OVERVIEW
The e-cd™ circulating device is an Eni-patented system used in managed pressure drilling operations to enable continuous circulation and hole cleaning even while making connections. It is used while either drilling or tripping in or out of the hole. The e-cd circulating sub, when used in conjunction with the e-cd diversion manifold, allows connections to be made without ever turning rig pumps off.

In today’s drilling environment, the industry is facing greater pressure-related challenges while developing mature and unconventional fields, both on land and offshore. There is also greater focus on improving the feasibility of marginal wells while increasing efficiency with improvement in safety. Managed Pressure Drilling (MPD) is an enabling technology which aids in accomplishing these goals while mitigating drilling risks.

FEATURES
» The sub has a dual flapper valve configuration. The upper flapper valve acts as a check valve when disconnecting the top drive while adding a new stand.
» The side flapper entry port connection is used when making a drill pipe connection without turning off the mud pumps. A second metal-metal plug seal acts as another barrier.
» During drill pipe connections, a highpressure flexible hose is connected to the side port to maintain flow down the drill string.
» Subs are preinstalled at the top of drill pipe stands needed to drill the next open hole section. The number of subs required is dependent on the length of open hole section to be drilled.
» During a connection, once mud flow has been diverted from the top drive to the side entry radial port while making a new connection, the process forces the upper axial valve to close and seal.
» After confirmation of axial valve sealing is received, the top drive can then be broken out and a new stand can be installed in the drill string.
» Once the new stand is installed, the e-cd manifold is then used to divert the mud flow back through the standpipe/top drive and drilling can continue. All processes are safely concluded with the rig pumps running, maintaining constant ECD.

BENEFITS
» Used to drill over 135 wells successfully since 2006.
» The e-cd system enables the mud pumps to maintain uninterrupted flow during connections, allowing constant equivalent circulating density and hole cleaning during the connection process.
» Reduce transition errors during connections.
» Reduce likelihood of connection gas.
» Reduce stuck pipe incidents.
» Reduce ballooning effects.
» No bottom hole temperature variations due to stopped circulation.
» Allows real-time monitoring during connections.
» The upper axial valve is not springloaded when closed; therefore, wireline/intervention operations can be performed.
» Subs can act as reverse flow check with 1.5 bbl/min back flow.
### Equipment Specifications | Standard Grades

<table>
<thead>
<tr>
<th>Connections</th>
<th>7&quot; e-cd sub</th>
<th>7&quot; e-cd sub</th>
<th>7&quot; e-cd sub</th>
<th>7&quot; e-cd sub</th>
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<td>Drillpipe Manufacturer</td>
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<td>VAMEIS</td>
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### Equipment Specifications | Grant Prideco

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### Notes:
- Refer to the equipment databook for individual equipment specifications.
- These ratings are guidelines only. Contact your local Halliburton representative for more information.

For more information, contact your local Halliburton representative or visit us on the web at www.halliburton.com