AQUA-LAB MD™

CHEMICAL DISPENSING SYSTEM

User Manual

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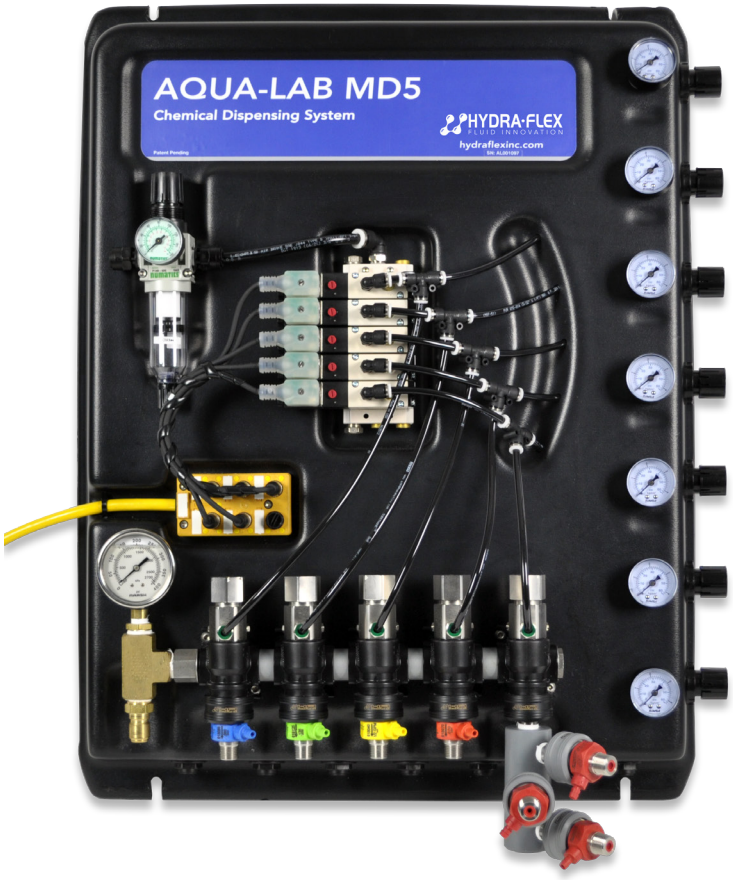

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HYDRA·FLEX
FLUID INNOVATION

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SPECIFICATIONS

POWER REQUIREMENTS	
PUMPS	**AIR-ACTUATED VALVES**
20 GPM	24 VAC or 24 VDC or 120 VAC, 3.5 Watts Per Port
208-230V/3PH/8.9A or 460V/3PH/4.1A or 575V/3PH/4.1A	

DIMENSIONS (W x H)					
PUMP ASSEMBLIES			**PANELS**		**MOTOR CONTROL UNIT**
1-Pump	2-Pump	3-Pump	MD3	MD5	Single / Dual
24"x 48"	24" x 48"	36" x 48"	22" x 29"	22" x 29"	14" x 15"

WATER SUPPLY			
Water Inlet Lines	20 GPM		40 GPM
	1" ID		1 1/2" ID or 2x 1" ID
Solution Outlet Lines	Up to 3 GPM	3-5.5 GPM	6-8 GPM
	1/2" OD Polyflow	1/2" ID Min.	5/8" ID Min.
Operating Water Pressure	200 PSI (Factory Set) Assuming 40 PSI City Feed		
Maximum Water Source Temperature	140˚F		
Water Filtration (Suggested)	50 Micron		

AIR SUPPLY	
Air Inlet Line	3/8" OD Polyflow Per MD Panel
Air Outlet Line	3/8" OD Polyflow Per Application
Air Inlet Pressure	60-120 PSI Dry Air

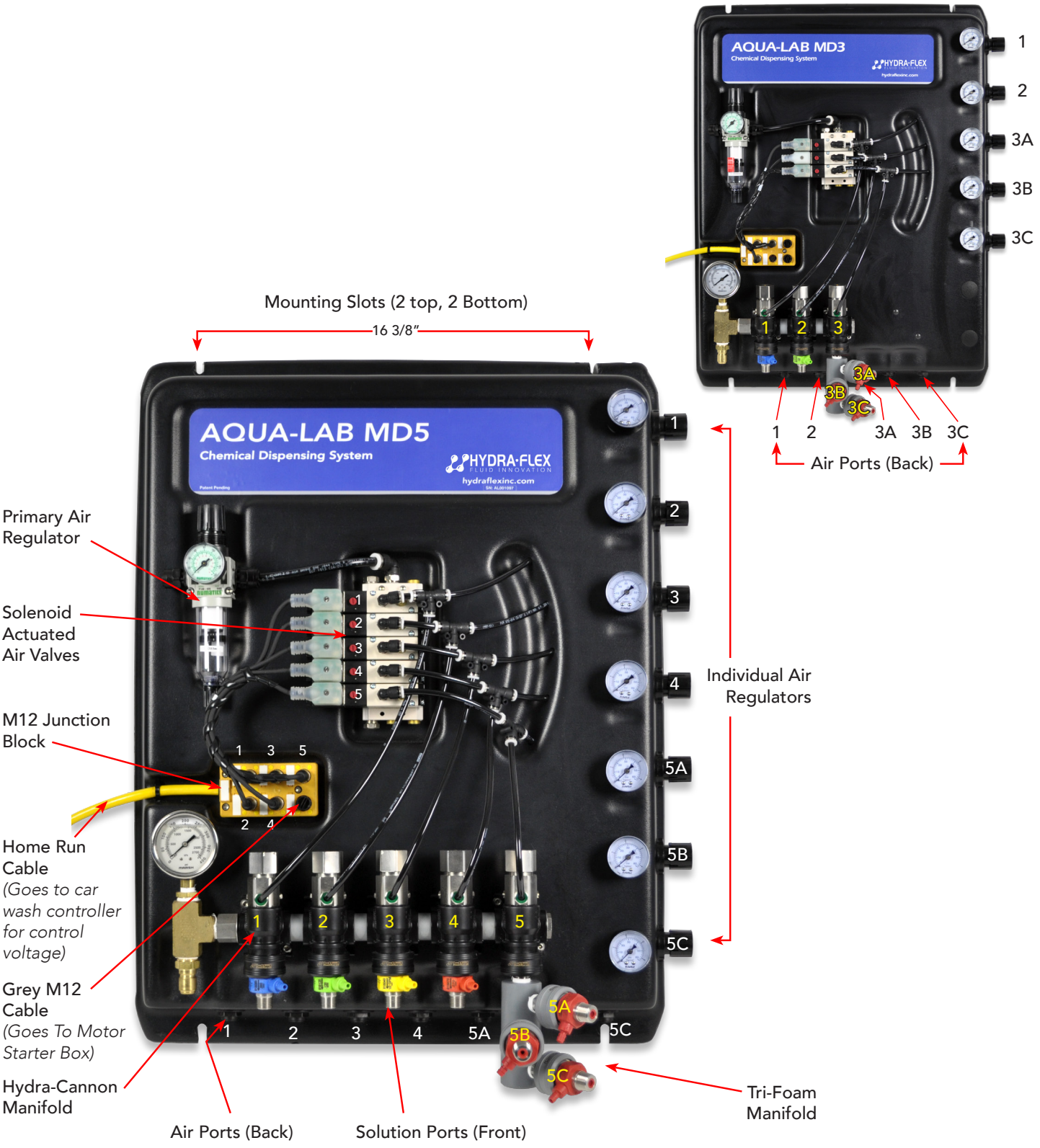
FOR ADDITIONAL SUPPORT CALL

952-808-3640

OR VISIT US ON THE WEB:

www.hydraflexinc.com

AQUA-LAB MD SYSTEM DIAGRAMS



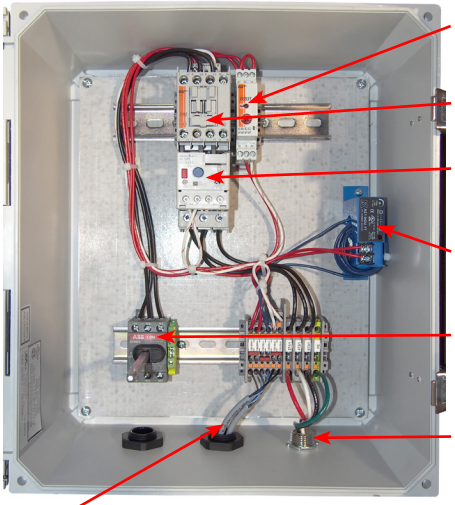
FOR PART NUMBERS & DIAGRAMS

Visit **www.hydraflexinc.com** and click on our Literature Tab located in the top right corner of our website. Then scroll down to the Sales Literature section & select the Vehicle Wash Catalog.

MOTOR STARTER/PUMP DIAGRAM

(SINGLE SOURCE / SINGLE PUMP SHOWN)

SPRECHER & SCHUH



Grey M12 Cables *(Carry signal from yellow M12 distribution block to motor starter that turns on the pump)*

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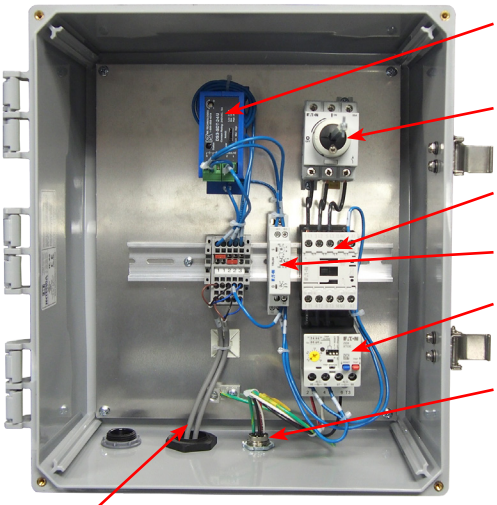
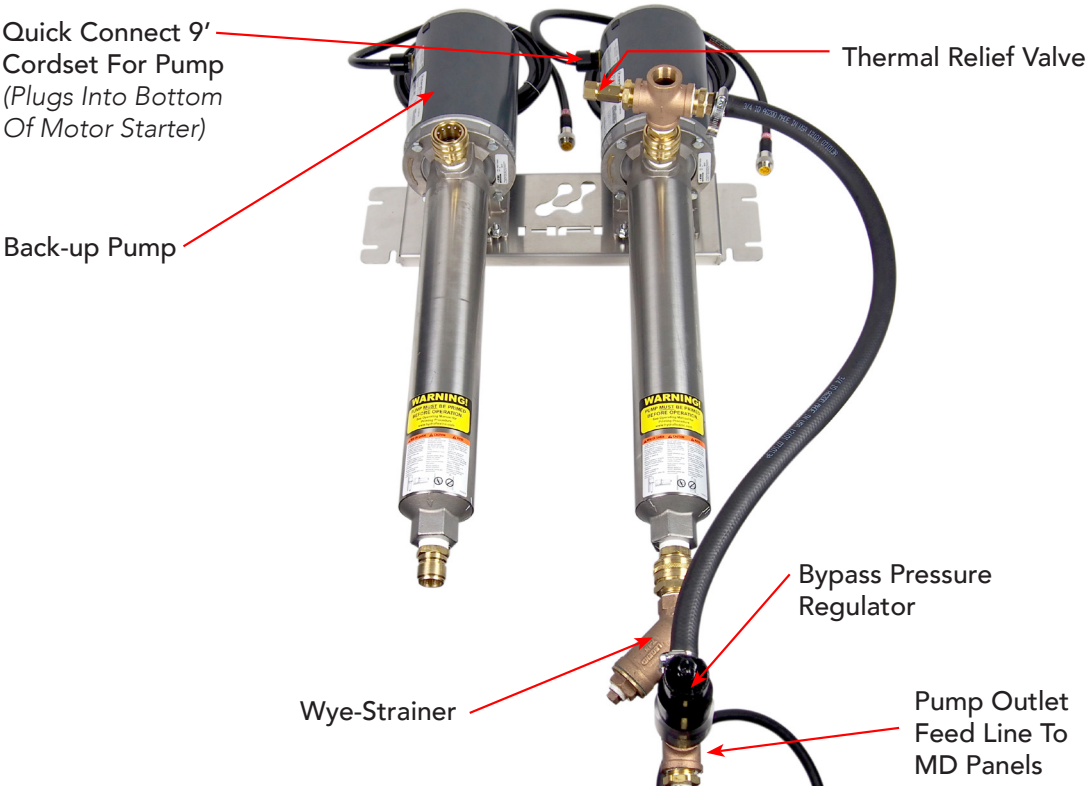


Grey M12 Cables *(Carry signal from yellow M12 distribution block to motor starter that turns on the pump)*



FOR PART NUMBERS & DIAGRAMS

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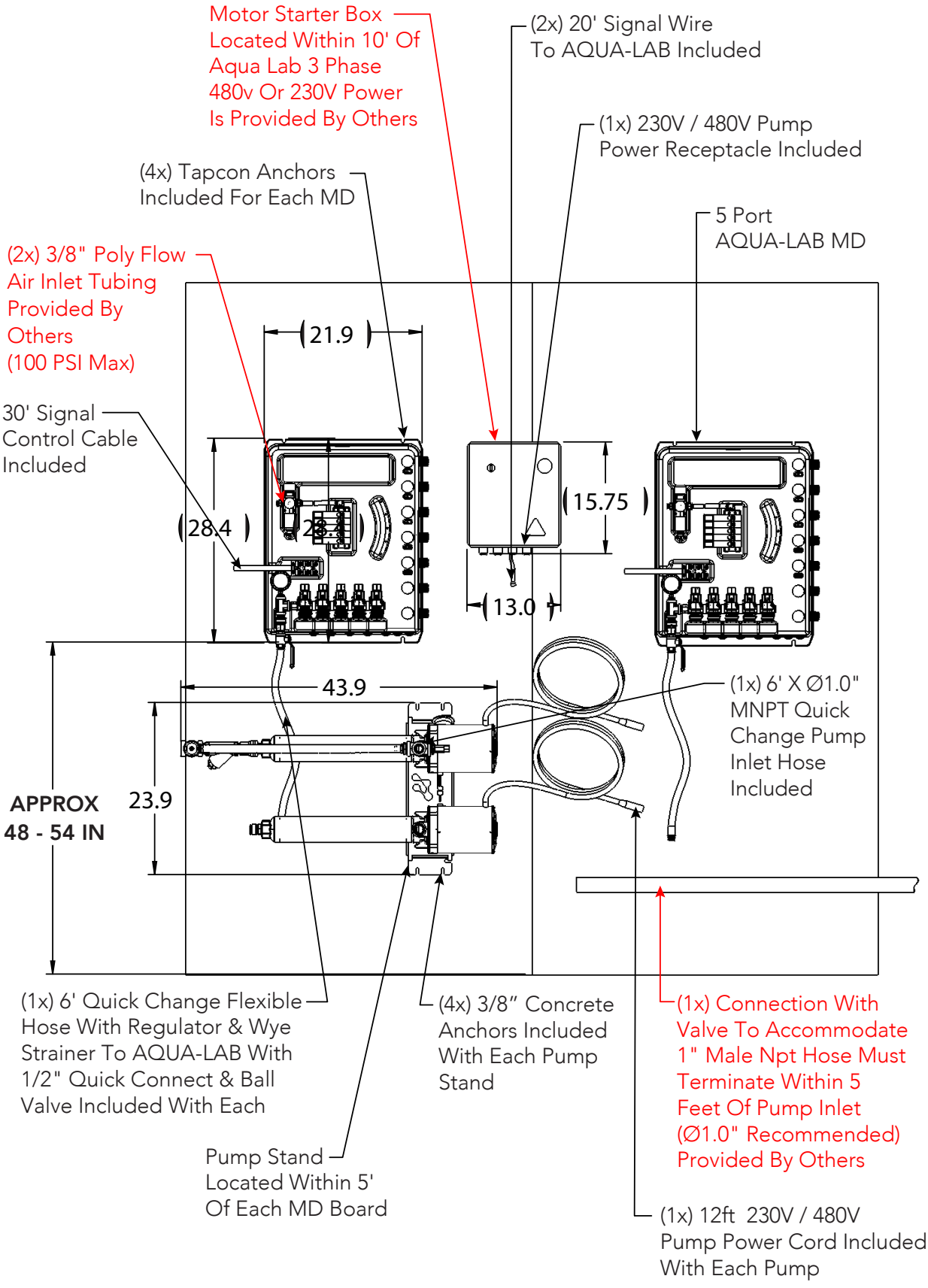
LAYOUT DRAWING



ESTIMATED INSTALLATION TIMELINE

PRE-INSTALLATION

WHO	TASK	EST. TIME
DISTRIBUTOR & CUSTOMER	DETERMINE LOCATION TO INSTALL EQUIPMENT	1 HR
PLUMBER	INSTALL WATER SUPPLY LINE	4 HR
ELECTRICIAN	INSTALL ELECTRICAL SUPPLY LINE	4 HR
TECHNICIAN	LABEL ALL CONTROLLER RELAYS AT CONTROLLER	1 HR
TECHNICIAN	RUN SOLUTION AND AIR LINES (IF NECESSARY)	5 HR
TECHNICIAN	INSTALL AIR SUPPLY LINE	1 HR
	TOTAL LABOR HOURS	**16 HRS**

INSTALLATION

WHO	TASK	EST. TIME
DISTRIBUTOR / TECHNICIAN	HANG EQUIPMENT	1 HR
TECHNICIAN	CONNECT WATER, AIR AND SOLUTION LINES	1 HR
TECHNICIAN	CONNECT CONTROL LEADS TO MAIN CONTROLLER OR JUNCTION BOX	2 HR
DISTRIBUTOR/TECHNICIAN	STARTUP (INJECTOR, METERING TIP AND NOZZLE SELECTION)	3 HR
DISTRIBUTOR/TECHNICIAN	DOCUMENT CONFIGURATION	1 HR
	TOTAL LABOR HOURS	**8 HRS**

POST INSTALLATION

WHO	TASK	EST. TIME
DISTRIBUTOR	MONITOR & RECORD PERFORMANCE	2 HR / WK
DISTRIBUTOR	MAINTENANCE PER SCHEDULE OR AS NEEDED	

TOTAL HOURS SPENT

TOTAL CUSTOMER	**1 HR**
TOTAL DISTRIBUTOR/TECHNICIAN	**15 HR**
TOTAL ELECTRICIAN	**4 HR**
TOTAL PLUMBER	**4 HR**

Installation takes approximately ONE day. An electrician and a plumber are needed for half a day.

INSTALLATION INSTRUCTIONS

General Skill Level

- Mechanical: Basic - mounting equipment
- Electrical: Advanced - three phase power and controls knowledge (local codes knowledge required)
- Plumbing: Moderate - principal supply line required
- Pneumatic: Basic- pneumatic utility connection required
- Chemical Knowledge: Moderate - chemical titrations required

Tools & Equipment Needed:

- Drill with Phillips head
- Concrete drill bit 3/8"
- Concrete drill bit 5/32"
- Hammer
- Tape measure
- Level
- Utility knife
- Wire stripper
- Socket set
- Adjustable wrench
- Screw driver set
- Teflon tape

Useful Tools:

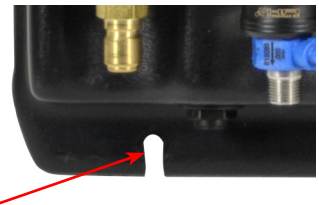
- Amp Meter
- Volt Meter

UNPACKING

The AQUA-LAB MD is shipped in a crate for protection.

1. Cut straps holding crate together, lift off top and sides
2. Un-bolt the pump from the pallet.
3. Lift the pump from the pallet. Use assistance if necessary.
4. *****Be sure not to discard the manuals and accessories box.**

LOCATION & MOUNTING

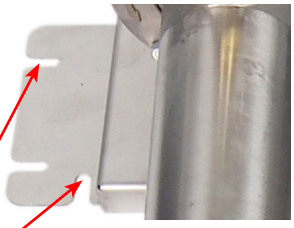


**If location was not identified during the Pre-Installation Process, make sure to consider the proximity to feed water, power supply, and the control cabinet as well as space near the system to store chemical containers.

*****See drawing in reference for general layout**

AQUA-LAB MD

1. Drill (4) 5/32" holes on the wall. 16 3/8" wide, 27 5/8" tall.
2. Press MD board tight against the wall.
3. Screw in 3/16" concrete screws with a washer.



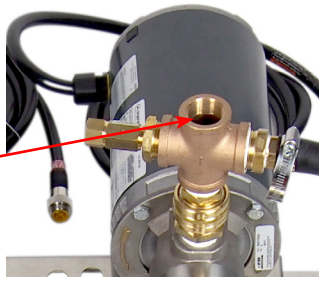
PUMP ASSEMBLY - NEED TO BE WITHIN 6' OF FURTHEST AQUA-LAB PANEL

1. Drill 3/8" holes in wall for bottom slots (20" on center pump nose down, 3.5" on center pump nose sideways - dual stand).
2. Insert concrete anchors, set pump on bolts and tighten down.
3. Hold pump stand in place, drill top holes, insert anchors and tighten.

MOTOR STARTER

1. Mount to the wall with 4 appropriate anchors.

FEED WATER CONNECTION

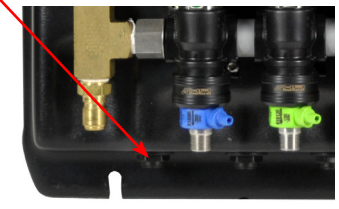


****PRIOR TO CONNECTION, ENSURE THAT THE FEED LINES ARE FREE OF DEBRIS BY FLUSHING OUT THE LINES FOR 15 MINUTES**

- Connect pre-run main water supply line to pump inlet with hose supplied.
  - Single operating pump: 1" MNPT
  - Dual operating pump: 1-1/2" MNPT

PNEUMATIC CONNECTIONS

- Connect pre-run 3/8" OD poly feed line to push connect fitting on the side of the primary regulator.
- Connect 3/8" OD poly lines from arch to each port that will be foaming.



****If there are unused air ports, back out the individual line regulator until air no longer flows.**

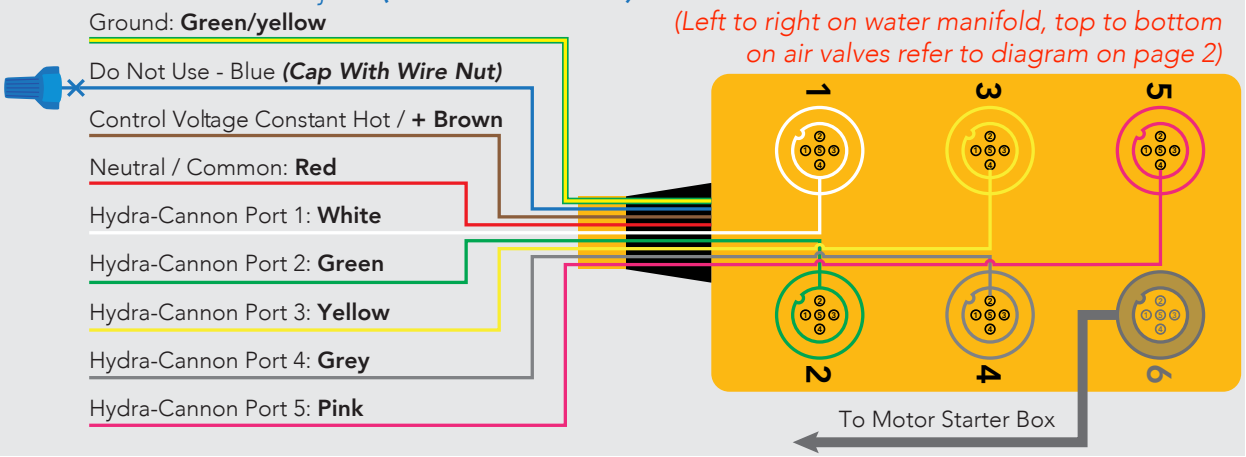
1. ELECTRICAL CONNECTIONS (HFI MOTOR STARTER)

a. Wire yellow homerun control cables to car wash control panel.
(See diagram below for wiring schematic)

- *Manifold position below designates which port is associated to what color wire.*
  - ***Example:** if you want Presoak 1 to be on manifold port 2, connect the green wire to your controller relay for Presoak 1.*

**********(HFI supplied motor starter)**********

*Make sure all BLUE wires are separately capped with wire nuts so that they do not touch any other electrical conductive objects **(One Wire Per Nut!)**.*



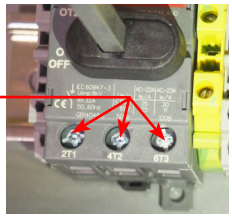
b. Remove the cap from port 6 then, connect the grey M12 cables hanging out of the motor starter box to the NEUTRAL/COMMON port 6 of the yellow M12 junction boxes.

i. If you have more panels than gray wires from the motor starter box, connect the lose gray wires sent in the shipment into the same jumpers as the pre-wired gray cables. (This step must be completed for unit to function.)

c. Connect Powerfast Cordset on motor(s) to motor starter box.

d. In the lower left of the enclosure, wire each leg of the incoming power to the terminals labeled
2T1, 4T2, and 6T3.

- *Make sure to follow all applicable electrical codes.*



2. ELECTRICAL CONNECTIONS *(ONLY FOR SYSTEMS RUNNING WITH NON HFI MOTOR STARTER)*

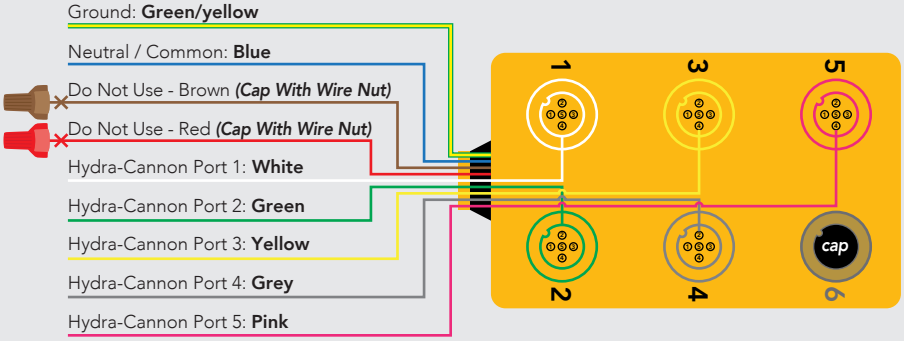
a. Connect yellow homerun control cables to car wash control panel.
(See diagram to the right for wiring schematic)

- *Manifold position below designates which port is associated to what color wire.*
- ***Example:** if you want Presoak 1 to be on manifold port 2, connect the green wire to your controller relay for Presoak 1.*

(Left to right on water manifold, top to bottom on air valves refer to diagram on page 2)

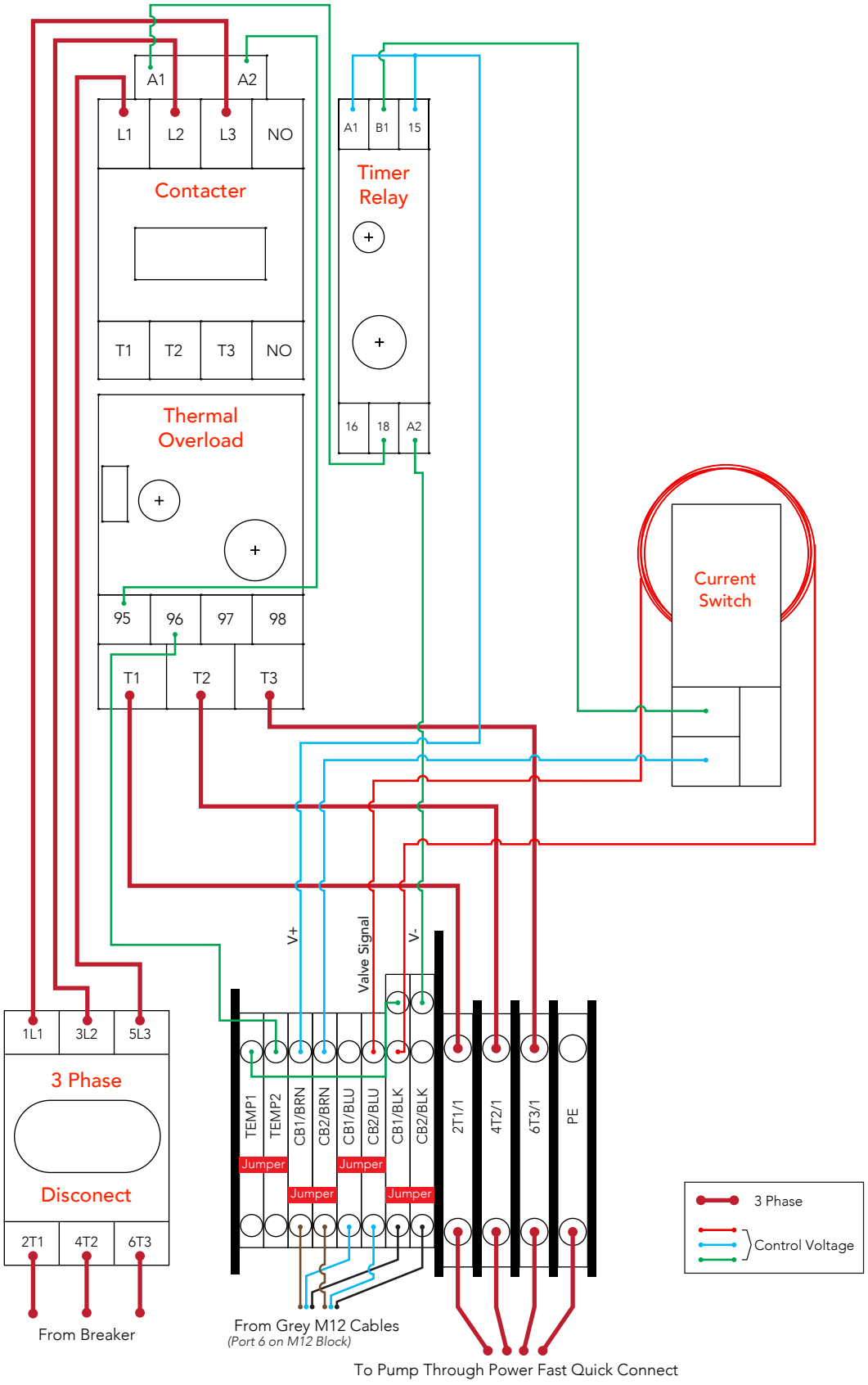
b. Wire each leg of power from your starter to each pump.

i. See diagram on pump for wiring schematic or pump manual.



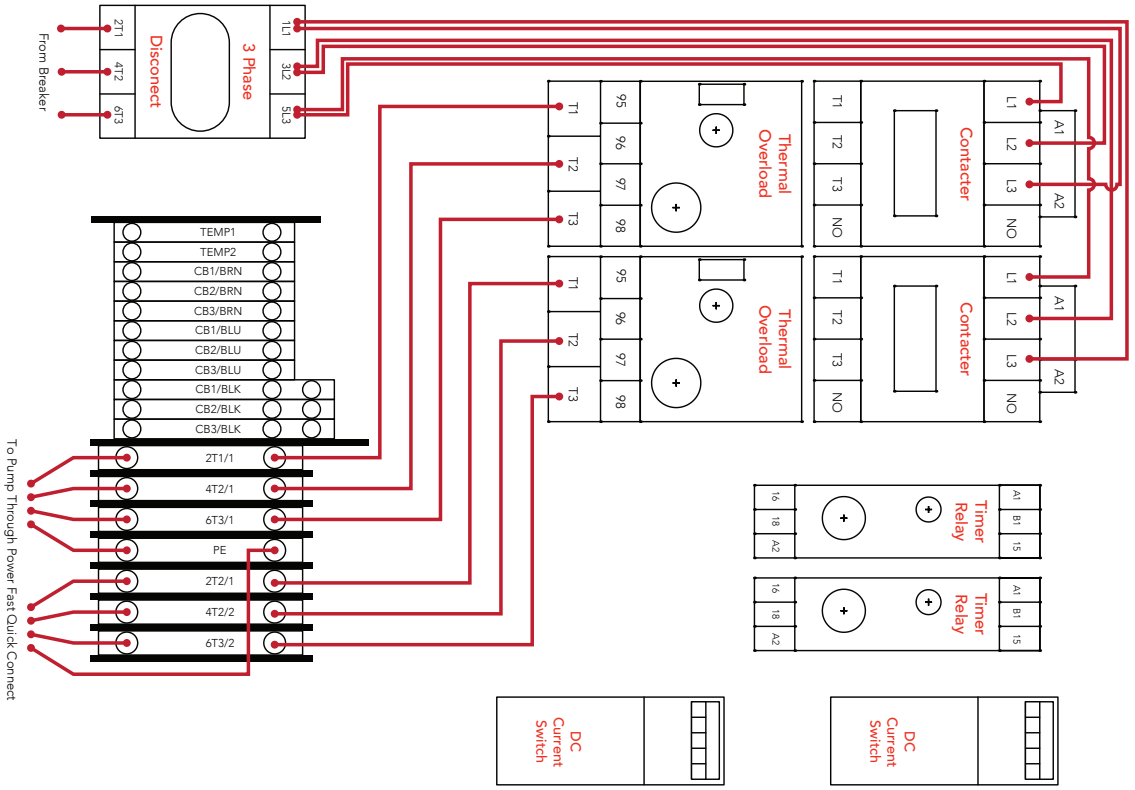
WIRING DIAGRAM

SINGLE PUMP

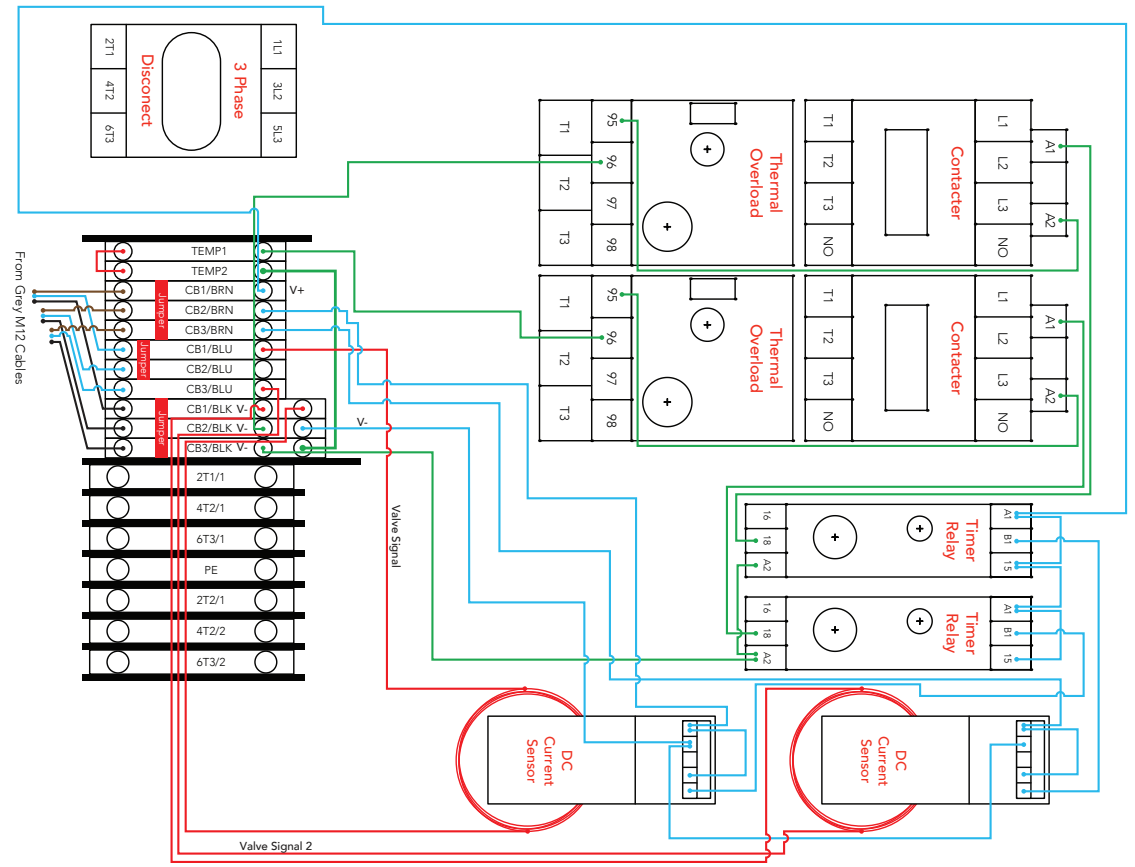


MULTI-SOURCE / DUAL PUMP

3 PHASE



CONTROL VOLTAGE



START UP

!WARNING! PUMP MUST BE PRIMED BEFORE OPERATION

1. **DISCONNECT & FLUSH**

   Close ball valve and remove the pump outlet line at the Hydra-Cannon Manifold quick-connect ***(Image 1)***. Make sure water supply to pump is turned on. Open ball valve and direct toward a drain or container to remove the majority of the air from the pump until a steady stream of water is flowing *(approx. 1 min)*. Then close the ball valve.

2. **CHECK ROTATION**

   Open Aqua-Lab™ Motor Starter Box (MSB) and ensure 3 phase disconnect is on. *(**Note:** Door will not open with disconnect on. Use a 1/4" wrench or crescent wrench to turn it back on after opening door.) (MSB with blue and black Eaton disconnect can be opened without shutting off by depressing button under switch handle. Press small button with screw driver to bypass disconnect **(Image 2)**. **!WARNING! - ELECTRIC SHOCK HAZARD. HIGH VOLTAGE PRESENT INSIDE MOTOR STARTER BOX - USE CAUTION!**)* Start the pump momentarily by depressing the center of the contractor ***(image 3)***. ***!WARNING! RUNNING THE PUMP BACKWARD WILL CAUSE CATASTROPHIC SYSTEM FAILURE! ENSURE THAT PUMP ROTATION IS CORRECT*** ***(image 4)*** as indicated by the arrow on the casting of the pump and that 200 psi can be reached.

   - *If pump cannot regulate to 200 psi, remove pump motor cover and look at shaft to confirm correct rotation.*
   - *Verify pump inlet pressure remains positive when running.*

3. **PURGE BYPASS**

   Start the pump and slowly open ball valve until it is wide open. Allow to run for 60 seconds to flush lines and then close valve.

4. **RECONNECT**

   Reconnect the pump outlet line to the Hydra-Cannon Manifold and open ball valve.

5. **DOUBLE CHECK**

   Confirm that the pump can obtain 200 psi while firing solenoids and that the pump housing *(stainless steel tube)* is cool to the touch after a minute in operation.

   - *If housing is hot or noisy, pump did not prime correctly.*
   - *If pump does not prime, repeat steps 3-5.*
   - *If not at 200 psi and the pump is correctly rotating you may need to adjust the bypass regulator to obtain 200 psi **(Image 5)**.*

Verify pump prime 24 hours after operation to ensure prime held. Pay close attention to the temperature of the pump shaft, the whole stainless steel area ***(Image 6)*** should be the same temperature. If it starts getting hotter than the supply water or greater than 140°, then it is likely that the pump did not prime correctly which ***WILL CAUSE DAMAGE TO PUMPS***. The motor housing (painted portion) will be hot during operation.

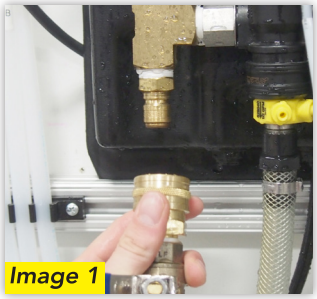


Image 1

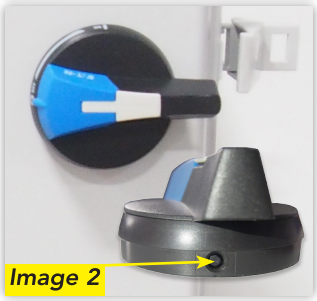


Image 2

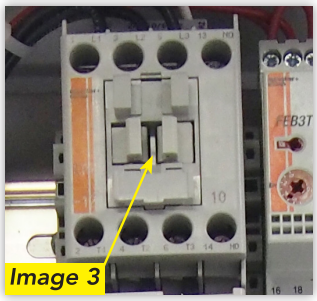


Image 3

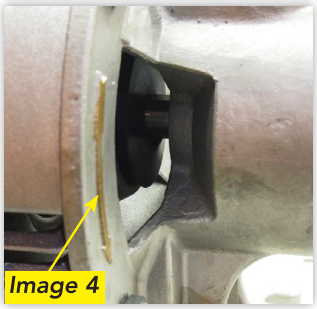


Image 4

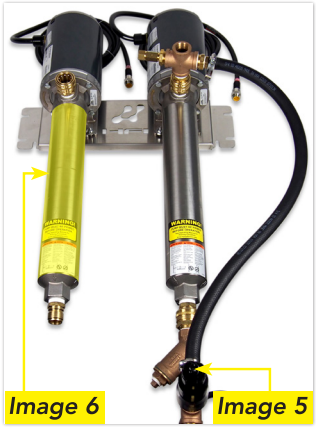


Image 6 Image 5

INITIAL INJECTOR SETUP

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

1. Using the recommended starting point (Page 19) or the target flow rate and the chemical dilutions chart (appendix Page 18) install the appropriate injector into each port.
2. Connect pre-run solution lines to each injector with the supplied coupler and push connect fitting.

    a. Be sure to use Teflon tape when connecting the injector to the coupler and push connect fitting to ensure there are no leaks.

    b. Do not over tighten poly fittings or they may crack.

3. Connect ¼" poly lines from each chemical container to the hose barb on 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 Page 18 for ratio charts to determine tip.)

TRIPLE FOAM SETUP

(For AQUA-LAB MD if ordered with extra regulators)

If your MD5 panel was ordered with 3 air valves and 5 air regulators or with 5 air valves and 7 air regulators the below instructions will show you how to setup your triple foam.

3 Valve / 5 Regulator MD Panel

- Your triple foam has been setup from the factory to be in **port 3**.
- Insert your triple foam manifold into position 3 with your selected injectors already inserted.
- On the side of the panel the 3A, 3B, and 3C regulators (see page 2 for reference) will control the air to each of your triple foam colors.
- Insert your air lines to the arch into the bulkhead fittings on the bottom of the panel. The 3A, 3B, and 3C bulkhead (see page 2 for reference) will be the airlines for each color.

5 Valve / 7 Regulator MD Panel

- Your triple foam has been setup from the factory to be in **port 5**.
- Insert your triple foam manifold into position 5 with your selected injectors already inserted.
- On the side of the panel the 5A, 5B, and 5C regulators (see page 2 for reference) will control the air to each of your triple foam colors.
- Insert your air lines to the arch into the bulkhead fittings on the bottom of the panel. The 5A, 5B, and 5C bulkhead fittings (see page 2 for reference) will be the airlines for each color.

Note: Occasionally if all three regulators are pre-set too high, you may need to lower all three regulators to their lowest setting and then turn them up to the desired pressure.

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?

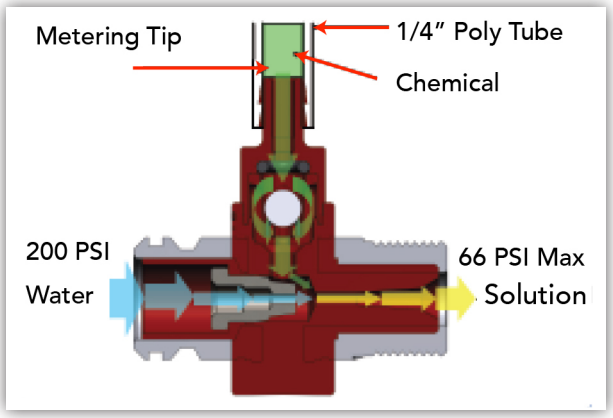
- Increases or decreases the amount of water in the solution.

What do metering tips do?

- Increases or decreases the amount of chemical in the solution.

What do nozzles do?

- Determines the pattern and back pressure of the solution.



APPLICATION OPTIMIZATION

(REPEAT FOR EACH APPLICATION)

- **Application too wet**
  - *Increase foaming air pressure*
  - *Reduce injector size (decreases water)*
  - *Increase metering tip (increases chemical)*
- **Application too dry**
  - *Decrease foaming air pressure*
  - *Increase injector size (increases water)*
  - *Decrease metering tip (decreases chemical)*
- **Nozzle sputters**
  - *Decrease foaming air pressure*
  - *Decrease number of 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/backpressure of injector for clogging (see page 17 for Injector Vacuum Check Instructions or pages 15 for troubleshooting)*
  - *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)*

NOZZLE SETUP

(Optional For Maximized Optimization)

- Using the recommended starting point (appendix) install the recommended nozzles.
  - This may involve removing and plugging some ports.
  - Due to the lower water usage determined by the injector of the AQUA-LAB you will need to match the flow of the application device to the injector.
  - Setup the nozzle spray patterns to "paint" the car - slightly overlapping each other.

MINIMUM NUMBER OF NOZZLES NECESSARY WITHOUT FOAMING AIR *(Assuming <10 PSI line loss and ~ 40 PSI at the nozzle)*									
		SPRAY NOZZLE SIZE							
		# 2.0	# 3.0	# 4.0	# 5.0	# 6.0	# 7.0	# 8.0	# 9.0	# 10.0
INJECTOR FLOW RATE @ 200 PSI (GPM)	0.25	1	1	1	1	1	1	1	1	1
	0.50	2	1	1	1	1	1	1	1	1
	0.75	3	2	1	1	1	1	1	1	1
	1.0	5	3	2	2	1	1	1	1	1
	1.5	7	5	3	3	2	2	1	1	1
	2.0	10	6	5	4	3	2	2	2	2
	2.25	11	7	5	4	3	3	2	2	2
	3.25	16	10	8	6	5	4	4	3	3
	5.5	27	18	13	11	9	7	6	6	5

MINIMUM NUMBER OF NOZZLES NECESSARY WITH FOAMING AIR *(Assuming <10 PSI line loss and ~ 40 PSI at the nozzle)*									
		SPRAY NOZZLE SIZE							
		# 2.0	# 3.0	# 4.0	# 5.0	# 6.0	# 7.0	# 8.0	# 9.0	# 10.0
INJECTOR FLOW RATE @ 200 PSI (GPM)	0.25	4	2	2	1	1	1	1	1	1
	0.50	8	5	4	3	2	2	2	1	1
	0.75	13	8	6	5	4	3	3	2	2
	1.0	17	11	8	7	5	5	4	3	3
	1.5	26	17	13	10	8	7	6	5	5
	2.0	35	23	17	14	11	10	8	7	7
	2.25	39	26	19	15	13	11	9	8	7
	3.25	56	37	28	22	18	16	14	12	11
	5.5	96	64	48	38	32	27	24	21	19

Elbows/Pipe Fittings

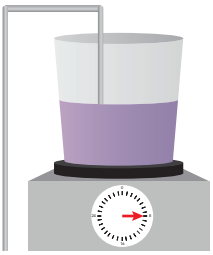
- Elbows and other pipe fittings add back pressure by causing the fluid to change direction and thus changing the fluid's momentum. Try to find simpler ways to route your fluid without elbows.

Line Length

- Longer lines add back pressure due to the inherent resistance caused by friction. See if you can reduce the line length or increase the inside diameter.

CHEMICAL USAGE MEASURING

VERIFY TITRATION OF CHEMICALS BEFORE PROCEEDING



1. Set up 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 1 vehicle (or manually for the same amount of time it would be on for 1 vehicle).
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 the **Per Car Weight** in grams by the specific gravity of the chemical to determine the milliliters of chemical used per vehicle.
9. Repeat for each chemical application.

RECOMMENDED MAINTENANCE

THE RECOMMENDED SERVICE AND MAINTENANCE ON THE AQUA-LAB SYSTEM ARE AS FOLLOWS.

Monthly

- Check/drain primary air regulator/filter separator.
- Check water filter and replace as needed (if installed).
- Check and clean wye strainer.

Semi-Annually

- Check and replace injector metering tips.
- Inspect and replace chemical lines as needed.
- Ensure lines are tightly secured to injector hose barbs, clip 1" off old hose as needed that was stretched by hose barb.

Annually

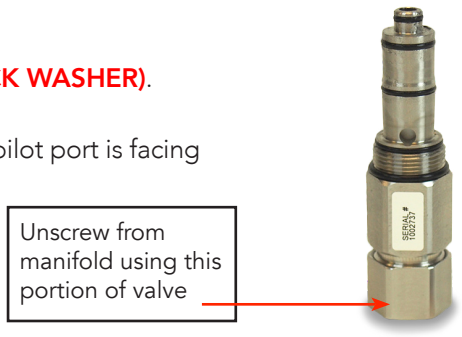
- Clean water regulator.
- Inspect motor starter for corrosion, if identified order replacement/spare parts.

1-3 Years

- Inspect and replace injectors.
- Replace water valves.
- Replace main pressure regulator.

AIR OPERATED VALVE REPLACEMENT

1. Shut off the ball valve to MD or Hydra-Cannon manifold.
2. Disconnect air line from front of valve.
3. Unscrew quick connect fitting by hand **(DO NOT LOSE BLACK WASHER)**.
4. Unscrew valve assembly from the Hydra-Cannon manifold.
5. Screw new valve into manifold until hand tight and threaded pilot port is facing forward.
6. Remove the cap from pilot port and thread in quick connect fitting to front of valve – **HAND TIGHT ONLY.**
7. Push air line back into fitting.
8. Open the ball valve to the Hydra-Cannon manifold.



TROUBLESHOOTING

PUMP ISSUES

PROBLEM	POTENTIAL CAUSES	SOLUTIONS
Pump Operates, But Only Delivering 100-150 Psi	Incorrect motor rotation	Reverse rotation by interchanging two leads.
Pump Operates, But Delivers Little Or No Water	Pump not primed	See priming instructions.
	Missing 1 of 3 phases	Wire according to diagram/check breaker (turn off on back).
	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.

PROBLEM	POTENTIAL CAUSES	SOLUTIONS
Pump Will Not Start Or Run At Full Speed	Constant hot not connected	Make sure constant control voltage is supplied in car wash controller.
	Blown fuse or circuit breaker	Could be due to blown pump motor. Try to turn breaker back on or replace fuse. If breaker trips after trying to fire motor it is most likely burned out. Replace with new motor and pump.
	Defective motor starter contactor	Replace motor starter contactor.
	Thermal overload set too low/tripped	Adjust setting on thermal overload to match voltage.
	Incorrect motor voltage	Voltage must be within 10% of motor rated voltage. (Check that pump is wired for correct voltage.)
	Defective motor	Replace motor.
	3 phase disconnect turned off	Turn disconnect on.
	Pump components damaged	Replace worn part or entire pump.
	Current Sensor not seeing any current	Turn on one valve and verify red light blinks fast, verify at least 10 wraps of wire around current sensor.
Excessive Noise From Pump	Pump not secured firmly	Secure properly.
	Restricted inlet	Clean or correct restriction.
	Water regulator fluttering / chattering	Try to adjust regulator down and then back up or replace regulator/remove check valves/pressure regulators from H20 feed to pump.
	Cavitation (sounds like marbles in pump)	Increase inlet size/inlet pressure.
	Worn mechanical seal	Replace pump.
	Not primed	Re-prime pump.
Pump Leaks	Loose fittings, and or not enough thread tape	Tighten fittings, and or take part off and put new thread tape on.
	Failed seals	Replace pump.

INJECTOR ISSUES

PROBLEM	POTENTIAL CAUSES	SOLUTIONS
Injector Is Not Drawing Chemical - Passes Vacuum Pressure Check	Clogged chemical feed	Check chemical hose, foot valve, metering tip, and hose barb for debris or clogs.
No Flow From Injector	Valve malfunction, valve not opening	Ensure minimum 60 psi on primary air regulator, ensure valve receiving signal.
	Clogged injector	Remove injector and blow out debris with compressed air.
	No water supply	Check that the system has a supply of water.
Injector Is Not Drawing Chemical - Fails Vacuum Pressure Check	Too much back pressure on injector	Clean or replace downstream check valves, increase nozzle size or quantity, use larger tubing, or use smaller flow injectors.
	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.
	Defective injector	Replace injector.
	Product specific - Sonny's Rain Bar	Remove elbow at inlet to foam generator and remove nozzle.
	Manifold inlet clogged (rare)	Remove end fittings and retention rod. Clean out inlet holes to allow full flow.
Injector stainless steel disintegrating	Strong Hydro-Fluoric Acid	Call Hydra-Flex and order composite version of injectors.

PRESSURE REGULATOR ISSUES

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 / switch 2 leads.
	Opening too many valves at once	System is limited by size of pump and size of injectors, increase flow by adding secondary pumps or reduce size / number of injectors open.
	Defective check valve (if applicable)	Replace check valve.
	Defective Regulator	Replace regulator.
	Defective Pump	Replace Pump.

FLOW / ARCH ISSUES

PROBLEM	POTENTIAL CAUSES	SOLUTIONS
Flow At Arch Is Too Low	Incorrect injector flow rate selection	Replace with larger injector
	System pressure too low	Ensure system pressure is set at 200psi
	Foam generator plugged	Ensure cleaned and clear
	Downstream plumbing restrictive	Increase size of plumbing / tubing, ensure check valves are cleaned or new, reduce elbows in line or other turns that would restrict

VALVE ISSUES

PROBLEM	POTENTIAL CAUSES	SOLUTIONS
Valve Will Not Open	Air pressure too low	Ensure primary air regulator reading at least 60 psi, turn up to 80-90psi if possible and check again.
	Internal valve o-ring jammed / twisted	Remove valve from manifold, Carefully remove top of valve **(caution – under high spring pressure)** push white piston up with small allen wrench from opposite end and check o-ring condition. Replace and lubricate if needed.
Valve Leaks Air Or Water Out Top	Internal o-ring seal damaged / worn	Remove valve from manifold, Carefully remove top of valve **(caution – under high spring pressure)** push white piston up with small screwdriver from opposite end and check o-ring condition. Replace with 018 & 008 Viton O-ring and lubricate with Dow 111 valve lube.
Valve Remains Open After Signal Is Off	Manifold pressure is above 230 psi	Reduce pressure to manifold to 200 psi operating pressure.
	Air exhaust muffler is clogged	Replace exhaust muffler.

INJECTOR OPTIMIZATION TOOL

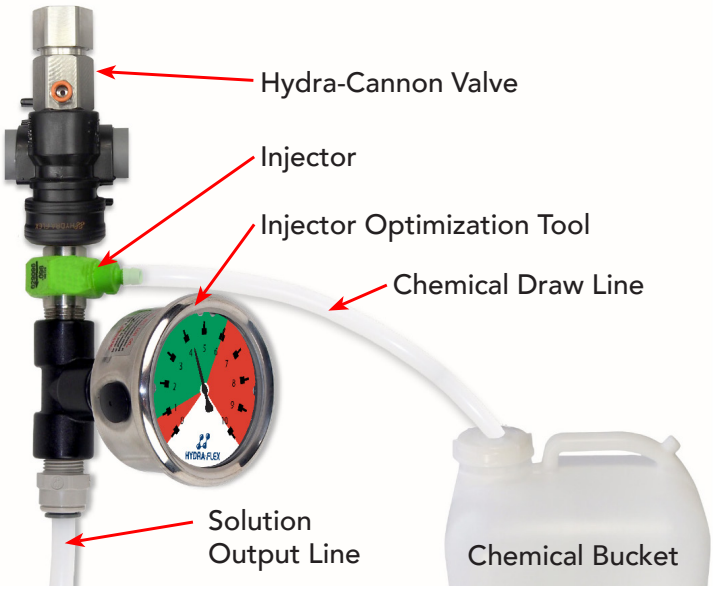
BACKGROUND:

This tool is for initial setup and troubleshooting of Chem-Flex™ Injectors and an Aqua-Lab™ Chemical Dispensing System. In order for the injector to work properly and draw chemical this gauge must be in the ***"GREEN"*** section when installed immediately after an injector that is running. If the gauge is in the red you will either see: intermittent chemical, no chemical draw, or chemical being applied at a very low pressure.

Back pressure refers to the pressure in the solution output line. Excessive back pressure is the main reason that injectors will not draw. If there is ever any concern to why an injector is not drawing chemical, the best and easiest way to diagnose the problem is to check the back pressure. See instructions below:

STEPS:

1. Plug the optimization tool into the outlet line of injector and connect solution output line.
2. Turn on function from car wash controller to actuate Hydra-Cannon valve such that fluid is flowing through both the injector and injector optimization tool and out to the applicator.
3. Read injector optimization tool.
4. If the gauge is in the ***"RED ZONE"*** the back pressure of the outlet line is either too low or too high. See steps below to correct.



BACK PRESSURE TOO HIGH

(UPPER RED SECTION):

(Back Pressure May Be Affected By One Or Several Of These Things)

1. Foam generators are clogged/degraded. Clean or replace media in generator.
2. Injector flow size is too large. Go down an injector size (less GPM).
3. Nozzle size on the arch is too small. Go up in nozzle size.
4. Check valves are dirty and or failing. Clean or replace check valves.
5. There is a kink in the line or excess fittings (elbows and reducers increase the back pressure). Check line and replace any kinked sections. Try to reduce fittings.
6. ID of tubing going out to the tunnel is too small. Go up a size in inside diameter.
7. Check valves have too high of cracking pressure. Replace check valve with lower pressure check valve.
8. Clean foot valve.

BACK PRESSURE TOO LOW

(LOWER RED SECTION):

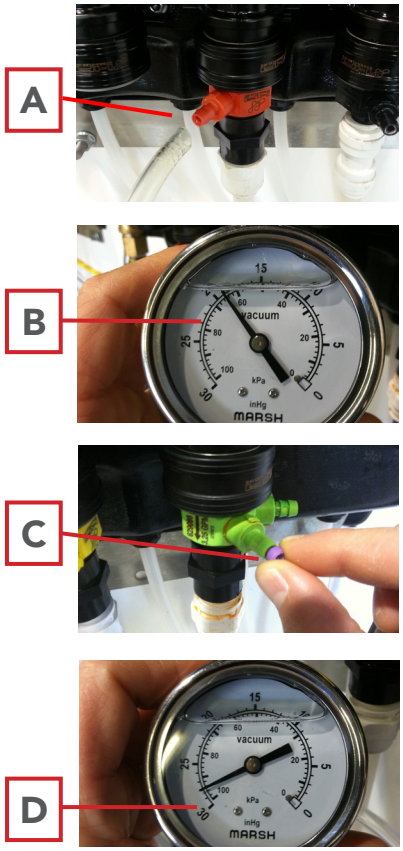
(Back Pressure May Be Affected By One Or Several Of These Things)

1. Injector flow too low. Increase injector size.
2. Nozzle size too large. Reduce nozzle size.

INJECTOR VACUUM CHECK

(FOR TROUBLESHOOTING INJECTORS)

1. At the Chem-Flex injector, remove the chemical feed line from the injector hose barb.
2. Attach the tubing of the vacuum gauge to the Chem-Flex hose barb (Image A).
3. With the pump(s) on, manually activate the chemical that is to be tested at the main car wash control cabinet. An injector that is working properly will have a reading greater than or equal to (≥) 20 in Hg.
4. If vacuum reads <20 in/Hg (image B), remove solution metering tip (image C) and retest.
   a. *If retest vacuum reads >20 in/Hg (image D), The solution metering tip is clogged. Replace the metering tip.*
   b. *If Retest vacuum reads <20 in/Hg, continue to STEP 5*
5. Remove a nozzle on the arch or the chemical feed line from the foam generator and retest vacuum.
   a. *If retest vacuum reads >20 in/Hg, back pressure is being created. Continue to STEP 6.*
   b. *If back pressure is not still not being created try these steps and retest after each:*
      1. *Clean nozzle tips.*
      2. *Loosely replace media in foam generator. Do not over pack.*
      3. *Decrease air pressure for foaming.*
      4. *Try smaller injector (this will produce less flow and thus less back pressure).*
   c. *If retest vacuum reads <20 in/Hg, replace injector and retest. If vacuum continues to read <20 in/Hg, call your service provider.*
6. Repeat steps 2-5 for each chemical lane that a vacuum reading is needed for.
7. Once testing is complete, turn off the AQUA-LAB pump from the main car wash control cabinet.



APPENDIX

CHEM-FLEX INJECTORS - CHEMICAL DILUTION RATIOS

(Assumes feed pressure of 200 PSI)

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.***

		#8-32 METERING TIPS								
	Flow Rate (GPM) at 200 PSI	0.25	0.50	0.75	1.00	1.50	2.00	2.25	3.25	5.50
	Injector Color →	White	Yellow	Tan	Red	Orange	Gray	Blue	Light Green	Dark Green
	Nozzle Size →	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)
Metering Tip	COPPER	1: 57	1: 104	1: 155	1: 195	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: 224
	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	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

There may be slight variations of performance in injectors and metering tips that are unavoidable due to manufacture 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.

		SPIRAL METERING PLUGS								
	Flow Rate (GPM) at 200 PSI	0.25	0.50	0.75	1.00	1.50	2.00	2.25	3.25	5.50
	Injector Color →	White	Yellow	Tan	Red	Orange	Gray	Blue	Light Green	Dark Green
	Nozzle Size →	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)
Spiral Plug Length	3.00"	1: 251	1: 503	1: 754	1: 1006	1: 1509	1: 2012	1: 2263	1: 3269	1: 5532
	2.00"	1: 181	1: 363	1: 544	1: 726	1: 1089	1: 1451	1: 1633	1: 2359	1: 3991
	1.00"	1: 104	1: 208	1: 311	1: 415	1: 623	1: 831	1: 934	1: 1350	1: 2284
	0.75"	1: 82	1: 165	1: 247	1: 329	1: 494	1: 659	1: 741	1: 1071	1: 1812
	0.50"	1: 59	1: 119	1: 178	1: 238	1: 357	1: 475	1: 535	1: 772	1: 1307
	0.25"	1: 34	1: 68	1: 102	1: 136	1: 204	1: 272	1: 306	1: 442	1: 748

****Remove all standard metering tips when using a Metering Plug in an application. 3/8" Polyflow (LLDPE) tubing is required to ensure a seal between the tube wall and the flats on the OD of the Meter Plug.*

RECOMMENDED SETUP STARTING POINTS

APPLICATOR	INJECTORS PART NUMBER/COLOR		
Scent Dispenser	618057 (1 GPM)		
CTA Nozzles (For Showerhead, See Below)	618057 (1 GPM)		
Foam Stick	618070 (1.5 GPM)		
Mitter/Warp Nozzles	618070 (1.5 GPM)		
Undercarriage/Rust Inhibitor	618083 (2.0 GPM)		
V Jet Or Flat Fan Nozzle Arch	618086 (2.25 GPM)		
K12 Nozzle Arch	618086 (2.25 GPM)		
K15 Nozzle Arch	618098 (3.25 GPM)		
Hockey Puck	1 Row Of Holes 618051 (.75 GPM)	2 Rows Of Holes 618057 (1 GPM)	3 Rows Of Holes 618070 (1.5 GPM)
Showerhead	1 Row Of Holes 618057 (1 GPM)	2 Rows Of Holes 618070 (1.5 GPM)	3 Rows Of Holes 618083 (2.0 GPM)
Rain Bar	1 Row Of Holes 618086 (2.25 GPM)	2 Rows Of Holes 618098 (3.25 GPM)	3 Rows Of Holes 618125 (5.5 GPM)
Foam Curtain - Choose Foam Accessory Based On # Of Inputs/Foam Generators**	Duo-Foam w/ (2X) 618098 (3.25 GPM)	Triple-Foam w/ (3X) 618086 (2.25 GPM)	Quad-Foam w/ (4X) 618086 (2.25 GPM)
High Flow Foam Curtain Application (10+ GPM)	High Flow Device w/ 618086 (2.25 GPM)		

Foaming Air: Start at 25 PSI (adjust based on unique application)

CHEM-FLEX INJECTOR PART NUMBERS

QUICK CONNECT INJECTORS - PC2 X 3/8" NPT CONNECTIONS
(For exclusive use with Aqua-Lab™ Chemical Dispensing Systems)

COLOR	FLOW ORIFICE	FLOW RATE @ 200 PSI	SINGLE BARB	DUAL BARB	TRIPLE BARB
WHITE	0.029	.25 GPM	618029	-	-
YELLOW	0.040	.5 GPM	618040	629040	-
TAN	0.051	.75 GPM	618051	629051	639051
RED	0.057	1.0 GPM	618057	629057	639057
ORANGE	0.070	1.5 GPM	618070	629070	639070
GRAY	0.083	2.0 GPM	618083	629083	639083
BLUE	0.086	2.25 GPM	618086	629086	639086
LIGHT GREEN	0.098	3.25 GPM	618098	629098	639098
DARK GREEN	0.125	5.5 GPM	618125	629125	639125

SPECIFICATIONS		
Pressure Range:	**Temperature Range:**	**Maximum Wrench Torque:**
Up to 500 PSI Max. (34 bar) Inlet, 333 PSI (23 bar) Max. Outlet	33°F - 175°F (.5°C - 79°C)	30 ft-lbs (41 N-m)

PRESSURE LOSS IN RUN LENGTH

GREEN = GOOD | YELLOW= USE CAUTION | RED = NOT RECOMMENDED

All solution line tubing should be selected for 10 PSI or less of pressure loss.

**20 PSI pressure loss may be acceptable depending upon nozzle sizing, foamers, check valves and other line restrictions present in application.*

All numbers represent pressure loss in PSI for selected solution line tubing.

5/8" ID BRAIDED

		INJECTOR								
	Flow Rate (GPM) at 200 PSI →	0.25	0.50	0.75	1.00	1.50	2.00	2.25	3.25	5.50
	Injector Color →	White	Yellow	Tan	Red	Orange	Gray	Blue	Light Green	Dark Green
	Nozzle Size →	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)
Run Length	150'	1 PSI	1 PSI	1 PSI	1 PSI	2 PSI	3 PSI	4 PSI	7 PSI	18 PSI*
	125'	1 PSI	1 PSI	1 PSI	1 PSI	2 PSI	3 PSI	4 PSI	6 PSI	16 PSI*
	100'	1 PSI	1 PSI	1 PSI	1 PSI	2 PSI	2 PSI	3 PSI	5 PSI	13 PSI*
	75'	1 PSI	1 PSI	1 PSI	1 PSI	1 PSI	2 PSI	3 PSI	4 PSI	9 PSI
	50'	1 PSI	1 PSI	1 PSI	1 PSI	1 PSI	1 PSI	2 PSI	3 PSI	6 PSI
	25'	1 PSI	1 PSI	1 PSI	1 PSI	1 PSI	1 PSI	1 PSI	2 PSI	4 PSI

1/2" ID BRAIDED

		INJECTOR								
	Flow Rate (GPM) at 200 PSI →	0.25	0.50	0.75	1.00	1.50	2.00	2.25	3.25	5.50
	Injector Color →	White	Yellow	Tan	Red	Orange	Gray	Blue	Light Green	Dark Green
	Nozzle Size →	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)
Run Length	150'	1 PSI	1 PSI	2 PSI	3 PSI	6 PSI	9 PSI	11 PSI*	21 PSI	56 PSI
	125'	1 PSI	1 PSI	2 PSI	3 PSI	5 PSI	8 PSI	9 PSI	18 PSI*	47 PSI
	100'	1 PSI	1 PSI	2 PSI	2 PSI	4 PSI	7 PSI	8 PSI	14 PSI*	36 PSI
	75'	1 PSI	1 PSI	1 PSI	2 PSI	3 PSI	5 PSI	6 PSI	11 PSI*	26 PSI
	50'	1 PSI	1 PSI	1 PSI	1 PSI	2 PSI	4 PSI	4 PSI	8 PSI	18 PSI*
	25'	1 PSI	1 PSI	1 PSI	1 PSI	1 PSI	2 PSI	2 PSI	4 PSI	9 PSI

3/8" ID, 1/2" OD POLY TUBE

		INJECTOR								
	Flow Rate (GPM) at 200 PSI →	0.25	0.50	0.75	1.00	1.50	2.00	2.25	3.25	5.50
	Injector Color →	White	Yellow	Tan	Red	Orange	Gray	Blue	Light Green	Dark Green
	Nozzle Size →	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)
Run Length	150'	1 PSI	5 PSI	7 PSI	11 PSI*	22 PSI	36 PSI	44 PSI	88 PSI	239 PSI
	125'	1 PSI	4 PSI	6 PSI	9 PSI	18 PSI*	30 PSI	37 PSI	73 PSI	200 PSI
	100'	1 PSI	3 PSI	5 PSI	7 PSI	14 PSI*	23 PSI	28 PSI	54 PSI	142 PSI
	75'	1 PSI	2 PSI	4 PSI	6 PSI	12 PSI*	18 PSI*	22 PSI	42 PSI	106 PSI
	50'	1 PSI	1 PSI	3 PSI	4 PSI	8 PSI	12 PSI*	15 PSI*	28 PSI	73 PSI
	25'	1 PSI	1 PSI	1 PSI	2 PSI	3 PSI	6 PSI	7 PSI	13 PSI*	34 PSI

AQUA-LAB MD™ WARRANTY

FACTORY LIMITED

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

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.

HYDRA·FLEX
FLUID INNOVATION

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