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Executive Summary

Why Halliburton...

Operators and drilling contractors want to reduce capital expenditures and operational costs. They are looking for reliability, innovation, and operational integrity. How are these qualities from a particular supplier of goods or services determined? They are determined by looking at the record of accomplishment, at capabilities, and at capacity.

Halliburton began operations in 1919 as an oil field service company when Erle Palmer Halliburton began using engineering methods to develop better ways to cement oil wells, and, in 1924, Mr. Halliburton’s invention of the JET™ mixer transformed the company and the industry by providing greater efficiency and effectiveness. From that time through the present, Halliburton has been committed to delivering maximum value through wellbore stabilization, displacement, and lost-circulation/ fluids migration remedies. Pumping and mixing services, supported by Halliburton’s state-of-the-art onshore and offshore cementing equipment, are industry standards; and Halliburton continues to lead the industry in providing reliable casing equipment and services.

With nearly 72,000 employees in approximately 80 countries, the company serves the upstream oil and gas industry throughout the life cycle of the reservoir, from locating hydrocarbons and managing geological data, to drilling and formation evaluation, well construction and completion, and optimizing the production life of the field. Halliburton’s structure is unique among its competitors in that it has integrated its oilfield product and service lines. Halliburton’s structure provides the flexibility to react quickly to customer needs, provide total solutions to problems, and to provide customers access to all of Halliburton’s services through one contact point.

To deliver long-term zonal isolation in extreme conditions anywhere in the world, Halliburton extensively trains service-delivery personnel and designs, manufactures, and operates fleets of land and offshore cementing pumping and mixing units, along with associated support equipment, to pump a wide and varied range of cements, including Halliburton’s Tuned™ cementing systems. Halliburton supports both its products and services with the largest oilwell cementing technology organization in the industry. Recognized as leaders in cementing technology, Halliburton scientific and engineering teams continue to develop better ways to accomplish clients’ goals today and for the future.

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Technology

Halliburton operates major research facilities in Texas, India, and Brazil. The facility in Texas is Halliburton’s largest technology center with a focus on chemistry, sensor physics, and electronics, and the center of excellence for casing equipment. The center in Brazil was established for collaborative projects with leading Brazilian universities and customer research centers for solving subsurface challenges. The center in Pune supports fluids chemistry and engineers, fluids delivery systems, and reservoir knowledge.

Representing universities worldwide and numerous educational disciplines, Halliburton’s research and development (R&D) personnel use the latest research methods and testing technology to find solutions for the energy industry. For instance, the Duncan Technology Center contains a full shop complex with numerous large-scale testing setups, including four data monitoring high pressure and temperature controlled test bays. A 5,000-ft well simulates actual well conditions in testing prototype and existing equipment. Research and development activities include both destructive and nondestructive testing. Questions are answered and problems are solved for a wide variety of customers, ranging from single-well operators to research departments of major companies. Halliburton’s Technology Center clients also include Halliburton field personnel and the Halliburton research and development community.

To ensure a continuing flow of information and expertise, Halliburton R&D personnel continually develop liaison partnerships and joint research projects with operating companies, universities, technical institutions, technical societies, and national laboratories. The information gleaned and developed by Halliburton is shared with the industry through improved products and services, technical presentations, and trade journal articles.

Halliburton currently holds more than 4,000 patents worldwide for its technology. Throughout the decades of the Intellectual Property Owner’s Association reporting of the top organizations granted patents in the United States annually, Halliburton has been routinely among the top 150 organizations granted patents in the United States.

Quality

Halliburton’s dedication to quality originates at all levels of management and continues through domestic and international field operations. Halliburton maintains specific procedures for manufacturing, appraising, and testing products to provide customers a level of quality and service that meets or exceeds their requirements.

Halliburton also designs quality programs to meet or exceed the requirements of International Quality Standards. Several certifying authorities and customers have recognized and approved Halliburton’s quality programs as having met the requirements of the ISO 9001:2008 and/or API Q1. To maintain this recognition, these certifying authorities perform regular audits of Halliburton facilities to ensure compliance is maintained. Halliburton’s future quality plans include certification of its casing equipment manufacturing to the new API specification Q1 standard.

People Development and Training

Workforce development is a critical issue at Halliburton. With a workforce of more than 72,000 located in all of the major energy regions of the world, people development is an important component of the company’s sustaining development strategies.
People development is the primary responsibility of Training and Development (T&D) with a global staff representing each operation area. T&D administers and operates more than 10 global Training Centers, which deliver many programs including: workforce competency for all product lines, curriculum development support, as well as Health, Safety, and Environment (HSE) requirements.

The Halliburton Training Center in Duncan, Oklahoma conducts classes on the Cementing Product Service Line (including Casing Equipment). These facilities also arrange and conduct customer training specific to Halliburton products and services as well as industry practices.

Halliburton personnel development is competency based. T&D aligns learning activities with the knowledge and skills requirements of the student while mentors impart proper behaviors and application abilities in an operational environment. Thus, Halliburton focuses instruction on what employees must do in their job role and how to do it safely, effectively, and repeatedly. The practical application of acquired knowledge, skills, and behavior are the keys to successful performance.

Safety and the Environment

The ZERO program is striving to instill in each employee the realization that ZERO incidents is achievable in all areas of safety, environmental, and service quality performance.

At Halliburton, a focus on health, safety, and the environment will not be compromised for better business results. Halliburton understands its commitment to safety will minimize the impact on the environment, control risks to employees, and maintain safe work practices. This commitment provides a focus so that every Halliburton employee takes personal ownership of their own safety and the safety of others.

Halliburton’s Performance Improvement Initiative, a commitment to performance in service quality, health and safety, and the environment, has evolved into the ZERO program. ZERO was implemented in 2011 and drives to reduce safety incidents, environmental incidents, and nonproductive time, with a goal of ZERO: ZERO health and safety incidents. ZERO environmental incidents. ZERO nonproductive time.

Throughout the past decade, Halliburton has intensified focus on how safety practices impact safety statistics. Although the rig count has mostly risen throughout the years, Halliburton’s safety record has steadily improved through a program that instills in employees a mentality and culture that Zero is achievable in all areas of safety, environmental, and service quality performance.

Casing Equipment

Halliburton’s Cementing Casing Equipment strategy is to be the industry leader by delivering reliable and innovative cased-well integrity solutions. Matching casing equipment with its world class cementing material and services, along with a finely tuned engineered job design, Halliburton will deliver a faster casing placement and more successful long-term zonal isolation in today’s very challenging drilling environments. Halliburton’s Casing Equipment Solutions can satisfy customer’s needs—from shallow, straight hole applications, to deepwater, horizontal completions—by providing a single product or an array of products and services to deliver a quality job and a lasting engineered cementing solution.

Halliburton designs, builds, or contracts for casing equipment under stringent requirements that yield the same level of service and quality that customers expect from its cementing operations in the exploration and production of oil, natural gas, and geothermal resources from the time a well is drilled until the producing formation is depleted.

Since patenting the two plug system in 1922, Halliburton has continuously improved cementing methods and developed new techniques and casing equipment products.

Halliburton provides casing equipment to assist lowering costs and improving cementing success under all conditions, from shallow surface or conductor strings with Trophy Seal® floating equipment, to the deepest and hottest production casings and liners with Super Seal II® floating equipment. Halliburton developed the line of High Wiping Efficiency (HWE®) cementing plugs using breakthroughs in materials and mechanical design.

Halliburton’s casing equipment continues to deliver new innovations and commercializations, such as the industry award winning SuperFill™ surge reduction system, the all
composite, PDC drillable SSR-II™ subsurface release plug system, the HPUJ (High Port Up-Jet) float shoes, and the TRT (Tubing Release Tool).

Halliburton is recognized for its quality equipment and its economical methods of solving complex problems that arise in the oil, gas, and geothermal industry. The organization’s staff of design and project engineers coordinates complex design requirements—from the customer’s specifications through the manufacturing process—to deliver fit-for-purpose products that meet all levels of product certification for use on critical land and offshore well installations.

Manufacturing

Halliburton maintains top quality and state-of-the art manufacturing equipment including laser-, water-, and plasma-cutters, robotic welders, and numeric-controlled turning and milling equipment. The capabilities are unlimited for building standard and custom design casing equipment to fit any customer’s special well designs.

Halliburton manufactures casing equipment at its facility located in Johor, Malaysia. This facility has obtained the International Organization for Standardization (ISO) certifications of ISO 9001:2008 and ISO/TS 29001 for quality management. This certification signifies that this facility’s business processes are well-defined, consistent, and focused on continuously improving operational excellence.

In 2013, Halliburton added a facility in Houston, Texas dedicated to casing equipment. This facility works under certifications of ISO 9001:2008 and is submitting for ISO/TS 29001 approval.

This facility not only expands Halliburton’s manufacturing and distribution capabilities, but also incorporates research and development as well as customer service and support to create efficiencies for customers.
Halliburton is the only company that integrates cementing services and casing equipment on a global basis to increase the delivery of value to the customer. Wellbore architecture integrity is critically important to environmental sustainability and community interests so it is regulated by governing authorities around the world. Casing equipment contributes to wellbore architecture integrity by helping operators to run and land casing to depth and to achieve proper cement placement, including full coverage, lift of the cement to the intended top of cement, and a hydraulic annular seal to protect the producing zone.
Floating Equipment

Casing Equipment Materials

- Standard case material grade is API grade K-55 (suitable for \( \text{H}_2\text{S} \) service at all temperatures).
- Additional material grades readily available are L-80, P-110, and Q-125, from 4 1/2- through 13 3/8-in. equipment.
- For other premium material grades, 4140 is heat treated to match the strength of the desired material.
- Float equipment supplied for large-diameter casing (20 in. and larger) can be supplied with X-52 or X-56 material as specified in API Specification 5L.
- Other material grades, including exotic alloys, are available upon request.

Available Threads

API standard threads are cut in-house as are numerous selected premium threads up to certain sizes. Other premium and custom threading can be supplied and cut through Halliburton’s extensive vendor base.

Ordering Information

When ordering casing equipment, please consider the following details when providing well information to Halliburton’s sales and order representatives.

- Casing size
- Hole size
- Minimum ID restriction(s) of wellbore the casing will have to pass through.
- Connection or thread type
- Casing weight
- Casing grade
- Super Seal II* valve size or Trophy Seal* collar and/or shoe.
- Standard or non-rotating plug seat.
- Single or double valve
- Standard sealing sleeve or sealing sleeve with latchdown plug.
- Expected well pressures or any special pressure requirements needed.
- Plugs to be selective-release or subsurface release.
- Expected bottomhole circulating temperature (BHCT).
- Target depth of the well.
- Directional or deviated hole (Is directional information available?).
- Expected mud weights
- Expected pump rates and amount of fluids to be pumped (including circulating).
- Any expected hole problems when running casing (fill, swelling, LC, faults, etc.).

When ordering casing attachments, please provide the above and the following additional information:

- Threaded and coupled pipe or flush joint (external upset).
- Long thread and coupling or short thread and coupling collars.
- Whether casing will be rotated or reciprocated during cementing.
- Whether centralizers will be installed around limit clamps or casing collars.
- Whether set screw attachments will work on this grade of pipe.

HALLIBURTON’s Newest Cementing Unit in Use During a Primary Cementing Job

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Trophy Seal® Float Shoes and Collars

If proven performance is desired within a specific range of low temperatures and pressures and standard threading applies, why pay more than necessary? The Trophy Seal® line of float shoes and collars builds on the proven quality of Halliburton’s Super Seal II® line of floating equipment to deliver the dependability one has come to expect from Halliburton. Halliburton has engineered the Trophy Seal line of floating equipment to meet non-critical and shallow well needs.

Features
- API RP 10F IA rating.
- PDC drillable
- Tested to 1,500 psi at 250°F (121°C) and 2,500 psi at 150°F (66°C).
- Float collars and shoes available in 8rd and buttress. Also available in slip joint float shoes.
- Available in K55 stock only.
- Optional autofill kit available on request and sold separately.

Super Seal II® Float Shoes and Collars

The energy industry demands maximum performance from floating equipment under any conditions—shallow wells, deep wells, extreme temperature and pressure ranges, sour gas, and abrasive flow resistance. Super Seal II equipment is designed to perform reliably under the most severe downhole conditions. In fact, the Super Seal II valve, contained in all Super Seal II floating equipment, is certified by Lloyd’s Register to meet API RP 10F Category IIIC specifications. Category III requires the device to withstand a 24-hour flow of 10 bbl/min with a 2 to 4% sand laden 12.0 to 12.5 lb/gal mud. Category C requires the device to withstand a 5,000-psi backpressure or an 80% casing burst pressure (whichever is smaller) after an 8-hour, 400°F (204°C) heat soak. And, Super Seal II equipment provides economic benefits and performance features that allow custom design of the cementing string to specific requirements. The Super Seal II valve is the heart of many of Halliburton’s other float equipment assemblies.

Features
- Collar or shoe
- Standard and/or premium material grades.
- API or premium threads
- 2 1/4-in. valve in 2 7/8- through 4-in. equipment.
- 2 3/4-in. valve in 4 1/2-in. equipment and larger.
- 4 1/4-in. valve in 7-in. equipment and larger.
- Single- or double-valve options in collars and shoes.
- Sealing sleeve for inner-string cementing operations with or without latchdown plug.
- Down-jet and high-port up-jet float shoes.
- Non-rotating (NR) in 7- through 20-in. equipment.
- Tapered and offset tapered composite or aluminum noses.
- Centralized float shoes and collars.
- Reamer shoes with tapered composite or aluminum noses.
Standard Super Seal II® and Trophy Seal® shoes and collars come with short pins and long box ends to fit any style of API 8rd threads. Long thread box ends will accept short or long API threads.

**Super Seal II® Long Thread and Coupling Float Collars**

The long thread and coupling (LTC) option includes standard Super Seal II (K-55 grade) float collars with long thread pins and long end boxes. Standard Super Seal II collars come with short thread pins.

**Features**
- Can be made special order for any casing grade or premium thread.
- Allows for longer shoe joints with higher integrity.
- Available in sizes 4 1/2 in. to 9 5/8 in.
- Available in 2 3/4 and 4 1/4 valve configurations.

**Super Seal II Equipment Variations**

**Super Seal II Down-Jet Float Shoe**

In addition to the center hole through the float valve, there are four fluid ports located below the float valve in the side of the float shoe case body to help increase hole cleaning efficiency.

**Features**
- Ports force circulation flow in a downward jetting action.
- Increases cement bonding at shoe and reduces the chances of a wet shoe.
- Helps remove tough filter cake and cuttings.
- Resistant to plugging by providing alternate flow path should the shoe of casing become landed on target depth.

**Super Seal II Non-Rotating (NR) Float Collars and Shoes**

Super Seal II non-rotating (NR) float collars are equipped with a non-rotating plug seat to aid in faster drillout. Float shoes with non-rotating seats can be provided upon special request.

**Features**
- Designed to be used with non-rotating plug sets with locking teeth.

**Super Seal II High-Port Up-Jet Float Shoe**

Super Seal II high-port up-jet float shoe jets formation face to remove detrimental mudcake and cuttings for improved hole cleaning efficiency.

**Features**
- Six fluid discharge ports strategically located to jet circulation fluid upward.
- 40% fluid flow through the bottom of the shoe and 60% through the side ports upward.
- Allows for easier removal of bridges and jetting out fill on bottom of wellbore.
- Aids with easier removal of cave-in debris or packing above the float shoe when reciprocating.
Super Seal II® Double Valve Floating Equipment

Super Seal II double valve floating equipment offers a double valve float design built into one case body.

Features

- More economical than a float shoe and a float collar.
- Double valve helps ensure a backpressure seal in case one valve is damaged by wellbore fluids.
- Available in 2 3/4 and 4 1/4 valve designs.
- Design is available to combine with other equipment options, such as inner-string, non-rotating, and high-port up-jet (HPUJ).

Super Seal II Tubing Size Floating Equipment

The tubing size floating equipment offers the same Super Seal II equipment performance for tubing applications.

Features

- Available in standard and HPUJ designs.
- Prevents cement or well fluids backflow from entering the tubing.
- Because of size restrictions, autofill is not available on tubing equipment.
- Standard case material is L-80, with other grades available on request.
- Tubing size equipment should be drilled out with roller cone rock bits.
Special Nose Options for Severe Wellbore Conditions

**Tapered and Offset Tapered Noses**

Tapered and offset tapered noses help casing pass severe ledges, obstructions, high angles, and previous sidetracks. These noses also help protect the float valves from being damaged from debris while running in the hole.

**Features**

- Enables a one trip to bottom target depth casing run.
- With the high-port up-jet (HPUJ) or down-jet nose, cement bonding can be improved to jet wellbore clean, and to aid in circulating past tight spots.
- Available on all Super Seal II® equipment.
- Available in aluminum (PDC drillable) and composite material (PDC drillable).
- Available in standard design, HPUJ, and down-jet configurations.
- "Enclosed" down-jet option is available with molded plastic nose, which passes 60% of flow through the nose and 40% through the down-jet ports.

**Tapered Offset Noses Allow for Better Travel in Deviated Hole Sections**

**Tapered Down-Jet Nose Options in Composite**

**HAL24846**

**HAL31500**

**HAL31502**

Tapered Offset Noses Allow for Better Travel in Deviated Hole Sections
Centralized Float Shoes and Collars

The centralized float shoes and collars act as a built-in rigid centralizer to provide minimum stand-off at shoe and collar.

Features

- Fluid restrictions at the vanes also help produce turbulence at the shoe and/or collar.
- Available on all Super Seal II® equipment.
- Vane attachments are normally designed 1/8 to 1/4 in. smaller than drilled hole size.
- Can be supplied for any casing or hole size.
Reamer Shoes

Reamer shoes remove bridges or wellbore obstructions caused by formation swelling, unconsolidated formations, and caving and faulting conditions. Halliburton reamer shoes are available in straight vane (SV) and spiral vane (RPT) designs.

Features

- Equipped with a Cut-Rite carbide cutting material structure to help eliminate any obstructions and to keep from having to pull casing to make another wiper run by assuring near gauge hole when running casing.
- A tapered composite nose is standard with high-port up-jet and down-jet nose options to help jet away filter cake and low side debris in horizontal and deviated wellbores.
- For use with and without rotation.
- Manufactured with a Super Seal II float system (2 3/4 valve up to 7 in. and 4 1/4 valve in 7 in. and larger are standard with single and double valve options).
- Specially built to fit any casing and hole size combinations.
- PDC drillable
- Reamer shoes are equipped standard with an enclosed down-jet nose, aggressive cutting structure.
- Supplied in a P-110 casing grade.
- Built to 1/8 under gauge hole.
Life of the Well Float Equipment/
Float Equipment for Cementless Completions

Swell Technology systems are developing more applications for non-cemented liners, and in some cases, utilizing Swellpacker® systems for zonal isolation. In non-cemented installations, the float shoe and/or float collar are required to maintain pressure integrity between the formation and the liner for an extended period of time. Standard cementing float shoes (and collars) are designed for cementing operations only and are not designed to perform for extended time periods. Halliburton has developed special float equipment specifically for non-cemented applications where life of the well performance is required. Life of the well equipment is designed with metallic valves and seats to withstand the formation pressures and temperatures expected in non-cemented applications.

Specially Designed Float Shoes and Float Collars for Cementless Completions

Features

- Available as a system that includes double valve collars, double valve shoe, and a latchdown landing collar and latchdown plug.
- Design based on field-proven poppet valve integrity.
- Rated at 10,000-psi working pressure at 400°F (204°C).
- Durable 6-bbl/min flow rating with weighted fluids.
- Extensive fluid compatibility
- Can be packaged as a complete kit, which includes:
  - Landing collar;
  - Double valve float shoe and float collar;
  - Latch down plug with 10,000 psi working pressure differential.

Note: This equipment is non-drillable.
High-Pressure/High-Temperature (HP/HT) Float Equipment

Halliburton engineered designs—with field and lab tested performance—offer float equipment that has been built to perform reliably in the harshest downhole environments for use on tough cementing jobs under a full range of unusual conditions, including deep wells, high pressures, and high temperatures above 400°F (204°C).

**High-Temperature Float Shoes and Float Collars**

**Features**
- Based on Super Seal II® poppet valve design.
- Uses aluminum valve and valve seat for stable hydraulic seal at elevated temperatures.
- Successfully used above 450°F.
- Designed with PDC drillable material.

**Super Seal II® MR Valve Float Equipment (Mechanically Retained)**

At a time when the global demand for oil and gas is on the rise, the industry is faced with meeting that demand by overcoming increasingly difficult challenges. Recovering hydrocarbon from new discoveries requires innovative solutions to overcome challenges, such as ultra-high temperature, to make drilling and production monetarily viable.

The Halliburton Cementing product service line is dedicated to making drilling and production economically viable. One of the ways that is exemplified is through Halliburton’s casing equipment technology.

The SPE E&P glossary states that high temperature is where the undisturbed bottom hole temperature (at prospective reservoir depth or total depth) is greater than 300°F (150°C). At 500°F (260°C), ultra high temperature, the undisturbed bottomhole temperature exceeds the capabilities of most standard floating equipment.

Halliburton has designed a cementing float valve that can work in ultra-high-temperature well environments. Using the field proven technology of the Super Seal II® poppet valve engineering, Halliburton offers float valve options to meet 500°F (260°C) wells with valves capable of holding pressure of up to 10,000 psi (68.9 MPa).

The unique design feature of the high-temperature aluminum Super Seal II® MR poppet valve is a mechanically retained sealing element custom molded for the target environment. The MR case body includes a sealed valve seat, which increases pressure ratings at higher temperatures.

**Applications**
- High-temperature well environments up to 500°F (260°C).
- High differential pressures under higher temperatures after landing displacement plugs.
- Long strings
- Geothermal wells
Benefits

• Float equipment check valve offers cased well integrity in Ultra HP/HT well environments.
• Expands the opportunity to drill wells at deeper and higher temperatures with quality float equipment to support the well designs.
• Provides shoe joint integrity

Features

• Mechanically retained sealing element custom molded for the target environment.
• Poppet valve, valve stem, and valve body are made from high-grade, temperature-resistant aluminum.
• Aluminum valve components allow for higher material strengths at higher temperatures and pressures.
• Same flow areas and flow rates as Super Seal II float valves.
• Rated up to 500°F (260°C).
• Available in 2 1/4-, 2 3/4-, and 4 1/4-in. valve designs.
• Available in most casing grades and casing thread combinations.
• Available for tubing and casing sizes 2 7/8 through 13 3/8 in.
• Available in matched float shoe and float collar designs.
• Aluminum tapered and offset tapered aluminum noses available as float shoe nose options.
• Double valve available in 7-in. and larger casing sizes.
• O-ring seal in valve seat allows for pressure seal not reliant on just the concrete bond.
• Auto-fill capability as an option.
• PDC drillable
• Based on field proven Super Seal II poppet valve design.

PDF™ Pressure Differential Fill Equipment

Halliburton PDF™ pressure differential fill float equipment permits fluid entry into the casing through the bottom to maintain a controlled differential pressure between the inside and outside of the casing being run in the hole. In addition to providing casing fill-up, it helps protect formations from destructive high “ram effect” surge pressures as the casing is run.

PDF Float Shoes and Float Collars

Features

• Available in shoe and collar and can both be run in the same string, if required.
• Reliable autofill with casing circulation at any time, multiple times, during pipe running procedures.
• Has a ball drop deactivation autofill feature. After the ball passes the float valve, the PDF flapper closes against its seat, preventing wellbore fluids or cement from reentering the casing string.
• Standard 150-psi differential float valve spring. If more than one PDF valve is run, the psi is cumulative.
• Maintains a constant fluid height inside the casing.
• PDF equipment is not PDC drillable and should not be used on wellbores with greater than 30° deviation.
High-Strength Float Equipment

High-strength float equipment is for use when high pressures are applied to test casing to a higher than normal pressure after landing cement plugs on the float collar after a primary cementing job.

High-Strength Float Collars

Features
- Available in non-rotating collar design.
- Commonly available in sizes 9 5/8, 10 3/4, and 13 3/8 in.
- Must be used with high-strength, non-rotating plug sets.
- Longer case bodies with different internal tooling for higher pressure integrity.
- Additional cement volume with reinforced plug landing structures.

Insert Float Valve Equipment

Insert Float Valve (IFV)

This economical float valve is used for casing flotation and cementing operations in wells with moderate temperature (200°F/93°C) and depth. These valves are primarily designed for use in shallow wells with low bottomhole temperatures and expected low backpressures after plug landing. It can be used with differential pressures up to the collapse pressure of the lightest weight of J-55 casing in the casing size in which it is run.

Features
- Aluminum flapper-type backpressure float valve with autofill capability.
- Installed between pin and box ends of API 8rd (long or short) or buttress casing.
- A weighted ball dropped from surface deactivates the fill-up assembly by shearing out the installed plastic fill-up tube.
- Fill-up assembly kits (ball and tube) are sold separately.
- Not recommended for wells with over 30° deviation if used with auto fill-up tubes.

Insert Float Collars and Shoes

Insert float collars and shoes are an economical one-piece solution using an integral API threaded body having an aluminum flapper-type backpressure float valve with autofill capability.

Features
- For use in shallow wells with low bottomhole temperatures and expected low backpressures (less than 2,500 psi) after plug landing.
- Valve assembly is made primarily of aluminum.
- A weighted ball dropped from surface deactivates the fill-up assembly by shearing out the installed plastic fill-up tube.
- Fill-up assembly kits (ball and tube) are sold separately.
- Not recommended for wells with over 30° deviation if used with auto fill-up tubes.
- Available in sizes 4 1/2 in. and 5 1/2 in. only and with 8rd thread as standard design.
- IFV collars and shoes can be made special order to fit any type casing grade or thread type on request.
Ball Guide

A ball guide should be used with the insert self fill-up float valve in 8 5/8 in. and larger OD casing sizes when hole deviation exists. In these larger sizes, a ball guide will aid the tripping ball to seat for discharging the orifice tube from the float valve.

Advantage™ IPV Insert Poppet Valve

The economical poppet-style insert float assembly prevents cement flowback, provides greater erosion resistance, and faster drillout than conventional insert float equipment.

Features

- Contains 60% less aluminum than insert flapper valve assemblies and is PDC drillable.
- Flow tested with abrasive, sand-laden fluids for 24 hours.
- Uses Super Seal II® valve technology.
- Auto fill-up capabilities
- Installed in casing collar between two pin ends.
- Made for API thread couplings.

EZ Float™ Valve Assembly

The EZ Float™ valve assembly is a wireline deployed poppet type float valve that can be installed after the casing/liner has been run to total depth (TD), hung off, or landed. Primarily designed for casing-while-drilling applications where typical float equipment does not have the flow capacity to survive the entire drilling process.

Features

- Can be placed in the casing string when and where desired.
- Allows for cementing operations with an effective backpressure valve and seal.
- Uses the same Halliburton proven tool technology of the EZ Drill® cementing retainer coupled with a Super Seal II valve.
- Can be used in conjunction with casing while drilling operations.
- This equipment is not made of drillable materials.
Halliburton Insert Style Float Equipment: Advantage™ IPV (Left) and Insert Float Valve with Fill-Up Kit (Right)

Pressure Differential Fill Valve Cutaway View with Deactivation Ball

Stacked Double Flapper Valve Design with Deactivation Ball in Place

Deactivation Ball in Place to Slide Sleeve in Order to Release Upper Flapper and Deactivate Fill-Up Adapters
Pressure Testing of Float Valves Before Installation on Casing

The Super Seal II® float equipment family of products has been expanded to include field testing capabilities of certain float valve assemblies for operators who require pre-job confirmation of equipment integrity. The new capabilities available build on knowledge and experience gained from operating globally and in the most severe well conditions.

For operators who plan on pre-testing float assemblies before running in hole (RIH) with Super Seal II float equipment, the float shoe and float collar can be manufactured with special external thread and seal capabilities to incorporate the specially designed test fixtures.

Note-These items are built to order by special request. This equipment incorporates two unique features that are not incorporated in standard Super Seal II floating equipment.

Features

• Internal seal plate described in U.S. Patent 5,472,053 (Leakproof Floating Apparatus and Method for Fabricating Said Apparatus). The internal seal plate enables cementing float equipment to be pressure tested successfully with clean fluids that would normally flow through the porous and permeable cement used to mechanically retain the valve assembly in the steel case.

• External thread and seal feature that allows a test cap to be attached to the float assemblies so post-production testing can be performed. The test cap is size-dependent and is reusable.

The combination of the seal plate, Super Seal II valve, external thread, and seal, together combine discrete technologies that provide user friendly post-production test operations for operators who request such capabilities.

The ability to pressure test float equipment before being installed onto the casing provides the necessary verification for operators to proceed with planned difficult casing running operations through possible trouble zones.

Specially designed float equipment that allows post-production pressure-testing operations to be performed has been proven to provide a viable method of mitigating unfavorable well conditions while running casing.
Inner-String Cementing Equipment

Inner-string float equipment allows large diameter casing strings to be cemented through the drillpipe or tubing that is stung into and/or sealed into the float shoe or float collar. It provides the following advantages.

- Economical alternative for cementing large casing compared to conventional methods.
- Helps eliminate the need for large diameter cementing plugs or heads.
- Helps reduce cement contamination.
- Helps reduce the amount of cement that has to be drilled out of large-diameter casing.
- Helps decrease cementing displacement time.
- Helps reduce risk of casing collapse when a surface pack-off is used.
- Sealing adapters available to perform cementing through conventional float shoes and collars.
Super Seal II® Inner-String Float Shoes and Float Collars

Features

- Inner-string float equipment available in shoe or collar designs, utilizing Super Seal II® valves.
- Available in three methods of operation:
  - Method 1 – Stab-in adapter with o-ring seals for stinging into sealing sleeve receptacle. Allows physical insertion into float valve sleeve assembly and provides an effective seal in more slightly deviated wells.
  - Method 2 – Stab-in with latchdown plug has the same adapter with o-ring seals for stinging into sealing sleeve receptacle. It also allows physical insertion into float valve sleeve assembly but offers a latchdown inner-string wiper plug.
  - Method 3 – Flat face sealing adapter for use with standard Super Seal II float shoes and collars. Enables an effective seal by applying work string weight with the adapter to form a seal to the float valve landing surface of the float equipment. Works best in straight and shallow hole conditions. Allows the ability to decide to cement inner-string or conventional at the last minute.
- Available in double float valve configurations and available in 2 3/4 and 4 1/4 valve sizes.
- Drillpipe centralizers are recommended to help centralize the drillpipe on or into sealing surfaces.

METHOD TYPE 1

METHOD TYPE 2

METHOD TYPE 3
Extended Sealing Sleeve (ESS) Inner-String Cementing Equipment

The methods and equipment used to place cementitious fluids in the annulus have evolved significantly throughout the last several decades. One specific area where significant changes in placement methods and equipment have occurred is offshore environment; specifically, cementing operations from mobile offshore drilling units (MODUs). The benefits of traditional inner-string cementing (ISC) methods have not been available to operations in rough seas from floating platforms where the ocean swells exceed the capabilities of the compensators on the rig. As such, new equipment designs are necessary to enable use of the ICS method from MODUs operating in rough seas. It can be less costly than cementing large casing using the conventional plug-displacement method.

Super Seal II® ESS Inner-String Float Collars

Features
- ESS Inner-string float equipment available in collar designs use Super Seal II® valve technologies.
- Used in cementing operations on floaters where rough seas are problematic to conventional ICS cementing.
- Reduces surge and swab effects.
- Allows ISC from a floater with additional 60-in. stroke length and maintains a stab-in seal.

Engineered Float Collar for ESS Adapter

Engineered Float Collar with ESS Adapter Fully Inserted

Engineered Float Collar with ESS Adapter Floating with Ocean Swell while Maintaining Hydraulic Sealing Engagement with Float Collar
Super Seal II® Load-Carrying Float Equipment

Load-carrying float equipment is special high-strength inner-string cementing equipment designed to transfer casing weight to the drillpipe through the float equipment.

Super Seal II® Load-Carrying Float Shoe and Float Collar

Features

- Equipment has internally threaded receptacle that can be connected to drillpipe through a connector.
- Can support a casing load of 400,000 lb.
- Works on cementing subsurface scab liners and large diameter casings.
- Allows pipe reciprocation during cementing.
- Available in shoe and collar styles utilizing Super Seal II® valve designs.
- Not recommended for drillout with PDC bits.
- Inner-string and load-carrying drillpipe adapters are available from local Halliburton field locations as rental items. They are also available for purchase.
- Drillpipe centralizers and limit clamps, to aid in guiding stab-in and load-carrying adapters, are available for most drillpipe and casing combinations.

Halliburton Cementing Crew Running a Job Involving Float Equipment
Reverse Cementing Float Equipment

Halliburton’s reverse cementing float valve assemblies are downhole backpressure valves designed to allow complete well control while running casing. The valves are designed to allow cementing operations through the casing and up the annulus as is performed in standard operations. The well can also be cemented with reverse cementing operations (cement pumped down the annulus with well fluid returned up the casing) by tool activation or additional tool operation procedures.

Double Flapper Stab-In System

This versatile float valve system is used for casing flotation and cementing operations in wells that are planned to be reverse cemented. The system is primarily designed for use in shallow wells with low bottomhole temperatures and expected low backpressures after the stinger is pulled from the float assembly. Job execution is performed similar to an inner-string cementing procedure.
Features

- Well can be circulated conventionally while running casing procedures and at target depth (TD).
- Equipment features double aluminum flapper type backpressure float valves.
- Halliburton double flapper valves are engineered into a single float shoe or float collar application.
- Stinger sub allows flow up the drillpipe or tubing during reverse circulation and cementing.
- If desired, reverse cementing operations can be performed until returns are seen at surface. Then by unstinging from the valve assembly, the valves close and cement equalized inside casing and drillpipe/tubing can be reversed out, or circulated out the long way, to clear the inside of the newly cemented casing string.
- Equipment is not designed for auto fill and casing must be filled from surface.
- Equipment is not recommended for drillout with PDC bits.
- The stinger assembly should be centralized with tubing/drillpipe centralizers and limit clamps. These items are available separately.

Poppet Valve Pump Out System

The pump out valve assembly can be activated by landing a ball on the valve and shearing the valve from the collar, allowing a full bore through the collar. The well can be cemented with the reverse cementing operations (cement pumped down the annulus with well fluid returned up the casing). The backpressure valve and ball will fall into the rat hole below the shoe joint. Once cement placement is complete, surface pressure must be held on the casing while the cement sets.

Features

- Well can be circulated conventionally while running casing procedures and at target depth.
- Allows cementing operations to be conducted in either the standard or reverse method after the casing has been landed.
- Equipment features the reliability of our Trophy Seal® float valve assembly combined with our dependable shear pin sleeve mechanism.
- Shear out pressures can be tailored for job design.
- Discharged valve is designed to fall in mud weights as heavy as 13.8 ppg. Weight can be added to the assembly for heavier mud weights to help ensure valve does not flow back up into the casing.
- Equipment is PDC drillable.
- A standard full opening guide shoe must be run with this assembly.
- Equipment can be set for auto fill.
Casing Equipment Installation Aids

Pipe Dope

Pipe dope is used to help prevent galling while the joints are made up in a casing string. Halliburton sells and is a provider of Bestolife® thread compounds. Bestolife Corporation (Dallas, Texas) is the manufacturer of Bestolife® Products and is recognized as a leader in thread compounds.

Features

- Most thread dopes are inert to chemical attack and stable up to 600°F.
- Most pipe dopes are lead and zinc-free and are also excellent for preventing corrosion of casing stored in the casing yard.
- Halliburton offers a variety of container sizes and brushes for easy application of pipe dope.
- All Bestolife® products listed below conform with ISO 13678 and API RP-5A3 guideline.

**Bestolife® Pipe Dope and Accessories**

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Bestolife® Thread Cleaner

Bestolife® Green Clean breakthrough all-purpose cleaner/degreaser is designed with high-quality materials to remove grease, wax, and other contaminants from many surfaces. Upon request, Halliburton can provide Bestolife® pipe thread cleaner products to use with Halliburton casing equipment.

Features

Bestolife Green Clean cleaner/degreaser is biodegradable, hydrocarbon-free, and is safe to the environment. Its formula is nonflammable, nontoxic, and noncorrosive. It contains a low-suds surfactant for easy removal of residue.

Bestolife® Thread Cleaner / Degreaser

<table>
<thead>
<tr>
<th>SAP Number</th>
<th>Product</th>
<th>Type</th>
<th>Container</th>
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</thead>
<tbody>
<tr>
<td>102299359</td>
<td>Green Clean</td>
<td>Cleaner degreaser</td>
<td>Quart spray bottle, 4 per case</td>
</tr>
<tr>
<td>102299361</td>
<td>Green Clean</td>
<td>Cleaner degreaser</td>
<td>Gallon refill containers, 4 per case</td>
</tr>
</tbody>
</table>

Halliburton Weld A™ Thread Locking Compound

Halliburton Weld A™ thread compound has proved superior to tack welding as an aid for locking threaded connections tightly and permanently on any casing string, saving time and money.

Features

- Each kit contains one can of Halliburton Weld A thread-locking compound, one vial of hardener, and one applicator.
- Each kit will lock the number of joints indicated.

<table>
<thead>
<tr>
<th>Casing Size, in.</th>
<th>Number of Joints</th>
</tr>
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<tbody>
<tr>
<td>4 1/2 to 5 1/2</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>7 5/8 to 9 5/8</td>
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</table>

<table>
<thead>
<tr>
<th>Product Temp., °F</th>
<th>Working Time, min.</th>
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</thead>
<tbody>
<tr>
<td>60</td>
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<td>75</td>
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<td>80</td>
<td>110</td>
</tr>
<tr>
<td>90</td>
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</table>

Running Casing, the Beginning Phase of Primary Cementing
Guide and Casing Shoes

Guide shoes are attached to the lower most end of the casing string to provide a low-cost method of enabling the casing to pass ledges or obstructions in the wellbore and aid with bit re-entry. Halliburton offers several guide shoe styles for varying customer requirements.

Casing shoes are also available as a means of reinforcing the bottom joint of the casing. The casing shoe allows the casing to be worked through swelled zones without fear of causing damage to the casing.

Any size casing grade material and thread type can be made on a special-order basis on all guide and casing shoes.

Standard Guide Shoes

Features
- Protects the casing string from the impact associated with landing casing on bottom.
- Directs casing away from ledges, reducing the chance of sidewall cave-in.
- Helps casing pass through narrow, deviated holes and areas with hard shoulders.
- Provides a re-entry angle to help ensure bits and other bottomhole assembly (BHA) hardware are able to enter the casing during tripping operations.
- Has large diameter hole through the center of the shoe, allowing for maximum cement pumping rates and passage of autofill tubes and deactivation balls.
- Noses available in cement and plastic designs.
- PDC drillable.

Down-Jet Guide Shoes

Features
- Down-jet guide shoes have additional side ports in the steel case that allow fluids to discharge through both the cement nose and the ports.
- 80% of the fluid flow is through the nose opening and 20% is through the side ports.
- The jetting action of the fluid pumped through these ports helps remove wellbore cuttings and filter cake.
- Creates turbulence around the shoe to help improve cement distribution and casing to formation bonding for a strong shoe cement job.
- The external jets provide an alternate flow path if the bottom center port becomes blocked in the event the casing is landed at target depth (TD).
- PDC drillable
Standard Casing Shoes

Features

- A standard casing shoe is a steel reinforcing collar installed on the bottom joint of the casing string.
- The shoe prevents casing abrasion or distortion as casing is forced past obstructions on the wall of the borehole.
- The bottom of a standard casing shoe is tapered to the ID to allow drill bits used to drill deeper after setting casing to easily re-enter the casing.

Tiger Tooth™ (Texas Pattern) Casing Shoes

Features

- This casing shoe helps solve a major problem that plagues certain casing running programs. The problem occurs as a result of formation swelling into the wellbore, which reduces the wellbore ID to below gauge diameter.
- The Texas Pattern casing shoe is saw-cut to produce teeth on the bottom of the shoe, which might be necessary while running casing in the hole.
- The casing can be rotated slowly to cut past obstructions in the borehole.
Halliburton Manufactures Guide and Casing Shoes to Fit a Variety of Applications.
Cementing Wiper Plugs

Halliburton cementing plugs are designed for use with Halliburton cementing heads and float equipment. Halliburton cementing plugs, regardless of the plug type, should be used with caution when used with competitors’ plug containers or float equipment because competitors’ cementing heads can cause the cementing plugs to be released prematurely or the plugs could fail to hold pressure when the top plug lands on the float collar. Additionally, competitors’ plugs should be used with caution with Halliburton plug containers or float equipment for the same reasons.

HWE® High Wiping Efficiency Cementing Plugs

The HWE® top and bottom cementing plugs are designed to help improve wiping efficiency during cementing operations. The wipers of the HWE plug are a deep-cup design, which provides greater wiping efficiency to remove mudcake, mud film, rust, and mill scale.

Features
- The deep pocket wiper cups are slightly energized from pumping pressure to aid maximum casing wall contact.
- The bottom plug is supplied with a 750-psi rupture disk that helps ensure the plug reaches the float collar and can be more effective in shallower wells to give an indication at surface that it has landed at the float valve.
- The rupture disk design on the bottom plug allows for a larger unrestricted opening, which is more capable of handling lost circulation materials.
- Because of its rubber molding, the HWE plug can be run in water-based (WBM), oil-based (OBM), and synthetic-based mud (SBM) systems.
- New rubber and phenolic plastic designs offer increased drillout benefits with smaller debris, tighter gripping, and easier drillout than standard five wiper plugs.
- HWE plugs are drillable with PDC and roller cone bits.
- HWE plugs are suitable for up to 400°F (204°C).
- The top plug is black; the bottom plug is orange.
- Available for use in combination casing string.

Five Wiper Cementing Plugs

Halliburton’s standard five wiper plug is designed to provide fluid separation during displacement and wiping efficiency for wiping wellbore casing and tubulars clean of drilling mud, spacers, and cement. They provide excellent protection from over displacement and an indicator when displacement is complete.

The plugs act as a seal on top of the float collar to allow pressure testing of casing after plug landing. They provide a means of fluid separation during the cementing process.

Features
- In all types of five wiper cementing plugs, the top cup of the top cementing plug is a deep-cup design that provides improved wiping efficiency.
- The top plug is black; the bottom plug is orange or red.
- Standard five wiper plugs are available for WBM, OBM, and SBM systems.
- Available for casing and tubing sizes (2 3/8 to 20 in.), not all styles available for tubing.
- Temperature rating is 400°F (204°C)
- Available top and bottom plastic insert bodies
- Top and bottom aluminum body inserts are available in certain sizes. They are not recommended for drillout with PDC bits.
- The standard five wiper plug should not be used with float valve equipment with a tapered top (i.e., inner-string equipment with sealing sleeve).
- Bottom plugs have a 350-psi rupturable diaphragm.
Non-Rotating (NR) Five Wiper Cementing Plugs

Top and bottom non-rotating (NR) plugs have added locking teeth that help prevent the equipment from spinning during drillout, which can reduce drillout times and associated rig costs.

Features

- Designed for use with Super Seal II® NR float collars.
- The high-strength plastic inserts used in NR plugs increase plug-landing pressures and allow easy drillout with both PDC and roller-cone rock bits.
- NR plugs are only available in casing sizes from 7 to 20 in.
- All NR plugs are made of a synthetic service compound that is compatible with all WBM, OBM, and SBM systems.

High-Strength Non-Rotating Five Wiper Cementing Plugs

Five wiper high-strength NR cementing plugs can be used with high-strength float collars to pressure test casing immediately after primary cementing operations are completed, and the wiper plug has been landed.

Features

- Allow for a higher applied pressure than normal plug sets.
- Available only in sizes 9 5/8, 10 3/4, 11 3/4, and 13 3/8 in.
- Must be used with high-strength NR float collars.

SSR® Subsurface Release Five Wiper Cementing Plug Systems

With the SSR® subsurface release cementing plug system, cementing operations can be performed from a floating vessel or fixed platform that uses a subsea wellhead. The SSR cementing plug set is installed in the top joint of the casing string and is made up to the bottom of an installation tool that is attached to the casing string. The installation tool and casing string are lowered on a drillpipe string, landed, and sealed in the subsea wellhead on the ocean floor.
Features

• These plugs can also be used on land rigs for use on liner jobs and other subsurface primary cementing applications.
• The SSR® top plug is available for running below a retrievable packer to separate the cement slurry and displacing fluid during a squeeze cementing job.
• The well can be circulated with the SSR plug system in place before cementing operations.
• Plugs are operated and released with wiper darts and/or releasing balls.

SSR-II™ Subsurface Release II Cementing Plug Systems

The new SSR-II™ plug set is used to remotely release cementing plugs at a selected subsurface depth. This plug set consists of composite inner mandrels connected to the plugs, which are then released as a result of establishing positive pressure to shear pins holding the sleeves in place.

Features

• The plug set is made of composite material, which helps improve drillability, thus helping save costs during operation.
  – Essentially no metallic components.
  – A 13-well case study with a 17-minute drillout time on a two-plug system compared to an industry average of 94 minutes.
• Uses highly efficient HWE® cement wiper plug design.
• Currently available in 9 5/8 through 20 in.
• Multiple plug system options:
  – Top plug only;
  – Top and bottom plug;
  – Top plug and two bottom plugs available in the following sizes: 9 5/8 in., 9 5/8- × 10 3/4-in. combo, and 13 3/8 in.
• Features positive foam wiper darts for release of two cementing plugs:
  – A phenolic ball is used to drop the very bottom plug on a three-plug system;
  – Wiper darts are available for a variety of drillpipe designs and sizes.
  – Applicable with WBM, OBM, and SBM systems.
  – SSR plug sets are available in the following styles:
    – Single plug (top plug only) or dual plug (top and bottom plug);
    – Plastic or aluminum insert body;
    – Non-rotating combinations;
    – Combination casing size plug sets.
  – Field proven technology from previous equipment designs, the single collet release mechanism (SCRM) offers greater reliability of releasing darts.
  – A single foam dart size used for 4 1/2 through 6 5/8-in. drillpipe range.
  – Noticeable plug releasing and bypassing pressure indications.
  – Rated at 300°F and flow tested at 20 bbl/min for 24 hours.
  – 75% greater flow area than standard SSR plug sets.

Other tool operating accessories include:

Multi-chamber Top-drive Cementing Head

• Halliburton Commander™ 1000 or the Commander™ 500 Top-Drive Cementing Head (recommended) [Note: more information about this product is available in the “Surface Circulating Equipment” section];
• Or, a specifically designed rental cementing head item designed to use with multiple wiper darts and releasing balls.
  – Available with at least two or three (two darts and one ball) chamber designs.
  – A remote control kit accessory option is also available for either cementing head option.

Foam Dart Loading Kit

Required for use to compress foam darts for safe loading without damage to dart integrity.

TP Swivel Equalizer Isolator Sub

• Defines and equalizes the volume of annular fluid that might be trapped between the SSR plugs and the isolator.
• Equalizes pressure above the isolator into the drillpipe.
• Allows the running tool to be turned (swiveled) during makeup.
• Eliminates the need to run additional equalizer valves in tapered landing strings.

**Landing Collar and Bypass Baffle**  
*(not required with single plug system)*

• Installed in the casing string to allow a multiple plug landing and provide a released mandrel catching system.
• Keeps the float valves from being damaged from released mandrels.

### SSR-II™ Subsurface Release II Cementing Plug Systems

- **SSR-II™ Top Plug Only System**
- **SSR-II™ Top and Bottom Plug System**
- **SSR-II™ System with Three-Plug System**
- **Top Plug Releasing Foam Dart**
- **Bottom Plug Releasing Foam Dart**
- **Landing Collar**
- **TP Swivel Isolator Assembly**
- **Bypass Baffle**
- **Dart for top plug only**
- **Dart for bottom plug only**
- **Releasing Ball for First Bottom Plug on Three-Plug System**
Tubing Latchdown Plugs

Halliburton’s tubing wiper plugs aid effective fluid displacement and wiping efficiency in tubing strings during cementing or other well-related operations.

Features

- The wipers of these plugs are of a resilient ball (Omega™ plug style) and/or a five wiper design, which provide greater wiping efficiency to remove mudcake, mud film, rust, and mill scale. The five wiper version is available in multiple plug configurations.
- The latching snap ring mechanism of the plug, used with the aluminum or cast iron insert latching baffle, also aids as a backpressure check valve when cementing.
- This equipment is generally not PDC drillable.
- Tubing latchdown plugs are available in three styles:
  - Omega latchdown;
  - Omega five wiper latchdown;
  - Straight five wiper latchdown.
- Combination style with increased wiping efficiency and displacement reliability.
  - Multi-stacked five wiper plug design.
  - Standard five wiper efficiency only multiplied.
- Compatible with OBM, SBM, and WBM systems.
- These plugs are rated at 400°F (204°C) at 5,000 psi differential in either direction, unless otherwise stipulated by engineering.
Casing Latchdown Plugs

A casing latchdown plug and baffle can be used above most conventional floating equipment to help control fluid and pressure from below. Preventing fluid entry into the casing string can help allow release of surface pressure immediately after the cement column has been pumped into place.

Features

- If the plug is properly latched into a latch ring in the baffle, the latchdown feature helps prevent the cement or top plug from moving back up the casing.
- The latching baffle is typically installed one to two joints above the guide or float shoe.
- A casing latchdown plug can be used in place of a float collar when the casing does not need to be floated in the hole.
- Casing latchdown plugs can be of two types:
  - Multiple-stage cementer (MSC) plug with a latchdown nose;
  - MSC with Omega™ plug or ball plug ball design is also available;
  - Finned wiper type plugs with a latchdown nose.
- Available in three and five wiper, and Omega™ plug combo designs.
- Compatible with WBM, OBM, and SBM systems.
- The latching baffles are cast iron, which makes this equipment not recommended for use with PDC bits.
- These plugs are rated at 400°F (204°C) at 2,500 psi differential in either direction, unless otherwise stipulated by engineering.
The Omega™ HWE® cementing plug combines the wiping technology of two designs (HWE plug + Omega ball) to achieve maximum wiping capabilities to help maximize casing wall cleaning and reduce the amount of cement fill on top of the plug after displacement.

**Features**

- The wipers of the HWE plug are a deep-cup design, which provides greater wiping efficiency to remove mudcake, mud film, rust, and mill scale. The Omega plug or ball plug ball provides maximum surface contact as a secondary wiper mechanism.
- The deep pocket wiper cups are slightly energized from pumping pressure to aid maximum casing wall contact.
- These plugs are available in top plug only.
- Because of its rubber molding, the Omega HWE plug can be run in WBM, OBM, and SBM systems.
- New rubber material offers increased drill-up benefits with smaller debris, tighter gripping, and easier drillout than standard five wiper plugs.
- Can be used with standard type float equipment that can provide a flat landing surface for the nose of the plug to land and seal upon.
- Designed to fit HES compact cement heads without the use of a MSC extension.

**HWE High Wiping Efficiency Latchdown Plug Assembly**

The HWE latchdown cementing plug assembly combines two technologies:

- The HWE plug to achieve maximum wiping capabilities of casing wall cleaning and reduce the amount of cement fill on top of the plug after displacement.
- The insert float valve (IFV) to provide a low-pressure and low-temperature backpressure valve to aid with well control when running casing and as a latching displacement plug for use as a positive check valve at the end of a cementing job.
Five Wiper Cementing Plugs for Combination Casing Strings

Use combination plugs to cement multiple casing string sizes and weights in single casing string well designs. Use of combination cementing plugs allows the cementing of tapered casing strings while helping ensure efficient cement removal from the various casing IDs in the same casing string.

Features

- Compatible with WBM, OBM, and SBM systems.
- These style of plugs are available in a variety of size combinations and several design types, such as:
  - Combination string standard top and bottom five wiper plugs;
  - Combination string standard non-rotating top and bottom five wiper plugs;
  - Combination string standard top and bottom five wiper plugs for use with SSR® subsurface release plug systems;
  - Combination string standard non-rotating top and bottom five wiper plugs for use with SSR subsurface release plug systems.
- Surface release combination plugs are PDC drillable, whereas the SSR style can have reduced PDC drillable characteristics. Contact a Halliburton representative for further application information and size combination availability.

Light-Duty Cementing Plugs

Wooden or plastic light-duty plugs can provide an economical method of separating fluids during primary cementing and then provide for an easy drillout.

Features

- These plugs should be used where high-pressure sealing and shutoff are not necessary.
- Primarily designed for use on shallow large ID casings that require fast drillout and weight on bit is not applicable.
- These plugs can only offer wiping efficiency for short casing strings.
- Work great on large diameter surface casings and conductor pipes.
- Have a two wiper rubber cup design with either a wood base or plastic body.
- Rubber wipers and cups are of component design and assembled to the body of the plug base material.
- Available in a top plug only design and are PDC drillable.
Nose-less Drillpipe Wiper Darts

Halliburton nose-less drillpipe wiper darts offer enhanced fluid separation and wiping efficiency for drillpipe. They are designed for use in plug cementing operations when open ended drillpipe is to be used. The nose-less DP wiper dart effectively wipes cement from the drillpipe ID to help prevent the permanent deposition of a cement sheath or scale that can cause plugging problems with bit nozzles, mud motors or other tools installed in the BHA below the drillpipe.

Features

- Efficiently wipes the drillpipe ID.
- Designed for internal upset work strings.
- Phenolic plastic mandrel provides stiffness and stability for the elastomer wiper segments.
- Can be launched from a conventional SSR® head, top plug drive cementing head, or installed directly into the drillpipe.
- Compatible with WBM, OBM, and SBM drilling fluids.
- Suitable for use in temperatures up to 300°F (149°C).
- Currently available for use in 4 1/2- to 6 5/8-in. drillpipe.
  - Other sizes available on request and by special order.
Multiple-Stage Cementing Equipment

With the use of multiple-stage cementing tools, cement slurry can be placed at selected intervals around the casing string. Multiple-stage cementing tools can be used in the following circumstances:

- In wells where the hydrostatic head of the cement is greater than the formation pressure, resulting in a breakdown of low-pressure formations;
- In deep, hot holes where time to pump the desired quality and quantity of cement is insufficient;
- Where only certain portions of the wellbore require cementing;
- Where different blends of cement must be safely pumped in the wellbore;
- In horizontal wellbores where the bend radius of the well requires cementing.

Two to three stages can be cemented.

Unlimited number of stages can be placed using FO cementers. (See page 8-12.)

With three-stage cementing applications, the lower tool can be a Type H, while the upper tool should be a Type P. The option of using two Type P tools is also a consideration.

All Halliburton stage cementers are rated for continuous service up to 275°F (135°C).

The high-performance ESX Cementer is available with special seals to allow multi-stage cementing procedures up to 350°F (177°C) and can offer higher pressure benefits after drill out.

Type P ES-II™ and H ES-II™ Cementers

Features

- Short, single-piece mandrel design without threaded or welded segments.
- Field-adjustable opening and closing pressures.
- Clear surface indications of opening and closing.
- Internal smooth bore after drillout with no exposed sleeves to interfere with the operation of workover tools on subsequent trips in and out of the casing string.
- External closing sleeve that is double locked by two latching rings when the closing plug is landed after second-stage cementing and the tool is closed.
- The use of an external closing sleeve allows the cementing ports to be mechanically covered and not exposed to the open formation after drill out.
- Tools have heavy-duty seals and backup rings that prevent seal damage during operations.
- Compatible with three-stage cementing applications.
- Compatible with second-stage bottom plug sets.
- Halliburton recommends no more than two stage cementing tools be run in a single application.
- All ES-II™ cementers and ES-II™ IPCs have improved PDC drillability with the use of a Type H (hydraulic open) tool or Type P (plug open) tool and a composite free-fall opening plug.
- The standard case material grade is L-80 steel.
- Other casing grades and premium threads can be provided upon the customer’s request.

Type P ES-II™ Cementer

On Type P (plug type) cementers, the second-stage opening sleeve is opened by dropping a free-fall opening plug from surface. Once seated, additional surface casing pressure is applied, and the sleeve shifts open. It is closed with a displacement closing plug when cementing the second stage.

Features

- Type P external sleeve (ES) cementers can be used in most vertical wells, regardless of depth, pressure, or temperature.
- Operated with the use of a standard free-fall plug set.
- The Type P cementer should not be used in wells deviated more than 30° from vertical when using a free-fall opening plug. Otherwise, the free-fall opening plug will not fall by its own weight through the well casing.
- Displacement type plug sets are available for wells over 30° deviation.
**Type H ES-II™ Cementer**

The Type H ES-II™ cementer operates much like a Type P cementer, but it can also be opened with applied internal casing pressure as an option to the free-fall opening plug.

**Features**

This hydraulic open feature saves time by eliminating the need for dropping a free-fall plug from the surface.

- A baffle adapter is recommended in the casing string above the float collar to provide a high pressure seat for the first-stage shutoff plug.
- When the first-stage cementing plug has seated, casing pressure can be applied to hydraulically open the Type H ES-II cementer.
- Normally, the cementer should be opened immediately after the first-stage cement is pumped and the shutoff plug has been bumped.
- If the well is deviated less than 30° from vertical, the Type H ES-II cementer can also be opened with a free-fall plug dropped through the casing ID.
- The Type H cementer can be used in highly deviated wells, in horizontal wells, and above an openhole completion or slotted liner.

**Fidelis™ Stage Cementer**

The Fidelis™ stage cementer is a precision-built, multiple-stage cementing tool constructed to enable placement of cement in stages. After the cementing operations are completed and the internal sleeves are closed, the tool is designed to withstand the cyclic loading from geomechanical stresses throughout the life of the well to help maintain wellbore integrity. The tool’s functional purpose is specifically for cementing operation, but the resiliency of the tool contributes to wellbore integrity during the cumulative stresses of later well events, such as well testing, injection and stimulation treatments, and production cycling.

**Operations**

- Can be used in most vertical wells, regardless of depth, pressure or temperature.
- Operated with the use of a standard free-fall type plug set for wells with up to 30° deviation.
- Displacement type plug sets are available for wells with over 30° deviation.

**Features**

- Internal sleeves are housed within the body of the tool.
- Dual lock rings on the closing sleeve latch into the outer case and lock the tool closed after completion of the second cementing stage, retaining structural integrity.
- Two large sets of packer type seal rings are used to seal the ports using a special compound for long-term sealing capacity.
- Improved sealing allows for higher pressure operations.
- PDC-drillable seats are sequentially locked together and secured to the stationary lower body of the cementer to help prevent rotation during drill out.
- Designs readily available in sizes 4 1/2-in. through 13 3/8-in., and larger sizes are available on special design request.
External Sleeve Inflatable Packer Collar (ESIPC™) Tool

The external sleeve inflatable packer collar (ESIPC™) tool is a combination of the ES (Type P or Type H) cementer and a casing inflation packer. This tool provides controlled packer element inflation through the stage-tool opening seat, eliminating hydraulic valving bodies normally used with inflatable packer elements. The ESIPC tool is commonly used in horizontal well applications for cementing casing in the bend radius or vertical portion of the wellbore, above an openhole completion or a slotted liner.

Features

- Applied casing pressure opens the Type P ESIPC tool after either the free-fall or displacement plug lands in the opening seat. After this “primary” opening, fluid passes through the cementing ports to inflate the packer. A “secondary” opening occurs when a rupture disk opens after the packer is inflated.
- The packer element is inflated to prevent cement from flowing downhole when it is pumped into the annulus above the tool.
- The rubber inflatable packer element is constructed with reinforcing metal slats to reduce packer element damage during inflation.
- The inflatable elements come in 3- and 10-ft lengths.
- These inflatable packer elements support differential pressures up to 4,000 psi from above the packer.
- The ESIPC tool is available by special order for any casing grade or premium thread.
- The ESIPC tool is operated with standard stage tool plug sets.
- The ESIPC tool’s operating pressures are not field-adjustable.
- The ESIPC tool can be PDC drillable with proper equipment selection and accessories.

External Sleeve Inflatable Packer Collar II (ESIPC™-II) Tool

The External Sleeve Inflatable Packer Collar II (ESIPC™-II) tool is a combination of the ES-II (Type P or Type H) cementer and a casing inflation packer. This tool offers the same enhanced features of the ES-II Cementer and the ESIPC tool mated together with an 18-in. metal bladder packer element.

- This configuration uses a shorter solid metal rubber coated bladder, primarily for cased hole applications.
- These inflatable packer elements support differential pressures up to 4,000 psi from above the packer.
Multi-Stage Inflatable Packer Collar (MSIPC)

The multi-stage inflatable packer collar (MSIPC) is a combination of the reliable plug-operated Halliburton MS cementer tool and a metal bladder casing inflation packer. This economical tool provides controlled packer element inflation through the stage-tool opening seat, eliminating hydraulic valve bodies normally used with inflatable packer elements. The metal bladder tools are recommended for use when setting in a hard rock formation or when inside casing.

Features
- Can hold up to 4,000 psi differential.
- Standard tools can be used in sour gas environments.
- Tools are operated with standard free-fall plug sets or displacement-type plug sets.
- MSIPCs are considered PDC drillable when used with a composite opening plug.
- Available in P Type only.

Multi-Stage Packer Cementing Collar (MSPCC)

The multi-stage packer cementing collar (MSPCC) is a stage cementer with an integral, solid rubber, compression-set packer element. Like the other stage-cementing packer collars, the MSPCC is used either to prevent gas migration or to support the hydrostatic pressure of the cement with a packer. The compression-set (or mechanical) packer elements, however, do not hold as much differential pressure as inflatable elements and are sensitive to hole size.

Features
- More economical than inflatable packers.
- Can hold up to 1,000 psi differential pressure.
- The recommended hole size applications are smaller than with inflatable tools.
- Tested for wells with bottomhole temperatures of 200°F or less.
- Tools are operated with standard free-fall plug sets or displacement type plug sets.
- MSPCCs are considered PDC drillable when used with a composite opening plug.
- Available in P Type only.
Multiple-Stage Operating Plug Sets

Plug sets are needed to operate Type P and Type H ES cementers. Plug sets for operating both types must be ordered separately from the cementer. The individual components of each plug set are dependant on the type of tool to be operated. A standard plug set for two-stage cementing consists of the following equipment:

- A first stage shutoff baffle to be installed on top of the float collar (for 8rd and buttress).
- A first stage shutoff plug (for both Type P and Type H cementers).
- A free-fall second stage opening plug (required for the Type P cementer; optional for the Type H cementer) (Note: For PDC drillability, composite opening plugs are now available in most casing sizes 4 1/2 in. and larger.)

- A second stage closing plug (for both Type P and Type H cementers).
- An optional baffle adapter is available to be installed one or more joints above the float collar (for the Type H cementer). Use of a baffle adapter is necessary when using a Type H cementer with a first-stage bottom plug or premium thread equipment.
- Optional bottom plugs are available for first stage and second stage cementing and are separate from the basic operating plug sets. A standard top cementing plug is used with a second stage bottom plug to close the completion of second stage cement placement.
- First stage latchdown shutoff plugs and baffle or baffle adapter are available upon request if needed.
  - These replace the standard first-stage shutoff plug and baffle.
  - Can be used to help prevent flowback.
  - This arrangement can also be used for testing the casing to a high pressure. By using a special-order, high-pressure cement baffle adapter and latchdown plug, the casing can be pressure-tested to 80% of the burst pressure before doing a second stage.

Wells can also be cemented in three stages with two ES cementer tools and a three-stage plug set. A three-stage plug set must be ordered separately from the cementers.
Free-Fall Plug Sets

The free-fall plug set is the basic operating plug set for both Type P and H tools. Even though the opening plug is not necessary with a Type H tool, it is recommended to have it on location in case needed as a backup to open the Type H tool.

Features

- This plug set contains:
  - First-stage shutoff baffle or baffle adapter collar—the optional baffle adapter collar is available in specially tailored plug kits and required for premium threads to provide a reliable high-pressure plug seat to reliably support the ΔP required to open Type H cementers and packer collars.
  - First-stage displacement plug (shutoff plug).
  - Second-stage free-fall opening plug.
  - Second-stage closing plug.
- Special free-fall plug sets available for three-stage cementing using two-stage cementers and/or packer collars.
- Free-fall plug sets should not be used in wells with over 30° deviation.
- When a stage cementer is run as a contingency, but not used (just in case a second stage of cement would be required to achieve cement to surface), Halliburton offers second-stage cancellation rings (in all sizes) and cancellation plugs (8 5/8-in. and larger). If the stage cementer is not used, these free-fall accessories fully cycle the stage cementer (open then closed) in a single operation in preparation for drilling.

Standard Free-Fall Plug Set

DV tool second-stage cancellation ring available for use in applications where cement comes to surface in the first stage and the second stage is not needed.
Displacement Type Plug Sets

Displacement plug sets should be used in the following situations:

- When cement must be brought up past a Type P stage tool on the first stage to fill the entire annulus with cement.
- When the hole is deviated 30° or more off vertical at or above a Type P stage tool.
- When a plug-opened stage tool is run with an integral packer above an openhole completion above 30° deviation (the displacement opening plug can keep cement off the bottom of the hole by opening the stage tool and setting the integral packer).
- When cementing in air-drilled holes where liquid should be kept off the production zone.
- When the cementer must be placed closer than 500 ft from the shutoff baffle, which could cause excessively high-opening pressures because of the need to compress the fluid in a closed free-fall plug setup.
- When using a hydraulically opened stage tool cannot overcome any of the above considerations.
Features

- Pumping operations can be continuous.
- Fluid volumes must be accurately calculated and carefully measured.
- This plug set contains:
  - First-stage bypass baffle;
  - First-stage bypass plug;
  - Second-stage displacement opening plug;
  - Second-stage closing plug.
- Special displacement plug sets available for three-stage cementing using two ES cementers.
- When used for three-stage cementing, the displacement method can be used only on the first two stages. The free-fall method must be used on the third stage to open the uppermost stage tool as the casing is closed to flow by the lower stage tool’s closing plug.

Two SR plug systems are available:

- Type H SR plug sets.
- Type S liner plug sets.

Displacement Plug Set for Three-Stage Cementing with Two-Stage Tools

Two SR plug systems are available:

- Type H SR plug sets.
- Type S liner plug sets.

Typical Cementing with Multiple-Stage Cementing Tool and Displacement Type Plug Set
Type H Selective-Release (SR) Plug Set

Selective-release (SR) plug systems allow you to run a two-stage cement job in a liner and/or in an offshore application where the casing is hung off a subsea hanger system.

Features

- Used on Type H ES cementers and Type H ESIPC tools.
- The plug set allows two-stage cementing of liners or casing strings suspended from a casing hanger.
- It can be used to cement a slotted liner suspended below a Type H ESIPC tool or below an external casing packer below a Type H ES cementer.
- The plug set is compatible with both hydraulic-set and mechanical-set hanger systems.
- The setting ball for hydraulic-set liner hangers must be small enough to pass through the plug set and first-stage shutoff baffle adapter.
- The selective-release feature helps prevent the closing plug from releasing prematurely before the first-stage latchdown shutoff plug has been released (7 in. and larger).
- A latchdown baffle adapter collar must be ordered separately for use with this plug set.
- Type H SR plug sets with a built-in liner setting ball option are available for select casing sizes.
- This plug set is PDC drillable.
Type S Liner Plug Set

A Type S liner plug set can allow you to operate a cementer off a floater, or on a conventional liner job on land when a first-stage cement job is not required. The cementer is opened by dropping a ball to the opening seat insert that is installed in the opening seat. The Type S multiple-stage closing plug is released by pumping down a drillpipe releasing plug. A Type H cementer will have to be opened by dropping the ball unless the casing is run into the hole blanked off.

Features

- Useful for setting slotted liners and other applications.
- Simple modifications to the stage tool are easily performed.
- Used on land and offshore well applications.
- Used in applications when only cementing above the stage tool.
Launching Collars for Type H and Type S SR Plug Systems

By using launching collars, you can suspend Type H SR or Type S plug sets independently of the liner hanger. Launching collars also allow the liner hanger company to set its liner hanger without having to contend with plugs tied to a stinger below the liner hanger. The launching collar consists of a box-to-pin-thread collar with a cemented, aluminum receptacle. This receptacle accepts the end of a liner hanger stinger that is used to pump launching darts to the plug sets. The lower end of the SR collar launching mandrel hangs below the pin thread of the collar, and the SR plugs are installed on this mandrel. This launching collar, along with any remnant of the SR plug set, is drilled out after use.

Full-Opening (FO) Multiple-Stage Cementer

The full-opening multiple-stage cementer or FO cementer (FOC) is used to place any number of stages of cement or other fluids outside a casing string at different selected points along the casing. This tool is operated manually and requires the use of a drill or tubing string and the sleeve positioner operating tools. These operating tools are available through Halliburton tool departments as a rental item. They are also manufactured for customer purchase.

These cementers are made of heat-treated stock to a maximum hardness of RC 21. FO cementers are suitable for use with H-40, J-55, K-55, L-80, and N-80 grades of casing. They can even be used in sour service applications (sour gas – $\text{H}_2\text{S}$ and sour oil) at any temperature.

Features

- In addition to being used with combination strings, these cementers can be used for selective water injection/production.
- If located across from a suitable uncemented zone, FOCs can be used for mud disposal.
- FOCs can be used to perform inner-string cementing when used with standard inner-string cementing equipment.
- Any number of tools can be run in the same casing string.
- No plugs or seats must be drilled out at the cementer.
- Operators can open or close the tool whenever necessary.
- The tool can be used to test, treat, and evaluate a zone in the well before it is re-closed.
- Can be used in sour gas applications.

FO Sleeve Positioner Tool (High-Pressure Surface Pack Off Required)

FO Sleeve Positioner Tool with Port Isolation Packer (Surface Pack Off Required)
Formation Packer Shoes and Collars

A formation packer shoe or collar, which is installed on the casing string, is used when casing will be set in a vertical hole on top of a predrilled low-pressure formation. A mechanical packer element seals the annulus between the casing and the wellbore, allowing cement to be pumped into the annulus above the packer element. Formation packer shoes/collars are available in two types: 852 Series™ packer shoes (poppet valve) and 855 Series™ packer shoes (flapper valve).

852 Series™ Formation Packer Shoes and Collars

The 852 Series packer shoe provides an economical method to pack off and help protect a low-pressure formation from cement contamination. These packer shoes can be used to float casing to the bottom, but they do not provide for casing fill while going into the well. The inverted check valve at the bottom of the packer shoe allows well fluids to circulate any time before the packer is set. The 852 Series packer shoe and collar are two separate product lines and cannot be converted in the field from one tool to the other.

Features

- Used to set liners and perforated pipe.
- Used to set screens in saltwater disposal wells and water flooding projects.
- Used when cementing wells where full hole cementing is required.
- Equipment is ball and plug operated and not recommended in wells with over 30° deviation where tool will be operated.
- Rated for 1,000 psi differential at 200°F (93°F).
- Should not be run above a gas zone or any high-pressure zone where the formation pressure may exceed the hydrostatic pressure in the annulus above the packer.
- Can be used below an ES cementer tool.
- This equipment is PDC drillable.

855 Series™ Formation Packer Shoe*

Halliburton 855 Series formation packer shoes with flapper valves help protect low-pressure formations from pressure surges while casing is being run. They also help prevent contamination of the cement caused by gas pressure below the formation packer. The 855 Series packer shoe is supplied as a float shoe and can be converted to a collar when the float shoe is removed.

*Can be field modified to a collar.
Features

- Used in well applications to:
  - Protect lower formations from hydrostatic pressure when cementing;
  - Protect lower wellbore annulus from cement contamination;
  - Help prevent contamination of cement caused by gas pressure below the formation packer.
- With the use of an orifice fill-up tube, this equipment can be set up for auto fill.
- Equipment is ball and latchdown plug-operated. It is not recommended in wells with over 30° deviation where tool will be operated.
- Rated for 1,000 psi differential at 200°F (93°F).
- Can be run above a gas zone.
- Can be used below an ES cementer tool.
- This equipment is not PDC drillable.

Cup-Type Packer Shoes

Cup-type casing packer shoes are used in cased holes but perform the same function as packer shoes set in open hole. These tools are most often used in workover operations where new casing or tubing is set inside deteriorated or damaged casing above an existing pay zone. When using these tools, cementing an inner string of pipe while keeping cement off the existing pay zone(s) can be accomplished.
Off Bottom Inflatable Cementing Casing Shoe

Halliburton’s Off-Bottom Inflatable Cementing Shoe (ICS) Assembly is a suite of tools that offer improved cementing capabilities above an openhole section, a process often referred to as “off bottom cementing.” This assembly is designed to be installed on the bottom of the casing string in applications where casing will be set and cemented in place immediately above a producing formation. This assembly allows operators to successfully run casing to the intended depth above the producing formation, even in difficult and tortuous wellbores, then, serves to pack off an openhole below the casing to isolate and protect the producing zone from the cement slurry as it is placed in the annular space around the casing above.

Features

- Tapered composite nose float shoes coupled with inflatable stage packer collars combine to serve as a highly-effective off-bottom cementing system.
- Suitable for vertical, highly-deviated, tortuous, and horizontal wellbore applications.
- Available in casing sizes 4 1/2-in. and larger.
- Available in 3- and 10-ft elastomer packer lengths.
- Differential pressure capabilities up to 4,000 psi.
Halliburton’s multiple-stage fracturing technique using baffles and balls is designed to fracture multiple zones in one operation faster and more economically than conventional methods. This technique can be used to perforate several partitions of a thick interval and individually fracture each set of perforations within the interval. Multiple-stage fracturing using this method is restricted by the initial breakdown pressure of the zone in the well and the size and availability of baffles and balls. The baffles are made from cast iron and must be installed in the casing at predetermined locations as the casing is run in the wellbore before primary cementing operations.

**Frac Baffles and Balls (Free-Fall Plugs)**

When the ball and baffle multiple-stage fracturing technique is used, one or more casing baffles are installed on the completion string as it is run. These baffles are located between the zones to be stimulated. Depending on treating string size, as many as five baffles may be installed, providing for up to a six-stage fracturing treatment.
Features

- Pre-fracture job planning during primary cementing operations is critical to the proper installation of these tools.
- Wiper darts must be used to displace primary cement job due to upsets caused by the baffles. Standard five wiper and HWE® plugs cannot be used.
- Smallest ID baffle is installed at the lowest fracture interval and the largest ID at the top fracture interval of the well in order for the baffles to pass within themselves.
- The balls are dense enough to fall through treating fluids and depending on well pressures can be reversed back out during post-fracture job flowback procedures.
- The baffle and ball technique can eliminate the need for bridge plugs or straddle packers that require relocation between fracturing stages.
- Because bridge plugs and straddle packers are not necessary, the time to drill them out or retrieve them is saved, and rig time between stages is reduced.
- Additionally, the initial cost of baffles and balls is less than approximately 25% of the cost of a drillable bridge plug, further reducing the cost of zone treatment.
- If higher fracturing pressures are anticipated, free-fall plugs (from DV tool applications) can be used to achieve up to 6,000 psi if needed. These plugs will need to be drilled up or retrieved by wireline operations.

Halliburton frac baffles are designed and installed into the casing during the primary cementing process.
SuperFill™ Surge Reduction Equipment

When casing is being run into a well before cementing it in the wellbore, the well is usually full of drilling fluids that were used to drill the wellbore. Unless these fluids are allowed to flow freely into the casing itself, the casing will act as a piston, pushing the fluids into the formation. This not only can cause valuable drilling fluid to be lost but also damages the formation. Without a reliable auto-fill system, much rig time can be wasted filling the casing at the surface while running in the hole.

The SuperFill™ family of products is Halliburton’s most versatile pressure deactivated auto-fill system. SuperFill equipment can be used in almost any wellbore situation and can be supplied for use with most any casing size, weight, grade, or thread in either a shoe or collar assembly.

SuperFill equipment provides a reliable way for wellbore fluid to enter the casing or liner ID while the casing is being run into the hole, thereby reducing the effective wellbore surge pressure and the volume of fluid lost to the formation.

Benefits
- Complete surge reduction package system.
- Allows increased pipe running speeds.
- Helps reduce surge pressures on weak formations.
- Helps reduce costly mud losses when running tubulars.
- Reliable auto-fill equipment designed to not accidentally deactivate.
- High LCM fluid systems compatible.
- PDC drillable.

Applications
SuperFill equipment can be used for the following applications:
- On conventional fullbore casing.
- Near the bottom of a tie-back casing string (run above the tie-back stinger).
- On subsea completions.
- When a liner is run and cemented in the wellbore.

SuperFill™ Float Collars and Float Shoes
Halliburton offers several SuperFill auto-fill assemblies that allow wellbore fluids to enter the casing at an increased rate as it is being run into the wellbore. Equipment can be supplied for use with most any casing size, weight, grade, or thread in either a shoe or collar assembly.

SuperFill float collars and float shoes allow wellbore fluid to enter the casing freely through less unobstructed flow paths. Fluid entry into casing helps prevent surge pressures and fluid losses. Because of the design of the system, the tool is less susceptible to plugging of the shoe track and float valves. Double SuperFill™ float valve options are available. There are three valve sizes available with related deactivation balls of 1 3/8-in., 2 3/8-in., and Halliburton’s largest fill opening valve with a 3 1/4-in. ball for 9 5/8-in. casing sizes and larger.

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SuperFill™ Type FV (Flapper Valve)

Features

- Circulation can be established anytime without affecting the auto-fill feature.
- Allows for multiple circulations.
- Ball deactivated, internal sleeve shifting.
- Once activated, works as standard flapper type float valve.
- Single valve equipment as standard.
- Double valve equipment available in 7 in. and larger.
- Drop ball option compatible with SSR-II™ two plug or SSR® top plug assemblies with small deactivation ball, assuming deviation is no greater than 30° at the SuperFill FV assembly.
- Special ball carry bottom wiper plugs for use in placement over 30° deviation.
- Non-rotating plug seat option.
SuperFill™ Type FVB
(Flapper Valve Ball Retained)

Features

• Circulation can be established anytime.
• Deactivation of auto-fill feature occurs with first circulation.
• Retained ball is:
  – Carried in with tool.
  – Required for conventional SSR® plug sets (two plugs).
  – Required for all horizontal subsurface release applications.
• NR plug seat (7-in. through 20-in.) is an optional feature for surface launch or subservice applications when retained ball feature is used.

Ready To RIH
Auto-fill
Ball at deactivation sleeve (first circulation)
Ball at second deactivation sleeve
Auto-fill deactivated ball pumped through

SuperFill™ FVB Operational Schematic
SuperFill™ Type FVB Plus (Flapper Valve Ball Retained with Multiple Circulations Option)

Features

- Allows circulation while RIH without deactivating auto-fill feature.
- Incorporates a retained ball that allows multiple circulations for a specified rate within a certain pressure limit over a recommended time period.
- Increasing circulation rate deactivates auto-fill feature.
- Retained ball option required for conventional SSR® plug sets (two plugs).
- NR plug seat (7 through 20 in.) is an optional feature for surface launch or sub-service applications when retained ball feature is used.

For well construction programs that use liners and liner tie-backs where the tie-back is to be cemented, Halliburton offers two equipment options for the tie-back string. SuperFill™ Type TB (Tie-Back) collars and Super Seal II® Orifice collars offer two operational methods to be used.
SuperFill™ Collar Type TB
(For Tie-back String Above the PBR)

Features

- Reduces the risk of PBR damage.
- Allows connection from SuperFill TB Collar to PBR tie-back receptacle first. This allows cementing through SuperFill ports without withdrawing the tie-back string from the PBR.
- The SuperFill TB collar can also be convenient for use in tight, annular clearances where moving the tie-back might be impossible after cement placement.
- Does not require casing movement after final cement placement.
- Plug operated to close.
- Available in standard or non-rotating plug seats.
Super Seal II® Orifice Collar

Specialized equipment is used when a production liner has been set, and a tie-back string is tied back to surface. Typically, tie-back strings are run with a polished bore receptacle (PBR) stinger on bottom. The PBR stinger (with seals) is stabbed into the PBR to provide a seal at the connection of the two casing strings. Once it is confirmed that the PBR stinger and receptacle fit correctly, typically, the tie-back string with the PBR Stinger is withdrawn several feet from the receptacle so cementing operations can be performed. Once cement displacement is complete, the tie-back string is reinserted into the PBR. The PBRs can be of enough length that, when the PBR stinger is stabbed into the PBR and the tie-back string is lowered fully into the PBR, compression locking can cause the seals of the PBR to be cut or damaged. With the use of a SuperFill Orifice collar, the pressure can be allowed to leak off during insertion and reduce the chances of fluid compression damage to the seals and float equipment.

Features

- Designed to match the size, weight and grade of the liner tie-back string.
- Incorporates a conventional Super Seal II® valve assembly with a modified poppet valve that incorporates orifice flow ports to allow insertion of the PBR stinger without becoming hydraulically locked.
- Allows pre-cementing pressure test to be performed on the PBR and stinger.

SuperFill™ Diverter Tool

The SuperFill™ diverter is another part of a complete surge reduction package available from Halliburton. This tool enhances the SuperFill float valve systems by relieving additional pipe running surge pressures. Halliburton’s SuperFill Diverter tool is designed to be run above the liner or casing running tool to provide a flow path for the well bore fluids now entering inside the smaller ID drillpipe to exit back out of the work string into the larger ID annular space around the drillpipe work string.
SuperFill™ Diverter Tool Features

- Used in subsurface applications.
- Tool stays inside cased hole above the liner top.
- Provides flow path from drillpipe ID to drillpipe annulus above liner.
- Reduces frictional pressure loss.
- Full bore ID before and after closure.
- Remains open until closed.
- Auto-fill feature is deactivated with a 1 3/4-in. closing ball.
- Diverter tool has optional design to be closed by a dropped canister from the surface when used with foam wiper dart technologies.
- Confirmation sub provides ability to prove the tool is closed before cementing.
- Closing ball is caught in cementing plug ball catcher.
- Compatible with 7- to 11 3/4-in. VersaFlex® expandable liner hanger cementing plug assemblies with ball catcher nose.
- Quickly and easily redressed for subsequent jobs.
- Available in 6 5/8-in. FH or 4 1/2-in. IF (NC50) drillpipe connections.

SuperFill™ Confirmation Sub Features

- Designed to be run in conjunction with the SuperFill™ Diverter tool.
- Run in the drillpipe work string, and positioned one to two stands below the SuperFill Diverter tool.
- Designed for confirmation that the SuperFill Diverter tool has been functioned closed.
- Temporarily detains SuperFill Diverter tool activation ball after closing the diverter sleeve.
- Allows for second 1,200 to 1,800 psi pressure spike to be seen at surface.
- Ball is discharged down the drillpipe to be retained in the liner plug set.
- Load rated and matches the performance of the SuperFill Diverter tool.
- Available in sizes to match the SuperFill Diverter tools.
Casing Attachments

Casing attachments are items attached to the casing OD as the casing is run in the wellbore. These items are designed to contribute to a successful primary cementing job. Over time, numerous casing attachments have been developed for use in primary cementing operations. These attachments can help the operator successfully run and land the casing string to planned depth in the well. Additionally, these attachments enhance mud removal from the wellbore and increase the probability of full cement placement. With cement serving as the primary barrier, effective proper placement of cement is fundamentally important, and because it contributes to a successful cementing operation, the correct casing attachment selection can be just as important. The main objectives for using this equipment are:

- A need to get tubulars to target depth (TD) of a well design.
- Help achieve optimum circulation and zonal isolation.
- Help reduce chances of differential sticking.

This section contains information about the following casing attachments:

- **Centralizers:**
  - Provide uniform annular clearance and reduce drag when running casing.

- **Stop collars:**
  - Secures placement and limits travel on attachments to casing string.

- **Cable wipers:**
  - Remove mudcake on the wellbore.

- **Cement baskets:**
  - Helps support cement in the annulus.

Halliburton has supplier agreements with several top rated casing attachment manufacturers. To offer customers a wide selection of centralizer options and designs, Halliburton is also a distributor and supplier of the following manufacturer's product lines:

- Centek
- Top-Co
- Casewell
- Mego Afek
- Ray Oil Tool
- Downhole Products

Products offered through Halliburton from these manufacturers provide options for all types of well designs from shallow land wells to the deepest offshore extended-reach horizontal wells. Size combinations are available on request and can be custom built; special-order items can be quoted as needed. Contact a local Halliburton sales representative for additional information.
Protech™ Centralizer Family of Products

Centralization that delivers run in and standoff without compromise

Halliburton’s Protech™ family of centralizers is designed to contribute to well integrity by delivering optimized standoff for a successful cementing operation while reducing the risk and time for running and landing casing to depth. For standoff without compromise, Protech centralizer blades can also be used when the pass through ID is too narrow for centralizer subs. Protech centralizer blades consist of solid-type blades resistant to compression stresses.

The Protech centralizer blades consist of a ceramic and carbon fiber blend that is adhered directly to the casing or pipe substrate with chemical bonding, resulting in very high adhesion values for superior downhole impact resistance, toughness, and flexibility. The spacing and geometry of the blades are customized and provide full circumference standoff while allowing unrestricted flow paths. These blades act as a single unit with the casing or drillpipe. The result is rig-time efficiencies that contribute to personnel safety while enabling optimized run-in speeds and higher probabilities for landing the casing to depth.

The Protech Centralizer family of products includes:
- Protech CRB* centralizers for use with casing strings
- Protech DRB* centralizers specifically for use on drillpipe

Features

• Ceramic composite material molded onto customer’s casing.
• Designed to fit specific well applications.
• Can be installed on any grade of pipe, including corrosion-resistant alloys (CRA).
• Unique bonding process helps ensure a strong mechanical bond.
• Provides centralization option for close tolerance wellbores.
• Provides smooth, uninterrupted flow during circulation attributed to the absence of any banded product placed around the casing.
• Ideal for deviated sections of borehole as material provides a low coefficient of friction.
• Field-proven technology.
• Material is CO2 and H2S resistant.
• Composite centralizers successfully used in both conventional and slim profile wells.
• Helps enable homogeneous cement slurry distribution.
• Product applications are usually performed in a pipe yard where customer’s pipe is stored. Field location installations are available.
• Composite material exhibits extreme abrasion resistance.
• Protech DRB centralizers are typically designed for drillpipe applications and have enhancing materials to provide a higher resistance to wear.

Process

The Protech family of centralizers are recommended to be applied in one of Halliburton’s environmentally controlled mass installation facilities but can also be installed in customer’s pipe yard, or on location if prearranged.
Step 1—To prepare the pipe, special high-tech sand-blasting techniques are performed to the blade area.

Step 2—Sandblasting is performed to achieve a near-white metal finish to ensure a rough profile to allow the carbon fiber ceramic blend to bond to the micro peaks and valleys in the pipe’s surface.

Step 3—The roughness is checked with pressure applied roughness test strips.

Step 4—The test paper is then measured for proper pipe and/or profile and is correct per specification.

Step 5—Injection molds are produced according to the computer-designed centralizer profile and installed with special double-sided, pressure-sensitive tape during application.

Step 6—The blade material is prepared using a precision blending and mixing unit.

Step 7—The blade material is injected into molds using a controlled process for a solid fill of the blade mold cavity.

Step 8—After installation, the blades are allowed to cure and final inspection for material quality control is performed.

Step 9—Final check of OD measurements are performed before being ready for shipment.

Step 10—The final process of protective packaging devices are installed to prepare pipe for delivery to customers.
Centek Centralizers

Centek centralizers are manufactured in the UK (England) and in the USA (Oklahoma) by Centek Ltd and Centek Inc., respectively. Halliburton is a non-exclusive distributor by agreement, yet holds exclusivity to sell and market Centek centralizers in numerous regions. Centek centralizers are built to gauge to offer easier RIH and maximize standoff for primary cementing operations. The UROS range of centralizers are built mostly for passing through close tolerance situations and then opening back up into underreamed sections or washed out sections, while still providing quality standoff performance. Centek bow springs are based on a straight bladed principle, but are curved in both axial and tangential directions. This cross curvature tangential conforms to the borehole wall, while the axial curvature changes proportionally as it encounters different loads. As the loads increase, the surface contact area also increases, reducing the load per square unit of area. This helps avoid compression and shear failure of the formation surface.

Centek S2 Slip-on Centralizer

Features
- Rating—API Specification 10D and NQA 9001-2008
- Design features
  - Smooth bow profile overall
  - Non-welded
  - Made to gauge
  - Integral bow design for increased strength and performance
  - Zero weak points, such as hinges, welds, or mechanical interlocks
  - Flexible to absorb both axial and radial loading
  - Powder coated red finish
- Performance
  - Zero start and running force with exceptional restoring force
  - Improved flow by area and improved pipe rotation
  - Low torque and low drag units
  - Improved zonal isolation
- Applications
  - Used in most well applications and geometries for vertical, horizontal extended reach drilling, close tolerance, or underreamed well conditions
  - Specialized in centralization for underreamed sections
- Recommended to be run between limit clamps
- Sizes available—2 7/8 to 20 in.; custom sizes available
- Minimum hole size—2 7/8 in. (4 in.) hole
- Maximum hole size—20 in. (26 in.) hole
Centek UROS Centralizer

The Centek underreamed offset (UROS) bow centralizer is designed for drag reduction on initial insertion and reduced accumulative loads on restarting and running forces during running in hole (RIH). The unit is designed primarily for underreamed wells. This design is also suitable for washed out sections where good centralization is still a critical requirement. The UROS centralizer shows significant reduction on initial insertion forces as well as reduced running forces through the previous set casing. Once through this compressed stage, the unit will revert to gauge, maximizing standoff with zero drag.

Features

- Rating—There is no current API standard for any underreamed application; however, testing of such units are to API Specification 10D and NQA 9001-2008.
- Description—Typical design is of a slip-on, semi-rigid, six-bow centralizer, with two offset placements of three alternating opposite end offset bows, whereas only three larger nominal OD end bows enter the restriction at one time. Then, as the centralizer continues to enter into the restriction at midpoint, the other three opposing offset bows now enter the restriction.
- Performance—Smooth bow profile overall, non-weld integral bow design for increased strength and performance. A robust, ultra-high-strength, one-piece construction centralizer with no weak points, such as hinges or mechanical interlocks. Flexible to absorb both axial and radial loading.
  - Designed to easily pass through previously set casings.
  - Engineered for tight clearance/close tolerance applications.
  - Ideal for underreamed holes sections.
  - Offers lower starting forces when entering restrictions.
  - Gives adequate restoring force to support the casing.
  - Helps with well cleanout and circulation.
  - Reduces risk of differential sticking.
- Casing sizes available—7 to 16 in.
- Minimum hole size—9 1/2 to 20 in.
Centek Temporary Underreamed (TUR) Centralizer

Based on the single piece, non-weld S2 design, the Centek TUR bow spring centralizer is further engineered to pass through known restrictions and return to openhole specifications. The TUR casing centralizer has the versatility to be used in the most challenging underream applications. It is proven to provide good cementation in tight casing and close tolerance applications or known washed out formations during the casing running phase.

Features

- **Rating**
  - There is no current API standard for underreamed applications; however, the TUR units are tested to API Specification 10D and NQA 9001-2008.

- **Description**
  - Slip-on, semi-rigid centralizer
  - Ultra-high strength due to single piece, laser cut, non-weld construction and unique metallurgy
  - All units made to gauge
  - Flexible to absorb axial and radial loading

- **Performance**
  - Provides low initial insertion forces into previous set casing
  - Reduced restart force on RIH
  - Reduces running force and drag; saves rig time on RIH
  - Positive location in underreamed or washout conditions with excellent standoff performance

- **Operation**
  - Durability allows for makeup at the pipe yard or on the pipe rack improving efficiency and safety vs. makeup on the rig floor.

Applications

- Horizontal/ERD wells
- Highly deviated
- Tight casing tolerances
- Underreamed well sections
- Vertical washout sections
- S-type/J-type
Isolizer™ Centralizer

Specially designed and built bow spring centralizer with composite resin blend limit bands available in several options

The Isolizer™ centralizer is an alternative solution to centralizer subs for tight-tolerance applications. Unlike conventional centralizer subs that can only be placed between joints, the Isolizer centralizer provides the flexibility of placement at any point on the casing string. This design helps increase both safety and efficiency by eliminating the need for additional connections made on the rig floor.

The Isolizer centralizer is designed to be used in applications such as tight tolerance and underreamed hole sections that demand the powerful restoring force of a high-performance centralizer. The Isolizer centralizer is available in almost any casing size or openhole combination to allow casing centralization for even the most challenging wellbore configurations.

The Isolizer centralizer is a slip-on, tight-tolerance, steel bow spring centralizer integrated with composite-resin-blend stop collars. The stop collars are chemically bonded directly to an abraded surface of the casing joint with field-proven adhesion-bond values so high that the stop collar is essentially integral to the casing.

The Isolizer centralizer in combination with the casing-bonded stop collars can be installed on the customers’ casing in a pipe yard, a Halliburton facility, or certain field locations. This design accommodates casing stand lengths, which stay within the limits of the pipe stand while reducing any wait time for grade- or thread-specific matches.

Application

• Designed for lean-profile drilling applications in which centralizers are required to pass through close-tolerance sections with powerful restoring force to centralize casing in underreamed hole sections
• Meets most deepwater well construction designs and requirements

Benefits

• Offers placement flexibility anywhere on the casing string and is not limited to placement between joints as with conventional centralizer subs.
• Utilizes the rugged integrity of various Centek centralizer model options.
• Easy installation onto the casing by a trained installation crew and can be completed in a pipe yard, a Halliburton facility, or as required in certain field locations.
• Pre-installation results in rig-floor safety improvements over conventional centralizer subs by reducing the number of connections to be made on the rig floor by as much as 50%.
• Configuration reduces casing stand length over conventional centralizer subs.
• Ideal for corrosion-resistant alloy (CRA) tubulars and are not casing weight, grade-or thread-dependent.
• The slip-on design avoids the need for grade- or thread-specific matches to the casing string significantly reducing lead time over the conventional centralizer subs manufacturing requirements.
**Isolizer™ Centralizer Features**

- Allows for casing rotation.
- Centralizer placement for optimized mud displacement and cement placement can be modeled with Halliburton’s industry unique predictive analysis and modeling service, iCem® Service.
- Finite Element Analysis (FEA) is conducted to validate the performance of each individual centralizer design according to specific well parameters.
- Centralizer bow springs and stop collars can be custom designed to meet unique well parameters.
- Composite-resin-blend stop collars are field proven and the bonding process for applying stop collars helps assure a strong mechanical bond.
- Helps mitigate corrosion as the process is non-damaging to the tubulars.
- Can be used in high temperature environments.
- Can be installed on any grade of casing including CRA.
Centek and Halliburton have collaborated to develop the Inter Casing Centralizer Sub II (ICCS II) for deep water. In deepwater operations and tight-annulus application, where narrow margins between pore pressure and the fracture gradient exist, centralizers must compress virtually flat. This new product allows casing and attachments to travel through a series of tight casing strings but still retain the restoring force that enables expansion to the designed openhole size.

The Centek centralizer sub body is machined to Centek and Halliburton exacting standards. Patented Centek underreamed offset (UROS) bow centralizer technology is installed to the sub body manufactured by Halliburton in a process that complies with (or even exceeds) the toughest of quality control standards in the industry today. This helps ensure the UROS centralizer will fully compress within the sub body for ultra-narrow annulus casings.

**Features and Benefits**

- Designed specifically for ultra-tight tolerance applications
- Can fully compress within the centralizer sub body
- Low equivalent circulating density (ECD) signature to lower surge effect during run in hole (RIH)
- Allows for rotation when fully compressed
- Fewer bows for more efficient RIH
- Will meet or exceed host casing burst and collapse specifications
- Offers repeatability of bow performance with no set occurring
- Lowers insertion force
- Reduces the chances of scoring the wellhead; unique bow design does not produce a knife edge when bow is compressed
- New jigsaw join design for increased strength
- Can also be built utilizing the Centek TUR centralizer as an alternative
Centek Stop Collars

A key element of the Centek stop collar is its high axial load capability. All Centek stop collars are heat treated to improve tensile strength, especially in the critical internal thread area. This is combined with high-strength set screws of a specific thread pitch to match the low profile characteristics of the product. Thus, when tightened to 35 lb/ft, the Centek stop collars provide a vastly superior axial holding force when compared to other stop collars. With these properties and the correct makeup, the stripping of threads has been eliminated.

Features

• Rating—tested in accordance to API recommendations.
• Design appearance—one-piece slip-on type with set screws. Non-welded design. Manufactured from high-grade, heat-treated steel. Centek stop collars have a high quality powder coated finish.
• Performance—offers extremely high holding performance to Centek centralizers.

Applications

• Used in all types of well designs.
• Sizes available—2 7/8 to 20 in. (custom sizes available).

Benefits

• High axial load capability.
• Special use high-strength holding force set screws.
• Large contact surface area.

Options

• Heat treated, eliminates internal thread stripping.
• Available with stainless steel set screws.
• Available in heavy-duty style with extended length and two rows of set screws with one side beveled.
HALLIBURTON

Top-Co Centralizers and Casing Accessories

Halliburton has a Master Purchase Agreement in place with Top-Co to offer and distribute their centralization products as a quality centralizer solution to our valued customers.

Top-Co is a multinational corporation specializing in the design and manufacture of casing equipment. Top-Co centralizers and casing accessories are designed and manufactured to assist casing running and cementing. The company was founded in 1963 and today maintains three manufacturing plants: original facility in Edmonton, Alberta; a strategically located manufacturing platform in Weatherford, Texas; and a state-of-the-art facility conveniently located in Tianjin Free Trade Zone, China.

Top-Co conducts equipment testing at its state-of-the-art test facility, which features a fully computerized centralizer test bench. Starting, running, and restoring force tests are performed according to API Specification 10D, and holding force tests are executed as per API RP 10D-2.

Top-Co is certified to internationally recognized Quality Management Standards including ISO 9001:2008 and API Q1. Required products are traceable in accordance with API Q1 specifications and are ISO Quality Management System compliant. Top-Co maintains traceability and product verification systems in all manufacturing processes for float equipment from receipt of raw materials to shipment of finished goods.

Top-Co offers and supports a complete casing attachment product line and can custom build to fit most casing and hole size combinations.
Mego Afek Centralizers and Casing Accessories

Dedicated to the manufacture and distribution of equipment and accessories for cementing oil wells, Mego Afek had its beginnings in Maracaibo, Venezuela in 1982. Halliburton and Mego Afek began working together more than 30 years ago with an agreement between the two companies regarding float equipment manufacture and distribution in South America. Currently, Mego Afek has a signed technology contract with Halliburton for Mego Afek to manufacture casing flotation equipment under license from Halliburton. Mego Afek manufactures centralizers and float equipment from Halliburton designs as well as quality products from their own engineered designs.

Today, Mego Afek has two manufacturing facilities with one located in Maracaibo, Venezuela and another in Reynosa, Mexico. Warehouses and distribution centers are located in the US and Colombia. This infrastructure allows them to serve the oil drilling and recovery market in the Americas.

Mego Afek operates in a framework of continuous improvement to help enable constant increase in productivity, environmental protection, and cost efficiency to deliver value through people, processes, and products for the benefit of the oil and gas well operators.

Mego Afek can custom build standard limit clamps and centralizers to fit most casing and hole size combinations when requested and mass produces a product line of casing attachment products.

Mego Afek Centralizers

- Standard hinged bow spring welded
- Standard hinged bow spring welded with turbo fins
- Extended bow spring for drill pipe and large hole IDs
- Close tolerance slip-on bow spring
- Semi rigid (dual contact) hinged welded
- Hinged welded positive bar
- Turbo slip-on solid bar positive solid body (in R, L, S, 6 in. and 8 in.)
- Turbo slip-on hollow vane positive solid body (in R, L, S, 8 in. and 10 in.)
- Turbo slip-on positive bar with end rings (10 in. straight)

Set screw options available on most centralizer models.

Mego Afek Limit Clamps

- Friction grip
- Slip-on solid with set screws (one side beveled options)
- Heavy duty slip-on solid with set screws (one side beveled options)
- FASGRIP™ with dogs

Mego Afek Centralizers

- Standard
- Standard with Turbo Fins
- Close Tolerance

Standard Bow Spring Centralizers

- Standard
- Standard with Turbo Fins
- Close Tolerance

Positive/Rigid Centralizers

- Positive Bar
- Turbo
- FASGRIP™ with Dogs, Slip-on, and Friction Collars

Limit Clamps

- Standard
- Standard with Turbo Fins
- Close Tolerance

Set screw options available on most centralizer models.
Halliburton utilizes Casewell on selected projects and awarded tenders. Casewell Services started its beginning in 2003 and is a leading ancillary manufacturer in the petrochemical industry, producing centralizers and casing accessories. Headquartered in Manesar, Haryana, India, Casewell products are designed, assembled, tested, and inspected at their fully automated plant that deploys state-of-the-art robotic and special purpose machines to manufacture oil tools with rigid quality control. Quality management systems are fully practiced and adhered to as per API Specification Q1 and ISO 9001-2008.

Casewell calculates the total load on centralizer at each deflection and prepares a load deflection curve using arithmetic average of force readings. This determines the restoring force specified in the API Specification 10D. In addition to API testing, Casewell also performs the following test, considering extreme conditions these products can encounter. Tensile stress testing on these centralizers is performed to help ensure even a severely damaged centralizer will remain intact, rather than damaging the completion process. The compression tests are conducted to help ensure even badly distorted centralizer bows will not fracture and leave metal fragments in the well.

*The Casewell philosophy is to provide the best possible solution to any centralizing problem.*

**Features**
- API-certified products.
- Efficient management system.
- World-class infrastructure.
- High quality in production.
- Fully traceable QA/QC.
- ISO 9001, 14001, 18001 certified.
- Strong, committed marketing, R&D, and operations teams continuously strive to make every delivery on time.

**Offerings**

**Non-Welded Bow Spring Centralizer**
- Hinged non-weld bow spring centralizers.
- Semi rigid non-weld bow spring centralizers.

**Welded Bow Spring Centralizer**
- Hinged welded bow spring centralizer.
- Slip-on welded bow spring centralizer.
- Rotating welded bow spring centralizer.

**Rigid Positive Bow Centralizers**
- Hinged non-weld positive centralizer.
- Slip-on positive welded spiralizer.
- Heavy-duty slip-on welded spiralizer.
Turbolizer Bow Spring Centralizers
- Non-welded turbolizer
- Welded turbolizer

Solid Rigid Centralizers
- Straight solid rigid centralizer
- Spiral solid rigid centralizer

Stop Collars
- Hinged bolted stop collars
- Hinged spiral nail stop collars
- Hinged set screw stop collars
- Heavy-duty set screw stop collars
- Slip-on aluminum set screw stop collars

Cement Baskets
- Hinged cement baskets
- Slip-on cement baskets
Ray Oil Tool centralizers are manufactured in Louisiana and Scotland by Ray Oil Tool Company Inc. with headquarters in Broussard, Louisiana. Halliburton sells and is a provider of Ray Oil Tool Products. These solid blade centralizers are cast of a high-strength aluminum alloy, which provides high impact and shock resistance combined with high tensile and yield strength. These centralizers are also corrosion resistant. The solid centralizers are designed to slip easily over the pipe OD from the casing pin end. The centralizers should be installed between two stop rings or between a casing collar and stop ring. This method of installation allows the centralizer to move freely during running casing into the wellbore and during rotation or reciprocation of the casing during cementing operations.

Solid centralizers can also be secured to the casing with set screws where it is not desirable to rotate or reciprocate the casing during cement operations.

Solid Straight Blade Cast Alloy Centralizers

Solid vane straight blade centralizers are designed to provide a fixed casing standoff, regardless of lateral load. This positive standoff helps ensure even distribution of cement around the well casing.

**Features**

- **Rating**—not governed by API
- **Design appearance**
  - Straight, smooth cast alloy ribs cast into solid bodies (one-piece castings).
  - Available with and without set screws.
  - Straight ribs offer 360° evenly spaced openhole coverage.
- **Performance**
  - Provide positive casing standoff.
  - Limited corrosion effects with a cast alloy product.
  - Reduced electrolysis due to non-similar metals.
  - Lighter in weight than steel versions.
- **Applications**
  - Used in most types of well designs.
  - Most suited for horizontal and high directional well designs; favorable in cased hole situations.
- **Sizes available**—4 1/2 to 20 in.; custom sizes available.
- **Actual OD**—1/8 to 1 in. below stated hole size, depending on casing and hole size.
- **Minimum hole size**—5 3/4 in.
- **Maximum hole size**—25 in.
- **Length**—8 to 30 in.
Ray Oil Spiral Solid STAND-OFF™ Cast Alloy Centralizers

The spiral STAND-OFF™ centralizer by Ray Oil is designed with a 360° overlapping solid vane to provide maximum wellbore contact and maximum wellbore fluid swirl. The spiral STAND-OFF centralizer is recommended to be used on shoe joints, through production zones, liner overlaps, and other areas where a good cement bond is essential. The recommended spacing through productive zones is every 20 ft, using the left- and right-hand spiral design in every other sequence.

Features

- Rating—not governed by API
- Design appearance
  - Spiral smooth cast alloy ribs cast into solid bodies (one-piece castings).
  - Available with and without set screws.
  - Spiral ribs offer 360° evenly spaced openhole coverage.
- Performance
  - Provide positive casing standoff.
  - Limited corrosion effects with a cast alloy product.
  - Reduced electrolysis because of non-similar metals.
  - Lighter in weight than steel versions.
- Applications
  - Used in most types of well designs.
  - Most suited for horizontal and high directional well designs; favorable in cased hole situations.
- Sizes available—2 7/8 to 13 3/8 in.; custom sizes available.
- Actual OD—1/8 to 1 in. below stated hole size, depending on casing and hole size.
- Minimum hole size—4 1/2 in.
- Maximum hole size—17 1/2 in.
- Length—6 to 15 in.

Ray Oil Tool Stop Rings

The Ray Oil tool stop ring design is a one-piece type that slips over the pin end of the pipe and secures in place with set screws. These stop rings have a superior holding force and are especially applicable in close tolerance situations.

Features

- Rating—tested in accordance to API recommendations
- Design appearance
  - One-piece slip on with set screws.
  - Manufactured from high-grade tubular steel.
- Performance—offer high performance to Ray Oil Tool aluminum centralizers

Applications

- Used in all types of well designs
- Sizes available—2 7/8 to 20 in. (custom sizes available)

Benefits

- Flat end ring surface allows for smooth bearing surface to mated aluminum centralizers, allowing high performance during pipe rotation.

Options

- Available with stainless steel set screws.
- Available with one side beveled.
- Available in aluminum and steel designs.
Downhole Products

Downhole Products are specialist oilfield designers and manufacturers of the ultimate drag and torque reduction solid body zinc alloy centralizers, as widely used in the world’s demanding horizontal and extended-reach wells. Downhole Products is a British-based company with headquarters in Aberdeen, Scotland, UK, and offices in the USA, Asia, and the Middle East. Downhole Products designs, manufactures, and supplies a wide range of casing accessories and completion tools. Its technologies are reinforced by dedicated engineering and manufacturing teams responsible for designing its selected range of products that Halliburton offers, to include the SPIR-O-LIZER™ centralizers, SPIR-O-LIZER BLADERUNNER™ centralizers, and their matching series of limit clamps.

Downhole Products commitment to quality and its customers is to deliver the best value to customers and markets by finding the optimum balance of performance, quality, and price, which in turn can result in the most effective solution to their completion requirements.

Features

- Complies with pertinent ISO and OHSA requirements.
- BS EN ISO 9001:2008 registered company.
- Comply with the requirements of ISO 9001:2008 in addition to appropriate statutory and regulatory requirements.
- Ongoing in-house research and development.
- UK facility also accommodates Downhole Products engineering with the provision of a purpose-built precision machine shop with availability 24/7.
- Downhole Products uses the latest CNC machines and other ancillary equipment.

Offerings

SPIR-O-LIZER™ Centralizers

SPIR-O-LIZER centralizers are positive standoff wellbore centralizers specifically designed for casing, liners, and sand control screens to eliminate costly recurring problems common in today’s demanding wells. Zinc-alloy centralizer affording proven torque and drag reduction designed with maximum flow-by helps ensure problem-free running with the lowest pressure drop of any centralizer available.

Features

- Maximum torque and drag reduction.
- Spiral blade design assists hole cleaning and cement placement.
- Maximum flow-by with self-cleaning blade design.
- Unique non-sparking alloy.
- Exceptional wear resistance.
- Extends casing life.
- Designed to reduce operating costs.

The BLADERUNNER™ Centralizer

The BLADERUNNER™ ultimate friction reduction SPIR-O-LIZER™ centralizer performs equally in open or cased holes. This centralizer maximizes drag reduction, minimizing startup torque using patented ultra-low friction buttons and sleeves. The cost-effective alternative to roller-type centralizers is based on an already proven design used in some of the world’s most demanding wells.

BLADERUNNER LD™ Centralizer

Maximum drag reduction can be achieved in cased/open holes using the BLADERUNNER LD™ (low drag) zinc alloy SPIR-O-LIZER centralizer enhanced with ultra-low friction buttons. It eliminates moving parts and breakdown caused by ingress of cuttings.

BLADERUNNER LT™ Centralizer

The BLADERUNNER LT™ (low torque) zinc alloy SPIR-O-LIZER centralizer incorporating the ultra-low friction sleeve minimizes startup torque and offers proven low friction zinc alloy construction with SPIR-O-LIZER features for rotating liners and casings.
**BLADERUNNER™ Centralizer Features**

- Works equally well in both cased hole and open hole, regardless of deviation.
- Lower drag when running through cased hole sections and out into open hole through milled sections.
- Provides enhanced cleanup and cement placement properties.
- Lowest friction coefficient of any centralizer available today.
- Patented ultra-low friction buttons perform through even the longest casing runs.

**Spir-o-lok™ Ductile Iron (DI) Stop Collar**

The Downhole Products DI Stop Collar is designed to be run in conjunction with the SPIR-O-LIZER™ range of products. The collar is fitted with Downhole Products high holding force knurled tip stainless steel set screws.

**Features**

- One-piece construction
- Manufactured in ductile iron low friction material to API specification
- High hoop strength holding forces in excess of 20 tons
- Maximum flow-by
- Easy installation
Foam Wiping Technology

Foam Wiper Darts

The foam wiper dart is designed to wipe drillpipe or tubing string clean of cement, fluids, or debris and can be used to separate fluids. The dart has a high parting stretch ratio compared to conventional molded rubber wiper plugs and darts, which means it can pass through small restrictions without being damaged. It easily passes through internal upset restrictions, such as mechanical setting tools, diverters, and liner running tools, and through tapered strings. Foam wiper darts have been used with most types of drilling and displacement fluids.

The foam wiper section of the dart is made from a frothy matrix that can effectively wipe drillpipe sizes ranging from 4 1/2 through 6 5/8 in.

The foam wiper dart has been deployed with SSR-II™ plugs since 2005. Since this time, the foam dart has also been used with standard SSR® plug sets, BHKA disconnect assembly, and VersaFlex® expandable liner hanger assemblies.

The foam wiper dart is not recommended to use on cementing work where the dart has to continuously pass through extremely tight restrictions repeatedly.

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Features

- Can efficiently wipe combination drillpipe and tubing strings with various inside diameters
- These wiper darts are made of urethane and have been tested for five hours in a wet environment at a temperature range of 40 to 350°F.
- Foam darts can be equipped to have landing/seating and latchdown nose profiles.
- The foam wiper dart is not susceptible to wrinkling in restricted ID cementing heads like conventional floppy wiper darts.
- Several plugs available in a variety of selected wiping range interval
- A special foam dart loader is required for proper loading and launching procedures.
Foam Wiper Balls

The foam wiper ball is designed to wipe drillpipe or tubing string clean of cement, fluids, or debris and can be used to separate fluids. These wiper balls are made of natural rubber of open cell design. The ball has a parting stretch of 380 to 440%, which means it can pass through small restrictions without being damaged. It easily passes through internal upset restrictions, such as mechanical setting tools, diverters, and liner running tools, and multiple balls can be pumped, if necessary.

The foam wiper ball is not recommended to use on cementing work where the ball must continuously pass through extremely tight restrictions repeatedly.

Foam wiper balls cannot be preinstalled into a plug container because the foam ball can be sucked past the plunger prematurely.

Features

- Can efficiently wipe combination drillpipe and tubing strings with various inside diameters.
- Used in wells with a temperature range of 40 to 302°F (4 to 150°C)
- The wiper ball can be loaded into drillpipe or tubing connections.
- Foam wiper balls have been used with all types of drilling and displacement fluids.
- Can pass and shred through bit mud nozzle jets, if required. Allows wiping of drillpipe with drill bit on bottom.
- Special manifold launching systems are available for rental.
- Several ball sizes available from 3 to 8 in. in a variety of selected wiping range intervals
Drillpipe Foam Wiper Ball Loader

The use of foam wiper balls in the oil industry has become very common. The flexible and resilient nature of foam technology makes foam balls ideal for fluid separation and wiping of drillpipe or other tubular goods with different inside diameters. However, the loading or installation of these foam wiper balls into the tubing can sometimes be difficult. Halliburton has a foam ball loading apparatus that allows foam wiper balls to be easily installed into tubular goods with pneumatic pressure. This apparatus allows installation of the ball on a drilling rig floor or other shop environment in a way that is safe to personnel and equipment.

Operation

• The apparatus includes a chamber in which a foam wiper ball is installed by hand.
• Protrusion alignment rods center the apparatus between two pieces of the drillpipe work string. One end is installed in the box end of the drillpipe and a receptacle for a pneumatic line is attached. The direction in which the ball is loaded (into the tubular section located above or below the apparatus) is chosen based on the preference of the user.
• After installing the cap, a clasping bar is installed through the chamber, thereby securing the cap to the chamber.
• Next, a standard pneumatic line is connected to the cap. The air pressurizes the compartment created by the foam wiper ball and cap, which subsequently forces the ball through the tapered section of the chamber and into the work string.
• Finally, the upper tubular of the work string is lifted, the loading apparatus is removed, and the work string is threaded together.

Features

• Fits multiple foam wiper ball sizes.
• Works in multiple sizes of drillpipes.
• Allows loading without damage to foam wiper ball.
• Low-pressure system
• Reusable
• Saves time and reduces associated risk.
Drillpipe Foam Wiper Ball Loader Components

Drillpipe Foam Wiper Ball Installed in Drillpipe
Plug Setting Aids

The CST™ cement support tool, tubing release tool (TRT), bottomhole kickoff assembly (BHKA) disconnect tool, and bottomhole kickoff assembly (BHKA) tool system were designed to aid in setting balanced and competent cement plugs during remedial and primary cementing operations. These tools, when used with cementing best practice applications, can help to improve the attempts to get a proper cement plug set the first time without the need for additional plugs. These tools are available to order through your nearest Halliburton sales office or field camp. Additional application information and product data can be supplied upon request. The following Matrix can help you select which tool can offer the most benefit for your cement plugging operations.

### Plug Setting Aids Matrix

<table>
<thead>
<tr>
<th>Description</th>
<th>CST™ Tool</th>
<th>TRT Tool</th>
<th>BHKA Disconnect</th>
<th>BHKA Assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td>This tool aids in setting kick off plugs</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>This tool aids in setting abandonment plugs</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>This tool aids in setting plugs to help cure lost circulation to continue drilling</td>
<td>×</td>
<td>✓</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Improves overall success rate of trying to get competent cement plug on first attempt</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Allows the escalated use of more aggressive cement designs due to use of sacrificial tail pipe</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Compatible with all known drilling fluids</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Allows the setting of an undisturbed plug with a sacrificial tubing tail</td>
<td>×</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Minimizes risk of differentially sticking work string</td>
<td>×</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Cement plug can be left drillable with use of this tool</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Can be used in a lost circulation well environment condition</td>
<td>×</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Requires the use of an HES tool operator or location supervisor</td>
<td>×</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Has a diverter tool accessory option</td>
<td>✓**1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Suitable for use in over 30° to horizontal well conditions</td>
<td>✓</td>
<td>×</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Ability to set excessive length cement plugs with a non-drillable tail pipe option</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>×</td>
</tr>
<tr>
<td>Option of using drillable or non-drillable tail pipe</td>
<td>✓**2</td>
<td>✓</td>
<td>✓</td>
<td>×</td>
</tr>
<tr>
<td>Creates a false well bottom</td>
<td>✓</td>
<td>×</td>
<td>×</td>
<td>✓</td>
</tr>
<tr>
<td>Helps prevent downhole fluid movement effects</td>
<td>✓</td>
<td>×</td>
<td>×</td>
<td>✓</td>
</tr>
<tr>
<td>Can be rebuilt and reused on location by installing another lower assembly</td>
<td>×</td>
<td>✓</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Tool contains a tubular fluid retention device</td>
<td>×</td>
<td>✓</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Tool can be used in a low fluid level well environment</td>
<td>×</td>
<td>✓</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Torque capable disconnect available</td>
<td>×</td>
<td>×</td>
<td>✓</td>
<td>×</td>
</tr>
<tr>
<td>Aids to support a hydrostatic fluid column</td>
<td>×</td>
<td>×</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

*1 = Unique diverter is required for use with CST
*2 = Drillable and non-drillable tail pipe can be used as long as CST can pass through ID restrictions

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The CST™ tool is designed and manufactured by Perigon in Norway. Halliburton is proud to be a distributor for this tool and its technology. The CST tool is designed to create a physical barrier between a cement plug and the fluid below the plug. The purpose of this barrier is to prevent slumping of the heavier cement into the fluid below the plug. The basic operation of the CST tool consists of loading the tool inside the work string at the surface, pumping it down hole with a dart until it exits the work string and spotting a cement plug above the tool.

**Features**

- The CST tool is predominantly made from aluminum and composites and fabricated in a way that it can be folded together like an umbrella inside the work string.
- Once exiting the pipe, it will unfold out and fill the hole.
- The membranes will then fill the ID of the hole and help prevent wellbore fluid below from mixing with the cement.
- Multiple cement plugs can be set in the wellbore with multiple CST tools with only one trip in the hole.
- The CST tool can be pumped or placed before the pre-job circulation.
- The dart displaces the CST tool and prevents contamination in the string.
- No other plug support is required as long as formation integrity is adequate to support the cement hydrostatic column, and hole geometry is fairly smooth and within maximum ID.
- In horizontal or uphill wellbores, the CST tool can be placed at TOC to prevent slumping at the top as it also supports from below.
- The CST is commonly used for off-bottom plug cementing applications such as plug and abandon, kickoff, anchor for cased hole whipstock, and other remedial work.

**Optional Equipment**

- A specially designed diverter tool has been designed and is currently available to aid in hole cleaning and work in unison with the installation of the CST tool.

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When to Use the CST™ Tool

- The CST™ tool can be used for any off-bottom plugging operations as long as there is no loss circulation problem below the tool.
- It can be used in hole sizes up to 45-in. ID.
- It can be placed through restrictions of 2-, 2 1/2-, and 4-in. ID.
- Inclination from 0° to horizontal and higher if required.
- No hydrostatic pressure limitation.
- Compatible with all known drilling fluids.

When Not to Use the CST Tool

- When fluid losses below the point where the CST tool will be placed are experienced.
- If hole size is believed to be larger than 45 in. or highly irregular, washed out, etc.
- If the whole plug length is to be drilled out (i.e., setting the whole cement plug inside casing) including the CST tool, then special precautions should be made regarding bit selection.
- When there is a combination of 3 1/2-in. drillpipe (DP) and 6 5/8-in. DP in the same string, a non-standard dart with a wider working range must be used.
Tubing Release Tool (TRT)

The purpose of the tubing release tool (TRT) is to enable the placement of a competent cement plug downhole with a sacrificial tubing tail. The TRT tool helps ensure a competent plug on the first attempt for kickoff, side tracking, or plug and abandonment purposes. The disconnect mechanism’s upper portion, located near the top of cement plug, is made of non-drillable materials and is retrieved to the surface with the work string. The TRT tool will also retain the displacement fluid inside the work string after the separation of the drillpipe from the lower tubing/tailpipe has occurred. The release ball prevents displacement fluid from falling from the work string and mingling with placed cement. The tubing can be equalized on demand once the drillpipe has been pulled up a safe distance away from the top of the plug. Consequently, the cement plug will remain free of damage and contamination that could be caused by the displacement fluid falling from the drillpipe ID.

Features

- This tool features the ability to set longer length cement plugs without the fear of getting stuck when trying to pull out. It offers the ability to set more aggressive (higher amounts of LCM), thixotropic, and faster setting cement plugs to help cure lost circulation. The sacrificial tubing tail can be placed directly across, and through, a loss zone or unstable wellbore area without the fear of becoming stuck.

- The TRT tool can be used in vertical to highly deviated wellbores depending on where the tool is placed. This is a ball activated tool and not recommended for over 30° deviation placement. Centralizers may be necessary in large wellbore configurations to help ensure maximum displacement efficiency and to help hold tubing in place.

- This tool can be extremely useful in a low fluid level well where calculating displacements to balance a plug can be difficult. The TRT tool helps ensure accurate displacements.

- The disconnect mechanism’s lower portion is made up of drillable or non-drillable materials, depending on the application. This portion of the TRT tool remains connected to the tailpipe, which remains in the wellbore.

- Sacrificial tailpipe can be aluminum or fiberglass.

- A 3.75-in. OD and a 6-in. OD tool are available to work with 2 7/8-in., 3 1/2-in., and 4 1/2-in. tubing tails.

- TRT tool is operated and supplied with two foam wiper balls to wipe the work string and one steel activation ball to operate the release mechanism at the disconnect point.
Bottomhole Kickoff Assembly (BHKA) Disconnect Tool

The primary purpose for the bottomhole kickoff assembly (BHKA) disconnect tool is to place a competent cement plug for kickoff/sidetrack/plug and abandonment purposes on the first attempt with the use of a mechanically operated release device and a sacrificial tubing tail. This simplified tool is more economical and cost effective, but it does not offer a fluid retention device. It is not recommended for low fluid level wells and should be used in a balanced hole environment.

Features

- The tool features a surface-released, dart-operated disconnect mechanism. Placing the release mechanism near the top of cement can minimize contamination by minimizing swabbing of the cement plug while the work string is pulled out of the hole.
- The tailpipe remains in the cement plug to prevent cement contamination as the work string is being pulled out of the hole. The tailpipe length is equal to the length of the cement plug, less approximately 20 ft. This tool also features the ability to set longer length cement plugs without the fear of getting stuck when trying to pull out. It offers the ability to set more aggressive (higher amounts of LCM), thixotropic, and faster setting cement plugs to help cure lost circulation. The sacrificial tubing tail can be placed directly across, and through, a loss zone or unstable wellbore area without the fear of becoming stuck.
• This disconnect assembly can be placed anywhere in the wellbore in vertical, deviated, and highly deviated applications.

• Centralizers may be necessary in large wellbore configurations to help ensure maximum displacement efficiency and to help hold tubing in place.

• 3.75-in., 4.5-in., and 6.75-in. OD tools are available to work with 2 7/8-in., 3 1/2-in., and 4 1/2-in. tubing tails. Sacrificial tailpipes can be aluminum or fiberglass.

**Optional Equipment**

• A specially designed diverter tool is currently available to aid in hole cleaning and work in unison with the BHKA disconnect tool.
BHKA-Disconnect Torque-Capable Assembly

Features

A BHKA-disconnect torque-capable assembly is available for when pipe rotation is desired during circulation and cementing with the use of sacrificial tubing technology.

This tool is designed for use with steel or aluminum sacrificial tubing. This disconnect is available in different tubing and tool size configurations and rated to handle tensile loadings from sacrificial tubing up to 100,000 lb. These torque capable tools have a torque rating from 6,300 up to 30,000 ft/lb. depending on tubing and tool sizes.
Bottomhole Kickoff Assembly (BHKA) Tool

The bottomhole kickoff assembly tool was designed as a premium method to get a competent cement plug set in a wellbore environment where setting a successful plug on the first attempt could be questionable. It is designed to help secure a bottom floor in order to support the base of the cement plug. This tool can be used for kickoff/sidetrack/plug and abandonment purposes. It is mechanically operated by wiper darts released from surface. This tool system utilizes the BHKA disconnect tool, an aluminum sacrificial tubing tail, an inflatable packer, and a diverter sub to help create a favorable well condition for successful plug cementing operations.

Features

This tool system features four major components:

• The BHKA disconnect tool located at the top of the cement plug:
  – Cement contamination is minimized by placing the release mechanism near the TOC. This minimizes swabbing the cement plug while pulling the work string out of the hole.

• Drillable or non-drillable tailpipe:
  – This drillable tailpipe remains in the cement plug to prevent cement contamination as the work string is being pulled out of the hole. The aluminum or steel tailpipe length is equal to the length of the cement plug less 20 ft. Tailpipe is not included with tool assembly.

• Inflatable packer element:
  – The inflatable packer element creates a false bottom to prevent cement movement. It also seals the formation from gas or water migration. This portion of the tool system is not drillable.

• Diverter sub:
  – Located at the bottom of the sacrificial tubing. This allows the wellbore to be washed from top to bottom at the location the cement plug is to be placed across.

• The tool operates with two surface released darts.

• This system can be used in vertical, deviated, and highly deviated applications.

• This plug setting aid system helps reduce detrimental effects of fluid extrusion, spiral flow contamination, and boycott effects.

• Centralizers may be necessary in larger wellbore configurations.

This tool is available in the following sizes:

• 4 /12-in. OD tool.
  – Fits 5 1/2- to 8-in. hole.

• 5 9/16-in. OD tool.
  – Fits 6 1/2- to 10 1/2-in. hole.

• 10 1/4-in. tool.
  – Fits 10 1/2- to 15 1/2-in. hole.
Basic Job Operations

- Run in hole with tool assemblies.
- Wash the wellbore across the plug setting area with diverter tool.
- Launch the inflation and port opening dart and inflate the packer.
- Establish circulation above the packer.

- Place cement plug in the wellbore to the top of disconnect assembly.
- Launch releasing dart and pump displacement as required.
- Land dart and pressure up to activate release mechanism.
- Release from tubing and pull above the plug or out of the hole.
Plug Setting Aid System

The plug setting aid system combines the field proven BHKA disconnect assembly and sacrificial tubing plug cementing operations with two new products: the drillable tail pipe centralizer and the centralizer diverter shoe. These items, when used together, help with setting a competent cement plug in vertical, inclined, and horizontal wellbore conditions. The drillable centralizer and centralizer diverter shoe help centralize the sacrificial tubing by incorporating multiple layers of flexible fabric belt diffusers that also direct the flow of cement into the sacrificial tubing and wellbore annulus. The diffusers are fully adjustable in size and flow pattern to allow the “trapping” of a cement plug between the top of the diverter shoe through the centralizers and up to the BHKA disconnect tool. All of these items can be used together as a system or separately to enhance cement plug setting operations.

Basic Operation of the PSA Concept

- Install centralized diverter shoe on end of tubing.
- Run the plug-setting tubing string to bottom.
- Sacrificial tubing string installed from bottom of where cement plug is to be placed, up to desired top of cement (TOC) and the tubing release point.
- TOC point to include another drillable centralizer.
  - Note: Additional drillable tubing centralizers can be used if required.
- BHKA-disconnect tool installed on top of upper most drillable centralizer.
- Run in hole with standard retrievable work string tubing to surface.
- Use Halliburton dart/ball-drop cementing head.
- While circulating, drop the diverter ball to activate the drillable diverter and circulate clean the interval where the cement plug will be set.
- Set the cement plug with the option of using a more aggressive cement design because the tubing string will not be removed.
  - Higher viscosity/density.
  - Faster set/gelling time.
  - Higher lost circulation material (LCM) concentrations.
- Release displacement dart from surface and displace to balance plug as calculated and until dart lands.
- Pressure up on tubing string and activate the disconnect, then pull tubing up above top of plug for reverse out option, or pull out of hole as pre-determined.
Drillable Centralizer and Diverter Shoe

**Features and Benefits**

- Helps centralize the sacrificial tubing in the wellbore.
- Improves mud displacement and cement slurry placement.
- Helps keep sacrificial falling through light weight cement plugs after disconnect.

Drillable Diverter Shoe

**Features and Benefits**

- Guides tail pipe into wellbore with elastomeric centralizer.
- Centralizer assembly on shoe allows one way fluid movement.
- Provides jetting action for hole cleaning and cement placement.
- Provides base to eliminate annular fluid movement caused by gravity.
- Mitigates annular fluid movement after slurry placement.
- Prevents slumping in horizontal wells.

**Sizes Available**

- The current sizes available for the centralizer and diverter shoe are 2 7/8- and 3 1/2-in.
  - Note: Other sizes can be considered for design upon request.
- The drillable tail pipe centralizer incorporates multiple layers of fabric belting that can be configured for multiple hole diameters.
- The flexible fabric layers allow the assembly to be configured with a variety of annular flow path options.
- The configuration can be optimized for particular cementing operations to be performed.
- Configuration options include optimization of blade centralizer ring OD, annular flow shape, and stiffness.
PSA System used in Vertical Well Application

PSA System used in Deviated Well Application
Wellbore integrity during the well construction and completion process is a key component to the long-term economic viability of oil and gas production and injector wells. Halliburton’s swellable technology systems provide unique and complementary solutions to already existing technologies to meet the ever-increasing demands and requirements placed on operators to create safe and competent wellbores. The simplicity inherent in swellable technology systems provides low risk, fit-for-purpose solutions that can be used throughout the wellbore to help enhance overall wellbore integrity.

The advent of swellable technology presents a competent solution to many of the challenges that are encountered. Swellpacker\textsuperscript{®} isolation systems, along with swellable elastomers in cement, change and adapt along with downhole conditions. The device uses swelling elastomer technology to fill in possible mud channeling or possible flow paths that can open up behind the casing at any time during the life of the well. The combination of hydrated cement and the Swellpacker system provides the necessary high-quality zonal isolation critical to optimum well performance.

\textbf{Swellpacker\textsuperscript{®} Isolation Systems}

The Swellpacker system is chemically bonded to the base pipe, or is available in a slip-on version, and includes end rings to both protect the element during the run in hole process and to act as extrusion limiters once the packer is set. Swellpacker systems can be engineered to optimize the construction of your well using the following options:

- **Swellpacker Oil Swelling (OS) isolation systems** are a blend of polymers that react and swell when contact is made with any liquid hydrocarbon. Swellpacker OS systems can be rated up to 15,000 psi (1034 bar) and 390°F (200°C).

- **Swellpacker Water Swelling (WS) isolation systems** are a blend of polymers that react and swell when contact is made with water. Swellpacker WS systems can be rated up to 10,000 psi (690 bar) and 320°F (160°C).

- **Swellpacker Hybrid Swelling (HS) isolation systems** are a blend of polymers that react and swell when contact is made with water and/or liquid hydrocarbon. Swellpacker HS systems can be rated up to 10,000 psi (690 bar) and 390°F (200°C).
Applications

Swellpacker® Systems Above Top of Cement

Swellpacker isolation systems used above the top of cement (TOC) will prevent pressure migration to surface (sustained casing pressure) from lower reservoirs, without regard to the competency of the original cement job. Swellpacker TOC systems help prevent sustained casing pressure should the well cement become de-bonded from the casing during the life of the well, which could create channels for the pressure to migrate from the formation.

Swellpacker Systems at Shoe Joints

Swellpacker systems used on shoe joints to create a competent pressure seal on the shoe joint and allow for a formation integrity test (FIT), regardless of the condition of the tail cement. Swellpacker shoe joint systems are designed to swell using the base fluid used in the drilling fluid, generally water or oil. If competent tail cementation is achieved, the Swellpacker shoe joint system does not activate. If there is insufficient mud cleanout in the shoe joint area, the contaminated fluid is the fuel for the packer.

Swellpacker Isolation Systems Below Liner Hangers

Swellpacker systems on liner casing, below a mechanical liner hanger inside the parent casing, create assurance of a positive seal to isolate the openhole section from the surface. The liner hanger Swellpacker system can be designed to swell either before the mechanical liner hanger is set, or after the mechanical liner hanger pack off is energized.

Swellpacker Isolation Systems in Production Zones with Cement

Swellpacker systems in production zones with cement are used to complement the cement slurry in providing total zonal isolation. During cementing, there are many circumstances that can affect the efficiency of the cement job. Insufficient centralization, poor mud cleanout, lack of rotation and reciprocation, and reduced velocity during cementation can negatively impact the quality of the cement job. Swellpacker systems, when combined with primary cementing operations, can provide comprehensive long-term zonal isolation, increasing the productive life of the well and minimizing the potential of an expensive workover operation. Swellpacker systems in production zones with cement will also add the benefit of providing a reactive downhole means to address the microannulus that would occur when set cement debonds from the casing. The Swellpacker system will remain dormant while encased in the cement sheath. Once the microannulus has opened up and liquids or gas attempt to flow through the microannulus, the packer will then swell to close off the flow path. The swellable rubber will conform to almost any irregular geometry in the casing or cement.
Swellpacker® Isolation Systems on Liner Tiebacks

When running a tieback string, one normally tack-cements the tieback string in place. The cement is there simply to anchor the tieback string and seal assembly in place. When cementing the tieback string in place, one runs the risk of needing to move the tieback string through unset cement to sting the seal assembly into the tieback receptacle. There is also the issue of having to drill and clean out the remnants of the cement, float equipment, and cementing plugs before completing the well. By using Swellpacker systems on the liner tiebacks, all of these issues can be avoided. The Swellpacker systems are installed above the seal assembly and the tieback string is run in the hole to the tieback receptacle. The seal assembly is pressure tested and then fuel for the swellable element is circulated to the proper location (if fuel is not already in place).

The seal assembly is lowered back into the tieback receptacle, and the Swellpacker system is allowed to swell. The Swellpacker system provides pressure-holding capability and also creates an enormous anchoring force for the liner tieback string. There is no cement, float equipment, or cement plugs to drill. Much of the risk has been reduced and days of operations have been eliminated.

Swellpacker Isolation Systems on Scab Liners

Scab liners are placed in the well to simply provide a casing conduit from the lower liner to the upper tieback casing string. Cementing a scab liner in place is time consuming and the risk/rewards are high. Using Swellpacker systems on scab liners helps reduce the risk of performing a competent cementing job in relative small annuli. Swellpacker systems will provide high-pressure sealing capabilities.
Buoyancy Assisted Casing Equipment

**BACE™ Buoyancy Assisted Casing Equipment Assembly**

BACE™ buoyancy-assisted casing equipment is designed to help get casing to bottom in highly deviated or horizontal wellbores. When running casing in highly deviated or horizontal wellbores, drag forces between the casing and the formation often exceed the hook weight of the casing, resulting in the inability to run to the desired setting depth. This problem is compounded in shallow-depth horizontal wells.

In an effort to further extend the reach of horizontal wells, the need to reduce excessive casing/formation drag resulted in a concept of floating the casing into the wellbore. This light fluid or air creates a buoyant chamber on the lower end of the casing as a result of wellbore fluids. The buoyant chamber can significantly reduce the casing weight resting on the wellbore, resulting in less drag between the casing and the formation. The chamber may be almost any length depending on the reduction in casing weight desired. Less casing drag generally allows the casing to be run to greater depths.

When used with Super Seal II® floating equipment, BACE equipment provides a means to trap lightweight fluids or air at the lower end of the casing string for the purpose of reducing the casing weight. Any such reduction in casing weight results in lower drag forces, which relates to increased possible running depth without risk of casing buckling or sticking.

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BACE™ Buoyancy Assist Casing Equipment

Drilling Mud

BACE™ Buoyancy Assist Casing Equipment

Buoyant fluid from float shoe to BACE™ Assembly

Super Seal II® float equipment

(shoe track is the space between the floats)

Typical BACE™ Equipment

Cement Job Setup

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**Features**

- Enables the ability to trap lightweight fluids or air in the lower end of casing string to reduce casing weight.
- This reduction in weight results in lower drag forces and allows greater running depth without buckling or sticking.
- A Halliburton Super Seal II® float shoe with tapered nose, along with a Super Seal II® float collar, are required to be used with this system.
- Full casing ID after release of BACE™ internal mechanism.
- Large clearance between the OD of the Halliburton BACE assembly and the casings ID.

**BACE with Perculation Method Procedures**

After pressure is applied to rupture the BACE equipment, buoyant fluid percolates through casing to the surface.

**BACE with Circulation Method Procedures**

After pressure is applied to rupture the BACE equipment, the well is circulated clean. Typically, the compressed buoyant fluid remains inside the shoe track.
To learn more about the BACE™ assembly, the practical and economical way to get casing to the bottom in highly deviated, horizontal, or difficult to circulate clean wellbores, contact your local Halliburton representative.
Surface Circulating Equipment

One of the most important operations performed at the well site involves circulating fluids through casing to condition or clean the well before other operations are performed. Halliburton has long provided the industry with the two main methods of attaching circulating equipment to casing—plug containers and circulating swedges. Now, improved design and practices can provide even more reliability and safety during this operation.

Halliburton surface circulating equipment is available for rental on cement jobs through local Halliburton field camps. Contact your local Halliburton representative for additional information.

Halliburton Compact™ Plug Container

The Compact™ plug container is the latest plug container design supplied by Halliburton for use with all Halliburton standard cementing plugs. The Compact plug container incorporates several unique design features that help improve safety, function, and performance.

Features

- It is approximately 33% shorter and lighter than previous Halliburton plug containers.
- It includes an integral Quick-Latch™ coupler that allows safe and quick installation and eliminates taper-threaded connections from the plug container/casing assembly.
- It uses a single manifold utilizing Halliburton Lo Torc® plug valves.
- It includes a plunger assembly that attaches to the plug container body with a 3-in. 1502 union half, allowing easier removal and maintenance.
- It includes a lifting swivel and has a seamless, weldless cap with bar holes for easy makeup.
- These heads have an external plug indicator assembly to indicate when wiper plugs have left the cementing head.
- Available in single and double wiper plug configurations.
- Designed for use on collared tubular products only.

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High-Pressure Cementing Head (HPCH)

Halliburton has introduced high-pressure cementing heads for locations needing higher than conventional working pressures for surface launch cementing applications. These heads are available in select sizes, featuring a heavy duty Quick-Latch™ coupler (QLC) for connection to the casing with specially designed adapters. A casing adapter is required to provide a sufficient shoulder for the QLC.

Features

• Based on the field proven Compact™ plug container configuration.
• Double plug configuration allows loading of top and bottom plugs prior to cementing.
• Allows operators a higher working pressure which permits a higher final circulation pressure than other surface launch cementing heads.
  – Working pressures from 10,000 to 12,000 psi
  – Test pressures during manufacturing at 15,000 to 18,000 psi.
• The HPCH uses a single manifold utilizing Halliburton Lo Torc plug valves.
• The HPCH includes twin plunger assemblies that attach to the plug container body with a 3-in. 1502 union half, allowing easier removal and maintenance.
• Head is supplied with a built-in lifting swivel.
• These heads have external plug indicator assemblies to indicate when wiper plugs have left the cementing head.
• HPCH is available in three head size ranges that cover most API casing sizes from 4 1/2 through 10 3/4 in.
• Blank adapters available to fit casing sizes from 4 1/2 to 10 3/4 in. available for most API and premium threads.

Halliburton Quick-Latch™ Coupler

Halliburton’s Quick-Latch™ coupler provides easier and faster attachment of the cementing plug container to the casing string. It is pre-installed on the plug container and simply clamps on the casing coupling. This helps reduce installation time and adds increased reliability for both cementing and circulating operations.
Compact™ Plug Container Ball Drop Sub

The Compact™ plug container ball-drop sub is to be used in conjunction with 5 1/2-in Compact plug containers. With the appropriate adapters, the ball-drop sub can also be used with 4 1/2-in Compact plug containers. The purpose of the ball-drop sub is to improve the efficiency of launching foam balls behind darts for RapidSuite™ completion tool applications by allowing foam balls to be released after a predetermined amount of spacer fluid has been pumped above the dart during cement displacement. It is important to have a spacer fluid between the foam balls and the dart to prevent the foam balls from interfering with the dart while passing through restrictions, such as the baffles found in RapidSuite tools. The ball-drop sub, along with the appropriate dart canister, allows the dart and up to two foam balls to be preloaded in a Compact plug container.

Features

- The ball-drop sub is placed between the body and the cap of a Compact™ plug container.
- Equipped with a ball valve that keeps foam balls from prematurely launching.
- Rated to 8,000 psi working pressure.
- Convertible to pneumatic actuation.
- Capability to launch two 6- or 7-in. foam balls simultaneously.
- Capability to launch foam balls after a predetermined amount of spacer fluid has been pumped behind the dart or plug.
- Directly compatible with 5 1/2-in. Compact plug containers.
- Compatible with 4 1/2-in. Compact plug containers using adapters.
- In addition to launching foam balls in RapidSuite tool applications, the ball-drop sub can be used in any application where foam balls must be launched behind cementing plugs or darts using a 4 1/2- or 5 1/2-in. Compact plug container.
SSR® High-Strength Continuous-Head Plug Containers

SSR® High-Strength Continuous-Head Plug Containers (250-Ton Lift)

The SSR* High-Strength plug container is designed to lift drillpipe weight. The maximum load rating is 250 tons (500,000 lb with no internal pressure applied). This plug container is commonly used for releasing the ball and drillpipe plug for SSR* plug sets.

Features

- It can be used with 4 1/2-in. API IF drillpipe.
- Max. lift capacity 250 tons (226,800 kg) with no internal pressure.
- Max. working pressure 9,500 psi (65.5 MPa) with no lift.
- Max. pressure test 14,000 psi (96.5 MPa).
- Has separate fit for purpose high-pressure pumping manifold.
- Optional lifting sub available.
- Available option to allow displacement with top-drive rigs.

![Schematic of SSR® 250-Ton Cementing Head with Manifold and Top Drive Displacement Capability Option]
**Type-Certified SSR® High-Strength Continuous-Head Plug Containers (500-Ton Lift)**

Certain surface circulating equipment is available in a type-certified version. Type-certified equipment has fully traceable components with material mechanical properties verified by lab tests. In addition, a certificate of design strength approval for the design is issued by Lloyd’s Register.

For the Type-certified SSR HSCHP 500-ton cementing head, Duncan quality assurance issues a data book that specifies test and working capabilities as well as safety specifications for each high-strength type-certified SSR plug container. A design review certificate from a certifying authority, such as Lloyd’s Register, is included in the data book along with other manufacturing documents. The type-certified plug container is completely traceable and can lift 500 tons with 10,000 psi internal pressure. This style of plug container is commonly used in offshore environments where strict government regulations exist, such as in the North Sea and other deepwater markets.

**Features**

- It is available in the following drillpipe sizes:
  - 4 1/2-in. IF.
  - 5 1/2-in. FH.
  - 6 5/8-in. FH.
- Max. lift capacity 500 tons (453,600 kg).
- Max. working pressure 10,000 psi (68.9 MPa).
- Max. pressure test 15,000 psi (103.4 MPa).
- Max. torque 25,000 ft-lb.
- Has separate fit-for-purpose high-pressure pumping manifold.
- Optional lifting sub available.
- Available option to allow displacement with top-drive rigs.

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**6 5/8-in. FH SSR® Type Certified 500-Ton Cementing Head with Manifold and Top-Drive Displacement Capability Option**

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**SSR® Type-Certified 500-Ton Cementing Head Optional Lifting Sub**
The Commander™ Series of Top-Drive Cementing Heads

Commander™ 1000 Top Drive Cementing Head

Halliburton’s modular top-drive head is designed for the next generation of offshore wells being drilled. The Commander™ 1000 head has integral features in support of cementing and liner operations for the most severe well construction operations and where deepwater wells are being drilled:

- Pre-salt
- Extended salt formations
- When a heavier casing/work string is required

The Commander 1000 top-drive cementing head is designed for offshore operations to surface launch balls and/or darts to operate subsea plug sets and associated tools. The Commander 1000 head can be configured for wireless remote operation capability using radio-frequency. The wireless remote system can also operate upper and lower safety valves. The combined functional working parameters/ratings for the Commander 1000 top-drive cementing head are 10,000 psi, 1,000 Imperial tons (2,000,000 lbm), and 75,000 ft-lbf torque rating. The Commander 1000 head is designed with 6 5/8 FH connections.

Features

- Lloyds and DNV type and product certified.
- DNV certified baskets.
- Launch balls and drillpipe darts.
- Dynamic plug launch/drop plugs while flowing.
- Number of chambers can be increased.
- Integrated swivel design.
- Remote operated 4.0-in ID Kelly valves.

Benefits

- Wireless remote system removes personnel risk:
  - Removes the need for personnel being raised into the derrick to operate valves.
  - Remote operation capability using radio-frequency to operate self-contained technology or pneumatic systems.
- Logic programmed into the wireless controller ensures that darts cannot be dropped out of sequence and also allows for automatic valve sequencing for flushing the head after the job is complete.

- Ability to load plugs offshore and in the basket without breaking the tool apart to install the plugs.
  - Allows loading of drillpipe wiper plugs through swivel (disassembly of head is not required).
- Designed to allow minor maintenance in the field and for improved reliability.
- Modular multi-chamber configuration allows the head to be configured for well-specific operational requirements with additional chambers, as required.
- Integral swivel design reduces the overall assembly length.
- A removable (3.06-in. ID) side entry port located below the dart chambers allows multiple insertions of activating balls up to 3 in. (pin ID of 3.06-in. is the actual restriction). This side entry port also has remote-control capabilities.
- Activating balls of sizes 3 in. to a minimum of 1.75 in. can also be preloaded into a dart chamber, if needed.
Commander™ 500 Top-Drive Cementing Head

Halliburton’s modular top-drive head technology is also available for smaller jobs and land-based operations. The Commander™ 500 top-drive cementing head offers the same features, benefits, and wireless remote capabilities as the Commander 1000 head, except at proportionally lower ratings and size. The combined functional working parameters/ratings for the Commander 500 top-drive cementing head are 10,000 psi, 500 Imperial tons (1,000,000 lbm), and 50,000 ft-lbf torque rating. The Commander 500 head is designed with 5 1/2 FH box and pin connections.
Halliburton Circulating Swedges

Circulating swedges are used in many oilfield applications to circulate fluids down tubing, drillpipe, or casing. The swedge is attached to the top of the tubulars via a threaded connection. Flow lines at the surface are then attached to the swage to allow circulation. Halliburton maintains a wide array of other accessories to aid in fluid circulation with swedges.

Features

- Halliburton circulating swedges are available with 8rd and BTC threads and can be built special order for most premium threads.
- Swedges are supplied with a 1502 female top thread coupling.
- Manufactured from P-110 equivalent material.
- Production pressure tested after manufacturing process.
- Rental items are routinely pressure tested for use in field operations.
- Available with an extended neck and holes for use with an operating bar.
- Swedges can be made to work with Quick-Latch™ couplers.

Halliburton Circulating Water Bushings

Circulating water bushings are used in many oilfield applications to circulate fluids down casing. The water bushing is installed into the top casing joint as a normal casing swedge. Drilling rig tubulars, or the drilling kelly assembly are then attached at surface to the water bushing via a tool joint to allow circulation.

Features

- Halliburton circulating water bushings are available in most drillpipe and casing size combinations.
- They can be built special order for any application to match strength, tensile, and torque capabilities to work with the casing and drillpipe being used.
- Manufactured from P-110 equivalent material.
- Production pressure tested after manufacturing process.
- Rental items are routinely pressure tested for use in field operations.
- Available with holes for use with an operating bar.
**Halliburton Triple Water Bushing**

The Halliburton triple water bushing allows the use of combined technologies. This device allows for combining the use of SSR® type cementing heads with SSR® and SSR-II™ plug sets on surface launch applications. Now, the operator has a wider range of wiping technologies available along with the continuity of Halliburton’s new Commander™ series of cementing heads. Offshore technology can now be used on land-based rigs or fixed offshore platforms when casing is run to surface.

**Operation**

- Run in hole with casing to desired depth.
- Install SSR plug set onto lower end of triple water bushing.
- Insert SSR plug set into landed casing on rig floor and screw triple water bushing into casing and make up to proper torque.
- Install SSR® cementing head.
- Rig up top drive to cementing head.
- Rig up circulating/cementing iron.
- Proceed with primary cementing procedures.

**Benefits**

- Cement head can be fully remote operated.
- With remote operation of head, wiper plugs can be launched without having to stop pumping.
- Less effect on ECDs by continuous pumping operations.
- Safety is optimized by eliminating trips into the derrick to launch plugs.
- Option of pumping through top-drive when circulating and displacing.
- Ability to reciprocate and rotate simultaneously.
- Less time spent on drilling out cement plugs when using SSR-II plug systems.
Lo Torc® Plug Valves

The high value, dependable performance, and low maintenance requirements of Halliburton Lo Torc® valves can help reduce overall operating costs and help cut downtime. These field-proven valves are the same ones that have been used on all Halliburton pumping equipment since their invention. These valves are available in many configuration designs to fit any type of application for equipment machinery or pipeline use. Rebuild kits and replacement parts are available through Halliburton.

Contact your local Halliburton representative for further information on sizes, styles, pressure ratings, and replacement parts. Special valves are available for sour gas service.

The following features have made Lo Torc valves the choice of high-pressure plug valve users worldwide. These valves are available in various types of threaded, molded, and flange type designs. Gear style operators are available for larger type valve styles.
Features

- Provides outstanding value.
  - Even though it leads the industry in quality and performance, the Lo Torc® valve, size for size and service for service, is more reasonably priced than most other high-pressure plug valves on the market—even valves without stainless steel plugs.

- Helps reduce valve replacement costs.
  - The rugged construction of the Lo Torc valve provides long, dependable service under severe conditions. The stainless steel cylindrical plug is heat treated to help eliminate galling during operation and provides maximum resistance to corrosion.

- Meets a broad range of operating requirements.
  - Lo Torc valves perform dependably at high working pressures. The sealing principle of the valve compensates for body deflections. Each valve is hydrostatically tested to the pressure specified by API Specification 6A.

- Offers installation versatility.
  - Lo Torc valves are lightweight. This feature makes the valve suitable for many applications, including mobile installations.

- Helps reduce maintenance costs.
  - The “low torque” design provides for in-line maintenance. Repair or maintenance can be accomplished in minutes with the valve body left in the line. Total disassembly of the entire valve involves removing only two cap screws, adjusting nut, and handle adapter or wrench. Every part in the Lo Torc valve may be replaced with standard parts. None of the parts require factory return of the valve for servicing.

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**Lo Torc® Plug Valve Assembly**

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Part Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Valve body</td>
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<tr>
<td>2</td>
<td>Handle adapter</td>
</tr>
<tr>
<td>3</td>
<td>Grease fitting</td>
</tr>
<tr>
<td>4</td>
<td>Flat washer</td>
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<tr>
<td>5</td>
<td>Lock washer</td>
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<tr>
<td>6</td>
<td>Cap screw</td>
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<tr>
<td>7</td>
<td>Adjusting nut</td>
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<tr>
<td>8</td>
<td>O-ring</td>
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<tr>
<td>9</td>
<td>Plug seal</td>
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<td>Inserts</td>
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<td>O-ring</td>
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<td>13</td>
<td>Roll pin</td>
</tr>
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<td>14</td>
<td>Stop collar</td>
</tr>
<tr>
<td>15</td>
<td>Handle wrench</td>
</tr>
<tr>
<td>16</td>
<td>Snap ring</td>
</tr>
</tbody>
</table>

Replacement Parts Available Through Your Local Halliburton Service Center
Halliburton Casing Equipment Resources

iCem® Service

iCem® service offers an advanced way for Halliburton to work in a collaborative manner with operators to increase the probability of wellbore-integrity success. iCem service is a comprehensive software-simulator-based service to help operators optimize the cement operation regardless of the well type or asset. This scientifically grounded analytical tool is operated by Halliburton-certified technical professionals globally. iCem service evaluates the effect of changes to variables, including mud displacement, slurry properties, casing/pipe movement and centralization, fluid volumes, pump rates, and temperature/pressure differentials. Sheath integrity can be assessed at any point during the life of the well. Simulations that took days to develop and execute are now reduced to hours.

Key wellbore architecture design data provided by the operator can be entered into iCem service tool and used to run various simulations and calculations including:

- Two-dimensional equivalent circulating density (ECD) hydraulic simulator.
- Three-dimensional spacer and cement placement simulator.
- Cement sheath stress analysis is a finite element analysis model to predict the risk of cement failure during various stress-inducing operations to generate thermal and mechanical properties required to retain zonal isolation.
- Tracking surge pressure against the fracture gradient and swab pressure against pore pressure according to casing shoe measured depth.
- Optimize fluid rheologies by assessing the likelihood of fluid bypass based on pressure drop versus flow rate for each successive fluid.
- Rotational torque, slackoff weight, static weight, and pickup weight as a function of casing shoe measured depth.
- Centralization optimizer includes plot detailing standoff of each centralizer and the mid-point.

iCem Service—Hydraulic Simulation

iCem service provides a comprehensive suite of hydraulic modeling for simulating cementing operations:

- ECD management.
- The effect of dynamic temperature on fluid properties.
- Pump schedule design with and without foam cement along with automatic calculation of cement sacks required to achieve top of cement (TOC).
- Balanced plug with or without stinger.
- Standoff.
- Torque and drag.
- Surge and swab.
- Mud removal and erodibility.
- Advanced rheological modeling.
- Integrated fluid-flow potential calculations.
- Complex land and offshore wellbore geometry designs.
- Automatic pump rate adjustment to stay below fracture gradient.

Centralization Optimization Module

With the centralization optimization module within iCem service, Halliburton technical professionals can help operators determine the effect on standoff for individual wells based on centralizer placement. The system supports any combination of holes, pipe sizes, and centralizers of one or more types. This helps operators determine the optimum plan for centralization to help achieve the desired standoff. Reports and graphs are available to review after each model is run.

- Centralizer design flexibility that works with any type of centralizer in any combination (even non-Halliburton), any pipe size, and any hole size.
- Integrated and flexible units of measurement throughout.
- Three-dimensional display of the wellbore configuration to help aid assessment and analysis.
- Centralizer selection and placement.
- Contact your local Halliburton representative to have them run this program on your next well design to help aid in proper centralizer selection and placement.

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Landmark WELLPLAN™ Software Suite

Landmark’s WELLPLAN™ software suite is an integrated well operations technology system unique to the drilling and completions industry. WELLPLAN software, a component of The Engineer’s Desktop™ application, provides the modern drilling and completions engineer with a comprehensive set of engineering tools for analysis, well planning, modeling, and well operations optimization. The technology offered in the WELLPLAN suite functions together as an integrated system and includes built-in links to Landmark’s well data management software.

The WELLPLAN suite is now deployed on Landmark’s Engineer’s Data Model™ (EDM™) software. EDM software is the platform for a fully integrated suite of well engineering and data analysis products providing one-time data entry, a system to promote best practices, and an environment for managing and accessing operational knowledge and lessons learned.

This Landmark software can be made available through connections with your local Halliburton representative, or contact the Landmark web site directly at www.landmarksoftware.com

Features

- WELLPLAN suite provides a complete suite of seamlessly integrated modules to address data collection, analysis, well planning, and modeling, creating a powerful workstation for the engineer.
- Optimizes workflows with “plug and play” compatibility across the WELLPLAN suite and with other EDM applications enables comprehensive engineering workflows from a single application. The result is an optimized engineering environment and enhanced efficiency.
- Operates in a standalone or in a fully concurrent multi-user network environment with powerful user management and data locking features. Built to scale from a single user application to a corporate engineering system.
- The user can save strings and fluids to a library. These items can be imported back into their editors for use in other cases. In addition, entire libraries can be imported/exported to another WELLPLAN database. These libraries are also shared with OpenWells® software.

The following WELLPLAN™ system modules provide detailed, compatible well planning tools for an optimized engineering workflow:

- Torque/drag analysis—provides detailed analysis of the torque and drag forces affecting the work string.
- Hydraulics—provides comprehensive pressure drop calculations, bit hydraulics, and hole cleaning analysis.
- Bottomhole assembly (BHA) drillahead—models drilling performance of steerable directional drilling assemblies.
- Critical speed analysis—models BHA behavior and identifies critical rotary speeds and high stress concentration in the drillstring.
- Cementing/OptiCem™ software—provides tools to design and simulate the optimum cement job.
- WellControl—complete modeling of pressure effects observed in the wellbore during kill operations (generates kill sheets).
- Surge—transient fluid analysis to help avoid well control problems and formation damage during drilling and cementing operations.
- StuckPipe—calculates stuck point, backoff force, and jar setting and tripping forces.
Casing Sales Manual

The Halliburton Casing Sales Manual (100004707) was developed to include all technical data on sales products that are available in our casing equipment product line. This manual is available on CDs or book version to our customers for field use. The manual is also available online and is a live document updated frequently. Information on sizes, dimensions, material grades, and compatibility are listed.

These manuals are available from your local HES representative or online at myhalliburton.com.

Features

- Complete casing equipment portfolio.
- Dimensions and available sizes.
- Technical drawings.
- Proper applications.
- Compatibilities.
- Family product line pictures.
- Current part numbers.

Halliburton's engineered casing solutions support a variety of services including wireline and perforating and fracture stimulation. Halliburton indicator collars help orient logging tools with casing string depths, and frac baffles provide efficiencies for hydraulic fracturing services.
Halliburton Website

Halliburton is committed to providing world-class products and services to our customers. We realize this commitment requires developing a diverse and global communication network of resources. The upstream petroleum industry depends on Halliburton for the broadest range of products and services worldwide. Our vision is “to be the preferred upstream service company for the development of global oil and gas assets.”

To learn more about our company, casing equipment products, and our services, check out our corporate website at www.halliburton.com.

Features

- Company information and history.
- Our complete line of products and services.
  - Including our complete line of casing equipment.
- Divisions and locations.
- Press releases.
- Investor relations.
- Career information.

For more information on this product line of Halliburton solutions or any other Halliburton casing equipment product, please contact us by the following methods:

- A local Halliburton representative.
- Your nearest Halliburton sales office.
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