

CONTROL SYSTEM OF HIGH PRESSURE PARAOSCILLATORS

“RVSA”, Ltd factory develops a universal control system Boiler units of drum-type type. The system is built with use of the equipment and Devices of manufacture of firms "Siemens", "AAB", "JUMO", "Moeller", resources which allow to solve almost all problems connected with automation, protection and the signalling system of a process of a steam production.

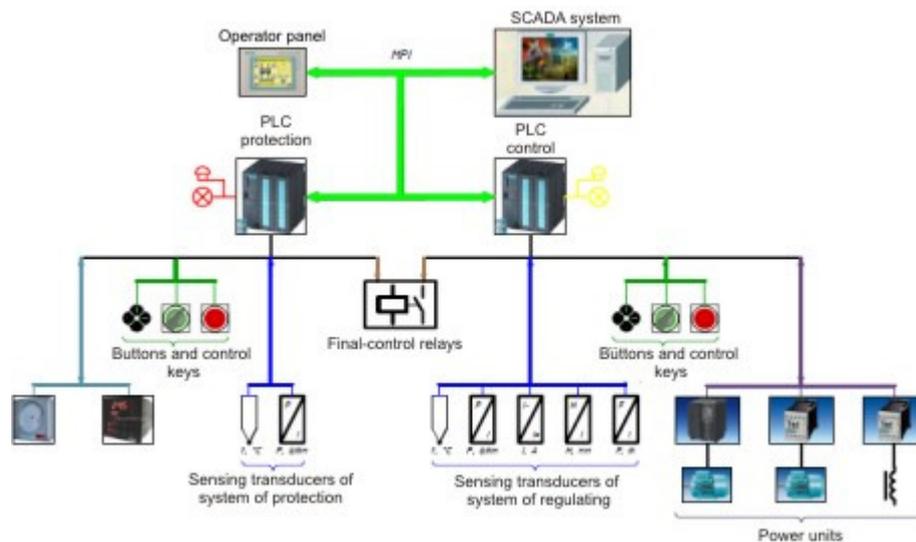
The control system *is divided on two subsystems*:

- Actually the boiler unit with a dust feeding system.
- Coal pulverisation with a feeding system of crude coal.

The automatic control system carries out following functions:

- Visualisation of processes of the boiler unit by means of SCADA systems with Software Simatic WinCC.
- Automatics of protection.
- Regulatings of key parametres of a steam production and a coal dust.
- Emergency and the warning.

The general block diagramme of system of automation is resulted on picture 1:



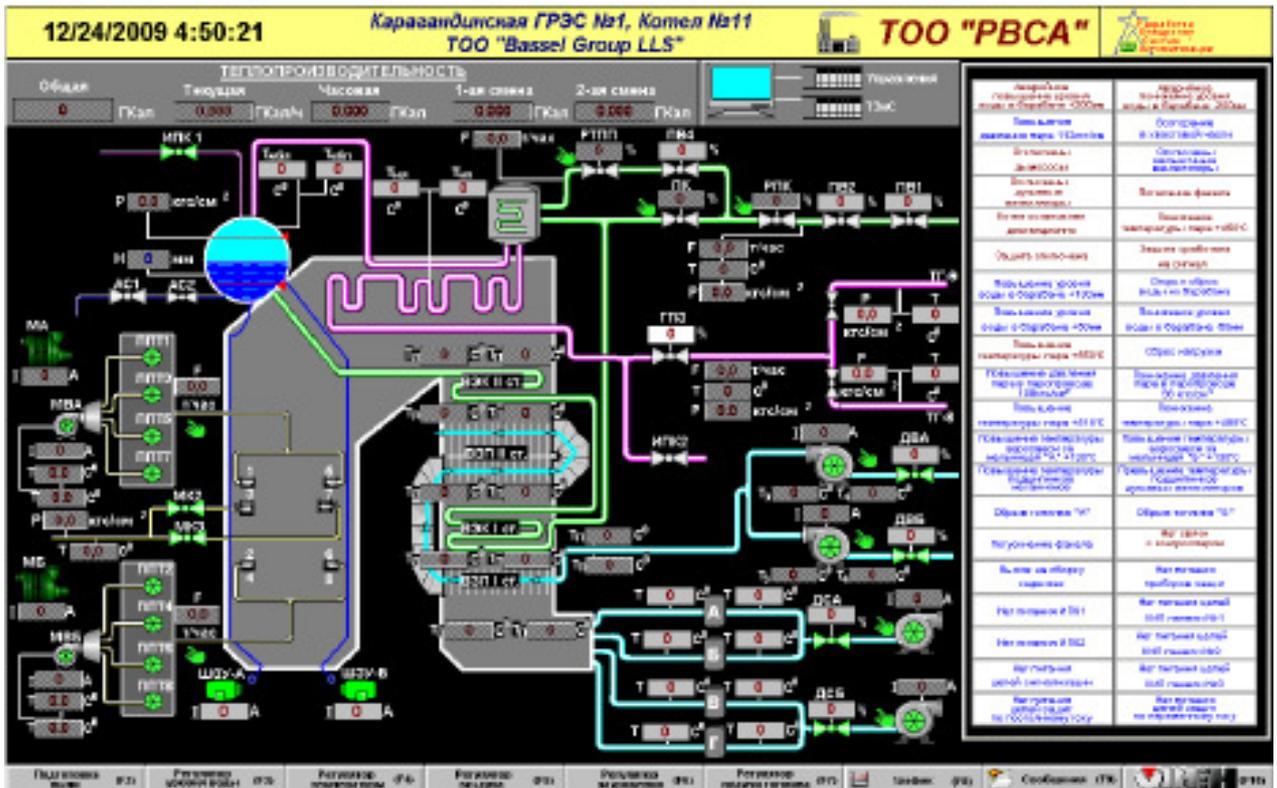
Picture No1

Two control units (regulating and protection) accept discrete and continuous signals from sensing transducers and secondary devices of measures. On the gained Informations control units perform logic and mathematical operations of machining the accepted information on the put in pawn algorithms managing directors also give out and signalling commands on power units and visualisation panels. Visualisation of processes is provided by means of two panels of operators (LCD the monitor and TR-177V). Installation of the third panel separately for system is possible protection automatics.

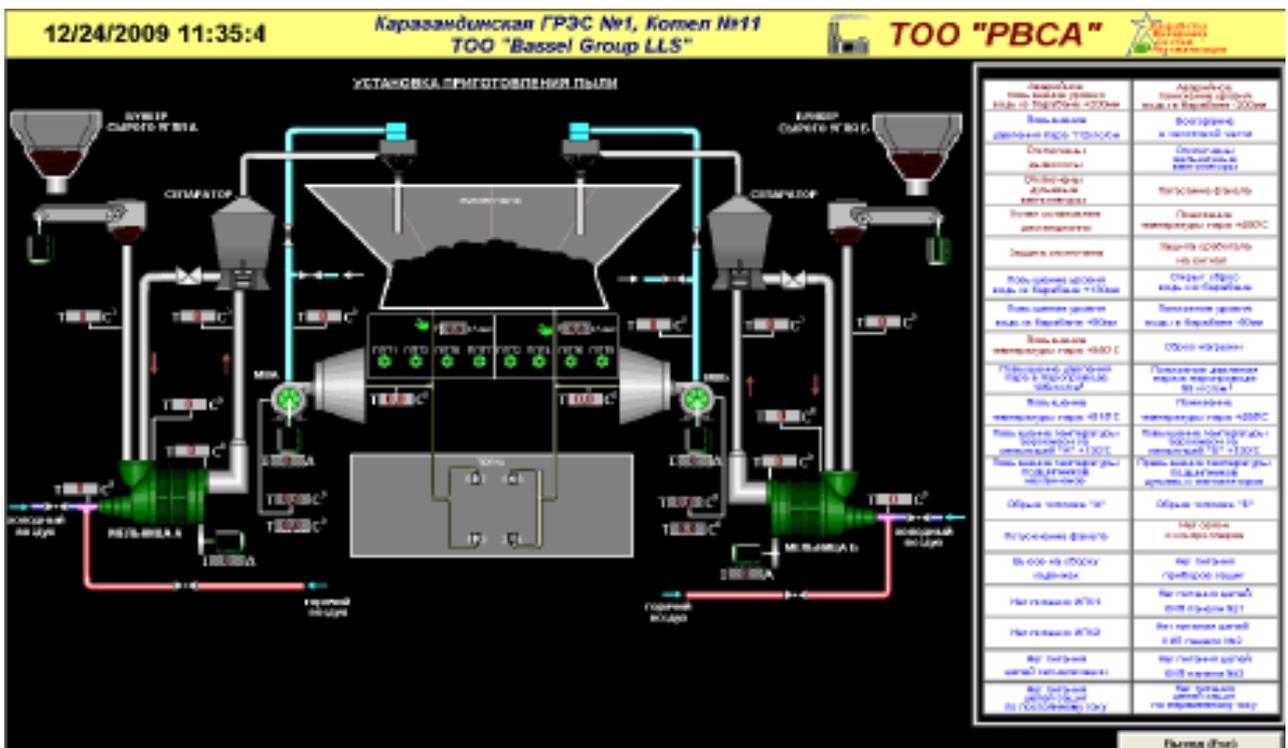
On the monitor it is represented scheme with animation on which it is possible to trace work of mechanisms of a copper, the basic technological parametres and as are inferred text messages precautionary and the fault signalling.

Representations take places in several windows:

- a copper, (picture No2)
- system of coal pulverisation, (picture No3)
- regulators, (picture No4)
- messages, (picture No2) and etc.



Picture No2. The copper circuit design



Picture No3. The circuit design of system of preparation of a dust

System of visualisation besides representation of key parameters arriving directly from sensing transducers of physical quantities such as: pressure, temperature, level, the charge, rule of final control elements and токовые loadings electric motors, makes as calculation of thermal productivity of a copper, fuel rate and a specific fuel rate on 1 Gcal.

For calculation of thermal productivity of a copper calculation formulas are used antalpii waters and pair, resulted in recommendations MI 2412-97 and MI 2451-98 VNIIM of D.I.Mendeleyev, accuracy of calculation is not worse than 0,5 %. Calculation of the expense of fuel (A coal dust) it is made on speed of rotation and quantity of the working feeders according to their adjusting characteristics.

On scheme in the form of pictogrammes the operating mode of the executive is displayed The mechanism - manual or automatic.

On all screens messages are on the right side deduced. Again appeared message blinks, while it not blinker. A signal on which has occurred emergency stop, it is marked by a shone point in the field of the message. The disconnected protection is marked grey field of the message, corresponding signal.

Automatics of protection provides a copper automatic stop in critical modes when this or that parameter exceeds admissible size on to conditions of safety of process, or the developed situation can lead to destruction of the equipment or ecological accident. Work of emergency system is accompanied by the sound and light alarm system, a conclusion of text messages to the basic and duplicating panels of operators. The system fixes the original cause which has caused an emergency. All events are fixed in a window of messages in chronometric sequence with the direction of a concrete time of their origination, receipting and disappearance. Algorithms of work противоаварийной automatics are realised in the programmed controller **Simatic S7**, specially intended for this purpose, and having a food from two independent sources (~220V and =220V) with UPS. The control unit противоаварийной automatics can be completed, instead of luminous panels, own display for representation of messages. The analysis of a condition of a copper is defined on discrete signals of achievement of marginal levels by the copper operation factors, arriving from secondary devices by which the copper is equipped.

In addition signals of marginal levels arrive from the regulating control unit **Simatic S7 300** which processes signals of analogue sensing transducers, than it is provided duplicating of an alarm.

Regulating of technological parameters is provided with the program of the second controller. Automatic control key parameters:

- Water level in the boiler drum.
- Steam Temperature on an exit from a copper.
- Pressure in the boiler drum or/and a steam pressure in front of the turbine.
- The Discharge in a fire chamber.
- The Relationship fuel-air, or productivity - air.
- Loading of the coal crumber.
- Temperature of a mix of a dust and air.

All regulators process the arriving information from sensing transducers in a digital form on in advance put in pawn algorithms. The signal from the level detector is processed on special algorithm taking into account the changing density of water and saturated steam (depending on pressure in the boiler drum). Ample opportunities of control unit Simatic S7 300 and its speed has allowed to build the interconnected adaptive regulators reacting not only on deviations of parameter, but also on disturbing affecting (the combined system of regulating with conducting and subordinated by

regulators of intermediate parameters or their derivatives). It allows to gain pinpoint accuracy of maintenance of parameters at the set level at satisfactory dynamics (stability, the minimum overcorrections, sweeping restoration).

The regulators affecting power units of directing apparatuses and regulating valves, have knot of compensation of gaps of the mechanism of the drive. Besides, the drive of valves and power units can be completed with the frequency drive that will allow to provide exact and smooth regulating of parameters, to lower electric and mechanical dynamic loads on the drive. Frequency are controlled the drive (FCD) it is possible to operate on a network and to gain the information on speed and loadings. For locked latches FCD will allow to retard speed at the approach to the closed rule and on the moment (FCD gives out a moment signal) to disconnect the drive (reliable and safety closing). The drive with FCD are less subject to breakages in a mechanical part of the mechanism and propellers fail (highly reliable and a scram protection) less often. Thus it is possible to represent more than the information on work of power units. The bumpless transfer from hand control on an automatic regime and back is provided.

Regulating zumpings out and air supplies with dual system of flue-gas pumps and ventilating fans provides uniform loading of propellers (a regulator division of loadings). Besides, at emergency switching-off of one of propellers, second it is automatically inferred on the maximum productivity (the greatest possible opening of the directing apparatus on a condition current loadings) and then is connected to regulator, the system defines necessity of automatic decrease in loading of a copper.

Was possibly installation FCD for flue-gas pumps and ventilating fans that provides regulating without use of directing apparatuses (very much a cow-hitch), smooth dispersal without dynamic loads, decrease in a slump of voltage and starting currents at start-up, that positively affects durability of electric motors. Regulating by means of turns reduces loadings on the mechanism and increases service life of flue-gas pumps and ventilating fans. In addition to stated all above the current consumption decreases and raises COS.

The regulator of a relationship air - fuel has some modifications:

- With correction on O_2
- On difference on the air heater
- On the measured active current
- On a full current, with active current scaling on propeller model

All regulators have system of capture of an operating point, it when in a manual regime the machinist of a copper infers parameter on demanded value and then the automatic regime is switched on, the system thus supports work in the chosen point. The system allows to displace productivity of even and odd group of pulverised-coal feeders, choosing optimum process of burning.

For air regulator the system of extreme regulating with an automatic search of an operating point of a relationship air-fuel, providing the minimum specific fuel rate on manufacture of one Gcal heat develops.

Loading of the crumber and temperature airdust mixes is controlled by change of productivity to the DOG with the frequency drive and extent of opening of gates depending on:

- Current of the drive,
- Differential head on the crumber.
- Temperatures airdust mixes.

Work of the coal crumber is blocked with dust level in loading pockets for what level detectors of radar type and sensing transducers of marginal levels of vibrating type are installed.

12/25/2009 1:00:20			Карагандинская ГРЭС №1, Котел №11 ТОО "Bassel Group LLS"		ТОО "РВСА"		
Двадцать сообщений							
Дата	Время	№	Текст сообщения				
23/12/09	12:05:20	62	Ошибка датчик разряжения в топке (слева)				Повышение температуры пара в барабане +200к
23/12/09	12:05:20	63	Защита отключена				Повышение температуры пара в барабане +200к
23/12/09	12:05:20	72	Накладка "Повышение температуры пара +550°С" в положении "Защита"				Повышение температуры пара в барабане +200к
23/12/09	12:05:20	73	Накладка "Повышение давление пара 112 кгс/см2" в положении "Защита"				Повышение температуры пара в барабане +200к
23/12/09	12:05:20	75	Накладка "Понижение температуры пара +485°С" в положении "Защита"				Повышение температуры пара в барабане +200к
23/12/09	12:05:20	76	Накладка "Аварийное повышение уровня воды в барабане +200к"				Повышение температуры пара в барабане +200к
23/12/09	12:05:20	77	Накладка "Аварийное понижение уровня воды в барабане -200к"				Повышение температуры пара в барабане +200к
23/12/09	12:05:20	78	Накладка "Погасание факела" в положении "Защита"				Повышение температуры пара в барабане +200к
23/12/09	12:05:20	79	Накладка "Отключены дутьевые вентиляторы" в положении "Защита"				Повышение температуры пара в барабане +200к
23/12/09	12:05:20	80	Накладка "Отключены дроссолы" в положении "Защита"				Повышение температуры пара в барабане +200к
23/12/09	12:05:20	81	Накладка "Отключены медьничные вентиляторы" в положении "Защита"				Повышение температуры пара в барабане +200к
23/12/09	12:07:37	59	Ошибка датчика разряжения в топке (справа)				Повышение температуры пара в барабане +200к
23/12/09	12:07:37	60	Неверно задание скорости pulverizatorov четной группы				Повышение температуры пара в барабане +200к
23/12/09	12:07:37	61	Неверно задание скорости pulverizatorov четной группы				Повышение температуры пара в барабане +200к
23/12/09	12:07:37	62	Ошибка датчик разряжения в топке (слева)				Повышение температуры пара в барабане +200к
23/12/09	12:07:37	63	Защита отключена				Повышение температуры пара в барабане +200к
23/12/09	12:07:37	72	Накладка "Повышение температуры пара +550°С" в положении "Защита"				Повышение температуры пара в барабане +200к
23/12/09	12:07:37	73	Накладка "Повышение давление пара 112 кгс/см2" в положении "Защита"				Повышение температуры пара в барабане +200к
23/12/09	12:07:37	75	Накладка "Понижение температуры пара +485°С" в положении "Защита"				Повышение температуры пара в барабане +200к
23/12/09	12:07:37	76	Накладка "Аварийное повышение уровня воды в барабане +200к"				Повышение температуры пара в барабане +200к
23/12/09	12:07:37	77	Накладка "Аварийное понижение уровня воды в барабане -200к"				Повышение температуры пара в барабане +200к
23/12/09	12:07:37	78	Накладка "Погасание факела" в положении "Защита"				Повышение температуры пара в барабане +200к
23/12/09	12:07:37	79	Накладка "Отключены дутьевые вентиляторы" в положении "Защита"				Повышение температуры пара в барабане +200к
23/12/09	12:07:37	80	Накладка "Отключены дроссолы" в положении "Защита"				Повышение температуры пара в барабане +200к
23/12/09	12:07:37	81	Накладка "Отключены медьничные вентиляторы" в положении "Защита"				Повышение температуры пара в барабане +200к

Picture No 5. Window of messages

All operating equipment is protected from mechanical injuries and to dust penetration for what filters and leakproof cabinets are provided. Hand control bodies (buttons, keys of sampling of a regime have illumination) take places on benchmark boards taking into account ergonomics and convenience demands Managements.

Cabinets with the switching equipment are equipped by safety keys, the signalling system and protection against loss of a phase and incorrect phasing.

Partially this system has been realised in the course of repair-regenerative works on a type copper - PC 10. A copper pulverizator, drum-type, water trumpet, with the vertical shields, consisting of the basic and prepowered drum, system of screen and connecting pipes.

Productivity - 230 t/hour., workers pressure in a drum - 109 атм., gaseous steam temperature - fuel S.Szhiganie's 510 grades torch, copper configuration P-shaped. The copper is rigid by 8 pulverised-coal burners.

That attains accuracy of maintenance of a water level in the boiler drum in an automatic regime +/-7 mm. Accuracy of maintenance of temperature on an entry in the general collecting channel +/-10 °C, at an arrangement yteam cooler before a prime of the steam superheater and without the temperature control between the first and second steps of the steam superheater because of absence of the sensing transducer, i.e. most not favorable conditions for automatic control system.