ORDER

U. S. DEPARTMENT OF TRANSPORATION

FEDERAL AVIATION ADMINISTRATION
Western-Pacific Region

WP 6980. 13

SUBJ: **MAINTENANCE AND OPERATION OF FUEL STORAGE TANK MONITORING SYSTEMS**

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1. **PURPOSE:** This Order provides the instructions for maintenance and operations of fuel storage tank monitoring systems in the Western-Pacific Region.

2. **DISTRIBUTION:** This Order is distributed to all Western-Pacific Region Airway Facilities Field Offices, System Management Offices, Branches and all other Airway Facilities Division Offices in the FAA.

3. **BACKGROUND:** The Fuel Storage Tanks Monitoring System in the Western Pacific Region (AWP) is unique to this Region. This Order will enable the AWP to meet the requirements of the Environmental Protection Agency's 40 CFR Part 280 for Underground Storage Tanks (UST's) and 40 CFR Part 112 for above Ground Storage Tanks (AST's).

4. **GENERAL INFORMATION AND REQUIREMENTS**

a. **Introduction** - This order provides the necessary guidance for the proper testing, operation and maintenance of the fuel storage tank monitoring systems, which includes tank tightness, leak detection and overfill protection for above ground (AST) and below ground (UST) tanks in accordance with FAA policies, responsibilities and guidelines as well as Environmental Protection Agency (EPA) requirements for protection of the environment.

b. **Background** - All AST and UST tanks, (with the exception of propane tanks), shall be monitored using automatic tank gauging systems that meet strict EPA requirements, including 40 CFR part 280 for UST's and 40 CFR part 112 for AST's. These systems, which meet all requirements of FAA Order 1050.15A, continually monitor the tank integrity for leaks, presence of water and overfilling, as well as monitoring fuel lines for leaks. In the event of a leak, water presence, overfill or any other alarm condition, a local alarm will be generated.

c. **Equipment description** - This order applies to the following two fuel storage tanks monitoring systems:

(1) RONAN X76ETM-4X Leak Detection System

(2) P6 (OPTO-22) FST Monitoring System

Distribution: A-X(AF)-3; A-FAF-O (LTD) **Initiated By:** AWP-470

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d. **Each system is designed** to comply with environmental regulations, provide local status/alarm condition and be compatible with FAA Environmental Remote Monitoring Subsystems (ERMS). ERMS will provide remote notification to the MCC of system status and utilizes separate alarm thresholds. See ERMS instruction book TI 6145.1 for more detailed information.

e. **Each has a processor/controller** and the necessary components to provide continuous electronic monitoring and notification of the status and integrity of both underground and aboveground fuel storage tanks.

f. **The components of the systems** are the keyboard/display, fuel probe, annular space sensor, and fuel line sensors, The keyboard/display is used for user input and output for functions such as configuration, calibration, and alarm annunciation. The fuel probe is used to measure real-time fuel level, water presence and level as well as fuel temperature. The annular space sensor is used to detect the presence of fluid within the annular space. The fuel line sensors are used to detect the presence of fluid within the secondary containment around the fuel supply and return lines.

5. **TECHNICAL DESCRIPTION** - This section provides block diagrams of the RONAN and P6 (OPTO-22) systems illustrating configuration of the major components (See Figures 1 and 2). Detailed technical descriptions can be found in the respective system manuals: **RONAN X76ETM Leak Detection System** or **OPTO-22 FST Monitoring System.**

Figure 1

Block Diagram RONAN System

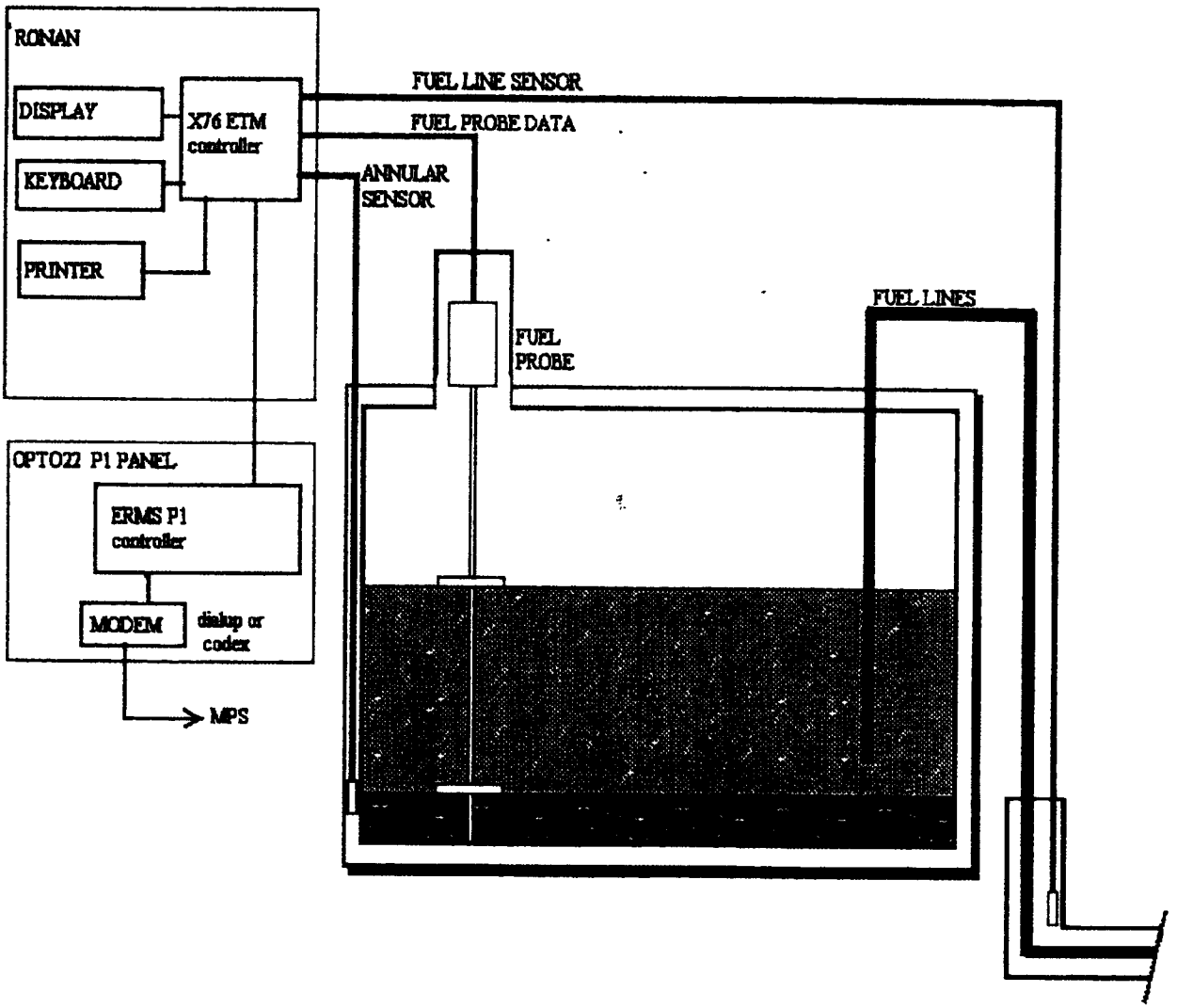
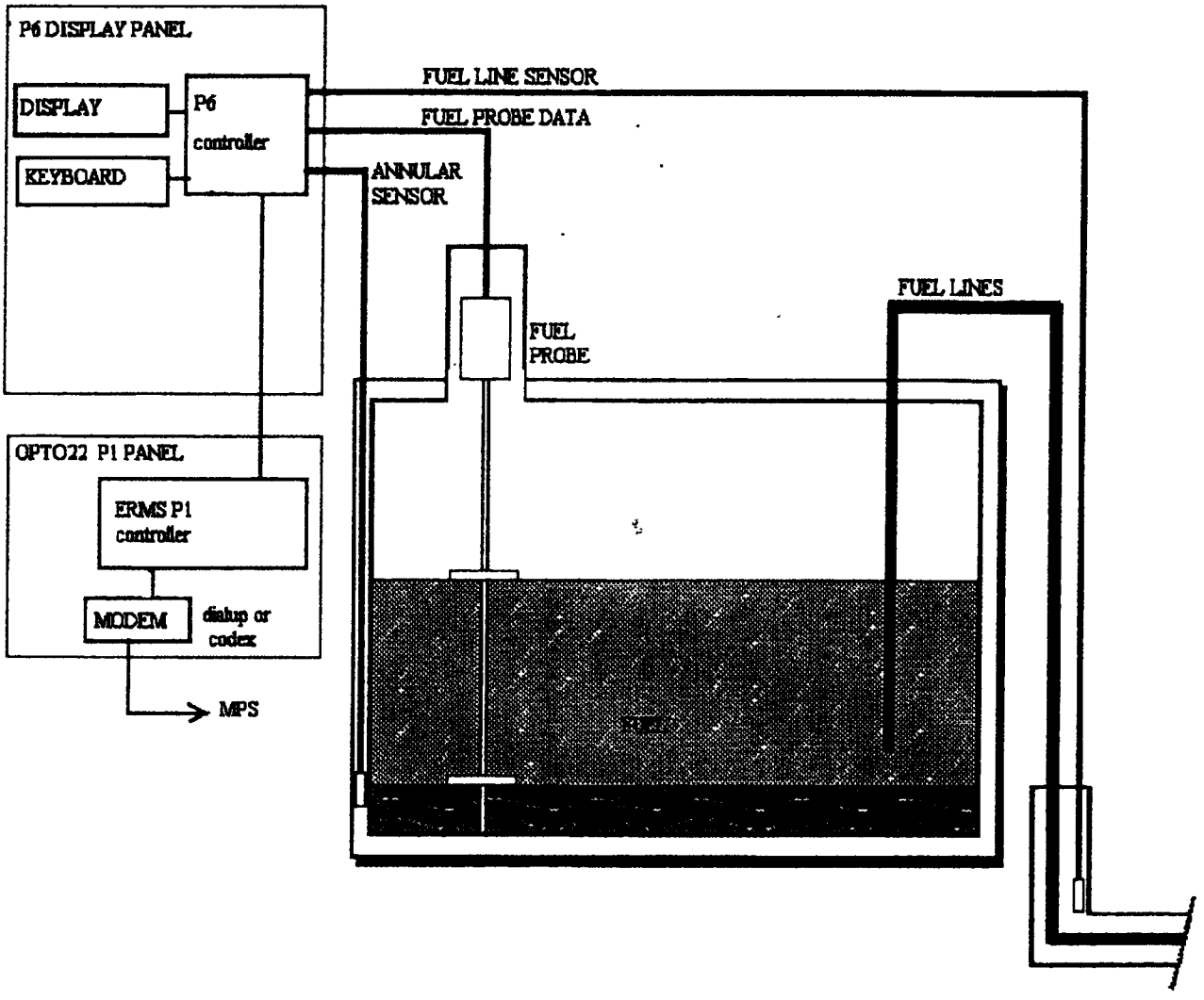


Figure 2

Block Diagram P6 (OPTO-22) System



6. STANDARDS AND TOLERANCES

a. General - This section lists the pertinent and corresponding standards and tolerances for the equipment.

b. Alarm parameters in this section pertain to setting the "local" alarm thresholds for both the RONAN and the P6 system. The programming of these values are found in section 8 "Maintenance Procedures."

c. Remote alarm notification will be provided by ERMS, and are independent of the local alarms. Procedures for setting these alarm thresholds are found in ERMS Handbook Technical Issuance (TI) 6145.1 (Figure 3).

Figure 3

STANDARDS AND TOLERANCES TABLE

	Parameter	Standard	Tolerance/Limit Initial	Operating
1.	RONAN System			
	a. Primary Power	115vac	+/-5vac	SAI *
	b. Power Supply	24vac	+/-0.5vdc	SAI
	c. Overfill Alarm (local) **	90% Capacity	90% Capacity	SAI
	d. Water Alarm (local) **	0.5 inches	+/-0.1	SAI
	e. Low Fuel Alarm (local)	g = 36 hrs. runtime remaining	+/-10g	SAI
2.	P6 (OPTP-22) System:			
	a. Primary Power	115vac	+/-5vac	SAI *
	b. P6 Power Supply	24vdc	+/-0.5vdc	SAI
	c. Overfill Alarm (local) **	90% Capacity	90% Capacity	SAI
	d. Water Alarm (local) **	0.5 inches	+/-0.1 inches	SAI
	e. Low Fuel Alarm (local) **	g = 36 hrs. runtime remaining	+/-10g	SAI

* - SAI = same as initial

** - ERMS will also report these as remote independent "warning" and "hard" alarms to the MCC (See ERMS handbook TI 6145.1 to set alarm threshold values)

7. PERIODIC MAINTENANCE

a. Introduction - This section establishes essential maintenance activities required for the fuel storage tank monitor systems on a periodic recurring basis, and provides schedules for their accomplishment to ensure proper operation. Each site visit shall include a visual inspection of the tank and monitor system to ensure no alarm or abnormal condition exists.

b. Onsite Verification and Calibration Checks Table - If the system has Automatic Tank Leak testing capability, the site technician shall ensure the test is enabled and that the last test was successfully completed.

8. MAINTENANCE PROCEDURES. This section provides the necessary procedures to accomplish annual system tests that ensure proper operation and compliance with the FAA Orders 1050.15A - "Fuel Storage Tanks at FAA facilities", 6980.11C - "Maintenance of Engine Generators", 1050.17 - "Airway Facilities Environment and Safety Compliance Program" and applicable EPA regulations.

a. Calibrate Tank Probe

(1) The **"Calibrate Water Level"** parameter is used to calibrate the bottom most float on the fuel probe with the actual water level. This parameter must be set at the initial system startup and should be reset annually thereafter as part of the periodic maintenance program. To calibrate this parameter, the actual water level at the point of the fuel/water probe should be measured by placing the fuel tank measuring stick (using "kolor kut" or similar paste designed to detect water) in the fuel filler port. Ensure the stick is set on the bottom of the tank. Carefully remove the stick and note the distance in inches from the bottom of the stick to the location best representing the water line. The noted distance (in inches) should then be programmed into the FST Monitoring System using the appropriate procedure:

(a)	RONAN System:	-Put System in "Program" mode. -Press **F,73, ENT**. Enter the noted water level distance (in inches) (example: 0.25) -Press **ENT**. -Return system to "Run" mode.
(b)	P6 (OPTO-22) System:	-Access 1st Programming Screen labeled: **"CALIB WATER LEVEL"** -Enter the noted water level (in inches)

(2) The **"Calibrate Fuel Level"** - The "Calibrate Fuel Level" parameter is used to calibrate the top most float on the fuel probe with the actual fuel level. This parameter must be set at the initial system startup and should be reset annually thereafter as part of the periodic maintenance program. To calibrate this parameter, the actual fuel level at the point of the fuel probe should be measured. This measurement can be taken by placing the fuel tank measuring stick in the fuel filler port and ensuring the stick is setting on the bottom of the tank. Carefully removing the stick and noting the distance in inches from the bottom of the stick to the location best representing the fuel line. The noted distance should then be programmed into the FST Monitoring System using the appropriate procedure:

(a)	RONAN System	-Put System in "Program" mode. -Press **F,72, ENT**. -Enter the noted fuel level distance (in inches) (example 32.75) -Press **ENT** -Return System to "Run" mode.
(b)	P6 (OPTO-22) System:	-Access 2nd Programming Screen- labeled: **"CALIB FUEL LEVEL"** -Enter the noted fuel level (in inches). (example: 32.75)

b. High Water Alarm Threshold

(1) **Programming** - The Water Alarm Threshold is used to trigger the High Water visible and audible alarms. An alarm will occur when the actual water level rises above this threshold parameter. This parameter must be set at the initial system startup. It is recommended that this parameter be set to "0.5 inches" using one of the following procedures:

(a)	RONAN System:	-Put System in "Program" mode -Press **F, 76, ENT.** -Enter **0.5** –Press **ENT.** -Return System to "Run" mode.
(b)	P6 (OPTO-22) System:	-Access 3rd Programming screen labeled: **"HIGH WATER THRESHOLD"** -Enter **0.5.**

(2) **Test** - This test is to validate the annunciation and indication of the high water alarm. Fuel probe calibration (fuel and water level) should be accomplished prior to testing this alarm, It is recommended that this test be performed by simulation using the following procedure: (caution: ensure power is removed while disconnecting/reconnecting the probe).

(a) Remove the fuel probe from the tank and reconnecting it to its electrical connection.

(b) Place the probe horizontally on the top of the tank ensuring that it does not roll off

(c) Locate the lower (water) float somewhere related to a "Normal" (no alarm) condition (e.g. if the high water alarm threshold is set to "0.5 inches", locate the float at about "0.25 inches" from the end of the probe). Make sure that the float is **not** located past the end of the probe or the probe will provide erroneous readings.

(d) Observe system alarm status and move the float toward an alarm threshold level. As the float crosses the alarm level, a "High Water" Alarm condition should develop.

(e) Move the lower float back to a location related to its "Normal" condition. This should eliminate the alarm condition.

c. Low Fuel Alarm Threshold

(1) **Programming** - The Low Fuel Alarm Threshold parameter is used to trigger the low Fuel visible and audible alarms. An alarm will occur when the actual fuel level drops below this threshold parameter. Engine Generator Order 6980.11C requires a minimum level of fuel that supports 36 hours of operation. Based on site specific facility load and rate of consumption data, the number of gallons required for 36 hours of runtime should be calculated and programmed as the Low Fuel Alarm Threshold in the RONAN System. The OPTO-22 System requires this value be expressed in an equivalent number of "inches" of fuel (retrieved from tank measuring stick or tank chart). Programming the Low Fuel Alarm Threshold parameter shall be accomplished, using the appropriate procedure:

(a)	RONAN System:	-Put System in "Program" mode. -Press the **LO** KEY. -Enter the number of gallons -Press **ENT**. -Return System to "Run".
(b)	P6 (OPTO-22) System:	-Access 4th Programming screen labeled: "**LOW FUEL THRESH**" -Enter Low Fuel Level in inches.

(2) **Test** - This test is to validate the indication of a Low Fuel Alarm. Fuel probe calibration should be accomplished prior to testing this alarm. The best way to test this would be to actually remove and add fuel to the tank. This is usually not feasible, therefore an alternate method of simulation is offered using the following procedure: (caution: ensure power is removed while disconnecting/reconnecting the probe).

(a) Remove the probe from the tank and reconnect to its electrical connection.
(b) Place the probe horizontally on the top of the tank, ensuring that it does not roll off, with the bottom float located approximately 0.25 inches from the bottom and the upper (fuel) float located at "normal" fuel level.
(c) Observe the system alarm status, and move the upper float down the probe simulating a loss of fuel. As the float crosses the programmed Low Fuel Alarm Threshold a Low Fuel Alarm condition should develop.
(d) Move the upper float back to a location related to its "normal" position, and the alarm condition should clear.

d. Overfill Alarm Threshold

(1) **Programming** - The Overfill Alarm Threshold parameter is used to trigger the Overfill visible and audible alarms. An Alarm will occur when the actual fuel level rises above this threshold parameter. This parameter must be set at the initial system startup. **It is required by EPA regulations that the Overfill Alarm initiates at 90% by volume of the tank capacity.** This value is programmed in the RONAN System by entering the 90% value in "gallons", and programmed in the OPTO-22 System by entering the 90% value equivalent in "inches" (retrieved from tank measuring stick or tank chart). The Overfill Alarm Threshold shall be programmed using the appropriate Procedure:

(a)	RONAN System	-Put System in "Program" mode. -Press the **HI** key. -Enter the 90% value (in gallons). -Press **ENT**. -Return System to "Run" mode.
(b)	P6 (OPTO-22) System	-Access 5th Programming screen labeled:"**OVERFILL THRESH**" -Enter the 90% value (in inches).

(2) **Test** - This test is to validate the indication of an overfill alarm as a result of an overfill condition. Fuel probe calibration should be accomplished prior to testing this alarm. It is recommended that this test be performed by simulation using the following procedure: (caution: ensure power is removed while disconnecting/reconnecting the probe)

(a) Remove the fuel probe and reconnect to its electrical connection.
(b) Place probe horizontally on the top of the tank, ensuring that it does not roll off, with the bottom float located approximately 0.25 inches from the bottom of the probe and the upper (fuel) float located at "normal" fuel level.
(c) Observe the system alarm status, and move the upper float up the probe simulating a fuel gain. As the float crosses the 90% level an "overfill" alarm condition should develop.
(d) Move the upper float back to a location related to its "normal" position, and the alarm condition should clear.

e. Testing liquid (LS-3) sensors: This test will verify proper operation of the annular space and fuel line leak detect sensors, by simulating liquid detected in the tank annular space and liquid detected in the underground fuel piping secondary containment. The sensors consist of a magnetically operated reed switch that, when no liquid is present, provides a normally closed (short circuit) signal to the controller. In the presence of liquid, a magnetic float will rise opening the reed switch that will cause the controller to generate an alarm. It is recommended that this test be performed by simulation using the following procedure:

(1) Gain access or remove the sensors from their containment zones.
(2) Individually test the sensor by turning the sensor upside down or submersing into a bucket of water.
(3) Verify this action has created the appropriate alarm condition.
(4) Acknowledge the alarm to silence the annunciator. Confirm the alarm condition still exists.
(5) Return the sensor to its original position, the alarm condition should clear.
(6) Reinstall the sensor in the appropriate containment zone.
(7) Repeat steps "2" through "6" for each sensor.

f. Automatic Tank Integrity Test: The RONAN system is capable of being programmed for automatic tank leak testing through a static test when the tank is inactive using the following procedures.

(1) **RONAN System:** The RONAN system must be programmed in order for this test to be operational. The test duration shall be a minimum of 4 hours. The RONAN tests shall be programmed on a weekly basis using the following instruction sequence: (example: 8 hour test - start: midnight Sunday, stop: 8am Monday)

(a) Turn the Mode key to the **PROGRAM** position.
(b) Press **F,88,ENT** to enable Auto Leak Test Mode (1=enable).
(c) Press **F,87,ENT** to access Setup Auto Tank Leak Detect Mode and enter the following keys at the respective display prompt: (See Figure 4)

Figure 4

RONAN TEST

DISPLAY PROMPT	USER ENTRY (weekly test)
SELECT TANKS AUTO LEAK DETECT>	**1 ENT**
TANK 1 TESTED>NONE, 1=D, 2=W, 3=M	**2 ENT**
ENTER WEEKS BETWEEN TEST>0 (default)	**1 ENT**
ENTER DAY FOR LEAK TEST>1=S, 2=M, 3=T	**2 ENT**
TANK 1 START TIME> 00:00am (24 hr clock example)	**00.00 ENT**
TANK 1 STOP TIME> 08:00am (Monday)	**08.00 ENT**

(d) Press **F,89,ENT** to print out auto leak parameters. (midnight to 8:00 am Monday)

(e) Turn the Mode key to **RUN**

(2) **P6 (OPTO22) System:** Refer to ERMS Instruction book TI 6145.1 to determine if the ERMS System has Automatic Leak testing software installed, and follow the appropriate procedures. First determine if the P6 (OPTO22) System has the Tank Leak Test capability, by accessing the programming mode via the P6 panel. Scan the "program" screens and note if a "**Automatic Leak Test**" screen is present. If that screen is present, the preprogrammed automated test begins on Sunday evening at 2200 hours and ends eight hours later on Monday at 0600. If that screen is not present, the Tank Leak Test is **not** available on that system. If the "**Automatic Leak Test**" screen is present, the automatic tank leak test mode **can** be entered using the following procedure:

(a) Verify the Manual Leak Test is turned off by setting the "**Manual Leak Test**" screen to a value = **0.**

(b) At the "**Automatic Leak Test**" screen, set the value = **1.** This will enable a weekly preprogrammed test. It is extremely **important** that the next three screens are set correctly:

(c) "**System Date**" (MMDDYY) screen,

(d) "**Day of the Week**" (0=S, 1=M, etc) screen,

(e) "**System Time**" (HHMM) (24hr) screen

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