METHOD FOR DETERMINATION OF THE DISTANCE BETWEEN ELECTRODES TO ELECTROHYDEAULIC UNDERWATER THROUGH SCINTILLAS DISCHARGE

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Abstract: *In this paper to present a method for fast-track determination of the distance between electrodes to the discharge of the energy from a condensator batherry for a realize electrohysraulic effect, in function of the principal work parameters of the installation, tension of loading U and capacity C, as well as maximal work tension of the batherry* $U_{\max}$.

Key words: *electrical, energy, vapacitor, tension, capacity, electrohydraulic, effect.*

1. INTRODUCTION

It is knuw the fact that the electrohydraylic effect to generate to the sudden perforation of the electrolyte between of the electrofs from the electrohydraulic chamber, under electrical high tension, with which is loaded yhe capacitor bathery, to the sudden discharge of the electrical loaded energy in the capacitor energy. To the sudden discharge energy, to generate a pression impuls which can be utilize in technological purposes.

2. CONDITIONS FOR THE REALIZATION ELECTROHYDRAULIC EFFECT

For the realization electrohydeaulic underwater through scintillas discharge is necessarytheelectrical perforation between electrodes. There are following situations respecting electrical perforation of the interval from the two electrodes and namely>

- If rhe intensity of the electrical field between electrods $E \geq 360 \, {}^{KV}\!/_{m}$ to realise sudden perforation, which is favourable for execution of the technological operations, because in this case to generate the pression impulse;
- If rhe intensity of the electrical field betwe enelectrods $30 \, {}^{KV}\!/_{m} \langle E \langle 360 \, {}^{KV}\!/_{m}$ to realise thermal perforation, with heating and place ionization of the liquide with to realise the pression impulse;Clearly, that this situation can not utilise in teghnological purpose;
- If rhe intensity of the electrical field between electrods $E \leq 30 \, {}^{KV}\!/_{m}$ the perforation of the liquide is not possible.

In other papers, to recommend that for the determination of the maximum distance between electrods which produce sudden discharge, to utilise the equation:

$$\delta_{\max E} = 0{,}06 \cdot \sqrt[3]{C} \cdot U^2 = K_1 \cdot U^2 [mm] \quad (1)$$

in which:

U - the tension of loading pf the capacitor batherry in KV’;

C - the electrical capacity of the batherry in μF . From the first condition on the electrical field from electrods, result equations (2)and (3):

$$\delta_{\max C} = \frac{U \cdot 1}{360}[m] = \frac{1000}{360} \cdot U[mm] =$$
$$= K_2 \cdot U = 2{,}777 \cdot U[mm]$$
(2)

$$\delta_{\min} = \frac{U \cdot 1}{30}[m] = \frac{1000}{30} \cdot U[mm] =$$
$$= K_3 \cdot U = 33{,}333 \cdot U[mm]$$
(3)

where:

δ_{naxC} - the maximum distance for to realise sudden discharge;

$\delta_{\min}$ - the minimum distance for which the perforation of the liquide is not possible.

The angles of inclination pf the rights, in comparations wirh abscissa asis, are:

- For $\delta_{\max C}$:

$$\alpha = arctgK_2 = arctg2{,}777 = 70{,}20^0$$
(4)

- For $\delta_{\min}$:

$$\beta = arctgK_3 = arctg33{,}333 = 88{,}25^0$$
(5)

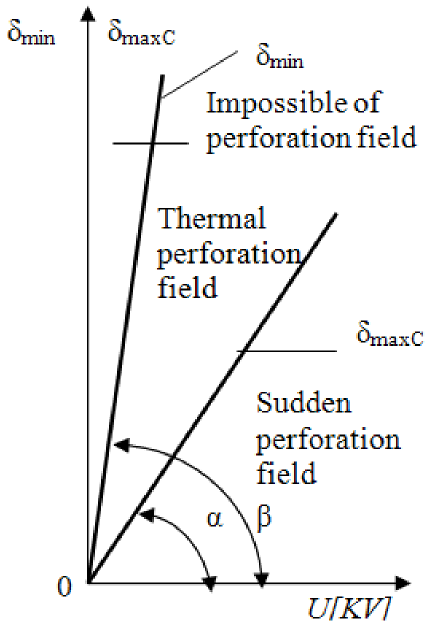

Figure1. The fields for different ways of perforation of the liquide function of the tension and the distance between electrods.

From the equality equation (1) and (2) result:

$$K_2 \cdot U = 0{,}06 \cdot \sqrt[3]{C} \cdot U^2 = K_1 \cdot U^2$$
(6)

$$U_e = \frac{K_2}{K_1}$$
(7)

where U_e is tension for which:

$$\delta_{\max C} = \delta_{\max E}$$
(8)

The value $K_2 = 2{,}777$ and the value K_1 for the capacity of the instalation from laboratoy $C = 70\mu F$ is:

$$K_1 = 0{,}06 \cdot \sqrt[3]{70} = 0{,}247$$
(9)

For this case result:

$$U_e = \frac{K_2}{K_1} = \frac{2{,}777}{0{,}247} = 11{,}2KV \qquad (10)$$

The maximum distance between electrods in this case is:

$$\delta_{\max e} = K_2 \cdot U = 2{,}777 \cdot 11{,}24 = 31{,}2mm$$
(11)

In figure 3 are represented the two curves:

$$\delta_{\max C} = K_2 \cdot U = 2{,}777 \cdot U[mm] \qquad (12)$$
$$\delta_{\max E} = K_1 \cdot U^2 = 0{,}247 \cdot U^2[mm]$$
(13)

To find that for $U \langle U_e$, the condition (15) is principalbecause if this is accomplidhed, result that and the the condition (14) is accomplidhed.

For $U \rangle U_e$ the condition (14) is principal, because if this is accomplidhed, result that and the the condition (15) is accomplidhed.

If the capacity of the bathery increase, then the value of the tension U_e desrease. For example, if $C = 350\mu F$, the value $K_1 = 0{,}06 \cdot \sqrt[3]{350} = 0{,}422$ and $U_{e1} = \frac{2{,}777}{0{,}422} = 6{,}6KV$.

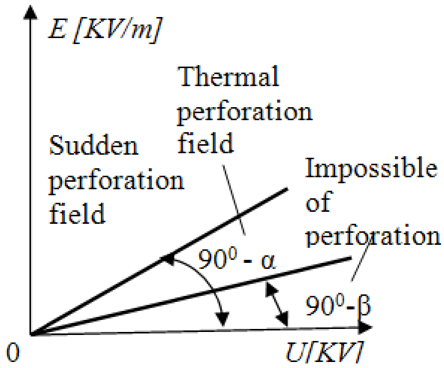

Figure 2. The fields for different ways of perforation of the liquide function of the tension and the intensity of the electrical field

So, with the increase of capacity, decrease the interval for which the condition (15) is principal. For the capacities very large, the maximum distance between electrods, is determined of the condition (14).

The optimal distance is:

$$\delta_o \approx \frac{\delta_{\max}}{2} \tag{14}$$

because the variation of the electrical current in the interval $[0, \delta_{\max}]$ is about that in figure 4.

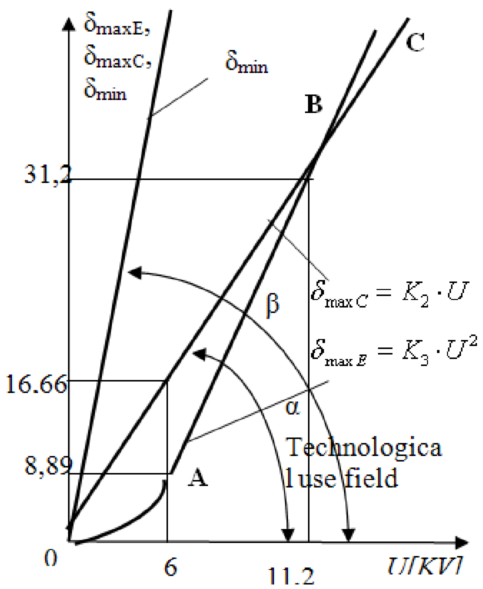

Figure 3. The variation maximum distance between electrods for the two case $\delta_{\max C}$ and $\delta_{\max E}$ function of loading tension of the batherry.

The value $\delta_{\max} = \delta_{\max E}$, if maximum work tension of the insyalation $U_{\max} \langle U_e$ and $\delta_{\max} = \delta_{\max C}$ if maximum work tension of the insyalation $U_{\max} \rangle U_e$

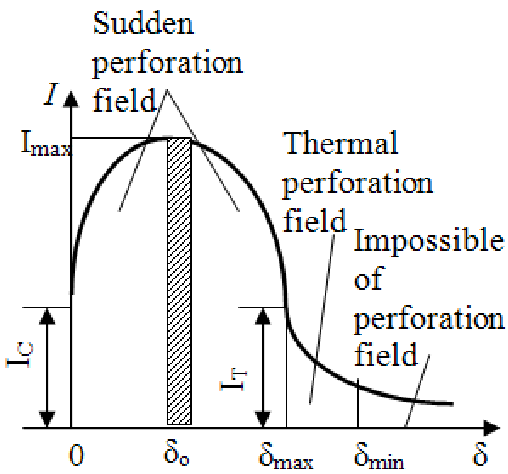

Figure 4. The variation pf the discharge current function of the distance between electrods.

I_C - the intensity of the current determined in very large part of electronic conducted current: ;

I_T - the intensity of the current determined in very large part of thermal ionization.:

For the capacity of the instalation from laboratory $C = 70\mu F$, the tension $U_e = 11{,}2KV$ and maximum work tension $U_{\max} = 6KV \langle U_e = 11{,}2KV$. So, in this case $\delta_{\max} = \delta_R = 8{,}892mm = 8{,}9mm$. The optimaum value result:

$$\delta_0 = \frac{\delta_{\max E}}{2} = \frac{8{,}892}{2} = 4.446mm \approx 4.45mm \tag{15}$$

vvalue with wich have work for texperimentation.

The experimental determinations confirm full previous assumpsions.

The technological work comain is under curve OABC from the figure 3.

For the tensions $U_{\max} \leq 6KV$, proper for the installation from plastic deformation laboratoryof the mechanical engineering faculty, maximum and the optimal values to present in the table

Tabel 1.

Tension U, KV	1	2	3	4	5	6
Maximum distance $\delta_{\max E}$, mm $\delta_{\max E} = K_2 \cdot U^2 = 0{,}247 \cdot U^2$	0,247	0,988	2,223	3,952	6,175	8,892
Optimal distance δ_0, mm $\delta_0 = \frac{\delta_{\max E}}{2}$	0,123 ≈ 0,1	0,494 ≈ 0,5	1,111 ≈ 1,1	1,976 ≈ 2,0	3,087 ≈ 3,1	4,446 ≈ 4,5

3. CONCLUSIONS

Virtually, for the determination of the maximum and optimum distance from electrodes, to underwater scintillas discharge, to propose following methpdology:

- Function of the capacity of the capacitor bathery, to determine the value K_2
- To determine the balue of the yension U_e for which the two distances is rqual:

$$U_e = \frac{K_2}{K_1}[KV] \quad (16)$$

- To compare the maximum work tension of the installation $U_{\max}$ with the value U_e
- If $U_{\max} \langle U_e$ the maximum distance between electrodes is δ_{naxE};
- If $U_{\max} \rangle U_e$ the maximum distance between electrodes is δ_{naxC};
- The optimal distance from electrodes id:

$$\delta_o = \frac{\delta_{\max}}{2} \quad (17)$$

The value $\delta_{\max}$ from the equation (19) is equal with δ_{naxE}, or with δ_{naxC},function of report $\frac{U_{\max}}{U_e}$. Clear, that for $U_{\max} = U_e$, is whatever which from the two equation to utilise, because to obtain same result.

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