CONTENTS

UNFOLDINGS OF THE CYLINDRICAL SURFACES USED IN THE INDUSTRIAL INSTALLATIONS

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Abstract: *The connections in the construction of the various industrial installations: pipes, boilers, joints elements and fittings have a cylindrical configuration, or similar cylindrical shape. The execution and their installation require knowledge of the unfolding and intersection curves, which compose them. The graphical solving of the problems of technical representation has enabled the formation of abstract geometric of the pieces forms and the ability to see into space. The paper proposes to establish the unfolding of a connection, used in the industrial equipments, by the classical method of the descriptive geometry and mathematics, using appropriate software.*

Keywords: cylinder, intersection curve, unfolding, methods.

1. THEORETICAL CONSIDERATIONS

This paper addresses a theme met in technical design of the connections in which the knowledge of the unfolding of the geometric elements, which compose them, is the basis of making, required in installation. The design, the execution and their installation requires tracing of the unfolding of the geometric elements of the respective connection[1]. The intersection of three cylinders of equal diameter $D = 30\text{mm}$ and axis concurrent, inclined at an angle of 60^{0} is considered (Figure 1). This paper aims to resolve in two ways, by methods of the descriptive geometry and mathematics, such an application.

2. DESCRIPTIVE GEOMETRY METHOD

The problem can be reduced to an intersection of cylinders with equal diameters and axis concurrent inclined at a known angle. Because of the symmetry of the case only unfoldings of the middle cylinder and only one side are determined. To determine the curve of intersection between the cylinders, we use the method of the auxiliary planes. The number of auxiliary planes is bigger, obvious the accuracy of the intersection curve is higher. The intersection of the outer cylinders on the common section can be considered simplier as an intersection of a cylinder with a plan. The angle that the plane makes with the horizontal axis of the cylinder is of 60^{o}.

To determine the intersection points that define the curve, the cylinder base is divided into 8 equal parts, that horizontal (lateral) with the points $1,2,...,8$ and the middle with the points $m,n,...,v$. Through these points, the limit planes $f_1, f_2,...,f_5, l_1,...l_5$ are constructed. At the intersection of the corresponding planes the $m5, n4 = v6, p3 = u7,$ intersection points of the curve are obtained and the $p1 \equiv u1$ point. It is obvious that the true sizes of the generators are measured in the vertical plane. The unfolding will be a rectangle, with a side length equal to the base circle and the other side equal with the $l_1, l_2,...,l_5$ lengths generators, respectively l_6, l_7, l_8.

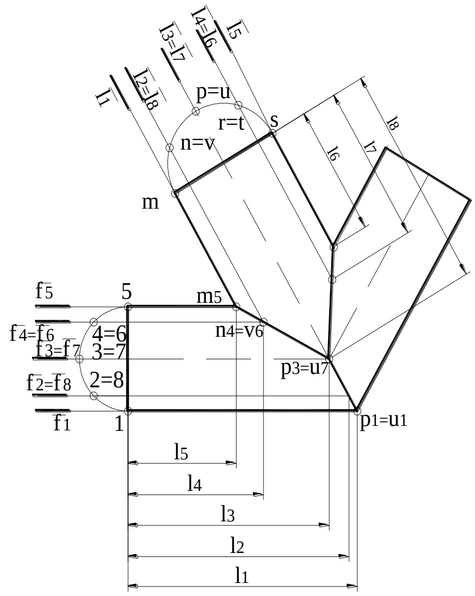

Fig. 1. *Connections intersection*

The Figure 2 shows the unfolding of the horizontal cylinder, where the length of the segment is $\overline{1_0 1_0} = 2\pi 30$, and the other dimension is $\overline{1_0 P1_0} = l_1,...,\overline{5_0 M5_0} = l_5$. The points of the intersection curve will be: $P1_0,...,M5_0,...,P1_0$.

The Figure 3 presents the unfolding of the middle cylinder, where the segment length is $\overline{M_0 M_0} = 2\pi 30$, and the other dimension is $\overline{M_0 M5_0} = l_6,...,\overline{P_0 P3_0} = l_8$. The points of the intersection curve will be: $M5_0, N4_0, P3_0,...,M5_0$.

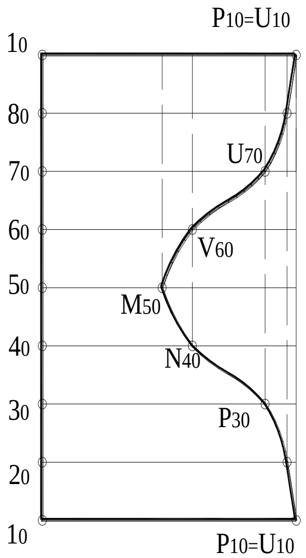

Fig. 2. *Unfolding of the horizontal cylinder*

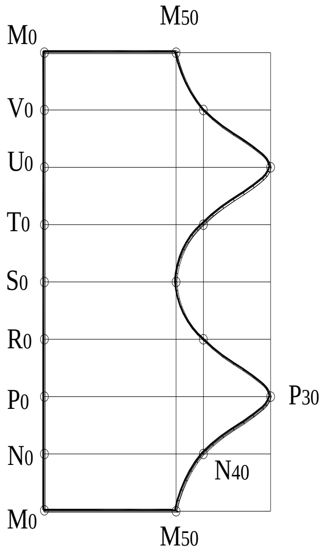

Fig. 2. *Unfolding of the middle cylinder*

3. MATHEMATICAL METHOD

In the Figure 4 is presented the setting way of the cylinders.

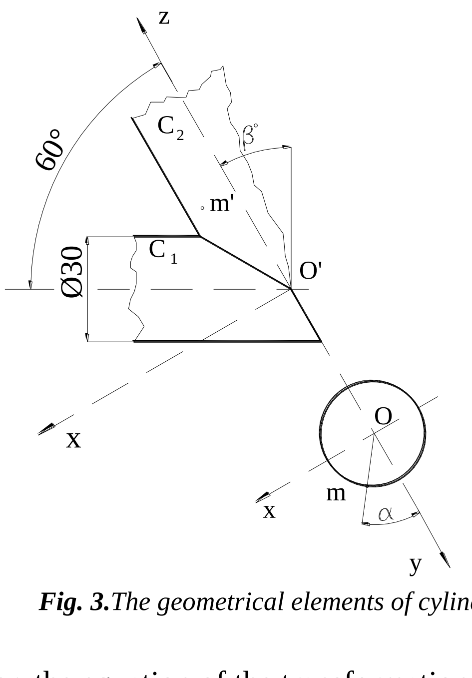

Fig. 3.*The geometrical elements of cylinders*

For the C_2 cylinder, the equation of the transformation curve, is obtain by applying the transformation (2), (3) to the equation (1), [2-7].

$$z = (x - x_0)\ tg\beta,\ x \in [-\pi R,\ \pi R] \tag{1}$$

$$x = R \sin\alpha \tag{2}$$

$$z = z_d\ ,\ \alpha \in [0,\ 2\pi] \tag{3}$$

In this case:

$$x_d = R\alpha$$

$$x = R\sin(\frac{x_d}{R})$$

$$z = z_d$$

Those we obtain:

$$z_d = tg\ \beta\ (R\sin\frac{x_d}{R}),\ x_d \in [0, 2\pi R] \tag{4}$$

For an angle $\beta = 60^0$ and a cylinder radius $R = 15\text{mm}$, we obtain the Figure 5, by introducing the relation (4) into the Mathematica program. The Figure 5 show the unfolding for the C_2 cylinder.

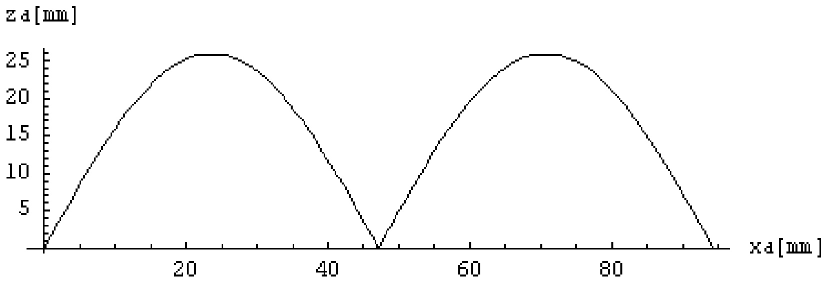

Fig. 4. *Unfolding of the middle cylinder*

For the horizontal cylinder we consider a reunion between definition domains, and the same method, but the C_1 cylinder is cutting with tho oblique plane (Figure 6).

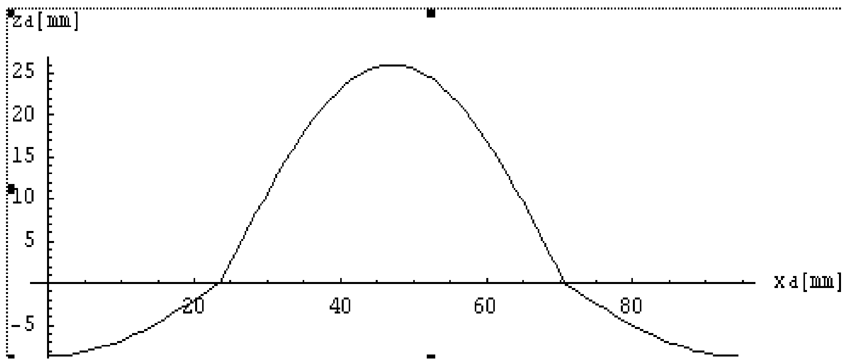

Fig. 5. *Unfolding of the horizontal cylinder*

4.CONCLUSIONS

For the correct execution of some pieces or subassemblies with complex form, which meet the requirements, the methods of descriptive geometry are absolutely necessary. Resolve the difficulties of producing patterns, by determining the types of surfaces that are part of that is very necessary.The presented method is very speedy and exactly and using the program we can obtain the cylinders unfoldings for any other dimensions. The two methods have the same results.

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EXPERIMENTAL INVESTIGTION OF THE FRETTING PHENOMENON-DEPENDENCE OF NUMBERS CYCLES

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Abstract: *Fretting damage is often the origin catastrophic failures or loss of functionality in many industrial applications. Considered as a plague for modern industry, fretting is encountered in all quasi-static loadings submitted to vibration and thus concerns many industrial branches. The main parameters were reported to be amplitude displacement, normal load, frequency, surface roughness and morphology, and residual stresses. The present paper argues that adhesion forces and elastic deformation in the contact zone may contribute significantly to the relative displacement during fretting of metals.*

Keywords: fretting, wear, experiment

1. INTRODUCTION

Fretting is now fully identified as a small amplitude oscillatory motion which induces a harmonic tangential force between two surfaces in contact. It is related to three main loadings, i.e. fretting-wear, fretting-fatigue and fretting corrosion.

The main parameters were reported to be amplitude displacement, normal load, frequency, surface roughness and morphology, and residual stresses. More recently fretting has been discussed using the third-body concept and using the means of the velocity accommodation mechanisms introduced by Godet et al.

Fretting regimes were first mapped by Vingsbo[1]. In a similar way, three fretting regimes will be considered: stick regime, slip regime and mixed regime. The mixed regime was made up of initial gross slip followed by partial slip condition after a few hundred cycles. Obviously the partial slip transition develops the highest stress levels which can induce fatigue crack nucleation depending on the fatigue properties of the two contacting first bodies. Therefore prediction of the frontier between partial slip and gross slip is required.

The type of surface damage that occurs in fretting contact depends on the magnitude of the surface normal and tangential tractions. In existing fretting models the relative displacement is assumed to be accommodated mainly microslip in the contact surface [2],[3].

The present paper argues that adhesion forces and elastic deformation in the contact zone may contribute significantly to the relative displacement during fretting of metals. A simultaneously applied tangential force and normal into contact appears a adhesion force. A tangential force whose magnitude is less equal on greater than the force of limiting friction will not give rise on give rise to a sliding motion. It is determined the energy loss dissipated per fretting cycle.

2.EXPERIMENTAL MEANS

For the study of the fretting phenomenon in case of elastics assemblages spring slides with multiple sheets, I used the experimental stall from fig.1.[4],[5].
The stall permits testing for one slide and for spring slides with multiple sheets, too.

2.1. Description of the stall

On the rigid support the elastic lamella is assembling through the agency of the superior plate and of the screws .

The assemblage is made through the agency of 8 balls (4 balls inferior and 4 superior balls) who assure a point contact between the ball and the lamella.

The elastic lamella oscillates because of the rod crank mechanism with eccentric. This mechanism is actioned with the electrical engine assuring the necessary conditions for producing the fretting phenomenon.
The contact is charged with the assistance of 4 screws through the agency of some helicoidally springs and through the agency of some radial-axial bearings with conic rolls.
The helicoidally springs beforehand standard permit a charge with a normal and known force, the presence of the radial-axial bearings assuring the eliminate of friction between the screw and the superior plate.

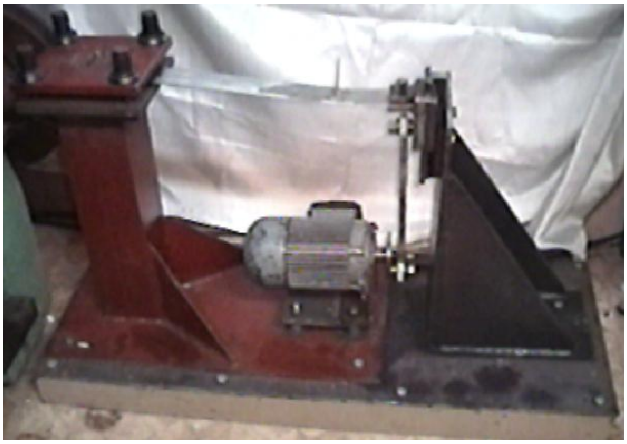


Fig.1. *Experimental stall*

The stall can be used for the testing at fretting of some couples by different materials. This stall can be adapted for study of the lamellar springs with many sheets.

The lamellas used in experiments have the dimensions 560x56x2 mm and are realized by spring steel having hardness 55 HRC.

The balls are spring balls and have 19 mm in diameter. The lamella is supported in inferior side on 4 balls (fig.2) in superior side the charge of the contact is made through the agency of 4 balls. The rod-crank mechanism permits adisplace at the end (extremity) of the 20 mm lamella and can modify this displace by changing of the system eccentricity (Fig.3). The system is actioned through the agency of electrical engine having revolution of 750 rot/min.

Fig.2 *Inferior side*

Fig.3.*The system excentricity*

Helping with this experimental stall we can made fretting tries for normales and different forces for different numbers of solicitation cycles. We obtained different wear traces corresponding fretting wear. So, we find the dependence of the normal charging force, and we can compare the different fretting traces by comparing of different fretting zones for certain conditions of contact.

Therewith we can compare the theoretical results previously presented with the experimental results. Traces wear obtained was assumed with a video camera and processing on the computer. The displacement at the contact level was determined, like we shown previously helping with the video camera and computer. The determination of displacement was made for the two ranges of balls.

In the table 1. are the traces wear obtained for a normal charging of 150 N on the each screw. For comparing the traces wear obtained with the theoretical results obtained for the fretting phenomenon we determined the central area and the annular adjacent area, and the results are in the table 2 for the front balls and in the table 3, for the back balls. In fig.4. and 5 are the dependence of the wear traces by the cycles numbers for a normal force by 150 N and for the two position of the balls in front and back.

Table 1

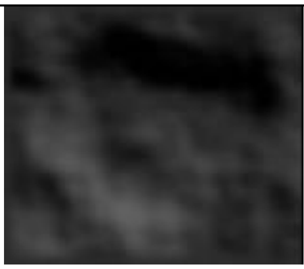
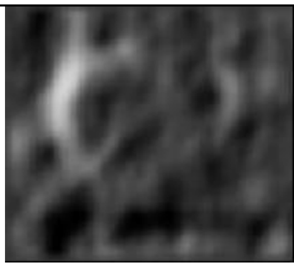
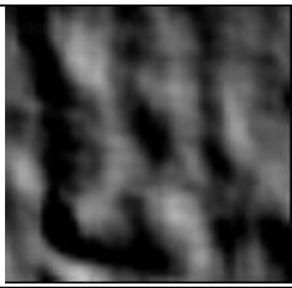
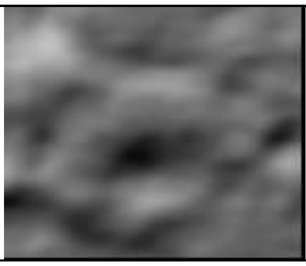
Number of cycles	Pozition of balls	
	face	back
30000		
40000		
50000		

Table 2

Nr. crt.	Loading [N]	Number of cycles	Area central [mm^2]	Radius central [mm]	Area ext. [mm^2]	Radius ext. [mm]	Area annular [mm^2]
1	150	30000	0.09087	0.17007	0.75040	0.4887	0.65953
2	150	40000	0.14207	0.21265	0.99770	0.5635	0.85563
3	150	50000	0.18636	0.24356	1.22522	0.6245	1.03886

Table 3

Nr. crt.	Loading [N]	Number of cycles	Area central [mm^2]	Radius central [mm]	Area ext. [mm^2]	Radius ext. [mm]	Area annular [mm^2]
1	150	30000	0.09610	0.17489	0.54559	0.4167	0.44949
2	150	40000	0.11547	0.19172	1.32867	0.6503	1.21320
3	150	50000	0.16672	0.23037	1.37761	0.6622	1.21089

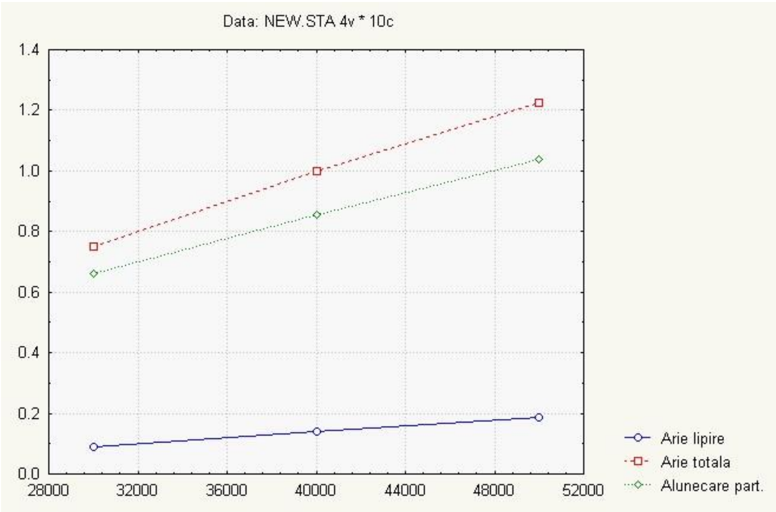


Fig.4. *The dependence of the wear traces by the numbers of cycles for F= 150N; in front*

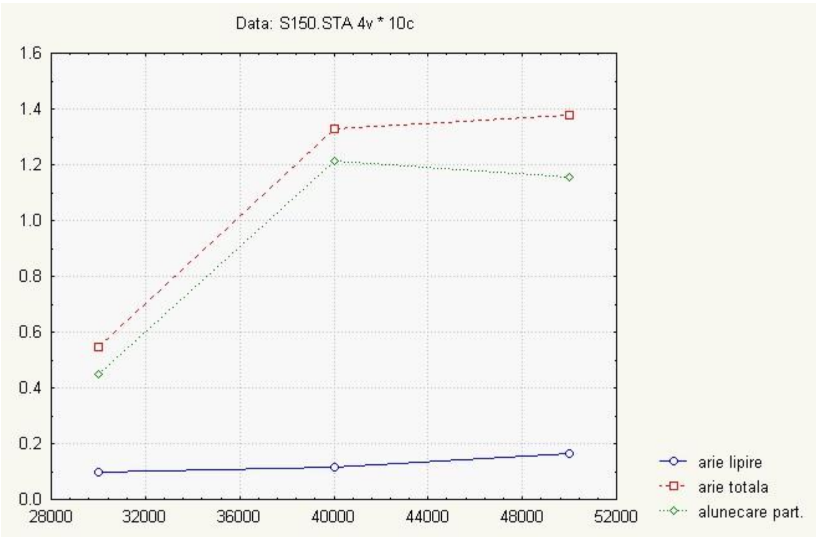


Fig.5. *The dependence of the wear traces by the numbers of cycles for F= 150N;back*

In fig.6. and 7 are the dependence of the partial sliding by the cycles numbers for a normal force by 150 N and for the two position of the balls in front and back.

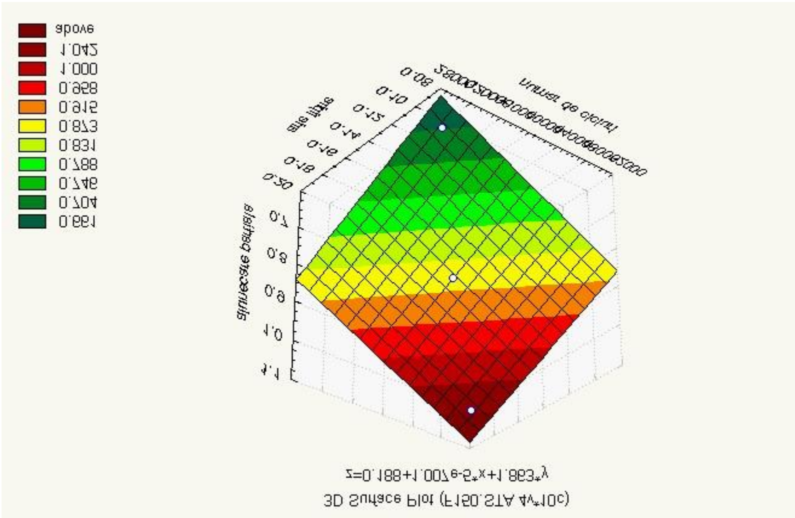


Fig.6 *Partial sliding from*
F=150N – front

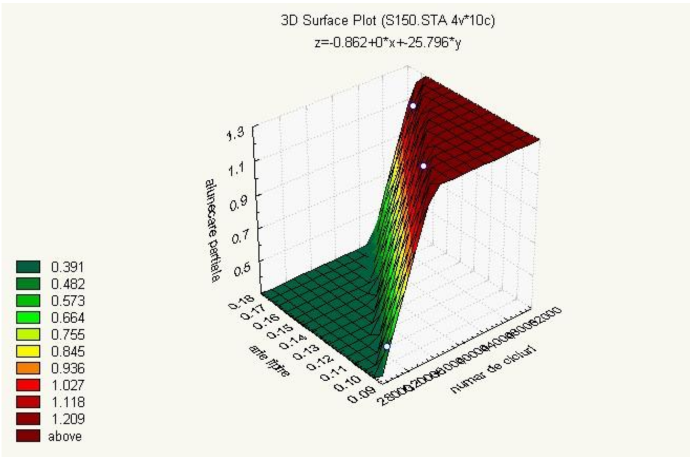


Fig.7 *Partial sliding from*
F=150N - back

In fig.8, 9 and 10 are the dependence of the partial sliding by the cycles numbers for a normal force by 150 N

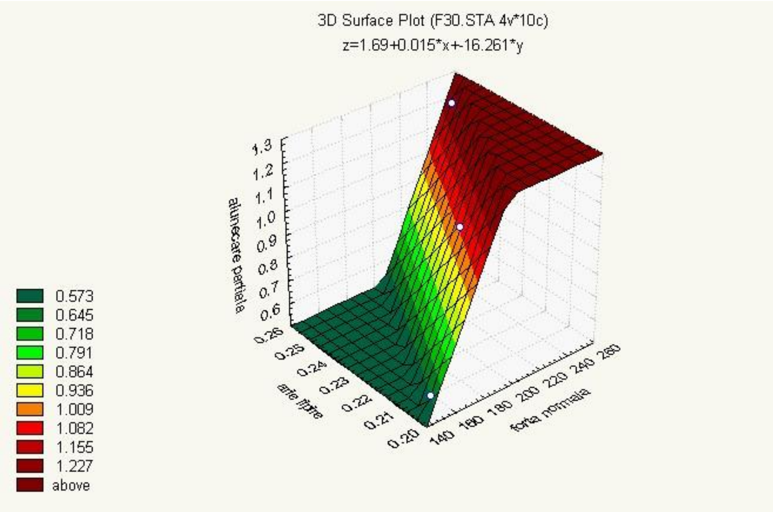


Fig.8 *Partial sliding from Nc=30000 cycles*

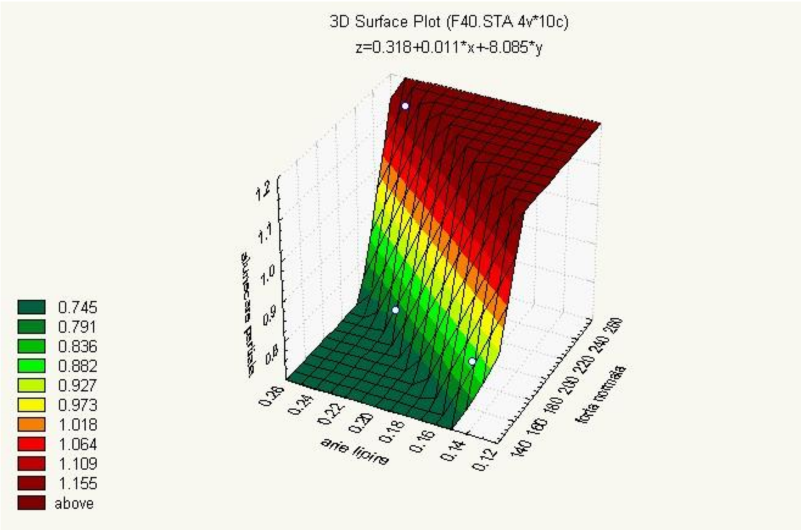


Fig.9 *Partial sliding from Nc=40000 cycles*

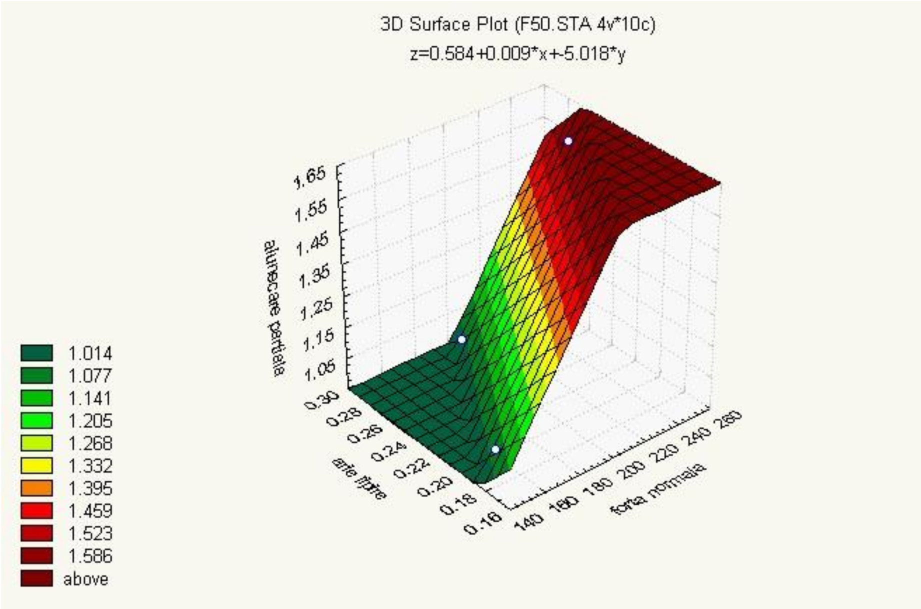


Fig.10 *Partial sliding from Nc=50000 cycles*

3.CONCLUSIONS

The experimental stall permits realization of the experimental tries for the study of fretting. We can determine the different size of the fretting areas and we can compare these with the theoretical results.

Can be made considerations for existence of one friction coefficient who is variable between the surfaces corresponding by one fretting contact.

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MATERIALS FROM MACHINED BERINGS BY ELECTRICAL EROSION

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Abstract :*Chromium alloy rings for bearings p stockings and the rolling bearings were selected steels with high carbon about 1.00% and a chromium content of 1.5%, according to ISO 683-17.Although case hardening steels are rarely seen in manufacturing of bearings, they are used with good results in exploitation. These steels are usually recommended in the execution of large bearings andwhere bearing operation performed on shock and vibration. Bearings run in hardened steels are less susceptible to damage accidental, due to soft ductile core. Bearing cage materials are important elements of building bearing. The main function of the cage is to prevent direct contact between the rollingandguide their raceways. The ring bearings removable retaining cage serves rolling elements, suchthat they can not fall off when installing or removing them. Depending on the material used, as well as manufacturing technology, cages can be: cages pressed sheet steel, low carbon extra deep drawing according to EN 10130 + A1,cages of brass CuZn40PbT STAS 199/2.*

Key words: bearings, electrical erosion, temperature, bearing materials.

1.INTRODUCTION.

The magnitude and direction of loads greatly influence the selection of bearings.Generally, for the same dimensions, the cylindrical roller bearing stands heavy loads than the deep groove balls bearing. The bearings with more rows of rolling elements, especially rollers have heavy load carring capacity. According to the load acting direction, the following situation are distinguished:

a) Radial load:cylindrical roller bearings without ribs at one of the rings, with one row of rollers (type N orNU) or with two rows of rollers (type NN or NNU) and needle roller bearings are to be used.

b) Axial load:thrust balls or roller bearings according to the load magnitude, are to be used. The simple
effect thrust roller bearings can be loaded only in a single direction and the double effect thrust roller
bearings can be loaded in both directions.

c) Combined load:the simultaneous action of radial and axial load means that on the roller bearing acts a
combined load. For light axial loads together with radial loads are used: deep groove ball bearings, single row. (combined load supported rises if the radial clearance is greater than normal), cylindrical roller bearings of the NUP and NJ+HJ types and spherical roller bearings. NJ type cylindrical roller bearings can only accommodate axial loads acting in a single direction and for axial displacement of the shaft in both directions it is recommended to mount roller bearings of the same type. If the axial load is heavy, a thrust bearing must be mounted together with a radial roller bearing. The angular contact balls bearing or four-point contact bearings (Q or QJ type) used when axial load predominates are mounted with

clearance fit for housing. In case of combined loads in which heavy axial load predominates, angular contact ball bearings single or double rows taper roller bearings or spherical roller thrust bearings. In which the black triangles indicate the loads direction for which the respectivebearing was designed and the white triangles are indicating the possible loads. The size of the bearings is selected considering the condition of life requirements ensuring for imposed conditions of load, rating life and reliability ofoperation. Selection is done on the basis of a characteristic variable: basic load ratings.

2.PROCESSING BY ELECTRICAL FROM EROSION BEARINGS.

Fig.1.*Electrical erosion machine AR-4300*

The AF-4300 is indicated for the production of large molds and is considered to be one of the best cars in its class in the world. AF- 4300 offers racing 2.100mm X axis, Y axis 900mm Z axis 500mm SSI supports loads up to 10.000kg. Two independently controlled heads CNC, allowing erosion to two independent cavities and simultaneously. In addition, equipped with an open design 32/64 CNC, the machine is easy to integrate into the user management system. AF 4300 belongs to the class of modular EDM machines from Novick family. The piece de resistance of this machine is its versatility, since customers can choose different elements to set up a car for their needs. This EDM machine can be used with a tank split, thus functioning as two cars own CNC system.

2.1.Selection of bearing type considering the alignment between shaft and housing.

Angular misalignments occur generally when the shaft bends under the operating load or when bearings adjoint parts have form or position deviations. In such cases, self-aligning ball bearings, spherical roller bearings or spherical roller thrust bearings should be used. A certain bearing bent angle can compensate for errors of alignment and maximum angle values are shown for each type in the introductory texts of the table sections. When misalignments should be compensated, radial and axial clearance are important. The larger the clearance, the greater the possibility of self-aligning. If the misalignment exceeds the permissible values shown in the introductory texts of the bearing tables, the bearing rating life decreases. The greater the ratio Fr/C0r, the shorter the rating life. If 0.1 <F0r/C0r< 3, the rating life decreases with about 25%.

2.2.Selection of bearing type considering the operating temperature.

Maximum operating temperature to which the bearings designed for normal applications can be used is of 120°C. Over this temperature in the material of the contact elements (rings and rolling elements) there are produced structural transformations with negative implications over the dimensional stability and physical and mechanical characteristics which determine the resistance to contact fatigue and, through implication, to the life of the bearing. Thus, at higher temperatures it is recommended to use special bearings having the component parts made of special steel brands or stabilized through thermal treatments. These bearings have special symbols. Remark: when the working conditions of bearing allow great temperature differences in operation for the two rings (interior and exterior) we recommend the use of bearings with radial clearance greater than normal (groups C3, C4, C5).

2.3.Selection of bearing internal clearance.

In most cases, while operating, bearings should have a small radial clearance that can be defined as "the possible value of displacement in radial direction of one bearing ring in relation to theother without parts deformations". While operating, bearing internal clearance is diferent from the one at delivery, since the latter is reduced when mounting bearings with a certain tight fit. Under operating conditions, internal clearance change is also caused by different temperatures between the outer and inner ring. Bearings are generally delivered with a normal radial or axial clearance according to the values shown for each rolling bearing group.

The decrease in radial clearance due to the tight fit and operating temperature is considered to be between 60-80% of the tightening value, depending on bearing series and size. After the clearance in bearings has been decreased, a large enough operational clearance should remain, so that the lubricant film shouldn't be destroyed. Deep groove ball bearings should have an operational clearance close to zero. There may be often a light-preload, due to the point-contact between the rolling elements and raceways. Small-sized cylindrical roller and needle roller bearings should have an operational clearance of 5-10 μm and larger-sized bearings a clearance of 10-30 μm.Bearing producers can also manufacture - at request-bearings with radial and axial clearancesmaller (C1 and C2) or larger (C3, C4 and C5) than normal, so that the most favorable operating conditions for bearings should be asured. Cylindrical and needle roller bearings can be manufactured with interchangeable rings (no special designation) and with non interchangeable rings (suffix NA). Bearings with non interchangeable parts have a smaller radial clearance than bearings with interchangeable parts. Changing rings from one bearing to another is not allowed. In case of bearings with interchangeable parts, the rings may be changed and the values of radial clearance will be not altered.Bearing types and technical characteristics

Bearing type is selected depending on the technical characteristics required by a certain application. A suggestive graphic symbol has been determined for each main technical characteristics. Thus, a proper bearing for each purpose can be easily chosen. According to the specifications in this catalogue, the proper type and size of bearing can be selected, together with all manufacturing and operating technical conditions.

3. MATERIALS FOR ROLLING BEARINGS.

Due to various operating conditions and intricate aspects of deterioration phenomena, directconnections between mechanical characteristics and materials used for bearing manufacturing havebeen ascertained. Experimental studies proved that the following characteristics have to beconsidered, when appreciating the quality of bearing steels: rating life and contact fatigue loading,hardness at environment temperature and high temperatures, coefficient of expansion, tenacity,corrosion resistance and metallurgical conversion characteristics. In case of normal applications and operating conditions, only the first two characteristics are of importance, the other being of importance only in case of bearings used for special applications. Material behavior when being loaded at fatigue contact is difficult to be estimated due to the complex of the factors involved while hardness can be estimated by classic methods. These led to the selection of some steels, which are able to satisfy the main demands of normal and special operating conditions. The steels that meet the requirements for rings and rolling elements manufacturing are the following:

3.1.Chrome-alloy bearing steels.

Steels with high carbon content 1 % and with chrome 1.5% according ISO 683-17 have beenchosen for bearing rings and rolling elements.

3.2.Case - hardening steels.

Although case-hardening steels are not usually selected for bearing manufacturing, for certainapplications they can be successfully used. These steels are generally recommended for large-sized bearings and where bearings are operated under shock, loads and vibrations.Bearings manufactured of case-hardening steels are less liable to casual failure due to the ductile and soft core of these steels. The case-hardening bearing steels used and the chemical content are according ISO 683-17.

3.3.Bearing cages

Bearing cages are of great importance for bearing design.The main purpose of the cage is to prevent immediate contact between two neighboring rolling elements and to guide them on raceways. Where bearings are of separable design, the cage also serves to retain the rolling elements when one bearing ring is removed duringmouting and dismounting.Considering the cage manufacturing technologies, they can be classified as follows :pressed cages of steel sheet, low carbon content, for extra-deep drawing. Polyamide cages are used for some small and medium-sized bearings due to the following properties: low density, high elasticity , low wear at sliding movement, low inertia moment.

***Fig.2**. Medium carbon steel insulated system transformed Fe, C 0.4, 1.3 Ni, 0.65 Cr, 0.65 Mo*

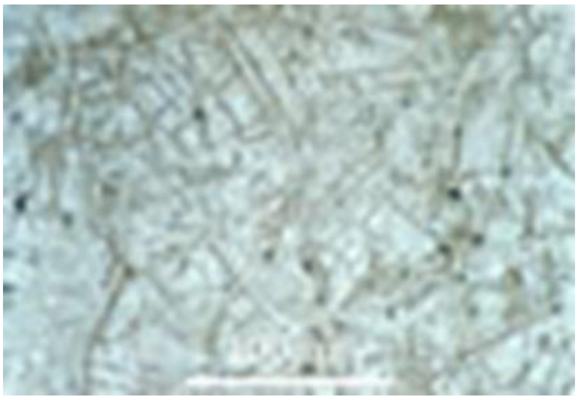

***Fig.3.** Medium carbon steel insulated system transformed Fe, C 0.4, 1.3 Ni, 0.65 Cr, 0.65 Mo*

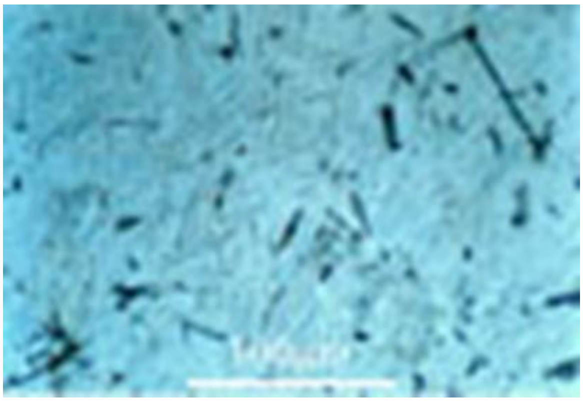

***Fig.4.** Medium carbon steel insulated system transformed Fe, C 0.4, 1.3 Ni, 0.65 Cr, 0.65 Mo*

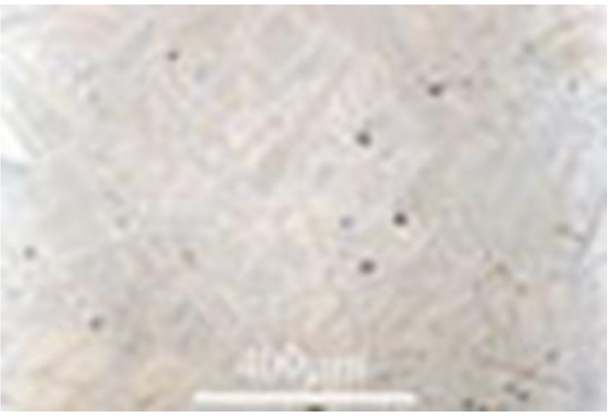

Fig.5.*Medium carbon steel insulated system transformed Fe, C 0.4, 1.3 Ni, 0.65 Cr, 0.65 Mo*

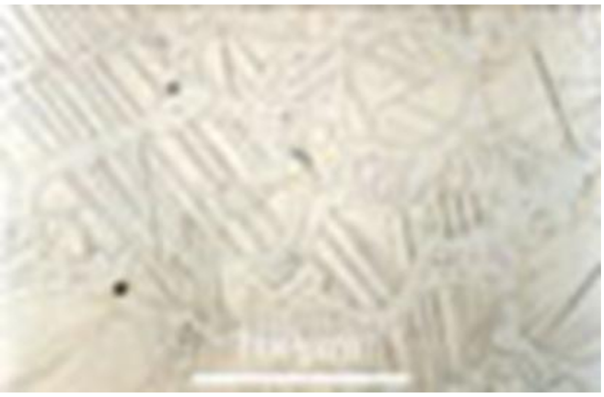

Fig.6.*Medium carbon steel insulated system transformed Fe, C 0.4, 1.3 Ni, 0.65 Cr, 0.65 M*

Fig.7.*Nickel Stainless martensitic Fe, 2.95 C, 0.60 Si, 0.60 Mn, 4.00 Ni, 1.90 Cr*

***Fig.8.**Ball bearings*

***Fig.9.**Radialbearings*

4.CONCLUSION.

Bearing steels are steels that must meet specific requirements or demands of machine bearings analog tensile strength, wear and fatigue very high and good dimensional stability. Steel bearings a hipereutectoide(C> 1%) Low Alloy Cr, Cr-Si avoiding alloying with elements that would increase the percentage of residual austenite. Use the martensiteafter quenching and low return. Bearings can be radial or axial to radial, axial those and other types of bearings are designed for combined loads (radial and axial). In general, ball bearings are suitable for small and medium load tasks and roller bearings are suitable for high load tasks. Bearings can be radial or axial to radial, axial those and other types of bearings are designed for combined loads (radial and axial). In general, ball bearings are suitable for small and medium load tasks and roller bearings are suitable for heavy duty load.

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INFLUENCE OF THE COAL EXPLOITING ACTIVITY IN PINOASA QUARRY ON THE QUALITY OF THE ENVIRONMENTAL FACTORS

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Abstract. *The activities specific to the coal exploiting quarries have a direct action with negative effects on all the environmental factors. They produce air pollution by the powder emissions and by the noise produced by the installations of the quarry, but also significant soil pollution by getting certain important field surfaces out of the agricultural circuit. This paper presents aspects regarding the quality of the environmental factors affected by the coal exploiting activity in the perimeter of Pinoasa quarry.*

Keywords: quarry, environment, quality.

1. INTRODUCTION

The mining industry exerts special influences on the environment and these influences are manifested in all the phases of the technological processes of production. The influence on the environmental factors starts with the activity of prospecting and exploring the deposits and it continues and gets higher with the development of the productive activities. In certain cases, the negative influence manifests for a long time, even after the total stopping of the productive activity in the area. Nowadays, there is the extension of the ecological risks due to some real and special situations when many of the mining units develop their activity:

– in the first place, it is about the increasing volumes of sterile rocks which are extracted, transported and deposited, because of the increase of the needs of mineral raw materials necessary to the society and to the real situation of exploiting and capitalizing deposits with more and more reduced useful components;

– in the second place, it is about the extension of the mining activity in areas having particular features resulting long term negative influences extended at great distances;

– in the third place, we should show that mining activity is mandatorily developed in a place strictly connected to the deposit existence and that this could create special ecological problems in a sensitive area for conserving the ecosystem [1-3].

The perimeter of Timiseni-Pinoasa quarry is in the West of Rogojelu Power Station, delimited in the South by Timiseni Valley, in the East of the perimeter of Rogojelu mine inside Rogojelu Power Station, in the North by Tismana I and Tismana II quarries, and in the West by a natural embankment –Glavan Hill. The mining perimeter occupies a surface of 913.99 ha and it is developed in the area of eight villages belonging to the townships of Negomir and Farcasesti. The main operations in developing the process of lignite exploitation in Pinoasa quarry are: excavating, depositing and transporting the coal. Timiseni – Pinoasa lignite quarry capitalizes the coal-lignite deposit in Pinoasa perimeter for an industrial reserve estimated at 206,737 thousand tons, respectively at a yearly capacity of 8 million tons/year.

The morphology of the area where the quarry is placed was intensely changed due to the human activity, the arrangements imposed by the objective functioning totally changed the initial aspect of the area [6].

2. INFLUENCE OF THE ACTIVITIES IN TIMISENI- PINOASA QUARRY ON THE QUALITY OF THE ENVIRONMENTAL FACTORS

2.1. Soil quality

The production activity developed in the quarry framework produces soil and subsoil damage and pollution by:

- getting significant surfaces out of the agricultural and forester circuit and using them in certain purposes;
- excavations of coal and sterile;
- transporting the sterile and the coal with the transporting treads;
- depositing the sterile resulted from the deposit excavation;
- depositing the coal into intermediary and main deposits;
- depositing the resulted waste on platforms and in specially arranged storerooms [4,5].

For establishing the influence of the production activity in the framework of Pinoasa quarry on the soil, and also for spotlighting its degree of chemical pollution, four soil samples were taken, considering the history of the placement, the potential pollution sources and the inhabited areas in the neighbourhood. The vegetation was completely removed from the sampling area and the samples were taken at about 25 cm deep from the soil surface. The soil samples were taken from the following spots: Sample 1 – Barhoti I; Sample 2 – Barhoti II; Sample 3 – Deposit of recovered materials; Sample 4 – Distribution knot. The results of the accomplished determinations are presented in tab.1.

Tab.1. *Values of the determinations accomplished for establishing the degree of chemical pollution of the soil.*

Quality indicator (mg/kg)	Values obtained				ALV according to the Order no.756/1997
	Sample 1	Sample 2	Sample 3	Sample 4	
Zinc	1,41	1,32	1,447	1,21	100
Cooper	0,106	0,087	0,107	0,092	20
Cobalt	1,56	1,69	1,501	1,72	15
Hexavalent chromium	0,167	0,202	0,214	0,149	1
Manganese	5,72	4,2	2,78	3,12	900
Molybdenum	0,56	0,72	0,643	0,89	2
Nickel	1,12	1,67	0,343	1,2	20
Lead	0,292	0,321	0,396	0,279	20
Free cyanide	0,001	0,003	0,021	0	1
Total petroleum hydrocarbons (TPH)	1,92	3,6	2,02	2,1	<100

By analysing the results of the accomplished determinations (tab.1), in report to ALV (admitted limit value) according to the Order no.756/1997 regarding the evaluation of the environmental pollution, it resulted that, from the viewpoint of the environmental factor – soil – pollution, the measured values do not cross the maximum admitted concentrations [6].

2.2. Air quality

The air quality is especially affected by the technological process in the coal quarry, stock and deposit, by the increase of the mining perimeter in certain points, of the powder concentration. For determining the air quality, the following sample types were taken: powders in suspension PM_{10}, sedimentary powders and noise level. The results of the determinations accomplished for the analysis of the powders in suspension and of the sedimentary powders are presented in tab.2 and tab.3.

Tab.2. *Values of the concentration of powders in suspension.*

No. sample	Sampling point	Mean measured ($\mu g/m^3$)	ALV according to the Order 592 /2002
P1	Rosia deposit	112,55	50
P2	Timiseni deposit	281,37	
P3	Distribution knot	129,22	
P4	Boncea village	58,35	
P5	Negomir dump	73,04	

Tab.3. *Values of the concentration of sedimentary powders.*

No. sample	Sampling point	Mean measured ($\mu g/m^3$)	ALV according to the Order 592 /2002
P1	Distribution knot Caragui	13,49	17
P2	Timiseni deposit	37,67	
P3	Boncea village	8,51	
P4	Barhoti village	5,39	
P5	Negomir dump	1,94	
P6	Rosia deposit	48,03	

By analysing the results of the determinations accomplished for the evaluation of the air pollution level (tab.2 and tab.3) as a consequence of the activity of Pinoasa quarry, the following facts may be observed:

- the values of the concentration of powders in suspension overdraw the limits imposed by the Order no. 592/2002.
- the values measured for the concentration of sedimentary powders overdraw the limits imposed by the Order no. 592/2002, in the functional areas of Timiseni Deposit and Rosia Deposit.

For establishing the noise level in Pinoasa quarry, there were measurements in six sampling spots, as it results from the data presented in tab.4. The measured values do not overdraw the admitted noise level except for the functional area of Rosia deposit.

Tab.4. *Values of the noise level in Pinoasa quarry.*

No. sample	Sampling point	Mean measured (dB)	The maximum noise level (dB)
P1	Functional area Rosia deposit	53,1	65
P2	Functional area Rosia deposit	73,4	
P3	Functional area distribution knot Timiseni	64,2	
P4	Functional area Pinoasa quarry – west	40,3	
P5	Functional area Pinoasa quarry – south	39,4	
P6	Functional area Negomir dump– south-west	39,1	

2.3. Quality of wastewaters

For determining the pollution degree of the wastewaters evacuated from Pinoasa quarry, there was a sample of technological used water from the collecting channel evacuated in Timiseni stream, at the exit of the unit, and there were analyses of the main quality indicators of the used waters (tab.5).

Tab.5. *Quality indicators of wastewaters Pinoasa quarry.*

Indicator measured	Unit	Value measured	MAC according to the NTPA 001/2002	Method of analysis
Anionic detergents	mg/l	0,283	0,5	**
Total suspended materials	mg/l	5	35 - 60	**
pH	pH unit	7,5	6,5 - 8,5	SR ISO 10523/1997
CBO_5	mgO_2/l	2,4	25	STAS 6560/1982
CCO-Cr	mgO_2/l	6,57	125	**
Ammonia nitrogen ($N\text{-}NH_4^+$)	mg/l	0,023	2,0 (3,0)	**
Nitrates (NO_3^-)	mg/l	0,9	25,0 – 37,0	**
Nitrites (NO_2^-)	mg/l	0,028	1,0 – 2,0	**
Chlorides	mg/l	17,5	500	**
Sulphates	mg/l	138	20	**
Extracts by solvent	mg/l	6,4	5	SR 7587 - 1996
Petroleum products	mg/l	1,7	5	SR 7877-1/1995

*** Analyses conducted in natural receivers – limit values according by GD 352/2005 – NTPA 001 (*technical standards for the protection of water).

From the analysis of the results presented in tab.5 it is found that the measured values do not overdraw the maximum admitted concentrations (MAC), according to NTPA 001/2002, (amended and completed by GD no.352/2005) and the alert levels – Order no. 756/1997, necessary to the evacuation of the used waters into the natural receivers.

3. CONCLUSIONS

The activity developed in the framework of Pinoasa Quarry of exploiting the lignite at the surface, represents the main pollution source of the atmosphere with particles in suspension and sedimentary powders. The excavated coal has a low mechanical resistance, adding a reduced humidity especially during the hot season, leading to powder forming. The pollution level with powders in suspension and with sedimentary powders overdraws the limits imposed by the valid norms, therefore some measures are imposed or reducing the emissions of these polluters into the air, such as: moistening more intensely the quarry surfaces by the permanent functioning of the moistening installations, at the same time with the transporter's functioning, splashing the access roads, projecting an installation of mechanical exhaustion at the transporting treads etc.

The soil is affected due to the activities of coal excavation, stocking and transport, by getting important surfaces out of the agricultural and forester circuit, by depositing the sterile resulted from the excavation in the stocks and by depositing the coal in intermediary and main deposits. The determinations accomplished for establishing the degree of chemical pollution of the soil in the investigated area do not indicate any overdrawing of the limit values admitted by the valid norms. The effects due to the physical pollution produced on the soil by the activities specific to Pinoasa quarry impose a strict monitoring of the actions of ecological reconstruction of the affected fields.

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NUMERICAL ANALYSIS OF EXPLOSIVES AEROSOL DETONATION AND BIOLOGICAL EFFECTS CAUSED

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Abstract: *In this article it will be studied the effect of overpressure in the shock wave front on the human body, generated from the detonation of a quantity of explosive / explosive atmosphere. It will take account of the duration of the positive phase of the overpressure, and impulse default value, to determine the percentage that can cause injury or even lethality. In this article will study the detonation of an explosive atmosphere formed by liquefied petroleum gas - air, compared to a similar amount of TNT detonation, using numerical modeling of ANSYS AUTODYN software product.*

Keywords: AUTODYN, air explosive, detonation.

1. INTRODUCTION

For studying the overpressure resulting from the detonation, I choose an amount of 5 kg LPG and a similar mass of TNT. LPG disseminated into the air form explosive atmospheres with extremely high volumes (volumic shared percentage of fuel being below 10%), which resulted, from a statistically point of view, to many explosives aerosol accidents [1].

In numerical simulation, I choose a mixture of 8% propane and 92 % butane, which falls within the boundaries of constituents of LPG, as defined in SR 66:2007 [2].

Using a program for calculating chemical equilibrium compositions (Computer Program for Calculation of Complex Chemical Equilibrium Compositions and Applications - abbreviated CEA), we have calculated Chapman - Jouguet detonation parameters for LPG-air explosive atmosphere. Disseminated amount of liquefied petroleum gas is 4% of the explosive atmosphere total volume. For this quantity it was obtained a pressure of 19.4 bar and a detonation velocity of 1830 m/s. The method used to obtain the detonation parameters is described by Zeleznik and Gordon [3, 4].

The overpressure resulting from the detonation of an explosive atmosphere is about the same throughout the entire disseminated volume.

2. NUMERICAL SIMULATION OF DETONATION USING ANSYS – AUTODYN MODELING

To simulate the detonation, it was defined a one-dimensional numerical model for both LPG-air mixture and for TNT, having a predefined geometry of "wedge" type. Explosive loads were defined as spherical, in an open space.

For numerical simulation, I have used materials already existing in the AUTODYN library: AIR and TNT.

AIR material (air) is modeled as an ideal gas, its equation of state being defined by the following relationship [5]:

$$P = (\gamma - 1)\frac{\rho}{\rho_0}E \qquad (1)$$

where: P is the pressure, γ is the ratio of specific heats (γ = 1.4 for a diatomic gas like air), ρ_0 is the initial density of air (ρ_0 = 1225 kg/m3), ρ is the density (current) and E is specific internal energy.

For TNT material (trinitrotoluene) AUTODYN program uses both Lee-Tarver equation of state to shape the explosive detonation and "Jones - Wilkins - Lee" (JWL) equation to model the explosive in its initial state (uninitiated). JWL equation of state can be written as below [6, 7]:

$$p = C_1\left(1 - \frac{\omega}{r_1 v}\right)e^{-r_1 v} + C_2\left(1 - \frac{\omega}{r_2 v}\right)e^{-r_2 v} + \frac{\omega e}{v} \qquad (2)$$

where: p is the hydrostatic pressure, v = 1/ρ is the specific volume, ρ is the density, and C1, r1, C2, r2 and ω (adiabatic constant) are experimentally determined constants that depend on the type of explosive.

After calculations it was determined that for a load of TNT weighing 5 kg correspond a radius of 90.13 mm. Explosive atmosphere was disseminated at 18 ° C and 1 bar pressure. Liquefied petroleum gas density is ρ = 575,4 kg/m^3 [8], calculated under the conditions stated above. Explosive aerosol volume was calculated corresponding to a quantity of 5 kg, and it occupies a sphere with a radius of 2335 mm (Figure 1).

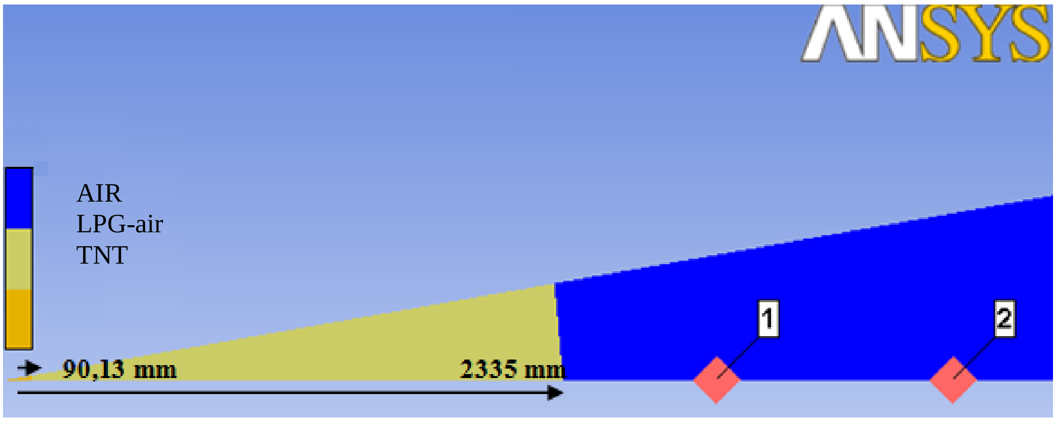

***Fig. 1** Dimensional numerical model*

The figure above show the arrangement of explosive/explosive atmosphere quantities. Thus, it was defined a domain length of 5000 mm, applying, however, the initial condition previously established (P = 1 bar).

From the meshing process resulted 500 elements. To be able to view the overpressure values at different distances from explosive / explosive atmosphere load, it was set two virtual transducers at distances of 3000 mm and 4000 mm respectively. Detonation point was established in (0,0).

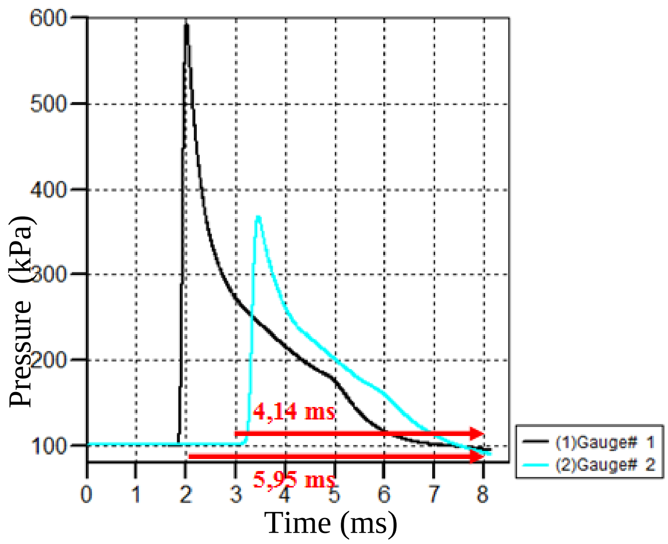

Fig. 2 *Overpressures in shock wave front resulting from the detonation of LPG-air aerosol*

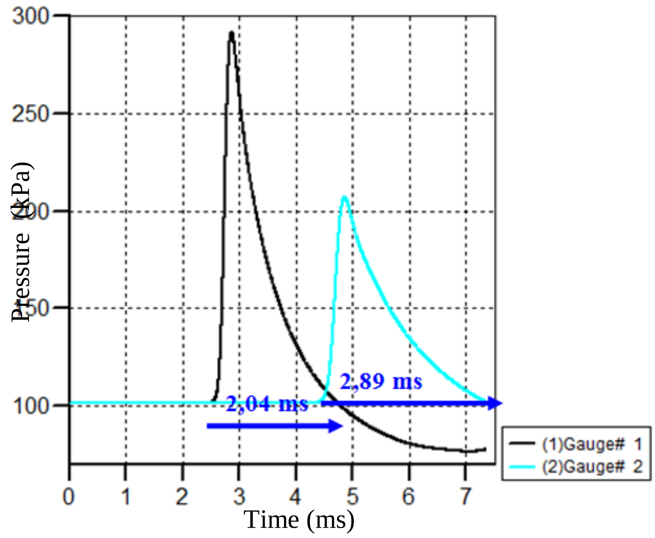

Fig. 3 *Overpressure shock wave front resulting from the detonation TNT's*

Figure 2 shows the overpressures recorded by virtual transducers after the explosive atmosphere detonation. Positive phase duration is 5.95 ms value for an overpressure value of about 6 bar, indicating a high value for impulse.

Figure 3 indicates the overpressure values obtained by virtual transducers, located at the same distance, as in the case of detonation of explosive atmosphere. An overpressure of above 6 bar causes 100% lethality [9]. At the same distances, recorded overpressures are much lower in case of TNT detonation.

At a distance of 3000 mm, it was recorded a much smaller value for impulse then in case of detonation of explosive atmosphere.

As we can see, in case of explosive atmosphere detonation, we get higher pressures because it is disseminated in a very large volume of air.

3. BIOLOGICAL EFFECTS OF OVERPRESSURE

Over time there were developed three models to assess the damage caused by overpressure in front of a shock wave: the Bowen model, Stuhmiller model and Axelsson model. Bowen and Stuhmiller models are focused on lung injury, while Axelsson model includes damage to all internal organs.

Bowen described four cases when may occur lethality, depending on the person positioning relative to the propagation direction of the shock wave.

In this article I made an analysis of the case when the person is standing (perpendicular to the ground), because it has a high probability to be met in reality.

In the previous section it was performed a numerical simulation of detonation and the following values were obtained corresponding to positive phases for propagation duration of overpressure in the shock wave front:

Table 1 *Values for the positive phase corresponding virtual transducers*

No.	**Positive phase duration [ms]**		**Distance that were set the transducers [m]**
	Explosive aerosol	**TNT**	
1	5.95	2.04	3
2	4.14	2.89	4

Figure 4 shows the overpressure plot depending on positive phase of propagation duration and mortality percentage that can occur:

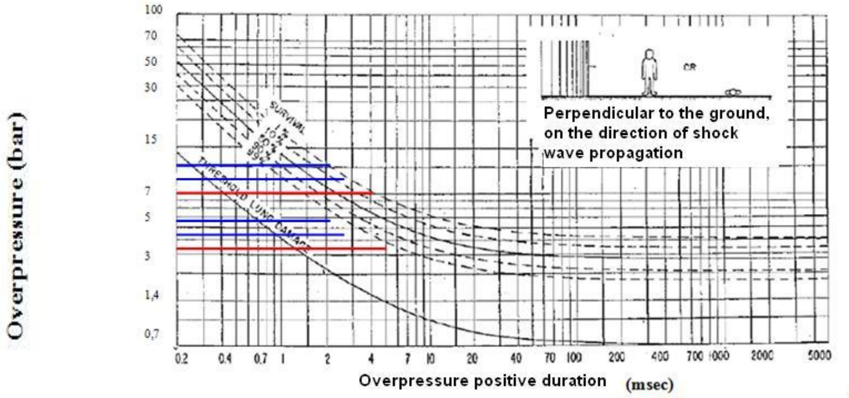

Fig. 4 *Survival of a person weighing 70 kg, depending on the pressure while the phase of the [10]*

Bowen realized rates of mortality corresponding graphs for a person weighting 70 kg.

After analyzing the results shown in Table 1 and after their introduction in the graph shown in Figure 4 we obtain the following results:

Table 2 *Overpressure values corresponding to different survival rates*

No.	**Survival rate [%]**	**Positive phase duration [ms]**			
		Explosive atmosphere		**T.N.T.**	
		5.95	4.14	2.04	2.89
		Necessary pressure for obtaining indicated survival rate [bar]			
1	**1**	6.2	7.2	12	9.7
2	**10**	5.8	6.4	9	7.4
3	**50**	5	5.3	7.3	6.7
4	**90**	3.7	4.2	6.7	5.9
5	**99**	3.3	3.8	5.1	4.4

In Table 2 we notice overpressures values corresponding to survival rate, depending on the duration of the positive phase. We can conclude that a high lethality rate can be achieved with a lower overpressure if the duration of the positive phase is high.

4. CONCLUSIONS

To achieve an explosive atmosphere consisting of liquefied petroleum gas and air, volumic shared values of fuel are relatively low. This allows the formation of large volumes of explosives aerosols by disseminating the fuel into the air. To calculate the detonation characteristics it was used CEA program Their values were introduced in ANSYS AUTODYN software to define explosive atmosphere material. For a volume share of 4% fuel into the air it was obtained an explosive atmosphere, that formed overpressures of 19 bar after detonation. Following the numerical simulation I have obtained different values for the positive phase duration of overpressure in the shock wave front. Based on the Bowen model it was found that for high values the impulse is needed a low overpressure to cause strong injuries.

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STUDY OVER LUMINOUS CHARACTERISTICS OF THE TRACER COMPOSITIONS

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ABSTRACT: *The study of the evolution of the luminous characteristics of the tracing pyrotechnic mixtures under static conditions aims to determine the sizes specific to the lighting technique and their evolution in time, according to various chemical and loading parameters. Comparative studies of munitions with tracer bullet show that we can count , with good accuracy , on identical behavior of tracers , in case of static strains (with no movement of the tracer bullet) and dynamic on the trajectory (characteristics of flames for the bullets on their trajectories in air).*

KEYWORDS: luminous characteristics, tracer compositions, tracer bullet

1. FOREWORD

In efforts to design retardant, intermediary (optional) and tracing composition, that is to assess the chemical composition , the parameters of the loading (dosage and pressing pressures , possibly the pressing temperatures also), a theoretical and experimental method is proposed. It consists into determination of the luminous characteristics of the pyrotechnical mixtures , of their evolution in time, for more versions of the loading process and then to extrapolate the behavior of these mixtures to the strains that occur during the travel of the tracer on its exterior pathway. The following can be thus estimated :

- the necessary time for combustion of the retarding layer, responsible for the „invisible" path of the tracer ;
- the chemical composition of the retarding mixture , doses and other parameters of the loading regime;
- loading characteristics of a possible interlayer, able to transfer the flame from the retardant to successive layers of tracing pyrotechnic mixture.;
- combustion time and luminous characteristics of the flames resulted from the burning of the pyrotechnic tracing mixture.

2. QUANTITIES, UNITS AND RELATIONS INVOLVED IN THE CALCULATION OF THE LUMINOUS EFFECT

The luminous effect of the pyrotechnic loads is given by their combustion flame. Therefore the flame obtained must have some characteristics that should allow the user of the illuminating system to observe the objectives. There is a general idea on the significance of the concept of flame, but it is quite difficult to find the right words to define it.

Most of the time the concept of flame is associated with the emission of light, namely the light of electromagnetic radiation. In the spectrum of electromagnetic radiation, luminous radiation is a relatively narrow field , within approx. 400 and 750 nm (0.4 - 0.75

□ m). They have the property to impress the retina of the human eye , producing a visual sensation. Under the conventional limit of 400 nm up to 10 nm defines the ultraviolet radiation while from 750 nm up to 106 nm is the field of infrared radiation.

The visible spectrum , obtained through dispersion of the natural light through a prism , has the following approximated limits :

- violet 400 <λ< 440 nm;
- blue 440 <λ< 500 nm;
- green 500 <λ< 570 nm;
- yellow 570 <λ< 610 nm;
- red 610 <λ< 750 nm.

To calculate or estimate the effect of the lighting systems we have to know the following sizes specific to the lighting technique.

2.1. Luminous Flux Φ

A source of radiation, in particular a light source, sends some radiant energy to the environment, measured in joules. So light radiation can be studied in terms of energy. The intensity of light impression on the eye depends on the radiated power and not energy radiated. In the theory of radiation, the radiated power (measured in watts) is called *radiated energy flux*:

$$\Phi_e = \frac{dW}{dt} \qquad (1)$$

where W – radiated energy.

The ratio of the energy flux emitted within a small infinite interval around a wavelength and the size of this interval is called the *spectral density of energy flux*:

$$\Phi_{e\lambda} = \frac{d\Phi_e}{d\lambda} \qquad (2)$$

Experience shows that light radiation of a certain energy flow, strikes the eye based on the wavelength of the radiation. Therefore there is a need to introduce the notion of luminous flux , closely related to energy flow or, more correctly, in connection with the spectrum density of the energy flow. Because the eye sensitivity varies from person to person, we use the conventional observer of photometric reference, whose sensitivity has been determined experimentally, using a large number of real observers.

For the observer of photometric reference, eyes are most sensitive to monochromatic yellow - greenish radiation with wavelength λ = 0.556 μm. The luminous radiations with different wavelengths produce smaller light feeling. In other words, assuming that we have a radiation with a given energy flux and that its wavelength gradually changes from 0.4 mm to 0.76 mm, the light feeling will vary according to the wavelength that is emitted.

The ratio of luminous flux density and spectral density of energy flux for monochromatic radiation is called *relative luminous spectral efficacy* (or coefficient of relative visibility).

$$V_{\lambda} = \frac{\Phi_{e\lambda}}{\Phi_{\lambda}} \qquad (3)$$

The figure below shows the variation of the relative spectral luminous efficiency V_{λ}, whose values are in the range [0, 1].

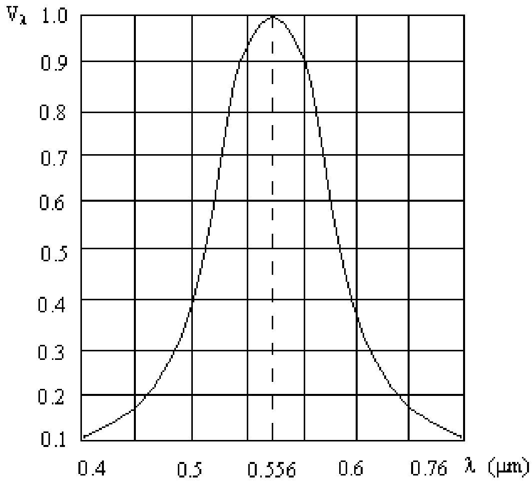

Fig. 1. *Spectral luminous efficiency curve* V_{λ}

In conclusion we can say that the luminous flux means the radiated energy flux evaluated after light feeling produced.

Luminous flux, which is actually a power, is measured in light watts (Wl). But this measure was not adopted and a K times smaller unit called the lumen was preferred instead.

The lumen is defined independently of the power unit (light watt), depending on the unit of luminous intensity (candela) because the fundamental standard of measurement was set for this unit.

The lumen is the luminous flux uniformly distributed, delivered in a solid angle of one steradian by a point source, which has the luminous intensity of one candela from the axis of the solid angle.

Light Watt is equal to the luminous flux produced by a monochromatic radiation of wavelength λ = 0.556 mm and an energy flux of 1W. So : lm = 1/680 Wl

2.2. Luminous intensity I

Light sources do not distribute the luminous flux uniformly in all directions. To characterize the action of light in a particular direction we use the concept of luminous intensity.

Luminous intensity, I, of a source in a given direction is defined as the ratio of the luminous flux dΦ and the size of the solid angle ω which defines the flux.

$$I = \frac{d\Phi}{d\omega} \quad \text{(cd)} \tag{4}$$

From the above relation is observed that luminous intensity is actually a spatial density of luminous flux in a given direction. The concept of luminous intensity applies correctly to point sources only. In lighting technique, the point sources are considered to be those sources of much smaller dimensions than the distances to which we determine the luminous effects.

If the flux Φ is uniformly distributed in solid angle ω, the equation (4) becomes:

$$I = \frac{\Phi}{\omega} = \frac{\Phi}{4 \cdot \pi} \tag{5}$$

If the total luminous flux Φ_t of a light source would be equally distributed in the whole space ω = 4 π = 12.57 sr we would get the average spherical luminous intensity:

$$I_0 = \frac{\Phi_t}{4 \cdot \pi} \tag{6}$$

So the average spherical luminous intensity of a light source is defined as the luminous intensity of a source with uniform flux distribution, whose flux is equal to the flux of the source considered.

As a unit of measure for luminous intensity we use candela , which is the fundamental unit in lighting. Candela is the luminous intensity in the normal direction of a surface of 1/60 cm^2 of the full radiator (black body), at the platinum solidification temperature (T = 2046.5 ^{0}C).

2.3. Illumination E

Illumination measures the light flux density on a surface. Illuminating a surface in one of its points, is the ratio of the luminous flux dΦ received by the elementary surface dS around the point considered and the area of the surface element:

$$E = \frac{d\Phi}{dS} \quad \text{(lx)} \tag{7}$$

If the flow Φ is distributed evenly over the surface S, then:

$$E = \frac{\Phi}{S} \quad \text{(lx)} \tag{8}$$

As can be seen, even from the introduction of the concept of illumination , this is measured in flux unit per area. unit. The international system uses the *lux*.

The lux is the illumination of a surface that receives a one lumen flux evenly distributed on a square meter: 1 lx = 1 lm/1 m^2

2.4. Luminance L

Luminance (old name : brightness) is the photometric size directly perceived by the eye related to both the light sources and the illuminated surfaces, characterizing the degree of illumination. It also indicates the character of the spatial distribution of the luminous flux emitted by sources of light, in different directions. Light feeling depends on retinal illumination, so that of a number of factors such as:

- τ is the coefficient of transmission of transparent substances in the eye ;
- S_p is the area of the pupil opening.

They can be considered constant. The relationship that gives us the lumination is:

$$L = \frac{dI_{\alpha}}{dS \cdot \cos\alpha} \tag{9}$$

Its value does not depend on the distance l between the luminous surface and eyes, as long as the environment between these two elements does not absorb the luminous flux. light output. Definition of luminance results from the relation above.

Luminance L, at a point of a luminous area and on a given direction is defined as the ratio between the intensity of the light emitted in the direction given by the surface element containing the point and the projection of the surface element on a plane perpendicular to the given direction.

The unit of luminance is candela per unit area. The international system uses the *nit.*: 1 nt = 1 cd/1 m^2 .

The nit is the uniform luminance of a surface of 1 m^2 whose luminous intensity in the direction normal to the surface is of one candela .

3. CALCULATION OF MINIMUM LUMINOUS INTENISTY OF THE TRACERS FLAME

Perception by man of a bright spot at a big distance depends primarily on the general illumination of the place and on background luminance on which there is the bright spot .

Background luminance can vary within wide limits, depending on the time of the observation, on the ground but also on the weather. For the eye to perceive a bright spot, it is necessary that the illumination produced by the spot on the pupil surface exceeds the minimum visibility limit in conditions of a given luminance of the background.

Minimum illumination values at day or night are given in the following table :

Table 1. *Minimum required illumination for day and night time observation*

Colour of the fire	Illumination limit E_{lim} [lx]	
	night	day
Red	$0.8 \cdot 10^{-6}$	$0.5 \cdot 10^{-3}$
Green	$1.2 \cdot 10^{-6}$	$0.9 \cdot 10^{-3}$
Yellow	$2.0 \cdot 10^{-6}$	$1.0 \cdot 10^{-3}$
White	$3.0 \cdot 10^{-6}$	$1.5 \cdot 10^{-3}$

Absorption of light by the atmosphere requires the use of higher intenisty light sources as tracers.

The light intensity that should be released by a tracer can be calculated with the equation:

$$I = \frac{E_{\lim} \cdot r^2}{a^{\left(\frac{r}{1000}\right)}} \quad (10)$$

where a is the is the coefficient of permeability of the atmosphere, for a region with a thickness of 1000 m. Its values are given in Table 2.

Table 2. *The permeability coefficient of the atmosphere*

Characterization of time	Permeability coefficient
Clear time	0.9
Mean time	0.8
Mist	0.6
Fog	0.37
Strong fog	0.005

The value of minimum light intensity of tracers that can be perceived by the human eye, depending on the distance is calculated in the following table.

Table 3. *The calculated values of the minimum luminous intensity for red flame tracer*

DAYTIME		NIGHT TIME	
R = 600M	R = 900M	R = 600M	R = 900M
A=0,37 I =326	A=0,37 I =991	A=0,37 I =0,523	A=0,37 I =1,586
A=0,005 I =4324	A=0,005 I =47685	A=0,005 I =6,918	A=0,005 I =76,29

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QUALITY MANAGEMENT IN PROJECTS – ESTABLISH THE QUALITY OBJECTIVES OF THE PROJECT

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Abstract: *The project is defined as an ensemble coordinated by some activities accomplished in order to reach a well determined purpose, namely the project defines a process. Quality management in projects includes the processes necessary for providing the fact that the project satisfies the necessities it had been accomplished for. The settlement of the main (strategic) objective of the project and of the lower objectives together with the establishment of the methods by means of which these objectives are reached represent the quality planning in projects.*

Keywords: quality planning, quality management, quality objectives

I. INTRODUCTION

Association for Project Management from England gave the following definition for quality management in projects "*Quality management in projects is the discipline that is applied to ensure that the project outcomes and processes so that results are delivered to meet the needs of stakeholders"* [1].

Quality is thus defined as being the degree of compliance of the results and processes.

The term "project" can be simply defined as a task with a known end. So that a project can be considered as an assembly of coordinated activities and performed to achieve a target, i.e. the project represents a process [3]. The process has a fixed time, and therefore, the project will have a fixed and determined in time.

Regardless of the type of project that has a main objective, single, called general objective or goal of development. The overall objective is the reason for funding and developing a project.

Determining the overall objective is made by answering to the questions:

- Why I want to do this project?
- What will I receive at the end of the project and do not have at present?

The objective of the project on the final result will be identical to the objective quality of the project and will be named the strategic objective of quality. Identification and the fixed clear strategic objective of the project quality is a vital first step of transforming the vision (thinking project) in reality (end or goal of the project).

II. CONTENT

Quality management in projects applies from the initiation of the project, project processes, project results, project management, at the end of the project.

Within the projects the quality management must include all the following major processes, fig1,*Quality Planning, Quality Assurance, Quality Control, Quality Improvement*[12].

Fig.1. *Major processes of quality management in projects.*

A - Quality planning is a key function of quality management, which aims to establish policy, quality objectives and strategies to achieve them [4].

B - Quality Assurance project is a key issue for efficient project management, because the goals are the same as project management of quality management [11].

Through all the planned and systematic activities implemented by SMC will provide confidence that quality requirements will be met, namely that the project will satisfy quality standards or quality requirements. Quality assurance in project activities include acceptance and testing processes, check the requirements for quality activities of programming and communication, etc.

C - Quality Control project is to monitor the results of specific projects during the project, and thus eliminating the causes that lead to results / poor performance or unsatisfactory [13].

In the project the quality control is done in all project phases: initiation, planning, execution, etc. It is shown that the application of quality control is effected by the use of statistical quality control, which requires the implementation of the project team some people to have knowledge of the application of this method of quality control (samples, charts, trend analysis, etc...).

D - Improving the quality of projects is overlaid quality control process and will be a permanent objective of the PM's and the implementation team. The measurement and analysis of project allows the project manager to draw accurate conclusions about the errors, irregularities, mistakes or changes affecting the project objectives and determine actions required for proper project targets under the planned budget, the time or other resources established in the planning process [4]. Improved quality will be continuously in all phases of project management.

The objective of a project can be classified into one of three categories below:

a) performance;
b) cost;
c) time available.

The triad "performance / cost / time" is a series of interrelated factors and usually contradictory between them when desired achieving the objective, fig. 2.

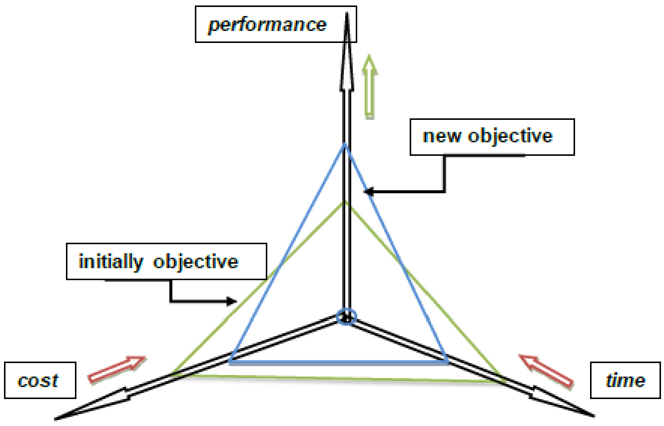

Fig.2. *The triad "performance / cost / time".*

In fig.. 2, the objective of the project is a fixed target on quality. Quality objectives should meet the following characteristics:

- Be expressed in quantitative (measurable);
- Be achieved in a certain period of time;
- Be realistic and mobilizing four staff organization;
- Be clearly formulated and uninterpretable;
- Be compatible with the other objectives of the project of the organization.

The strategic objective of the project of quality takes place (divides) on the lower quality objectives of the project, i.e. taking concrete and measurable results by the project implementation team, fig 3.

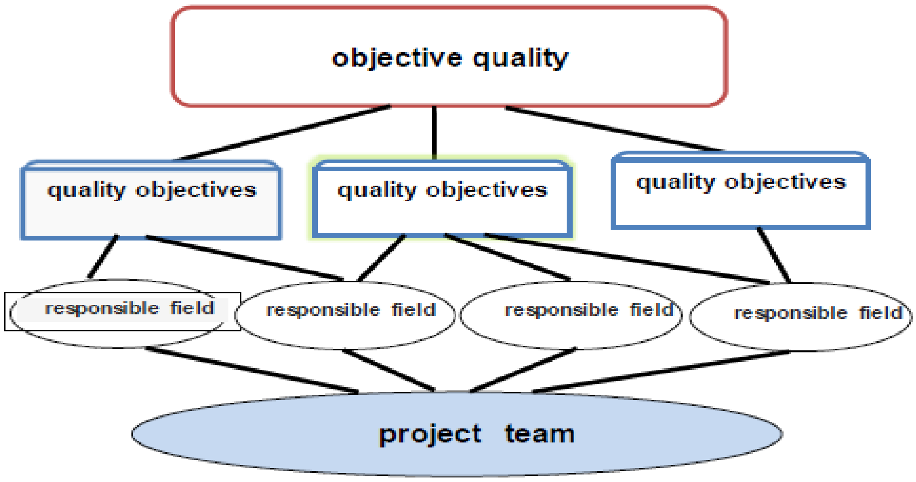

Fig. 3.*Division the strategic objective quality.*

The strategic objective of the project quality should reflect the target (goals) of the project, the purpose of the project, the project results. After fixing quality strategic objective of the project it pass to the first major process of quality management in projects and namely to the quality of the planning projects. Quality planning is done only after being set an objective; it cannot be planned something abstract.

Planning will be the development of products and processes required to achieve those objectives.

III. CONCLUSIONS

- The strategic objective of the project of quality represents a goal that we intend to achieve in terms of quality;
- The quality objectives are a moving target;
- The settlement of the quality strategic objective of the project is vitally important and it provides the transformation of the manager's vision into practice;
- The PM needs to establish the strategic quality objective causing the lower quality objectives assigned to the team members of the project.

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DETERMINATION METHODS OF THE INTERSECTION CURVE BETWEEN A CYLINDER AND A TRUNK OF PYRAMID

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Abstract: *This paper, based on the descriptive and analytical geometry, shows the trace elements of the unfoldings various intersections of geometric corps, the mathematical relations of calculation, necessary to determine some characteristic points.The paper presents some considerations on the theory of unfolding a pyramidal surface and a cylinder solved using the descriptive geometry and mathematical approach of the problem. As an application, a trunk of pyramid and a cylinder of a given diameter there is.*

Keywords: cylinder, pyramidal surface, intersection curve, unfolding, methods.

1. THEORETICAL CONSIDERATIONS

The ventilation pipes from the silo linking the technological transport equipment with the ventilators and the separation dust catchers. They are made, mostly, of sheets whose thickness is taken according to the diameter pipes. These pipes are made, usually, with a circular section (fig.1).

To achieve a network of aspiration is necessary, that the first, the main pipe, connected only in a certain way with the secondary pipes of ramification, because any change of direction of the air is causing losses of supplementary pressure. These losses are even greater with the change direction are more sudden. For these reasons, the connections make changes in direction as extended. With both the angle formed by the pipe axis with the axis of shunt bus is lower, with both losses pressure ramifications are lower.

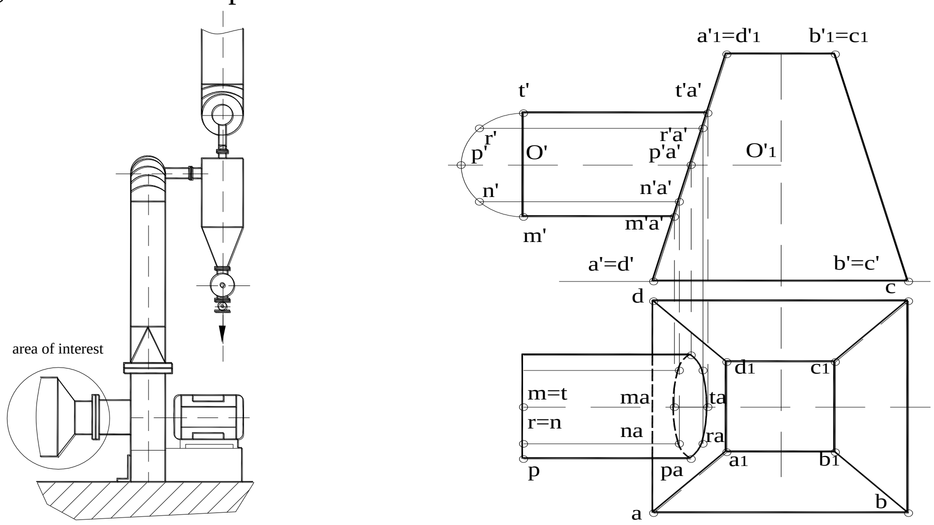

Fig. 6. *Corps intersections*

The variety and the big frequency of the calculation and construction problems of the corps unfoldings, used in various industrial installations, made bywrapping sheet, requires a graphical and analytical solving of the encountered cases[1].

The paper presents some considerations on the theory of unfolding the cylindrical and pyramidal surfaces solved using the descriptive geometry and mathematical approach of the problem.

The rapid introduction of modern methods to perform various problems in practice, give the possibility of using the computers to solve the unfolding problems.

It is considered that application encountered in practice, the intersection of one cylinder: 1 cylinder C, having the diameter $D = 30mm$ and the trunk of pyramid having the face inclined to 15^{0} (Figure 1).

2. DESCRIPTIVE GEOMETRY METHOD

The variety and the frequency of the calculation and construction problems of the unfoldings corps made by wrapping sheet, requires a swift and thorough resolution of the case. For the case shown in Figure 1, the problem is reduced to the intersection of a truncated pyramid as the $ABCDA_1B_1C_1D_1$ basis, with a OO_1 right circular cylinder, with perpendicular axes.

The points of intersection, between the cylinder with the axis perpendicular on the height of the pyramid, are obtained easily, considering its intersection with a plane (which is the pyramid face that intersect). After the intersection, the $m'a', n'a',...,t'a'$ points result in the vertical plane of projection.

2.1.Intersection unfolding

The cylinder unfolding is a rectangle, with one side equal to the $\pi\overline{MT}$ length of the base circle and the otherside equal to the $\overline{m'm'a'},...,\overline{t't'a'}$ generators lengths (Figure 2) It is obvious that the true size of the generators is measured in the vertical plane represented. If a more precise unfolded curve of the cylinder is necessary, its base can be divided into several n', r' equal parts. Thus the points of the unfolded curve of intersection will be: $M_oA_o, N_oA_o,...,M_oA_o$.

To obtain the unfolding of the truncated pyramid must know the true size of its edges. For this, a pyramid faces rabate on the horizontal plane of projection will be made (Figure 3).

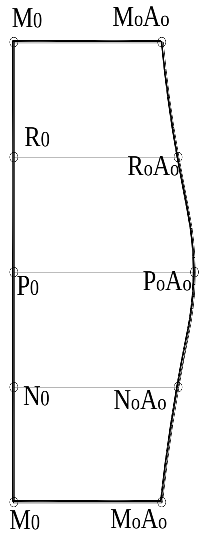

Fig.2. *Circular cylinder unfolding*

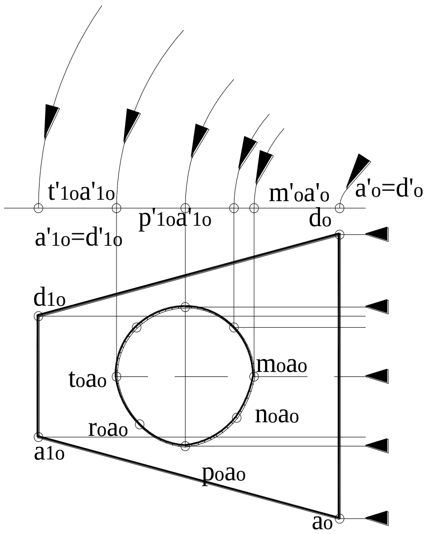

Fig.3 *Rebate on the horizontal plane*

Thus, it results in true size pyramid edges $a_o a_{1o}, d_o d_{1o}$ and the curve of intersection with the $t_o a_o, r_o a_o, \ldots, m_o a_o$ cylinder. Figure 4 show the unfolded truncated pyramid with the $A_o A_{1o} D_o D_{1o}$ face, where enter the cylinder and the $C_o C_{1o} D_o D_{1o}$ face, the others sides being identical.

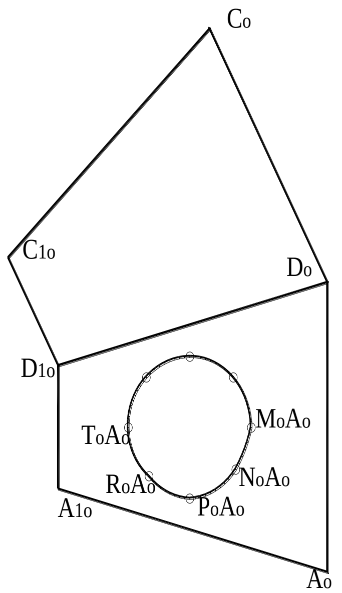

Fig.4. *Pyramid unfolding*

3. MATHEMATICAL METHOD

In the Figure 5 is presented the setting way of the cylinder and the pyramid [2-4]. For the cylinder the equation of the transformation curve, is obtain by applying the transformation (2), (3) to the equation (1).

$$y = (x - x_0)\, tg\varphi,\ x \in [-\pi R, \pi R] \tag{1}$$

$$x = R \sin\alpha \tag{2}$$

$$y = y_d,\ \alpha \in [0, 2\pi] \tag{3}$$

In this case:

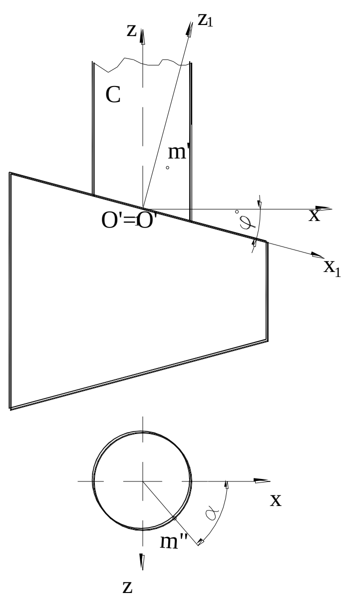

Fig. 5. *The geometrical elements of the cylinders*

$$x_d = R\alpha; \quad x = R\sin(\frac{x_d}{R}); \quad y = y_d$$

Those we obtain:

$$y_d = tg\,\varphi\ (R \sin\frac{x_d}{R}), x_d \in [0, 2\pi R] \tag{4}$$

For an angle $\varphi = 15^0$ and a cylinder radius $R = 15\text{mm}$, we obtain the Figure 6, by introducing the relation (4) into the mathematical program. The Figure 6 show the unfolding for the C cylinder.

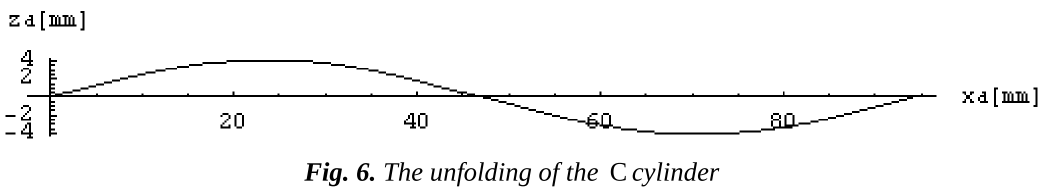

Fig. 6. *The unfolding of the* C *cylinder*

In accordance with the Figure 5 we take the cylinder C, of diameter D, and its reference system $Oxyz$ and the P pyramid, and its reference system $O_1x_1y_1z_1$, where $y \equiv y_1$ and $O \equiv O_1$.

The equations expressed in the chosen reference systems are:

$$x^2 + y^2 = R^2 \tag{5}$$

$$z_1 = 0 \tag{6}$$

The two reference system are rotated, one given another, by the angle φ. The transformation formulas of the coordinates, to passing from the system $Oxyz$ into $O_1x_1y_1z_1$ and vice versa are:

$$x_1 = x\cos\varphi - z\sin\varphi \tag{7}$$

$$z_1 = x\sin\varphi + z\cos\varphi \tag{8}$$

$$x = x_1\cos\varphi + z_1\sin\varphi \tag{9}$$

$$z = z_1\cos\varphi - x_1\sin\varphi \tag{10}$$

By eliminating the variable x, we obtain the equation of the vertical projection of the intersection:

$$(x_1\cos\varphi + z_1\sin\varphi)^2 + y_1^2 = R^2 \tag{11}$$

$$x_1^2\cos^2\varphi + y_1^2 = R^2 \;/:R^2 \tag{12}$$

In this case the following equation of the ellipse is:

$$\frac{x_1^2}{\dfrac{R^2}{\cos^2\varphi}} + \frac{y_1^2}{R^2} = 1 \tag{13}$$

We obtain the Figure 7, by introducing the relations (13) into Mathematica program. For comparison, because the circle and the ellipse are closer, we represented the circle, too.

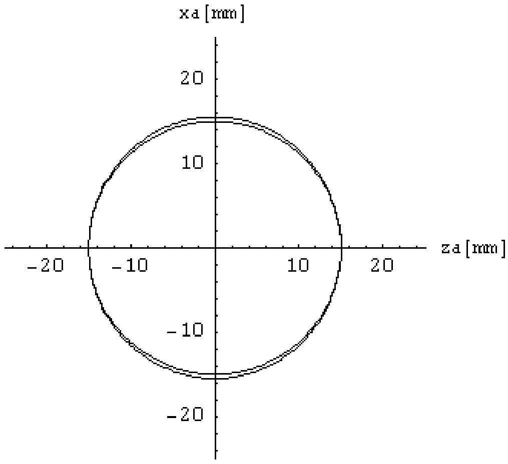

Fig. 7. *The unfolding of the intersection curve*

4.CONCLUSIONS

For the correct execution of some pieces or subassemblies with complex form, which meet the requirements, the methods of descriptive geometry are absolutely necessary. The presented method is very speedy and exactly and using the program we can obtain the corps unfoldings for any other dimensions. The two methods have the same results.

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GEAR WHEEL BY BRONZE MACHINED ELECTRICAL EROSION

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Abstract: *Them with beryllium bronze alloys are characterized by high corrosion resistance, good plasticity fresh quality, fatigue resistance, abrasion. Tin bronzes contain up to 29% Sn, being recognized for their skills and fatigue wear, anti-friction properties . Melt at high temperatures and tend to absorb gases insolidification interval showing a strong tendency to the formation of segregation. Mechanical and physical properties depend on the content of tin, so register a maximum resistance to 15% Sn, the hardness increases continuously andelongation decreases sharply to 5-6% Sn.*

Key words: copper, electrical erosion, CNC, properties.

1.INTRODUCTION.

Lead bronze bearings are used to manufacture that must withstand high speeds and pressures , is more suitable phosphor bronze lead. This is done by including a 3,5 % lead in phosphor bronze . Lead is use genuine and obtaining lead- tin bronzes . Tin bronzes with high , up 20% lead bearings are used for high performance .Traditional red bronzes contain about 88 % copper , 8-10 % 2-4 % tin and zinc. Red bronze with nickel containing up to 5% nickel . Originally used in the manufacture of pipes rifles, red bronze is used in machine building components , including bearings .Aluminum bronze is as soft and durable as steel has good resistance to corrosion , including dilute acid action . It is used in the manufacture of propellers , parts for hydraulic equipment of heavy and chemical technology equipment , such as tanks and pumps acid resistant .Aluminum bronzes have up to 9.8% Al. Were mechanical resistance, high resistance to corrosion, but antifriction qualities worse than usual.Ordinarybronzes(Cu - Sn)up to 14% Snaremonophasic.

2.PROCESSING ELECTRICAL EROSION AND BRONZE MATERIAL.

Fig.1.*Erosionmachine AW 310 T.*

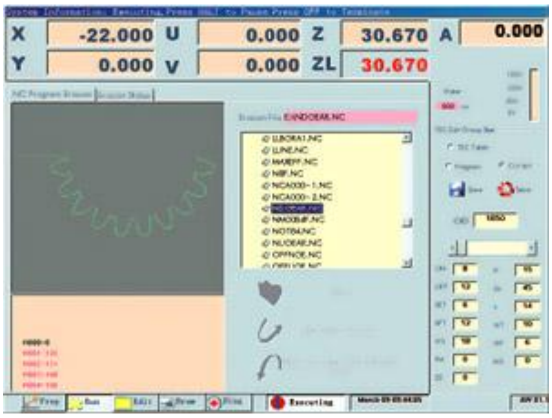

Fig.2. *The bronze gear wheel.*

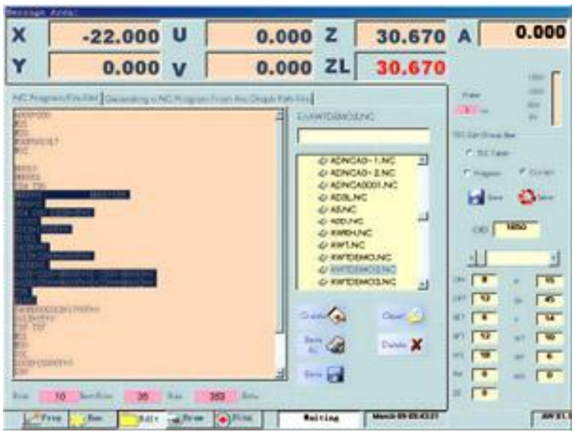

Fig.3. *The bronze gear wheel.*

Fig.4.The bronze gear wheel

Multitasking control software in real time enables preparation of the next program while processing machine CNCprogramming works. The flexible system operators can satisfy both beginners and advanced users. As the term artificial intelligence, the term fuzzy logic is hard to define. Application to the EDM is very exciting, and means that the control unit does not follow strict rules to reach decisions or conclusions but consider options depending on desired results. This approach is recommended in situations where a problem has more than one answer. Fairness is based on user priorities, which may vary from case to case.

Fuzzy logic is a promising development in the field of EDM as encouraging strategic planning while improving automatic operation. For example, processing conditions to achieve high accuracy and finish quality are similar to those required to obtain prompt processing. Choosing different results is a strategic decision that involves different processing parameters and settings, and choosing the correct parameters is a complex process. Electroerosion is by nature a process variable and the management of these variables is the key to effective treatment.At this point, the user can analyze options and may reconsider may choose an alternative from the list of recommendations. For example, if a finish and extremely high accuracy are indicated as priorities, processing time will be very long.

The user can decide if it is too long and can look again to see what alternatives you finish and precision are available at higher speeds. Final selection settings are determined automatically.

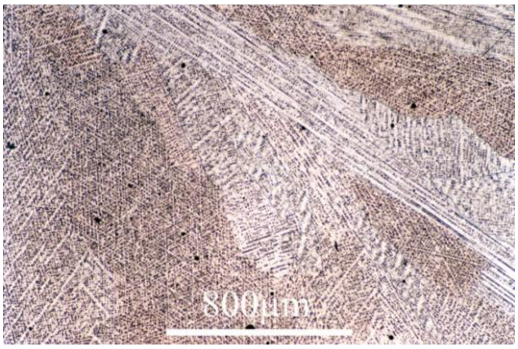

Fig.5.*The structure of thealloywithphosphorus*
Cu 95 Sn 5 P 0,15

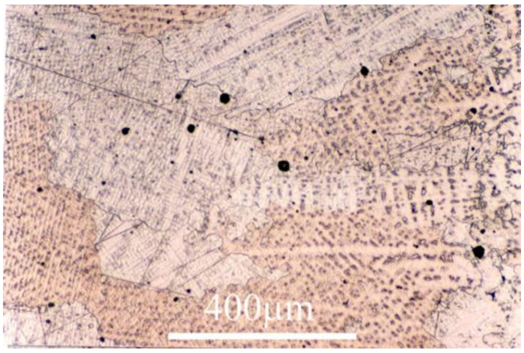

Fig.6.*The structure of thealloywithphosphorus*
Cu 95 Sn5 P 0,15

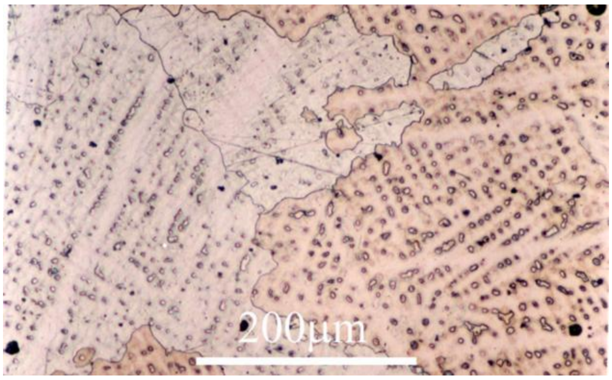

Fig.7.*The structure of thealloywithphosphorus Cu 95 Sn 5 P 0,15*

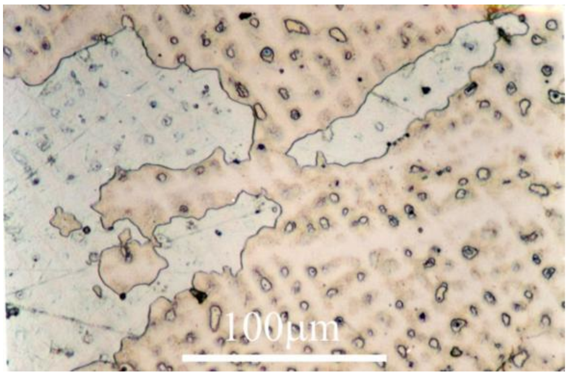

Fig.8.*Recrystallized alloy structure Cu 90Zn10*

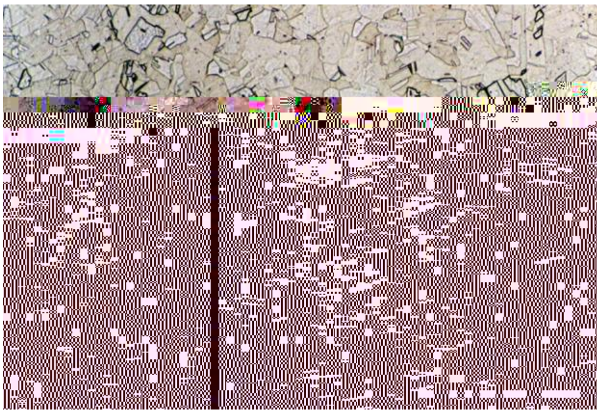

Fig.9.*Recrystallized alloy structure Cu 90 Zn10*

Fig.10.*Alloydendritestructure Cu 90, 10 Zn*

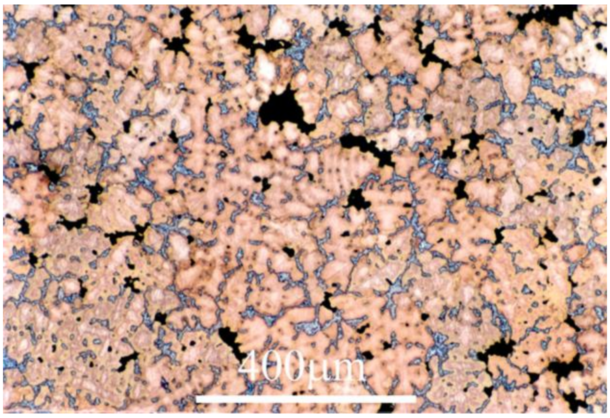

Fig.11.*Alloydendritestructure Cu 90 Zn10*

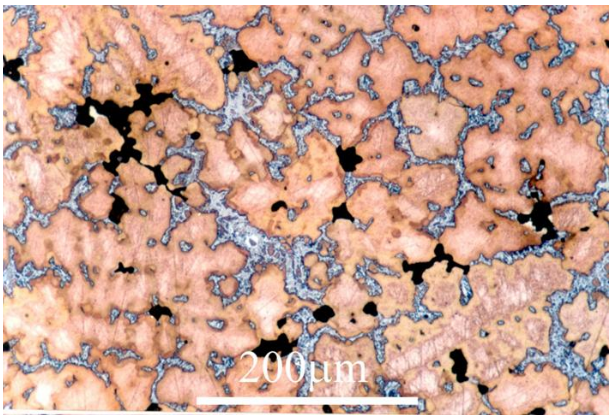

Fig.12.*Alloydendritestructure Cu 90Zn10.*

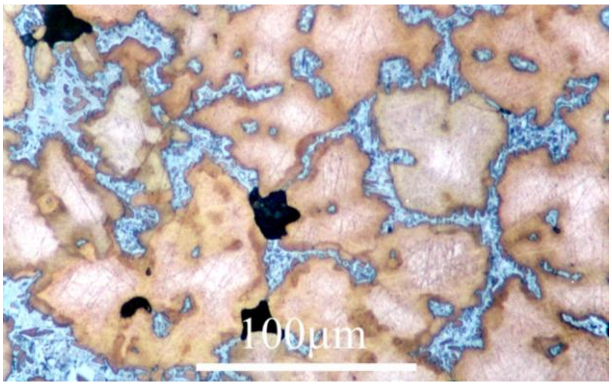

Fig.13.*Alloydendritestructure Cu 90 Zn10*

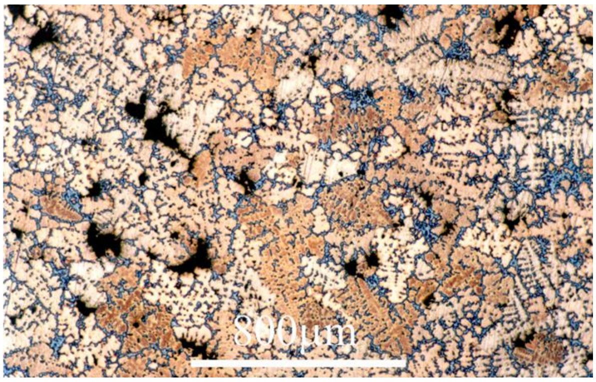

Fig.14.*Alloy structure Cu 88 Sn 8 Zn 4.*

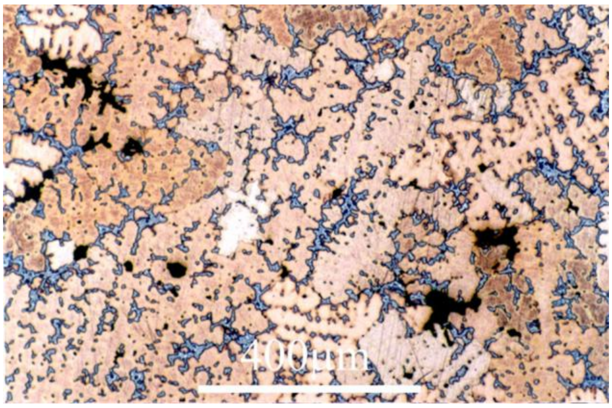

Fig.15.*Alloy structureC u88 Sn 8 Zn 4.*

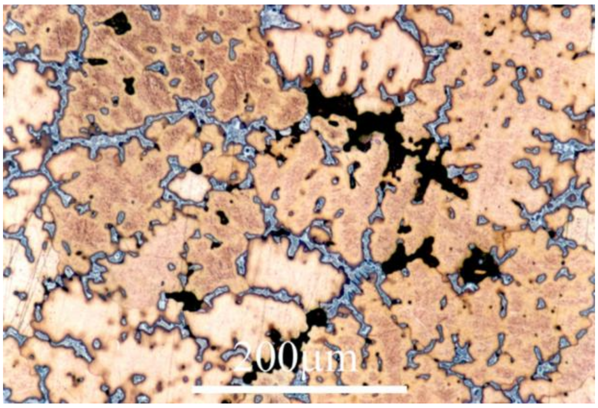

Fig.16.*Alloy structure Cu 88 Sn 8Zn 4.*

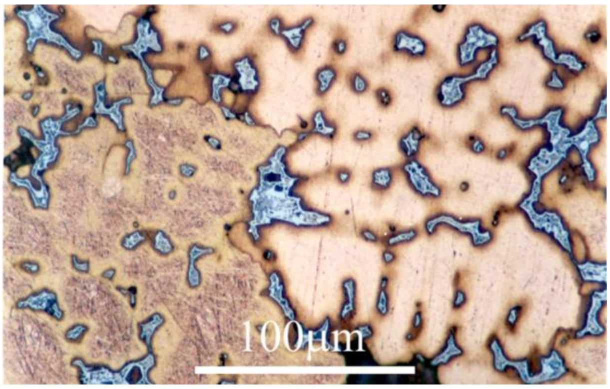

Fig.17.*Alloy structure Cu88Sn8 Zn 4*

3.CONCLUSION.

Easy to use digital controls for all three axes allows for holes of 0,3 mm in diameter with a ratio diameter / depth of 1:200. Modern EDM equipment performance are extremely high: high processing speed, efficiency automation, interconnection and memorizing very longprocessing cycles. If solid electrode erosion, the desired shape is formed in the workpiece with a three-dimensional electrode. The movements superimposed on the main axes X, Y, Z, C, different shapes, indentations and cavities are created in a way impossible with other processing systems

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INFLUENCE OF THE PRODUCTION ON THE PACE LINER TECHNOLOGY AND EQUIPMENT

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Abstract: *The pace of technological line is a parameter influenced by the nature of production and the level of technology of the company. Technical inspection of equipment - includes operations that are executed before a current or capital repair. By making a technical revision aims to determine the technical condition of equipment and establishing operations to be carried out in the current and capital repairs. During technical inspection may be made of the adjustment and consolidation of parts or subassemblies in order to ensure normal operation until the first repair. Repair of equipment can be of two types: current repair and overhaul.*

Keywords: process line, rate, production, devices and tools, operations, technical inspection

1. INTRODUCTION

The pace of technological line is defined as the time required achieving a product under continuous manufacture of that product on a production line where each operation is carried out with machine tools, devices and tools, such as technical standards for any operation to more than line rate. The pace of technological lines in mass production and mass determines the division of the technological process in elementary operations and the degree of mechanization and automation of the entire process equipment used.

$$R_L = \frac{F_n^{'}}{P_p^{'}} \tag{1}$$

$$F_n = 60 \cdot z \cdot s \cdot h,\ F_n^{'} = \eta \cdot F_n \tag{2}$$

$$\eta = 0.9 \div 0.95$$

$$P_p^{'} = (1 + k_1 + k_2) \cdot P_p \tag{3}$$

$$k_1 = 0.05 \div 0.1; \quad k_2 = 0.1 \div 0.3$$

$$P_1p^{\dagger\prime} = (1 + k_11 + k_12\ ) \cdot P_1p^{\prime} \tag{4}$$

k_1 = coefficient related to the number of scrap parts
k_2 = number of pieces made as spare parts

2. INTRODUCTION

Management and organization of production of the company was in direct dependence from type production. By type of production means an organizational and functional status of the company as determined by the nomenclature of manufactured products, production volume executed on each heading of the degree of specialization of the company, departments and jobs, how to travel to different raw materials , elements from one job to another.

In practice distinguish three types of production:
- The type of individual production;
- The type of production in series;
- Type of mass production.
a) Type of mass production
- Running a single type of product in large quantities and very high;
- Specialized jobs are serviced by a workforce specialized in the development of technological operations ;
- Job location will be in order of succession of technological operations in a straight line;
- The movement of goods from one place to another is made piece by piece;
- Internal transport are continuous flow (conveyor , inclined planes) , etc. .
b) Type of serial production
- Depending on the size and volume of production, there are large series production types, medium and low;
- Jobs are specialized (if large series production) or universal (the production of middle and low range);
- The movement of goods is done piece by piece or in small batches of products;
- Job location is based on the sequence of execution of operations or by homogeneous groups of machines;
- Internal transport stream can be continuous or the discontinuous flow (strollers, electro cars, forklifts, etc.).

Mass production criteria take the following form;
• large volume production;
• nomenclature is extremely low;
• qualification of workers is low;
• processing productivity is very high;
• processing cost is very low.
• there is a well established manufacturing cycle;
• automatic machine tools are arranged strictly in order of the sequence of operations required for the benchmark is running forming technological lines include: intermittent and continuous. The production line is characterized by the parameter called the rate of Line (R), defined as the ratio of actual annual fund for machine tools in the technological line (F_{ar}) and number of pieces landmarks (N).

$$R_L = \frac{F'_n}{P'_p} \quad \text{[min. / piece]} \qquad (5)$$

In a production line with actual processing intermittent times (t_{ei}) from each machine tools that make up that line are different in size and also their value differs from the rhythm track technology: $te_1 \neq te_2 \neq R_L$.

In a continuous production line with actual processing times (t_{ei}) of every equipment that make up some of that production lines are equal size and equal to the rate of Line: $te_1 = te_1 = R_L$.

During their use in production machines shall be subject to wear and tear. The repair work carried out in order to maintain in operation the machinery which removes defects found in operation and is achieved partial or total replacement of those components which have a shorter duration of operation compared to others. Maintainability is the ability of a machine / equipment to restore functional and technical characteristics of the service and maintenance and also maintainability is the property they own a car, machine or plant life as its easy to maintain with as little intervention and minimum spending.

3. CONCLUSIONS

Rate calculation process line is influenced by the production and equipment. If it is mass production and the equipment is well done and has good performances then the rate calculation process line is higher and the equipment will be charged accordingly. By developing the system of programming the repairs was intended to provide a set of measures of double maintenance and repair, namely. Prophylactic nature consists in the fact that this system provides for the adoption and maintenance of control measures by which to prevent the possibility of a premature wear leading to decommissioning of the machine before the deadline. Planned character in the fact that various maintenance and repairs are performed at certain calendar dates fixed in advance. This dual character system gives-planned preventive repairs evident superiority over the previous system, influencing directly the quality of repairs, reducing their execution time and cost. It is important to schedule the repair of equipment depending on the nature of production in order to ensure the pace of technological line.

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VERIFICATION OF THE STRAIN AND MOTIONS RECIPROCITY THEOREM FOR BARS

PhD. Assoc. MINODORA MARIA PASĂRE, University „Constantin Brâncuşi" of TG-JIU

ABSTRACT: *In the present study we propose to determine the displacements produced by a concentrated load P, in a beam embedded at one end and free at the other and into a beam simply supported comparing the experimental results with those that are obtained by integration of the differential equations. Also we verify the reciprocity theorem for that kind of bars.*

KEY WORDS: verification of the strain, motions reciprocity theorem, bars, force

1. THEORETICAL CONSIDERATIONS

The displacements of the common straight bars after bending stresses can be calculated taking into account the boundary conditions by integrating the differential equation fiber deformed environments:

$$EI_i = \frac{d^2 v}{dx^2} = -M \qquad (1)$$

For embedded beam may present two kinds of problems:

a) The force P is applied in section (1) located at a distance "a" from embedding and **f_{21}** displacement requires in a certain section which is between embedding and the point of load application (Fig. 1a).

b) The force P is applied in section (2) at a distance "b" from embedding and **f_{21}** displacement requires a certain section of the right of force (Fig. 1b).

In both case with the notations of the figure, the displacement is given by the expression:

$$f_{12} = f_{21} = \frac{Pb^2}{EI_i}\left(a - \frac{b}{3}\right) \qquad (2)$$

For simply supported beam, the displacement f_{21} produced in point 2 is the following:

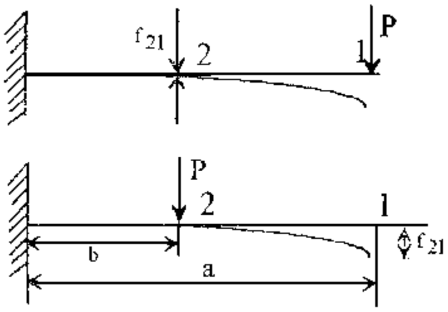

Fig. 1. Beam embedded at one end and free at the other

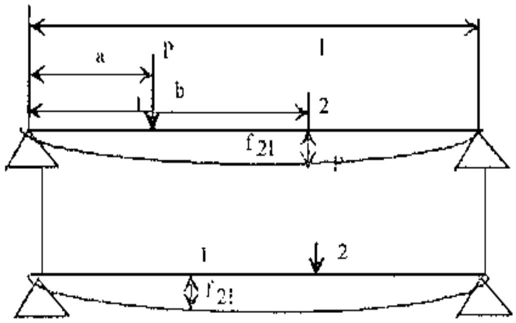

Fig. 2. Beam simply supported beam

The load applied in the point number 1 (fig 2a) or the displacement $\mathbf{f_{12}}$ caused by the load applied in in the point number 2 (Fig. 2b), is given by the relationship:

$$f_{12} = f_{21} = \frac{P}{6EI_i}\left(a^2b + b^3 - a^2l + 2bl^2 - 3b^2l\right) \qquad (3)$$

in which we admitted that a <b;

The displacement reciprocity theorem travel
The reciprocity theorem, in the simple way as it is applied in this paper, is expressed as follows:
"The $\mathbf{f_{12}}$ displacement produced in section 1 of a beam by a load P applied in section 2, is equal to the $\mathbf{f_{21}}$ **displacement** produced in section 2 of the same load applied in the section 1".
Relationships (1) and (2) show verification of this theorem in the two special cases shown in fig. 1 and fig. 2.

2. PRACTICAL CONSIDERATIONS

For the practical application of the two theorems are used the specials devices (fig. 3 and fig. 4).

The device for study the deformations of the embedded beam of fig. 3 is composed of: motherboard, supporting column B, support of comparator D, comparator C, the E specimen and the weight P, which produces the bending phenomenon. The specimen studied is of steel and has constant diameter on a circular section.

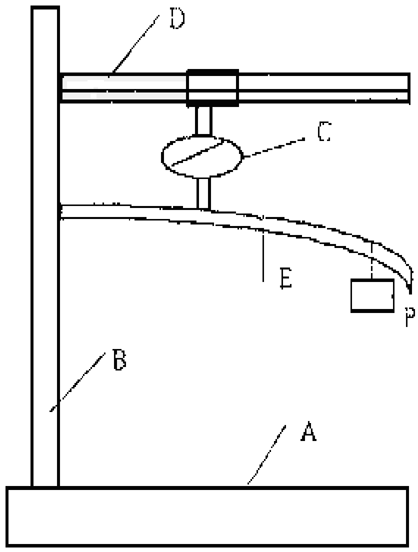

Fig. 3. Device for checking the beam embedded deformations

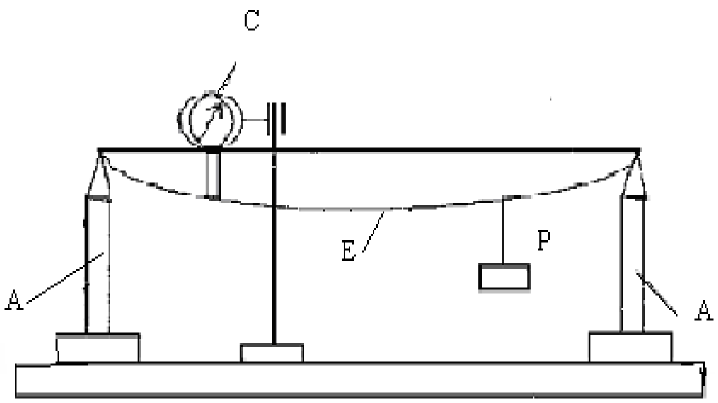

Fig. 4. Device for checking strains from simply supported beam

The device for study the deformations of the simply beam simply supported (Fig. 4) is formed from two simple supports A, the E specimen is leaning on it, the weight P and the comparator C, which measures the deformations.

The specimen studied is of steel of rectangular section. The material they are made of both specimens has the longitudinal steel modulus $E = 2.1 \times 10^6$ kgf/cm^2.

In order to check deformation should the following steps:

- Measure with a micrometer, cross- sectional dimensions of the specimen, the circular section takes into account the average of two perpendicular diameters.
- Fix the comparator in a certain section, which will cause the displacements. Raise your finger dial gauge probe and probe was allowed to walk on the specimen. Let those comparator indications in mm and hundredths of mm.
- The hanging weight of P in the section where we apply the load. Under its action, the specimen deforms and moves the dial gauge needle. Note the final indication.
The difference between initial and final indication gives the size of the arrows. The arrows will measure both the left and the right of the point of application of the load.
In order to prevent reading errors, the load is applied and removed for 2 or 3 times for determining the displacement in a point.
To verify the reciprocity theorem is necessary the steps:
- Select two points 1 and 2, at distances a and b (cm integer selected for ease of calculation).
- Place the weight P in section 1 and measure by comparison displacement f_{12} in section 2.
- Then move the weight P in section 2 and measure the displacement f_{21} in section 1. The two displacements have to be equal. Repeat the operation for 2-3 pairs of random points for the determination of the displacements.

3. CONCLUSIONS

Verification of the strain and motions reciprocity theorem for bars is utilized for obtaining the equation of the medium fiber deformed shape. Using the reciprocity theorem movements will draw deformed shape average fiber produced by a concentrated load applied at a point of the specimen.

We consider point i the point where the load applied. dividing the specimen length in n equal parts, numbered 1 ... n, these points occur the $\mathbf{f_{1i}\ f_{2i},\ f_{3i},...,f_{ni}}$ displacement due to the load applied in i point.

These displacements can be measured by moving the comparator in every one point 1 to n. To avoid this operation, which is heavy, it can do (on the movement's reciprocity theorem) as follows: place the comparator in section i and load P is applied successively in sections 1 ... n, measuring the displacements in section i.

Because $\mathbf{f_M = f_{1i},\ fj2 = f_2}$ we can draw the average fiber deformed shape due to a load applied in the i point.

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CORROSION BY FOULING THE HEAT EXCHANGERS INSTALLATIONS

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***Abstract**: The origin of the corrosion may be the process fluid itself, or a constituent of it, or corrosion may be the result of the presence of impurities, perhaps in trace quantities carried in the fluid stream. In one sense corrosion may be regarded as reaction fouling, with the chemical reactions involving the surface rather than the constituents of the process fluid.*

Key words: corrosion, transfer, electrochemical, oxidation

1.INTRODUCTION

Corrosion in process plant is an ever present problem and the engineers responsible for design, operation and maintenance need to be vigilant in the control of corrosion. Corrosion may be defined as the deterioration and loss of material due to some form of chemical attack. The origin of the corrosion may be the process fluid itself, or a constituent of it, or corrosion may be the result of the presence of impurities, perhaps in trace quantities carried in the fluid stream. In one sense corrosion may be regarded as reaction fouling, with the chemical reactions involving the surface rather than the constituents of the process fluid.

Corrosion is often accelerated by the presence of other deposits such as scale or biofilms. On the other hand corrosion protection is often afforded by the presence of metal oxides on surfaces. If the oxide layer is removed by chemical action or erosion then the underlying metal may be seriously affected. It is possible to limit corrosion or eliminate the problem altogether, by the correct choice of material of construction.

For products with a high added value however, the first cost (investment) may be entirely justified particularly where contamination from products of corrosion cannot be entertained. There is a wide variety of different materials of construction for the fabrication of corrosion resistant heat exchangers. Mild steel tubes are also used for low cost applications. In certain operating conditions a combination of environments involved on the inside and outside of the tubes may require the use of "duplex" or bimetal tubes.

2.LIQUID CORROSION THEORY

The well known brown rust (ferric hydroxide) is formed by the combination of metallic iron with oxygen and water. The overall relationship is:

$$4Fe + 3O_2 + 6H_2O \sim 4Fe(OH)_3 \qquad (1)$$

Equation 1 illustrates the most common corrosion mechanism involving an electrochemical process essentially metal oxidation, and necessitates the removal of electrons from a metal.

Equations 2 and 3 illustrate the release of electrons from iron metal to produce first ferrous ions followed by conversion to ferric ions by further oxidation.

$$Fe \sim Fe^{2+} + 2e \quad (2)$$

$$\text{Ferrous ion and } Fe^{2+} \sim Fe^{3+} + e \quad (3)$$

The removal of a metal atom from an anodic site on the metal surface gives an ion in solution and an excess of electrons on the metal surface. Utilisation of the electrons on a nearby cathodic site gives a balancing reaction which in solutions that have a near neutral pH, usually involves the reduction of dissovled oxygen to hydroxyl ions according to

$$O_2 + 2H_2O + 4e \sim 4OH^- \quad (4)$$

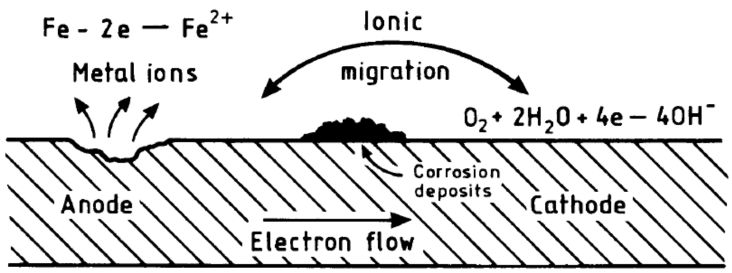

***Fig.1.**The electrochemical corrosion cell*

Corrosion of heat transfer surfaces subject to gaseous environments can occur at almost any temperature. It is useful however to divide the discussion into two parts, namely low and high temperature corrosion, since in general, the mechanisms involved are different.

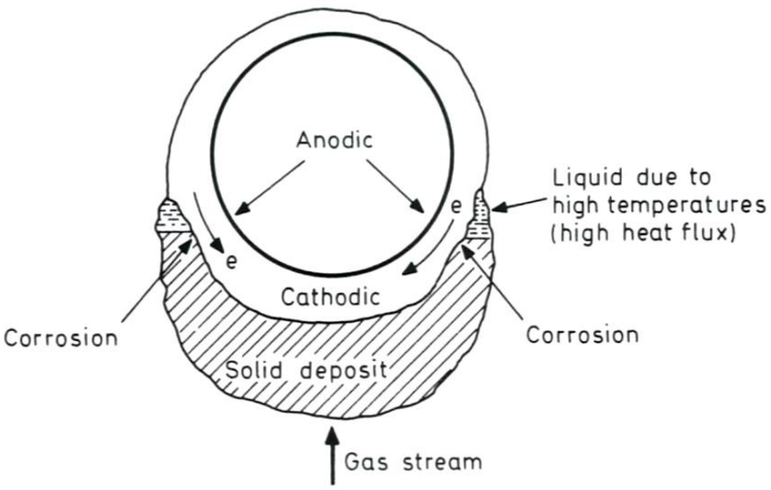

***Fig.2** Corrosion of a heat exchanger tube in association with the deposition of particulate matter*

As already described the presence of a metal oxide on a surface affords protection against further oxidation and metal wastage, but where corrosion occurs in gaseous atmospheres, the oxide layer may become involved in chemical reactions thereby removing the protection, and allow corrosion to proceed. The effects may be severe, even in the presence of an oxidising environment.

3. MATERIALS OF CONSTRUCTION TO RESIST CORROSION

The images in Figure 3 show the effects of pipe material deposits of the power plant heat changer Rovinari.

Fig.3 *Aspects of corrosion residue deposition*

Although glass and plastic materials have been used for the fabrication of heat exchangers there are limitations to their use. In the former the problem of fragility exists and in the latter there are temperature restrictions. At the present time the majority of heat exchangers are usually fabricated from metallic alloys where corrosion is anticipated.

In the following I will present the options open to the designers of chemical process plant, including heat exchangers. They give the following useful summary of advice on metallic alloys generally for use in liquid systems.

1. Standard austenitic stainless steels such as type 316 (18 Cr: 10 Ni: 3 Mo) have useful if limited resistance, to acids and reasonable resistance to pitting corrosion. Type 304 (18 Cr: 10 Ni) stainless steel has a good resistance to nitric acid. Austenitic stainless steels have relatively low strength, poor antierosion and abrasion properties and do not possess the ability to resist stress corrosion cracking.

2. Super austenitic stainless steels with relatively high nickel content (approx. 20 Cr: 29 - 34 Ni), sometimes referred to as "alloy 20" are more costly than standard austenitic steels but provide excellent resistance to acids and some acid chlorides.

3. Duplex stainless steels offer high strength, coupled with resistance to abrasion and erosion and to stress corrosion cracking. It is claimed that Ferralium alloy 255 (with 25% Cr), has excellent pitting and crevice corrosion with good resistance to acids.

4. Nickel based alloys, such as Hastelloy, have outstanding corrosion resistance in reducing acids, mixed acids and acids at high temperatures. The principal restriction in their use is the high cost.

5. Claddings the surfaces with corrosion-resistant materials, with the possibility of replacing elements add (fig.4).

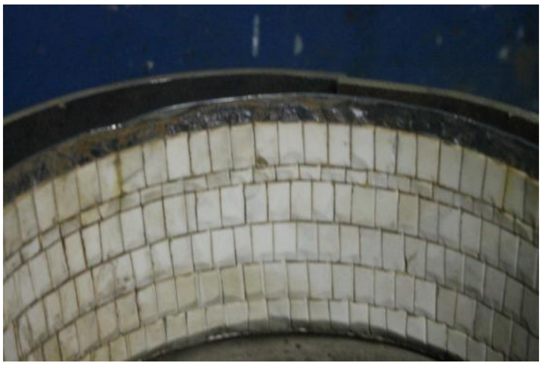

Fig.4 *Plated pipe*

4. CONCLUSION

The final choice adopted for the relief of a particular fouling problem depends on many actors but the prime considerations will be that of cost and safety. Cost, not only for the leaning operation itself and the associated equipment requirement, but also for off-line cleaning, the down time involved, will usually dictate the method adopted. Safety not only of personnel involved in the cleaning operations, but also of the plant itself and the environment must be given .serious consideration in relation to the techniques available. The cheapest may not be the safest.

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