THE ANALYSIS OF JOINT CONDITIONS OF POWER BLOCK OF A STATE DISTRICT POWER STATION

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ABSTRACT

It is displayed, that the specific number and average duration of joint estates of power-generating units of the state district power stations calculated analytically on indexes of reliability of power-generating units is essential exceed direct experimental data. Principal causes of a divergence are suppositions about equal reliability and undercount of run-down states of power-generating units. The pointed divergence leads to magnifying of an emergency standby of power.

As a joint condition of power block (PB) a state district power station during the any moment of time t we shall understand realization of set of possible combinations of their workers (PB it is included in a network) and non-working (PB is disconnected) conditions. If to designate number PB through n_b, that j-th realization of this set, be presented as sequence of conditions of station numbers PB placed in ascending order $S_{1,j}, S_{2,j}, ...S_{n_b}$. Joint conditions PB are defined by process of change of a condition of everyone PB and interrelation of conditions PB

Non-working conditions are subdivided into following types:

- emergency idle time. This condition takes place at emergency switching-off PB for the reasons, not dependent on reliability of its equipment and devices (for example, at power interruptions, absence of fuel, short circuits on the switching centre where it is connected PB, etc.);
- sudden emergency repair. PB it is under abnormal condition disconnected owing to refusal of its equipment or devices. Switching-off occurs automatically or under abnormal condition manually and defines an emergency reserve of capacity. Sudden emergency switching-off can occur both at sudden refusals, and at the refusals caused by deterioration;
- emergency repair at switching-off PB under the emergency application. Consequences of switching-off PB in this condition, as a rule, it is essential below, than at sudden switching-off;
- emergency repair owing to refusal at start-up PB. Refusals at start-up are caused by poor-quality repair or lacks of a retentively of the equipment at idle time PB;
- emergency repair at repeated refusals. Occurs owing to poor-quality repair or the insufficient control of a technical condition;
- cold reserve.
- scheduled average repair;
- scheduled major overhaul.

Let's note one prominent feature of process of change of conditions PB. With a view of decrease number of start-up on power stations translation PB from one non-working condition in another practices. For example, PB from a cold reserve it is translated in emergency repair at detection as a result of test of the equipment and devices PB of implicit defects. From scheduled repair PB can be deactivated, etc.

Now the state district power stations have the unique statistical data describing changes previous the present moment of conditions PB. On the basis of these data can be calculated as the average parameters of reliability (PR) PB a state district power station, and parameters of individual reliability. These data allow define and PR, describing joint conditions PB. However PR joint conditions, owing to labors input of the manual account and absence of the corresponding software,

are estimated by settlement methods for which are characteristic a number of assumptions quite often far from the validity [2]. These PR have as independent value, and form a basis of specification of analytical methods of calculation, methods of imitating modeling of process of change of conditions PB at forecasting reliability of a state district power station, the analysis of dynamics of change of a necessary reserve of capacity. Great volumes of the information, bulkiness and labors input of the manual account, possible mistakes demand development of specialized algorithms and programs of the analysis of statistical data and estimation PR of joint conditions PB, as component of the automated system of the analysis of reliability of a state district power station [2].

Algorithm of recognition type of joint condition PB and calculation of parameters of reliability.

The integrated block diagram of algorithm is resulted on fig.1, and on fig.2 time diagrams of some variants of joint conditions PB are shown.

Block 1. The set version of sequence of joint conditions (SJC) gets out of the menu. The menu provides an opportunity of recognition and calculation:

- numbers and duration of a finding in the disconnected condition of several PB. In particular, specific number, total duration and average duration of joint conditions, relative size the electric power, operating ratio of working capacity. As it has noted been [1], these parameters are calculated for any way set interval of time;
- number and duration of a finding in the same non-working condition of several PB;
- numbers of simultaneous switching-off of several PB;
- laws of change in time PR of joint conditions.

Block 2. The algorithm provides input of following data:

- interval of time during which there is an analysis of joint conditions PB (ΔT). For example, an interval of the autumn-winter period;
- number PB (n_b);
- certain in ascending order the moments of change of conditions of everyone PB sequence of conditions (SC) all PB a state district power station. The information file of each condition includes: date and time of the beginning and the end of conditions, number of the block, type of a condition, a kind of switching-off, the name of the given up installation and a number of other data. This information is concentrated in empirical tables of a database [1].

Block 3. The current number PB, forming a joint condition is defined.

Block 4. From SC gets out next i- th a condition, where i=1, m_c, m_c-number of conditions

Block 5. If this first condition from SC, management transferred the *block 6*, otherwise-to the *block 21*.

Block 6. The moment of the beginning of the first condition $T_{H1} \geq T_H$ is registered.

Block 7. Duration of a joint condition, as a difference between the moments of occurrence (T_{Hi}) and end (T_{Kj}) this condition is defined.

Block 8. In the empirical table data on joint condition PB are brought. These data include: date and time of the beginning and the termination of a joint condition, its duration, number PB, being a non-working condition, station and a serial number disconnected PB, with the instruction of type of a condition and a kind of switching-off of everyone PB.

Block 9. The moment of the beginning of the new joint condition T_{Hj} equal to the moment of end of the preceded joint condition $T_{K,(j-1)}$ is fixed.

Block 10. If joint non-working conditions during the moment T_{Hj} are absent, management is transferred the block 11. Otherwise – to the *block 12*.

Block 11. In this block end of consideration of all non-working conditions SC is supervised. If $i \leq m_S$, management is transferred the *block 3*. Otherwise – to the *block 23*, where the analysis of statistical data SJC PB is carried out.

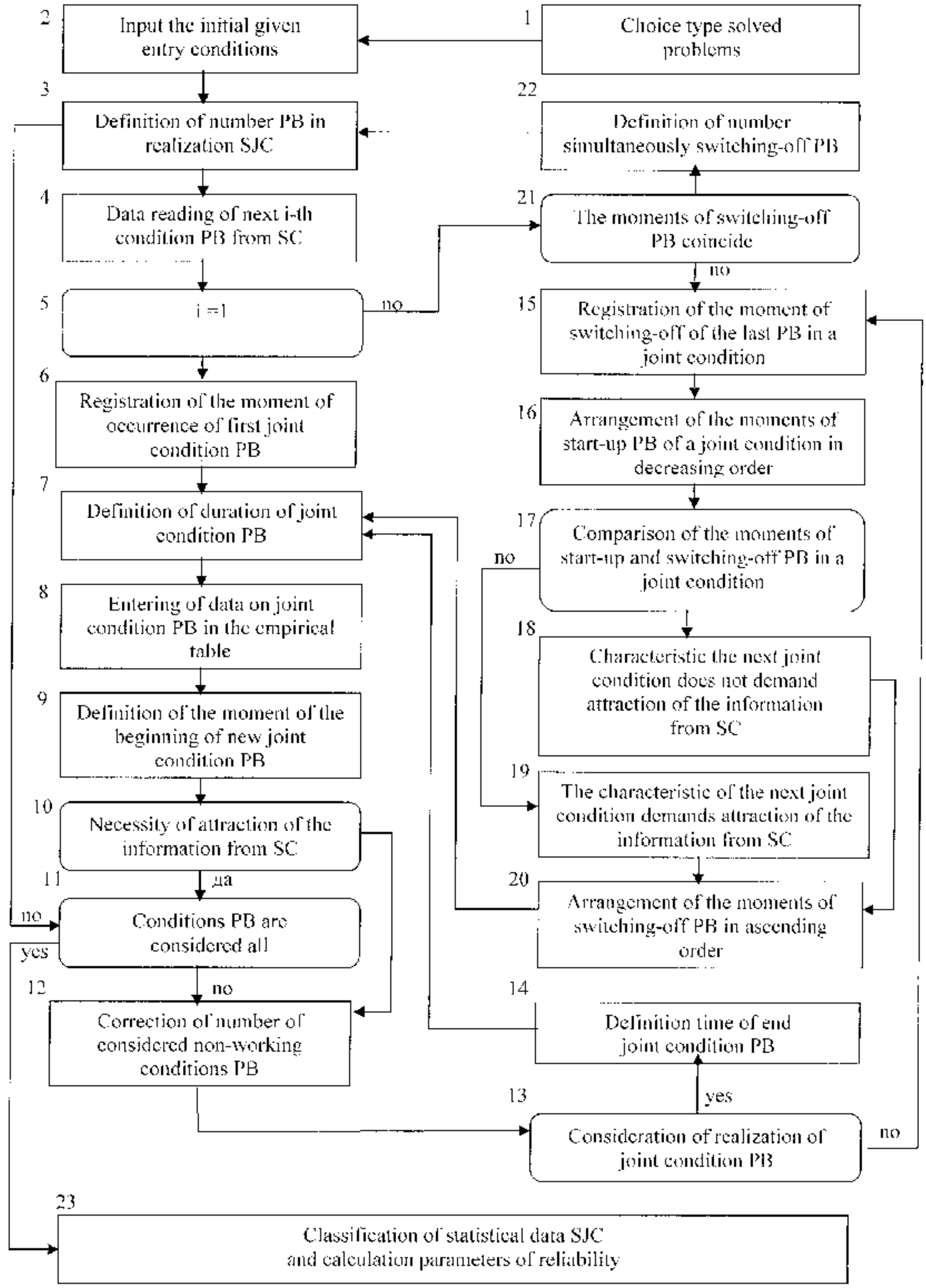


Fig. 1 Integrated block diagram of algorithm of recognition of type of joint condition PB

Block 12. Joint non-working conditions PB presented by set of consistently occurring various joint conditions PB. So, on the time diagram fig. 1в on an interval $(T_{K1} - T_{K5})$ three joint non-working conditions from which one includes three non-working conditions PB and two – two non-working conditions PB take place. And on the time diagram fig.2c took place two joint non-working conditions of two PB and one (on an interval $(T_{H4} - T_{K3})$) overlapping of three non-working conditions PB. In the *block 12* correction of number of the remained joint conditions made.

Block 13. If all joint conditions are considered, management is transferred *the block 14* for calculation of time of last joint condition with the subsequent transfer of management to the block 17. Otherwise - to the block 15. *Blocks 15-19* are intended for the characteristic of next joint condition ЭБ.

Block 15. The moment of last switching-off PB in a joint condition is defined.

Block 16. Accommodation of the moments of start-up PB of a joint condition in decreasing order is spent.

Block 17. Comparison of the moments of start-up $T_{K\xi}$ and switching-off PB in a joint condition is spent. If the moment of start-up does not exceed the moment of a stop corresponding PB management is transferred the *block 18* where duration of a condition is calculated, the moment of the termination of a condition is fixed and, the main thing, is registered absence of necessity of attraction of the new information from SC for the characteristic of the subsequent joint condition. Otherwise – to the *block 19*

Block 19. It is inherently similar to the *block 18* with that difference that in this block necessity of attraction of data from SC about next non-working condition PB is marked.

Block 20. Here it is restored initial SC the considered joint condition PB, changed in the *block 16.* Then management transferred the *block 17*.

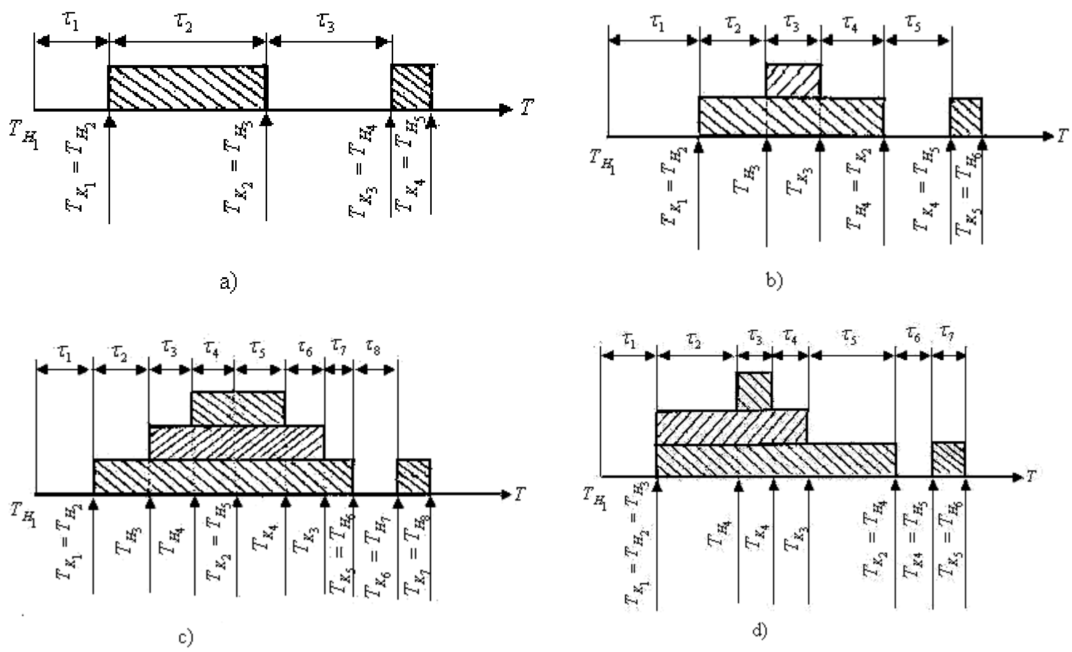


Fig.2. Time diagrams of joint conditions PB a state district power station.

Block 21. At power interruptions (increase of frequency) or at short circuits on the switching centre 110 kv. also simultaneous switching-off of some PB are above possible. The indicator of simultaneous switching-off of some PB is equality of the moments of switching-off PB. If for two adjacent conditions PB the moments of occurrence of non-working conditions coincide, the number simultaneously disconnected PB (reference value L=1) increases for unit (*the block 22*) and management is transferred to the *block 3* that allows to define the general number simultaneously disconnected PB. Otherwise, management transferred to the *block 15*.

Block 23. Classification of statistical data SJC spent according to the *block 1* where research problems formulated

To classification attributes concern:

1. Number PB (i), simultaneously being a non-working condition (i=0,n_b). The version of an attribute i=0 corresponds to a case when all PB are in working order.

2. Type of non-working condition PB by way of their stop. At coding versions of attributes the identifier excluding classification to this attribute is entered.

3. A kind of switching-off PB by way of their stop. We shall distinguish sudden switching-off (automatically or under abnormal condition manually), switching-off under the emergency application and scheduled switching-off. By analogy to versions of type of switching-off the identifier shunting this attribute is entered.

These attributes allow classifying SJC for an estimation of a real number of joint conditions under the list of solved problems. In particular, it is possible to estimate number of joint conditions i PB, deduced in emergency repair, or simultaneously disconnected at a power interruption, the number of emergency switching-off PB during a finding of one of PB in a reserve, etc. should be had in view of, that the number of joint non-working conditions PB of the set type insufficiently full characterizes reliability of work PB. If to address to fig.2b it is easy to notice, that on an interval $(T_{H2} - T_{K2})$ three joint conditions took place, in two of which one has been disconnected PB, and in the third – two PB. But from the point of view of switching-off PB one of n_b PB has originally been disconnected, and then, during emergency repair – one more was disconnected PB. I.e. differing joint conditions can arise both as a result of switching-off PB, and at start-up PB. From the point of view of duration of conditions and the general number of arising joint conditions spent by algorithm fig.1 classification is authentic. To define number of cases of occurrence of the joint conditions connected only with switching-off PB, it is necessary from the general number of joint conditions i PB to subtract the general number of cases of joint conditions (i+1) PB with $i \geq 2$ provided that the conditions caused by simultaneous switching-off of some PB are excluded from consideration, connected with failures in system. On the basis sample of the empirical table of a joint condition of j-th type assuming a finding in non-working condition $n_{b,j}$ PB, following PR are calculated:

- Estimation of specific number of joint conditions of j-th type under the formula

$$\lambda^*_{jc,j} = \frac{\sum_{\nu=1}^{C_{n_b}^{n_{b,j}}} n_{jc,j,\nu}}{\sum_{\nu=1}^{C_{n_b}^{n_{b,j}}} T_{w.\Sigma,\nu}} \qquad (1)$$

where $n_{jc,j,\nu}$ - number of joint conditions of j-th type and ν-th combination PB;

$T_{w.\Sigma,\nu}$ - total duration of working condition $n_{b,j}$ PB on the considered period of time (ΔT).

$$T_{w.\Sigma,\nu} = n_{b,\nu} \cdot T_{sr,\Sigma,\nu} - T_{cr,\Sigma,\nu} + \sum_{i=2}^{n_{b,j}} (i-1) \cdot T_{jc.\Sigma,\nu,i} \qquad (2)$$

$T_{sr.\Sigma,\nu}$ - total duration of scheduled repairs $n_{b,j}$ PB for ν-th combination; $T_{cr.\Sigma,\nu}$ - total duration of a condition of cold reserve $n_{b,j}$ PB for ν-th combination; $T_{jc.\Sigma,\nu,i}$ - total duration i joint conditions PB disconnected on scheduled repair or in a cold reserve for ν-th combination PB;.

- average duration of a joint condition of j-th type - under the formula

$$M^*(\tau_{jc,j}) = \frac{\sum_{\nu=1}^{C_{n_b}^{n_{b,j}}} \sum_{i=1}^{n_{jc,j}} \tau_{jc,j,i,\nu}}{\sum_{\nu=1}^{C_{n_b}^{n_{b,j}}} n_{jc,j,\nu}} \qquad (3)$$

where $\tau_{jc,j,i,\nu}$ - realization of duration of a joint condition of j-th type

- an estimation of probability of occurrence of a joint condition of j-th type – under the formula

$$K^*_{jc,j} = \frac{\sum_{\nu=1}^{C_{n_b}^{n_{b,j}}} \sum_{i=1}^{n_{ss,j}} \tau_{jc,j,i,\nu}}{\sum_{\nu=1}^{C_{n_b}^{n_{b,j}}} T_{w,\Sigma,\nu} + \sum_{\nu=1}^{C_{n_b}^{n_{b,j}}} \sum_{i=1}^{n_{jc,j,\nu}} \tau_{jc,j,i,\nu}} \qquad (4)$$

The size $K^*_{\Gamma,jc,j} = 1 - K^*_{jc,j}$, as a matter of fact, represents analogue of a known parameter in practice – factor of readiness, with that difference that event of refusal of one PB, and event of occurrence of a joint condition of j-th type (an estimation of probability of is considered not that on the set interval of time simultaneous emergency repair $n_{b,j}$ PB will not occur).

We shall consider sequence of work of algorithm for each of presented on fig.2 variants of joint conditions PB. With a view of decrease in the bulkiness, carried out calculations we shall present sequence of numbers of blocks of algorithm.

Example 1 (fig.2a). The simple case – switching-off of one PB during the moment T_{H2} with duration of idle time τ_2 is considered most.

$\tau_1 \rightarrow$ 1,2,3,4,5,6,7,8,9,10,11,3

$\tau_2 \rightarrow$ 3,4,5,21,15,16,17,18,20,7,8,9,10,12

$\tau_3 \rightarrow$ 12,13,14,7,8,9,10,3

Example 2 (fig.2b). In this example the case when during idle time of one PB another is disconnected PB is considered. And duration of its idle time does not exceed residual duration of idle time before disconnected PB

$\tau_1 \rightarrow$ (look τ_1. an example 1)

$\tau_2 \rightarrow$ 3,4,5,21,15,16,17,19,7,8,9,10,11

$\tau_3 \rightarrow$ 12,13,14,7,8,9,10,12

τ_4 and $\tau_5 \rightarrow$ (look τ_3 an example 1)

Example 3 (fig.2c). In this example number PB, being simultaneously in a non-working condition to equally three. Besides first of disconnected PB (for example, in a reserve) during the moment T_{H5} has been translated in other type of a condition (for example, at its start-up there was a refusal of one of elements and PB has been deduced in emergency repair). The algorithm of calculation τ_1 also τ_2 is similar to calculation of intervals τ_1 and τ_2 an example 1, the algorithm of calculation $\tau_4 \div \tau_5$ is similar to calculation τ_3 of an example 2, and the algorithm of calculation $\tau_6 \div \tau_8$ is similar to calculation τ_3, an example 1.

Example 4 (fig. 2d). In this example during the moment T_{H2} there is a simultaneous switching-off of two PB and further in an interval of their idle time there is a switching-off of the third PB. The sequence of calculation of duration of joint conditions PB τ_2 looks like:

$\tau_2 \rightarrow$ 3,4,5,21,22,3

Calculation of duration of conditions $\tau_3 \div \tau_6$ is similar to calculation, accordingly, conditions τ_4, $\tau_6 \div \tau_8$ fig.2c.

Thus, despite of essential distinction of variants of the joint conditions represented on fig. 2, sequence of calculation of duration of set of joint conditions it is same and, in essence, are reduced to calculation of duration of joint conditions, when:

- all PB are in work;
- the number simultaneously being in due course increases in disconnected condition PB;
- the same, but decreases;
- simultaneous switching-off of some PB takes place.

SOME RESULTS OF CALCULATIONS.

The purpose of these calculations are, first of all, quantitative characteristics of joint conditions and revealing of features which should be considered at imitating modeling process of change SJC with the purpose of forecasting of reliability of a state district power station. In table 1 the average parameters of joint non-working conditions PB for a number of years of supervision, and in table 2 similar parameters for one year of operation are resulted. Data of these tables confirm intuitively clear values of number of joint conditions PB. Even for one year of operation their number is estimated in hundreds.

Is of interest laws of change specific number of joint non-working conditions and average duration of these conditions depending on number simultaneously disconnected PB. It would seem, the number simultaneously being disconnected condition PB is more, the specific number of such joint conditions will be less. The same assumption can be made and concerning average duration of joint conditions. However, results of the analysis (see tab.1 and tab.2) testify to an inaccuracy of these assumptions. As the number of joint conditions is great enough, these features are observed both in tab.1, and in tab.2 they obviously cannot be explained only casual character of estimations of these parameters. As to relative duration of joint conditions here our representations about its monotonous decrease with growth of number of simultaneously disconnected conditions PB prove to be true.

Table 1

Characteristic of number and duration of a finding in disconnected condition of several power block

Number of simultan. switch-off PB	Total duration of condition, h	Number of condition	Average of conditions (con.year)	Average duration of a condition,h	Relative duration of a condition,h	Relative size not developed the electric power, %
0	5918,8	147	21	40,3	9,64	0
1	18765,6	336	48	55,9	30,58	3,82
2	13603,6	381	54	35,7	22,17	5,54
3	13094,3	330	47	39,7	21,34	8
4	8205,5	182	26	45,1	13,37	6,69
5	1395,5	49	7	28,5	2,27	1,42
6	213,8	10	1	21,4	0,35	0,26
7	14,5	1	0	14,5	0,02	0,02
8	0,4	1	0	0,4	0,001	0,001
Operating ratio of working capacity of station – 74,2%						

Table 2

Characteristic of number and duration of a finding in disconnected condition of several power block

Number of simultan. switch-off PB	Total duration of condition, h	Number of condition	Average of conditions (con.year)	Average duration of a condition,h	Relative duration of a condition,h	Relative size not developed the electric power, %
0	451,3	15	15	30,1	5,15	0
1	3040,7	29	29	104,9	34,71	4,34
2	1730,2	54	51	33,9	19,72	4,94
3	2811,2	64	64	43,9	32,09	12,03
4	1032,1	29	29	35,6	11,78	5,89
5	8,9	3	3	3	0,0	0,06
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
Operating ratio of working capacity of station – 72,7%						

Is of interest also laws of change of relative size not developed the electric power during the periods of switching-off of several PB. Here there are the laws which are distinct from laws of change of specific number and average duration of joint conditions PB. If we shall subtract from unit total value of relative size not developed the electric power on all joint conditions we shall receive a component of operating ratio of the established generating capacity ($К_R$) on a state district power station caused by switching-off PB. Results of calculations show, that this size according to tab.1 makes 74,2%, and according to tab.2 – 72,7%. If to calculate $К_R$ as the attitude of the electric power developed for the considered period to product of duration of the settlement period and total capacity PB we shall receive accordingly $К_R$=75,1% and $К_R$=74,7%. Hence, $К_R$ approximately on 95% depends on joint non-working conditions PB. Thus, increase $_{КИ}$ can be reached, first of all, by decrease in specific number and average duration unforeseen by a production schedule of non-working conditions PB.

Feature tab.1 and tab.2 is independence of a joint condition of type of switching-off PB

Considering casual character of occurrence of refusals, joint emergency repair of some PB can arise in current of all period of supervision. However the probability of a joint finding in emergency repair PB depends as on number disconnected PB in a cold reserve and on scheduled repair, and from results of restoration of deterioration.

One of versions of joint conditions is simultaneous switching-off PB at the power interruptions connected with infringement of parallel work of adjacent power supply systems and automatic switching-off of significant loading, and at short circuits on trunks 110 kv. and above switching centers of a state district power station. The number of such switching-off changes from $(1 \div n_b)$, however the probability of occurrence of the set number simultaneously disconnected PB, as one would expect, is various.

Let us consider known methodology of analytical calculation of number and duration of a finding in a condition of emergency repair of several PB and it is comparable these estimations to real data. According to one year of operation 39 emergency switching-off of eight PB with the average duration of restoration equal 67h were observed. In seven cases overlapping emergency repairs of two PB took place. Hence, on the average occurred 39/8=4,9 emergency switching-off of everyone PB in a year (the first assumption: parameters of reliability of all PB the same). Total duration of idle time of one PB is equal emergency repair 4,9·67=326,6h. On this interval remained seven PB could give up 326,3·7·4,9/8760=1,28 sw./year (the second assumption: all PB, except for given up, are in work). For eight PB the general number совмещений conditions of repairs of two PB will be equal 1,28·8=10,2 sw./year. The valid size is equal 7sw./year. Average duration of a condition of simultaneous finding PB on statistical data is equal emergency repair 22h., and the settlement size makes 67/2=33,5h. If to consider the second assumption noted divergence of estimations decreases.

Let's lead similar calculations for a joint condition in which two PB are deduced in a reserve. For the same year of operation it was observed 51 switching-off PB in a reserve with average duration of a condition 176h. On the average, each of blocks was disconnected in a reserve 51/8=6,4h. Total duration of idle time PB is equal a cold reserve of one 6,4·176=1126,4h. On this interval remained seven PB could be disconnected (1126,4·7·6,4)/8760=5,8h. For eight PB the general number of the combined conditions of a reserve of two PB is equal 5,8·8≈46h. The real number of joint conditions of a cold reserve of two PB for the considered period equally 37. Average duration of a simultaneous finding of two PB in a condition of a cold reserve equally 66h., and settlement value is equal 176/2=88h. Here, as well as in preceded calculation it is supposed, that during switching-off PB in a cold reserve all PB are in work. Besides non-uniformity of switching-off PB in a cold reserve within a year is not considered. In particular, the analysis of time diagrams of switching-off PB in a reserve has shown a state district power station that the specific number of switching-off of two PB in a reserve during march-september increases, and cases of switching-off in a reserve of three PB occurs only during the period specified above. This process has mainly determined character with that difference, that in a cold reserve the least reliable are disconnected and the least economic PB. For this reason switching-off concrete PB in a cold reserve is event casual, depending from technical condition PB. The condition of a cold reserve is often used for carrying out of operating repair, elimination of defects which liquidation demands small time, carrying out of preventive tests of the equipment and devices.

Let's consider one more characteristic example of calculation. We shall assume, that one of PB is deduced in a cold reserve and during a finding of it PB in a cold reserve there is a switching-off of one of remained PB in emergency repair. It is necessary to estimate parameters of reliability of this condition and it is comparable them to statistical data. This example is interesting to that allows to check up the assumption of casual character of refusals PB. We shall take advantage of data of previous calculations. Total duration of idle time of one PB is equal a cold reserve 1126,4h. On the average, 4,9 emergency switching-off of everyone PB were observed. Hence, number of emergency switching-off PB during a finding of one of PB in a cold reserve equally 1126,4*4,9*7*8/8760=35,3 sw./year. According to operation it was observed 23 sw./year. Average duration of this condition pays off as an average geometrical длительностей conditions of emergency repair and a condition of a cold reserve, i.e. 176*67/(176+67)=48,5h. Statistical data testify that average duration of a considered condition is equal 30h.

Comparison of settlement and experimental estimations of parameters of joint conditions of eight power block 300 Mwt is resulted by capacity in tab.3, These data as a whole testify that the error of calculation makes tens percent, and settlement estimations of parameters of reliability are exceeded by operational data. operational settlement

Table 3.

Comparison of settlement and experimental estimations of parameters of joint conditions of power block

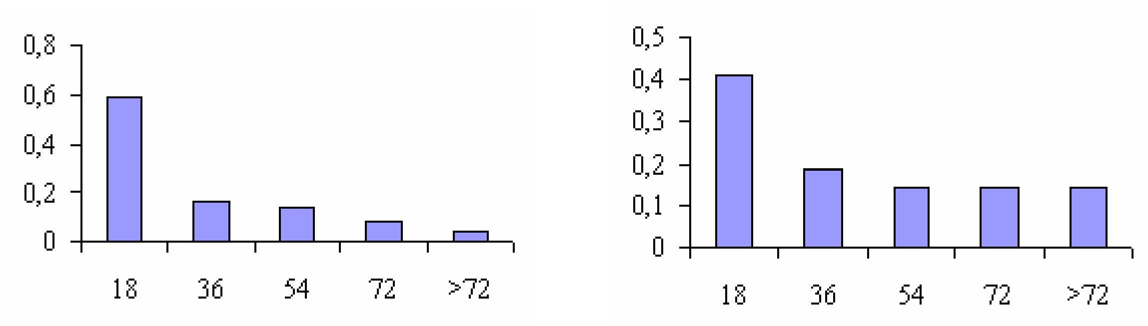
Condition PB	Parameter of a condition			
	Specific number		Duration of a condition	
	operation	settlement	operation	settlement
Emergency repair of one PB	4,9	-	67,0	-
Cold reserve of one PB	6,4	-	176,0	-
Overlapping of emergency repair of two PB	7,0	10,2	22,0	33,5
Overlapping of a cold reserve of two PB	37,0	46,0	66,0	88,0
Overlapping of cold reserve PB with emergency repair of another PB	23,0	35,3	30,0	48,5

The observable divergence of results of calculation is caused both functional and statistical by components. The importance of a functional component is characterized by a degree of distinction of real process of display of a joint condition of the set type and used model, distinction of parameters of individual reliability PB. Really, the distinction of the same parameters of reliability PB is more, the less estimation of the parameters describing joint condition PB. The statistical component is most full shown by consideration of improbable events. For example, calculation average duration of a joint condition of emergency repair three and greater number PB. Influence of a statistical component can be lowered according to SJC for some years of supervision.

However the increase in the period of supervision is not always expedient, since thus the new assumption of constant reliability of everyone PB in this period is entered. In conditions when service life exceeds settlement, this assumption, as a rule, is unacceptable. Change of parameters of reliability before capital and average scheduled repairs is not considered also.

Fluctuations of distinction of compared estimations PR can be lowered if even to consider distinction PR PB and finding PB in a non-working condition when the analyzed joint condition appears impossible. At the same time, the account of these and of some other features leads to bulkiness, labors input an analytical method, including «green light» for development and uses of imitating model.

Alongside with dot estimations of parameters of number and duration of joint non-working conditions and, in particular, conditions of emergency repair are of interest their functions of distribution of duration and law of change of number of joint conditions in time. On fig.3a,b histograms of change of duration of a joint finding of two PB in emergency repair and in a cold reserve are shown. Asymmetry of distribution of duration of emergency repair of two PB (fig.3a) speaks aspiration of operation personnel as much as possible to accelerate restoration and more quickly to put into operation one of PB. During the years period at presence of a cold reserve instead of damaged PB, as a rule, it is entered into work PB, being in a cold reserve. And after restoration of damage under abnormal condition disconnected PB, as a rule, it is translated in a condition of a cold reserve. Distribution of duration of a joint finding of two PB in a condition of a cold reserve also is asymmetric (see fig.3b). However, asymmetry of distribution in this case speaks dependence of duration of a joint condition on a season. The greatest values of duration it is observed the years period, and the least - in the spring and autumn periods. The analysis of data SJC testifies that the probability of occurrence of simultaneous emergency repair of two PB does not depend on a season, however changes essentially on years. It appears appreciable at end капительных repairs PB and especially appreciable after modernization PB.



a) b)

Fig. 3 Histograms of change of duration of a joint finding of two PB in emergency repair (a) and in a cold reserve (b).

CONCLUSION

1. The algorithm and the program of the analysis of joint conditions PB according to about conditions of everyone PB are developed. The program is a component of the automated system of the analysis of technical condition PB a state district power station [2].
2. Comparison of operational data and results of analytical calculation testifies to their essential divergence. A principal cause to that is not the account distinction of parameters of reliability PB, opportunities of finding PB in scheduled repair and a cold reserve, interrelation of conditions PB on years, etc. Such divergence is natural non-uniformity of occurrence of joint conditions, as the account of these features much more increases bulkiness of analytical formulas, labors input of calculation, probability of occurrence of mistakes.
3. Direct comparison of experimental and settlement data, fluctuation of their parity in various intervals of time demands, applications of the special approach considering casual character of estimations of parameters of reliability
4. Overcoming of methodical and information difficulties can be reached on the basis of the imitating model reflecting features of change of conditions PB [3].

Discussion of the imitating model developed by authors is beyond present clause. It is possible to note only, that the developed algorithm has allowed estimating parameters of reliability and their accuracy for various number PB disconnected in emergency repair and by that to solve a problem of an objective estimation of distribution of emergency decrease in capacity of a state district power station.

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