TMG/ROF

Grease Testing Machine

General Description

Lubricating greases, that are developed for high temperature or high speed bearing applications or for a combination of both, should offer what they promise.
The problem, whatever, is to check these promises.
Current test methods give inadequate results. This is why many years ago SKF developed its own grease testing machine in order to be able to evaluate the most suitable grease qualities to perform with the SKF high quality bearings. The SKF TMG/ROF Grease Testing Machine now is available on the market.

Purpose of the Test

The purpose of the test is to measure the ability of a grease to lubricate under various speeds and at various temperatures. Grease quality is measured by recording the number of running hours it takes before the grease ceases to lubricate and as a consequence the bearings fail. The longer the number of running hours in the test unit, the better the grease is at lubricating under those conditions. In this way the maximum operating speed and temperature for a particular grease can be determined.

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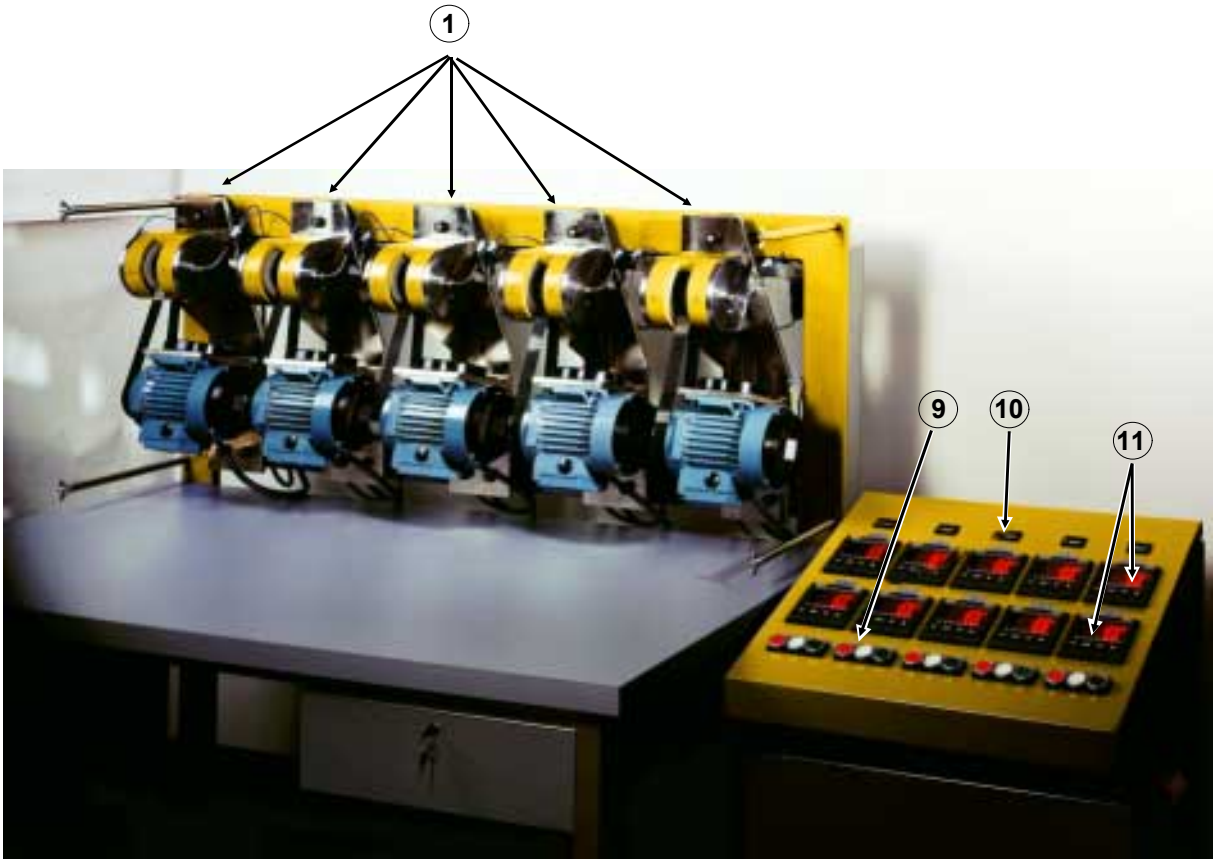
Machine Description

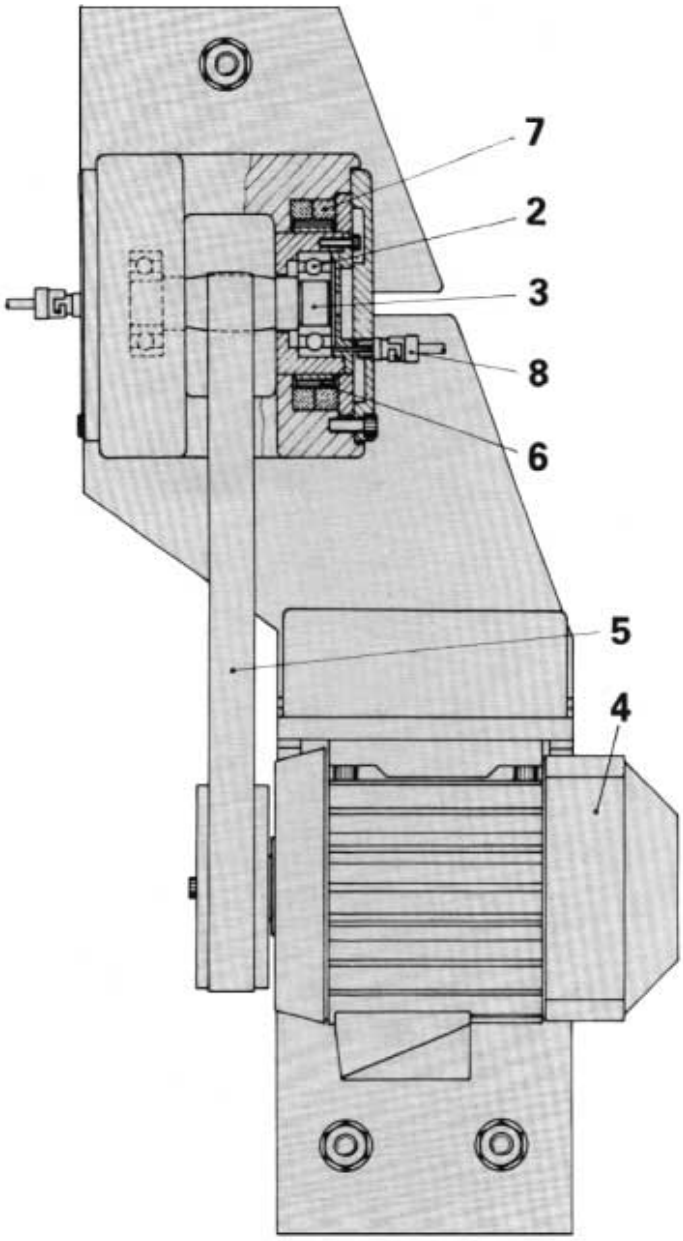
The SKF TMG/ROF Grease Testing Machine basically consists of two parts: a mechanical test unit and an electronic control unit.



The mechanical unit contains five cast-iron housings **1** . Each housing contains two bearings **2** , mounted on a shaft **3** , the total number of test bearings being ten.
The test bearings are normal standard production bearings 6204/C3. The shields are delivered separately. The shaft is rotated by an electrical motor **4** by means of a flat belt **5** .

The cast-iron housing contains a heating element **6 ,** embedded in two insulating rings **7** . Each housing half has a feeler **8** to check and regulate the temperature.

The electronic part contains five ON/OFF switches **9** , five hour counters **10** , five groups of two electronic temperature controllers **11** and one main switch.



Test Method

In the mechanical unit the test grease is checked in ten bearings at a given temperature and speed and at fixed loading conditions. The standard running speed is 10000 r/min (d_m x n ~ 335000). The running speed can easily be changed to 20000 rpm/min (d_m x n ~ 670000) or to 6000 rpm/min (d_m x n ~ 210000) by changing the shaft diameter.

The test temperature can vary from room temperature up to 170° C.
The radial load (Fr) is 50 N/bearing.
The axial load (Fa) is 100 N/bearing.
In the electronical part the test temperature can be set and controlled and the running hours are recorded.

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Test Procedure

The test bearings are standard 6204/C3 bearings with separate shields. The test bearings and shields are washed, rinsed, dried and lubricated with a standard quantity of the test grease, corresponding to one third of the free volume in the bearing, after which the shields are fitted.
The bearings are mounted on the shafts and in the housings and the whole mechanical test machine is assembled. The bearings are slowly brought up to the test temperature.

Each bearing is individually temperature-controlled by means of a thermocouple.
When the test temperature increases or drops by 20° C over or under its preset test temperature, the unit involved will be switched off automatically (Sudden Death Test). The other units will continue running.
Each unit is connected to a counter, which records the total number of hours each unit has run.

Test Results

In the SKF ROF Grease Testing Machine greases are checked on their grease life at high temperature and high speed application.
The longer the running time, the better the grease.
The bearings run in pairs in a housing. Consequently to this, when one of the bearings fails due to temperature rise or seizing, both bearings stop running, although the other bearing may still be in excellent condition (Sudden Death Test Strategy).
From the number of running hours, the following values can be calculated, using the Weibull Probability Plotting.

a) Median life (L_{50}):

This is the estimated number of hours at which 50% of the bearings fail because of undue temperature change or seizing, caused by inadequate lubrication.

b) L_{10}:

This is the estimated number of hours at which 10% of the bearings fail because of undue temperature change or seizing, caused by inadequate lubrication.

c) Weibull Exponent β:

This is a measure of the spread in grease life. For greases the exponent is very often between 1 and 3.
The smaller the exponent, the higher the spread.

d) 90% Confidence Limits for the L_{50} and L_{10}:

There is a 90% probability that the real L_{50} or L_{10} lies between the 90% confidence limits.

Thus, there is a 5% probability that grease life is less than the lower limit, and a 5% probability that grease life is higher than the upper limit.
Testing with more than 5 groups will tighten these confidence limits (give a higher accuracy).

WEIBEST software is available from SKF to carry out these statistical calculations.

Applicability to Service Conditions

From the results obtained, a calculation can be made how bearings will behave in practice. Also the important parameter, the relubrication interval can be calculated.

As relubrication intervals are linked to bearing failure, precise knowledge of the grease behaviour is of extreme importance.

Test Cost

The test bearings 6204/C3 are normal production bearings. They are the only component that has to be renewed for each test. The machine controls itself and no personnel involvement is necessary during the test. The total cost therefore is extremely low.

Other Test Machines

Over the years SKF has developed a number of grease testing machines like:

- the SKF TMG/EMCOR Grease Testing Machine to test the corrosion inhibiting properties of greases: a ISO, DIN, IP/BS, NFT and SIS standardized method
- the SKF TMG/V2F Grease Testing Machine to test the mechanical stability of greases
- the SKF TMG/R2F Grease Testing Machine for testing mechanical-dynamic behaviour of roller bearing greases
- the SKF BEQUIET+ Grease Noise Testing Machine to assess the noise characteristics of a grease.

All test methods are linked very closely to practice.

Technical Data

Mechanics	
Dimensions	length 1750 mm width 900 mm height 1430 mm
Weight	271 kg

Electronics	
Dimensions	length 650 mm width 450 mm height 930 mm
Weight	74 kg

Electric	
Connection	3 x 400 V/50/60 Hz

For more information on your specific application, please contact our engineers at QTC.

QTC, the "Quality Technology Centre" in Steyr, develops, manufactures and markets systems, which are used to ensure the quality in these special fields:

- Roundness and Form Analysis
- Noise and Vibration Control
- Optical Inspection
- Nondestructive Material Testing
- Dimensional Measurement
- Washing
- Laser Marking
- Grease Testing
- Demagnetization
- Cleanliness
- Assembly
- Packaging

QTC supplies the latest technology and highly innovative equipment to customers worldwide and is also the Competence Centre for measuring and quality-related equipment for the SKF Group on a global scale.

QTC, Quality Technology Centre, is located in Steyr - Austria.
You are always welcome to visit us.
The best way to reach us is a flight to Linz via Vienna, Frankfurt or Zurich.

We will, of course, arrange the pick up at the airport.