This SOP is subject to
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BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT

TECHNICAL SERVICES DIVISION

QUALITY ASSURANCE PROJECT PLAN

MET SOP 509

TILT TOWERS

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Dick Duker

Digitally signed by Dick Duker
DN: CN = Dick Duker, C = US, O = BAAQMD, OU = Technical Division
Reason: I am approving this document
Date: 2008.08.06 10:29:45 -07'00'

Dick Duker, Manager
MQA Section

Mark Stoelting

Digitally signed by Mark Stoelting
DN: CN = Mark Stoelting, C = US, O = Bay Area AQMD, OU = Technical Services
Reason: I am approving this document
Date: 2008.08.06 12:54:36 -07'00'

Mark Stoelting, QA Officer
Technical Services Division

BAY AREA AIR QUALITY MANAGEMENT DISTRICT
939 ELLIS STREET
SAN FRANCISCO, CA 94109

STANDARD OPERATING PROCEDURE
BAAQMD Technical Services Division

Tilt-down Meteorological Towers

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Purpose

The purpose of this Tilt-down Meteorological Tower Standard Operating Procedure (SOP) is to standardize procedures for raising and lowering 10 m aluminum tilt-down meteorological towers. The goal is to define safe and reliable tower handling procedures to minimize the risk of staff injury and equipment damage.

Background

The District operates many meteorological stations within the Bay Area to measure continuous ambient meteorological parameters. Most stations utilize fixed, self-supporting 10 m steel towers that can be climbed to service meteorological sensors. The remaining stations use 10 m tilt-down aluminum towers located on building rooftops or in places where pouring a permanent concrete tower footing is not feasible. These towers are hinged at the base and guyed from near the top of the tower in three directions. To service meteorological sensors attached to the tower above about 6 feet, the tower must be lowered to a horizontal position.

Tilt-down Procedure Overview

These procedures should be followed when lowering or raising 10 m tilt-down meteorological towers. Ideally, two people will be present whenever this procedure is executed. But if this is not the case, towers can be safely raised or lowered by one person under less windy conditions.

The most critical factor in raising or lowering a tower is the local wind condition. A steady wind in the plane of tower movement is the easiest to manage. A gusty crosswind greatly increases the difficulty in handling a tower.

DO NOT ATTEMPT TO ARREST AN UNCONTROLLED, FALLING TOWER. It is far better to let an uncontrolled tower fall without intervention than to risk bodily injury. Before any tower tilt procedure is initiated:

- All personnel must note the approximate location of a 12 m “safety circle” around the base of the tower. If a tower falls, everyone must move as quickly as possible to a location outside this circle.
- Every person must identify and communicate to others an intended direction to run to the safety circle. This will normally be in a direction at right angles from a partially tilted tower and should account for guy wires or other obstructions that may lie or fall across the path.
- If control is lost during the raising or lowering of a tilt-down tower, either of a two (or more) person team must yell “Falling!” and all should run outside the safety circle.

Two-person procedure to lower a tower

1. Evaluate local wind conditions. Towers should not be raised or lowered if winds exceed approximately 15 mph or 7 m/s (including gusts) along the plane of tower movement. If the wind is blowing perpendicular to the tower movement, winds should not exceed 10 mph or 5 m/s.
2. Place a tower support such as a ladder or stool approximately 3/4 of the way up the tower height in the direction of the horizontal tower. This will keep the tower off the ground and protect the sensors. It also makes the tower easier to service.
3. Remove the tower bolt from the leg that will pivot up from the base. The other two tower legs should each have one remaining bolt each around which the tower will pivot.
4. To lower, a “tower person” stands and pushes as high as possible against the tower face that will approach the ground. A second “guy person” releases the opposite guy wire by removing the clip and clevis pin at the ground anchor. Both should use sturdy gloves.
5. As guy wire tension on the tower is released, any crosswind component will immediately push the tower sideways to the tilt direction. The person under the tower must push against this tendency to keep the tower movement aligned in the desired tilt direction. A wind pushing in the direction of tilt will enhance the tower’s tendency to fold over. A wind pushing against the tilt will require some pulling by the “tower person” to initiate the tilt.
6. With a coordinated effort, the “guy person” holding the released guy wire gradually plays out the wire while the “tower person” under the tower guides the fall and gradually assumes more of the tower weight.
7. The “guy person” must hold the wire to maximize control leverage which generally means standing as far away from the tower base as possible. With a crosswind, the “guy person” may move toward the wind to help steer the tower against the wind while lowering. As the tower lowers, the “guy person” must walk toward the tower base and gradually loses leverage to support the tower.
8. The “tower person” stands under the tower as it is lowered and adjusts his hold on the tower upwards as the tower approaches the ground. The tower should be supported with arms outstretched overhead and a wide stance facing the tower base for maximum stability and control.
9. When the tower angle is about 20 degrees from the ground, about half of the tower weight will be supported by the “tower person.” At this point, the “guy

person" should (slowly) release the tension on the wire, and assist the "tower person" lowering the tower further onto the support placed in step 2 above.

Two-person procedure to raise a tower

1. Evaluate local wind conditions as in step 1 above.
2. Check the two attached guy wires for freedom to extend as the tower as raised.
3. Both people lift the tower off the support until the tower angle is about 20 degrees from the ground. A "tower person" assumes about half of the tower weight standing roughly 6 m from the base with arms outstretched overhead and a wide stance facing the tower base for maximum stability and control.
4. The second "guy person" moves to the opposite side of the tower and, holding the end of the unattached guy wire, moves as far from the "tower person" as possible.
5. At this point, the "guy person" (slowly) increases tension on the wire, and assists the "tower person" raising the tower. As the tower angle increases, the "tower person" adjusts his hold downward as he approaches the tower base and the "guy person" moves backward away from the tower base.
6. As the tower is raised, the "tower person" must compensate for any crosswind forcing the tower sideways. As the tower approaches vertical, far less force is required and the "guy person" assumes control of raising the tower to vertical, pulling it tight against the two fixed guys, and securing the third guy wire to the ground anchor with a clevis pin and clip.
7. Check all guy wires for poor alignment, wire kinks, loose hardware, etc.
8. Install the tower bolt on the leg facing the third guy wire and check the other two tower legs bolts.

Single-person procedure to lower a tower

1. Evaluate local wind conditions. Towers should not be lowered if winds exceed approximately 7 mph or 3 m/s (including gusts). Do not consider lowering the tower with one person if the wind is blowing more than about 4 mph or 2 m/s in the direction of the tower tilt. Under these conditions, it will be very hard to keep the tower from spontaneously falling.
2. Place a tower support such as a ladder or stool approximately 3/4 of the way up the tower height in the direction of the horizontal tower. This will keep the tower off the ground and protect the sensors. It also makes the tower easier to service.
3. Remove the tower bolt on the leg that will pivot up from the base. The other two tower legs should each have one remaining bolt around which the tower will pivot.
4. Using gloves, release the guy wire opposite the direction of tilt by removing the clip and clevis pin at the ground anchor. Maintain tension on the released guy while walking to the base of the tower.
5. When reaching the tower, release the guy and immediately apply force directly to the tower toward the released guy (keeping the tower vertical against the two remaining guys). Continuing to apply force, step around the tower until facing the tower face opposite the released guy.
6. With arms extended overhead and a wide stance, slowly start tilting the tower down, applying upward force to control the tilt angle, and stepping backward

away from the tower base as the tower lowers. The upward force required to support the tower will increase with the tilt angle, approaching about half the tower weight at a horizontal position.

7. As the tower angle approaches horizontal, place the upper end of the tower onto the support placed in step 2 above.

Single-person procedure to raise a tower

1. Evaluate local wind conditions. Towers should not be raised by one person if winds exceed approximately 7 mph or 3 m/s (including gusts). Do not consider raising the tower with one person if the wind is blowing more than about 4 mph or 2 m/s in the direction of the tower tilt. Under these conditions, it will be very hard raise the tower and keep it there while securing the third guy wire.
2. Carefully check the two attached tower guys to confirm they will not snag on anything during tower erection. The unattached guy should lie next to the tower for ready access after the tower is up.
3. Follow the reverse procedure outlined in steps 7, 6, 5, and 4 above, attaching the third guy wire in step 4 to the ground anchor with a clevis pin and clip to secure the tower.
4. Reinsert the tower bolt in the third leg and inspect all tower bolts, guy wires, and associated hardware.

Authors, Revisions, and Approvals

August 2007 (original version)
Author: Mark Stoelting, Principal Air and Met Monitoring Specialist

References

Campbell Scientific, Inc., UT30 Weather Station Instruction Manual