

Dome Closure Rules

When to close the dome due to weather

To: Observers, Assistant Observers, *Staff*

Subject: Rules for Closing due to Weather.

Observers are operationally responsible for the safety of the telescopes. Whenever weather conditions prohibit safe operation, Observers must close the domes and suspend operation. In many instances a combination of factors, no one exceeding stated limits, will dictate to the reasonable observer that operation should be suspended.

There is no general exemption for remaining open during closure conditions! If for some reason you believe there is a compelling reason to remain open during a closure condition, **first close the dome**. Then contact one of the following:

Local:

Coyne Gibson (x114, x661)

Dr. Teznie Pugh. Superintendent (x633, x646)

Absent engaging with either the McDonald West Texas Observing Support Manager, or McDonald West Texas Superintendent, **you must close**, unless one of those individuals has evaluated conditions, and taken responsibility to remain open during a weather closure. ***Failure to observe this protocol may result in the loss of your observing privileges.***

Some of our observing stations are located so that the observer does not have good knowledge of the present weather or of impending weather conditions. Any observer who is aware of immediate or threatening weather conditions requiring action by other observers for the safety of telescopes, domes, instruments, etc. should notify the other observers immediately.

All Observers must continuously monitor the available weather sensors and Weather program conditions for indications requiring closure. Weather program information is accessible via a 107" control room monitor, the Sun workstations by entering "wx" on the command line, by checking the 2.7m TCS GUI, and by selecting "...Current Weather" on the OS web page at nexus.as.utexas.edu with any networked computer.

Summary: There are four general types of closure events; precipitation, wind, humidity, and dust. One or more of these events may exist simultaneously. When any one event type reaches a threshold condition, closure of the dome is required. You must wait thirty (30) minutes before re-opening the dome. Closure conditions and their thresholds are documented in the following text.

Closure Alert Stations:

The 2.7m, 2.1m, and 0.8m dome control rooms are equipped with a rack-mounted Weather Alert/Closure station on the console. The Closure Alert system consists of an LCD display panel, a red Silence button, a visual Close Dome indicator, and an audio alert. In the event of a closure condition, including precipitation, wind, particle count, or combination of these event thresholds, the panel will sound an audio alert, illuminate the Close Dome indicator, and display a message related to the cause of the closure alert on the LCD display. The alarm condition can be acknowledged by pressing and holding the Silence button for three seconds. The most recent event is listed first in the display, along with a time-stamp.

1. Precipitation

All domes must be closed when rain, mist, hail, sleet or snow appear imminent in the immediate area. Local precipitation alarms/indications are available in the 2.7m dome as well as via the Weather program which has a sensor at the 2.1m weather tower. If the local 2.7m alarm is flashing/sounding or the Weather program indicates a closing condition, at least one drop of rain has been detected and the domes should not be opened. If the domes are open, they should be closed immediately. If only the 2.7m alarm is indicating, other Mt. Locke observers must be alerted as well. Should the alarm sound while the dome is open, immediately close the mirror cover, begin closing the dome shutter, move windscreens and/or telescope to best protect the primary mirror and instrument. As soon as possible, alert other observers as to the situation and then check outside conditions. False alarms are very rare so please carefully evaluate the outside conditions and Weather program status before reopening. Note that you are required to wait thirty (30) minutes from the time the precipitation event alert expires before re-opening.

Note that snow is a special case of precipitation. Snow may accumulate on the domes, dome shutters, and exterior surfaces. Even though there may be no active snowfall, and rain sensors may not indicate precipitation, snow may still blow into the dome through open dome shutters, or fall from the shutter surfaces. Accumulations of snow may create difficulty in operating (rotating) the dome and/or dome shutters - if the dome shutters fail to fully open, or fail to fully close you must immediately contact an Observing Support team member for instructions. In the interim, move/point the telescope away from the dome slit, and raise the wind curtain(s) to protect the dome interior. If dome rotation is possible, rotate the dome slit down-wind. During operations, after a snow event, visually check the dome and dome slit to insure that no snow is blowing or falling into the dome interior.

2. Wind

In high or strong, gusty winds dome rotation becomes difficult to control and may endanger the telescope or other equipment and personnel inside. The shutters are very large sail-like protrusions when open and could easily be damaged by the wind. Likewise, the windscreens can be damaged or forced from the guides and fall to the floor or onto the telescope or personnel. The telescopes are unlikely to be directly damaged by wind although falling objects easily could cause serious damage to mirrors or instruments.

The primary source for wind information will be the local weather station data as supplied by the WEATHER program. A backup instrument is available: the R. M. Young anemometer readout in the 2.7m control room as well as weather data from the HET site. The sensors for both instruments are mounted on the tower west of the 2.1m dome and additional sensors are at the HET weather tower. In case all these instruments fail, hand-held anemometers are available in the 2.7m control room. The R. M. Young anemometer has a long time—constant, effectively averaging data over several seconds. Therefore, gusts do not record at their peak values and allowance for this must be made in reading the records.

If the WEATHER program is not usable then it is the responsibility of the observer at the 2.7m telescope to notify other observers when critical wind speeds are reached.

All telescope domes will be closed when frequent wind gusts exceed 45 mph (as shown by at least three maximum readings above 45 mph in the previous five samples) or the 5-minute average of wind speed exceeds 50 mph or if single gusts greater than 50 mph are noted. If windblown gravel or debris is hitting a dome, it must be closed immediately; regardless of wind speed. Observers should elect to close at lower wind speeds should their work be affected by telescope vibration or if the wind causes severe difficulties with turning the dome.

In addition, precautionary measures will be taken at somewhat lower wind speeds for the 2.7m and 2.1m telescopes. These actions are summarized in the following table:

Wind Condition Table, 2.7m and 2.1m Telescopes

5-min. Average Speed	Single Gusts	Action
----------------------	--------------	--------

50 mph	50 mph or 3 gusts >45 in 5m interval*	Close dome
45-50 mph	50 mph	Work downwind, be alert to close
40-45 mph	45 mph	Turn dome downwind at observer's earliest convenience
35-40 mph	40 mph	Close the shutters and and windscreens to the minimum opening possible for the observations

* The wx program will keep track of this and report it; observers should check wx when the winds are high.

After closing or taking precautionary action, wait at least 30 minutes after the latest readout greater than the speed criterion before resuming operation. Weather program warnings will be removed when conditions are considered safe.

Special Note for the 2.7m / 107" Dome - Holding Brake: When the system is in E-stop mode, the dome control system, which consists of the twin drive units, and holding brake, are disabled, in a power-off state. The dome is allowed to "weather-vane," or rotate on the stem wall freely, based on wind speed, and the prevailing wind direction. In the Reset state, the dome drive controller is energized, and the dome's holding brake is enabled. When the brake initializes, a pump runs, pressurizing the brake disc. Once the set-point pressure is reached, the brake controller hydraulically compresses the brake's caliper and pad system, holding the dome in place against wind pressure. The brake, and dome structure are designed to tolerate wind gusts up to 45mph, or sustained wind at 50mph. Above those thresholds, mechanical stresses on the system produced by high wind speed can damage the dome structure. There is a dome holding brake control located in the North Control Room, on the pump and servo control panel. From time to time, the holding brake disable may be in use, which allows the Visitor Center staff to conduct daytime tours in high-wind conditions - this requires the system be in Reset mode. The brake disable is used to allow Reset to be enabled, without activating the dome's holding brake. If the brake disable is in use, a red holographic display will be clearly visible on the back wall of the North Control Room, and a high-brightness red LED array on the control rack will be illuminated. Observing support will normally enable, or disable the dome holding brake, and the action will be logged in the night report. If you note the brake is disabled, and conditions support observing, the brake must be enabled to prevent unwanted dome motion due to winds.

3. Humidity

Both relative humidity and dew point sensor data are available via WEATHER on computer network. The RH/Dewpoint sensors are located on the tower west of the 2.1m dome. When humidity becomes too high WEATHER will issue a warning at the bottom of the display.

Steadily increasing humidity and varying local conditions result in situations where the onset of condensation is difficult to determine. At high humidity levels each observer must monitor the weather using the control room displays where available as well as the wx program. Each observer is responsible for monitoring the humidity reports and conditions then alerting other observers when relative humidity rises above 95%. Assuming the rain detectors have not already alarmed, follow the recommendations below.

If water is dripping into a dome from the edges of the shutter opening, the dome is to be closed. All domes should close if condensation is detected at any dome. Telescopes should be parked and windscreens positioned so that drops do not enter the front of the telescope or hit instruments.

Reopening

After domes have been closed for high humidity, they must not be reopened unless the relative humidity, as indicated by the weather program is below 95%, wait at least 30 minutes and observer inspection indicates the conditions are safe.

When reopening, care must be exercised to avoid letting water drop off a dome shutter and onto a mirror.

After reopening be alert for conditions which may require closing again.

4. Dust

Domes and mirror covers should be closed if high dust conditions are reported by the Weather program. The weather program issues a warning at 50,000 counts (1 μ m particles) however it does not require closure until it reaches 100,000. In many cases this level is too high so observers should carefully check for particles in the air using the dust monitor flashlight. If there is some question about the conditions reported by the weather program, observers must use their best judgment or call Observing Support personnel for assistance. Remember that wind and dust together create a greater problem for the optics than either alone.

Note that the dust sensor is shut down if humidity exceeds 85% as it cannot function properly above that level.

You must wait thirty (30) minutes after the dust/particle count event alert expires before re-opening the dome.