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FRONT SEALS-SELECTION CRITERIA

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Abstract— The work has been attempted a systematization in choosing front seals and we proposed two methods to choose the front seal, by default of their constituent parts: a simplified method of choice and an analytical method.

Keywords— front sealing, fluid sealed, criterion, temperature, speed, pressure, mounting.

I. INTRODUCTION

THE choice of the type of EF and materials suitable for building blocks of it shall be made taking into account:
- sealed fluid parameters: its nature, temperature, pressure, viscosity, aggressiveness chemical, suspensions abrasives, etc.
- construction machine served: the diameter of the shaft, engine speed, eccentricity, workbench, available space, etc.

We propose two ways of choice:
a. A simplified method of choice - using the information in table 1 and identifying the type of EF after catalog;
b. An analytical method, which is based on a program of calculation, in which the parameters of which are to be taken into account have a much greater complexity, and an indication of the most indicated EF is given by the computer.

To do this, it has drawn up a study followed by a program of calculation.

They have been established six criteria of choice of the EF, namely:

i. nature sealed fluid
ii. sealed fluid pressure (P1)
iii. temperature (working) of refrigerant fluid (T)
iv. criterion slip speed (Wave)
v. the criterion for heating, "p1.Wave"
vi. the criterion "special conditions"

Within each of the criteria are developed constructive recommendations and suitable material for items EF, and the types of EF indicated, using coding in accordance with Burgman catalog.

Abbreviations: I. P. -primary ring; C. I. - counter-to-ring; E. S. -secondary seal; S. E. A. -spring-mass-system by pressing it.

The program of calculation has been drawn up in language Borland Pascal, and includes both a part of front seal selection recommended for the parameters, as well as a part of the design, namely drawing and listing. The program is intended to be used either in a design, as well as in the educational.

II. THE CRITERION: "THE FLUID SEALED"[1]

1. ACIDS:
i. I. P.: Carbo-graffiti impregnated with resins
ii. C. I.: ceramic (Al2O3); SIC - and of feedback -
iii. E. S.: PTFE
iv. S. E. A.: Spring singular helical; multiple springs; spring curl
v. types recommended: simple; dual; M74D; M7; M7F; H7.
2. BASES:
i. I. P.: Tungsten carbide (WC Co) reinforced with Ni
ii. C. I.: tungsten carbide (WC Co) reinforced with Ni
iii. E. S.: Type "O"; rubber propane ethylene
iv. S. E. A.: Helical coiled spring singular; spring curl; steel alloy with Cr Ni Mo
v. types recommended: M74D; M7; M7F.
3. HYDROCARBONS:
i. I. P.: Carbo-graffiti impregnated with resins
ii. C. I.: alloy Fe Cr -
iii. E. S.: Type "O"; rubber floor - carbon dioxide; PTFE
iv. S. E. A.: Spring singular helical; multiple springs; alloy steel with Cr Ni Mo
v. types recommended: M7; M74D; H7N.
4. PASTA, MUD, SUSPENSIONS:
i. I. P.: Tungsten carbide (WC Co)
ii. C. I.: tungsten carbide (WC Co)
E. S.: Type "O"; silicon elastomeric; rubber nitric-butadiene; PTFE;
iii. S. E. A.: Spring singular helical; silicon; steel Cr Ni; PTFE
v. types recommended: M377
5. WATER:
i. I. P.: Carbo-graffiti impregnated with resins Carbo-graffiti impregnated with antimony SiC-and
ii. C. I.: Cr alloy Mo-Fe SiC-and a sinter-carbo-graffiti impregnated with antimony
iii. E. S.: Type "O"; silicone; rubber ethylene-propylene; PTFE; graphite PUR.
iv. S. E. A.: Springs simple; multiple; corrugated iron steel Cr Ni Mo Cr Ni
v. Types recommended: M3; MG2; MG3; M7; H7; HC127G15; HSP; HSHFI.

III. THE CRITERION: PRESSURE OF THE SEALED [2]

1. p1 = 0 ÷ 1
i. I. P.: Carbo-graffiti impregnated with resins
ii. Carbo-graffiti impregnated with antimony
iii. C. I.: alloy steel with CrMo
iv. E. S.: Type "O"; silicone; rubber ethylene-propylene;
v. "S. E. A.: Type: Spring singular; alloy steel Cr Ni Mo
vi. types recommended: M3; M32N MG2; MG3;
2. p1 =1 ÷ 1.6
i. I. P.: Carbo-graffiti impregnated with resins
ii. C. I.: alloy steel with CrMo
iii. E. S.: Type "O"; rubber ethylene-propylene;
iv. "S. E. A.: Type: single spiral springs; springs corrugated iron; alloy steel Cr Ni Mo
v. types recommended: H76N; M7N;
3. p1 =1.6 ÷ 3.5
i. I. P.: Carbo-graffiti impregnated with resins; construction compensated
ii. C. I.: SIC reaction; rigid bearing
iii. E. S.: Type "A" with the bearing ring; rubber ethylene-propylene;
iv. "S. E. A.: Type: single spiral springs; springs corrugated iron; alloy steel Cr Ni Mo
v. types recommended: H7N; H76N; H7N10; H76N10; H76G15;
4. p1 >4 (MPa)
i. P. I.: Carbo-graffiti impregnated with antimony; construction compensated
ii. C. I.: SIC reaction; rigid bearing
iii. E. S.: Type "A" with the bearing ring; rubber ethylene-propylene;
iv. "S. E. A.: Multiple springs alloy steel Cr Ni Mo
v. types recommended: Hydrostatic or multiple H7F; H76F; HSP; HSHF

IV. THE CRITERION: "TEMPERATURE OF THE FLUID SEALED"

1. below 0°C (cryogenic):
i. I. P.: Carbo-graffiti impregnated with resins Carbo-graffiti impregnated with antimony
ii. C. I.: alloy steel with CrMo; SIC - and of feedback
iii. E. S.: Type "O"; silicone-metallic; an alloy Hastelloy (NiMo);
iv. S. E. A.: Spring singular helical; metal silicone; alloy steel Cr Ni Mo
v. types recommended: M74D; H74D; H7N; M7N; M32N; M7;
2. 0°C - 100°C:
i. I. P.: Carbo-graffiti impregnated with resins
ii. C. I.: Fe-Cr alloys; ceramic (Al2O3)
iii. E. S.: Type "O"; rubber ethylene propylene;
iv. S. E. A.: Spring singular; multiple; corrugated iron;
v. Recommended types: M7; H7;
3. 100°C - 150°C:
i. I. P.: Carbo-graffiti impregnated with resins Carbo-graffiti impregnated with antimony SiC-and reaction
ii. C. I.: Fe-Cr alloy carbon-graffiti impregnated with antimony SiC-and of feedback
iii. E. S.: Rubber ethylene-propylene; PTFE; graphite PUR
iv. S. E. A.: Arc singular helical; multiple springs; arc curl; steel Cr Ni Mo
v. types recommended: H7N; M7N; M3; S3;
4. 150°C - 200°C:
i. I. P.: Carbo-graffiti impregnated with resins
ii. C. I.: Fe-Cr alloy pressed into the housing
iii. E. S.: Type "O"; PTFE;
iv. S. E. A.: Helical coiled spring singular; arc curl; steel Cr Ni Mo
ii. types recommended: M7; M7N;
5. Over 200°C:
i. I. P.: Carbo-graffiti impregnated in antimony
ii. C. I.: alloy CrFe
iii. E. S.: Metal cuffs; labyrinths
iv. S. E. A.: Steel Cr Ni
vi. types recommended: MFL; HSHF;.

5. THE CRITERION "SLIPPAGE SPEED WILL"

1. Less than 10 m/s
i. -I. P.: Carbo-graffiti impregnated with resins Carbo-graffiti
ii. -I. P.: Carbo-graffiti impregnated with resins Carbo-graffiti impregnated with antimony SiC-and reaction
iii. C. I.: Cr alloy Mo-Fe; SiC -and of feedback
iv. E. S.: O - ring; rubber ethylene-propylene;
v. "S. E. A.: Helical coiled single spring on conic; steel Cr Ni Mo
vi. types recommended: M3; MG2; MG3; M7; H76N; H7N10; H76N10; H74G15; H76G15; HJ977GN;
2. 10 M/s ÷ 25 m/s
i. I. P.: Carbo-graffiti impregnated with antimony
ii. C. I.: SIC-and reaction Carbo-graffiti impregnated with antimony
iii. E. S.: O-ring; rubber ethylene-propylene;
iv. "S. E. A.: Springs mounting multiple fixed; steel CrNiMo
v. types recommended: H7N; H76N; G15; H76G15; H7F; H76F; M32; M7N; H74D; M74D;
3. 25 m/s ÷ 50 m/s .
i. -I. P.: SiC -and is Limited, Slow; carbide metal
ii. C. I.: Carbo-graffiti impregnated with antimony; carbide metal
iii. E. S.: Rubber ethylene-propylene;
iv. "S. E. A.: Multiple springs mounted on guides springs corrugated iron; steel Cr Ni Mo
v. types recommended: HSP; HSHF; HSHV; H - D1/88
4. More than 50 m/s
i. I. P.: SIC; Carbide Sintered metal; solutions HD
ii. C. I.: SIC; Carbide Sintered metal; solutions HD
iii. E. S.: PTFE

iv. S. E. A.: Springs mounted multi-way VHF radiotelephone apparatus, encased;

VI. THE CRITERION: "Pv"[2]

1. Pv ≤ 10 (MPa, m/s)
i. I. P.: Carbo-graffiti impregnated with resins carbo -graffiti impregnated with antimony
ii. C. I.: CrMo alloy - Fe
iii. E. S.: Type "O"; silicone; rubber ethylene-propylene;
iv. "S. E. A.: Helical coiled spring singular, multiple; spring curl; steel Cr Ni Mo
v. types recommended: M3; M32N; MG2; MG3; M7N; H76N;

2. 10 < Pv ≤ 50 (MPa, m/s)
i. I. P.: Carbo-graffiti impregnated with antimony; SIC-and are Limited, Slow
ii. C. I.: Carbo-graffiti t impregnated with antimony; SIC-and are Limited, Slow;
iii. E. S.: O-ring; rubber ethylene-propylene;
iv. "S. E. A.: Spring multiple single waves; steel CrNiMo
v. types recommended : H7N; H76N; M7; M7N; H74G15; H76G15; H7N10; H76N10; HC127G15; H7F; H76F; SFH 950/96075; H75F; H74-D; H75 (double back - back)

3. 50 < Pv ≤ 100 (MPa, m/s)
i. I. P.: SIC sintered; construction compensated;
ii. C. I.: Carbo-graffiti with metal impregnation;
iii. E. S.: O-rings'; rubber ethylene-propylene hardness > 80° shore;
iv. "S. E. A.: Multiple springs; spring curl; steel CrNiMo;
v. types recommended: H75; H8; S2;

4. Pv > 100 (MPa, m/s)
i. I. P.: SIC sintered; construction compensated;
ii. C. I.: Carbo-graffiti with metal impregnation;
iii. E. S.: The O-rings with the bearing ring; rubber ethylene-propylene with minimum of 80° shore;
iv. "S. E. A.: Multiple springs; spring curl; steel CrNiMo;
v. types recommended: HSHF; HSP; HF(v); SFH 950/960 (hydrostatic or multiple);

TABLE I

Nr crt.	Sealed environment	Entries	Seal requirements
1.	Water fuels	elastomer NBR up to 100°C FKM up to 150°C. Carbo - graffiti / Ceramic, or Carbide of Si and. Spring sing. Hatred,	URA, TI, RA
2.	Pasta, mud, suspensions	Silicone metal embossed as Fronts in hard materials	RA
3.	The gaiter hygienic	Protective gaiter elastomeric resistant sterilization until 120°C multiple springs. You can also use metal silicon. Embossed asymmetrically.	RA, CN, RS
4.	Environmental fluids corrosives and compressors for refrigeration The PTFE, multiple springs embossed metal silicone asymmetrically. URA, RC,RA,	The PTFE, multiple springs embossed metal silicon .asymmetrically.	URA, RC RA, SM
5.	Highly corrosive Fluids	Gaiter PTFE, mounted multiple outer springs May be used embossed metal silicon asymmetrically.	URA, RC RA, SM, DV
6.	Hot hydrocarbons	Single spring and seal with up to prevent fouling or up with many of them - spring and silicon, welded metal. Fault heat-resistant material.	URA, TI, RA, SM
7.	Cold hydrocarbon	Use various types of seals. The C face must be resistant to cavitation Constructions with multiple springs and O-rings are the most used	PI, SM
8.	Pipelines Pumps	Fitting in the sleeve to the uses for high speeds (6000 rpm) and high pressures (83 bar).	PI, RA, TIA, SM
9.	Cryogenic	Welded metal silicon..	TJ, SM
10	Power supply for e.g. boilers	Springs springs welded or multiple	TI,IP,TIA SM, DV
11	Gas compressors	Spiral grooves on the front wheel- engines that push against gas leaks	TI, PI, TIA, SM
12	MIXERS and agitators	Double seals mounted vertically for vertical shaft seal.	URA, RC TI, RA

VII. THE CRITERION "SPECIAL CONDITIONS"[3][4]

1. Abrasive fluids
i. sand and solid objects
a. - C. I. - tungsten carbide.
b. - I.R. messages - The carbide of tungsten.
c. - Secondary seal: the O-rings.
d. - The springs: helix, singular on - conic.

Seal Type: Double with coolant dam:
a. oil VG < 10 m/s
b. grease for VG< 5 m/s

ii. salts and crystals:
a. C. I.: Steel Cr Ni Mo, tungsten carbide.
b. I.R. messages: Steel Cr Ni Mo, Al2O3, tungsten carbide.
c. Secondary seal: rubber ethylene propylene.
d. The springs: helix on conic, singular.

Seal Type: Double with coolant dam water.

iii. Fibrous materials: - the springs protects with gaiters.

iv. Nuclear energy:

a. - C. I.: Steel Ni - Cr serrated rings THD semicircular

b. - I.R. messages: Steel Cr - Mb

c. - secondary seal: rubber ethylene propylene (O-rings").

d. - The springs: helix on conic, singular.

Seal Type: multiple

2. Very high pressures:

a. -C. I.: carbon impregnation with the metal.

b. -I.R. messages: Tungsten carbide.

c. -Secondary seal: stiffness minimum 80° shore (in order not being expelled from Romania).

Seal Type: fitting rigid C. I. on housing, the spline rings hydro-dynamic.

3. Space for fitting:

a. - coil springs - big spaces.

b. -The springs corrugated iron - smaller spaces.

4. Low temperatures:

a. - use metal gaiters (steel, CrNiMo).

b. - Fluids used of dam: methyl alcohol, ethyl, ethylene glycol, glycerin.

Seal Type: Double.

5. Extreme Heat:

a.- using metal gaiters special steel, with welded blades.

b. - Use of carbon rings was relieving in metal sleeves (steel with Ni).

6. High speeds:

i. Vg > 50 m/s.

a. - IS used intermediate ring float.

b. - Coolant flow with small viscosity: 50 ÷ 100 l/min.

ii. Vg > 35 m/s.

a. - The springs will be executed to fixed assembly so we will have the sealing head fixed in the housing and C. I. rotating groups.

7. Trees with oscillations and vibrations [5]

a. - rubber was mounting C. I. into the housing.

VIII Conclusion

Except for defects that occur in bearing components during manufacturing, the cage is usually the last component to fail. The typical failure sequence is as follows: defects form on the races, the balls, and then finally the cage.

A severely damaged cage can cause constant frequency shifts that are observable with the use of a real-time analyzer. When the cage is broken in enough places to allow the balls or rollers to bunch up, wide shifts in frequencies accompanied by loud noises can occur. When these signs are present, bearing seizure is imminent[6].

A single defect in a bearing can be identified by the frequency it generates. When several defects are present, some or all of them may be identified from the basic frequency, but sum and difference frequencies are almost always present in the spectra.

Analysis of complex spectra can be difficult. One approach is to first identify any basic frequencies. Multiples of the basic frequencies - lx, 2x, etc. - must then be identified. Finally, any remaining frequency peaks are identified as combinations of the basic frequencies already identified.

In rare cases when one or more rollers are missing from a bearing, the FTF can be generated. The problem occurs as a purse at the FTF. The frequency spectra contain a series of harmonics of the FTF. The amplitude of the first harmonic is quite low, the second, third, and fourth harmonics are higher in amplitude as determined by the purse.

Sometimes, attempts to lubricate sealed or shielded bearings can cause the seal or shield to deflect inward. If the cage touches the seal or shield, the FTF and /or two times FTF plus harmonics can be generated.

Excessive clearance in an antifriction bearing can cause the generation of a discrete frequency at the FTF and/or modulations of the FTF at rotating speed and harmonics.

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