Eclipse GEN 2.0™ CAF System Operation and Maintenance Instructions

Applies to the following CAFS Models:

System	Pump Model	Transmission Model	Compressor CFM	CAFS Model
Air Compressor Only	--	--	150	150-ECL
Air Compressor and Water Pump	CXN CXS CXV	K or PA	150	750-150-ECL
				1000-150-ECL
				1250-150-ECL
		C20	150	150-ESECL
	CM, CMU, CS, CSU	C20	150	150-ECL
	HL200 HL300 HL400	K	150	150-ECL
Air Compressor and PTO	TC20B, TC20C, TC20D, TC20 E, TC20F (TC20 Series PTO)		150	150-ESECL

Read through the operation instructions carefully before using your Waterous CAF System.

NOTE: Instructions subject to change without notice

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Safety Information

Read through the safety information and operating instructions before using your Waterous CAF System.

⚠ WARNING

Compressed air can be dangerous. Read and understand the operating instructions for the Waterous compressed air foam unit and individual components prior to operating.

⚠ WARNING

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 and nozzles or to perform maintenance to prevent serious personal injury.

⚠ WARNING

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.

CAUTION

Nozzle reaction force is significantly increased at the time the nozzle valve is opened in compressed air foam operations. Open CAFS nozzles slowly.

CAUTION

Do not use the compressed air foam unit as an air source for SCBA or any breathing air supply

CAUTION

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

NOTICE

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.

NOTICE

When towing, disconnect the drive shaft that connects the pump transmission’s rear output (coupling) shaft to the vehicles differential. Failure to do so may result in damage from lack of lubrication.

Air Compressor Function

The air compressor used is an Ingersoll Rand 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. The 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/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 the 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.

The compressor's air output is controlled by a modulating inlet valve. The inlet valve is opened and closed by the Pressure Modulating Control (PMC) 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.

It is important to ensure that there is a water supply from the fire pump whenever the compressor system is running. Pump and/or compressor damage may result from running the pump dry.

Operation

Daily Checks

Check the following fluid levels daily or prior to operating the system:

- Compressor system oil (Oil level should be visible within the sight glass on the sump and should be checked daily or before or after used.)
- Foam concentrate
- Onboard water supply

Modes of Operation

The Waterous 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 vary foam consistencies (expansion ratios) from different discharges simultaneously.

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

NOTE: The instructions are for a typical system. The illustrations in this manual may differ slightly from the parts that were shipped.
The units all have a belt-driven compressor.

Multiple Uses

The Waterous 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.

Power Up Procedure

⚠ WARNING

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 and nozzles or to perform maintenance to prevent serious personal injury.

1. Connect discharge hose(s) to unit.
2. Fill water and foam tanks.
3.
   a. If flowing from tank, fully open Tank to Pump valve.
   b. If filling tank via hydrant, fully open Tank to Pump valve and open the tank fill slightly.
   c. If running from a hydrant, open tank fill slightly and close Talk to Pump valve.
4. Reference the pump operation instructions to begin startup of the fire pump.
5. Leave tank fill open slightly and lock for recirculation of water.
6. Increase pump pressure to a minimum of 120 psi.
7. Once a glowing ring appears on the Tellurus™ panel as shown below, push to start

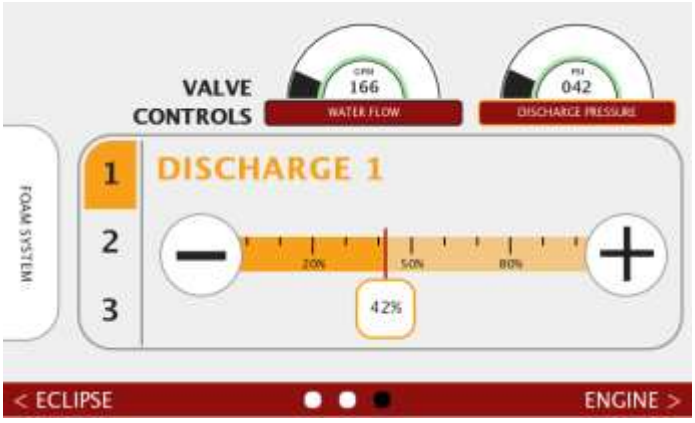
8. Tap one of the three discharge buttons to begin process.
9. Begin initial attack with Wet CAFS from a long range by tapping the Wet CAFS button. Example below showing the process done by tapping Discharge 1.

10. Select other discharges as needed (Wet CAFS, Dry CAFS, Air Only).

Foam Only Operation

1. Turn off Wet, Dry CAFS by tapping button.
2. Turn off Monitor or Hose Reel by tapping button.
3. Select Solution screen.
4. Engage the Foam Pump by tapping the Foam button.

5. Select Valve Controls and open valve as needed for foam.
6. To turn off Discharge Valve, move slide to 0%



Water Only Operation

1. On the Foam Solution screen, turn off Foam.
2. Open discharges by using the slide function.
3. To stop flowing water, move the slide function to 0%.

Flush Procedure

1. On the Tellurus screen, turn off Wet or Dry CAFS discharges by tapping the Wet or Dry CAFS buttons.
2. While the Monitor and Hose Reel discharges are still activated, double tap the Flush button.
3. Flow clear water through discharge hose(s) until bubbles are no longer present.
4. Tap the Flush button once to stop flushing.
5. To dry the hoses, double tap the Air Only button on each discharge.
6. Touch the Air Only button once to stop air flow.
7. Close the Discharge Valves.
8. Shut down the pump.

Compressed Air Only

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. During this 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. Maximum is 250°F. Compressor system overheat is also indicated by the panel mounted warning alarm.

1. Expand one of the discharges. Air pressure will rise to approximately 125 psi.
2. 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 far proper compressor cooling. In this case, cooling water will flow into the booster tank at 10-20 GPM, eventually overflowing the tank, if the return is plumbed to tank.

Compressor Shut-Down

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

CAUTION
Allow system to bleed down the pressures for approximately 2-3 minutes prior to re-engaging. Otherwise, re-engagement may cause the engine to stall.

Guidelines

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 may prevent potentially costly damage.

1. There is a sight gauge provided on the oil reservoir/sump. 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 AW68 low foaming/anti-foaming hydraulic oil and is sold under various trade names. Many are sold as “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 that unit.
3. Change the compressor system oil filter at the same time as the oil is changed. Call Waterous for replacement elements.
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). A slightly loose Poly Chain is acceptable. An over-tightened Poly Chain may cause equipment failure and may void the product warranty.
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. Call Waterous for replacement separator cartridges.
8. Completely drain the water from the compressor oil cooler in cold weather to prevent freeze damage.

Oil Cooler Strainer

A Wye-strainer is provided to strain water before it enters the cooler’s water inlet. The Wye-strainer requires regular inspection, and should be in an easily accessible location for inspection, removal and cleaning.

CAUTION

Waterous is not responsible for damage due to plugged strainers. If the customer’s water system contains excessive debris, or the vehicle relies on drafting for its water supply, it may be necessary to install a larger strainer and/or a clean-out valve on the Wye-strainer.

Without good water flow through the heat exchanger, the compressor will overheat. Compressor performance will be inadequate, and it may fail completely.

Omitting the Wye-strainer or removing the screen from the Wye does not improve water flow. It will allow debris into the cooler, which can clog the tiny heat exchanger tubes and restrict water flow.

Lubrication

Compressor:

Fill the sump with hydraulic oil until the level is 1/2 way up the sight glass. Use ISO AW68 Anti-Wear, low foaming/anti-foaming hydraulic oil.

Note that the level will need to be re-checked and additional oil added to compensate for oil that fills the hydraulic lines and compressor after the initial compressor run.

Pump Transmission or PTO:

C20 Series Pump Transmission or TC20 Series PTO:

ATF (all climates) or SAE 20 300 SSU at 100°F in Ambient Temperatures over 90°F. Fill to the bottom of plug labeled “Oil Level” or window in sight plug.

K Series:

SAE 80W-90 Gear Oil. Fill to the bottom of plug labeled “Oil Level.”

PA Series:

ATF (all climates) or SAE 20 300 SSU at 100°F in Ambient Temperatures over 90°F. Fill to the bottom of plug labeled “Oil Level.”

Foam Pump:

Synthetic 10W-30 motor oil (Mobil 1 recommended)

Advantus 3E and 6E Models:

Fill to 1/4" (6 mm.) from top of oil fill port.

Aquis 1.5 and 2.5 Models:

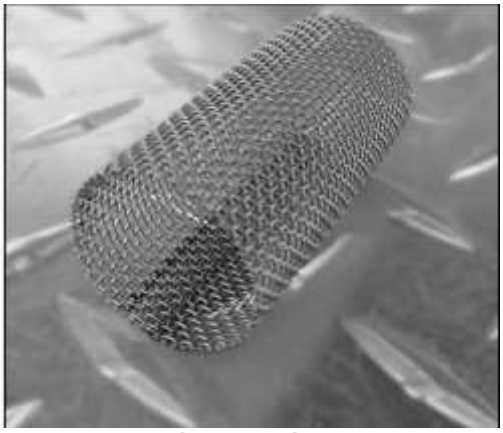
Fill to marking located on oil fill dip stick.

Maintenance Schedule

	Check oil level & for oil leaks	Change compressor oil	Change oil filter	Change separator cartridge	Compressor Hydraulic Oil
Daily or after each use	x				ISOAW68 Anti-Wear, Low Foaming, Anti-Foaming
Annually		x	x		
Every 24 months				x	

Wye Strainer

Wye-strainer installed, with cleanout valve.



Clean Strainer

Dirty Strainer

Towing

When towing, disconnect the drive shaft that connects the pump transmission's rear output (coupling) shaft to the vehicles differential. Failure to do so may result in damage from lack of lubrication.

Nozzles

Compressed air foam can be discharged through various types and sizes of nozzles. Fog nozzles break down the bubble structure of the foam, resulting in “wetter” or reduced expansion foam. The preferred way to make foam is utilizing smooth bore nozzles with a given hose diameter, smaller tips will discharge “wetter” foam.

Foam Concentrate Ratios

Proportioner setting of 0.2% - 0.6% is typically adequate to produce compressed air foam that is formed in a hose line and used on Class A combustibles. Higher settings will result in “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 hose line.

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.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.

NOTE: Compressed air foam systems have the ability to produce 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 typically suited for defensive operations such as exposure protection, barriers or fuels pretreatment.

CAFS

Problem	Probable Cause	Recommended Action
Lack of air pressure from compressor	Lack of air supply to clutch (for air-clutch systems)	Repair air leak or re-establish air supply
Compressor not engaging	No PTO engagement	Confirm OK TO PUMP light is on, if not check wiring for damage or disconnected wire, check PTO.
Compressor engaging. No air supply to discharges or insufficient air supply	Verify there is power to the air solenoid and check operation of solenoid	Air discharge solenoid not working. Repair/ replace solenoid. Air solenoid working – leak between solenoid and discharge. Repair leak.
	Master air check valve defective	Replace or correct installation
	Trim valve out of adjustment	Trim valve should be set 3 turns open from the closed position
	Restricted minimum pressure valve	Clean rust or debris from valve
	Incorrect air line size between compressor and generators	Size according to discharge and replace line with correct size
System functioning correctly, pressure gauge reading obviously incorrect.	Pressure sensor malfunction, air line detached	Check for air leaks, replace pressure sensor
Air discharge pressure too high	Red hose circuit (compressed air control) has leaked or is disconnected.	Repair leak or attach hose
	PMC Air regulator	Verify air regulator is set to the correct pressure (normal: 125 psi, High Rise: 175 psi.

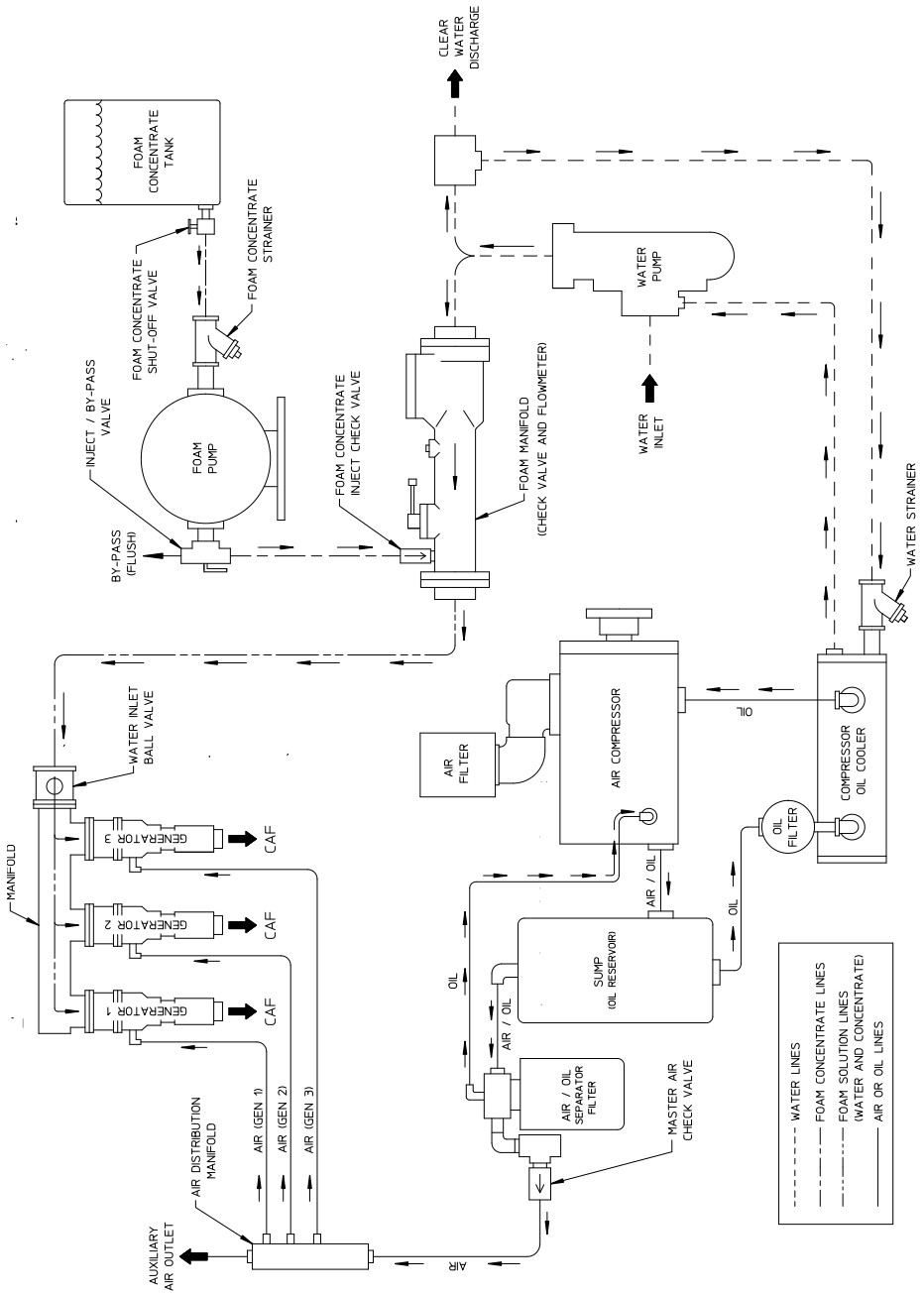
CAFS (Continued)

Problem	Probable Cause	Recommended Action
System overheating	Inadequate water flow through cooler	Ensure adequate water flow through pump. Check Wye-Strainer for obstruction, clean and reinstall Drain and flush cooler water tubes.
	Adequate water flow through cooler	On-board tank used for cooling for a prolonged period – water too hot to effectively cool the compressor. Locate source of lower temperature water. Check oil level – adjust level to half of the sight glass on level surface
	Low compressor oil level	Check the hydraulic lines for kinks, change oil filters
	Temperature sending unit and/or gauge circuit malfunction	Check wire connections at sending unit
High Oil Consumption	Overfull compressor oil	Adjust level to half of the sight glass on level surface
	Running in excess of 150 CFM air flow	Back down RPM's and flow CAFS to relieve pressure, then recheck. Replace Air/Oil Separator Filter
	Air/Oil Separator Filter damaged (could be caused by air flow of higher than 150 CFM)	System being operated at higher than capacity
"Excessive" compressor bleed down time on shutoff	Systems vary in bleed down time	If Auto-Sync/PMC is operating correctly, and compressor output is within spec, do nothing.
Engine stalls upon compressor engagement	Engaging compressor while under load	Allow compressor to bleed down before re-engagement
	Running system without flowing air causes oil to accumulate in compressor acting like hydraulic pump	Bleed down air, restart compressor, and move air
	Underrated engine horsepower	Raise engine RPM
	High oil level	Check oil level, adjust level to half of the sight glass with vehicle parked on a level surface
	Compressor locked up	Repair/replace compressor
Compressor locked up	High oil level (compressor is flooded)	Check oil level, adjust level to half of the sight glass with vehicle parked on a level surface
	Sump fire	Check system and repair
	Low oil level or no oil	Check system and repair

CAFS (Continued)

Problem	Probable Cause	Recommended Action
Poor CAFS (wet or dry) or no CAFS (assuming air pressure to generator is OK)	Using wetting agent and not foam concentrate	Use foam concentrate
	Foam proportioning rate turned too low	Increase amount of concentrate delivered to manufacturer recommended amount
	Foam proportioning control OFF or turned too low, foam tank empty.	Make sure proportioner is turned on and proper rate setting on Tellurus screen, foam supply valve is open, foam tank has concentrate, Wye-Strainer is clean, and supply line is connected to injector.
	Discharge hose not matched to generator setting.	Verify generator air injector and generator valve percentage settings. Hose size used must match generator settings. If generator is set up for 1 1/2" hose and a 2 1/2" hose is used, poor CAFS will result
Discharge hose shaking (slug flow)	Foam proportioner ON, setting correct, and tank has foam concentrate, but not providing foam solution	Refer to foam proportioner manufacturer's instructions for detailed calibration and troubleshooting instructions
Foam in the water system (when proportioner turned off)	Foam concentrate was poured into the on-board water tank	Flush tank and pump with clean water, refill
	Foam manifold drain lines not isolated from water drain lines	Isolate to separate drain valve
	Cooler line plumbed from manifold	Relocate line to discharge side of pump
	Foam manifold check valve defective	Rebuild/replace check valves
Water in compressor oil/air	Leaking inside cooler Freeze damage	Isolate cooler and check for leaks, replace if needed, check drain
	Defective master air check valve	Replace or check
	Defective air check valve for generator	Check inline air check valve at generator if it is stuck or malfunctioning.
Safety pop off valve opening at low pressure	Sump fire damaged pop off valve	Check system for other damage and replace valve
Safety pop off valve repeatedly opening	Trim valve or inlet completely open	Trim valve should be set 3 turns open from closed position.

Basic CAFS Schematic



BASIC CAFS SCHEMATIC
ECLIPSE GEN 2.0