

# Chapter 6



## The Test

# Chapter 6 - The Test



- **Overview**

- Pretest Determinations Relating to Tolerances and Product Storage Identification**

- Understand and Use of the Test and Test Notes Portions of the Examination Procedure Outline**

- Identify Testing Procedures for Single-Product Dispensers**

- Identify Testing Procedures for Blended-Product Dispensers**

# Testing Retail Motor-Fuel Dispensers for Performance Requirements



- **Accurate and Consistent**
  - **Measurement and Delivery of Fuel**
  - **Indications**
  - **Computations**
  - **Recorded Delivery**

# **Performance is tested against specified tolerances.**



## **Tolerances**

- Acceptable range of inaccuracy**
- Small enough not to cause serious economic injury**
- Not so burdensome to create unreasonable manufacturing and maintenance costs**
- When established in code seen as minimum requirements by manufacturers**

# Two Sets of Tolerances



- **Acceptance Tolerances (G-T.1.)**
  - **New devices**
  - **Reconditioned devices returned to service**
  - **Devices adjusted or repaired after rejection**
  - **Devices undergoing Type Evaluation**
  - **1/2 Maintenance Tolerances**

# Two Sets of Tolerances (cont)



- **Maintenance Tolerance (G-T.2.)**
  - **Equipment in service for more than 30 days**

# **Tolerances apply to both: (G-T.3.)**



- **Underregistration - Indication of less product volume than delivered, and in the buyer's favor.**
- **Overregistration - Indication of more product volume than delivered and in the seller's favor.**

# **Tolerances are based on the quantity of the test draft.**



- **For example if the test draft is 5 gallons**
- **In accordance with paragraph T.2. and table T.2.**
  - **Maintenance Tolerance is 6 cu in**
  - **Acceptance Tolerance is one half that or ( $1/2 \times 6$  cu in) 3 cu in**

# Tolerance Values

## Table T.2. NIST HB 44

**Table T.2. Accuracy Classes for Liquid Measuring Devices Covered in  
NIST Handbook 44 Section 3.30**

Accuracy Class	Application	Acceptance Tolerance	Maintenance Tolerance	Special Test Tolerance
<b>0.3</b>	Petroleum products including large capacity motor fuel devices (flow rates over 115 L/min (30 gpm)**, heated products at or greater than 50 °C asphalt at or below temperatures 50 °C, all other liquids not shown where the typical delivery is over 200 L (50 gal)	<b>0.2 %</b>	<b>0.3 %</b>	<b>0.5 %</b>
<b>0.3A</b>	Asphalt at temperatures greater than 50 °C	<b>0.3 %</b>	<b>0.3 %</b>	<b>0.5 %</b>
<b>0.5*</b>	Petroleum products delivered from small capacity (at 4 L/min (1 gpm) through 115 L/min (30 gpm)** motor-fuel devices, agricultural liquids, and all other applications not shown.	<b>0.3 %</b>	<b>0.5 %</b>	<b>0.5%</b>
<b>1.1</b>	Petroleum products and other normal liquids from devices with flow rates** less than 1 gpm and devices designed to deliver less than one gallon.	<b>0.75 %</b>	<b>1.0 %</b>	<b>1.25%</b>

\*The maintenance tolerances on normal and special tests for 5-gallon and 10-gallon test drafts are 6 cubic inches and 11 cubic inches, respectively. Acceptance tolerances on normal and special tests are 3 cubic inches and 5.5 cubic inches.

\*\* Flow rate refers to designed or marked maximum flow rate.

# T.3. Repeatability



- **Tests at the approximate same rate & draft size**
- **All other conditions of the test are the same**
- **Minimum three consecutive drafts**
  - (see N.4.1.2. Added 2001)
- **The range of tests (spread) shall not exceed 40 percent of the absolute value of the maintenance tolerance.**
  - **For example  $0.40 \times 6 \text{ cu in} = 2.4$  or 2 cu in**

# **Tolerances determined and recorded before the test begins.**



- **Test Drafts for Retail Devices (N.3.4. )**
  - **Max flow rate < 20 gal per minute require a 5 gallon draft**
  - **Max flow rate > 20 gal per minute require a draft at least the amount delivered over one minute at the maximum discharge rate**

# Product Storage Identification



- **Separate Tanks**
  - **Consumer gets what is paid for**
  - **Avoids damage to engine**

## **UR.2.5. Product Storage Identification.**

**(a) The fill connection for any petroleum product storage tank or vessel supplying motor-fuel devices shall be permanently, plainly, and visibly marked as to product contained.**

**(b) When the fill connection device is marked by means of a color code, the color code key shall be conspicuously displayed at the place of business.**

**(Added 1975 and amended 1976)**

# Test Notes



- **Test procedure is described in EPO 21 and 22**
- **Similar procedures for single- and blended-product dispensers**
- **Additional concern in returning blended product to storage**

# Test Notes (cont)



- **Totalizers (S.5.) (1/1/95)**
  - **Money and/or volume**
  - **Inventory management/reconciliation**
  - **Detect fraud or pilfering**
  - **If used as primary indicating elements must meet comparability and computation requirements**
  - **Interlocked with other indicating elements**

# Recorded Representation



- **Automatic Ticket Printer are subject to requirements for:**
  - **readability**
  - **maximum allowable variation (MAV) for money value**
  - **agreement with other primary elements**

# Recorded Representation (cont)



## **UR.3.4. Printed Ticket. – any printed ticket issued by a device**

**Total Price**

**Total Volume**

**Price per Gallon or Liter**

- **Some of this information may be hand written**
- **Paragraph UR.3.4. does not apply to bank card readers or other printing elements that are not interfaced with a retail motor-fuel dispenser, console or other portion of the measuring system**

# Recorded Representation (cont)



- ***S.1.6.7. Recorded Representations.  
(1/1/86)***
  - **Except for fleet and price contract sales, receipts from point-of-sale, debit-, credit card- or cash activated systems shall have**
    - **total volume of the delivery**
    - **unit price**
    - **total computed price, and**
    - **product identity**

# Money Values



## **S.1.6.5. Money-Value Computations.**

**(b)The analog sales price indicated for any delivered quantity shall not differ from a mathematically computed price (quantity x unit price = total sales price) by an amount greater than the value in Table 1.**

**(Amended 1984 and 1989)**

**N.4.3.2. Field Tests. - In the conduct of field tests to determine compliance with paragraph S.1.6.5., the maximum allowable variation in the indicated sales price shall be as shown in Table 1.**

# Money Values (cont)

**G-S.5.5. Money Values, Mathematical Agreement. - Any recorded money value and any digital money-value indication on a computing-type weighing or measuring device used in retail trade shall be in mathematical agreement with its associated quantity representation or indication to the nearest one cent of money value. This does not apply to auxiliary digital indications intended for the operator's use only, when these indications are obtained from existing analog customer indications that meet this requirement. (Amended 1973)**

# Money Values (cont)



**G-S.5.5. Mathematical Agreement - Primary elements agree exactly**

**Digital values must agree to within the nearest 1¢ with the mathematically computed value**

**Formula: Quantity x Unit Price = Sales Price  $\pm$  1/2¢**

**Variation in excess of the MAV may indicate:**

- malfunction of the computer**
- RFI/EMI**
- tampering with the computing device**

## **G-S.5.2.2.**

# **Digital Indication and Representation**



- **Agrees with like values in the system**
- **Coincides with its associated analog value to the nearest minimum graduation**
- **Rounds off to the nearest minimum unit that can be indicated or recorded**
- **Displays zero indication to include zero values for all places to the right and one to the left of the decimal**

## **S.1.6.5.5.**

### **Display of Quantity and Total Price**



- **When a delivery is completed, the total price and quantity for that transaction shall be displayed on the face of the dispenser for at least 5 minutes or until the next transaction is initiated by using controls on the device or other customer-activated controls.**

# Printed Ticket

**GAS TO GO**  
**1234 Fifth Street**  
**Your Town, State Zip**

**Trans. # 87654321**                      **11/17/97**                      **8:40 A**

<u>Product</u>	<u>Quantity (gal)</u>	<u>Price</u>	<u>Total</u>
Prem. unl.	8.678	\$1.299	\$11.27
Other Merchandise (incl. Tax)			2.89
<b>Total Purchase</b>			<b>\$14.16</b>

# Auxiliary Elements (S.1.6.6.)



- **Quantity values may vary from the primary indicator if:**
  - **all total money values agree exactly**
  - **computed money value displayed agrees to within the mathematically computed value to the closest cent**

# The Test



- **Normal Test**

- **Duplicates operating characteristics of the system during normal deliveries**
- **Tests the entire systems ability to measure and indicate correctly**

# Type of Liquid



- **N.1.1. Type of Liquid. The liquid used for testing a liquid-measuring device shall be the type the device is used to measure, or another liquid with the same general physical characteristics.**
- **Primarily intended for loading rack meters**
- **Certificate of Conformance Application Section**

# The Test (cont)



- **Reset the dispenser to zero**
- **Drain residual product from nozzle**
- **Remove the nozzle and switch on**
  - **Reset to zero**
- **Observe any “computer jump”**

# Computer Jump



- **Deteriorated or substandard discharge hose**
- **Malfunctioning check or relief valve**
- **Malfunctioning antidrain means**
- **Effects of temperature change**

# **Suppression of Computer Jump (S.1.6.1.)**



- **Computer jump occurs each time the pump is pressurized**
- **In accordance with S.1.6.1.  
Suppression of the first 0.009 gal  
and the associated price is permitted**

# N.4.1. Normal Tests

- **Maximum discharge flow rate developed under the conditions of installation**
- **Flow rates down to and including one-half the sum of the maximum discharge flow rate and rated minimum discharge flow rate**
  - **Max Flow Rate = 20 gal per min**
  - **Min Flow Rate = 5 gal per min**
  - **Breakpoint  $(20 + 5)/2 = 12.5$  gal per min**

# The Test (cont)



- **Dispense Test Draft**
- **Test the nozzle's automatic shut-off valve**
- **Compare reading of the indication to the test measure**
- **Record the reading on the report form**
  - NOTE: Errors close to tolerance limits may warrant a second draft**
- **Observe agreement between primary indicating and recording elements**

# The Test (cont)

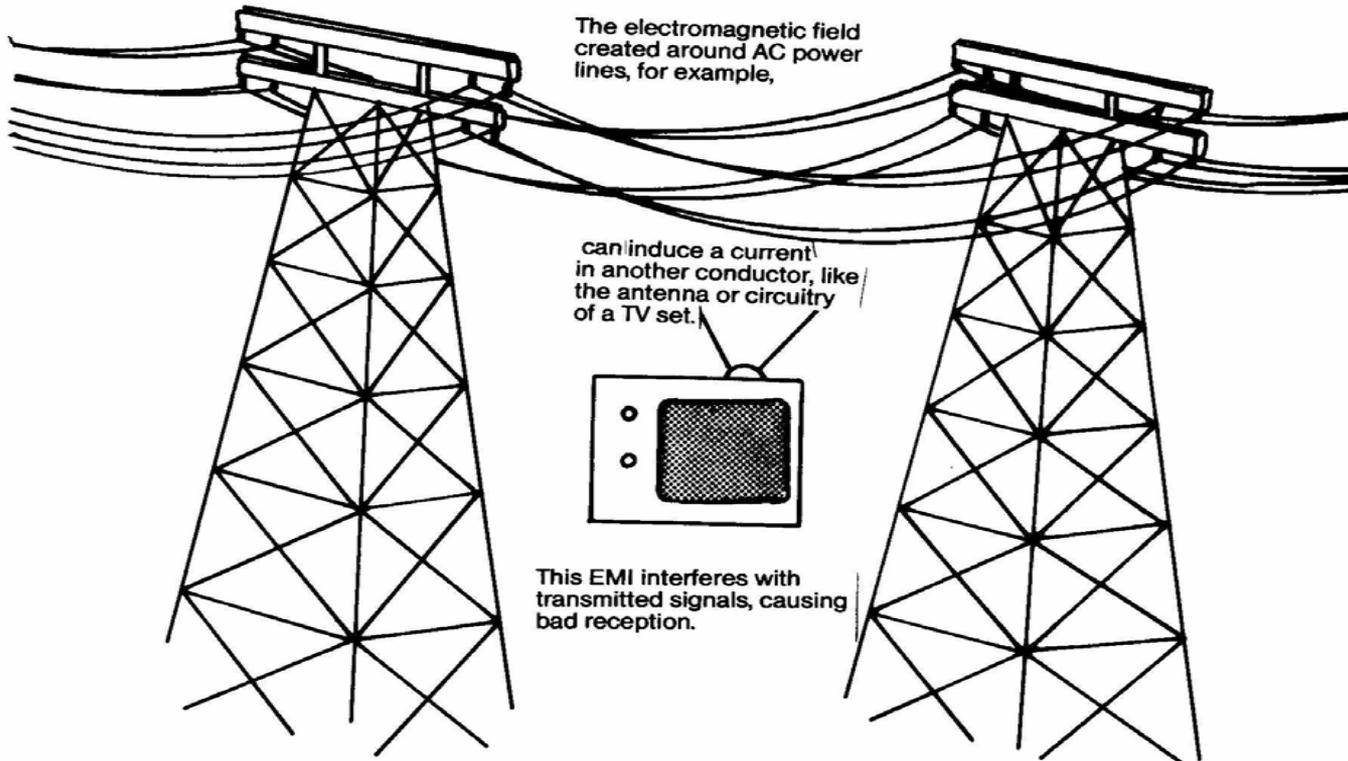
- **Special Test (Slow Flow) - Performance of the device under conditions that are not usual (N.4.2.)**
- **Determine appropriate flow rate for test**
  - **Retail Motor-Fuel Dispenser Slow Flow Test is the least of the following: (N.4.2.2.)**
    - **5 gal per minute**
    - **minimum marked discharge rate**
    - **minimum rate when the automatic nozzle is at its lowest setting**

# **Radio Frequency Interference (RFI)/ Electromagnetic Interference (EMI)**



- **Sources**
  - **Radio Frequency Transmitters (Broadcast facilities, mobile transmitters, etc.)(RFI)**
  - **Generators (EMI)**
  - **Electrical Discharge Ignition (EMI)**
  - **Power Supply Lines (EMI)**
  - **Appliances (EMI)**
  - **Fluorescent Lighting (EMI)**
- **Test with sources operating during Normal Test**

# Electromagnetic Interference (EMI)



# RFI/EMI



- **G-UR.1.2. Environment**
- **G-UR.3.2. Associated and Nonassociated Equipment**
- **G-UR.4.2. Abnormal Performance**
- **G-N.2. Testing with Nonassociated Equipment**

# The Test (cont)



- **Antidrain Means (S.3.7.)**
  - **Prevents nozzle from draining at the end of a delivery**
- **The Antidrain Means Test**
  - **Turn dispenser off**
  - **Open discharge valve**
  - **Raise three feet of hose higher than nozzle**
  - **Fuel flow indicates a malfunction**

# The Test (cont)



- **Zero-Setback Mechanism**
  - Prevents preceding deliveries being included in subsequent deliveries
  - On/off control is interlocked with the zero-setback mechanism
  - Dispenser control switch is not left in the on position after a delivery is complete
- **S.2.5. Zero-Setback Interlock**
- **UR.3.5. Steps After Dispensing**

# The Test (cont)



- **Zero-Setback Mechanism Test**
  - **Activate dispenser and verify zero indication**
  - **Attempt to return nozzle to hanging position**
  - **Remove nozzle and verify manual or automatic reset functions before dispenser is turned on**
  - **Verify control valve (remote and single-product dual dispenser)**
    - **Remove nozzle and operate without turning on**
    - **Switch on dispenser served by same pump, then operate pump under test**

# The Test (cont)



- **Power Loss Test - Indicating functions are maintained long enough to complete transactions**
  - **Test is not recommended for routine examination**
  - **System should be shut off by owner or operator**
    - **Information should be maintained and readable at the dispenser or console for 15 minutes**
    - **Shut off power:**
      - **remote devices**
      - **dispensers**
      - **both remote devices and dispensers**

# The Test (cont)

- **Testing Blended Product Dispenser**
  - **Test if units operate independently**
  - **Test units operating together**
  - **EPO 22**
    - **Normal and Special Test (highest and lowest grade)**
    - **Special Tests**
      - **Intermediate Blend**
      - **First Blend above the lowest grade**
      - **First Blend beneath the highest grade**
    - **Remaining Grades**
      - **Dispense one gallon**
      - **Check money-values**

# Summary



- **Prior to the Test is the Pretest Determination to establish applicable tolerances and other factors**
- **Tolerances are the acceptable limits of inaccuracy**
- **The Test establishes the system performs within tolerances**
- **The Test**
  - **Proper function of system elements**
  - **System performance**