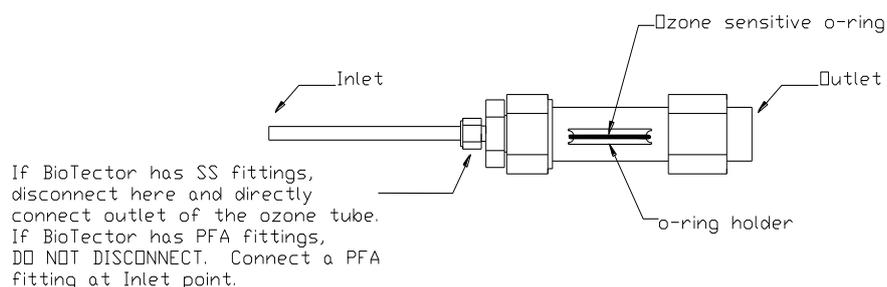


PROCEDURE to CHECK the OZONE LEVEL in BIOTECTOR

To check the ozone level in BioTector, please follow below procedures:

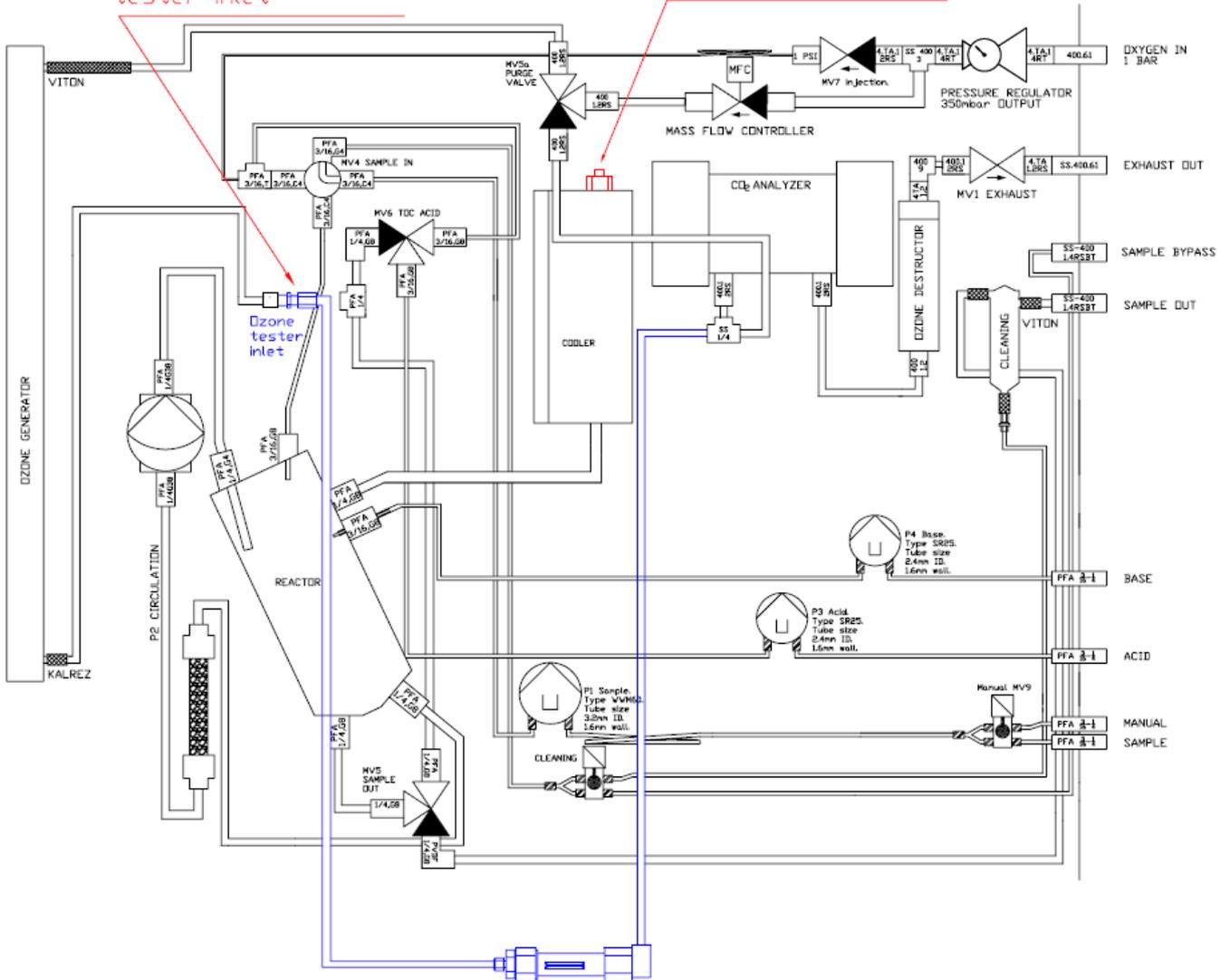
1. If BioTector was in standby mode or was not running for a prolonged period of time, it is recommended to run a minimum of 10 analyses reactions before the ozone test is carried out.
2. Obtain a BioTector Ozone Testing Kit “ozone tester” from your local distributor or directly from the manufacturer. See drawing below. The metal o-ring holder inside the PFA tubing already contains an ozone sensitive o-ring. The o-ring is placed onto the holder for illustration purposes only. It is strongly recommended that a new o-ring is installed onto the o-ring holder before the ozone test is carried out.



3. Note that, if an o-ring is left on the o-ring holder for a prolonged period of time, the o-ring stretches and loses its original tensile strength properties. In such cases the ozone test may become invalid. Therefore a brand new o-ring must be installed and used during the ozone test.
4. Depending on the type of the reactor and the type of the fittings used in the BioTector, and referring to the system layout drawings on pages 2 and 3 below, disconnect the ozone generator outlet tube (or the tube connecting the TOC acid valve to the reactor at the T fitting) and the cooler outlet tube at the outlet ports. These tubes are marked with **RED** in the system layout drawings below. Connect the ozone tester so that it will be located between the ozone generator outlet tube and the CO₂ analyzer inlet tube. The lines are marked with **BLUE** in the system layout drawings below.
 - i) As can be seen in the drawings below, the elbow fitting, removed from the cooler outlet tubing, is connected to the 12mm OD PFA outlet tubing on the ozone tester.
 - ii) As can be seen in the drawing above and the drawings below, if the BioTector has stainless steel “SS316” fittings, disconnect the brass fitting and the ¼” PFA tube from the ozone tester, and connect the ozone generator outlet tube directly to the ozone tester.
 - iii) If the BioTector has PFA fittings, do not disconnect the brass fitting and the ¼” PFA tube from the ozone tester. Remove the PFA fitting, which connects the TOC acid valve to the reactor at the T fitting. Place the removed PFA fitting (and the ferrules) on to the ¼” PFA tube on the ozone tester. Connect the ozone tester inlet tubing to the T fitting located between the TOC acid valve and the reactor.
5. Go to Commissioning, Information, Identification menu and record the system serial number. The serial number is also available in BioTector manual and inside the BioTector electronics enclosure.
 - a) If the BioTector serial number starts with 95, 97, 99, BS4 1.34 and any software version below 1.34, which is a number smaller than 1.34 (e.g. BS4 1.06, BS4 1.15 etc.) follow **PROCEDURE A** below.
 - b) If the BioTector serial number starts with BAC, BS4A 1.00 and any software version above 1.00, which is a number greater than 1.00 (e.g. BS4A 1.04, BS4A 2.01 etc.), follow **PROCEDURE B** below.

Disconnect ozone tube outlet before TOC Acid valve tee connector and connect to the ozone tester inlet

Disconnect tube from cooler outlet and connect to the ozone tester outlet



PROCEDURE A:

1. Go to Maintenance, Process Simulate 1 menu.

a. Set the MFC (Mass Flow Controller) to 10 l/h. Confirm the MFC flow reading is ~10l/h.

```

PROCESS SIMULATE 1 09:17:28 12-09-02
MFC=10.01/h CO2= 35.0ppm
1 < *MFC 10.01/h
2 OZONE GENERATOR OFF
3 ACID PUMP OFF 1
4 ACID VALVE OFF
5 BASE PUMP OFF 1
6 BASE VALVE OFF
7 SAMPLE IN VALVE SEN1
8 BYPASS VALVE OFF
9 *SAMPLE PUMP SLOW 5
10 INJECTION PUMP ON
11 CIRCULATION PUMP OFF
    
```

b. Switch the OZONE GENERATOR on. Depending on software version of the system, the ozone generator will either activate directly or the system will carry out a pressure test automatically to check that there are no loose fittings or leak in the system. The display will show "PLEASE WAIT".

```

PLEASE WAIT
    
```

c. If the pressure test passes in systems the pressure test is carried out, the ozone generator will activate and system will start to generate ozone. When ozone generator is ON, an asterisk "*" sign will be displayed in front of the OZONE GENERATOR in the Process Simulate 1 menu.

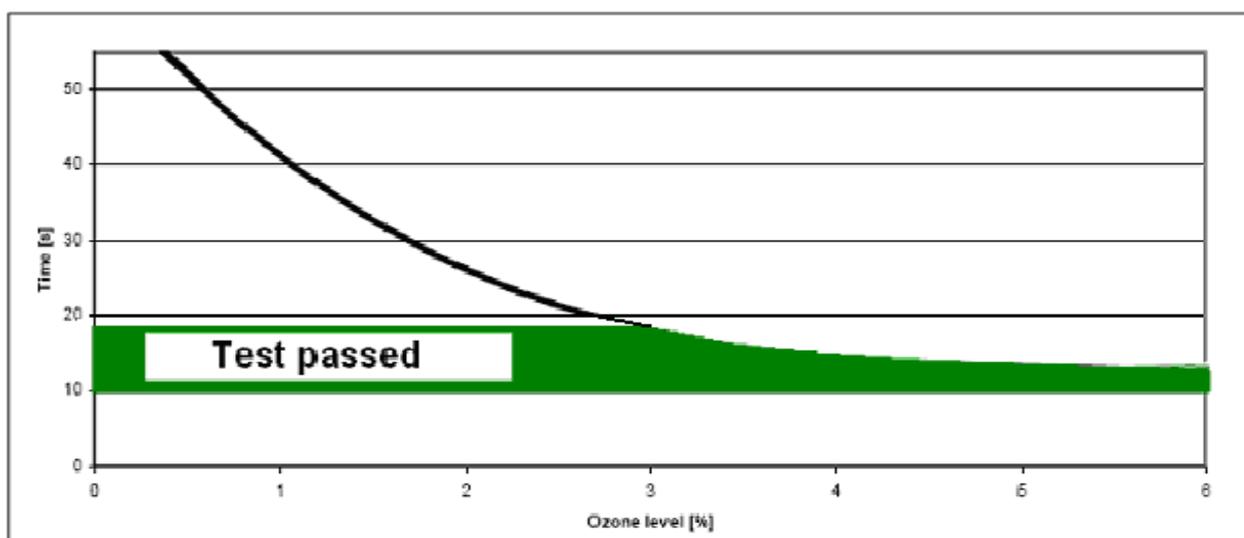
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PROCESS SIMULATE 1 09:17:28 12-09-02
MFC=10.01/h CO2= 35.0ppm
1 *MFC 10.01/h
2 < *OZONE GENERATOR ON
3 ACID PUMP OFF 1
4 ACID VALVE OFF
5 BASE PUMP OFF 1
6 BASE VALVE OFF
7 SAMPLE IN VALVE SEN1
8 BYPASS VALVE OFF
9 SAMPLE PUMP OFF
10 INJECTION PUMP OFF
11 CIRCULATION PUMP OFF
    
```

2. As ozone is generated, the ozone sensitive o-ring will break within a certain period of time. Measure the time with a stopwatch from the point where OZONE GENERATOR is ON (when Ozone Generator is activated or when the pressure test is passed) to the point ozone sensitive o-ring breaks. Record the time it takes for the o-ring to break.
3. Using the graph on page 5 below, estimate the % wt/wt ozone concentration against the measured time above. The measured time should typically be less than or equal to 18 seconds. 18 seconds is the factory programmed OZONE TEST TIME in System Configuration, Fault Setup menu. Measured times less than or equal to 18 seconds indicates that the generated ozone concentration is at acceptable levels and therefore the ozone test is passed.
4. If the time measured is more than 18 seconds, it is recommended to repeat the ozone test using a new o-ring.
5. When the test is complete, switch the OZONE GENERATOR off. Set the MFC to 20 l/h and run oxygen gas for 2 minutes until all the ozone has been purged out from the ozone testing kit through the ozone destructor. After the purging process, remove the ozone testing kit from the lines and reconnect the necessary fittings.

PROCEDURE B:

1. Go to Process Test, Ozone Test menu.
2. Select "START TEST" and follow on screen instructions. The software instructions are available inside the BioTector user manual.
3. When the ozone test is started, BioTector automatically carries out a pressure test, to ensure that there is no leak or loose fittings in the system. In the case of a leak, the system displays a "FAIL" message on the screen. To abort the ozone test anytime, press the ESC key on the keyboard. Do not open the ozone testing kit during the ozone test.
4. The ozone generator is switched on. As soon as the o-ring in the ozone testing kit breaks, press the "STOP TEST" menu item. The time period, from the point Ozone Generator is activated (or when the pressure test is passed) to the point ozone sensitive o-ring breaks is calculated automatically and displayed on the screen.
5. Depending on the measured time the system displays a "PASS" or "LOW OZONE" messages on the screen.
6. If the measured time is less than or equal to 18 seconds, a "PASS" message is displayed. 18 seconds is the factory programmed OZONE TEST TIME in System Configuration, Fault Setup menu. If the measured time is greater than 18 seconds, a "LOW OZONE" message is displayed. In the "LOW OZONE" case, it is recommended to repeat the ozone test using a new o-ring. Note that the maximum allowed time for the ozone test is 60 seconds, after which the "LOW OZONE" message is displayed.
7. Using the graph in this page below, % wt/wt ozone concentration level can be estimated from the measured time displayed on the screen.
8. When the ozone test is complete, BioTector automatically purges the system until all the ozone has been purged out from the ozone testing kit through the ozone destructor. Follow on screen instructions and do not open the ozone testing kit if there is any warning message on the screen.
9. When the test is complete after the purging process, remove the ozone testing kit from the lines and reconnect the necessary fittings.



If necessary, contact your local distributor or the manufacturer for technical support.