

Lamp Reference Guide

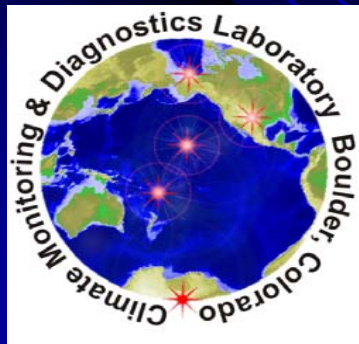
For Dobson Spectrophotometer observers



World Dobson Calibration Center
Climate Monitoring and Diagnostics
Laboratory

Written by:

Brooke Walsh and Bob Evans



Overview

- Welcome Note
- Introduction
 - Why lamps are important
 - Important lamp safety precautions
 - Our Network
- How to run a mercury lamp test
- How to run a standard lamp test
 - Reference instructions
 - lamp testing schedule
- Problems and Questions
- Conclusion
- World Dobson Calibration Center Staff



The World Dobson Calibration Center, Boulder Staff

(from left to right: Brooke Walsh, Mike O'Neill, Sam Oltmans, Bob Evans, Gloria Carbaugh, Dorothy Quincy)

Welcome

From all of us here in Boulder, we thank you for your help in our continuing effort to obtain the best, most accurate data set of total ozone measurements. Many of your stations have over 30 years of data. It's people like you that have made this program successful. Your continued help and cooperation is essential for the survival of the global network. We thank you for all that you do!

Introduction



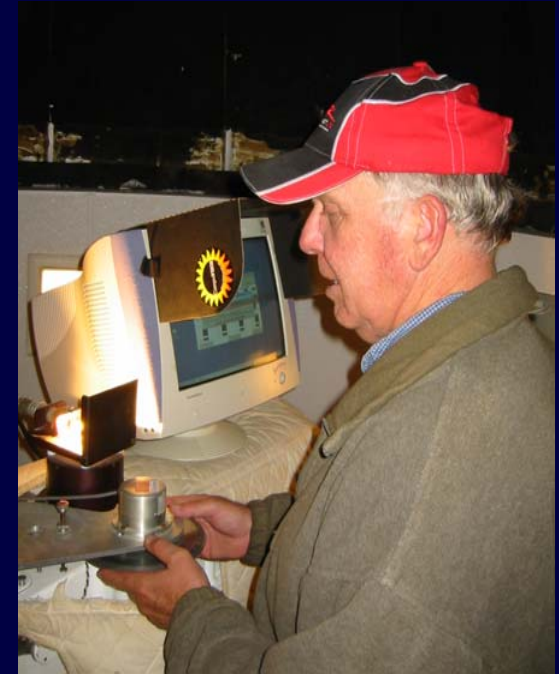
Brooke Walsh, CMDL Boulder

- This guide is a reference tool, and does NOT take the place of hands on training by the Boulder Staff.



Karl Venneberg, NWS Bismarck, ND

- Lamp tests are very important. It is essential that they are done correctly and promptly.

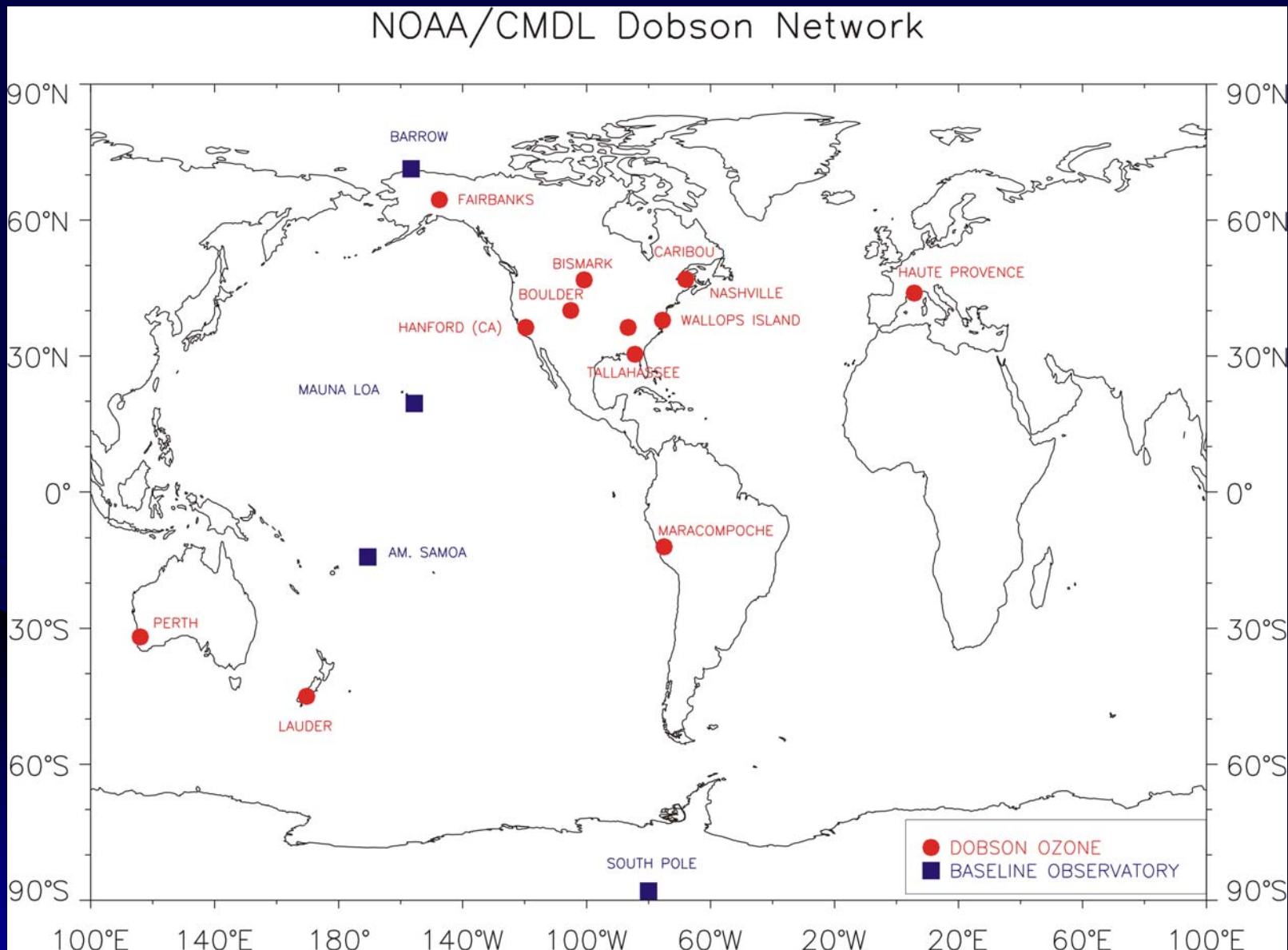


Duane Wolfe, NWS Caribou Maine

Importance of Standard Lamps

- The monthly lamp tests help track the calibration drift of the instrument between intercomparisons here in Boulder.
- They are also used in processing as a correction factor for generation of total ozone values.
- Sudden or drastic shifts in lamp correction values help identify problems in the instrument.

Our Network of Dobsons



Safety Reminders



- **NEVER** touch the bulb in a standard lamp.
- Keep both the mercury and standard lamps in a cool, dry place.
- The lamp covers should **NEVER** be put over the hot bulb. This can cause premature burn out or in some cases a fire if improperly handled.

Nick Tarrish, NWS Nashville, TN

Safety Precautions

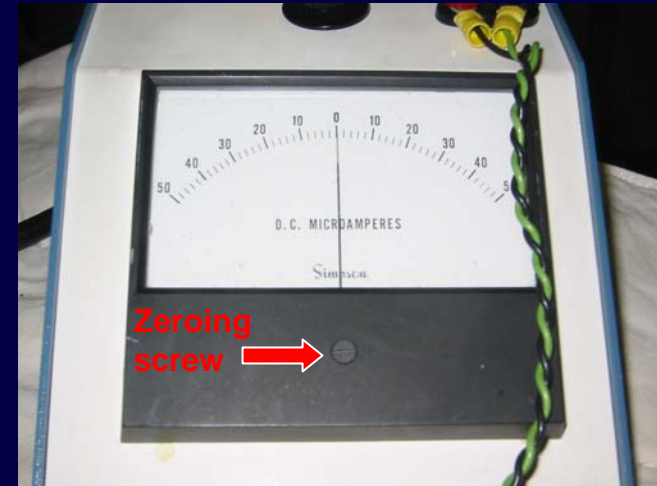
- Use caution when removing lamp units. They become very hot, very quickly.
- Use only the black cover on the lamp holder to block light.
 - Covering the lamp will cause the unit to overheat and burn out.



Black lamp cover

Mercury Lamp Test

- Check to make sure that microammeter (meter) is zeroed while the instrument is off.
- If not zeroed, take a flat head screw driver and adjust the small screw on the front of the meter.
- Turn the instrument on and put the Ground Quartz Plate (GQP) inside the inlet window.
- Turn on and warm up Mercury light for approximately 5 minutes.
- **DO NOT look directly at the mercury lamp light!!** The Hg wavelength can be very damaging to your eyes!!



Microammeter

TABLE OF SETTINGS OF Q

Boulder, CO
Inst. No. 65
Apr. 25, 95

Issues at 15 Degs C: 48.06 74.86 106.07 82.60
 Eff Deg. Q / Deg. C: A: 0.084 C: 0.125 D: 0.122 Hg3129: 0.126

Temperature	A	C	D	HG	Temperature	A	C	D	HG	Temperature	A	C	D	HG
-5.0	46.35	72.35	103.65	80.10	10.0	47.65	74.25	105.45	81.95	25.0	48.90	76.10	107.30	83.85
-4.5	46.40	72.45	103.70	80.15	10.5	47.70	74.30	105.50	82.05	25.5	48.95	76.15	107.35	83.90
-4.0	46.45	72.50	103.75	80.20	11.0	47.75	74.35	105.55	82.10	26.0	49.00	76.20	107.40	84.00
-3.5	46.50	72.55	103.80	80.25	11.5	47.75	74.40	105.65	82.15	26.5	49.05	76.30	107.50	84.05
-3.0	46.55	72.60	103.85	80.35	12.0	47.80	74.50	105.70	82.20	27.0	49.05	76.35	107.55	84.10
-2.5	46.60	72.70	103.95	80.40	12.5	47.85	74.55	105.75	82.30	27.5	49.10	76.40	107.60	84.15
-2.0	46.60	72.75	104.00	80.45	13.0	47.90	74.60	105.85	82.35	28.0	49.15	76.50	107.65	84.25
-1.5	46.65	72.80	104.05	80.50	13.5	47.95	74.65	105.90	82.40	28.5	49.20	76.55	107.70	84.30
-1.0	46.70	72.85	104.10	80.60	14.0	48.00	74.75	105.95	82.45	29.0	49.25	76.60	107.80	84.35
-0.5	46.75	72.95	104.20	80.65	14.5	48.00	74.80	106.00	82.55	29.5	49.30	76.65	107.85	84.45
0.0	46.80	73.00	104.25	80.70	15.0	48.05	74.85	106.05	82.60	30.0	49.35	76.75	107.90	84.50
0.5	46.85	73.05	104.30	80.75	15.5	48.10	74.90	106.15	82.65	30.5	49.35	76.80	107.95	84.55
1.0	46.90	73.10	104.35	80.85	16.0	48.15	75.00	106.20	82.75	31.0	49.40	76.85	108.05	84.60
1.5	46.90	73.20	104.40	80.90	16.5	48.20	75.05	106.25	82.80	31.5	49.45	76.90	108.10	84.70
2.0	46.95	73.25	104.50	80.95	17.0	48.25	75.10	106.30	82.85	32.0	49.50	77.00	108.15	84.75
2.5	47.00	73.30	104.55	81.00	17.5	48.25	75.15	106.40	82.90	32.5	49.55	77.05	108.20	84.80
3.0	47.05	73.35	104.60	81.10	18.0	48.30	75.25	106.45	83.00	33.0	49.60	77.10	108.25	84.85
3.5	47.10	73.45	104.65	81.15	18.5	48.35	75.30	106.50	83.05	33.5	49.60	77.15	108.35	84.95
4.0	47.15	73.50	104.75	81.20	19.0	48.40	75.35	106.55	83.10	34.0	49.65	77.25	108.40	85.00

Example of a Q-table

Mercury Lamp Test



Q2 set to 15°C



Koji Miyagawa, Japanese Meteorological Agency, reading the thermometer

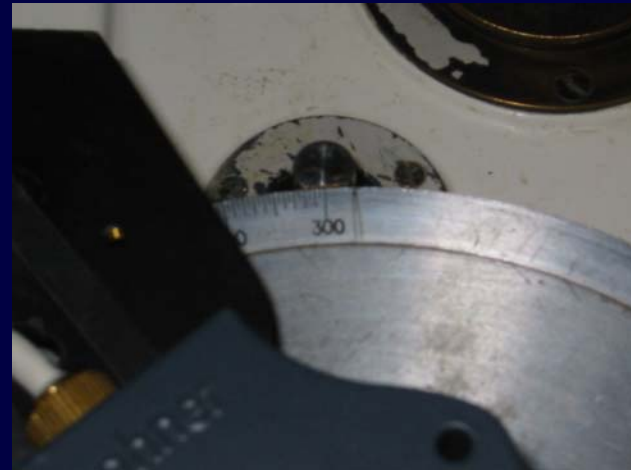
- Verify that the **Q2** lever is always set to the **15° C** Hg temperature setting defined in the Q-table.
- Read the temperature of the instrument to the nearest tenth of a degree. Remember the value to record into program at the beginning of the test.
- Q1 should be placed at the Hg setting on the Q-table that equates with temperature of the instrument.

Mercury Lamp Test

- Reset the Counter and make sure it is zeroed.
- Turn the R-dial to 300.



Mercury Lamp in place



R-dial at 300



Duane Wolfe, NWS Caribou
Maine

Mercury Lamp Test

- Go to the maintenance tab on the home screen of the program and scroll down to Mercury.

Main Form: Version date 31MAR04_JogIcTime 38

exit Obs Comment Reports **maintEnance** Info

UTC: 20:37:23 Mu: 1.482

LST: 13:37:23 Local Date: 26 Sep 20

Help: Bob Evans, 303-497-6679, email: Robert.D.Evans@noaa.gov

Encoder
Mercury
Standard
Change Q Table
Print Q table
Intercomparison

to Stop reading encoder encDr_reset
Computer controls speed.
controlled sPeed

Main Menu 083 at Boulder, Colorado, USA Day of Year:270 09-26-2004

No ADDS Obs. Yet Today
No AD Zenith Obs. Yet Today
No CDDS Obs. Yet Today

Short Cut Keys

F1:ADDSGQP F3:ADZB F5:CC'ZB
F4:ADZC F6:CC'ZC

Currently in the high Sun mu range.
Multiple Observations on various observation types is always useful

DATE AND TIME ARE SET THROUGH WINDOWS- USE A NETWORK TIMESETTER PROGRAM

Mercury Lamp Test

- Start with the sensitivity switches fully counterclockwise.
- Observe the meter while adjusting the A wavelength sensitivity switch clockwise and moving Q1 up and down.
- If the needle does not move, continue to adjust the sensitivity clockwise until movement on the meter is observed.

Sensitivity switches are set for individual wavelengths



Mercury Lamp Test

- After movement is detected on the meter, continue to move the Q1 lever up while watching for the needle to hit a maximum point and then returning back down.
 - This may require adjusting the sensitivity control to keep the needle from going past full scale and causing damage to the meter movement.
- Adjust Q1 until the maximum point is once again reached. At this point, adjust the sensitivity so the needle reads approximately 20 on the meter.
 - This is the max power point. Mercury tests measure the values located at the half power points, in this case 10 on the meter.

Mercury Lamp Test

- From the maximum point, move Q1 up until the needle reads approximately 10, half of the max power peak.

How to do a
Mercury Test

Quick movie on how to start a
mercury test

Mercury Lamp Test

- Read the position of Q1 and record the information into the program.

Mercury Test on instrument 083 on 09-26-2004 By: BMW

Info Comment

Perform the Test by moving the Q1 lever first up (lower numbers), then down so the microampmeter reads approximately one half the peak reading.
Example: for a peak reading of approximately 19, move the Q1 lever for a reading of 10.
ONCE THE ONE HALF CURRENT POINT IS SELECTED, IT MUST REPEATED EXACTLY!
The test consists of 5 readings of the upper and lower Q1 position for the half current points on the microampmeter
Enter the starting and ending instrument temperature to a 0.1 Deg C.

Start End Degs C. Average

Upper:

Lower:

Q1 Readings at Half Current on MicroAmpMeter

Test Average:

Table value:

@ Average Temp

Difference based on Table Dated 09-21-2002

Accept Start Over eXit:No Save Done(Save)

Record value here

Mercury Lamp Test

- Move Q1 in the opposite direction until the needle once again reads half of the max power peak, and record.
- The needle should move back up to the max power point and then come back down again.

Mercury Test on instrument 083 on 09-28-2004 By: BMW

Info Comment

Perform the Test by moving the Q1 lever first up (lower numbers), then down so the microammeter reads approximately one half the peak reading.
Example: for a peak reading of approximately 19, move the Q1 lever for a reading of 10.
ONCE THE ONE HALF CURRENT POINT IS SELECTED, IT MUST REPEATED EXACTLY!
The test consists of 5 readings of the upper and lower Q1 position for the half current points on the microammeter
Enter the starting and ending instrument temperature to a 0.1 Deg C.

Start End Degr C. Average

Upper: 1st 2nd 3rd 4th 5th

Q1 Readings at Half Current on MicroAmpMeter

Lower:

Test Average:
Table value:
@ Average Temp
Difference based on Table Dated

Accept Start Over eXit:No Save Done(Save)

Record the lower value here

Mercury Lamp Test

- Repeat the upper and lower measurements five times as prompted.
- Record the final temperature of the instrument into the program.
- After completion, click Accept, then Done(Save).
- Accept will give the table difference.

Mercury Test on instrument 083 on 09-26-2004 By: BMW

Info Comment

Perform the Test by moving the Q1 lever first up (lower numbers), then down so the microampmeter reads approximately one half the peak reading.
Example: for a peak reading of approximately 19, move the Q1 lever for a reading of 10.

ONCE THE ONE HALF CURRENT POINT IS SELECTED, IT MUST REPEATED EXACTLY!
The test consists of 5 readings of the upper and lower Q1 position for the half current points on the microampmeter
Enter the starting and ending instrument temperature to a 0.1 Deg C.

Start End Degs C. Average

Upper:

Q1 Readings at Half Current on MicroAmpMeter

Lower:

Test Average:

Table value:

@ Average Temp

Difference based on Table Dated 09-21-2002

Click Accept first

Then Done (Save)

Mercury Lamp Test

- If the results are less than ± 0.3 , the findings are acceptable within the programs parameters.

Mercury Test on instrument 083 on 09-26-2004 By: BMW

Info Comment

Perform the Test by moving the Q1 lever first up (lower numbers), then down so the microammeter reads approximately one half the peak reading.
Example: for a peak reading of approximately 19, move the Q1 lever for a reading of 10.
ONCE THE ONE HALF CURRENT POINT IS SELECTED, IT MUST REPEATED EXACTLY!
The test consists of 5 readings of the upper and lower Q1 position for the half current points on the microammeter
Enter the starting and ending instrument temperature to a 0.1 Deg C.

Start	21.2	End	21.3	Degs C.	Average	+ 21.3
Upper:	1st 80.50	2nd 80.50	3rd 80.50	4th 80.50	5th 80.50	Test Average: 84.25
Q1 Readings at Half Current on MicroAmpMeter						
Lower:	88.00	88.00	88.00	88.00	88.00	Table value: 83.93
						@ Average Temp
						Difference based on Table Dated 09-21-2002
						+0.32

Accept Start Over eXit:No Save Done(Save)

- If the results are greater than ± 0.3 the test needs to be re-done. If the findings on the second test are still above ± 0.3 contact Brooke.Walsh@noaa.gov or Robert.D.Evans@noaa.gov for further instruction.

Standard Lamp Tests

- Always make sure to have the Ground Quartz Plate (GQP) in!!
- Place the lamp holder over the inlet window and attach all cords to the power supply.



Ralph Troutman, NWS Nashville, TN



Standard Lamp Test setup

Standard Lamp Test

- Slide the lamp into the lamp holder firmly, taking care **NOT** to touch the bulb.



Slide into lamp holder touching only the lamp base



The lamp holder needs to be in place over the GQP before sliding the lamp in



Always hold the lamp from the base

Standard Lamp Test

- Hold down the warm up switch on the orange power supply. While holding, flip the power switch and release.
- Continue to hold the warm up switch until the fans finish starting up and the lamp begins to dimly glow. Release the warm up switch.
- Adjust the voltage on the power supply to 24 +/- 0.02 volts.



Powering on the orange power supply



Attach a volt meter to the power supply to verify voltage

Standard Lamp Test

- Let the lamp warm up for approximately 5 minutes.
- Press Alt-E (on the maintenance tab) and scroll down in the menu to Standard.

Main Form: Version date 31MAR04_JogICtime 38

exit Obs Comment Reports maintEnance Info

UTC: 01:41:01 Mu: No Sun

LST: 18:41:01 Local Date: 27 Sep 20

Encoder
Mercury
Standard
Change Q Table
Print Q table
Intercomparison

Help: Bob Evans, 303-497-6679, email: Robert.D.Evans@noaa.gov

to Stop reading encoder encDr_reset

Computer controls speed.

controlled sPEED

Main Menu 083 at Boulder, Colorado, USA Day of Year:272 09-28-2004

No ADDS Obs. today
No AD Zenith Obs. today
No CDDS Obs. today

The Sun Is Under the Horizon -- Only Moon Obs Possible
-- Press Alt O for Menu

DATE AND TIME ARE SET THROUGH WINDOWS- USE A NETWORK TIMESETTER PROGRAM

Standard Lamp Test

- Read the temperature off the thermometer located on the right side of the Dobson, and record into the program.
- Click on the lamp that is in use, located in the drop down menu.

Standard Lamp Test

Info Comment Encoder Check

Choose or enter lamp name. eXit

83Q1 select N-Adj's from 09/27/2004 Using 83Q5

83Q1 ▲ New Temperature A: -1.1 C: -0.9 C': 1.1 D: -1.0

83Q3 ▼ Reference Values.

A: C: C': D:

Q-settings for 21.3 Degs C.

Q1 A: 49.1 C: 76.2 ROD IN D: 107.3

Q2 A: 48.6 C: 75.4 106.6

Test A: Test C: Test C': Test D:

1: 1: 1: 1:

2: 2: 2: 2:

3: 3: 3: 3:

Ave: Ave: Ave: Ave:

Start Accept Reject

Selected lamp

Standard Lamp Test

- Adjust the Q-stops for the A and D wavelengths defined by the temperature setting in the Q-table.
- Set both Q1 and Q2 to the A wavelength or upper setting.
- Turn the R-dial until the meter reads close to 0.
- Increase the sensitivity until the needle has about a $\pm 0.5\mu\text{A}$ “wobble” over 0.

Selected Lamp Test

- Press S on the menu.
- The program will verify what to set the Q-levers values to.

Standard Lamp Test

Info Comment Encoder Check

Choose or enter lamp name. eXit

83Q1	seLect	N-Adj's from 09/27/2004 Using 83Q5			
		A: -1.1	C: -0.9	C: 1.1	D: -1.0
83Q1	New Temperature	83Q1 Ref Vals.			
83Q3		A: 18.1	C: 19.2	C: 80.5	D: 19.4

Q-settings for 21.3

Q1 A: 49.1	Q2: 48.6	Q1: 49.1	Q2: 107.3
Q2 A: 48.6			Q1: 106.6

Test A:

1: []	3: []	3: []
2: []	Ave: []	Ave: []
3: []		

Test D:

1: []	3: []
2: []	Ave: []
3: []	

Waiting for Observer Prompt.

Set the Q-levers for the A wavelength:
Q2: 48.6 Q1: 49.1
To Start the A Measurement No: 1

Continue: Space Bar

Escape key will stop lamp test.

Start Accept Reject

Each setting will pop up before the selected wavelength pair



Alt- S to start

Standard Lamp Test

- With the Q-levers set to the designated values on the screen, begin your measurement by keeping the needle on the meter close to 0.
- Repeat until all measurements are taken.
 - If values have changed considerably, do not accept the values. Re-test.
- If you do make a mistake, you can exit out of the lamp test at any time by hitting the escape key.

Clip of a
Standard
Lamp Test

Movie of meter and lamp test

Standard Lamp Test

- After standard lamps are completed
 - release the lamp from the housing using a screwdriver, levering it between the socket and plug (keep the shield up to prevent the lamp from falling out of the unit).
 - Use vice grips to remove the lamp from the unit, and set aside to cool down.
- After cooled, return the lamps to their holders and store away.



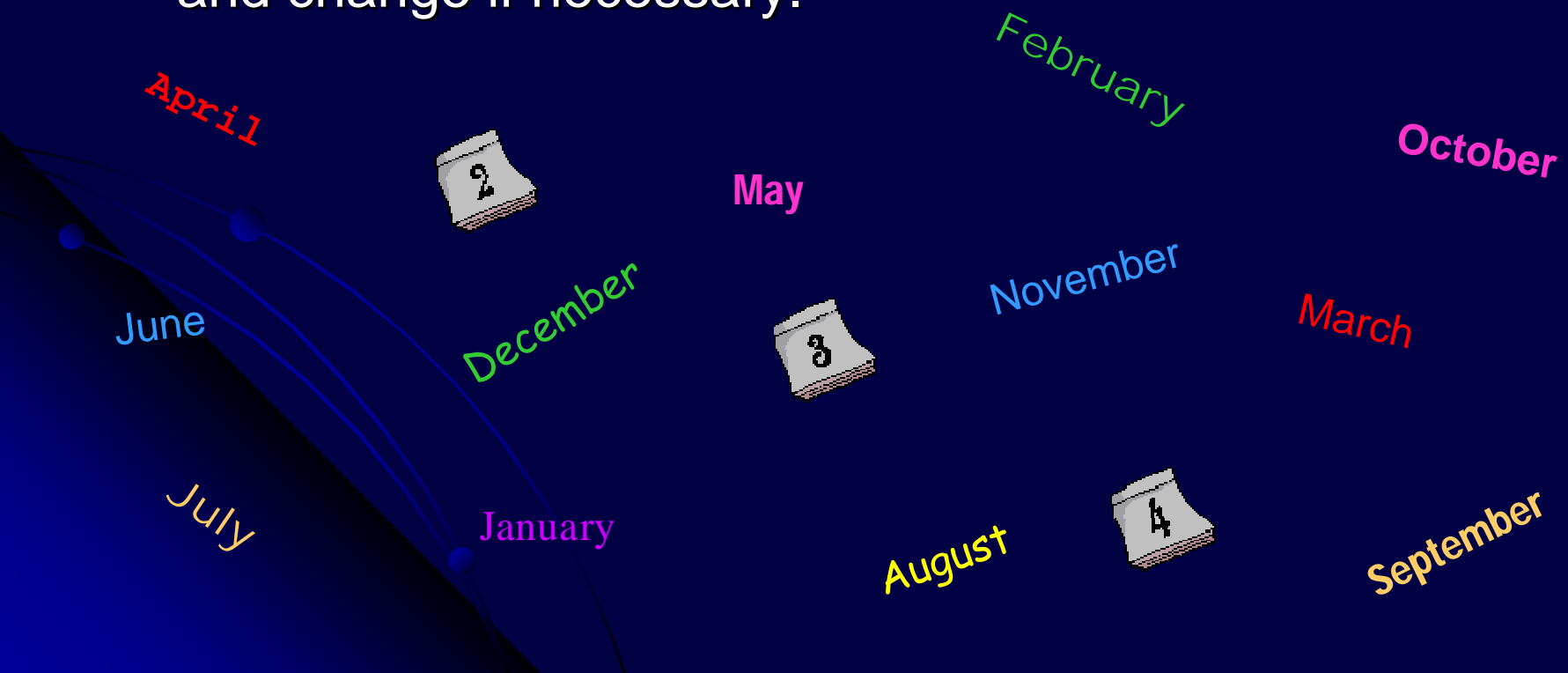
Each station should have at least two standard lamps



Return the lamp to the holder and store in a cool dry place

Lamp Test

- Standard lamps are to be done the **first week** of each month.
- Use the lowest numbered lamp once a month, all lamps every three months.
- After running the lamps, one should check the **desiccant** and change if necessary.



Problems and Questions

- **If your standard lamp test fails:**
 1. **DON'T PANIC!** Re-do the test again.
 2. Reference the standard lamp section in this guide to make sure all steps have been completed.
 3. Double check all of your settings.
 4. Verify that the lamp power supply is at **24 volts** with a volt meter.
 5. Check to see if the bulb is failing.
 6. Has the lamp warmed up for at least five minutes?

Problems and Questions

- **If your standard lamp fails to ignite:**
 1. **DON'T PANIC!** Try another lamp to see if you can get another bulb to light.
 2. If you cannot get any of the bulbs to light:
 1. Double check all power connections to and from the lamp housing unit and try to re-ignite the bulbs.
 2. Hold down the warm up switch longer than normal to see if you can get the bulbs to light after powering up.
 3. If the lamps still do not light:
 1. Contact us in Boulder, your power supply has either failed, or is failing.

Problems and Questions

- Reference the online [Dobson Troubleshooting guide](http://www.cmdl.noaa.gov/gallery/dobson_troubleshooting)
http://www.cmdl.noaa.gov/gallery/dobson_troubleshooting
- If a lamp breaks
 - Collect the pieces carefully and ship back to Boulder.
 - Contact Brooke.Walsh@noaa.gov to notify which lamp broke, and the highest numbered lamp the station has remaining.

Problems and Questions

- Record the problem you are having in the program under the comments section (Alt-C).

Main Form: Version date 31MAR04_JogICtime 38

eXit Obs **Comment** Reports maintEnance Info

UTC: 19:15:52 Mu: 1.352 R-Dial: NoEnc Help: Bob Evans, 303-497-6679, email: Robert.D.Evans@noaa.gov

LST: 12:15:52 Local Date: 28 Sep 2004 UnCheck to Stop reading encoder encDr_reset

Place a comment in the day file.
Type in a Comment and press ENTER; or press Escape to return to

type your comments here...

Main Menu 083 at

Short Cut Keys

F1:ADDSGQP	F3:ADZB	F5:CC'ZB
F4:ADZC	F6:CC'ZC	

Currently in the high Sun mu range.
Multiple Observations on various observation types is always useful

DATE AND TIME ARE SET THROUGH WINDOWS- USE A NETWORK TIMESETTER PROGRAM

Problems and Questions

- If you're still having trouble with your standard lamps:
 1. Run the other lamps to see if they fail also.
 - If all lamps fail, report the incident immediately.
 - If other lamps pass, record the results into the comments section and send an email to Boulder.
 2. Check for any sort of water damage around the instrument. The Dobson may have been damaged and needs immediate attention. **REPORT IMMEDIATELY!!**



Water damage near the seal on the Dobson. Water in the instrument can cause SIGNIFICANT damage

Problems and Questions

- If you are having trouble with your **mercury lamp tests**:
 1. Confirm the settings on the Q-levers are accurate.
 2. Verify the lamp has warmed up for at least five minutes.
 3. Check the temperature of the instrument, values more than a degree apart can cause the test to fail.

Problems or Questions

- If you continue to have trouble with your mercury lamp test, please do not hesitate to email or call the station liaison,

Brooke Walsh at:

Brooke.Walsh@noaa.gov (303) 497-6666

Or Bob Evans at:

● Robert.D.Evans@noaa.gov (303) 497-6679

Some problems are easy to deal with, others may require further investigation. Either way, let the staff in Boulder know. We are here to help!!

Conclusion

- Lamps are an essential part to the upkeep of the Dobson network.
- Monthly processing depends on the timeliness of the lamps tests.
- If you have any questions please do not hesitate to contact us in Boulder with any further questions.



Staff in Boulder NOAA / CMDL



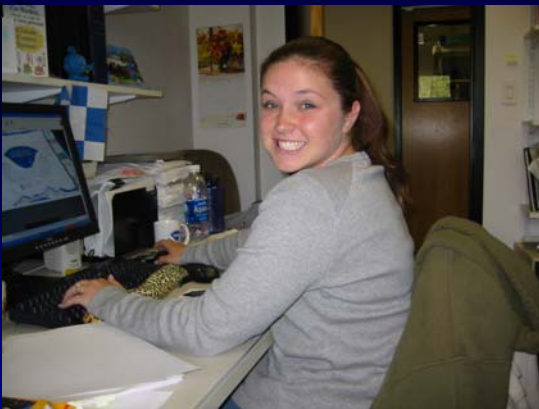
**Bob Evans, Project
Leader of Dobson
Total Ozone**



**Dorothy Quincy, Data
analysis, Dobson operator**



**Sam Oltmans,
Supervisory Physicist
Head of Ozone and
Water Vapor NOAA /
CMDL**



**Brooke Walsh, station liaison,
data analysis, Dobson
operator/maintenance**



**Mark Clark, data
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operator/maintenance**

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