Application of Technology of Utilization Associated Petroleum Gas for Power Generation

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Abstract -There are power plants, whose application would be most practical for primary crude oil processing stations. The power plant is intended for generating electricity as well as, if necessary, for using of heating energy. As well as the other power plants under control of the operator's console, the reception department operates an industrial programmable controller. The controller manages the operation of the discrete and analog input/output to which measuring instruments are connected (flow meters, level meters, temperature sensors, etc.). The number of measuring instruments and actuators, if necessary, is determined by the process diagram of power plant for the oil processing unit. Hence, most active oil and refinery enterprises are looking for the application of intelligent and integrated in production manufacturing systems of cogeneration in order to meet the customer demands and be the winners in the competitive market in that field. With available technologies and systems in the field of cogeneration and its related technologies, such application for primary crude oil processing is a reality and can meet the need of the enterprises. Today technical mangers are confused with varying equipment that prevail in this field. This article is aimed at overcoming the confusion with the new technologies that have been generated in the past five years. Further, this paper showes that all these new proposals are indeed very important and can be applicable for primary crude oil processing and cogeneration. Finally, this article focuses on latest research developments towards modern cogeneration system for primary crude oil processing stations.

Key words – cogeneration, distributed control system, associated petroleum gas, monitoring and archiving of the data, control system

I. Introduction

There are power plants, whose application would be most practical for primary crude oil processing stations. The power plant is intended for generating electricity as well as, if necessary, for using of heating energy. As well as the other power plants under control of the operator's console, the department operates an industrial programmable controller. The controller manages the operation of the discrete and analog input/output to which measuring instruments are connected (flow meters, level meters, temperature sensors, etc.). The number of measuring instruments and actuators, if necessary, is determined by the process diagram of power plant for the oil processing unit.

Technological process of autonomous Power plant consists of preparing of the associated petroleum gas,and then.. in producing and distributing of the electrical energy. Preparing of the associated petroleum gas - is the process of separation from the mechanical impurity, water, and hard hydrocarbon.

Hence, most active oil and refinery enterprises seek the application of intelligent and integrated manufacturing systems of cogeneration in order to meet the customer demands and be the winners in the competitive market in the that field. With available technologies and systems in cogeneration and its related technologies, the application for primary crude oil processing is a reality and can meet the need of the enterprises. Today mangers in many enterprises are confused with varying equipment that prevail in this field. This review is aimed at overcoming the confusion with the new technologies that have been generated in the past decade. Further, this paper articulates that all these new proposals are indeed very important and can be applicable for primary crude oil processing.

II. Preparing of the associated petroleum gas for Power Generation Unit of Primary Crude Oil Processing Station

Associated petroleum gas, coming from the crude oil processing station with pressure P=0,5 MPa and temperature +5 Celsius is going to the first undergroung flashbox for the separation of the condensed moisture.

From the first undergroung flashbox condensed moisture arrived to the first drainage tank. For the eviction condensed moisture we have a automatic pump, which can switch on automatically because maximum level of the tank. Liquide from the first drainage tank coming to the crude oil processing station for the further processing.

From the undergroung flashbox associated petroleum gas comes (for the drying and purification from the mechanical impurity) throw the site of preparing of associated petroleum gas,to the vertical gas separator which have volume 8 cubic meters and pressure 1 MPascal. Internal construction of the separator has wire-mesh plate for retention of the condensed moisture and mechanical impurity.

Condensed moisture in the low part of the gas separator, after the reaching of the maximum level going to the second drainage tank. From the second drainage tank that liquid is pumping out to the crude oil processing stations for the further processing.

After gas separation, associated petroleum gas coming to the gas calculation platform. Technological schema provide bypass line for the maintenance and repairing without the stop of technological process.

After the calculation platform, associated petroleum gas coming to the site of absorption. Gas with temperature+5 coming to the pipe heat exchanger and it is cooling till the temperature +4,19 Cesius there, because of heat exchange with gas flow(temperature +3,93 C) which comes from the centrifugal vortical separator.

Further we have an injection of absorbent into the flow of cooled gas by means of two mechanical ejectors.

Application of the mechanical injection of the absorbent into the pipeline is provided by the technological schema. Dispersed absorbent is taking up into itself petroleum tailings of the gas. But what is the absorbent in this case? Absorbent, which supply to

ejectors from the booster tank. This absorbent has temperature +11.3 C. As a result of mixed gas and absorbent, the temperature of liquid-gas mixture became +10.2C. And gas-condensate comes from the centrifugal vertical separator to the booster tank. So, we have permanent circulation of the liquid from centrifugal vertical separator to the booster tank through the pumps and injection of absorbent to the flow of associated petroleum gas.

Volume of the liquid in the booster tank increasing permanently because petroleum tailings are swallowing by absorbent and then we can see their separation from the associated gas in centrifugal vertical separator.

After the reaching of maximum level of the liquid in booster tank in automatic mode defined volume of oil condensate from the pump going to the crude oil processing station for the further processing.

After injection of the absorbent liquid-gas mixture supplying to the pipe heat exchanger for the cooling till the temperature+6.4. Cooler - it is condensate, which have temperature -0,14 C, comes from absorber. Then, cooled liquid-gas mixture comes to the absorber. Liquid from the absorber(P=0.5MPa, t=+6,41) is supplying to the heat exchanger. As a result of reducing, the temperature of the condensate decreasing till -0,14 C.

Treated from the hydrocarbon gas, it goes to the centrifugal vortical separator for the final drying. Principle of operation of the separator - is the separation of the flows due to influence of centrifugal force. Gas is supplying to the deflector. Due to tangential input and the deflector construction we shall have curling of the flow and that flow gets necessary centrifugal force.

In the centrifugal vortical separator we have whirl of the flow, and as a result we have stable separating of liquid and gaseous fraction of the mixture.

Separated suspended solids and moisture extracts from the centrifugal vortical separator into the booster tank. After centrifugal vortical separator gas is supplying to the heat exchanger, where has heating. Till the +5,12 Celsius.

Then, from the heat exchanger gas coming to the Associated Petroleum Gas Plant.

Necessary pressure of the gas (0.5MPa) is controlling by the valves before the input of the power-generating unit.

III. Reciprocating gas engines, fuel system and supplying of electrical energy

Power-generating unit usually consists from the gas jet or reciprocating engine and three fase synchronic alternator. In case if the capacity of power plant no more then 44 MWatt, power-generating unit of reciprocating type recommended.

It can be 20-cilinders gas reciprocating engine with spark ignition, water cooling and turbosupercharger gas injection.

Gas engines are working in according to the principle LEANOX, which means development of the engines with high part of air and low part of gas(so-called poor mixture) Using the poor mixture gets decreasing of the deleterious metter exhaust during the combustion action.

In the regulator of the gas flow, gas is mixting with inlet air and supplying to the turbosupercharger by the pipes. After the turbosupercharger depressed air-gas mixture passed the cooler(heat changer) of the mixture.Then in the output of the cooler, air-gas mixture gets through the throttle,where amount of mixture is regulating and supplyes to the pipes of the cylinders.

Further the schema of power supply provide transmission of electrical energy to the power consumer by means the supplying the power from associated petroleum gas power plant through Closed Distribution Unit, for example, 6 kV to the distribution unit of power consumer.

Conclusion

In this paper the instructions for creating and explotation of cogeneration system for Primary Crude Oil Processing Station are given.

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