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API Perforator System Registration – Section 2 Witness Instructions			

1. Introduction

- a. To simplify and standardize the witnessing process and minimize the amount of documentation, data shall be recorded on “Section II Data Sheet” and “Section II Witness Report”. The former includes “Published Data Sheet” worksheet and a series of worksheets (i.e. “Test Series @ 1500psi”, ...). Additional information is required to be verified and shall be recorded on “Section II Witness Report”, which consists of “Published Data Sheet” section and “Test Series Data Sheet” section.
- b. Ensure the correct Data Sheets are completed based on the method used to determine the UCS, either Plug or Scratch.
- c. The Section II Data Sheet worksheets are completed by the Test Company and the API witness’ role is to verify the information recorded. The Section II Witness Report is completed by the API Witness.
- d. The API witnessing will begin after all targets have been saturated and UCS measurements taken. Data associated with activities prior to test setup will be reviewed by the API witness based solely on the records provided by the Testing Company. Activities that must be witnessed are identified in the headings as (Mandatory to Witness).
- e. These witness instructions do not necessarily address each and every requirement in API RP 19B. While the scope of the API Witness Program is limited to the activities identified in these witness instructions, the Testing Company is responsible for ensuring that all requirements of API RP 19B are met.

2. Section II Datasheet

		General Information to Fill Out - Published Data Sheet
Row – Plug	Row – Scratch	
1	1	Verify the Name of the Testing Company is recorded. This must be the name of the company whose name/signature will appear as the certifying company on the “Certification Data Sheet” worksheet of Section II Witness Report. On the right side, verify the Dates of Testing have been recorded as the date the first shot was completed and the date the last shot was completed.
2	2	Verify the Charge Name is recorded as it will appear on the “Certification Data Sheet” worksheet of Section II Witness Report.
3	3	Verify the Charge Manufacturer Part Number is recorded as it will appear on the Certification Datasheet and on the right side, verify the Charge Date Shift Code has been entered.
4	4	Verify the Explosive Type and Weight in grams used in the Charge is recorded as it will appear on the “Certification Data sheet” worksheet of Section II Witness Report; verify the Charge Case Material has been entered on the right side, for example steel or zinc.



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5	5	Verify the Gun System(s) being simulated has (have) been recorded as it (they) will appear on the Certification Datasheet, which needs to be verified by reviewing the engineering drawing.
6-7	6-7	Record any Comments to further clarify the above entrees.
Row – Plug	Row – Scratch	Target Configuration - Published Data Sheet
9-12	9-12	Verify the Test Conditions. The “Standard Conditions” box should be checked if the casing, cement, and fluid gap match the “Standard” thickness and composition. The “Special Test Conditions” box on the right should be checked if different. Verify OMS or Water used for the fluid clearance has been designated. For reference: the “Standard” simulated casing is made from 4140 Mill 80k psi yield strength and 0.5 inches thick, the Cement is Class A, Type I or II Portland 0.75 inches thick, and the fluid gap should measure 0.75 inches.
13	13	Verify the Overburden Pressures to be 1500, 5500, and 9500 psi for “Standard Test Conditions” or record the pressures used under “Special Test Conditions”.
Row – Plug	Row – Scratch	Target Properties - Published Data Sheet
16	16	Verify the Target type is recorded, Berea Sandstone or other.
17	17	Verify the Saturating Fluid is recorded and whether the Bedding Plane Orientation is Perpendicular, Parallel, or indeterminable. For a Standard Test, the bedding plane orientation of the target shall be parallel to the target axis.
18	18	Verify the UCS Measurement Method is recorded. Use the correct template for Core Plug or Scratch method, respectively.
Row – Plug	Row – Scratch	General Information to Fill Out – Test Series Data Sheets (applicable to all test series)
3	3	Verify the Name of the Testing Company is recorded.
4	4	Verify the Charge Name is recorded as it will appear on the Certification Data Sheet of Section II Witness Test Report.
5	5	Verify the Test Date is recorded.
6	6	Verify the Saturating Fluid used is recorded, OMS or water.
7	7	Verify the Saturating Fluid Density in g/cc is recorded to the nearest 0.01 g/cc.
Row – Plug	Row – Scratch	Pre-Test Measurements – Test Series Data Sheets (applicable to all test series)
13	13	Verify the Target Diameter is recorded to the nearest 0.01 in. Verify the target diameter is between 4.00 in. and 7.00 in. +/-0.10 in. by reviewing documentation supplied by the test company or taking a physical



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measurement of the target. (Note: If the target is larger than 7” nominal diameter, the test becomes a “special test”)

14	14	Verify the Target Length is recorded to the nearest 0.01 in. Note: The target length will vary and depend on the expected penetration depth of the charge being tested.
18	19	Verify the Final Dry Weight of the target is recorded to the nearest gram. Verify that the weight remained constant within 1 gram for the final 24 hours of drying by reviewing documentation supplied by the Test Company.
19	20	Verify the Saturated Weight of the target is recorded to the nearest gram.

Verify the Porosity is recorded to the nearest 0.1%. Verify the calculation of the core porosity to the nearest 0.1% using the given formulas. Verify that the core porosity is between 18.5% and 21.5%.

$$\Phi = \frac{V_p}{V_b} (100)$$

Where Φ is the porosity, V_p is the pore volume (cc) and V_b is the bulk volume (cc)


20	21	$V_p = \frac{W_{sat} - W_{dry}}{\rho_{sat.fluid}}$
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Where W_{sat} is the saturated weight of the core (g), W_{dry} is the dry weight of the core (g) and $\rho_{sat.fluid}$ is the density of the saturating fluid

$$V_b = \frac{\pi d_{core}^2}{4} l_{core} (16.39)$$

Where d_{core} is the diameter of the core (in.) and l_{core} is the length of the core (in.) and 16.39 is the conversion from cubic inches to cubic centimeters

N/A	26	Verify the Average Target UCS is recorded to the nearest 10 psi. Review documentation on the scratch method used. Verify that an overall average of the UCS data has been calculated, disregarding the first 0.5 inch and the last 0.5 inch of the data.
13	N/A	Verify the Diameter of each of the 3 core plugs from each end of the target is recorded to the nearest 0.01 in. Verify that the diameter of each of the 3 three core plugs was at least 0.95 inches +/-0.01 in. by reviewing documentation supplied by the Test Company.
14	N/A	Verify the Length of each of the 3 core plugs from each end of the core target is recorded to the nearest 0.01 in.
15	N/A	Verify the Length:Diameter Ratio is recorded. Calculate the ratio of the length to the diameter (Length:Diameter). Verify that the Length:Diameter ratio is between 2.0:1 and 2.5:1.

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18	N/A	Verify the Dry Weight of each of the 6 core plugs is recorded to the nearest 0.01 gram.
19	N/A	Verify the Saturated Weight of each of the 6 core plugs is recorded to the nearest 0.01 gram. Note: The Saturated Weight is not required to be recorded. Some companies may elect to record the data for reference purposes only.
20	N/A	Verify the Saturated Porosity of each of the 6 core plugs is recorded to the nearest 0.1%. Note: Porosity is not required to be recorded. Some companies may elect to record the data for reference purposes only.
22	N/A	Verify the Plug UCS is recorded to the nearest 10 psi for each of the 3 core plugs from each end of the target.
25	N/A	Verify the Average Target UCS for the rock is recorded to the nearest 10 psi. For Core Plug Method, calculate an average compressive strength using all compressive strength values for each end, note that failure must be shear failure and checked in the check box for validity showing an approximate failure angle of 45°. Verify that the compressive strength of the rock averages at least 5700 psi.


Row – Plug	Row – Scratch	Test Setup (Mandatory to Witness) – Test Series Data Sheets (applicable to all test series)
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33	34	Verify the Nominal Casing Thickness is recorded from the Published Datasheet.
34	35	Verify the Nominal Cement Thickness is recorded from the Published Datasheet
35	36	Verify the Nominal Fluid Clearance is recorded from the Published Datasheet


Row – Plug	Row – Scratch	Test Performance and Post-Test Measurement Data (Mandatory to Witness) – Test Series Data Sheets (applicable to all test series)
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Note: All measurement instruments must be verified to be calibrated on an annual basis and be accurate within 0.01 inches. Once target is removed from the test vessel, clearly identify all parts of the setup for each test. If data recording will occur after all tests have been conducted, put all items from each test in a sealed box to ensure test materials stay separated.

43	44	Verify the Total Core Penetration is recorded to the nearest 0.10 in. Total Core Penetration is the length from the face of the target to deepest evidence of penetration such as carbon from explosive or evidence of liner debris. A crack with no evidence of carbon or liner debris is NOT to be included in penetration depth. Verify that at least 3.00 in. of un-penetrated core remain after the shot by taking a physical measurement of the remaining core or calculating it by subtracting the Total Core Penetration from the original target length.
44	45	Verify the Undamaged Core Length is recorded to the nearest 0.10 in. The Undamaged Core Length is calculated from the Total Core Length minus the Total Core Penetration and must be 3 in. or greater.

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45	46	Verify the Total Target Penetration is recorded to the nearest 0.1 in. as the Total Core Penetration plus the Casing Thickness plus the Cement Thickness.
46	47	Verify the Distance from Jet Tip to Target Edge is recorded to the nearest 0.10 in. The jet tip must not be closer than 0.75 in. to the core outside diameter for a valid shot.
47	48	Verify the Casing Through Hole, minor diameter is recorded to the nearest 0.01 in.
49	50	Verify the Casing Through Hole, major diameter is recorded to the nearest 0.01 in.
50	51	Verify the Casing Through Hole Average is recorded to the nearest 0.01 in. The Casing Through Hole average is calculated as the average of the major and minor diameters.
Row – Plug	Row – Scratch	Test Conditions (Mandatory to Witness) – Test Series Data Sheets (applicable to all test series)
37	38	Verify the Targeted Overburden Pressure is recorded to the nearest 50 psi from the Published Datasheet.
38	39	Verify the Actual Overburden Pressure read off the pressure Gauge during the test is recorded to the nearest 50 psi.
39	40	Verify the Targeted Well Bore Pressure to the nearest 5 psi is recorded from the Published Datasheet.
40	41	Verify the Well Bore Pressure from the pressure Gauge is recorded to the nearest 5 psi.
Row – Plug	Row – Scratch	Data Recording (Mandatory to Witness) – Published Data Sheet
23	23	Verify the Casing Through Hole, minor diameter is recorded to the nearest 0.01 in. from the Test Series Datasheets for each Test Series.
24	24	Verify the Casing Through Hole, major diameter is recorded to the nearest 0.01 in. from the Test Series Datasheets for each Test Series.
25	25	Verify the Casing Through Hole Average is recorded to the nearest 0.01 in. from the Test Series Datasheets for each Test Series.
27	27	Verify the Total Core Penetration is recorded to the nearest 0.1 in. from the Test Series Datasheets for each Test Series.
28	28	Verify the Total Target Penetration is recorded to the nearest 0.1 in. from the Test Series Datasheets for each Test Series.
29	29	Verify the Average Target UCS is recorded to the nearest 10 psi from the Test Series Datasheets for each Test Series.
30	30	Verify the Target Porosity is recorded to the nearest 0.1% from the Test Series Datasheets for each Test Series.
23-28	23-28	Verify the following averages for each Overburden Pressure are calculated and recorded. <ul style="list-style-type: none"> • Casing Through Hole, minor (0.01 in.) • Casing Through Hole, major, (0.01 in.)

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- Casing Through Hole, average (0.01 in.)
- Total Core Penetration (0.1 in.)
- Total Target Penetration (0.1 in.)
- Core UCS (10 psi)
- Core Porosity (0.1%)

Row – Plug	Row – Scratch	Manufacturer Certification – Published Data Sheet
31	31	Sign on the “Third Party” line if signatory is the API witness. (Note: Signing electronically by typing the full name is acceptable)
33-34	33-34	Check the box “Certified by” if being certified for the first time, or check the “Recertified by” box if being recertified.
		Observe the Company Official sign with title, date, company and address. (Note: Signing electronically by typing the full name is acceptable)
36	36	Record the name of test as it should appear on the API website.
37	37	Record name of test as it appears on Application and Application Date.

3. Section II Witness Report

Line	General Information to Fill Out – Published Data Sheet
1	Record the Location of the Testing Company including the City, State and Country.
2	Verify a minimum of 300 charges with qualified ages (28 days or older) available for charge selection. Record the Quantity of Charges available for the selection process.
3	<p>If testing occurred on the same day as the charge selection, record “Test on same day as charge selection.” If testing is to occur at a later date, the charges selected must be repackaged and resealed in the same manner as originally done by the manufacturer. Additionally, the box(es) must then be sealed by taping shut. The witness’s signature must then be indelibly written, preferably in several places, across the tape in a manner that would make tampering evident. Record the method of sealing and marking such that any witness can recognize that the charge box(es) have not been tampered with. It must include the quantity selected for the test.</p> <p>Each selected charge should be marked or initialed by the witness in a permanent marker.</p>
Line	Target Configuration – Published Data Sheet
4	Record any comments on the test configuration.
Line	Target Properties – Published Data Sheet
5	Record any comments on the target properties
Line	General Information to Fill Out – Test Series Data Sheet
1	Record the Location of the Testing Company including the City, State and Country.
Line	Pre-Test Measurements – Test Series Data Sheet
2	Record the Calibration Date and Precision of the scale. The scale must have been calibrated within the last year and have a precision of 1 gram for loads of 1000 grams or greater.



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- 3 Record the Calibration Date of the Vacuum Gauge on the Saturation Chamber. The Gauge must have been calibrated within the last year.
- 4 Record the Drying Temperature to the nearest 1°F. Verify the temperature setting of the drying oven to be between 200°F and 210°F and that it is functioning properly by reviewing documentation supplied by the Test Company.
- 5 Record the Weight of the Target reported at least 24 hours prior to the drying end time along with the date to the nearest gram.
- 6 Record the Time and Date when fluid was first admitted into the chamber. Verify that the rock core remained under vacuum for at least 3 hours prior to when fluid was first admitted in the chamber by reviewing documentation supplied by the Test Company.
- 7 Record the Time and Date when 1 mmHG was first achieved. Verify a minimum of 1 mmHG vacuum level was maintained by reviewing documentation supplied by the Test Company.
- 8 Record the Time and Date of when the target was first determined to be fully saturated.


Following are required as attachment:

Record of the Time at which the core was removed from the chamber. Verify that the target remained under vacuum, inside the chamber, for at least 2 hours prior to being removed by reviewing documentation supplied by the Test Company.

Record of the Density of the saturating fluid at the core saturating temperature to the nearest 0.01 g/cc and °F, respectively.

SCRATCH TEST METHOD: Attach a plot of the Average UCS vs. Position Data to point out any variability in the UCS of the core along its length.

Line	Test Setup (Mandatory to Witness) – Test Series Data Sheet
9	Record the Stand Off to the nearest 0.01 in. The Stand Off is defined as the space between the charge and the ID of the simulated gun wall. Verify the Stand Off distance is within 0.03 in. of the Stand Off specified in engineering drawings supplied by the Test Company by taking a physical measurement of the Stand Off used.
10	Measure and Record the Scallop Plate Thickness to the nearest 0.01 in. The Scallop Plate simulates the gun wall and is the first steel plate the jet will pass through.
11	Record the Fluid Clearance to the nearest 0.01 in. The Clearance Dimension is the distance from the outer scallop surface to the casing ID. Verify the clearance dimension is 0.75 in. +/- 0.03 in. by taking a physical measurement.
12	Record the Fluid Type used to fill the Clearance (water or OMS).
13	Record the Casing Plate Thickness to the nearest 0.01 in. The Casing Plate is a flat plate used to simulate the casing or tubing. Verify the Casing Plate thickness is 0.50 in. +/- 0.02 in. by taking a physical measurement. Note: if the Casing Plate is a coupon that contains the cement, the thickness of the Casing Plate must be verified before pouring the cement, or after the test has been conducted.

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Verify that the Casing Plate is AISI 4140 of minimum 80kpsi yield strength by reviewing the supporting documents provided by the Test Company.

14	Record the Casing Plate Diameter or Square Dimensions to the nearest 0.10 in. Verify the casing plate is at least 1.5 in. diameter or 1.5 in. square by taking a physical measurement.
15	Record the Cement Thickness to the nearest 0.01 in. The Cement is used to simulate the cement between the casing and formation in the well and is placed between the Casing Plate and rock core in this test. Verify the Cement thickness is 0.75 in. +/- 0.03 in. by taking a physical measurement.
16	Record the Cement Diameter to the nearest 0.01 in. Verify the diameter of the Cement is at least 1.5 in. or 1.5 in. square by taking a physical measurement.
17	Record the Type of Cement used. Verify the Cement is standard API Class A or ASTM Type I / Type II cement by reviewing documentation supplied by the Test Company.
18	Record the Date the cement was poured. Verify that the cement has cured for a minimum of 5 days by reviewing documentation supplied by the Test Company.

Line	Test Performance and Post-Test Measurement Data (Mandatory to Witness) – Test Series Data Sheet
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Note: All measurement instruments must be verified to be calibrated on an annual basis and be accurate within 0.01 inches. Once target is removed from the test vessel, clearly identify all parts of the setup for each test. If data recording will occur after all tests have been conducted, put all items from each test in a sealed box to ensure test materials stay separated.

19	Comments
Line	Test Conditions (Mandatory to Witness) – Test Series Data Sheet
20	If necessary, attach any documentation with pressure Gauge values recorded.
21	Verify that the Pore Pressure is vented to ambient with at least 0.075 in. ID tubing.
22	Record the Calibration Date of the Pressure Gauge. The Pressure Gauge must have been calibrated within the last year.

Line	Data Recording (Mandatory to Witness) – Test Series Data Sheet
23	Record any additional comments.

Line	Manufacturer Certification – Published Data Sheet
6	Record the Witness's Name
7	Sign and Date the Witness Report with the signature of the witness.