



## **Equipment, Tools, Specific Tools Checklist for Installation of Water Level / Tidal & Met Stations or Sensors**

**Procedure Number: 5.2.2.1**

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All of the following items will not be required on every installation. This list is intended to serve as a reminder so that necessary tools or equipment are not forgotten. The requirements of the specific site will dictate which of these are brought. There may be special equipment required at some sites that is not mentioned here.

### Tool Box

1. A complete tool box with wrenches, drivers and hand tools is required for all installations. The following headings may name specific tools that are already part of the tool box but in all cases, a complete tool box is assumed.
2. A steel measuring tape graduated in meters, of at least 15 meters length will be required for documentation, deck test, leveling collimation check and many other uses.
3. Soldering iron and solder
4. Drill motor, bits and hole saw kit

### Electronics and test equipment

1. Laptop computer with cables for connecting to Sutron gauges, Satlink transmitter, Paroscientific sensors, IP modem and any other instruments. Must be loaded with appropriate software. If equipped with an air card it can be used for checking IP modems and data output on CO-OPS web site while still at station. Refer to 5.2.3.1 Computer and Software Checklist for a comprehensive list of required software and computer accessories.
2. Multimeter
3. Hand held GPS for station and sensor metadata. Also required to calibrate wind sensor.
4. Barometer standard to calibrate station barometer
5. Temperature standard to check installed air, water and well thermistors
6. Headlamp or flashlight is handy for work inside gauge enclosures
7. In-line watt meter and dummy load for testing transmitter output and reflected power.
8. Camera for documentation.

### Personal

1. Any required Personal Protective Equipment (PPE)
2. Any desired but not required PPE, such as gloves, boots, rain gear, sun block



3. Personal Flotation Device
4. First Aid kit

#### Instrument Enclosure (Tide House)

1. Concrete pad already poured, concrete pier deck, wood pier deck
2. Mast or other means of mounting antennas and solar panels. Anchors and mounts.
3. Ladder
4. Anchors and mounting hardware to fasten the enclosure to the material you are mounting it on. Local conditions (tsunami hazard, extreme weather) must be taken into consideration
5. Rock drill and rock bits
6. A means to place the enclosure, i.e. forklift, rollers, overhead crane, many strong crew members
7. Trencher, shovel and pick if trenching is required for utilities or tubing and cabling from sensors
8. Conduit, junction boxes, hangers and mounting hardware

#### Gauges

1. Gauges, antennas, solar panels and mounts
2. Batteries for gauges and pumps
3. Manuals for gauges, pumps, sensors and test equipment
4. Hanging hardware, Unistrut & twist nuts, studs, drywall anchors etc.
5. Hand level
6. Cabling from sensors and between gauges
7. Small screwdrivers and diagonal cutters for cabling
8. Wire terminals
9. Ty-Wraps

#### Stilling well and Orifice installation (SCUBA specific equipment covered under separate heading)

1. Climbing gear and fall arrester
2. Ropes, slings and pulleys
3. Brackets, allthread, nuts and washers of proper size and number for your installation
4. Beams and mounting hardware if required
5. Stilling well material, typically 6" white Sch. 80 PVC pipe.
6. Unions and flanges to construct well
7. PVC primer and cement. Latex gloves.
8. Screen vent covers
9. Sounding tube kit
10. Thermistors (T1, T2, WT)
11. Well top plate, sounding tube clamp and mounting hardware
12. Tophat and 3/4" stainless bolts & nuts
13. Cabling to gauges
14. Well junction box and conduit
15. Pressure sensor orifice(s)



16. Mounting clamp, board and mounting hardware for orifice(s)
17. Bubbler tubing sufficient to reach gauges

#### SCUBA diving

1. Sufficient number of divers to perform work, plus a tethered stand-by diver, plus a Designated Person in Charge. All of these must be current in First Aid, CPR, Oxygen delivery, and have a knowledge of the tasks to be performed and diving physiology. OSHA requirement.
2. Individual dive gear including RASS
3. Full SCUBA bottles. If need to rent, where?
4. At remote sites a compressor may be required to fill bottles
5. Lead for weight belts, see above.
6. First Aid kit
7. Oxygen kit
8. Dive flag
9. Diving Accident Management Plan (DAMP)
10. Tending line for stand-by diver
11. Gear bag and line
12. Tools appropriate for the work to be performed. This may include pneumatic tools which must include sufficient air hose to reach the job and a source of compressed air.

#### Met sensors

1. Mast, base and mounting hardware
2. T-head if dual wind installation
3. Wind, air temp and other required sensors
4. Cabling sufficient to get back to gauges
5. Conduit, hangers and mounting hardware

#### Bench Mark installation

1. Stamp kit and hammer
2. Block or other means to secure BM while stamping
3. Rock drill and rock bits
4. Cold chisel
5. Hydraulic cement and bags for mixing
6. Water
7. Gas hammer for 3D marks
8. Logo cap and PVC pipe for 3D marks
9. Tripod, rope and pulley for gas hammer for 3D marks
10. Post hole digger, shovel, pick for 3D marks
11. Cement mixer for 3D marks
12. Cement and sand for 3D marks
13. Witness posts and driver
14. Witness signs and mounting hardware
15. Compass, hand-held GPS, steel tape, camera, paper & pen for descriptions



## 16. Survey quality GPS and tripod and observation forms

### Leveling

1. Level instrument
2. Tripod
3. Survey rod(s)
4. Turtle(s)
5. If digital levels, processing software on laptop computer
6. If optical levels, HP-200 and observation and abstract forms
7. Lumber crayon, paint stick, upside down marking paint

### Station specific

1. It is impossible to include all possibilities in this list but you must carefully consider the recon report, site reports, local knowledge and any other sources of information available to be assured of having the necessary tools and equipment. Some sites have very specific tools required, for example Prudhoe Bay needs a purpose made pusher pole and a come-along to raise the wind sensor mast.
2. Secure areas of Ports now require a TWIC card for unescorted access.
3. Military facilities may require a CAC card or prior notification of the Security Officer for clearance.
4. Some sites require specialized training such as Hydrogen Sulfide (H<sub>2</sub>S) safety, or refinery operations.
5. Many sites require various levels of permits to perform work. These can include Work Permits, Hot Work Permits and a pre-work safety walk through or meeting.
6. Hazardous work sites may vary the work permitted depending on operations being performed at the time i.e. no Hot Work Permits during loading or unloading operations at petroleum terminals.
7. Sites may require PPE such as Nomex clothing, hard hats, steel toe shoes etc.
8. Sites may require certain levels of grooming such as no beards in H<sub>2</sub>S environments.