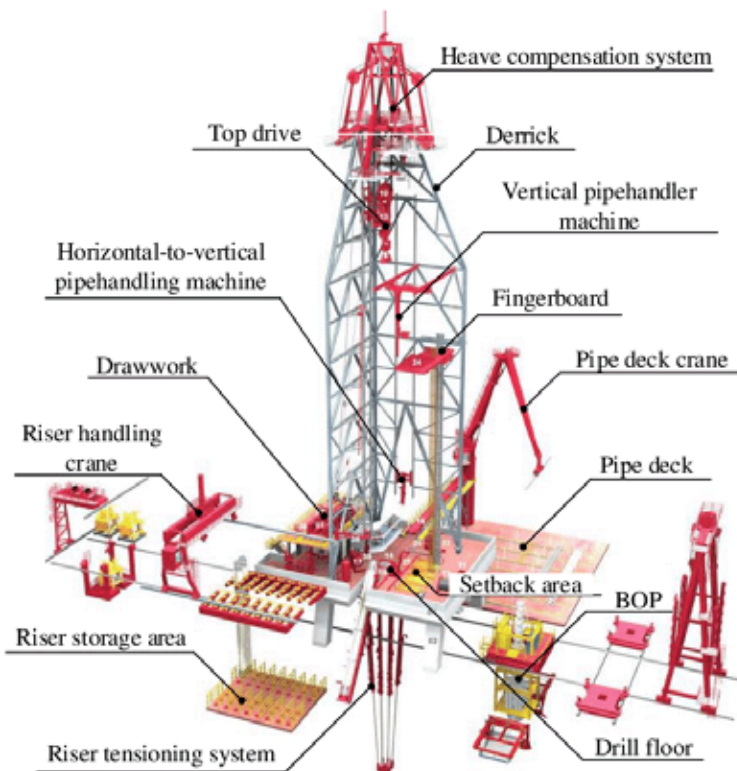


NEWS ALERT



Layup of Land Based Drilling Rigs



During downturns in the oil and gas industry, land-based oil rigs are some of the first production facilities to be closed. During these periods of extended shutdown, the rig requires corrosion protection of the assets. The objective of this document is to provide recommendations for multi-year corrosion protection using environmentally responsible vapor phase and migrating corrosion inhibitors. With proper selection, many of these do not require removal prior to startup, simplifying preservation and minimizing or eliminating potential EPA disposal issues/concerns.

ACRONYMS

PAG	Polyalkylene Glycol
PAO	Polyalphaolefin
NOV ST80 (Roughneck)	(National Oilwell Varco) Electric/hydraulic machine for making up drill pipe joints (screwing together)
DW	Draw Works (Heavy Lifter)
HPU	Hydraulic Power Unit
E-BRAKE	Electrically Powered Brake
VFD	Variable Frequency Drive
BOP	Blowout Preventer
MCC	Motor Control Center
HMI	Human Machine Interface
PLC	Programmable Logic Controller

DRILLING RIG EQUIPMENT

Diesel Engines

- Lubrication system
 - Add M-531 at 5% by volume to engine oil
 - Run engine for a minimum of 1 hour after M-531 is applied



Cortec® Corporation is the global leader in innovative, environmentally responsible VpCI® and MCI® corrosion control technologies for the Packaging, Metalworking, Construction, Electronics, Water Treatment, Oil & Gas, and other industries. Headquartered in St. Paul, Minnesota, Cortec® manufactures over 400 products distributed worldwide. ISO 9001, ISO 14001, and ISO 17025 Certified.





- If engine is already rigged down, use available ports to fog M-531 at 1 oz./ft³ (1 L/m³)
- Cooling system
 - Add M-640 L to cooling system at 2.5% by volume. Run engine for a minimum of 1 hour after M-640 L is applied
 - If engine is already rigged down, use available ports to fog VpCI® -337 W at 1 oz./ft³ (1 L/m³)
 - *If currently running SPX 50/50 coolant, do not treat. Treating with this coolant will void the warranty*
- Fuel system
 - Add VpCI®-707 at 0.2% by volume to fuel tanks
 - Run engine for a minimum of 30 minutes
 - If system has been drained, fog VpCI®-707 into fuel tank, lines, and air intake to diesel engine



Mud Pumps

- If still rigged up, fill slug tank with fresh water containing 1% by volume VpCI®-649 liquid
 - Circulate through entire mud system; this method would require each mud line and component be capped once they are rigged down
- If the rig is already stacked, fog each individual component with VpCI®-337 at 1 oz./ft³ (1 L/m³) and cap
- Mud pumps have two “sides”: the gear end and fluid end
 - The gear end houses the crankshaft and is filled with a type of gear oil that will tend to require M-528
 - Add M-528 at 5% to oil and operate for a minimum of 30 minutes
 - If rigged down and empty, fog with M-528 at 1 oz./ft³ (1 L/m³)
- The fluid end can be protected by flushing with treated fresh water, containing 1% VpCI®-649, from the slug tank if in operation
- If rigged down
 - Fog with VpCI®-337 at 1 oz./ft³ (1 L/m³)
 - Grease caps with CorrLube™ VpCI® Lithium EP Grease



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Boiler

- With boiler shut down and cold:
 - Remove any external rust with VpCI®-423
 - Remove VpCI®-423 residual and neutralize with a 10% solution of VpCI®-414
 - Place Boiler Lizard® in waterside of boiler (one pouch per 1000 gallons of water [3.8 m³])
 - Fog fireside with VpCI®-337 W
- Control panels
 - Deenergize
 - Spray internal surfaces with ElectriCorr® VpCI®-239
 - Place appropriate size emitter in panel
 - VpCI®-105 – 5 ft³ (0.14 m³)
 - VpCI®-111 – 11 ft³ (0.31 m³)
- Valves
 - Spray all stems, bonnet bushings, packing body nuts, and bonnet nuts with CorShield® VpCI®-369
- Piping (uninsulated)
 - Remove any external rust with VpCI®-423
 - Remove VpCI®-423 residual and neutralize with a 10% solution of VpCI®-414
 - Spray with VpCI®-391
- Piping (insulated)
 - Inject VpCI®-658 under insulation



Top Drive

This is a complex system. These top drives have multiple lubricating systems, a multitude of grease points, and piping for the mud system.

- Mud lines
 - If operational, the mud lines will be treated with fresh water and 1% VpCI®-649
- Oil system
 - If operational, add one of the below additives, depending on lubricant type, at 5% by volume
 - M-528 – PAG
 - M-529 – PAO
 - M-530 – Mineral
 - M-531 – PAO
 - If nonoperational, fog with one of the below additives, depending on lubricant type, at 1 oz./



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ft³ (1 L/m³)

- M-528 – PAG
- M-529 – PAO
- M-530 – Mineral
- M-531 – PAO
- Grease points
 - Purge with CorrLube™ VpCI® Lithium EP Grease

NOV ST80

Each head houses its own lubricating system for the rotating portions and is driven by hydraulic pressure. Can be treated while operating or rigged down.

- If operational, add one of the below additives, depending on lubricant type, at 5% by volume
 - M-528 – PAG
 - M-529 – PAO
 - M-530 – Mineral
 - M-531 – PAO
- If nonoperational, fog with one of the below additives, depending on lubricant type, at 1 oz./ft³ (1 L/m³)
 - M-528 – PAG
 - M-529 – PAO
 - M-530 – Mineral
 - M-531 – PAO



Draw Works

The draw works is the heavy lifter. This is a large drum that houses the drill line and moves the top drive along with the drill string.

- Drill line should be treated with VpCI®-369 and covered with VpCI®-126 HP UV Shrink Film
- Lubrication system
 - If operational, add one of the below additives, depending on lubricant type, at 5% by volume
 - M-528 – PAG
 - M-529 – PAO
 - M-530 – Mineral
 - M-531 – PAO
 - If nonoperational, fog with one of the below additives, depending on lubricant type, at 1 oz./ft³ (1 L/m³)
 - M-528 – PAG



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- M-529 – PAO
- M-530 – Mineral
- M-531 – PAO
- Electronic control system
 - Spray all internal cabinet surfaces with ElectriCorr® VpCI®-239
 - Install appropriate size emitter
 - VpCI®-101 – 5 ft³ (0.14 m³)
 - VpCI®-111 – 11 ft³ (0.31 m³)

HPUs

Several types and sizes (e.g., DW brake, rig system, brake calipers)

- If operational, add one of the below additives, depending on lubricant type, at 5% by volume
 - M-528 – PAG
 - M-529 – PAO
 - M-530 – Mineral
 - M-531 – PAO
- If nonoperational, fog with one of the below additives, depending on lubricant type, at 1 oz./ft³ (1 L/m³)
 - M-528 – PAG
 - M-529 – PAO
 - M-530 – Mineral
 - M-531 – PAO
- Calipers can be coated with VpCI®-391 prior to activation of the E-Brake



Catwalk Hydraulic Operated

- If operational, add one of the below additives, depending on lubricant type, at 5% by volume
 - M-528 – PAG
 - M-529 – PAO
 - M-530 – Mineral
 - M-531 – PAO
- If rigged down, most have no spill connections so the oil will stay internal
- The connections will need to be sprayed with VpCI®-369 and covered



AC Traction Motors (5hp to 2000hp)

- Fog internals with ElectriCorr® VpCI®-239
- Add VpCI®-101 Emitter to junction box



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- Coat externals with VpCI®-391 and cover with VpCI®-126 HP UV Shrink Film

VFD

Electrical house, drillers cabin, computers, touch screen HMIs, battery packs, PLCs, AC drives, rectifiers, transformers, air conditioners, etc.

- Spray cabinet internals with ElectriCorr® VpCI®-239
- Install appropriate size emitter
 - VpCI®-105 – 5 ft³ (0.14 m³)
 - VpCI®-111 – 11 ft³ (0.31 m³)
 - VpCI®-308 Pouch – 35 ft³ (1 m³)
 - Each of these should be in a vessel that can be at least partially sealed

Mud Pits

(tanks open top) hold oil and water-based drilling fluids, agitators, shakers

- Agitators will receive additive in the lubrication reservoirs
- Wash tank walls with 10% solution of VpCI®-414
- Coat with VpCI®-391



Diesel Fuel Tanks

- Should be emptied and will need to be fogged with VpCI®-707 at 1 oz./ft³ (1 L/m³)

Water Tanks

- Should be emptied and will need to be fogged with VpCI®-337 at 1 oz./ft³ (1 L/m³)

Accumulators Hydraulic Operated

- Gauges and valves: spray with CorShield® VpCI®-369
- Fog accumulators with one of the below, depending on lubricant type, at 1 oz./ft³ (1 L/m³)
 - M-528 – PAG
 - M-529 – PAO
 - M-530 – Mineral
 - M-531 – PAO
- Gauges should be covered with VpCI®-126 HP UV Shrink Film to prevent UV damage



BOPs Hydraulic Operated

- VpCI®-369 on all surfaces and completely wrap the



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BOP segments with MilCorr® VpCI® Shrink Film

VFD and MCC Houses

- Spray cabinet internals with ElectriCorr® VpCI®-239
- Install appropriate size emitter
 - VpCI®-105 – 5 ft³ (0.14 m³)
 - VpCI®-111 – 11 ft³ (0.31 m³)
 - VpCI®-308 – 35 ft³ (1 m³)

Rig Houses for the Employees

- Recommendations will depend on size and level of preservation required

Rotary Tables

- Purge with CorrLube™ VpCI® Lithium EP Grease. Internals will receive treated hydraulic fluid if still rigged up and operational



Choke Manifold and Gas Buster

- If in operation this will be covered with the fresh water treated with VpCI®-649 at 1% by volume
- If rigged down, we will need to fog and cap with VpCI®-337 at 1 oz./ft³ (1 L/m³)

Air Compressors

- Bleed down and treat the lubricating reservoirs depending on lubricant type, at 1 oz./ft³ (1 L/m³)
 - M-528 – PAG
 - M-529 – PAO
 - M-530 – Mineral
 - M-531 – PAO
- Treat electrical panels with VpCI®-111 Emitters and cover with VpCI®-126 HP UV Shrink Film



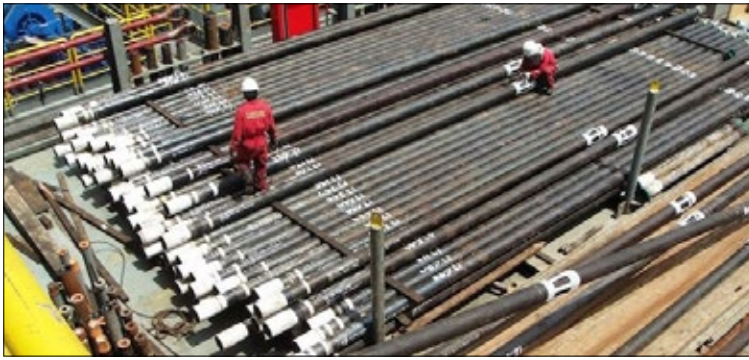
BOP Lifting Winches, Pneumatic and Hydraulic

- Pneumatic will require VpCI®-369 on moving components. Coat exterior with VpCI®-391 and cover with VpCI®-126 HP UV Shrink Film
- Hydraulic will receive treated fluid if still operational
- These winches do not hold fluid; they are run off air or hydraulic pressure



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Drill Pipe

- Fog with VpCI®-337 at 1 oz./ft³ (1 L/m³) and cap. Pipe dope should have already been applied to threads. If not, we can apply CorrLube™ VpCI® Lithium EP Grease or VpCI®-369 before replacing thread protectors

Choke Hoses, and Vibrating Hoses 10k rated

- Fog with VpCI®-337 at 1 oz./ft³ (1 L/m³) and cap

Product	NSN (National Stock Number)	Qualified MIL Spec	Standard Test Methods
CorrLube™ VpCI® Lithium EP Grease			ASTM D-566 ASTM D-1743 ASTM D-942 ASTM D-2509 ASTM D-2596
CorShield® VpCI®-369/ VpCI®-369		MIL-PRF-16173E, Grade 2 (Commercial Equivalent)	ASTM D-1735 ASTM D-1748 ASTM B-117 ASTM D3690 ASTM D522 NACE (Minimum Surface Preparation Guideline) NACE RP0487-2000 SSPC (Minimum Surface Preparation Guideline)
ElectriCorr® VpCI®-239	6850-01-600-4422		ASTM D-1748 ASTM B-117 NACE RP0487-2000
M-528			OECD Method 301D ASTM D-4172 ASTM D-130 ASTM D-665 ASTM D-974 ASTM D-1748 ASTM D-2196
M-529	8030-01-630-5244	MIL-PRF-46002 (Commercial Equivalent) MIL-PRF-85062 (Commercial Equivalent)	ASTM D-4172 ASTM D-130 ASTM D-665 ASTM D-974 ASTM D-1401 ASTM D-1748 ASTM D-2196
M-530			
M-531			



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M-640 L	8030-01-630-0186		ASTM D-1384 ASTM D-3306 ASTM D-4627 ASTM G-31
MilCorr® VpCI® Shrink Film	8340-01-629-6601	MIL-PRF-121 (Commercial Equivalent) MIL-PRF-22019 E (Performance Requirements) (Commercial Equivalent)	ASTM D-882 ASTM D-882A ASTM D1709, Method A ASTM D-1922A ASTM D-3420 ASTM D6988-07 ASTM D1748 ASTM D2732-30 ASTM F3429 ASTM D3985 NACE TM0208-2008 NACE RP0487-2000
VpCI®-101	6850-01-338-1392	MIL-I-22110C (Commercial Equivalent)	NACE TM0208-2008 NACE RP0487-2000
VpCI®-105	6850-01-406-2060		
VpCI®-111	6850-01-408-9025		
VpCI®-126 HP UV Shrink Film		MIL-PRF-22019E (Performance Requirements) (Commercial Equivalent) MIL-PRF-22020E (Commercial Equivalent)	ASTM D-882 ASTM D-882A ASTM D-1922 ASTM D-3420 ASTM D6988-07 ASTM D1748 ASTM D1735 ASTM D2732-30 NACE TM0208-2008 NACE RP0487-2000
VpCI®-308 Pouch		MIL-I-22110C (Commercial Equivalent)	NACE TM0208-2008 NACE RP0487-2000
VpCI®-337	6850-01-629-9146		
VpCI®-369M (1 qt.)	8030-00-244-1295	MIL PRF-16173E (Grade 2)	ASTM D-1735 ASTM D-1748 ASTM B-117 ASTM D3690 ASTM D522 NACE (Minimum Surface Preparation Guideline) SSPC (Minimum Surface Preparation Guideline)
VpCI®-369M (1 gal.)	8030-00-244-1297		
VpCI®-369M (5 gal.)	8030-00-244-1298		
VpCI®-369M (55 gal.)	8030-01-149-1731		



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VpCI®-391			ASTM D-1748 ASTM B-117 ASTM D3690 ASTM D522 NACE RP0487-2000 NACE (Minimum Surface Preparation Guideline) SSPC (Minimum Surface Preparation Guideline)
VpCI®-414			ASTM G-31 ASTM D4627 OECD Method 301D
VpCI®-423	6850-01-482-4536		ASTM F-519 ASTM D-6866-11 OECD Method 301D
VpCI®-649	6850-01-535-2531		NOEC/LOEC – Toxicology Testing ASTM D4627 ASTM G-31

CASE HISTORIES

CORROSION INHIBITING VpCI® POWDERS

CASE HISTORY

Preservation of Land Rig

LOCATION
Iraq

PRODUCT
VpCI®-111
VpCI®-309
VpCI®-368
VpCI®-369
VpCI®-609
VmcCI®-307
M-640 L
Cor-Pak® VpCI® Shrink Film

DATE
2017

CORTEC® REPRESENTATIVE
Gaffney-Kroese

CUSTOMER
International Drilling Operator

PRESENTED BY
CORTEC
MIDDLE EAST
Environmentally Safe VpCI®/MCI® Technologies
www.cortec-mea.com

PROBLEM
Two land rigs had finished contracts and needed preservation before everything was packed up and sent to home base in the UAE.

APPLICATION
Cortec® products were established with a solid track record of delivering effective component preservation. All products were airfreighted direct to the client's site within days of ordering due to Cortec's strategic hub in Jebel Ali, Dubai, being able to support the client on short notice. The client used its own drill team to stack the rig.

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Preservation of Land Rig in Iraq
https://www.corteccasehistories.com/?s2member_file_download=access-s2member-level1/ch633.pdf

HIGH PERFORMANCE VpCI® PACKAGING

CASE HISTORY

Preservation of Land Rig in Kuwait

LOCATION
Kuwait

PRODUCT
VpCI®-111
VpCI®-309
VpCI®-368
VpCI®-369
VpCI®-609
VmcCI®-307
M-640 L
Cor-Pak® VpCI® Shrink Film

DATE
2017

CORTEC® REPRESENTATIVE
Gaffney-Kroese

CUSTOMER
International Drilling Operator

PRESENTED BY
CORTEC
MIDDLE EAST
Environmentally Safe VpCI®/MCI® Technologies
www.cortec-mea.com

PROBLEM
Four land rigs had finished contracts and needed preservation before everything was packed up and shipped back to home base.

APPLICATION
Cortec® products were established with a solid track record of delivering effective three-component preservation. All products were airfreighted direct to the client's site within days of ordering due to Cortec's strategic hub in Jebel Ali, Dubai, being able to support the client on short notice. The client used its own drill team to stack the rig.

CONCLUSION
Immediate availability of trusted products and solutions ensured the client was satisfied with the solution provided.

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Preservation of Land Rig in Kuwait
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CORROSION INHIBITING VpCI® POWDERS

CASE HISTORY

Preservation of Land Rig in Saudi Arabia



DATE
2017

CUSTOMER
Drilling Operator

LOCATION
Saudi Arabia

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PRODUCT
VpCI®-111
VpCI®-309
VpCI®-368
VpCI®-369
VpCI®-609
VnCI 307®
M-640 L
Coe-Pak® VpCI® Shrink Film

PROBLEM
Two land rigs had finished contracts and needed stacking at a yard in Saudi Arabia's Eastern Province.

APPLICATION
Cortec® products were established with a solid track record of delivering effective component preservation. All products were airfreighted direct to the client's site within days of ordering due to Cortec's strategic hub in Jebel Ali, Dubai, being able to support the client on short notice. The client used its own drill team to stack the rig.

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Preservation of Land Rig in Saudi Arabia
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CORROSION INHIBITING VpCI® POWDERS

CASE HISTORY

Preservation of Land Rig in Algeria



DATE
2017

CUSTOMER
Drilling Operator

LOCATION
Algeria

PRESENTED BY
CORTEC
MIDDLE EAST
Environmentally Safe VpCI®/MCI® Technologies

PRODUCT
VpCI®-309
VpCI®-111
M-640 L
M-529
ElectriCoat® VpCI®-248
VpCI®-705
VnCI 307®

PROBLEM
Several land rigs had finished contracts and needed preservation before being shipped back to home base.

APPLICATION
Cortec® products were established with a solid track record in delivering effective preservation of components. All products were airfreighted direct to the client site within days of ordering due to Cortec's strategic hub in Jebel Ali, Dubai, being able to support the client at short notice. The client used its own drill team to stack the rig.

VpCI®-309 was applied to various exposed metal surfaces. ElectriCoat® VpCI®-248 was used to clean electrical equipment, and VpCI®-111 emitters were placed inside electronic/electrical cabinets for corrosion protection. M-640 L was used for cooling system preservation. M-529 was added to gearboxes, and VpCI®-705 was added to fuel tanks. VnCI 307® was used for internal protection of all major equipment.

CONCLUSION
Immediately available trusted products and solution ensured the client was satisfied with the remedy provided.

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Preservation of Land Rig in Algeria
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