

Application of Integrated Device for Produced Liquid Preliminary Separation and Desanding in Oil Field Production

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Abstract: At home and abroad, there is a large number of theoretical and experimental research on hydro-cyclone separation equipment, of which the research on the multiphase hydrocyclone desanding device already has certain theoretical basis. In Daqing oilfield, desanding technology and equipment was adopted in the produced fluid gathering and transferring process. This paper mainly introduces the application of sand removal equipment in the oil field research.

1 INTRODUCTION

After the development and production of Daqing Oil Field entered the stage of high water cut period, the produced fluid composition changed a lot and the composition became more complex. To improve oil recovery, many key technologies, like chemical flooding, are applied and thus lead to the obvious sand content in the produced fluid. Long-term oil field production practice showed that sand deposition appears in the three-phase separator in the process of the oil and gas gathering and transportation and influences the oil-water separation. This will cause severe scaling in the heating furnace and finally lead to burning failure of the equipment at an early stage. To solve the above problem, preliminary separation and desanding technology was applied in Daqing oil field produced fluid gathering and transportation process and special integrated equipment was designed. This paper mainly introduces the application of integrated device in oil field production.

2 TECHNOLOGICAL PROCESS

2.1. The Application of the Existing Sand Removal Device

Sand Removal Device (SRD) was specially designed in Daqing Oil Field in the previous produced fluid gathering and transportation process and this causes mud existence in the whole process and thus lead to a series of problems. To place the preliminary separation and desanding device in the upstream part of the gathering and transportation process, that is, before the three-phase separator, is expected to minimize the negative impact of mud sediment on the gathering and transferring process.

Structure principle and process flow of the existing design prototype are shown in Figure 4. Sediment by cyclone desander after separation from the bottom, to facilitate the separation of sediment accumulation, clearance and observation, sedimentation tank in the swirl portion of the bottom sediment design, part of the settlement tank in the upper left part of the cyclone underflow and sediment, sedimentation tanks.

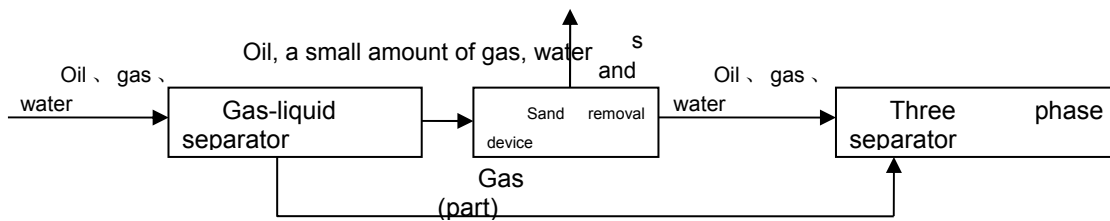


Figure 1 process schematic diagram.

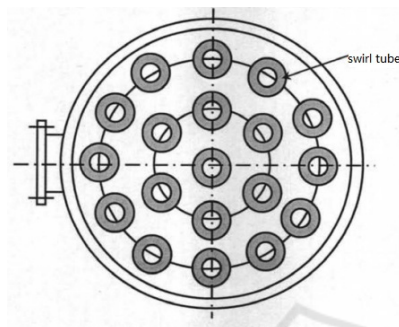


Figure 2 overlook structure .

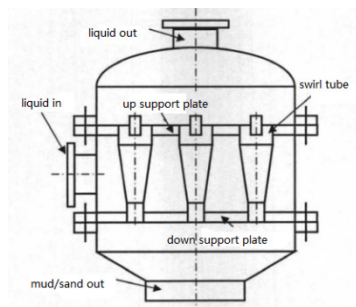


Figure 3 front section view.

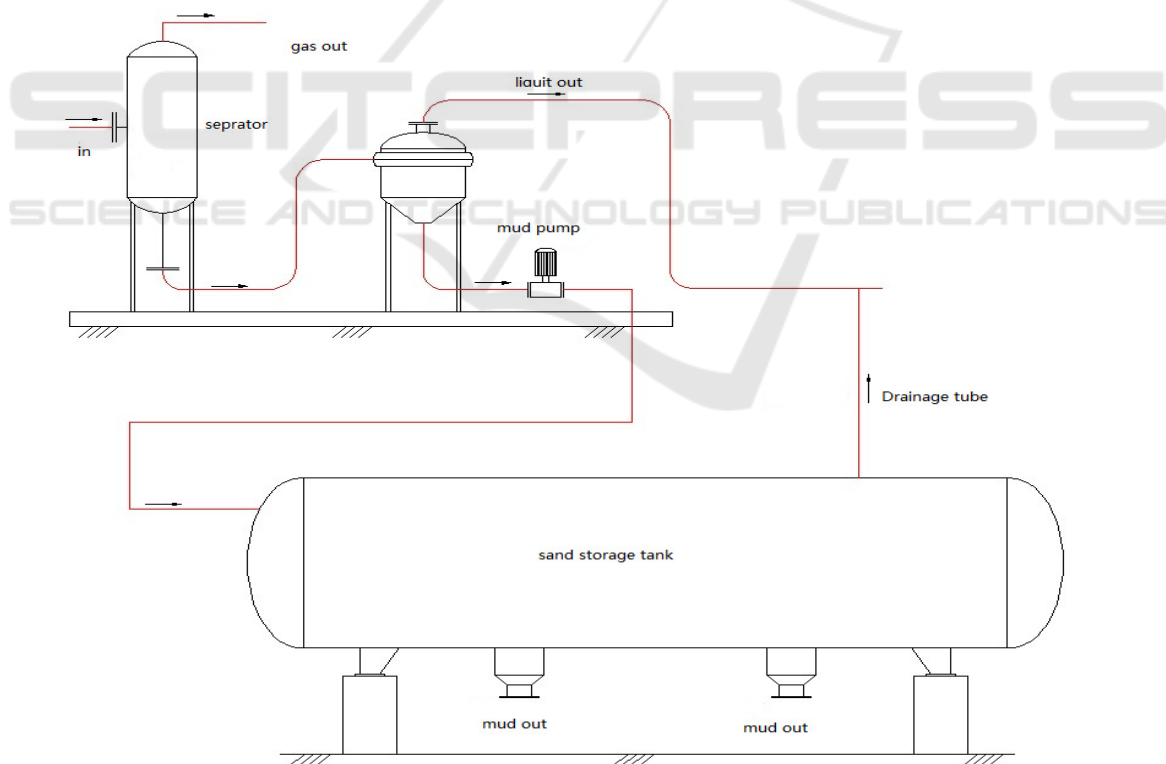


Figure 5 device layout.

2.2. Improvement of Integrated Sand Removal Device (ISRD)

Although the original prototype is convenient for the separation of sediment after separation, it also brings many unfavorable problems to the operation of the equipment. Because the SRD is arranged on the upper part of the sediment settling tank, the total height of the sediment settling tank is about 4~5 meters, which will cause the pressure drop of the system to increase by 0.04 to 0.05MPa. The normal production of the oil station basic working pressure 0.35~0.4 MPa, increasing desanding integrated device equals the pressure drop increased by 10% to 12.5%, due to the pressure drop device compared with the general assembly have an impact on the oil field ground process system, the most direct is the super pressure safety valve, therefore need to be solved to increase integration device system after increasing the pressure drop problem.

Because the cyclone SRD needs to consume a certain amount of energy to obtain the swirling flow power, under the current conditions, the system pressure drop caused by the best efficiency of the integrated device is inevitable. Therefore, the system pressure drop of the whole integrated device is reduced by reducing the static pressure of liquid column in the main stream.

The optimized layout of the ISRD is shown in Figure 5. The sand is arranged in the division level or above, through the mud pump after the separation of sand and sediment discharge to the settling tank lifting. Without affecting the normal process, the pressure drop of 0.04 ~ 0.05MPa due to the height difference is reduced. At the same time, by adding the sludge pump to compensate the pressure drop of the system, although the investment has increased, it ensures the feasibility and stability of the operation of the whole device.

3. ISRD UNIT PRYING AND MOUNTING

With the continuous improvement of the construction technology of the oilfield ground construction, the integrated integrated device is also used in Daqing oilfield to be used in the existing process. This set of SRD has skid mounted design, which integrates mechanical technology, electrician technology, automatic control technology and information technology. It has the advantages of saving investment, saving land, convenient

transportation and installation, high reuse rate and shortening construction period.

3.1 Skid Design

The dynamic equipment, the static equipment, the process pipeline, the valve instrument and the electrical control are put on the joint sled seat to form an integrated integrated device. Consider the following main design factors: one is the application of advanced design method, optimization of combined skid in space, so space utilization efficiency, operation and maintenance of reasonable space; two is the selection of small and efficient equipment, coordination and optimization of equipment and piping of the opening, the application of multi way valve piping installation structure is simplified; the three is for the convenience of transportation, reasonably determine the skid the size of a single skid base length should not be more than 15 meters wide, not more than 2.8 meters, a large device can adopt multiple skid joint assembling form; four is to consider the overall layout of the device more stable to prevent the lifting process and overthrow.

3.2 Design Example

As shown in the Figure 6, the oil and gas separation and SRDs are used as a sled unit, and the sludge pump itself becomes a sled unit. The construction period can be shortened greatly, and more than 80% of the field work can be reduced. In the actual application process, sometimes it is necessary to place the mud pump skid outside. Considering the environmental requirements of winter operation in Daqing area, we will upgrade the pump to a pumping room with features of skid mounted (its design meets the specific requirements of fire protection and explosion-proof regulation).

At the same time, the whole device sets the heat tracing system, the heat source adopts the heating furnace inside the station, the device and the outside of the pipeline use the insulation material for heat preservation treatment. In the process of practical application, the device is part of the process system, and the medium of the device is in the state of operation, which can meet the demand of winter operation. Considering the device some exposed instrumentation components affected by low temperature, there will be a bad situation with heat, pressure transmission device failure, affecting the normal operation of the device, so it is necessary to take measures to increase the electrical heating of

key components, in order to avoid the disadvantages of low temperature operation.

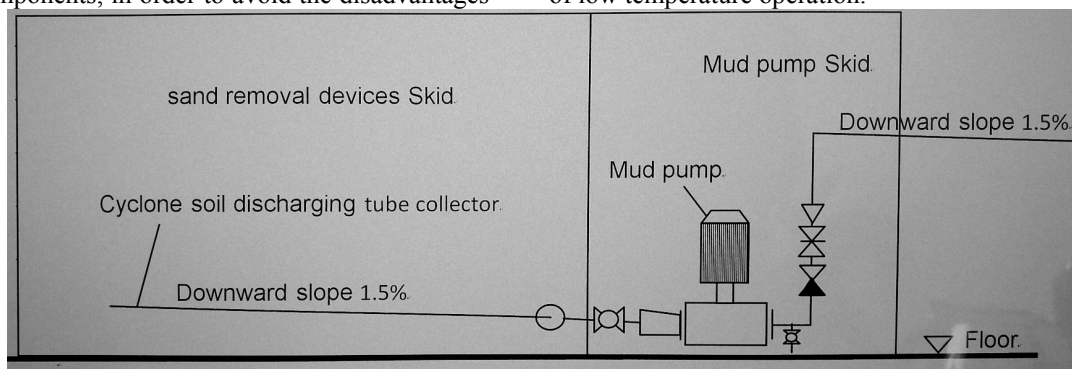


Figure 6 design example.

4. CONCLUSIONS

The integrated device for separating and removing sand from the produced liquid has the characteristics of integration and automation. It can realize standardized design, modular precast and automatic control, and is suitable for the production of similar produced liquid in Daqing oilfield and other cold regions. Through field tests, the data show that the application of the pre-distributary sand removal process and the installation of special integrated equipment can effectively reduce the sediment content of the produced liquid and greatly improve the treatment effect of the subsequent three-phase separator.

With oil production to the standardized, modular, intelligent direction, such as the pre diversion sand special integrated device developed into crude oil desanding proprietary technology products, effectively saving investment, saving land, transportation and convenient installation, high recycling rate, shorten the construction period and other advantages, will have broad application prospects.

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