THE LIFE OF WELDED FRICTION DISCS 4K4016 IN CZECH REPUBLIC

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ABSTRACT. The mining equipment of type 4K4016 at OKD, a.s., Ostrava is delivered by ČKD Praha. In the region of cyclic stressing 5.10^7 cycles it is necessary to repair the welding parts. The article brings the solution of design.

ДЪЛГОТРАЙНОСТ НА ЗАВАРЕНИ ТРИЕЩИ СЕ ДИСКОВЕ ТИП 4К4016 ПРОИЗВЕДЕНИ В РЕПУБЛИКА ЧЕХИЯ

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РЕЗЮМЕ. Минното оборудване тип 4К4016 работещо в Минно-обогатителен комплекс гр. Острава се доставя от машиностроително предприятие в гр. Прага с дълготрайност 5.10^7 работни цикъла, след което е необходимо да се възстановят заварките в детайла. В статията се предлага ново конструктивно решение, при което е повишена дълготрайността на детайла.

1. Introduction

For the coal mining in OKD, a.s., Ostrava we use the hoisting machines (HM) of the type 4K5016 and 4K4016. We are always speaking about the main skip HM. With regards to the mining intensification it is necessary to innovate the friction discs after the distinct time.

2. Parameters of the 4K4016

The friction disc	…	Ø 4 m
The width of disc	…	1,6 m
Number of lifting ropes	…	4
Ropes	…	Ø40 mm
Lifting capacity	…	1185 kN
Depth of mining	…	900 m
Movement rate	…	16 $m.s^{-1}$
Loading	…	210 kN

3. The friction discs

Delivery and assembly is secured by ČKD PRAHA. The delivered discs were always divided on two parts and on the site, after placing them on the shaft, they have been welded together. The drawing of the assembly of disc is designated 0 HOR 512 61, the static calculation is designated 4HOR 2312 P. The base of the disc is the steel mantle from the plate of thickness t = 28 mm (the material ČSN 11425.1) of outer diameter 3740 mm. The side walls are doubled, t_1 = 12 mm, t_2 = 6 mm (internal). On both sides of discs are situated twice the brake coils of 280 mm width for the shoe swinging brakes.

4. Operation details

Since the year 1970 are working in OKD, a.s., the following HM:

Mine ČSM	2
Mine ČSA	2
Mine Staříč	1
Mine Zbyšov u Brna	1
Mine Moštěnica (Poland)	2

By these machines, after 5 x 10^7 loading cycles, microcracks and then macrocracks were observed in weldments of either mantle or the side walls of discs.

There have been elaborated the matemathical computed methods by using the method of finite elements (FEM). All these calculations were confoming the mining rule 12/82, including the public notice ČBÚ č. 415/2003 Sb. But even after such repaires the micro and macrocracks reappeared. The most extensive calculations and structure design changes have been carried out by the INCO engineering, s. r. o. It concerns the strength and fatigue life calculations of the friction disc and the main shaft, both for the original state and the state after the modification, i. e. for HM 3/1 and HM 3/2, air shaft No. 3, OKD, a.s., Mine ČSA and Mine ČSM. For those HM also exist the professional evaluation of friction disc after the designed modification from the point of view of fatigue life at the dynamic loading (2/2001). Also in the document about the evaluation of the driving barrel of HM 4K4016 and the results

of tensometric measurements from the VÍTKOVICE, Institute of Applied Mechanics Brno, s.r.o., 6/2001.

The modified discs (the welded parts) displayed again the micro and macro-cracks after some 5 x 10^6 cycles. The new structure using the FEM method of calculation and the newest knowledge from the design of large shell units has limited the solution to the elimination of weldments in the divided plane, but the holding is done by matching screws including the mock-up HYDROCAM SKF.

At the same time the shoe brake is replaced by disc brake with the hydraulic regulation of the individual brake aggregates including the reconstruction of the engineer desk. The hoisting machines are working at the coal mining completely automatically.

5. Conclusion

The sequential innovation of friction discs and the replacement of shoe brakes by the disc brakes brings the possibility of further mining form the depth 1000 m and more at the time of existence of underground reserve of coal for further 20 – 25 years.

Recommended for publication
of Editorial board

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