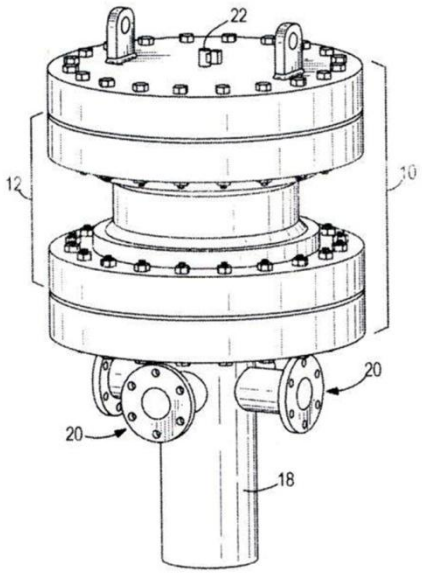
DSI INTENSIFIER VALVE™

DEEP SEA INNOVATIONS LLC

Monee, Illinois USA

www.deepseainnovations.com



Valve Technology That Provides

Reliable and Safe

Oil & Gas Field Disaster Control

DSI INTENSIFIER VALVE™

Table of Contents

Deep Sea Innovations LLC
Monee, Illinois USA

Website: www.deepseainnovations.com
Email: deepseainnovations@gmail.com

September-2016

Deep Sea Innovations LLC developed its valve technology, The Intensifier Valve™, (U.S. Patents 8,485,261 & 8,826,990) in response to leak disasters occurring in the oil and gas fields worldwide, such as the one experienced in the Gulf of Mexico in 2010. This situation presented a need for a quick, reliable and cost savings response.

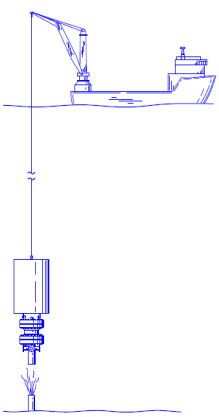
The Intensifier Valve™ has only one moving part which is not connected to any other part. With the valve's simplicity of design, a high level of reliability in performance is assured. This technology has no practicable limit to the depth of the ocean (surface to 30,000 feet) at which it can operate:

- For shallow water sites, accumulators can be employed to operate the valve to close and to re-open a well.
- At greater depths the ambient hydrostatic pressure of the ocean can be used in a first cycle of closing and opening the well and accumulators can subsequently be employed.

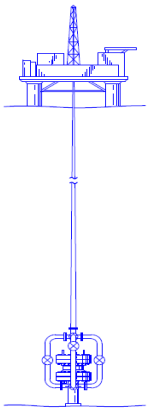
The Intensifier™ valve has multiple applications in oil and gas fields:

- Emergency Response and Well Recovery During Exploration
- Production Control and Security
- Temporary or Permanent Cap

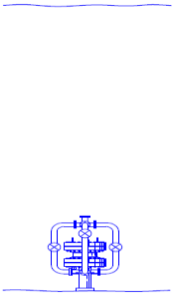
The basic valve is compact with dimensions of approximately 41 inches in width x 76 inches in height and with a weight of approximately 6 tons. For a given well pressure, the valve will remain compact regardless of the need for deeper deployment.



Emergency and Well Recovery



Production Control and Security



Temporary or Permanent Cap

TECHNOLOGY

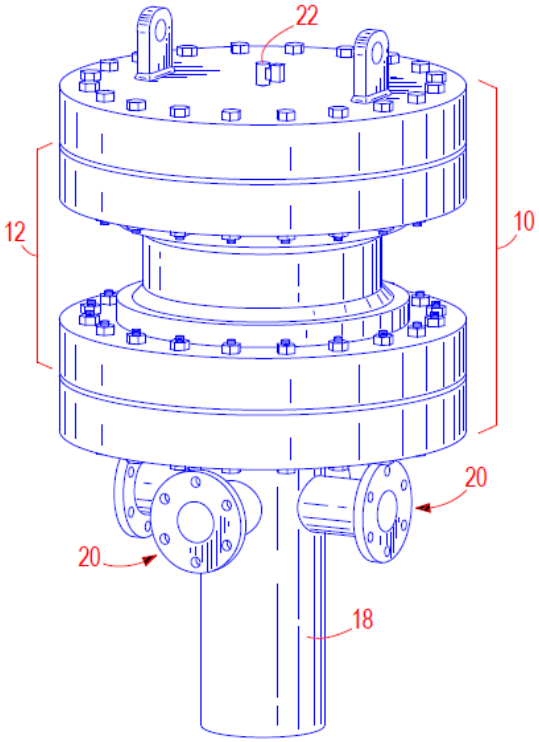


Figure 1

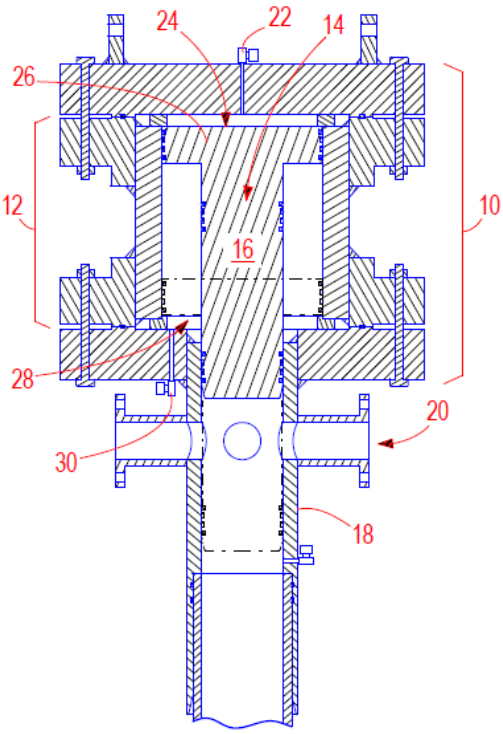


Figure 2

The DSI Intensifier Valve™ in Figure.1 is shown in perspective and in Figure 2 in cross section.

- The upper portion (10) of the valve defines a sealed chamber (12) which contains at least a portion of the movable piston-like member (14). An arm (16) of piston (14) will move within the engagement cylinder (18) positioned below sealed chamber (12). Vent openings (20) extend from and are positioned symmetrically about engagement cylinder (18).

- The general operation of the valve, whether in deep or in shallow water conditions, includes opening upper valve (22) to let in ambient water or hydraulic fluid from an accumulator to pressurize the upper portion (24) of the sealed chamber (12). Upper valve (22) can control the rate of flow into upper portion (24) of sealed chamber (12). The closing of the valve can be accomplished within the industry approved (API) time requirements. The pressurized upper portion (24) of sealed chamber (12) will exert a force onto the head (26) of piston (14) and cause piston (14) to move downwardly wherein arm (16) of piston (14) moves downwardly within engagement cylinder (18) closing vent openings (20).

- Seals are positioned about head (26) maintaining a sealed condition between upper portion (24) of sealed chamber (12) and lower portion (28) of sealed chamber (12). Seals are also positioned on arm (16) sufficiently spaced apart to provide sealing between vent openings (20) and lower portion (28) of chamber (12). These seals can also be strategically positioned in the interior sidewalls of engagement cylinder (18). Whether the seals are positioned on arm (16) or on the interior of sidewalls of engagement cylinder (18), these seals maintain the lower portion (28) of chamber (12) sealed from vent openings (20). With arm (16) in a closed position, head (26) of piston (14) is positioned in a lower portion of chamber (12) (as seen by dashed lines for head (26)) creating a sealed lower portion (28) of the chamber (12).

- The valve can be reopened from a closed position with opening lower valve (30) and leaving upper valve (22) open. Again, depending on the depth of operation and the pressure needed, the ambient ocean or hydraulic pressurized fluid from an accumulator will be let in through lower valve (30) to exert a pressure within the lower portion (28) of sealed chamber (12). The pressure brought in through lower valve (30) exerts a force on the underside of head (26) of piston (14) and pressure from the oil or gas from the well may be used, if the conditions so dictate, to exert a force on arm (16) of piston (14). The upward force exerted on piston (14) causes piston (14) to rise and arm (16) moves above vent openings (20) thereby opening the vent openings (20). Subsequent, successive opening and closing of the valve can be accomplished with using accumulators secured to upper valve (22) and lower valve (30).

- This valve is scalable and capable of providing very high levels of closure force. It can be demonstrated by the following example: a 24 inch diameter head (26) has a surface area of approximately 452.4 square inches. A pressure of 2500 psi brought through upper valve (22) will cause a force of approximately 1,131,000 pounds to be exerted on arm (16). With arm (16) having a diameter of 9 inches has a surface area of approximately 63.6 square inches which would thereby exert a closure force of approximately 17,783 psi on the well. By merely scaling the dimensions of the valve components this valve technology permits a user to customize the valve to provide adequate safety margins for operation and protection of their well.

- Technology has been reviewed by PhD and Professional Engineers who have concluded this valve is the solution for closing and subsequent reopening of oil and gas wells in both shallow and deep water environments.

- The valve has been **Computational Fluid Dynamically (CFD)** analyzed such that the valve can be successfully guided to the leak outlet source through a 5000 gallon per minute leak flow. The valve's scalable closure force can close relatively low well pressures to higher well pressures of 30,000 psi and greater as needed.

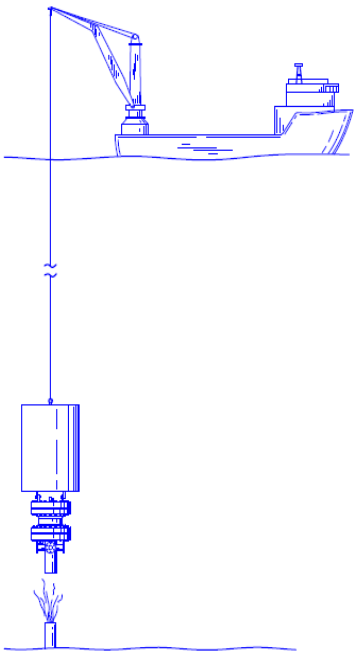


Figure 3

EMERGENCY RESPONSE AND WELL RECOVERY

In **Figure 3**, the DSI Intensifier Valve™ is being lowered to close a leak outflow source that may have occurred from an occurrence of any number of events, at the time of exploration or while in production:

- The well itself
- Manmade, whether intentional or unintentional
- Weather related
- Platform control system failure

When a leak occurs, the valve is lowered into position over the leak outflow source and the engagement cylinder (18) with suitable adaptable engagement configuration engages the leak outflow source allowing oil or gas to flow out of the vents (20) in a symmetric pattern. This flow out of vents (20) provides stability in the lowering of the valve into engagement position. This closure technology is also applicable for closing a failed blowout preventer.

A weight is shown secured to the valve to provide additional resisting inertia to assist the valve to confront the force of the exiting oil or gas force exiting the well. In the alternative the valve can be secured and lowered on a drill string to provide additional resisting inertia. If it is contemplated to reopen the well, the valve can be easily pre-connected to a manifold which will direct the oil or gas around the valve back toward the surface with the manifold s secured to a conduit.

With the leak flow source positioned within the engagement cylinder (18), in this example, the valve is ready to move to a closed position. The chamber of the valve is pressurized and the piston with its associated arm (16) moves downwardly. The pressurization can be generated by ambient water or in circumstances, such as shallow water depth, by accumulators. A leveraging of the force applied to the piston head (26) is transmitted to the smaller dimensioned arm (16). The arm (16) moves within the engagement cylinder (18) and closes the vent openings (20) from which the oil or gas is escaping.

The lower portion of the engagement cylinder, in some circumstances, may be flared and the bottom edge of the same beveled, all in the interest of easily receiving the leak outflow source. Application of flanges and mandrels among other configurations can be utilized as well. The valve can be adapted to meet the client's needs such that, for example, the valve can be configured to adapt to connect an H4 connector or be used with a packer for connection to a damaged leak outflow source.

With the leak closed, the operator may choose to weld the perimeter of the engagement cylinder to the leak outflow source thereby securing the valve to the leak outflow source. With the well closed, the manifold can then be connected to the surface with conduit connected to the manifold. At that time the valve can be reopened the well is then placed back into production. In the alternative, the operator may elect to top kill the well through the valve.

This process of closing a leak outflow source can be completed in a relatively short period of time thereby eliminating large losses of oil or gas and damage to the environment. This technology provides the operator the ability to thereafter re-open the well for production or kill the well.

PRODUCTION CONTROL and SECURITY

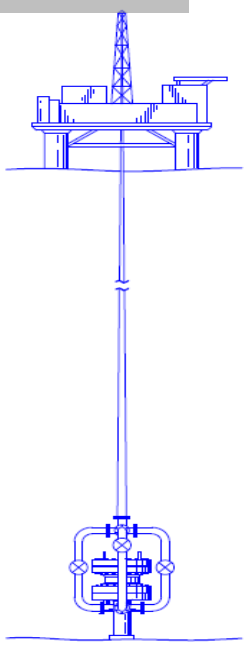


Figure 4

In **Figure 4**, the DSI Intensifier Valve™ is positioned to operate at the well head for production. The valve provides protection should an unfortunate event occur and at the same time permit easy opening and closing of the well as needed without the danger of leaks or damage to the well.

- If the well infrastructure has been severely damaged and/or conduits are dislocated, the well can be safely closed and later reopened with repairs or replacements to the well being made.
- Three way ball valves are positioned within the piping of the manifold.
- Additional flanged access connections can be provided to the engagement cylinder.

In shallow waters accumulators can be used to operate the valve for particularly high pressured wells and for repetitive cycling of the valve. In deeper water environments, ambient ocean pressures can be used to initially cycle the valve between opened and closed positions. For subsequent cycling of the valve accumulators would be employed.

TEMPORARY or PERMANENT CAP

In **Figure 5**, the DSI Intensifier Valve™ is positioned on the well head. The valve was installed, either at the time of production or at a time the operator decided to shut down production.

With the valve in position, it can be closed, shutting off flow of gas or oil from the well either permanently or temporarily. The valve permits the operator to cement the well through the valve and the valve can then be used as a back-up closure or check valve to the closed well

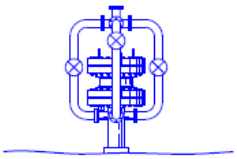


Figure 5

The valve can remain onsite and used as a production valve at any time the valve is later re-opened and the well is put back into production.

BENEFITS

- **Lowers well exploration and production costs** in terms of savings in insurance premiums and/or safety protection programs. **The Intensifier Valve™** provides the oil and gas industry the ability to protect their wells quickly and seamlessly at their platforms

- **Eliminates capital costs** by avoiding the need to drill kill wells to stop a leak and the need to drill a replacement well should the leaking well have maintained operability

- **Prevents incurring an economic disaster** from the payments of governmental imposed fines because of environmental leak damages

- **Versatility** with the valve being able to service all three phases of the well's life: exploration, production and capping

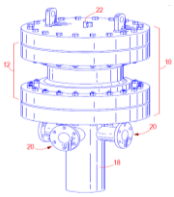
- **Reliability** of the **Intensifier Valve™**, with the simplicity of the design of only one moving part unconnected to any other part of the valve and the ability to selectively operate the valve with ambient water pressure.

- **Multiple concurrent shutdowns are now possible** should unwanted events occur to multiple wells at the same time, all wells can be easily shutdown with this affordable technology; each well can now be fitted with its own valve

- **Environmental Protection** from manmade, accidental or intentional actions, or from environmental destructive forces originating from natural occurrences, in water environments

- **No damage to the well** with repeated openings and closings of the well

- **Portability** based on the **Intensifier Valve™** convenient compact size and weight, it can be easily transported to and stored at the site. Dimensions are approximately 41 inches wide x 76 inches high, with a weight of approximately 6 tons. For a given well pressure, the valve will remain compact regardless of the need for deeper deployment.



SUMMARY

The DSI Intensifier Valve™ is versatile and can protect and service all three (3) phases of the well's life: exploration, production and capping.

With the DSI Intensifier Valve™ present at the time of exploration, the operator is insulated from the numerous potential incidents that may occur during the drilling phase. The operator can be reassured a leak could be closed quickly and the well reopened when desired.

Once the drilling has been completed and the well is ready for production, the blow out preventer is removed from the site; the DSI Intensifier Valve™ can be installed at the well head to be an on-line production control and security valve.

The DSI Intensifier Valve™ can also be placed on site of a production well to insure against any failure or disaster occurring during production. The valve can be lowered and installed quickly should an unfortunate event occur and permit the operator to reopen the well when desired, avoiding the need to drill any kill or replacement well.

Finally, with the valve in position, it can be closed, capping off the flow of gas or oil from the well either permanently or temporarily. The valve further provides the operator the ability to cement the well through the valve and have the valve provide a redundant check valve function. The valve can then be available as a production valve should the well be later placed back into service.

Operators of multiple wells can be assured that having a valve available for each platform provides them a strategy to avoid a disaster striking one or multiple wells at the same time.

The simplicity of the valve's construction, with the one moving part unconnected to any other part of the valve, provides a design of maximum reliability of performance at any depth. The valve also provides the versatility of using ambient water pressure to operate the valve in selected operations.

The scalability of the valve provides ease in operation from shallow depths to the deepest reaches of the ocean of over 30,000 feet, as well as, providing the needed stopping forces to close any well in the oil or gas fields.

The valve will bring great cost savings with its use in all three phases of the well. Expenses related to disaster insurance or safety protection programs can be greatly reduced or eliminated. Should a leak occur, the cost of closing and securing the well will be greatly reduced. With the valve's quick response capability the valve minimizes the loss of oil or gas which would otherwise contribute to the spill or leak. Additionally, the valve avoids

uncontrolled environmental risk which can result in potential enormous governmental fines. These concerns will both now be concerns of the past.

The DSI Intensifier Valve™ should be standard equipment at each site, whether the oil or gas field is positioned in deep or shallow water.