PACIFIC GAS AND ELECTRIC COMPANY

Hydrostatic Test Program

Quality Sampling

Revision History

Date	Change Requested By	Revision	Change(s) Made	Affected Sections
July 9, 2011		1	Pilot release	All
July 15, 2011		1.1	Pilot release	3.2 - 100%
Aug 11, 2011		1.2	Descriptions & Diagrams added	3.8.1.5
Sep 01, 2011		1.3	Descriptions added, misc. grammar	7.2,7.7
Sep 21, 2011		1.4	Section 7 Changed, Appendix add	7.2,7.7

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1. Background & Purpose

"As part of the response to the San Bruno Incident, Pacific Gas and Electric (PG&E) developed the Pipeline 2020 Modernization Program initiative. Part of the initiative is the Hydro-Test Program. The objectives of the Hydro-Test Program are to verify the Material of Record, to hydrostatically test all identified pipeline segments, and to create new supporting documentation to validate the pipe segments' historically accepted maximum allowable operating pressure (MAOP) for each pipeline segment. In 2011, the Hydro-Test Program focuses on testing 152 miles of pipeline segments that are of the same vintage or have other similar characteristics (e.g., pipe diameter, age, records, etc.) to the ruptured segment of Line 132 in San Bruno."

-PG&E: Hydro-Test Program: Process Manual and Program Execution Plan, 6/23/2011

The purpose of this quality guide is to assist the assigned project inspectors and quality technicians to understand the methods and objectives of quality sampling so that they can properly apply the procedures for site specific characteristics and satisfy the intended objectives and requirements of the Hydro-Test program.

Project inspectors are required to confirm that project work meets required PG&E standards and specifications (i.e. 13024). Project inspectors complete the data gathering forms provided to them by PG&E GC Construction Management.

Quality Assurance will use the procedures and forms defined in this manual to complement and confirm the data captured by on-site inspection. Quality Assurance will work with on site inspectors and contractors, PG&E General Construction and Hydrostatic Test Program Engineering, to provide the required confidence that results are meeting expectations.

1.1 Using the Hydrostatic Test Sampling Procedures

For the quality sampling to be performed correctly, the following steps must be followed for data gathering at each specific test site.

- Open and save a copy of the blank quality sampling forms from the S: drive folder to the site test folder.
- Before filling out the sampling forms, rename the document as **T-[#] Quality Data [*Activity*].doc,** where the specific activity results are recorded.

NOTE: *There are completed quality sampling forms that have been used for previous test sites.* ***DO NOT*** *use these documents as templates. The stored sampling form has the most current information and the preferred language. Refer to prior quality sampling only as a reference for similar logistical arrangements.*

2. References and Resources

The information needed to fill out the Hydrostatic Test Quality Sampling Procedure can be found by referencing the following resources:

- **Site Specific Hydrostatic Test Procedure:** Developed by Engineering

- **Design Drawings:** Developed by Engineering and posted in the SharePoint test folder.
- **Strength Test Pressure Report:** Developed by Engineering and posted in the SharePoint test folder.
- **General Construction QAQC Manual:** Referenced for quality sampling procedures.
- **PG&E Construction Specification 13024:** Reference for contractors.

3. Quality Sampling Checkpoints

3.1 Hydrostatic Test Design Package Development – 50% Completion

Quality Sampling Under Development:: Quality tracking will primarily concentrate on the timely availability of required information to complete the engineering development. All required documents should be tracked for getting into engineering on time. If documents are late, the amount of delay should be tracked and trended. Documentation delay is a common and very impacting issue affecting engineering scheduling at this stage.

Documents will be assumed to have all required information. If experience suggests otherwise, document quality will be assessed and tracked, with the intent of correcting information quality at the source.

3.2 Hydrostatic Test Design Package Development – 100% Completion

Quality Sampling Under Development:: As performed at the 50% completion level, the tracking of timely submission of required documentation is critical to engineering success. At the time the test package is scheduled to be complete, any delayed documentation or incomplete information should be noted and tracked for actual completion.

Documents will be assumed to have all required information. If experience suggests otherwise, document quality will be assessed and tracked, with the intent of correcting information quality at the source.

3.3 Construction Inspection – Site Specific Hydrostatic Test Procedure

Quality Assurance will facilitate a pre-construction meeting for contractors new to the quality process. All project constructors and inspectors should participate in at least one kickoff of the Hydrostatic Test Program QAQC with this manual detailing quality expectations and procedures. These activities are not anticipated to conflict with contractor's standard procedures, but should reinforce the expected results, particularly in areas of known quality concern.

An area of focus will be the Hydrostatic Test Procedure developed for the test under construction. Key responsible individuals are required to sign off milestone progress at engineered points. Quality review of documentation status will assure required activities are being executed and tracked on schedule.

Below are repeated task measurement activities to be performed by inspection / quality control and sampled during quality assurance. Inspectors working for CM are required to complete their own data gathering to match Specification 13024. Assigned roles for the inspection activities will be recorded at the beginning of measured projects.

3.4 Trenching and Bell Holes

Trenching and bell holing are expected to follow the Program Process Manual, or the Construction Specification, whichever is more restrictive.

Excavation is performed per the utility procedures found in Appendix A, including the following references:

- Utility Procedure WP4412-05, "Excavation Procedures for Damage Prevention"
- Utility Standard S4415, "Excavation Safety."
- Utility Procedure TD-4412P-06, "Handling Excavators, Contractors, and the Public Working Unsafely Around Utility Facilities"
- Utility Procedure WP4412-03, "Marking and Locating PG&E Underground Facilities"

If trench water encountered during excavations must be removed, the groundwater will be characterized, and either transported to a permitted disposal facility in accordance with applicable federal, state, and local requirements, discharged to a POTW under permit, or land applied as an authorized non-storm water discharge under the California Storm Water General Construction Permit or other Regional Board Permits or Waivers.

3.5 Form A and Form H

Quality Sampling Under Development:: Construction Management has the Canus inspection contractor completing the Form A. This is an operator qualification and PG&E will provide training. Person filling out the Form A should be OQ'ed. General Electric is the contractor completing the Form H. Copies of the Form H are provided to the Hydrostatic Test Program and the PG&E Lead Corrosion Specialist.

Once the pipeline is exposed and the pipe coating has been removed, Advanced Technology Corporation's Automatic Ball Indentation (ABI) technique is performed as per the ABI Assessment Procedure, found in Appendix A, to verify yield strength. Also, the overall pipe diameter, wall thickness, and longitudinal seam type are recorded using Form A, "Data Element Check Sheet" and Form H, "Direct Examination Data Sheet",

3.6 Material Tracking – Chain of Custody Procedure

Quality Sampling Under Development:: When the pipeline has been placed into clearance and test ends have been cut out, the removed pipe sample material is sent to a testing laboratory per the Chain of Custody procedure, as described in the Supply Chain section of this manual. The ABI yield results are reviewed against the as built documentation. Engineering confirms that the ABI tested values match or exceed the as built values. The results are then posted in the share point website in the T-40/Engineering Documents folder.

If the materials of record details on the design drawings do not agree with the findings of the verification task during site preparation, then testing cannot commence, and engineering is notified. Engineering must review the findings and amend the Hydrostatic Test Procedure as necessary to accommodate the unexpected details.

Once the hydrostatic test site has been prepared, the open clearance and shutdown procedures are performed, and the construction crew removes the cutout sections of the pipe as part of the hydrostatic test preparation. The Construction Manager ensures that the pipe segments are marked with the following information:

- Transmission Line Number (e.g. TL 132)
- The Top of Pipe is noted at the top center of the pipe (e.g. T.O.P.)
- Gas Direction of Flow is noted with an arrow (e.g. Direction of Flow-)
- Mile Point from project overview for the location (e.g. 40.8350)
- Nearest street address (e.g. 1500 Crest Drive)
- Date removed (e.g. 05/26/2011)

The cutout sections are transported to the storage facility. Prior to transporting the pipe to storage, the Construction Manager / Inspector ensures that digital photos of the removed sections are taken and the Chain of Custody form is completed. The form must include the information marked on the pipe and any additional identifying information. Before transport, the completed form contains the following information:

- GPS Coordinates taken from the project job package (for example, 122.44229d / 37.64087d Lat Long/NAD83)
- Location description from the project overview (for example, Camera Insertion Location #1)
- The full name of the employee coordinating pipe removal and transportation

Once at the storage facility, Storage contacts PG&E's ATS facility to arrange for a test segment to be cut from the removed pipe and transported to the ATS facility for testing. The pipe is marked before the test segment is cut, and the RMR is completed to track the chain of custody when the pipe is moved from storage to ATS, from ATS to any third-party testing locations, from third-party testing locations back to ATS, and from ATS back to storage.

3.7 Welding

Project inspectors are frequently qualified visual weld inspectors. They are responsible for quality measurement results for contract welders, as defined by PG&E Specification 13024. PG&E welders that complete tie ins and other completion work are not inspected by third parties. PG&E welders will perform visual inspections as defined by the General Construction QA/QC Program.

Project inspectors must confirm that a copy of the proper weld procedure is available at the project location, and that the proper welding materials are being used per the weld procedures. Certified inspectors will also perform a visual inspection of welds as defined by PG&E Gas Standard D-40. It is also suggested that the welder's initials and date are written on the pipe at the weld location.

Radiographic inspection of welds must be closely monitored as defined by PG&E Gas standard D-40, or per engineered drawings, whichever is more stringent. Inspectors are responsible for maintaining results documentation of weld sketches, pipe material tracking and x-ray records.

Expected results for welding and procedures are defined in:

- PG&E construction drawings;
- PG&E Gas Standards: D-22, "Arc Welding Procedure Requirements for All Stress Levels";
- D-30.2, "Arc Welder Qualification for Working on Pipelines that Operate at Over 20% of SMYS";
- D-31, "Welder Qualification for Under 20% of SMYS"; and
- D-40, "Weld Inspection";
- PG&E Weld Procedures

3.8 Stage One As-Built Documentation

Immediately following a hydrostatic test, the Strength Test Pressure Report (STPR) and supporting documentation must be completed as specified in PG&E Standard A-37 and in compliance with Piping Design and Test Requirements A-34. The following checks are to detail the expected documentation activities and critical test data checkpoints.

3.8.1 STPR and Test Instructions

The Hydrostatic Test Program engineering team develops a site specific hydrostatic test procedure and provides much of the information required to accurately complete the STPR. These steps have been developed to help ensure that the critical STPR documentation is correctly applied and is legible.

3.8.1.1 STPR - Part I Footage Verified

The Design Data section (Part I) of the STPR must be completed in the field. The hydrostatic test supervisor is provided an estimate of the pipe footage to be tested. Immediately next to that is the column labeled Pipe Spec and Footage Verified in the Field. Measured lengths of exposed pipe should be used to add or subtract from the Footage to be Tested column provided by engineering. The test supervisor should confirm that accurate pipe measurements are recorded in the STPR by initialing the measured amounts.

All changes in test configurations, at any location, must be reflected in adjustments to the amount of tested pipe. Constructed test heads rarely match the engineered plans – there are always expected to be adjustments to measured pipe lengths.

3.8.1.2 STPR – Part II Required Pressure Calculations

Test supervisor should use engineered data provided from the pipeline profile sheet (i.e. sheet 3) to transfer the calculated test pressure requirements into Part II of the STPR. Most critical are the Max and Min Required Test Pressure at Test Point. (Fig 1 below)

The test location in the field must match the engineered specifications. Any change in test location must be communicated to engineering. Any required adjustments to test pressures must be accurately calculated before the test begins.

Fig 1. Sample pressure calculations from engineered drawings

LOCATION	"R"	ELEV.	RAMP PRESSSURE	MIN. PRESS	MAX. PRESS
MIN. PRESSURE CONTROL POINT	211+92	15'	693 psig	630 psig	
MAX. PRESSURE CONTROL POINT	59+50	-15'	706 psig		671 psig
LOCATION A	211+92	15'	693 psig	630 psig	657 psig
LOCATION B (TEST STATION)	**0+00**	**12'**	**695 psig**	**632 psig**	**658 psig**

3.8.1.3 STPR – Part II Recorded Test Data

All fields of the STPR must be filled out accurately. Specific instructions are provided for correctly preparing all blanks in the STPR. (Appendix - 6.1) The test supervisor must confirm that Part II of the STPR is correctly recorded, legibly handwritten in ink, with proper signatures and dates.

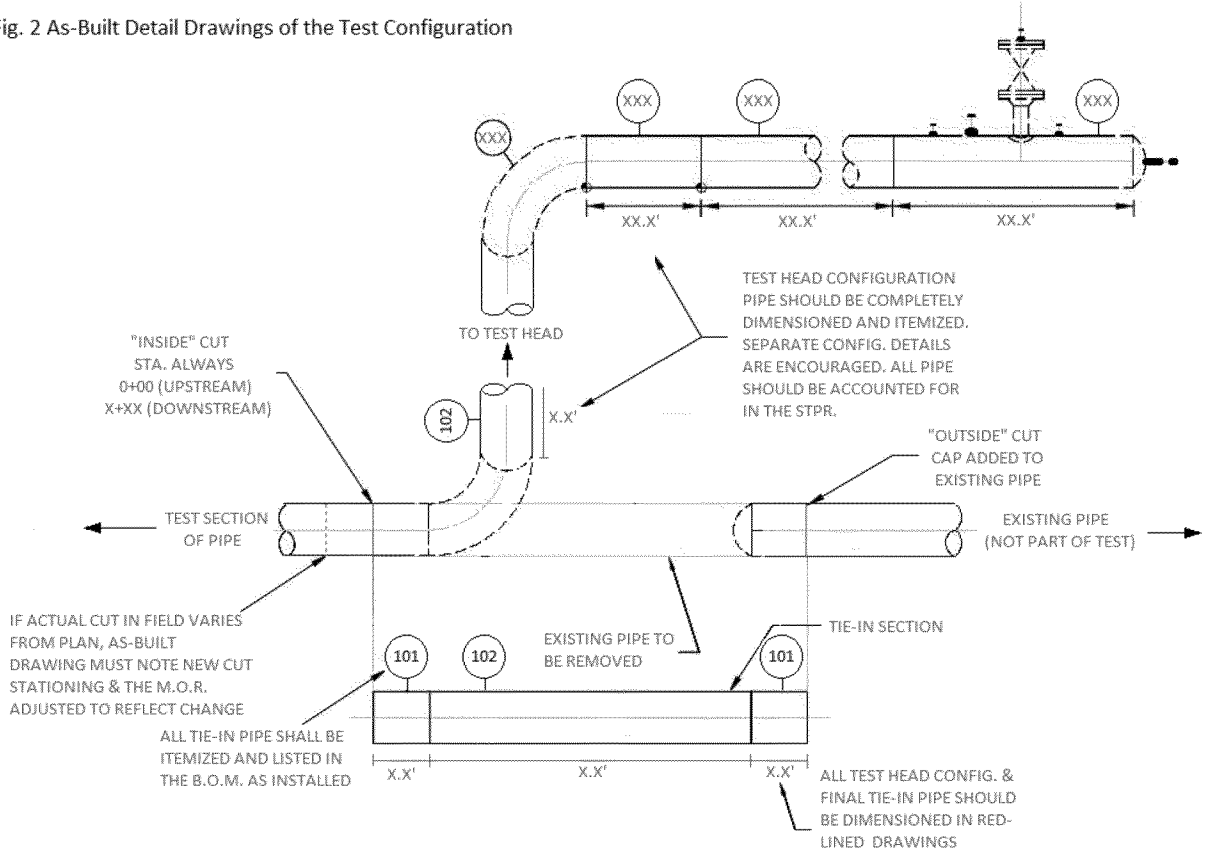
3.8.1.4 Design Change Notices (if any)

All project design changes should be accounted for during the hydrostatic test preparations. Updated drawings should be included with Stage 1 as-built Documentation.

3.8.1.5 Required Drawings – Pipeline Profile and Test Configuration Details

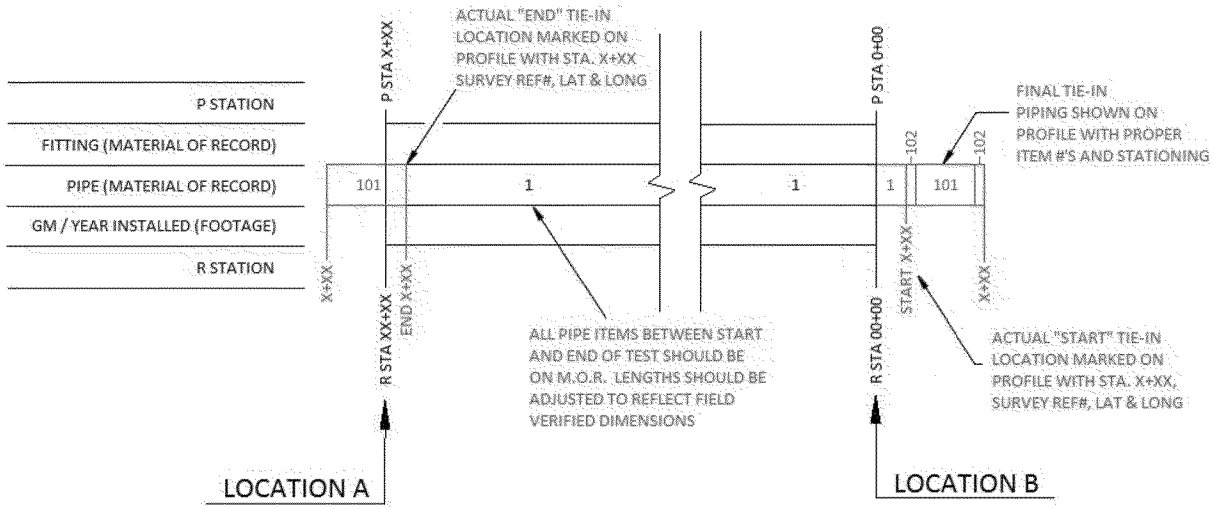
The pipeline profile (i.e. sheet 3) must portray the same elevation data and footage as indicated in the STPR. Correct as-built stationing is critical; station 0+00 should always start on the "inside" of the clearance cut out, upstream of the test. The end station X+XX should be on the "inside" of the downstream clearance cut out. This start and end stationing should be marked on the profile drawing as well as the test configuration details. All existing pipe and pipe used in the test configuration should be on the STPR.

Fig. 2 As-Built Detail Drawings of the Test Configuration



The profile drawing should show dimensions and item numbers for all existing pipe. The field verified start and end stations should also be clearly marked. Additionally, the final tie in pieces, item number(s) and lengths should be red lined.

Fig 3 Profile Sheet with As-Built Red Line Changes



If completed correctly, the test head configuration details and the profile drawings should combine to catalog all pipe involved in the test. The values found in the STPR should be compared to the profile and configuration details as a check; a visual depiction of this process can be seen in Fig 4 on the next page.

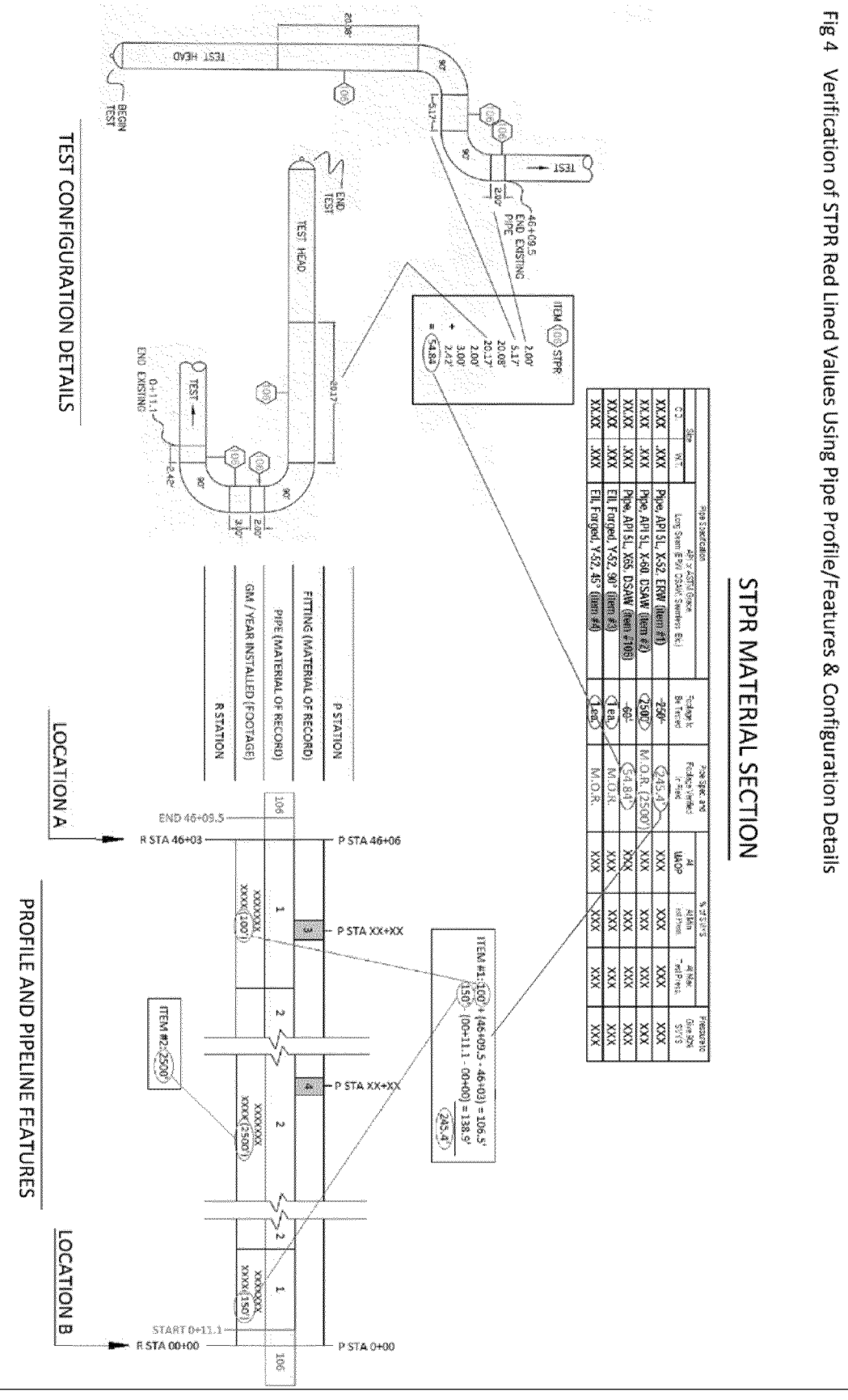


Fig 4 Verification of STPR Red Lined Values Using Pipe Profile/Features & Configuration Details

Finally, the M.O.R. and B.O.M. should catalog the total length of all items of existing and installed pipe (item #1, #2, #3, #101 etc.). The M.O.R. should list all existing pipe and should match the profile "pipe details" drawing. Typically, the exposed existing pipe at the clearance cut outs should be red lined to accurately reflect field verified dimensions/stationing. The B.O.M. will include all other installations (pipe, fittings, valves, etc.) that are part of the final product. It is critical that the material used in the final tie-in pieces is accounted for in the B.O.M.; tie-in lengths should match and the source material (often from the test head configuration) should be clearly identifiable. The lengths of tie-in pipe listed in the B.O.M. will be shorter than the "total tested" lengths shown on the STPR.

Fig 5 Bill of Materials, Material of Record As-Built

PIPE LENGTHS OF CUT SECTION ARE RED LINED TO REFLECT FIELD STATIONING CHANGES. ALL ITEMS SHOULD MATCH INFORMATION ON PROFILE.

MATERIAL OF RECORD

Item Number	Description	PG&E Mateial Code	UNITS	QUANTITY	ABI SMYS Results
1	Pipe, 34.000", 0.3125" WT, X-52, DSAW		Ft.	~~3255~~ XX.X'	
2	Casing, 42.000" OD		Ft.	125	
3	Casing, 42.000" OD		Ft.	110	
4	Casing, 42.000" OD		Ft.	95	

BILL OF MATERIAL LENGTHS ARE RED LINED AND REFLECT ACTUAL LENGTHS OF PIPE USED IN THE FINAL TIE-IN. ITEM NUMBERS SHOULD MATCH THE SOURCE PIPE, TOTAL LENGTH SHOULD BE LESS THAN TESTED IN THE STPR.

BILL OF MATERIAL

Item Number	Description	PG&E Material Code	Units	Quantity	Heat / Serial Number (As-Built for pipe & HY fittings)
101	Pipe, 34.000", 0.505" WT, X-60, DSAW, FBE COATED	01-0780	Ft.	~~40~~ XX.X'	
102	Pipe, 34.00" OD, 0.375" WT, X-60, DSAW, BARE	01-1056	Ft.	~~28~~ XX.X'	
113	Elbow, 34.000" OD, 0.505" WT, Y-60, 90°	02-1437	Ea.	4	
148	Cap, 34.000", 0.505" WT, Y-60	02-2199	Ea.	2	
181	Save-A-Valve, 2"	02-2289	Ea.	4	

Ensure the profile and detail drawings show all dimensions, item #'s, descriptions and stationing. Verify that drawings make sense and values match up with the STPR, M.O.R. and B.O.M.

3.8.1.6 Dead Weight Pressure Logs

A recommended template for the dead weight pressure recordings is provided. Records must be handwritten in ink with date, time and pressure readings entered as specified. Each log must be signed and dated by the test supervisor.

3.8.1.7 Pressure and Temperature Recording Charts

Chart records must be executed according to PG&E Standard A-34, Section 9. The pressure recording chart must be verified to match the dead weight pressure readings. If the chart readings do not match the dead weight, a qualified hydrostatic test supervisor (or agent) should adjust the pressure chart stylus to make the measurements accurate.

The front and back of each chart should have handwritten in ink, the required details specified in A-34. A PG&E stamp may be used on the back, as a template for collecting all required data. Pipe Specification details and lengths should match the engineered drawing details for each specific test, and should have corresponding label numbers.

3.8.2 RCP Report

The RCP analysis of each hydrostatic test is a critical deliverable for the Program. The RCP pressure data must match the STPR pressure documentation, dead weight and pressure / temperature recording charts. Any discrepancies must be explained.

The RCP analysis also includes a 30 minute pressure Ramp Test at the beginning of the pipeline pressurization. The Ramp Test is part of the total hydro test. Records must accurately indicate the Ramp Test specifications were achieved. Any concerns from RCP analysis should be captured in the documentation.

3.8.3 Site Specific Hydrostatic Test Procedure – Stage 1

At the time of the hydrostatic test, the critical supporting data must be handwritten in ink. All data should be accurately recorded and available in the field, through the pressure release HOLD POINT. Instructions for filling out the Site Specific Hydrostatic Test Procedure are included (Appendix - 6.1)

Critical elements to review include Test Criteria, test instrument calibration records, and signed off hold points. Completion of each activity should be signed off, with date and time.

3.9 Dewatering and Drying

Quality Sampling Under Development:: The water is released by connecting a compressor to the test head, which is then connected to the baker tanks. Safety zones must be established from all discharge piping before dewatering may begin. Access is limited to the personnel necessary to perform the work. The details for the storage tanks, piping, test heads, etc. are detailed in the Hydrostatic Test Procedure.

Once the Test Supervisor has verified that all piping connections are secured with rigid piping, they sign off on the hold point.

Dewatering the line begins by propelling the poly pig, which is already in the line, with compressed air. The test water remains in the baker tanks for either reuse or disposal.

Once dewatering is complete, the test heads are removed and the pig traps are installed. The pig traps are connected to the air compressor and the baker tanks. Details about the baker tanks are specified for each specific test site in the Hydrostatic Test

Procedure. Poly pigs are sent along the pipe to remove any residual water from the dewatering operation. Multiple pig runs may be required. The Construction Manager determines when pigging is no longer required.

Dryers are then set up and connected to the pig traps. Foam pigs are propelled from end to end with dry air until the specified dew point level is achieved. Electronic Dew Point Meters are used to measure and confirm the dew point. Once the drying procedure has been completed, the Test Supervisor signs off on the hold point in the Hydrostatic Test Procedure. The final dew point is recorded in the Dew Point Test Form,

At the conclusion of the drying operation, the drying heads are removed and the ends of the pipeline are sealed to keep the pipeline free of dirt, water, and other contaminants.

3.10 Surface Preparation and Coating

After the tie in is completed, the installed pipeline sections must be coated as engineered and to current PG&E specifications. Contractors are required to meet PG&E Standards, using specific coating industry procedures, for surface preparation, coating, coating repairs and coating transitions. Inspectors on site will measure and record that contractors are achieving required results.

Quality sampling will also confirm and record that measured results are meeting PG&E requirements. Quality sampling results that are out of range will be brought to the attention of the inspector and the contractor.

All surface preparation and coating work should follow these standards and references:

- Standard E-35, "Selecting and Applying Coatings for Buried Transmission Pipe";
- Standard E-30, "Selecting and Applying Coatings on Exposed Gas Piping"; and
- Utility Work Procedure WP 4100-12, "Sandblasting Steel Gas Facilities";
- ASTM Standard D4285, "Standard Test Method for Indicating Oil or Water in Compressed Air";
- ASTM Standard D4417, "Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel";
- SSPC SP-1, "Solvent Cleaning";
- SSPC SP-2, "Hand Tool Cleaning";
- SSPC SP-3, "Power Tool Cleaning";
- SSPC SP-10, "Near White Metal Blast Cleaning";
- SSPC AB-1, "Mineral and Slag Abrasives";
- PG&E Gas Information Bulletin 191;
- SSPC PA-2, "Measurement of Dry Coating Thickness with Magnetic Gages"; Coating Manufacturer's Product Specifications (Product Data Sheets);
- Protal Application Job Aid;
- NACE SP0188, "Standard Practice for Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates".

3.11 Backfill and Compaction

With pipeline segments properly coated and dried to required hardness, then backfill and compaction is performed. Contractors are required to meet PG&E Standards and engineered specifications for backfill and compaction. Inspectors on site will monitor and record that contractors are achieving required results. In the absence of project specifications, the standard minimum requirement is 85% relative compaction on right-of-way, and 95% in roadways. Farmland should be de-compacted to a depth of 18 inches.

Quality sampling will confirm and record that measured results are meeting PG&E requirements. Quality sampling results that are out of range will be brought to the attention of the inspector and the contractor.

All backfill and compaction work should follow these standards and references:

- PG&E Gas Standard A-36, "Design and Construction Requirements";
- Design Change Procedure WP 4900; Standard Practice 463-4;
- Material Specification 4123, "Backfill Sand".

3.12 Site Restoration

Quality Sampling Under Development:: Site restoration can be different from location to location. Contractors are required to meet PG&E engineered specifications for restoring the hydrostatic test sites. Inspectors on site will monitor and record that contractors are meeting expectations.

Quality sampling will confirm that results are meeting PG&E requirements. Quality results that are out of range will be brought to the attention of the inspector and the contractor.

3.13 Stage Two As-Built Documentation – Project Completion

At the conclusion of the project, the required documentation should be clearly assembled and delivered for quality assessment. All applicable documentation listed below must be included with the final as-built package. Quality sampling will confirm that data has been accurately recorded as measured or captured in the field.

Critical elements are tracked in the As-Built Documentation Checklist. Completion of each as-built document should be signed off, with date and time.

- Site Specific Hydrostatic Test Procedure
- Compile All Required STPRs for Project (including isolation caps and other test assemblies)
- Completed Red Lined Drawings with Weld Inspection Stamp and GPS Coordinate Data
- Weld Map
- Bill of Material and Material of Record
- Radiographers Daily Inspection Sheets
- Weld procedures
- Dew Point Test Form (and relevant procedures)
- Main Inspection Report - Form A
- Direct Examination Data Sheet – Form H
- ABI Test
- Chain of Custody
- Destructive Test Results
- Non-destructive test results form
- Emergency Pipe Repairs
- Construction Inspection Records
- Quality Sampling Records
- Bureau Veritas Certification and Web Posting
- Kiefner pressure analysis report
- All related design change notices