

# Phase-Two Water Detector

## Frequently Asked Questions



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## Background on Phase Separation

### 1. *What is phase separation?*

Phase separation is an ethanol-water mixture that sits at the bottom of a tank of ethanol-blended gasoline. It can cause damage to cars if it enters the fueling system. The ethanol-water mixture is very corrosive and can cause damage to the petroleum infrastructure of a gas station.

Phase separation occurs when water enters an underground storage tank. Some of the water will be suspended in the fuel, binding to the ethanol. The rest of the water will fall to the bottom of the tank, pulling ethanol with it. Over time, this ethanol-water mixture will continue to pull more ethanol from the fuel. *It is important to note that you will never have pure water sitting at the bottom of a tank of ethanol-blended gasoline.*

### 2. *How does water get into a tank?*

Water can enter a tank through a variety of means. Common sources are:

- Water in delivery of fuel
- Water in delivery spill bucket released into tank
- Delivery riser cap not replaced after delivery, rain water entry
- Hole in vent cap / line, rain water entry
- Leaky tanks / Groundwater entry
- Degraded or cracked seals of sump lid
- Condensation of water vapor

### 3. *How much water does it take to create phase separation?*

In a perfectly mixed tank of E10 gasoline at 68°F, phase separation will occur when the fuel contains 0.5% of water (by volume). However, in a real-world situation of a large storage tank, very small amounts of water at less than 0.5% concentration can cause localized regions of phase separation at the bottom of the tank.

#### **4. How often does phase separation occur?**

In North America, about 1 out of 100 gas stations has a phase separation incident that affects customers' vehicles. However, we believe that phase separation occurs much more frequently but at smaller levels, which over time can corrode the bottom of tanks.

#### **5. Can phase separation occur in the middle of a tank?**

Phase separation (ethanol-water) has a higher density than ethanol-blended gasoline, which means that it is heavier. Therefore, upon formation, phase separation will quickly sink to bottom of a tank.

Dispenser filters that protect against water and phase separation may clog up even with little-to-no phase separation at the bottom of the tank. This is because the water that stays suspended in the fuel will also clog up the filter.

#### **6. Why is phase separation a problem for automatic tank gauges?**

The water float in an automatic tank gauge (ATG) was developed to detect pure water in pure gasoline tanks. Phase separation, which is a mixture of ethanol and water, has a lower density than pure water. Therefore, when phase separation forms at the bottom of a tank, the water float may not rise.

#### **7. What should I do if the Phase-Two Water Detector detects water / phase separation?**

In some states, there are specific guidelines for dealing with water in ethanol blended fuels. In the absence of these guidelines, we have observed some effective methods of remediation:

- **Get a fuel delivery:** small amounts of water will get re-suspended in the tank after another delivery, which may take care of the problem by itself
- **Pump out the tank bottom and sweeten:** Service providers can pump out the bottom of the tank where the phase separation resides. After removal, the remaining fuel will be ethanol and octane depleted. In order to bring the octane level back up, stations can add more pure ethanol or add higher octane fuel (premium gasoline to a regular tank). This "sweetening" procedure must conform to standards placed by fuel branders and local ordinances.
- **Dispose of entire tank load of fuel.** When phase separation is severe enough, it can render the entire tank of fuel unusable. And as mentioned above, some branders will not allow ethanol-depleted fuel to be sweetened. In these cases, the entire tank of fuel must be disposed.

#### **8. How can a station ensure that no water or phase separation enters a vehicle?**

The Phase-Two Water Detector will report the level of water or phase separation in a tank. Warning and alarm limits can be set which will alert the station when these thresholds are reached so that the station operator can manually shut down the tank. For an added step of security, the TLS feature Positive Shutdown can be installed which ties the TLS to the submersible turbine pump, and will automatically turn off the tank once a water alarm becomes activated.

## Fuel Compatibility

**9. What blend levels of ethanol is the Phase-Two Water Detector compatible with?**

The Phase-Two Water Detector is recommended for all gasoline blended with up to 15% ethanol.

**10. Can the Phase-Two Water Detector be used in gasoline with no ethanol?**

Yes, the Phase-Two Water Detector functions in “pure gasoline” (no ethanol content) with better performance than the existing gasoline float kit. In particular, the minimum detectable water height is improved from 0.63” (standard 4” water float) to 0.38”.

**11. Can the Phase-Two Water Detector be used with diesel or any other fluid?**

No, the Phase-Two Water Detector should not be used with diesel or other fluids.

**12. How does the Phase-Two Water Detector respond if the ethanol content changes from one bulk delivery to the next?**

The Phase-Two Water Detector will reliably work under all ethanol blends from 0% to 15%, including changes in ethanol content from delivery to delivery.

## Equipment Compatibility

**13. What TLS consoles does the Phase-Two Water Detector work with?**

The Phase-Two Water Detector is compatible with the Veeder-Root models:

- TLS-450
- TLS-350 (excluding TLS-350J)
- TLS-300 (excluding IFSF)

**14. Do I need to upgrade my TLS console software to work with the Phase-Two Water Detector?**

Yes, the consoles will need at minimum the following updated software versions:

- TLS-450: Version 3A      Started shipping August 16, 2010
- TLS-350: Version 30B      Started shipping August 11, 2010
- TLS-300 Version 30B      Started shipping August 11, 2010

These updated software versions support the Phase-Two Water Detector in two ways:

1. They have the ability to select the new float upon setup
2. They have algorithms to determine phase separation

**15. How do I know what software version I have on my TLS console?**

From the TLS-350 console, print out the System Diagnostic Report. It will return the Software Revision Level.

A return string of VERSION 110.01 would be interpreted as version 10B.

A return string that includes the code 346130-100-AXA would be interpreted as version 30 (last 2 digits of 6-digit string).

The printouts below show consoles before and after upgrade:

```
SOFTWARE REVISION LEVEL
VERSION 121.00
SOFTWARE# 346121-100-A
CREATED - 00.11.15.13.23

NO SOFTWARE MODULE
SYSTEM FEATURES:
  PERIODIC IN-TANK TESTS
  ANNUAL IN-TANK TESTS
```

Version 21A

```
SOFTWARE REVISION LEVEL
VERSION 330.01
SOFTWARE# 346330-100-B
CREATED - 10.07.23.17.25

NO SOFTWARE MODULE
SYSTEM FEATURES:
  PERIODIC IN-TANK TESTS
  ANNUAL IN-TANK TESTS
```

Version 30B

Version 24 software contains the ECPU2, which was launched in October 2003. Any software version prior to version 24 will also need an ECPU2 upgrade to get to the latest version of software. See the Serial Interface Manual for more details on this command.

Alternatively, you can remotely run the following serial command:

- CNT A I90200

You will then need to interpret the version number as described above.

### **16. How do I know if I have an ECPU2 installed (TLS-350)?**

From the console, you will need to open the door and view the version number on the CPU board.

The following photo shows the ECPU2 label on the board.



Alternatively, you can remotely run the following serial command:

- `CNT A I@F700`

If the return string contains `EPCU2 BOARD`, then you have it installed. If it says `EPCU BOARD` or something else, you do not have it installed. See the Serial Interface Manual for more details on this command.

### **17. What probes does the Phase-Two Water Detector work with?**

The Phase-Two Water Detector is compatible with Mag Plus Probes, which are probe type MAG7, MAG8, or MAG9. These probes were introduced in North America in May 2006, and have form numbers 8463xx-1xx, -2xx, or -3xx, and circuit codes D004, D005, D006. The float does NOT work with Standard Mag (MAG1, MAG2, MAG3), Retrofit probes nor MAG-D (Density) probes.

### **18. What float size does the Phase-Two Water Detector work with?**

The Phase-Two Water Detector is compatible with 4" floats. It is not compatible with 2" or 3" floats.

### **19. How do I know which probes and floats I have? Can I remotely check?**

From the TLS-350 console, print out an In-Tank Diagnostic report. Under Probe Type, look for the ID CHAN field.

- If the ID CHAN returns 0xD004, 0xD005, 0xD006, you have Mag Plus probes which are compatible to the Phase-Two Water Detector.

- If the ID CHAN returns 0xC000, 0xC001, 0xC002, you have Standard Mag probes and will need to upgrade.

The printout below (from a TLS-350) shows the output of an In-Tank Diagnostic report.

```

IN-TANK DIAGNOSTIC
-----
PROBE DIAGNOSTICS
T 1: PROBE TYPE MAG7
SERIAL NUMBER 281819
LENGTH 48.00
DATE CODE = 5236
ID CHAN = 0xD004
GRADIENT = 396.2200
PROBE INIT:
  JUL 23, 2010 11:02AM

OPTIONS:
LOW TEMPERATURE

NUM SAMPLES = 20

C00 1053.0 C01 14611.0
C02 14611.0 C03 14611.0
C04 14611.0 C05 14611.0
C06 14611.0 C07 14611.0
C08 14611.0 C09 14611.0
C10 14611.0 C11 43342.6
C12 17409.2 C13 17744.9
C14 17866.8 C15 17735.9
C16 17909.6 C17 17873.8
C18 43341.2

SAMPLES READ = 441276
SAMPLES USED = 441064
LAST ERROR = 344414
LAST SAMPLE ERROR TIME:
  JUL 27, 2010 6:18AM

TEMP SENSOR DATA
T6: 73.992 F
T5: 73.239 F
T4: 72.967 F
T3: 73.260 F
T2: 72.871 F
T1: 72.951 F

ORIG REF DISTANCE
JUL 24, 2010 52.47
CURR REF DISTANCE
JUL 28, 2010 52.47
  
```

Either Probe Type or ID CHAN can be used to determine probe type. This probe is a Mag Plus probe

In the TLS-450, you can find the same information under the probe diagnostics screen.

In particular:

- Go to Diagnostics Screen
- Select Probe
- Select General tab

The printout below shows one probe from the TLS-450

PROBE 1:			- TANK 1			
TYPE	CODE	LENGTH	SERIAL NO	DATE YR/WK	REV	GRADIENT
MAG7	D004	1219.20	201018	X4/74	01	396.9700

Indicates Mag Plus probe

Alternatively, you can remotely run the following serial command:

- CNT A IA0100 This will return the Probe Type, code, and size

You will then need to interpret the circuit code results the same as the ID CHAN.

## Phase-Two Operability

### ***20. How does the Phase-Two Water Detector detect Phase Separation?***

Phase Separation is an ethanol-water mixture that has a higher density than gasoline, but considerably lower density than water. The Phase-Two Water Detector uses multiple densities to differentiate between heavy gasoline and light phase separation. The net effect is that the float will detect even very light phase separation, while minimizing false alarms due to high density gasoline.

### ***21. Does the Phase-Two Water Detector detect phase separation before or after a phase separation incident?***

The Phase-Two Water Detector is designed to detect phase separation when it occurs. However, it does not predict phase separation. The Phase-Two works similar to a traditional water float, in that it detects the presence of the contaminant and measures the level. The difference is that a traditional water float only will detect pure or nearly pure water at the bottom of the tank, while the Phase-Two Water Detector will detect water and phase separation at the bottom of the tank.

### ***22. Does the Phase-Two Water Detector differentiate between water and Phase Separation?***

No, both are reported as “Water” on the TLS console and in reports. When water enters a tank of ethanol-blended fuel, some of the water will fall to the bottom, pulling ethanol with it. As such, you will never have pure water at the bottom of the tank, but instead water with varying degrees of ethanol mixed in. Therefore, the Veeder-Root TLS will report one number, minimizing the changes in daily standard work and in reports.

### ***23. Are there any new alarms with the Phase-Two Water Detector?***

Yes, there is a new “Fuel Quality” alarm. The Phase-Two Water Detector is designed to work under a wide range of temperatures and fuel densities. In rare cases, good fuel may have similar temperature and density characteristics to Phase Separation. In these cases, the TLS will issue a Fuel Quality Alarm. If a station owner sees this new alarm, he or she



should verify the fuel using manual methods such as sticking the tank with paste or analyzing a fuel sample.

***24. Has the fuel / product float changed in the Phase-Two Water Detector?***

No, the fuel float is the same as in earlier pure gasoline float kits. However, we recommend that you change out the fuel float with the new one enclosed in this new float kit.

***25. Why is the minimum fuel height in the Phase-Two Water Detector higher than the normal Gasoline Float Kit?***

The design of the Phase-Two Water Detector is much taller than the older water float, and therefore the fuel float can only go down about 7.0” before it hits the Phase-Two Water Detector and gives an Invalid Fuel alarm.

***26. Is the Phase-Two Water Detector third-party certified?***

Yes, the Phase-Two is certified for water detection (similar to previous generation water floats) and listed with the National Workgroup.

***27. Why does the Phase-Two Water Detector contain two floats and not just one (phase separation float)?***

The Phase-Two Water Detector contains two floats – an inner float for phase separation, and an outer float for water. Earlier design concepts with just an inner float had the problem of excessive false alarms, as the inner float mistakenly identified certain blends of summer fuel (with very high densities) as phase separation. The Phase-Two’s outer float has a cage that will “catch” the inner float rising in high-density gasoline. Additional algorithms in the TLS prevent it from alarming in these non-threatening situations.