THE INFLUENCE OF SPARE PARTS EXPENSES ON PRODUCTION COSTS WITH THE PREPARATION OF THE JIU VALLEY COAL

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Abstract

The activity of supply and that of exploitation of the spare parts from the composition of the equipments that realize the preparation of the Jiu Valley coal influence its production costs.
In this respect, this paper deals with, during some periods of time, initially determined, the specific costs of the spare parts for the sieves, pumps and pipes, equipments, and also auxiliary equipments that are part of the endowment of the Exploitation of the Jiu Valley coal preparation.
The results got can be used to rank and determine the causes which determine the high expenses of some spare parts categories as well as the possibility to reduce the production costs within E.P.C.V.J.

Keywords: *spare parts, energetic coal, washing subjected coal, sterile.*

Introduction

The Jiu Valley exploitation of coal preparation is a subunit of C.N.H. – S.A. PETROŞANI, it realises the raw coal processing and preparation extracted by the mining units, as well as the delivery of final products obtained.

Part of the extracted raw coal is directly delivered to the beneficiaries from the loading points belonging to the mining units after making a claubage that consists of manual evacuation of rocks, wood, metal, rubber etc and that of some sifting operations; after that it is loaded into wagons and delivered under the name of sorted energetical coal.

The remained raw coal quantity is subjected to concentration at the Coroesti factory within E.P.C.V.J.-Vulcan , where the following finite products are obtained:

Superior energetical coal
Washed energetical coal
Mixed energetical coal
Hydro-cycloned energetical coal
Filtered coal slate

The technological flow consists of: claubaging, sieving and breaking the raw coal received from the mining units, followed by its concentration in the machines and the draining of the obtained products with the help of draining sieves and of the vibrating spins.

The small coal in the circulation waters is concentrated with the help of the hydro-cycloning and recovery batteries, as well as drained with the help of draining sieves. The soft sterile from the residual waters is purged in the decanters of sterile sludge, and then filtered in press filters. The big sterile resulted after the preparation process is drained in cups elevators and transported with the help of the cableway on the sterile landfills.

Spare parts expenses in coal preparation process

The vibrating sieves realise hard and exact screenings, through the vibrating system with " obliged oscillation", obtained by means of an eccentric tree, fixed in the walls on the chassis, that leads to the same amplitude of oscillation of the housing independently from the material weight, that

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is better material selection. The oscillating housing is made up of superior width board and the selection stands are fixed with auto locked screws, avoiding the risk of internal tension forming in the welded areas, tensions that can provoke leaks or breakings of the housing.

The single-deck vibrating screen **WK1 – 2.6 x 5.0** is designed for classification of coal and other granular materials on screens. The vibrating screen includes:

Riddle
Sieve-deck
Inertial drive / vibrator
Drive of the vibrating screen
Support of the vibrating screen

The riddle is made of two side-plates tied toghether with box girders which form a bearing for the sieve deck. Inside the side walls, mounting pcokets of the vibrator bearings are fastened, connected by a tube shielding the shaft of the vibrator.

The sieve deck is made of sieve panels placed with a slight sloping on oblong ribs lined with protective pads. On the sides, the sieves are fastened by means of terminal strips.

Perforated sieves, made of sheet or woven of wire, can be applied in the vibrating screen. The kind of sieves and the size of sieves meshes in the deck depend on the required technology.

The vibrator of the inertial type vibrating screen forms a long unbalanced bearing shaft in two special barrel bearings. The bearings are fastened in the side walls of the riddle in removable mountings sealed by labyrinth covers. Extra unbalanced masses, allowing to change the pitch of the vibrating screen, are placed on the pins of the shaft.

The vibrator is originally assembled with 1 pads g = 20 mm in the weight. The remaining two pads are given separately.

The choice of weights of the vibrator shaft other than the installed g = 10 mm can be made exclusivley with acceptance of the producer.

The two-deck vibrating screen **SccII – 1.8x5.25** is designed for dewatering and classification. This vibrating screen includes the following units:

Riddle
Inertial drives
Sieve-decks
Drive of the vibrating screen
Support of the vibrating screen

The **riddle** is made of two plates tied toghether with bearing and stiffening beams of the I-section. In the walls of the riddle, bearing mountings of the vibrators are fastened. The central casings of drives work as additional beams stiffening the construction of the riddle.

The inlets and outlets fastened to the terminal beams of the riddle enable supply and reception of products.

The upper sieve deck consists of panels of welded sieves. The lower sieve deck is the made of slotted sieves in the form of frames. On the sides, the sieves are fastened by means of shielding terminal strips.

The vibrating screen is equipped with two **inertial drives** (each composed of two vibrators), fastened in the sides of the riddle, connected directly with electric motors. The whirling unbalanced backward masses of the vibrators generate centrifugal forces, neutralizing each other or accumulating in definite positions, inducing a harmonic motion of rectilinear trajectory or near-eliptical trajectory of the springily supported riddle.

The vibrator consists of a mounting fastened with a flange to the riddle side. Inside the mounting, a short shaft on two roller bearing is mounted. Weights witch replaceable cylindrical pads are placed on the shaft necks, allowing the change of the stroke of the vibrating screen. Two opposite vibrators are connected together with a coupling shaft. All rotating elements are protected by protective shields. The same numbers of pads must be mounted in all weights of a given vibrating screen.

Originally, vibrators are equipped with 2 pads, 16 mm thick, in each weight. The remaining pads are supplied separately. To a maximum, one pad 8 mm thick can be mounted additionally with the approval of the producer. Also, another amount and size of pads can be mounted in the weights after obtaining the producer's acceptance.

The **drive of the vibrating screen** consists of two electric motors mounted on a common frame. The motors are connected directly with vibrators by means of properly shielded bow-clutches.

The **support of the vibrating screen** consists of four sets of spiral springs. The upper seats of the supports are fastened to the pins of the riddle, while the lower seats are connected with the supporting construction (substructure). The support allows to change the angle of inclination of the vibrating screen according to technological instructions of the development design.

Table 1. Technical characteristic of the vibrating screen SccII – 1.8 x 5.25

PARAMETER	UNIT	VALUE
Size of sieve holes of the upper deck	mm	21
Gap width of slotted sieves of the lower deck	mm	1
Frequency of vibration	min^{-1}	960
Stroke of the riddle	mm	9 ± 0.5
Surface of the sieve	m^2	2 x 11
Type of the vibrator	-	100W/1800
Engine power	kW	2 x 11
Engine speed	min^{-1}	960
Static load of 1 pillar	kN	17.2
Dynamic load of 1 pillar	kN	± 2.6
Mass of the vibrating screen	kg	7680

The supporting construction of the vibrating screen should be appropriately rigid in order to take over strengths and vibrations generated by the vibrating screen effectively and to guarantee proper work of the machine.

The construction should ensure a comfortable access to:

sieve decks and sides of the riddle

vibrators and their lubricating points

supporting springs

clutches and driving motors

Chutes, funnels and elements of the stationary construction should be installed with the minimum distance of 50 mm from the riddle. The supplying chute should ensure smooth distribution of the feed over the whole breadth of the vibrating screen.

The oscillating group disposes of an eccentric tree, treated and rectified, mounted on 4 special bearings for vibrating machines width a large front. According to the selection needs, on the stands sieves can be mounted or steel bars. The main stand is made of sections that confer an adequate support, having a dismountable and protected with anti-wear board or with rubber.

The spare parts for sieves and pumps, as well as the transports pipelines of the water and the material influence the production costs for the coal that is "subjected to washing", as well as the "washed net".

Table 2 The specific expenses with spare parts for sieves

Nr. crt.	EQUIPMENT NAME	YEAR	SPARE PARTS NAME	CONSUM-PTION (piece)	VALUE (lei)	THE COST INFLUENCE ON THE WASHING SUBJECTED (lei/to)	THE COST INGLUENCE ON THE WASHED NET (lei/to)
1.	SIEVES	2005	Surface. Ranking	24	23509.68	0.024943296	0.041157395
			Surface. Ranking 18 G 2A(perforated board)	6	10152.54	0.01077164	0.017773619
				TOTAL 2005	33662.22	0.035714936	0.058931014
2.		2006	Spring damper sieve	28	6860	0.010427053	0.017016463
			Elicoidal spring damper sieve	96	26880	0.040857025	0.066676754
			Typical sieve beam	16	35900	0.054567232	0.089051171
				TOTAL 2006	69640	0.10585131	0.172744388
3.		2007	Spalt OL 600x875 mm with holes 0,8	132	177067.56	0.34704159	0.496390794
			Typical sieve housing	2	133078	0.260824742	0.373070562
			Delivery system for the sieve	2	168910.36	0.331053977	0.473522918
				TOTAL 2007	479055.92	0.938920309	1.342984273
4.		2010	Sieve arches	48	21840	0.039218362	0.075703481
			Spalts 650x875	96	165120	0.296508057	0.572351591
			Spalts 600x875	73	110960	0.199252265	0.384618051
			Perforated board 8x1000x2000-20	50	41100	0.073803786	0.142463968
			Perforated board 8x1000x2000-50	50	37750	0.067788149	0.130851941
				TOTAL 2010	376770	0.67657062	1.305989033
5.		2011	Spring damper sieve	8	13702.16	0.059886801	0.110409579
			Spring damper sieve	8	8086.56	0.035343202	0.065160069
				TOTAL 2011	21788.72	0.095230003	0.175569648

Table 3. Specific spare parts expenses Warman pumps

Nr. crt.	NAME	YEAR	SPARE PARTS NAME	U.M.	CON-SUMPTION	VALUE(lei)	THE COST INFLUENCE ON THE WASHING SUBJECTED (lei/to)	THE COST INGLUENCE ON THE WASHED NET (lei/to)
1.	Warman pumps	2010	Overall group bearings	Pcs	4	74696.38	0.134133228	0.258918314
			Sealing gland	Pcs	16	1225.28	0.002200251	0.004247159
			Gland	Pcs	4	3205.94	0.005756947	0.011112675

			Discharge seal	Pcs	4	756.76	0.001358923	0.002623139
			Suction plate	Pcs	4	25994.66	0.046678937	0.090104682
			Intake gasket	Pcs	4	684.08	0.001228411	0.00237121
			Sealing gasket	Pcs	4	1296.68	0.002328465	0.004494652
			O-Ring	Pcs	4	122.52	0.000220011	0.000424688
			Rotor	Pcs	4	54164.06	0.097263083	0.187747613
			Wear shirt	Pcs	4	72113.24	0.129494651	0.249964436
			Seal wear shirt	Pcs	8	1592.76	0.002860139	0.005520947
			Discharge board	Pcs	4	21635	0.038850241	0.074992894
			Sealing liner	Pcs	4	13936.66	0.025026235	0.048308318
			Restrictor ring	Pcs	4	1123.12	0.002016801	0.003893045
			Distance	Pcs	4	3808.34	0.006838684	0.01320076
			Wearing sleeve	Pcs	4	4645.56	0.00834209	0.016102796
					TOTAL 2010	281001.04	0.504597096	0.974027328

Along with screeners and pumps, pipelines (with diameters between 76 and 325mm) introduce high specific costs as shown in Table 4.

Table 4. Specific expenses for pipelines

Nr. crt.	NAME	YEAR	PIPELINE TYPE	U.M.	CONSUMPTION	VALUE(lei)	THE COST INFLUENCE ON THE WASHING SUBJECTED (lei/to)	THE COST INGLUENCE ON THE WASHED NET (lei/to))
1.	PIPELINES	2005	Pipe Ø 108	Pcs	50	21500	0,022811066	0,037639133
			Pipe Ø 219	Pcs	50	8900	0,00944272	0,015580851
					TOTAL 2005	30400	0,032253786	0,053219984
2.		2006	Pipe Ø 108	Pcs	20	4700	0,006933135	0,01165851
			Pipe Ø 259	Pcs	62	16965,68	0,02502667	0,042083946
					TOTAL 2006	21665,68	0,031959806	0,053742456
3.		2007	Pipe Ø 108	Pcs	50	7535,5	0,014769119	0,021125004
			Pipe Ø 800	Pcs	1,5	933,46	0,001829525	0,00261686
					TOTAL 2007	8468,96	0,016598644	0,023741863
4.		2009	Pipe Ø 76	Pcs	10	1719,5	0,035685379	0,005930537
			Pipe Ø 159	Pcs	10	3271,4	0,067892498	0,011283024
			Pipe Ø 325	Pcs	20	10160	0,210854	0,035041733
			Pipe Ø 325	Pcs	85	15045	0,312234098	0,051890046
					TOTAL 2009	30195,9	0,626665975	0,10414534
5.		2010	Pipe Ø 108	Pcs	25	6514,75	0,011698618	0,022581925
			Pipe Ø 159	Pcs	22	9559	0,017165216	0,033134138
			Pipe Ø 325	Pcs	4	2032	0,003648888	0,007043474
					TOTAL 2010	18105,75	0,032512723	0,062759537
6.		2011	Pipe Ø 108	Pcs	30	7229,9	0,031599075	0,058257254

			Pipe Ø 159	Pcs	30	13458	0,058819673	0,108442181
			Pipe Ø 219	Pcs	25	17250	0,075393027	0,138997446
			Pipe Ø 325	Pcs	90	15714	0,06867977	0,12662063
					TOTAL 2011	53651,9	0,234491545	0,43231751

Tables 2 and 4 reflect the specific expenses with the spare parts that are necessary for sieves and pipes, during 2005-2010 (inclusively for 10 months of 2011); in table 4 there are the specific spare parts expenses necessary for the Warman pipelines in 2010.

It results that with a production of 228.801 to of washed coal, in those 10 months of year 2011, the expenses are:

-for spare parts necessary for sieves: 0.095230003 lei/to x 228.801 to=10348.66992 lei

-for pipes: 0,234491545lei/to x 228.801to=53651.89999 lei

As for the net coal, the situation of the spare parts expenses is the following:

- for spare parts necessary for sieves: 0.175569648 lei/to x 124103 to=21788.72003 lei

-for pipes: 0,43231751 lei/to x 124103 to=53651.89994 lei

At the same time, in 2010, for a production of 556882 to, washed coal, the spare parts expenses necessary for pumps are 0.504597096 lei/to x 556882 to=281001.04 lei, and for the net coal 0.974027328 lei/to x 288494 to=281001.04 lei.

The costs influences with spare parts differs from one year to another, as well as from a machine to the other due to their usage, in the production process, but also the maintaining[3] activities that are difficultly realised. There is a double in the specific spare parts expenses for sieves, pumps and pipes.

All the above mentioned costs reflect a high financial effort both for the washed coal and for the net one, that is necessary both for respecting the maintenance activities of the machines/equipment and for their reconditioning (where possible).

By reconditioning, the maintenance costs are reduced with 30-70% as the reconditioning cost can be between 20% and 70% out of the factory cost of a new part, of an appropriate quality. The reconditioning cost of a part can be determined (in a workshop or office) with the help of the relation:

$$C=c_{mc}+c_m+c_r \text{ ,lei} \quad (1)$$

where:

c_{mc}- the cost of the materials consumed to recondition the part, lei
c_m-the manoeuvre cost, lei
c_r-the workshop activity, lei

The economical efficiency condition includes both the new part working time (t_{pn}) as well as the reconditioned part working time (t_{pr}):

$$C_{pr} / t_{pr} \leq C_{pn} / t_{pn} \quad (2)$$

where:

C_{pr} –the reconditioned part cost
C_{pn} –the new part cost.

It`s estimated that at least 50% out of the spare parts mentioned in tables 1,2 and 3 can be reconditioned, without any supplementary endowments, within the enterprises belonging to C.N.H.Petroşani, which could allow an important increase of the coal preparation activity worth.

Routine maintenance and fault finding for Warman Pumps

Warman pumps are of sturdy construction and when Correctly assembled and installed, they will give long Trouble-free service with a minimum amount of maintenance. However, regular observation checks by the operator can minimise the risk of costly stoppages.

It should be periodically checked gland seal water supply and discharge. Operator should always maintain a very small amount of clean water leakage along the shaft by regularly adjusting the gland. When gland adjustment is no longer possible replace complete gland pack.

Maintenance personnel should inspect gland packings at regular intervals, not longer than six months (1800 hours) to determine when packings need to be changed. Warman International Limited can supply all recommended packings in individual blocked rings, cut to length and moulded to the correct size for each type of pump.

Warman pump performance is inversely proportional to the clearance between the impeller and the intake liner. This is more pronounced with an open impeller.

With wear, the clearance increases and pump efficiency drops. For best performance it is necessary, therefore to stop the pump occasionally and adjust the forward impeller clearance. This adjustment can be carried out without any dismantling of the pump.

Before restarting, it should be checked that impeller turns freely and that bearing housing clamp bolts are tight.

Maintenance personnel should open bearing housing at regular intervals (not longer that twelve months) to inspect bearings, lubricant and to determine each time the course of action and the period for the next inspection.

The wear rate of a solids handling pump is dependant on the severity of the pumping duty and of the abrasive properties of the material handled. Therefore, the life of wearing parts, such as impellers and liners, varies from pump and from one installation to another.

Wearing parts must be replaced when the performance of a given pump no longer satisfies the requirements of the particular installation. Where a pump is used on a particular duty for the first time and especially where failure of wearing part during service could have serious consequences, it is recommended that the pump be opened at regular intervals, parts be inspected and their wear rate estimated so that the remaining life of the parts may be established.

Where stand-up-pumps are standing idle for long periods, it is advisable to turn their shafts a quarter of a turn by hand once a week. In this way all the bearing rollers in turn are made to carry static loads and external vibrations. Alternatively run all pumps at weekly intervals.

Conclusions

Reconditioning and rehabilitation of the parts for the coal preparation equipments, as well as the equipments of the maintenance activities meant to re-establish the geometrical shape of the used landmarks and even to improve their physical- mechanical proprieties according to the initial ones, appear as an immediately applicable solution and with effects of productive activity worth.

The opportunity of spare parts reconditioning is made according to technical-economical analysis, regarding their final reconditioning and sustainability. The correct choice of the material as well as the already applied treatments to the part, the functional conditions and requests, the limit performances that are to be assured, the usage size and the reconditioning cost.

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