GAS TREATMENT AND TRANSPORTATION AT THE SATALANTEPA FIELD

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Abstract. *This article reviews the proposed preliminary gas treatment unit (PGTU) and export pipeline for the Satalantepa gas-condensate field in Uzbekistan. Based on the project design document, it summarizes the feed-gas properties, process arrangement and hydraulic calculations for a 168 mm diameter, approximately 6 km pipeline. The proposed facility includes a vertical separator, gas metering, liquid degassing, produced-water handling and a flare. The design considers two operating cases and seasonal conditions. Reported gas velocities are 8.4–9.5 m/s, below the project criterion of 10 m/s, while the calculations indicate no hydrate formation under the analyzed conditions. The article interprets the project data and identifies information that should be confirmed during detailed design.*

Keywords: *Satalantepa; natural gas; preliminary gas treatment; gas separation; degassing; gas metering; pipeline; hydraulic calculation.*

Аннотация. *В статье рассмотрены проектные решения по предварительной подготовке газа и его транспортировке с Саталантепинского газоконденсатного месторождения. На основе проектной документации кратко описаны состав газа, технологическая схема установки, а также гидравлические расчёты трубопровода диаметром 168 мм и длиной около 6 км. В состав установки входят вертикальный сепаратор, узел учёта газа, дегазатор, система отвода пластовой воды и факельная установка. Расчёты выполнены для двух режимов и летних и зимних условий. Скорость газа составляет 8,4–9,5 м/с, что ниже принятого в проекте предела 10 м/с. В документе также указано отсутствие гидратообразования в рассмотренных условиях. Выводы статьи основаны на анализе предоставленной проектной документации.*

Ключевые слова: *Саталантепа; природный газ; предварительная подготовка газа; сепарация; дегазация; учёт газа; трубопровод; гидравлический расчёт.*

Annotatsiya. *Maqolada Satalantepa gaz-kondensat konida gazni dastlabki tayyorlash va quvur orqali tashish bo‘yicha loyiha yechimlari ko‘rib chiqiladi.*

Loyiha hujjatlari asosida gaz tarkibi, qurilmaning texnologik sxemasi hamda diametri 168 mm va uzunligi taxminan 6 km bo‘lgan quvurning gidravlik hisoblari qisqacha tahlil qilinadi. Qurilma vertikal separator, gazni hisobga olish uzeli, degazator, qatlam suvini chiqarish tizimi va fakeldan iborat. Hisoblar ikki ish rejimi hamda yozgi va qishki sharoitlar uchun bajarilgan. Gaz tezligi 8,4–9,5 m/s bo‘lib, loyihada qabul qilingan 10 m/s chegaradan past. Hujjatda tahlil qilingan sharoitlarda gidrat hosil bo‘lmasligi qayd etilgan. Xulosalar taqdim etilgan loyiha hujjatlari bilan cheklangan.

Kalit so‘zlar: *Satalantepa; tabiiy gaz; gazni dastlabki tayyorlash; separatsiya; degazatsiya; gaz hisobi; quvur; gidravlik hisob.*

1. Introduction

Natural gas from a gas-condensate field may contain liquid hydrocarbons, formation water and water vapor. If these components are not adequately removed or controlled, they can affect metering, pipeline operation and the reliability of downstream equipment. Preliminary treatment therefore provides an important transition between well production and gas transportation. The Satalantepa project addresses this needs through a field gathering system, a preliminary gas treatment unit and a pipeline connection to the gas transportation system. This article summarizes the documented process and hydraulic design basis without treating the project calculations as independent verification or certification.

2. Geographic setting and field context

The Satalantepa (also written Setalantepa) gas field is part of the Bukhara–Khiva oil and gas region of western Uzbekistan. A geographic reference places it in Bukhara Region, approximately 35–40 km south-east of Kogon railway station [11]. The project studied here concerns facilities for collecting, preliminarily treating and transferring the field's gas to the transportation system.

The project document associates the field's operating data with Mubarek Oil and Gas Production Department and uses ground-temperature data for a nearby location in Kashkadarya Region. Public geographic references, however, place Setalantepa in Bukhara Region and the Bukhara–Khiva oil and gas area [11, 12]. Since the design document gives no coordinates or district name, this article avoids assigning an unverified district. The final project record should confirm the licensed field boundary and administrative location.

The location also affects gathering-line routing, access, logistics and seasonal operation. The project describes a connection from the Satalantepa treatment unit toward the Akzhar–Northern Maimanakh collector system. The pipeline route,

length and tie-in point should be verified against the approved survey and current drawings.

3. Materials and methods

The study is based on the project document "Construction of a preliminary gas treatment unit and a 168 mm diameter, 6,000 m pipeline from Satalantepa to the gas transportation system. The method consists of extracting the reported design data, describing the process sequence and comparing the two hydraulic cases in summer and winter conditions. Where the project does not provide equipment capacities, detailed safeguards or environmental design parameters, these are identified as information gaps rather than estimated.

The analysis is documentary and comparative. Values are reproduced from the design basis rather than independently recalculated. The two flow cases are kept separate because Case 1 follows the design assignment and Case 2 reflects the March 2026 well regime. Seasonal conditions are compared because temperature and pressure affect buried-pipeline hydraulics.

The article distinguishes field inputs from calculated outputs and engineering interpretation. Gas composition and well operating data are project inputs; pipeline velocities and pressure drops are reported calculation results. Conclusions are limited to the criteria and scenarios stated in the source, while unresolved matters are left for detailed engineering verification.

4. Feed-gas characteristics and design basis

The project reports a methane-rich dry gas: methane 91.31 mol%, ethane 3.524%, propane 0.854%, nitrogen 3.222%, carbon dioxide 0.323% and hydrogen sulphide 0.002%. The reported potential C5+ content is 23.2 g/m³, while moisture is 189.4 g/m³. These values indicate that liquid separation and control of water content are relevant to reliable operation. The project also presents a wet-gas calculation basis that explicitly includes water vapor; therefore, dry- and wet-basis composition figures should not be compared without accounting for their different bases.

The design basis gives expected annual gas production of up to 180.0×10^6 m³/y. The March 2026 operating data include a wellhead pressure of 53.0 kgf/cm², maximum static pressure of 93.2 kgf/cm² and average daily gas rate per well of 51.7×10^3 m³/d. The project also identifies cold-weather operation as a design consideration and calls for assessment of chemical reagents and their consumption where required.

Moisture is especially important in gas transportation. Water may be present as vapor in the gas phase or as free liquid entrained from the reservoir and gathering system. The separator is intended to remove bulk liquid, but a separator alone does not necessarily establish a final water-dew-point specification. The project document

reports a moisture value and a wet-gas calculation basis; it does not set out a complete dehydration process or a guaranteed export dew point. Therefore, the scope of preliminary separation should not be confused with deep dehydration. If the receiving network has a strict water specification, the interface requirements should be confirmed with the network operator.

The annual production figure is a design target, while the March 2026 well regime is an operating snapshot. Actual production changes as wells are started, shut in or operated at different choke settings. Equipment selection should consider turndown and changing liquid loads as well as nominal throughput. A complete operating envelope would include minimum, normal and maximum rates for individual wells and the combined system.

5. Proposed process configuration

The field gathering arrangement is described as radial. Production from the wells is collected through flowlines and routed to the PGTU inlet. The purpose of preliminary treatment is to remove free liquid from the gas before it enters the export pipeline. The principal equipment and streams described in the project are summarized below.

5.1. Separation and gas metering

The well stream enters vertical separator C-101. Gas leaves the upper section and proceeds to the metering unit, while separated liquid is withdrawn from the vessel. The separator reduces liquid carry-over into downstream equipment; the metering unit records the prepared-gas flow before delivery to the pipeline. The project describes one metering line but does not provide a complete specification of the measurement technology, so the final instrument selection and calibration arrangements require confirmation during detailed design.

Gas measurement supports production accounting, comparison with the receiving network and detection of abnormal operating trends. Accuracy depends on the meter range, pressure and temperature compensation, gas-property inputs, installation geometry and calibration. If differential-pressure measurement is selected, the primary element and upstream/downstream piping affect uncertainty. The final design should specify the meter type, accuracy, flow computer, transmitters, sampling and verification procedures.

The radial gathering system should allow individual wells to be isolated while the remaining wells continue operating. Valves, drains, vents, pressure indicators and sampling points must support safe start-up, shutdown and inspection. Detailed line lists and tie-in drawings are needed to confirm the final arrangement.

C-101 performance depends on gas flow, pressure, temperature, liquid loading and vessel internals. Adequate residence time promotes droplet separation. Excessive gas velocity can cause liquid carry-over, while poor level control can allow liquid into the gas outlet or gas into the liquid outlet. The separator sizing calculations and internals should be checked against the equipment datasheet and vendor documentation.

Stable operation requires pressure and level monitoring, suitable alarms and shutdown functions defined by the safety study. Drain performance and liquid carry-over should be checked during commissioning. The approved process and instrumentation diagrams must define the final protection architecture.

5.2. Liquid handling, degassing and flare

Liquid from C-101 is throttled through a choke and sent to degasser D-1. Pressure reduction releases flash gas and separates the liquid into flash gas, produced water and unstable condensate. The project states that flash gas is metered and directed to the flare, produced water is metered and sent to an evaporation pond, and unstable condensate is transported by road. These streams require separate operating and environmental controls. The supplied document does not specify the evaporation pond capacity or all of its lining and groundwater-protection details.

The degasser has a different duty from the inlet separator: it reduces pressure on the separated liquid and releases dissolved or entrained gas. The resulting flash gas, produced water and unstable condensate need separate routing. The flash-gas line must accommodate flow fluctuations, while water and condensate require reliable measurement, containment and disposal or transport procedures.

The evaporation pond's suitability depends on water composition and volume, evaporation conditions, soil permeability, groundwater depth, lining and drainage design. Seepage, overflow, stormwater entry and access control require assessment. The project material does not provide enough detail to evaluate these matters; they should be addressed in environmental and civil-design documents.

Road transport of unstable condensate requires safe loading connections, vapour control, spill prevention, tank integrity and transport documentation. Condensate quantity and quality should be measured to reconcile the production balance. Procedures should cover transport interruption and limited storage capacity.

The flare provides a controlled destination for degassing gas that is not routed to the transmission system. Cold-weather operation is also considered in the project, including possible use of chemical reagents. The detailed design should define the conditions for reagent injection, monitoring and safe handling, together with the operating limits of the flare and liquid-handling equipment.

6. Material and heat balance

The project contains material and heat balance calculations for two cases. Case 1 represents the design-assignment basis and an inlet gas flow of 408.0 × 10^3 m^3/d for the pipeline hydraulic assessment. Case 2 represents the March 2026 operating regime and a flow of 169.2 × 10^3 m^3/d. The process calculations show a reduction in water content after separation, supporting the role of C-101 in removing free liquid from the gas stream. The liquid balance also explains the need for D-1: pressure reduction separates flash gas from produced water and unstable condensate. The balances are design calculations and should be checked against actual operating data during commissioning.

7. Hydraulic assessment of the 168 mm pipeline

The project evaluates a 168 mm diameter pipeline with a stated length of 6.0 km. The reported results for the two flow cases and seasonal conditions are presented in Table 1.

Table 1. Reported hydraulic results for the 168 mm, 6 km pipeline [1].

Calculation case	Season	Flow (10^3 m^3/d)	Velocity (m/s)	Pressure, start → end (kgf/cm^2)
Case 1	Summer	408.0	9.3	34.4 → 29.0
Case 1	Winter	408.0	8.4	34.4 → 29.0
Case 2	Summer	169.2	9.5	14.4 → 12.0
Case 2	Winter	169.2	8.7	14.4 → 12.0

The calculated velocities range from 8.4 to 9.5 m/s and remain below the 10 m/s criterion adopted in the project. For Case 1, the reported pressure decreases from 34.4 to 29.0 kgf/cm^2; for Case 2, it decreases from 14.4 to 12.0 kgf/cm^2. The project uses ground temperatures of +26.8 °C and +7.2 °C at a depth of 0.8 m for the seasonal assessment. It reports no hydrate formation under the analyzed conditions. This conclusion applies to the stated calculation cases and does not remove the need for operational monitoring of pressure, temperature and water content.

The 10 m/s velocity limit is a project criterion, not a universal guarantee of pipeline integrity. Velocity affects frictional pressure loss and may influence vibration, erosion where solids or droplets are present, and liquid accumulation at low points. Since summer values approach the stated limit, the hydraulic model's assumptions for flow, composition, temperature, pressure, internal diameter and roughness should be preserved and verified.

The pressure decreases over 6 km results from friction and local resistance. The higher-flow case has the larger absolute pressure drop, while the lower-flow case has lower inlet and outlet pressures. Before approval, the model should be checked against the surveyed elevation profile, actual internal diameter, fittings, valves and receiving-system backpressure. Operating pressure must remain within connected equipment limits.

The project reports no hydrate formation for its analyzed seasonal cases, using ground temperatures at 0.8 m depth. Hydrate risk depends on pressure, temperature and water availability together. Shutdown, restart or liquid accumulation may differ from steady-state assumptions, so operations should monitor pressure and temperature and define procedures for low points and prolonged shutdowns.

8. Discussion

The proposed process creates a clear sequence from well production to transportation: gathering, bulk liquid separation, gas metering and pipeline delivery. Treating the liquid separately through a degasser is important because the separated liquid contains components with different handling requirements. Flash gas is routed to the flare, produced water to the evaporation pond and unstable condensate to road transport. Each route therefore needs suitable measurement, containment and operating procedures.

The two-case approach is useful because it considers both the project design basis and a lower operating flow. The hydraulic results indicate that the selected diameter meets the stated velocity criterion in the cases examined. However, a complete assessment would also require confirmation of pipeline material, wall thickness, design pressure, corrosion allowance, route profile, isolation and pressure-protection facilities, and the applicable construction and integrity requirements. These details are not fully available in the reviewed process document.

The receiving network interface must define acceptable pressure, temperature, composition and flow. These conditions should appear in the interface agreement and control philosophy. The tie-in point, ownership boundary, metering responsibility and isolation arrangements should be consistent across approved drawings and procedures.

Commissioning should verify each process stage: piping pressure and leak tests, alarm and shutdown tests, meter calibration, separator level control, flare ignition and monitoring, and liquid-handling routes. Baseline data should be recorded to detect later changes in pressure drop, liquid production or gas composition.

Operational monitoring may track inlet/outlet pressure, gas temperature and flow, separator pressure and level, degasser pressure, flare status, produced-water volume and condensate dispatch. Trends can reveal liquid loading, fouling, instrument drift or changes in well contribution. The operator should define alarm limits and response actions in the approved operating philosophy.

An additional reliability consideration is the ability to operate the facility during changing well conditions. When a well is shut in or its flow rate changes, the combined inlet flow and liquid loading at the PGTU may change quickly. The control system should therefore be designed to maintain stable separator pressure and

liquid level over the expected operating range, while preventing pressure or level excursions from propagating to downstream equipment. Start-up and shutdown sequences should define the order in which wells, the separator, the degasser, metering and the export line are brought into or taken out of service. Where temporary bypasses or maintenance connections are required, their use should be controlled by written procedures and risk assessment. The project description establishes the main process units, but the operating philosophy and cause-and-effect logic should be completed as part of detailed engineering. This is particularly important where the field is connected to a third-party transportation network, because an interruption at the receiving system may require the field facility to reduce production or shut-in wells safely.

9. Limitations

The source is a project design and process-technology document, not a construction, commissioning or long-term operating report. It supports a description of the proposed arrangement and reported calculations, but it does not independently demonstrate equipment performance or regulatory compliance. Detailed capacities and specifications for the separator, degasser, flare, metering system and evaporation pond are not fully reproduced. The source also contains wording that should be reconciled in controlled project documentation, including references to the pipeline as both an existing connection and a proposed construction. The final project version should clarify the pipeline scope and the consistent spelling of the field name.

A preliminary process concept is not a complete engineering package. Detailed design should include approved process and instrumentation diagrams, equipment datasheets, line lists, plot plans, hazardous-area classification, relief and flare calculations, electrical, instrumentation and civil drawings, construction specifications and operating procedures. The reviewed source does not contain all these deliverables; this article therefore makes no claim of construction readiness or full compliance.

10. Conclusions

The Satalantepa project proposes a preliminary gas treatment and transportation system consisting of radial gathering, vertical separator C-101, gas metering, degasser D-1, produced-water handling, a flare and a 168 mm, approximately 6 km pipeline. The reported feed gas is methane-rich and contains measurable moisture and potential heavier hydrocarbons, supporting the need for preliminary separation and controlled liquid handling.

For the two hydraulic cases, the reported gas velocities are 8.4–9.5 m/s, below the project criterion of 10 m/s. The project also reports no hydrate formation under the analyzed seasonal conditions. These results support the proposed concept within

the stated design envelope, but detailed design, commissioning and operational monitoring remain necessary. The conclusions presented here are an interpretation of the supplied project document, not an independent engineering approval.

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