5.5" (17.0#) SCORPION™ COMPOSITE FRAC PLUG

1. PURPOSE

1.1. To provide preparation and operational instructions for the Scorpion™ 4.47" OD Composite Frac Plug.

2. SCOPE

2.1. This written procedure governs the recommendations or best practices for running the Scorpion™ 4.47" OD Composite Frac Plug, including the plug with wireline adapter assemblies listed below.

WLAK Part #	Description	
06-0002-0437-A20	06-0002-0437-270	Setting Sleeve, 4.18 OD, Scorpion Setting Kit, Baker 20. QTY:1
	06-0002-0437-230	Tension Mandrel, 4.37 OD, Scorpion Setting Kit, Baker 20. QTY:1
	70.SHCS.014.2012	1/4-20 x 1/2, Socket Headless Set Screw, Cup Point, Steel. QTY:3
	70.SHCS.014.2014	1/4-20 x 1/4, Socket Headless Set Screw, Cup Point, Steel. QTY:2
06-0002-0437-A30	06-0002-0437-330	Tension Mandrel, 4.37 OD, Scorpion Setting Kit, Go Compact, WLAK. QTY:1
	06-0002-0437-350	Go Setting Nut, 4.37 OD, Scorpion Setting Kit, Go Compact. QTY:1
	06-0002-0437-370	Setting Sleeve, 4.37 OD, Scorpion Setting Kit, Go Compact. QTY:1

3. SAFETY

3.1. All employees are required to supply their own safety equipment and Personal Protective Equipment (PPE) when performing the procedures in this technical unit. The employee's PPE and safety equipment must meet or exceed the customer's safety standards.

4. IMPORTANT DISCLOSURES

4.1. This procedure is meant to be used as a general guideline only. It is meant to be used for the Scorpion™ 4.47" OD Composite Frac Plug. It is not the same procedure to be referenced when running other plug types or sizes.

4.2. To achieve optimal product performance, it is recommended to utilize a setting tool with all ancillary energetics which have been qualified for use with the Scorpion™ 4.47" OD Composite Frac Plug.

4.3. A clean, reasonably straight wellbore is assumed, and certain conditions may warrant modifications to this procedure. Any suggested or proposed modifications need to be analyzed and approved by Nine Energy Service Engineering support group.

4.4. Use of a gauge ring or gauge device is recommended prior to running the Scorpion™4.47" OD Composite Frac Plug.

4.5. Seasoning the wireline should not be performed with a plug installed.

4.6. Keeping a dedicated pump primed is extremely important. Pump cavitation can lead to presets and pump-offs. Additionally, unwanted debris in pump can cause further problems during pumpdown.

5. SCORPION™ 4.47" OD COMPOSITE FRAC PLUG PROCEDURES

5.1. Assembling the Scorpion™ 4.47" OD Composite Frac Plug onto the Wireline Adapter Setting Kit.

5.1.1. Drop tension mandrel through setting sleeve then tighten tension mandrel to setting tool bottom connection. If setting tool is a Baker 20, ensure set screws are tight. If setting tool is a Compact, ensure jam nut is tight.

5.1.2. Loosely make up setting sleeve to setting tool bottom connection, allowing rotation to install shear screws through setting sleeve access holes.

5.1.3. Slide the plug shear hub into the tension mandrel. Align plug mandrel shear holes with tension mandrel shear thread profile. Install all set screws.

5.1.4. **It is critical to install QTY: 6 shear screws when making up the Scorpion™ 4.47" OD Composite Frac Plug to ensure proper plug function. Failure to do so could result in a plug failure.**

5.1.5. Tighten setting sleeve. If setting tool is a Baker 20 ensure set screws are tight. If setting tool is a Compact, ensure lock ring is tight.

5.2. Running the Scorpion™ 4.47" OD Composite Frac Plug.

5.2.1. After plug is assembled on setting tool in preparation to pick up, precautions should be implemented to prevent tool string weight from being stacked on plug, it will also prevent plug from being dragged on surface while lifting. This can be achieved by utilizing a roller dolly.

5.2.2. If it becomes necessary to set down on the tool trap, it is recommended to stack as minimal weight on the plug as possible.

5.2.3. Confirm efficient and thorough flush was properly displaced prior to RIH. This will assist in achieving an unobstructed path of travel.

5.2.4. While running in the vertical section of the well under optimal well conditions, do not exceed 250 ft/min unless pumping fluid around plug.

5.2.5. It is critical to consider annular fluid velocity in collars, patches, and liners when determining appropriate pumpdown speed. If plug is conveyed through a restriction in the vertical section, do not exceed 50 ft/min. If conveying through a restriction in the lateral section, pump lowest rate possible, while still maintaining movement.

5.2.6. It is recommended to stay within the calculated blue zones of the running tables for horizontal pumpdown applications *(reference Figure 1)*. Failure to do so may increase risk of presetting the plug.

5.2.7. It is important to understand pump rate, annular velocity, and tortuosity of the well affect the tool speed. Therefore, it is critical the winch operator continually monitors the pumpdown process.

5.2.8. Adjust line speed as plug passes through liner top or any other crossover assembly that increases or decreases casing inner diameter. Failing to perform this task will affect annular fluid velocity, increasing preset risk. It could potentially damage tool string if plug inadvertently "stacks out." It may also rapidly increase unexpected wireline tension.

5.2.9. If a Scorpion™ 4.47" OD Composite Frac Plug is conveyed to any depth, unable to be deployed in the casing and required to be pulled out of hole, the plug must be replaced. DO NOT RERUN the plug.

5.2.10. If it becomes necessary to return to surface with the plug still attached to the setting equipment, do not exceed 150 ft/min while pulling out of the hole.

5.3. Ball Seating Procedure.

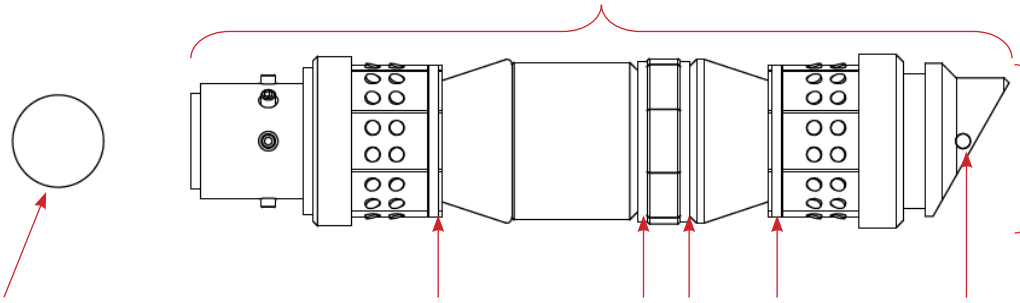
5.3.1. A variety of specific gravity balls are available for the Scorpion™ 4.47" OD Composite Frac Plug. The primary frac ball included with the Scorpion™ 4.47" OD Composite Frac Plug is a 2.375" 1.84 SG frac ball. Confirm correct ball for the application is utilized.

5.3.2. It is recommended to displace the ball no faster than 25 BPM. Rate should be slowed approximately 50 BBLS prior to landing ball. Slow rate and land the ball at no more than 10 BPM.

6. SCORPION™ COMPOSITE FRAC PLUG ASSEMBLY FIELD INSPECTION

6.1. Verify all plug and WLAK parts are accounted for and prepared for field service.

Nine Energy Service Scorpion™ 4.47" OD Composite Frac Plug w/ Easy Mill Mule Shoe



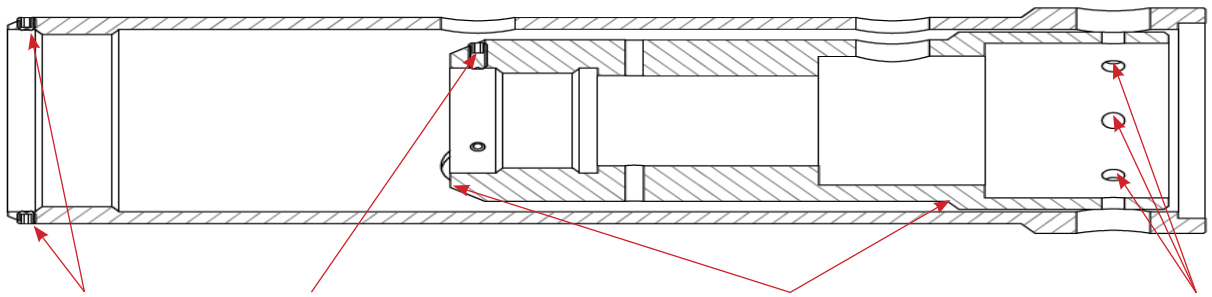
Confirm OD of plug is correct.

Verify Frac ball 2.375" 1.80 SG.

Inspect all retaining bands to ensure they are tightly seated in correct groove. Considering a restriction in the wellbore may be present, **this is a CRITICAL inspection.**

Inspect mandrel for proper dowel pin setting with mandrel.

6.2. Nine Energy Service 5.5" Scorpion™ Composite Frac Plug WLAK Setting Kit with Baker 20.

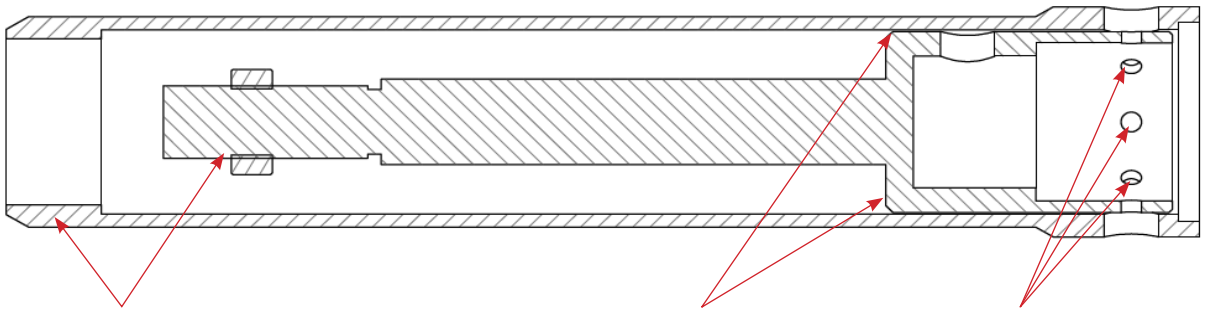


Inspect setting sleeve and tension mandrel threads. Confirm no visual defects present. Ensure set screw utilization.

Thoroughly inspect setting sleeve load shoulder confirming there are no burrs or deformed edges.

Inspect tension mandrel end threads for visual defects.

6.3. Nine Energy Service 5.5" Scorpion™ Composite Frac Plug WLAK Setting Kit with 3.58" Go Compact.

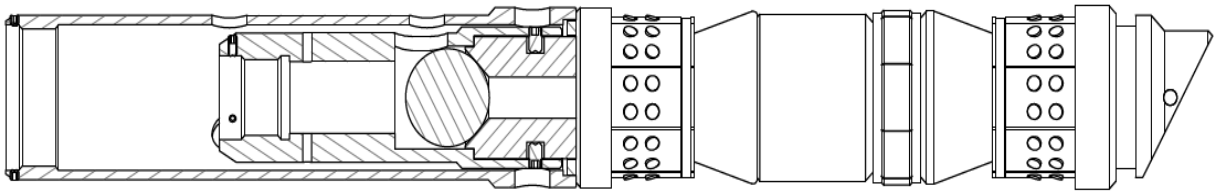


Inspect setting sleeve and tension mandrel threads. Confirm no visual defects present. Ensure jam nut is utilized.

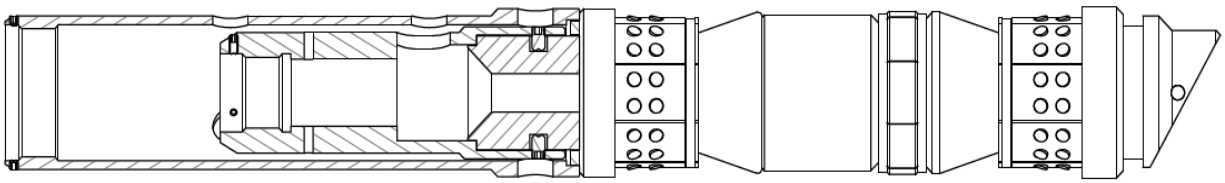
Thoroughly inspect setting sleeve load shoulder confirming there are no burrs or deformed edges.

Inspect tension mandrel end threads for visual defects.

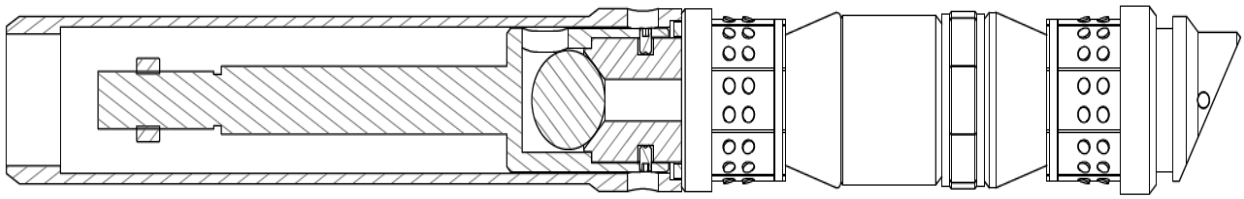
6.4. Configured as Running Ball-in-Place with Baker 20 Setting Kit.



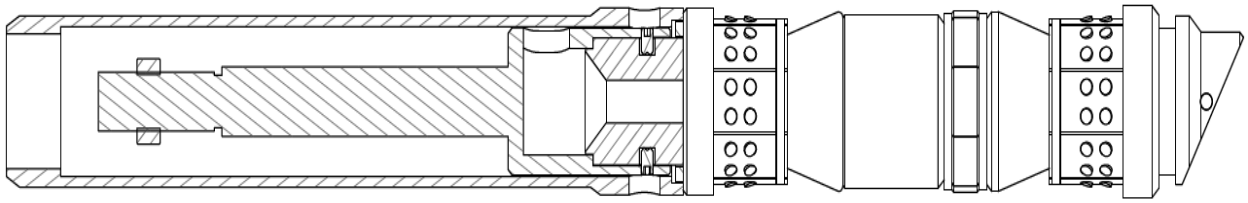
6.5. Configured as Running Ball Drop with Baker 20 Setting Kit.



6.6. Configured as Running Ball-in-Place with Go Compact Setting Kit.



6.7. Configured as Running Ball Drop with Go Compact Setting Kit.



7. RECOMMENDED RUNNING TABLES FOR HORIZONTAL PUMPDOWN APPLICATIONS

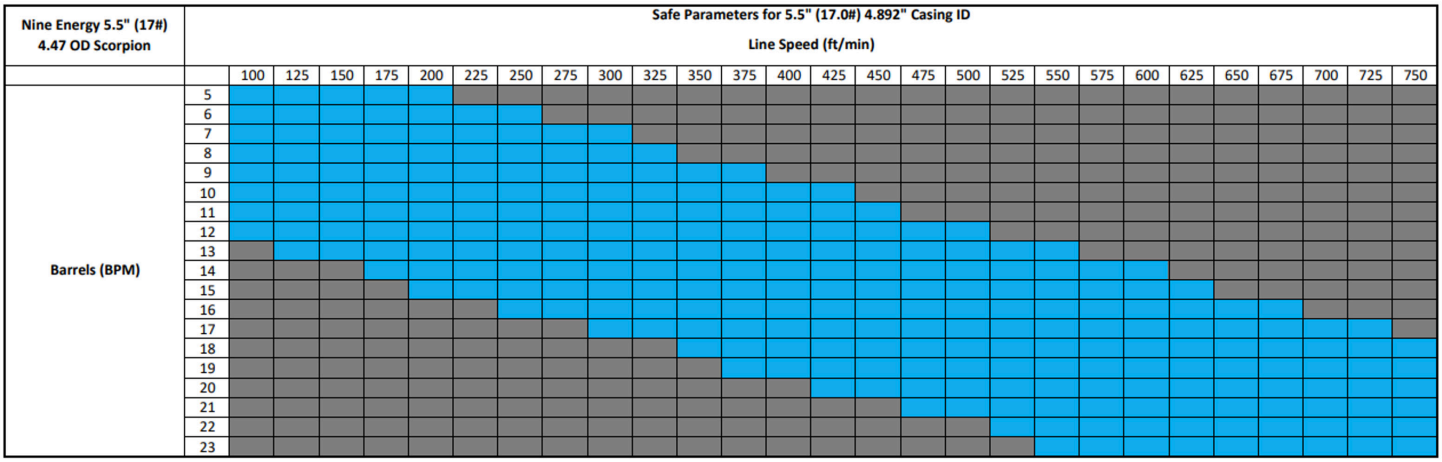
7.1 The recommended pump rate tables *(reference Figure 1)* are to be used as a guideline when pumping the Scorpion™ 4.47" OD Composite Frac Plug in deviated or horizontal wellbores. The Customer and Nine Energy Personnel's knowledge of the project should be considered when planning all pumpdown operations. Failure to run the plug within the pumpdown table parameters can lead to a possible pre-set plug and other potential failures.

7.2. Line tension is not calculated within these recommendations; the wireline operator is responsible for maintaining a safe line tension during pumpdown operations to avoid pumping the bottom hole assembly off the wireline.

7.3. It is important to note that with increased speed, the risk of a preset increases if a restriction or obstruction is encountered.

Nine Energy Service Scorpion™ Composite Frac Plug - 4.47" OD 5.5 in., 17 lb. /ft. Casing.

Figure 1



8. RECOMMENDED MILL TYPE AND MILL SIZE

8.1. Mill / Bit Type.

8.1.1. Considering the composition of the Scorpion™ Composite Frac Plug is mainly composite, it is recommended to utilize a sealed-bearing, tr- cone bit.

8.2. Mill / Bit Size.

8.2.1. Recommended mill/bit OD is approximately 98% of casing/tubing drift diameter. (Example: 5.5" 20.0# casing with a drift of 4.653" would yield a recommended 4.625" OD mill/bit). Undersized mills/bits increase the possibility of sticking due to coring of the plug after removing multiple plugs with the same mill/bit in the hole. The below table can be used as a guide for size selection *(reference Figure 2).*

8.2.2. The use of an oversize mills/bits is effective for finer milling or grinding of the plug when required for milling of multiple plugs. This allows for extended mill/bit life over the number of plugs attempting to be removed. Larger bit watercourses allow sufficient cutting removal and should be addressed when using the oversized designs.

Figure 2

CASING DIMENSIONS AND BIT CLEARANCE

CASING								BIT		
OUTSIDE DIAMETER		WEIGHT		INSIDE DIAMETER		DRIFT		SIZE		BIT CLEARANCE
INCH	MM	LB/FT	KG/M	INCH	MM	INCH	MM	INCH	MM	
4.50	114.30	9.5	14.14	4.090	103.89	3.965	100.71	3 7/8	98.43	0.09
4.50	114.30	11.6	17.26	4.000	101.60	3.875	98.43	3 3/4	95.25	0.125
4.50	114.30	13.5	20.09	3.920	99.57	3.795	96.39	3 3/4	95.25	0.045
4.50	114.30	15.1	22.47	3.826	97.18	3.701	94.01	3 5/8	92.08	0.076
5.00	127.00	11.5	17.11	4.560	115.82	4.435	112.65	4 3/8	111.13	0.06
5.00	127.00	13.0	19.35	4.494	114.15	4.369	110.97	4 1/4	107.95	0.119
5.00	127.00	15.0	22.32	4.408	111.96	4.283	108.79	4 1/4	107.95	0.033
5.00	127.00	18.0	26.79	4.276	108.61	4.151	105.44	4 1/8	104.78	0.026
5.00	127.00	21.4	31.85	4.126	104.80	4.001	101.63	3 7/8	98.43	0.126
5.50	139.70	13.0	19.35	5.044	128.12	4.919	124.94	4 3/4	120.65	0.169
5.50	139.70	14.0	20.83	5.012	127.30	4.887	124.13	4 3/4	120.65	0.137
5.50	139.70	15.5	23.07	4.950	125.73	4.825	122.56	4 3/4	120.65	0.075
5.50	139.70	17.0	25.30	4.892	124.26	4.767	121.08	4 5/8	117.48	0.142
5.50	139.70	20.0	29.76	4.778	121.36	4.653	118.19	4 5/8	117.48	0.028
5.50	139.70	23.0	34.23	4.670	118.62	4.545	115.44	4 1/2	114.30	0.045
5.50	139.70	26.0	38.69	4.548	115.52	4.423	112.34	4 3/8	111.13	0.048

9. RECOMMENDED MOTOR SPECIFICATIONS

9.1. Any (2-7/8" and 3-1/8") motor with a bearing pack should be used in frac plug removal applications.

9.2. RPM ranges should be in the 250 – 600 range. This depends on the motor size used.

9.3. WOB capability should be in the 1,000 – 3,000 lbs. range when milling on frac plugs, also depending upon motor size. High WOB may be required to stabilize a spinning plug to complete the milling process. Not all motors are sufficiently rated for this application.

9.4. Coil tubing torsional yield should be at least twice the minimum output torque of the motor being used. This is especially important when running larger motors with higher torque ratings.

9.5. Larger diameter coil tubing should generate less friction loss, allowing higher pump rate capacity for a given pressure. It should also reduce the annular flow area, which should increase the annular velocity to assist in hole cleaning.

9.6. Pump rates utilized should be sufficient to maintain fluid velocities sufficient to carry the cuttings and clean the hole. Special attention must be exercised when using commingled milling fluids with nitrogen.

10. RECOMMENDED GENERAL MILLING PROCEDURE

10.1. Make up coil tubing connector and perform pull test. Inspect connector to ensure no movement has taken place, and the connection was maintained. Tighten coil tubing connector and repeat test again, ensuring that a post-test inspection reveals no abnormalities.

10.2. Install dual flapper check valve, hydraulic disconnect, and potentially a circulating sub, agitator, and jars. Pressure test BHA to ensure no leak is detected.

10.3. Install motor / bit and pressure test at various anticipated flow rates through BHA. Log "off-bottom" pressures at each flow rate.

10.4. RIH with minimum pump rate following recommended operational procedures for coiled tubing unit while going in the hole.

10.5. Slow coil tubing running speed when within 1000' of plug or tag depth to start milling. Maintain a safe running speed until plug is tagged.

10.6. Once tag is made, pick up approximately 6' to 10' and increase flow rates. Note pump pressure prior to proceeding to bottom.

10.7. Set down on the plug and establish positive milling WOB via monitoring of differential pressures.

10.8. Patience should be exercised as a cutting pattern is established. Multiple stalls can characterize this period until such time as the mill has had an opportunity to establish a cutting pattern.

10.9. Continue slacking off weight as differential pressure indicates plug removal.

11. ADDITIONAL RECOMMENDATIONS

11.1. Mill using a minimum to mid-range flow rate. Maximum flow rate may hydraulically lift the BHA off the plug. You can correct this with more WOB or decrease pressure. Drill off differential pressure readings, not WOB. Your WOB should fluctuate. Keep the differential pressure reading constant.

11.2. If the plug is not milling up in a timely fashion, pick up 3'–5' off the plug and attempt to drive the BHA into the plug by applying the max weight the coil company and motor parameters allow without exceeding WOB limitation of the motor/BHA. This will assist with plug lockup and establish a new stabilized cutting pattern for the mill.

11.3. Minimal to zero increase in pump pressure readings when applying additional WOB can also be a signal that the plug may be spinning. Lifting from bottom and impacting the plug with a downward blow can, on occasion be helpful. Caution and operator judgment on the force of the blow should be exercised.

11.4. When removing plugs that have a differential pressure below the plug greater than the pressure above, proceed slowly through the top eight to twelve inches of the plug allowing the pressures to equalize.

11.5. Pumping periodic sweeps is recommended to assist with carrying capacity of the well fluid in the vertical. This can also assist in maintaining turbulent flow in the wellbore.

CONTACT

For any additional questions or concerns, please email EngineeringServices@nineenergyservice.com.

AMENDMENT SUMMARY

Amendment Summary (latest 5 revisions)				
Rev. No.	**Date**	**Section(s)**	**Revision Description**	**Revised by**
1	9/17/2021	8	Updated bit selection guidelines and casing table.	TD
2	5/4/2022	5	Updated Running Procedures.	ME
3	4/01/2023	1-11	Added Numeric Citation.	J. Limon

Approved			
5/17/2021	M. Eichelsdorfer		
Date	Originator	Checked By	Authorized By