

Discussion on Measurement Management Strategies for Natural Gas Stations

Xinting Ma

Shaanxi Oil and Gas Transportation Branch, National Pipeline Network Group Beijing Pipeline Co., Ltd., Yulin 719000, Shaanxi, China

Abstract: Measurement management of natural gas stations is crucial for ensuring gas supply quality and economic benefits. Core measuring equipment such as flow meters and chromatographic analyzers require precise conversion of gas volumetric flow rate to volumetric or mass flow rate under standard reference conditions. The key points of management include energy metering methods, process condition control, metering instrument management, application of ultrasonic flow meters, metering automation, and strengthening inspections. Optimize the measurement process, select high-precision flow meters, integrate automation systems, continuously monitor flow, manage and analyze data, and provide equipment maintenance and operator training to jointly improve measurement accuracy and stability, ensuring safe and efficient operation of the station.

Keywords: Natural Gas Station; Measurement Management; Flowmeter; Automation; Data Management

1. Introduction

With the continuous optimization of the global energy structure and the strengthening of environmental awareness, natural gas, as a clean and efficient energy source, has seen an increasing proportion in energy consumption year by year. As an important node for natural gas transmission and distribution, the accuracy and stability of metering management in natural gas stations directly affect the quality of gas supply, economic benefits, and user satisfaction. Therefore, conducting in-depth research on the metering management of natural gas stations and exploring effective management strategies is of great significance for ensuring the safety and economy of natural gas supply. Measurement

management is an important component of natural gas station operation management, which involves the precise use and maintenance of various measuring equipment and instruments such as flow meters, pressure transmitters, temperature transmitters, flow computers, and chromatographic analyzers. The performance of these devices directly affects the measurement accuracy of natural gas flow, which in turn affects the economic benefits and gas supply stability of the station [1]. Therefore, how to ensure accurate measurement of natural gas flow through scientific measurement management has become the key to natural gas station management.

2. Composition of Natural Gas Station Metering System

In natural gas stations, the metering system consists of a series of professional metering equipment and instruments, with the core components including flow meters and conversion devices equipped with multiple parameter transmitters. A complete measurement system typically includes key components such as flow meters, pressure transmitters, temperature transmitters, flow computers, and chromatographic analyzers for flow meters, their function is to convert the volumetric flow rate in the actual working environment into volumetric or mass flow rate under standard reference conditions, and even energy values. This conversion process depends on the density of the gas in a standard reference state, which can be determined through continuous measurements or calculations based on the specific composition of the gas. Multiple measurements of temperature and pressure are also required to ensure accuracy.

3. Key Points of Metering Management in 2 Natural Gas Stations

3.1 Energy Metering Method

For A-level stations with large daily gas transmission capacity, energy metering mainly relies on online chromatography systems. For B-class stations with relatively stable natural gas composition, regular on-site sampling is usually adopted for energy measurement, or fixed coefficients are set according to standard regulations. For B-class stations with significant changes in natural gas composition, cumulative sampling technology is used to obtain the flow weighted average heat generation through a cumulative sampler, or through remote measurement [2]. C-level stations and civilian and commercial users mainly calculate energy through regular sampling or set fixed coefficients according to standards.

3.2 Control of Process Conditions

The design of the process flow must comply with management regulations. The metering and pressure regulation of natural gas stations mainly adopt the main/backup mode, and the metering branch is generally equipped with a series comparison function. Regular measurement series comparison helps to detect and calibrate anomalies in the process flow in a timely manner. The different positions of backup branches may lead to missed or overcounted situations. The design of instantaneous gas flow rate needs to be based on the specific situation of the equipment. The on-site nameplate of the ultrasonic flowmeter records parameters including maximum and minimum operating flow rates, critical flow rate, etc. Different brands may have different labeling methods, but the critical flow rate is usually 10% of the maximum operating flow rate. If the instantaneous gas flow rate under on-site conditions does not reach the critical flow rate, the flow meter may not operate optimally, affecting the accuracy of measurement.

3.3 Management of Measuring Instruments

A measuring instrument is a device that actually measures the value of natural gas. When selecting a measuring instrument system, it should be scientifically evaluated based on the actual gas supply situation of the station to ensure that the measurement accuracy meets the design requirements, in order to obtain accurate

natural gas flow data and provide data support for the optimization of pipeline gas transmission systems.

3.4 Application of Ultrasonic Flow Meter

Ultrasonic flow meters are highly suitable for gas transmission measurement in large-diameter pipelines due to their high precision and wide measurement range. It is necessary to strengthen management, utilize its advantages to reduce measurement errors, ensure that gas supply flow meets demand, and improve gas transmission efficiency. Choose a suitable ultrasonic flowmeter and select a model with strong corrosion resistance based on the actual situation of natural gas in the gas supply system to extend its service life, reduce the probability of damage, and ensure measurement accuracy [3]. Ensure correct installation, avoid throttling affecting measurement accuracy, and ensure the economic benefits of the system.

3.5 Measurement Automation

To improve the accuracy of measurement, the measurement system should be optimized, and a highly automated measurement system should be selected to avoid large errors affecting the efficiency of the enterprise. According to automation requirements, the flow metering instrument is effectively connected to the SCAD system, and through automated regulation and management, the gas transmission volume meets user needs, peak adjustment is carried out, and the deviation of the metering instrument is avoided from affecting peak shaving accuracy, reducing economic losses [4]. The application of flow transmitters can achieve real-time measurement of natural gas flow, and automatic control systems can adjust gas transmission valves in real time to ensure matching with demand. In the automatic control system, each link needs to be effectively connected. Once a leak occurs, the air valve should be immediately closed to prevent environmental pollution.

3.6 Strengthen Patrols

The execution status of the gas supply plan is an important indicator for evaluating the level of station management. The ultimate goal of metering management is to fully implement the gas supply plan based on compliance with regulations and operating procedures. This

includes developing and implementing inspection systems, switching measurement processes, and applying measurement equipment. In the process switching, follow the principle of opening first and then closing to ensure the orderly execution of the gas supply plan. During inspection, compare and analyze the differences in temperature, pressure, and other indicators of the measuring branch compared to other areas.

4. Optimization Strategies for Metering Management of Natural Gas Stations

4.1 Optimization and Automation Integration of Measuring Equipment

In the operation and management of natural gas stations, metering management is a key link to ensure gas supply quality and economic benefits. It is particularly important to optimize the gas supply metering process based on the specific characteristics of the station. In the optimization process, the first step is to evaluate the existing measuring equipment and select the most suitable flow meter instrument for the station requirements. As the core component of the metering system, the accuracy of the flowmeter directly affects the accuracy of the metering data. Choosing high-precision and high stability flow meters is crucial for improving the level of measurement management. Combining automated control equipment and instruments with flow meters can greatly enhance the automation level of the measurement process. The automation control system can monitor and adjust the gas transmission volume in real time, reduce human operation errors, and improve the accuracy and reliability of measurement. Automated systems can effectively respond to emergencies such as leaks, and ensure the safe and stable operation of gas transmission systems through rapid response mechanisms.

4.2 Traffic Monitoring and Data Management

Continuous monitoring of flow is another key measure to ensure gas supply stability. By real-time analysis of traffic data, abnormal situations in the system can be detected in a timely manner and corresponding peak shaving measures can be taken. Peak shaving processing can not only ensure stable gas supply, but also

flexibly adjust gas transmission volume according to changes in user demand, improving the adaptability and flexibility of the gas supply system. Optimizing the gas supply metering process also includes managing and analyzing metering data. By analyzing historical data, patterns and trends in the measurement process can be discovered, providing a basis for prediction and planning [5]. Through in-depth analysis of measurement data, potential opportunities for energy conservation and consumption reduction can also be identified, providing support for energy conservation, emission reduction, and cost control in the station.

4.3 Equipment Maintenance and Personnel Training

In practical operation, it is necessary to strengthen the maintenance and management of measuring equipment. Regular calibration and maintenance can ensure the long-term stable operation of flow meters and reduce measurement errors caused by equipment failures. Training and assessment of operators are also important links in improving the level of measurement management. Only by ensuring that operators possess professional operational skills and a rigorous work attitude can the accuracy and reliability of the measurement process be guaranteed. Through these measures, the accuracy and stability of gas supply metering can be effectively improved, providing a solid guarantee for the safe and efficient operation of the station. This not only meets the demand of users for gas supply, but also improves the stability and reliability of the entire gas transmission network, contributing to the sustainable development of the natural gas industry [6].

5. Conclusion

With the development of the natural gas industry and the increasing market demand, metering management of natural gas stations has become an important link in ensuring gas supply quality and economic benefits. This article discusses the composition of the natural gas station metering system, key points of metering management, and optimization strategies, emphasizing the core position of precise metering in the operation and management of natural gas stations. Through

in-depth analysis of the selection of measuring equipment, control of process conditions, integration of automation systems, flow monitoring and data management, as well as equipment maintenance and personnel training, this article proposes a series of strategies and suggestions for optimizing measuring management.

Taking into account the high precision and stability of measuring equipment, the real-time monitoring and adjustment capabilities of automation systems, as well as the continuous monitoring and in-depth analysis of measuring data, can effectively improve the measurement management level of natural gas stations. This not only ensures the quality of gas supply and meets user needs, but also improves the stability and reliability of the entire gas transmission network, providing a solid guarantee for the sustainable development of the natural gas industry. In the future, with the continuous advancement and innovation of technology, the metering management of natural gas stations will become more intelligent and automated. By introducing advanced measuring equipment, optimizing process flow, strengthening data analysis, and improving personnel quality, the measurement management of natural gas stations will be more efficient and accurate,

laying a solid foundation for the long-term development of the natural gas industry.

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