

Selecting the Orifice using WINPUL Software

Selecting the Orifice using WINPUL Software

At the completion of this presentation you should be able to:

- 1. Select the correct orifice for the 650, Slimhole, and Superslim systems.
- 2. Select the correct orifice and poppet stand-off for the 1200 system.
- 3. Use the sensitivity analysis to predict the results of "What-if?" situations.

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What is an Orifice?

- An opening through which the mud flows
- Part of a flow restrictor (with the poppet) that creates the pulse
- Made of solid tungsten carbide to resist erosion

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What does it do?

The poppet extends into the orifice to create the positive pulse

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What does it do?

Approximate retracted position



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What does it do?

Approximate extended position



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Types of Orifices

- Three types
 - Standard
 - Used on 650 system
 - Dovetail
 - Used on Slimhole and Superslim
 - 1200 system
 - Used on 1200 system only

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These are Orifices



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What's the deal with the Funky looking Dovetail?

- Designed for better lost circulation material (LCM) tolerance
- Additional benefit of limiting lateral movement of the poppet
- Disadvantage of unbalanced
 erosion

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What's the deal with the Funky looking Dovetail?

 Cannot be reversed, tapered side always towards the poppet





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- Twenty-two standard orifice sizes
 - 1.5625 to 1.6375 inch
 - In increments of 0.0125 inch
 - 1.650 to 2.000 inch
 - In increments of 0.025 inch

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- Sixteen dovetail orifice sizes
 - 1.5625 to 1.6375 inch
 - In increments of 0.0125 inch
 - 1.650 to 1.850 inch
 - In increments of 0.025 inch

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Six 1200 orifice sizes

- 1.85 to 2.35 inch
 - In increments of 0.1 inch

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How do we Measure orifice Size?

Caliper the ID of a standard orifice

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Caliper the Orifice ID



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How do we Measure orifice Size?

Use a gauge for a dovetail orifice

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Gauging a Dovetail Orifice



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Gauging a Dovetail Orifice



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Gauging a Dovetail Orifice



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What's the original ID of a worn orifice?

- The ID of used orifices may be larger than the original ID
- The original ID will be the next smallest standard ID size

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What's the original size of a worn orifice?

- For Example
 - If the worn orifice's measured ID is
 1.642 inch
 - This is between a 1.6375 and a 1.650 inch orifice
 - The ID when new must have been the smaller of the two, a 1.6375 inch

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Using a worn orifice

 The downstream side of a standard orifice will become rounded due to erosion

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Using a worn orifice







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Using a worn orifice

- If the orifice passes the wear-out criteria it can still be used
- Install the orifice with the rounded edge away from the poppet

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Why do we have different sizes of Orifices?

- As mud flow rate increases the orifice opening must also increase to reduce the force on the poppet in the extended position
 - Limited to 800 lb for MKVI/MKVII
 - Limited to 1000 lb for MKVIII

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How do we Select the Correct Orifcice Size?

Use WINPUL software

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This is WINPUL

ENTED			UTO			BECOM		CETUD	LINI	те
Custom Config	FROGRAMINE					RECOIVII	VIENDEL	SETUP		13
Drill Collor ID		lin	-	Dawn	of Otanal aff					
		in		Popp	et Stand-oli	J			j m	
		linA2								
Ponnet Cyl OD		500-1 520 > lin				FLU	JW & WI			
1 opper cyr ob		ΜΔΥ		_		TARGET	MIN	MAX		
Flow Rote		luco anm	-	Dov	Vnhole Gen Pulse Amn				Insi	+
Mud Weight	<u> </u>				(APPROX)				Ibor	
Plastic Viscosity		CP		P	oppet Load				lb	
r laone moceony j	FINAL CHOICE	UNITS								
Orifice ID Lised		in		PRESSU	RE DROP					
PSO/Pon Cvl	i i			N	Ion-Pulsing				psi	-
Job Number					Pulsing				psi	-
Bitrun									8	
										_
SENS	ITIVITY ANALYSIS	CASE 1	CAS	E 2	CASE 3	C/	ASE 4	UNIT	S	
ENTER :	Orifice ID	<u> </u>		-		·	*] in		
	Poppet Stand-off							in		
	Flow Rate							gpm	-	
	MudWeight							ppg	-	
	Plastic Viscosity]¢P	-	
ESULTS : Down	nhole Gen Pulse Amp							psi	-	
	Poppet Load							lb	T.	
1	PRESSURE DROP									
	Non-Pulsing							psi	*	

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- Selects orifice size for all systems
- Calculates poppet stand-off for the 1200 system
 - This is the distance between the poppet and the orifice in the retracted position
 - This distance is variable for the 1200 system. It is a fixed distance for all other systems

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- Calculates approximate
 - Downhole generated pulse amplitude
 - Poppet load
 - Pulsing and non-pulsing tool pressure drop

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- Provides Sensitivity Analysis or What-if?
 - Change inputs
 - Orifice ID
 - Poppet stand-off (1200 System only)
 - Flow Rate
 - Mud Weight
 - Plastic Viscosity

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- Provides Sensitivity Analysis
 - View results for up to four cases
 - Downhole generated pulse amplitude
 - Poppet load
 - Pulsing and non-pulsing tool pressure drop

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How do I use WINPUL?

Nine inputs required

- Pulser Type
 - MKVI / MKVII or MKVIII
- System Configuration
 - 1200/1500
 - 650
 - Slimhole
 - Superslim
- Drillpipe/Coil Tubing ID

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How do I use WINPUL?

- Drill Collar ID
- One of the following
 - Number and size (in 32nds) of jets
 - Total flow area (TFA)
 - Pressure drop below the tool (PD)
- Poppet cylinder OD
- Flow rate
- Mud weight
- Plastic viscosity

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What are the input units?

Quantity				
Length	in	cm	mm	
Pressure	psi	kPa	bar	
Flow Rate	gpm	M ³ /mi	L/min	
Density	ppg	Psi/ft	kPa/m	SG
Viscocity	сР	MPa s		
Force	lb	N	kgf	

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Measuring Poppet Cylinder OD





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Measuring Poppet Cylinder OD



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View Results

					_ 0	×
	RESULTS	RECON	UNITS			
	Orifice ID	1.8000	lin			
	Poppet Stand-off				in	
		99 19	<i>a</i> .			
Poppet Stand-off is only		TARGET FLOW & MUD	MIN FLOW & MUD	MAX FLOW & MUD		
Changes according to pulser type	Downhole Gen Pulse Amp (APPROX)	60	55	67	Dsi	-
	Poppet Load	561	503	651	Ь	-
	PRESSURE DROP:					
Poppet Load must not exceed	Non-Pulsing	278	250	327	psi	-
800 lb or 1000 lb	Pulsing	470	422	549	psi	-

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Orifice ID based on Target Flow & Mud

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Sensitivity Analysis

Select orifice ID and evaluate performance under various conditions

SENSIT	IVITY ANALYSIS	CASE 1	CASE 2	CASE 3	CASE 4	UNITS	
ENTER	Orifice ID	•	•	•	•	in	
	Poppet Stand-off				145 - 51 12	in	
	Flow Rate					gpm	-
	Mud Weight					ppg	-
	Plastic Viscosity					сР	-
RESULTS D	ownhole Gen Pulse Amp					psi	-
	Poppet Load					Ь	-
	PRESSURE DROP:						
	Non-Pulsing					psi	-
	Pulsing					psi	-

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