed increases progressively whilst slip reduces to its minimum value. (fig. 1)

Furthermore the fluid coupling provides protection against overload or stalling of the driven machine. In these cases, if the motor were rigidly connected, stopping of the rotor would occur immediately with overheating and instantaneous increase of current to the same values or more, of starting current.

With the fluid coupling when these factors occur, the motor decelerates until 100% of slip is reached (breakdown point). At this point the absorption of current is considerably less than the starting current (about 75%). (fig. 3)







2.2. TRANSFLUID coupling with delayed-fill chamber

TRANSFLUID couplings have very low starting torque ensuring that the electric motor does not exceed 200% nominal torque with standard circuit in max fill condition. It is possible to further limit the starting torque by reducing the oil quantity inside of circuit, obtaining starting torque values up to 160% of nominal torque.

This method has the disadvantage of increasing the coupling slip at rated speed and the operating temperature of the coupling.

The more technically sound method to obtain the limitation of starting torque, is the use of a Delayed-Fill Chamber. This is bolted on the external circuit having calibrated oil-bleed-orifices into the working circuit. (fig. 4a/b/c).

In standstill condition, the delayed-fill chamber contains part of the oil fill, reducing the oil quantity in the working circuit. (fig. 4a) For this reason, at start, the coupling transmits very limited torque, allowing the motor to immediately reach rated speed.

During starting oil flows proportionally to the speed from the delayed-fill chamber to inside working circuit. (fig. 4b)

When the coupling reaches rated speed almost all the oil is in the circuit and the torque is transmitted at minimum slip. (fig. 4c)

With standard or double delayed-fill chamber the starting torque reaches the 140% or less, of nominal torque. Thus it is particularly suitable for soft starting: typical application is on belt conveyors.

The advantages of the delayed-fill chamber are more obvious with high powers: for this reason it is available from size 12K.

3. SUMMARY OF THE ADVANTAGES OF THE TRANSFLUID COUPLING CAN BE RESUMED

~ At start-up, current peaks are reduced almost instantaneously. The motor starts on low load

~ Smooth and gradual starts. Protection of driving and driven member against overloads and stalling, due to slip.