

KES

For Transmission Bearing

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Appendix



1. Purpose

This standard aims at securing the proper quality by standardizing specifications.

Remark: This standard communicates the required specification accompanying the specification drawings.

2. Scope of Application

This standard specifies the roller bearing supporting the power supply shaft used for transmission of automobile.

3. Report of Evaluation Result

The quality evaluation results at each stage from development to mass production shall be submitted to KIA according to the Appendix.

4. Meaning of Terminology

- (1) Transmission of automobile: Denote the manual transmission, auto transmission, sub transmission (including 4WD Transfer) and final reduction gear in the power supply system used for automobile.
- (2) Bearing: Denote the roller bearing in the case of transmission supporting power supply shaft by used in transmission of automobile. Representative used parts are shown as ○ in the Figure 1~2.

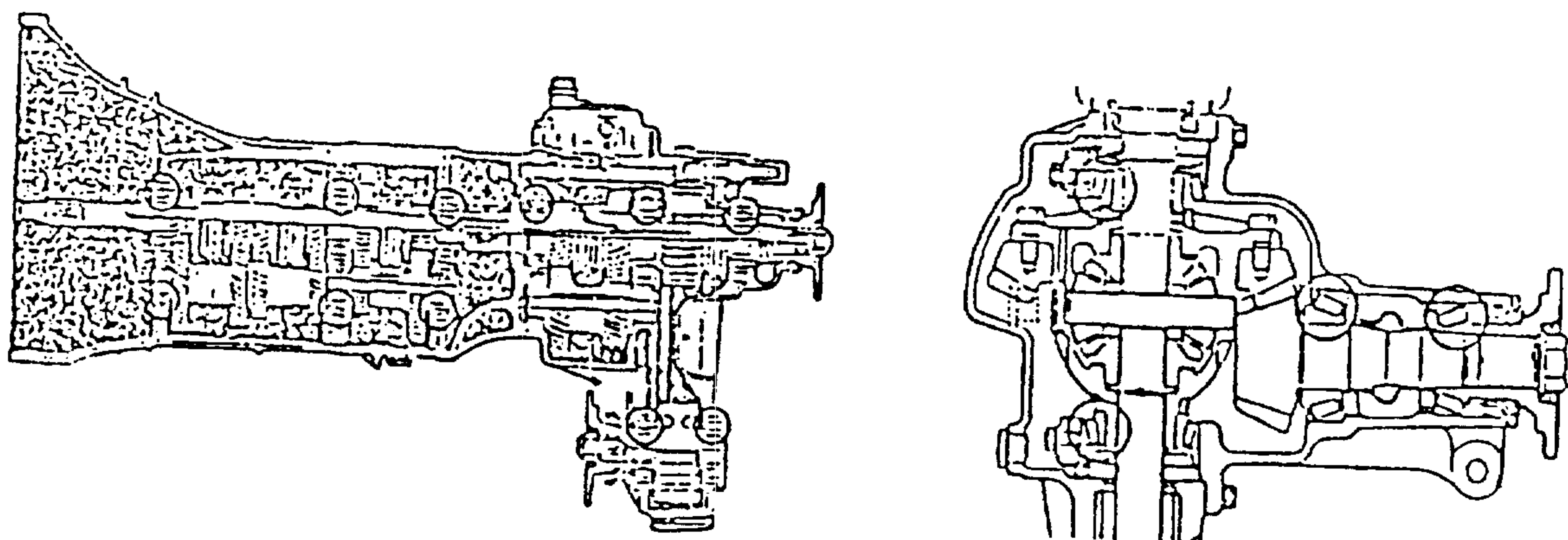


Fig. 1

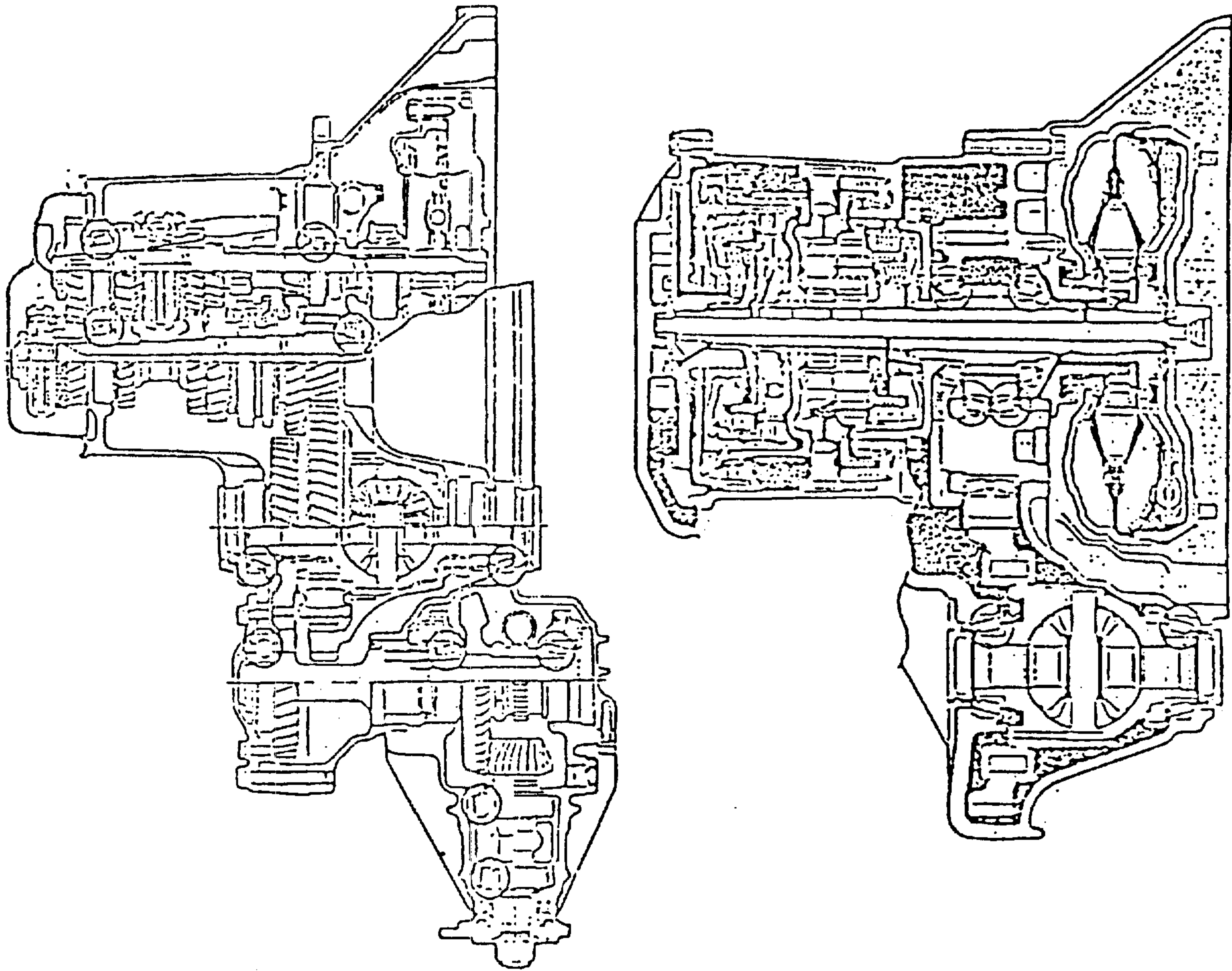


Fig. 2

- (3) Harmful dent: Indicate deep dent generally more than $5\ \mu\text{m}$ depth to the extent expected danger of early abnormality of bearing such as poor condition of revolution and exfoliation.
- (4) Impact coefficient(K): Indicate the ratio of bearing load for acceleration to bearing load for usual state.
- (5) Required life: Indicate the required time that bearing can revolve without the flaking. It shall be B_1 for 99% of remain probability and B_{10} , for 90% of remain probability.
- (6) Allowed temperature of bearing: Indicate the time that can use bearing continuously.
- (7) Guaranteed revolution time to operate the engine continuously indicate the max revolution that engine can be used without any abnormality for prescribed time. The prescribed time is variable according to the engine type.

5. Specification Indicated in Engineering Drawings

5.1 Types and Dimensions of Bearing

- (1) The type of Seal Lip(existence of seal, contact lip type or non-contact lip type and existence of air leaking).
- (2) Existence of grease seal-up
- (3) Dimension of the snap ring and groove of snap ring.

5.2 Application Condition

- (1) Load and revolution times loaded at bearing for max. torque of the engine
 - Radial Load: F_r
 - Thrust Load: F_a (for Taper Roller bearing, contain the induced thrust Load)
 - Revolution Time: N
- (2) Max. Revolution time of bearing(guaranteed revolution time to operate the engine continuously): N_{max}
- (3) Conditions for temperature
- (4) Class of lubricant and method of lubrication(Oil bath, cyclic oil supply, etc.)
- (5) Misalignment of bearing
Unless special indication, it shall be $2/1000$ rad
- (6) Impact coefficient: K
- (7) Regnired function
 - ① Regnired life: B_1 (Life period correspond with 99% of Remain Probability)
 - ② Starting torque (Room temp only for seal bearing)

6. Evaluation Standard

Table 1

Parts	Evaluating Term	Standard for Evaluating	Quality Rank	Evaluation Method
	Fatigue Strength	Shall be free from occuring of flaking at the under of regnired time.	B	7.2.1
	Strength to Load	① Shall be free from detrimental dent at inner and outer plane of the orbit. ② Shall be free from deformation, crack and failure at the sill of inner plane of the orbit, retainer, snap ring or the groove of snap ring.	B	7.2.3
	Durability of burn- ing and adhesion	① Temp. rise of bearing shall be below the allowed temp ② Shall be free from burning and adhesion.	B	7.2.5

Parts	Evaluation Terms	Evaluation Standard	Quality Rank	Evaluating Method
Strength Dura	Durability of wear	① Shall have difference of starting torque excessing 0 between with seal and without seal. ② Shall be free from crack, failure and deformation at seal lip ③ Shall be free from gap at seal lip	B	7.3.1
	Heat resistance	① Temp. rise of bearing shall be below the allowed temp. of material. ② Shall be free from crack, failure at seal lip	B	7.2.2
	Endurance the cold	① After completion of prescribed cycles, shall be free from crack, failure at seal lip. ② Shall be free from unusual noise on operation	B	7.3.2
	Starting Torque	Shall be below the required torque. Deviation of Starting torque by the change of temp shall be under $\pm 20\%$	B	7.4.1
	Strength against oil at high temp	Failure load shall be more than 1/2 of initial	B	7.2.4
	Heat resistance	Shall be free from crack and failure at resin retainer	B	7.2.2
	Endurance the cold	① After completion of prescribed cycles, shall be free from crack and failure at resin retainer ② Shall be free from unusual noise on operation.	B	7.3.2

7. Evaluation Method

7.1 Common Condition for Evaluation

(1) Standard state of test place

Unless special specified, shall be taken 20°C, 15class(20 $\pm$ 15°C) as standard temp state and 65%, 20 class (65 $\pm$ 20°C) as standard humidity state.

(2) Adjustment of test piece

As a rule, the test piece shall be taken as have passed 24 hours or more since manufactured. After leave the test piece 1 hour or more at room temp, the test shall be carried out.

(3) Mixing of an alien substance

- Mixed amount: 200mg/ $\varnothing$
- Hardness and nature: Powder of cast steel, hewing Hv 500~700.
- Shape and size: Spherical, 0.1mm or less

7.2 Strength, Durability

7.2.1 Fatigue strength

(1) Purpose of evaluation

Evaluate the fatigue strength(life) of bearing such as rolling fatigue of bearing material, durability of grease sealed up by 99% of remain probability.

(2) Evaluating conditions

Shall conform to the specification

(a) Applied Load (Radial Load F_r kgf, Thrust Load F_a kgf)

(b) Revolution of inner wheel (revolution times N_{rpm})

(c) Lubrication by oil bath (kinds of lubricant refer to figure in specification)

(d) Lubricant temp: $80 \pm 5^\circ\text{C}$ (constant)

(e) Misalignment Load (Misalignment θ)

(3) Test equipment

Test equipment shall be used as Figure 3.

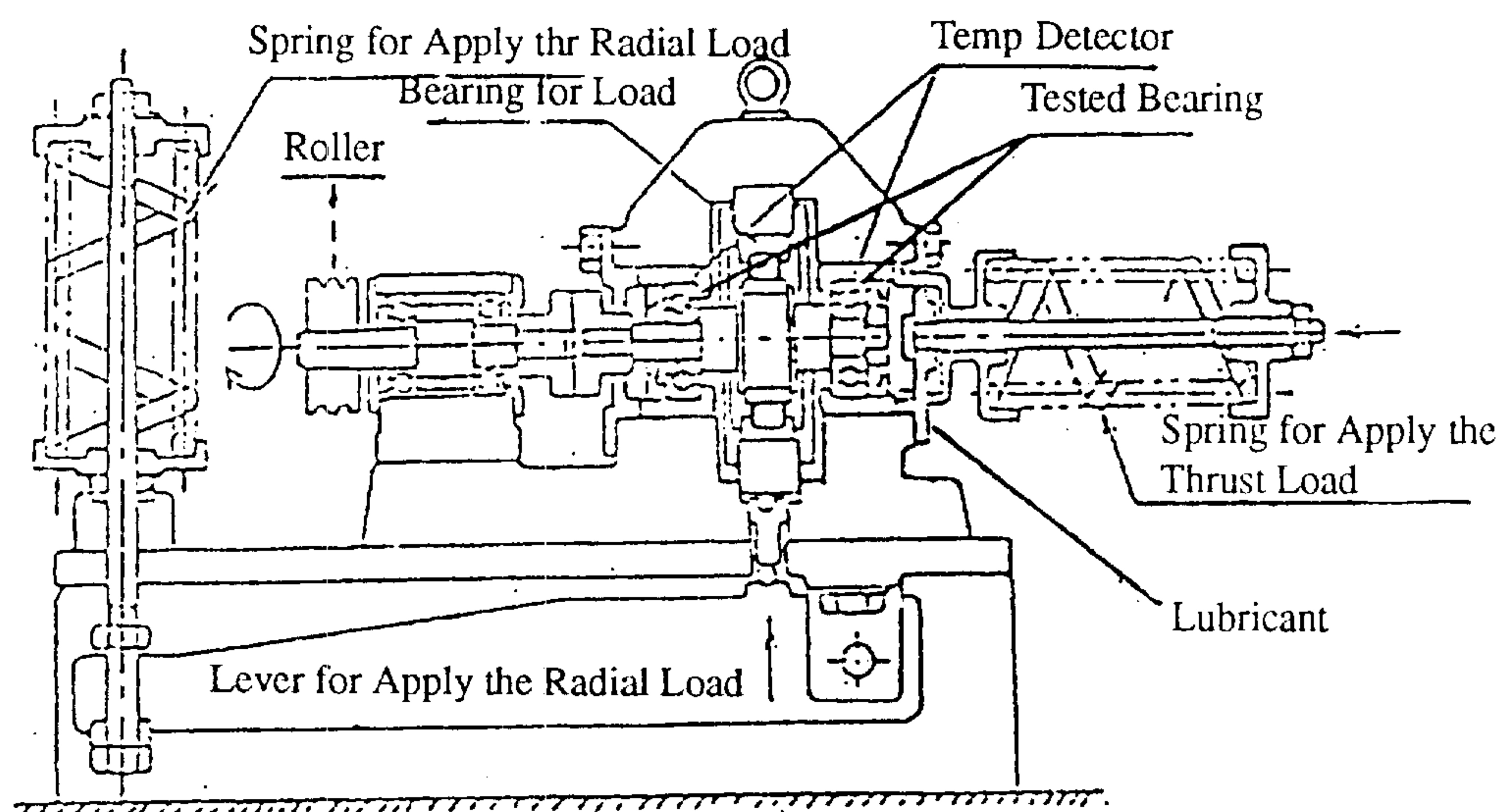


Fig. 3

(4) Test method

- (a) Attach the bearing for test to tester and apply the load, misalignment.
- (b) Supply the lubricant for test with mix an alien substance to test equipment.
- (c) Start the test by designated revolution times at the same time, record continuously the bearing temp.
- (d) Adjust the lubricant temp to ofixed temp by heater, with consideration of heat generation of bearing.
- (e) Stop the tester when detected abnormality of tested bearing by a vibration acceleration meter. This operation time shall be taken as fatigue life. When grease sealed up bearing is burned, thus operation time shall be taken as fatigue life.
- (g) The piece of test shall be 6 as standard.

(5) Evaluation

- (a) After completion of test of designated pieces, adjust each fatigue life by use a welbull probability paper and evaluate the B_1 life according to the 99% of remain probability as the required life.
- (b) B_1 as a result of life test shall be above the required life.
- (c) Bearing temp during operation shall be below allowed temp of bearing.

7.2.2 Heat resistance

(1) Purpose of evaluation

For the purpose of evaluating the heat resistance of each composed parts of bearing (especially, seal, resin retainer), check the test-completed pieces of 7.2.1.

(2) Conditions of evaluation

- (a) Revolution times of inner wheel $N=3,000$ rpm
- (b) Temp of lubricant shall conform to 5.2 (3)
- (c) Test time: 24Hr
- (d) Kinds of lubricant: Shall conform to 5.2 (4)

(3) Test equipment

Shall conform to 7.2.1

(4) Test method

Shall conform to 7.2.1

(5) Evaluating method

- (a) The temp rise of bearing shall be below the allowed temp of material.
- (b) Disassemble and check seal, retainer by naked eye or micro-scope shall be free from the crack, failure of seal lip and resin retainer.

7.2.3 Strength to load

(1) Purpose of evaluation

When supply the load like impact to bearing, evaluate the strength to load of bearing such as occurring the dent at plane of the orbit, crack and failure of bearing.

(2) Evaluation Condition

- (a) Applied Load (Radial Load $K \times Fr$ kgf, Thrust Load $K \times Fa$ kgf)
- (b) Impact coefficient K
- (c) Loading Time min 5 seconds

However Fa , Fr , Ka shall conform to diagram of specification.

(3) Test equipment

Test equipment shall be used like Figure 3.

Also it is allowed to test with load at mainbody of tester.

(4) Test method

- (a) Assemble the bearing to test equipment.
For the case of attach the snap ring to outer wheel, assemble the bearing for load most weak direction of the groove of snap ring.
- (b) Supply the load multicated by impact coefficient by static and sustain for designated time
- (c) After completed the test of designated pieces, disassemble and washing the bearing and check each parts.
Also check the depth of dent at the inner and outer plane of the orbit by the tyland detector.
- (d) For occurring of dent by supplied load, check the limit load occurs the dent.

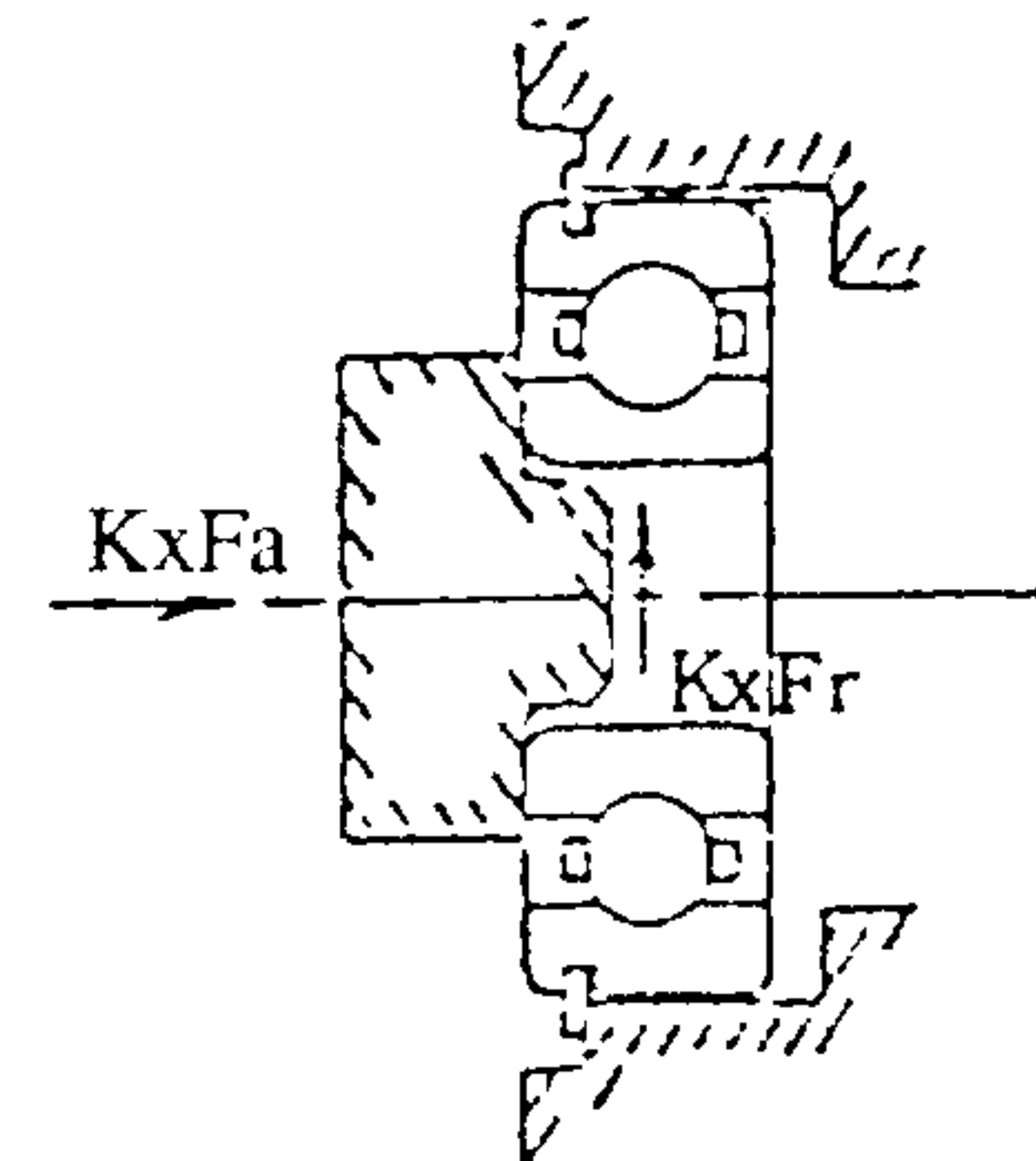


Figure 4

(5) Evaluation

- (a) With the check of depth and situation of dent at the plane of the orbit, evaluate the existence of detrimental dent.
- (b) In case the load occurring the dent excess the basic, regular load, consider the increasing of the bearing capacity or the need of amendment of load condition.
- (c) The evaluation of snap ring and groove of snap ring shall be carried out by the evaluation of crack and failure with naked eyes or color check method.

7.2.4 High temp, durable oil strength of resin retainer.

(1) Purpose of evaluation

The material strength application of resin retainer shall be evaluated by the degree of weakness because the strength of resin retainer become weak by the effect of component of lubricant and additive when used for a long time in a high temp lubricant.

(2) Conditions of evaluation

- (a) Shall evaluate by a body of retainer.
- (b) Condition of evaluation shall conform to table 2.