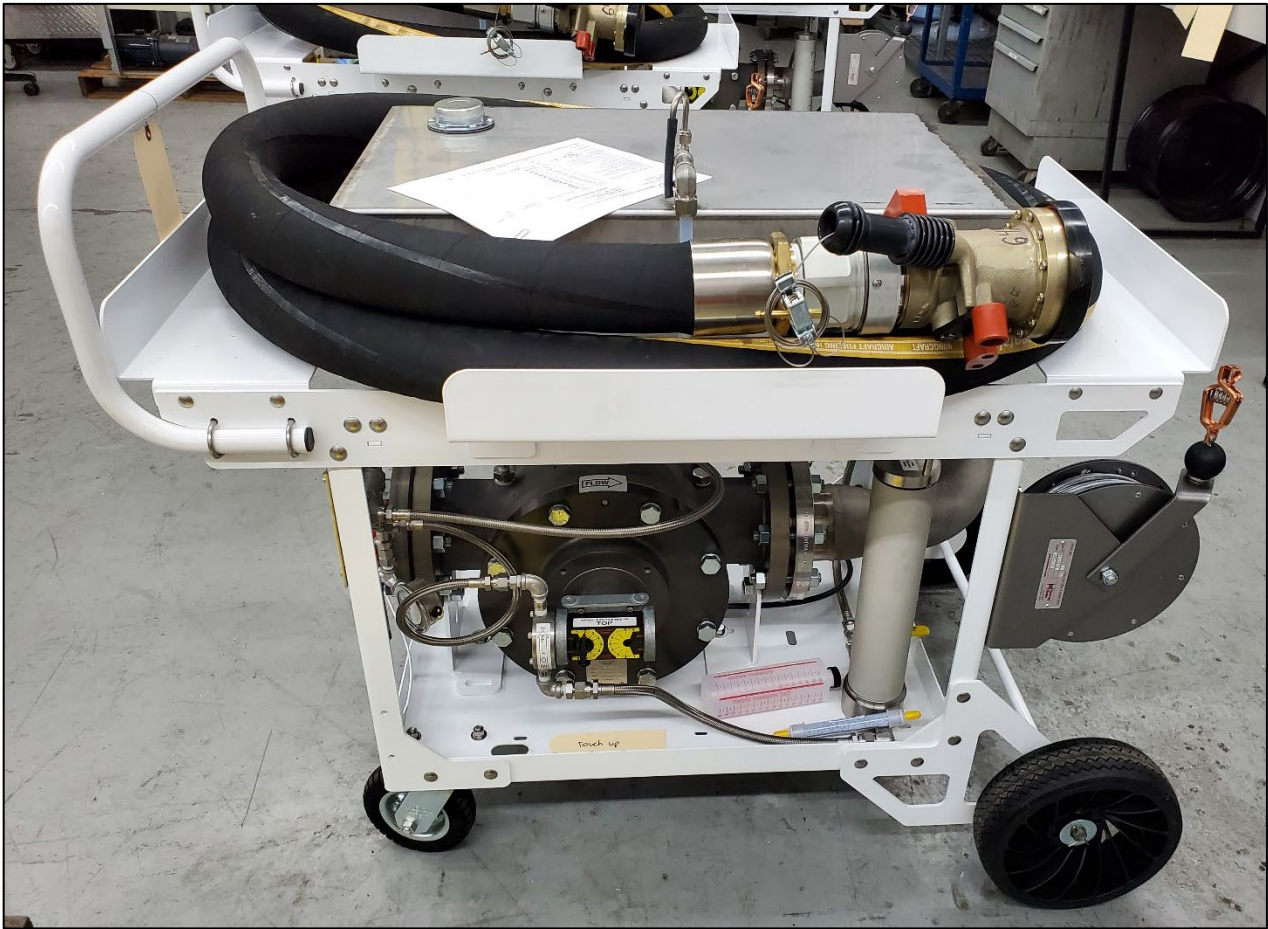




Hammonds Technical Services, Inc.

# HAMMONDS HC800-1S BIOCIDE INJECTION CART OPERATING INSTRUCTIONS





**A quick word about PPM by Weight vs PPM by Volume**

PPM by WEIGHT is different than PPM by VOLUME. Depending upon how you calculate the amount of additive to be injected will cause the number to vary. A simple way to see this difference is to look at a 12 fluid ounce can of Coca-Cola. The can contains 12 fluid ounces of soda by VOLUME, but the can of soda is 14.35 ounces by WEIGHT. The same scenario holds true for Biobor JF.

The short answer is that Biobor JF should be injected by WEIGHT but the Hammonds Injector injects additive by volume, hence the two different numbers on the **STROKE SETTING CHART**.

To keep things simple when talking about Biobor JF treat rates:

**270 ppm by WEIGHT is equal to 210 ppm by VOLUME -- TYPICAL SHOCK TREATMENT**  
**135 ppm by WEIGHT is equal to 105 ppm by VOLUME -- TYPICAL MAINTENANCE TREATMENT**

There is a series of calculations to prove this out but this conversion is a good and simple average that ensures proper dosage of the additive. If you work the full calculations, taking into account the actual weights and densities of the fuel and the additive at actual temperatures, you will obtain a slight variation from these numbers.

**To achieve 270 ppm by WEIGHT, the injector must inject 210 ppm by VOLUME for SHOCK TREATMENTS**

**To achieve 135 ppm by WEIGHT, the injector must inject 105 ppm by VOLUME for MAINTENANCE TREATMENTS**



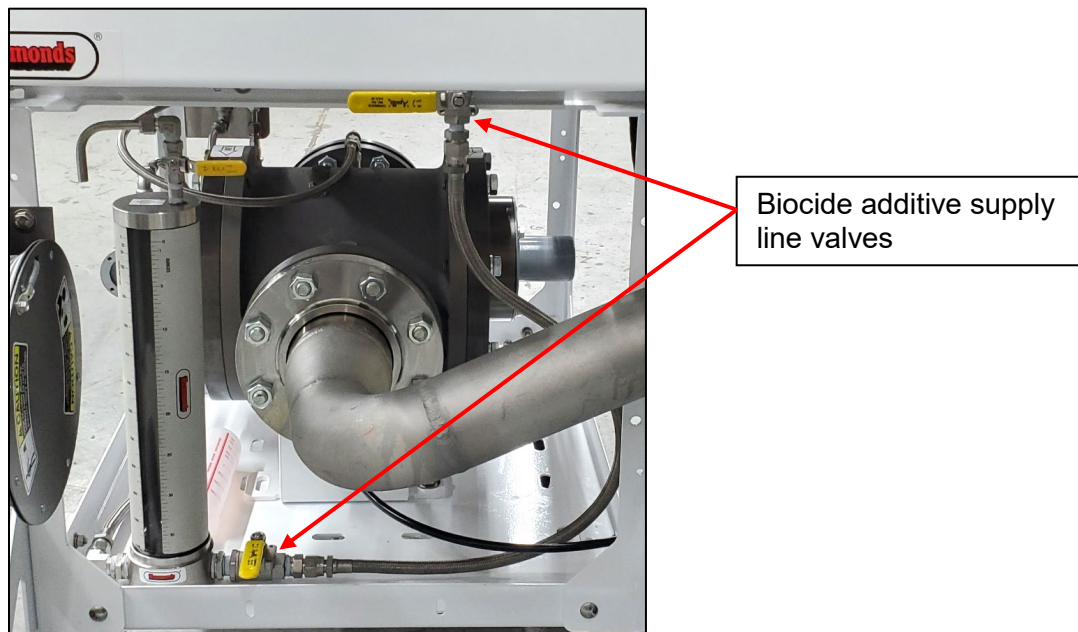
### I. Procedure – Additive Pump Priming

**WARNING: PERSONAL PROTECTION IS REQUIRED. PROLONGED BREATHING OF BIOCIDES FUELING MATERIAL OR REPEATED SKIN CONTACT MAY BE HAZARDOUS TO YOUR HEALTH.**

#### A. Standard Method – Fuel Recirculation

- (1) Connect fuel hose from a fuel truck to the Single Point Inlet of the Biocide Cart, and the Discharge Fuel hose to the fuel truck in order to recirculate fuel through the Biocide Cart.
- (2) Open the valves in the supply line for the biocide. See Fig. 1.

Fig. 1.

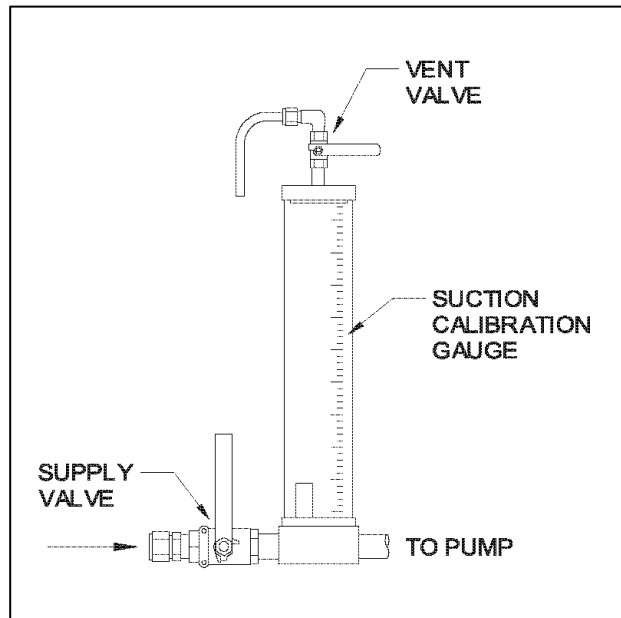


- (a) There are two valves in the supply line for the biocide... one mounted on the underside of the supply tank, and one just upstream of the Suction Calibration Gauge.

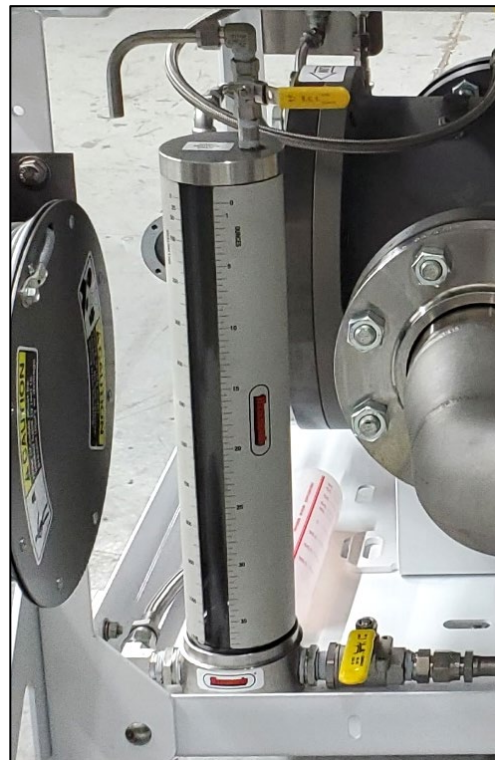
(3) Fill the Suction Calibration Gauge. See Figs. 2a and 2b.

- (a) Slowly open the Vent Valve at the top of the Suction Calibration Gauge to let air escape and biocide additive to flow in.
- (b) When the biocide nears the top of the Suction Calibration Gauge, close the Vent Valve.

**Fig. 2a: Suction Calibration Gauge**



**Fig. 2b: Suction Calibration Gauge**

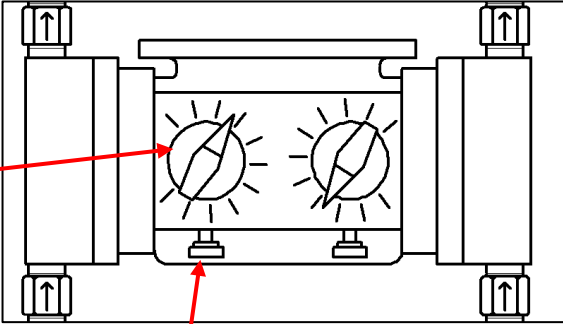




**Fig. 3: Pump Stroke Adjustment**

(4) Set the pump Stroke Adjustment Knob to "MAX" for the chosen biocide. See Fig. 3.

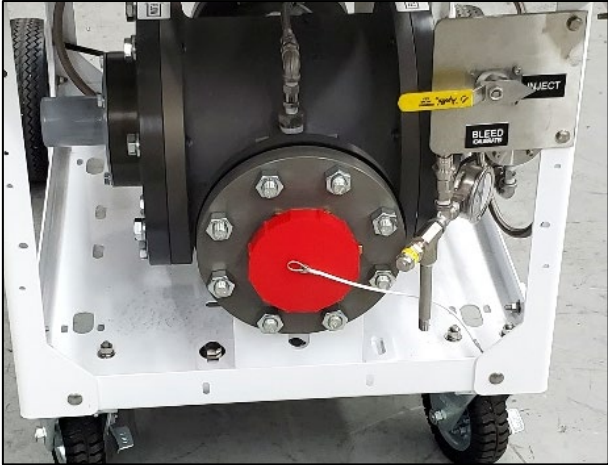
Stroke Adjustment Knob



Lock Screw

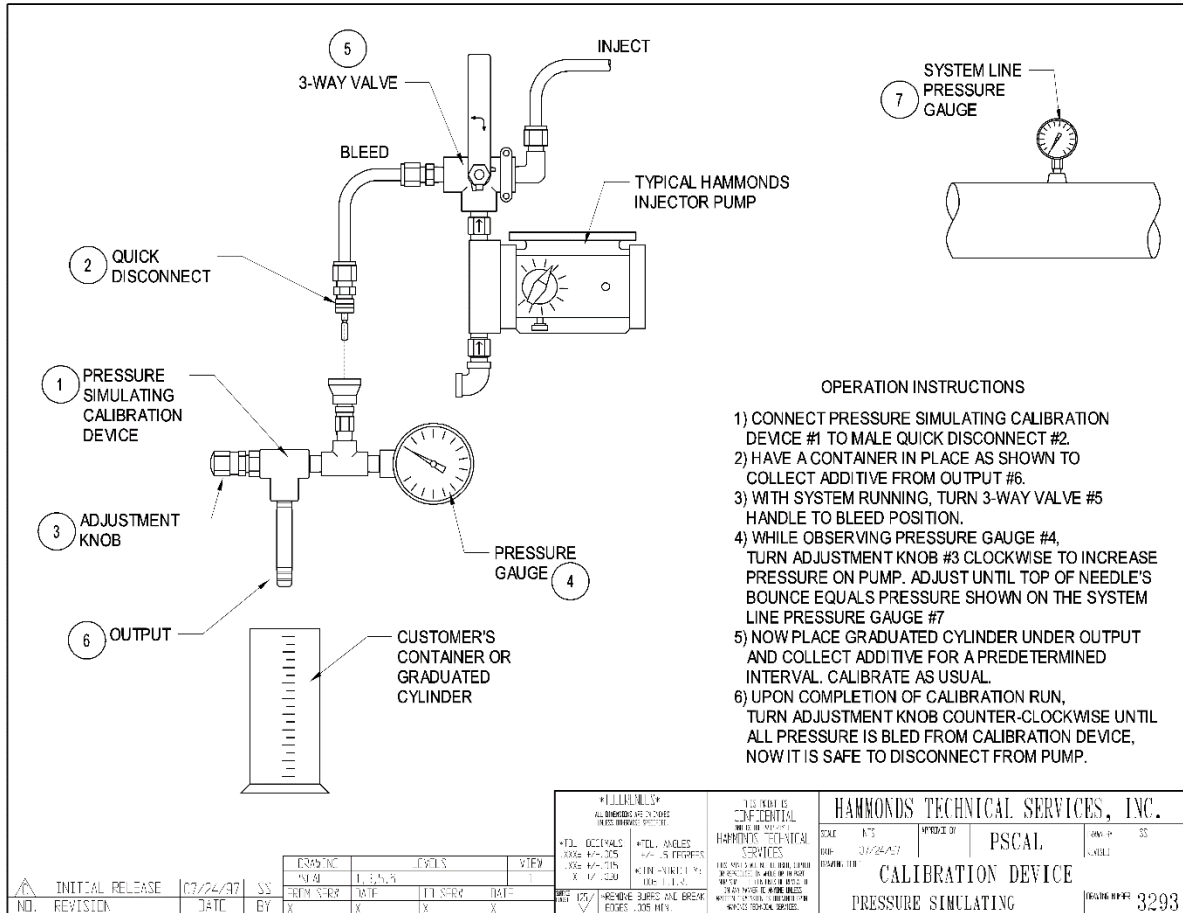
(5) Turn "INJECT/BLEED (CALIBRATE)" Valve to the "BLEED (CALIBRATE)" position. See Fig. 4a and 4b.

**Fig. 4a and 4b: "INJECT/BLEED (CALIBRATE)" Valve**



- (6) Place an appropriate vessel under the “BLEED” discharge tube to catch biocide during pump priming. Turn Pressure Adjustment Knob counter-clockwise to ensure the pump will be operating at atmospheric pressure / no pressure. See Fig. 5.

**Fig. 5.**



- (7) Start recirculation fuel flow through the biocide cart and monitor the “BLEED” discharge tube for a clear, air free stream of biocide. At this point the biocide pump is primed and recirculation fuel flow can be stopped.

- (8) Return “INJECT/BLEED (CALIBRATE)” Valve to the “INJECT” position. See Fig. 4a and 4b.

**B. Alternate Method – Pressurizing Additive Supply (Recommended)**

- (1) Open the valves in the supply line for the biocide. See Fig. 1.
  - (a) There are two valves in the supply line for each biocide... one mounted on the underside of the supply tank, and one just upstream of the Suction Calibration Gauge.
- (2) Fill the Suction Calibration Gauge. See Fig. 2.
  - (a) Slowly open the Vent Valve at the top of the Suction Calibration Gauge to let air escape and biocide additive to flow in.

- (b) When the biocide nears the top of the Suction Calibration Gauge, close the Supply Valve.
- (c) Set the pump Stroke Adjustment Knob to “MAX” for the chosen biocide. See Fig. 3.
- (d) Turn “INJECT/BLEED (CALIBRATE)” Valve to the “BLEED” position. See Fig. 4a and 4b.
- (e) Place an appropriate vessel under the “BLEED” discharge tube to catch biocide during pump priming. Turn Pressure Adjustment Knob counter-clockwise to ensure the pump will be operating at atmospheric pressure / no pressure. See Fig. 5.
- (f) Apply air pressure through the Vent Tube on the Suction Calibration Gauge in order to force biocide through the pump and monitor the “BLEED” discharge tube for a clear, air free stream of biocide. At this point the biocide pump is primed.

**NOTE: Carefully monitor the amount of biocide in the Suction Calibration Gauge to ensure that the entire volume is not pushed through the pump as this will leave the pump dry and not primed and require the process to be repeated. Hammonds suggests using a bicycle pump as shown in Fig. 6.**

**Fig. 6**



- (g) Close the Vent Valve at the top of the Suction Calibration Gauge.
- (h) Return “INJECT/BLEED (CALIBRATE)” Valve to the “INJECT” position. See Fig. 4a and 4b.



II. Procedure – Determine Metered Injection Adjustment

**WARNING: PERSONAL PROTECTION IS REQUIRED. PROLONGED BREATHING OF BIOCIDES FUELING MATERIAL OR REPEATED SKIN CONTACT MAY BE HAZARDOUS TO YOUR HEALTH.**

**NOTE:** Do these procedures with minimum fuel load (after flight, before fuel servicing). It is not necessary to defuel the aircraft prior to biocide treatment

This allows for larger quantity of Biocide treatment to be added.

**NOTE:** If the aircraft has no fuel remaining on board, use **Resource Table 1: Biocide Treatment Maximum Concentration** to determine the treatment rate for the chosen Biocide. Then use **Chart 1: 1S Stroke Setting Chart for Biobor JF** to find the beginning Stroke Setting for the biocide pump. Proceed to **III. Procedure – Calibration**.

- A. Complete Calculation 1 (using Resource Table 1) to calculate the metered injection adjustment (uplift PPM) for each tank.

**NOTE:** The metered injection adjustment (uplift PPM) is the concentration of Biocide required in the fuel being uplifted to the aircraft to account for the untreated fuel remaining on board. This higher treatment rate will result in the required Biocide concentration on **average** in the entire fuel load.

**Calculation Table 1: Metered Injection Setting – Fuel Tank Requirements**

METERED INJECTION SETTING – FUEL TANK REQUIREMENTS						
	A	B	C	D	E	F
FUEL TANK	NECESSARY FUEL QTY (TOTAL FUEL AFTER UPLIFT)  (MINIMUM OF 1/3 FULL)	ONBOARD FUEL QTY	FUEL TO BE ADDED  (B – A) or (A – B)	CONCENTRATION MULTIPLIER  (A ÷ C)	BIOCIDES MAXIMUM CONCENTRATION (PPM)  (SEE TABLE 2)	METERED INJECTION ADJUSTMENT (UPLIFT PPM)  (E × D)
No. 1						
No. 2						
EXAMPLE 1	10,000 LBS	2,000 LBS	8,000 LBS	1.25	270 PPMw	337.5 PPMw
EXAMPLE 2	1,493 Gallons	299 Gallons	1,194 Gallons	1.25	270 PPMw	337.5 PPMw

**NOTE:** The unit of measure used for fuel quantity in Calculation Table 1 does not matter. The ratio of total fuel after uplift to fuel being added will remain the same (concentration multiplier).



**Resource Table 1: Biocide Treatment Maximum Concentration**

BIOCIDE TREATMENT MAXIMUM CONCENTRATION	
BIOBOR JF	270 PPM BY WEIGHT

- B. Record Biocide maximum concentration for each tank (Column E in Calculation Table 1).
- C. Record necessary fuel quantity for each tank (Column A in Calculation Table 1).
  - (1) Record onboard fuel quantity for each tank (Column B in Calculation Table 1).
  - (2) Determine difference between necessary fuel quantity (Column A) and onboard fuel quantity (Column B) for fuel to be added for each tank.

**NOTE:** It does not matter the order of subtraction, just need the numerical difference between the two columns.

- (3) Record fuel to be added for each tank (Column C in Calculation Table 1).
- (4) Divide necessary fuel quantity (Column A) by fuel to be added (Column C) to calculate concentration multiplier for each tank.
- (5) Record concentration multiplier for each tank (Column D in Calculation Table 1).
- (6) Multiply Biocide maximum concentration (Column E) by concentration multiplier (Column D) for metered injection adjustment for each tank.
- (7) Record metered injection adjustment for each tank (Column F in Calculation Table 1).
- (8) Do not use a metered injection adjustment greater than 1000 PPM.

**NOTE:** ENSURE BIOCIDE AVERAGE IS NOT MORE THAN MAXIMUM CONCENTRATION LIMITS IN RESOURCE TABLE 1.

**CAUTION:** IF THE MAXIMUM CONCENTRATION OF BIOCIDE IS EXCEEDED, CONTACT TECHNICAL OPERATIONS TO DETERMINE IF THE AIRCRAFT NEEDS TO BE DEFUELED TO REDUCE CONCENTRATION OF BIOCIDE.

FOR BIOBOR JF: DO NOT EXCEED 1000 PPM CONCENTRATION OF BIOBOR JF IN THE FUEL TANKS. LARGE CONCENTRATION CAN CAUSE SALT DEPOSIT IN THE FUEL TANKS.

- (9) Calibrate the biocide treatment cart to the correct metered injection adjustment (Column F in Calculation Table 1).



(10) Find and set the pump to the appropriate beginning Pump Stroke Setting in the chart below for the biocide.

<b>Chart 1: 1S Stroke Setting Chart for Biobor JF</b>				
<b>Use PPM by Volume when adjusting the injector.</b>				
<b>STROKE %</b>		<b>PPM by Volume</b>		<b>PPM by Weight</b>
10 (MAX)	=	475	=	610
9.5	=	451	=	580
9	=	426	=	548
8.5	=	403	=	518
8	=	379	=	487
7.5	=	353	=	454
7	=	327	=	420
6.5	=	302	=	388
6	=	277	=	356
5.5	=	252	=	324
5	=	227	=	292
4.5	=	203	=	261
4	=	178	=	229
3.5	=	153	=	197
3	=	127	=	165
2.5	=	105	=	135
2	=	82	=	105
1.5	=	62	=	80
1	=	41	=	53
0.5	=	20	=	26
0 (MIN)	=	0	=	0

III. Procedure – Calibration

- A. **To verify calibration** at the beginning of the fuel uplift or while recirculating fuel when using a fuel truck, check that the biocide dosage rate is correct by using Calculation Table 2 to determine the amount of biocide required for a given amount of fuel.

**Calculation Table 2: Amount of Biobor JF Required for a Given Amount of Fuel**

AMOUNT OF BIOCIDES REQUIRED FOR A GIVEN AMOUNT OF FUEL					
	A	B	C	D	E
BIOCIDE	FUEL QUANTITY	PPM OF BIOCIDES BY VOLUME	CONVERT PPM TO DECIMAL FORM  (B ÷ 1,000,000)	GALLONS OF BIOCIDES REQUIRED  (A x C)	OUNCES OF BIOCIDES REQUIRED  (D X 128 oz/gal)
<b>EXAMPLE:</b> BIOBOR JF	50 GALLONS	262.5 PPMv	0.0002625	0.013125 GALLONS	1.68 OUNCES

**NOTE:** The unit of measure used for fuel quantity in Calculation Table 2 **must be in Gallons** as this is how the fuel delivery system (i.e. a fuel truck) measures the fuel being uplifted to the aircraft.

**NOTE:** The unit of measure used for biocide in Calculation Table 2 **must be in PPMv (PPM by Volume)** as this is how the biocide is measured when collected in the Suction Calibration Gauges.

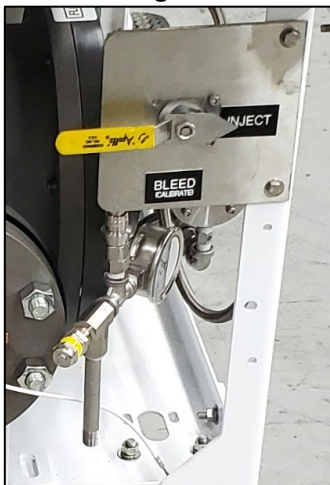


- B. Run 50 gallons of fuel through the biocide cart while measuring the amount of biocide being injected.

**(1) WHEN CALIBRATING WITHOUT INJECTING BIOCIDES INTO THE FUEL.**

- (a) Turn “INJECT/BLEED (CALIBRATE)” Valve to the “BLEED (CALIBRATE)” position. See Fig. 7.

**Fig. 7.**





- (b) Fill the Suction Calibration Gauge for the biocide. See Fig. 2.
  - i. Slowly open the Vent Valve at the top of the Suction Calibration Gauge to let air escape and biocide additive to flow in.
  - ii. When the biocide nears the top of the Suction Calibration Gauge, close the Supply Valve.
  - iii. Record the biocide level in the Suction Calibration Gauge.
- (c) Begin fuel flow.
  - i. Set the Pressure Adjustment Valve for the chosen Biocide to match the fuel pressure. See Fig. 8.

Fig. 8.



Pressure Gauge for Biocide

Pressure Adjustment Valve

- ii. Monitor the fuel delivery meter and stop fuel flow at 50 gallons.
- iii. Record the biocide level in the Suction Calibration Gauge.
- iv. Subtract the Beginning biocide level from the Ending biocide Level and compare it to the Ounces of Biocide Required from Column E in Calculation Table 2.
- v. Make stroke setting adjustment as necessary and repeat.
- vi. When a satisfactory amount of biocide has been delivered, return the "INJECT/BLEED (CALIBRATE)" Valve to the "INJECT" position in order to uplift fuel to the aircraft.
- vii. Refuel the aircraft to the necessary fuel quantity. **NOTE:** It is not necessary to drain the fuel tanks.
- viii. After biocide treatment is added, the recommended concentrations of biocide treatment can safely burn in the engines.

**(2) WHEN CALIBRATING WHILE INJECTING BIOCIDIC INTO THE FUEL.**

- (a) Turn “INJECT/BLEED (CALIBRATE)” Valve to the “INJECT” position. See Fig. 7.

**Fig. 7.**

- (b) Fill the Suction Calibration Gauge for the biocide. See Fig. 2.
- i. Slowly open the Vent Valve at the top of the Suction Calibration Gauge to let air escape and biocide additive to flow in.
  - ii. When the biocide nears the top of the Suction Calibration Gauge, close the Supply Valve.
  - iii. Record the biocide level in the Suction Calibration Gauge.
- (c) Begin fuel flow.
- i. Monitor the fuel delivery meter and stop fuel flow at 50 gallons.
  - ii. Record the biocide level in the Suction Calibration Gauge.
  - iii. Subtract the Beginning biocide level from the Ending biocide Level and compare it to the Ounces of Biocide Required from Column E in Calculation Table 2.
  - iv. Make stroke setting adjustment as necessary and repeat.
  - v. When a satisfactory amount of biocide has been delivered, return the “INJECT/BLEED (CALIBRATE)” Valve to the “INJECT” position in order to uplift fuel to the aircraft.
  - vi. Refuel the aircraft to the necessary fuel quantity. **NOTE:** It is not necessary to drain the fuel tanks.
  - vii. After biocide treatment is added, the recommended concentrations of biocide treatment can safely burn in the engines.