

	American Petroleum Institute	<b>Document Number</b> <b>WI-2008</b>	<b>Revision: 3.0</b>
			<b>Effective Date: 02/04/2022</b>
<b>API Perforator System Registration – Section 1 Witness Instructions</b>			

These instructions are to be used in conjunction with the current FM-3030 API 19B Section 1 (Concrete Targets) Perforator Witness Report.

**GENERAL INFORMATION (Input this data at the top of all 4 pages)**

1. Enter the name of the Testing Company. This must be the name of the company whose name/signature will appear as the certifying company on the Certification Data Sheet.
2. Enter the Perforating System Description as will appear as the Gun OD & Trade Name and Charge Name on the Certification Data Sheet.
3. Enter the location (city, state and country) where the test firing has taken or will take place.

**CHARGE SELECTION – Mandatory activity to witness (API RP 19B, Section 4.1.4)**

1. Enter the date that the charges have been selected for testing.
2. If the charge selection has taken place at a location different from the test site (Box # 2), enter the location (city, state and country) where the charges have been selected for testing.
3. Enter the description of the charge, as it will appear as the Charge Name on the Certification Data Sheet.
4. Enter the Charge Part #, as it appears on the box(es) which have been selected for testing. This is the Part Number that will appear as the Manufacturer Charge Part No. on the Certification Data Sheet.
5. Enter the Date Shift Code as it appears as the Date Shift Code, Manufacturing Date, or etc. on the box(es) which have been selected for testing. If more than one date appears on the box(es), list all dates.
6. Enter the Quantity of Charges Available for Selection Process. This is the quantity of charges that the witness may, at his free discretion and without restriction, select from. Enter the total number of charges, the total number of boxes, and the number of charges per box. The minimum number that must be available for the selection process is 300 for any explosive type under evaluation.
7. Enter the quantity of charges selected for testing. Indicate how many were chosen from each box (ex. 4 from box 001, 4 from box 006, etc.). It is recommended that the total number of charges be chosen from a minimum of 3 boxes and a maximum of 6.
8. If the testing occurs on the same day as the charge selection, mark "Tested 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 on the date of manufacture. If necessary, the charges chosen for QC and the charges chosen for the Section 1 test should be boxed and sealed separately. The box(es) must then be sealed by taping shut. The witness' signature and date must be indelibly written, preferably in several places, across the tape in a manner that would make tampering evident. The method of sealing and marking should be described in this box, such that any witness can recognize that the charge box(es) have not been tampered with.
9. Enter miscellaneous specific comments, if any, regarding charge selection that is appropriate.

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10. Print the witness' name.
11. Print the witness' company name.
12. Signature of the witness.
13. If a second witness was present, print the second witness' name.
14. If a second witness was present, print the second witness' company name.
15. Signature of the second witness, if present.

Additional Instructions - CHARGE SELECTION – Mandatory activity to witness (API RP 19B, Section 4.1.4 and 4.1.12.1)

16. Charge selection recording in the Witness Report for the Mixed Systems shall be the similar as defined in Section 1 of the Witness Report. The only difference will be the double entries into fields # 4 through # 9, as appropriate, one entry for each of the two types of charges used in the Mixed System.
17. Witness shall note in field # 9 when the Mixed System is being tested.

**GUN LOADING – Mandatory activity to witness, (API RP 19B, Section 4.1.3)**

1. Enter the date that the gun was loaded.
2. Enter the Gun Description, as it will appear as the Gun OD & Trade Name on the Certification Data Sheet.
3. Enter the Gun OD, as it will appear on the Certification Data Sheet. Measure the OD of the actual gun to be tested. If the actual Gun OD is different from the Gun OD that will appear on the data sheet, enter an explanation under Miscellaneous Comments on Gun Loading (Box # 16).
4. Enter the shot bank to shot bank phasing, as it will appear on the Certification Data Sheet. It must be the same as the actual gun to be tested.
5. Enter the number of shots per foot, as it will appear on the Certification Data Sheet. It must be the same as the actual gun to be used in the testing.
6. Enter the total number of charges loaded into the gun.
7. The gun hardware used in the test must be verified as being standard field equipment (Box # 7). Identify how this was done. It is recommended that the gun body, adapters/subs and positioners be verified by physical comparison (measure OD & ID, check scallop/port positioning, etc.) to drawings from the company's Engineering File. Any dimensional measurements must be within the tolerances stated on the drawings. It is recommended that detonating cord and gun positioners be verified as the types specified for field use by examining the company's Field Catalog. Guns must be loaded at the shot phasing and number of shots per foot as will be identified on the Certification Data Sheet.
8. Verify the depth of the scallops by measuring scallop depth and comparing to drawings from the company's Engineering File. For Port Plug gun systems, verify the screwport bulkhead distance and other dimensions with the drawings from the Engineering File. For both scallops and screwports, dimensions must be within tolerances stated on the drawings.

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9. Verify the diameter of the scallops by measuring and comparing to drawings from the company's Engineering File. The dimensions must be within the tolerances stated on the drawings.
10. Verify the ID of the gun by measuring the inside diameter and comparing to drawings from the company's Engineering File. The dimensions must be within the tolerances stated on the drawings.
11. Measure the OD of the standoff hardware, if any. If a gauge is required, it should be provided by the company and checked as accurate by the witness. Compare the measurements to drawings from the company's Engineering file. The dimensions must be within the tolerances stated on the drawings.
12. Enter the description of the detonating cord as it appears on the spool from which the cord was taken. Also, from physical observation, enter the color of the detonating cord jacket and the color of the explosive powder.
13. If the charges used were selected (see Charge Selection above) at the same time as the gun was loaded, and in sight of the witness at all times, enter "same time." If the charges were selected prior to the gun loading or not kept in sight of the witness at all times, describe how they were verified as being the same as those selected in the witnessed charge selection above. This should be by comparison of the sealing and marking described in Box # 13 with that of the box of charges loaded into the gun. The box should show no evidence of tampering.
14. Describe how top shot was marked on the gun to identify orientation at time of test.
15. If the testing occurs on the same day that the gun was loaded, mark "Tested on same day as loaded." If testing is to occur at a later date, the loaded gun must be sealed and marked for identification. It is recommended that the gun be sealed by taping shut with clear tape. The witness' signature must be indelibly written, preferably in several places, across the tape in a manner that would make tampering evident. The method of sealing and marking should be described such that any witness can recognize that the loaded gun has not been tampered with.
16. Enter miscellaneous specific comments, if any, regarding gun loading that are appropriate.
17. Print the witness' name.
18. Print the witness' company name.
19. Signature of the witness.
20. If a second witness was present, print the second witness' name.
21. If a second witness was present, print the second witness' company name.
22. Signature of the second witness, if present.

**GUN FIRING / DATA COLLECTION – Mandatory activity to witness (API RP 19B, Sections 4.1.8, 4.1.9 and 4.1.10)**

1. Enter the date that the gun was fired. This may not be the date the data collection was completed.
2. Measure the diameter of the culvert at two places, approximately 90 degrees from each other. Enter both measurements, to the nearest inch.



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3. Measure the O.D. of the casing at the top end at two places, approximately 90 degrees from each other. Enter both measurements, to the nearest 1/16".
4. Measure the wall thickness of the casing at 4 different places on the open end, each approximately 90 degrees from each other. Enter all 4 measurements, to the nearest 0.001 inch.
5. Verify that the casing used in the construction of the target meets the reported grade and weight by reviewing casing manufacturer's documentation.
6. Witness shall verify that the steel form or culvert remains intact during gun firing.
7. Check for your initials on the gun before it is loaded, and again before it is loaded in the target to be shot.
8. If the gun is to be decentralized in the target note if the standoff devices used are adequate to hold both the bottom and the top of the gun assembly against one wall of the casing. Any gun position other than complete decentralization should be measured from the gun O. D. to the casing I. D. at the minimum clearance position after the gun is inserted in the target and recorded to the nearest 1/16". The positioning device at the bottom of the gun should be checked before the gun is inserted in the target to ensure that it is equivalent to the device used at the top of the gun.
9. The top shot in the gun should be marked at the gun scallop for identification purposes. Note whether this shot is positioned at the minimum clearance position. If not note the clearance between the gun O. D. and the casing I. D. at this position.
10. After the gun is inserted into the casing, visually check to see if the water level in the annulus is above the top shot in the gun.
11. After the target is shot and opened, measure the distance from the top shot to the top of the cement and from the bottom shot to the bottom of the cement, and record to the nearest 1/4".
12. Witness the measurement of penetration for all shots.
13. Witness the measurement of casing hole size (EH) for all shots.
14. Get a complete Datasheet. As the witness you should be provided with a datasheet. The data sheet must be a current version found on the API website at [www.api.org/perforators](http://www.api.org/perforators)
15. This section should include any additional comments you might have or observations you made during the shooting and data collection phases.

Concrete Slurry Information (NOTE: Use of ASTM Type I Cement is Acceptable)

16. Enter the date the target was poured.
17. Enter the total amount of cement used in the cement mix to pour the target. This should be the total amount (in pounds) used in the truck. If multiple trucks are used to pour the target then list the amount used in each truck and the truck number. This information should be taken from documents supplied by the Redi-Mix Company or the company that supplies and/or delivers the cement mix. Witness must verify that the cement conforms to API Class A or ASTM type I.

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18. Enter the total amount of sand used in the cement mix to pour the target. This should be the total amount (in pounds) used in the truck. If multiple trucks are used to pour the target then list the amount used in each truck and the truck number. This information should be taken from documents supplied by the Redi-Mix Company or the company that supplies and/or delivers the cement mix. Witness shall request documentation to verify that the sand conforms to 16-30 Frac Sand; specification API RP19C, 1st edition.
19. Enter the total amount of water used in the cement mix to pour the target. This should be the total amount used in the truck. If multiple trucks are used to pour the target then list the amount used in each truck and the truck number. This information should be taken from documents supplied by the Redi-Mix Company or the company that supplies and/or delivers the cement mix.
20. Using the numbers above calculate the sand/cement ratio by dividing the total amount of sand used by the total amount of cement used. If multiple trucks were used to pour the target then add the totals together before calculating the ratio.
21. Using the numbers above calculate the water/cement ratio by dividing the total amount of water used by the total amount of cement used. If the amount of water is reported in gallons use the conversion of 8.34 lbs per US gallon to convert to weight to determine the water to cement ratio. If multiple trucks were used to pour the target then add the totals together before calculating the ratio.
22. Verify that the cement used in the target construction conforms to API Class A or Type 1 by reviewing the documentation provided by the supplier.
23. Verify that the 16-30 Frac Sand conforms to specification API RP19C 1st edition by reviewing the documentation provided by the supplier.

#### Witness Information

24. Enter the name of the person witnessing the test.
25. Enter the name of the company the witness represents.
26. Signature of the witness.
27. If a second witness was present, print the second witness' name.
28. If a second witness was present, print the second witness' company name.
29. Signature of the second witness, if present.

#### Additional Instructions - GUN FIRING/DATA COLLECTION - Mandatory activity to witness (API RP 19B, Section 4.1.8, 4.1.9, 4.1.10 and 4.1.11.6)

30. A minimum of 12 charges shall be loaded into a perforator. However, if some charges fail during the test, the number of remaining valid results, if less than 12, will make the test invalid. A minimum of 12 valid shots shall be recorded for the system validation.

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31. If any charge failed during the test, the failed charge has to be included in the report and total average calculation.
32. Note: “Lost shot” does not belong to the failed shot, and can be excluded from the total average calculation. “Failed shot” includes low performance shot, lower order shot or misfired shot. The “Lost Shot” is the shot results of which cannot be measured due to damage of the concrete target, i.e. crushed concrete, cracked concrete target line coinciding (aligned) with the perforation tunnel not allowing reliable perforation penetration measurement.
33. For the Mixed Systems, a minimum of 6 valid shots for each charge type shall be recorded to validate the system. If any charge from any system failed during the test, the failed charge has to be included in the report and total average calculation (see also 31 above.)
34. Paragraph 1.8 of API RP 19B defines the test results validity. The following rule shall also be observed:
  - a. Penetrated tunnel depth, casing whole diameter and burr height for shots fired within 12 inches from the concrete target top of 6 inches with the target bottom are not to be used for the average calculations;
  - b. For the shots penetrated the concrete target boundary or being within the 3 inch of the average distance from the target boundary, the penetrated tunnel length is not to be used for the average calculation; however, the casing whole diameter and burr height may be used for the average calculation.
35. For multi-directional firing (RP 19B Paragraph 1.5), perforator has to be positioned against the wall, if no positioning devices (centralizers) are used in the field application. Otherwise, a commercialized part or released engineering document/specification shall be presented to substantiate the deviation from the positioning requirement.
36. For unidirectional firing (RP 19B Paragraph 1.6) without positioning devices, only average results from the calculations using minimum and maximum clearances shall be reported in the API form that will be published on the API web site.
37. Target integrity shall be secured during the tests. Targets with ruptured external boundaries shall be disqualified from the witness tests. Also, targets that will fall apart immediately after the release of the outer culvert, if the target conditions do not allow for unbiased perforation tunnel length measuring, shall be disqualified from the further witness test.
38. The outer steel containment (culvert) of target cannot be taken out (loosen up) till the perforator has been fired.

**QC SHOTS-Mandatory activity to witness (API RP 19B, Section 4.1.9.1.d)**

1. Enter the date the QC shots are made.
2. Enter the location the QC shots were made if it is different from the API test location.
3. Enter the manufacturer’s description of the charge being tested. This information should be taken from the label on the box.
4. Enter the manufacturer’s part number for the charge being tested. This information should be taken from the label on the box.

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5. Enter the date the charge was manufactured. This information should be taken from the label on the box.
6. From the QC data sheet generated at the time of the production run, list the total number of charges manufactured, and the start/finish date for that production run. Witness shall retain a copy of the production run including QC data and submit to API along with the data sheet and witness report.
7. Verify that the charges tested are from the boxes that were selected and signed during the selection process.
8. Check the charge setup against the setup used for the QC shots during the production run. This information should be on the QC data sheet or other QC documentation. Using calipers verify the setup dimensions by measuring the standoff from the end of the charge case to the scallop plate, the thickness of the scallop plate, the clearance from the scallop plate to the casing plate, and the thickness of the casing plate. Check to see if the charge is fired through a water clearance or an air clearance and verify if the cement target diameter and length are the same as that specified on the QC documentation. Record testing company's QC document number and revision or equivalent.
9. A minimum number of six (6) QC shots shall be conducted.
10. Compare the data of the witnessed results to the original specification data used during the API Witnessed test. Calculate the % loss or gain from the original data, report to the nearest percent.
11. This section should include any additional comments you might have or observations you made during the shooting and data collection phases.
12. Enter the name of the person witnessing the test.
13. Enter the name of the company the witness represents.
14. Signature of the witness.
15. If a second witness was present, print the second witness' name.
16. If a second witness was present, print the second witness' company name.
17. Signature of the second witness, if present.

Additional Instructions - QC SHOTS - Mandatory activity to witness (No applicable API RP 19B Section)

18. The testing facility shall define the QC target preparation/design in their technical documentation, disregard what designs of the QC targets have been used.
19. Frequency of charge production run test with usage of the QC targets should be indicated in the relevant technical documentation, i.e., one QC test every 200, 300, 500, etc. charges produced, depending on explosive used or charge design.
20. The lower or higher penetration depth limits as related to charge production run test or the witness test average of the QC target penetration are not defined by API RP 19B Section 1.
21. QC target materials do not have to be the same as required for the big concrete target (can differ from materials specified in RP 19B 1.2.1).

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22. QC target materials must be the same for charge production run testing and for the witness testing. They should be defined in the facility technical documentation.
23. QC materials (i.e., sand and cement) regardless if the same as required by RP 19B 4.1.2.2 or not (other materials can be used) must be tested (i.e., UCS) to provide for the QC target consistency and records (with the test results) should be retained as required by the manufacturer.
24. Expected QC target penetration depth and plate hole diameter (no burr height) for each charge type shall be documented within the manufacturer charge technical documentation system, i.e. SOP or SOP relevant attachment.
25. Steel plates representing perforator body and the casing/tubing material must be the same, geometrically and material wise for the API witness testing purposes as used for QC test during the charge production run.
26. Composition/design of the QC charge set-up for the witness test must be the same as for the production run test for the given type of charge and shall be specified in the technical documentation.

**TARGET POURING (Optional activity to witness: If witnessed it is mandatory to record information from documentation) (API RP 19B, Section 4.1.2)**

1. Enter the date that the target was poured.
2. Measure the diameter of the culvert at two places, approximately 90 degrees from each other. Enter both measurements, to the nearest inch.
3. Measure the O.D. of the casing at the top end at two places, approximately 90 degrees from each other. Enter both measurements, to the nearest 1/16”.
4. Measure the wall thickness of the casing at 4 different places on the open end, each approximately 90 degrees from each other. Enter all 4 measurements, to the nearest 0.001”.
5. Verify that the casing used in the construction of the target meets the reported grade and weight by reviewing casing manufacturer’s documentation.
6. Record the number of concrete trucks used to fill the target.
7. Each truck should provide a slurry datasheet, listing the amount of sand, cement, and water. The sand and cement are normally listed in pounds. Water may be in pounds or gallons. Multiply gallons by 8.39 to convert to pounds. Confirm that the sand/cement ratio for each truck is within specification (between 1.98 and 2.02). Confirm that the water/cement ratio for each truck is within specification (between 0.5148 and 0.5252). List the ratios for each truck.
8. Sample used to prepare briquettes should be taken while middle portion of target is being poured. (Y/N)
9. Include any additional comments you might have or observations you made during the target pouring. Record the manner in which the target was marked for identification. Ex. “Target # 1234 painted on side of culvert” or “Target # 4567 written in top of concrete”.
10. Enter the name of the person witnessing the test.
11. Enter the name of the company the witness represents.
12. Signature of the witness.

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Additional Instructions - TARGET POURING

13. Target shall be under water for at least for 28 days or till the API 19B witness test day, whichever is greater.
14. Material evidence to prove that the target has undergone at least 28 days of curing at ambient temperature above 0°C, such as an official weather history from a local TV or meteorology authority, or heating equipment used.
15. Material evidence shall be provided to prove the target has been aged at least 28 days, such as a certified log by an independent pouring company, or digitized photograph embedded with an un-editable time stamp (iPhone can do it).
16. MTRs of the sand and cement used for the slurry and pouring shall be available to support that API 10A Class A or ASTM C150 Type I and API RP 19C 1st edition frac 16/30 sand were used.
17. **Note:** 5.2 through 5.4 are mandatory to review no matter if the target pouring activity is a witnessed activity or not.
18. **Note:** If excessive air bubbles are observed during the perforation penetration measurement, it should be noted in field # 9 of Section 5 of the Witness Report no matter if the target pouring activity is a witnessed activity or not.
19. Material evidence shall be provided, e.g. copy of a service company contract, P.O., job order, instruction, acknowledged by with the concrete making company, including a provision stipulating that the delivered by the service company materials, such as cement and sand, shall be stored in specified manner (assigned areas) preventing from being mixed with other similar product.

**BRIQUETTE PREPARATION (Optional activity to witness: If witnessed it is mandatory to record information from documentation) (API RP 19B, Section 4.1.2)**

1. Answer Yes or No as to whether the briquettes were prepared per API RP 19B. Procedure is as follows: Each mold compartment filled half full, then puddled 25 times each with a glass or non-corroding metal rod ¼ in. in diameter, then filled completely, then puddled 25 times, then excess slurry struck even with top of mold”. If procedure observed is different, describe how so.
2. Record the number of briquettes prepared. Note: the minimum number required is 6.
3. Include any additional comments you might have or observations you made during the briquette preparation.
4. Enter the name of the person witnessing the test.
5. Enter the name of the company the witness represents.
6. Signature of the witness.

Additional Instructions - BRIQUETTE PREPARATION

7. Concrete briquettes have to be stored on the top of the target in a white plastic box covered with water for the curing time. However, just before testing plus/minus 24 hours, i.e. on their

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way to the test laboratory, they can be placed in a wet closet, wet room or be wrapped in a wet cloth to provide the wet environment for the briquettes.

8. Laboratory used for briquettes' strength testing shall be accredited to ISO 17025 or other local equivalent accreditation system.
9. Material evidence shall be available to demonstrate that the calibration of the testing equipment is current.
10. A copy of a certified or properly authorized test report shall be available.
11. **Note:** 6.3 and 6.4 are mandatory to review no matter if Briquette Preparation is a witnessed activity or not.

**BRIQUETTE TESTING (Optional activity to witness: If witnessed it is mandatory to record information from documentation) (API RP 19B, Section 4.1.2)**

1. Record the make and model of the test equipment.
2. Record information from calibration tag. Is calibration current? RP 19B requires calibration every two years.
3. List the approximate time (in seconds) needed to crush each specimen, beginning when load is first applied and ending when sample yields. Make note if operator appears to make any changes to test equipment during sample crushing. (This is not allowed)
4. List total number of samples crushed.
5. Describe general appearance of crushed specimens. Were all very similar? Was the remaining, lower portion of the sample intact? Was there any particular shape to the remaining portion? Pyramid shaped? Diagonally fractured? Other?
6. List the maximum load and resulting compressive strength recorded for each specimen. Were specimens measured prior to testing? If dimensions varied more than 1/16" from 2.00" linear dimension, then actual area should be used for strength calculation rather than default (4.0 in<sup>2</sup>).
7. Include any additional comments you might have or observations you made during the briquette testing.
8. Enter the name of the person witnessing the test.
9. Enter the name of the company the witness represents.
10. Signature of the witness.

**GUN FIRING / DATA COLLECTION– (Burr Height Measurement) (Optional activity to witness, If witnessed it is mandatory to record information from documentation) (API RP 19B, Section 4.1.9.4)**

1. After the casing is retrieved, it is required that the burr height at each perforated hole is measured. This measurement is taken as the maximum height from the casing ID. Pieces of the burr that can be easily dislodged using a finger (no metal tools) can be removed prior to measuring. Ideally the measurement of the burr height for each hole should be witnessed. If not, then selected burrs should be re-measured and compare to the recorded data.



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2. Include any additional comments you might have or observations you made during the burr height measurement.
3. Enter the name of the person witnessing the test.
4. Enter the name of the company the witness represents.
5. Signature of the witness.