1. PURPOSE

This Program Requirements Document (PRD) provides the minimum requirements for developing and controlling test procedures and defines the process for field testing by the *subcontractor/supplier* (see def.) per the Idaho Cleanup Project (ICP) subcontract requirements, when performing work activities at ICP.

This PRD establishes basic requirements for construction testing of equipment, cables, devices, and systems.

2. APPLICABILITY

This PRD applies to ICP subcontractors/suppliers when specified by a subcontract.

Supplemental requirements may be specified for all or part of the work scope as determined to be appropriate by the *contractor* (see def.). The subcontractor/supplier shall implement the requirements of this PRD and all supplemental requirements, when and as specified by the subcontract, as defined on Form 540.10, "Subcontractor Requirements Manual (SRM) Applicability."

As used in this PRD, *equipment* is a general term that includes all material, fittings, devices, appliances, fixtures, and apparatus used as part of an equipment installation. A *device* is a unit of a system intended to carry but not use energy itself.

This PRD defines the activities necessary to test equipment and systems. Instructions are provided by the subcontract documents, such as the general conditions, special conditions, specifications, job safety analyses (JSAs), manufacturer installation instructions, work order packages, and the appendixes of this PRD.

3. RESPONSIBILITIES

Performer	Responsibilities
Contractor	Testing shall be witnessed and approved by the contractor representative.
Subcontractor/Supplier	Train personnel working to this PRD in accordance with PRD-5001, "Training and Indoctrination." Train personnel performing tests to the test procedures in accordance with PRD-5001. Calibrate and use all test equipment in accordance with PRD-5015, "Control of Measuring and Testing Equipment." Perform field testing utilizing the attached appendixes and forms, or contractor-approved, subcontractor/supplier-generated test procedures. Complete and maintain documentation in accordance with this PRD. Submit test documentation as required by the Vendor Data Schedule in accordance with PRD-5003, "Vendor Data Control."

4. REQUIREMENTS

4.1 The following appendixes show the following standard work processes:

A. Appendix A shows the standard work processes for electrical testing

B. Appendix B shows the standard work processes for pressure testing

C. Appendix C shows the standard work processes for sterilizing

D. Appendix D shows the standard work processes for torquing.

Alternate forms may be utilized by the subcontractor, provided they have been approved by the contractor in accordance with PRD-5003, separately or as part of the approved test procedure. However, they must meet the criteria defined in Appendixes A, B, C, and D.

4.2 Complete the appropriate form (see Table 1) for determining that the standard test instructions for common systems and equipment have been met.

Table 1. Equipment and system test forms.

Equipment	Form	Appendix
Cables and Electrical Equipment	Form 432.A16, Megger Data Sheet Form 432.A40, ICP DC High Potential (HI POT) Testing of Medium Voltage Power Cables Form 432.A43, Cable Pull Sheet	Appendix A, Electrical Testing
Transformers	Form 432.A18, Transformer Inspection Test	Appendix A
Motors and Rotating Equipment	Form 432.A19, Motors and Rotating Equipment Test	Appendix A
Fiber Optic Cables	Form 432.A20, Fiber Optic Cable Test	Appendix A
Lighting Systems and Receptacles	Form 432.A21, Lighting System and Receptacle Test	Appendix A
Grounding Systems	Form 432.A22, Grounding System Test	Appendix A
Data and Networking Cables	Form 432.A41, ICP Data and Networking Cable Test Data Sheet	Appendix A
Piping, Tubing, and Components	Form 432.A08, Pressure Testing Data Sheet	Appendix B, Pressure Testing
Water Piping Systems	Form 432.A42, Sterilization Data Sheet	Appendix C, Sterilizing
Electrical, Mechanical, and Structural Systems and Equipment	Form 432.A10, Torque Value Record	Appendix D, Torquing

4.3 Subcontractor/supplier personnel responsible for developing, approving, and controlling test procedures shall be trained to the requirements of this PRD in accordance with PRD-5001.

4.4 Subcontractors/suppliers must comply with the general requirements of this PRD, including the following specific requirements:

A. Verify test requirements

B. Verify that equipment/system to be tested has been released for testing

C. Properly isolate the equipment/system to be tested per applicable procedures

D. Notify the project Quality Representative when test will be performed

E. Properly document test results, including exceptions

F. Maintain and retain inspection and testing records.

4.5 Personnel responsible for performing or conducting required testing shall be trained to the applicable and approved test procedure in accordance with PRD-5001.

4.6 All testing required by the subcontract shall be performed in accordance with contractor-approved procedures (when specified in subcontract documents), unless the activities required by the procedure criteria are covered by one or more of the activities detailed in the appendixes to this PRD.

4.6.1 Subcontractor/supplier personnel work in accordance with applicable SRM procedures.

4.7 All testing shall be witnessed and approved by the contractor's representative, unless otherwise specified.

4.8 All test equipment shall be calibrated, identified, and controlled in accordance with PRD-5015.

4.9 Test procedures shall include, as a minimum:

A. Title or name of procedure

B. Procedure identification number, date, and revision number

C. Signature approval by a subcontractor/supplier representative

D. Applicable specification and/or code or standard reference

E. Test objectives, prerequisites, precautions, and variables

F. Personnel qualifications when required by contract documents

G. Safety measures requiring test limitations (such as pressure, heat, vacuum, amps, duration)

H. Equipment required

I. Calibrated equipment required

J. Test medium or electrical source or type

K. Test requirements and method of performance

L. Acceptance criteria.

M. Environmental conditions required

N. System or component restoration

O. Potential sources of uncertainty or error

P. Mandatory hold points.

4.10 Test reports or data sheets shall include, as a minimum:

A. Project identification number and/or name

B. Date of test

C. Procedure and revision number reference

D. List of all items or systems tested, including any test boundaries

E. Test equipment

F. Calibrated equipment used, including calibration due date and identification or serial number

G. Test medium used

H. Type of observation

I. Any instructions not performed or requirements not met, including any equipment substitutions

J. Any nonconformances or actions taken to correct deviations

K. Results, acceptability, and actions taken in connections with any deviations

L. Date, signature, and certification (if applicable) of person(s) performing the test

M. Date, signature, and certification (if applicable) of person(s) witnessing, evaluating, or verifying the test.

4.11 Documentation required by this PRD shall be completed, maintained, and stored in a single location in a secure and protected environment during the work activities.

4.11.1 All required documentation shall be legible, reproducible, free from erasure, correction fluid, and/or correction tape, and completed in black, indelible ink only.

4.11.2 When a correction to documentation is required, a single line shall be drawn through the information to be deleted; additional information, if needed, shall be recorded adjacent to the information being changed; and

the individual revising the document shall initial and date each entry adjacent to the correction.

4.11.3 When completed, all blanks or blocks shall be filled in on each document. If there is no relevant information, the blank or block shall be marked "NA."

4.11.4 All required documentation shall be made readily available for contractor review and/or audit.

4.11.5 All required supplier test documentation shall be submitted to the contractor when required by the subcontract, in accordance with PRD-5003.

4.11.6 Test reports that include portions of systems from related tests may be duplicated, provided the location (VDR Number) per PRD-5003 of the original test report is referenced in the test package.

5. DEFINITIONS

See LST-27, "Glossary," for definitions of the following terms:

Contractor

Subcontractor/Supplier

6. REFERENCES

Form 432.A08, "Pressure Testing Data Sheet"

Form 432.A10, "Torque Value Record"

Form 432.A16, "Megger Data Sheet"

Form 432.A18, "Transformer Inspection Test"

Form 432.A19, "Motors and Rotating Equipment Test"

Form 432.A20, "Fiber Optic Cable Test"

Form 432.A21, "Lighting System and Receptacle Test"

Form 432.A22, "Grounding System Test"

Form 432.A40, "ICP DC High Potential (HI POT) Testing of Medium Voltage Power Cables"

Form 432.A41, "ICP Data and Networking Cable Test Data Sheet"

Form 432.A42, “Sterilization Data Sheet”

Form 432.A43, “Cable Pull Sheet”

Form 540.10, “Subcontractor Requirements Manual (SRM) Applicability.”

PRD-5001, “Training and Indoctrination”

PRD-5003, “Vendor Data Control”

PRD-5015, “Control of Measuring and Testing Equipment”

7. APPENDIXES

Appendix A—Electrical Testing

Appendix B—Pressure Testing

Appendix C—Sterilizing

Appendix D—Torquing

Appendix A

Electrical Testing

Cable Pulling

Use Form 432.A43, "Cable Pull Sheet," to identify cable installation criteria per project drawings, specifications, and manufacturer instructions, as required.

Cable Testing

Check cables to verify the following:

- Wiring inside of junction boxes and terminal boxes is neatly dressed, trained, and color-coded
- Conductors are permanently tagged/labeled per project specifications
- The shielding is properly dressed, taped, and grounded
- There are no cuts or gouges in the insulation
- Conductor strands are not nicked or cut.

Use Form 432.A16, "Megger Data Sheet," to document megger and continuity testing of cables per project drawings, specifications, and manufacturer instructions.

Use Form 432.A40, "ICP DC High Potential (HI POT) Testing of Medium Voltage Power Cables," to document high potential testing of medium voltage cables per project drawings, specifications, and manufacturer instructions.

Transformer Testing

Check transformer terminations to verify the following:

- Transformers have been labeled per design documents before testing begins
- There are no cuts or gouges in the insulation
- Transformer is properly grounded.

Use Form 432.A18, "Transformer Inspection Test," to document transformer testing per project drawings, specifications, and manufacturer instructions.

Motors and Rotating Equipment Testing

Check motor and rotating equipment terminations to verify the following:

- Conductors are permanently tagged/labeled per project specifications
- The proper lug/connector/termination kit/crimping tool was used
- Motors have been labeled per design documents before testing begins
- There are no cuts or gouges in conductor and cable insulation
- Conductor strands at terminations, are not nicked or cut.

Use Form 432.A19, "Motors and Rotating Equipment Test," to document motor and rotating equipment testing per project drawings, specifications, and manufacturer instructions.

Fiber Optic Cable Testing

Fiber optic cables are labeled per design documents before testing begins.

Use Form 432.A20, "Fiber Optic Cable Test," to document fiber optic cable testing per project drawings, specifications, and manufacturer instructions.

Lighting System and Receptacle Testing

Light switch and receptacle cover plates have been labeled per design documents before testing begins

Use Form 432.A21, "Lighting System and Receptacle Test," to document lighting system and receptacle testing per project drawings, specifications, and manufacturer instructions.

Grounding System Testing

Grounding system connections and exothermic welds have been inspected and accepted prior to beginning of testing.

Use Form 432.A22, "Grounding Systems Test," to document grounding system testing per project drawings, specifications, and manufacturer instructions.

Data and Networking Cable Testing

Data and networking cables are labeled per design documents before testing begins.

Use Form 432.A22, "Grounding Systems Test," to document grounding system testing per project drawings, specifications, and manufacturer instructions.

Appendix B

Pressure Testing

Prior to the initiation of pressure testing, address and resolve the following:

- Verify that Project or System Engineer have identified piping systems that can be in-service tested.
- Verify the configuration of the system to be tested, and show isolation boundaries, valve positions, etc., on a current project drawing. Attach this mark-up to Form 432.A08, "Pressure Testing Data Sheet."
- Refer to Test Blind Fabrication Data at end of Appendix for test blind dimensions.
- Consider the maximum allowable pressure of the lowest rated component in the system.
- Review drawings and in the field the completeness and adequacy of pipe supports and identify the need for any temporary modifications, such as temporary supports or the blocking of spring-equipped supports for pneumatic or steam piping, that requires hydrostatic testing.
- Determine if relief valves are to be removed or left in place.
- Identify instrumentation (such as pressure gauges, pressure switches, thermowells, and transmitters) that is not rated for or designed to be part of the pressure test, and verify that it is isolated. Note that closing isolation valves is not an acceptable means of protecting the instruments.
- Identify the pressure test medium (such as low chloride or utility water, oil-free air, service oil, or nitrogen) called for on the drawings, specifications, and vendor data and, if required, recommend any alternatives. Refer to project engineering if a test medium is not specified.
- Determine if a relief valve is needed, and if used, ensure the set pressure is appropriate to prevent the pressure from exceeding the maximum allowable pressures established by the applicable code or project specification. Also take the appropriate measures, such as opening vents or drains outside the test boundaries, to prevent over-pressurization of adjacent systems in the event an isolation valve leaks by.
- Ensure that the calibration is current on the gauges used, that the maximum test pressure is within 25-75% of the pressure gauge range, and that the marked resolution is 1 psi or 1% of full range, whichever is greater.

It is recommended that two gauges be used to increase the reliability of the test should one gauge fail or documentation is unacceptable. Two gauges are mandatory if the test gauge is not within the sight of the test operator.

If utilized, relief valves that are sized to pass the full flow of the equipment used to fill the system should be installed as close as possible to the filling connection (at the pump, compressor, air cylinders, or existing air/water service main) and to the low point in the system.

Use Form 432.A08, "Pressure Testing Data Sheet," to document pressure testing per project drawings, specifications, and manufacturer instructions.

Hydrostatic Testing

Also, address the following issues specific to hydrostatic testing:

- For specified test pressure greater than 200 psig, the test pressure must be raised in steps (100 psig initially, and 10-20% increments thereafter, if not called out in design drawings, specifications, and vendor data) to preclude possible release of dangerous energy through the test medium erupting from a break. The system must be checked for leaks at each step.

- For piping systems with an allowable leak, the test pump must be disconnected from the water source and the test pressure must be maintained from a calibrated container.

- Fill the system from the lowest points possible to avoid air being trapped in the system. Monitor the system during filling to identify any leakage due to static head.

- Vent entrapped air from the system to the greatest extent possible prior to the pressure test. The presence of entrapped air will require more time to achieve the required pressure, and may even prevent the required pressure from being attained.

- Joints, including all welds, should be exposed and accessible during the initial pressure testing of each installation, unless the test is loss of pressure only.

- Over pressurization can occur in systems that are filled with water during a cool period (e.g., morning) and then allowed to heat up during a warmer period (e.g., afternoon) before the test is complete.

- After the testing is completed, the system should be laid up according to project drawings, specifications, and vendor data.

- In general, hydrostatic testing with water should not be performed when the air temperature is below 40°F, unless a suitable method is used to heat the test water or piping. Extra care should be used when draining systems in cold weather to ensure all pockets are drained and no liquid remains that may freeze. Keep vents open during draining.

- If leakage is discovered on components other than valve packing, valve seats, or gaskets, the system must be released and the leakage repaired prior to proceeding with the test. Leakage at valve seats, packing, or gaskets should be documented on the test data sheet for evaluation/repair during post-test restoration.

Pneumatic Testing

Also, address the following issues specific to pneumatic testing (greater than 30 psig):

- The volume of any pneumatic test should be minimized to limit the extent of damage in case of failure during testing. For tests at 225 psig and less, the free volume should be limited to 1,500 cubic feet, and for pressures above 225 psig, the free volume should be limited to 1,000 cubic feet.

- A double block and bleed valve arrangement must be included in the pressurizing line upstream of its connection to the line being tested. The test pressure gauge and safety relief valve must be downstream of the double block.

- The system must be purged of any hydrocarbon gases prior to pressurization.

- Specified test pressure must be attained gradually, and the tested system checked for leaks at each step, to preclude the possibility of a sudden expansion of a large volume of gas exhausting from a break. After each pressure step has been reached, close the block valve on the system side of the bleed valve and open the bleeder to the atmosphere. Refer to drawings, specifications, and vendor data for specific increments for pressurizing and relieving test pressure.

- Pneumatic tests must be scheduled to limit, to the extent possible, extraneous personnel in the test area. Exclude all nonessential personnel from the vicinity during testing.

- Set the compressor relief valve to discharge before damaging any of the system components, or at a maximum of 125% of test pressure.

- Whip restraints must be used on hoses and restraining devices must be installed on test plugs, as required.

- If leakage is discovered, the system must be released and the leakage repaired prior to proceeding with the test.

- After the test is completed, make sure all downstream and temporary piping pressure is relieved, and vent gases to a safe location (e.g., outside buildings).

- After depressurization, close the system and seal with nitrogen or dry air as required.

Static Head Testing

Also, address the following issues specific to static head testing:

- Refer to drawings, specifications, and vendor data to determine maximum allowable loss.

- An additional piece of pipe may have to be added to the highest point to reach the required head pressure.

- After the system is filled, for water absorbent materials (concrete, tile, etc.) the system should sit 24 to 48 hours before starting the test.

- Fill the system to the required water height. After the required hold period, the height is checked for any decrease and the hold time is recorded. Verify that the leakage is less than the allowable.

- Repair any visual leaks.

In-Service Testing, Vacuum Testing, Tracer Leak Testing, and Sensitive Leak Testing

Address issues specific to in-service testing, vacuum testing, tracer leak testing, and sensitive leak testing using project drawings, specifications, and vendor data.

TEST BLIND FABRICATION DATA

A = BLIND PLATE DIAMETER
B = PADDLE HANDLE WIDTH
C = HANDLE HEIGHT

t = required blind thickness
d = nominal diameter of pipe
P = line design pressure (psig)
S = allowable material stress

GENERAL NOTES:
1. PLATE MATERIAL TYPES
   A-36, S=12,600 PSI
   A-285 GR. C, S=18,350 PSI
   A-570 GR. 36, S=16,300 PSI

$$t = d\sqrt{\frac{3}{16} x \frac{P}{S}}$$

Note: This will provide a safety factor of 1.7 of yield. These same values may be used for A36 plate, however, the safety factor will be reduced to 1.4

TEST BLIND THICKNESS SCHEDULE (standardize & actual calculated) A285 Grade C

	Nominal	Blind			Class 150		Class 300		Class 600		Class 900		Class 1500		Class 2500	
Use	Size	A	B	C	225	450	750	1125	1500	2225	2750	3350	4500	5575	7500	9275
1/4 Inch Plate	1/2	1 3/8	1	3 1/2	1/16	1/16	1/16	1/16	1/16	1/16	2/16	2/16	2/16	2/16	3/16	3/16
	3/4	1 5/8	1	4	1/16	1/16	1/16	2/16	2/16	2/16	2/16	3/16	3/16	3/16	4/16	4/16
	1	2	1	41/2	1/16	1/16	2/16	2/16	2/16	3/16	3/16	4/16	4/16	5/16	5/16	6/16
	1 1/4	2 1/2	1	51/8	1/16	2/16	2/16	3/16	3/16	4/16	4/16	4/16	5/16	6/16	7/16	7/16
	1 1/2	2 7/8	1	51/4	1/16	2/16	3/16	3/16	4/16	4/16	5/16	5/16	6/16	7/16	8/16	9/16
	2	3 5/8	1	5 3/4	2/16	3/16	3/16	4/16	5/16	6/16	6/16	7/16	8/16	9/16	11/16	12/16
	2 1/2	4 1/8	1	61/8	2/16	3/16	4/16	5/16	6/16	7/16	8/16	9/16	10/16	12/16	13/16	15/16
	3	5	1	63/4	3/16	4/16	5/16	6/16	7/16	9/16	10/16	11/16	12/16	14/16	1	1 1/8
	4	6 1/4	1	10	4/16	5/16	7/16	8/16	10/16	12/16	13/16	14/16	1 1/16	1 1/8	1 3/8	1 4/8
1/2 Inch Plate	5	7 1/4	1 1/2	111/2	5/16	7/16	8/16	10/16	12/16	15/16	1	1 1/8	1 2/8	1 4/8	1 5/8	1 7/8
	6	8 1/2	1 1/2	125/8	6/16	8/16	10/16	12/16	14/16	1 1/16	1 2/8	1 3/8	1 4/8	1 6/8	2	2 2/8
	8	10 5/8	1 1/2	14	7/16	10/16	14/16	1 1/16	1 2/8	1 4/8	1 5/8	1 6/8	2 1/8	2 2/8	2 5/8	3
1 Inch Plate	10	12 3/4	1 1/2	151/2	9/16	13/16	1 1/16	1 2/8	1 4/8	1 7/8	2	2 2/8	2 5/8	2 7/8	3 3/8	3 6/8
	12	15	1 1/2	16	11/16	1	1 2/8	1 4/8	1 6/8	2 1/8	2 3/8	2 5/8	3 1/8	3 4/8	4	4 4/8
	14	16 1/4	1 1/2	16	13/16	1 1/8	1 4/8	1 6/8	2 1/8	2 4/8	2 7/8	3 1/8	3 5/8	4	n/a	n/a
	16	18 1/2	1 1/2	161/2	15/16	1 2/8	1 6/8	2 1/8	2 3/8	2 7/8	3 2/8	3 5/8	4 1/8	4 5/8	n/a	n/a
1 1/2 Inch Plate	18	21	1 1/2	173/4	1 1/16	1 4/8	1 7/8	2 3/8	2 6/8	3 2/8	3 5/8	4	4 5/8	5 1/8	n/a	n/a
	20	23	1 1/2	20	1 1/8	1 5/8	2 1/8	2 5/8	3	3 5/8	4	4 4/8	5 1/8	5 6/8	n/a	n/a
	22	25 1/4	1 1/2	22	1 2/8	1 6/8	2 3/8	2 7/8	3 2/8	4	4 4/8	4 7/8	5 6/8	6 3/8	n/a	n/a
	24	27 1/4	1 1/2	24	1 3/8	2	2 4/8	3 1/8	3 5/8	4 3/8	4 7/8	5 3/8	6 2/8	6 7/8	n/a	n/a

A = BLIND DIAMETER B = GRIP WIDTH C = HEIGHT FROM CENTER OF PADDLE TO TOP OF GRIP

Appendix C

Sterilizing

Use Form 432.A42, "Sterilization Data Sheet," to identify sterilization criteria per drawings, specifications, and manufacturer instructions as required.

Appendix D

Torquing

Perform torque tensioning of fastener hardware and electrical terminations per project drawings, specifications, and manufacturer instructions, and document on Form 432.A10, "Torque Value Record."