TECHNICAL ASPECTS OF THE DISTRIBUTION JOINTS FROM E.M.C. JILȚ

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Abstract: If in recent decades the importance of power coal has diminished in some Western countries, in Romania this mineral resource has continued and will continue to play an important role both in the economic development of the country, as well as to provide a basis for citizens life. Substantial participation of coal to support the economic activity in Romania is mainly carried out by its use as the main source of electricity production.
Keywords: distribution joints, lignite, flow sheet, belt conveyors.

Making an analysis of the current state of Romanian energy sector it is shown that the main objective is to improve the energy efficiency due to optimal use of primary energy resources (coal, natural gas, oil) to reduce energy dependency on other countries.

While reducing the oil and gas reserves, the role of indigenous coal and especially lignite has increased in the national energy balance.

Romania's lignite resources are estimated at 1.490 million tons, of which 445 million tones are exploited in the leased perimeters, and those located in other perimeters which are not leased, are about 1.045 million tons, located in Oltenia mining basin.

Because of the growing role of lignite in electricity production it is impose the superior capitalization of these reserves by adopting regulations to ensure rational and total exploitation (lossless) under conditions of maximum efficiency both in terms of exploitation, transport and storage at the beneficiary.

Considering these aspects, the lignite exploitation activity in the mining perimeters from Jilt basin is strictly controlled to ensure the needs of coal power plant Turceni, taking into account the increasing efficiency throughout the resource-production-transport-consumption chain.

According to this, it has been established several main objectives of the development strategy:

- adaptation of the technical potential of mining units to the demands for coal;
- carry out the upgrading and modernization programs;
- adaptation of organizational structures to the requirements of production capacity levels.

Distribution joints

The main tasks of the coal transport in the coal pits consist of moving the power coal to storage and delivery points, and from there to power plants, using the rail transport, respectively Drăgoteşti-Turceni on a distance of 38 km to the power plant scaffold.

The 'junction' is defined as the chosen place, outside the coal pit to which converge all the technology lines which transport the excavated mining mass from the coal pit and which ensure the distribution of tailings and coal to the storages.

For choosing the location, it has been considered the following criteria:
- to have a period of activity for at least 12 years;
- to ensure the connection of all excavation process lines to the main road which goes to the inner dumps and the coal storage;
- the junction can be used without disruption of coal pit activity.

The **factors** which influence the choice of junction location are:
- geometric shape of the exploitation perimeter;
- the dump location;
- the location of coal deposits;
- landforms adjacent to the perimeter;
- the existence of social and industrial buildings that need to be protected.

Analyses of distribution joints subsystem

For the coal pits from Jilt mining basin, which in the first half of 2011 have made more than 3,500 thousand tons of lignite, each coal pit has one distribution joint. Among the deficiencies noted in their operation:
- aging and obsolescence, because the main circuits are very old (over 12 years old);
- there haven't been upgrades for mechanical part or electrical part;
- the structure of distribution joints can affect the coal pits acticvity because the serial belt circuits on transport flow, preparation and distribution;

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- at the Jilț South coal pit, there is a decreasing in the junction efficiency, five belts goes in and three goes out for sterile, imposing the fourth output for sterile into the interior dump.

At present and in future (2025), the studies of increasing the extraction capacity lead to the need of increasing the transport capacity, storage, loading and delivery of Jilț North coal pit for not creating discrepancies in delivery of extracted lignite production.

To establish the narrow places, measures and actions to be taken to remove them, there is the necessity to optimize the technological flow at the household of Jilț North coal pit.

To remove the narrow places, the works to the Jilț North coal household has to be provided and the amplification of the lines device before the station, as well and a whole series of measures that will lead to better operation of existing plants and to avoid disruptions due to the equipment failure in the flow.

Under the existing technological flow resulting of a coal pit, results that the technological equipment components are connected in series, leading to failures or disruption if a component fail to work.

Diagnostic and statistical analysis shows us the main mechanical and electrical faults in the parts of the components located in the distribution joins.

These are:

a) mechanical faults:

- destruction of barrel arbor;
- seizure of the reducer balls of the driver gear;
- weakening of fixing on the chassis of the driver gear;
- low-reliability of some components which support the carpet rubber;
- higher weight of the driver gear;
- inefficient cleaning of the rubber carpet.

b) electrical faults:

- rotor strength for starting the main functions with frequent failures;
- CAM 6 kW contacts type have a higher rate of failure;
- electrical cable penetrations;
- faults in the main control panel and especially in the emergency cord system.

Obtaining the performance comparable with those of the countries with a tradition in power coal extraction from coal pits is possible by upgrading the present equipment and the technological lines.

Rehabilitation program of the Jilț mining basin having as an objecting the coal requirements for Turceni power plant, aimed mainly the Jilț South coal pit, the main coal provider of power plant, especially in terms of raising the standard of the electrical components of dynamic commutation.

By the rehabilitation - modernization of the conveyor belts is expected to improve the main operating parameters:

- increased hourly and annual productivity;
- time reduction for functional disruption planned for revisions and repairs and incidental parking.

Upgrading and rehabilitation action for Jilț North coal pit has been considered the modernization of one coal pit line and I + II dump line.

In the coal pit may find the following results:

- intensive index increased 1.4% due to increased of hourly production capacity;
- increasing evolution of extensively used index by 4.4%;
- upward change of general index of use, 1.8%.

In terms achieving the upgrade action, the following specifications are necessary:

- design and manufacturing documentation was Romanian;
- the listed modernization are made by Romanian companies;
- throughout the process of modernization, the local part represented over 60% of the works.

Technical solutions for improving the activity of distribution joints

Coal from the excavation benches, transported on front bands is discharged on two-lane collector. The existence of distribution points, equipped with extensible strip ends, has the role to open the door to more efficient use of working time of machines, using, where appropriate, the transport availability of the downstream circuits,because the possibilities that exist, that any line front to use any line of landfill or coal. This distribution method is applied successfully to Jilț North and Jilț South coal pit.

In the distribution joint of Jilț South go in five bands with extensible end and go out four, from which three go to the outer dump and one to the coal storage. The flow sheet is shown in figure 1.

Into the distribution joint from Jilț North coal pit go in 3 conveyor belts, sterile-coal (T225, T224 and T241) and go out only one conveyor belt for coal TMC1 and 3 for sterile (TMS2, TMS3 and T240).

It is necessary to maintain three lanes of sterile having considering the distribution of mining mass to the interior and outside dump. This conveyor belt system was designed and chosen so as to ensure evacuation of extracted mining mass (coal and sterile).

In the current exploitation conditions and operation of Jilț North coal pit is calculated for production transport for the current year and in the future: 2020 ÷2025. The flow sheet is shown in figure 2.

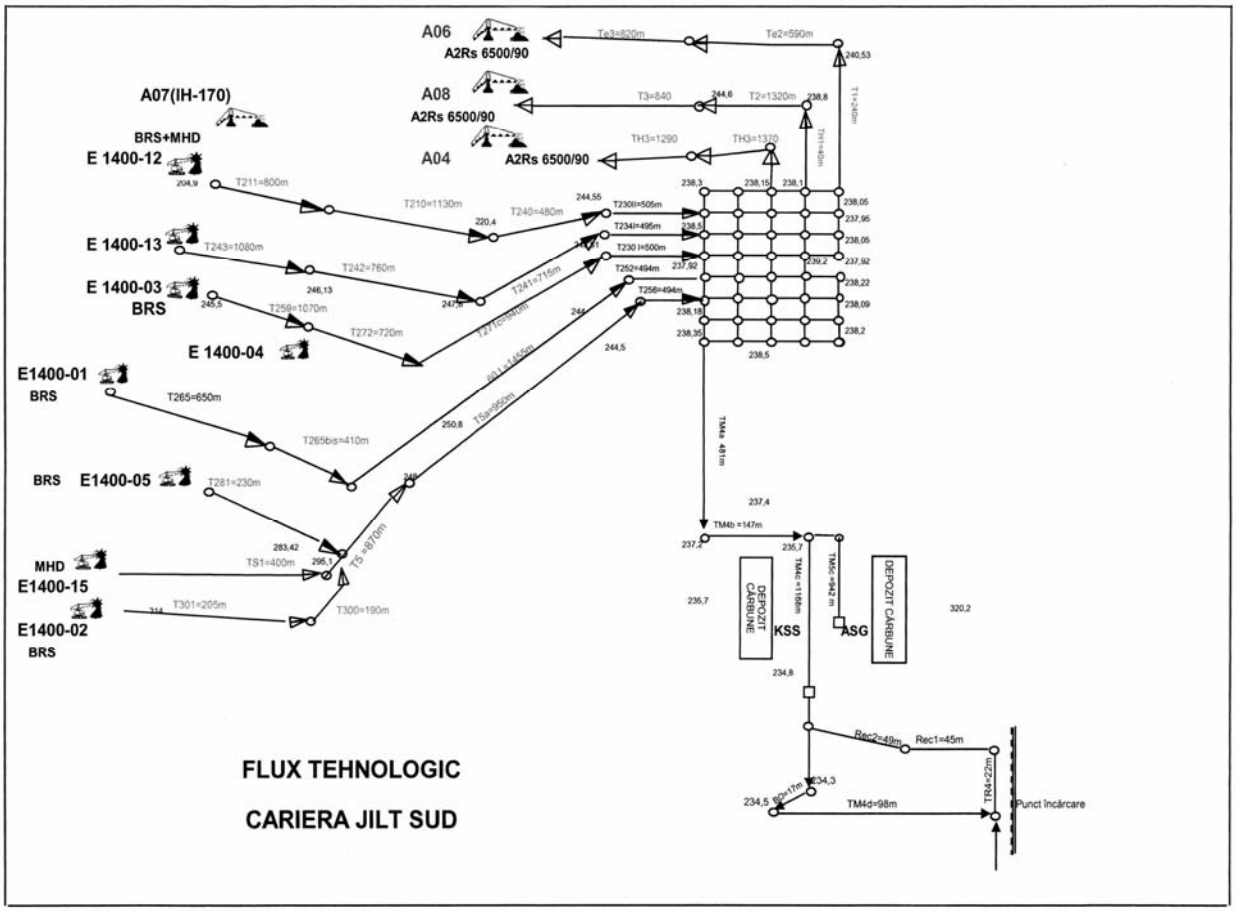

Figure 1. Flow sheet of Jilț South coal pit - S.C. C.E.T. S.A

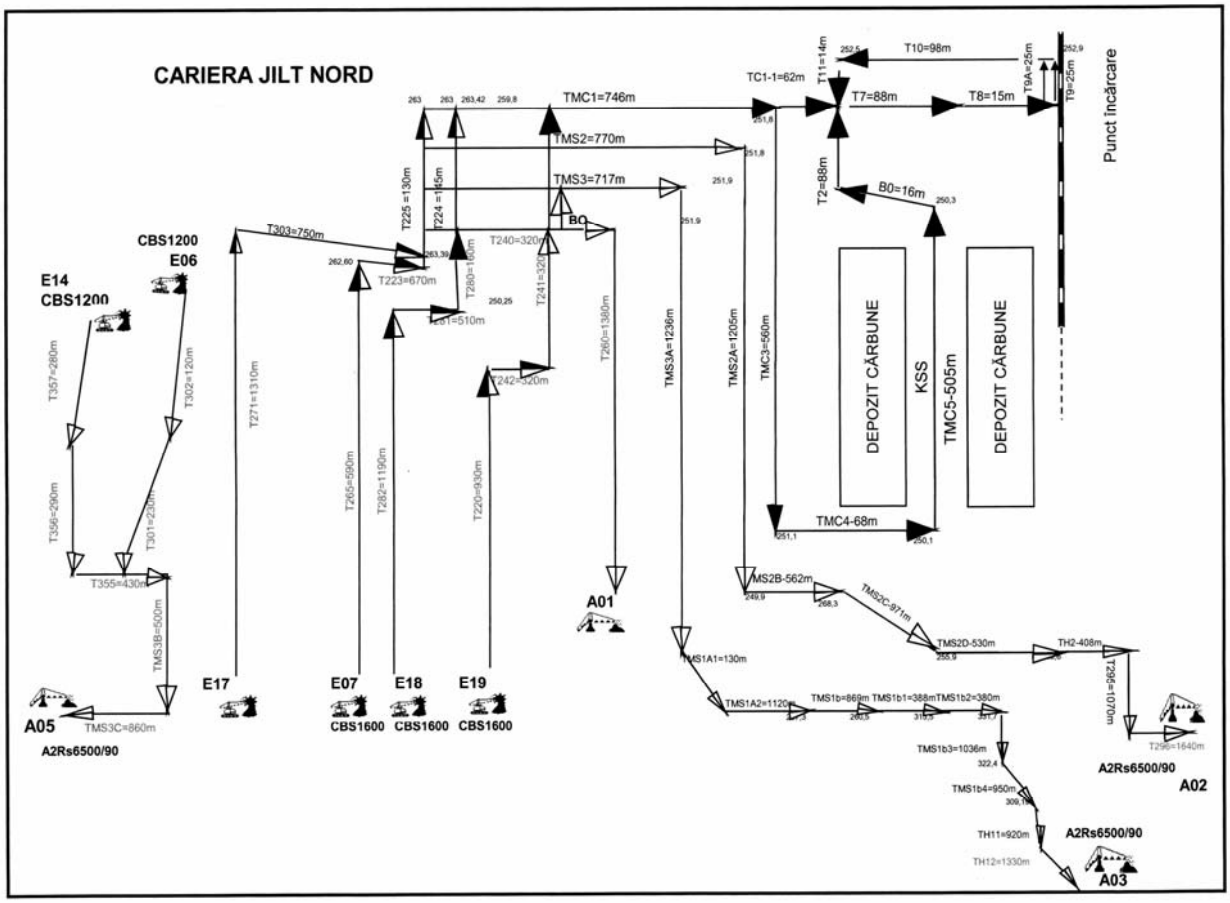

Figure 2. Flow sheet of Jilț North coal pit - S.C. C.E.T. S.A

Since the belt conveyor of distribution joints of the two coal pits are older than 12 years, it is necessary to modernize them both on the mechanical and electrical-side.

Modernization and rehabilitation measures aimed: the driving gears, return stations and layout elements. From the diagnosis analyze the following actions are required:

a) Mechanical part

Driving gear

- assembling the cylinder;
- assembling the deflection cylinder;
- activation on cleaning belts;
- assembling the battery of intensive rakes;
- modifying the bracing system of the rubber rake;
- greasing the cylinders;
- assembling the driving gear with 1 MAN band and stopping it's functions.

Layout

- replacing the band sections of B1400 mm width with B2000 mm sections
- mounting the brackets for adjustment of upper roller;
- sections with adjustable height of vertical sides in connecting areas with the drive and return stations
- arrangement of special places for vulcanization equipped with folding side sections with tripod for mat;

Return station

- mounting the carcase ploughs at the returning drums
- mounting the roller bed with impact brackets for increasing the reliability;
- changing the fixing system of drilling iron rods with improved quality for a quick replacement.

b) Electrical part

- changing the control facility
- resizing the electrical houses;
- installation of capacitor banks for power factor improvement;
- complete dispatch of conveyors.

For Jilț South coal pit it is necessary the fourth exit (band) for sterile to the internal dump.

Technical solutions for improving the maintenance of belt conveyors

The bibliography shows that the maximum slope that can be used by smooth rubber bands to carry depends on how material is transported and the angle of lateral rollers. Thus, the maximum angle which can be used for upward transportation is 16° - 18° when the material is coarse grained and can reach up to 20° - 22° when the material is small and lean side rollers is 36°. When the material is transported downward, must be considered that the maximum angle diminishes to 14° - 16°.

To use conveyor belt at larger angles are used different solutions which can be divided into:

- increasing the adhesion coefficient between transported material and rubber mat;
- increasing the down force of the material;
- usage of tall transverse walls or chicanes;
- tube band etc.

These solutions allow the gradient increasing up to 25° - 90°, but in conditions of reducing the transport capacity. They can not be used in coal pits because the sterile rocks, mainly clay, are having a very high bond to rubber mat, making difficult their cleaning.

Qualities of conveyor belt should not be worsened by sticking of the transported material on the "wet" surface of rubber mat, which can cause fouling / clogged up the rubber rollers, requiring special measures of protection depending on the material nature and the cleaning rate imposed. Therefore, belt conveyors will be also equipped with drum cleaners, intensive cleaning devices and plough type.

Step key for upper and lower carrying rolls of rubber mat from the conveyor belt will be chosen depending on the allowable load of rollers, so as the rubber mat arrow between two consecutive rolls should be checked and not to exceed 0.5% ÷1.5% at the higher branch and 2% ÷ 3% lower branch.

After determining the type of rubber mat construction, according to the limit of strength and connection type (hot vulcanization) the diameters driving drums, for back and drift are chosen, which are dependent on traction maximum force and the rubber mat thickness.

The electrical wiring for driving and automation ensure the functioning of the conveyor belts in the centralized system of the technological line that works with the possibility of local control when running repairs and revisions. Experience shows that any equipment is subject to restrictions of the downstream / upstream equipment, depending on its position.

The belt conveyor being a link of the technological chain has a blocking system for the upstream and downstream equipments by the automation scheme of technological line.

For proper functioning of the conveyor belt, was intended to use a whole series of security systems, which serve to prevent accidents, to protect the mining mass transport, to command and control the transport unit as a whole.

The justification of these measures, the use of transducers to prevent accidents and limit the

effects of possible technical accidents, is required by:
- the need to protect the conveyor belt;
- many possibilities of producing damages;
- partialism of human observer's surveillance.

These security systems can perform the following checks on the transport system / checks on the rubber mat:
- tensions;
- centered movement;
- slides / slips;
- security of longitudinal tearing.

In order to determine the necessary power to belt conveyors from distribution joints, I propose to use the computer program for automatic computation.

User card:

- File image: AEM – BSV.
- Algorithmic language: BASIC
- Generalities: The program was design for automatic computation of power, necessary to start a belt conveyor. By using this program it will be solved the demands required in the electromechanical field.
- Input data: The program user will fill in the following data:

Table 1

No	*Specification*	*Variable coding*	*Maximum variable dimensioning*	*Measure unit*
1	Name	Alphanumeric	7 character	-
2	Length	Digital (complete)	3 character	m
3	Width	Digital	3 character	mm
4	Vertical deviation	Digital (real) Positive or negative	6 character	m
5	Discharge	Digital (complete)	4 character	m^3/h

- Output data: after starting the program, the following data result:

Tabel 2

No	*Specification*	*Variable coding*	*Maximum variable dimensioning*	*Measure unit*
1	Power	Digital (one decimal place)	4 character	kW

- Editing: presentation of the main characteristics to identify the transporter and the estimated parameters will be as table form in the number of copies requested by the user.

Edited data:
- name of belt conveyor;
- lenght of belt conveyor, m;
- width of rubber mat, mm;
- vertical deviation, m;
- transportation discharge, m^3/h;
- power of driving units, kW.

Note:
- *due to computation program, the transport speed, (1,5; 3; 4,5 and 6 m/s).*
- *for a good function of program, the user must respect the dimensions and the order of input data.*

Conclusions

In this stage, Romanian economy is subject to constraints created especially by the lack of capital investment and lack of working capital arising from financial blockage.

The consequences of these major constraints are felt in slow steps to continue the modernization and rehabilitation of the lignite mining industry, important sector of the economy which requires funds from the state budget as grants and capital expenditure.

To provide a clear image of effects of possible modernization and rehabilitation would be necessary to follow the evolution of usage indices of equipment and specific costs before and after rehabilitation for a minimum of one year. It must be emphasized the importance of tracking the effects of rehabilitation to assess more accurately the effectiveness of such action (rehabilitation - modernization) and to take relevant decisions on the points and moments when is necessary to act for extending them widely.

After the analysis which has been performed and presented has resulted that during 2011-2025 to deliver the planned production of lignite from Jilt basin was necessary to modernize the distribution joints for improving the efficiency of activity.

After implementing the rehabilitation programs and in condition of sale can achieve better results compared to the situation when working without upgraded equipment.

The results of modernization and rehabilitation actions of flow sheets from the coal pit have lead to:
- reducing the number of interventions / supervision staff by 5-10%;
- lower electricity costs, materials and spare parts by 5-15%.

Therefore we can say that the actions of rehabilitation and modernization of flow sheets of the two coal pits should continue with modernization measures of distribution joints, for smooth transport activities of sterile into the dumps and coal transport into the storage related to these.

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