Source Test Procedure   **ST-36**

GASOLINE DISPENSING FACILITY
PHASE I VOLUMETRIC EFFICIENCY

(Adopted October 17, 1990)

REF: Regulation 8-7-301

1.   APPLICABILITY

1.1   This procedure is used to quantify the Phase I volumetric efficiencies during bulk gasoline deliveries at gasoline distribution facilities (GDF). It is applicable for the determination of compliance with Regulation 8-7-301 at those facilities which are not equipped with Hirt or Hasstech Phase II systems.

2.   PRINCIPLE

2.1   During a bulk gasoline delivery, the volume of gasoline delivered from the cargo tank to the GDF storage tank is recorded. The volume of gasoline vapor discharged from the vent pipe(s) of the storage tank(s) is measured. From these parameters the Phase I volumetric efficiency is determined. If a Phase I system fails to meet 95% volumetric efficiency, the gasoline cargo tank shall be tested, pursuant to Source Test Procedure ST-33, to determine compliance with the year-round standards for gasoline cargo tanks.

3.   RANGE AND SENSITIVITY

3.1   The minimum readability of the pressure gauges shall be 0.1 inches of water column.

3.2   The minimum accuracy of the pressure gauges shall be 2 % of full scale.

4.   INTERFERENCES

4.1   Any vapor leaks exceeding 100 % of the Lower Explosive Lim it (LEL) during the gasoline bulk delivery precludes the use of this method.

4.2   Gasoline cargo tanks exceeding the allowable year-round standards preclude the use of this method.

4.3   Unusually large cargo tank headspace volumes may cause low volumetric efficiencies under certain thermal conditions. Conversely, unusually small headspace volumes may result in abnormally high efficiencies.

5.   APPARATUS

5.1   Positive Displacement Meter(s). Use a rotary type positive displacement meter(s) with a back pressure less than 1.1 inches of water column at a

flowrate of 3,000 CFH. The meter shall be equipped with a 0-1 inch pressure gauge and a 0-150 ^{O}F thermocouple on the inlet side.

5.2   Tubing. Use 2.5 inch ID Flexhaust tubing, or equivalent, to connect the vent pipe outlet to the inlet of the rotary positive displacement meter. The length of the tubing shall be the minimum required for proper connection.

Figure 36-1

Cargo Tank Pressure Assembly
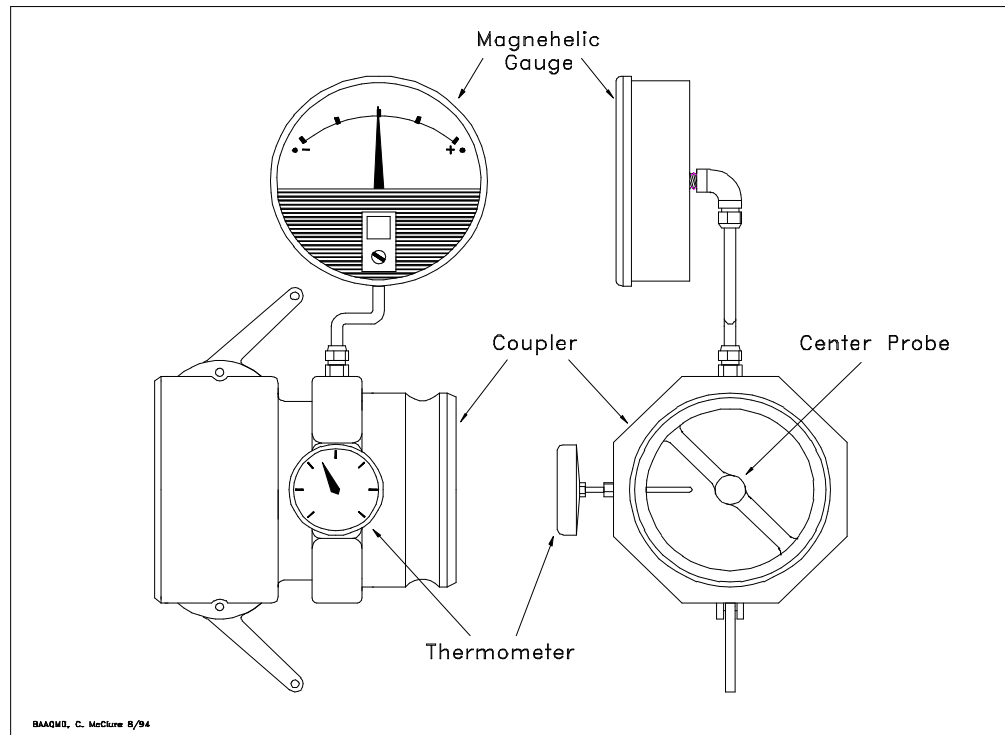
5.3   Cargo Tank Pressure Assembly. Use OPW 633-F and 633-D couplers, or equivalent, as shown in Figure 36-1. The assembly shall be equipped with a thermometer and a pressure gauge, or manometer (oil or water), capable of measuring -10 to +10 inches of water column pressure at the gasoline cargo tank vapor coupler.

5.4   Storage Tank Pressure Assembly. For two-point Phase I systems, use a compatible OPW 634-B cap(s), or equivalent, equipped with a 0-0.5 inches of water column pressure gauge and a center probe as shown in Figure 36-2. This equipment is only required if a test is conducted on a manifolded vapor recovery system.

5.5   Combustible Gas Detector. Use a Bacharach Instrument Company Model 0023-7356, or equivalent, to quantify any vapor leaks occurring during the gasoline bulk drop.

5.6   Barometer. Use a mercury, aneroid, or equivalent barometer accurate to within 5 millimeters of mercury (0.2 inches of mercury).

5.7   Thermometers. Use three thermometers, or equivalent, with a range of 0 to 150 $^\circ$F and accurate to within 2 $^\circ$F.

5.8   Stopwatch. Use a stopwatch accurate to within 0.2 seconds to time the delivery rate of gasoline during the bulk drop.

Figure 36-2

Storage Tank Pressure Assembly
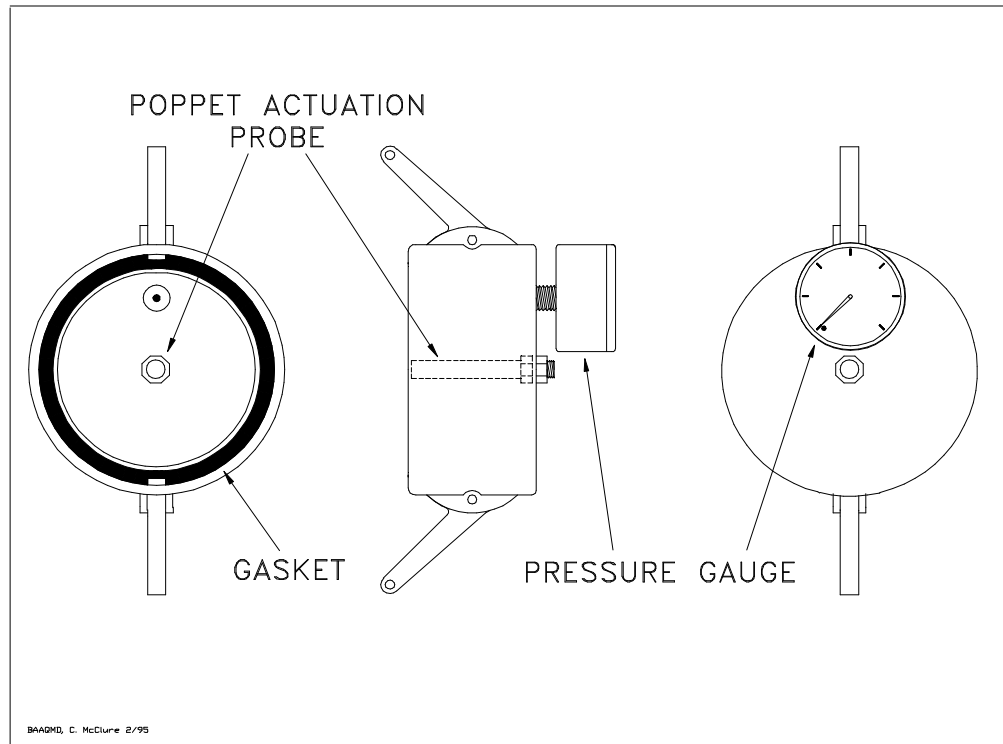
6.   PRE-TEST PROCEDURES

6.1   Perform a visual inspection of all storage tank couplers. Inspect all vapor connections at the gasoline dispensers if Phase II vapor recovery is present.

6.2   Connect the positive displacement meter to the appropriate storage tank vent pipe using the flexible tubing. If the Phase I system is manifolded or if a "normal" non-manifolded delivery consists of simultaneous delivery of more than one product grade, connect one positive displacement meter to each storage tank vent pipe.

6.3   Record the gas grade, capacity, and ullage for each storage tank on the Phase I Vapor Recovery Data Sheet (Form 36-1).

6.4   Record, on the Phase I Vent Pipe Data Sheet (Form 36-2), the initial meter readings from the positive displacement meter.

6.5   Record, on the Phase I Vapor Recovery Data Sheet, the barometric pressure.

6.6   Connect the Cargo Tank Vapor Assembly to the vapor coupler on the gasoline cargo tank. If the cargo tank vapor coupler is equipped with a poppet, be sure to use a pressure assembly with a center probe.

6.7   If a manifolded vapor recovery system with a two-point Phase I system is being tested, install a Storage Tank Pressure Assembly on the Phase I vapor connections of those tanks not receiving product. During each bulk drop record the maximum pressure in those tanks. For coaxial systems the pressure may be measured at the dispensers.

6.8   Insure that no vehicle refueling will occur during the bulk gasoline delivery.

7.   TESTING

7.1   Record, on the Phase I Vapor Recovery Data Sheet (Form 36-1), the gasoline grade(s) and quantities delivered during each bulk drop. Also record, on the Phase I Cargo Tank Data Sheet (Form 36-3), the cargo tank CT#, CARB decal number, expiration date, and the cargo tank compartment capacities.

7.2   Start the stopwatch when the bulk delivery begins and stop the stopwatch at the conclusion of the delivery. If possible, the delivery rate should be determined for each cargo tank compartment.

7.3   Record the following parameters every 15 seconds during each gasoline bulk drop:

      7.3.1   Meter readings, temperatures, and pressures at the positive displacement meter. Extreme care must be taken to record all positive displacements since occasional reverse flow conditions may occur. Record this data on the Phase I Vent Pipe Data Sheet (Form 36-2).

      7.3.2   Vacuum (or pressure) and temperature at the cargo tank pres sure assembly attached to the cargo tank vapor coupler. Record this data on the Phase I Cargo Tank Data Sheet (Form 36-3).

7.4   Continue to monitor the vent pipe emissions for a period of one hour after the bulk drop has been completed. During this one hour period the data collection required in 7.3.1 shall be recorded at 5 minute intervals. These emissions are to be included in the Phase I efficiency calculation.

8.   POST-TEST PROCEDURES

8.1   At the conclusion of the bulk drop, remove the Cargo Tank Pressur e Assembly from the cargo tank and the Storage Tank Pressure Assembly(s) from the storage tank(s).

8.2   Disconnect all instrumentation from the storage tank vent pipe(s) after concluding the one hour post-drop portion of the test.

8.3   Verify the quantities of gasoline delivered to each storage tank.

8.4   Record the final meter reading(s) at the storage tank vent pipe(s).

9.   CALCULATIONS

9.1   Volume of vapors discharged through "i-th" vent. This includes the storage tank vent(s) and any control system vent(s).

$$V_{vsi} = \frac{V_{vi} * 530[Pb + \Delta h / 13.6]}{T_{vi} * 29.92}$$

where:

V_{vsi} = Total volume of vapors discharged through the "i-th" vent pipe, corrected to $70^{0}F$ ($530^{0}R$) and 29.92" Hg, SCF

Pb = Barometric Pressure, inches Hg

V_{vi} = Total volume of vapors discharged through the "i-th" vent; ACF

T_{vi} = Average temperature in "i-th" vent line, ^{0}R

Δh = Average pressure at meter, inches $H_2 0$

13.6 = Inches of water per inch of mercury

i = Vent under consideration

9.2   Volume of vapors returned to the cargo tank:

$$V_t = \frac{0.1337 * G_t (530[Pb + \Delta h / 13.6])}{T_t * 29.92}$$

where:

V_t = Volume of vapors returned to the cargo tank corrected to $70^{0}F$ ($530^{0}R$) and 29.92" Hg, SCF

G_t = Volume of gasoline delivered, gallons

Δh = Final gauge pressure at cargo tank, in. H_2O

13.6 = Inches of water per inch of mercury

T_t = Average temperature of vapors returned to cargo tank, ^{0}R

Pb = Barometric Pressure, inches Hg

0.1337 = Conversion factor; gallons to Ft^3

9.3   Collection Efficiency:

$$E = \frac{V_t - V_{vsi}}{V_t} * 100$$

where:

E = Phase I Volumetric Efficiency, percent

V_t = From 9.2

V_{vsi} = From 9.1

10.   REPORTING

10.1   Results shall be reported as shown in Form 36-4.

PHASE I VAPOR RECOVERY DATA SHEET

Station:	Address:		City:
Contact:	Phone:		Date:
Number of Underground Tanks:		Number of Vent Pipes:	

TEST SEQUENCE	1	2	3	4
1. Ambient Temperature, °F				
2. Barometric Pressure, inches of Hg				
3. Gasoline Grade				
4. U.G. Tank Size, gallons				
5. Initial U.G. Tank Content, gal.				
6. Time Delivery Began				
7. Beginning Vent Meter Reading				
8. U.G. Tank Vapor Temperature, °F				
9. Vent Vapor Temperature, °F				
10. Vent Meter Pressure, inches of water				
11. Volume Delivered, gallons				
12. Time Delivery Ended				
13. Ending Vent Meter Reading				
14. Drop Flowrate, gallons/minute				
15. Volume of Vent Emissions , scf				
16. Volume of Vapor Returned to Cargo Tank, scf				
VAPOR RECOVERY EFFICIENCY, %				

TEST PERSONNEL: _____

$$\text{Efficiency} = \left(\frac{\#16 - \#15}{\#16} \right) x100$$

COMPANY NAME: _____

COMPANY ADDRESS: _____

_____

Form 36-2

PHASE I VENT PIPE DATA SHEET

Station	Address	City
GDF#	Contact	Phone
Date	Test Times	Manifolded (Y/N)

Drop#				Drop#				Drop#			
Grade(s)				Grade(s)				Grade(s)			
Gallons				Gallons				Gallons			
Time	Meter Reading	ΔP	Temp °F	Time	Meter Reading	ΔP	Temp °F	Time	Meter Reading	ΔP	Temp °F
0 sec				0 sec				0 sec			
15 sec				15 sec				15 sec			
30 sec				30 sec				30 sec			
45 sec				45 sec				45 sec			
1 min				**1 min**				**1 min**			
15 sec				15 sec				15 sec			
30 sec				30 sec				30 sec			
45 sec				45 sec				45 sec			
2 min				**2 min**				**2 min**			
15 sec				15 sec				15 sec			
30 sec				30 sec				30 sec			
45 sec				45 sec				45 sec			
3 min				**3 min**				**3 min**			
15 sec				15 sec				15 sec			
30 sec				30 sec				30 sec			
45 sec				45 sec				45 sec			
4 min				**4 min**				**4 min**			
15 sec				15 sec				15 sec			
30 sec				30 sec				30 sec			
45 sec				45 sec				45 sec			
5 min				**5 min**				**5 min**			
15 sec				15 sec				15 sec			
30 sec				30 sec				30 sec			
45 sec				45 sec				45 sec			
6 min				**6 min**				**6 min**			
15 sec				15 sec				15 sec			
30 sec				30 sec				30 sec			
45 sec				45 sec				45 sec			
7 min				**7 min**				**7 min**			

Form 36-3

PHASE I CARGO TANK DATA SHEET

Station	Address	City
GDF#	Contact	Phone
Date	Test Times	Manifolded (Y/N)

Drop#			Drop#			Drop#		
C. T. #			C. T. #			C. T. #		
CARB Decal #			CARB Decal #			CARB Decal #		
Decal Expires			Decal Expires			Decal Expires		
C. T. Capacity			C. T. Capacity			C. T. Capacity		
Grade(s)			Grade(s)			Grade(s)		
Gallons			Gallons			Gallons		
Time	ΔP	Temp ^{o}F	Time	ΔP	Temp ^{o}F	Time	ΔP	Temp ^{o}F
0 sec			0 sec			0 sec		
15 sec			15 sec			15 sec		
30 sec			30 sec			30 sec		
45 sec			45 sec			45 sec		
1 min			**1 min**			**1 min**		
15 sec			15 sec			15 sec		
30 sec			30 sec			30 sec		
45 sec			45 sec			45 sec		
2 min			**2 min**			**2 min**		
15 sec			15 sec			15 sec		
30 sec			30 sec			30 sec		
45 sec			45 sec			45 sec		
3 min			**3 min**			**3 min**		
15 sec			15 sec			15 sec		
30 sec			30 sec			30 sec		
45 sec			45 sec			45 sec		
4 min			**4 min**			**4 min**		
15 sec			15 sec			15 sec		
30 sec			30 sec			30 sec		
45 sec			45 sec			45 sec		
5 min			**5 min**			**5 min**		
15 sec			15 sec			15 sec		
30 sec			30 sec			30 sec		
45 sec			45 sec			45 sec		
6 min			**6 min**			**6 min**		
15 sec			15 sec			15 sec		
30 sec			30 sec			30 sec		
45 sec			45 sec			45 sec		
7 min			**7 min**			**7 min**		

Distribution:
 	
Firm
Permit Services
Enforcement Services
Technical Services
Planning
Requester
DAPCO
	BAY AREA
	AIR QUALITY MANAGEMENT DISTRICT
	
	939 Ellis Street
	San Francisco, California 94109
	(415) 771-6000
	
	Summary of
	Source Test Results
		Report No.: _____
		
		Test Date: _____
		
		Test Times:
		
		  Run A: _____
		
		  Run B: _____
		
		  Run C: _____

Source Information		**BAAQMD Representatives**
Firm Name and Address	Firm Representative and Title Phone No. (**)**	Source Test Engineers
Permit Conditions:	Source: Plant No. Permit No. Operates Hr/Day & Day/Yr.	Permit Services Division/Enforcement Division
		Test Requested By:
Operating Parameters		
Applicable Regulations:		VN Recommended:

Source Test Results and Comments:

METHOD	DROP #1	DROP #2	DROP #3	LIMIT
ST-36				
GASOLINE GRADE				
GALLONS DELIVERED				
VENT PIPE EXHAUST, SCF				
VAPORS RETURNED TO CARGO TANK, SCF				
PHASE I VOLUME EFFICIENCY, VOLUME %				95.0*

* Each bulk gasoline drop is subject to this standard.

Air Quality Engineer II	Date	Supervising Air Quality Engineer	Date	Approved by Air Quality Engineering Manager