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DISTRIBUTED NET TECHNOLOGY IN ACS OF WATER-INTAKE KNOTS OF OGUZ-GABALA WATER-PIPE

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With the growth of the number of Baku population, the problem of drink water deficiency interfering ecologically balanced social-economic development of the city is being intensified. Its fundamental solution is connected with the use of the resources of the underground waters of Alazan-Agrichay intermountain valley situated to the south-north slopes of the Big Caucasus (Oguz and Gabala – regions of the republic). The exception of Oguz-Gabala water-pipe project with technical point of view is in that, that firstly in the republic the water intake in such scaled volumes (to 15 m^3/sec.) will be produced from sub deep-well holes. Correspondently the technological process is brought to the water intake out of hundred territorially dispersed holes, which later on through a common collector is passed by pumps to the head reservoirs, and from where it already enters three main water pipe lines with the carrying capacity of 5 m^3/sec.each.

Since the cardinal question of Oguz-Gabala water pipe consists of the uninterrupted water-supply of the city with drink water, then the main controlling functions with water-intake knot brings on a round-the-clock basis keeping the balance between total water inflow out of the holes and its cumulative discharge into main water lines keeping the set levels in the disperse reservoirs. But for the concerted interaction of hundreds of pumps, realizing the intake and transport in the pipe-lines for half a million cube meter of water a day, it is necessary to provide the current control and regulation the parameters of water intake regime, to organize the operative control and controlling the condition of the apparatus and to make a system of water intake costing at the mouth of holes and its discharge in the main water-lines. The search of the solution of this problem on which, finally, depends the efficient and reliable functioning of Oguz-Gabala water-pipes, is directly connected with the study of opportunities of automatization of controlling process.

Water-intake knot, as the object of automatization possesses the following properties:

First of all-this is comparatively not a big difference of technological targets (water intake holes, pump stations and disperse reservoirs), equipped with technological equipment of the same type, chiefly, with well and transfer pumps, and also with pipe-lines with stop valves. Hence, on automatization of controlling, the conception oriented to the maximum use of the standard solutions with the use of universal hardware-software means created on the bases of designo-companionable set of unified models with standard software, easily configurated for each concrete type of equipment must be dominated.

Secondly, the controlling of the water-intake process brings to the keeping of the demanded pressure value, levels and water-discharge in the given points of the technological schemes by regulating pump efficiency, and also the change of working conditions of pumps and date valves. That's why, in contrast to most industrial targets, the output of the control action in the given situation is not connected with the realization of complicated and resourse-capacious calculated algorithms. It means, probably, the tasks concerning the class of logical control and management.

Thirdly, the controlling technological targets are dispersed on a large territory. And this is, most likely, the only property of the water intake knot, complicating the automatization. The fact is that the necessity of the operative control and regulation of the parameters of continuous technological regime, and also the controlling the equipment condition demands the use not only corresponding transducers and performing mechanisms, but also the organization of the communication canals for information exchange among them and remote master station. The

realization of the last demand-is the most expensive task. And also, taking into consideration, comparatively not high traffic, efficiency of canal using wishes a lot.

Thus, one of the most important tasks in creating automated system of controlling the water intake Oguz-Gabala water pipe is the choice of decision, favouring the cost decrease of information transforming. At present, all of them, in any case, are connected with the use of the distributed net technologies, the essence of which brings to the aim of shortening the time for the processing of technological information to the place of the generation and usage. As far as all the technological equipment (at the same time, the intake accessories of the pipe-line), equipped with transducers and operating mechanisms is located in the pavilions of the water intake holes, in the machine halls of the pump stations and on the grounds of the disperse reservoirs, and it is here that the local means, oriented, at least, for the assembly and preliminary processing of initial technological information and the working off of the controlling influence must be stationed. And there appears the opportunity to reduce the number of the canals of communication with the master station and to increase their loading.

At the same time such an approach stipulates the initial subdivision of the hardware and software means of automated control system of water-lines by the increasing force of calculating resources and the complexity of performing functions [1. p.9]. Taking into consideration the formulated previous properties of the water intake as an object of automatization, two apparatus levels, corresponding, in common case, to doublelevelled hierarchy of controlling answer this subdivision.

The lower level of automated control system of the water line forms the totality of the hardware-software means, located near the technological apparatus, that's the local controllers, flexibly completed (with account of the characteristics of a concrete object) modules of various functioning purposes, the main component of the element base of which is freely unified programming device Micro-PC format. The functioning opportunities of each module are oriented to the solution of independent task, exactly-organizations the canals of data exchange with standard interfaces and protocols, different signals input from the targets and control command output, transformation of standard net interfaces, etc. The controller, completed functionally with full set of such modules, performs not only traditional tasks of signal fixation, measurement, scaling, analogue-digital transformation and so on., but also unloads the upper level from routine operations of cyclic survey of transducers, filtration, preliminary processing and signal analysis for exceeding the set meanings and etc.

The advantages of the module arrangement of local controller are:

- openness of architecture and interfaces, that simplifies the initial programming of the controller and modified software link procedure;
- an opportunity to modify in wide scales of functionality and characteristics of completed controllers, stipulated practically by unlimited nomenclature of the components from various firms-producers;
- considerable calculating power and available cost of unified components, favouring the essential decrease of total expenses on the hardware system realization;
- simplicity of the service of technical means assembled of unified components, and decrease of the necessary composition and the volume of stock products;
- wide range of working temperature of modules-components letting the dislocation of local controllers in close proximity from technological equipment.

  As regards the data transformation, and then on organizing of the information exchange it should be used the radio canals, allowing to avoid the layings of expensive copper or fibro-optics cable lines and providing, at the same time, in the decimetric range quite stable link in the distance of 15-20 km. It should be taken into consideration that constructing the water intake knots, the pump stations are to be located nearer the holes and disperse reservoirs if possible in order to decrease the power consumption for technologically groundless water translation. Hence, one can recommend two-staged scheme of communication of remote master station (MS) with water intake holes and disperse reservoirs. It stipulates the organization of the radio communication canal of

the pump station with the master station for the information exchange both as directly among them and as for the retransmission of the traffic of the rest targets.

The rationality of such a scheme is stipulated with the concentration of not high traffic of the last and with the use for transmitting to the upper level of automatic control system of water intake of the common radio canal. However, the offered variant though is effective in comparison with the creation of direct canals, but it is realizable only when the information is retransmitted from the targets, and the dislocation radius of which from the pump station doesn't exceed some hundred meters. This limit, as a rule, is done for the water-intake holes, but not always for the disperse reservoirs. In the last case for the information exchange with the master station it will be available to use the direct radio canal. And now we can pass on the determination of the functional composition of hardware of automated control system of the water intake at each technological target, answering the set principles of the organization of processing and information transmission. Here, one can take into consideration that the technological regime of any of them, finally, is regulated with one of the same parameters – with the given water consumption at the outlet of the target. Exactly, this condition allows to take away at every target of the water intake the technological equipment and the parameters of the technological regime, the condition of which directly influences on the change of water consumption, that's , are subjected to the control, measurement and management within the limits of automated control system of the water intake. The condition of the technological equipment and the parameters of the regime of the main targets of the water intake knot are connected with the following signals.

1) Water intake holes:
- measurement of water consumption and pressure at the outlet of the pump, water level in the hole and the current of the pump motor;
- control and management of the working condition of the pump (switched on/switched off and to switch on/to switch off) and the gate valves (opened/closed and to open/to close).

2) Pump stations:
- regulations of regime adjusting of pump motors;
- measurement of the stator current of pump power and water consumption at the outlet of the machine hall of the pump station;
- control and management of the working condition of the pump power (switched on/switched off) and the gate valves at the inlet and at the outlet of the pumps (closed/opened and to open/to close);
- temperature control of the excitation winding of motor power, and also the bearings of motor power and pumps.

3) Disperse reservoirs:
- measurement of the water level in the reservoir and consumption at the outlet of the reservoir ground;
- control and management of the working condition of the gate-valves of the reservoir ground (opened/closed and to open/to close).

Returning to the functional composition of the hardware of the water intake targets, one can ascertain that each of them should be equipped by the local controller, performing enlarged functions of communication system with the target. Such a controller is completed by the module input/output, providing, preliminary processing transducer signals and the working off of the controlling influences by performing mechanisms. Besides, the controllers of the water intake holes and the disperse reservoir are additionally equipped with the communication modules for the organization of UKB canal with the radio equipment (for ex.UKB radio station) situated in the machine hall of the pump station and performing the role of the retransmitted of the traffics among these targets and remote master station (MS). If the distance between the pump station and disperse reservoir exceeds the opportunity of the communication module, then the radiocanal of direct information exchange with master

station due to UKB radio station, located in the operator ground of the disperse reservoir is organized. As to the local controller of the pump station, they might be put on some additional functions of automatic regulation of general efficiency of the pumps due to coordinated changes of the work regime of each of the motor power. Not going into details, one can only stress that the formation of the local contours connected with logical controlling will allow to produce managing influences for each pump aggregate, using as variables productivity values of all the rest. The suggested approach provides coordinated controlling by the pump aggregates directly in the lower level of automated control system of the water intake while the upper level takes only the function of production and the tasks of common (for the station as a whole) productivity in the form of corresponding regularities.

As the software of the lower level of controlling, any operating systems of the real time, beginning with having already recommended itself from positive side of various versions of OC QNX or OC Windows/NT and ending with modern, performed on the basis of versions OC Linux can be used. The generalized functions of controlling by water intake Oguz-Gabala water intake are realized on the upper level of automated control system of water intake, that's by the remote master station (MS), and don't differ from the traditional ones [1, p.10]. And the same concerns the hardware complex of the master station, (MS) which must switch on the automated working places of a dispatcher, an industrial engineer, a power engineer, equipped with industrial PC-computers, radio communication equipment working in the net medium Ethernet. Any product, realizing the functions of NMI-interface, can be served as software of the upper level of controlling. However, the use of the standard SCADA-pack, universal tooling of which accelerates the creation the software not giving up for the speed of response, resource capacitance and other indexes of efficiency to the analogues products of individual processing, and at the same time, don't demand the knowledge of procedure languages of general purposes, still makes recommend the use of the unified pack of any specialized firm-exploitator.

The suggested functional composition and set of hardware software of automated control system of water intake, on the one hand, offer the operating and dispatcher personnel the opportunity of wide control of the technological process of the water intake, and on the other hand-don't overload the system with the excess study, increasing the expenses for the realization and operating consumption. The potential efficiency of automation, assisting the pay back of the expenses for the creation of automated control system of water intake is combined due to reliability growth of the intake work, decrease of power expenses, increase of the service life of technical equipment and account of the water risen up to the surface. [2].

Literature

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