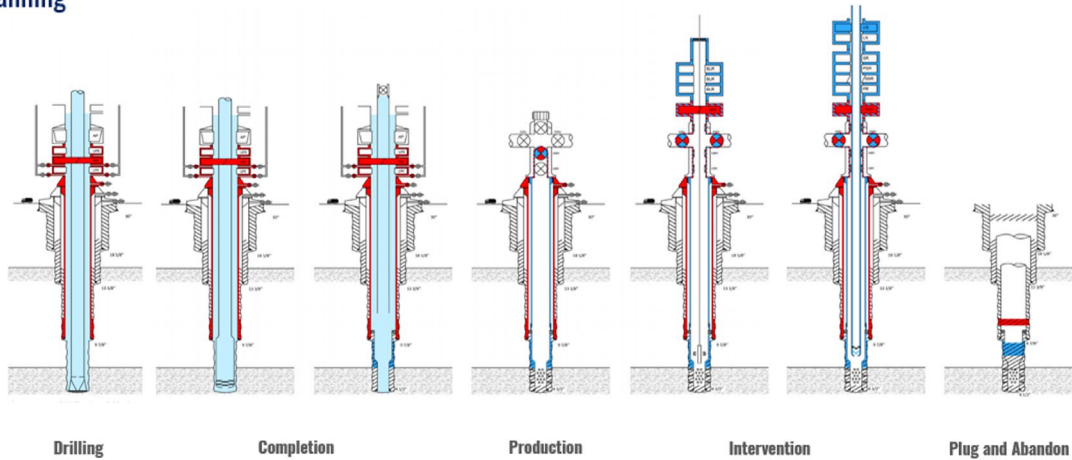


Wellbarrier Integrity Management



Understand and mitigate any well integrity risks throughout the well life cycle

Wellbarrier Planning



Wellbarrier Integrity Management

The Wellbarrier well integrity life cycle solution provides operators with a comprehensive, data-based life cycle perspective through its Wellbarrier Planning and Wellbarrier Integrity Management products.



A digital framework for managing well integrity throughout the well life cycle



Aligned with industry standards and best practices



Using the barrier definition to objectively determine risk



Single data repository and intuitive interface enable proactive collaboration.

Applications

- Data consolidated and enriched throughout the life cycle of the well
- Well Barrier Schematics prepared in minutes rather than hours and ensure stakeholders have a clear and common understanding of the barriers safeguarding the operation
- Objectively, systematically, and proactively manage risk and remedial action planning
- Qualifying and monitoring well barrier performance to ensure consistent understanding among multidisciplinary teams
- Consolidate and analyze data to proactively manage risk and optimize well integrity performance.

How to improve well integrity

Wellbarrier* Integrity Management is a product of the digital wellbarrier solution that provides an overview of well data from the construction phase through the operating phase, including the status of the elements safeguarding the well. The data are displayed on intuitive dashboards and reported to stakeholders to support collaborative decision making.

How it works

To ensure that all stakeholders have a clear and common understanding of risk throughout the well life cycle, the Wellbarrier well integrity life cycle solution is founded on the well barrier definition and comprises the elements and envelopes that contain hydrocarbons and pressure in the well. A consistent and structured approach to well integrity is ensured by following the robust, integrated methodology of the well integrity value chain, which spans the sequence of data collection, barrier definition, element verification, risk assessment, monitoring, and reporting.













The Wellbarrier solution consists of the following:

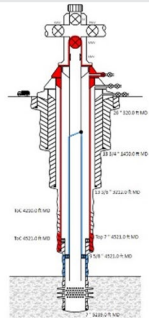
- **Wellbarrier Planning** supports decision making during planning operations and safeguards the execution of well activities.
- **Wellbarrier Integrity Management** provides a structured framework to proactively manage well integrity.

Wellbarrier Integrity Management

Both Wellbarrier Planning and Wellbarrier Integrity Management share the following five Wellbarrier solution features.





SECTION TYPE	HOLE		CASING	
	Size inch	Size inch	MD m	TVD m
Conductor	24.000	18.750	100.00	100.00
Surface casing	17.500	13.375	1200.00	1170.00
Production casing	12.250	9.625	2400.00	1900.00
Production liner	8.500	5.500	3600.00	2900.00

 Open well editor	 Downhole safety valve
 Casing cement	 Annulus safety valve
 Wellhead	 Storm choke
 Subsea tubing hanger	 Straddle
 High pressure riser	 Gas lift valve
 Reservoir section	 Chemical injection valve



Primary barrier elements			
Element	Qualification	Monitoring	
Downhole safety valve (121 150D)	Inflow test to sea psi	Tubing pressure	● ●
Tubing	Pressure tested to 5000 psi	A-annulus pressure	● ●
Production packer (3220 955D)	Pressure tested to 5000 psi	A-annulus pressure	● ●
Production liner cement	Logged interval 400-24	B-annulus pressure	● ●
Secondary barrier elements			
Element	Qualification	Monitoring	
Surface riser tree	Pressure tested to 3000 psi	Periodic testing	● ●
Spot wellhead B right access valve	Pressure tested to 5000 psi	External observation	● ●
Spot wellhead B	Pressure tested to 5000 psi	External observation	● ●
Casing hanger	Pressure tested to 5000 psi	A-annulus pressure	● ●
Production casing	Pressure tested to 3000 psi	B-annulus pressure	● ●
Production casing cement	IT tested to 3000 psi	B-annulus pressure	● ●
Healthy well, no or minor issue			

BARRIER ELEMENT	FAILURE MODE	P _r	CONSEQUENCE	C _r	R _r	MITIGATION	L _r	R _r	L _r	R _r
Downhole safety valve (3000 150D)	Burst	3	Containment by other technical barrier	1	None	None	0	1	1	1
	Collapse	1	Containment by other technical barrier	1	None	None	0	1	1	1
	Corrosion	2	Containment by other technical barrier	1	None	None	0	2	2	2
	Erosion	1	Containment by other technical barrier	1	None	None	0	1	1	1
	Leaking valve (3rd API test)	3	Containment by other technical barrier	1	None	None	0	3	3	3
Tubing	Burst	3	Containment by other technical barrier	1	None	None	0	3	3	3
	Collapse	2	Containment by other technical barrier	1	None	None	0	2	2	2
	Corrosion	2	Containment by other technical barrier	1	None	None	0	2	2	2
	Erosion	1	Containment by other technical barrier	1	None	None	0	1	1	1
	Leaking thread	1	Containment by other technical barrier	1	None	None	0	1	1	1
Wellhead	External impact	3	Full flow leak to atmosphere	5	15	Install physical collision barriers around wellhead	2	5	10	15
	Leaking connector seal	1	Small leak (fitting/jacking/Flange)	4	4	None	0	4	4	4
	Substage	1	Full flow leak to atmosphere	5	5	None	0	5	5	5
Casing hanger	Leaking sack-off seal	3	Containment by other technical barrier	1	None	None	0	3	3	3
Production casing		0		0	0		0	0	0	0
Production casing cement		0		0	0		0	0	0	0
Normalized risk index								14		35

Date Raised	Observation Title	Component	Source
05-Aug-21	LMV Failure	 Lower master valve (LMV)	Monitoring
01-Aug-21	Ran wireline and detected degraded tubing	 4 1/2" Tubing	Manual
29-Jul-21	Leak in SSSV	 Downhole safety valve (150 ftMD)	Monitoring
01-Aug-20	Bleed down pressure	 A Annulus	Manual

Well Data Integration

Defines the hole and casing configuration, completion components, reservoir sections, blowout preventer (BOP) configuration, and other well status information. Domain specialists can share, track, and augment data in real time. Built-in quality assurance continuously improves the data's richness and accuracy.

Illustrations

Quickly generates illustrations using intuitive drag-and-drop functionality to represent the well at any stage of its life cycle, enabling the creation of consistent and accurate illustrations in minutes.

Well Barrier Schematic

Conveys how the well activity should be safeguarded through easy-to-read schematics and summary tables of how to qualify and monitor the defined well barrier elements. The well barrier schematic is the foundation of the solution.

Risk Assessment

Enables performing objective failure mode effect and criticality analysis (FMECA) risk assessments for the well or specific operations. Systematic evaluation of failure modes and consequences supports understanding the risks and specifying mitigating measures to limit them.

Well Integrity Anomalies Tracking

Provides an overview of well integrity incidents identified during the well's construction and lifetime. This feature is used to assign actions to colleagues, set deadlines, and take corrective action.

Wellbarrier Integrity Management

Wellbarrier Integrity Management provides the following modules. These are closely aligned with legislative requirements and industry best practices and help provide a robust framework to manage well integrity. The data is then displayed on intuitive dashboards and reported to stakeholders to support collaborative decision making.



ASSET NO	DESCRIPTION	TOP MID (m)	LENGTH MID (m)	TOP TVD (m)	ID (inch)	OD (inch)	DRIFT ID (inch)	BURST (bar)	COLLAPSE (bar)
08	Tubing hanger mono bore 3.500inch	24.00	5.00	24.00	2.992	5.500	2.867	10160.0	10530.0
	Tubing 3.500inch 9.2# N80 MTC	29.00	150.00	29.00	2.992	3.500	2.867	10160.0	10530.0
07	Downhole safety valve 3.500inch	179.00	7.50	179.00	2.992	4.000	2.867	10160.0	10530.0
	Tubing 3.500inch 9.2# N80 MTC	186.50	150.00	186.50	2.992	3.500	2.867	10160.0	10530.0
06	Gas lift valve 3.500inch	336.50	7.00	320.00	2.992	4.000	2.867	10160.0	10530.0
	Tubing 3.500inch 9.2# N80 MTC	343.50	600.00	325.00	2.992	3.500	2.867	10160.0	10530.0
05	Downhole gauge 3.500inch	943.50	7.00	905.00	2.992	4.000	2.867	10160.0	10530.0
	Tubing 3.500inch 9.2# N80 MTC	950.50	200.00	905.50	2.992	3.500	2.867	10160.0	10530.0
04	Chemical injection valve 3.500inch	1150.50	7.00	975.00	2.992	4.000	2.867	10160.0	10530.0
	Tubing 3.500inch 9.2# N80 MTC	1157.50	50.00	976.00	2.992	3.500	2.867	10160.0	10530.0

Completion Diagram and MAASP

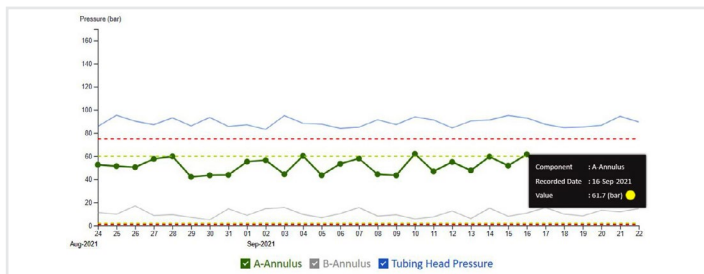
Generate well completion diagrams using well configuration data descriptions entered into the application. Accurate completion diagrams, together with detailed assembly drawings, can then be created, incorporating additional data if necessary. The completion diagram can be used as part of operation planning to maintain control over depth, ID, OD, and drift diameter. Th

The maximum allowable annulus surface pressure (MAASP) calculator is based on the well integrity lifecycle governance calculations defined in ISO 16530-1 and used to determine the greatest pressure that the annulus can contain as measured at the wellhead and without compromising the integrity of any components in the annulus.

PRESSURE TEST	Test date	Test pressure	
		Criteria (psi)	Recorded (psi)
Wellhead	01-Feb-2004	5000	5000
18 3/4" Surface casing	01-Feb-2004	5000	5000
9 5/8" Production casing	01-Feb-2004	5000	5000
9 5/8" Production casing hanger seals	01-Feb-2004	5000	5000
5" Tubing	01-Feb-2004	5000	5000
INFLOW TEST	Test date	Leak rate	
		Criteria (psi)	Recorded (psi)
Downhole safety valve (1000 ftMD)	01-Feb-2004	5000	0

Qualification

Provides a comprehensive overview of the tests that were performed on the well components when they were originally installed.



Monitoring

Monitors the annulus and tubing pressure and temperature. Results can be compared against acceptance criteria to verify the component integrity. These are the principal parameters used to determine the condition of many of the well components. Previous test results are also available for comparison to enable analysis of historic trends. Documents (e.g., test charts) can be uploaded as supporting evidence.



Insights

Customizes data to display multiple views for individual wells and a high-level summary at field, country, or company level. The dashboards are closely aligned with the well integrity value chain and show well data, well barriers, well categorization, qualification, risk assessments, monitoring, and usage (the latter for administrators).

Industry recognized

The Wellbarrier user community comprises more than 5,000 registered users across 51 countries worldwide. They are using the Wellbarrier solution's user-friendly and intuitive digital tool to efficiently and effectively prepare more than 95,000 barrier schematics to bring them unique, reliable insight to safeguarding their well integrity.

slb.com/wellbarrier

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