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Multiport flow selector optimises oil and gas production testing.

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Introduction

Using multiport flow selectors (MPFS) in oil and gas applications improves production testing and reservoir management. MPFSs facilitate cost-effective and compact selection and diversion of fluids from individual wells for testing, without disrupting the production from all other wells.

Testing of constituent flows is a crucial part of the production process. Oil, water, brine, condensate, gas and other fluids must be monitored and measured regularly. Historically, wells were connected to a complex piping network. One manifold connects all wells to production. A second manifold connects the well selected for testing to a shared multiphase flowmeter or separator plus single phase flowmeter set. While this conventional approach uses common valves, actuators, and piping components – it is more expensive and electrically complex than a multiport system.

Regardless of the test technology, individual well flow must be diverted for testing. Typical onshore oil & gas production has wells scattered over a large area, such that it is not practical manually to open and close the manifold on/off valves. The oil field may be in remote deserts, deep jungles, or in sub-zero environments such that local 24x7 human intervention means additional infrastructure. Any scattered network of wells requires high investment during the greenfield stage of the project and more maintenance during the operation stage. The initial CAPEX and future OPEX has a positive correlation with the spread and accessibility of the field. Consequently, the flow diversion is usually automated.

In offshore fields, it is important for platform equipment to be as light and small as practical so that the platform is less costly to construct, operate, and maintain. Developers are continually looking for technologies that make offshore platforms more economical. Compared with onshore fields, manual operations on remote platforms are more expensive.

Using the conventional approach, all the wells are connected to the common production and test lines. If a well 1 needs to be tested, its flow must be redirected from the production manifold to the test facility manifold while all other wells continue to the production line. This is accomplished by opening and closing the appropriate valves.

Using an MPFS, the complex network of piping can be minimised. Many elements like valves, control points and wiring of the conventional system can be reduced or eliminated as the MPFS directs multiple wells to a single production flow stream and one well into the test system at the same time.

Design

An MPFIS typically has eight inlet and two outlet connections. Seven inlets connect to seven wells, while often the eighth is used as a parking location for the selector plug. This allows for an observation port for temporary maintenance or flushing and allows production of all seven wells if the test system is offline. The internal plug diverts one well's fluid stream to the test port at a time. The plug is rotated to align with the well inlet to be tested. The MPFS test outlet connects to the test system and the group outlet carries the flow of all other wells together to the production header.

Normally the pressure drop across an MPFS is small, as the flow streams are only diverted, not restricted. In some applications, flow velocity will limit the maximum flow or maximum number of connected wells, but this condition is not different from using the conventional dual manifold system.

Operation

An electronic actuator enables easy control and monitoring of the MPFS. Whenever well testing is to be performed, operators simply issue a remote command to position the diverter plug to the desired inlet well. This reduces the chances of manual error in the field which may lead to production downtime and untoward incidents.

Operation can be carried out remotely or locally as an MPFS actuator supports numerous communication protocols. The actuator's display shows which well is under test at any given time. Built-in diagnostics also make sure that issues like control error, motor overload and power loss are resolved immediately.

The MPFS provides an additional advantage in sour oil and gas fields. When high nickel-chromium internal cladding is required, the simplified piping and fewer valves results in a much lower cladding cost.

Conclusion

In a nutshell, an MPFS system compares favourably with conventional manifold systems as detailed in the table.

Well test systems that use MPFSs have significant advantages in construction and operations compared with a traditional conventional manifold system. A single MPFS commonly replaces 14 valves and actuators and significantly reduces piping and wiring. These benefits are larger in offshore and sour field production.

With MPFS, well flow is inherently not interrupted when switching lines for testing. Automation is simplified with a single MPFS actuator and operations and maintenance work hours are reduced, along with the risks related to health, safety, and environmental standards.

Conventional	MPFS
Complex piping arrangement, valves actuators & controls	Simpler piping arrangement with minimum valves
Large number of leak points risking production downtime	Fewer leak points
Occupies more space and has higher weight	Compact system, reduced space and weight
Prone to human error	Reduces human error
Expensive	Economical

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