

Technical Manual for Eliminator Premium Cast Iron Bridge Plugs

ELIMINATOR CAST IRON PLUG



Introduction

The Eliminator bridge plug is a plug designed with the latest in new technology. The plug will set itself without the use of expensive setting tools. For years, the industry standard has always relied on setting tools to provide the power and force required to insure a secure set of a bridge plug.

Our new line of Premium Eliminator Bridge Plugs create their own internal force that, in turn, will provide a secure set all on its own. There are fewer parts for the consumer to keep in inventory, no redress time, and no manual bleed off at the surface. The bridge plug assembly is made up into three parts. The first part is the firing assembly. This is made up of the Hi-Pressure Firing Sub or Quick Change Assembly and the Igniter Sub. By utilizing the Hi-Pressure Firing Sub or Quick Change Assembly, no pressure can be released from the tool during the set. The Igniter Sub contains a low order electric igniter that will start the burn of the power charge contained in the bridge plug. The second part of the assembly is the appropriate power charge. It is imperative that the proper power charge be used with each corresponding plug. As the plug O.D. increases, the amount of surface area increases as well. The proper gram load of power charge mixture is used to set the plug as well as build internal pressure to the shear pressure and release the Firing Sub from the Bridge Plug. The third and final part of the assembly is the bridge plug.

The plug comes pre-assembled and ready to use. However, as with all equipment there are certain items that should be checked prior to running. The spot checks are just as a precautionary measure and are to be performed without exception. The plugs are constructed out of drillable G-2 cast iron bar stock and made by state of the art CNC machinery capable of keeping tolerances as close as 1/1000 of an inch. The rubber element is molded out of 75 durometer Viton material. Aflas and Ryton elements can be used by special order for corrosive environments such as H₂S and sour service.

How the Eliminator Cast Iron Bridge Plug Works

The Eliminator Bridge Plug is a pressure activated tool. It uses a solid oxidizer power charge to generate gases to provide the required pressure to activate the tool. The plug is lowered into the well on electric wire line to the desired depth. It is then activated by firing the initiator located in the igniter sub. The power charge is ignited and burns at a controlled rate. The pressure increases within the plug assembly and starts to move the sleeve up. The mechanical force of the sleeve acting on the slips, cones, and rubber element against the retaining shoe causes the slips to break into eight sections and begins the set. The pressure continues to rise until the plug is fully set within the tubing or casing. After a secure set is achieved the pressure will rise to the shear value of the (8) brass shear screws within the Igniter Sub, thus releasing and allowing the upper assemblies to be returned to the surface.

The upper assembly is reusable and includes rope socket assembly, casing collar locator and sinker bar (supplied by the service company). The High-Pressure Firing Head, Quick Change Assembly and Igniter Subs are supplied by Diamondback Industries, Inc.

Pre Assembly Procedures

1. Unpack all hardware components and perform the following spot checks.
2. Verify that the inside of the mandrill is free from debris such as packing material and metal shavings.
3. Check to be sure that the top slip is facing up, and that the bottom set is facing down. The slips should be facing away from the rubber element in the center of the plug.
4. Make sure that the shoe is tight (hand tight only). Check the lock down screw to make sure that it is tight. Over tightening of the shoe will flare the rubber element out. This may interfere with the running of the plug and could result in damage to the element.
5. Check to be sure that the O-Rings installed on the neck of the Eliminator Cast Iron Bridge Plug are in good working order and free from any cuts or damage of any kind.
6. The following pre operation procedures are to be performed on each plug. Failure to do so may result in the plugs failure. The following procedures are performed by the manufacturer during assembly and before packing. Due to reasons beyond our control such as shipping, unpacking, handling, and transport by the consumer, one or more of the following may have come loose or damaged. It is the consumer's responsibility to perform these spot checks prior to running the plug.

Assembly Procedures

1. Unpack the igniter and perform a continuity check. The igniter should read between 48 to 55 ohms.
2. After the igniter is loaded into the igniter sub, the High Pressure Firing Head or Quick Change is then installed on the top end. Either assembly will make contact with the igniter and complete the circuit. The assembly should be checked again through the firing head or quick change for continuity using a blasters mutimeter. You should read between 48 to 55 ohms. The firing assembly is ready to be attached to the line. As with all explosive tools, the power should be off and the firing panel in safe mode with the safety key in the possession of the operator prior to arming the firing assembly or attaching it to the electric line. Always check for stray current.
3. Select the proper power charge corresponding to the size of plug you are utilizing. For example, a 4.424 bridge plug with the part number DBK-ELM-5500-017-100 will utilize the power charge part number SSP-4240-100. Make sure to consult the chart provided in this manual to ensure you are utilizing the proper size power charge. Failure to do so will result in a failure. Each size of bridge plug will have its own assigned power charge based upon the amount of internal area within the plug.
4. Insert the power charge into the body of the plug. The power charge has only one end with a booster and must be loaded with the booster end up. Failure to do so will result in a failure.
5. The bridge plug is now ready for the final connection at the well head. Connect the plug to the firing assembly already attached to the line. Line up the shear screw holes on the igniter sub with the same recess holes on the neck of the Eliminator CIBP. Install all eight (8) shear screws, tighten to bottom, and then back off shear screw $\frac{1}{4}$ turn counterclockwise.
6. All power must remain off until the plug reaches 200 feet.

Operations in the Well Bore

1. A gage ring and junk basket should be run prior to setting a bridge plug in the well bore. This will remove scale and other debris from the casing or tubing wall. This will aid in the setting process of the plug. The slips must be set in good pipe or the plug may not hold pressure. If the casing is in poor condition, a casing scraper should be run prior to the gage ring and junk basket.
2. Make sure that the plug is rated for the conditions that they will be set in. These ratings include temperature, pressure, casing size, casing weight, and fluid type.
3. Casing should have 100% cement bond before running plug in the well.
4. Help guide the bridge plug and the rest of the tool string through lubricator, wellhead and blowout preventer.
5. When running under pressure, raise the plug to the top of the lubricator before equalizing the pressure into the lubricator.
6. Do not exceed recommended running speed of 200 feet per minute. Always slow down for liners and other restrictions that may be encountered.
7. Never set plug in a casing collar or where milling has occurred.
8. Always set plug in static well conditions.
9. Shock to the plug can result in a failure. Warn Service Company of the plug depth in order to avoid high impact collisions.
10. When using the plug for locating purposes, be gentle and ease the tools onto the plug. Never place tubing weight onto the plug.
11. When perforating, the bridge plug should be protected with a minimum of ten feet of cement dumped directly on top of plug. Cement should be given sufficient time to set up before perforating.
12. Perforating should not be done within fifty feet of the bridge plug.
13. When snubbing pipe, fifteen feet of cement should be placed on top of plug with a dump bailer.
14. If an obstruction is encountered, do not spud with the plug as this may set the slips prematurely and cause the plug to hang up.
15. When the desired setting depth is achieved, raise the current to approximately .5 to 1.8 amps until operator sees the resistor break in the igniter.
16. Allow the plug sufficient time to set keeping the line weight neutral. In most instances the plug should set in under two minutes.
17. When the plug shears and releases, the operator will notice a significant drop in the line weight. It will then settle back to the line weight minus the plug.
18. The line may be retrieved back to the surface. The igniter sub and the firing head can be redressed and used again. The shear neck and hydrostatic sleeve may be discarded.

Transportation Classification-Hazardous Materials

Igniters

1. Igniters
UN 0454
1.4S Explosive
PG II

Power Charges

2. Cartridges, Oil Well
UN0278
1.4C Explosive
PG II

Malfunctioning Tools

This section is included solely as a safety feature and is not meant to indicate the probability of tools malfunctioning. However, as with any pressure activated tool, the possibility exists and the following steps should be followed.

Causes of Malfunctioning tool

1. O-Ring failure which allows fluid into the mandrill of the plug. This would result in a wetted out power charge and either no burn or partial burn would occur. There would not be sufficient pressure to complete tool operation.
2. O-Ring failure which allows fluid into the mandrill of the plug. Under elevated hydrostatic conditions the plug would begin to stroke. If the plug reaches a pressure of 800 PSI, the rubber element would swell to a point that would not allow the plug to move down hole. If this occurs, the plug can be retrieved back to the surface by pulling approximately 800 LBS over string weight. The over pull should decrease as the hydrostatic pressure level drops.
3. Casing or tubing that is old may cause the plug to fail. If the casing condition deteriorates below 60 % of the minimum internal yield pressure, this may cause the plug to split the casing and fail to hold pressure.
4. Failure to run a gage ring and junk basket may leave debris in the well bore and hinder plug operations. If casing is in poor condition, and a casing scraper is not utilized, the slips may not be able to set in good pipe and may cause the elements on the plug to relax.
5. Utilizing the improper power charge will result in a partial set. There is insufficient pressure to complete tool operation.

Corrective Action

1. In the event of a partially set bridge plug where the tool does not release, and you have to pull out of the rope socket, the shear screws will part in a normal manner when the upper assembly is fished out. This happens when there is not enough pressure to complete the set and build up to the shear pressure to release. The shear point of all Eliminator shear screws are made to shear correctly and tolerances are held to high standards of accuracy. When fishing out the upper assemblies, you will notice the accuracy of the shear values when the plug and igniter sub parts assuming that there is no internal pressure on the plug. If the plug contains pressure, the shear value will be lower.
2. The shear values are listed as follows:
 - a. 1.710 9,300 LBS
 - b. 2.160 10,100 LBS
 - c. 2.750 13,000 LBS
 - d. 3.580 21,000 LBS
 - e. 4.424 25,000 LBS
 - f. 5.910 30,000 LBS
3. If the plug must be drilled out of the well bore, the following techniques are used as a general guide for the most successful drill out.
 - a. Utilize a hard formation Tri-Cone rotary bit for best results
 - b. Rotary speed should be between 80 to 120 RPM or as required.
 - c. Apply 5,000 to 7,000 LBS of force on the bit until the top retaining shoe and the upper part of the body is drilled away or approximately 3 to 5 inches.
 - d. Additional weight can be applied across the full bit diameter in the amount of 9,000 to 13,000 LBS.
 - e. A minimum of 8 drill collars should be utilized for 3.580 and 4.420 plugs. Use 12 drill collars for the 5.910 plug for 7 inch casing.
 - f. Spudding the work string, variations in rotary speed, and set down weight should be used to aid in breaking up large metal debris and prevent tracking of the bit.
 - g. One or more junk baskets should be used above the bit to catch debris while normal circulation is employed.
 - h. The drill out time may vary in many instances. Our case history files have recorded drill out times ranging from 45 to 105 minutes when following these techniques.

WARNING.

For your own safety, if you are not trained in the use and safe handling of explosives and hazardous materials, do not attempt the assembly, arming, or firing of any Eliminator Cast Iron Bridge Plug products. Doing so can result in injury or death to yourself and others on location plug product. Doing so can result in injury or death to yourself and others on location.

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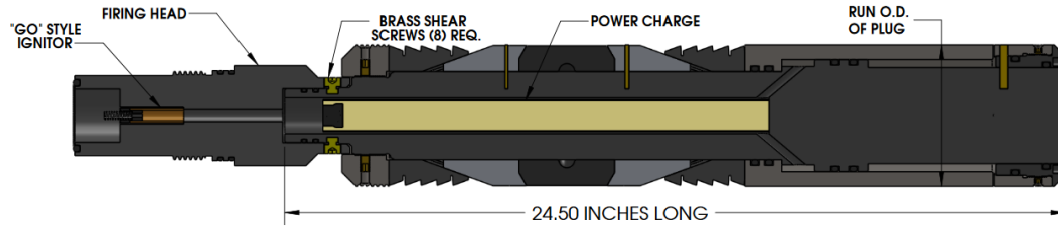


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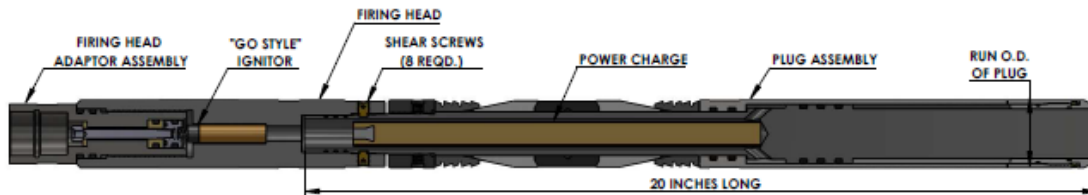
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Technical Specification and Schematics:



PART NUMBER	TOOL TYPE	PRESSURE RATING OF PLUG	TEMPERATURE RATING	CASING SIZE	CASING WEIGHT	RUN O.D. OF PLUG	CASING I.D.	REQUIRED SETTING FORCE
DBK-ELM-4500-116-100	ELIMINATOR GAS SET	10,000 PSI	205C (400F)	4-1/2"	10.5#	3.580	4.052	21,000
DBK-ELM-4500-116-100	ELIMINATOR GAS SET	10,000 PSI	205C (400F)	4-1/2"	11.6#	3.580	4.000	21,000
DBK-ELM-4500-116-100	ELIMINATOR GAS SET	10,000 PSI	205C (400F)	4-1/2"	12.6#	3.580	3.958	21,000
DBK-ELM-4500-116-100	ELIMINATOR GAS SET	10,000 PSI	205C (400F)	4-1/2"	13.5#	3.580	3.920	21,000
DBK-ELM-4500-116-100	ELIMINATOR GAS SET	10,000 PSI	205C (400F)	4-1/2"	15.1#	3.580	3.826	21,000
DBK-ELM-4500-116-100	ELIMINATOR GAS SET	10,000 PSI	205C (400F)	5"	23.2#	3.580	4.044	21,000
DBK-ELM-4500-116-100	ELIMINATOR GAS SET	10,000 PSI	205C (400F)	5"	24.1#	3.580	4.000	21,000
DBK-ELM-5500-017-100	ELIMINATOR GAS SET	10,000 PSI	205C (400F)	5"	11.5#	4.424	4.560	25,000
DBK-ELM-5500-017-100	ELIMINATOR GAS SET	10,000 PSI	205C (400F)	5"	13.0#	4.424	4.494	25,000
DBK-ELM-5500-017-100	ELIMINATOR GAS SET	10,000 PSI	205C (400F)	5-1/2"	14.0#	4.424	5.012	25,000
DBK-ELM-5500-017-100	ELIMINATOR GAS SET	10,000 PSI	205C (400F)	5-1/2"	15.5#	4.424	4.950	25,000
DBK-ELM-5500-017-100	ELIMINATOR GAS SET	10,000 PSI	205C (400F)	5-1/2"	17.0#	4.424	4.892	25,000
DBK-ELM-5500-017-100	ELIMINATOR GAS SET	10,000 PSI	205C (400F)	5-1/2"	20.0#	4.424	4.778	25,000
DBK-ELM-5500-017-100	ELIMINATOR GAS SET	10,000 PSI	205C (400F)	5-1/2"	23.0#	4.424	4.670	25,000
DBK-ELM-5500-017-100	ELIMINATOR GAS SET	10,000 PSI	205C (400F)	5-1/2"	26.0#	4.424	4.548	25,000
DBK-ELM-7000-026-100	ELIMINATOR GAS SET	10,000 PSI	205C (400F)	7"	20.0#	5.910	6.456	30,000
DBK-ELM-7000-026-100	ELIMINATOR GAS SET	10,000 PSI	205C (400F)	7"	23.0#	5.910	6.366	30,000
DBK-ELM-7000-026-100	ELIMINATOR GAS SET	10,000 PSI	205C (400F)	7"	26.0#	5.910	6.276	30,000
DBK-ELM-7000-026-100	ELIMINATOR GAS SET	10,000 PSI	205C (400F)	7"	29.0#	5.910	6.184	30,000
DBK-ELM-7000-026-100	ELIMINATOR GAS SET	10,000 PSI	205C (400F)	7"	32.0#	5.910	6.094	30,000



PLUG PART NUMBER	FIRING HEAD PART NUMBER	FIRING HEAD ADAPTOR PART NUMBER	POWER CHARGE PART NUMBER	TUBING SIZE	RUN O.D. OF PLUG	TUBING I.D.	TUBING WEIGHT	REQUIRED SETTING FORCE
DBK-ELM-2375-040-100	DBK-DEP-ELM-2375-040-002	DBK-ELM-FHA-1710-040-100	SSP-1710-100	2.375	1.710	1.853	6.2#	9,300
						1.867	5.8#	
						1.939	5.3#	
						1.995	4.6#	
						2.041	4.0#	
DBK-ELM-2875-064-100	DBK-DEP-ELM-2875-064-002	DBK-ELM-FHA-1710-040-100	SSP-2160-100	2.875	2.160	2.259	8.6#	10,100
						2.323	7.8#	
						2.441	6.4#	
DBK-ELM-3500-077-100	DBK-DEP-ELM-3500-077-002	DBK-ELM-FHA-1710-040-100	SPP-3500-100	3.500	2.750	2.922	10.2#	13,000
						2.992	9.2#	
						3.068	7.7#	