The M-I SWACO 3-Phase Separator vessel was developed for land frac flowback and well test operations and helps operators understand the performance characteristics of a well efficiently and safely. The separator consists of the vessel, an oil and water flow measuring system that utilizes turbine meters, and electronic gas flow measurement systems with several sampling points. To provide accurate measurements, the vessel is fitted with pneumatic regulators that maintain a constant pressure and a constant liquid level inside the vessel using control valves on the oil, water and gas outlets. The separator is fitted with a removable and serviceable effluent diverter tube, a mist extractor, a vortex breaker and a weir plate. These components reduce the risk of liquids in the gas line (carry over) and gas in the liquid line (carry under), which affect the flow rate measurements. The separator can also accommodate small quantities of sand or solids, disposed of via the trash line. The 3-Phase Separator is built in compliance with ASME VIII, Division 1 and NACE MR-0175 for H2S environments. Its skid can also be designed to SEPCO OPS05 and API RP2A standards.

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APPLICATIONS
The 3-Phase Separator is used for production well testing and frac flowback operations.

PROBLEMS
Not knowing the exact composition and volumes of well effluent can hinder sound economic decisions.

SOLUTIONS
3-Phase Separator effectively separates well effluent into three phases: oil, water and gas, allowing for correct distribution decisions.

ECONOMICS
The durable and easy to maintain 3-Phase Separator provides accurate dissection and measurement of effluent characteristics to facilitate cost-effective choices. Bypass capabilities allow full production to continue during any repairs that may become necessary.

ENVIRONMENTAL
Should the vessel become over-pressurized, multiple safety valves direct flow to a safe and contained area, thus reducing risk to personnel and the environment.

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Should the vessel become over-pressurized, multiple safety valves direct flow to a safe and contained area, thus reducing risk to personnel and the environment.
During the production test, the produced well effluent, including gas and liquids, flows into the inlet of the separator. The diverter tube redirects the flow providing entrainment that allows liquids to settle more readily within the separator. Free gas in the separator passes through a mist extractor that removes any entrained liquids remaining in the gas. Gas continues to percolate out of liquids while sitting in the separator. The gas then flows out of the top of the vessel and through the gas outlet, where it is measured and purged into the atmosphere if the volume is sufficient, or flared. A metal protector plate blocks any spilling liquid from entering and rising through the gas outlet.

Liquids continue to settle, with the oil separating from the water and rising out of solution. A water plate allows the oil to enter the oil chamber while keeping the water in the chamber. The level control valves on both the oil and water outlets allow the operator to control and measure the quantity of fluids removed, to be processed accordingly. Both the water and oil goes through meters to be measured and processed accordingly.

To learn more about the benefits of using a 3-Phase Separator technology, contact your nearest M-I SWACO representative.

### 3-Phase Separator Features

- Available in multiple configurations, sizes, and pressure ratings to meet individual customer needs
- Skid designed for easy transport
- Multiple safety valves to re-direct flow in cases of over pressurization
- Designed to meet all applicable specifications for related services, including API
- Replaceable inlet diverter tube to allow the operator to easily check and replace diverter tube during use
- Bypass capabilities allow operators to maintain production and repairs without having to shut in the well
- Corrugated capabilities of all field pipelines provide options on how to distribute output

### 3-Phase Separator Advantages

- Effectively separates free gas, oil, and water from well effluent
- Unbridled production for maintenance and repairs
- Designed with API in consideration for extended vessel life
- Safe for use in FW environments
- Long operational life
- Easily transportable
- Promotes cost-effective choices
- Environmentally acceptable
- Provides single-phase surface sampling and flow testing over a wide range of flow rates
- Low maintenance design

### General Specifications

- **Equipment Type**: Gas Well Testing 3-Phase Separator
- **Available Sizes**: 30” diameter x 120” seam to seam
- **Minimum Design Temperature**: -20°F (-29º C) on 30”, -10°F (-23º C) on 42”
- **Maximum Design Temperature**: 200°F (93º C) on 30”, 125°F (52º C) on 42”
- **Material of Construction**: SA-516-70
- **Application Standards**: ANSI B31.3 Class M (H2S)

### Mechanical Specifications

- **Inlet**: 4”
- **Outlet**: 4”
- **Size**: 30” and 42”
- **Units**: 30” and 42”
- **Connections**: 30” and 42”

### Performance Specifications

- **Process**: Gas Oil Water
- **Flow Rate**: 1 – 4³/₄ MCF/D, 1 – 4³/₄ BOPD
- **Level and Flow Monitoring**: 30” and 42”
- **Diameter Outlets**: 1” 6” 1” 6” Huber-Yale 1” 6” Huber-Yale
- **Use of Multiple Pressure Safety Valves (PSV)**: 2 – 3” 2 – 3”

### Data for Multiple Pressure Safety Valve

- **Minimum Design Temperature**: -20°F (-29º C) on 30”, -10°F (-23º C) on 42”
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- **Pressure Safety Valve (PSV)**: 2 – 3” 2 – 3”

### Equipment Type

- **Equipment Type**: Gas Well Testing 3-Phase Separator
- **Available Sizes**: 30” diameter x 120” seam to seam
- **Inlet Gas Outlet**: Oil Outlet Water Outlet Trash All
- **Sight Glasses**: Oil and Water Oil and Water
- **Wellhead**: 4” 6” & 4”
- **Clean Outs**: 1 – 4” 2 – 6”
- **Inspection**: 1 – 8”
- **Pressure Safety Valve (FSV)**: 3 – 3”
- **Liquid Level Controls**: 3 at 4” in (external fluid) 3 at 4” in (external fluid)

### Technical Specifications

- **Minimum Design Temperature**: -20°F (-29º C) on 30”, -10°F (-23º C) on 42”
- **Maximum Design Temperature**: 200°F (93º C) on 30”, 125°F (52º C) on 42”
- **Material of Construction**: SA-516-70, A36

### Cost Effective Solutions

- **Use of the M-I SWACO 3-Phase Separator was suggested as part of the high performance 3-Phase Separator increased the separation efficiency of well effluents and processed accordingly. Both the water and oil goes through meters to be measured and processed accordingly.

### Technical Objectives

- **M-I SWACO to successfully deliver and execute a solution that met the client’s specific needs
- **Result**: Use of the M-I SWACO 3-Phase Separator as part of the high-pressure, high-volumes, HPHT environment package allowed M-I SWACO to successfully deliver and execute a solution that met the client’s technical objectives. The design of the high performance 3-Phase Separator increased the separation efficiency of well effluents and processed accordingly. Both the water and oil goes through meters to be measured and processed accordingly. Both the water and oil goes through meters to be measured and processed accordingly.

### Conclusion

The results:

- **Use of the M-I SWACO 3-Phase Separator as part of the high-pressure, high-volumes, HPHT environment package allowed M-I SWACO to successfully deliver and execute a solution that met the client’s technical objectives. The design of the high performance 3-Phase Separator increased the separation efficiency of well effluents and processed accordingly. Both the water and oil goes through meters to be measured and processed accordingly. Both the water and oil goes through meters to be measured and processed accordingly. Both the water and oil goes through meters to be measured and processed accordingly. Both the water and oil goes through meters to be measured and processed accordingly.

### Key Highlights

- **Hpht sour gas application:**
- **Success story:**
- **Technical Objectives:**
- **Result:**
The M-I SWACO 3-Phase Separator is a technically advanced instrumented vessel designed to efficiently separate well effluent into three phases: oil, water and gas. This vessel was developed for land frac flowback and well test operations and helps operators understand the performance characteristics of a well efficiently and safely. The separator consists of the vessel, an oil and water flow measuring system that utilizes turbine meters, and electronic gas flow measurement systems with several sampling points. To provide accurate measurements, the vessel is fitted with pneumatic regulators that maintain a constant pressure and a constant liquid level inside the vessel using control valves on the oil, water and gas outlets. The separator is fitted with a removable and serviceable effluent diverter tube, a mist extractor, a vortex breaker and a weir plate. These components reduce the risk of liquids in the gas line (carry over) and gas in the liquid line (carry under), which affect the flow rate measurements. The separator can also accommodate small quantities of sand or solids, disposed of via the trash line. The 3-Phase Separator is built in compliance with ASME VIII, Division 1 and NACE MR-0175 for H2S environments. Its skid can also be designed to SEPCO OPS05 and API RP2A standards.

APPLICATIONS
The 3-Phase Separator is used for production well testing and frac flowback operations.

PROSPECTS
Not knowing the exact composition and volume of well effluent can hinder sound economic decisions.

SOLUTIONS
During well testing, the M-I SWACO 3-Phase Separator effectively separates well effluent into three phases: oil, water and gas, allowing for correct distribution decisions.

ECONOMICS
The durable and easy-to-maintain 3-Phase Separator provides accurate dissection and measurement of effluent characteristics to facilitate cost-effective choices. Bypass capabilities allow full production to continue during any repairs that may become necessary.

ENVIRONMENTAL
Should the vessel become overpressurized, multiple safety valves direct flow to a safe and contained area, thus reducing risk to personnel and the environment.

ACCURATE, SAFE SEPARATION AND MEASUREMENT OF OIL, GAS AND WATER FROM WELL EFFLUENT

The separator is fitted with a removable and serviceable effluent diverter tube, a mist extractor, a vortex breaker and a weir plate. These components reduce the risk of liquids in the gas line (carry over) and gas in the liquid line (carry under), which affect the flow rate measurements. The separator can also accommodate small quantities of sand or solids, disposed of via the trash line.

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Texas: 3-Phase Separator shines in HPHT sour gas application

The situation
A major operator in the Haynesville Shale required a robust, hostile service equipment package to handle high-temperature (HPHT) sour gas application against vessel over-pressurization and exposure to H2S gas. In addition, the 3-Phase Separator was suggested as part of the high-pressure, high-volume, high-temperature (HPHT) production test equipment package for a high-pressure, high-volume HPHT sour gas application.

The solution
After analyzing the customer’s requirements, M-I SWACO suggested a service delivery plan comprising a 108 psi working pressure equipment package that included its field-proven 3-Phase Separator. The 48-in. 1440 psi NACE 3-Phase Separator was suggested as part of a package. Critical to this operation was the capability of the separator to deliver longer retention times for better separation and the incorporation of multiple pressure relief valves to protect personnel and the environment against vessel over-pressurization.

The results
Use of the M-I SWACO 3-Phase Separator as part of the high-pressure, high-temperature, H2S environment package allowed M-I SWACO to successfully deliver and execute a solution that met the client’s technical objectives. The design of this high performance 3-Phase Separator increased the capacity to deliver at a rate of 7,000 bbl/day. With no zero production time (HPT) related to the separators, the overall equipment package allowed the customer to process the produced gas, producing greater than 20 MMcf/day of gas, with water rates exceeding 5,000 bbl/day.
Features
- Available in multiple configurations, sizes, and pressure ratings to meet individual customer needs
- Skid mounted for easy transport
- Designed to meet all applicable specifications for lethal service, including H2S
- Material of construction - SA516-70, SA516-70, A572 GR-50, A500 GR-B, A500 GR-B, A500 GR-B
- Pressure Safety Valve (PSV) - 2 – 3”
- Washout – Outlet Head - 1 – 6” Huber-Yale
- Washout – Inlet Head - 1 – 6” Huber-Yale, 1 – 6” Huber-Yale
- Liquid Level Controls - 2 sets of 2” (external floats)
- Sight Glasses - Oil and Water, Oil and Water
- Meter Run(s) - 4” 6” & 4”
- Clean Outs - 1 – 4” 2 – 6”
- Inspection - 1 – 8”
- Manway - None 1 – 18”
- Drag Skid 42” diameter x 180” seam to seam
- Nozzles SA-105, SA-350-LF2
- Elliptical Heads SA-516-70
- Shell SA-516-70
- NACE MR0175 (structural components)
- Available Sizes - 30” diameter x 120” seam to seam
- 42” diameter x 144” seam to seam
- Minimum Design Temperature - -20º F (-29º C) on 30”, -10º F (-23º C) on 42”
- Maximum Design Temperature - 200º F (93º C) on 30”, 125º F (52º C) on 42”
- Pressure (MAWP)- 1440 psig on 42” vessel, 2000 psig on 30” vessel

Advantages
- Effectively separates free gas, oil, and water from well effluent
- Uninterrupted production for maintenance and repairs
- Designed with 1/8-in. corrosion allowance for extended vessel life
- Allows for easy transitions in pressure and flow rates
- Easily transportable
- Promotes cost-effective choices
- Environmentally acceptable
- Provides single-phase surface sampling and flow metering over a wide range of flow rates
- Low maintenance design

Liquids continue to settle, with the oil separating from the water and rising out of the separator. A water plate blocks any spilling liquid from separating and rising through the gas outlet.

During the production test, the produced well effluent, including gas, oil, and liquids, flows into the inlet of the separator. Drift and entrainment flows through the top of the vessel and through the gas outlet, where it is measured and put in the sales line if the volume is commercially sufficient, or flared. A metal protector plate blocks any spilling liquid from separating and rising through the gas outlet.

Straightforward operation from beginning to end

3-Phase Separators

Equipment Type - Gas Well Testing 3-Phase Separator

Available Sizes - 30” diameter x 120” seam to seam

Minimum Allowable Working Pressure (MAP)- 1440 psig on 42” vessel, 2000 psig on 30” vessel

Maximum Design Temperature - 200º F (93º C) on 30”, 125º F (52º C) on 42”

Material of Construction - SA516-70

Applicable Standards - API 12J

3-Phase Separator

Success story

The situation

A major operator in the Haynesville Shale required a reliable reliable service equipment package that could withstand the high-temperature (HPHT) and the incorporation of multiple pressure relief valves to protect personnel and the environment against vessel over-pressure. The separator was designed to meet the operator’s needs for effective gas well testing in an H2S environment.

The situation

To address the customer’s requirements, M-I SWACO recommended a service delivery plan comprising a 105 psi working pressure equipment package that included its field-proven 3-Phase Separator. The 42” and 40 psi M-I SWACO 3-Phase Separator was selected as part of a package. Critical to this operation was the capacity of the separator to deliver longer retention times for better separation and the incorporation of multiple pressure relief valves to protect personnel and the environment against vessel over-pressure.

The results

Use of the M-I SWACO 3-Phase Separator as part of the high-pressure, high-temperature, H2S environment package allowed M-I SWACO to successfully deliver and execute a solution that met the client’s technical objectives. The design of the high performance 3-Phase Separator increased the capacity of the separator to deliver improved separation efficiency and the use of multiple pressure relief valves to protect personnel and the environment against vessel over-pressure.

The situation

The operator was facing a production test of a gas well in an H2S environment. As part of the high-pressure, high-temperature, H2S environment package, M-I SWACO successfully delivered and executed a solution that met the client’s technical objectives. The design of the high-performance 3-Phase Separator increased the capacity of the separator to deliver improved separation efficiency and the use of multiple pressure relief valves to protect personnel and the environment against vessel over-pressure.

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The operator was facing a production test of a gas well in an H2S environment. As part of the high-pressure, high-temperature, H2S environment package, M-I SWACO successfully delivered and executed a solution that met the client’s technical objectives. The design of the high-performance 3-Phase Separator increased the capacity of the separator to deliver improved separation efficiency and the use of multiple pressure relief valves to protect personnel and the environment against vessel over-pressure. The 3-Phase Separator shines in HPHT sour gas application.

To learn more about the benefits of using our 3-Phase Separator technology, contact your nearest M-I SWACO representative.
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Accurate, safe separation and measurement of oil, gas and water from well effluent

Applications

The 3-Phase Separator is used for production well testing and frac flowback operations.

Proving

Knowing the exact composition and volume of well effluent can hinder sound economic decisions.

Solutions

During well testing, the M-I SWACO 3-Phase Separator effectively separates well effluent into three phases: oil, water and gas, allowing for correct distribution decisions.

Economics

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Environmental

Should the vessel become overpressurized, multiple safety valves direct flow to a safe and contained area, thus reducing risk to personnel and the environment.

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