During operation, along with other data, the gradient chamber data is logged and displayed on the HMI system, and the operators can monitor trends such as temperature and gradient chamber pressures in real-time. This provides seal condition and performance monitoring and early seal wear detection.

### ADVANTAGES

- Monitoring seal condition and performance at all times.
- Allows planning seal replacement at a time that fits the operation.
- Easy and intuitive trend plots which can be customized by the operator.
- No personnel needed in the moonpool area for operating the PCD system.
- Clean and safe working conditions for the operator.

The PCD 5000 represents a flexible design which can be configured according to customer-specific operation requirements. The bottom housing of the PCD is interchangeable and can be replaced by:

- an integrated flow spool, with customer specified outlets, to minimize stack-up height
- any x-over, with customer specified outlets, to match stack-up interfaces

### CUSTOMER SPECIFIC

The PCD 5000 standard configuration

13\(\frac{3}{4}\)” PCD 5000 with 13\(\frac{3}{4}\)” flow spool

15” PCD 5000 with 13\(\frac{3}{4}\)” flow spool

For more information about our technology and products, please contact us at post@wellis-mpcd.com.
The PCD 5000 is a pressure control device to cap and seal return mud flow in managed pressure and underbalanced drilling operations. The control device uses the unique Wellis patented sealing solution, which provides safe, predictable, and efficient sealing technology using non-rotating sealing elements.

The condition and performance of the sealing elements are monitored and logged at all times. The condition monitoring system supports redundancy and capacity and provides predictability during drilling operations. Unlike many conventional RCD systems, the Wellis sealing elements pressure rating is not derated when the rpm increases. The PCD 5000 acts as a multi-seal barrier system in operations such as:

- Managed Pressure Drilling (MPD)
- Unbalanced Drilling (UDD)

### SYSTEM DESCRIPTION

The Wellis PCD system represents a new, innovative and safe sealing solution in MPD/UDD operations, wherein it is crucial to keep wellbore pressure under control to avoid loss of circulation.

The sealing elements are installed in a seal cartridge with a standard configuration of 4 seals. The wellhead pressure is distributed in the seal cartridge by means of grooves Chambers, hence the total load on each seal is significantly reduced. The gradient chamber pressure is monitored and automatically controlled by a HMI and IVS system.

- Should one seal fail, the wellhead pressure will be re-distributed over the remaining functional seals by monitoring the gradient chamber pressures.
- By monitoring the gradient chamber pressures at all times, the actual seal condition and performance is also monitored, and logged by the HMI system. This also enables early seal wear detection, which provides time to plan the operation and seal replacement.

The seals are replaced by retrieving the complete seal cartridge, and installing a new pre-loaded seal cartridge, using the drill string. This is a fast, safe and simple operation done by the rig crew, and has a direct impact on non-productive time.

The gradient chambers, valves, actuators and other hydraulic functions are all controlled by a robust control system.

### ADVANTAGES

- Predictable operation by maintaining full performance
- Redundancy through multiple seals
- Long seal lifetime
- Non-rotating seals - no bearings
- Increased rpm will not cause pressure derating
- Efficient lubrication and retrieval of seal cartridge on discharge
- Full bore access through the PCD with bore protector in place

### UNIQUE SEALING TECHNOLOGY

With the unique and patented sealing solution the Wellis PCD adds a new dimension to sealing capabilities within managed pressure drilling.

Direct lubrication of the seal face significantly reduces wear, maintaining full bore and existing full seal integrity when speed (rpm) and penetration rate (ROP) increases.

### PCD 5000 OPERATING RANGE

The bore protector is installed when not operating in MPD mode. It can be used as a wellbore barrier when the PCD is not operating in MPD mode through bore of 13 5/8”.

The gradient chambers are inclined in the seal cartridge, this is known as inclined configuration. The gradient chamber pressures are logged and unique a gradient chamber system, such that the differential pressure on each seal is 25% of the total wellhead pressure.

The seals are lubricated during operation by direct lubrication to the seal face. The sealing solution is patented by Wellis.

The sealing elements are stacked in the seal cartridge using the drill string, and lubricated by direct lubricant injection into the seal face.

The seals are replaced by retrieving the complete seal cartridge, and installing a new pre-loaded seal cartridge, using the drill string. This is a fast, safe and simple operation done by the rig crew, and has a direct impact on non-productive time.

The gradient chambers, valves, actuators and other hydraulic functions are all controlled by a robust control system.

### PCD 5000 SEAL CARTRIDGE

The bore protector is installed when not operating in MPD mode. It can be used as a wellbore barrier when the PCD is not operating in MPD mode through bore of 13 5/8”.

The gradient chambers are inclined in the seal cartridge, this is known as inclined configuration. The gradient chamber pressures are logged and unique a gradient chamber system, such that the differential pressure on each seal is 25% of the total wellhead pressure.

The sealing elements are stacked in the seal cartridge using the drill string, and lubricated by direct lubricant injection into the seal face. The sealing solution is patented by Wellis.

### PCD 5000 - Seal Cartridge

- Seal 1
- Seal 2
- Seal 3
- Seal 4

### SYSTEM OVERVIEW

The PCD 5000 is installed as a seal cartridge, this can be inclined configuration. It is run by the rig crew using the drill pipe and a fixed running tool.

The bore protector is installed when not operating in MPD mode. It can be used as a wellbore barrier when the PCD is not operating in MPD mode through bore of 13 5/8”.

The gradient chambers are inclined in the seal cartridge, this is known as inclined configuration. The gradient chamber pressures are logged and unique a gradient chamber system, such that the differential pressure on each seal is 25% of the total wellhead pressure.

The sealing elements are stacked in the seal cartridge using the drill string, and lubricated by direct lubricant injection into the seal face. The sealing solution is patented by Wellis.

### PCD 5000 - Seal Cartridge

- Seal 1
- Seal 2
- Seal 3
- Seal 4

### TECHNICAL DATA

- Rated design pressure PCD body: 5,000 psi [345 bar]
- Rated static pressure in operation: 3,000 psi [207 bar]
- Rated dynamic pressure in operation: 2,000 psi [138 bar]
- Max rpm: 265 rpm
- Through bore with bore protector: 13 5/8”
- Max drill pipe size: 16 5/8” [421 mm]
- PCD Top flange: 15 5/8” [396 mm]
- Gas bleed off: 2 1/2” [64 mm]

*Increased rpm does not cause pressure derating*

### PCD 5000 INSTALLATION AND OPERATION

The Wellis PCD system represents a new, innovative and safe sealing solution in MPD/UDD operations, wherein it is crucial to keep wellbore pressure under control to avoid loss of circulation.

The sealing elements are installed in a seal cartridge with a standard configuration of 4 seals. The wellhead pressure is distributed in the seal cartridge by means of grooves Chambers, hence the total load on each seal is significantly reduced. The gradient chamber pressure is monitored and automatically controlled by a HMI and IVS system.

- Should one seal fail, the wellhead pressure will be re-distributed over the remaining functional seals by monitoring the gradient chamber pressures.
- By monitoring the gradient chamber pressures at all times, the actual seal condition and performance is also monitored, and logged by the HMI system. This also enables early seal wear detection, which provides time to plan the operation and seal replacement.

The seals are replaced by retrieving the complete seal cartridge, and installing a new pre-loaded seal cartridge, using the drill string. This is a fast, safe and simple operation done by the rig crew, and has a direct impact on non-productive time.

The gradient chambers, valves, actuators and other hydraulic functions are all controlled by a robust control system.

### ADVANTAGES

- Predictable operation by maintaining full performance
- Redundancy through multiple seals
- Long seal lifetime
- Non-rotating seals - no bearings
- Increased rpm will not cause pressure derating
- Efficient lubrication and retrieval of seal cartridge on discharge
- Full bore access through the PCD with bore protector in place

### UNIQUE SEALING TECHNOLOGY

With the unique and patented sealing solution the Wellis PCD adds a new dimension to sealing capabilities within managed pressure drilling.

Direct lubrication of the seal face significantly reduces wear, maintaining full bore and existing full seal integrity when speed (rpm) and penetration rate (ROP) increases.

### PCD 5000 - SEAL CARTRIDGE

The seals are lubricated during operation by direct lubrication to the seal face. The sealing solution is patented by Wellis.

The seals are stacked in the seal cartridge using the drill string, and lubricated by direct lubricant injection into the seal face.

The seals are replaced by retrieving the complete seal cartridge, and installing a new pre-loaded seal cartridge, using the drill string. This is a fast, safe and simple operation done by the rig crew, and has a direct impact on non-productive time.

The gradient chambers, valves, actuators and other hydraulic functions are all controlled by a robust control system.

### TECHNICAL DATA

- Rated design pressure PCD body: 5,000 psi [345 bar]
- Rated static pressure in operation: 3,000 psi [207 bar]
- Rated dynamic pressure in operation: 2,000 psi [138 bar]
- Max rpm: 265 rpm
- Through bore with bore protector: 13 5/8”
- Max drill pipe size: 16 5/8” [421 mm]
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- Gas bleed off: 2 1/2” [64 mm]

*Increased rpm does not cause pressure derating*

### PCD 5000 INSTALLATION AND OPERATION

The Wellis PCD system represents a new, innovative and safe sealing solution in MPD/UDD operations, wherein it is crucial to keep wellbore pressure under control to avoid loss of circulation.

The sealing elements are installed in a seal cartridge with a standard configuration of 4 seals. The wellhead pressure is distributed in the seal cartridge by means of grooves Chambers, hence the total load on each seal is significantly reduced. The gradient chamber pressure is monitored and automatically controlled by a HMI and IVS system.

- Should one seal fail, the wellhead pressure will be re-distributed over the remaining functional seals by monitoring the gradient chamber pressures.
- By monitoring the gradient chamber pressures at all times, the actual seal condition and performance is also monitored, and logged by the HMI system. This also enables early seal wear detection, which provides time to plan the operation and seal replacement.

The seals are replaced by retrieving the complete seal cartridge, and installing a new pre-loaded seal cartridge, using the drill string. This is a fast, safe and simple operation done by the rig crew, and has a direct impact on non-productive time.

The gradient chambers, valves, actuators and other hydraulic functions are all controlled by a robust control system.

### ADVANTAGES

- Predictable operation by maintaining full performance
- Redundancy through multiple seals
- Long seal lifetime
- Non-rotating seals - no bearings
- Increased rpm will not cause pressure derating
- Efficient lubrication and retrieval of seal cartridge on discharge
- Full bore access through the PCD with bore protector in place

### UNIQUE SEALING TECHNOLOGY

With the unique and patented sealing solution the Wellis PCD adds a new dimension to sealing capabilities within managed pressure drilling.

Direct lubrication of the seal face significantly reduces wear, maintaining full bore and existing full seal integrity when speed (rpm) and penetration rate (ROP) increases.
The PCD 5000 is a pressure control device to cap and seal return mud flow in managed pressure and underbalanced drilling operations. The control device uses the unique Wellis’ patented sealing solution, which provides a safe, predictable, and efficient sealing technology using non-rotating sealing elements. The condition and performance of the sealing elements are monitored and logged at all times. The condition monitoring system enables capacity and provides predictability during drilling operations. Unlike many conventional PCD systems, the Wellis sealing elements’ pressure rating is not derated when the rpm increases. The PCD 5000 acts as a multi-seal barrier system in operations such as:

- Managed Pressure Drilling (MPD)
- Unbalanced Drilling (UBD)

**SYSTEM DESCRIPTION**

The Wellis PCD system represents a new, innovative and safe sealing solution in MPD/UBD operations, where it is crucial to keep wellhead pressures under control. The sealing elements are installed in a seal cartridge with a standard configuration of 4 seals. The wellhead pressure is distributed in the seal cartridge by means of grooves channels, hence the total load on each seal is significantly reduced. The gradient chamber pressure is monitored and automatically operated by a PLC of gradient chambers, hence the total load on each seal is significantly reduced. The total wellhead pressure is distributed over the four gradient chambers, hence the gradient pressure on each seal is 25% of the total wellhead pressure. Gas bleed off is applied to the bore protector in place.

The seals are replaced by retrieving the complete seal cartridge, and installing a new pre-assembled seal cartridge, using the drill string. This new safe, fast and simple operation done by the rig crew, and has a direct impact on non-productive time.

The gradient channels, valves, actuators and other hydraulic functions are all controlled by a robust control system.

**PCD 5000 OPERATING RANGE**

The bore protector is installed when not operating in MPD mode. It can be the seal cartridge using the rig string, and can be retrieved through bore of 13 5/8”.

**ADVANTAGES**

- Predictable operation by continuous monitoring of seal performance
- Reliability through multi-seal design
- Long seal lifetime
- Non-rotating seals - no bearings
- Increased rpm does not cause pressure derating
- Efficient running and retrieval of seal cartridge on drillpipe
- Full bore access through the PCD with bore protector in place

**UNIQUE SEALING TECHNOLOGY**

With the unique and patented sealing solution, the Wellis PCD offers a new standard in sealing capabilities within managed pressure drilling.

Direct lubrication of the seal face significantly reduces wear, increasing channel life and extending full seal integrity when speed (rpm) and penetration rate (ROP) increases.

**TECHNICAL DATA**

- Rated design pressure PCD body: 5 000 psi (34.5 bar)
- Rated static pressure in operation: 2 000 psi (13.8 bar)
- Max rpm: 250 rpm
- Through bore with bore protector: 13 5/8”
- Max drill pipe size: 16” 5K API
- PCD Top Flange: 13 5/8” 5K API
- Gas bleed off: 21” 5K API

*Increased rpm does not cause pressure derating

**SYSTEM OVERVIEW**

The PCD 5000  - SEAL CARTRIDGE

- Seal 1
- Seal 2
- Seal 3
- Seal 4

- Gradient chamber 1: 25% of wellhead pressure
- Gradient chamber 2: 50% of wellhead pressure
- Gradient chamber 3: 75% of wellhead pressure
- Gradient chamber 4: 100% of wellhead pressure

**INSTALLATION AND OPERATION**

The PCD 5000 is designed and tested in accordance with the API 16RCD specification.

The PCD 5000 is installed above the rig BOP/Annular and early seal wear detection.
The PCD 5000 is a pressure control device to cap and seal return mud flow in managed pressure drilling operations. The control device uses the unique Wellis patented sealing solution, which provides a safe, predictable and efficient sealing technology using non-rotating sealing elements.

The condition and performance of the sealing elements are monitored and logged at all times. The condition monitoring reduces redundancy and provides predictability during drilling operations. Unlike many conventional RCD systems, the Wellis sealing elements: pressure rating is not derived when the rpm increases. The PCD 5000 acts as a multi-wall barrier in operations such as:

- Managed Pressure Drilling (MPD)
- Unbalanced Drilling (UOD)

**SYSTEM DESCRIPTION**

The Wellis PCD system represents a new, innovative and safe sealing solution in MPD/UOD operations, where it is crucial to keep wellbore pressure under control.

The sealing elements are installed in a seal cartridge with a standard configuration of 4 seals. The wellbore pressure is distributed to the seal cartridge by means of grooved chambers, hence the total load on each seal is significantly reduced. The gradient chamber pressure is monitored and automatically operated by a PLC and HMI system.

Should one seal fail, the wellbore pressure can easily be re-distributed over the remaining functional seals by monitoring the gradient chamber pressures.

By monitoring the gradient chamber pressures at all times, the actual seal condition and performance are also monitored, and logged by the HMI system. This also enables early seal wear detection, which provides time to plan the operation and seal replacement.

The seals are replaced by re-filling the complete seal cartridge, and installing a new pre-pressured seal cartridge, using the rig string. This is a fast, safe and simple operation done by the rig crew, and has a direct impact on non-productive time.

The gradient chambers, valves, actuators and other hydraulic functions are all controlled by a rugged control system.

**PCD 5000 OPERATING RANGE**

- **ADVANTAGES**
  - Predictable operation by real-time monitoring of seal performance
  - Redundancy through multiple seals
  - Long seal lifetime
  - Non-rotating seals: no bearings
  - Increased rpm will not cause pressure derating

PCD 5000 - SEAL CARTRIDGE

- The bore protector is installed when not operating in MPD mode. It can be on the seal cartridge using the rig string, or installed in the bore protector in through bore of 13 5/8”
- The seal is lubricated during operation by direct lubricant injection into the seal face. The sealing solution is patented by Wellis.

**UNIQUE SEALING TECHNOLOGY**

With the unique and patented sealing solution from Wellis, PCD acts as a new technology in sealing capabilities within managed pressure drilling.

Direct lubrication of the seal face significantly reduces wear, increasing seal lifetime and existing full seal integrity when speed (rpm) and penetration rate (ROP) increases.

**INSTALLATION AND OPERATION**

The bore protector is run by the rig crew using the drill pipe and a fixed J-slot running tool. The seal cartridge is run by the rig crew using the drill string. The protector has a bore diameter of 13 5/8”.

**SYSTEM OVERVIEW**

The bore protector is installed when not operating in MPD mode. It can be on the seal cartridge using the rig string, or installed in the bore protector in through bore of 13 5/8”.

**TECHNICAL DATA**

| Rated design pressure PCD body | 5 000 psi [345 bar] |
| Rated static pressure in operation | 3 000 psi [207 bar] |
| Rated dynamic pressure in operation* | 2 000 psi [138 bar] |
| Max rpm | 255 rpm |
| Through-bore with bore protector | 13 5/8” |
| Max drill pipe size | 16 5/8” 5K API |
| PCD Flange range | 13 5/8” 5K API |
| Gas bleed off | 21” 5K API |

*Increased rpm does not cause pressure derating

**INSTALLATION**

- **PCD Weight**
  - 2 005 lbs [910 kg]
  - 2 205 lbs [1 000 kg]
  - 3 501 lbs [1 590 kg]

- **Total weight in operation (4 seals)**
  - 14 551 lbs [6 600 kg]

- **Rated design pressure PCD body**
  - 5 000 psi [345 bar]

- **Rated static pressure in operation**
  - 3 000 psi [207 bar]

- **Rated dynamic pressure in operation**
  - 2 000 psi [138 bar]

- **Max rpm**
  - 255 rpm

- **Through-bore with bore protector**
  - 13 5/8”

- **Max drill pipe size**
  - 16 5/8” 5K API

- **PCD Flange range**
  - 13 5/8” 5K API

- **Gas bleed off**
  - 21” 5K API

- **Increased rpm does not cause pressure derating**

**PCD 5000**

- **Seal Cartridge**
  - Ø 35.8” [910 mm]

- **Wellhead pressure**
  - 25% of wellhead pressure

- **Gradient chamber 1**
  - 50% of wellhead pressure

- **Gradient chamber 2**
  - 60% of wellhead pressure

- **Gradient chamber 3**
  - 70% of wellhead pressure

- **Gradient chamber 4**
  - 80% of wellhead pressure

The PCD 5000 is designed and tested in accordance with the API 16RCD specification.
During operation, along with other data, the gradient chamber data is logged and displayed on the HMI system, and the operators can monitor trends such as temperature and gradient chamber pressures in real time. This provides seal condition and performance monitoring and early wear seal detection.

**MONITORING**

During operation, along with other data, the gradient chamber data is logged and displayed on the HMI system, and the operators can monitor trends such as temperature and gradient chamber pressures in real time. This provides seal condition and performance monitoring and early wear seal detection.

**ADVANTAGES**

Monitoring seal condition and performance at all times.

Allows planning seal replacement at a time that fits the operation.

Easy and intuitive trend plots which can be customized by the operator.

No personnel needed in the moonpool area for operating the PCD system.

Clean and safe working conditions for the operator.

**CUSTOMER SPECIFIC**

13 5/8” PCD 5000 standard configuration

The PCD 5000 represents a flexible design which can be configured according to customer-specific operation requirements. The bottom housing of the PCD is interchangeable and can be replaced by (examples):

- an integrated flow spool, with customer specified outlets, to minimize stack-up height
- an x-over, with customer specified outlets, to match stack-up interfaces

The sealing solution in the Wellis PCD systems enables operation-specific seals to be used. For example:

- in aggressive drill fluids a purpose-built bottom seal can be used to protect the other seals from the drill fluid
- in operations with large pipe movements and misalignment, a purpose-built top seal can be used, to absorb pipe movement and align the pipe prior to entering the seal cartridge

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MONITORING

During operation, along with other data, the gradient chamber data is logged and displayed on the HMI system, and the operators can monitor trends such as temperature and gradient chamber pressures in real time. This provides seal condition and performance monitoring and early seal wear detection.

ADVANTAGES

- Monitoring seal condition and performance at all times.
- Allowing planning seal replacement at a time that fits the operation.
- Easy and intuitive trend plots which can be customized by the operator.
- No personnel needed in the moonpool area for operating the PCD system.
- Clean and safe working conditions for the operator.

The wellhead pressure (WHP) and the gradient chamber pressures (GC#) are continuously logged and monitored on the HMI system. The plot (right) shows a typical trend plot of WHP and the different GC pressures when a tool joint is run through the seal cartridge (moving up in this example).

The pressure increases when the tool joint enters the gradient chambers, and returns to pre-defined pressure level after the complete tool joint has passed through the seal.

The PCD 5000 HMI system gives the operator excellent control of seal condition and performance by monitoring the GC pressures and other parameters.

Furthermore, it provides early wear indication since any leakage through the seals is easily spotted on the trend plot. This gives superior predictability and makes it possible for the rig crew to be able to plan a seal cartridge change in advance.

CUSTOMER SPECIFIC

The PCD 5000 represents a flexible design which can be configured according to customer-specific operation requirements. The bottom housing of the PCD is interchangeable and can be replaced by (examples):

- an integrated flow spool, with customer specified outlets, to minimize stack-up height
- any x-over, with customer specified outlets, to match stack-up interfaces

The sealing solution in the Wellis PCD systems enables operation-specific seals to be used. For example:

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- in operations with large pipe movements and misalignment, a purpose-built top seal can be used, to absorb pipe movement and align the pipe prior to entering the seal cartridge

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PCD 5000 with 13 5/8" flow spool  PCD 5000 with 18 3/4" flow spool