

Ejection technologies for UGS

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Ejection technologies : General Info

Ejecting is a propulsion of lowenergy flow of gas or liquid by means of media pumping down, which is driven by the other higher-speed working flow. Flow moving under a head creates negative pressure and is referred to as ejecting (active) flow, and the driven flow is ejected (passive) flow. As a result of mixing, the passive flow obtains the energy of the active flow, it is followed by equalizing pressure, flows' velocities and temperature.







Connecting gas jet pump to the process service lines



Gas jet pump can be mounted both indoors and outdoors taking into account an easy approach for maintenance.

➤Gas jet pump doesn't require the autonomous protective measures against weather effects and electromagnetic fields.

Feeding lines of gas jet pump are equipped with the measuring and control valves at the high-pressure and lowpressure gas inlets and mixture outlet lines.



Gas dynamic behaviour of gas jet pump



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 P_d

P_{dk}

Back pressure



Basis of calculation of gas flow in gas jet pump

- Engineering algebraic model for bulk parametric analysis
- Imperfect (real) gas equation
- Nonstationary axiosymmetrical Navier-Stokes equations
- Account of gas flow in gas jet pump interaction with the gas flows in the adjacent equipment (pressure blower, reservoir bed, junction line)



1 – cavern; 2 – node; 3 – trunk gas pipeline; 4 – compressor; 5 – ejector



Gas flow field in gas jet pump













useful work;

The use of ejection technologies in UGS system is conditional on the following:

Possibility of using the formation energy of highpressure gas that is being irrecoverably lost at present in quick release and control valves with no performing a

The need to eliminate existing losses of low-pressure gas that is bled out of the technological equipment;

Possibility of mitigation of negative impact on environmental setting in residential areas situated close to UGS



Gas ejector are used in UGS system with the following purpose:

Reducing energy consumption and hazardous emissions in joint operation of gas pumping units and gas jet pumps in the initial stage of gas injection;

- ≻Capacity control of gas injection in the initial stage when the uncontrollable electrical gas pumping units are working in compressor department of UGS station;
- Deloading the loop of gas pumping units and gas pipeline system;
- >Enhanced gas recovery from the storage in presence of high-pressure gas sources;
- ➢Increase in performance of individual low-pressure wells by reducing the backpressure;
- ➤Gas withdrawal from man-made deposits;
- Recovery of products of gas combustion in the boiler stacks, igneous vaporizers, etc.



Process scheme of simultaneous gas compression and ejection during injection to the storage



1-Всасывающий коллектор компрессорного цеха

2-ГПА

3-Выкидной коллектор компрессорного цеха

4-Блок эжекторов

5-Коллектор подачи смешанного потока газа

6-Коллектор подачи эжектируемого потока газа на блок эжекторов

7-Нагнетательный газопровод газохранилища

8-Отсекающий кран выкидного коллектора компрессорного цеха

9,10,11-Запорная арматура для стравливания газа с блока эжекторов



Introduction of energy efficient injection technology at Peschano-Umetskoye UGS

The implementation of the technology at the Peschano-Umetskoye UGS increased the daily injection rate by 27,3% and reduced specific electric power consumption by 11%.



Gas ejector design was developed and patented in VNIIGAZ. Electors were manufactured at Voronezh Mechanical Plant.



Introduction of energy efficient injection technology at Peschano-Umetskoye UGS

Technology allows to increase the compressor gas injection rate above the total power of gas pumping units





Introduction of energy efficient injection technology at Peschano-Umetskoye UGS

Technology allows to Regulate the injection rate





Introduction of technology at Bernburg UGS



Introduction was done under scientific and technical cooperation program between JSC Gazprom and Verbundnetz Gas AG





- 1. Process scheme of simultaneous gas compression and ejection during injection to the storage
- 2. Calculation of gas dynamic interaction of gas pumping units, ejector unit and branched system of field pipelines
- 3. Engineering and technical design of the ejector unit integration into existing surface UGS facilities
- 4. Development of the technical documentation and manufacture of the ejector unit



Ejector design engineering







Approval of design documentation

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a Übergangsflansch, Übergangsstück auf DN150						26.07	.2010	Heinzmann	-	-		
b überarbeitet						10.08	.2010	Heinzmann	-	-		
c siehe Eintragungen						23.08	.2010	Heinzmann	-	-		
d siehe Eintragungen						30.10	.2009	Heinzmann	-	-		
e Pos.14. Pos.20						27.09	.2010	Heinzmann	-	-		
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Ejector assembling









Gazprom VNIIGAZ LLC has a long-term experience in development and adaptation of gas jet pumping units in the context of various technological processes Types of work:

 Assessment of gas jet pumping units feasibility for various technological processes
Prediction of gas-dynamic behaviour of gas jet pumping units
Scientific and engineering support of design documentation development and manufacturing of gas jet pumping units

Pilot testing of gas jet pumping units