Environment and Climate Change Canada
Environnement et Changement climatique Canada

Brewer Spectrometer Maintenance SOP

The Canadian Brewer Spectrometer Network

Réseau Canadian de spectrophotometric – Brewer

Updated: November 26, 2021

Version 2.2

By: Reno Sit

Canada

Contents

1. Important Notes

This standard operating procedure (SOP) is adapted from the Alert Global Atmosphere Watch (GAW) lab wiki document prepared by Kevin Rawling and Michael Brohart. This SOP is written for the Environment Climate Change Canada's Canadian Brewer Spretrometer Network and hence the contents are described as such. For questions on any parts of the SOP, please contact Michael Brohart (Michael.Brohart@ec.gc.ca) or Reno Sit (reno.sit@ec.gc.ca).

2. Principle of Operations

Brewer spectrophotometers track the Sun or Moon, and use a spectrometer combined with a photo-multiplier tube to take high-precision measurements of the intensity of ultraviolet light reaching the Earth's surface. These measurements are taken at the absorption wavelengths of ozone, which allows the total amount of stratospheric ozone in a column between the instrument and the Sun to be calculated.

Measurements made at this station are part of a worldwide network of 200+ currently operational Brewers in 40 different countries. Alert is the northernmost location in this network, while the Amundsen-Scott station at the South Pole is the southernmost. The data from these instruments are collected and analyzed to create a model of the Earth's stratospheric ozone cover.

3. Task List

• Software Check	Daily
• Dome/Lens Cleaning	Daily
• Drive Plate Cleaning	Monthly/Bimonthly
• Steps per Revolution Check	After Drive Plate Cleaning
• Sun Sighting	Twice monthly
• Moon Sighting (Polar sites)	Once monthly - Moon $^{3}/_{4}$ full or more
• Desiccant Change	As required
• Installing/removing winter covers	Before/After cold season if applicable

2.1 Daily Task

2.1.1 Dome/Lens cleaning

Tools and materials required

- Methanol
- Kim wipes
- Nitrile Gloves
    - Wear a glove to prevent methanol from contacting the skin.
    - Reuse glove if completely intact.

Methanol is toxic. Avoid inhaling and skin contact. Please wear nitrile gloves when using methanol to

Procedure

- Visual inspection and cleaning of the dome and window should be done daily
- Remove any snow accumulation using a non-abrasive soft-bristled brush
- Moisten a Kimwipe with methanol and clean the Brewer dome and windows complete to their edges

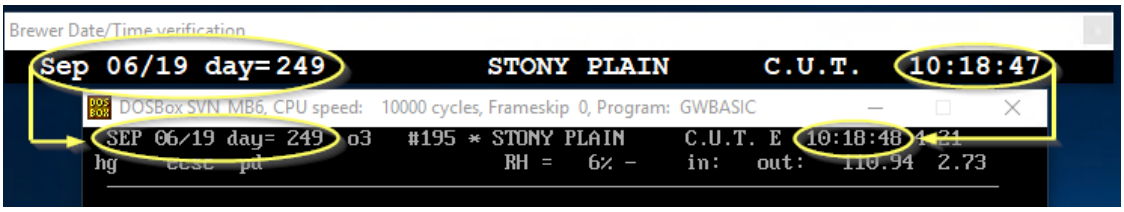
- If there is any ice accumulated on the window/dome, that can easily be removed, gently do so. Ensure hard objects do not accidentally come in contact with the quartz glass. (e.g. rings worn on the hands). If the ice is firmly attached to the window/dome, apply a small amount of methanol directly to act as a de-icer and allow the heater inside the Brewer will slowly melt the ice over time.

> ⚠ Never chisel the ice off the dome or window! Since glass is not fully transparent to UV wavelengths, the domes and window are made from precision-machined fused silica (quartz) which makes them extremely expensive to replace!

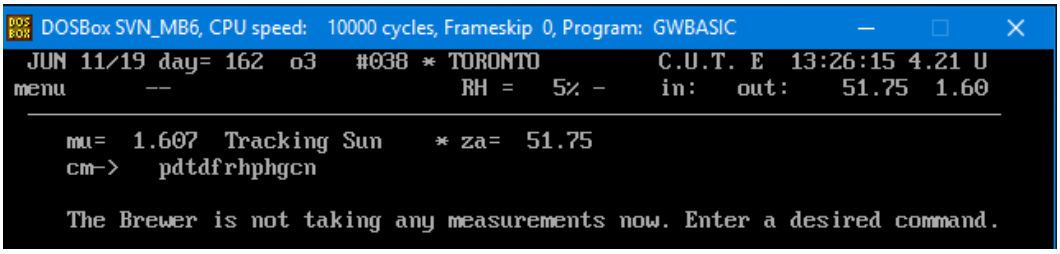
- Enter into the "Additional Notes" of the log form the presence of any ice build-up that cannot be removed.

2.1.2. Software check

1. Check if the Julian day in the Brewer software window is correct



   a. If the Brewer software is more then five (5) seconds off, report it in the addition notes section of the log form.
   b. Update the time by performing the following.
      - In the Brewer software window, press [HOME] to get into the main menu (This may take a few minutes depending on what the Brewer is currently doing.
      - Once the software gets to the menu, type 'pdtdfrhphgcn' [Enter]. This will update the time, locate the micrometers to their proper positions and restart the schedule.



2. If the Brewer was not running a schedule, type "skc" [Enter] to display a list of available schedules for use. Record in the log form that the Brewer had been out of scheduled operation, for what purpose it was taken out of schedule and the time it was returned it to schedule. If the Brewer was running on a schedule, typing "cn" [Enter] will return it back into the schedule it was running.
3. Inspect at the RH level and ensure that it is under 15%. (Note: The lettering will turn red once it hits 18% and above) The RH level may be artificially higher after a rainy/snowy day.
4. If the Brewer is found to be out of scheduled operation and is on "menu", type "recn"[ENTER] to reset all motors and restart the schedule. Inform the Brewer network staff of the instrument interruption so they can further diagnose the cause.

2.1.3. Log form

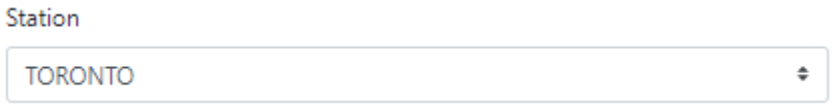
Purpose

The purpose for this log form is to provide ECCC Brewer technicians historical information on operator's daily task as well as any additional information such as program modifications, schedule changes, and other abnormalities. This web base form is an example of what ECCC operators uses, and can be replaced with any other format such as excel.

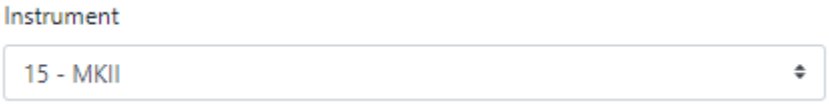
For a detail description of what each section does/is for, refer to Appendix A – Log Form.

Procedure

1. Open the Brewer network log form page (Default link is http://localhost/Brewer/Forms/BrewerLogForm.php)
   2. Select the station (i.e.,: Toronto)

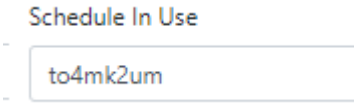
   3. Select the instrument (i.e.,: 015 – MKII)

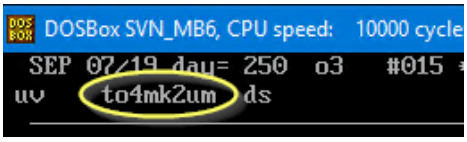
      

   4. Select the operator (I.e.,: Sit, Reno)

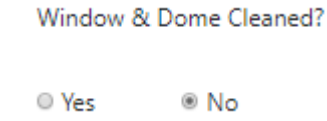
      

5. Verify the schedule in use is correct

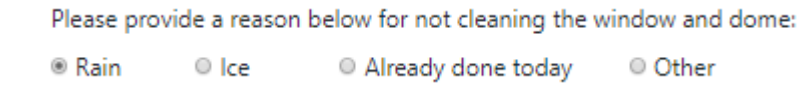
   

   6. Select either the windows is cleaned or not

      - If not, enter the reason why it was not cleaned

      - if "other" is selected, enter in the reason under additional notes at the bottom of the page

   7. Indicate a new humidity reading by selecting the "yes" button and adding the RH value in the Relative Humidity box, otherwise check no.

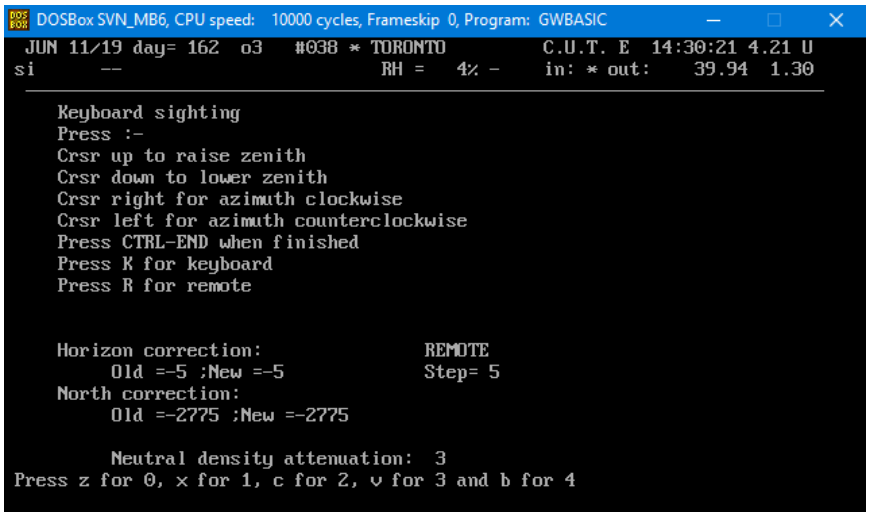
   8. Click save when all sections are completed, a Prompt will pop up saying "File successfully saved" Press OK.

   9. Repeat until a log for each instrument is completed.

2.2. Sightings

The Sun sightings need to be performed approximately every 2 weeks. If the operator's schedule allows, the optimal time for a sighting is roughly half way to, or after solar noon. A good estimation would be 2-2.5 hours either side of solar noon. Often operators may not be on site during these hours. In these cases attempt a sighting at the best time the schedule will allow. When sighting on the Moon during the winter, it will be easiest to sight the instrument when the Moon is near ¾ or more illuminated and close to its upper transit. If a Moon sighting is being performed, most of the lights near the Brewer will need to be turned off to allow your eyes time to adjust and detect the dim light over the entrance slit.

1. At the Brewer software prompt, type 'si' [ENTER] for a Sun sighting, or 'sim' [ENTER] for a Moon sighting.



2. Proceed to the Brewer and remove the viewing window cover.
3. Position yourself so that you do not block the light of the Sun or Moon from entering the aperture of the instrument (Light needs to enter at the slanted window and an operators shoulder can easily get in the way during sighting).
4. Look into the 'entrance slit viewer' and use the four push buttons on the front of the Brewer to centre the Sun's or Moon's image across the entrance slit.

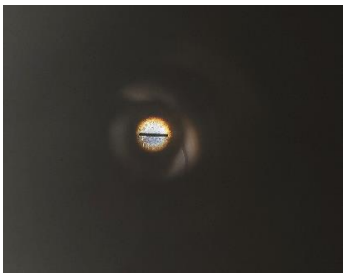
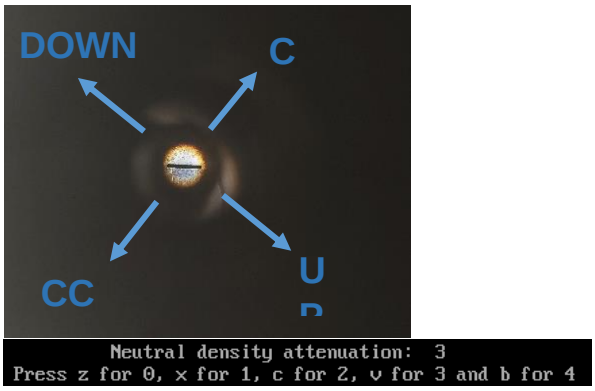


Image seen inside Brewer entrance slit viewing port

5. Replace the viewing window cover and return to the Brewer computer.
6. In the Brewer software, press [CTRL]+[END] to exit the sighting menu.
7. If a statement in red comes up saying “The adjustments are unusually large. Do Not save unless absolutely certain” it may mean the instrument was mis-positioned before the sighting. Type ‘N’ to keep the old values, then at the prompt type ‘tdazzesi’ [ENTER] (or for a Moon sighting ‘tdazze” [ENTER] then at the prompt type ‘sim’[ENTER]). This will ensure the correct time (td); set the azimuth reference position (az); set the zenith reference position (ze) and re-enter the sighting mode (si/sim). Redo steps 2-7. If the warning is still displayed after re-referencing the azimuth and zenith, contact the Brewer technician before proceeding.
8. If the only the statement, “Do you want the values saved? (Y/N) is displayed, type ‘Y’ to save the new values.
9. Record the new sighting values from the Brewer window into the log form as shown below. Click yes for “Sighting” and enter the corresponding values.

Sighting		Last sighting done on:	Horizon Correction (Steps)	North Correction (Steps)
◉ Yes	○ No	06/03/2019	-2	255

10. Type ‘cn’ [ENTER] to re-enter and continue the schedule.

Tips 1:	Tips 2:
You should be able to do a sighting even if it is slightly overcast. As long as a shadow is cast by the Sun, you should be able to see the Sun’s disc on the instruments entrance slit. The default ND filter setting is normally adequate. However if the image seems too bright or too dim you can adjust the brightness of the image by changing the neutral density (ND) filter setting, This is done by pressing z,x,c,v,b while in sighting mode. The lower the ND filter number, the brighter the image (use with thin cloud) and the higher the ND filter the dimmer the image.	The sighting buttons move the Sun’s image in the entrance slit viewer as shown. 

2.3. Drive Plate Cleaning

Tools and Materials Required

- Methanol
- Kimwipes
- Nitrile Glove
  - Wear glove to prevent methanol from contacting the skin.
  - Reuse glove if completely intact.

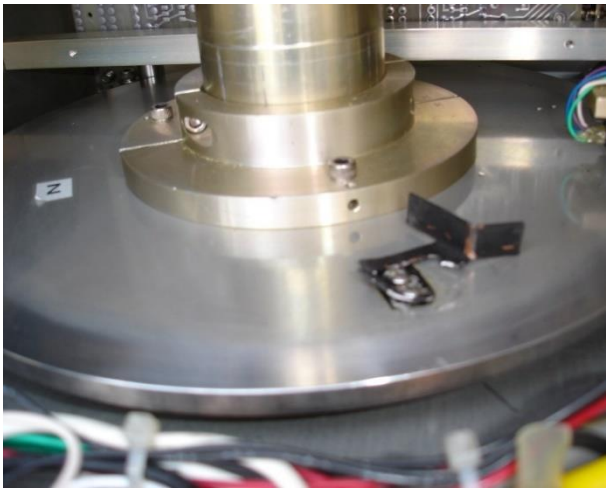
⚠ Methanol is toxic. Avoid inhaling and skin contact. Please wear nitrile gloves when using methanol to

Procedure

1. Press [HOME] in the Brewer software window to return to the command prompt.
2. Proceed to the Brewer instrument and switch off the tracker using the power button located on the side of the Tracker (not Brewer).

3. Remove the transparent magnetic cover of the tracker.

4. Clean only the edge of the drive plate, using a Kimwipe with a modest amount of methanol. Avoid the top of the plate to ensure the Kimwipe does not accidentally catch and bend the reference flag. Rub the drive edge briskly while slowly turning (slow walking pace) the tracker through 360° of clockwise rotation to access the entire circumference of the plate.



Even a small change to the bend on the reference flag can destroy the flag if it hits rather than passing through the sensor

5. After the plate is fully cleaned, inspect and clean the drive shaft where the shaft and plate meet. Also ensure the Kimwipe is not accidentally drawn under the drive shaft. This will press the fibers of the wipe onto the plate edge and leave a spot that the drive will slip on if not properly removed and re-cleaned.
6. If excessive methanol is used or it is too cold for the methanol to evaporate quickly, the drive plate edge should be re-wiped with a dry portion of the Kimwipe after cleaning
7. If any aluminum flakes are present on the drive shaft bearing, wipe clean; make an entry into the log form and inform the Brewer network staff.
8. Replace the transparent tracker cover and ensure that it is properly sealed.
9. Press the power button on the side of the tracker to turn it back on.
10. Complete a Steps per Revolution
11. Continue with a sighting or type ‘cn’ [ENTER] to re-enter and continue the schedule.

2.4. Steps Per Revolution

The steps per revolution check should ideally be done immediately after a drive plate cleaning. Ensure the methanol used in cleaning has completely dried from the plate or has been wiped with a dry Kimwipe after cleaning.

Procedure

1. Press [HOME] in the Brewer software window to return to the command prompt, if not already done during drive plate cleaning.
2. Type ‘sr’ [ENTER] to determine the steps per revolution. (This will take some time.)
3. Record the steps/rev value and date in the ‘Additional Notes’ section of the Log form.
4. Press [Y] in the Brewer software window to save this new steps/rev value. If it differs by more five steps from the previous value, repeat steps 2 and 3.
5. At this point a sighting should be performed. Proceed to the next section to perform the sighting or, if a sighting cannot be done, return the Brewer to its schedule by typing ‘cn’ [ENTER] to continue the schedule or ‘skc’ [ENTER] and enter in the desired schedule name excluding the extension.

2.5 Desiccant Change

Tools and Materials Required

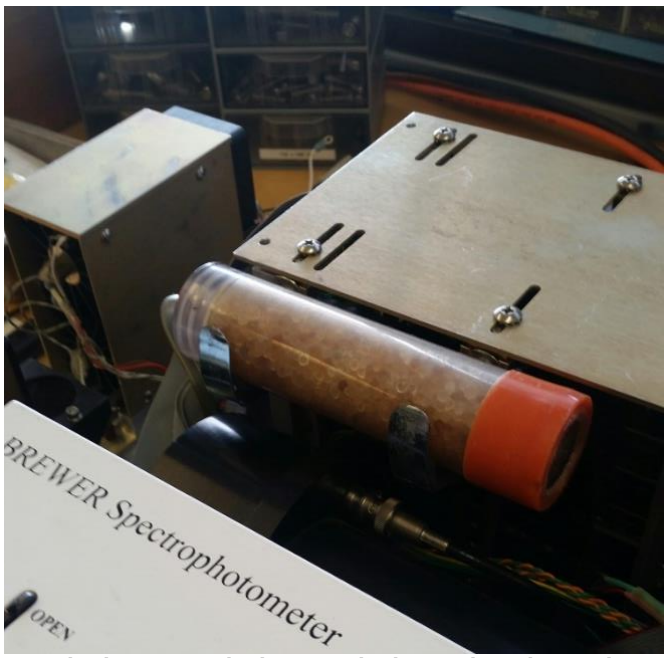
- Desiccant cartridge
- Desiccant tub
- UV dome cover

> ⚠ Do not perform a desiccant change if it is raining, snowing or foggy. The inside of the Brewer should never be exposed to

Note: The desiccant can be changed if the instrument needs to be entered for other reasons but normally is only changed when the displayed humidity moves above 15%

1. Press [HOME] in the Brewer software window to return to the command prompt.
2. Fill the spare custom-designed plastic box and tube with fresh desiccant.
3. Remove the insulating covers from the Brewer if present. (They should be used if temperature is below -10°C.)
4. Go to the Brewer and place the protective UV dome cover over the quartz UV dome to protect it from damage.
5. Undo the four latches securing the top cover and remove it. (After undoing the latches it is best to retighten/shorten them before removing the cover. This will prevent them from hooking onto the instrument, make removing the cover much easier.)
6. Exchange the desiccant box and tube.

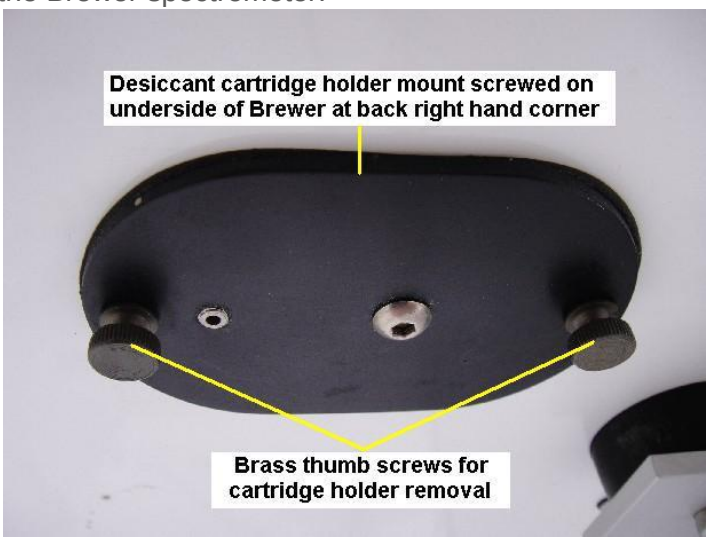
a. Single Brewers (Smaller)



Single Brewer desiccant tube located on the card cage.

Single Brewer desiccant tube located beside the spectrometer

b. Double Brewers (Bigger). The tube of desiccant will look like the one from a single Brewer, but it will be located in the middle of the Brewer spectrometer.



Double Brewer desiccant tube location and instructions on how to remove it.

7. Replaces the Brewer cover and secure it in place with the latches. Remove the protective UV dome cover. Take the spent desiccant back to be re-charged.
8. Return to the computer. If no other maintenance is to be performed then type 'cn' [ENTER], to re-enter and continue the schedule.
9. Enter into the Log form, in the "humidity checked" section, that the desiccant has been changed.

> ⚠ Please note it may take an hour or two for the humidity level to return to normal after the instrument cover has been off.

10. Place the expired desiccant in a bread pan and bake it at 150°C for a few hours, until it regains its original colour, using the provided toaster oven. When dried, return the desiccant to its container immediately. Be sure to switch off the oven afterwards!

Pan of spent desiccant

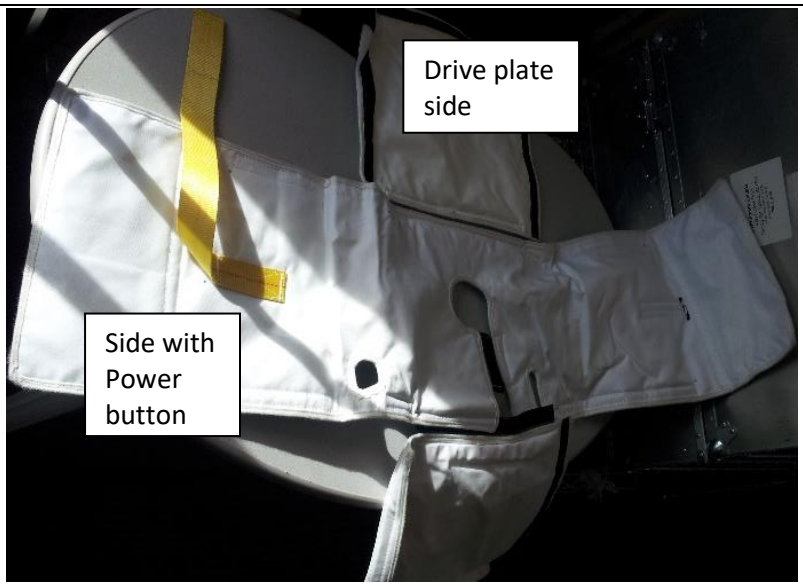
> ⚠ Do not leave the oven running unattended!

2.6. Installation/Removal of Winter Covers

The Brewer winter cover is required to be on during the colder months of the year. They should be on when temperature drops below 10^{o}c

Procedure:

1. First unwrap the insulated covers and separate Brewer and tracker covers.
2. Install the tracker's cover's first



a. First loop the bottom of the cover around the neck of the tracker as shown

b. Slide the strap above the tracker (below the Brewer)

c. Insert the strap through the open slit of the opposite side of the tracker cover	
d. Velcro the other two sides (front and back) as shown.	

3. Install the Brewer’s cover

a. Place the cover on top of the Brewer

b. Velcro the bottom of the front and rear Brewer cover to the tracker's cover	
c. Velcro the bottom sides of the Brewer cover to the tracker's cover	

3. Lamp Replacement

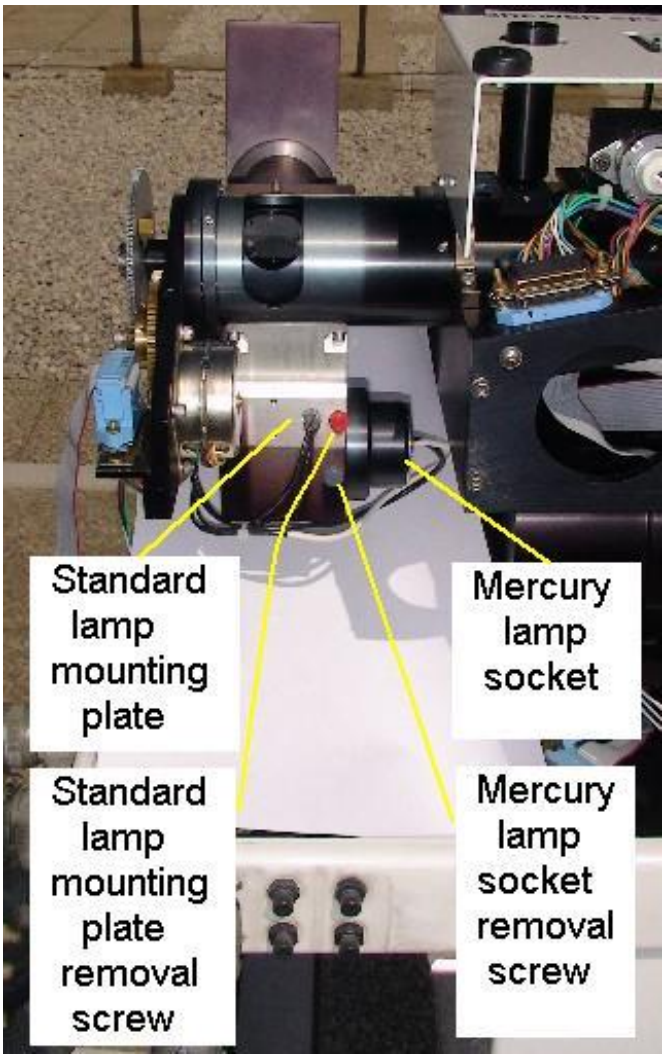
There are two different lamps used. The standard lamp and the mercury lamp. These should only be changed when instructed to by and in cooperation with the Brewer network staff.

3.1. Mercury Lamp

Tools and Materials Required

- New Mercury Bulb
- UV Dome cap
- UV Rated safety glasses
- Nitrile Glove
  - Wear glove to prevent skin directly contacting and leaving residue on the lamp
  - Reuse glove if completely intact.

> ⚠ Light emitted from the bulbs contains UV wavelengths that are harmful to your eyes. Always wear UV rated safety glasses while doing



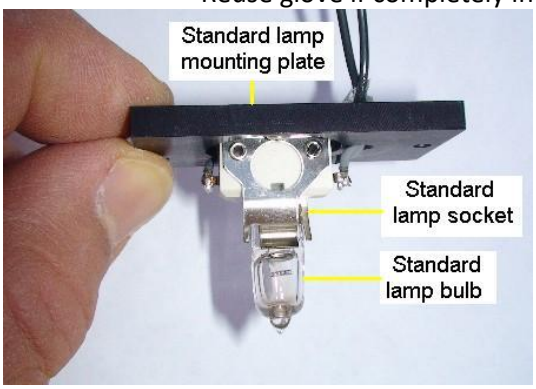
Procedure

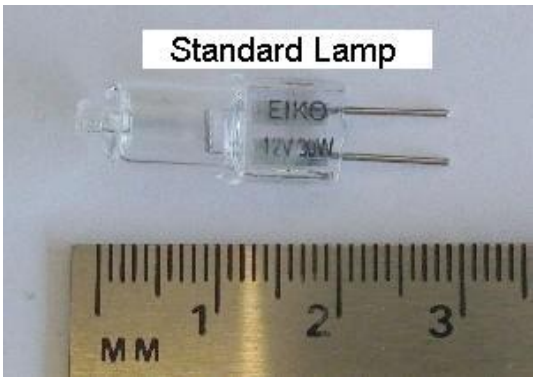
1. Press [HOME] in the Brewer software window to return to the command prompt.
2. Type “b0” at the menu prompt to turn off the lamp.
3. Close the DosBox (Brewer) software.
4. **Turn off the Brewer power**
5. Go to the Brewer. Remove the insulating covers from the Brewer if present.
6. Place the protective UV dome cover over the quartz UV dome to protect it from damage.
7. Undo the four latches securing the top cover and remove it. (After undoing the latches it is best to retighten/shorten them before removing the cover. This will prevent them from hooking onto the instrument and make removing the cover much easier.)
8. There are two black thumbscrews (one on the front and back of the lamp housing) to remove the mercury lamp holder from the housing. Loosen but do not completely remove the thumbscrews
9. Carefully remove the mercury lamp holder from the housing. (With smaller/single Brewers it gets tight to pull it out, be careful to avoid damage of the ribbon cables and wires.
10. With a kimwipe or gloves, unscrew the mercury lamp and replace it with a new bulb. (Ensure the bulb’s filament is 45 degrees to the lamp holder guide pin)
11. Return the bulb holder back into the lamp housing. Note the guide pin should be aligned upward (top dead centre) to mate into the housing properly.
12. Tighten the thumb screws; return the Brewer cover and secure the latches; return the insulated cover if present; remove the dome cover and turn the Brewer power back on
13. At the computer, re-launch DosBox (Brewer) software.

3.2. Standard Lamp

Tools and Materials Required

- New standard lamp Bulb
- UV Dome cap
- UV Rated safety glasses
- Nitrile Glove
  - Wear glove to prevent skin directly contacting and leaving residue on the lamp
  - Reuse glove if completely intact.





> ⚠ Light emitted from the bulbs contains UV wavelengths that are harmful to your eyes. Always wear UV rated safety glasses while doing

Procedure

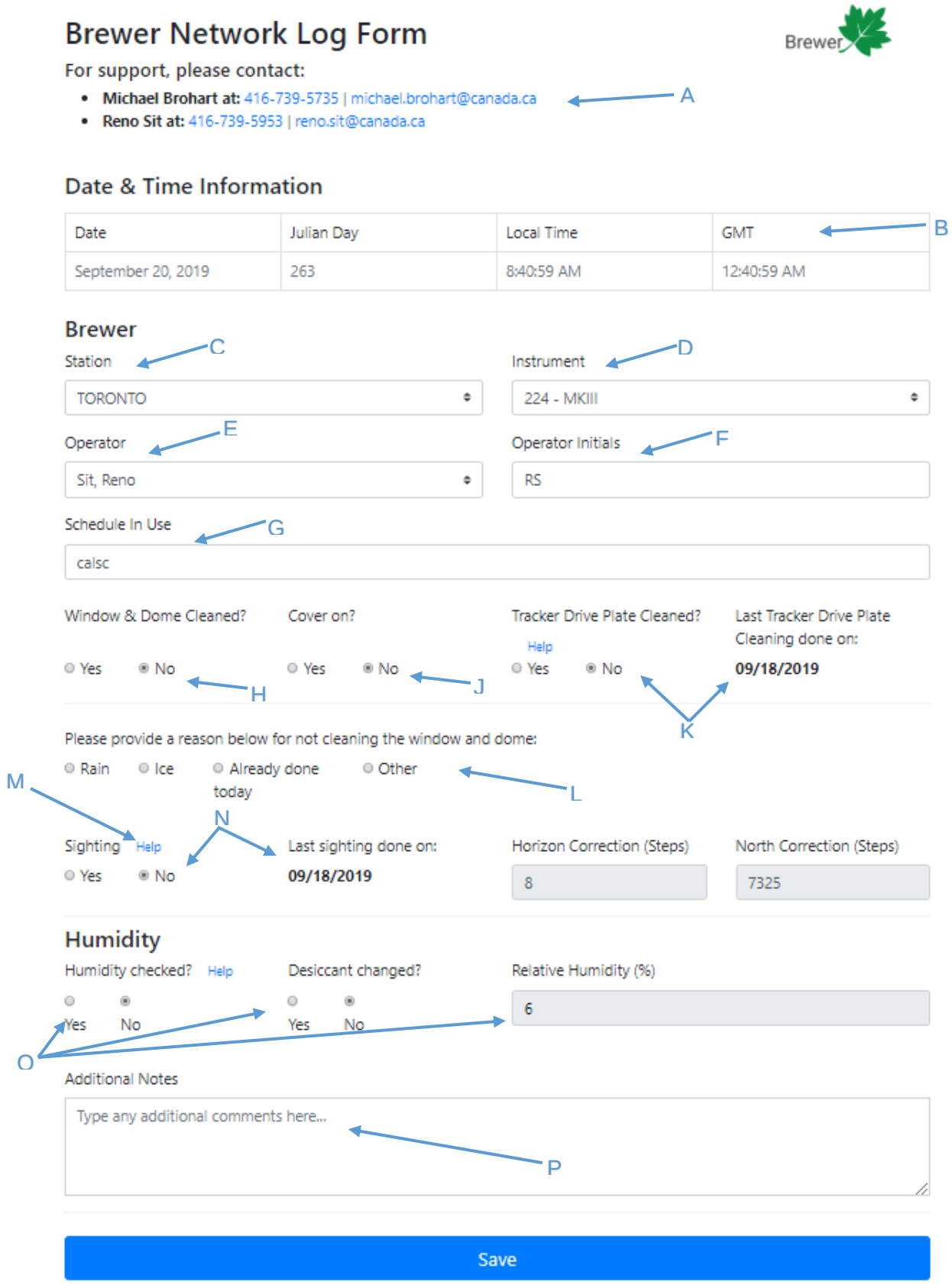
1. Press [HOME] in the Brewer software window to return to the command prompt.
2. Type “b0” at the menu prompt to turn off the lamp.
3. Close the dosbox (Brewer) software.
4. **Turn off the Brewer power**
5. Go to the Brewer. Remove the insulating covers from the Brewer if present.
6. Place the protective UV dome cover over the quartz UV dome to protect it from damage.
7. Undo the four latches securing the top cover and remove it. (After undoing the latches it is best to retighten/shorten them before removing the cover. This will prevent them from hooking onto the instrument and make removing the cover much easier.)
8. The red thumbscrew(s) at the front of the lamp housing need to be fully removed to take the standard lamp mounting plate off the housing.
9. IF the lamp has been off (this lamp gets HOT allow time to cool if it has been on) use a kimwipe or gloves to remove the standard lamp bulb out of the socket by pulling and wiggling the bulb strait away from the socket. Carefully replace it with a new bulb by aligning the pins to the socket holes then pushing and wiggling the bulb until fully seated.
10. Return the standard lamp mounting plate back onto the lamp housing and reinstall the thumbscrews.
11. Return the Brewer cover and secure the latches; return the insulated cover if present; remove the dome cover and turn the Brewer power back on.
12. At the computer, re-launch DosBox (Brewer) software.
13. Once the software gets to the main menu, type in ‘b2’ [ENTER]

14. Return to the Brewer to ensure the light band is over the iris hole as shown in the image below. If not please contact the Brewer technical team for more instructions.

Good: Band of light correctly over the iris hole.

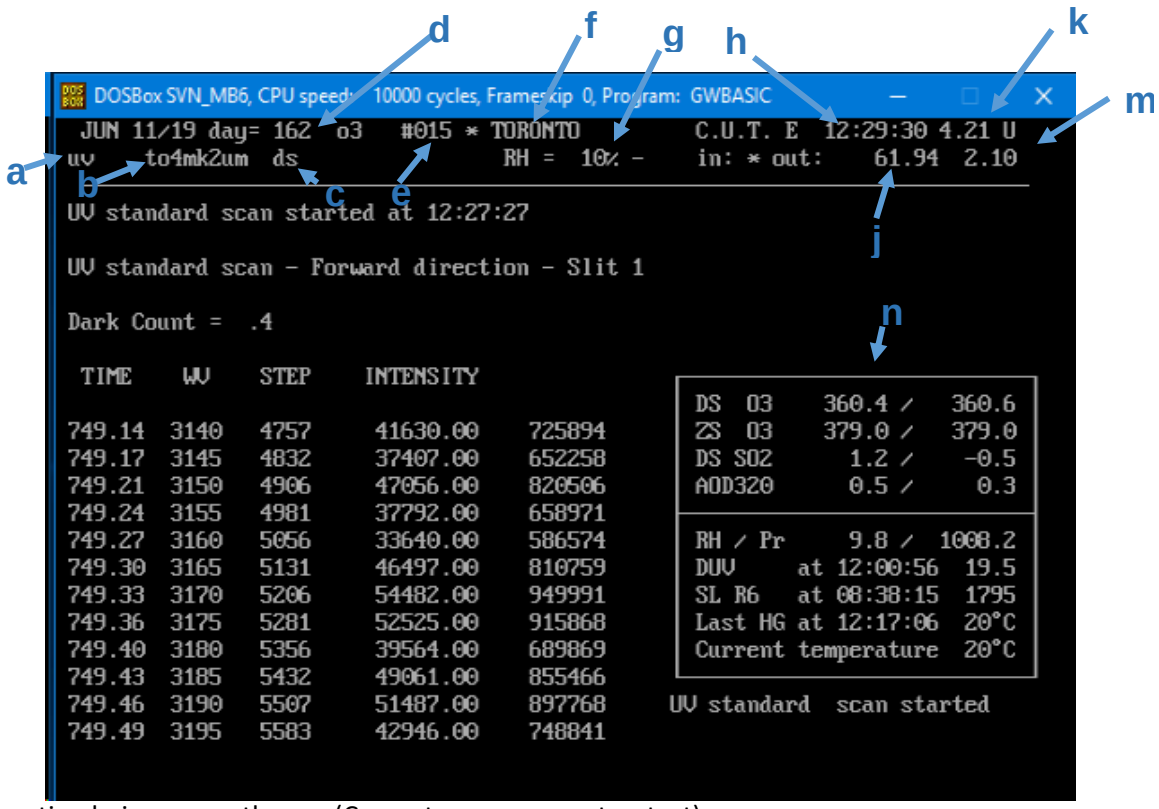
Bad: Band of light not directly / completely over the iris hole

i. Appendix A – Log Form



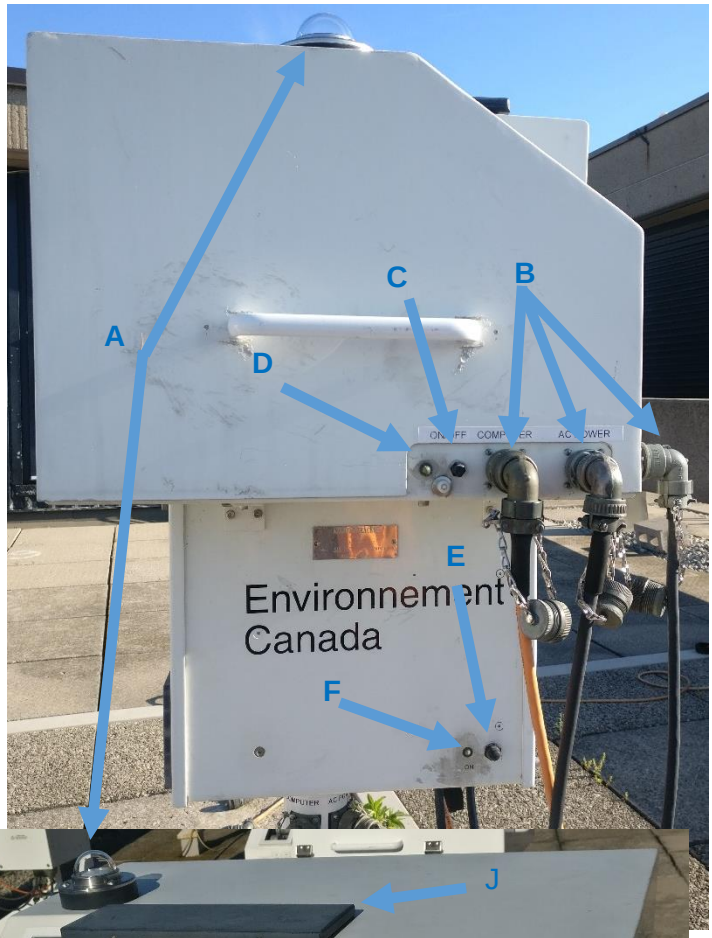
A) Contact info: This location indicates the latest and most up to date contact information
B) Date & Time: Date and time information is based on the computer date & time. Local time is based on the station selected in cell "C".
C) List of Stations: Select your location/station
D) Instrument: Brewer serial # based on the location selected in cell "C".
E) Operators: List of the operator that is at your station. This is based on the location selected in cell "C". If an operator is missing, select other. This will open up 4 extra fields to enter your First and last name, phone number and email. You should inform the Brewer network staff (contact info at A) if there are any new operators.
F) Operator's initials: this field is automatically filled in based on cell "E"
G) Schedule in used: Schedule input from the "skc" command and is currently being ran by the Brewer.
H) Window & Dome Cleaned?: Part of you daily task for window & and dome cleaning, check if yes or no. If you press No, Section L will show appear.
J) Cover On?: Indicate rather or not the brewer covers are installed. A timed pop up will appear to remind the operator that the cover needs to be on or not. This is controlled by the site location.
K) Tracker drive plate cleaned?: An indicator if the Tracker drive plate was cleaned and when it was last completed. (This will only get updated after 16:00 GMT)
L) Please provide a reason below for not cleaning the window & dome: Provide an explanation why the windows & domes were not cleaned. If the common radio buttons are not appropriate, choose "Other" and provide the description in the "Additional Notes" section of the form.
M) Help: These are tool tips for the related section. This will include things you should do as well as how to setup the brewer for it. This appears in Drive Plate Cleaning, Sightings, Desiccant Change
N) Sighting: An indicator if the Brewer was sighted, and when it was completed last. (This will also show the values from its previous sighting) if checked yes, the Horizon/north correction will change colour and allow you to enter a new value. The completed last section only gets updated after 16:00 GMT
O) Humidity check: An indicator if the Humidity reading was noted. If so, click "Yes" and enter in the current RH. When the desiccant is changed, indicate by clicking "Yes" at the appropriate radio button.
P) Additional notes: enter any extra information that may be important. i.e.: "the Brewer was sitting on menu when found"; "HG bulb was changed"; "icing formed over the windows/dome and", etc…

ii. Appendix B – DosBox



a) The routine being currently run. (Current measurement or test)
b) Current schedule in use
c) Shows the next routine to be run.
d) Day of the Year (JDay)
e) Instrument serial number
f) Location of the instrument
g) Current relative humidity inside the Brewer. The arrow beside it indicates an upwards/downwards/no trend.
h) Current UTC(GMT) time
j) Current Sun angle from zenith (overhead would be zero and the Sun on the horizon would be 90)
k) Software version
m) Current mu (The amount of atmosphere. Directly overhead would be 1 atmosphere. Any angle would cause a larger slant amount and is a multiple of 1 atmosphere)
n) Table shows the measured value and average value
    - DS – O3: The ozone via direct Sun measurements. Last/Average readings.
    - ZS – O3: The ozone via zenith sky measurements Last/Average readings.
    - DS –SO2: The SO2 via direct Sun measurements Last/Average readings.
    - AOD320: Aerosol optical depth. A measurement of light reduction from particles. Last/Average readings.
    - RH/PR: Shows the current Relative humidity and pressure inside the Brewer.
    - DUV: Daily UV value ($\frac{DUV}{25} = UV\ Index$)
    - SL R6: shows the current R6 value. (For diagnostic purposes)
    - Last HG at: Shows when the last HG was completed and at what temperature. If an indication in RED of "Last HG Failed" please note it in the log and inform the Brewer network staff.
    - Current temperature: shows the current temperature inside the Brewer.

iii. Appendix C – Brewer Spectrometer parts



A) UV Dome: Ordinary glass blocks UV light. The UV dome is made from precision-machined Fused Silica (Quartz); transparent to UV wavelengths. This component of the Brewer is very expensive to replace. ***Note: When ever the Brewer cover is taken off, you should always put a UV dome cover on!***
B) Brewer cables: Cables coming from the tracker to the Brewer. From left to right, Computer (Data), AC power and Azimuth (tracker control).
C) Brewer Power Button: Push button for the Brewer's power
D) Brewer Power LED: Brewer power LED indicator
E) Tracker Power Button: Push button for the tracker's power
F) Tracker Power LED: Tracker power LED indicator
G) Magnetic Cover: a magnetic cover to access the drive plate for drive plate cleaning
H) Zenith Window: Simpler to the UV dome, the UV window is also made from Fused Silica (Quartz).
J) Viewing Window Cover: The viewing window cover, friction fits over viewing window where the iris viewing port; the filter wheels and the entrance slit viewing port are found. The viewing ports are used while sighting the instrument.
K) Sighting buttons: The buttons used to adjust the tracker position and Brewer optics-pointing while in sighting mode.
L) Cover latches: Latches to remove the Brewer main cover. Twist counter clockwise to extend and unlatch, tip away from the base hooks then twist clockwise to retract the latches to ensure the latches do not snag the base hooks and inhibit removal of the cover.

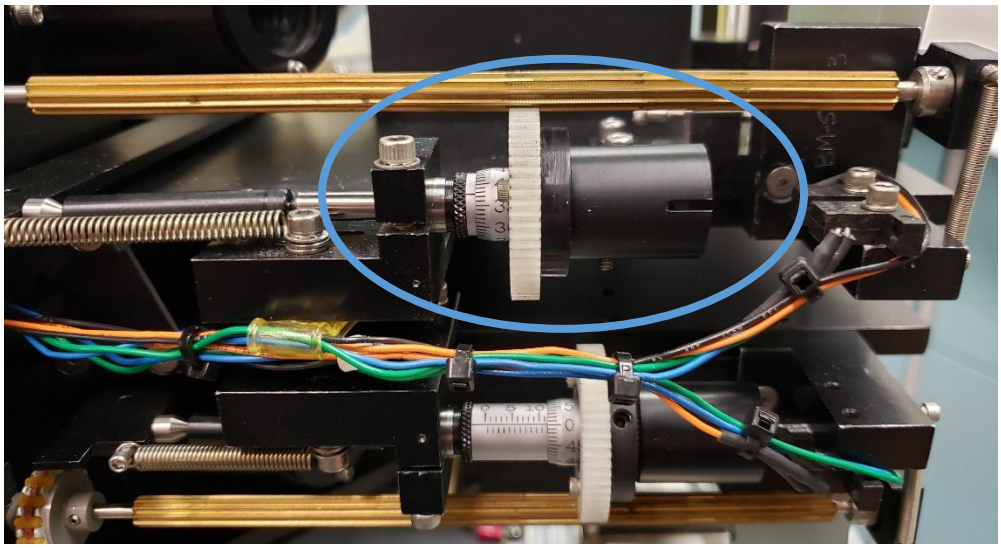
iv. Appendix D – Troubleshooting

a. Micrometer Jam

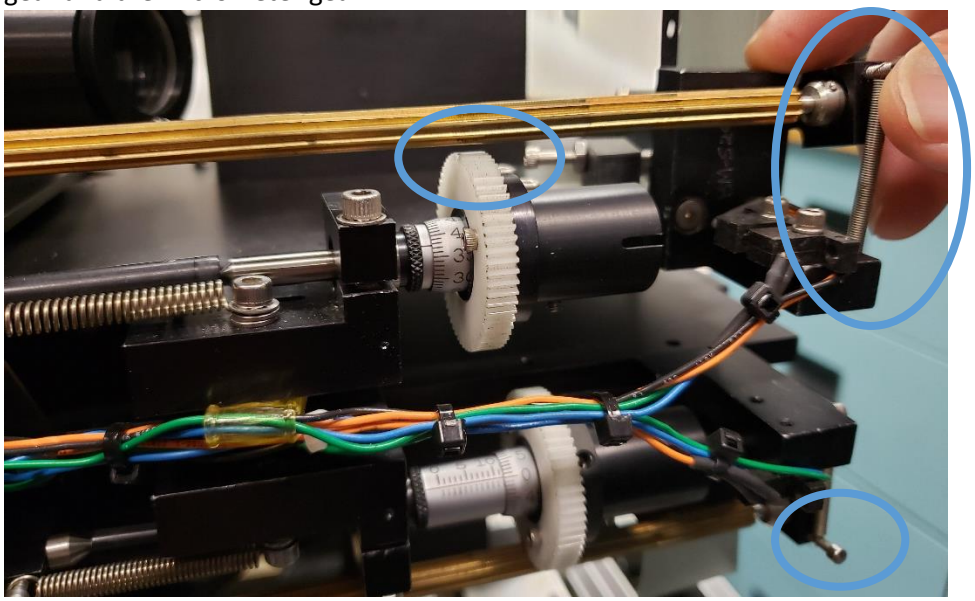
Problem: The micrometer inside the spectrometer will sometimes get stuck on either end. At this point the Brewer Spectrometer is not able to move to locate the proper reference location.

Solution: **Manually reposition the micrometer only when asked to do so by the brewer technician.** The weather must be calm and not raining/snowing. Alternatively the brewer can be brought indoors for this to be completed.

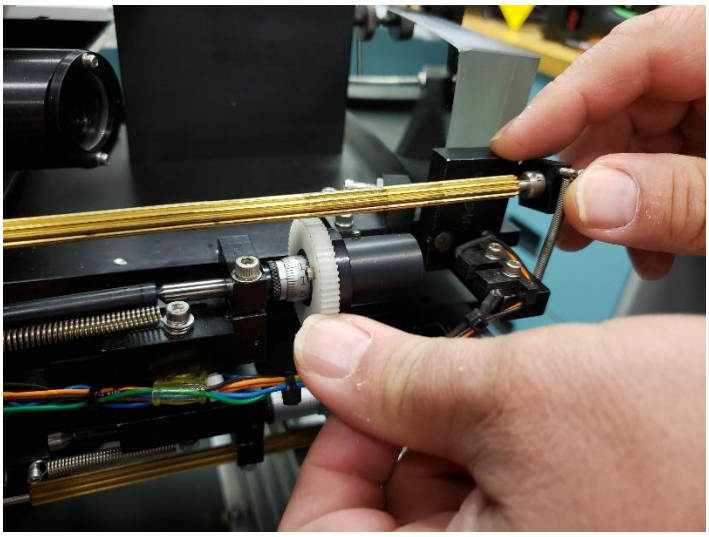
1. Place the dome cover over the UV dome and turn the brewer off.
2. If the winter covers is installed, remove the winter cover.
3. Release the 4 latches that hold the brewer lid in place and remove the Brewer lid.
4. Release the latches from the black spectrometer cover (Single/Shorter brewer has 2 latches, Double/Taller brewer has 4 latches on each side), remove and place in a safe spot.
5. If the micrometer is stuck it should look something like the top micrometer in the picture below. (It can be jammed fully to the right as well)

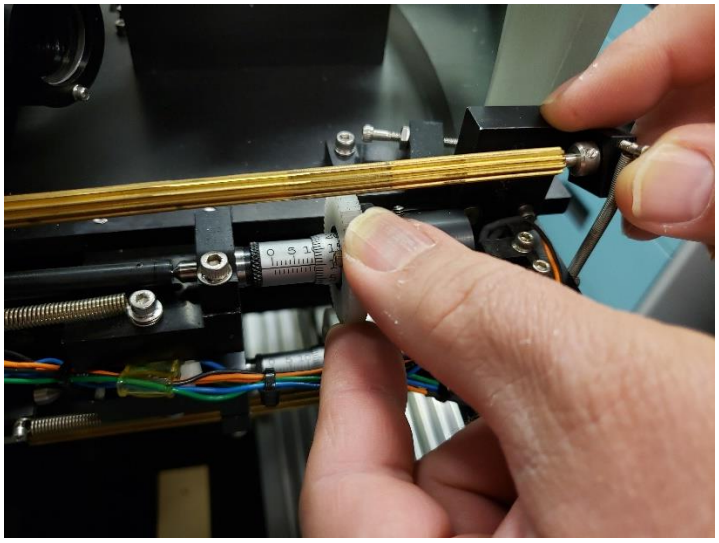


6. Gently lift the spindle of the stuck micrometer so that there is a small gap between the spindle gear and the micrometer gear.



7. Spin the micrometer gear until the micrometer is near the centre of travel (Near the 5 on the barrel for singles or near 10 on the barrel for double brewers as seen in the picture)





8. Repeat for the other micrometer if required.
   Note: If the other micrometer is not stuck, please leave as found.
9. Reseat the black box, ensuring motor wires do not get pinched and then latch in place.
10. Close and latch the Brewer lid and reinstall the Brewer winter covers if required.
11. Turn the brewer back on and restart dosbox.
12. Once dosbox is up and running inside menu, type `*RECN*` to reset all motors and restart the scheduled operation.

v. Appendix E – DuPont™ Krytox MSDS

Safety Data Sheet

DuPont™ Krytox® PFPE Oils

Version 2.0

Revision Date 04/02/2015 Ref. 150000000934

This SDS adheres to the standards and regulatory requirements of the United States and may not meet the regulatory requirements in other countries.

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	DuPont™ Krytox® PFPE Oils
Product Grade/Type	:	GPL: 100, 101, 102, 103, 104, 105, 106, 107, 107-500 VPF: 1506, 1514, 1520, 1525, 1525S, 1531, 1531E, 1618, 1645, 16256, 16350 CBF: 100A, 100B, 103B GBO: 14, 25 XHT- : 500, 750, 1000 FG 40 AUT 1045 4442, 4402, TFO, TLC, NBF140 TLF 8996 KDP-4885 Krytox ESP 250C Krytox SKY188 Zonyl 1045
Product Use	:	Lubricant, For professional users only.
Restrictions on use	:	Do not use product for anything outside of the above specified uses
Manufacturer/Supplier	:	DuPont 1007 Market Street Wilmington, DE 19898 United States of America
Product Information	:	1-800-441-7515 (outside the U.S. 1-302-774-1000)
Medical Emergency	:	1-800-441-3637 (outside the U.S. 1-302-774-1139)
Transport Emergency	:	CHEMTREC: +1-800-424-9300 (outside the U.S. +1-703-527-3887)
Other information	:	professional use

SECTION 2. HAZARDS IDENTIFICATION

Not classified as a hazardous substance or mixture according to the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard 2012.

Other hazards
The product as such is not hazardous., Inhalation of decomposition products from overheating may cause lung irritation or shortness of breath.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

This product does not contain any components that require disclosure according to OSHA Hazard Communication Standard 2012.

SECTION 4. FIRST AID MEASURES

General advice	:	When symptoms persist or in all cases of doubt seek medical advice.
Inhalation	:	Move to fresh air in case of accidental inhalation of fumes from overheating or combustion.
Skin contact	:	Wash with water and soap as a precaution.
Eye contact	:	Rinse with plenty of water. If eye irritation persists, consult a specialist.
Ingestion	:	Never give anything by mouth to an unconscious person. DO NOT induce vomiting unless directed to do so by a physician or poison control center.
Most important symptoms/effects, acute and delayed	:	No applicable data available.
Protection of first-aiders	:	If potential for exposure exists refer to Section 8 for specific personal protective equipment.
Notes to physician	:	No applicable data available.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	The product itself does not burn.

		Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable extinguishing media	:	No applicable data available.
Specific hazards	:	In fire conditions, toxic decomposition products may be formed. (see also section 10)
Special protective equipment for firefighters	:	Wear self-contained breathing apparatus (SCBA). Wear suitable protective equipment.
Further information	:	Standard procedure for chemical fires.

SECTION 6. ACCIDENTAL RELEASE MEASURES

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Safeguards (Personnel)	:	No applicable data available.
Environmental precautions	:	Prevent material from entering sewers, waterways, or low areas.
Spill Cleanup	:	Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust).
Accidental Release Measures	:	No applicable data available.

SECTION 7. HANDLING AND STORAGE

Handling (Personnel)	:	Avoid breathing vapors from overheated material. General industrial hygiene practice.
Handling (Physical Aspects)	:	No applicable data available.
Dust explosion class	:	No applicable data available.
Storage	:	No special storage conditions required. Keep container closed to prevent contamination. No decomposition if stored and applied as directed.
Storage period	:	No applicable data available.

Storage temperature : No applicable data available.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering controls : In the event that the polymer is heated above 350°C (662°F), local ventilation should be used to avoid exposure to fumes.

Personal protective equipment

Respiratory protection : No personal respiratory protective equipment normally required. In the case of hazardous fumes caused by overheating, wear self-contained breathing apparatus.

Hand protection : Additional protection: No particular glove type is recommended, but nitrile may used.

Eye protection : Safety glasses

Skin and body protection : No PPE is specified however, avoid contact with skin, eyes, and clothing. Preventive skin protection

Exposure Guidelines

Exposure Limit Values

Contains no substances with occupational exposure limit values.

This product does not contain any exposure limits that require disclosure according to OSHA Hazard Communication Standard 2012.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Physical state : liquid

Form : viscous, liquid

Color : colourless

Odor : none

Odor threshold : No applicable data available.

pH : neutral

Melting point/freezing point	:	pour point < -5 °C (23 °F)
Boiling point/boiling range	:	No applicable data available.
Flash point	:	Method: Pensky-Martens closed cup - PMCC does not flash
Evaporation rate	:	No applicable data available.
Flammability (solid, gas)	:	No applicable data available.
Upper explosion limit	:	No applicable data available.
Lower explosion limit	:	No applicable data available.
Vapour Pressure	:	No applicable data available.
Vapour density	:	No applicable data available.
Specific gravity (Relative density)	:	ca. 1.86 - 1.91 at 24 °C (75 °F)
Water solubility	:	insoluble
Solubility(ies)	:	No applicable data available.
Partition coefficient: n-octanol/water	:	No applicable data available.
Auto-ignition temperature	:	No applicable data available.
Decomposition temperature	:	ca.350 °C
Viscosity, kinematic	:	No applicable data available.
Viscosity	:	No applicable data available.

SECTION 10. STABILITY AND REACTIVITY

Reactivity	:	Stable at normal ambient temperature and pressure.
Chemical stability	:	Stable under normal conditions.

Possibility of hazardous reactions	:	Decomposes on heating.
Conditions to avoid	:	Decomposition temperature 350 °C (662 °F)
Incompatible materials	:	No applicable data available.
Hazardous decomposition products	:	Hazardous thermal decomposition products: Fluorinated compounds

SECTION 11. TOXICOLOGICAL INFORMATION

Carcinogenicity

The carcinogenicity classifications for this product and/or its ingredients have been determined according to HazCom 2012, Appendix A.6. The classifications may differ from those listed in the National Toxicology Program (NTP) Report on Carcinogens (latest edition) or those found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest edition).

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, or OSHA, as a carcinogen.

SECTION 12. ECOLOGICAL INFORMATION

SECTION 13. DISPOSAL CONSIDERATIONS

Waste disposal methods - Product	:	In accordance with local and national regulations.
Contaminated packaging	:	Dispose of container properly. If recycling is not practicable, dispose of in compliance with local regulations.

SECTION 14. TRANSPORT INFORMATION

Not classified as dangerous in the meaning of transport regulations.

SECTION 15. REGULATORY INFORMATION

TSCA : On the inventory, or in compliance with the inventory

SECTION 16. OTHER INFORMATION

Restrictions for use : Do not use DuPont materials in medical applications involving implantation in the human body or contact with internal body fluids or tissues unless the material has been provided from DuPont under a written contract that is consistent with DuPont policy regarding medical applications and expressly acknowledges the contemplated use. For further information, please contact your DuPont representative. You may also request a copy of the DuPont POLICY Regarding Medical Applications and DuPont CAUTION Regarding Medical Applications.

Revision Date : 04/02/2015

Contact person : MSDS Coordinator, DuPont Chemicals and Fluoroproducts, Wilmington, DE 19898, (800) 441-7515

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Significant change from previous version is denoted with a double bar.

v. Appendix E – Methanol MSDS

VAL TECH DIAGNOSTICS INC

Methanol

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Date of issue: 07/03/2013 Revision date: 12/12/2017 Supersedes: 12/12/2017 Version: 1.3

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form	:	Substance
Substance name	:	Methanol
CAS-No.	:	67-56-1
Product code	:	VT430
Formula	:	CH4O
Synonyms	:	acetone alcohol / alcohol C1 / alcohol, methyl / carbinol / colonial spirits / columbian spirits / green wood spirits / manhattan spirits / methyl alcohol / methyl hydrate / methyl hydroxide / methylen / methylol / monohydroxymethane / pyroligneous spirit / pyroxylic spirit / wood alcohol / wood naphtha

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture	:	Solvent

1.3. Details of the supplier of the safety data sheet

Val Tech Diagnostics, A Division of LabChem Inc
Jackson's Pointe Commerce Park Building 1000
1010 Jackson's Pointe Court
Zelienople, PA 16063
T 412-826-5230
F 724-473-0647

1.4. Emergency telephone number

Emergency number	:	CHEMTREC: 1-800-424-9300 or +1-703-741-5970

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

GHS-US classification

Flam. Liq. 2	H225
Acute Tox. 3 (Oral)	H301
Acute Tox. 3 (Dermal)	H311
Acute Tox. 3 (Inhalation)	H331
STOT SE 1	H370

Full text of H statements : see section 16

2.2. Label elements

GHS US labeling

Hazard pictograms (GHS US) :

GHS02 GHS06 GHS08

Signal word (GHS US) : Danger

Hazard statements (GHS US) : H225 - Highly flammable liquid and vapour
H301+H311+H331 - Toxic if swallowed, in contact with skin or if inhaled
H370 - Causes damage to organs (liver, kidneys, central nervous system, optic nerve) (Dermal, oral)

Precautionary statements (GHS US) : P210 - Keep away from heat, sparks, open flames, hot surfaces. - No smoking.
P233 - Keep container tightly closed.
P240 - Ground/bond container and receiving equipment.
P241 - Use explosion-proof electrical, ventilating, lighting equipment
P242 - Use only non-sparking tools.
P243 - Take precautionary measures against static discharge.
P260 - Do not breathe mist, vapors, spray.
P264 - Wash exposed skin thoroughly after handling.
P270 - Do not eat, drink or smoke when using this product.
P271 - Use only outdoors or in a well-ventilated area.

P280 - Wear protective gloves, protective clothing, eye protection, face protection.
P301+P310 - IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
P303+P361+P353 - IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P330 - If swallowed, rinse mouth
P361+P364 - Take off immediately all contaminated clothing and wash it before reuse.
P370+P378 - In case of fire: Use carbon dioxide (CO_2), powder, alcohol-resistant foam to extinguish
P403+P235 - Store in a well-ventilated place. Keep cool.
P405 - Store locked up.
P501 - Dispose of contents/container to comply with local, state and federal regulations

2.3. Other hazards

Other hazards not contributing to the classification : None.

2.4. Unknown acute toxicity (GHS US)

No data available

SECTION 3: Composition/Information on ingredients

3.1. Substances

Substance type : Mono-constituent

Name	Product identifier	%	GHS-US classification
Methanol (Main constituent)	(CAS-No.) 67-56-1	100	Flam. Liq. 2, H225 Acute Tox. 3 (Oral), H301 Acute Tox. 3 (Dermal), H311 Acute Tox. 3 (Inhalation), H331 STOT SE 1, H370

Full text of H-phrases: see section 16

3.2. Mixtures

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Check the vital functions. Unconscious: maintain adequate airway and respiration. Respiratory arrest: artificial respiration or oxygen. Cardiac arrest: perform resuscitation. Victim conscious with labored breathing: half-seated. Victim in shock: on his back with legs slightly raised. Vomiting: prevent asphyxia/aspiration pneumonia. Prevent cooling by covering the victim (no warming up). Keep watching the victim. Give psychological aid. Keep the victim calm, avoid physical strain.

First-aid measures after inhalation : Remove the victim into fresh air. Immediately consult a doctor/medical service.

First-aid measures after skin contact : Wash immediately with lots of water. Soap may be used. Do not apply (chemical) neutralizing agents. Remove clothing before washing. Consult a doctor/medical service.

First-aid measures after eye contact : Rinse with water. Remove contact lenses, if present and easy to do. Continue rinsing. Take victim to an ophthalmologist if irritation persists.

First-aid measures after ingestion : Rinse mouth with water. Immediately after ingestion, give alcohol to drink. Give nothing to drink. Do not induce vomiting. Immediately consult a doctor/medical service. Take the container/vomit to the doctor/hospital. Call Poison Information Centre (www.big.be/antigif.htm).

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/effects after inhalation : EXPOSURE TO HIGH CONCENTRATIONS: Coughing. Symptoms similar to those listed under ingestion.

Symptoms/effects after skin contact : Symptoms similar to those listed under ingestion.

Symptoms/effects after eye contact : Redness of the eye tissue. Lacrimation.

Symptoms/effects after ingestion : Nausea. Vomiting. AFTER ABSORPTION OF LARGE QUANTITIES: FOLLOWING SYMPTOMS MAY APPEAR LATER: Change in the blood composition. Headache. Feeling of weakness. Abdominal pain. Muscular pain. Central nervous system depression. Dizziness. Mental confusion. Drunkenness. Coordination disorders. Disturbed motor response. Disturbances of consciousness. Visual disturbances. Blindness. Respiratory difficulties. Cramps/uncontrolled muscular contractions.

Chronic symptoms : Red skin. Dry skin. Skin rash/inflammation. Headache. Disturbed tactile sensibility. Visual disturbances. Sleeplessness. Gastrointestinal complaints. Cardiac and blood circulation effects.

4.3. Indication of any immediate medical attention and special treatment needed

Immediately after ingestion, give a glass of strong drink, beer or wine to drink. Hospitalize at once for treatment with the right antidotes.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Quick-acting ABC powder extinguisher. Quick-acting BC powder extinguisher. Quick-acting class B foam extinguisher. Quick-acting CO_2 extinguisher. Class B foam (alcohol-resistant). Water spray if puddle cannot expand.

Unsuitable extinguishing media : Water (quick-acting extinguisher, reel); risk of puddle expansion. Water; risk of puddle expansion.

5.2. Special hazards arising from the substance or mixture

Fire hazard : DIRECT FIRE HAZARD. Highly flammable liquid and vapour. Gas/vapor flammable with air within explosion limits. INDIRECT FIRE HAZARD. May be ignited by sparks.

Explosion hazard : DIRECT EXPLOSION HAZARD. Gas/vapour explosive with air within explosion limits. INDIRECT EXPLOSION HAZARD. may be ignited by sparks. Reactions with explosion hazards: see "Reactivity Hazard".

Reactivity : Violent to explosive reaction with (some) metal powders and with (strong) oxidizers. Violent exothermic reaction with (some) acids and with (some) halogens compounds.

5.3. Advice for firefighters

Firefighting instructions : Cool tanks/drums with water spray/remove them into safety. Do not move the load if exposed to heat. Take account of toxic fire-fighting water. Use water moderately and if possible collect or contain it.

Protection during firefighting : Do not enter fire area without proper protective equipment, including respiratory protection.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : No flames, no sparks. Eliminate all sources of ignition. No naked lights. No smoking. Dike and contain spill.

6.1.1. For non-emergency personnel

Protective equipment : Gas-tight suit.

Emergency procedures : Keep upwind. Mark the danger area. Consider evacuation. Close doors and windows of adjacent premises. Stop engines and no smoking. No naked flames or sparks. Spark- and explosion-proof appliances and lighting equipment. Keep containers closed. Wash contaminated clothes.

6.1.2. For emergency responders

Protective equipment : Equip cleanup crew with proper protection.

Emergency procedures : Stop leak if safe to do so. Ventilate area.

6.2. Environmental precautions

Prevent soil and water pollution. Prevent spreading in sewers.

6.3. Methods and material for containment and cleaning up

For containment : Contain released substance, pump into suitable containers. Plug the leak, cut off the supply. Dam up the liquid spill. Try to reduce evaporation. Measure the concentration of the explosive gas-air mixture. Dilute combustible/toxic gases/vapours with water spray. Take account of toxic/corrosive precipitation water. Provide equipment/receptacles with earthing. Do not use compressed air for pumping over spills.

Methods for cleaning up : Take up liquid spill into a non combustible material e.g.: sand, earth, vermiculite slaked lime or soda ash. Scoop absorbed substance into closing containers. Carefully collect the spill/leftovers. Damaged/cooled tanks must be emptied. Do not use compressed air for pumping over spills. Clean contaminated surfaces with an excess of water. Take collected spill to manufacturer/competent authority. Wash clothing and equipment after handling.

6.4. Reference to other sections

No additional information available

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Use spark-/explosionproof appliances and lighting system. Take precautions against electrostatic charges. Keep away from naked flames/heat. Keep away from ignition sources/sparks. Measure the concentration in the air regularly. Work under local exhaust/ventilation. Comply with the legal requirements. Remove contaminated clothing immediately. Clean contaminated clothing. Handle uncleaned empty containers as full ones. Thoroughly clean/dry the installation before use. Do not discharge the waste into the drain. Do not use compressed air for pumping over. Keep container tightly closed.

Hygiene measures : Do not eat, drink or smoke when using this product. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Wash contaminated clothing before reuse.

7.2. Conditions for safe storage, including any incompatibilities

Incompatible products : Strong oxidizers. Strong bases. Strong acids. Acid anhydrides. Acid chlorides.

Incompatible materials : Direct sunlight. Heat sources. Sources of ignition.

Heat-ignition : KEEP SUBSTANCE AWAY FROM: heat sources. ignition sources.

Prohibitions on mixed storage : KEEP SUBSTANCE AWAY FROM: combustible materials. oxidizing agents. strong acids. (strong) bases. halogens. amines. water/moisture.

Storage area : Store in a cool area. Store in a dry area. Keep container in a well-ventilated place. Fireproof storeroom. Keep locked up. Provide for a tub to collect spills. Provide the tank with earthing. Unauthorized persons are not admitted. Aboveground. Meet the legal requirements.

Special rules on packaging : SPECIAL REQUIREMENTS: closing. dry. clean. correctly labelled. meet the legal requirements. Secure fragile packagings in solid containers.

Packaging materials : SUITABLE MATERIAL: steel. stainless steel. iron. glass. MATERIAL TO AVOID: lead. aluminium. zinc. polyethylene. PVC.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Methanol (67-56-1)		
USA ACGIH	ACGIH TWA (ppm)	200 ppm
USA ACGIH	ACGIH STEL (ppm)	250 ppm

8.2. Exposure controls

Appropriate engineering controls : Emergency eye wash fountains should be available in the immediate vicinity of any potential exposure. Keep concentrations well below lower explosion limits.

Personal protective equipment : Safety glasses. Protective clothing. Gloves. Full protective flameproof clothing. Face shield.

Materials for protective clothing : GIVE GOOD RESISTANCE: polyethylene/ethylenevinylalcohol. styrene-butadiene rubber. viton. GIVE LESS RESISTANCE: chloroprene rubber. chlorinated polyethylene. natural rubber. nitrile rubber/PVC. GIVE POOR RESISTANCE: leather. neoprene. nitrile rubber. polyethylene. PVA. PVC. polyurethane.

Hand protection : Protective gloves against chemicals (EN374).

Eye protection : Safety glasses.

Skin and body protection : Head/neck protection. Protective clothing.

Respiratory protection : Full face mask with filter type AX at conc. in air > exposure limit. High vapour/gas concentration: self-contained respirator.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state : Liquid

Appearance : Liquid.

Molecular mass : 32.04 g/mol

Color : Colourless.

Odor	:	Characteristic odour. Mild odour. Pleasant odour. Alcohol odour. Commercial/unpurified substance: irritating/pungent odour.
Odor threshold	:	No data available
pH	:	No data available
Relative evaporation rate (butyl acetate=1)	:	4.1
Relative evaporation rate (ether=1)	:	6.3
Melting point	:	-97.8 °C
Freezing point	:	No data available
Boiling point	:	64.7 °C (1013 hPa)
Flash point	:	9.7 °C (Closed cup, 1013 hPa, EU Method A.9: Flash-Point)
Critical temperature	:	240 °C
Auto-ignition temperature	:	455 °C (1013 hPa, DIN 51794: Self-ignition temperature)
Decomposition temperature	:	No data available
Flammability (solid, gas)	:	No data available
Vapor pressure	:	128 hPa (20 °C)
Vapor pressure at 50 °C	:	552 hPa
Critical pressure	:	79547 hPa
Relative vapor density at 20 °C	:	1.1
Relative density	:	0.79 - 0.80 (20 °C)
Relative density of saturated gas/air mixture	:	1
Specific gravity / density	:	790 - 800 kg/m³ (20 °C)
Solubility	:	Soluble in water. Soluble in ethanol. Soluble in ether. Soluble in acetone. Soluble in chloroform. Water: 100 g/100ml (20 °C) Ethanol: complete Ether: complete Acetone: complete
Log Pow	:	-0.77 (Experimental value)
Log Kow	:	No data available
Viscosity, kinematic	:	No data available
Viscosity, dynamic	:	0.544 - 0.59 mPa·s (25 °C)
Explosive properties	:	No data available
Oxidizing properties	:	No data available
Explosion limits	:	5.5 - 36.5 vol %

9.2. Other information

Minimum ignition energy	:	0.14 mJ
Saturation concentration	:	166 g/m³
VOC content	:	100 %
Other properties	:	Clear. Hygroscopic. Volatile. Neutral reaction.

SECTION 10: Stability and reactivity

10.1. Reactivity

Violent to explosive reaction with (some) metal powders and with (strong) oxidizers. Violent exothermic reaction with (some) acids and with (some) halogens compounds.

10.2. Chemical stability

Hygroscopic.

10.3. Possibility of hazardous reactions

No additional information available

10.4. Conditions to avoid

Direct sunlight. High temperature. Incompatible materials. Open flame. Sparks. Overheating.

10.5. Incompatible materials

Strong oxidizers. Strong bases. Strong acids. Peroxides. Acid anhydrides. Acid chlorides.

10.6. Hazardous decomposition products

Carbon dioxide. Carbon monoxide.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Methanol (\f)67-56-1	
LD50 oral rat	1187 - 2769 mg/kg body weight (BASF test, Rat, Male / female, Weight of evidence, Aqueous solution, Oral, 7 day(s))
LD50 dermal rabbit	17100 mg/kg (Rabbit, Inconclusive, Insufficient data, Dermal)
LC50 Inhalation rat (mg/l)	128.2 mg/l air (BASF test, 4 h, Rat, Male / female, Experimental value, Inhalation (vapours))
ATE CLP (oral)	100 mg/kg body weight
ATE CLP (dermal)	300 mg/kg body weight
ATE CLP (gases)	700 ppmV/4h
ATE CLP (vapors)	3 mg/l/4h
ATE CLP (dust, mist)	0.5 mg/l/4h

Skin corrosion/irritation : Not classified

Serious eye damage/irritation : Not classified

Respiratory or skin sensitization : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Reproductive toxicity : Not classified

Specific target organ toxicity – single exposure : Causes damage to organs (liver, kidneys, central nervous system, optic nerve) (Dermal, oral).

Specific target organ toxicity – repeated exposure : Not classified

Aspiration hazard : Not classified

Potential Adverse human health effects and symptoms : Toxic in contact with skin. Toxic if swallowed. Toxic if inhaled.

Symptoms/effects after inhalation : EXPOSURE TO HIGH CONCENTRATIONS: Coughing. Symptoms similar to those listed under ingestion.

Symptoms/effects after skin contact : Symptoms similar to those listed under ingestion.

Symptoms/effects after eye contact : Redness of the eye tissue. Lacrimation.

Symptoms/effects after ingestion : Nausea. Vomiting. AFTER ABSORPTION OF LARGE QUANTITIES: FOLLOWING SYMPTOMS MAY APPEAR LATER: Change in the blood composition. Headache. Feeling of weakness. Abdominal pain. Muscular pain. Central nervous system depression. Dizziness. Mental confusion. Drunkenness. Coordination disorders. Disturbed motor response. Disturbances of consciousness. Visual disturbances. Blindness. Respiratory difficulties. Cramps/uncontrolled muscular contractions.

Chronic symptoms : Red skin. Dry skin. Skin rash/inflammation. Headache. Disturbed tactile sensibility. Visual disturbances. Sleeplessness. Gastrointestinal complaints. Cardiac and blood circulation effects.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : Not classified as dangerous for the environment according to the criteria of Regulation (EC) No 1272/2008.

Ecology - air : Not included in the list of substances which may contribute to the greenhouse effect (IPCC). Not included in the list of fluorinated greenhouse gases (Regulation (EU) No 517/2014). Not classified as dangerous for the ozone layer (Regulation (EC) No 1005/2009).

Ecology - water : Not harmful to crustacea. Not harmful to fishes. Groundwater pollutant. Inhibition of activated sludge. Nitrification of activated sludge is inhibited. Not harmful to algae. Not harmful to bacteria.

Methanol (67-56-1)	
LC50 fish 1	15400 mg/l (EPA 660/3 - 75/009, 96 h, Lepomis macrochirus, Flow-through system, Fresh water, Experimental value, Lethal)
EC50 Daphnia 1	18260 mg/l (OECD 202: Daphnia sp. Acute Immobilisation Test, 96 h, Daphnia magna, Semi-static system, Fresh water, Experimental value, Locomotor effect)
ErC50 (algae)	22000 mg/l (OECD 201: Alga, Growth Inhibition Test, 96 h, Pseudokirchneriella subcapitata, Static system, Fresh water, Experimental value)

12.2. Persistence and degradability

Methanol (67-56-1)	
Persistence and degradability	Readily biodegradable in the soil. Readily biodegradable in water.
Biochemical oxygen demand (BOD)	0.6 - 1.12 g O □/g substance
Chemical oxygen demand (COD)	1.42 g O □/g substance
ThOD	1.5 g O □/g substance

12.3. Bioaccumulative potential

Methanol (67-56-1)	
BCF fish 1	1 - 4.5 (72 h, Cyprinus carpio, Static system, Fresh water, Experimental value)
Log Pow	-0.77 (Experimental value)
Bioaccumulative potential	Low potential for bioaccumulation (BCF < 500).

12.4. Mobility in soil

Methanol (67-56-1)	
Surface tension	0.023 N/m (20 °C)
Log Koc	0.088 (log Koc, SRC PCKOCWIN v2.0, Calculated value)
Ecology - soil	Highly mobile in soil.

12.5. Other adverse effects

No additional information available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Do not discharge into drains or the environment. Remove waste in accordance with local and/or national regulations. Hazardous waste shall not be mixed together with other waste. Different types of hazardous waste shall not be mixed together if this may entail a risk of pollution or create problems for the further management of the waste. Hazardous waste shall be managed responsibly. All entities that store, transport or handle hazardous waste shall take the necessary measures to prevent risks of pollution or damage to people or animals. Recycle by distillation. Incinerate under surveillance with energy recovery. Obtain the consent of pollution control authorities before discharging to wastewater treatment plants.

Additional information : Hazardous waste according to Directive 2008/98/EC, as amended by Regulation (EU) No 1357/2014 and Regulation (EU) No 2017/997.

SECTION 14: Transport information

In accordance with DOT

Transport document description : UN1230 Methanol, 3, II

UN-No.(DOT) : 1230

DOT NA no. : UN1230

Proper Shipping Name (DOT) : Methanol

Transport hazard class(es) (DOT) : 3 - Class 3 - Flammable and combustible liquid 49 CFR 173.120

Hazard labels (DOT) : 3 - Flammable liquid

DOT Symbols : D - Proper shipping name for domestic use only, or to and from Canada

Packing group (DOT) : II - Medium Danger

DOT Special Provisions (49 CFR 172.102)	: IB2 - Authorized IBCs: Metal (31A, 31B and 31N); Rigid plastics (31H1 and 31H2); Composite (31HZ1). Additional Requirement: Only liquids with a vapor pressure less than or equal to 110 kPa at 50 C (1.1 bar at 122 F), or 130 kPa at 55 C (1.3 bar at 131 F) are authorized. T7 - 4 178.274(d)(2) Normal..... 178.275(d)(3) TP2 - a. The maximum degree of filling must not exceed the degree of filling determined by the following: (image) Where: tr is the maximum mean bulk temperature during transport, tf is the temperature in degrees celsius of the liquid during filling, and a is the mean coefficient of cubical expansion of the liquid between the mean temperature of the liquid during filling (tf) and the maximum mean bulk temperature during transportation (tr) both in degrees celsius. b. For liquids transported under ambient conditions may be calculated using the formula: (image) Where: d15 and d50 are the densities (in units of mass per unit volume) of the liquid at 15 C (59 F) and 50 C (122 F), respectively.
DOT Packaging Exceptions (49 CFR 173.xxx)	: 150
DOT Packaging Non Bulk (49 CFR 173.xxx)	: 202
DOT Packaging Bulk (49 CFR 173.xxx)	: 242
DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27)	: 1 L
DOT Quantity Limitations Cargo aircraft only (49 CFR 175.75)	: 60 L
DOT Vessel Stowage Location	: B - (i) The material may be stowed "on deck" or "under deck" on a cargo vessel and on a passenger vessel carrying a number of passengers limited to not more than the larger of 25 passengers, or one passenger per each 3 m of overall vessel length; and (ii) "On deck only" on passenger vessels in which the number of passengers specified in paragraph (k)(2)(i) of this section is exceeded.
DOT Vessel Stowage Other	: 40 - Stow "clear of living quarters"
Marine pollutant	: -

Additional information

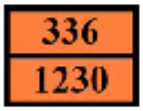
Other information : No supplementary information available.

ADR

Transport document description :

Hazard identification number (Kemler No.) : 336

Orange plates :



Tunnel restriction code : D/E

Transport by sea

UN-No. (IMDG)	: 1230
Proper Shipping Name (IMDG)	: methanol
Class (IMDG)	: 3 - Flammable liquids
Packing group (IMDG)	: II - substances presenting medium danger
EmS-No. (1)	: F-E
MFAG-No	: 19
EmS-No. (2)	: S-D

Air transport

UN-No. (IATA)	: 1230
Proper Shipping Name (IATA)	: Methanol
Class (IATA)	: 3 - Flammable Liquids
Packing group (IATA)	: II - Medium Danger

SECTION 15: Regulatory information

15.1. US Federal regulations

Methanol (67-56-1)

Listed on the United States TSCA (Toxic Substances Control Act) inventory
Subject to reporting requirements of United States SARA Section 313

Methanol (67-56-1)	
RQ (Reportable quantity, section 304 of EPA's List of Lists)	5000 lb
SARA Section 311/312 Hazard Classes	Physical hazard - Flammable (gases, aerosols, liquids, or solids) Health hazard - Acute toxicity (any route of exposure) Health hazard - Specific target organ toxicity (single or repeated exposure)

15.2. International regulations

CANADA

Methanol (67-56-1)	
Listed on the Canadian DSL (Domestic Substances List)	
WHMIS Classification	Class B Division 2 - Flammable Liquid Class D Division 2 Subdivision A - Very toxic material causing other toxic effects Class D Division 2 Subdivision B - Toxic material causing other toxic effects

EU-Regulations

No additional information available

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Flam. Liq. 2	H225
Acute Tox. 3 (Inhalation)	H331
Acute Tox. 3 (Dermal)	H311
Acute Tox. 3 (Oral)	H301
STOT SE 1	H370

Full text of H statements : see section 16

Classification according to Directive 67/548/EEC [DSD] or 1999/45/EC [DPD]

Not classified

15.2.2. National regulations

No additional information available

15.3. US State regulations

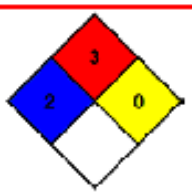
Methanol(67-56-1)	
U.S. - California - Proposition 65 - Carcinogens List	No
U.S. - California - Proposition 65 - Developmental Toxicity	Yes
U.S. - California - Proposition 65 - Reproductive Toxicity - Female	No
U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No

SECTION 16: Other information

Full text of H-phrases: see section 16:

H225	Highly flammable liquid and vapour
H301	Toxic if swallowed
H311	Toxic in contact with skin
H331	Toxic if inhaled
H370	Causes damage to organs

NFPA health hazard	: 2 - Materials that, under emergency conditions, can cause temporary incapacitation or residual injury.
NFPA fire hazard	: 3 - Liquids and solids (including finely divided suspended solids) that can be ignited under almost all ambient temperature conditions.
NFPA reactivity	: 0 - Material that in themselves are normally stable, even under fire conditions.



Hazard Rating

Health	: 2 Moderate Hazard - Temporary or minor injury may occur
Flammability	: 3 Serious Hazard
Physical	: 0 Minimal Hazard
Personal protection	: H

SDS US ValTech