



**Weatherford**



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| REVISION     | A.2        |
| DATE         | 1/25/2011  |
| DOCUMENT No. | D000446283 |

## Float Equipment

# Flow-Activated Mid-Bore Auto-Fill Float Collar Model M45AP

The Weatherford Flow-Activated Mid-Bore Auto-Fill Float Collar contains a surge reducing and debris tolerant PDC drillable valve that allows low circulating rates without conversion. It is recommended for use in wells where running string restrictions or high wellbore inclinations may prevent release of a trip ball from the surface. The integral landing plate accommodates Weatherford's WiperLok™ non-rotating cementing plugs

## Applications:

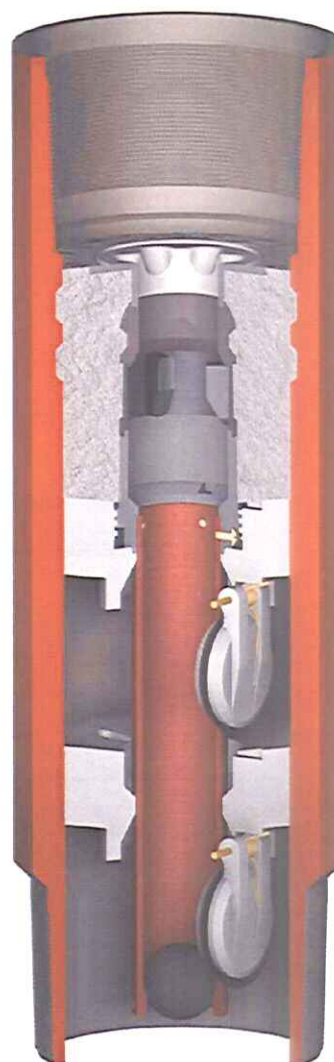
- Pressure sensitive formations and close tolerance annuli, where surge reduction or fast running speeds are desirable.
- Wells with inclinations greater than 30° from vertical.

## Features:

- Available in 6-5/8" through 8-5/8" casing sizes
- Large, open bores for solids tolerance and surge reduction
- Can be used in high deviation wellbore profiles
- Two valves for security.
- Flow-activated check valves
- Up to 4 bbl/min circulating rate prior to conversion (8 bbl/min optional)
- 5 to 8 bbl/min de-activation flow rate at 500 to 700 psi (9-13.5 bbl/min optional)
- 1.93" auto-fill diameter
- Valves have 2-3/8" bores after conversion.
- Auto-fill Tube/Cage Assembly made of composite materials
- PDC drillable components.
- Trip ball retained within valve assembly

## Performance:

- Back pressure rating:
  - 5000 psi (6-5/8" - 7-5/8")
  - 3000 psi (8-5/8")
- Plug bump pressure rating with Wiperlok plugs:
  - 6800 psi (6-5/8" - 7")
  - 6500 psi (7-5/8")
  - 6400 psi (8-5/8")
- Temperature rating: 400°F (204°C).
- API RP 10F category: IIIC
- Maximum flow rate (24 hours): 10 bbl/min after conversion.
- Conversion pressure:
  - Standard: 500 - 700 psi.
  - Optional: 300 - 400 psi
  - (Conversion pressure is stenciled on float collar)
- Minimum flow area after conversion: 4.33 in².

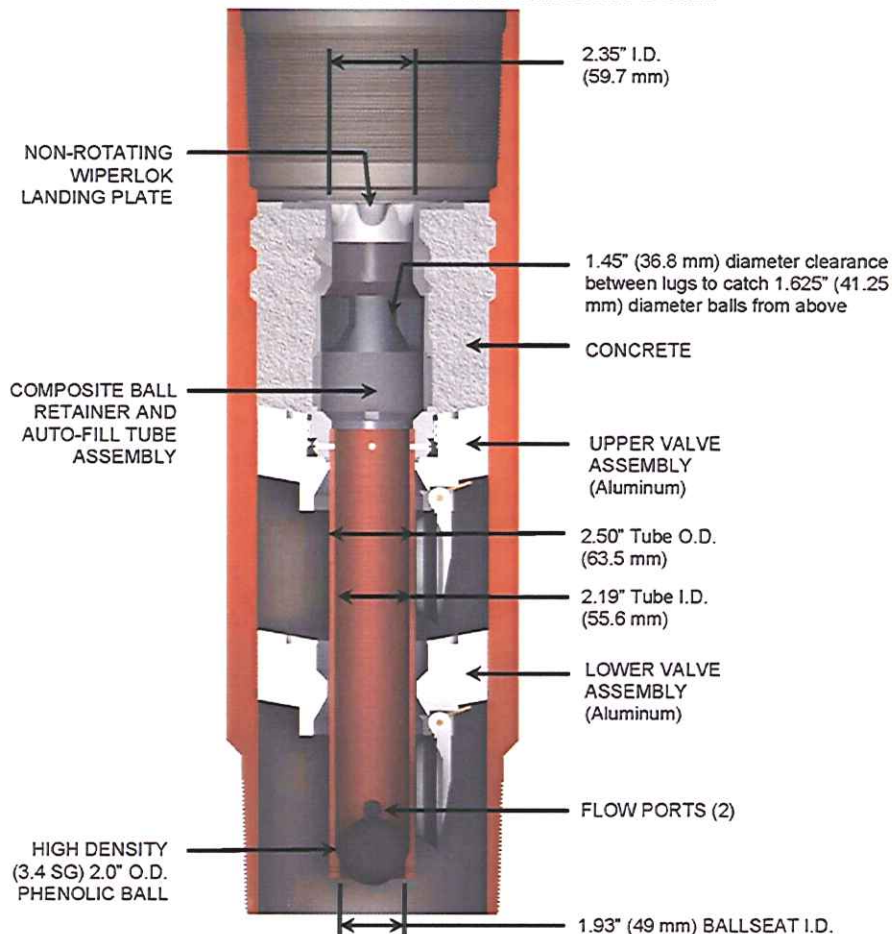




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**M45AP Flow-Activated Mid-Bore Auto-Fill Float Collar**



| SIZE<br>in. (mm) | O.D.<br>in. (mm) | GRADE | CASING<br>WEIGHT<br>RANGE<br>lbs/ft | DRILLOUT<br>I.D.<br>in. (mm) | OVERALL<br>LENGTH<br>(8 RND & BTC)<br>in. (mm) | BACK<br>PRESSURE<br>RATING<br>psi | BUMP<br>PRESSURE<br>RATING<br>psi |
|------------------|------------------|-------|-------------------------------------|------------------------------|--|-----------------------------------|-----------------------------------|
| 6-5/8<br>(168,3) | 7.39<br>(187,7)  | STD.  | 20.00-32.00                         | 5.944<br>(150,98)            | 25.25<br>(641)                                 | 5000                              | 6800                              |
|                  |                  | P.G.  | 20.00-32.00                         | 5.944<br>(150,98)            |  |                                   |                                   |
| 7<br>(177,8)     | 7.66<br>(194,6)  | STD.  | 20.00-32.00                         | 6.351<br>(161,32)            | 25.25<br>(641)                                 | 5000                              | 6800                              |
|                  |                  | P.G.  | 23.00-38.00                         | 6.270<br>(159,26)            |  |                                   |                                   |
| 7-5/8<br>(193,7) | 8.50<br>(215,9)  | STD.  | 26.40-39.00                         | 6.864<br>(174,35)            | 25.50<br>(648)                                 | 5000                              | 6500                              |
|                  |                  | P.G.  | 26.40-39.00                         | 6.864<br>(174,35)            |  |                                   |                                   |
| 8-5/8<br>(219,1) | 9.63<br>(244,6)  | STD.  | 24.00-49.00                         | 7.992<br>(203,00)            | 25.75<br>(654)                                 | 3000                              | 6400                              |
|                  |                  | P.G.  | 32.00-49.00                         | 7.845<br>(199,26)            |  |                                   |                                   |

Note: These dimensions and weight ranges apply to Std. and P.G. 8-round and buttress float collars only. Other equipment may vary from the above specifications. Verify dimensions and weight ranges on labels furnished with equipment.

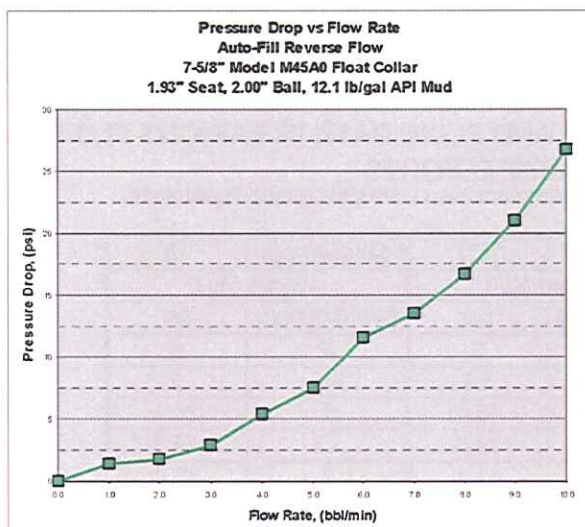




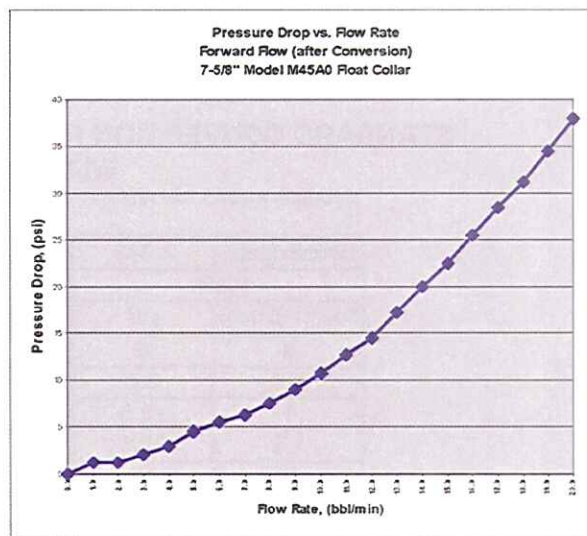
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## PRESSURE DROP



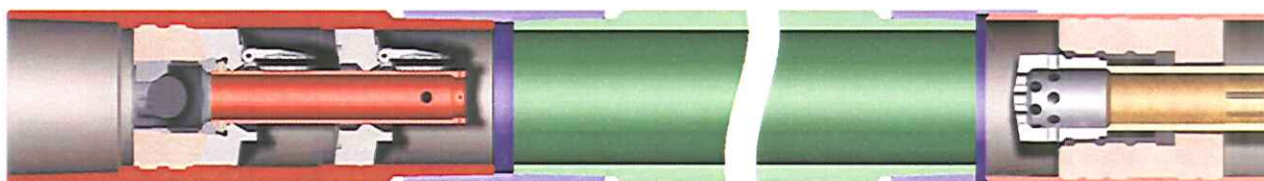
Auto-fill Mode



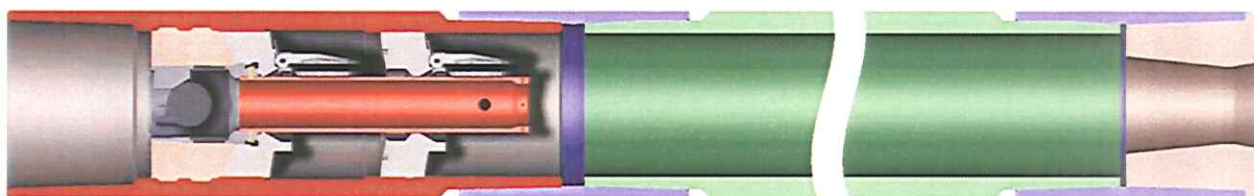
After Activation

## RECOMMENDED GUIDE SHOE USAGE

*MudMaster Filter Shoe with Hanging Collar (Recommended), M45A0 shown*



*Cemented or Composite Guide Shoe with 3-1/2" Bore, M45A0 shown*





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## CONVERSION PRESSURE AND FLOW RATE

The Flow-Activated Mid-Bore Auto-Fill Float Collar has a pre-set conversion pressure. Conversion at 500 - 700 psi is achieved by four (4) #10-24 UNC brass screws. The Float Collar can be ordered with an optional conversion pressure of 300 - 400 psi. Two (2) #10-24 UNC brass screws produce the optional conversion setting of 300 - 400 psi. The pre-set conversion pressure is stenciled on the Float Collar's shell. Conversion flow rate will depend on fluid density.

### STANDARD CONVERSION PRESSURE AND FLOW RATE IN VARIOUS FLUIDS WITH TWO - 0.578"Ø PORTS

(SHADED AREAS REPRESENT CONVERSION PRESSURE AND CORRESPONDING FLOW RATE)

| density(ppg)   | 8.343 | density(ppg)   | 12.2  | density(ppg)   | 16     |
|----------------|-------|----------------|-------|----------------|--------|
| Water          |       | 12.2 ppg Mud   |       | 16 ppg Mud     |        |
| flow (bbl/min) | psi   | flow (bbl/min) | psi   | flow (bbl/min) | psi    |
| 0              | 0     | 0              | 0     | 0              | 0      |
| 0.5            | 2.6   | 0.5            | 3.8   | 0.5            | 5      |
| 1              | 10.5  | 1              | 15.4  | 1              | 20.1   |
| 1.5            | 23.6  | 1.5            | 34.6  | 1.5            | 45.3   |
| 2              | 42    | 2              | 61.4  | 2              | 80.6   |
| 2.5            | 65.7  | 2.5            | 96    | 2.5            | 125.9  |
| 3              | 94.5  | 3              | 138.2 | 3              | 181.3  |
| 3.5            | 128.7 | 3.5            | 188.2 | 3.5            | 246.8  |
| 4              | 168.1 | 4              | 245.8 | 4              | 322.3  |
| 4.5            | 212.7 | 4.5            | 311   | 4.5            | 407.9  |
| 5              | 262.6 | 5              | 384   | 5              | 503.6  |
| 5.5            | 317.8 | 5.5            | 464.7 | 5.5            | 609.4  |
| 6              | 378.2 | 6              | 553   | 6              | 725.2  |
| 6.5            | 443.8 | 6.5            | 649   | 6.5            | 851.1  |
| 7              | 514.7 | 7              | 752.7 | 7              | 987.1  |
| 7.5            | 590.9 | 7.5            | 864   | 7.5            | 1133.1 |
| 8              | 672.3 | 8              | 983.1 | 8              | 1289.3 |

NOTE: For conversion flow rates for fluid densities not listed in the chart above, the equation  $Q = \sqrt{\frac{P}{1.259\rho}}$ , where Q is flow rate in bbl/min, P is conversion pressure in PSI, and  $\rho$  is fluid density in lb/gal, approximates the value for conversion flow rate given pressure and fluid density for float collars with the 0.578" ports.





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## OPTIONAL – HIGH CIRCULATION CONVERSION PRESSURE AND FLOW RATE IN VARIOUS FLUIDS WITH TWO - 0.75"Ø PORTS

(SHADED AREAS REPRESENT CONVERSION PRESSURE AND CORRESPONDING FLOW RATE)

| Density(ppg)<br>8.343 |       | Density(ppg)<br>10.5 |        | Density(ppg)<br>12.2 |        | Density(ppg)<br>14 |        |
|-----------------------|-------|----------------------|--------|----------------------|--------|--------------------|--------|
| Water                 |       | 10.5 ppg Mud         |        | 12.2 ppg Mud         |        | 14 lppg Mud        |        |
| Flow (bbl/min)        | psi   | Flow (bbl/min)       | psi    | Flow (bbl/min)       | psi    | Flow (bbl/min)     | psi    |
| 5.0                   | 92.7  | 5.0                  | 116.7  | 5.0                  | 135.6  | 5.0                | 155.6  |
| 5.5                   | 112.2 | 5.5                  | 141.2  | 5.5                  | 164.0  | 5.5                | 188.3  |
| 6.0                   | 133.5 | 6.0                  | 168.0  | 6.0                  | 195.2  | 6.0                | 224.0  |
| 6.5                   | 156.7 | 6.5                  | 197.2  | 6.5                  | 229.1  | 6.5                | 262.9  |
| 7.0                   | 181.7 | 7.0                  | 228.7  | 7.0                  | 265.7  | 7.0                | 304.9  |
| 7.5                   | 208.6 | 7.5                  | 262.5  | 7.5                  | 305.0  | 7.5                | 350.1  |
| 8.0                   | 237.3 | 8.0                  | 298.7  | 8.0                  | 347.1  | 8.0                | 398.3  |
| 8.5                   | 267.9 | 8.5                  | 337.2  | 8.5                  | 391.8  | 8.5                | 449.6  |
| 9.0                   | 300.4 | 9.0                  | 378.1  | 9.0                  | 439.3  | 9.0                | 504.1  |
| 9.5                   | 334.7 | 9.5                  | 421.2  | 9.5                  | 489.4  | 9.5                | 561.6  |
| 10.0                  | 370.9 | 10.0                 | 466.7  | 10.0                 | 542.3  | 10.0               | 622.3  |
| 10.5                  | 408.9 | 10.5                 | 514.6  | 10.5                 | 597.9  | 10.5               | 686.1  |
| 11.0                  | 448.7 | 11.0                 | 564.8  | 11.0                 | 656.2  | 11.0               | 753.0  |
| 11.5                  | 490.5 | 11.5                 | 617.3  | 11.5                 | 717.2  | 11.5               | 823.0  |
| 12.0                  | 534.0 | 12.0                 | 672.1  | 12.0                 | 780.9  | 12.0               | 896.1  |
| 12.5                  | 579.5 | 12.5                 | 729.3  | 12.5                 | 847.4  | 12.5               | 972.4  |
| 13.0                  | 626.7 | 13.0                 | 788.8  | 13.0                 | 916.5  | 13.0               | 1051.7 |
| 13.5                  | 675.9 | 13.5                 | 850.6  | 13.5                 | 988.4  | 13.5               | 1134.2 |
| 14.0                  | 726.9 | 14.0                 | 914.8  | 14.0                 | 1062.9 | 14.0               | 1219.7 |
| 14.5                  | 779.7 | 14.5                 | 981.3  | 14.5                 | 1140.2 | 14.5               | 1308.4 |
| 15.0                  | 834.4 | 15.0                 | 1050.2 | 15.0                 | 1220.2 | 15.0               | 1400.2 |

$$Q = \sqrt{\frac{P}{0.445 \cdot \rho}}$$

NOTE: For conversion flow rates for fluid densities not listed in the chart above, the equation where Q is flow rate in bbl/min, P is conversion pressure in PSI, and  $\rho$  is fluid density in lb/gal, approximates the value for conversion flow rate given pressure and fluid density for float collars with the 0.75" ports.

### MAKE-UP ON CASING STRING:

The Flow-Activated Mid-Bore Auto-Fill Float Collar should be run with a Weatherford MudMaster filter shoe. A guide shoe that has a minimum 3-1/2 inch bore inside diameter may also be run, but at an increased risk of debris settling above the float collar, possibly resulting in plugging or early conversion of the float collar. The 3-1/2 inch bore guide shoe will allow the Auto-Fill Tube to pass through the nose without plugging it off.

Make up the float collar onto the casing string at least one joint above the guide or filter shoe. Apply Weatherford Tube Lok<sup>™</sup> compound to the bottom six thread connections and the float collar threads. Apply to the pin thread only. This helps prevent the shoe joint from backing off during drill-out.

If a trip ball larger than 1.625" diameter will be used above the Flow-Activated Mid-Bore Auto-Fill Float Collar, a ball catching device should be included above the float collar to prevent it from being plugged off.



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## RUNNING INTO THE WELL:

When running into the hole the valve should be monitored to confirm that fluid is filling the casing. Observation of fill can be accomplished by several methods. One is by watching the weight indicator and graph to ensure that the string is continually gaining weight and not decreasing or losing weight. Another is to use a thin sheet of paper such as newspaper placed over the top of the casing. The air being displaced out of the casing will blow a parachute effect on the paper. However, a careful grip should be maintained on the paper so as to prevent the paper from being pulled into the casing from a sudden vacuum formed by U-tubing effects.

Well conditions with small annular clearances can produce an overfilling effect, in which well fluids are displaced out of the top of the casing, rather than out of the annulus. This overfill can occur at the rig floor if the mud level is relatively close to the rig floor. This effect can be reduced or eliminated by increasing the weight of the fluid in the casing.

If the casing stops filling automatically, the casing should be filled from the surface and circulation established to clear cuttings and debris.

## CIRCULATION:

Should it be necessary to circulate during the casing running operation, the circulation should be kept below 4 bbl/min to prevent premature deactivation of the auto-fill equipment. The duration of circulation should be limited to one hour at 4 bbl/min or eight hours at 2 bbl/min prior to conversion with the standard 0.578"  $\varnothing$  ports. With the optional 0.75"  $\varnothing$  ports, the duration of circulation should be limited to one hour at 8 bbl/min or eight hours at 4 bbl/min prior to conversion. If after extended circulation the surface pressure drops below the pressure shown in the Conversion Pressure and Flow Rate in Various Fluids tables for a given flow rate and fluid density (plus friction losses), circulation should be stopped. If higher circulation flow rates are required, the flow rate should be increased to convert the auto-fill valves to hold backpressure.

## ACTIVATION OF THE CHECK VALVES:

A pressure of 500 psi to 700 psi (300-400 psi optional) is required to shear the Auto-Fill Tube from the Valve Assembly. The flow rate required to achieve this pressure is listed in the tables above and ranges from 5 to 8 bbl/min for the standard 0.578"  $\varnothing$  ports or 9 to 13.5 bbl/min for the optional 0.75"  $\varnothing$  ports, depending on fluid density. Pump at a flow rate that will exceed the 700-psi pressure drop for the corresponding fluid density. A reduction in pressure should be noted when the auto-fill tube is released. The auto-fill tube will then be pumped through the valve assembly.

## CEMENTING:

Weatherford WiperLok non-rotating plug sets are recommended for use with Mid-Bore Auto-Fill Float Collars. The top cementing plug should be released while pumping cement. Pump an additional volume of cement equivalent to 10 - 15 feet (three to four meters) on top of the plug, if allowed, to improve drill-out. The displacement rate should be reduced to between 3 and 4 bbl/min to land plugs.

The maximum plug bump pressure is the allowable amount of pressure, above the displacement pressure, prior to bumping the plugs. The maximum plug bump pressures, by size, are listed in the chart included with this document

## VERIFICATION OF CHECK VALVE FUNCTION:

If leakage occurs past the Mid-Bore Auto-Fill Valve after displacing cement, circulate the returned displacement volume through the valve, and check for proper operation of the flapper valves. This circulation will produce a forced





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opening and closing of the flappers. This will assist in removing debris from the valve, which could cause a malfunction.

## DRILL-OUT:

Mid-Bore Auto-Fill equipment may be drilled with roller cone or PDC bits. Recommendations for roller cone and PDC bit drill-out can be found in the Weatherford Float Equipment Manual.



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## **Flow-Activated Mid-Bore Auto-Fill Float Collar Model M45AP**

### **OPERATIONAL SEQUENCE -**

