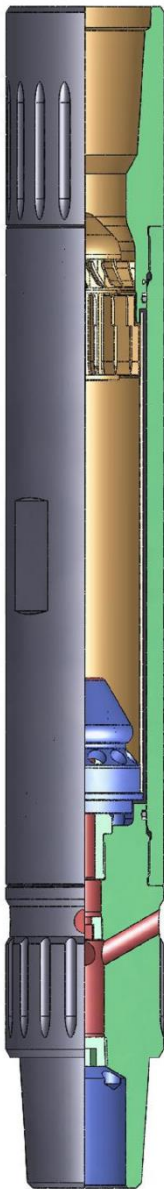


Motor Gas Separator (MGS™) Tool



This tool incorporates a rotary drum separator that removes the gas from energized flow before it reaches the downhole motor. Bypassing the gas allows operation of the motor at the design flow rate while simultaneously running high gas flow rates. The MGS™ tool incorporates a changeable gas orifice that can be sized as needed.

High-Efficiency Gas Separation

- Removes free nitrogen from the flow through the motor
- Reduces nitrogen damage to stators
- Prevents motor overspeed
- **Extends motor life**

Rotary Drum Separator

- Compact length simplifies setup of the BHA
- Accommodates severe doglegs and multilateral completions
- Compatible with common well service fluids
- All units are sour gas compatible

Specifications

Tool diameter	1.69 in. (43 mm)	2.12 in. (54 mm)	2.88 in. (70 mm)	3.38 in. (86 mm)
Length (connected)	16.0 in. (406 mm)	16.6 in. (422 mm)	19.4 in. (493 mm)	29.5 in. (749mm)
Flow capacity (maximum commingled flow equivalent)	2.1 bpm 90 gpm (340 lpm)	2.1 bpm 90 gpm (340 lpm)	5.0 bpm 210 gpm (640 lpm)	5.0 bpm 210 gpm (640 lpm)
Maximum pressure loss from tool	< 70 psi (0.5 MPa)		≈200 psi (1.4 MPa)	
Max. gas fraction at inlet	80%			
Typical gas cut at outlet	< 0.5%			
Maximum temperature	400°F (200°C)			
Fluid compatibility (clear fluids)	Clear fluids: water, 1% acid, seawater, 3% KCl, scale dissolvers			
Gas compatibility	Nitrogen and air			

Motor Gas Separator Performance Software

A proprietary analysis program supplied with the MGS™ tool allows the operator to select the best separator performance range for the job. All pertinent parameters of the job requirements are entered, and the program outputs the optimum performance and operational ranges, as shown below in a screen shot from the program.

TEMPRESS®		Gas Separator Performance	
String and Well Data		US Units	Metric Units
Length of CT	15,000	ft	4.57 km
Coiled tubing OD	2.00	in	50.8 mm
CT wall	0.125	in	3.2 mm
ID of Casing	3.75	in	95.3 mm
Horizontal ID (cased or open hole)	4.50	in	114.3 mm
Temperature gradient, deg F/1000 ft	18.0		32.8 C/km
Estimated fluid flow lost to formation	20%	wt%	
BHA Data			
Min. passage through subs & valves	0.59	in	upstream of gas separator
Gas separator size	2.88	in	
Tool(s) below gas separator	2.88 PDM BOT M1V		
Bit nozzle diameter	0.400	in	
Number of bit nozzles	4		
Tempress-JetRotor™ specification			Maximum Flow Capacity
JetRotor™ nozzle configuration			455 lpm 2.9 bpm
Operating Parameters			
Measured Depth (MD)	12,000	ft	3.66 km
Total Vertical Depth (TVD)	10,000	ft	3.05 km
Nitrogen flow rate	1000	scfm	28 scmm
Water pump flow rate	2.70	bpm	430 lpm 113 gpm
Brine concentration	0%	wt%	
Wellhead choke pressure (gage)	50	psig	345 kPa
Separator Port Sizing			
On-Bottom (Milling) or Off-Bottom	ON-BOTTOM		water bypass
Gas separator bypass port size	0.240	inch	6.1 mm
Performance Model Results		<i>Press F9 key to complete solution</i>	
Total BHA pressure drop	1200	psi	8.3 MPa
Pump pressure (drilling/milling)	4308	psi	29.7 MPa
Bottomhole circulating pressure (BHCP)	3175	psi	21.9 MPa
Bottomhole temperature	256	F	124 C
Total motor or JetRotor™ equivalent flow	2.47	bpm	393 lpm OK
Total bypass equivalent flow	1.23	bpm	195 lpm
Vertical cuttings transport ratio (1-mm sand)	83%		OK
Water velocity in horizontal section	214	fpm	1.1 m/s velocity should be > 200 fpm
Stratified flow in horizontal section?	Mixed - OK		
Bypass water	0.23	bpm	37 lpm 8.5%
Bypass nitrogen	1.00	bpm	158 lpm 100%
Water flow to tool	2.47	bpm	393 lpm 91%
Nitrogen cut in tool	0.00	bpm	0 lpm 0%
Revision		12/17/2009 JJK/KT	

Circulating Pressure

Pressure, psi

Tubing on Reel, ft <==== Measured Depth ====> In Well, ft

Gas Port Sizing Instructions for Motor:

- Set gas port to balance flow when OFF-BOTTOM (no gas in motor, minimal water bypass).
- Check water bypass when tool is ON-BOTTOM and milling.

Bypass

Equivalent Flow (bpm)

Motor or JetRotor™

Equivalent Flow (bpm)

MGS™ Operation Guide

An operation guide is included with the MGS™ tool. This guide explains how to change out the gas orifice and provides cleaning and inspection procedures for multiple runs between redresses.