



**STATE OF WISCONSIN**  
Department of Agriculture,  
Trade and Consumer Protection

**Approval # 20230002**  
(Replaces 20190009R1)

Bureau of Weights and Measures  
Storage Tank Regulation  
P.O. Box 7837  
Madison, WI 53707-7837

## **Wisconsin ATCP 93 Material Approval**

Equipment: TMS2000, TMS2000W, TMS3000, TMS4000,  
TMS4000M Volumetric In-Tank and LC1000 and  
LC2000 Secondary Containment Leak Detection

Facility Owner: Pneumercator Co., Inc.  
1785 Expressway Drive N.  
Hauppauge, NY 11788

Expiration of Approval: December 31, 2026

---

### **SCOPE OF EVALUATION**

The TMS2000, TMS3000, and TMS4000 Tank Management Systems with the Ametek Patriot 7100 series magnetostrictive tank probe (Pneumercator Model MP450S probe) was evaluated as a means of monthly monitoring in accordance with **s. ATCP 93.510(3)(a) and 93.515 (5)**. TMS2000, TMS2000W, and TMS3000 Tank Management Systems, LC1000, and LC2000 alarm consoles, as used with the LS600 series, LS610, RSU80x series, and ES825 series detectors/sensors, were evaluated as a means of interstitial and/or containment sump monitoring in accordance with **s. ATCP 93.510(3)(a), 93.510(4)(a)3 and 93.515 (7)**.

This evaluation summary is condensed to provide the specific installation, application and operational parameters necessary to maintain the subject systems in compliance with the Wisconsin Administrative Code – ATCP 93.

## **DESCRIPTION OF PROTOCOL**

### **Automatic Tank Gauging Systems:**

Pneumercator TMS2000, TMS3000, and TMS4000 Tank Management Systems with the Ametek Patriot 7100 series magnetostrictive tank probes, (Pneumercator Model MP450S probe) are approved as complying under the following criteria:

The systems may be used for tanks containing gasoline, ethanol blends up to 10%, diesel, biodiesel blends B6-B20 meeting ASTM D7467, biodiesel B100 meeting ASTM D6751, aviation fuel, solvents, and other products that will not physically damage the probe and are of uniform specific gravity. Number 6 heating oil may be gauged for inventory only and only if the product is heated.

The systems test for water incursion. The minimum water level in the tank that the system can detect is approximately 1/2 inch. The minimum change in water level that can be detected by the system is approximately 1/8 inch provided the water level is above the threshold.

**Note: The Pneumercator TMS2000W has not been third-party approved for automatic tank gauging; it has only third-party approved for monitoring sensors as detailed below.**

### **Leak Detection Sensors:**

#### **RSU800 Liquid Float-switch Sensor**

The RSU800 sensor is a liquid float switch designed for hydrostatic liquid monitoring of double wall fiberglass tanks where the interstice between the walls of the tank are filled with a brine or glycol solution. The sensor is installed in a reservoir chamber and actuates a dual point switch which activates an alarm on the console when the brine or glycol level rises or falls to the levels of the sensor thresholds.

The RSU800 sensor can be used with the LC1000, LC2000 consoles and the TMS2000, TMS2000W, TMS3000, TMS4000 automatic tank gauges.

The low level alarm threshold is approximately 2.3 inches from the bottom of the sensor. The high level alarm threshold is approximately 13.0 inches above the bottom of the sensor.

The time to alarm after the liquid level exceeds the thresholds is less than one second for hard wired sensors, and up to 65 seconds for wireless sensors. The alarm is not maintained if the liquid level changes so that it no longer exceeds the thresholds.

The ability to detect a release of product into the interstice will depend on reservoir geometry and sensor placement.

#### **LS600 LD Liquid Float-Switch Sensor**

The LS600 LDBN is a float actuated leak sensor with one magnetic Buna-N float only, the

LS600 LDSS is a float actuated leak sensor with one stainless steel float. When used with the correct console, an alarm is activated when the switch is activated. The alarm threshold for the LS600 LD is approximately one inch from the bottom of the sensor.

The LS600 LD sensor can be used with the LC1000, LC2000 consoles and the TMS2000, TMS2000W, TMS3000, TMS4000 automatic tank gauges.

#### LS610 Liquid Float-Switch Sensor

The LS610 consists of a flat float that swivels up and down on a square shaped body. The float actuates a switch when the liquid level rises to the threshold activating the console alarm. The alarm threshold for the LS610 is approximately 0.125 inches of liquid.

The LS610 sensor can be used with the LC1000, LC2000 consoles and the TMS2000, TMS2000W, TMS3000, TMS4000 automatic tank gauges.

#### ES825 Series Liquid Sensors

The ES825-100F/XF/CF and ES825-300F/XF/CF series sensors are non-discriminating sensors utilizing electro-optical technology to detect the presence of liquid. The ES825-200F/XF and ES825-400F/XF sensors are product discriminating sensors utilizing both electro-optical and conductivity technologies to discriminate between water and hydrocarbons. All sensors have a fault-detect option that allows the TMS to continually monitor for sensor or wiring faults.

The ES825-100F/XF/CF and ES825-200F/XF sensors can be used with the LC2000 console and the TMS2000, TMS3000 automatic tank gauges.

The ES825-300F/XF/CF and ES825-400F/XF sensors can be used with the TMS2000W automatic tank gauge.

#### LLP203 Line Leak Sensor

The LLP203 is an EPA-compliant line leak detector intended for use with pressurized liquid piping systems, and is for applications where 3 GPH catastrophic line leak detection with audible and visual alarms is required, but pump shutdown is not desired. The LLP203 is designed to be compatible with all TMS2000, TMS3000 and TMS4000 Tank Management Systems using Pneumercator's standard, universal leak sensor inputs, which means the LLP203 sensor capacity is limited by the number of available inputs to a maximum of 16. Additionally, any TMS built after 2003 can support the LLP203 with a firmware upgrade.

<b>LLP203 Piping Volume Limits Table</b>									
<b>Charge Pressure [psi]</b>	<b>Bulk Modulus [psi]</b>								
	<b>2000</b>	<b>5000</b>	<b>10000</b>	<b>20000</b>	<b>30000</b>	<b>40000</b>	<b>50000</b>	<b>60000</b>	<b>70000</b>
4	1015	1179	1179	1179	1179	1179	1179	1179	1179
5	707	1179	1179	1179	1179	1179	1179	1179	1179
10	467	1167	1179	1179	1179	1179	1179	1179	1179
15	292	729	1179	1179	1179	1179	1179	1179	1179
20	233	584	1167	1179	1179	1179	1179	1179	1179
25	156	389	778	1179	1179	1179	1179	1179	1179
30	117	292	584	1167	1179	1179	1179	1179	1179
35	93	233	467	934	1179	1179	1179	1179	1179
40	78	195	389	778	1167	1179	1179	1179	1179
45	67	167	333	667	1000	1179	1179	1179	1179
50	58	146	292	584	875	1167	1179	1179	1179
55	52	130	259	519	778	1037	1179	1179	1179
60	47	117	233	467	700	934	1167	1179	1179
65	42	106	212	424	637	849	1061	1179	1179
70	39	97	195	389	584	778	973	1167	1179
75	36	90	180	359	539	718	898	1077	1179
80	33	83	167	333	500	667	834	1000	1167
85	31	78	156	311	467	622	778	934	1089
90	29	73	146	292	438	584	729	875	1021
95	27	69	137	275	412	549	686	824	961
100	26	65	130	259	389	519	648	778	908
105	25	61	123	246	369	491	614	737	860
110	23	58	117	233	350	467	584	700	817
115	22	56	111	222	333	445	556	667	778
120	21	53	106	212	318	424	530	637	743
125	20	51	101	203	304	406	507	609	710
130	19	49	97	195	292	389	486	584	681
135	19	47	93	187	280	373	467	560	654
140	18	45	90	180	269	359	449	539	628
145	17	43	86	173	259	346	432	519	605
150	17	42	83	167	250	333	417	500	584

**TESTS AND RESULTS**

Testing of the Pneumercator TMS 2000, TMS 3000, and TMS4000 Tank Management Systems with the Ametek Patriot 7100 series magnetostrictive tank probes (Pneumercator Model MP450S) for monthly monitoring and tank tightness testing was conducted in accordance with the EPA Automatic Tank Gauging Systems protocol. When using leak declaration thresholds of 0.05 gph and 0.10 gph, the probabilities of detection of a leak of 0.10 and 0.20 gph, respectively, were certified to within the 95-5 ranges required by the EPA protocols.

Testing of the liquid and brine sensors were conducted in accordance with a modified version of the EPA Standard "Liquid-Phase Product Detectors" protocol.

**MONITORING SYSTEM OUTPUT**

DATCP Material Approval No. 20230002 (Replaces  
20190009R1) Page 5 of 8

Detailed here are examples of the typical Probe/Sensor Alarm Status, In-Tank Leak Test Results, and In-Tank Leak Test History.

<pre>***** NNNNNNNNNNNNNNNNNNNN XXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXX  MM/DD/YY hh:mm  Site id   XXXXX Unit id   XX -----</pre>	<p>"Log" if On-Demand from Log Menu or else Log</p> <p>Printer Header Line 1 Printer Header Line 2</p> <p>Month / Day / Year – Printed Hour : Minute – Printed</p> <p>Site ID Unit ID</p>
---	---

**Header - applicable to all reports**

<pre>***** Current Alarm Status  XXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXX  MM/DD/YY hh:mm  Site id   XXXXX Unit id   XX -----  Tank Alarms T          P P A          R R N N          W T O K L       A H T S R E S S S T E I Y M I A P P P E F M N A D K 1 2 3 R T E C L  ## X X X X X X X X X  Leak Sensor Alarms T S N E K N / S D           N O S           A O R P           L R I I           A M D D           R A                 M L  ##          nnnnnn L N  ALARM STATUS KEY A = GENERAL ALARM F = GENERAL FAULT O = OPEN-CIRCUIT FAULT P = PRODUCT ALARM S = SHORT-CIRC. FAULT W = WATER ALARM ----- *****</pre>	<p>Printer Header Line 1 Printer Header Line 2</p> <p>Month / Day / Year – Printed Hour : Minute – Printed</p> <p>Site ID Unit ID</p> <p>## = Tank ID, X for applicable column, 1 line per probe</p> <p>## = Sensor ID, n is sensor name, L refer to legend below printout, N for normal status, 1 line per sensor</p>
---	--

**Probe/Sensor Alarm Status**

<pre> Log      Tank Leak xx Date      MM/DD Starttime hh:mm End Time  hh:mm Name      xxxxxxxxx Prod Type xxxxxxxxx Tank ID   xx  Net Begin xxxxxxxx Gal Net End   xxxxxxxx Gal  Beg Temp  xxx.x degF End Temp  xxx.x degF  Leaklimit gph 0.x Rate gph  xxx.xxx  Result    xxxxx ----- Rate Hr1  xxx.xxx Rate Hr2  xxx.xxx Rate Hr3  xxx.xxx Rate Hr4  xxx.xxx Rate Hr5  xxx.xxx Rate Hr6  xxx.xxx Rate Hr7  xxx.xxx Rate Hr8  xxx.xxx </pre>	<pre> Entry Number (only when On-Demand from Log Menu) Month / Day – of occurrence Hour : Minute – of occurrence Hour : Minute – of occurrence Tank Name Product Type Tank ID  Beginning Net Volume Ending Net Volume  Beginning Temperature Ending Temperature  Programmed Leak Limit Detected Leak Rate (GPH)  In-Tank Leak Test Result  Average Leak Rate after 1 Hour Average Leak Rate after 2 Hour Average Leak Rate after 3 Hour Average Leak Rate after 4 Hour Average Leak Rate after 5 Hour Average Leak Rate after 6 Hour Average Leak Rate after 7 Hour Average Leak Rate after 8 Hour </pre>
---	---

**In-Tank Leak Test Results**

<pre> Log      Leak Hist xx Tank id   xx Name      xxxxxxxxx Prod Type xxxxxxxxx Date      MM/DD/YY Starttime hh:mm End Time  hh:mm  Leaklimit gph 0.x Rate gph  xxx.xxx  Result    xxxxx </pre>	<pre> Entry Number (only when On-Demand from Log Menu) Tank ID Tank Name Product Type Month / Day / Year – of occurrence Hour : Minute – of occurrence Hour : Minute – of occurrence  Programmed Leak Limit Detected Leak Rate (GPH)  In-Tank Leak Test Result </pre>
--	---

**In-Tank Leak Test History**

**LIMITATIONS / CONDITIONS OF APPROVAL**

- All monitoring equipment shall be installed, calibrated, operated, and maintained in accordance with the manufacturer instructions, and certified every 12 months for operability, proper operating condition, and proper calibration in accordance with **s. ATCP 93.510 (2)**. Records of sampling, testing, or monitoring shall be maintained in accordance with **s. ATCP 93.500(9)(a)**.

- The manufacturer shall submit for a revision to this Wisconsin Material Approval application if any of the functional performance capabilities of this equipment are revised. This would include, but not be limited to changes in software, hardware, or methodology.
- While 3rd party testing does determine a required minimum tank level, EPA leak detection regulations require testing of the portion of the tank system which routinely contains product. Consistent testing at low levels could allow a leak to remain undetected.

During leak testing, a minimum level of product in tank shall be maintained so as to ensure testing of the portion of the tank and/or piping that routinely contains product, regardless of testing system capability. For instance, if product levels are routinely maintained at 60%, but the leak detection system is capable of testing at 15% product level, then testing shall be performed at 60% levels.

- If performing a tank tightness test, minimum tank level shall be 95%, regardless of leak detection system minimum capability, in accordance with **s. ATCP 93.515 (4)**.
- Automatic tank gauges shall be programmed to provide an audible and visual alarm in the event of a tank test fail, periodic monthly tank test not performed within a 30-day interval, or tank interstitial sensor actuation. Silencing of the alarm shall require manual operator action.
- Electronic line leak detection shall be programmed to provide an audible and visual alarm in addition to providing shut-down of the submersible pump in the event of a line test fail. The ELLD shall also be programmed to provide an audible and visual alarm in the event a periodic monthly line test was not performed within a 30-day interval. Silencing of either alarm shall require manual operator action.
- Sensors used for interstitial line monitoring shall be programmed to provide an audible and/or visual alarm in addition to providing shut-down of the submersible pump or individual dispenser(s) in the event of a sump/interstitial monitoring sensor actuation. Silencing of the alarm shall require manual operator action.

**TMS2000. TMS3000. TMS4000 Automatic Tank Gauging Systems with Pneumercator probe model MP450S:**

The systems may be used for tanks containing gasoline, diesel fuel, aviation fuel, #2 and #4 heating oil, most gear oils and lubricants and some solvents. Number 6 heating oil may be gauged for inventory only and only if the product is heated.

<b>Parameters applicable to all testing</b>	
Minimum wait time after filling tank 8 hours	8 hours
Maximum tank size 75,000 gallons for TMS2000 and TMS3000 consoles	75,000 gallons
Maximum tank size 30,000 gallons for TMS4000 consoles	30,000 gallons



**For Tank Capacities 20,000 Gallons or less:**

Minimum product level required for testing	20% of total tank capacity (0.2 gph testing only- 0.1 gph testing must be performed at 95%)
<b>0.1 gal/hr leak rate</b>	
Minimum length of time to conduct test	7 hours*
<b>0.2 gal/hr leak rate</b>	
Minimum length of time to conduct test	2 hours*

**For Tank Capacities Greater Than 20,000 Gallons:**

Minimum product level required for testing	50% of total tank capacity
<b>0.2 gal/hr leak rate</b>	
Minimum length of time to conduct test	8 hours*

\* The probabilities involved in detecting leaks and minimizing false alarms improve with longer test times. There are no acceptable deviations in the standard test protocol.

**Leak Detection Sensors:**

The Liquid Sensors shall be placed such that a release from any portion of the tank or piping will be detected.

Part Number	Description	Application	Console/ATG
<b>RSU-800</b>	Dual Float Liquid Level	Brine or Glycol Filled Interstitial of Double Wall Fiberglass Tank	LC1000, LC2000 TMS2000, TMS2000W, TMS3000, TMS4000, TMS4000M
<b>LS600 LD</b>	Non-Discriminating Liquid Float Switch Sensor	Steel Tank Double Wall Dry Interstitial, Double Wall Piping, and Containment Sumps	LC1000, LC2000 TMS2000, TMS2000W, TMS3000, TMS4000, TMS4000M
<b>LS610</b>	Non-Discriminating Liquid Float Switch Sensor	Dry Interstitial of a Fiberglass Double Wall Tank	LC1000, LC2000 TMS2000, TMS2000W, TMS3000, TMS4000, TMS4000M
<b>ES825-100F/XF/CF</b>	Electro-optical Nondiscriminating Liquid Sensor	Fiberglass or Steel Tank Dry Interstitial, Double Wall Piping, and Containment Sumps	LC2000 TMS2000, TMS3000, TMS4000, TMS4000M
<b>ES825-200F/XF</b>	Electro-optical Discriminating Liquid Sensor	Fiberglass or Steel Tank Dry Interstitial, Double Wall Piping, and Containment Sumps	LC2000 TMS2000, TMS3000, TMS4000, TMS4000M
<b>ES825-300F/XF/CF</b>	Electro-optical Nondiscriminating Liquid Sensor	Fiberglass or Steel Tank Dry Interstitial, Double Wall Piping, and Containment Sumps	TMS2000W
<b>ES825-400F/XF</b>	Electro-optical Discriminating Liquid Sensor	Fiberglass or Steel Tank Dry Interstitial, Double Wall Piping, and Containment Sumps	TMS2000W


This approval will be valid through December 31, 2026, unless manufacturing modifications are made to the product or a re-examination is deemed necessary by the department. The Wisconsin Material Approval Number must be provided when plans that include this product are submitted for review.


**DISCLAIMER**

The Department is in no way endorsing or advertising this product. This approval addresses only the specified applications for the product and does not waive any code requirement unless specified in this document.

Effective Date: April 13, 2023

Type text here

Approved by:  Date: 4/13/2023  
Erik Otterson  
Environmental Specialist

Reviewed by:  Date: 4/13/2023  
Greg Bareta, P. E.  
Section Chief  
Storage Tank Regulation  
Bureau of Weights and Measures