

**HFI**  
**HYDRA-FLEX INC**

**AQUA-LAB™**

**CS1**

**Chemical Dispensing System**



# **Installation and Operation Manual**

REV A

**For Additional Support Call:  
952.808.3640**

## *Table of Contents*

Specifications .....	- 1 -
Illustration .....	- 1 -
Installation and Set Up.....	- 2 -
Initial Injector Setup .....	- 3 -
Injector Vacuum Check (for troubleshooting injectors) .....	- 5 -
Foaming Prep Setup.....	<b>Error! Bookmark not defined.</b>
Optimizing the System.....	- 6 -
Application Optimization (repeat for each application) .....	- 6 -
Chemical Usage Measuring .....	- 7 -
Recommended Maintenance.....	- 7 -
Troubleshooting .....	- 8 -
Appendix.....	- 10 -

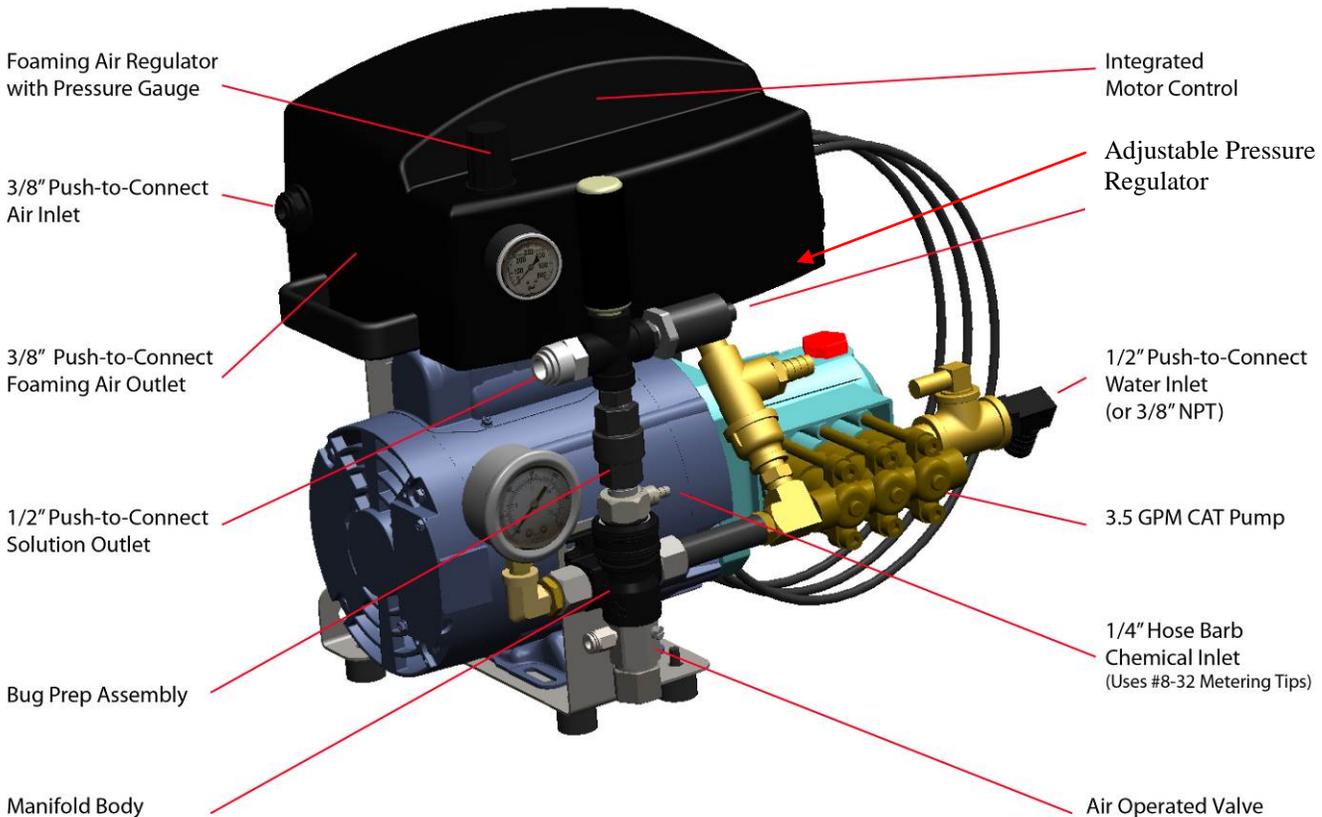
## Specifications

1. Operating water pressure: 200 psi (Factory set)
2. Pneumatics operating pressure: 100 psi Max Feed
3. Maximum water source temperature 140° F
4. Operating ambient temperature: 40-120° F
5. Signal – No signal from Car Wash Controller required
6. Electrical supply
  - a. 120/208-230VAC (1-phase) – 8 foot cord included
  - b. 3/4 hp pump 10 amps @ 120 volts or 5 amps @ 208 volts
7. Water supply
  - a. 50 micron filtration or better recommended
  - b. 1/2" OD Poly Flow or 3/8" ID Hose
  - c. Inlet pressure: Flooded-80 psi
    - i. If pump is fed from tank, water level must be ~28" above pump.
8. Air supply
  - a. 3/8" feed per system
  - b. 20 CFM @ 100 psi supply
9. Solution Outlet lines
  - a. 1/2" poly lines(3/8" ID)
  - b. Max pressure of outlet line is 66psi
10. Space requirement: 20" L x 12" W x 16"H
11. Weigh ~45lbs

## Illustration



## Operating Manual



## Installation and Set Up

1. Unpack from crate and inspect for damages
2. Anchor Mounting bracket to the wall in the desired location using three 1/4" wall anchors.
  - a. Make sure that the mounting bracket is level
3. Hang CS1 on mounting bracket
4. Plumb water inlet using attached 1/2" push to connect fitting or remove and use the 3/8" NPT to adapt to the fitting of your choice.
5. Plumb the air inlet using 3/8" poly flow hose ( a minimum of 60psi is required to open the valve properly)
6. Plumb the solution outlet to the desired location using 3/8" poly flow tubing or other hose of your choice.
7. Optional - Plumb the air outlet tubing using 3/8" poly flow tubing to a convenient location as near the gun as possible and tee into the solution line and install check valve on the air line.
8. Connect the gun with foam generator to the end of the solution line
9. Plug the 120VAC cord into a dedicated 20 amp plug in
10. Turn the on / off switch on and the system should turn on and pressurize the outlet tubing to the set point of the pressure switch and turn off
11. Have someone use the gun and monitor the system to make sure that the pump is not cycling unnecessarily. If it is turning on an off rapidly address one of the three below issues.

## Operating Manual

- a. Increase the pressure set point of the pressure switch by removing the Phillips head screw and using a 1/8" hex key or Allen wrench to turn the set screw clockwise, replace the



- b. Increase the size of the nozzle on the gun
  - c. Decrease the size of the injector on the system
12. Make sure that the pressure gage at the manifold is set at 200psi by adjusting the pressure regulator.
    - a. Make sure to engage the lock nut after adjustment
  13. At the end of each day make sure that the system switch is turned off to ensure that the system doesn't cycle on and off during the night and will not cause a flood if there is a hose or fitting failure downstream of the system

### Initial Injector Setup

*(Based on field experience this is HFI's recommended starting point)*

1. All HFI Prep systems ship with an 3/4 GPM injector, a foam generator and a standard spray gun. If you would like to use the CS1 Prep system without using the foaming feature you can remove the foam generator and eliminate the air line from the installation instructions. Please refer to the chart below and select the injector / nozzle combination that best meets your needs.



Injector Size	Nozzle Size	Nozzle Oriface	Approx. Back Pressure
0.029	3	0.043	40

## Operating Manual

0.029	4	0.052	15
0.04	5	0.057	50
0.04	6	0.062	25
0.04	7	0.067	10
0.051	7	0.067	50
0.051	8	0.072	40
0.051	10	0.08	15
0.057	8	0.072	60
0.057	10	0.08	45
0.057	15	0.096	18

2. Connect solution lines to the bug prep assembly using the attached push connect fitting
  - a. Do not over tighten poly fittings or they may crack
3. Connect ¼" poly lines from each chemical container to the appropriate injector
  - a. Ensure a foot valve or similar check valve/filter is installed on each line
    - i. These must be present or metering tips may clog
4. Metering tips will need to be installed to set dilution ratio (see appendix for ratio charts to determine tip)

**If the spray nozzles on the gun is too small for the injector chosen, the back pressure put on the injector may cause the injector not to function and chemical will not be pulled. The back pressure should not exceed 66 psi. Back pressure gauges are available for purchase from HFI. (P/N 1001105) Water will continue to flow as normal.**

## ***Injector Vacuum Check (for troubleshooting injectors)***

1. At the ChemFlex injector, remove the chemical feed line from the injector hose barb.
2. Attach the tubing of the vacuum gauge to the ChemFlex hose barb
3. With the gun open and the system running an injector that is working properly will have a reading greater than or equal to ( $\geq$ ) 20 in Hg
4. If injector is not functioning:
  - a) Check metering tip for clogs (can be tested with no metering tip to ensure injector is performing)
  - b) Try smaller injector (this will produce less flow and thus less backpressure)
  - c) Remove a nozzle(s) at the arch, allowing water to free flow (this will reduce backpressure)

There is a variation of performance in the injectors that comes from slight variations in the dimensions of the parts and in assembly that are unavoidable. It is common to see the resultant vacuum range from 20 in Hg all the way up to 28. There is also variation in the through hole size on the meter tips from Dema (within their manufacturing tolerances). Using the same tip color from site to site is a good starting point. However with the potential for variation from part to part it is reasonable to still need to do some adjustments from there.

## Optimizing the System

*Consistently achieve the desired cleaning and presentation/performance using the least amount of chemical and water*

### ***Injectors vs. Metering Tips vs. Nozzles***

*The key to optimizing the system is through trial and error.  
Don't be afraid to try these steps to achieve your ideal performance.*

What do injectors do?

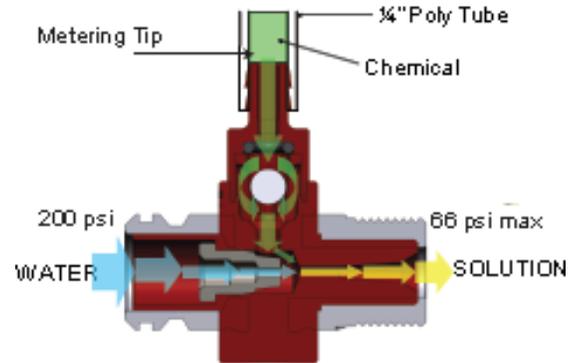
- Increases or decreases the amount of water in the solution

What do metering tips do?

- Increases or decreases the amount of chemical in the solution

What do nozzles do?

- Determines the pattern and backpressure of the solution



### ***Application Optimization (repeat for each application)***

View Performance at Gun with Decision Maker

- Application too wet
  - Increase air
  - Reduce injector size (decreases water)
  - Increase metering tip (increases chemical)
- Application too dry
  - Decrease air
  - Increase injector size (increases water)
  - Decrease metering tip (decreases chemical)
- Nozzle sputters
  - Decrease air
  - Decrease nozzle(s) and/or size used on arch
  - Increase injector size (increases water)
- Too much chemical used
  - Decrease metering tip
  - Decrease metering tip and injector size (to maintain desired ratio)
- No chemical
  - Check vacuum of injector (see instructions on page 9)
  - Check foot valve
  - Check metering tip
- Nozzle fan pattern not filled
  - Reduce nozzle size
  - Increase injector size (increases water)
- Water not present at all nozzles on arch
  - Verify check valves are functioning
  - Verify nozzles are not plugged
  - Reduce number of nozzles
  - Reduce nozzle size
  - Increase injector size (increases water)

## Chemical Usage Measuring

Verify titration of chemicals before proceeding

1. Setup lab scale with small bucket of chemical to be measured.
2. Put the suction line into the bucket.
3. Run the application being tested to “prime” the line. (All air bubbles must be removed for accuracy)
4. Record the **Initial Weight** from the scale. (Tarring the scale with weight on the scale can affect accuracy)
5. Run the application for 6 vehicles (or manually for the same it would be on for 6 vehicles).
6. Record the **Final Weight** from the scale.
7. Subtract the Initial Weight from the Final Weight to determine the weight of used product.
8. Divide this **Used Weight** by 6 to get a per car weight.
9. Divide the **Per Car Weight** in grams by the specific gravity of the chemical to determine the milliliters of chemical used per vehicle.

## Recommended Maintenance

The recommended service and maintenance on the AQUA-LAB System are as follows.

### Monthly

- Check water filter and replace as needed (if installed)

### Semi-Annually

- Check and replace injector metering tips
- Clean / check air and water valves
- Check and clean Y strainer (if installed)
- Inspect and replace chemical lines as needed

### Annually

- Clean water regulator
- Inspect motor starter for corrosion, if identified order replacement/spare parts

### 2 Years

- Inspect and replace injectors
- Rebuild valves
- Rebuild water regulator

## Troubleshooting

PROBLEM	POTENTIAL CAUSES	SOLUTIONS
Pump Operates, but delivers little or no water	Pump not primed	See priming instructions
	Inlet Restriction	Check all in-line filters and inlet plumbing for restrictions. Check valves and backflow preventers
	Inadequate water supply	Check pressure on inlet side of pump to be sure positive pressure is maintained
	Undersized piping	Replace with larger piping
	Leak on the Inlet side	Make sure connections are tight
	Worn or defective pump parts	Replace worn parts or entire pump, Clean parts if required
	Pump check valves clogged	Clean and check all 6 pump check valves
	Incorrect Motor rotation	Reverse motor rotation by interchanging any two leads
Pump won't start or run at full speed	Blown fuse or circuit breaker	Replaced fuses or close circuit breaker
	Defective Motor Starter contactor	Replaced motor starter contactor
	Defective pressure switch	Replace pressure switch
	Incorrect Motor Voltage	Voltage must be within 10% of motor rated voltage
	Defective motor	Replace motor
	Pump components damaged	Replace worn part or entire pump
Excessive Noise from Pump	Not Primed	Reprime pump
	Pump not secured firmly	Secure properly
	Restricted Inlet	Clean or correct restriction
	Water regulator fluttering	Try to adjust regulator down and then back up or replace regulator
	Pump check valves clogged	Clean and check all 6 pump check valves
	Cavitation (Sounds like marbles in pump)	Increase inlet size
Pump cycles on and off	Pressure Switch set too low	Increase set point of pressure switch
	Foam generator clogging	clean foam generator
Pump Leaks	Worn mechanical seal	Replace shaft seal
	Worn o-ring seals	Replace
Injector is not drawing chemical - <b>Passes Vacuum Pressure check test</b>	Clogged chemical feed	Check chemical hose, foot valve, metering tip and hose barb for debris or clogs
Injector is not drawing chemical - <b>Fails Vacuum Pressure check test</b>	Too much back pressure on injector	Perform back pressure check test outlined in Section IV if this manual. If the result is higher than 66 psi then Increase arch nozzle size or quantity, use larger tubing, or use a smaller flow injector
	Clogged injector check valve	Blow compressed air through the chemical hose barb on the injector to remove debris
	Clogged injector nozzle	Remove injector and blow out any debris with compressed air

## Operating Manual

PROBLEM	POTENTIAL CAUSES	SOLUTIONS
System won't regulate up to 200 psi	Pump not primed	Follow priming instructions
	Debris in regulator	Remove regulator and clean out debris
	Motor rotation incorrect	Verify rotation and adjust wiring to correct
	Pump check valves clogged	Clean and check all 6 pump check valves
	Defective Check Valve	Replace check valve if broken
	Defective Regulator	Replace Regulator
	Defective Pump	Replace Pump
Flow at gun is too low	Incorrect Injector Flow Rate Selection	Replace with desired injector size
	System pressure too low	Ensure system pressure is set at 200 psi
	Foam Generator Plugged	Ensure cleaned and clear
	Downstream plumbing restrictive	Perform Back pressure test outlined in Section IV of this manual, if over 66 psi, increase tube size and reduce elbows, turns or other restrictive plumbing
No flow from injector	Solenoid valve malfunction	Ensure valve is receiving the correct electrical signal and voltage
		Valve may be assembled incorrectly
		Disassemble valve and clean out debris (See valve replacement instructions)
	Clogged Injector	Remove injector and blow out debris with compressed air
Valve stuck open – Staying open when signal is off	No water supply	Check that the system has a supply of water
	O-ring failure	Replace O-rings inside valve

# Appendix

## ChemFLEX Injectors - Chemical Dilutions Ratio (Assumes feed pressure of 200 psi)

Flow Rate (GPM) at 200 psi	Nozzle Size								
	0.25	0.50	0.75	1.00	1.50	2.00	2.25	3.25	5.50
Metering Tip	0.029" (0.7 mm)	0.040" (1.0 mm)	0.051" (1.3 mm)	0.057" (1.4 mm)	0.070" (1.8 mm)	0.083" (2.1 mm)	0.086" (2.2 mm)	0.098" (2.5 mm)	0.125" (3.2 mm)
Copper	1: 57	1: 104	1: 155	1: 146	1: 281	1: 406	1: 468	1: 629	1: 1074
Pumpkin	1: 43	1: 82	1: 119	1: 126	1: 238	1: 348	1: 398	1: 554	1: 946
Burgundy	1: 34	1: 67	1: 97	1: 111	1: 207	1: 304	1: 347	1: 495	1: 845
Lime	1: 28	1: 57	1: 81	1: 100	1: 183	1: 270	1: 307	1: 447	1: 764
Tan	1: 28	1: 57	1: 81	1: 100	1: 183	1: 270	1: 307	1: 447	1: 764
Orange	1: 23	1: 44	1: 64	1: 78	1: 137	1: 196	1: 215	1: 314	1: 536
Turquoise	1: 17	1: 31	1: 45	1: 55	1: 91	1: 126	1: 134	1: 197	1: 336
Pink	1: 14	1: 24	1: 35	1: 42	1: 68	1: 93	1: 98	1: 143	1: 244
Light Blue	1: 11	1: 17	1: 24	1: 31	1: 47	1: 64	1: 66	1: 98	1: 166
Brown	1: 10	1: 15	1: 22	1: 28	1: 43	1: 58	1: 59	1: 88	1: 150
Red		1: 12	1: 17	1: 23	1: 34	1: 45	1: 46	1: 69	1: 116
White		1: 12	1: 16	1: 22	1: 31	1: 42	1: 43	1: 64	1: 108
Green		1: 11	1: 14	1: 20	1: 28	1: 37	1: 38	1: 55	1: 94
Blue		1: 10	1: 12	1: 17	1: 23	1: 30	1: 31	1: 46	1: 77
Yellow			1: 9	1: 12	1: 16	1: 20	1: 22	1: 31	1: 52
Black				1: 10	1: 13	1: 16	1: 17	1: 24	1: 40
Purple				1: 6.6	1: 8.3	1: 9.0	1: 10	1: 13	1: 21
Gray				1: 5.3	1: 6.7	1: 6.9	1: 7.6	1: 10	1: 16
Open				1: 4.9	1: 5.3	1: 5.2	1: 6.0	1: 6.1	1: 10

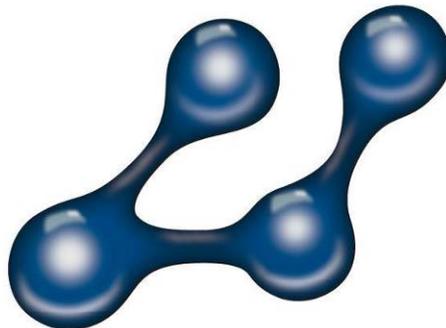
NOTE: Dilution Ratios given above are based on Drawing Water through the Metering Tips and are meant as a Starting point for System Configuration - Results are expected to vary when drawing chemicals due to differences in Viscosity and Temperature

**Chem-Flex Injector Listing**



**Aqua-Lab Chem Flex Injector Listing**

Part Number	# Barbs	GPM
618029	1	0.25
618040	1	0.50
618051	1	0.75
618057	1	1.00
618070	1	1.50
618083	1	2.00
618086	1	2.30
618098	1	3.20
618125	1	5.40
629029	2	0.25
629040	2	0.50
629051	2	0.75
629057	2	1.00
629070	2	1.50
629083	2	2.00
629086	2	2.30
629098	2	3.20
629125	2	5.40



# AQUA-LAB WARRANTY

## Factory Limited

Hydra-Flex Inc warrants its equipment to be free from defect in material or workmanship under proper normal proper use for a period of one (1) year beginning the date of purchase.

The Hydra-Flex Inc's liability shall be limited to repair or replacement of parts found to be defective within the warranty period and following Hydra-Flex Inc's inspection. Hydra-Flex Inc shall have the option requiring the return of defective material to establish the purchaser's claim. In the event of repair or replacement this limited warranty is non-cumulative. Neither labor nor transportation charges are included in this warranty.

This warranty is based upon the proper care and maintenance of the warranted equipment. Warranty does not apply if the merchandise is altered or modified in any way. Warranty does not apply to any equipment which has been subject to misuse, inappropriate use of tools, including exposure to harsh chemicals, neglect, lack of maintenance, freezing, fluid hammer, accident, third party damage, fluid impurities such as sand or minerals, acts of God or acts of war. Nor does it apply to any equipment which has been repaired or altered by anyone not so authorized by Hydra-Flex Inc. All equipment must be properly installed in accordance with specified plumbing, electrical, and mechanical requirements. The warranty does not apply to normal wear and tear or routine maintenance components as described in the equipment manual.

Except as expressly stated herein, Hydra-Flex Inc shall not be liable for damages of any kind in connection with the purchase, maintenance, or use of this equipment including loss of profits and all claims for consequential damages. This limited warranty is in lieu of all other warranties expressed or implied. Hydra-Flex Inc neither assumes nor authorizes any person to assume for it any other obligation or liability in connection herewith. This warranty is neither assignable nor transferable.

Transportation damage claims are to be submitted to the carrier of the damaged material.