

## **Modular System**

# **Operating Instructions**

Applies to the Pneumax model

**160-80-DS**

Unit Serial Number \_\_\_\_\_

Pneumax, Inc.  
8557 North 78th Ave.  
Peoria, Arizona 85345  
623-979-3398  
Fax: 623-979-6949  
[www.pneumaxcafs.com](http://www.pneumaxcafs.com)

## **OPERATING INSTRUCTIONS**

Check the following fluid levels daily or prior to starting unit:

- Engine oil
- Engine coolant
- Compressor system oil (oil level should be visible within the pump panel mounted sight glass)
- Foam concentrate
- Onboard water supply

### **MULTIPLE USES**

The Pneumax modular compressed air foam unit can be operated in several pumping modes; water only, foam solution without compressed air, compressed air foam and compressed air only for support operations such as operating air tools, filling rescue air bags, etc. It is possible to pump foam solution from one discharge while pumping compressed air foam from another, or varying foam consistencies (expansion ratios) from different discharges simultaneously.

**NOTE:** Monitor engine and compressor instruments during any and all operations.

### **WATER PUMPING OPERATIONS**

All unit operations begin with pumping water. These steps must be followed for operations involving pumping water, foam solution, compressed air or compressed air foam.

Connect the hose(s) to the desired discharge(s)

**Prior to starting the engine, the Auto Sync controls should be in the UNLOAD position, which allows the air compressor to "free wheel" without pumping air.**

- If pumping water from an onboard booster tank, fully open the tank to pump valve. If pumping from an overboard source, the tank to pump valve should be fully closed.
- If so equipped, turn on the main power switch to the CAFS unit.
- To start the engine, open the Vernier throttle one to two counter-clockwise turns, move the ignition switch to the "ON" position, wait until the glow plug light is no longer lit and push the start button to crank the engine until it starts.
- Throttle-up to desired pressure. If pump pressure is absent, it will be necessary to prime the pump utilizing the Pneumax Jet Primer. The Jet Primer utilizes compressed air from the onboard compressor system, which is passed through a venturi, creating a vacuum within the water pump.

## **WATER PUMPING OPERATIONS (continued)**

- To prime, move the Auto Sync controls to the FIXED position to build air pressure. Once air pressure has risen, move the Jet Primer to the ON position. The rush of air through the priming venturi will be audible. As water is drawn into the pump, some will be vented through the venturi and spill onto the ground. When the water discharge pressure gauge rises, the pump is primed.
  - After prime is achieved, move the Jet Primer the OFF position. For water only operations, move the Auto Sync controls back to the UNLOAD position.
- Open desired discharge valves and throttle-up to desired pressure.

**CAUTION: Running the unit with a dry fire pump can cause damage to the pump and air compressor system.**

## **FOAM SOLUTION OPERATIONS**

Follow the instructions above for water pumping operations. Turn on the foam proportioner to inject foam concentrate into the water stream. Refer to the foam proportioner operation manual for instructions in the proper operation of the installed proportioning system.

## **COMPRESSED AIR FOAM OPERATIONS**

Follow the instructions above for foam solution operations. Safe operations dictate the presence of foam concentrate in the water stream prior to the injection of compressed air. If foam concentrate is not present, a condition known as "slug flow" will occur, where unmixed water and air is discharged through a nozzle in an erratic manner.

Discharge pressures for compressed air foam operations typically range between 80 and 120 PSI in a flow state. Set water discharge pressure at the desired level.

**NOTE:** Compressed air foam does not have the hydraulic characteristics of plain water or foam solution. Therefore, standard pump hydraulics practices do not apply to CAFS operations.

- Move Auto Sync control to the FIXED position. Air pressure as shown on the air pressure gauge should rise to within plus or minus 5% of the water discharge pressure. The Auto Sync -system will balance the air and water pressures throughout a range of 40 PSI up to 150 PSI. Optimal compressed air foam system performance occurs at discharge flow pressures of 80-120 PSI.
- Set proportioner at 0.2% - 0.3% for normal Class A combustibles. The type and brand of foam concentrate used and the tactical dictate proportioning rates objective.

## **COMPRESSED AIR FOAM OPERATIONS (continued)**

- Open desired discharge valve(s) by pulling the "TEE" handle approximately 1-1/2" from the closed position. Controlling the amount of foam solution entering the discharge stream sets the foam expansion ratio. High solution flows restrict the amount of air admitted and result in lower expansion or "wet" foam. To produce higher expansion or "drier" foam, simply gate back the amount of solution admitted.
- Fully open the air valve(s) to the desired discharge(s). Adjust the solution now to produce the desired foam consistency.

Foam is formed during the transition through the hose. To produce acceptable finished foam, sufficient hose length must be provided on the discharge. Refer to SUGGESTED GUIDELINES for CAFS operations.

---

## **WARNING**

Nozzle reaction force is significantly increased at the time the nozzle valve is opened in compressed air foam operations. **OPEN CAFS NOZZLES SLOWLY!**

---

## **SHUT-DOWN PROCEDURE**

- Close air valve(s)
- Turn off Foam proportioner
- Flow clear water through discharge hose(s) until no bubbles are present
- Close discharge valve(s)
- Move Auto Sync control to UNLOAD
- Shut engine down

After the engine is shut down, the compressor system will vent itself, creating an audible hiss as compressed air is evacuated from the pressure vessel/sump.

## COMPRESSED AIR ONLY OPERATION

Follow instructions for water pumping operations without opening discharge valves. Air compressor cooling is via water that is circulated by the fire pump through the compressor cooler and returned back to the booster tank. Compressed air only operation time is limited by the amount of available cooling water.

The water in the booster tank will eventually become heat saturated and ineffective at cooling the air compressor. Watch the compressor temperature gauge closely!

Compressor system overheat is also indicated by the panel mounted warning light and alarm.

After engine start, ensure that the water pressure as shown on the panel mounted gauge rises. Move Auto Sync controls to the FIXED position. Air pressure will rise to the preset pressure setting on the air compressor, approximately 150 PSI with the engine throttled-up. For lower operating pressures, move the Auto Sync controls to the AUTO position and use the engine throttle to control the air pressure.

Connect the air discharge hose to the fitting on the pump operator's panel and open the air supply valve.

Extended compressed air only operations necessitate connection of an external water source to the pump inlet and closing of the tank to pump valve for proper compressor cooling. In this case, cooling water will flow into the booster tank at 8-12 GPM, eventually overflowing the tank.

---

## WARNINGS

- Compressed air can be dangerous. Read and understand the operating instructions for the Pneumax compressed air foam unit and individual components prior to operating.
- **DO NOT** use the compressed air foam unit as an air source for SCBA or any breathing air supply.
- Discharge outlets that are capped, hose lines that are valved and charged and the air compressor sump may contain compressed air. Relieve all pressure **BEFORE** attempting to remove any caps, fittings, nozzles, or to perform maintenance to prevent serious personal injury.
- Nozzle reaction force is significantly increased at the time the nozzle valve is opened in compressed air foam operations. **OPEN CAFS NOZZLES SLOWLY!**

---

Operating the compressed air foam unit with water and compressed air pumped through a discharge without foam concentrate will create a potentially dangerous condition known as "Slug Flow"; where unmixed pockets of water and air are passed through the nozzle, causing erratic nozzle reaction.

For compressed air foam operations, use only fire hose that is rated at 200 PSI or higher working pressure.

The unit operator should have a thorough understanding of "Boyle's Law" (The law of compressed gases) prior to operating the compressed air foam unit.

# SCA9D Water Cooled Rotary Screw Air Compressor

## HOW IT WORKS

The air compressor used in this application is a model SCA9D, oil flooded rotary screw type. Rotary screw air compressors are very common in industrial applications. This type of compressor injects oil into itself, where it lubricates, seals, cools, and silences the compressor. The oil is then entrained into the air discharge from the compressor. This air/oil mixture is discharged into a sump tank where most of the oil separates from the air. The oil is then sent via hydraulic hose to a combination cooler/thermostat/filter unit. It is cooled to remove compression and friction heat, filtered, and sent to the oil injection port on the compressor. The cycle is then repeated.

The oil mist that remains in the air stream is recovered by an air/oil separator system. This system recovers the oil mist in a spin-on cartridge that has a siphon tube that picks-up the recovered oil for return to the air compressor.

A modulating inlet valve controls the compressor's air output. The inlet valve is opened and closed by the Auto Sync pressure control system.

The compressor cooling system circulates water from the fire pump through the compressor oil cooler and back to the tank to remove heat from the compressor oil system. The compressor oil temperature should not exceed 250°F. If this occurs, check the water supply, pump prime, restrictions in the cooling water system, and for low oil level in the sump.

The air compressor (air end) is mounted to the transmission of a Waterous CPK-2 single stage pump and driven by a dry Poly Chain. The pump / air end are directly driven by the engine. It is important to ensure that there is a water supply to the pump whenever the engine is running. Pump and/or compressor damage may result from running the pump dry.

# AIR COMPRESSOR SYSTEM SERVICE AND MAINTENANCE

Excessive heat build-up and oil system contamination are the most common causes of compressor system problems and premature wear. With proper operation and maintenance, the compressor system should far outlast the vehicle it is mounted on.

Adherence to the following guidelines will prevent potentially costly damage.

1. There is a sight gauge provided on the oil reservoir and visible through a hole on the pump panel. The oil level should be at approximately halfway up the window. Check the oil on level ground, prior to system start up. If the system has recently been run, wait 10 minutes after shutdown for the oil to stabilize before checking the oil level. The compressor uses common hydraulic oil. This oil is classified by an ISO standard as ISO 68 viscosity and is sold under various trade names. Many are sold as in "anti wear" hydraulic oil and are available from auto parts or lubricating oil suppliers.
2. The oil should be changed after the first 30 hours of system operation. After that, the oil should be changed annually. There is a drain plug located at the bottom of the sump. The oil fill cap is located on top of the unit.
3. Change the compressor system oil filter at the same time as the oil is changed. The spin-on filter cartridge is a Mann/Hummel hydraulic oil filter. (See next page for part number)
4. Run the compressor for 2 minutes after changing the oil, then re-check the oil level and add oil as necessary. **DO NOT OVERFILL.**
5. Visually inspect the compressor oil system weekly for signs of leaks. Check the air compressor Poly Chain drive for proper tension and signs of wear monthly or more frequently as dictated by the amount of use. Proper tension on the Poly Chain is to a no slack setting
  - **If in Doubt, Do Not Tighten the Poly Chain, contact Pneumax.**
6. Inspect the compressor air intake filter and clean or replace as necessary. The environment in which the unit operates will determine the frequency of air filter service and replacement. In any situation, replace no less frequently than yearly.
7. Replace the oil / air separator cartridge every 24 months, or if the unit's oil consumption suddenly increases. A sudden increase may be caused by a hole in the internal media of the cartridge allowing oil to carry through and discharge with the compressed air. (See next page for part number).
8. Completely drain the water from the compressor oil cooler in cold weather to prevent freeze damage.

# AIR COMPRESSOR SYSTEM SERVICE AND MAINTENANCE (cont.)

## Maintenance Schedule

	Check oil level and for oil leaks	Change Compressor Oil	Change Oil Filter	Change Separator Cartridge
Daily or After Each Use	<b>X</b>			
Annually	<b>X</b>	<b>X</b>	<b>X</b>	
Every 24 Months	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>

## MAINTENANCE ITEMS

<b>COMPRESSOR</b>
<b>AIR FILTER</b> CO85003 (Pneumax part # 2030041)
<b>SEPARATOR FILTER</b> LB 1374/2 (Pneumax part # 2030015)
<b>HYDRAULIC FILTER</b> WD920 (Pneumax part # 2030058)
<b>HYDRAULIC OIL</b>
ISOAUW68 Anti-Wear, Low-Foaming, Anti-Foaming
<b>ENGINE</b>
<i>(refer to Engine Manual for Maintenance Schedule)</i>
<b>AIR FILTER</b> Mann + Hummel C14200 (Pneumax part # 2030080)
<b>OIL FILTER</b> 2030074 (Pneumax part # 2030074)
<b>FUEL/WATER FILTER</b> 2030075 (Pneumax part # 2030075)
<b>ENGINE OIL</b> Refer to Engine Manual

# **CAFS NOZZLE / FLOW RATE / HOSE COMBINATIONS**

## **NOZZLES**

Compressed air foam can be discharged through various types and sizes of nozzles. Fog nozzles breakdown the bubble structure of the foam, resulting in "wetter" or reduced expansion foam. Similarly, when utilizing smooth bore nozzles with a given hose diameter, smaller tips will discharge "wetter" foam.

## **FOAM CONCENTRATE RATIOS**

Proportioner settings of 0.2% and 0.3% are typically adequate to produce compressed air foam that is formed in a hoseline and used on Class A combustibles. Higher settings will result in a "drier" appearing foam. Lower settings may result in "slug flow" or discharge pulsation caused by insufficient foam concentrate in solution to form foam in the hoseline.

For Class B or other type foam ratio settings, follow the instructions provided by the foam concentrate manufacturer.

## **HOSE**

Utilize fire hose that is rated by the hose manufacturer for use with CAFS. Since the foam is formed during its transition through the hoseline, it is important to utilize the minimum recommended hose lengths, unless a static mixer is utilized. There is significantly less friction and head loss with compressed air foam as compared to water or foam solution. Hence, effective fire streams can be achieved with longer hose lays. Refer to the Suggested Guidelines for the Production of Mid-Range Compressed Air Foam.

## **NOTE**

Compressed air foam systems have the ability to produce a foam of shaving cream consistency. While this type of foam is highly stable and possesses a long drain time, it is essential to ensure that the foam will release sufficient water to extinguish a fire in a direct attack situation. This type of foam is typically suited for defensive operations such as exposure protection, barriers or fuels pretreatment.

# **SUGGESTED GUIDELINES FOR THE PRODUCTION OF MID-RANGE COMPRESSED AIR FOAM**

## **1" HOSE DIAMETER**

### 1 GPM to 1 CFM

½" Tip Water Flow: 15 GPM Air Flow: 15 CFM

Disch. Pressure: 125-150 PSI

Min/Max Hose Length: 35' to over 400'

### 2 GPM to 1 CFM

½" Tip Solution Flow: 30 GPM Air Flow 15 CFM

Disch Pressure 100-150 PSI

Min/Max Hose Length: 35' to over 400'

### 1 GPM to 1 CFM

¾" Tip Water Flow: 20 GPM Air Flow: 20 CFM

Disch. Pressure: 125-150 PSI

Min/Max Hose Length: 35' to over 200'

### 2 GPM to 1 CFM

¾" Tip Water Flow: 40 GPM Air Flow 20 CFM

Disch Pressure: 100-150 PSI

Min/Max Hose Length: 35' to over 200'

## **1-1/2" HOSE DIAMETER**

### 1 GPM to 1 CFM

1" Tip Water Flow: 30-40 GPM Air Flow: 30-40 CFM

Disch. Pressure: 110-150 PSI

Min/Max Hose Length: 100' to over 800'

### 2 GPM to 1 CFM

1" Tip Water Flow: 60-80 GPM Air Flow 30-40 CFM

Disch Pressure: 100-150 PSI

Min/Max Hose Length: 100' to over 800'

### 1 GPM to 1 CFM

1-3/8" Tip Water Flow: 50-60 GPM Air Flow: 50-60 CFM

Disch. Pressure: 110-150 PSI

Min/Max Hose Length: 100' to over 400'

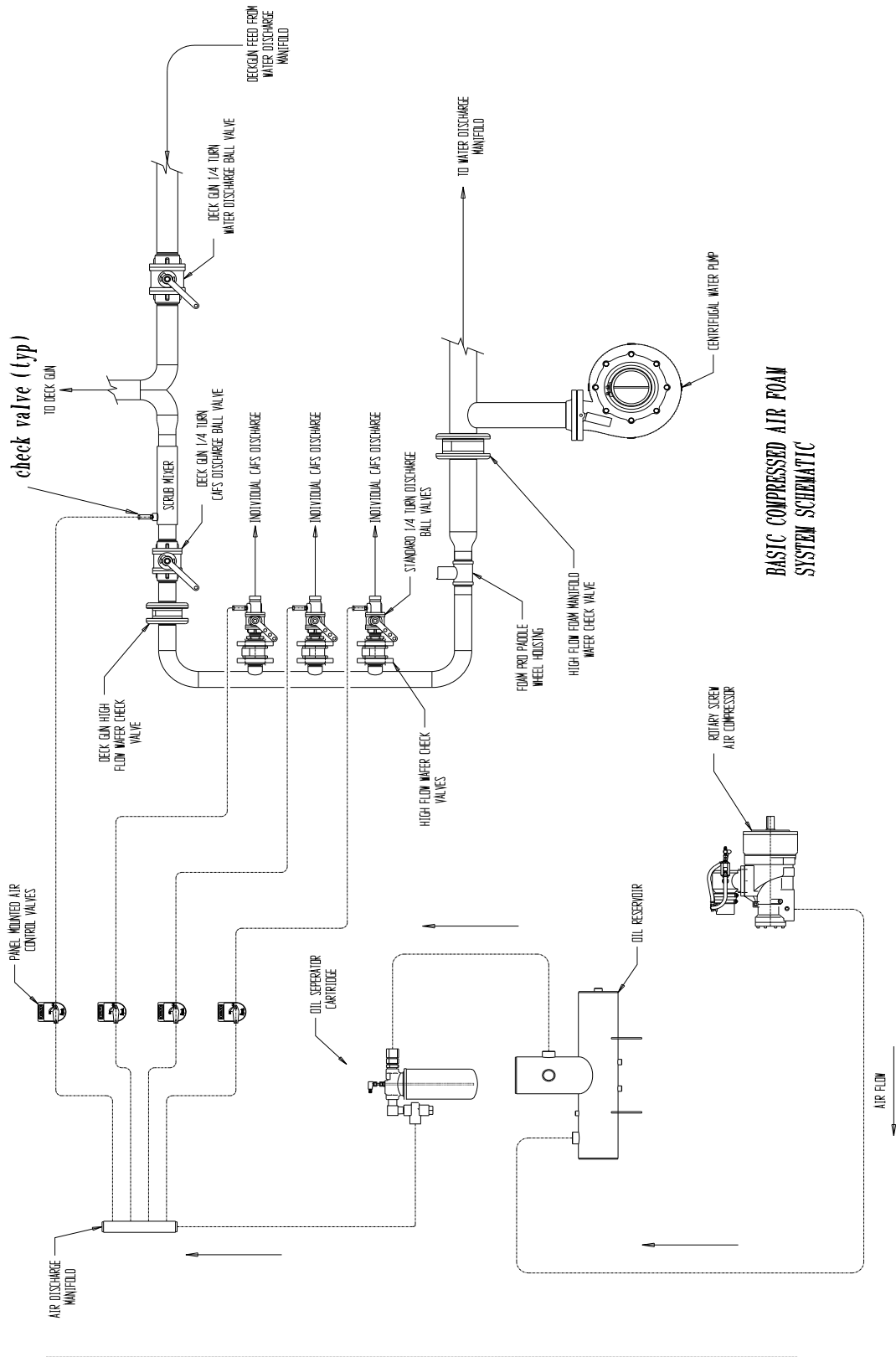
### 2 GPM to 1 CFM

1-3/8" Tip Solution Flow: 90-120 GPM Air Flow: 50-60 CFM

Disch Pressure: 100-150 PSI

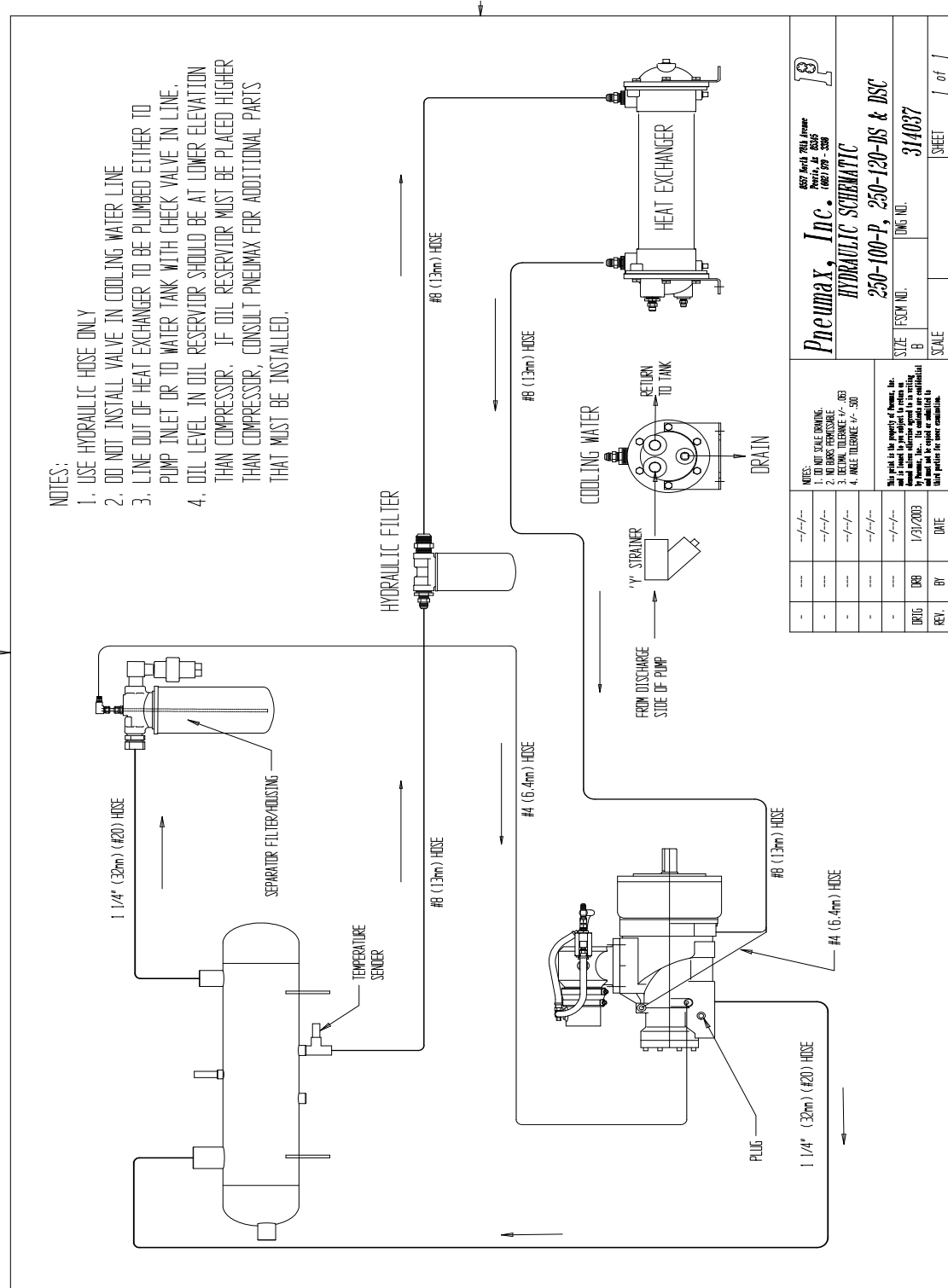
Min/Max Hose Length: 100' to over 800'


# BASIC CAFS SCHEMATIC

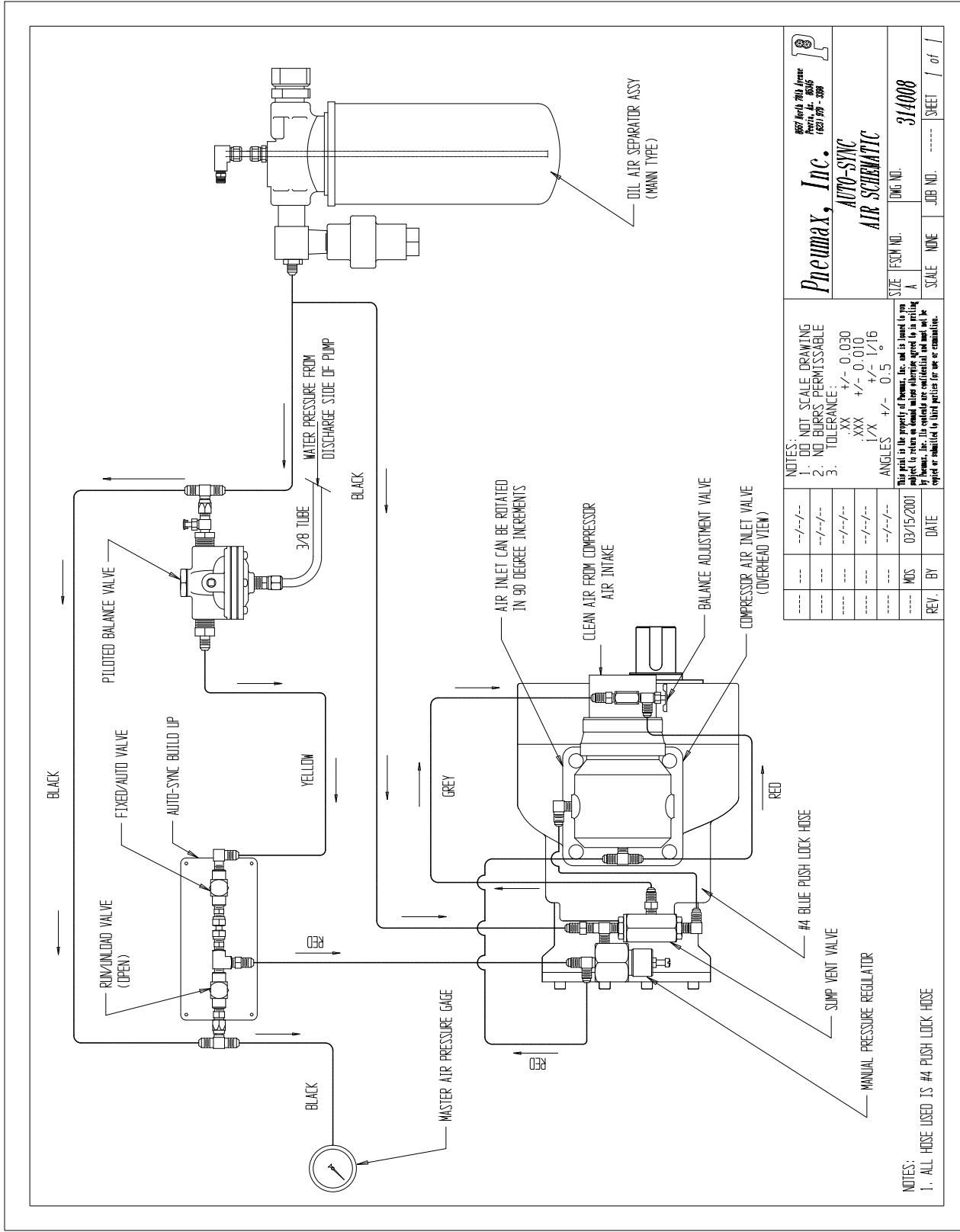


BASIC COMPRESSED AIR FOAM SYSTEM SCHEMATIC

- NOTES:
1. USE HYDRAULIC HOSE ONLY
  2. DO NOT INSTALL VALVE IN COOLING WATER LINE
  3. LINE OUT OF HEAT EXCHANGER TO BE PLUMBED EITHER TO PUMP INLET OR TO WATER TANK WITH CHECK VALVE IN LINE.
  4. OIL LEVEL IN OIL RESERVOIR SHOULD BE AT LOWER ELEVATION THAN COMPRESSOR. IF OIL RESERVOIR MUST BE PLACED HIGHER THAN COMPRESSOR, CONSULT PNEUMAX FOR ADDITIONAL PARTS THAT MUST BE INSTALLED.



 <b>Pneumax, Inc.</b> 857 North 77th Avenue Peoria, IL 61616 (309) 291-3388		<b>HYDRAULIC SCHEMATIC</b> <b>250-100-P, 250-120-DS &amp; DSC</b>	
REV.	BY	DATE	SCALE
DRUG	DRB	1/31/2003	B
REV.	BY	DATE	SCALE
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
NOTES: 1. DO NOT SCALE DRAWING. 2. NO DIMS DIMENSIONABLE. 3. DETAIL TOLERANCE 1/16". 4. ANGULAR TOLERANCE 1/2°-50°.			F50N NO. 314037 DWG NO.
This print is the property of Pneumax, Inc. and is loaned to you without license. It is not to be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage and retrieval system, without the prior written permission of Pneumax, Inc.			SHEET 1 of 1



 <b>Pneumax, Inc.</b> AUTO-SYNC AIR SCHEMATIC		652 North 9th Avenue Phoenix, AZ 85006 (602) 998-3388
NOTES: 1. DO NOT SCALE DRAWING 2. NO DIMS. PERMISSIBLE 3. TOLERANCES: XX   +/- 0.030 XXX +/- 0.010 1/X   +/- 0.060 ANGLES +/- 0.5	SIZE T/SCM NO. A	DWG. NO. <b>314008</b>
This print is the property of Pneumax, Inc. and is loaned to you subject to return or demand without alternative agreed to in writing by Pneumax, Inc. All contents are confidential and must not be copied or duplicated in any form for use or circulation.	DATE 03/15/2001	JOB NO. -----
REV. BY MDS	DATE 03/15/2001	SCALE NONE
--- / --- / --- --- / --- / --- --- / --- / --- --- / --- / --- --- / --- / ---	--- / --- / --- --- / --- / --- --- / --- / --- --- / --- / --- --- / --- / ---	SHEET / of /

NOTES:  
 1. ALL HOSE USED IS #4 PUSH LOCK HOSE