

PBL Multiple Activation Autolock Bypass System

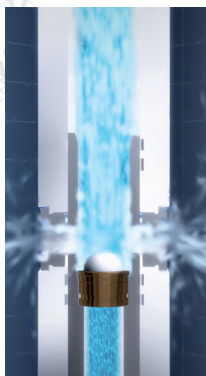
The PBL® Multiple Activation Bypass System is a simple, reliable tool that can assist you in reducing drilling costs associated with different types of hole conditions. Originally developed to enable the aggressive pumping of LCM materials and to increase circulation rates for enhanced hole cleaning, the PBL has evolved to benefit many applications in the drilling, completion, and workover phases of a well such as:

- Pumping all types of LCM pills, including aggressive pills and cement squeezes
- Increasing circulation rates for improved hole cleaning resulting in reduced torque and drag, thereby increasing ROP
- Increasing annular velocity in highly deviated and horizontal wellbores where removal of cutting beds and hole cleaning are problematic
- Fluid displacements
- Sub-sea riser/BOP jetting
- Acidizing and stimulation treatments
- Coring applications

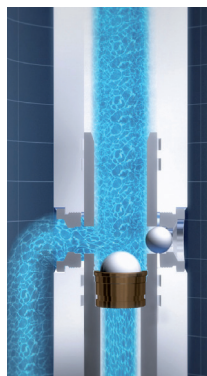
In addition, the PBL has several unique features:

- The PBL tool will close when the pumps are shut down minimizing a U tubing effect or possible well control issues that can occur in other tools
- The Autolock option, which allows for pulling a dry workstring or filling the drillstring while tripping in the hole. The Autolock option also provides an option to reverse circulate if necessary
- The PBL can be cycled numerous times in a single trip
- The ball shearing pressure can be set to the operator's preference
- The main body and the catcher sub can be placed in different sections of the BHA to optimize workstring operations.

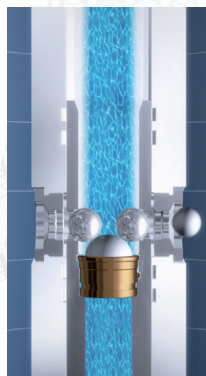
Open Position



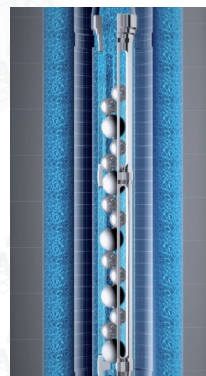
Locking Ball



De-activation



Ball catcher sub



Technical Specifications for PBL Multiple Activation Bypass System

TOOL SIZE (INCHES)	2 7/8	3 1/8	3 1/2	4 3/4	6 1/4	6 1/2	6 3/4	8	8 1/4	9 1/2
NUMBER OF PORTS	2	2	2	2	2	2	2	2	2	2
DRIFT (WHEN NO BALLS ARE IN TOOL) (1)	0.562	0.562	1.00	1.25	1.27 (1.50)	1.27 (1.50)	1.27 (1.50)	1.50 (2.27)	1.50 (2.27)	1.50 (2.27)
DRIFT (WHEN BALLS ARE IN TOOL)	No drift	No Drift	No Drift	No Drift	No Drift	No Drift	No Drift	No Drift	No Drift	No Drift
MAXIMUM O.D. (")	2.88	3.125	3.5	4.75	6.25	6.5	6.75	8	8.25	9.5
STANDARD RIG ENDS (2)	2 3/8 PAC	2 3/8 REG	2 3/8 IF	3 1/2 IF	4 1/2 XH	4 1/2 IF/ XH	4 1/2 IF	6 5/8 REG	6 5/8 REG	7 5/8 REG
ACTIVATION BALL SIZE (")	1	1	1 1/4	1 1/2	2	2	2	2 1/2	2 1/2	2 1/2
LOCKING BALL MATERIAL / SIZE (")	Torlon/ 0.700	Torlon/ 0.700	Torlon/ 0.700	Torlon/ 1 1/8	Ertalyte/ 1 1/8	Ertalyte/ 1 1/8	Ertalyte/ 1 1/8	Ertalyte/ 1 3/8	Ertalyte/ 1 3/8	Ertalyte/ 1 3/8
STEEL DE-ACTIVATION BALL SIZE (")	7/8	7/8	1 1/16	1 3/8	1 3/8	1 3/8	1 3/8	1 3/4	1 3/4	1 3/4
NO.OF BALLS NEEDED TO ACTIVATE TOOL	1	1	1	1	1	1	1	1	1	1
NO. OF BALLS NEEDED TO DE-ACTIVATE TOOL	2	2	2	2	2	2	2	2	2	2
NUMBER OF CYCLES	4	4	3	4	5	5	5	5	5	5
NUMBER OF CYCLES W/ DARTED BALL IN TOOL	2	2	2	3	3	3	3	4	4	4
FLOW AREA (SQ/IN) THROUGH TOOL	0.78	0.78	1.18	1.67	2.92	2.92	2.92	4.6	4.6	4.6
PORT DIAMETER (IN) STANDARD/AUTOLOCK	0.75/ 0.68	0.75/ 0.68	1.00/ 0.68	1.25/ 1.10	1.25/ 1.10	1.25/ 1.10	1.25/ 1.10	1.50/ 1.35	1.50/ 1.35	1.50/ 1.35
TFA (SQ/IN) WHEN TOOL IS OPEN (STANDARD)	0.884	0.884	1.571	2.454	2.454	2.454	2.454	3.534	3.534	3.534
TFA (SQ/IN) WHEN TOOL IS OPEN (AUTOLOCK)	0.72	0.72	0.72	1.901	1.901	1.901	1.901	2.863	2.863	2.863
WEIGHT (LBS)	115	115	132	300	750	800	800	1000	1000	1600
TENSILE STRENGTH (LBS)	415,000	490,000	490,000	1,000,000	1,900,000	2,500,000	3,100,100	3,500,000	3,700,000	6,000,000
TORSIONAL STRENGTH (LBS)	12,000	16,500	19,000	49,500	130,000	166,000	190,000	295,000	335,000	565,000
MAKE-UP TORQUE (FT-LBS)	2,200	3,000	3,700	11,500	26,710	34,190	34,840	41,800	45,450	81,290

(1) Standard drift listed, larger drifts are available to accommodate coring balls, reamer balls and wireline accessories

(2) Alternative Rig End Connections may be available