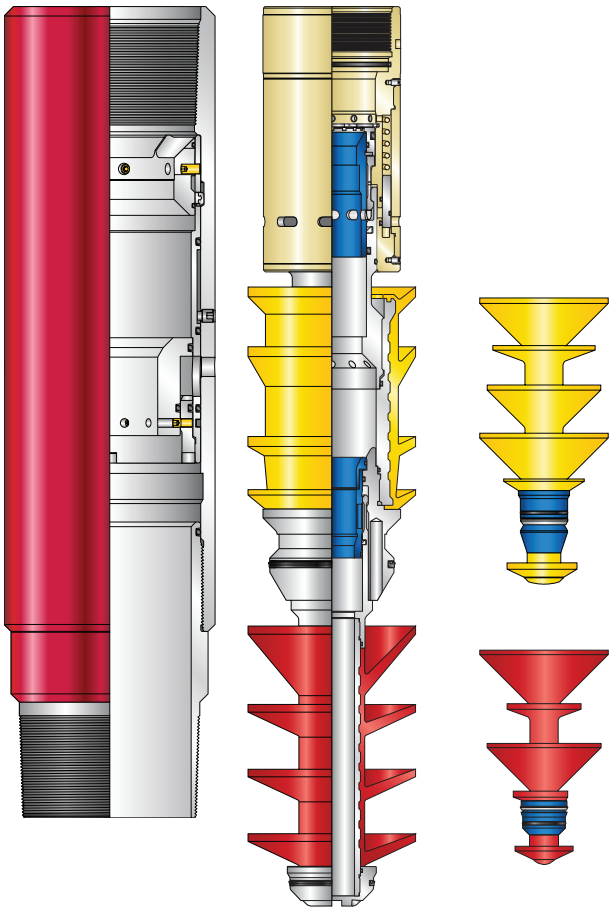
Hydraulic Stage Tool

Model 754PD with 854BS Liner Plug Set

Weatherford's reliable, field-proven Model 754PD stage tool meets the challenges of cementing holes at any angle with a hydraulically opened port system. Designed specifically for horizontal completions in today's complex formations, the multistage cementing tool uses Weatherford's 854BS liner plug set and can be placed anywhere in the casing string with a liner hanger or subsea casing hanger. The 854BS plug set is fully compatible with Weatherford's mechanical ball seat (MBS) and features a patented, integral pressure-equalizer to prevent premature plug release due to pressure buildup above the plugs.

The bottom dart is pumped behind the first-stage cement slurry from surface and latches into and releases the first-stage shutoff plug, displacing the cement slurry in the casing. When the shutoff plug lands on the landing collar, increased internal casing pressure hydraulically opens the stage tool, enabling circulation and the second-stage cement to pass through the ports into the annulus above the tool. The top dart is pumped behind the cement slurry and lands in the closing plug. After the closing plug is released, it wipes the casing ID clean of cement before bumping on a closing seat connected to the unitary sleeve. Increased pressure shifts the closing seat downward, releasing locking lugs and enabling the unitary sleeve to move down across the ports, closing the tool. A snap ring locks the sleeve in position, ensuring the stage tool remains locked.

The stage tool can be used with Weatherford's BULLDOG™ annulus casing packers (ACP™) to ensure cement slurry is displaced to precise depths in the annulus and provide long-term isolation. When the first-stage shutoff plug lands on the landing collar, the *ACP* inflates, isolating weak formations below from hydrostatic pressures above.



754PD with 854BS plug set for 7- and 7 5/8-in. sizes

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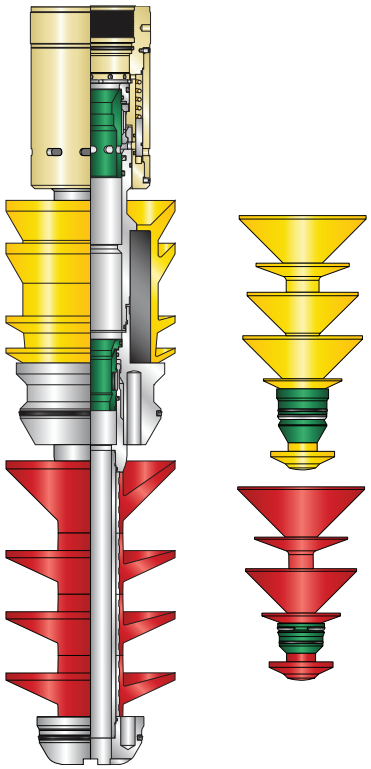
Applications

- Liners or subsea casing strings that require multiple-stage cementing due to weak formations or wellbore hydrostatics
- Liners running Weatherford's BULLDOG™ ACP™ to isolate weak formations below from hydrostatic pressures above
- Use with an *ACP* to cement the last casing string above openhole completions
- Use with an *ACP* to isolate formations with high temperature gradients in geothermal or steam-injection wells



854BS plug set for 9 5/8- through 13 3/8- to 14-in. sizes

Features, Advantages and Benefits

- First-stage shutoff and closing plugs are released by darts that maintain fluid separation through the drillpipe and casing, preventing cement contamination.
- The first-stage shutoff plug provides positive indication of displacement and a hydraulic means of testing casing, opening the hydraulic stage tool, and/or setting an *ACP* to ensure proper zonal isolation.
- The closing plug provides a durable seal in the closing seat of the 754PD hydraulic stage tool, enabling accurate liner testing.
- Polyurethane plug fins offer superior abrasion resistance and excellent wiping action, resulting in a clean-casing inside diameter (ID) after passage.
- The material of the plugs are compatible with water and oil- and synthetic-base drilling fluids and are durable at well temperatures up to 257°F (125°C), providing a suitable system that meets most well environments.

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Features, Advantages and Benefits

- The opening pressure of the stage tool can be adjusted at the rig site to meet well requirements, providing operational flexibility.
- The plug system provides a positive separation design, minimizing the potential for fluid bypass at the cementing collar.
- Fully compatible with Weatherford's MBS to eliminate the need for a ball seat within the plugs or the landing collar for improved reliability.
- The patented, integrated pressure equalizer prevents pressure buildup above the plugs, avoiding premature release.
- The system is PDC-drillable with anti-rotation features on the plugs, stage tool, and landing collar to prevent rotation during drillout, simplifying drillout and saving rig time and associated costs.

Options

- Stage tools and running accessories are available and can be ordered to perform three-stage cementing operations.
- Multiple combinations of pipe grade and threads are available to meet specific well conditions.

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Specifications

Size (in./*mm*)	Grade	Weight Range (lb/ft, *kg/m*)	Maximum OD (in./*mm*)	Maximum Drill-Out ID (in./mm)	Overall Length (in./*mm*)	Hydraulic Sleeve ID (in./*mm*)	Closing Seat ID (in./*mm*)	Opening Pressure* (psi/*bar*)		Safe Load Below Tool (1,000 lb/*1,000 kg*)		Maximum Pressure (psi/*bar*)		HNBR Seal Temperature Limit** (°F/°C)
					BTC		754PD	Per Screw	Range	8 RND	BTC	Internal	External	
4-1/2 *114.3*	L80	9.5 to 13.5 *14.1 to 20.1*	5.562 *141.3*	3.975 *101.0*	30.5 *774.7*	2.500 *63.5*	3.187 *80.9*	700 *48.3*	700 to 4,200 *48.3 to 289.6*	146 *66*	199 *90*	8,290 *571*	7,900 *544*	350 *177*
	P110	11.6 to 15.1 *17.1 to 22.4*		3.885 *98.7*						237 *107*	306 *138*	11,460 *790*	11,940 *823*	
5 *127.0*	L80	11.5 to 15.0 *17.1 to 22.4*	6.090 *154.7*	4.445 *112.9*	31.5 *800.1*	3.000 *76.2*	3.750 *95.3*	600 *41.4*	1,200 to 3,600 *82.8 to 248.2*	177 *80*	233 *105*	8,010 *552*	6,730 *464*	350 *177*
	P110	15.0 to 18.0 *22.3 to 26.8*		4.293 *109.0*						315 *142*	390 *177*	10,810 *745*	10,510 *724*	
5-1/2 *139.7*	L80	14.0 to 17.0 *20.8 to 25.3*	6.625 *168.3*	4.897 *124.4*	31.5 *800.1*	3.000 *76.2*	4.062 *103.2*	440 *30.3*	880 to 3,520 *60.6 to 242.7*	218 *98*	278 *126*	7,040 *485*	6,710 *462*	350 *177*
	L80	15.5 to 20.0 *23.0 to 29.7*		4.835 *122.8*						247 *112*	305 *138*	7,950 *548*	7,580 *522*	
	P110	17.0 to 23.0 *25.3 to 34.2*		4.777 *121.3*						359 *162*	439 *199*	11,400 *786*	10,970 *756*	
7 *177.8*	L80	20.0 to 26.0 *29.7 to 38.7*	8.200 *208.3*	6.341 *161.1*	32.5 *825.5*	3.750 *95.3*	5.000 *127.0*	340 *23.4*	680 to 3,400 *46.9 to 234.0*	298 *135*	385 *175*	5,470 *377*	5,210 *359*	350 *177*
	L80	26.0 to 32.0 *38.7 to 47.6*		6.161 *156.5*						398 *180*	485 *220*	7,550 *520*	7,200 *496*	
	P110			6.161 *156.5*						540 *245*	646 *293*	9,940 *685*	9,470 *653*	
7-5/8 *193.7*	L80	26.4 to 29.7 *39.3 to 44.2*	8.875 *225.4*	6.854 *174.1*	38.4 *975.4*	4.500 *114.3*	5.875 *149.2*	600 *41.4*	1,200 to 3,600 *82.8 to 248.2*	384 *174*	487 *221*	6,290 *433*	5,990 *413*	350 *177*
	P110	29.7 to 39.0 *44.2 to 58.0*		6.760 *171.7*						596 *270*	724 *329*	9,580 *660*	8,850 *610*	
8-5/8 *219.1*	L80	24.0 to 32.0 *35.7 to 47.6*	10.125 *257.2*	7.982 *202.7*	39.2 *995.7*	5.500 *139.7*	6.625 *168.3*	700 *48.3*	1,400 to 4,200 *96.6 to 289.6*	340 *154*	460 *209*	5,420 *373*	3,980 *274*	350 *177*
	P110	40.0 to 44.0 *59.5 to 65.5*		7.610 *193.3*						795 *361*	952 *432*	7,130 *491*	6,080 *419*	
9-5/8 *244.5*	L80	32.3 to 40.0 *48.1 to 59.5*	11.125 *282.6*	8.855 *224.9*	38.8 *985.5*	6.125 *155.6*	7.750 *196.9*	600 *41.4*	1,200 to 3,600 *82.8 to 248.2*	463 *210*	608 *276*	5,610 *386*	5,340 *368*	350 *177*
	L80	40.0 to 47.0 *59.5 to 70.0*		8.689 *220.7*						582 *264*	734 *333*	6,990 *482*	5,980 *412*	
	P110	43.5 to 53.5 *64.7 to 75.9*		8.609 *218.7*						867 *394*	1,062 *482*	9,190 *633*	7,290 *502*	
10-3/4 *273.1*	L80	40.5 to 51.0 *67.7 to 75.9*	12.312 *312.7*	9.904 *251.6*	38.8 *985.5*	7.250 *184.2*	8.875 *225.4*	630 *43.4*	1,260 to 3,780 *86.8 to 260.6*	552 *250*	739 *335*	5,450 *375*	3,700 *255*	350 *177*
	P110	51.0 to 60.7 *75.9 to 90.4*		9.704 *246.5*						959 *435*	1,214 *551*	7,510 *517*	4,170 *287*	
13-3/8 *339.7*	L80	61.0 to 72.0 *90.8 to 107.2*	15.000 *381.0*	12.375 *314.3*	38.8 *985.5*	9.250 *235.0*	11.000 *279.4*	500 *34.5*	1,000 to 3,000 *69.0 to 207.0*	618 *280*	1,007 *457*	4,400 *303*	2,070 *142*	350 *177*
	P110			12.375 *314.3*						841 *382*	1,355 *615*	6,200 *427*	2,550 *175*	

*The operator, cementer, or a trained Weatherford field technician can easily adjust opening pressure in the field to precisely match well requirements.
**Temperature limits are for HNBR seals (standard). Limits for Viton® seals (special request) are 400°F (204°C).

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Specifications (continued)

854BS Liner Plug Set

Plug size (in./*mm*)	**7** ***177.8***	**7-5/8** ***193.7***	**9-5/8** ***244.5***	**9-5/8 to 10-3/4** ***244.5* to *237***	**13-3/8 to 14** ***339.7* to *355.6***
Maximum plug-bump pressure (psi/*MPa*)	5,000 *34.47*				
Shutoff plug launch pressure (psi/*MPa*)	800 to 1,200 *5.52* to *8.27*				
Closing plug launch pressure (psi/*MPa*)	2,000 to 2,500 *13.79* to *17.24*				
Pressure required to open equalizer (psi/*kPa*)	50 to 100 *345* to *689*		30 to 60 *207* to *414*		
Minimum plug ID (in./*mm*)	1.78 *45.2*		2.11 *53.5*		
Minimum flow area (in.^{2}/*mm*^{2})	2.49 *1605*		3.50 *2256*		
Maximum rigid dart diameter (in./*mm*)	2.12 *54*		2.46 *63.3*		
Minimum pump-through drift diameter for dart (in./*mm*)	2.17 *55*		2.54 *64.5*		
Flow endurance	10 BPM for 24 hr *1.5 m^3/day*		18 BPM for 16 hr *2.86 m^3/day*		
Maximum circulating temperature (°F/°*C*) (BHCT)	257 *125*				
Maximum static temperature after bump (°F/°*C*) (BHCT)	302 *150*				
Thread connection box up (in.)	4.750 - 6 Stub Acme 2G				

*Model 854 plug sets are available for 4 1/2- to 5 1/2-in. liner sizes.

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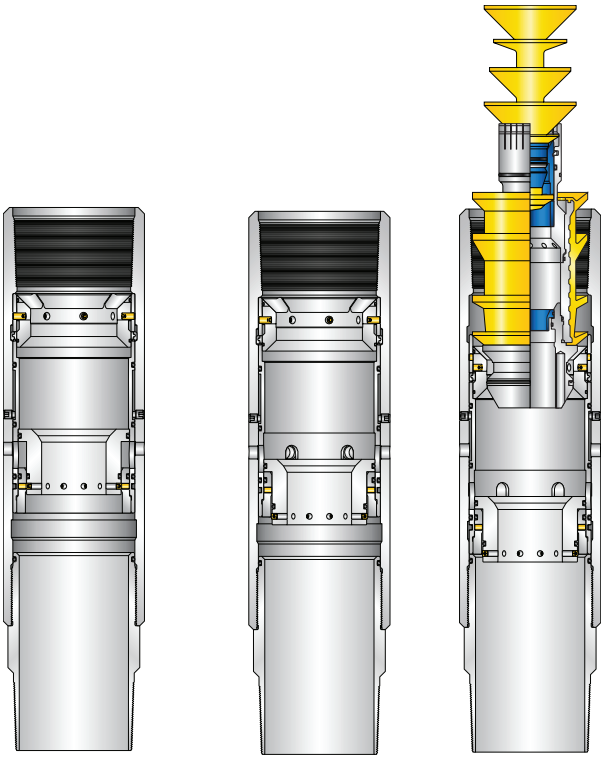
Liner Operational Sequence



Running-in-hole:
ports closed

Bump closing plug:
closes ports

Bump first-stage shutoff plug:
opens ports