STALLASSIST™ SOFTWARE

DETECT, MITIGATE, AND RECOVER FROM DOWNHOLE STALLS

95% of operators experience motor/rotary steerable system (RSS) stalls downhole. Frequent stalls can result in premature bit and BHA failures that lead to unplanned trips, tools lost in hole, sidetracks or cement plugs – and in some cases plugging and abandoning a well if the mitigation efforts are unsuccessful. H&P StallAssist™ software was designed not only to detect downhole stalls, but to mitigate and help recover from them. By increasing bit and BHA reliability this technology can help **decrease sidetracks or lost in hole occurrences and increase motor and bit longevity, translating into more footage drilled per BHA and reduced time to target.**

HOW DOES IT WORK?

INFORMATION NEEDED FOR DETECTION OF A MUD MOTOR STALL

› Driller enters maximum operating and stall differential pressure from the motor manufacturer for rotary and slide drilling.

› Control system monitors the differential pressure based on the performance limits entered and the rate of exchange in differential pressure to determine when a stall has occurred.

AUTOMATED SEQUENCE FOR REACTING TO & MITIGATING STALL

| 1. Rotation or oscillation is stopped | 2. Autodriller is switched OFF | 3. Pumps are stopped or reduced depending on configuration | 4. Surface torque is unwound | 5. Drillstring is picked up off bottom* | 6. Flow is re-established* | 7. Rotation is re-established** |

* If configured ** If configured & rotating at time of stall
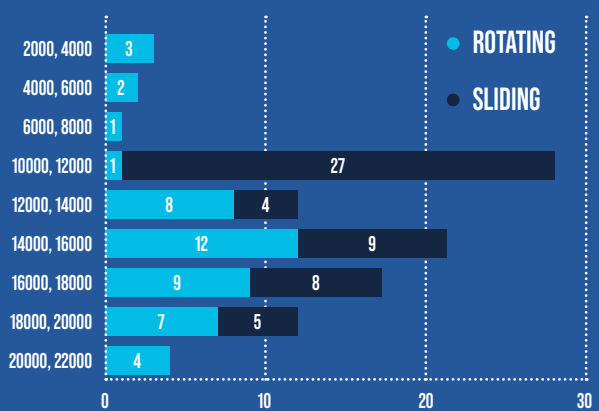
FEATURES	ADVANTAGES	OUTCOME
As pressure is reaching the stall rating, the system **continually** and **simultaneously** evaluates several factors; pressure, the speed in which the pressure is rising and motor specifications	**Dynamic, real-time calculations** prevent the motor from ever seeing the strain of pressure that is outside motor limitations	Detects and actions a stall much **faster** than a human can feasibly do, **stopping significant wear** from excessive force on elastomer and mechanical motor components
Within in just a couple of seconds of detection, StallAssist **immediately** and **automatically** executes the full sequence to react to a stall	**Consistent** and **immediate** action. Without StallAssist software, a driller would have to action each step in the process; See steps 1-7 above. The driller can now focus on the full spectrum of drilling operation activities	Helps **eliminate delayed or inconsistent reactions** that put additional strain on the motor, **reducing premature BHA failure** and associated replacement costs
Configured based on operators operational preferences and practices. As an example, pumps can be slowed or stopped after stall detection	Allows for **quicker recovery** of electrical and mechanical systems	Quickly resume operations, **reducing downtime**
Unlike other industry offering, StallAssist is a **software-based system**	**No downhole tools** are required	**Avoid additional risk and cost** associated with downhole tools
StallAssist software **detects** and **mitigates** stalls during both rotating and sliding activity	Not dependent on drilling method	**Confidence** throughout the drilling process

After 2 years of testing StallAssist™ software:
No Stall Undetected. No False Detections.

StallAssist™ Software Statistics

DETECTION TYPE	MODE	DATE - TIME	DEPTH	WOB SETPOINT	WOB ACTUAL	AD DELTAP SETPOINT	MAX RECORDED DIFF (PSI)	MUD MOTOR DIFF STALL SETPOINT	PERCENTAGE OF MUD MOTOR STALL RATING
Auto	Rotating	12/14/21 - 09:56:11	17,629.10	40.00	37.33	1,000.00	1,066.51	2,115.00	50.43
Auto	Sliding	12/15/21 - 05:18:17	19,104.97	27.61	26.45	222.00	1,185.06	2,115.00	56.03
Auto	Sliding	12/15/21 - 11:36:45	19,415.28	28.00	12.71	296.00	1,203.32	2,115.00	56.89
Auto	Sliding	12/15/21 - 17:03:16	19,779.91	20.00	14.54	276.00	1,158.53	2,115.00	54.78
Auto	Rotating	12/16/21 - 08:30:40	20,675.89	37.00	36.64	1,200.00	1,294.31	2,115.00	61.20
Auto	Sliding	12/21/21 - 20:30:41	11,466.63	24.00	18.96	315.00	1,421.50	2,115.00	67.21
Auto	Sliding	12/21/21 - 20:59:04	11,474.20	24.00	2.52	386.00	1,392.12	2,115.00	65.82
Auto	Sliding	12/21/21 - 23:19:26	11,563.18	40.00	26.19	621.00	1,331.94	2,115.00	62.98
Auto	Sliding	12/22/21 - 00:00:37	11,594.64	15.00	15.28	345.00	1,323.40	2,115.00	62.57
Auto	Sliding	12/22/21 - 00:51:01	11,605.77	10.00	12.52	209.00	1,362.43	2,115.00	64.42
Auto	Sliding	12/22/21 - 02:57:03	11,650.76	15.00	19.74	286.00	1,389.87	2,115.00	65.71
Auto	Sliding	12/22/21 - 03:27:11	11,658.68	30.00	15.26	388.00	1,466.23	2,115.00	69.33
Auto	Sliding	12/22/21 - 04:02:30	11,678.32	30.00	28.91	462.00	1,361.97	2,115.00	64.40
Auto	Sliding	12/22/21 - 06:04:43	11,720.56	27.00	22.59	340.00	1,434.39	2,115.00	67.82
Auto	Sliding	12/22/21 - 06:44:02	11,728.48	18.00	18.84	266.00	1,344.47	2,115.00	63.57
Auto	Sliding	12/22/21 - 07:14:41	11,732.56	18.00	16.74	251.00	1,401.69	2,115.00	66.27
Auto	Sliding	12/22/21 - 08:16:47	11,763.66	22.00	21.12	250.00	1,332.72	2,115.00	63.01
Auto	Sliding	12/22/21 - 09:14:34	11,778.42	40.00	39.59	200.00	1,230.34	2,115.00	58.17
Auto	Sliding	12/22/21 - 09:38:46	11,781.23	28.00	26.81	225.00	1,255.24	2,115.00	59.35
Auto	Sliding	12/22/21 - 10:15:35	11,798.49	30.00	30.34	700.00	1,370.54	2,115.00	64.80
Auto	Sliding	12/22/21 - 10:39:03	11,805.40	35.00	30.86	150.00	1,303.85	2,115.00	61.65

STALL COUNT BY DETECTION TYPE

- ROTATING
- SLIDING

Depth Range	Rotating	Sliding
2000, 4000	3	
4000, 6000	2	
6000, 8000	1	
10000, 12000	1	27
12000, 14000	8	4
14000, 16000	12	9
16000, 18000	9	8
18000, 20000	7	5
20000, 22000	4	

47 ROTATING STALLS

53 SLIDING STALLS

% OF STALLS ABOVE/BELOW MUD MOTOR RATING

2 (2%)

- < 100%
- 100-150%

98 (98%)
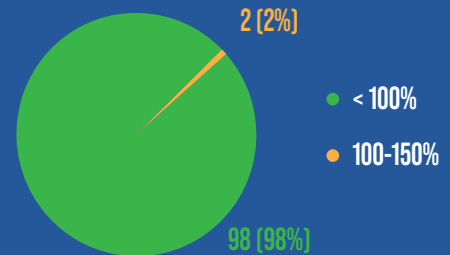
In almost all cases, StallAssist™ software detects stalls faster than the driller does.

CONTACT US

For more information on how our StallAssist™ software can help you achieve better drilling outcomes, contact an H&P sales representative today or contact us through our website at **helmerichpayne.com/contact**.

It's time to follow through on your drilling performance potential.