LWD 1

Selecting the Orifice using WINPUL Software

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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.**

What is an Orifice?

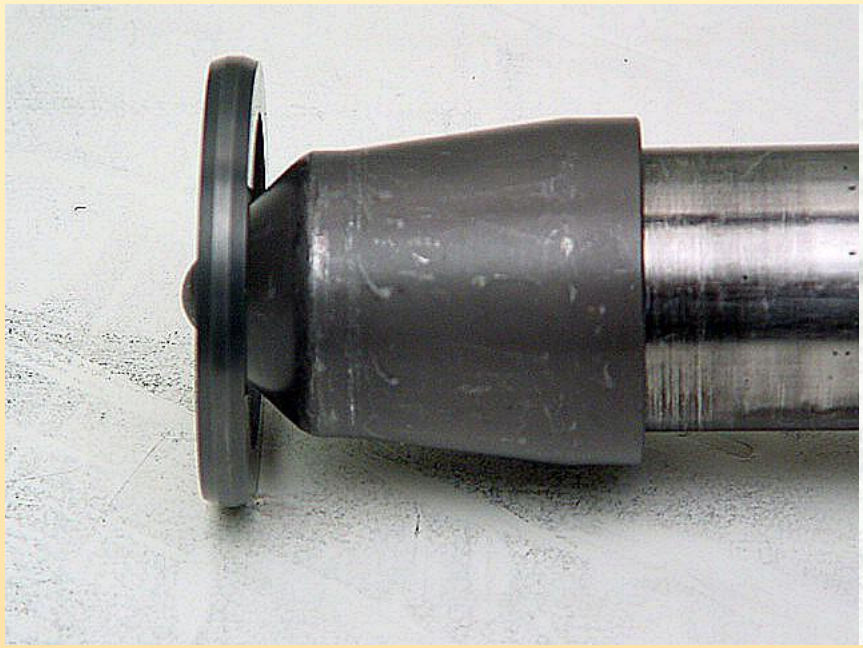
- An opening through which the mud flows
- Part of a flow restrictor (with the poppet) that creates the pulse
- Made of solid tungsten carbide to resist erosion

What does it do?

- The poppet extends into the orifice to create the positive pulse

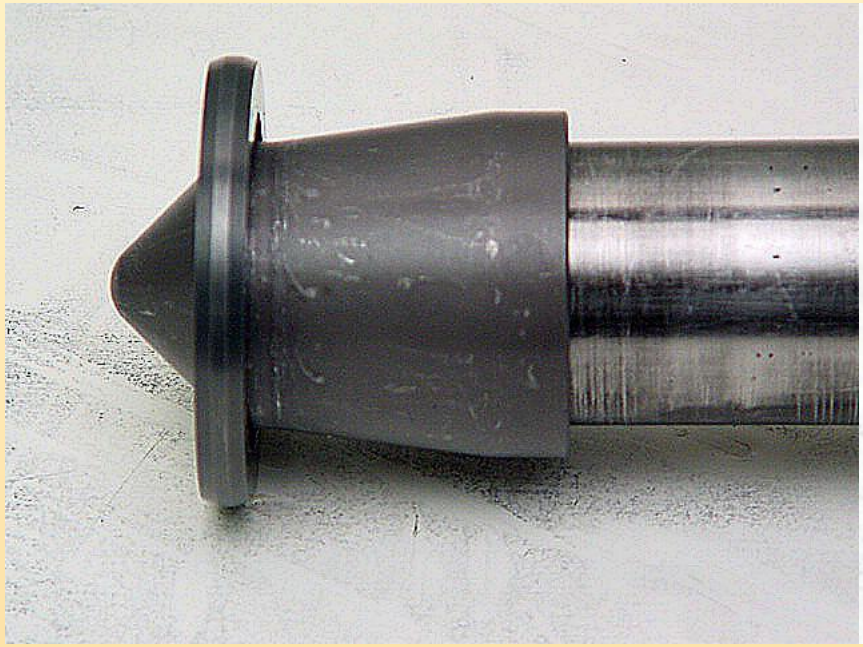
What does it do?

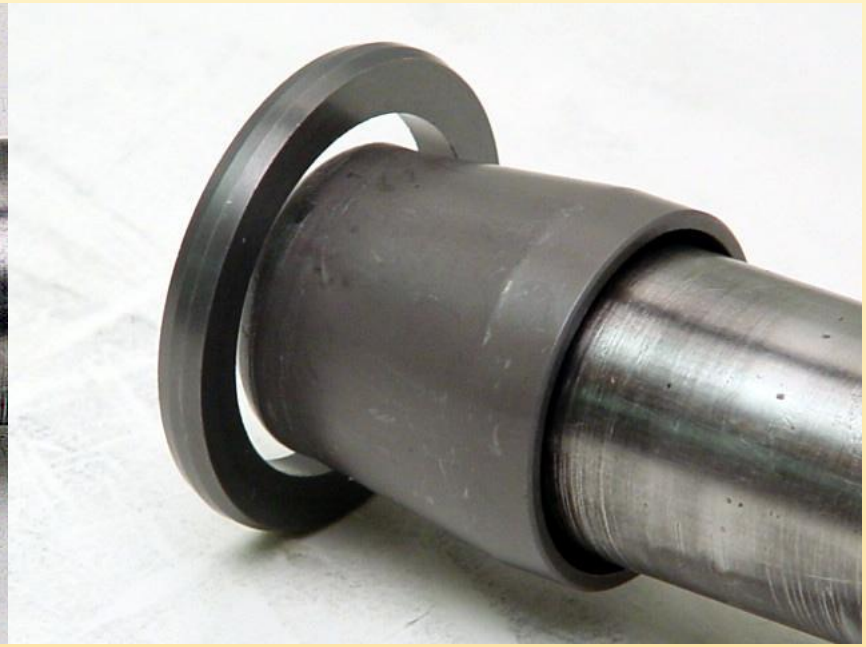
- Approximate retracted position



What does it do?

- Approximate extended position





Types of Orifices

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

These are Orifices

Standard

Dovetail

1200 System

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

What's the deal with the Funky looking Dovetail?

- Cannot be reversed, tapered side always towards the poppet

Orifices come in several different sizes

Orifices come in several different sizes

- 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

Orifices come in several different sizes

- 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

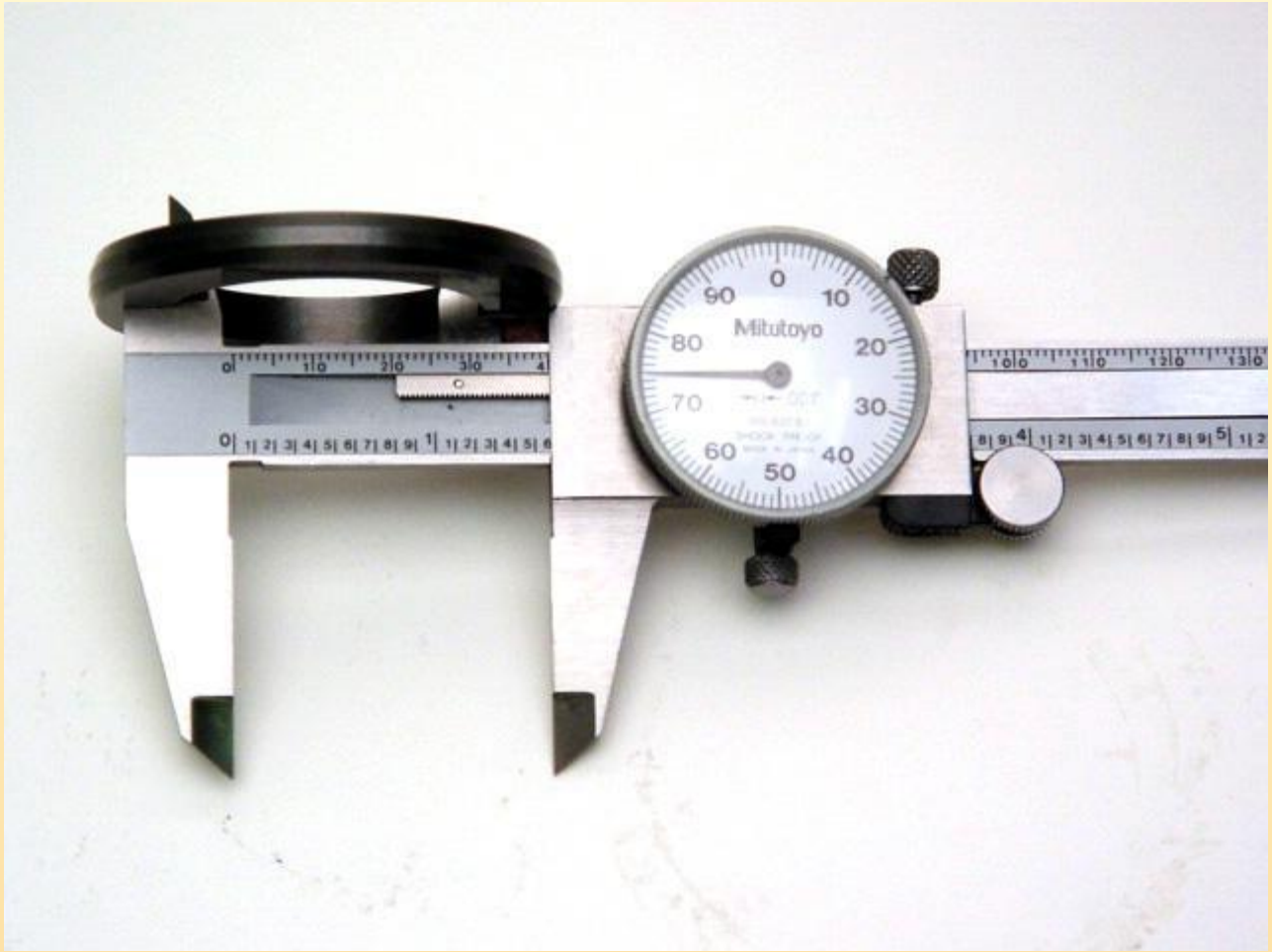
Orifices come in several different sizes

- Six 1200 orifice sizes
  - 1.85 to 2.35 inch
    - In increments of 0.1 inch

How do we Measure orifice Size?

- Caliper the ID of a standard orifice

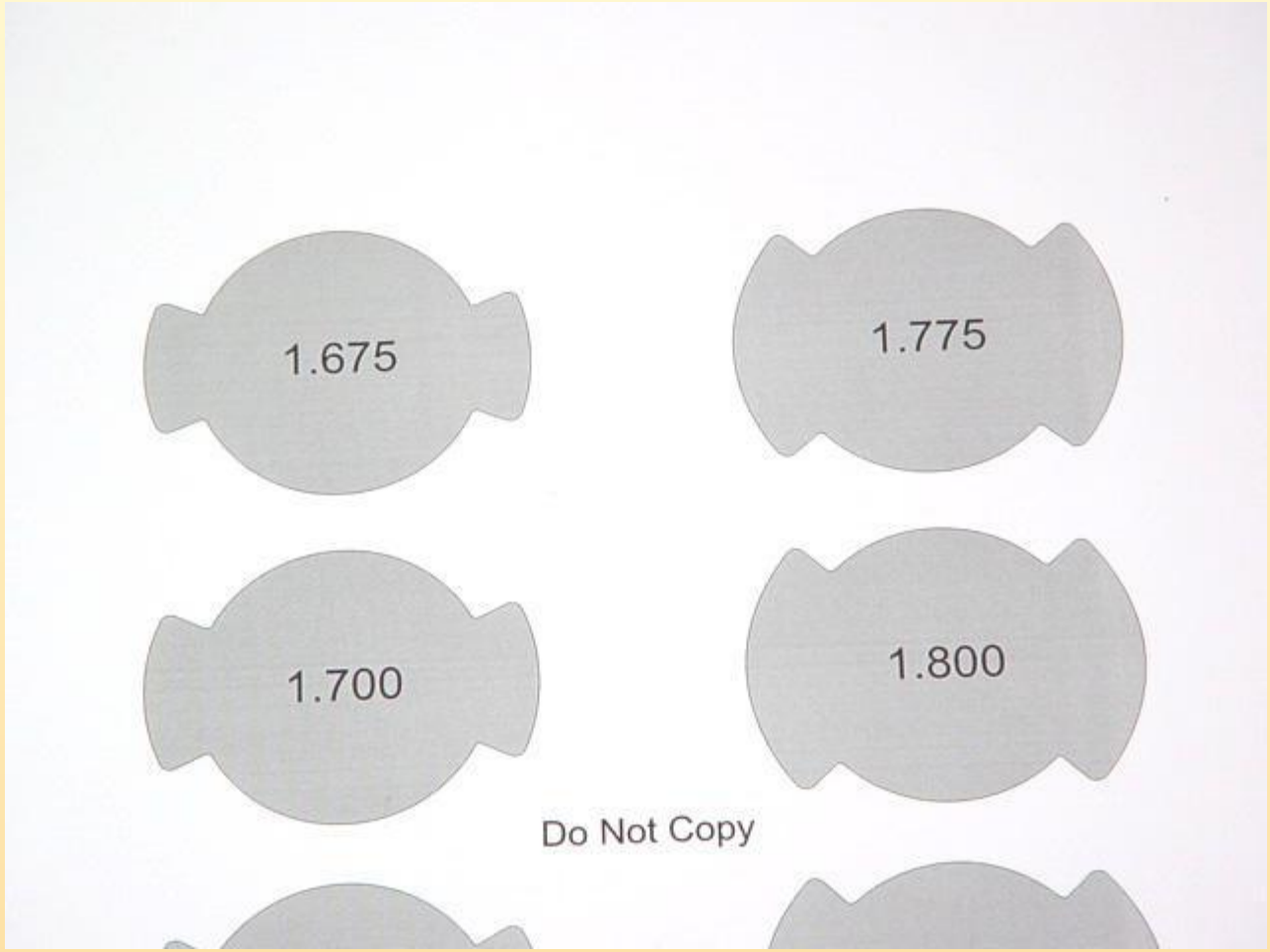
Caliper the Orifice ID



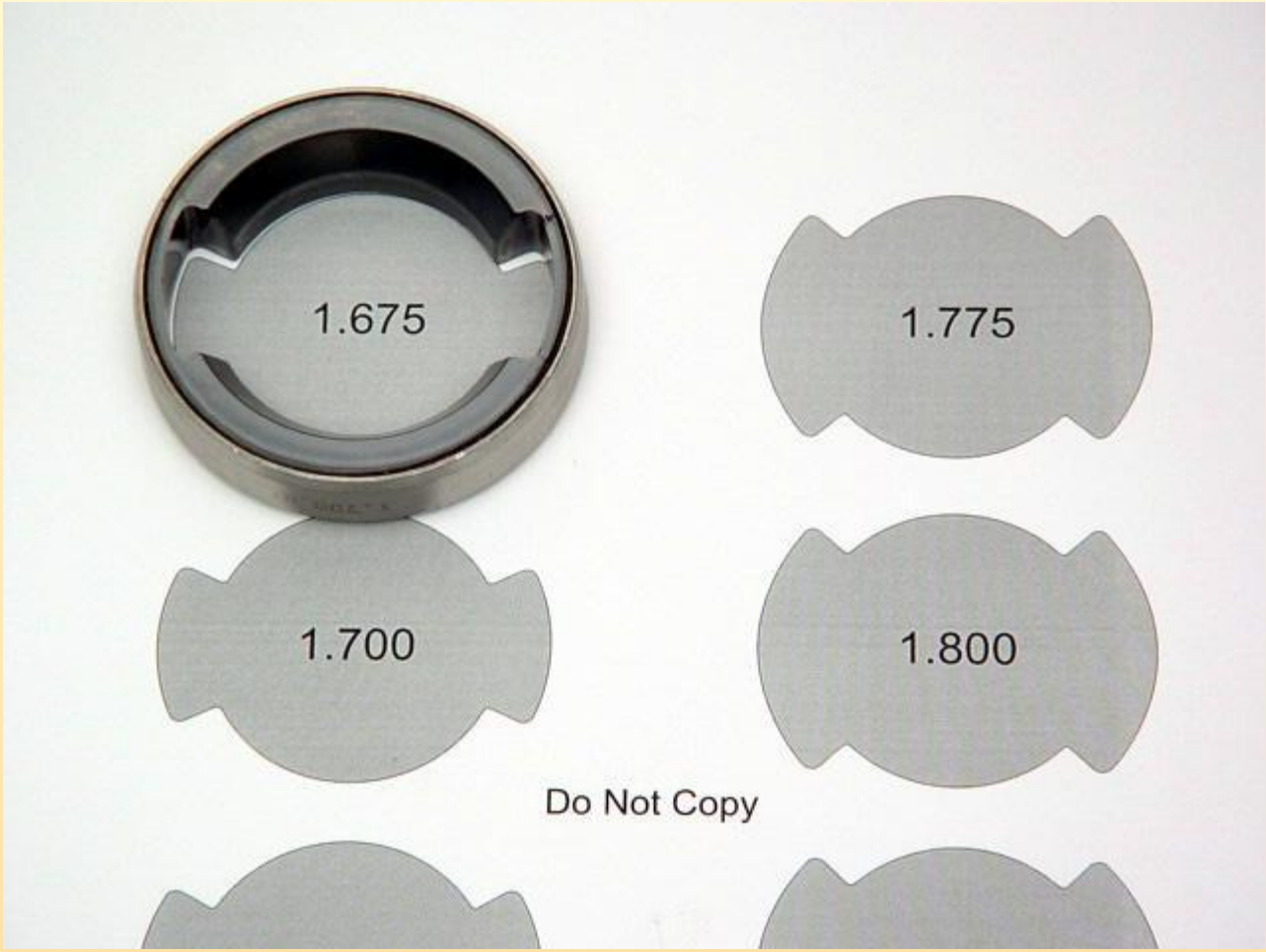
How do we Measure orifice Size?

- Use a gauge for a dovetail orifice

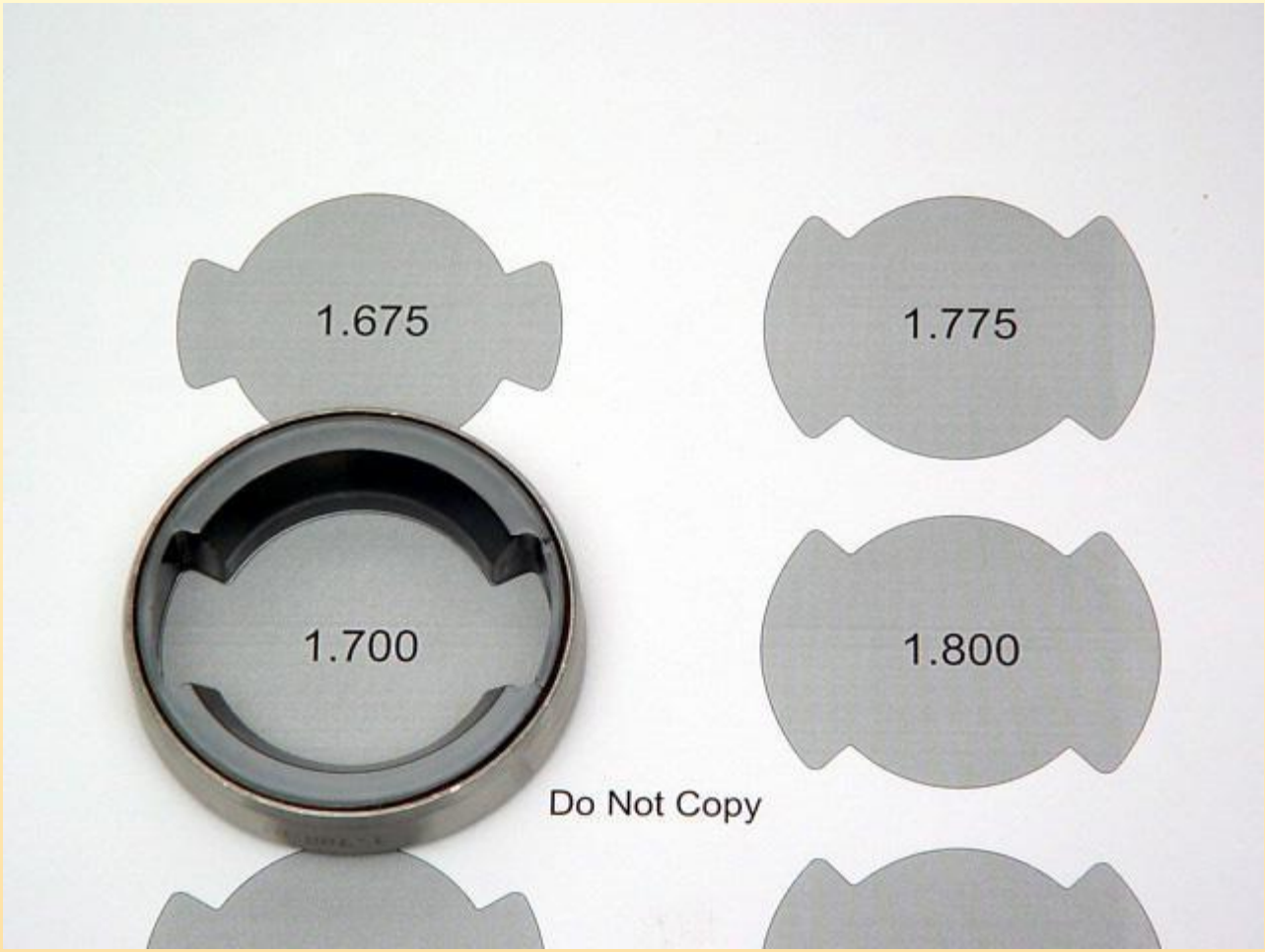
Gauging a Dovetail Orifice



Gauging a Dovetail Orifice



Gauging a Dovetail Orifice



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

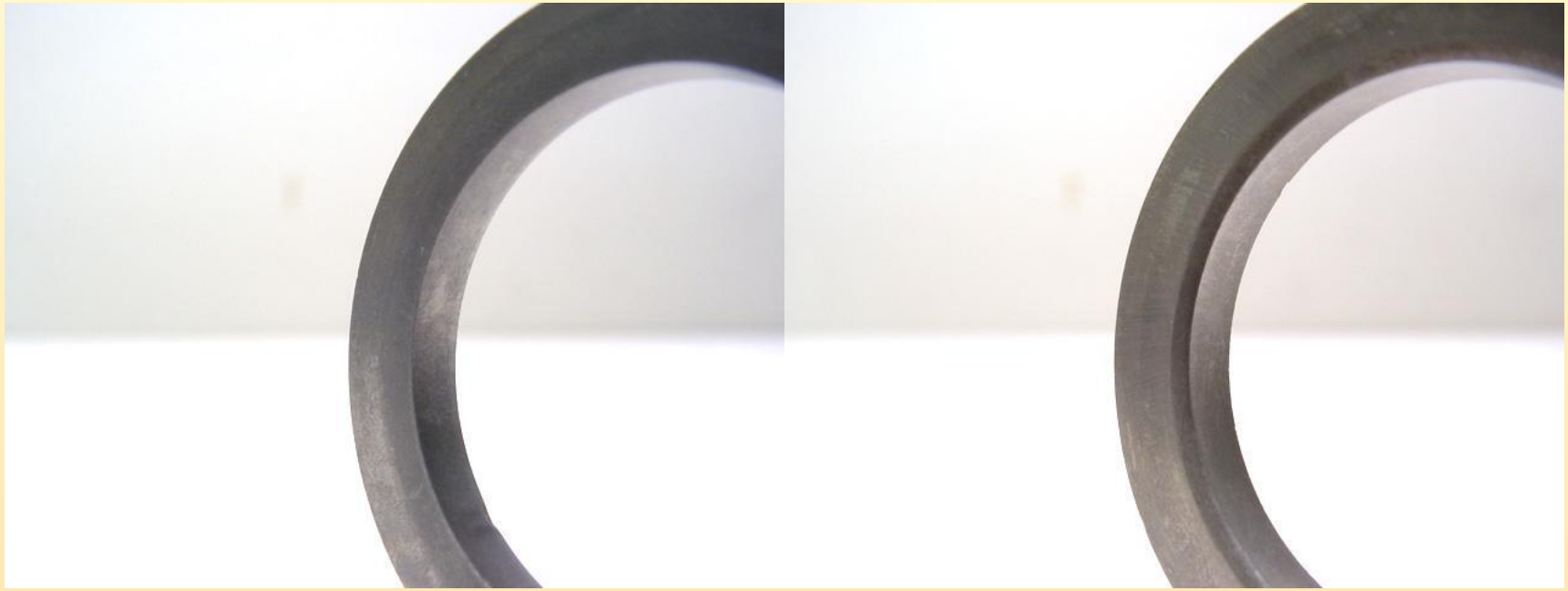
What's the original size of a worn orifice?

- 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

Using a worn orifice

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

Using a worn orifice



Sharp Edge

Rounded Edge

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

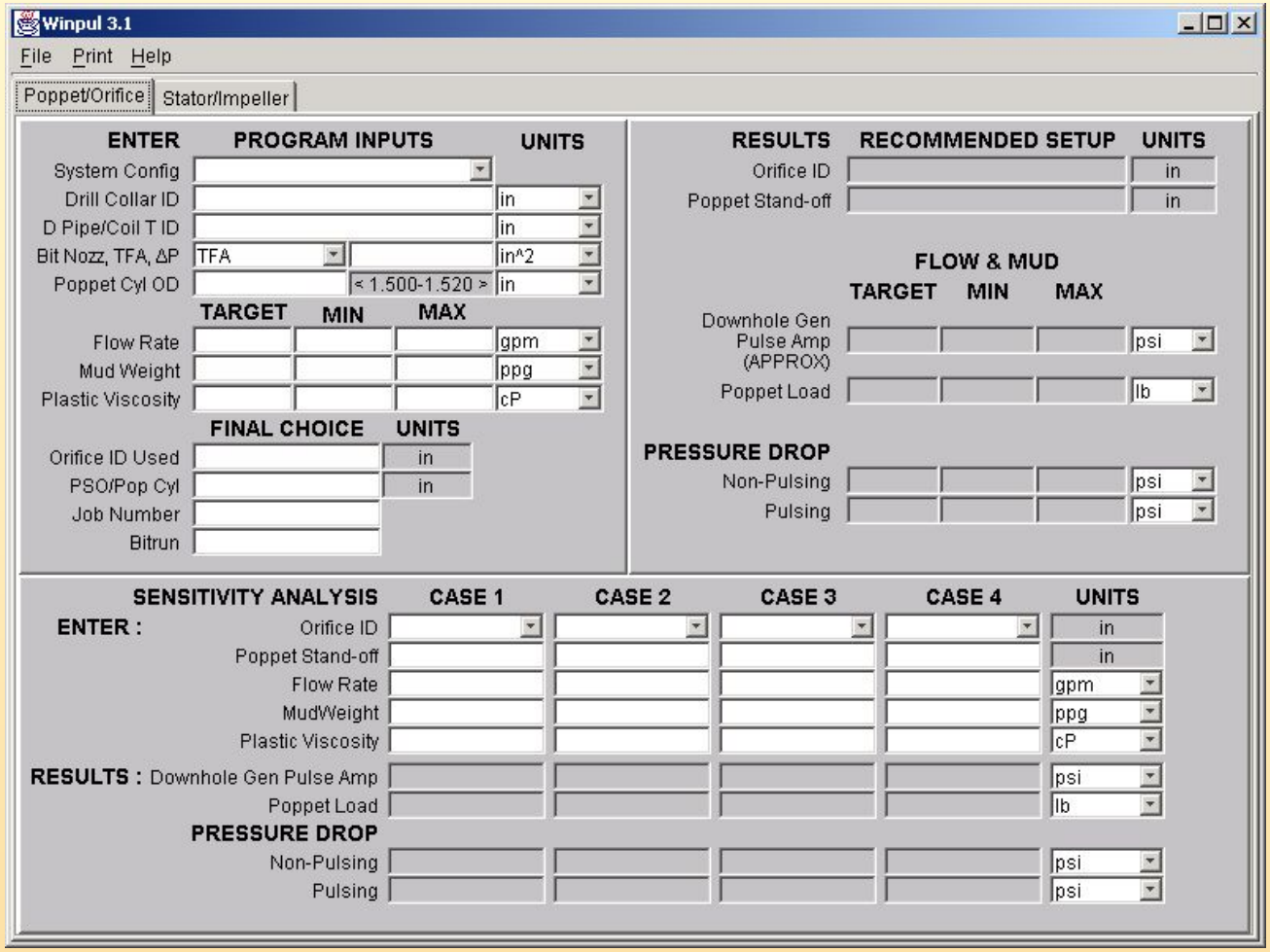
Why do we have different sizes of Orifices?

- 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

How do we Select the Correct Orifcice Size?

- Use WINPUL software

This is WINPUL



What does WINPUL Do?

- 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

What does WINPUL Do?

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

What does WINPUL Do?

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

What does WINPUL Do?

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

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

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

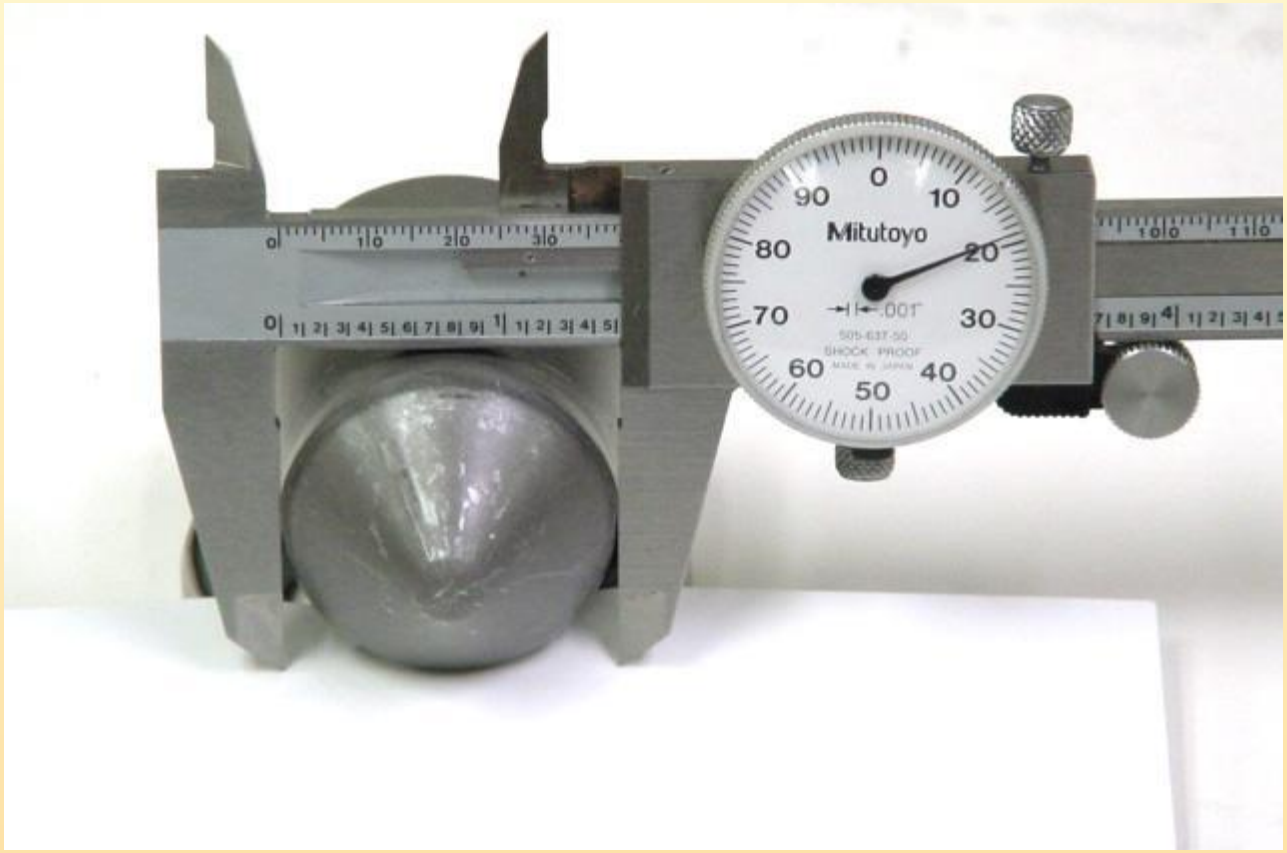
What are the input units?

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	cP	MPa s		
Force	lb	N	kgf	

Measuring Poppet Cylinder OD

Cylinder

Measuring Poppet Cylinder OD

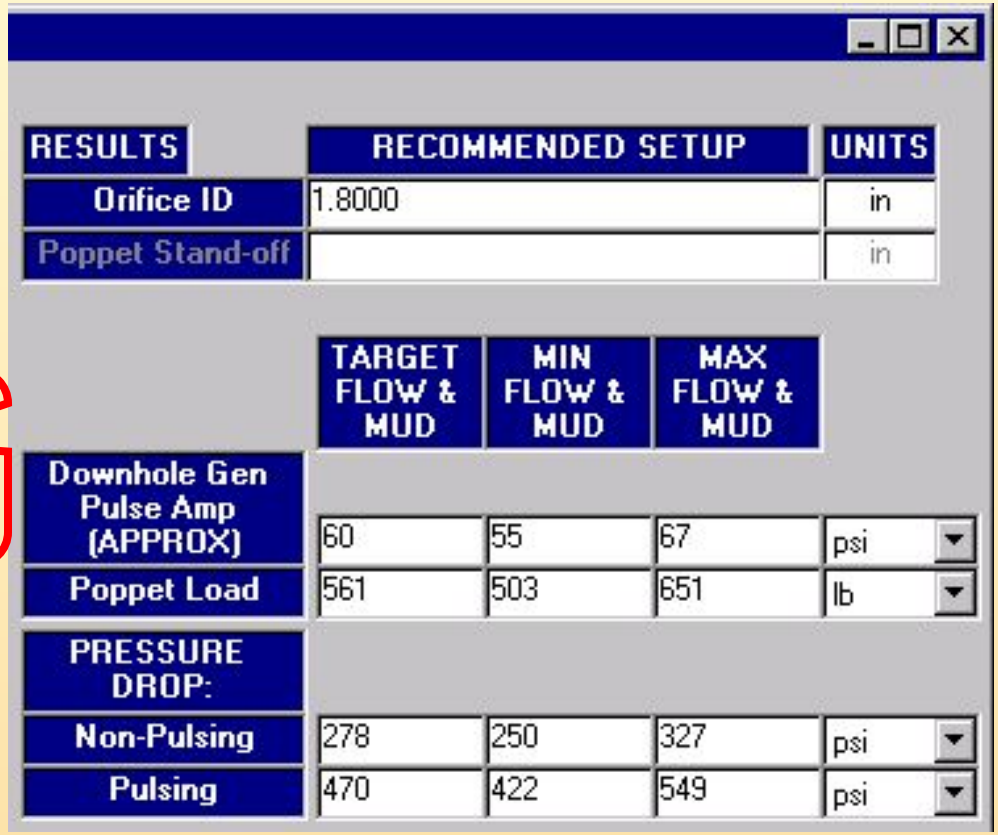


View Results

Orifice ID based on Target Flow & Mud

Poppet Stand-off is only for the 1200 System Changes according to pulser type

Poppet Load must not exceed 800 lb or 1000 lb



RESULTS	RECOMMENDED SETUP			UNITS
Orifice ID	1.8000			in
Poppet Stand-off				in
	TARGET FLOW & MUD	MIN FLOW & MUD	MAX FLOW & MUD	
Downhole Gen Pulse Amp (APPROX)	60	55	67	psi
Poppet Load	561	503	651	lb
PRESSURE DROP:				
Non-Pulsing	278	250	327	psi
Pulsing	470	422	549	psi

Sensitivity Analysis

- Select orifice ID and evaluate performance under various conditions

SENSITIVITY ANALYSIS		CASE 1	CASE 2	CASE 3	CASE 4	UNITS
ENTER	Orifice ID					in
	Poppet Stand-off					in
	Flow Rate					gpm
	Mud Weight					ppg
	Plastic Viscosity					cP
RESULTS	Downhole Gen Pulse Amp					psi
	Poppet Load					lb
	PRESSURE DROP:					
	Non-Pulsing					psi
	Pulsing					psi

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