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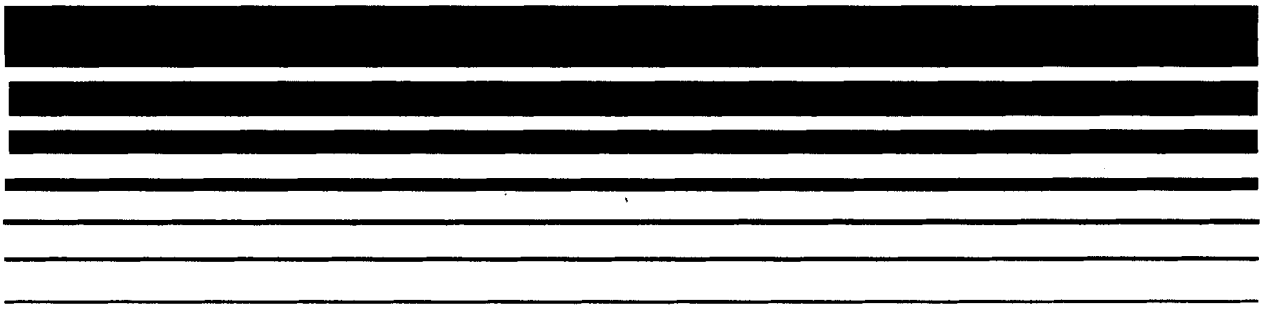
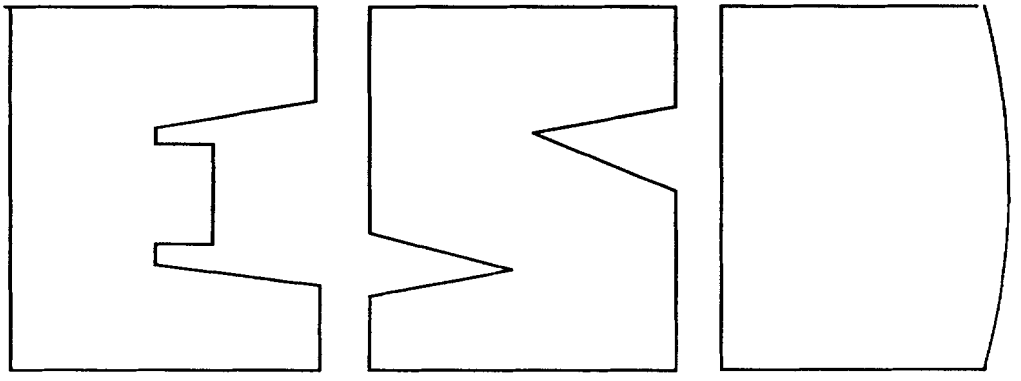
EPA

Technical Guidance - Stage II Vapor Recovery Systems for Control of Vehicle Refueling Emissions at Gasoline Dispensing Facilities

Volume II: Appendices





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Technical Guidance -

Stage II Vapor Recovery Systems for Control of Vehicle Refueling Emissions at Gasoline Dispensing Facilities

Volume II: Appendices

Emission Standards Division

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Radiation
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711
November 1991

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APPENDIX A

LUNDBERG SURVEY INCORPORATED INDIVIDUAL COUNTY SIZE DISTRIBUTION

The Lundberg Survey information discussed in Chapter 2 provided the number of service stations in each of the following counties along with the average monthly gasoline throughput.

Syracuse, NY	Houston-Galveston-Brazoria, TX
Phoenix, AZ	St. Louis, MI-IL
San Diego, CA	Portland-Vancouver, OR-WA
Detroit-Ann Arbor, MI	Milwaukee-Racine, WI
Lansing, MI	New York-Newark-Long Island, NY-NJ-CT
Grand Rapids, MI	Providence-Pawtucket-Fall River, MA-RI
El Paso, TX	Madison, WI
Orlando, FL	Santa Barbara-Santa Maria-Lompoc, CA

There were approximately 11,000 individual service stations in the database. For each individual county, the service stations were placed into seven categories according to monthly gasoline throughput. The distribution for all of these areas combined was given in Table 2-8 and is restated in Table A-1. However, the distribution for each county was also calculated. In order to provide comparisons between these counties, the counties were then sorted according to population and number of service stations. These distributions are shown in Tables A-2 and A-3, respectively.

TABLE A-1. RETAIL SERVICE STATION DISTRIBUTION BASED ON LUNDBERG DATA FROM 16 METROPOLITAN AREAS

GASOLINE THROUGHPUT RANGE (gallons/month)	PERCENTAGE OF SERVICE STATIONS
0 - 5,999	3.8
6,000 - 9,999	4.8
10,000 - 24,999	15.0
25,000 - 49,999	23.5
50,000 - 99,999	32.3
100,000 - 199,999	18.2
> 200,000	2.4

Source: Lundberg Survey, Incorporated.

TABLE A-2

SIZE DISTRIBUTIONS OF COUNTIES SORTED BY POPULATION

Lundberg Survey
Incorporated Census Data
Gasoline Throughput For U.S.Environmental Protection Agency

COUNTY	POPULATION	SIZE1	SIZE2	SIZE3	SIZE4	SIZE5	SIZE6	SIZE7
MONROE, IL	22365	13.3	6.7	33.3	40.0	6.7	0.0	0.0
WALLER, TX	23150	22.0	9.8	24.4	19.5	17.1	7.3	0.0
CLINTON, IL	33455	12.9	25.8	19.4	32.3	6.5	3.2	0.0
BRISTOL, RI	48288	0.0	14.3	4.8	42.9	28.6	9.5	0.0
LIBERTY, TX	52241	12.0	12.0	34.7	26.7	12.0	2.7	0.0
YAMHILL, OR	65307	0.0	3.2	38.7	29.0	29.0	0.0	0.0
LAPEER, MI	74340	27.5	13.7	15.7	17.6	15.7	7.8	2.0
FRANKLIN, MO	80413	13.4	5.2	13.4	46.6	17.5	4.1	0.0
OSCEOLA, FL	104104	1.1	2.3	17.2	29.9	39.1	9.2	1.1
WASHINGTON, RI	108003	1.6	4.7	14.1	31.3	31.3	15.6	1.6
LIVINGSTON, MI	114958	13.3	4.4	11.1	17.8	22.2	15.6	15.6
MACOMB, IL	117206	0.7	1.3	5.7	14.3	40.3	30.0	7.7
SUSSEX, NJ	129633	1.3	5.1	15.4	26.9	39.7	10.3	1.3
KENT, RI	159900	1.0	1.9	12.5	28.8	37.5	17.3	1.0
JEFFERSON, MO	170254	4.7	3.8	7.5	27.4	42.5	13.2	0.9
MONTGOMERY, TX	180394	9.9	11.5	28.1	27.1	13.5	8.3	1.6
BRAZORIA, TX	190891	10.7	12.6	34.0	27.9	13.0	1.9	0.0
GALVESTON, TX	216175	3.8	10.9	35.9	25.0	18.5	6.0	0.0
FORT BEND, TX	224751	12.5	10.6	17.3	29.8	20.2	9.6	0.0
CLARK, WA	237277	1.9	4.9	14.6	29.1	34.0	15.5	0.0
SOMERSET, NJ	239188	0.8	1.7	11.7	19.2	48.3	17.5	0.8
MADISON, IL	246762	2.4	4.8	18.2	41.8	28.5	4.2	0.0
CLACKAMAS, OR	277791	4.2	2.5	10.1	21.0	37.0	21.8	3.4
WASHTENAW, MI	280222	4.9	4.9	10.6	9.8	44.7	22.0	3.3
SEMINOLE, FL	285213	0.7	2.0	20.5	18.5	35.1	18.5	4.6
WASHINGTON, OR	309883	0.0	2.4	6.1	14.6	40.2	35.4	1.2
RICHMOND, NY	349549	5.1	2.5	14.4	33.1	29.7	13.6	1.7
MORRIS, NJ	419456	1.6	2.4	9.8	28.9	37.0	19.1	1.2
OCEAN, NJ	429076	3.0	1.2	15.1	25.3	28.3	19.3	7.8
PASSIAC, NJ	442895	1.7	3.9	16.7	29.6	36.5	11.2	0.4
UNION, NJ	490000	2.8	6.0	15.5	21.6	31.4	21.6	1.1
HUDSON, NJ	533598	7.4	5.5	12.9	23.9	30.1	17.8	2.5
MONMOUTH, NJ	548793	0.8	2.7	7.0	23.4	39.1	25.0	2.0
MULTINOMAH, OR	580029	3.2	0.8	7.9	26.5	40.3	19.0	2.4
PROVIDENCE, RI	585763	3.5	5.5	14.8	33.5	27.7	13.9	1.0
MIDDLESEX, NJ	667761	4.3	4.8	12.1	31.5	26.1	18.0	3.2
ORANGE, FL	670213	2.8	3.3	13.9	23.6	37.1	17.3	1.9
ESSEX, NJ	749355	1.1	9.9	19.1	23.2	36.8	9.6	0.4
BERGEN, NJ	818237	3.0	5.1	16.5	24.5	35.6	14.0	1.3
OAKLAND, MI	1076234	1.8	2.0	5.7	13.3	39.8	33.0	4.3
BRONX, NY	1203789	5.1	3.3	16.7	27.0	27.9	18.1	1.9
NEW YORK, NY	1420702	2.5	1.3	5.0	17.5	28.8	30.0	15.0
QUEENS, NY	1881375	5.3	5.9	18.8	27.7	27.7	13.8	0.8
WAYNE, MI	2049294	2.1	3.2	5.8	11.3	46.6	28.1	2.9
KINGS, NJ	2300664	4.6	4.8	18.0	24.5	30.0	16.1	1.9
SAN DIEGO, CA	2465961	2.5	1.2	6.8	14.3	33.1	34.4	7.8
HARRIS, TX	2791102	4.2	6.8	21.0	25.2	27.7	14.3	0.8

TABLE A-3

SIZE DISTRIBUTIONS OF COUNTIES SORTED BY THE NUMBER OF SERVICE STATIONS

Lundberg Survey
Incorporated Census Data
Gasoline Throughout For U.S.Environmental Protection Agency

COUNTY	STATIONS	SIZE1	SIZE2	SIZE3	SIZE4	SIZE5	SIZE6	SIZE7
MONROE, IL	15	13.3	6.7	33.3	40.0	6.7	0.0	0.0
BRISTOL, RI	21	0.0	14.3	4.8	42.9	28.6	9.5	0.0
CLINTON, IL	31	12.9	25.8	19.4	32.3	6.5	3.2	0.0
YAMHILL, OR	31	0.0	3.2	38.7	29.0	29.0	0.0	0.0
WALLER, TX	41	22.0	9.8	24.4	19.5	17.1	7.3	0.0
LIVINGSTON, MI	45	13.3	4.4	11.1	17.8	22.2	15.6	15.6
LAPEER, MI	51	27.5	13.7	15.7	17.6	15.7	7.8	2.0
WASHINGTON, RI	64	1.6	4.7	14.1	31.3	31.3	15.6	1.6
LIBERTY, TX	75	12.0	12.0	34.7	26.7	12.0	2.7	0.0
SUSSEX, NJ	78	1.3	5.1	15.4	26.9	39.7	10.3	1.3
NEW YORK, NY	80	2.5	1.3	5.0	17.5	28.8	30.0	15.0
WASHINGTON, OR	82	0.0	2.4	6.1	14.6	40.2	35.4	1.2
OSCEOLA, FL	87	1.1	2.3	17.2	29.9	39.1	9.2	1.1
FRANKLIN, MO	97	13.4	5.2	13.4	46.6	17.5	4.1	0.0
CLARK, WA	103	1.9	4.9	14.6	29.1	34.0	15.5	0.0
KENT, RI	104	1.0	1.9	12.5	28.8	37.5	17.3	1.0
FORT BEND, TX	104	12.5	10.6	17.3	29.8	20.2	9.6	0.0
JEFFERSON, MO	106	4.7	3.8	7.5	27.4	42.5	13.2	0.9
RICHMOND, NY	118	5.1	2.5	14.4	33.1	29.7	13.6	1.7
CLACKAMAS, OR	119	4.2	2.5	10.1	21.0	37.0	21.8	3.4
SOMERSET, NJ	120	0.8	1.7	11.7	19.2	48.3	17.5	0.8
WASHTENAW, MI	123	4.9	4.9	10.6	9.8	44.7	22.0	3.3
SEMINOLE, FL	151	0.7	2.0	20.5	18.5	35.1	18.5	4.6
HUDSON, NJ	163	7.4	5.5	12.9	23.9	30.1	17.8	2.5
MADISON, IL	165	2.4	4.8	18.2	41.8	28.5	4.2	0.0
OCEAN, NJ	166	3.0	1.2	15.1	25.3	28.3	19.3	7.8
GALVESTON, TX	184	3.8	10.9	35.9	25.0	18.5	6.0	0.0
MONTGOMERY, TX	192	9.9	11.5	28.1	27.1	13.5	8.3	1.6
BRONX, NY	215	5.1	3.3	16.7	27.0	27.9	18.1	1.9
BRAZORIA, TX	215	10.7	12.6	34.0	27.9	13.0	1.9	0.0
PASSIAC, NJ	233	1.7	3.9	16.7	29.6	36.5	11.2	0.4
MORRIS, NJ	246	1.6	2.4	9.8	28.9	37.0	19.1	1.2
MULTINOMAH, OR	253	3.2	0.8	7.9	26.5	40.3	19.0	2.4
MONMOUTH, NJ	256	0.8	2.7	7.0	23.4	39.1	25.0	2.0
ESSEX, NJ	272	1.1	9.9	19.1	23.2	36.8	9.6	0.4
UNION, NJ	283	2.8	6.0	15.5	21.6	31.4	21.6	1.1
MACOMB, IL	300	0.7	1.3	5.7	14.3	40.3	30.0	7.7
PROVIDENCE, RI	310	3.5	5.5	14.8	33.5	27.7	13.9	1.0
MIDDLESEX, NJ	372	4.3	4.8	12.1	31.5	26.1	18.0	3.2
KINGS, NJ	416	4.6	4.8	18.0	24.5	30.0	16.1	1.9
ORANGE, FL	423	2.8	3.3	13.9	23.6	37.1	17.3	1.9
OAKLAND, MI	442	1.8	2.0	5.7	13.3	39.8	33.0	4.3
QUEENS, NY	506	5.3	5.9	18.8	27.7	27.7	13.8	0.8
BERGEN, NJ	534	3.0	5.1	16.5	24.5	35.6	14.0	1.3
SAN DIEGO, CA	774	2.5	1.2	6.8	14.3	33.1	34.4	7.8
WAYNE, MI	822	2.1	3.2	5.8	11.3	46.6	28.1	2.9
HARRIS. TX	1801	4.2	6.8	21.0	25.2	27.7	14.3	0.8

These tables could be used to predict a distribution for an area where data are not available to actually calculate this distribution. For example, assume a county has a population of approximately 225,000. From Table A-2, the counties of Galveston, TX, Fort Bend, TX, Clark WA, and Somerset, NJ have similar populations. An average size distribution could be calculated using this information and the number of stations from Table A-3. This could then be used as an estimate of the size distribution for the example county.

APPENDIX B
STAGE II FACILITY COSTS

This appendix is taken in its entirety from Draft Regulatory Impact Analysis: Proposed Refueling Emission Regulations for Gasoline-Fueled Motor Vehicles - Volume I Analysis of Gasoline Marketing Regulatory Strategies. EPA-450/3-87-001a. U.S. EPA, Research Triangle Park, N.C. July 1987.

APPENDIX B
STAGE II PER-FACILITY COSTS

B.1 INTRODUCTION

Cost data were obtained and developed on a per-facility basis for each model plant size. These per-facility costs were then combined with data on the number of facilities requiring controls within each model plant category so that nationwide costs could be determined.

The Agency obtained cost data from numerous sources (vendors, equipment suppliers, and construction contractors) in determining reasonable estimates for the capital and annualized costs that would be incurred by installation of Stage II vapor recovery systems, due either to retrofit on an existing facility or to the incorporation of controls during construction of a new facility. All data were obtained during the third and fourth quarters of 1984, and these values are taken to represent third quarter 1984 costs. Information for determining Stage II costs was compiled based on vapor recovery systems currently available and certified in California; i.e., the individual balance system, the manifolded balance system, the hybrid system, and two types of vacuum assisted systems. The reasons for using only the systems currently certified in California are that these systems are in actual operation and have been demonstrated to meet the control efficiencies assumed in this analysis, and detailed information is available on the exact components that make up each approved system. The presented per-facility cost estimates are based upon the 95 percent theoretical efficiency since this is the efficiency at which the systems are certified. However, when extrapolating these per-facility costs to nationwide or nonattainment areas, in-use efficiencies are assumed.

Both the individual and manifolded balance systems are considered in this analysis because each is currently certified for use in California and because when the analysis effort was begun the magnitude of the cost difference between the two systems was not known. The cost analysis for the hybrid system is based solely on the Healy System, because this is the only one for which accurate cost data were available. Cost data were not available from the other hybrid manufacturer, Red Jacket, since this company's system is not currently being manufactured. The costs shown for the vacuum assist systems are based on the Hirt system and the Hasstech system. Throughout this appendix, the title Assist-1 is used to denote the Hirt System, Assist-2 is used for the Hasstech System, Hybrid is used for the Healy system, Bal-I is used to indicate an individual balance system, and Bal-M is used for a manifolded balance system.

Several terms are used during the discussion of Stage II capital costs. The "purchase cost" of an item represents the manufacturer's quoted selling price for the item. The "direct cost" of an item equals the item's purchase cost plus the direct expenses incurred during the installation of the item (e.g., labor, materials, and site preparation). The "capital cost" of an item equals the sum of the item's direct cost and its indirect cost (e.g., model study, contingencies, startup). However, since Stage II systems are relatively small and simple, no indirect costs are incurred. Therefore, in this case, the capital cost of an item is the same as its direct cost. The cost components that comprise the "annualized cost" of a Stage II system are defined as they appear later in this discussion.

A summary of the aboveground and underground component cost analysis is presented in Section B.2. Section B.3 presents the per-facility cost results for retrofitting an existing facility, and Section B.4 presents the costs for installation during the construction of a new facility.

B.2 COMPONENT COSTS

This section presents the capital and annualized costs of both the aboveground (B.2.1) and underground (B.2.2) equipment components of a Stage II system retrofitted to an existing service station. This analysis incorporates the conclusion of Appendix I, which evaluated Stage II dispenser configurations. The analysis presented here assumes that all existing and new facilities incorporate coaxial hose configurations and that one-fourth of the existing and three-fourths of the new facilities will incorporate multiproduct dispensers.

The capital cost data for all Stage II vapor recovery systems were re-evaluated and broken down into aboveground costs, which include the costs for dispenser components, and underground costs, which include the installation cost of an underground piping system. The capital

recovery cost factor used to calculate annualized costs was based on an equipment life of 8 years for the dispenser and auxiliary equipment, and 35 years for the underground piping system.

B.2.1. Aboveground Costs

To calculate aboveground costs, EPA obtained a list of the aboveground components certified for use in California. The vendors of the components on this list were then contacted to obtain a current retail price for each component. Finally, the price range for each individual component type was averaged to arrive at a single price for each component type.

Table B-1 contains a component list of the equipment necessary to modify an existing dispenser into a balance, or Hirt, Stage II vapor recovery dispenser. This equipment list was obtained from an Executive Order issued by the State of California Air Resources Board (G-70-52-AE: Exhibit 2) (I-F-113)* and represents the equipment certified for use in the Stage II systems. This table provides a list of manufacturers and model numbers for each piece of equipment; other makes of the same equipment are not certified and, thus, may not be used in California. This Executive Order also presents exhibits (Exhibits 4-10) that depict the dispenser configurations that may be used (see Figures B-1, through B-7). Exhibits 8 through 10 depict multi-product dispensers. Multi-product dispensers, which are relatively new, offer three grades of product on each side of the dispenser (six nozzles per dispenser).

B.2.1.1 Dispenser Modification Equipment Costs (Not Including Nozzles)

A specific subset of the component list shown in Table B-1 is applicable to each exhibit, thereby providing a different cost for each exhibit. The manufacturers of the components listed in Table B-1 were contacted to obtain current costs. These costs for each dispenser type are summarized by exhibit number in Table B-2. This table lists the lowest, highest, and average price of each component within each exhibit configuration. In this manner, an average cost has been obtained for the exhibit configurations shown in Figures B-1 through B-7. Based on the conclusions of Appendix I, the cost analysis

*Numbers indicated in this format are references (Section B.5) and correspond to docket item numbers in Docket No. A-84-07.

Table B-1. COMPONENT LIST FOR BALANCE OR HIRT STAGE II VAPOR RECOVERY SYSTEMS (from Reference I-F-113)

Item/Manufacturer and Model No.	Exhibit 4	5	6	7	8	9	10
Nozzles							
Emco Wheaton A 3003	X		X	X			
Emco Wheaton A 3005		X	X		X	X	X
Emco Wheaton A 3006	X		X	X			
Emco Wheaton A 3007		X	X		X	X	X
OPW 7V-E (34,36,47,49)	X		X	X			
OPW 7V-H (34,36,47,49, 60-63)	X		X	X			
OPW 11V-C (22,24,47,49)	X	X	X	X	X	X	X
OPW 11V-E (34,36,47,49)	X	X	X	X	X	X	X
High-Retractor Hose Configurations							
Overhead Hose Retractors							
Pomeco 100A, B, C	X	X					
Pomeco 102	X	X					
Petro-Vend PV-8	X	X					
CNI Series 9900, 9910 and 9930	X	X				X	
Dresser Wayne Model 390-IL			X	X	X		
Gasboy Model 90-750-2	X	X					
Gilbarco						X	
High-Retractor Dispensers							
Dresser Wayne Series 370/380			X				
Dresser Wayne Decade Marketer Series 310/320				X			
Gasboy Series 50	X	X					
Tokheim Series 162	X	X					
Dresser Wayne Series 390 MGD					X		
Tokheim Models 330A and 333A MMD					X		
High-Hang Hose Configurations							
Dispensers							
Gilbarco MPD						X	X
Coaxial Hose Assembly							
B.F. Goodrich Co-Ax		X	X		X	X	X
Liquid Removal Systems							
Gilbarco Venturi							X

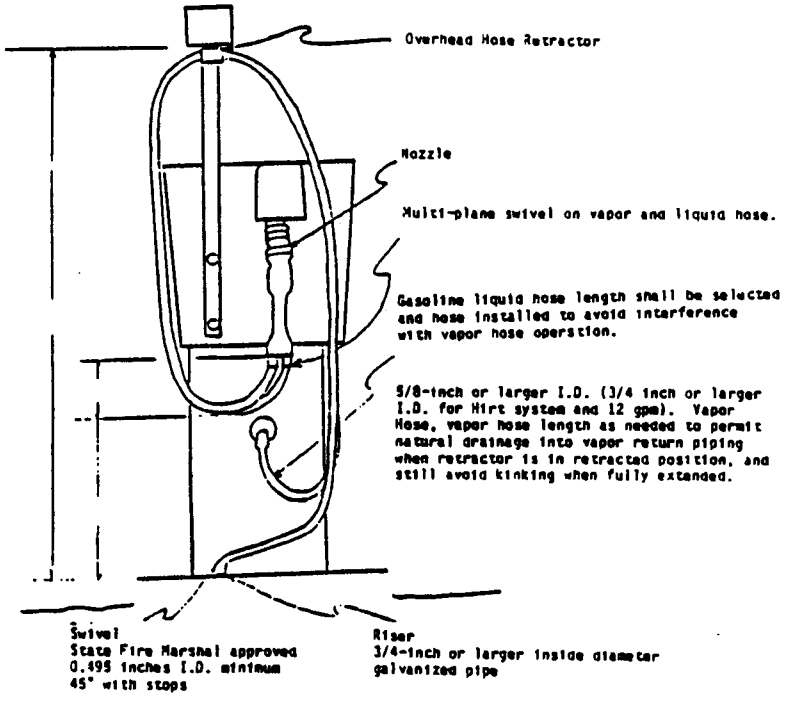
(Table concluded on next page.)

Table B-1. COMPONENT LIST FOR BALANCE OR HIRT STAGE II VAPOR RECOVERY SYSTEMS (from Reference I-F-113) (concluded)

Item/Manufacturer and Model No.	Exhibit 4	5	6	7	8	9	10
Swivels							
Nozzle							
Pomeco Model 7	X		X	X			
Husky I-VI	X		X	X			
Emco Wheaton							
A 4110-001(45°)		X			X	X	
A 4113-001(90°)					X	X	
OPW 43	X		X	X			
OPW 43-C (45°)		X			X	X	
OPW 43-T	X		X	X			
OPW 33-CV	X		X	X			
Island							
Emco Wheaton							
A 93-001		X					
OPW 36-C		X					
Dispenser							
Emco Wheaton							
A 4113-001 (90°)					X		
Emco Wheaton							
A 92-001		X					
Wedgon PS 3445 VRM	X		X				
Retractor Swivel							
Searle Leather & Packing B-1399 or State Fire Marshal approved equivalent		X					
Flow Limiter							
Emco Wheaton A-10 or State Fire Marshal approved equivalent	X	X	X	X	X	X	X
Recirculation Traps[a]							
Emco Wheaton							
A 008-001	X	X	X	X			
Emco Wheaton							
A 94-001	X	X	X	X			
Emco Wheaton							
A 95-001	X	X	X	X			
OPW 78, 789-S, 78E, 78-ES	X	X	X	X			

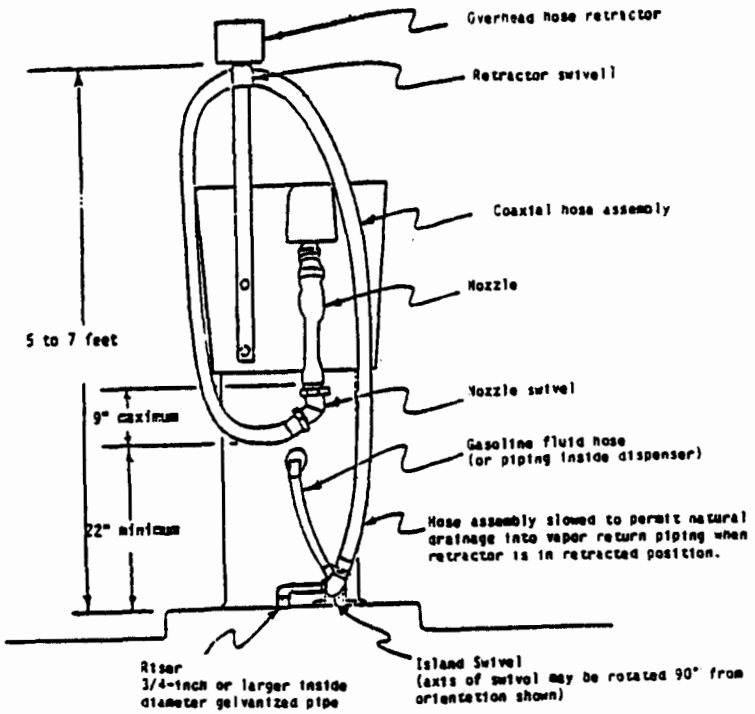
[a] Due to the law in California requiring all balance systems to have high-hang retractors by 1986, recirculation traps will no longer be required after 1986.

Figure B-1. Exhibit-4, Twin Hose Side-Mount High-Retractor Configuration (from reference I-F-113)



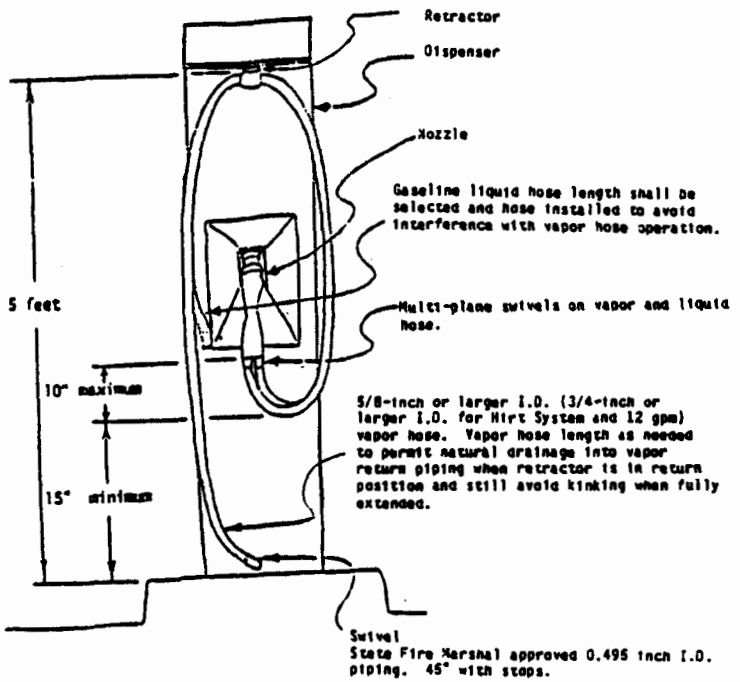
Notes:
1. See Exhibit 2 for the component list.
2. A flow limiter is required on all dispensers using Emco Wheaton nozzles except the Hirt system using Emco Wheaton Model A3096 and 3/4-inch vapor hoses.
3. A recirculation trap is not required.
4. Use appropriate hose ties.
5. Vapor return piping may be installed on the inside or on the outside of the dispenser cabinet.

Figure B-2. Exhibit-5, Coaxial Hose Side-Mount High-Retractor Configuration
(from reference 1-F-113)



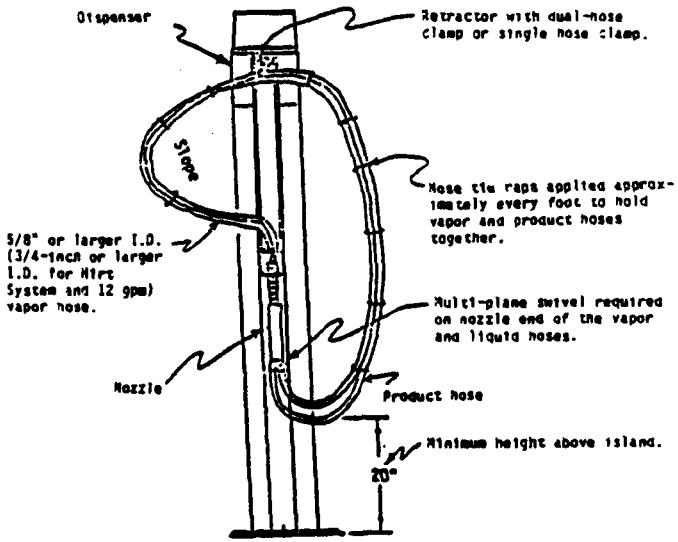
Notes:
1. See Exhibit 2 for the component list.
2. A flow limiter is required on all dispensers using Emco Wheaton nozzles except the Hirt system using Emco Wheaton Model A3096 and 3/4-inch vapor hoses.
3. A recirculation trap is not required.
4. Vapor return piping may be installed on the inside or on the outside of the dispenser cabinet.

Figure B-3. Exhibit-6, Twin Hose or Coaxial Hose Dispenser-Mount, High-Retractor Configuration
(from reference I-F-113)



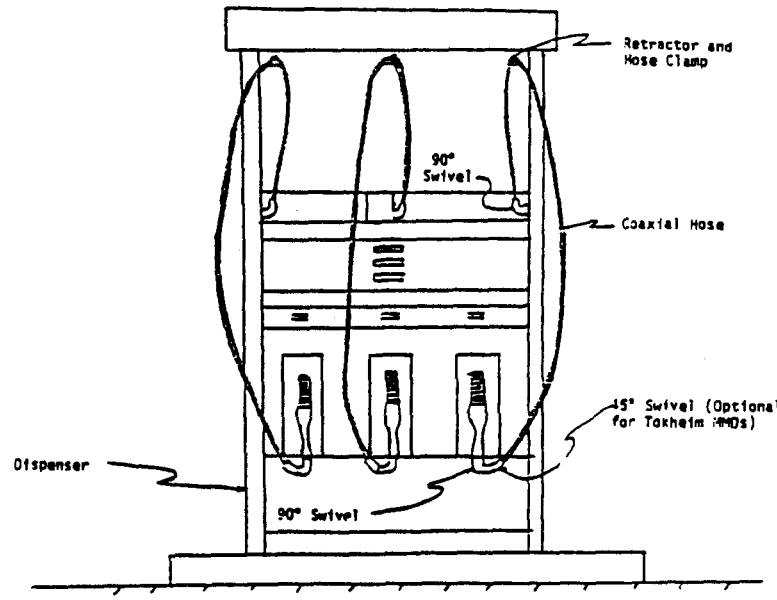
Notes:
1. See Exhibit 2 for the component list.
2. A flow limiter is required on all dispensers using Emco Wheaton nozzles except the Hirt system using Emco Wheaton Model A3096 and 3/4-inch vapor hoses.
3. A recirculation trap is not required.
4. Use appropriate hose ties.
5. Vapor return piping may be installed on the inside or on the outside of the dispenser cabinet.
6. Riser, 3/4-inch or larger inside diameter galvanized pipe.

Figure B-4. Exhibit-7, Twin Hose Dispenser-Mount, High-Retractor Configuration (from reference I-F-113)



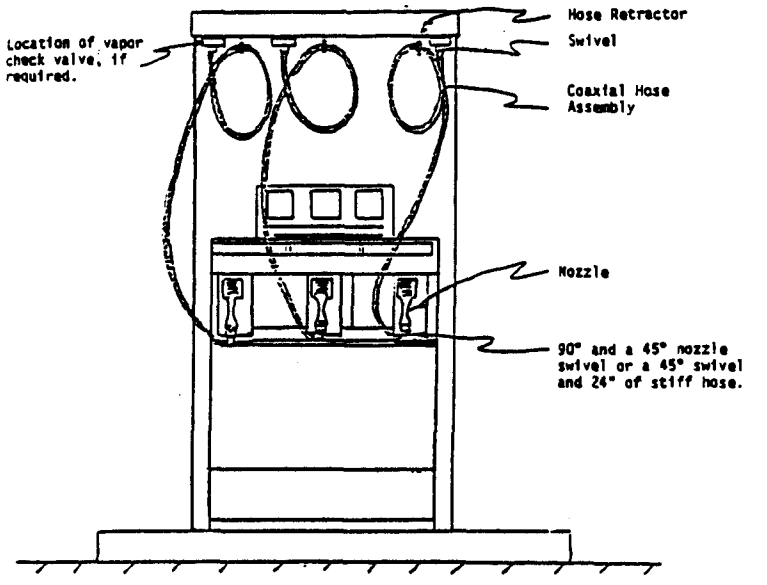
Notes:
1. See Exhibit 2 for the component list.
2. A flow limiter is required on all dispensers using Emco Wheaton nozzles except the Hirt system using Emco Wheaton Model A3096 and 3/4-inch vapor hoses.
3. A recirculation trap is not required.
4. Hose swivels not required at dispenser end of hoses.
5. Riser must be 3/4-inch or larger inside diameter galvanized pipe.

Figure B-5. Exhibit-8, High Retractor Dispenser-Coaxial Configuration For All New And Existing Installations (from Reference I-F-113)



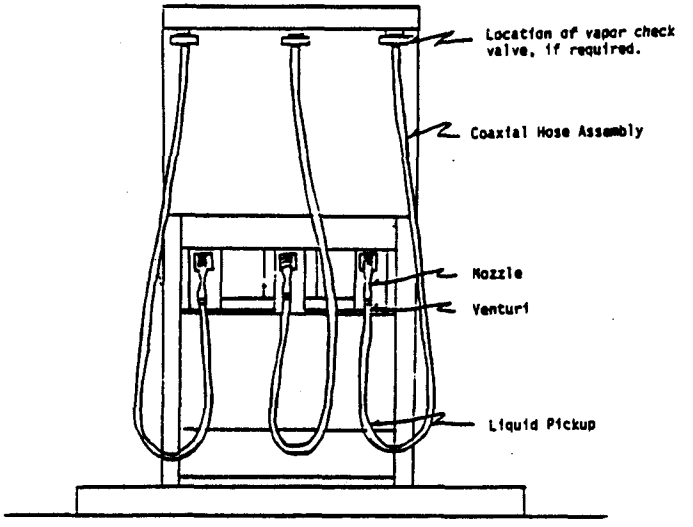
Notes:
1. Use a 1 inch or larger inside diameter galvanized pipe for riser.
2. A recirculation trap is not required.
3. A flow limiter is required on dispensers that have a maximum flowrate in excess of 10 gpm. A flow limiter may be required on all gasoline dispensers at the option of the local air pollution control district.
4. For dispenser islands greater than 4 feet in width, each vapor hose length, shall not be longer than the sum of one-half the dispenser island width, in feet, plus 7 feet.
5. For dispenser islands less than 4 feet, the maximum hose length is 9 feet.
6. Coaxial hose stiffeners must be included and long enough to prevent kinking or flattening of hose.
7. Retractor must retract coaxial hose to top of dispensers when not in use.
8. Tension on retractor hose clamp must not be in excess of that required to return hose to top of dispenser.
9. The Emco Wheaton Model A4000 series nozzles and the OPW 11V Model F vapor recovery nozzles are permitted only when used in conjunction with approved vapor check valves.

Figure B-6. Exhibit 9, High-Hang Hose Configuration With Retractor For All New And Existing Installations (from Reference I-F-113)



Notes:
1. Use a 1 inch or larger inside diameter galvanized pipe for riser.
2. A recirculation trap is not required.
3. A flow limiter is required on dispensers that have a maximum flowrate in excess of 10 gpm. A flow limiter may be required on all gasoline dispensers at the option of the local air pollution control district.
4. For dispensers islands greater than 4 feet in width, each vapor hose length shall not be longer than the sum of one-half the dispenser island width, in feet plus 7 1/2 feet.
5. For dispenser islands less than 4 feet, the maximum hose length is 9 1/2 feet.
6. Coaxial hose stiffeners must be included and long enough to prevent kinking or flattening of hose.
7. Retractor must retract coaxial hose to top of dispensers when not in use.
8. Tension on retractor hose clamp must not be in excess of that required to return hose to top of dispenser.
9. 90° swivel is not required if hose stiffener at nozzle is >24 inches in length.
10. The Emco Wheaton Model A4000 series nozzles and the OPW 11V Model F vapor recovery nozzles are permitted only when used in conjunction with approved vapor check valves.

Figure B-7. Exhibit 10, High-Hang Coaxial Hose Configuration With Liquid Removal System For All New And Existing Installations (from I-F-113)



Notes:
1. Use a 1 inch or larger inside diameter galvanized pipe for riser.
2. A recirculation trap is not required.
3. Hose length = 10 1/2 ft. maximum.
4. Coaxial hose stiffeners must be included and long enough to prevent kinking or flattening of hose.
5. An ARB certified liquid removal system must be installed and maintained according to manufacturer's specifications.
6. A flow limiter is required on all dispensers that have a maximum flowrate in excess of 10 gpm. A flow limiter may be required on all gasoline dispensers at the option of the local air pollution control district.
7. The Emco Wheaton Model A4000 series nozzles and the OPW 11V Model F vapor recovery nozzles are permitted only when used in conjunction with approved vapor check valves.

Table B-2. BALANCE SYSTEM DISPENSER MODIFICATION EQUIPMENT PURCHASE COST[a]
($/Nozzle)

EXHIBIT 4 - Twin Hose Side-Mount	Cost of Component LOW	HIGH	AVERAGE
High Hose Retractor	94.00	102.50	96.08
Swivels for Nozzles	42.40	75.00	54.87
Swivels for Isl or Disp	21.50	21.50	21.50
Swivels for Retract	0.00	0.00	0.00
Flow Limiter	20.00	20.00	20.00
Hose	13.50	35.28	24.39
Disp-Hook & Handle	16.00	38.00	27.00
Total Purchase Cost	207.40	292.28	243.84
EXHIBIT 5 - Coaxial Hose Side-Mount			
High Hose Retractor	94.00	102.50	96.08
Swivels-Nozzles	40.00	58.80	49.40
Swivels-Isl or Disp	58.80	82.10	70.45
Swivels-Retract	8.08	8.08	8.08
Flow Limiter	20.00	20.00	20.00
Hose	100.00	100.00	100.00
Disp-Hook & Handle	16.00	38.00	27.00
Total Purchase Cost	336.88	409.48	371.01
EXHIBIT 6 - Twin or Coaxial Hose Dispenser-Mount (Average of twin and coaxial presented)			
High Hose Retractor	94.00	102.50	96.08
Swivels-Nozzles	42.40	75.00	54.87
Swivels-Isl or Disp	21.50	21.50	21.50
Swivels-Retract	0.00	0.00	0.00
Flow Limiter	20.00	20.00	20.00
Hose	56.75	67.64	62.20
Disp-Hook & Handle	16.00	38.00	27.00
Total Purchase Cost	250.65	324.64	281.65
EXHIBIT 7 - Twin Hose Dispenser-Mount			
High Hose Retractor	94.00	102.50	96.08
Swivels-Nozzles	42.40	75.00	54.87
Swivels-Isl or Disp	0.00	0.00	0.00
Swivels-Retract	8.08	8.08	8.08
Flow Limiter	20.00	20.00	20.00
Hose	13.50	35.28	24.39
Disp-Hook & Handle	16.00	38.00	27.00
Total Purchase Cost	193.98	278.86	230.42

[a]See docket entries I-E-18, I-E-19, I-E-20, I-E-22, I-E-26, I-E-27, I-E-28, I-E-31, I-E-32, I-E-58, I-E-62, I-E-63, I-E-64, I-E-65, I-E-66, I-E-67, I-F-110, and I-F-111.

Table B-2. BALANCE SYSTEM DISPENSER MODIFICATION EQUIPMENT PURCHASE COST[a]
($/Nozzle)
(concluded)

EXHIBIT 8 - Coaxial High Retractor	Cost of Component LOW	HIGH	AVERAGE
Overhead Hose Retractor	94.00	102.50	96.08
Swivels for Nozzles	80.00	117.60	98.80
Swivels for Isl. or Disp.	0.00	0.00	0.00
Swivels for Retractor	40.00	58.80	49.40
Flow Limiter	20.00	20.00	20.00
Hose	90.00	112.50	103.45
Liquid Removal Venturi	0.00	0.00	0.00
Dispenser Modification	38.00	55.00	46.50
	362	466.4	414.23
EXHIBIT 9 - High-Hang Hose			
Overhead Hose Retractor	85.84	100.00	92.92
Swivels for Nozzles	80.00	117.60	98.80
Swivels for Isl. or Disp.	0.00	0.00	0.00
Swivels for Retractor	40.00	58.80	49.40
Flow Limiter	20.00	20.00	20.00
Hose	95.00	118.17	108.92
Liquid Removal Venturi	0.00	0.00	0.00
Dispenser Modification	54.17	54.17	54.17
	375.01	469.32	424.21
EXHIBIT 10 - Coaxial High-Hang Hose with Liquid Removal System			
Overhead Hose Retractor	0.00	0.00	0.00
Swivels for Nozzles	40.00	58.80	49.40
Swivels for Isl. or Disp.	0.00	0.00	0.00
Swivels for Retractor	40.00	58.80	49.40
Flow Limiter	20.00	20.00	20.00
Hose	105.00	131.25	119.82
Liquid Removal Venturi	200.00	200.00	200.00
Dispenser Modification	54.17	54.17	54.17
	459.17	523.02	492.79
Average Total Purchase Cost[b]			354.75

[b]Average cost analysis of 75 percent coaxial single dispensers (Exhibits 5 and 6) and 25 percent coaxial multiproduct dispensers (Exhibits 8 through 10).

is based on the use of all coaxial hoses and 75 percent single dispensers (average of exhibits 5 and 6) and 25 percent multiproduct dispensers (average of Exhibits 8-10). This weighted average cost was used as the purchase cost incurred when modifying a standard dispenser to a vapor recovery equipped dispenser utilizing a balance Stage II vapor recovery system.

The dispenser modification equipment list for the Hybrid system was obtained directly from the manufacturer of the hybrid system (I-E-25), and includes the Model 100 jet pump, Model CX-6 adapter, Model S swivel, Model CX hose, Model 143 control valve, and an installation kit. The total price is $435 per nozzle.

The dispenser modification equipment cost (excluding nozzles) for the Assist-1 system is the same as that for the balance system (i.e., about $355), plus the cost of a ball check valve ($16.95, I-E-23). Thus, the total unit price for dispenser modification equipment for the Assist-1 system was estimated to be $367 per nozzle.

The dispenser modification cost for the Assist-2 system was obtained directly from the manufacturer of the system (I-F-106), and includes the Hasstech vapor hose, ITT flow control valve, A.Y. McDonald impact valve, hose swivels, and Hasstech Model 1025 flame arrestor. The unit price is $205.

Tables B-3 through B-7 present the aboveground direct costs that would be incurred for each model plant. These tables include the component costs for the balance system, the Hybrid System (Healy) and the vacuum assist system (Hirt = Assist-1, Hasstech = Assist-2). Table B-8 outlines the information on nozzles and islands assumed in the cost analysis for each model plant. The data for single dispensers include the same nozzle-per-station assumptions used in the 1984 EPA analysis found in "Evaluation of Air Pollution Regulatory Strategies for Gasoline Marketing Industry," EPA-450/3-84-012a (I-A-55). The assumptions for the multiproduct dispensers (MPD's) include the installation of one 4-nozzle MPD to replace each 3-dispenser island. An uneven number of nozzles results from the 75/25 weighting of the nozzles associated with single/multiproduct dispensers.

TABLE B-3. MODEL PLANT 1 STAGE II ABOVEGROUND DIRECT COST

ABOVEGROUND COMPONENTS	UNIT COST	NUMBER OF COMPONENTS				
		BAL-1	BAL-M	HYBRID	ASSIST-1	ASSIST-2
DISPENSER COMPONENTS						
NOZZLE BALANCE (a)	197	2.50	2.50			
NOZZLE HYBRID (b)	215			2.50		
NOZZLE ASSIST-1 (c)	178				2.50	
NOZZLE ASSIST-2 (d)	124					2.50
MOD EQUIP BALANCE (e)	355	2.50	2.50			
MOD EQUIP HYBRID (f)	435			2.50		
MOD EQUIP ASSIST-1 (g)	372				2.50	
MOD EQUIP ASSIST-2 (h)	205					2.50
AUXILIARY ITEMS (i)						
ASSIST-1	3,975				1.00	
ASSIST-2	3,900					1.00
INSTALLATION						
BALANCE DISPENSER (j)	80	2.50	2.50			
HYBRID DISPENSER (k)	100			2.50		
ASSIST-1 DISPENSER (l)	45				2.50	
ASSIST-2 DISPENSER (m)	50					2.50
ASSIST-1 AUXILIARY (n)	1,400				1.00	
ASSIST-2 AUXILIARY (o)	1,200					1.00
DISPENSER PURCHASE COST		1,379	1,379	1,625	1,373	823
AUX ITEMS PURCHASE COST		0	0	0	3,975	3,900
DISP INSTALLATION COST		200	200	250	113	125
AUX INSTALLATION COST		0	0	0	1,400	1,200
DISPENSER DIRECT COST		1,579	1,579	1,875	1,486	948
AUX ITEMS DIRECT COST		0	0	0	5,375	5,100
TOTAL DIRECT COST		1,579	1,579	1,875	6,861	6,048

* Weighted average costs assuming 75 percent single dispensers and 25 percent multiproduct dispensers.

TABLE B-4. MODEL PLANT 2 STAGE II ABOVEGROUND DIRECT COST

ABOVEGROUND COMPONENTS	UNIT COST	NUMBER OF COMPONENTS				
		BAL-1	BAL-M	HYBRID	ASSIST-1	ASSIST-2
DISPENSER COMPONENTS						
NOZZLE BALANCE (a)	197	3.25	3.25			
NOZZLE HYBRID (b)	215			3.25		
NOZZLE ASSIST-1 (c)	178				3.25	
NOZZLE ASSIST-2 (d)	124					3.25
MOD EQUIP BALANCE (e)	355	3.25	3.25			
MOD EQUIP HYBRID (f)	435			3.25		
MOD EQUIP ASSIST-1 (g)	372				3.25	
MOD EQUIP ASSIST-2 (h)	285					3.25
AUXILIARY ITEMS (i)						
ASSIST-1	3,975				1.00	
ASSIST-2	3,900					1.00
INSTALLATION						
BALANCE DISPENSER (j)	80	3.25	3.25			
HYBRID DISPENSER (k)	100			3.25		
ASSIST-1 DISPENSER (l)	45				3.25	
ASSIST-2 DISPENSER (m)	50					3.25
ASSIST-1 AUXILIARY (n)	1,400				1.00	
ASSIST-2 AUXILIARY (o)	1,200					1.00
DISPENSER PURCHASE COST		1,793	1,793	2,113	1,785	1,669
AUX ITEMS PURCHASE COST		0	0	0	3,975	3,900
DISP INSTALLATION COST		260	260	325	146	163
AUX INSTALLATION COST		0	0	0	1,400	1,200
DISPENSER DIRECT COST		2,053	2,053	2,438	1,931	1,832
AUX ITEMS DIRECT COST		0	0	0	5,375	5,100
TOTAL DIRECT COST		2,053	2,053	2,438	7,306	6,932

* Weighted average costs assuming 75 percent single dispensers and 25 percent multiproduct dispensers.

TABLE B-5. MODEL PLANT 3 STAGE II ABOVEGROUND DIRECT COST

ABOVEGROUND COMPONENTS	UNIT COST	NUMBER OF COMPONENTS				
		BAL-1	BAL-M	HYBRID	ASSIST-1	ASSIST-2
DISPENSER COMPONENTS						
NOZZLE BALANCE (a)	197	6.50	6.50			
NOZZLE HYBRID (b)	215			6.50		
NOZZLE ASSIST-1 (c)	178				6.50	
NOZZLE ASSIST-2 (d)	124					6.50
MOD EQUIP BALANCE (e)	355	6.50	6.50			
MOD EQUIP HYBRID (f)	435			6.50		
MOD EQUIP ASSIST-1 (g)	372				6.50	
MOD EQUIP ASSIST-2 (h)	285					6.50
AUXILIARY ITEMS (i)						
ASSIST-1	3,975				1.00	
ASSIST-2	3,900					1.00
INSTALLATION						
BALANCE DISPENSER (j)	80	6.50	6.50			
HYBRID DISPENSER (k)	100			6.50		
ASSIST-1 DISPENSER (l)	45				6.50	
ASSIST-2 DISPENSER (m)	50					6.50
ASSIST-1 AUXILIARY (n)	1,400				1.00	
ASSIST-2 AUXILIARY (o)	1,200					1.00
DISPENSER PURCHASE COST		3,586	3,586	4,225	3,570	2,139
AUX ITEMS PURCHASE COST		0	0	0	3,975	3,900
DISP INSTALLATION COST		520	520	650	293	325
AUX INSTALLATION COST		0	0	0	1,400	1,200
DISPENSER DIRECT COST		4,106	4,106	4,875	3,863	2,464
AUX ITEMS DIRECT COST		0	0	0	5,375	5,100
TOTAL DIRECT COST		4,106	4,106	4,875	9,238	7,564

* Weighted average costs assuming 75 percent single dispensers and 25 percent multiproduct dispensers.

TABLE B-6. MODEL PLANT 4 STAGE II ABOVEGRO ND DIRECT COST

ABOVEGROUND COMPONENTS	UNIT COST	NUMBER OF COMPONENTS				
		BAL-I	BAL-M	HYBRID	ASSIST-1	ASSIST-2
DISPENSER COMPONENTS						
NOZZLE BALANCE (a)	197	9.75	9.75			
NOZZLE HYBRID (b)	215			9.75		
NOZZLE ASSIST-1 (c)	178				9.75	
NOZZLE ASSIST-2 (d)	124					9.75
MOD EQUIP BALANCE (e)	355	9.75	9.75			
MOD EQUIP HYBRID (f)	435			9.75		
MOD EQUIP ASSIST-1 (g)	372				9.75	
MOD EQUIP ASSIST-2 (h)	285					9.75
AUXILIARY ITEMS (i)						
ASSIST-1	3,975				1.00	
ASSIST-2	3,900					1.00
INSTALLATION						
BALANCE DISPENSER (j)	80	9.75	9.75			
HYBRID DISPENSER (k)	100			9.75		
ASSIST-1 DISPENSER (l)	45				9.75	
ASSIST-2 DISPENSER (m)	50					9.75
ASSIST-1 AUXILIARY (n)	1,400				1.00	
ASSIST-2 AUXILIARY (o)	1,200					1.00
DISPENSER PURCHASE COST		5,380	5,380	6,338	5,355	3,200
AUX ITEMS PURCHASE COST		0	0	0	3,975	3,900
DISP INSTALLATION COST		780	780	975	439	488
AUX INSTALLATION COST		0	0	0	1,400	1,200
DISPENSER DIRECT COST		6,160	6,160	7,313	5,794	3,695
AUX ITEMS DIRECT COST		0	0	0	5,375	5,100
TOTAL DIRECT COST		6,160	6,160	7,313	11,169	8,795

* Weighted average costs assuming 75 percent single dispensers and 25 percent multiproduct dispensers.

TABLE B-7. MODEL PLANT 5 STAGE II AB OVEGROUND DIRECT COST

ABOVEGROUND COMPONENTS	UNIT COST	NUMBER OF COMPONENTS				
		BAL-I	BAL-M	HYBRID	ASSIST-1	ASSIST-2
DISPENSER COMPONENTS						
NOZZLE BALANCE (a)	197	16.25	16.25			
NOZZLE HYBRID (b)	215			16.25		
NOZZLE ASSIST-1 (c)	178				16.25	
NOZZLE ASSIST-2 (d)	124					16.25
MOD EQUIP BALANCE (e)	355	16.25	16.25			
MOD EQUIP HYBRID (f)	435			16.25		
MOD EQUIP ASSIST-1 (g)	372				16.25	
MOD EQUIP ASSIST-2 (h)	285					16.25
AUXILIARY ITEMS (i)						
ASSIST-1	3,975				1.00	
ASSIST-2	3,900					1.00
INSTALLATION						
BALANCE DISPENSER (j)	80	16.25	16.25			
HYBRID DISPENSER (k)	100			16.25		
ASSIST-1 DISPENSER (l)	45				16.25	
ASSIST-2 DISPENSER (m)	50					16.25
ASSIST-1 AUXILIARY (n)	1,400				1.00	
ASSIST-2 AUXILIARY (o)	1,200					1.00
DISPENSER PURCHASE COST		8,966	8,966	10,563	8,925	5,346
AUX ITEMS PURCHASE COST		0	0	0	3,975	3,900
DISP INSTALLATION COST		1,300	1,300	1,625	731	813
AUX INSTALLATION COST		0	0	0	1,400	1,200
DISPENSER DIRECT COST		10,266	10,266	12,188	9,657	6,159
AUX ITEMS DIRECT COST		0	0	0	5,375	5,100
TOTAL DIRECT COST		10,266	10,266	12,188	15,032	11,259

* Weighted average costs assuming 75 percent single dispensers and 25 percent multiproduct dispensers.

FOOTNOTES FOR TABLES B 3 THROUGH B-7

[a]Average cost of new nozzles certified by California for use with a balance system. Costs for new nozzles range from $196 to $198 (I-E-28, I-F-110, and I-F-111).

[b]Actual cost of a new Healy Model 200 nozzle (I-E-25).

[c]Average costs of new nozzles certified by California for use with the Hirt system. Costs of new nozzles range from $151 to $198 (I-E-28, I-F-110, and I-F-111).

[d]Actual costs of a new Husky Model HP-2 nozzle. Reference I-F-106 states that eight of these nozzles cost $992.

[e]Modification equipment includes the average cost of the high-hang retractor system, swivels, flow limiter, and hoses as certified by California (see Tables B-1 and B-2).

[f]Modification equipment includes the Model 100 jet pump, Model CX-6 adapter, Model S swivel, Model CX hose, Model 143 control valve, and an installation kit (I-E-25).

[g]Modification equipment includes the same equipment as listed for the balance system (footnote "f") plus a $16.95 ball check valve (I-E-23 and Tables B-1 and B-2).

[h]Modification equipment includes the Hasstech vapor hose, ITT flow control valve, A.Y. McDonald impact valve, hose swivels, and Hasstech Model 1025 flame arrestor (I-F-106).

[i]Auxiliary equipment includes a P/V valve, collection unit, and processing unit (I-E-35 and I-F-106).

[j]Reference I-E-46.

[k]Reference I-E-25.

[l]Reference I-E-35.

[m]Reference I-F-106 states installation for an 8-nozzle station costs $400.00.

[n]Reference I-E-35.

[o]Electrical installation costs $500 and base unit installation costs $700 (I-F-106).

Table B-8. MODEL PLANT CONFIGURATIONS[a]

Parameter	Model Plant 1	2	3	4	5
Average Monthly Throughput (gal/mo)	5,000	20,000	35,000	65,000	185,000
Throughput Range (gal/mo)	0-10,000	10,000-25,000	25,000-50,000	50,000-100,000	>100,000
No. of Islands	1	1	2	3	4
No. of Nozzles					
- Single Dispensers	2[c]	3	6	9	15[b]
- Multiproduct dispensers	4	4	8	12	20
- Weighted average[d]	2.50	3.25	6.50	9.75	16.25
No. of Dispensers	2[c]	3	6	9	12
- Single Dispensers	2[c]	3	6	9	12
- Multiproduct dispensers	1	1	2	3	5

[a]A typical island contains three single nozzle dispensers for each gasoline type (i.e., leaded, unleaded, and unleaded premium).

[b]Three islands have dual nozzle dispensers.

[c]Contains a single nozzle dispenser for leaded and unleaded only.

[d]Weighted average for existing facilities = 75 percent single dispensers and 25 percent multiproduct dispensers. (Weighted average for new facilities = 25 percent single dispensers and 75 percent multiproduct dispensers).

B.2.1.2 Nozzle Costs

The unit cost for each nozzle type shown in Tables B-3 through B-7 represents the cost of a new vapor recovery nozzle for each specific system manufacturer. The cost shown for a balance system nozzle is an average of several prices obtained from manufacturers of the approved nozzles listed in Table B-1 (i.e., Emco Wheaton, OPW, References I-E-28, I-F-110, and I-F-111). The new vapor recovery nozzles cost from $196 to $198, and thus a price of $197 for both balance-individual nozzles and balance-manifolded nozzles was used. These cost were later verified by again contacting the equipment manufacturers (I-E-65, I-E-66) and reflect the costs of the newest light-weight certified nozzles.

The unit cost shown in Tables B-3 through B-7 for the Assist-1 nozzle is an average cost of new nozzles certified by California for use with the Hirt system. Costs were obtained from the manufacturers of the nozzles used with this system (I-E-28, I-F-110, and I-F-111). The prices ranged from $157 to $198, and thus the average unit price of $178 was used.

The Assist-2 nozzle unit cost shown in Tables B-3 through B-7 is the actual cost of the Husky Model HP-2 nozzle (I-F-106).

While rebuilt nozzles are available as replacement equipment, new nozzle prices were used in the estimation of costs because information on the use and durability of rebuilt nozzles was not available to EPA when these costs were being collected.

B.2.1.3 Dispenser Installation Costs

The balance system costs were obtained from one contractor (I-E-46) who estimated that it would take 2 man-days to install all aboveground equipment at a two-island six-nozzle station. The following shows the information obtained and how the unit costs for a balance system were calculated:

2 man-days at $200/day	= $400,
Profit (20%)	= $ 80,
Total cost for 6-nozzle station	= $480,
Unit cost for 1-nozzle station	= $ 80.

The Hybrid, Assist-1, and Assist-2 dispenser installation costs, obtained directly from the manufacturers of these systems, are $100, $45, and $50 per nozzle, respectively (I-E-25, I-E-35, and I-F-106).

B.2.1.4 Auxiliary Equipment and Installation

The auxiliary items for the Assist-1 and Assist-2 systems include a pressure/vacuum (P/V) valve, blower collection unit, and processing unit. The costs for these items and their installation were obtained directly from the system manufacturers (I-E-35 and I-F-106). The costs for auxiliary items for Assist-1 and Assist-2 systems are $3,975 and $3,900, respectively, while the installation of these items costs $1,400 and $1,200, respectively.

B.2.2 Underground Costs

To estimate the costs of the underground piping systems, the layout of each model plant had to be determined. A representative equipment configuration was then determined for each model plant and, for each configuration, costs were estimated.

B.2.2.1 Station Layout and Equipment Configuration

A survey of about 40 service stations was performed around the Research Triangle Park area in North Carolina. No one specific layout was a rule for a specific model plant, but general tendencies in design and average distances between islands, storage tanks, and stations were determined. The general design guidelines chosen to establish the layout of each model plant are as follows:

1. The storage tanks are approximately 50 feet away from the main service island.
2. There is approximately 24 feet between adjacent service islands and station building.
3. Vent risers were typically located on the side of the station building.

Figures B-8 through B-12 incorporate these guidelines to provide a "reasonable" service station layout for each model plant. An infinite number of layouts is possible; however, the layouts presented supply the necessary means to calculate reasonable costs for the underground piping systems.

After the model plant layouts were determined, the underground piping was designed. Several guidelines were used:

1. Vapor recovery lines are located away from product lines as much as possible to avoid disruption of the existing product lines (I-E-39).

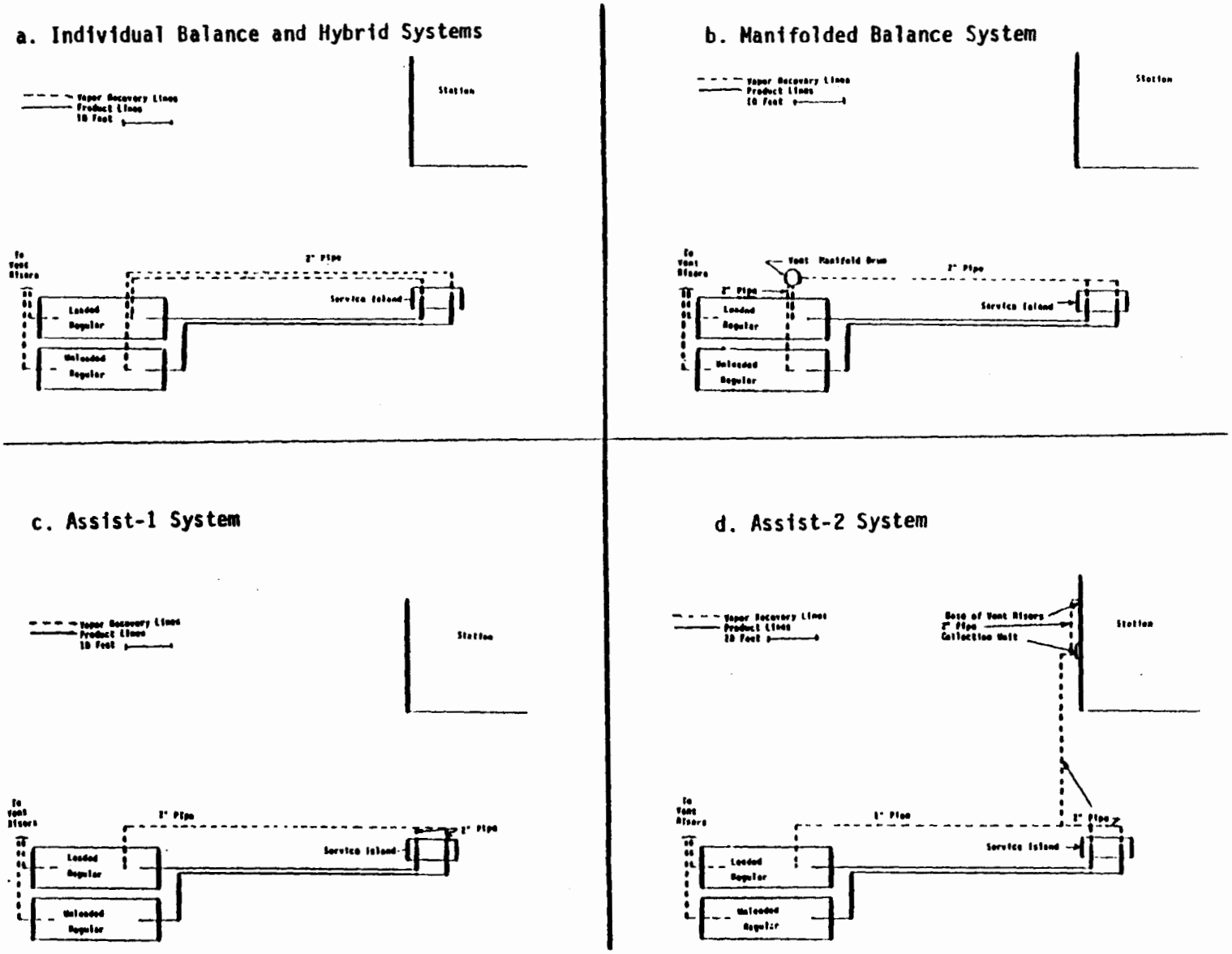
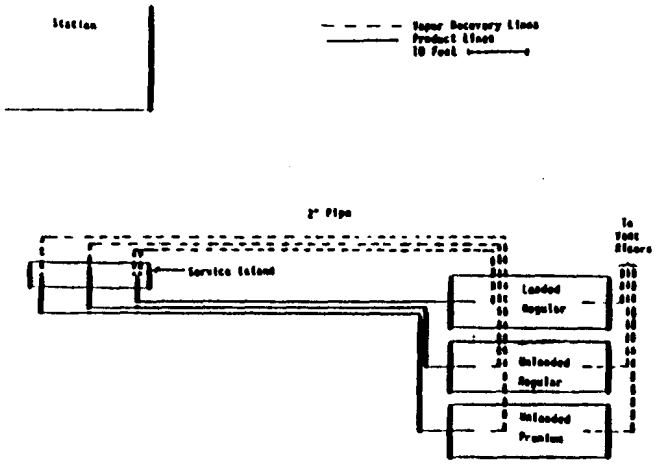
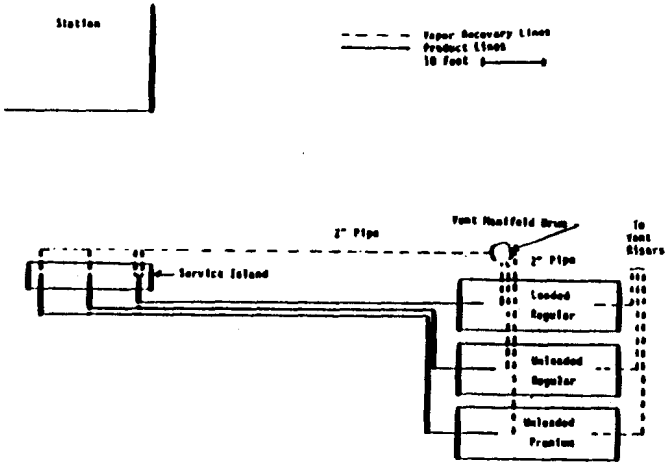


Figure B-8. Stage II Underground Piping Layouts for Model Plant 1

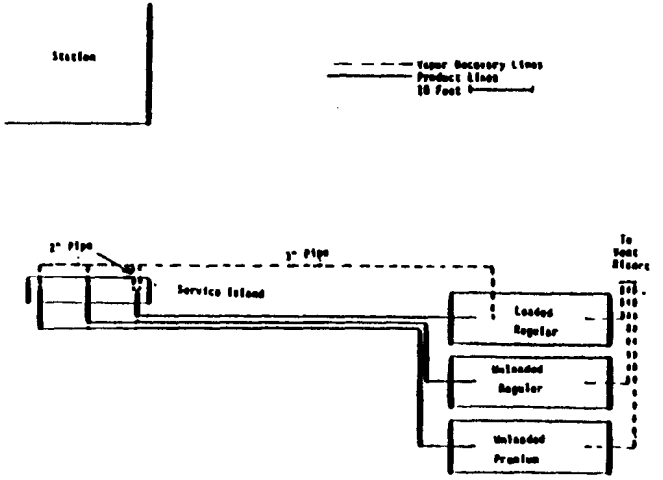
a. Individual Balance and Hybrid Systems



b. Manifolded Balance System



c. Assist-1 System



d. Assist-2 System

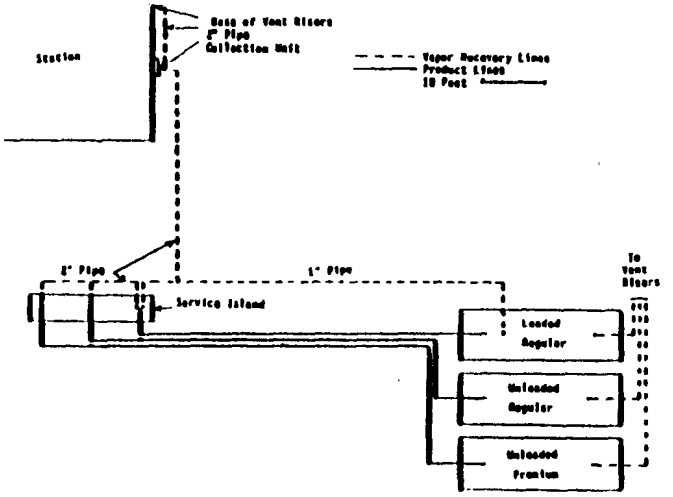


Figure B-9 Stage II Underground Piping Layouts for Model Plant 2

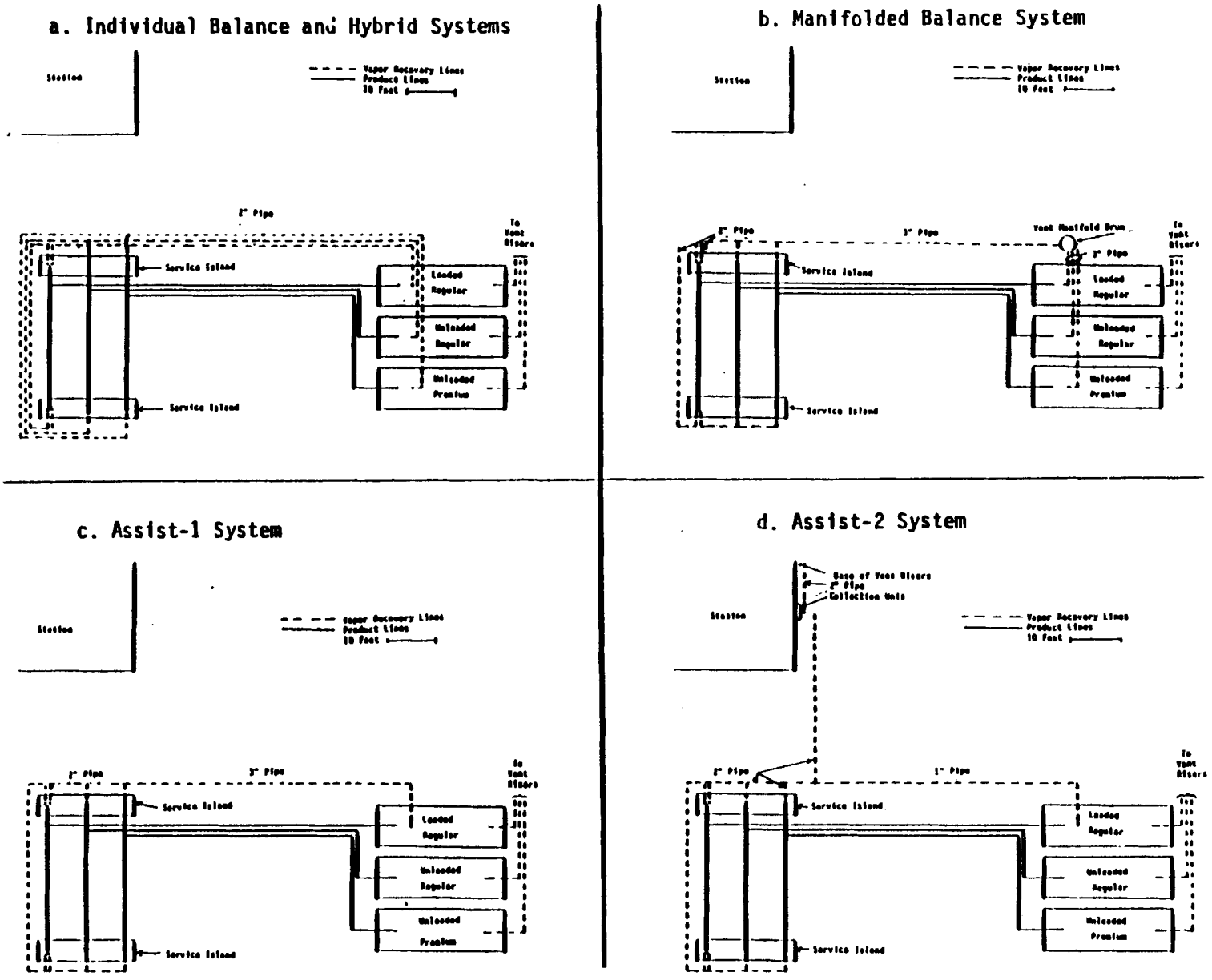
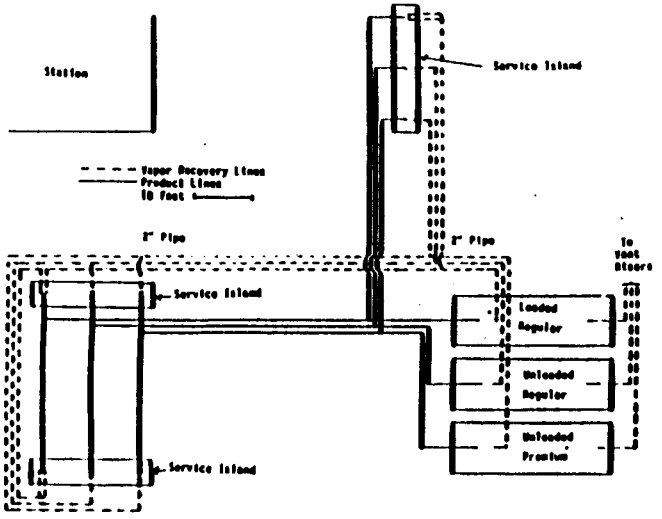
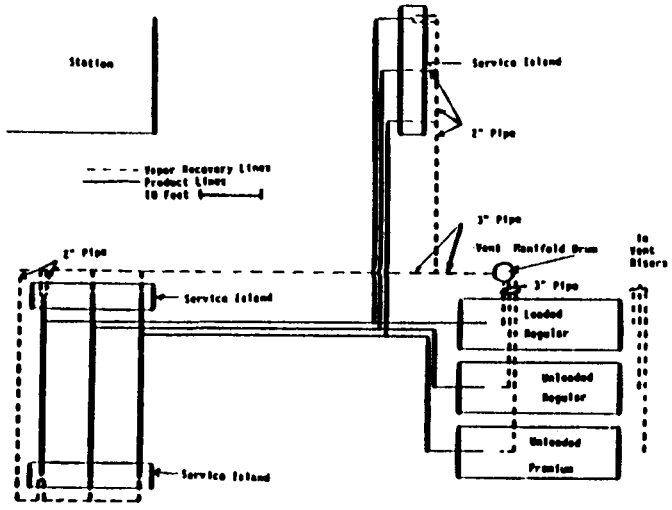


Figure B-10. Stage II Underground Piping Layouts for Model Plant 3

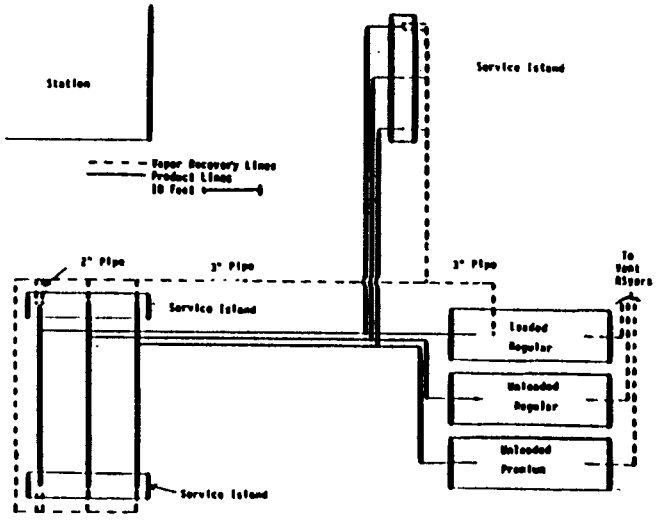
a. Individual Balance and Hybrid Systems



b. Manifolded Balance System



c. Assist-1 System



d. Assist-2 System

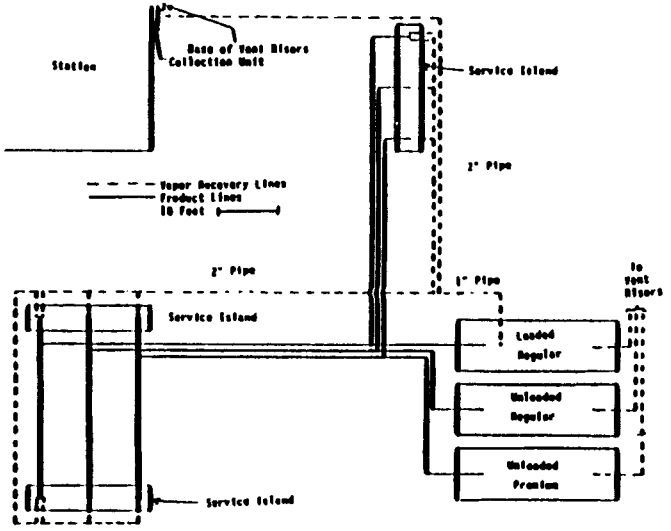
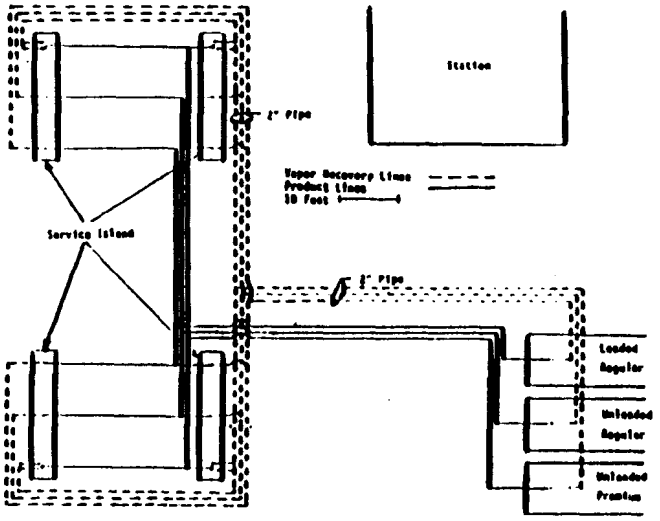
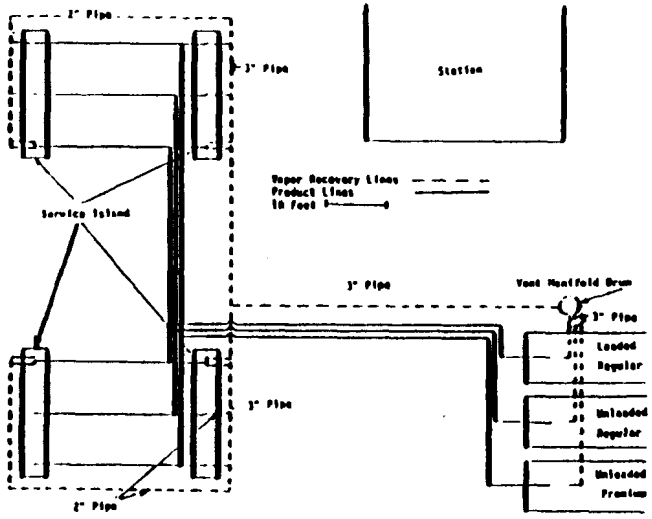


Figure B-11. Stage II Underground Piping Layouts for Model Plant A

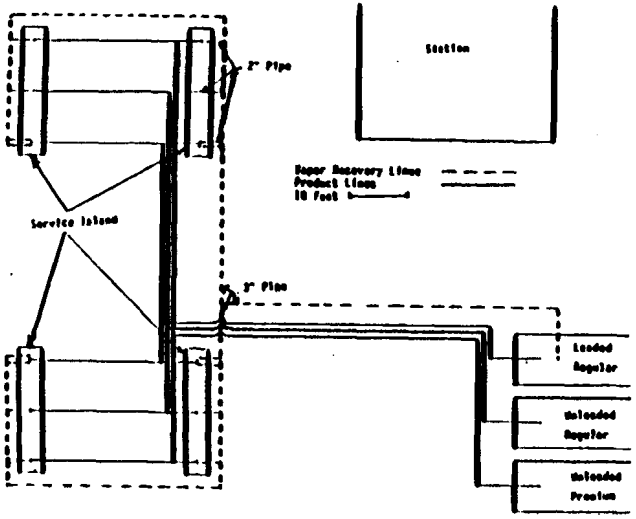
a. Individual Balance and Hybrid Systems



b. Manifolded Balance System



c. Assist-1 System



d. Assist-2 System

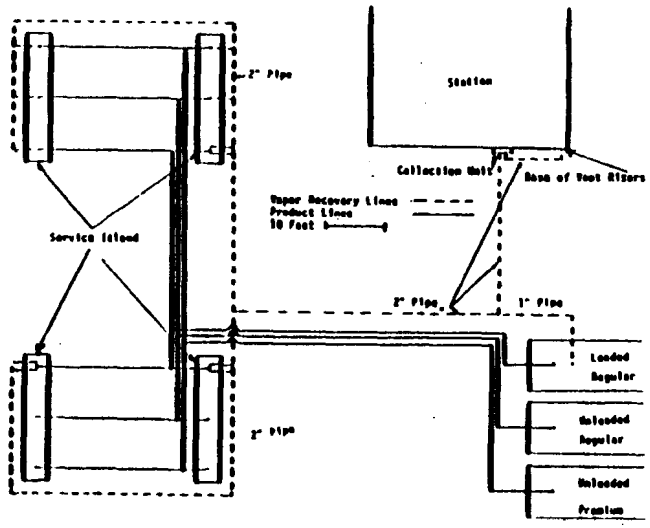


Figure B-12. Stage II Underground Piping Layouts for Model Plant 5

2. One trench holds one or more vapor recovery lines.
3. Maximum pipe lengths equal 20 feet (for determination of the number of pipe couplings) (I-E-34).
4. Pipe sizes were obtained from applicable California Executive Orders (I-F-114, I-F-115, I-F-116, and I-F-117).

B.2.2.2 Underground Equipment Costs

Tables B-9 through B-13 present the underground piping costs on a model plant basis, as depicted by Figures B-8 through B-12. All unit costs for pipe (galvanized and fiberglass) were obtained from pipe vendors in the Research Triangle Park area of North Carolina (I-E-33 and I-E-34). In addition, one salesman stated that his company typically gives a 15 percent discount on all components purchased by major plumbing contractors (I-E-33). For estimating purposes, it was assumed that the companies installing the underground piping would be major contractors, so the unit costs shown have been discounted 15 percent.

A complete breakdown of parts and prices is provided to enable the costing of various piping layouts; however, the trench length of the system is the overriding cost factor (about 70 percent of the total costs of the underground system).

The cost of the vent manifold drum for the manifolded balance system is an engineering estimate; i.e., no specific quote could be obtained at this time.

Information received from contractors (I-E-40 and I-E-44) also indicated that approximately 20 percent (or fewer) of the tanks currently in use would need to be equipped with an extra bung to accept the Stage II vapor recovery line. The installed cost would be about $300/bung (I-E-52). Since all the model plants, except model plant 1, have three tanks, the cost of the bungs can be calculated as: 1 bung/tank x $300/bung x .20 x 3 tanks/model plant = $180/model plant. For model plant 1 the cost is: 1 bung/tank x $300/bung x .20 x 2 tanks/model plant = $120.

B.2.2.3 Underground Installation Costs

Installation costs can be determined for the underground equipment necessary for model plants 1 through 5 (Tables B-9 through B-13). The cost of laying piping for an individual balance system is the same as for a manifolded balance system. This is because the additional time it takes to assemble the two extra lines to the storage tanks for

TABLE B-9. MODEL PLANT 1 STAGE II UNDERGROUND DIRECT COST

UNDERGROUND COMPONENTS	UNIT COST	NUMBER OF COMPONENTS				
		BAL-I	BAL-M	HYBRID	ASSIST-1	ASSIST-2
GALVANIZED PIPE (a)						
1" PIPE (FT)	0.89	4	4	4	4	65
2" PIPE (FT)	1.88	1	1	1		
3" PIPE (FT)	3.86					
3/4" CLOSE NIPPLE	0.46	3	3	3	3	3
1" CLOSE NIPPLE	0.70	5	5	5	5	7
2" CLOSE NIPPLE	1.42	2	2	2		
3" CLOSE NIPPLE	5.41				2	
1" ELBOW	1.51	5	5	5	5	8
2" ELBOW	4.48	4	4	4		
3" ELBOW	20.11				2	
1" X 3/4" REDUCER	1.73	3	3	3	3	3
2" X 1" REDUCER	3.84	3	3	3	3	4
3" X 2" REDUCER	13.14					
2" X 1" BUSHING	2.81					1
4" X 2" BUSHING	11.09	2		2		1
4" X 3" BUSHING	11.09				1	
1" UNION	1.13					1
2" TEE	6.43					1
FIBERGLASS PIPE (b)						
2" PIPE (FT)	1.89	152	98	152	10	70
3" PIPE (FT)	2.89				73	
2" THREADED ADAPTER	7.23	5	5	5	3	5
3" THREADED ADAPTER	10.58				1	
2" ELBOW	16.41	4	2	4		4
3" ELBOW	22.82				2	
2" TEE	23.50	0	2	0		3
3" TEE	26.61		0		2	
2" COUPLING	4.68	5	2	5		3
3" COUPLING	7.23				2	
3" X 2" REDUCER	11.14		0		3	
GLUED JUNCTIONS	3.25	11	9	11	11	13
ADDITIONAL ITEMS (c)						
4" X 2" TANK BUSHING	2.61		2			
4" X 3" TANK BUSHING	2.61					
2" FLOAT CHECK VALVE	32.55		2			
VENT MANIFOLD DRUM (d)	500.00		1			
BUNGS (e)	120.00	1	1	1	1	1
LABOR COMPONENTS						
TRENCHING (FT) (f)	30.00	85	85	85	75	120
ASSEMBLY (FT) (g)	6.00	85	85	85	75	120
TOTAL PURCHASE COST		640	1,065	640	632	500
TOTAL INSTALLATION COST		3,060	3,060	3,060	2,700	4,320
TOTAL DIRECT COST		3,700	4,125	3,700	3,332	4,900

See footnotes next page.

FOOTNOTES FOR TABLE B-9

[a]Reference I-E-33.

[b]Reference I-E-34.

[c]Reference I-F-110.

[d]Unit cost is an estimated cost since no information on this was readily available.

[e]References I-E-40 and I-E-44 (see text for discussion).

[f]References I-E-41 and I-E-46 (see text for discussion).

[g]Reference I-E-46 (see text for discussion).

TABLE B-10. MODEL PLANT 2 STAGE II UNDERGROUND DIRECT COST

UNDERGROUND COMPONENTS	UNIT COST	NUMBER OF COMPONENTS				
		BAL-I	BAL-M	HYBRID	ASSIST-I	ASSIST-2
GALVANIZED PIPE (a)						
1" PIPE (FT)	0.89	5	5	5	5	66
2" PIPE (FT)	1.88	2	2	2		
3" PIPE (FT)	3.86					
3/4" CLOSE NIPPLE	0.46	3	3	3	3	3
1" CLOSE NIPPLE	0.78	7	7	7	7	9
2" CLOSE NIPPLE	1.42	3	3	3		
3" CLOSE NIPPLE	5.41				2	
1" ELBOW	1.51	7	7	7	7	10
2" ELBOW	4.48	6	6	6		
3" ELBOW	20.11				2	
1" X 3/4" REDUCER	1.73	3	3	3	3	3
2" X 1" REDUCER	3.84	3	3	3	3	4
3" X 2" REDUCER	13.14					
2" X 1" BUSHING	2.81					1
4" X 2" BUSHING	11.09	3		3		1
4" X 3" BUSHING	11.09				1	
1" UNION	1.13					1
2" TEE	6.43					1
FIBERGLASS PIPE (b)						
2" PIPE (FT)	1.89	271	138	271	13	83
3" PIPE (FT)	2.89				83	
2" THREADED ADAPTER	7.23	6	6	6	3	5
3" THREADED ADAPTER	10.58				2	
2" ELBOW	16.41	6	3	6		4
3" ELBOW	22.82				2	
2" TEE	23.58	0	2	0		3
3" TEE	26.61		0		2	
2" COUPLING	4.68	0	2	0		3
3" COUPLING	7.23				2	
3" X 2" REDUCER	11.14		0		3	
GLUED JUNCTIONS	3.25	17	12	17	13	15
ADDITIONAL ITEMS (c)						
4" X 2" TANK BUSHING	2.61		3			
4" X 3" TANK BUSHING	2.61					
2" FLOAT CHECK VALVE	32.55		3			
VENT MANIFOLD DRUM (d)	500.00		1			
BUNGS (e)	100.00	1	1	1	1	1
LABOR COMPONENTS						
TRENCHING (FT) (f)	30.00	105	105	105	85	130
ASSEMBLY (FT) (g)	6.00	105	105	105	85	130
TOTAL PURCHASE COST		1,034	1,313	1,034	789	782
TOTAL INSTALLATION COST		3,780	3,780	3,780	3,060	4,600
TOTAL DIRECT COST		4,814	5,093	4,814	3,849	5,382

those for Table B-9.

TABLE B-11. MODEL PLANT 3 STAGE II UNDERGROUND DIRECT COST

UNDERGROUND COMPONENTS	UNIT COST	NUMBER OF COMPONENTS				
		BAL-1	BAL-H	HYBRID	ASSIST-1	ASSIST-2
GALVANIZED PIPE (a)						
1" PIPE (FT)	0.89	10	10	10	10	71
2" PIPE (FT)	1.88	2		2		
3" PIPE (FT)	3.86		2			
3/4" CLOSE NIPPLE	0.46	7	7	7	7	7
1" CLOSE NIPPLE	0.70	13	13	13	13	15
2" CLOSE NIPPLE	1.42	3		3		
3" CLOSE NIPPLE	5.41		6		2	
1" ELBOW	1.51	13	13	13	13	16
2" ELBOW	4.48	6		6		
3" ELBOW	20.11		6		2	
1" X 3/4" REDUCER	1.73	7	7	7	7	7
2" X 1" REDUCER	3.84	7	7	7	7	8
3" X 2" REDUCER	13.14		3			
2" X 1" BUSHING	2.81					1
4" X 2" BUSHING	11.09	3		3		1
4" X 3" BUSHING	11.09				1	
1" UNION	1.13					1
2" TEE	6.43					1
FIBERGLASS PIPE (b)						
2" PIPE (FT)	1.89	476	86	476	26	156
3" PIPE (FT)	2.89		125		143	
2" THREADED ADAPTER	7.23	10	10	10	7	9
3" THREADED ADAPTER	10.58		3		1	
2" ELBOW	16.41	16	2	16		6
3" ELBOW	22.82		2		4	
2" TEE	23.50	3	2	3		7
3" TEE	26.61		3		6	
2" COUPLING	4.68	9	1	9		4
3" COUPLING	7.23		2		3	
3" X 2" REDUCER	11.14		4		7	
GLUED JUNCTIONS	3.25	34	26	34	26	24
ADDITIONAL ITEMS (c)						
4" X 2" TANK BUSHING	2.61					
4" X 3" TANK BUSHING	2.61		3			
2" FLOAT CHECK VALVE	32.55		3			
VENT MANIFOLD DRUM (d)	500.00		1			
BUNGS (e)	100.00	1	1	1	1	1
LABOR COMPONENTS						
TRENCHING (FT) (f)	30.00	165	165	165	140	185
ASSEMBLY (FT) (g)	6.00	165	165	165	140	185
TOTAL PURCHASE COST		1,779	2,053	1,779	1,253	1,046
TOTAL INSTALLATION COST		5,940	5,940	5,940	5,040	6,660
TOTAL DIRECT COST		7,719	7,993	7,719	6,293	7,706

Footnotes are the same as those for Table B-9.

TABLE B-12. MODEL PLANT 4 STAGE II UNDERGROUND DIRECT COST

UNDERGROUND COMPONENTS	UNIT COST	NUMBER OF COMPONENTS				
		BAL-1	BAL-H	HYBRID	ASSIST-1	ASSIST-2
GALVANIZED PIPE (a)						
1" PIPE (FT)	0.89	15	15	15	15	33
2" PIPE (FT)	1.88	2		2		
3" PIPE (FT)	3.86		2			
3/4" CLOSE NIPPLE	0.46	10	10	10	10	10
1" CLOSE NIPPLE	0.70	20	20	20	20	22
2" CLOSE NIPPLE	1.42	3		3		
3" CLOSE NIPPLE	5.41		6		2	
1" ELBOW	1.51	20	20	20	20	23
2" ELBOW	4.48	6		6		
3" ELBOW	20.11		6		2	
1" X 3/4" REDUCER	1.73	10	12	12	12	12
2" X 1" REDUCER	3.84	10	12	12	12	13
3" X 2" REDUCER	13.14		3			
2" X 1" BUSHING	2.81					1
4" X 2" BUSHING	11.09	3		3		1
4" X 3" BUSHING	11.09				1	
1" UNION	1.13					1
2" TEE	6.43					1
FIBERGLASS PIPE (b)						
2" PIPE (FT)	1.89	579	139	579	39	384
3" PIPE (FT)	2.89		125		183	
2" THREADED ADAPTER	7.23	13	13	13	10	12
3" THREADED ADAPTER	10.58		3		1	
2" ELBOW	16.41	22	3	22		7
3" ELBOW	22.82		2		5	
2" TEE	23.50	6	5	6		10
3" TEE	26.61		4		9	
2" COUPLING	4.68	11	2	11		8
3" COUPLING	7.23		2		4	
3" X 2" REDUCER	11.14		5		10	
GLUED JUNCTIONS	3.25	48	35	48	37	36
ADDITIONAL ITEMS (c)						
4" X 2" TANK BUSHING	2.61					
4" X 3" TANK BUSHING	2.61		3			
2" FLOAT CHECK VALVE	32.55		3			
VENT MANIFOLD DRUM (d)	500.00		1			
BUNGS (e)	100.00	1	1	1	1	1
LABOR COMPONENTS						
TRENCHING (FT) (f)	30.00	205	205	205	180	240
ASSEMBLY (FT) (g)	6.00	205	205	205	180	240
TOTAL PURCHASE COST		2,259	2,370	2,272	1,659	1,511
TOTAL INSTALLATION COST		7,380	7,380	7,380	6,480	8,640
TOTAL DIRECT COST		9,639	9,750	9,652	8,139	10,151

Footnotes are the same as those for Table B-9.

TABLE B-13. MODEL PLANT 5 STAGE II UNDERGROUND DIRECT COST

UNDERGROUND COMPONENTS	UNIT COST	NUMBER OF COMPONENTS				
		BAL-I	BAL-M	HYBRID	ASSIST-1	ASSIST-2
GALVANIZED PIPE (a)						
1" PIPE (FT)	0.89	24	24	24	24	44
2" PIPE (FT)	1.88	2		2		
3" PIPE (FT)	3.86		2			
3/4" CLOSE NIPPLE	0.46	16	16	16	16	16
1" CLOSE NIPPLE	0.70	33	33	33	33	35
2" CLOSE NIPPLE	1.42	3		3		
3" CLOSE NIPPLE	5.41		6		2	
1" ELBOW	1.51	33	33	33	33	36
2" ELBOW	4.48	6		6		
3" ELBOW	20.11		6		2	
1" X 3/4" REDUCER	1.73	16	16	16	16	16
2" X 1" REDUCER	3.84	16	16	16	16	17
3" X 2" REDUCER	13.14		3			
2" X 1" BUSHING	2.81					1
4" X 2" BUSHING	11.09	3		3		1
4" X 3" BUSHING	11.09				1	
1" UNION	1.13					1
2" TEE	6.43					1
FIBERGLASS PIPE (b)						
2" PIPE (FT)	1.89	797	185	797	65	331
3" PIPE (FT)	2.89		171		249	
2" THREADED ADAPTER	7.23	19	19	19	16	18
3" THREADED ADAPTER	10.58		3		1	
2" ELBOW	16.41	32	6	32		8
3" ELBOW	22.82		2		7	
2" TEE	23.58	12	6	12		16
3" TEE	26.61		9		15	
2" COUPLING	4.68	12	2	12		6
3" COUPLING	7.23		3		5	
3" X 2" REDUCER	11.14		10		16	
GLUED JUNCTIONS	3.25	72	57	72	60	48
ADDITIONAL ITEMS (c)						
4" X 2" TANK BUSHING	2.61					
4" X 3" TANK BUSHING	2.61		3			
2" FLOAT CHECK VALVE	32.55		3			
VENT MANIFOLD DRUM (d)	500.00		1			
BUNGS (e)	180.00	1	1	1	1	1
LABOR COMPONENTS						
TRENCHING (FT) (f)	30.00	265	265	265	245	280
ASSEMBLY (FT) (g)	6.00	265	265	265	245	280
TOTAL PURCHASE COST		3,180	3,041	3,180	2,381	1,874
TOTAL INSTALLATION COST		9,540	9,540	9,540	8,820	10,080
TOTAL DIRECT COST		12,720	12,581	12,720	11,201	11,954

Footnotes are the same as those for Table B-9.

the individual balance system (three lines from island to underground tank as opposed to one line for the manifolded system) is assumed equivalent to the additional time required to plumb the service islands when using the manifolded balance system (exact pipe lengths, sloping, additional pipe joints, etc.).

The physical characteristics of the trench for both the manifolded and individual balance systems are basically the same; therefore, the cost of trenching ($/ft) is the same for all systems.

Only two contractors provided the information necessary to determine the cost of installation for the underground piping (I-E-41 and I-E-46). All of those questioned, except one, said that a specific layout was needed before an estimate could be determined; the one exception said that he used a factor of $25 per foot of trench to estimate the cost of trenching (I-E-41).

Due to the time involved in preparing an estimate, only one contractor agreed to provide EPA with an approximate installation cost (I-E-46). The following is an estimate for installing the piping for model plant 3.

Day 1:	Dig Trench		$1,600
	4 man-days at	$200/day	
	1 backhoe-day at	$400/day	
	1 truck-day at	$400/day	
Days 2 & 3:	Lay Pipe		$ 800
	4 man-days at	$200/day	
	Modify Dispensers		$ 800*
	4 man-days at	$200/day	
Day 4:	Fill Trench and Pour Concrete		$1,750
	4 man-days at	$200/day	
	1 truck-day at	$400/day	
	pea gravel - 13 tons at $10/ton		
	concrete - 6 yds at $70/yd		
Day 5:	Lay Asphalt and Clean Up		$1,350
	3 man-days at	$200/day	
	1 truck-day at	$400/day	
	0.5 roller-day at	$400/day	
	asphalt - 5 tons at $30/ton		

Profit: 20-25 percent of total = 22.5%
Trench Length: 165 feet
Trenching = (1600 + 1750 + 1350)(1.225) = $5760/165 ft = $35/ft
Assembly = (800)(1.225) = $980/165 ft = $6/ft

*Not included in total.

The trenching cost estimate was calculated by averaging the above $35/ft and $25/ft value, previously discussed. The cost of pipe assembly was used as shown since $200/day for a pipefitter seemed reasonable. These figures were then combined with the model plant trench lengths (feet) to obtain the installation costs presented in Tables B-9 through B-13.

B.2.3 Summary of Capital Costs

The total capital cost of a control system is the sum of direct costs, indirect costs, and contingency costs. Direct costs include purchased equipment costs (i.e., control devices, auxiliary equipment, instrumentation and controls, and freight and taxes) and installation costs (i.e., foundation and supports, erection and handling, electrical, piping and insulation). Indirect costs consist of in-house engineering design and supervision costs, architect and engineering contractor expenses, contractor fees, construction fees, and preliminary testing costs. All indirect costs have been included in the installation costs, and freight and taxes were assumed to be included in the total purchased equipment costs obtained from control system vendors. Contingency costs include such fees as penalties incurred for failure to meet completion dates set out in performance specifications. Due to the nature of this analysis, contingency costs are not appropriate.

Table B-14 presents the direct cost summary for the five Stage II systems applied to the five model plants. This table summarizes the costs shown in Tables B-2 through B-7 and B-9 through B-13. As can be seen, the use of a single cost basis for a balance system and the use of a single cost basis for an assist system should not bias subsequent cost evaluation because the cost differences between individual and manifolded balance systems and between Assist-1 and Assist-2 systems are very small. In addition, the future installation ratio of these systems is not known.

B.2.4. Annual Costs and Cost Effectiveness

Table B-15 presents an annualized cost breakdown for the model plants. As was the case when determining capital costs, several assumptions had to be made. The following points should be noted in connection with Table B-15.

TABLE B-14. STAGE II DIRECT COST SUMMARY

COMPONENT	COST OF COMPONENT				
MODEL PLANT 1	BAL-I	BAL-M	HYBRID	ASSIST-1	ASSIST-2
DISPENSER PURCHASE COST	1,368	1,368	1,625	1,361	823
AUXILIARY PURCHASE COST	0	0	0	3,975	3,900
PIPING PURCHASE COST	640	1,065	640	632	580
TOTAL PURCHASE COST	2,010	2,430	2,260	5,970	5,300
INSTALLATION COST	3,260	3,260	3,310	4,210	5,650
TOTAL DIRECT COST	5,270	5,690	5,570	10,180	10,950
MODEL PLANT 2					
DISPENSER PURCHASE COST	1,780	1,780	2,110	1,770	1,070
AUXILIARY PURCHASE COST	0	0	0	3,975	3,900
PIPING PURCHASE COST	1,034	1,313	1,034	789	702
TOTAL PURCHASE COST	2,810	3,090	3,140	6,530	5,670
INSTALLATION COST	4,040	4,040	4,110	4,610	6,040
TOTAL DIRECT COST	6,850	7,130	7,250	11,140	11,710
MODEL PLANT 3					
DISPENSER PURCHASE COST	3,560	3,560	4,230	3,540	2,140
AUXILIARY PURCHASE COST	0	0	0	3,975	3,900
PIPING PURCHASE COST	1,780	2,050	1,780	1,250	1,050
TOTAL PURCHASE COST	5,340	5,610	6,010	8,770	7,090
INSTALLATION COST	6,460	6,460	6,590	6,730	8,190
TOTAL DIRECT COST	11,800	12,070	12,600	15,500	15,280
MODEL PLANT 4					
DISPENSER PURCHASE COST	5,330	5,330	6,340	5,310	3,210
AUXILIARY PURCHASE COST	0	0	0	3,975	3,900
PIPING PURCHASE COST	2,260	2,370	2,270	1,660	1,510
TOTAL PURCHASE COST	7,590	7,700	8,610	10,950	8,620
INSTALLATION COST	8,160	8,160	8,360	8,320	10,330
TOTAL DIRECT COST	15,750	15,860	16,970	19,270	18,950
MODEL PLANT 5					
DISPENSER PURCHASE COST	8,890	8,890	10,560	8,850	5,350
AUXILIARY PURCHASE COST	0	0	0	3,975	3,900
PIPING PURCHASE COST	3,180	3,040	3,180	2,380	1,870
TOTAL PURCHASE COST	12,070	11,930	13,740	15,210	11,120
INSTALLATION COST	10,840	10,840	11,170	10,950	12,090
TOTAL DIRECT COST	22,910	22,770	24,910	26,160	23,210

TABLE B-15. STAGE II ANNUAL COST SUMMARY

COMPONENT/SYSTEM (a)	BAL-I	BAL-M	HYBRID	ASSIST-1	ASSIST-2
CAPITAL RECOVERY COST (b)					
MODEL PLANT 1	677	722	735	1,630	1,640
MODEL PLANT 2	881	910	960	1,770	1,740
MODEL PLANT 3	1,560	1,590	1,710	2,380	2,220
MODEL PLANT 4	2,150	2,160	2,370	2,930	2,700
MODEL PLANT 5	3,230	3,210	3,600	3,960	3,350
MAINTENANCE COST (c)					
MODEL PLANT 1	475	475	497	465	406
MODEL PLANT 2	617	617	646	575	498
MODEL PLANT 3	1,234	1,234	1,292	1,050	897
MODEL PLANT 4	1,852	1,852	1,938	1,525	1,295
MODEL PLANT 5	3,086	3,086	3,230	2,475	2,091
INSPECTION COST (d)					
MODEL PLANT 1	0	0	0	0	0
MODEL PLANT 2	0	0	0	0	0
MODEL PLANT 3	0	0	0	0	0
MODEL PLANT 4	0	0	0	0	0
MODEL PLANT 5	0	0	0	0	0
OTHER INDIRECT COSTS (e)					
MODEL PLANT 1	211	228	223	407	438
MODEL PLANT 2	274	285	290	446	468
MODEL PLANT 3	472	483	504	620	611
MODEL PLANT 4	630	635	679	771	758
MODEL PLANT 5	916	911	996	1,046	928
RECOVERY CREDITS (f)					
MODEL PLANT 1	129	129	129	65	65
MODEL PLANT 2	518	518	518	259	259
MODEL PLANT 3	906	906	906	453	453
MODEL PLANT 4	1,683	1,683	1,683	841	841
MODEL PLANT 5	4,790	4,790	4,790	2,395	2,395
ADDITIONAL CREDITS (g)					
MODEL PLANT 1	0	0	0	0	0
MODEL PLANT 2	0	0	0	0	0
MODEL PLANT 3	0	0	0	0	0
MODEL PLANT 4	0	0	0	0	0
MODEL PLANT 5	0	0	0	0	0
TOTAL ANNUALIZED COST					
MODEL PLANT 1	1,230	1,300	1,330	2,440	2,420
MODEL PLANT 2	1,250	1,290	1,380	2,530	2,450
MODEL PLANT 3	2,360	2,400	2,600	3,600	3,270
MODEL PLANT 4	2,950	2,960	3,300	4,380	3,910
MODEL PLANT 5	2,440	2,420	3,040	5,090	3,970

See next page for footnotes.

FOOTNOTES FOR TABLE B-15

[a]Bal-I = Balance-Individual, Bal-M = Balance-Manifolded, Assist-1 = Hirt; Assist-2 = Hasstech; Hybrid = Healy.

[b]Capital Recovery Cost = (Capital Cost) $\frac{i\,(1+i)^a}{(1+i)^a - 1}$

where: i = interest rate (10 percent)
a = equipment life (8 years for dispenser and auxiliary equipment; 35 years for underground piping system)

[c]1. Nozzle Maintenance - All Systems.
Replace nozzle every 2 years with new nozzle (same lifetime as standard nozzle); therefore, annual cost equals half the incremental cost between standard nozzle ($50) and vapor recovery nozzle (see Table B-3 for costs). For multiproduct dispensers, the nozzles are assumed to last twice as long; therefore, maintenance costs are half ($25).

2. Hose Maintenance - All Systems.
Replace vapor hose every 2 years (same lifetime as liquid hose on standard dispenser); therefore, annual cost equals half the incremental cost between standard liquid hose ($24.39) and coaxial liquid/vapor recovery hose system ($110.73 from Exhibits 8-10, Table B-2).

3. Boot/Faceplate Assembly Maintenance - Balance Systems.
Replace boot/faceplate assembly three times per year; parts cost $19 per replacement and it takes 20 minutes per replacement at $25 per hour.

4. Boot/Faceplate Assembly Maintenance - Assist Systems.
Replace boot/faceplate assembly two times per year; parts cost $15 per replacement and it takes 20 minutes per replacement at $25 per hour.

5. Boot/Faceplate Assembly Maintenance - Hybrid Systems.
Replace boot/faceplate assembly two times per year; parts cost $33 per replacement and it takes 20 minutes per replacement at $25 per hour.

6. Processing Unit Maintenance - Assist Systems.
Maintenance performed once a year by a qualified professional at a cost of $100 per visit.

[d]This expense is included in the government enforcement costs, and thus, it is not attributable to the model plant annual cost.

[e]Value includes property tax (1%), insurance (1%), and administration (2%), equalling 4 percent of the total capital cost.

FOOTNOTES FOR TABLE B-15
(concluded)

[f]Stage II recovery credit calculations:

Balance and Hybrid

Emission factors: Displacement = 1,552 mg/liter
Emptying loss = 120 mg/liter

Assuming 95% recovery of both displacement and emptying losses,

recovery factor = (0.95)[(1,552 + 120)mg/liter] =

1,588 mg/liter.

Example of recovery credit:

$$1{,}588 \text{ mg/liter} \times 75{,}700^{*} \frac{\text{liters}}{\text{mo.}} \times \frac{\text{kg}}{10^{6}\text{mg}} \times \frac{\text{liter}}{0.67\text{kg}} \times \frac{12 \text{ mo.}}{\text{yr}} \times \$0.24/\text{liter}$$

= $518/year.

Assist 1 & 2

Same emission factors as above.

Assuming 50% recovery of balance system losses, recovery factor =

(0.50)(0.95)(1,552 mg/liter + 120 mg/liter) = 794 mg/liter.

Example of recovery credit:

$$794 \text{ mg/liter} \times 75{,}700^{*} \frac{\text{liters}}{\text{mo.}} \times \frac{\text{kg}}{10^{6}\text{mg}} \times \frac{\text{liter}}{0.67\text{kg}} \times \frac{12 \text{ mo.}}{\text{yr}} \times \$0.24/\text{liter}$$

= $259/year.

Throughout this analysis, the Model Plant 1 throughput used was 5,000 gallons per month to allow a comparison with the July 1984 analysis. However, the new analysis uses recovery credits based on Model Plant 1a (2,000 gallons per month) and Model Plant 1b (6,000 gallons per month) when calculating nationwide or nonattainment area cost impacts.

[g]No additional credits taken. These could include investment tax credits or energy conservation tax credits.

*Throughput for model plant 2.

1. Discussions with dispenser equipment vendors and the manufacturers of the two assist systems indicated that the additional dispenser equipment needed for Stage II (retractors, flow limiters, hanger kits) and the processing unit equipment will last a minimum of 5 years and should last about 10 years; 8 years was assumed for capital recovery calculation purposes (I-D-45, I-E-22, I-E-23, and I-E-25).
2. Several vendors of fiberglass piping, used quite often for vapor recovery piping in California, were contacted about the expected life of fiberglass pipe used in underground situations. All vendors contacted, except one, indicated that there was no reason why the pipe should ever need replacing (I-E-37 and I-E-38). One indicated that it would last at least 30 years (I-E-38). For purposes of this analysis, the underground piping lifetime for fiberglass pipe was estimated to be 35 years.
3. Additional credits that could be included in the calculation of "Total Annualized Cost" are, for example, investment tax credits or energy conservation tax credits. However, these are not included in this analysis.
4. Rebuilt nozzles were not included in the maintenance scenario due to insufficient data on their use at this time.
5. Currently, the annualized costs do not include enforcement costs. These costs are calculated separately and on a nationwide basis, and are included in the regulatory strategy analysis.
6. The assumptions shown in the Table B-15 footnotes were made to calculate maintenance costs. These assumptions are based on conversations with vendors of Stage II equipment (I-E-20, I-E-22, I-E-24, I-E-26, I-E-27, and I-E-29).
7. Recovery credits are calculated as shown in footnote (f) of Table B-15, using a displacement emission factor of 1,552 mg/liter and an emptying loss emission factor of 120 mg/liter. Also, the cost credit for a liter of gasoline is based on $0.24/liter gasoline ($0.91/gallon).

For balance and hybrid systems, a 95 percent recovery o. both displacement and emptying losses was assumed, while for the assist systems a 50 percent recovery of balance system displacement and emptying losses was assumed. These are theoretical efficiencies used for the purpose of determining per-facility costs. For the regulatory analyses, actual in-use efficiencies were used to calculate recovery credits.

8.3 SUMMARY

Detailed costs were obtained for the five basic Stage II vapor recovery systems. The costs for the two balance systems and the costs for the two assist systems compared favorably enough that a single cost could be used for either balance system and for either assist system. The average cost of the two assist systems was taken to represent a generic cost for the assist system, since the future installation ratio of Assist-1 to Assist-2 systems is not known. Table 8-16 presents the generic capital cost summary for each Stage II system type on a model plant basis. These costs are used to compute generic annualized costs on a model plant basis, as shown in Table 8-17.

Information gathered also indicated that discounts on nozzles and modification equipment of approximately 30 percent are available to large volume buyers (I-E-18, I-E-24, I-E-26, and I-E-27). Table 8-18 shows the generic Stage II capital cost summary with this 30 percent discount included. Table 8-18 is used to calculate Table 8-19, which shows the generic annualized cost summary including the 30 percent discount.

8.4 INSTALLATION OF STAGE II VAPOR RECOVERY SYSTEMS DURING THE CONSTRUCTION OF A NEW FACILITY

The additional dispenser costs incurred due to the installation of a Stage II system during the construction of a new facility are shown in Table 8-20. This table is the same as Table 8-2 except that incremental costs above the purchase of conventional refueling equipment were used.

The following specific changes were made:

1) The cost of a single nozzle swivel ($32.75 for an OPW-33 nozzle swivel, I-F-110) was subtracted from the cost of the vapor recovery swivel.

Table 8-16. GENERIC STAGE II CAPITAL COST SUMMARY: NO DISCOUNTS
(Retrofit to Existing Facility)

COMPONENT	COST OF COMPONENT		
MODEL PLANT 1	BALANCE	HYBRID	ASSIST
DISPENSER DIRECT COST	1,568	1,880	1,211
AUXILIARY DIRECT COST	0	0	5,238
PIPING DIRECT COST	3,910	3,700	4,120
TOTAL DIRECT COST	5,480	5,580	10,570
TOTAL INDIRECT COST	0	0	0
TOTAL CAPITAL COST	5,480	5,580	10,570
MODEL PLANT 2			
DISPENSER DIRECT COST	2,040	2,440	1,570
AUXILIARY DIRECT COST	0	0	5,238
PIPING DIRECT COST	4,950	4,810	4,620
TOTAL DIRECT COST	6,990	7,250	11,430
TOTAL INDIRECT COST	0	0	0
TOTAL CAPITAL COST	6,990	7,250	11,430
MODEL PLANT 3			
DISPENSER DIRECT COST	4,080	4,880	3,150
AUXILIARY DIRECT COST	0	0	5,238
PIPING DIRECT COST	7,860	7,720	7,000
TOTAL DIRECT COST	11,940	12,600	15,390
TOTAL INDIRECT COST	0	0	0
TOTAL CAPITAL COST	11,940	12,600	15,390
MODEL PLANT 4			
DISPENSER DIRECT COST	6,110	7,310	4,720
AUXILIARY DIRECT COST	0	0	5,238
PIPING DIRECT COST	9,690	9,650	9,140
TOTAL DIRECT COST	15,800	16,960	19,100
TOTAL INDIRECT COST	0	0	0
TOTAL CAPITAL COST	15,800	16,960	19,100
MODEL PLANT 5			
DISPENSER DIRECT COST	10,190	12,190	7,870
AUXILIARY DIRECT COST	0	0	5,238
PIPING DIRECT COST	12,650	12,720	11,580
TOTAL DIRECT COST	22,840	24,910	24,690
TOTAL INDIRECT COST	0	0	0
TOTAL CAPITAL COST	22,840	24,910	24,690

Table B-17. GENERIC STAGE II ANNUAL COST SUMMARY: NO DISCOUNTS
(Retrofit to Existing Facility)

COMPONENT	ANNUAL COST OF COMPONENT		
	BALANCE	HYBRID	ASSIST
MODEL PLANT 1			
CAPITAL RECOVERY COST	700	735	1,640
MAINTENANCE COST	475	497	436
INSPECTION COST	0	0	0
OTHER INDIRECT COSTS	220	223	423
RECOVERY CREDIT	129	129	65
ADDITIONAL CREDITS	0	0	0
TOTAL ANNUALIZED COST	1,270	1,330	2,430
MODEL PLANT 2			
CAPITAL RECOVERY COST	896	960	1,760
MAINTENANCE COST	617	646	537
INSPECTION COST	0	0	0
OTHER INDIRECT COSTS	280	290	457
RECOVERY CREDIT	518	518	259
ADDITIONAL CREDITS	0	0	0
TOTAL ANNUALIZED COST	1,280	1,380	2,500
MODEL PLANT 3			
CAPITAL RECOVERY COST	1,580	1,710	2,300
MAINTENANCE COST	1,230	1,292	970
INSPECTION COST	0	0	0
OTHER INDIRECT COSTS	478	504	616
RECOVERY CREDIT	906	906	453
ADDITIONAL CREDITS	0	0	0
TOTAL ANNUALIZED COST	2,380	2,600	3,430
MODEL PLANT 4			
CAPITAL RECOVERY COST	2,160	2,370	2,820
MAINTENANCE COST	1,852	1,938	1,410
INSPECTION COST	0	0	0
OTHER INDIRECT COSTS	633	679	765
RECOVERY CREDIT	1,683	1,683	841
ADDITIONAL CREDITS	0	0	0
TOTAL ANNUALIZED COST	2,960	3,300	4,150
MODEL PLANT 5			
CAPITAL RECOVERY COST	3,220	3,600	3,660
MAINTENANCE COST	3,090	3,230	2,280
INSPECTION COST	0	0	0
OTHER INDIRECT COSTS	914	996	987
RECOVERY CREDIT	4,790	4,790	2,400
ADDITIONAL CREDITS	0	0	0
TOTAL ANNUALIZED COST	2,430	3,040	4,530

Table B-18. GENERIC STAGE II CAPITAL COST SUMMARY: WITH DISCOUNTS
(Retrofit to Existing Facility)

COMPONENT	COST OF COMPONENT		
MODEL PLANT 1	BALANCE	HYBRID	ASSIST
DISPENSER DIRECT COST	1,157	1,390	883
AUXILIARY DIRECT COST	0	0	5,238
PIPING DIRECT COST	3,910	3,700	4,120
TOTAL DIRECT COST	5,070	5,090	10,240
TOTAL INDIRECT COST	0	0	0
TOTAL CAPITAL COST	5,070	5,090	10,240
MODEL PLANT 2			
DISPENSER DIRECT COST	1,500	1,800	1,150
AUXILIARY DIRECT COST	0	0	5,238
PIPING DIRECT COST	4,950	4,810	4,620
TOTAL DIRECT COST	6,450	6,610	11,010
TOTAL INDIRECT COST	0	0	0
TOTAL CAPITAL COST	6,450	6,610	11,010
MODEL PLANT 3			
DISPENSER DIRECT COST	3,010	3,610	2,300
AUXILIARY DIRECT COST	0	0	5,238
PIPING DIRECT COST	7,860	7,720	7,000
TOTAL DIRECT COST	10,870	11,330	14,540
TOTAL INDIRECT COST	0	0	0
TOTAL CAPITAL COST	10,870	11,330	14,540
MODEL PLANT 4			
DISPENSER DIRECT COST	4,510	5,410	3,440
AUXILIARY DIRECT COST	0	0	5,238
PIPING DIRECT COST	9,690	9,650	9,140
TOTAL DIRECT COST	14,200	15,060	17,820
TOTAL INDIRECT COST	0	0	0
TOTAL CAPITAL COST	14,200	15,060	17,820
MODEL PLANT 5			
DISPENSER DIRECT COST	7,520	9,020	5,740
AUXILIARY DIRECT COST	0	0	5,238
PIPING DIRECT COST	12,650	12,720	11,580
TOTAL DIRECT COST	20,170	21,740	22,560
TOTAL INDIRECT COST	0	0	0
TOTAL CAPITAL COST	20,170	21,740	22,560

Table B-19. GENERIC STAGE II ANNUAL COST SUMMARY: WITH DISCOUNTS
(Retrofit to Existing Facility)

COMPONENT	ANNUAL COST OF COMPONENT		
	BALANCE	HYBRID	ASSIST
MODEL PLANT 1			
CAPITAL RECOVERY COST	623	644	1,580
MAINTENANCE COST	475	497	436
INSPECTION COST	0	0	0
OTHER INDIRECT COSTS	203	204	410
RECOVERY CREDIT	129	129	65
ADDITIONAL CREDITS	0	0	0
TOTAL ANNUALIZED COST	1,170	1,220	2,360
MODEL PLANT 2			
CAPITAL RECOVERY COST	832	880	1,710
MAINTENANCE COST	617	646	537
INSPECTION COST	0	0	0
OTHER INDIRECT COSTS	266	273	446
RECOVERY CREDIT	518	518	259
ADDITIONAL CREDITS	0	0	0
TOTAL ANNUALIZED COST	1,200	1,280	2,430
MODEL PLANT 3			
CAPITAL RECOVERY COST	1,380	1,480	2,140
MAINTENANCE COST	1,230	1,292	970
INSPECTION COST	0	0	0
OTHER INDIRECT COSTS	435	453	581
RECOVERY CREDIT	906	906	453
ADDITIONAL CREDITS	0	0	0
TOTAL ANNUALIZED COST	2,140	2,320	3,240
MODEL PLANT 4			
CAPITAL RECOVERY COST	1,860	2,010	2,580
MAINTENANCE COST	1,852	1,938	1,410
INSPECTION COST	0	0	0
OTHER INDIRECT COSTS	569	602	713
RECOVERY CREDIT	1,683	1,683	841
ADDITIONAL CREDITS	0	0	0
TOTAL ANNUALIZED COST	2,600	2,870	3,860
MODEL PLANT 5			
CAPITAL RECOVERY COST	2,720	3,010	3,260
MAINTENANCE COST	3,090	3,230	2,280
INSPECTION COST	0	0	0
OTHER INDIRECT COSTS	807	870	902
RECOVERY CREDIT	4,790	4,790	2,400
ADDITIONAL CREDITS	0	0	0
TOTAL ANNUALIZED COST	1,830	2,320	4,040

TABLE B-20. BALANCE DISPENSE MODIFICATION EQUIPMENT PURCHASE COST[a]
(New Facility)

	COST OF COMPONENT		
EXHIBIT 4	LOW	HIGH	AVERAGE
HIGH HOSE RETRACTOR	94.00	102.50	96.08
SWIVELS-NOZZLES	9.65	42.25	22.12
SWIVELS-ISL OR DISP	21.50	21.50	21.50
SWIVELS-RETRACT	0.00	0.00	0.00
FLOW LIMITER	20.00	20.00	20.00
HOSE	13.50	35.28	24.39
DISP-HOOK & HANDLE	16.00	38.00	27.00
TOTAL PURCHASE COST	174.65	259.53	211.09
EXHIBIT 5			
	LOW	HIGH	AVERAGE
HIGH HOSE RETRACTOR	94.00	102.50	96.08
SWIVELS-NOZZLES	7.25	26.05	16.65
SWIVELS-ISL OR DISP	41.55	64.85	53.20
SWIVELS-RETRACT	8.08	8.08	8.08
FLOW LIMITER	20.00	20.00	20.00
HOSE	75.61	75.61	75.61
DISP-HOOK & HANDLE	16.00	38.00	27.00
TOTAL PURCHASE COST	262.49	335.09	296.62
EXHIBIT 6			
	LOW	HIGH	AVERAGE
HIGH HOSE RETRACTOR	94.00	102.50	96.08
SWIVELS-NOZZLES	9.65	42.25	22.12
SWIVELS-ISL OR DISP	21.50	21.50	21.50
SWIVELS-RETRACT	0.00	0.00	0.00
FLOW LIMITER	20.00	20.00	20.00
HOSE	44.56	55.45	50.00
DISP-HOOK & HANDLE	16.00	38.00	27.00
TOTAL PURCHASE COST	205.71	279.70	236.70
EXHIBIT 7			
	LOW	HIGH	AVERAGE
HIGH HOSE RETRACTOR	94.00	102.50	96.08
SWIVELS-NOZZLES	9.65	42.25	22.12
SWIVELS-ISL OR DISP	0.00	0.00	0.00
SWIVELS-RETRACT	8.08	8.08	8.08
FLOW LIMITER	20.00	20.00	20.00
HOSE	13.50	35.28	24.39
DISP-HOOK & HANDLE	16.00	38.00	27.00
TOTAL PURCHASE COST	161.23	246.11	197.67
AVG TOTAL PURCHASE COST	201.02	280.11	360.00

[a]See docket entries I-E-18, I-E-19, I-E-20, I-E-22, I-E-26, I-E-27, I-E-31, I-E-32, I-E-58, I-E-62, I-E-63, I-E-64, I-E-65, I-E-66, I-E-67, I-F-110, and I-F-111.

TABLE B-20. BALANCE DISPENSER MODIFICATION EQUIPMENT PURCHASE COST[a] (New Facility) (concluded)

Exhibit 8	Low	High	Avg.
Overhead Hose Retractor	94.00	102.50	96.08
Swivels for Nozzles	47.25	84.85	66.05
Swivels for Islands or Disp.	0.00	0.00	0.00
Swivel for Retractor	40.00	58.80	49.40
Flow Limiter	20.00	20.00	20.00
Hose	65.61	88.11	79.06
Liquid Removal Venturi	0.00	0.00	0.00
Dispenser Modification	38.00	55.00	46.50
	304.86	409.26	357.09

Exhibit 9	Low	High	Avg.
Overhead Hose Retractor	85.84	100.00	92.92
Swivels for Nozzles	47.25	84.85	66.05
Swivels for Islands or Disp.	0.00	0.00	0.00
Swivel for Retractor	40.00	58.80	49.40
Flow Limiter	20.00	20.00	20.00
Hose	70.61	94.36	84.53
Liquid Removal Venturi	0.00	0.00	0.00
Dispenser Modification	54.17	54.17	54.17
	317.87	412.18	367.07

Exhibit 10	Low	High	Avg.
Overhead Hose Retractor	0.00	0.00	0.00
Swivels for Nozzles	7.25	26.05	16.65
Swivels for Islands or Disp.	0.00	0.00	0.00
Swivel for Retractor	40.00	58.80	49.40
Flow Limiter	20.00	20.00	20.00
Hose	80.61	106.86	95.43
Liquid Removal Venturi	200.00	200.00	200.00
Dispenser Modification	54.17	54.17	54.17
	402.03	465.88	435.65

2) The cost of a single island or dispenser swivel ($17.25) was subtracted from the island or dispenser vapor recovery swivel cost. This subtracted cost is the average cost of the OPW-36E ($18.40), OPW-36S-5080 ($15.35), and the OPW-36S-5090 ($18.00) (I-F-110).
3) The cost of a single hose ($24.39) was subtracted from the coaxial hose cost shown in Exhibit 5.
4) For new facilities, it was assumed that 75 percent would use MPD's and 25 percent would use conventional dispensers.

Table B-21 shows the aboveground cost for the installation of a Stage II system during the construction of a new facility at model plant 2. This table is the same as Table B-4 except that the unit costs have changed as follows:

1) The nozzle cost for all the systems is the cost shown in Table B-4, minus the cost of a conventional nozzle ($50) (I-F-110 and I-F-111).
2) The modification equipment cost for a balance system is taken from Table B-20.
3) The modification cost for Assist-1 is the same as the balance cost plus the cost of a ball check valve ($17) (I-E-23).
4) The modification cost for the hybrid system includes the Model 100 jet pump, Model CX-6 adapter, Model S swivel, Model CX hoses, Model 143 control valve, and an installation kit, minus the cost of a single hose ($24.39) (I-E-25).
5) The installation cost for all systems is assumed to be zero. It was assumed that there would be no additional cost because the new dispensers would come equipped for Stage II.

The per-nozzle costs for model plants 1, 3, 4, and 5 are the same as those for model plant 2.

Table B-22 shows the underground cost incurred due to the installation of a Stage II system during the construction of a new facility at model plant 2. This table is the same as Table B-9 except it is assumed that there would be no additional cost for trenching since the product lines and vapor return lines could be put into the same trench, and no bungs are required since the tanks would already be equipped for Stage II. The same unit costs are used for piping lengths associated with model plants 1, 3, 4, and 5.

TABLE B-21. MODEL PLANT 2 STAGE II ABOVEGROUND DIRECT COST

ABOVEGROUND COMPONENTS	UNIT COST	NUMBER OF COMPONENTS				
		BAL-I	BAL-M	HYBRID	ASSIST-1	ASSIST-2
DISPENSER COMPONENTS						
NOZZLE BALANCE (a)	147	3.75	3.75			
NOZZLE HYBRID (b)	185			3.75		
NOZZLE ASSIST-1 (c)	129				3.75	
NOZZLE ASSIST-2 (d)	74					3.75
MOD EQUIP BALANCE (e)	360	3.75	3.75			
MOD EQUIP HYBRID (f)	411			3.75		
MOD EQUIP ASSIST-1 (g)	377				3.75	
MOD EQUIP ASSIST-2 (h)	205					3.75
AUXILIARY ITEMS (i)						
ASSIST-1	3,975				1.00	
ASSIST-2	3,900					1.00
INSTALLATION						
BALANCE DISPENSER	0	3.75	3.75			
HYBRID DISPENSER	0			3.75		
ASSIST-1 DISPENSER	0				3.75	
ASSIST-2 DISPENSER	0					3.75
ASSIST-1 AUXILIARY	1,400				1.00	
ASSIST-2 AUXILIARY	1,200					1.00
DISPENSER PURCHASE COST		1,901	1,901	2,159	1,892	1,046
AUX ITEMS PURCHASE COST		0	0	0	3,975	3,900
DISP INSTALLATION COST		0	0	0	3	3
AUX INSTALLATION COST		0	0	0	1,400	1,200
DISPENSER DIRECT COST		1,901	1,901	2,159	1,892	1,046
AUX ITEMS DIRECT COST		0	0	0	5,375	5,100
TOTAL DIRECT COST		1,901	1,901	2,159	7,267	6,146

(a) Average cost of nozzles certified by California for use with a balance system minus the cost of a normal nozzle ($50) (I-E-28, I-F-110, and I-F-111).

(b) Actual cost of the Healy Model 200 minus the cost of a normal nozzle ($50), (I-E-25).

(c) Average cost of the nozzles certified by California for use with the Hirt system minus the cost of a normal nozzle ($50), (I-E-28, I-F-110, and I-F-111).

(d) Actual cost of the Husky Model HP-2 nozzle minus the cost of a normal nozzle ($50), (I-F-106).

(e) Modification equipment includes the average cost of the high-hang retractor system, swivels, flow limiter, and hoses as certified by California (see Tables 1 and 20).

(f) Modification equipment includes the Model 100 jet pump, Model CX-6 adapter, Model S swivel, Model CX hose, Model 143 control valve, and an installation kit minus the cost of a single hose ($24.39), (I-E-25).

(g) Modification equipment includes the same equipment as listed for the balance system (footnote "f") plus a ball check valve (I-E-23 and Tables 1 and 2).

(h) Modification equipment includes the Hasstech vapor hose, ITT flow control valve, A.Y. McDonald impact valve, hose swivels, and Hasstech Model 1025 flame arrestor (I-F-106).

(i) Auxiliary equipment includes a P/V valve, collection unit, and processing unit (I-E-23).

TABLE B-22. MODEL PLANT 2 STAGE II UNDERGROUND DIRECT COST

UNDERGROUND COMPONENTS	UNIT COST	NUMBER OF COMPONENTS				
		BAL-I	BAL-M	HYBRID	ASSIST-1	ASSIST-2
GALVANIZED PIPE (a)						
1" PIPE (FT)	0.89	6	6	6	6	67
2" PIPE (FT)	1.88	2	2	2		
3" PIPE (FT)	3.86					
3/4" CLOSE NIPPLE	0.46	4	4	4	4	4
1" CLOSE NIPPLE	0.70	8	8	8	8	10
2" CLOSE NIPPLE	1.42	3	3	3		
3" CLOSE NIPPLE	5.41				2	
1" ELBOW	1.51	8	8	8	8	11
2" ELBOW	4.48	6	6	6		
3" ELBOW	20.11				2	
1" X 3/4" REDUCER	1.73	4	4	4	4	4
2" X 1" REDUCER	3.84	4	4	4	4	5
3" X 2" REDUCER	13.14					
2" X 1" BUSHING	2.81					1
4" X 2" BUSHING	11.89	3		3		1
4" X 3" BUSHING	11.89				1	
1" UNION	1.13					1
2" TEE	6.43					1
FIBERGLASS PIPE (b)						
2" PIPE (FT)	1.89	273	140	273	15	85
3" PIPE (FT)	2.89				83	
2" THREADED ADAPTER	7.23	7	7	7	4	6
3" THREADED ADAPTER	10.58				2	
2" ELBOW	16.41	6	3	6		4
3" ELBOW	22.82				2	
2" TEE	23.50	0	2	0		4
3" TEE	26.61		0		3	
2" COUPLING	4.68	8	2	8		3
3" COUPLING	7.23				2	
3" X 2" REDUCER	11.14		0		4	
GLUED JUNCTIONS	3.25	17	11	17	15	16
ADDITIONAL ITEMS (c)						
4" X 2" TANK BUSHING	2.61		3			
4" X 3" TANK BUSHING	2.61					
2" FLOAT CHECK VALVE	32.55		3			
VENT MANIFOLD DRUM (d)	500.00		1			
BUNGS (e)	0.00					
LABOR COMPONENTS						
TRENCHING (FT) (f)	0.00	105	105	105	85	130
ASSEMBLY (FT) (g)	6.00	105	105	105	85	130
TOTAL PURCHASE COST		869	1,140	869	646	550
TOTAL INSTALLATION COST		630	630	630	510	780
TOTAL DIRECT COST		1,499	1,770	1,499	1,156	1,330

See footnotes next page.

FOOTNOTES FOR TABLE B-22

[a]Reference I-E-33.

[b]Reference I-E-34.

[c]Reference I-F-110.

[d]Unit cost is an estimated cost since no information on this was readily available.

[e]Not needed on new tanks.

[f]Cost is absorbed in trenching cost for product lines.

[g]Reference I-E-46 (see text accompanying Table B-9 for discussion).

Tables B-23 and B-24 present the capital cost and annualized cost breakdown for the model plants. The same basic assumptions used in Tables B-14 and B-15 are used here; however, for new facilities more nozzles are assumed in the analysis based upon 25 percent single dispensers and 75 percent multiproduct dispensers (vs. 75 percent single dispensers and 25 percent multiproduct dispensers for existing facilities).

Table B-25 presents the generic capital cost summary for each Stage II system type on a model plant basis. The costs shown are used to compute generic annualized costs on a model plant basis, as shown in Table B-26. Table B-27 shows the generic Stage II capital cost summary, assuming the 30 percent discount for large volume buyers. This table is used to calculate Table B-28, which shows the generic annualized cost summary including the 30 percent discount.

TABLE B-23. STAGE 1I DIRECT COST SUMMARY (NEW FACILITY)

COMPONENT	COST OF COMPONENT				
MODEL PLANT 1	BAL-I	BAL-M	HYBRID	ASSIST-1	ASSIST-2
DISPENSER EQUIPMENT	1,775	1,775	2,015	1,766	977
AUXILIARY EQUIPMENT	0	0	0	3,975	3,900
UNDERGROUND PIPING	548	959	548	586	517
TOTAL PURCHASE COST	2,320	2,730	2,560	6,330	5,390
INSTALLATION COST	510	510	510	1,850	1,920
TOTAL DIRECT COST	2,830	3,240	3,070	8,180	7,310
MODEL PLANT 2					
DISPENSER EQUIPMENT	1,900	1,900	2,160	1,890	1,050
AUXILIARY EQUIPMENT	0	0	0	3,975	3,900
UNDERGROUND PIPING	869	1,140	869	646	550
TOTAL PURCHASE COST	2,770	3,040	3,030	6,510	5,500
INSTALLATION COST	630	630	630	1,910	1,980
TOTAL DIRECT COST	3,400	3,670	3,660	8,420	7,480
MODEL PLANT 3					
DISPENSER EQUIPMENT	3,800	3,800	4,320	3,780	2,090
AUXILIARY EQUIPMENT	0	0	0	3,975	3,900
UNDERGROUND PIPING	1,630	1,880	1,630	1,150	920
TOTAL PURCHASE COST	5,430	5,680	5,950	8,910	6,910
INSTALLATION COST	990	990	990	2,240	2,310
TOTAL DIRECT COST	6,420	6,670	6,940	11,150	9,220
MODEL PLANT 4					
DISPENSER EQUIPMENT	5,700	5,700	6,480	5,680	3,140
AUXILIARY EQUIPMENT	0	0	0	3,975	3,900
UNDERGROUND PIPING	2,120	2,200	2,130	1,580	1,410
TOTAL PURCHASE COST	7,820	7,900	8,610	11,240	8,450
INSTALLATION COST	1,230	1,230	1,230	2,480	2,640
TOTAL DIRECT COST	9,050	9,130	9,840	13,720	11,090
MODEL PLANT 5					
DISPENSER EQUIPMENT	9,510	9,510	10,790	9,460	5,230
AUXILIARY EQUIPMENT	0	0	0	3,975	3,900
UNDERGROUND PIPING	3,070	2,930	3,070	2,390	1,840
TOTAL PURCHASE COST	12,580	12,440	13,860	15,830	10,970
INSTALLATION COST	1,590	1,590	1,590	2,870	2,880
TOTAL DIRECT COST	14,170	14,030	15,450	18,700	13,850

Table B-24. STAGE II ANNUAL COST SUMMARY (NEW FACILITY)

COMPONENT/SYSTEM (a)	BAL-I	BAL-M	HYBRID	ASSIST-1	ASSIST-2
CAPITAL RECOVERY COST (b)					
MODEL PLANT 1	442	485	487	1,450	1,270
MODEL PLANT 2	512	540	560	1,480	1,290
MODEL PLANT 3	980	1,010	1,080	1,920	1,560
MODEL PLANT 4	1,420	1,420	1,560	2,350	1,840
MODEL PLANT 5	2,270	2,250	2,510	3,180	2,300
MAINTENANCE COST (c)					
MODEL PLANT 1	600	600	623	556	497
MODEL PLANT 2	643	643	668	588	525
MODEL PLANT 3	1,290	1,290	1,340	1,080	950
MODEL PLANT 4	1,930	1,930	2,000	1,560	1,370
MODEL PLANT 5	3,210	3,210	3,340	2,540	2,220
INSPECTION COST (d)					
MODEL PLANT 1	0	0	0	0	0
MODEL PLANT 2	0	0	0	0	0
MODEL PLANT 3	0	0	0	0	0
MODEL PLANT 4	0	0	0	0	0
MODEL PLANT 5	0	0	0	0	0
OTHER INDIRECT COSTS (e)					
MODEL PLANT 1	113	130	123	327	293
MODEL PLANT 2	136	147	146	337	299
MODEL PLANT 3	257	267	277	446	369
MODEL PLANT 4	362	365	393	548	444
MODEL PLANT 5	567	561	618	748	554
RECOVERY CREDITS (f)					
MODEL PLANT 1	129	129	129	65	65
MODEL PLANT 2	518	518	518	259	259
MODEL PLANT 3	906	906	906	453	453
MODEL PLANT 4	1,683	1,683	1,683	841	841
MODEL PLANT 5	4,790	4,790	4,790	2,395	2,395
ADDITIONAL CREDITS (g)					
MODEL PLANT 1	0	0	0	0	0
MODEL PLANT 2	0	0	0	0	0
MODEL PLANT 3	0	0	0	0	0
MODEL PLANT 4	0	0	0	0	0
MODEL PLANT 5	0	0	0	0	0
TOTAL ANNUALIZED COST					
MODEL PLANT 1	1,030	1,090	1,100	2,270	2,000
MODEL PLANT 2	770	810	860	2,150	1,860
MODEL PLANT 3	1,620	1,660	1,790	2,990	2,430
MODEL PLANT 4	2,030	2,030	2,270	3,620	2,810
MODEL PLANT 5	1,260	1,230	1,680	4,070	2,680

See next page for footnotes.

FOOTNOTES FOR TABLE B-24

[a]Assist-1 = Hirt; Assist-2 = Hasstech; Hybrid = Healy.

[b]Cost of Capital = (Capital Cost) $\frac{i\,(1+i)^a}{(1+i)^a - 1}$

where: i = interest rate (10 percent)
a = equipment life (8 years for dispenser and auxiliary equipment; 35 years for underground piping system)

[c]1. Nozzle Maintenance - All Systems.
Replace nozzle every 2 years with new nozzle (same lifetime as standard nozzle); therefore annual cost equals half the incremental cost between standard nozzle ($50) and vapor recovery nozzle.

2. Hose Maintenance - All Systems.
Replace vapor hose every 2 years (same lifetime as liquid hose on standard dispenser); therefore, annual cost equals half the incremental cost between standard liquid hose ($24.39) and liquid/vapor recovery hose system ($110.73 from Exhibits 8-10, Table B-2).

3. Boot/Faceplate Assembly Maintenance - Balance Systems.
Replace boot/faceplate assembly three times per year; parts cost $19 per replacement and it takes 20 minutes per replacement at $25 per hour.

4. Boot/Faceplate Assembly Maintenance - Assist Systems.
Replace boot/faceplate assembly two times per year; parts cost $15 per replacement and it takes 20 minutes per replacement at $25 per hour.

5. Boot/Faceplate Assembly Maintenance - Hybrid Systems.
Replace boot/faceplate assembly two times per year; parts cost $33 per replacement and it takes 20 minutes per replacement at $25 per hour.

6. Processing Unit Maintenance - Assist Systems.
Maintenance performed once a year by a qualified professional at a cost of $100 per visit.

[d]This expense is included in the government enforcement costs and, thus, it is not attributable to the model plant annual cost.

[e]Value includes property tax (1%), insurance (1%), and administration (2%), equalling 4 percent of the total capital cost.

[f]Stage II recovery credit calculations:

Balance and Hybrid

Emission factors: Displacement = 1,552 mg/liter
Emptying loss = 120 mg/liter

FOOTNOTES FOR TABLE B-24
(concluded)

Assuming 95% recovery of both displacement and emptying losses, recovery factor = ((1,552 mg/liter)(.95)) + ((120 mg/liter)(.95)) = 1,588 mg/liter.

Example of recovery credit:

$$1{,}588\ \text{mg/liter} \times 75{,}700^{*}\ \frac{\text{liters}}{\text{mo.}} \times \frac{\text{kg}}{10^6\text{mg}} \times \frac{\text{liter}}{0.67\text{kg}} \times \frac{12\ \text{mo.}}{\text{yr}} \times \$0.24/\text{liter}$$

= $518/year.

Assist 1 & 2

Assuming 50% recovery of balance system losses, recovery factor =

(0.50)(0.95)(1,552 mg/liter) + (120 mg/liter) = 794 mg/liter.

Example of recovery credit:

$$794\ \text{mg/liter} \times 75{,}700^{*}\ \frac{\text{liters}}{\text{mo.}} \times \frac{\text{kg}}{10^6\text{mg}} \times \frac{\text{liter}}{0.67\text{kg}} \times \frac{12\ \text{mo.}}{\text{yr}} \times \$0.24/\text{liter}$$

= $259/year.

[f]Throughout this analysis, the Model Plant 1 throughput used was 5,000 gallons per month to allow a comparison with the July 1984 analysis. However, the new analysis uses recovery credits based on Model Plant 1a (2,000 gallons per month) and Model Plant 1b (6,000 gallons per month) when calculating nationwide or nonattainment area cost impacts.

[g]No additional credits taken. These could include investment tax credits or energy conservation tax credits.

*Throughput for model plant 2.

Table B-25. GENERIC STAGE II CAPITAL COST SUMMARY: NO DISCOUNTS
(NEW STATION COSTS)

COMPONENT	COST OF COMPONENT		
MODEL PLANT 1	BALANCE	HYBRID	ASSIST
DISPENSER DIRECT COST	1,775	2,010	1,371
AUXILIARY DIRECT COST	0	0	5,238
PIPING DIRECT COST	1,260	1,060	1,140
TOTAL DIRECT COST	3,030	3,070	7,750
TOTAL INDIRECT COST	0	0	0
TOTAL CAPITAL COST	3,030	3,070	7,750
MODEL PLANT 2			
DISPENSER DIRECT COST	1,900	2,160	1,470
AUXILIARY DIRECT COST	0	0	5,238
PIPING DIRECT COST	1,630	1,500	1,240
TOTAL DIRECT COST	3,530	3,660	7,950
TOTAL INDIRECT COST	0	0	0
TOTAL CAPITAL COST	3,530	3,660	7,950
MODEL PLANT 3			
DISPENSER DIRECT COST	3,800	4,320	2,940
AUXILIARY DIRECT COST	0	0	5,238
PIPING DIRECT COST	2,740	2,620	2,010
TOTAL DIRECT COST	6,540	6,940	10,190
TOTAL INDIRECT COST	0	0	0
TOTAL CAPITAL COST	6,540	6,940	10,190
MODEL PLANT 4			
DISPENSER DIRECT COST	5,700	6,480	4,410
AUXILIARY DIRECT COST	0	0	5,238
PIPING DIRECT COST	3,390	3,360	2,750
TOTAL DIRECT COST	9,090	9,840	12,400
TOTAL INDIRECT COST	0	0	0
TOTAL CAPITAL COST	9,090	9,840	12,400
MODEL PLANT 5			
DISPENSER DIRECT COST	9,510	10,790	7,350
AUXILIARY DIRECT COST	0	0	5,238
PIPING DIRECT COST	4,590	4,660	3,690
TOTAL DIRECT COST	14,100	15,450	16,280
TOTAL INDIRECT COST	0	0	0
TOTAL CAPITAL COST	14,100	15,450	16,280

Table B-26. GENERIC STAGE II ANNUAL COST SUMMARY: NO DISCOUNTS
(NEW STATION COSTS)

COMPONENT	ANNUAL COST OF COMPONENT		
MODEL PLANT 1	BALANCE	HYBRID	ASSIST
CAPITAL RECOVERY COST	464	487	1,360
MAINTENANCE COST	600	623	527
INSPECTION COST	0	0	0
OTHER INDIRECT COSTS	122	123	310
RECOVERY CREDIT	129	129	65
ADDITIONAL CREDITS	0	0	0
TOTAL ANNUALIZED COST	1,060	1,100	2,130
MODEL PLANT 2			
CAPITAL RECOVERY COST	526	560	1,390
MAINTENANCE COST	643	668	557
INSPECTION COST	0	0	0
OTHER INDIRECT COSTS	142	146	318
RECOVERY CREDIT	518	518	259
ADDITIONAL CREDITS	0	0	0
TOTAL ANNUALIZED COST	790	860	2,010
MODEL PLANT 3			
CAPITAL RECOVERY COST	1,000	1,080	1,740
MAINTENANCE COST	1,290	1,340	1,020
INSPECTION COST	0	0	0
OTHER INDIRECT COSTS	262	277	408
RECOVERY CREDIT	906	906	453
ADDITIONAL CREDITS	0	0	0
TOTAL ANNUALIZED COST	1,650	1,790	2,720
MODEL PLANT 4			
CAPITAL RECOVERY COST	1,420	1,560	2,100
MAINTENANCE COST	1,930	2,000	1,465
INSPECTION COST	0	0	0
OTHER INDIRECT COSTS	364	393	496
RECOVERY CREDIT	1,683	1,683	841
ADDITIONAL CREDITS	0	0	0
TOTAL ANNUALIZED COST	2,030	2,270	3,220
MODEL PLANT 5			
CAPITAL RECOVERY COST	2,260	2,510	2,740
MAINTENANCE COST	3,210	3,340	2,380
INSPECTION COST	0	0	0
OTHER INDIRECT COSTS	564	618	651
RECOVERY CREDIT	4,790	4,790	2,400
ADDITIONAL CREDITS	0	0	0
TOTAL ANNUALIZED COST	1,240	1,680	3,370

Table B-27. GENERIC STAGE II CAPITAL COST SUMMARY: WITH DISCOUNTS (NEW STATION COSTS)

COMPONENT	COST OF COMPONENT		
MODEL PLANT 1	BALANCE	HYBRID	ASSIST
DISPENSER EQUIPMENT	1,242	1,410	960
AUXILIARY EQUIPMENT	0	0	5,238
UNDERGROUND PIPING	1,260	1,060	1,140
TOTAL DIRECT COST	2,500	2,470	7,340
TOTAL INDIRECT COST	0	0	0
TOTAL CAPITAL COST	2,500	2,470	7,340
MODEL PLANT 2			
DISPENSER EQUIPMENT	1,330	1,510	1,030
AUXILIARY EQUIPMENT	0	0	5,238
UNDERGROUND PIPING	1,630	1,500	1,240
TOTAL DIRECT COST	2,960	3,010	7,510
TOTAL INDIRECT COST	0	0	0
TOTAL CAPITAL COST	2,960	3,010	7,510
MODEL PLANT 3			
DISPENSER EQUIPMENT	2,660	3,020	2,060
AUXILIARY EQUIPMENT	0	0	5,238
UNDERGROUND PIPING	2,740	2,620	2,010
TOTAL DIRECT COST	5,400	5,640	9,310
TOTAL INDIRECT COST	0	0	0
TOTAL CAPITAL COST	5,400	5,640	9,310
MODEL PLANT 4			
DISPENSER EQUIPMENT	3,990	4,530	3,090
AUXILIARY EQUIPMENT	0	0	5,238
UNDERGROUND PIPING	3,390	3,360	2,750
TOTAL DIRECT COST	7,380	7,890	11,080
TOTAL INDIRECT COST	0	0	0
TOTAL CAPITAL COST	7,380	7,890	11,080
MODEL PLANT 5			
DISPENSER EQUIPMENT	6,650	7,550	5,140
AUXILIARY EQUIPMENT	0	0	5,238
UNDERGROUND PIPING	4,590	4,660	3,690
TOTAL DIRECT COST	11,240	12,210	14,070
TOTAL INDIRECT COST	0	0	0
TOTAL CAPITAL COST	11,240	12,210	14,070

Table B-28. GENERIC STAGE II ANNUAL COST SUMMARY: WITH DISCOUNTS (NEW STATION COSTS)

COMPONENT	ANNUAL COST OF COMPONENT		
	BALANCE	HYBRID	ASSIST
MODEL PLANT 1			
CAPITAL RECOVERY COST	364	374	1,280
MAINTENANCE COST	600	623	527
INSPECTION COST	0	0	0
OTHER INDIRECT COSTS	100	99	294
RECOVERY CREDIT	129	129	65
ADDITIONAL CREDITS	0	0	0
TOTAL ANNUALIZED COST	940	970	2,040
MODEL PLANT 2			
CAPITAL RECOVERY COST	419	440	1,310
MAINTENANCE COST	643	668	557
INSPECTION COST	0	0	0
OTHER INDIRECT COSTS	119	120	300
RECOVERY CREDIT	518	518	259
ADDITIONAL CREDITS	0	0	0
TOTAL ANNUALIZED COST	660	710	1,910
MODEL PLANT 3			
CAPITAL RECOVERY COST	790	840	1,580
MAINTENANCE COST	1,290	1,340	1,020
INSPECTION COST	0	0	0
OTHER INDIRECT COSTS	216	226	373
RECOVERY CREDIT	906	906	453
ADDITIONAL CREDITS	0	0	0
TOTAL ANNUALIZED COST	1,390	1,500	2,520
MODEL PLANT 4			
CAPITAL RECOVERY COST	1,100	1,200	1,850
MAINTENANCE COST	1,930	2,000	1,465
INSPECTION COST	0	0	0
OTHER INDIRECT COSTS	296	316	443
RECOVERY CREDIT	1,683	1,683	841
ADDITIONAL CREDITS	0	0	0
TOTAL ANNUALIZED COST	1,640	1,830	2,920
MODEL PLANT 5			
CAPITAL RECOVERY COST	1,730	1,900	2,330
MAINTENANCE COST	3,210	3,340	2,380
INSPECTION COST	0	0	0
OTHER INDIRECT COSTS	450	489	563
RECOVERY CREDIT	4,790	4,790	2,400
ADDITIONAL CREDITS	0	0	0
TOTAL ANNUALIZED COST	600	940	2,870

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APPENDIX C

CALIFORNIA AIR RESOURCES BOARD
STAGE II (PHASE II) CERTIFICATION TEST PROCEDURES

As discussed in Chapter 4, the California Air Resources Board tests and certifies Stage II systems to be capable of controlling VOC emissions from vehicle refueling at an efficiency of 95 percent of greater. Because it is not practical or necessary to test the efficiency of the vapor recovery system in each service station, CARB utilizes a "generic" equipment certification approach. In this program a prototype Stage II vapor system is evaluated and specifications developed. Systems that meet these "certified" specifications may be installed without individual efficiency tests. This Appendix provides CARB's certification requirements and test procedures used in this process. Specifically, this appendix contains:

Section C.1	CARB Test Method 2-2: Certification Procedures for Gasoline Vapor Recovery Systems at Service Stations. (includes "90 day test")
Section C.2	CARB Test Method 2-1: Test Procedures for Determining the Efficiency of gasoline Vapor Recovery Systems at Service Stations. ("100 car test")

As also discussed in Chapter 4, the approval of three other State agencies is required as a precondition to CARB certification. State law provides that the State Fire Marshal determine whether any component of system creates a fire hazard. The Department of Food and Agriculture, Division of Measurement Standards, is given sole responsibility for the measurement accuracy aspects, including gasoline recirculation, of any component or system. Finally, the Division of Occupational

Safety and Health is designated the agency responsible for determining whether any gasoline vapor control system or component creates a safety hazard other than a fire hazard. The regulations and test methods applicable to Stage II vapor recovery for these three organizations are also included in this appendix as follows:

Section C.3	California Department of Measurement Standards Requirements and Test Procedures
Section C.4	California Occupational Health and Safety Requirements
Section C.5	California Fire Marshal Requirements

APPENDIX C.1

CARB TEST METHOD 2-2: CERTIFICATION PROCEDURES FOR GASOLINE VAPOR RECOVERY SYSTEMS AT SERVICE STATIONS

State of California

AIR RESOURCES BOARD

Certification Procedures for Gasoline Vapor Recovery Systems at Service Stations

Adopted: March 30, 1976

Amended: August 25, 1977

Amended: December 4, 1981

Note: To assist the user, the most recent amendments to these procedures are set forth in italics.

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State of California

AIR RESOURCES BOARD

Certification Procedures for Gasoline
Vapor Recovery Systems at Service Stations

I. General Applicability

These certification procedures are adopted pursuant to Section 41954 of the Health and Safety Code and are applicable to vapor recovery systems installed at gasoline service stations for controlling gasoline vapors emitted during the filling of storage tanks (Phase I) and vehicle fuel tanks (Phase II). *Vapor recovery* systems are complete systems and shall include all necessary piping, nozzles, couplers, processing units, underground tanks and any other equipment necessary for the control of gasoline vapors during fueling operations at service stations.

The certification procedures are not intended to be used to certify individual system components. For systems which are identical in design and include the same components as systems tested and certified, but differ, primarily in size, the *manufacturer* may demonstrate compliance capability and obtain certification by submitting engineering and test data demonstrating the relationship between capacity and throughput of each component whose performance is a function of throughput.

II. Definitions

A. Vapor-balance or displacement vapor recovery system - A gasoline vapor control system which uses direct displacement to force vapors into the underground tank (or bulk delivery tank) to prevent the emission of displaced vapors to the atmosphere during Phase I and/or Phase II operations.

B. Vacuum-assisted or vacuum-assisted secondary system - A gasoline vapor control system, which employs a pump, blower, or other vacuum inducing devices, to collect and/or process vapors generated during vehicle fueling (Phase II) operations.

C. Phase I - Control of vapors from underground tank fueling operations.

D. Phase II - Control of vapors from vehicle fueling operations.

E. Automatic Nozzle - ~~A nozzle which will dispense fuel without being hand-held.~~ *A hose nozzle valve provided with automatic closing features to safeguard its use.*

F. On-Stream Efficiency Factor - That factor which indicates the fraction of time that the vapor recovery system is operating as the system was designed to operate.

$$\text{On-Stream Efficiency Factor} = \frac{t_s - t_d}{t_s}$$

Where t_s = System Time, Hours

t_d = System Down-Time, Hours

G. System Time - Hours that the system needs to be capable of controlling vapor emissions. For the 90-day reliability test period, this would be 2160 hours (24 hours per day x 90 days).

H. System Down-Time - The time (in hours) that the vapor recovery system is not operating as designed.

I. *Spitback - A loss of more than one milliliter of liquid gasoline occurring during the dispensing of gasoline into the vehicle fuel tank.*

J. *Spillage - A loss of more than one milliliter of liquid gasoline from the gasoline nozzle occurring as a result of preparing to fuel a vehicle or at the end of a fueling operation in returning the nozzle to the dispenser.*

III. General Standards

A. Certification of a system by the California Air Resources Board does not exempt the system from compliance with other applicable codes and regulations such as fire, weights and measures, and safety codes.

B. Phase II systems must be capable of fueling, without the use of nozzle spout extenders, any motor vehicle that may be fueled at service stations not equipped with vapor recovery systems.

IV. Performance Standards

A. The system shall complete an operational test of at least 90 days. During the test, replacement of components or alteration of the control system is not allowed, except that the Executive Officer may allow replacement or alteration of a component if the component has been damaged due to an accident or vandalism and if he/she determines that the replacement or alteration would not affect the operational test results. No maintenance or adjustment to the system will be allowed during the certification test unless such action is specifically called for in the system's maintenance manual. The control system will be sealed in such a manner that unauthorized maintenance or adjustment may be detected. Maintenance or adjustment is to be performed only after notification of the person in charge of the testing, except in case of an emergency. Unauthorized maintenance or adjustment may be reason for immediate failure of the test.

A system component submitted to the Executive Officer for evaluation subsequent to July 1, 1977, may be subjected to a shorter operational test, if the Executive Officer determines that the reliability of the component may be adequately demonstrated in a period shorter than 90 days.

B. The system shall prevent emission to the atmosphere of at least 90 percent or that percentage by weight of the gasoline vapors displaced during the filling of the stationary storage tank as required by applicable air pollution control district rules and regulations. The percentages of control shall be determined as described in Section 2.0 of the "Test Procedures for Determining the Efficiency of Gasoline Vapor Recovery Systems at Service Stations" as incorporated in Title 17, subchapter-8, Section 94000, California Administrative Code.

C. The system shall prevent emission to the atmosphere of an average of at least 90 percent or that percentage by weight of the gasoline vapors displaced during the filling of the vehicle fuel tanks as required by applicable air pollution control district rules and regulations. The specified percentage of control shall be determined by multiplying the on-stream efficiency factor (definition F, Section II) by the efficiency of the system as determined by testing in accordance with the procedures in Section 3.0 of the "Test Procedures for Determining the Efficiency of Gasoline Vapor Recovery Systems at Service Stations" as incorporated in Title 17, Chapter-1v-subchapter-8, Section 94000 of the California Administrative Code.

D. No more than ten spitbacks or twenty instances of spillage per 100 vehicle fuelings shall occur during the testing in accordance with the procedures in Section 3.0 of the "Test Procedures for Determining the Efficiency of Gasoline Vapor Recovery Systems at Service Stations" as incorporated in Title 17, Section 94000 of the California Administrative Code. In addition, the Executive Officer shall certify only those systems which he or she determines: (i) will not increase the quantity of liquid lost through spitback or spillage over that quantity typical of non-vapor recovery systems, (ii) can be expected to perform with such durability and reliability that excessive spitbacks or spillage will not be caused by failure of critical system components, and (iii) incorporate provisions to prevent a buildup, during fueling of the vehicle, of pressure in the vehicle fuel tank sufficient to cause forceful ejection of gasoline. This determination shall be based on data obtained during the testing in accordance with Section 3 of the Test Procedures referred to above, failure mode testing, evaluation of reliability and durability of the system, and such other performance testing as the Executive Officer deems necessary.

E. ~~D.~~ Prior to Air Resources Board certification of the vapor recovery system, plans and specifications for the intended

generic system shall be submitted to the State Fire Marshal's Office for review to determine whether the system creates a hazardous condition or is contrary to adopted fire safety regulations. Final determination by the State Fire Marshal may be contingent upon a review of each pilot installation of the proposed system. Compliance with the State Fire Marshal's requirements shall be a precondition to certification by the Air Resources Board.

F.-E. Prior to Air Resources Board certification, the system shall be submitted for type approval to the California Department of Food and Agriculture, Division of Measurement Standards and certified by such Division. Only those systems meeting the requirements of the California Business and Professions Code and the California Administrative Code will be issued certificates of approval by the Division of Measurement Standards; such certification shall be a precondition to certification by the Air Resources Board. Certification testing by Measurement Standards and the Air Resources Board may be conducted concurrently.

G.-F. Prior to certification of the system, the manufacturer of the system shall submit the system to the California Occupational Safety and Health Administration (Cal OSHA) for determining compliance with appropriate safety regulations.

This may be conducted concurrently with certification testing by the Air Resources Board. Compliance with Cal OSHA requirements shall be a precondition to certification by the Air Resources Board.

V. General Requirements Applicable to Certification of all Control Systems

A. An operating and required maintenance manual shall be submitted to the Executive Officer for each gasoline vapor control system submitted for certification. The operating manual shall, as a minimum, contain:

1. Identification of critical operating parameters affecting system operation, e.g., maximum dispensing rates; liquid to vapor flow rate ratios; pressures; etc. The operating range of these parameters associated with normal, in-compliance operation of the control system shall be identified. These operating data shall be determined and/or verified during the performance test of the system.

2. Identification of specific maintenance requirements and maintenance schedules necessary to ensure on-going operation in compliance with the applicable standards. Maintenance requirements shall be clearly identified as being capable of performance by the operator, or as requiring authorized service only. Operating manuals shall provide clear instruction on operator

maintenance and shall provide clear warnings against unauthorized service. Maintenance schedules shall, at a minimum, reflect the life of individual components such as regulators, compressors, nozzles, pressure vacuum valves, catalysts, combustor components, etc. Systems requiring maintenance which the Executive Officer finds unreasonable will be disapproved.

3. Identification of system components for each control system certified. Components shall, as applicable, be identified by brand name, part number, and/or performance characteristics. The identification shall be sufficiently clear so as to allow determination of comparability between tested and untested models, and/or to allow determination of the adequacy of replacement parts.

4. A warranty statement which complies with the requirements of Paragraph V. C. herein.

B. Indicating gauges, or alarms, or detection devices, or combination thereof, shall be included in each control system as required to enable monitoring of the critical system operation parameters. The gauges and alarms shall serve to alert and warn the gasoline service station owner or operator with an audible signal or warning light when the gasoline vapor control system is malfunctioning. Such gauges and alarms shall, as applicable,

include temperature and pressure indicators, pass/fail hydrocarbon detectors, etc. These shall indicate the performance of critical components such as compressors, carbon canisters, etc. Specific examples of necessary devices are: temperature indicators installed in control systems which utilize refrigeration as a control technique; pressure indicators installed in control systems which utilize compression as a control technique; hydrocarbon breakthrough detectors installed in control systems which utilize carbon adsorption or flexible bladders or seals as a control technique, and pressure differential indicators on vapor return lines to detect liquid blockage of the lines.

C. The manufacturer of the vapor recovery system shall provide a three-year warranty for the system. An exception to the warranty may be for those components of the system which the maintenance manual identifies as having expected useful lives of less than three years; the warranty in these cases may specify the expected life.

The manufacturer of each vapor recovery system shall warrant in writing to the ultimate purchaser and each subsequent purchaser that such vapor recovery system is:

1. Designed, built, and equipped so as to conform at the time of sale with the applicable regulations; and
2. Free from defects in materials and workmanship which cause such vapor recovery system to fail to conform with applicable regulations for three years.

D. The adequacy of methods of distribution, replacement parts program, the financial responsibility of the applicant, and other factors affecting the economic interests of the system purchaser shall be evaluated by the Executive Officer and determined by him or her to be satisfactory to protect the purchaser. A determination of financial responsibility by the Executive Officer shall not be deemed to be a guarantee or endorsement of the applicant.

E. The Executive Officer shall certify only those systems which, on the basis of an engineering evaluation of the system design and component quality, can be expected to perform with reasonable durability and reliability over the three-year warranty period specified in Paragraph V.C. herein.

F. *Whenever these Certification Procedures are amended to include additional performance standards or other requirements for certification of systems, any system which is certified as of the effective date of the additional standards or requirements shall remain certified for a period of six months from such date, or until the Executive Officer has determined whether the system conforms to the additional standards or requirements, whichever occurs first. However, if during this period the system manufacturer does not comply with such conditions as the Executive Officer deems necessary to*

assure prompt evaluation of the system pursuant to the additional standards or requirements, the Executive Officer may revoke the prior certification.

In determining whether a previously certified system conforms with any additional performance standards or other requirements adopted subsequent to certification of the system, the Executive Officer may consider any appropriate data obtained in the previous certification testing or evaluation of the system in lieu of new testing or evaluation.

VI. Application for Certification

A. An application for certification of a vapor recovery system (Phase I or Phase II) may be made to the Air Resources Board by any manufacturer. Certification will be granted to any applicant meeting the applicable standards and criteria.

B. The application shall be in writing, signed by an authorized representative of the manufacturer, and shall include the following:

1. A detailed description of the configuration of the vapor recovery system including but not limited to the following:
   a. The underground piping configuration and specifications (pipe sizes, lengths, fittings, material(s), etc.);
   b. Gasoline dispensing nozzle to be used for Phase II;

c. Engineering parameters for pumps and vapor processing units to be used as part of the vapor recovery system; and

d. Allowable pressure drops through the system.

2. Evidence demonstrating the vapor recovery reliability of the system or device for 90 days;

3. A description of tests performed to ascertain compliance with the general standards, and the results of such tests;

4. A statement of recommended maintenance procedures, equipment performance checkout procedures, and equipment necessary to assure that the vapor recovery system, in operation, conforms to the regulations, plus a description of the program for training personnel for such maintenance, and the proposed replacement parts program;

5. Six copies of the service and operating manuals that will be supplied to the purchaser;

6. A statement that a vapor recovery system, installed at an operating facility, will be available for certification testing no later than one month after submission of the application for certification. The facility submitted for certification testing shall have a minimum throughput of 100,000 gallons per month and shall include at least six nozzles of each type submitted for approval. There shall not be more than two types of nozzles at any one test facility.

7. The retail price of the system and an estimate of the installation and yearly maintenance costs;

8. A copy of the warranty or warranties provided with the system;

9. If the application is for a system previously tested, but not certified, the application shall include identification of the system components which have been changed; including all new physical and operational characteristics; together with any new test results obtained by the applicant; and

10. Such other information as the Executive Officer may reasonably require.

VII. Fees and Testing

A. A fee not to exceed the actual cost of certification will be charged by the Air Resources Board to each applicant submitting system(s) for certification. The applicant is required to demonstrate ability to pay the cost of testing prior to certification testing. This may take the form of posting a bond of not less than $20,000. A resolution of certification of the system will not be issued until the test fee has been paid in full to the Air Resources Board.

B. Testing may be conducted by an independent contractor under contract to the Air Resources Board. The contractor will be responsible solely to the Air Resources Board for the conduct of the certification test and the test results.

VIII. Certification

A. If the Executive Officer determines that a vapor recovery system conforms to all requirements set forth in paragraphs I through VII herein, he or she shall issue an order of certification. The order may prescribe the conditions for issuance of the certification including but not limited to: a minimum allowable on-stream factor, maximum allowable monthly throughput, installation constraints, operating parameters, compliance with safety codes and regulations, compliance with measurement standards regulations, and approval for use at self-service stations or at only attendant-serve stations.

B. If after certification of a system the manufacturer wishes to modify the system, the proposed modifications must be submitted to the Executive Officer in a format specified by the Executive Officer for approval prior to their implementation. Such modifications may include substitution of components, elimination of components and modification of the system configuration. No person shall install or operate a system which is different in any significant respect from the system certified by the Air Resouces Board.

C. If after certification of a system, the Executive Officer finds the system to no longer meet the specified certification specifications, the Executive Officer may, as appropriate, revoke or modify his or her prior certification. Except in cases where the public safety requires immediate protection, the Executive Officer shall not revoke or modify a prior certification without the manufacturer's consent unless the Executive Officer conducts a public hearing. The manufacturer shall be notified of the public hearing in writing and the notification shall be given so as to be received by the manufacturer at least ten days before the hearing date.

D. Any manufacturer of a system shall, as a condition of certification of the system by the Air Resources Board, agree that so long as only one such system is certified by the Air Resources Board, such manufacturer shall either: (1) agree to enter into such cross-licensing or other agreements as the Executive Officer determines are necessary to ensure adequate competition among manufacturers of such systems to protect the public interest; and (2) agree as a condition to such certification that if only such system from one manufacturer is made available for sale to the public, the Executive Officer shall, taking into consideration the cost of manufacturing the system and the manufacturer's suggested retail price, and in order to protect the public interest, determine the fair and reasonable retail price of such system, and may require, as a condition to continued certification of such system, that the retail price not exceed the retail price determined by the Executive Officer.

APPENDIX C.2

CARB TEST METHOD 2-1: TEST PROCEDURES FOR DETERMINING THE EFFICIENCY OF GASOLINE VAPOR RECOVERY SYSTEMS AT SERVICE STATIONS

State of California

AIR RESOURCES BOARD

Test Procedures for Determining the Efficiency of
Gasoline Vapor Recovery Systems at Service Stations

Adopted: December 9, 1975

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Amended: December 4, 1981

Amended: September 1, 1982

Note: To assist the user, the most recent amendments to these procedures are set forth in italics and deletions are shown as struck through.

State of California

AIR RESOURCES BOARD

Test Procedures for Determining the Efficiency of
Gasoline Vapor Recovery Systems at Service Stations

1. Introduction

The following test procedures are for determining the efficiency of vapor recovery systems (Sections 2 and 3) for controlling gasoline vapors emitted during the filling of storage tanks and vehicle fuel tanks.

The test procedures for determining the efficiency of systems for controlling gasoline vapors displaced during filling of underground storage tanks requires determination of the weight of gasoline vapors vented through the storage tank vent and the volume of gasoline dispensed. The percentage effectiveness of control is then calculated from these values.

The test procedures for determining the efficiency of systems to control gasoline vapors displaced during vehicle fueling requires that the weight of vapors collected at the vehicle, corrected for vent losses, be compared to the potential mass emission calculated for that vehicle. A standard test sample of the vehicle population is to be tested and an average efficiency calculated.

The potential mass emissions are determined during the fueling of vehicles by measuring the mass of hydrocarbons collected from

vehicles from which no leak occurred. Potential emissions are expressed as a function of the vapor pressures of the dispensed fuel, the temperature of the dispensed fuel and the temperature of the gasoline in the test vehicle tank. The relationship is used as the baseline or reference from which the efficiency of a vehicle fueling vapor control system is evaluated.

The sample of vehicles to be used for testing control systems shall be comprised of vehicles representative of the on-the-road vehicle population in terms of vehicle miles travelled.

The test will be conducted during the normal operation of the service station. For vehicle fueling at a self-servce station, the customers shall fuel the vehicles; at a full-service station, the service station attendant shall fuel the vehicles during the test period. No more than 30 days prior to the 100 vehicle efficiency test, the entire vapor recovery system is to be tested for leaks. ~~In accordance with the criteria specified in Title 19 Chapter 1 Subchapter 11.5 Section 1918.36 (j) and 1918.56 (j), in the State Fire Marshall's regulations.~~ *The vapor piping system, including the storage tanks, dispensing nozzles and hoses, shall be pneumatically tested to 150% of the maximum working pressure of the system, or to 10 inches of water column pressure, whichever is greatest. Test pressure shall be maintained for not less than 5 minutes, with the system sealed, with a pressure drop not to exceed 10% of the test pressure. An inert gas,*

e.g., nitrogen, shall be used. At no time shall air be used from an external power source to pressurize the system.

In addition, the total ullage space shall not be more than 6,000 gallons. During the performance test, maintenance, adjustment, replacement of components or other such alteration of the control system is not allowed unless such action is specifically called for in the system's maintenance manual. Any such alteration shall be recorded on the day on which the alteration was performed. During the testing, the control system will be sealed in such a manner that unauthorized maintenance may be detected. Maintenance is to be performed only after notification of the person in charge of the testing except in case of an emergency. Unauthorized maintenance may be reason for immediate failure of the test.

For systems which are identical in design and include the same components as systems tested and found to comply with the test procedures, but differ, primarily in size, the owner or vendor may demonstrate compliance capability and obtain approval by submitting engineering and/or test data demonstrating the relationship between capacity and throughput of each component whose performance is a function of throughput. Examples of such components include: blowers, catalyst, carbon or other adsorbant, compressors, heat exchangers, combustors, piping, etc.

2. Underground Tank Fueling Test Procedure (Phase I Systems)

2.1 Principle and Applicability

(a) Principle. During a fuel delivery, the volume of gasoline delivered from the tank truck to the underground tank is recorded and the concentration of gasoline vapor returning to the tank truck is measured. The weight of gasoline vapor discharged from the vent of the underground tank and, if applicable, from the vent of the vacuum assisted secondary processing unit during the same period is determined. The efficiency of control is calculated from these determinations.

(b) Applicability. The method is applicable to all control systems which have a vapor line connecting the underground tank to the tank truck.

2.2 Apparatus

(a) For each vent, including restricted vents and vents of any processing units, a positive displacement meter, with a capacity of 3,000 SCFH, a pressure drop of no more than 0.05 inches of water at an air flow of 30 SCFH, and equipped with an automatic data gathering system that can differentiate direction of flow and records volume vented in such a manner that this data can be correlated with simultaneously recorded hydrocar

concentration data. A manifold for meter outlet with taps for an HC analyzer, a thermocouple*; and a pressure sensor is to be used with the positive displacement meter.

(b) Coupling for the vent vapor line to connect the gas meter. Coupling to be sized for a minimum pressure drop.

(c) Coupling for the vent of the vacuum assisted secondary processing unit to connect the gas meter. Coupling to be sized so as to create no significant additional pressure drop on the system.

(d) Coupling for tank truck vapor return line with thermocouple, manometer† and HC analyzer taps. Coupling to be the same diameter as the vapor return line.

(e) Coupling for tank truck fuel drop line with thermocouple tap. Coupling to be the same diameter as the fuel line.

(f) Two (2) hydrocarbon analyzers (FID or ARB approved equivalent) with recorders and with a capability of measuring total gasoline vapor concentration of 100 percent as propane. Both analyzers to be of same make and model.

* ~~The use of the word thermocouple is to imply temperature sensing device throughout this procedure.~~ *Wherever in this procedure the use of a "thermocouple" is specified, another equally effective temperature sensing device may alternatively be used.*

† ~~The use of the word manometer is to imply pressure sensing device throughout this procedure.~~ *Wherever in this procedure the use of a "manometer" is specified, another equally effective pressure sensing device may alternatively be used.*

(g) Three (3) flexible thermocouples or thermistors (0-150°F) with a recorder system.

(h) Explosimeter

(i) Barometer

(j) Three manometers or other pressure sensing devices capable of measuring zero to ten inches of water.

(k) Thermometer

2.3 Procedure

(a) The test for underground fueling will be conducted under, as closely as feasible, normal conditions for the station. Normal conditions will include delivery time and station operating conditions.

(b) Connect manifold to outlet of positive displacement meter and resulting to system vent of underground tank using the coupler or if the vent has a restriction, remove the restriction and connect the coupler, manifold and the meter system to the vent and connect restrictor to manifold outlet. If appropriate, connect another manifold and meter to the vent of the vacuum assisted secondary processing unit, or, if appropriate, use E.P.A. stack sampling techniques. If the system uses an incinerator to control emissions, use the test procedures set forth in Section 3.6.

(c) Connect the HC analyzer with recorder, thermocouple and manometer to the vent manifold. Calibrate the equipment in accordance with Section 3.3.

(d) Connect the couplers to the tank truck fuel and vapor return lines.

(e) Connect an HC analyzer with a recorder, a manometer and a thermocouple to the taps on the coupler on the vapor return line. Connect thermocouple to the tap on the coupler on the fuel line.

(f) Connect tank truck fuel and vapor return lines to appropriate underground tank lines in accordance with written procedure for the system.

(g) Check the tank truck and all vapor return line connections for a tight seal before and during the test with the explosimeter.

(h) Record the initial reading of gas meter(s).

(i) Start fueling of the underground tank in accordance with manufacturers' established normal procedure.

(j) Hydrocarbon concentrations, temperature and pressure measurements should be recorded using stripchart recorders within the first 15 seconds of the unloading period. The gas meter reading is to be taken at 120 second intervals.

(k) Record at the start and the end of the test barometric pressure and ambient temperature.

(l) At the end of the drop, disconnect the tank truck from the underground tank in accordance with manufacturers' instructions (normal procedure). Leave the underground tank vent instrumentation in place.

(m) Continue recording hydrocarbon concentrations, temperatures, pressure and gas meter readings at the underground tank vent and/or the exhaust of any processing unit at 20-minute intervals. Do this for one hour for balance systems and until the system returns to normal conditions as specified by the manufacturer for secondary systems.

(n) Disconnect instrumentation from the vent(s).

(o) Record volume of gasoline that is delivered.

(p) Record final reading of gas meter.

2.4 Calculations

(a) Volume of gas discharged through "i th" vent. This includes underground tank vent and any control system vent.

$$V_{vsi} = \frac{V_{vi} \times 520 \times P_b}{T_{vi} \times 29.92}$$

Where:

V_{vsi} = Volume of gas discharged through "i th" vent, corrected to 60°F and 29.92 in. Hg; Ft^3.

P_b = Barometric Pressure, in. Hg.

V_{vi} = Volume of gas recorded by meter on "i th" vent, corrected for amount of vapor removed for the hydrocarbon analysis, Ft^3.

T_{vi} = Average temperature in "i th" vent line, °R.

i = The vent under consideration.

(b) Volume of gas returned to the tank truck.

$$V_t = \frac{0.1337G_t \ (520 \times [P_b + \Delta H])}{T_t \times 29.92}$$

Where:

V_t = Volume of gas returned to the tank truck at 60°F and 29.92 in. Hg; Ft^3.

G_t = Volume of gasoline delivered, gal.

ΔH = Final gauge pressure of tank truck; in. Hg.

T_t = Average temperature of gas returned to tank truck, °R.

P_b = Barometric pressure, in. Hg.

0.1337 = Conversion factor gallons to Ft^3.

(c) Collection efficiency

$$E = \frac{V_t \times C_t \times 100}{(V_t \times C_t) + \Sigma[C_{vi} \times V_{vsi}]}$$

Where E is the efficiency of control in percent.

V_t = Form (b) above.

C_t = The average fractional volume concentration of gasoline vapor in the return line to the truck as determined by the hydrocarbon analyzer, decimal fraction.

C_{vi} = The average fractional volume concentration of gasoline vapors in the "i th" vent as determined by the hydrocarbon analyzer, decimal fraction.

V_{vsi} = From (a) above.

3. Vehicle Fueling Test Procedure

3.1 Principle and Applicability

3.1.1 Principle. Tests are conducted on a sample of vehicles representative of the vehicle population to determine the weight of gasoline vapor returned to the underground tank and the weight of vapor lost through any vents in the system. Baseline data (the weight of gasoline vapor displaced per gallon of gasoline dispensed for given temperatures of the gasoline in the vehicle tank and the dispensed gasoline, and given vapor pressure of the dispensed gasoline) are determined from vehicles from which no significant leaks occurred during fueling. The efficiency of the vapor recovery system is then calculated by comparing the amount of vapor returned during fueling, corrected for vent losses, to the baseline data.

3.1.2 Applicability. The method is applicable to all control systems in which vapors are returned from the vehicle tank to the underground tank or disposal system through a vapor line.

3.2 Determination of Gasoline Vapor Transferred to Underground Tank and Discharged through Vent of Underground Tank and Control System During Vehicle Fueling.

3.2.1 Apparatus

(a) Positive displacement meter with a capacity of 3000 SCFH and a pressure drop of no more than 0.05 inches water at 30 SCFH. If testing is to be conducted concurrently at more than one pump, an additional positive-displacement meter will be required for each additional pump. The positive displacement meter must be calibrated at 10, 30, 50, 60, 90, 120, 180, 300, and 3000 SCFH.

(b) A manifold, for connection to the nozzle vapor line at the nozzle, with ports for a thermocouple, a pressure sensor, and HC analyzer sample line. A manifold, for connection to the nozzle gasoline line at the nozzle, with a tap for a thermocouple. A set of these manifold will be required for each pump to be included in the test.

(c) A modified nozzle (of the type to be tested) with a 1/8 inch copper tube as a pressure tap. The tube enters through the nozzle body into the dispensing spout and exits through the wall of the dispensing spout about two inches from the end of the spout. The pressure tap is connected to the pressure transducer with 1/8 inch teflon tubing.

(d) A manifold for the inlet to the positive displacement meter with taps for a thermocouple and a pressure transducer.

(e) A manifold for the outlet of the positive displacement meter. The manifold will have a one inch I.D. valve for closing off flow to the vapor return line. Between the valve and positive displacement meter will be a 1/4 inch or 3/8 inch tap for connecting the flow system for pressurizing the vehicle fill neck for the leak rate check.

(f) The pressure system for conducting the pre-fueling leak rate check consists of a nitrogen bottle (2000 psig), commercial grade), a control valve for regulating the bottle pressure to 1 psig, a needle valve, two Magnehelic gauges (0 - 30 and 0 - 10 inches water) for determining the pressure upstream and downstream of the needle valve, and a dry gas meter (175 SCFH), alternately an adequate flowmeter), a device for ensuring a tight seal with the vehicle fill-pipe, and a hose for supplying pressure to the vehicle tank. The device (see Figure 3) is to have a tap for allowing monitoring of the pressure in the fill-pipe during the leak check.

(g) The pressure system for conducting the post-fueling leak rate check consists of a nitrogen bottle (2000 psig), commercial grade, a control valve for regulating the bottle pressure to 1 psig, a needle valve, two Magnehelic gauges (0 - 30 and 0 - 10 inches water, for determining pressure upstream and downstream of the needle valve, and a dry gas meter (175 SCFH), alternately an adequate flowmeter.

(h) A positive displacement meter, with a capacity of 3000 SCFH, a pressure drop of no more than 0.05 inches at 30 SCFH, and equipped with automatic data gathering system that can differentiate direction of flow and records volume vented in such a manner that this data can be correlated with simultaneously recorded HC data. A manifold with taps for an HC analyzer, a thermocouple, and a pressure sensor is to be used with the positive displacement meter.

Such a system is required for each vent of the station unless the vents can be manifolded together without affecting the vapor recovery system operation. If the underground tanks are vented separately then only the vent(s) of the underground tank for the grade of gasoline used during the test is (are) required to be instrumented.

(i) Four flexible thermocouples or thermistors (0 - 150°F) with recorders.

(j) Two pressure transducers (± .5 psi) with recorder.

(k) Two HC analyzers (FID or ARB approved equivalent) with recorders and with a capability of measuring gasoline vapor concentrations of 100 percent as propane.

It is suggested that the recorder for the HC analyzer to be used at the vent manifold be equipped with an event marker that will record when outbreathing occurs on the HC strip chart. If not, then periodic readings of the dry gas meter will be required and the time of the readings must be noted on the HC strip chart.

(l) Barometer.

(m) Thermometer.

(n) Explosimeter.

(o) Containers for RVP samples.

(p) Apparatus for determining RVP by ASTM test method D323-72, and/or apparatus for determining RVP by the Chevron Research Corporation's micro-technique.

(q) Flexible thermocouple (0 - 150°F) or type for determining vehicle tank temperatures with system to ensure contact with liquid.

3.2.2 Procedure for Determination of Gasoline Vapor Transferred to Underground Tank and Discharged Through Vent of Underground Tank During Vehicle Fueling.

(a) Connect the appropriate manifolds to the nozzle. Connect a thermocouple, and an HC analyzer to the manifold on the vapor return side of the nozzle. Connect a thermocouple and the gasoline delivery line to the manifold on the gasoline inlet side of the nozzle. Connect pressure transducer line to the nozzle pressure tube.

(b) Connect the appropriate inlet manifold to the inlet of the positive-displacement meter and connect a thermocouple and pressure transducer to the inlet manifold. Connect the appropriate outlet manifold to the outlet of the positive-displacement meter and connect the leak-rate pressure line to the outlet manifold. For a balance system, connect a one-inch polypropylene line from the outlet manifold on the vapor return side of the nozzle to the inlet manifold of the

positive-displacement meter, and connect a one-inch polypropylene line from the outlet of the one-inch valve downstream of the meter to the underground vapor recovery line. (System should be arranged so that pressure drop through the system is approximately the same with measuring devices connected as when system is operated normally.)

(c) Connect the manifold with dry gas meter, thermocouple, and HC analyzer to the vent of the underground tank. If the vents cannot be manifolded together, when a vacuum-assisted system is being tested, connect similar instrumentation to the vent of the gasoline vapor control system. When an incinerator is used to process gasoline vapors, install the positive displacement meter and manifold into the line to the incinerator. Connect HC analyzer, thermocouple, and pressure sensor to manifold taps.

(d) Assemble apparatus for conducting leak check of vehicle fuel tank. Connect 3/8 inch pressure supply hose and pressure sensor to leak check device. Connect supply hose to needle valve and pressure sensors upstream and downstream of needle valve. Connect regulator to bottle of nitrogen and exhaust of regulator by 3/8 inch line to the needle valve.

(e) Calibrate all instruments according to their manufacturers operating manuals for spans appropriate to the test requirements (Section 3.3). Calibrate the instruments at least at the start and end of the day's testing.

(f) Record the ambient barometric pressure and temperature after each vehicle test.

(g) Take five samples of gasoline from the underground tank in accordance with ASTM Method D270-65 and determine their RVP by ASTM test Method D323-72 or the Chevron micro-technique. Repeat after each fuel delivery to the underground tank.

(h) At the start and end of the test day, record the liquid volume readings on each gasoline pump at the service station. For systems using an incinerator, record the meter reading of the positive-displacement meter installed in the vapor line to the incinerator.

(i) At the start and end of the test period, record the positive-displacement vapor meter readings of the meters in the vents. Monitoring of vent emissions shall be 24 hours per day.

3.2.2.1 Leak check of vehicle fuel tanks to be done prior to vehicle tests is described below.

(a) Connect device for determining vehicle tank leak rate to vehicle fill-pipe.

(b) Open main valve on the nitrogen supply bottle and adjust the needle valve until the pressure in the fill neck reaches one half (1/2) inch water (gauge) and is stable.

(c) Determine the rate at which vapor is leaking by either timing a volume of 0.1 $ft.^3$ or by selecting a time period of 15 seconds, whichever results in a smaller volume being transferred to the vehicle tank. Record readings. If a stable pressure cannot be maintained due to too large a leak, note this.

(d) Remove device from the vehicle fill-pipe and proceed with the procedures as described in Section 3.2.2.2.

(e) If a leak-rate greater than 0.01 cfm is determined the vehicle may not be a base-line vehicle and the post-fueling leak check need not be conducted.

3.2.2.2 The following steps are for performing the individual vehicle tests.

(a) All dispensing from any nozzle not being tested, but connected to the same vapor return line as the test nozzle, must be done carefully by a service station attendant and not by a self-service customer. This procedure applies regardless of the mode of operation used during the 90-day reliability period. Even if certification is being sought for a totally manifolded system that is to be used in the self-service mode, all dispensing during the 100-car test, except dispensing which is done with the test nozzle, must be done very carefully by an attendant.

(b) For each vehicle tested insert a thermocouple into the vehicle tank, ensure thermocouple comes in contact with the liquid, allow sufficient time for the instrument to stabilize, and record the initial temperature of gasoline in its fuel tank.

(c) Instruct station attendant or self-service customer to connect nozzle. Note the type of fit obtained and note the make, model and year of vehicle being tested. The note on the type of fit obtained should include:

1) whether or not the nozzle could be latched,

2) problems encountered when inserting the nozzle, and

3) whether or not the nozzle was hand-held.

(d) Record the initial positive-displacement meter reading, turn chart recorders on, and verify operation of sensors. Set HC sample flowrate to approximately 500 cubic centimeters per minute.

(e) Instruct station attendant or self-service customer to start fueling vehicle at the maximum desired automatic flow-rate. Record the setting.

(f) Indicate on charts and/or other data printouts the point at which fueling commences.

(g) Record the dispensed liquid and returned vapor temperatures and record the positive-displacement meter readings at five gallon intervals. Indicate on the chart recordings the point at which each five gallon increment is passed. Take background explosimeter reading.

Use explosimeter to detect any leaks at the nozzle-fillneck interface. (Warn person dispensing gasoline that an explosimeter will be used and this is not to affect the person's normal mode of operation.)

(h) Indicate on the chart recordings the point at which fueling is terminated. Need a minimum of four gallons of fuel dispensed for an acceptable test. This is to allow for instrumentation responses to stabilize.

Record the total gallons dispensed and the final positive-displacement meter readings. Note any incidents of "spitbacks" or spills. Note the combustible gas detector readings. Instruct station attendant or self-service customer not to disturb the nozzle.

3.2.2.3 The post-fueling leak rate check is not to be conducted for vacuum assisted systems. Steps (a) through (e) are for leak rate check for displacement systems.

(a) Close the valve in the vapor return line under test so that the vapor return line is closed to gas flow. (Be sure HC analyzer sample pump has been turned off.)

(b) Open the main valve on the nitrogen supply bottle and adjust the needle valve until the pressure in the fillneck is at the desired level and is stable. It is suggested that the leak rate be determined at three fillneck pressures, one point below the average pressure experienced during fueling, one at average pressure and one above average pressure.

(c) Determine the rate at which vapor is leaking by timing a convenient volume (suggest a minimum of 0.1 $ft.^3$ or 15 seconds). Mark the chart pressure trace

at the start and finish of each timed interval. Record the time and volume. Repeat for each pressure setting. If a stable pressure cannot be maintained due to too small a leak (probably through vehicle's evaporative emission control system) so note. If the pressure experienced during the fueling cannot be obtained because the leak is too large, note this also.

(d) Remove the nozzle from the vehicle fill-neck and replace on the gasoline pump. Purge HC analyzer system and zero pressure transducers. Open the valve in the vapor return line.

(e) Measure the final temperature of the gasoline in the vehicle tank and record.

3.2.2.4 Continue tests for the test sample. The sample shall be statistically representative of the vehicle population, weighted according to vehicle miles travelled (Section 3.4 6).

(a) The vehicle population is to meet the specified vehicle matrix within three vehicles. The test vehicles are to be selected on a first-in-first tested basis. The exception to this is when a vehicle is rejected for one of the reasons in (b) below.

(b) The only acceptable reasons for rejection of a vehicle are: (1) incomplete test data, (2) vehicle has been modified in the vicinity of the fill-pipe opening or vehicle fill-pipe has been modified or damaged, (3) vehicle test matrix category already full, (4) less than required minimum fuel dispensed, (5) vehicle did not have fill-pipe cap upon arrival at station.

3.2.2.5 At the end of the testing determine the number of baseline vehicles (those vehicles which met the conditions of 3.2.3 (g)) if this number is not 40 or more, continue testing until this number is obtained. These additional vehicles will only be used in estimating actual vehicle emissions and

will not be used in calculating the system efficiency. (Any additional baseline vehicles have to meet the conditions in 3.2.3 (g).

3.2.2.6 Any test vehicle which had an initial vehicle tank temperature more than 10°F outside the range of temperatures for the baseline vehicles will be discarded from the test fleet.

3.2.2.7 Record pressure of the vehicle tank and the underground tank during various rates of fueling and determine the pressure drop in the line from the nozzle to the underground tank.

3.2.3 Calculations

(a) Volume of gas transferred to underground tank during vehicle fueling.

$$V_{rs} = \frac{V_r \times 520 \times (P_b + \Delta H_r/13.6)}{T_r \times 29.92}$$

Where:

V_{rs} = Volume of gas corrected to 60°F and 29.92 in. Hg. passing through dry gas meter in nozzle vapor line for each vehicle, $Ft.^3$.

V_r = Actual volume of gas passing through the dry gas meter in the nozzle vapor line for each vehicle. Corrected for amount of vapor removed for the hydrocarbon analysis, $Ft.^3$.

P_b = Average barometric pressure, in. Hg.

ΔH_r = Average manometer pressure, in. H_2O.

T_r = Average temperature in the nozzle vapor line, °R taken at meter inlet.

(b) Weight of gasoline vapor transferred to underground tank during vehicle fueling.

$$W_r = \frac{C_r \times V_{rs} \times M_r \times 454}{379}$$

Where:

W_r = Weight of gasoline vapor transferred to underground tank for each vehicle, Gm.

C_r = Average fractional concentration of hydrocarbons, decimal fraction.

V_{rs} = From (a) above.

M_r = Molecular weight of hydrocarbon used to calibrate hydrocarbon analyzer, lbs/lb. Mole.

(c) Volume of gas discharged from vent of underground tank during vehicle fueling.

$$V_{as} = \frac{V_a \times 520 \times P_b}{T_a \times 29.92}$$

Where:

V_{as} = Total volume of gas discharged from vent of the underground tank plus from vent of control system if a vacuum-assisted system, corrected to 60°F and 29.92 in. Hg, $Ft.^3$.

V_a = Actual volume of gas passing through dry gas meter, or meters, corrected for amount of vapor removed for the hydrocarbon analysis, $Ft.^3$.

P_b = Average barometric pressure, in. Hg.

T_a = Average temperature of gas discharging from vent, or vents, °R.

(d) Weight of gasoline vapor discharged from vent of underground tank during vehicle fueling.

$$W_a = \frac{C_a \times V_{as} \times M_a \times 454\ G_d}{379\ G_s}$$

Where:

W_a = Weight of gasoline vapor discharged from the vent of the underground tank, plus from vent of control system if a vacuum-assisted system, weighted for the gallons of gasoline sold through the pump where vehicle testing occurs, Gm.

C_a = Average fractional concentration of hydrocarbons at vent, decimal fraction.

V_{as} = From (c) above.

M_a = Molecular weight of hydrocarbons compound used to calibrate hydrocarbon analyzer, lbs/lb. Mole.

Note: If an incinerator is used to process vapors, see Section 3.6 for calculation of incinerator emissions.

G_d = Total volume of gasoline dispensed to the test vehicles, gal.

G_s = Total volume of gasoline dispensed from all the station pumps, gal.

Note: If the rate of volume emissions and the hydrocarbon concentrations

of the vent emissions are not constant with time, the product of $C_a \times V_{as}$ must be integrated with respect to time. Numerical integration techniques are recommended.

(e) Weight of gasoline vapor displaced during vehicle fueling of the test fleet.

$$W_x = \sum_{i=1}^{n} \left[\frac{U}{L}\right]_i (G)_i$$

Where:

W_x = Baseline weight of total gasoline vapor displaced during vehicle fueling, Gm.

$\left[\frac{U}{L}\right]_i$ = From regression equations developed from baseline vehicle data. Gm/gal.

$(G)_i$ = Number of gallons transferred during "i th" fueling.

i = Individual fueling.

Note: For calculating W_x for baseline vehicles, use W_{ri} instead of $\left[\frac{U}{L}\right]_i G_i$.

(f) Efficiency of fueling control system.

$$E_r = \frac{\left[\sum_{i=1}^{n} W_{ri} - W_{ai}\right] \times 100}{W_x}$$

Where:

E_r = Efficiency of vehicle fueling control system, percent.

W_r = From (b) above.

W_a = From (d) above.

W_x = From (e) above.

i = Individual fueling.

(g) Regression equations for estimating the actual weight of gasoline vapor displaced during vehicle fueling of the test fleet.

For a balance system, select those vehicles from the total list of vehicles tested which had: (1) complete test data, (2) a pre-fueling leak rate of equal to or less than 0.01 CFM, (3) a post-fueling leak rate of equal to or less than 0.01 CFM, (4) explosimeter readings for the fueling period equal to or less than 0.1 LEL (except for a monetary spike such as

the end of fueling). It is desireable that baseline vehicles be those where "hands-off" fueling occurred; however, this may not be possible due to the nature or mode of operation of the system being tested. These vehicles and their measured data will be used to develop the regression equation to determine $\left[\frac{u}{L}\right]$; for a balance type vapor recovery system.

For a vacuum-assisted system, select those vehicles from the total list of vehicles tested which had: (1) a pre-fueling leak rate of equal to or less than 0.01 CFM, (2) a zero or negative pressure in the vehicle fillneck for the fueling period, (3) explosimeter readings for the fueling period equal to or less than 0.1 LEL (except for a monetary spike such as at the end of fueling), and (4) a complete set of data. These vehicles and their measured data will be used to develop the regression equation to determine $\left[\frac{u}{L}\right]$; for a vacuum-assisted type vapor recovery system. Using step-wise regression techniques, determine a multivariable linear regression equation for the

emissions from baseline vehicles (those vehicles selected by the above criteria) using as the dependent variable - grams HC vapor per gallon of gasoline dispensed,

$$\left(\frac{W_r}{\text{gallons of gasoline dispensed to vehicle}}\right)$$

and as the independent variables - the vapor pressure of the dispensed gasoline, the initial temperature of the gasoline in the vehicle tank (T_v), and the average temperature of the dispensed gasoline (T_d). An equation of a different form (such as a quadratic) or an equation using different independent variables may be used if the alternate equation gives a statistically better fit at the 0.01 level of confidence.

3.3 Calibrations

3.3.1 Flow meters. Standard methods and equipment shall be used to calibrate the flow meters. The calibration curves are to be traceable to National Bureau of Standards (NBS) standards.

3.3.2 Temperature recording instruments. Calibrate daily prior to test period and immediately following test period using ice water (32°F) and a known temperature source about 100°F.

3.3.3 Pressure recording instruments. Calibrate pressure transducers prior to the 100 vehicle Phase II test with a static pressure calibrator for a range of -3 to +3 inches water or appropriate range of operation. Zero the transducers after each individual vehicle test.

3.3.4 Total hydrocarbon analyzer. Follow the manufacturer's instructions concerning warm-up time and adjustments. On each test day prior to testing and at the end of the day's testing, zero the analyzer with a zero gas (<3 ppm C) and span with 30 percent and 70 percent concentrations of propane. Prior to the Phase I and Phase II testing perform a comprehensive calibration in the laboratory. Check the analyzer with several known concentrations of propane to determine linearity. The HC calibration cylinders must be checked against a reference cylinder maintained in the laboratory before each field test. This information must be entered into a log identifying each cylinder by serial number. The reference cylinder must be checked against a primary standard every six months and the results recorded. The reference cylinder is to be discarded when the assayed value changes more than one percent. Any cylinder is to be discarded when the cylinder pressure drops to 10 percent of the original pressure.

3.3.5 A record of all calibrations made is to be maintained.

3.4 Acceptance of Systems

When a system is accepted, it will have certain physical features such as piping sizes and configurations which may have to be modified to accomodate the requirements of each installation. Because the pressure drops and other characteristics of the system are influenced by these features and these in turn influence effectiveness, it may be necessary to condition acceptance upon certain criteria which account for physical parameters such as pressure drops and flow rates. When systems are tested for acceptance, these parameters will be ascertained.

Some of the conditions that may be imposed upon an acceptance are:

(a) Allowable pressure drop in the lines leading from the dispensing nozzle to the underground tank.

(b) The method of calculating the pressure drop.

(c) The model of dispensing nozzle which may be used.

(d) The manner in which vapor return lines may be manifolded.

(e) The type of restriction to be placed on the vent of the underground tank.

(f) The number of dispensing nozzles which may be serviced by a secondary system.

(g) Allowable delivery rates.

(h) Use of the system on full-service stations only.

3.5 Test Sample

A total of 100 vehicles are required to be tested for determining the efficiency of a Phase II system. The vehicle distribution based on model year, vehicle miles travelled and manufacturer for use until September 1976 is given in Table I. An up-date table will be issued in September of each subsequent year. Vehicles will be tested as they enter the station ("first in" basis) until a specific matrix block of the distribution is filled. Additional tested cars that fit into a completed matrix block can be used as baseline vehicles but may not be substituted for earlier complete tests. Exception to this is when more than two identical vehicles arrive to be tested, only the first two will be used. (An example of this would be if three 1975 Impala station wagons come in for testing, only the first two would be used unless one was rejected for other reasons such as missing data.) The only other reasons for excluding a vehicle from the test fleet are: (1) incomplete data for vehicle (missing vehicle temperature, HC concentration, volume

returned); (2) less than require minimum fuel dispensed; (3) vehicle has been modified in the vicinity of the fillpipe opening or has significantly damaged or modified fuel tank fillpipe; (4) vehicle was agreed upon by applicant and ARB as being unacceptable; (5) vehicle did not have fillpipe cap upon arrival at station.

3.6 Test Procedures for Determining Incineration Emissions

3.6.1 Principle and Applicability

3.6.1.1 Hydrocarbon and carbon dioxide concentrations in the exhaust gases, and gas volume and HC concentrations in the inlet vapor, and ambient carbon dioxide concentrations are measured. These values are used to calculate the incinerator HC control efficiency and mass emission rate based on a carbon balance.

3.6.1.2 Applicability: This method is applicable as a performance test method for gasoline vapor control incinerators used at service stations equipped for Phase I and II vapor control.

3.6.2 Test Scope and Conditions

3.6.2.1 Station Test Status: The procedure is designed to measure incinerator control

efficiency under conditions that may be considered normal for the station under test. All dispensing pumps interconnected with or sharing the control system under test shall remain open as is normal for the station operation. Vehicles shall be fueled as is normal for the test period. As underground tank filling produces vapor volumes different from vehicle tank filling, no underground tank filling should be performed during the test period. A separate test is to be made to determine vapor control efficiency during Phase I operations.

3.6.2.2 Fuel RVP: The RVP of the fuel dispensed during the test shall be within the range normal for the geographic location and time of the year.

3.6.3 Test Equipment

3.6.3.1 HC Analyzers: HC analyzers using flame ionization detectors calibrated with known concentrations of propane in air are used to measure HC concentrations at both the incinerator inlet and exhaust. A suitable continuous recorder is required to record real-time output from the HC analyzer.

3.6.3.2 Sample System: The sample probe is to be of a material unaffected by combustion gases (S.S. 365). The sample pump should be oil-less and leak-tight. Sample lines are to be inert, teflon is recommended. A thermocouple (0-2000°F) shall be used to monitor temperature of exhaust gases at the inlet to sampling system.

3.6.3.3 Carbon Dioxide Analyzer: A nondispersive infrared analyzer calibrated with known quantities of CO_2 in air is used to measure CO_2 concentrations in the exhaust gas.

3.6.3.4 Other equipment is specified in Section 3.2.1.

3.6.4 Test Procedure

3.6.4.1 Visual Inspection: Any visual emissions except for steam, from vapor incinerators are an indication of poor combustion. An incinerator shall not emit air contaminants (not including moisture) in such a manner that the opacity of the emission is greater than 10 percent for a period or periods

aggregating more than one minute in any 60 consecutive minutes; or greater than 40 percent opacity at any time. Should such visible emissions from the exhaust be detected, the control system is unacceptable and the problem must be corrected and an application made to the ARB for reconsideration for certification.

3.6.4.2 Sample Location: The sampling point should be located in the exhaust stack down-stream of the burner far enough to permit complete mixing of the combustion gases. For most sources, this point is at least eight stack diameters downstream of any interference and two diameters upstream of the stack exit. There are many cases where these conditions cannot be met. The sample point should be no less than one stack diameter from the stack exit and one stack diameter above the high point of the flame and be at a point of maximum velocity head as determined by the number of equal areas of cross-sectional area of the stack. The inlet sampling location is in the system inlet line routing

vapors to the burner. A HC sample tap, a pressure sensor tap, and a thermocouple connection to monitor gas temperature must be installed on the inlet side of the volume meter.

3.6.4.3 Monitoring Equipment Set-Ups: Span and calibrate all monitors. Connect sampling probes, pumps and recorders to the monitors and mount sampling probes in the stack and at the inlet.

3.6.4.4 Measurements: Mark strip charts at the start of the test period and proceed with HC, CO_2, and volume measurements for at least three burning cycles of the system. The total sampling time should be at least three hours. Sampling for HC's and CO_2 must occur simultaneously. At the end of each cycle, disconnect CO_2 instrument and obtain an ambient air sample. This step requires that the CO_2 instrument be calibrated for the lower concentrations expected at ambient levels.

3.6.4.5 Gasoline Liquid Volume: Record the gasoline liquid dispensed during the test period.

3.6.5 Calculations

3.6.5.1 Symbols

CO_2	=	Carbon dioxide concentration in the exhaust gas (ppmv).
CO_{2a}	=	Average carbon dioxide concentration in the ambient air (ppmv).
HC_i	=	Hydrocarbon concentration in the inlet gas to the burner (ppmv as propane).
HC_e	=	Hydrocarbon concentration in the exhaust (ppmv as propane).
L_d	=	Gasoline liquid volume dispensed during test period (gallons).
P_i	=	Static pressure at inlet meter (in H_g).
T_i	=	Temperature of gas at inlet meter (°F).
V_i	=	Inlet gas volume (ft^3).
F	=	Dilution Factor
51.6×10^{-6}	=	Correction factor for grams of hydrocarbon per gas volume parts per million propane $\left(\frac{g}{(SCF)\ (ppmv)}\right)$
3	=	Number of carbon atoms per propane molecule.

3.6.5.2(a) Calculate the standard total gas volume (V_s) at the burner inlet for each test. (Standard temperature 60°F, standard pressure 29.92 in Hg).

$$V_s = V_i \frac{(P_i + 29.92)}{(T_i + 460)} \frac{520}{29.92} \quad (1)$$

(b) Calculate an average vapor volume to liquid volume (v/l) at the inlet for each test.

$$(v/l)_i = \frac{V_s}{L_d} \frac{(SCF)}{gal} \quad (2)$$

(c) A carbon dilution factor, F, can be calculated for the incinerator using the inlet and outlet CO_2 concentrations, the inlet and outlet HC concentrations and the ambient CO_2 concentration. The important criterion for this calculation is that all the significant carbon sources be measured. The values used in the calculation should represent average values obtained from strip chart readings using integration techniques. Some systems have more than one burning mode of operation. For these it is desirable to have high and low emission levels calculated. This requires that

corresponding dilution factors (v/L) values and $(m/L)_i$, values be calculated for each period in question.

$$F = \frac{HC_i}{HC_e + \frac{CO_{2e} - CO_{2a}}{3}} \quad (3)$$

(d) The mass emission rate $(m/L)_e$ is calculated using the inlet $(m/L)_i$ from equation (3) and the carbon dilution factor from equation (4). The exhaust HC concentration will vary with time and operation of the system. It is likely that, in addition to an overall average mass emission rate using an average HC_i, several peak values of $(m/L)_e$ will be required as discussed above. If some correlations between HC_i and HC_e occurs over the burning cycle of the system, this calculation should be used to show the change in mass emission rate.

$$(m/L)_e = F \left(\frac{HC_e}{HC_i}\right) (m/L)_i \quad (g/gal) \quad (5)$$

(e) Mass control efficiency (% E) can be calculated for an average value over each test interval. It represents the reduction of hydrocarbon mass

achieved by the incinerator system and this efficiency can vary depending on the loading cycle or the inlet loading.

$$\%E = 100 \left[1 - \frac{(F)\ (HC_e)}{(HC_i)}\right] \quad (6)$$

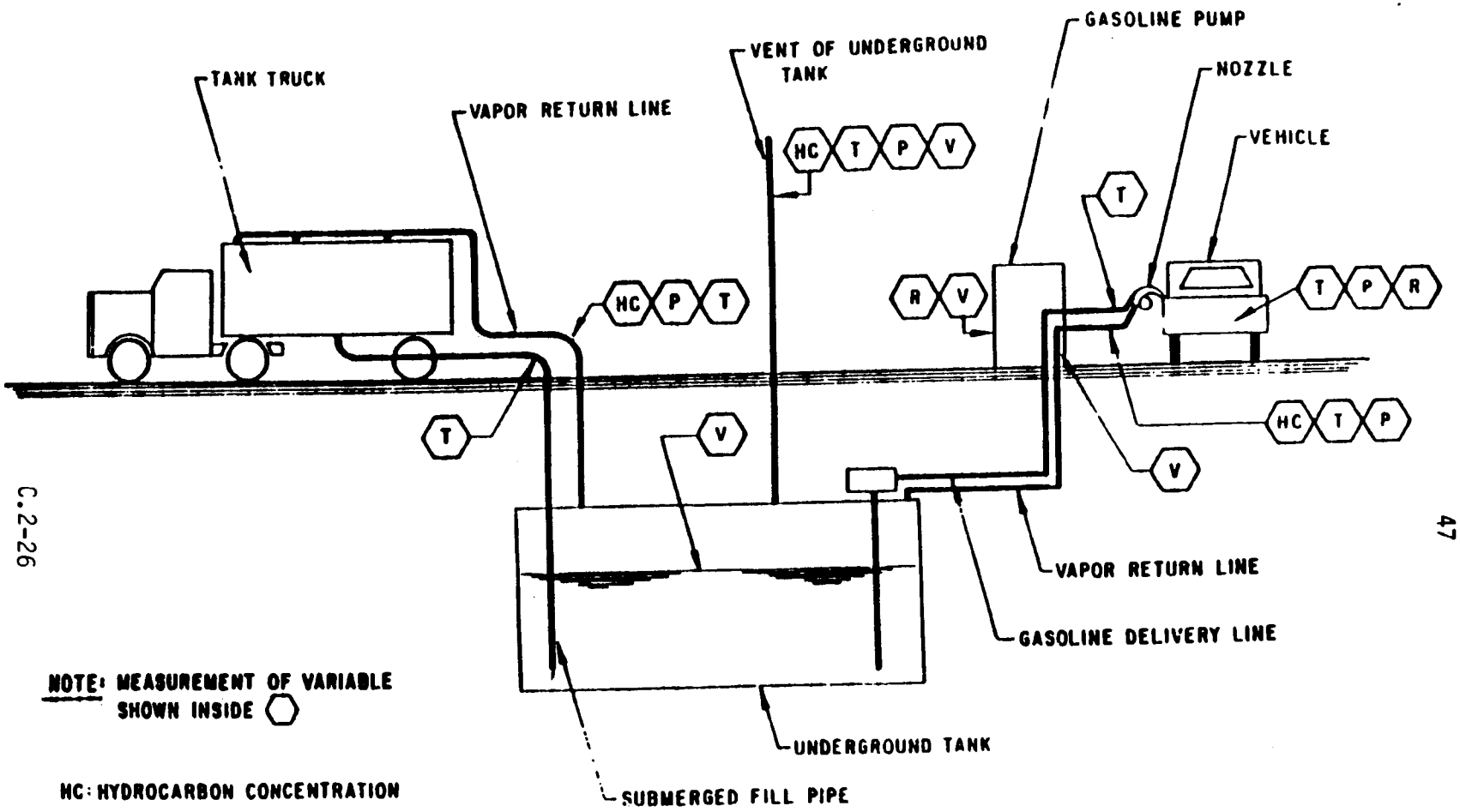
3.6.6 Calibrations

3.6.6.1 Total Hydrocarbon Analyzers: Flame ionization detectors or equivalent total hydrocarbon analyzers are acceptable for measurement of exhaust hydrocarbon concentrations. Calibrations should be performed following the manufacturer's instructions for warm-up time and adjustments. Calibration gases should be propane in hydrocarbon-free air of known concentrations prepared gravimetrically with measured mass quantities of 100 percent propane. A calibration curve shall be produced using a minimum of five (5) prepared calibration gases in the range of concentrations expected during testing. The calibration curve shall be used in determining measured levels during testing. The calibration of the instrument need not be performed on site, but shall be performed

prior to and immediately following the test program. During the test program, the HC analyzer shall be spanned on site with zero gas (<3 ppmv C) and with known concentrations of propane in hydrocarbon-free air at a level near the highest concentration expected. The spanning procedure shall be performed at least twice each test day.

3.6.6.2 Carbon Dioxide Analyzer: Nondispersive infrared analyzers are acceptable for measurement of exhaust CO_2 concentrations. Calibrations should be performed following the manufacturer's instructions. Calibration gases should be known concentrations of CO_2 in air. A calibration shall be prepared using a minimum of five prepared calibration gases in the range of concentrations expected. The calibration of the instrument need not be performed on site but shall be performed immediately prior to and immediately following the test program. During the testing the analyzer shall be spanned with a known concentration of CO_2 in air at a level near the highest concentration expected. The spanning procedure shall occur at least twice per test day.

3.7 Alternate equipment and techniques may be used if prior approval is obtained from the ARB.



NOTE: MEASUREMENT OF VARIABLE SHOWN INSIDE ⬡

HC: HYDROCARBON CONCENTRATION

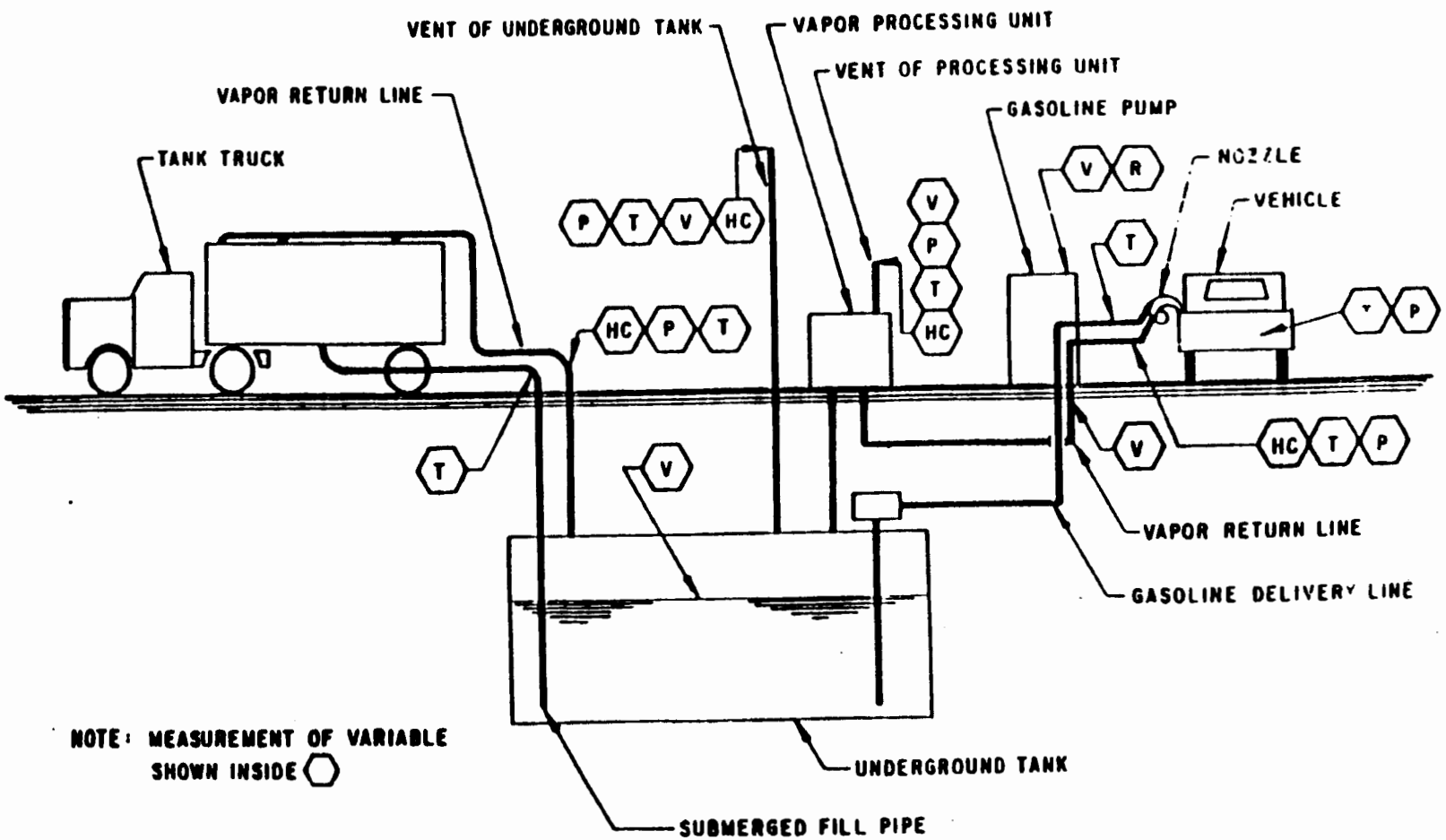
P: PRESSURE

R: REID VAPOR PRESSURE

T: TEMPERATURE

V: VOLUME

FIGURE 1 DISPLACEMENT SYSTEM



NOTE: MEASUREMENT OF VARIABLE SHOWN INSIDE ⬡

HC = HYDROCARBON CONCENTRATION
P = PRESSURE
R = REID VAPOR PRESSURE
T = TEMPERATURE
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FIGURE I! VACUUM ASSISTED SECONDA

FIGURE 3

PRE-FUELING LEAK CHECK DEVICE

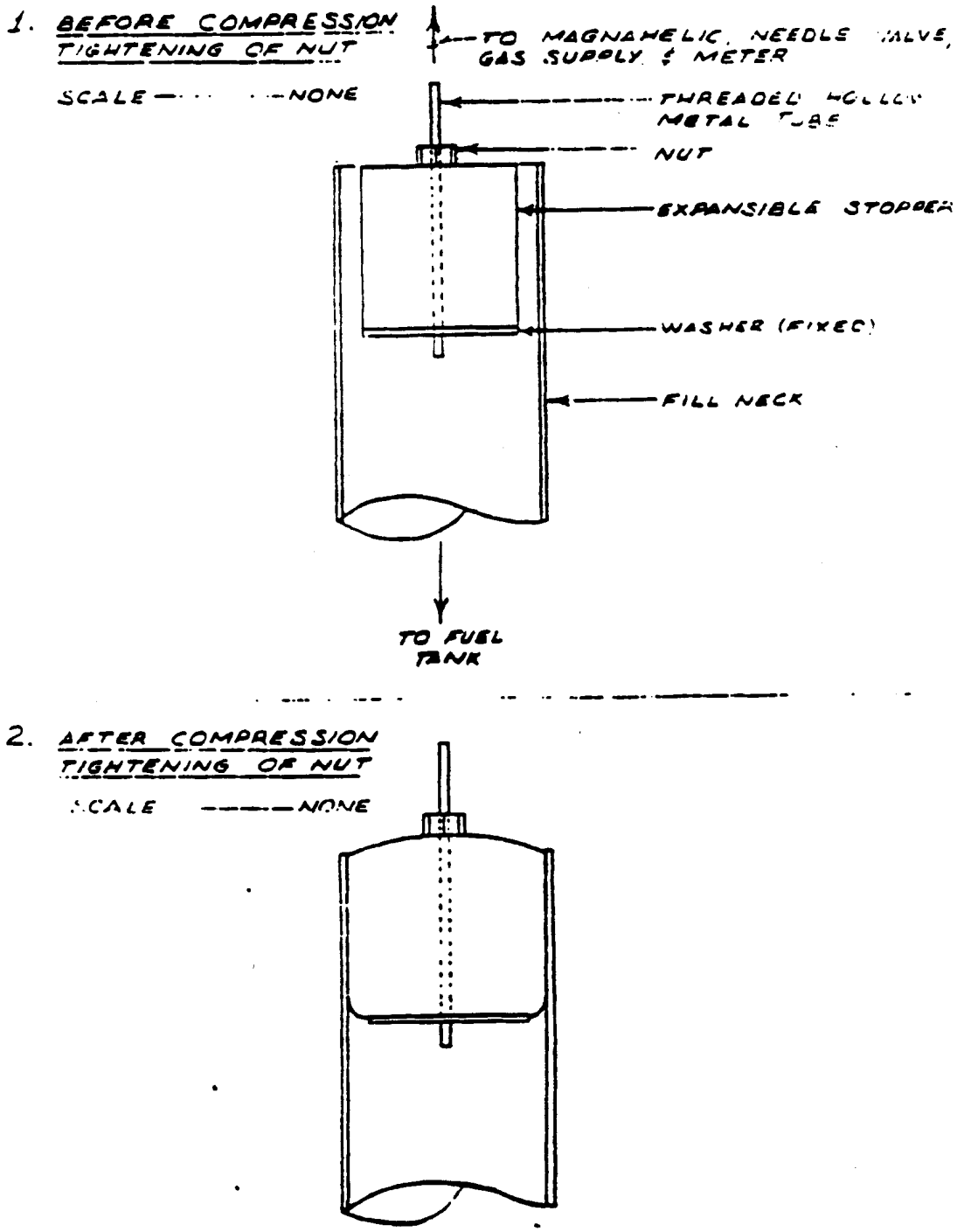

TABLE I

Test Sample for Determining the Efficiency of Phase Two Systems by Model Year, Vehicle Miles Travelled and Manufacturer

Model Year	Percent Distribution by VMT	Automobile Manufactured				
		General Motors	Ford Motor Company	Chrysler Corporation	American Motors Corporation	Imports
Pre 1970	12	5	3	2	0	2
1970	5	2	1	1	0	1
1971	7	2	2	1	0	2
1972	9	3	2	1	0	3
1973	10	4	3	1	0	3
1974	12	4	3	1	0	3
1975	15	5	4	1	1	5
1976	17	5	4	2	1	5
1977	12	4	2	1	0	5
1978	1	0	0	0	0	0

October 1977

APPENDIX C.3

CALIFORNIA DEPARTMENT OF MEASUREMENT STANDARDS REQUIREMENTS AND TEST PROCEDURES

TYPE EVALUATION APPLICATION PROCEDURES

I. INTRODUCTION

The Pre-Sale and Pre-Use type approval of new models of commercial weighing and measuring devices is required by Division 5, Section 12500.5 of the California Business and Professions Code:

> 12500.5. The Director by rules and regulations shall provide for submission for approval of types or designs of weights, measures, or weighing, measuring, or counting instruments or devices, used for commercial purposes, and shall issue certificates of approval of such types or designs as he shall find to meet the requirements of this code and the tolerances and specifications thereunder.
>
> It shall be unlawful to sell or use for commercial purposes any weight or measure, or any weighing, measuring, or counting instrument or device, of a type or design which has not first been so approved by the department; provided, however, that any such weight, measure, instrument, or device in sue for commercial purposes prior to the effective date of this act may be continued in use unless and until condemned under the provisions of this code.

II. NATIONAL TYPE EVALUATION PROGRAM (NTEP)

California is a participant in the National Type Evaluation Program (NTEP) and is authorized to conduct NTEP evaluations.

III. REQUEST FOR TYPE EVALUATION

1. To obtain National Type Evaluation, submit a letter of request to:

   National Type Evaluation Program
   c/o National Conference on Weights and Measures
   National Institute of Standards and Technology
   Gaithersburg, MD 20899

2. To obtain California only type evaluation, submit a letter of request to:

   Division of Measurement Standards
   8500 Fruitridge Road
   Sacramento, California 95826
   Attn: Type Approval Program

   The request for California evaluation should include the requesting company's federal or California tax identification number.

3. For National or California type evaluation:

   A. Authorize the billing of all incurred costs by the Participating Laboratory conducting the evaluation.

B. Complete the attached Application Form giving the requested description of the device, including its operating characteristics and instructions, its intended application, model number, capacity, size, and shipping weight.

C. Following acknowledgement of request, ship the device intact and ready for evaluation to the assigned testing location (if special installation arrangements are required, they must be made by the requestor prior to the time of evaluation).

NOTE: Manufacturers who have not previously submitted their equipment for approval in California or have a record of delinquent payments will be required to remit a deposit in advance. This payment will be based upon our estimate of the cost to conduct the necessary tests. In such cases, evaluation of the equipment cannot begin until the estimated amount is received by the "Cashier" of the Department of Food and Agriculture.

IV. PUBLICATIONS

Both the California Business and Professions Code, containing the basic laws, and the California Code of Regulations, Title 4, Chapter 9, containing the tolerances and specifications, may assist the manufacturer before and during the approval process. These publications may be obtained by sending a check or money order for the appropriate amount, payable to "Cashier", to the Department of Food and Agriculture, 1220 N Street, Sacramento, California 95814.

#400 California Business and Professions Code
(Weights and Measures) $4.50

#401 California Code of Regulations
Title 4, Chapter 9, Weights and Measures . . . $7.00

#402 Examination Procedure Outline - Commercial
Weighing and Measuring Devices $7.00

The National Institute of Standards and Technology Handbook 44, 1989 Edition, is available for $15.00, postpaid, from:

Superintendent of Documents
U. S. Government Printing Office
Washington, D.C. 20402

(Stock No. 003-003-02888-6)

(Telephone No.: (202) 783-3238)

Publication 14 "National Type Evaluation Program" is available in limited quantities from the NIST Office of Weights and Measures (301) 975-4004.

Article 2 is adopted:

ARTICLE 2. PROCEDURES FOR TYPE APPROVAL CERTIFICATION EVALUATION AND FIELD COMPLIANCE TESTING OF VAPOR RECOVERY SYSTEMS

4054. A. Application.

A.1. Vapor recovery systems.

This code applies to Stage II vapor recovery systems designed to control motor vehicle fuel vapors which result from fueling operations pursuant to Sections 41954, 41956, and 41956.1 of the Health and Safety Code. This code establishes regulations to govern some design characteristics of those systems and their operation to ensure liquid recirculation is prevented.

A.1.1. Balance system.

The balance vapor recovery system utilizes fuel delivery nozzles with a bellows and face plate designed to make an "intended tight seal" with the vehicle fill pipe opening. Liquid filling a fuel tank displaces the existing vapor space creating a positive pressure in the tank. That higher pressure achieves equilibrium with the supply tank's vapor pressure through the vapor return line making the system "balanced".

A.1.2. Assist system.

Assist vapor recovery systems may utilize more than one type of fuel delivery nozzle. One has a bellows and face plate designed to make a "non-intended tight seal" with the vehicle fill pipe opening. Another has no bellows, uses a coaxial metal fill spout with perforations in the outer

tube to remove vapors, and allows visual observation of the fill pipe opening. These systems employ a mechanism to create vacuum which "evacuates" displaced vehicle fuel tank vapors by a negative pressure in the vapor return line.

A.2. Responsibility of Director and manufacturer.

A.2.1. Director.

As specified in subsection A.1., a system submitted for type approval certification shall be evaluated by the Director applying the procedures established in this article plus any additional tests he determines necessary to assure compliance of the system with the specifications and performance requirements contained herein.

A.2.2. Manufacturer.

Prior to type approval certification testing, the applicant shall submit information to the Director pertaining to the design of a system, including schematics, blueprints, instruction manuals, brochures, components, and all other information necessary for preliminary review. If defects are found in the design, manufacture, service, repair, or any other characteristic of the system, the Director may permit the applicant to modify and resubmit the system for further review. After successful completion of preliminary review, the applicant shall be authorized to install its system of a specified number of components in a prescribed location for use in the type approval certification testing.

A.3. Revocation of type approval certification.

The Director's issuance of type approval certification pursuant to Section 4054 obligates the manufacturer to continue producing its system in accordance with the same specifications and proper performance characteristics as when submitted and approved. The Director by his own

motion, or upon the request of any county sealer or other interested person, may reexamine any type-approved system to determine if the system continues to meet the applicable requirements. If testing of the systems operating within the State reveals a defect involving more than one percent of the sample selected and examined, the Director may initiate a proceeding pursuant to the California Administrative Procedure Act (Government Code Section 11500 *et seq.*) to determine if the type approval should be revoked or modified. Nothing herein, however, shall prevent the Director from undertaking discussions with the manufacturer to resolve any problem prior to initiating adverse action.

A.4. Procedure.

The Director shall, in cooperation with the county sealer of weights and measures for the designated location, observe and examine the system in operation normally within 30 to 90 days. One or more examinations shall be conducted during the prescribed test period to determine compliance with Sections 4054.1, 4054.2, and 4054.3 which relate to specifications, performance, and accuracy. If, during or at the conclusion of any examination, the system fails to maintain reliability and accuracy within the tolerances specified in Section 4054.3, the Director shall so advise the applicant and may refuse further testing unless the defects are corrected. However, type approval certification shall not be issued until the applicant submits a report of evaluation by an independent testing laboratory as specified in Section 4054.2, N.6.

A.5. General code application.

The general code requirements for weighing and measuring devices as specified in Section 4000 shall also apply.

NOTE: Authority cited: Sections 12107 and 12500.5, Business and Professions Code; and Sections 41956(a) and 41956(c), Health and Safety Code. Reference: Sections 12107 and 12500.5, Business and Professions Code; and Sections 41956(a) and 41956(c), Health and Safety Code.

4054.1. S. Specifications.

S.1. System Components.

Systems governed by this article utilizing motor vehicle fuel nozzles shall contain in each nozzle adequate and automatic means to prevent measured liquid from either recirculating (entering the vapor return line) or overflowing a vehicle fill pipe opening.

S.1.1. Nozzles.

(a) All nozzle types shall have a primary shut-off device which automatically activates when liquid covers the nozzle primary shut-off sensing mechanism.

(b) Balance type nozzles shall have a secondary shut-off device or other effective means to prevent liquid recirculation. Secondary shut-off devices shall automatically activate after liquid has entered the vapor return line because the primary shut-off device has failed. (Typically, secondary shut-off devices are pressure-activated and shut off when liquid in the vapor return line blocks the return of vapors).

(c) Assist type nozzles may have a secondary shut-off device or else some other effective means to avoid liquid overflowing a vehicle fuel tank because the primary shut-off device has failed. "Other effective means" include, but are not limited to, permitting liquid to be seen either by observing the fill pipe opening or hearing and seeing liquid overflow spillage.

S.2. Field compliance test unit.

S.2.1. Use.

The field compliance test unit shall be used to examine the proper operation of:

(a) primary shut-off devices,

(b) secondary shut-off devices, and

(c) inches of H_2O column vacuum for assist systems.

S.2.2. Design.

S.2.2.1. Tank.

The test unit shall be a rigid metal vessel 13-inches high and 9-inches in diameter with a liquid capacity of 3 gallons (all measurements approximate). A commercial-sized, 30 pound Freon recharging tank is typically used.

S.2.2.2. Base support/stand.

The test unit may be supported either:

(a) on a metal base 3/16-inch thick, 6-inches wide, and 17-1/2 inches long (all measurements approximate) or,

(b) by a stand which elevates the test unit to accommodate a bottom-inserted 3/4 inch ball valve for emptying purposes.

S.2.2.3. Fuel fill pipe.

The test unit shall have a metal fuel fill pipe welded to the tank at a 45 degree angle from horizontal. Placement of the fill pipe is critical. It shall enter the test unit at the middle of the curvature between the top and sides of the vessel so that a specified ullage (vapor space) is created. The fill pipe shall have no internal vent, shall be 2-1/4- inch outside diameter and 10 inches long (both measurements approximate), and shall extend inside the tank no more than 1/4 inch. A

longitudinal part of the fill pipe near its fill opening shall be cut away in order to observe that the nozzle primary shut-off device sensing mechanism is immersed in liquid. The cut-away is approximately 5 inches long to a depth of 1/2 the pipe's diameter. The fill pipe shall have transparent flexible tubing slipped over its entire length. The fill opening shall be modified to accommodate nozzle spouts at least 15/16 inch outside diameter (leaded fuel). The test unit shall be airtight when the fill pipe opening is sealed.

S.2.2.4. Other equipment.

A rigid, transparent plastic tube approximately 12 inches long and 3-7/8 inches inside diameter should be installed around the fill pipe to contain liquid overflow. A 5/16-inch valve with an outlet to attach a hose shall be installed at the top center of the vessel for obtaining pressure readings. Handles for carrying and emptying the test unit may be attached. All metal parts of the test unit shall be electrically bonded together. Refer to the test unit illustrations in Figure 1.

S.3. Assist system inches of H_2O column vacuum.

Assist vapor recovery systems shall be designed to operate at not more than -10 inches H_2O column vacuum as measured at the nozzle or test unit during a delivery typical of customer usage.

NOTE: Authority cited: Sections 12107 and 12500.5, Business and Professions Code; and Sections 41956(a) and 41956(c), Health and Safety Code. Reference: Sections 12107 and 12500.5, Business and Professions Code; and Sections 41956(a) and 41956(c), Health and Safety Code.

4054.2. N. Notes - Type Approval Certification Evaluation.

N.1. System installation.

A minimum of 6 nozzles shall be installed in a test location on hoses of both leaded and unleaded fuels. Hoses may be selected to anticipate maximum customer usage and efficient observer interaction. The test nozzles shall not fail to operate as designed for the duration of the evaluation.

N.2. Dispenser measurement accuracy.

Prior to the field examination of a vapor recovery system, the dispenser meters for the test nozzles shall be tested and adjusted, if necessary, to be within maintenance tolerance.

N.3. Performance accuracy - primary and secondary shut-off devices.

N.3.1. Test method.

Examination of the test nozzles shall be performed with a field compliance test unit as specified in subsection S.2.

NOTE: Two or more test units will expedite the examination significantly.

N.3.1.1. Test procedure - primary shut-off device.

N.3.1.1.1. Initial test.

Dispense fuel into the test unit with each nozzle. All nozzles shall shut off automatically at any delivery flow rate as the test unit becomes full as specified in subsection S.1.1.(a).

N.3.1.1.2. Override test.

After the initial primary shut-off device activates, dispense enough additional fuel into the test unit to immerse the nozzle primary shut-off sensing mechanism in liquid. Record the dispenser indicator gallons.

Make 10 additional consecutive override attempts duplicating a range of customer usage and record the new indicated gallons. All 10 attempts shall result in automatic nozzle shut off before the dispenser volume indicator increases more than the 1/10 gallon limit as specified in subsection T.1.1. The 10 override attempts shall be performed on a minimum of 6 nozzles, each tested a minimum of 3 times during this examination.

N.3.1.2. Test procedure - secondary shut-off device (if equipped).

Introduce sufficient fuel into the vapor return line (approximately 1/10 gallon or 375 milliliter) to block the return of vapors through the line. Hold in place a "U-shaped" configuration of the fuel discharge hose at a level lower than the nozzle to concentrate the liquid. Make a minimum of 10 attempts to dispense fuel into an empty test unit. Record the dispenser indicator gallons before and after each attempt. (Balance-type nozzles must make their intended tight seal at the fill pipe opening.) The nozzle shall shut off automatically before the dispenser volume indicator increases more than the 3/10 gallon limit for each attempt as specified in subsection T.1.2. This procedure shall be performed on a minimum of 6 nozzles.

NOTES: (1) The test unit must be empty initially to insure liquid does NOT interact with the primary shut-off device sensing mechanism. (2) For some hose configurations, introducing additional fuel into the vapor return line during the test procedure may be necessary. Introduced liquid can be returned to storage by building vapor line pressure produced by this procedure.

N.4. Delivery accuracy - 150 vehicle test.

N.4.1. Test method.

Compliance with delivery accuracy requirements shall be based upon data recorded for at least 150 vehicles while observing customers fueling (self-serve) with the test nozzles under normal field conditions.

N.4.2. Test procedure.

Install a transparent trap, or other suitable means, between each nozzle and dispenser outlet connection for the hose. Any liquid entering a vapor return line will be collected while observing the fueling operations. Then after each fueling, the liquid shall be drained into the trap, removed, and measured. Trap placement and observer actions shall produce the least possible interference with normal operations at the test location.

The liquid collected from both one individual delivery and the total of all individual deliveries shall not exceed the tolerances as specified in subsections T.3.(a) and T.3.(b), respectively.

The 150 or more vehicles should be representative of California vehicles, including various sizes of passenger vehicles, vans, and trucks. This examination should include varied fuel delivery rates and nozzle orientations plus complete and partial fills. The system may be retested if the Director by his own initiative, or at the request of the applicant, determines the test was not representative of field conditions.

N.5. Performance accuracy - assist system evaporation and volume change.

N.5.1. Test method.

An appropriate means (manometer, column gauge, etc.) shall be used to determine the inches of H_2O column vacuum. Excessive vacuum may result in

artificial evaporation of customer fuel which would decrease the measured volume and also cause possible implosion of vehicle fuel tanks.

N.5.2. Test procedure.

Install the vacuum indicator at the nozzle or test unit. Record the value of the reading while the system is operating in a normal manner to determine if it is functioning within the -10 inches H_2O column vacuum limit as specified in subsection T.2.

N.6. Independent laboratory evaluation.

Pursuant to Section 41958 of the Health and Safety Code, type approval certification regarding recirculation shall include evaluation by an independent testing laboratory approved by the Director. The laboratory evaluation shall determine, but is not limited to, proper secondary shut-off device operation with the primary shut-off device inoperable.

NOTE: Authority cited: Sections 12107 and 12500.5, Business and Professions Code; and Sections 41956(a) and 41956(c), Health and Safety Code. Reference: Sections 12107 and 12500.5, Business and Professions Code; and Sections 41956(a) and 41956(c), Health and Safety Code.

4054.3. T. Tolerances.

T.1. Performance accuracy - primary and secondary shut-off devices.

T.1.1. Primary shut-off device overrides.

The required, additional attempts, in total, to override any nozzle primary shut-off device shall not increase the dispenser volume indication by more than 1/10 gallon.

T.1.2. Secondary shut-off device.

With the vapor return line blocked by fuel (simulating recirculation due to primary shut-off device failure), each attempt to dispense fuel shall result in automatic nozzle shut off before the dispenser volume indication increases more than 3/10 gallon.

T.2. Assist system inches of H_2O column vacuum.

Assist vapor recovery systems shall operate at the inches of H_2O column vacuum recommended by the manufacturer, but shall not exceed -10 inches of H_2O column vacuum.

T.3. Delivery accuracy - 150 vehicle test.

The quantity of measured liquid collected in the vapor return line/lines shall not exceed both:

(a) 0.2 percent of any one individual vehicle fuel delivery, and

(b) 0.02 percent of the sum of the fuel deliveries to all vehicles observed (150 or more) during the delivery accuracy tests.

NOTE: Authority cited: Sections 12107 and 12500.5, Business and Professions Code; and Sections 41956(a) and 41956(c), Health and Safety Code. Reference: Sections 12107 and 12500.5, Business and Professions Code; and Sections 41956(a) and 41956(c), Health and Safety Code.

4055. N. Notes - Field Compliance Testing.

N.1. Test method - primary and secondary shut-off devices.

Examination of primary and secondary shut-off devices to determine the acceptability of an individual nozzle shall be performed using motor vehicles with fuel tanks and fill pipes representative of California

vehicles and/or a field compliance test unit as specified in subsection S.2.

N.2. Test procedure - primary and secondary shut-off devices.

N.2.1. Initial test - primary shut-off device.

Dispense fuel into the fill pipe opening of a vehicle fuel tank or test unit in accordance with the instructions for the vapor recovery device, if any, and common public usage. The nozzle shall shut off automatically when the nozzle primary shut-off sensing mechanism is covered by the liquid. Automatic nozzle shut off shall occur with the dispenser operating at discharge rates both greater than and equal to the minimum rate allowed by the slowest hold-open clip setting, if any, or 3 gallons per minute, whichever is less.

N.2.2. Override test - primary shut-off device.

After the initial primary shut-off device activates, dispense enough additional fuel into the test unit to immerse the nozzle primary shut-off sensing mechanism in liquid. Record the dispenser indicator gallons. Make 6 additional, consecutive override attempts duplicating a range of customer usage and record the new indicated gallons. All 6 attempts shall result in automatic nozzle shut off before the dispenser volume indicator increases more than the 1/10 gallon limit as specified in subsection T.1.1.

NOTE: A test unit must be used for this procedure so the primary shut-off device sensing mechanism can be seen immersed in liquid.

N.2.3. Secondary shut-off device (if equipped).

Introduce sufficient fuel into the vapor return line (approximately 1/10 gallon or 375 milliliter) to block the return of vapors through the line. Hold in place a "U-shaped" configuration of the fuel discharge hose

at a level lower than the nozzle to concentrate the liquid. Make one or more attempts to dispense fuel into an empty test unit or vehicle fuel tank that is within 3 gallons of being full, including the fill pipe. (Balance-type nozzles must make their intended tight seal at the fill pipe opening.) The nozzles shall shut off automatically before the dispenser volume indicator increases more than the 3/10 gallon limit for each attempt as specified in subsection T.1.2.

N.3. Assist systems.

To test assist systems for proper operation at the specified inches of H_2O column vacuum, refer to Section 4054.2, N.5.

NOTE: Authority cited: Sections 12107 and 12500.5, Business and Professions Code; and Sections 41956(a) and 41956(c), Health and Safety Code. Reference: Sections 12107 and 12500.5, Business and Professions Code; and Sections 41956(a) and 41956(c), Health and Safety Code.

FIELD COMPLIANCE TEST UNIT

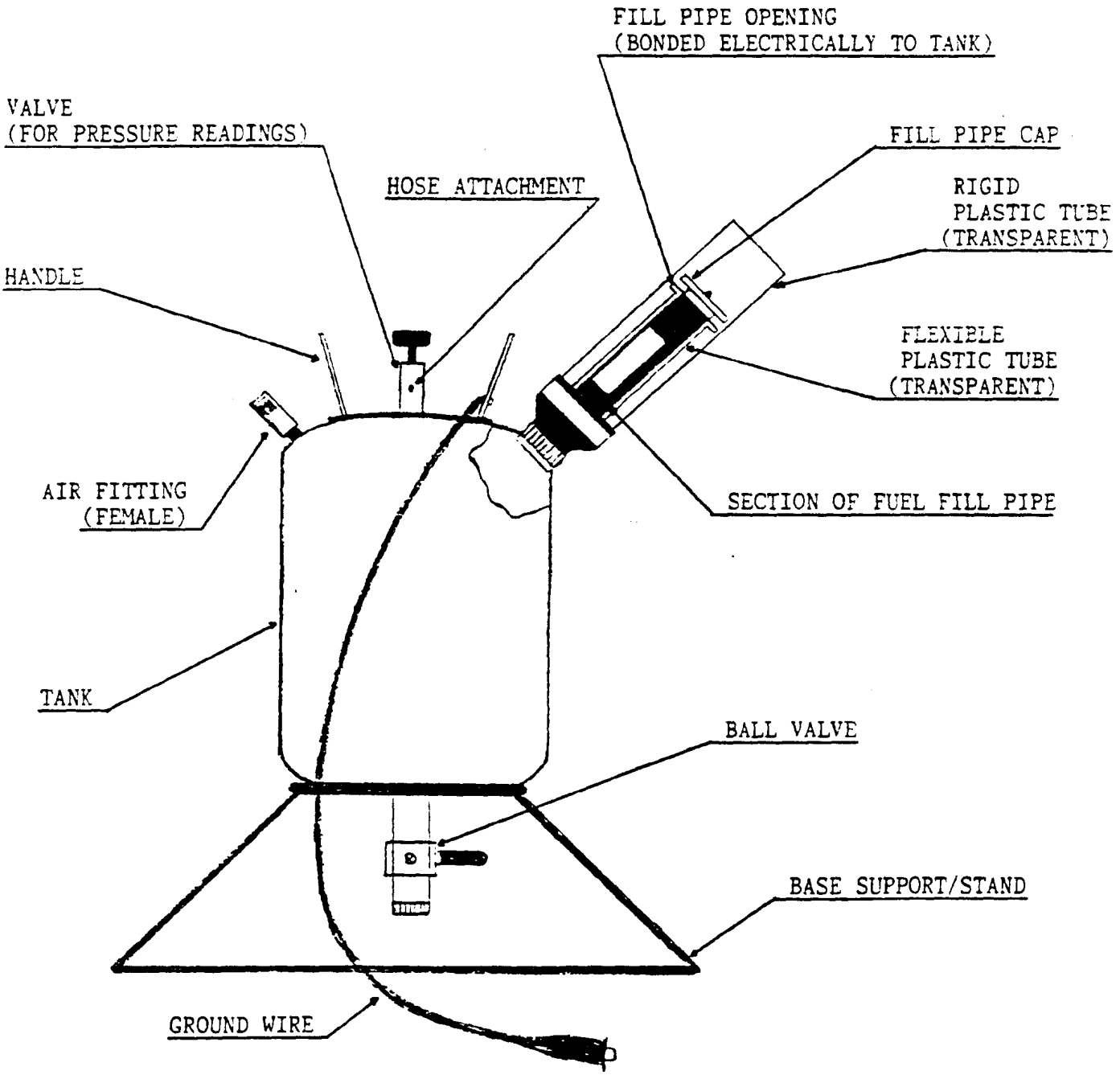

FIGURE 1

APPENDIX C.4

CALIFORNIA OCCUPATIONAL HEALTH AND SAFETY REQUIREMENTS

Where the special hazards of operation, sources of ignition, or exposures indicate a need, consideration shall be given to providing protection by one or more of the above means. Inserting for Fire and Explosion Prevention, NFPA No. 69–1973, provides information on inserting. (Title 24, T8–5557(a), (b))

History

1. Amendment filed 7–16–76; effective thirtieth day thereafter (Register 76, No. 29).

§ 5558. Tank Vehicle and Tank Car Loading and Unloading.

Tank vehicle and tank car loading or unloading facilities shall be separated from aboveground tanks, warehouses, other plant buildings or nearest line of adjoining property which may be built upon by a distance of 25 feet for Class I liquids and 15 feet for Class II and Class III liquids measured from the nearest position of any fill stem. Buildings for pumps or shelters for personnel may be a part of the facility. Operations of the facility shall comply with the appropriate portions of Article 147, Bulk Plants.

§ 5559. Fire Control.

(a) Approved portable fire extinguishers of appropriate size, type and number shall be provided. See Article 157.

(b) An approved automatic sprinkler system or an equivalent extinguishing system shall be installed when required by state or local regulations. Such systems shall comply with the applicable NFPA standard. (Title 24, T8–5559)

History

1. Amendment filed 7–16–76; effective thirtieth day thereafter (Register 76, No. 29).

§ 5560. Sources of Ignition.

(a) Precautions shall be taken to prevent the ignition of flammable vapors. Sources of ignition include but are not limited to open flames; lightning; smoking; cutting and welding; hot surfaces; frictional heat; static, electrical and mechanical sparks; spontaneous ignition, including heat–producing chemical reactions; and radiant heat.

(b) Class I liquids shall not be dispensed into metal containers unless the nozzle or fill pipe is in electrical contact with the container. This can be accomplished by maintaining metallic contact during filling, by a bond wire between them, or by other conductive path having an electrical resistance not greater than 106 ohms. Bonding is not required where a container is filled through a closed system, or the container is made of glass or other nonconducting material.

(c) See Article 140 for electrical classifications.

§ 5561. Maintenance and Repair.

(a) When necessary to do maintenance work in a flammable or combustible liquid processing area, the work shall be authorized by a responsible member of supervision.

(b) Hot work, such as welding or cutting operations, use of spark–producing power tools, and chipping operations shall be permitted only under supervision of a qualified person. The individual in charge shall make an inspection of the area to be sure that it is safe for the work to be done and that safe procedures will be followed for the work specified.

§ 5562. Housekeeping.

(a) Maintenance and operating practices shall be in accordance with established procedures which will tend to control leakage and prevent the accidental escape of flammable or combustible liquids. Spills shall be cleaned up promptly.

(b) Adequate aisles shall be maintained for unobstructed movement of personnel and so that fire protection equipment can be brought to bear on any part of the processing equipment.

(c) Combustible waste material and residues in a building or operating area shall be kept to a minimum, stored in closed metal waste cans, and disposed of daily.

(d) Ground area around buildings and operating areas shall be kept free of tall grass, weeds, trash or other combustible materials.

Article 144. Service Stations

§ 5565. Scope.

This Article applies to both automotive and marine service station (Title 24, T8–5565)

History

1. Amendment filed 7–16–76; effective thirtieth day thereafter (Register 76, N 29).

§ 5566. Storage.

(a) Liquids shall be stored in closed containers not exceeding 60 g lons capacity, in tanks in special enclosures as described in 5567, in ab veground tanks as provided for in (e), or in tanks located underground in Sections 5597, 5598 and 5599. Vent pipes on tanks storing gasoli shall discharge only upward in order to disperse vapors. Also see Secti 5578.

(b) Aboveground tanks, located at an adjoining bulk plant, may be cc nected by piping to service station underground tanks if, in addition valves at aboveground tanks, a valve is also installed within control service station personnel. Apparatus dispensing Class I liquids into t fuel tanks of motor vehicles of the public shall not be located at a bu plant unless separated by a fence or similar barrier from the area in whi bulk operations are conducted.

(c) Class I liquids shall not be stored or handled within a building h ing a basement or pit into which flammable vapors may travel, unl such area is provided with ventilation which will prevent the accumu tion of flammable vapors therein.

(d) Tanks supplying marine service stations and pumps not integ with the dispensing unit shall be on shore or on a pier of the solid–fill ty except as provided in (1) and (2).

(1) Where a shore location would require excessively long supply li to dispensers, tanks may be installed on piers provided that applica portions of Article 145 relative to spacing, diking and piping are cc plied with and the quantity so stored does not exceed 1,100 gallons agg gate capacity.

(2) Shore tanks supplying marine service stations may be located a veground where rock ledges or high water tables make undergro tanks impractical.

(e) Where tanks are at an elevation which produces a gravity hea on the dispensing unit, the tank outlet shall be equipped with a device, s as a solenoid valve, positioned adjacent to and downstream from he valve specified in Section 5596(b), so installed and adjusted that liq cannot flow by gravity from the tank in case of piping or hose fai re when the dispenser is not in use.

Note: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3 Labor Code.

History

1. Amendment of subsections (a) and (f) filed 12–19–78; effective thirtieth day thereafter (Register 79, No. 1).
2. Amendment of subsection (a) filed 12–12–84; effective thirtieth day there fter (Register 84, No. 50).
3. Repealer of subsection (d), and relettering of subsections (e) and (f) to sul sections (d) and (e) filed 5–6–87; operative 6–5–87 (Register 87, No. 19).

§ 5567. Special Enclosures.

(a) When installation of tanks in accordance with Sections 5597, 5598 and 5599 is impractical because of property or building limitations, t nks for flammable or combustible liquids may be installed in buildings i enclosed as described in (b).

(b) Enclosure shall be liquid and vaportight without backfill. Sides top and bottom of the enclosure shall be of reinforced concrete at least 8 inches thick, with openings for inspection through the top only. Tank connections shall be so piped or closed that neither vapors nor liquid ca escape into the enclosed space. Means shall be provided to use por able equipment to discharge to the outside any liquid or vapors which might accumulate should leakage occur.

Note: Authority cited: Section 142.3, Labor Code. Reference: Section 142. Labor Code.

C.4-2

History

1. Amendment filed 7–16–76; effective thirtieth day thereafter (Register 76, No. 29).
2. Amendment of subsection (b) and repealer of subsection (c) filed 9–18–80; effective thirtieth day thereafter (Register 80, No. 38).

§ 5568. Inside Buildings.

(a) Except where stored in tanks as provided in Section 5567, no Class I liquids shall be stored within any service station building except in closed containers of aggregate capacity not exceeding 120 gallons. One container not exceeding 60 gallons capacity equipped with an approved pump is permitted.

(b) Class I liquids may be transferred from one container to another in lubrication or service rooms of a service station building provided the electrical installation complies with Table FL–9 and provided that any heating equipment complies with Section 5575. See also Section 5580 for other possible sources of ignition.

(c) Class II and Class III liquids may be stored and dispensed inside service station buildings from tanks of not more than 120 gallons each.

§ 5569. Piping, Valves and Fittings.

(a) The design, fabrication, assembly, test and inspection of the piping system shall be in accordance with Article 146 except that, where dispensing is from a floating structure, suitable lengths of oil–resistant flexible hose may be employed between the shore piping and the piping on the floating structure as made necessary by change in water level or shore line.

(1) Where excessive stray currents are encountered, piping handling Class I and Class II liquids at marine service stations shall be electrically insulated from the shore piping.

(2) Piping shall be located so as to be protected from physical damage.

(3) A readily accessible valve to shut off the supply from shore shall be provided in each pipeline at or near the approach to the pier and at the shore end of each marine pipeline adjacent to the point where a flexible hose is attached.

(4) After completion of the installation, including any paving, that section of the pressure piping system between the pump discharge and the connection for the dispensing facility shall be tested for at least 30 minutes at the maximum operating pressure of the system. Such tests shall be repeated at 5–year intervals thereafter.

§ 5570. Remote Pumping Systems.

(a) This Section shall apply to systems for dispensing Class I liquids where such liquids are transferred from storage to individual or multiple dispensing units by pumps located elsewhere than at the dispensing units.

(b) Pumps shall be designed or equipped so that no part of the system will be subjected to pressures above its allowable working pressure. Each pump shall have installed on the discharge side an approved leak detection device which will provide an indication if the piping and dispensers are not essentially liquid–tight.

(c) Pumps installed above grade, outside of buildings, shall be located not less than 10 feet from lines of adjoining property which may be built upon, and not less than 5 feet from any building opening. When an outside pump location is impractical, pumps may be installed inside buildings as provided for dispensers in Section 5571(b), or in pits as provided in (d). Pumps shall be substantially anchored and protected against physical damage.

(d) Pits for subsurface pumps or piping manifolds of submersible pumps shall withstand the external forces to which they may be subjected without damage to the pump, tank or piping. The pit shall be no larger than necessary for inspection and maintenance and shall be provided with a fitted cover.

(e) An emergency shutoff valve, incorporating a fusible link or other thermally actuated device, designed to close automatically in event of severe impact or fire exposure shall be properly installed in the supply line at the base of each individual island–type dispenser or at the inlet of each overhead dispensing unit. If a coupling incorporating a slip–joint feature is used to join the emergency valve to the dispenser piping, the emergency valve shall automatically close before the slip–joint can disengage. The automatic closing feature of this valve shall be checked at the time of initial installation and at least once a year thereafter by manually tripping the hold–open linkage.

§ 5571. Fuel Dispensing System.

(a) Dispensing devices at an automotive service station shall be so located that all parts of the vehicle being served will be on the premises of the service station. Dispensing devices at marine service stations may be located on open piers, wharves, or floating docks or on shore or on piers of the solid–fill type and shall be located from other structures so as to provide room for safe ingress and egress of craft to be fueled. Dispensing units shall be in all cases at least 20 feet from any activity involving fixed sources of ignition.

(b) Dispensing units installed inside buildings after January 1, 1976, shall be separated from other areas by not less than a one–hour fire separation and shall be provided with adequate ventilation.

(c) When dispensing units are located below grade, only mechanical ventilation shall be used and the entire dispensing area shall be protected by an approved automatic sprinkler system. Ventilating systems shall be electrically interlocked with gasoline dispensing units so that the dispensing units cannot be operated unless the ventilating fan motors are energized.

§ 5572. Emergency Power Cutoff.

A clearly identified and easily accessible switch(es) or circuit breaker(s) shall be provided at a location remote from dispensing devices, including remote pumping systems, to shut off the power to all dispensing devices in the event of an emergency. (Title 24, T8–5572)

History

1. Amendment filed 7–16–76; effective thirtieth day thereafter (Register 76, No. 29).

§ 5573. Fuel Dispensing Units.

(a) Class I liquids shall be transferred from tanks by means of fixed pumps designed and equipped to allow control of the flow and prevent leakage or accidental discharge.

(b) Only listed nozzles may be used for dispensing Class I liquids. No such nozzle may be used if it shows evidence of having been dismantled.

Exception: Nozzles which are an integral part of a gasoline vapor recovery system, certified by the State Air Resources Board and the State Fire Marshal pursuant to the provisions of Sections 41954 through 41961, inclusive, of the California Health and Safety Codes.

(c) Every dispensing nozzle for Class I liquids installed after December 31, 1978, shall contain evidence of listing so placed that any attempt to dismantle the nozzle will result in damage to such evidence, visible without disassembly or dismounting of the nozzle.

Exception: Nozzles which are an integral part of a gasoline vapor recovery system, certified by the State Air Resources Board and the State Fire Marshal pursuant to the provisions of Sections 41954 through 41961, inclusive, of the California Health and Safety Codes.

Note: A rebuilt nozzle valve shall be deemed in substantial compliance with (b) and (c) if:

(1) The nozzle valve has been approved, within the meaning of Section 3206; or

(2) The user of the nozzle valve shows a certificate prepared by the rebuilder which certifies that:

(A) The nozzle valve:

1. Has a spout that will break off at 150 pounds or less;
2. Will shut off automatically when dropped from a height of 22 inches to a concrete floor;
3. Has been pressure tested to 10 psi;
4. Has a poppet seat that has been pressure tested to 50 psi.
5. Will shut off automatically at a minimum flow rate of 5 gallons per minute; and
6. Can be reasonably expected to operate without malfunctioning due to mechanical failure in excess of 100,000 cycles under laboratory conditions; and

(B) The rebuilder of the nozzle valve has made application to a nationally recognized testing laboratory to obtain a listing in accordance with the Occupational Safety and Health Act of 1970.

(d) A control shall be provided that will permit the pump to operate only when a dispensing nozzle is removed from its bracket or normal position with respect to the dispensing unit, and the switch on this dispensing unit is manually actuated. This control shall also stop the pump when all nozzles have been returned, either to their brackets or to the normal non-dispensing position.

(e) Class I liquids shall not be dispensed by applying pressure to drums, barrels and similar containers. Approved pumps taking suction through the top of the container or approved self-closing faucets shall be used.

(f) The dispensing unit and its piping, except those attached to containers, shall be mounted on a concrete island or protected against collision damage by suitable means. If located indoors, the dispenser shall also be mounted either on a concrete island or protected against collision damage by suitable means and shall be located in a position where it cannot be struck by a vehicle that is out of control descending a ramp or other slope.

History

1. Amendment of subsections (b) and (c) filed 3-3-77; effective thirtieth day thereafter (Register 77, No. 10).

§ 5574. Electrical Equipment.

(a) This Section shall apply to areas where Class I liquids are stored, handled or dispensed. For areas where Class II or Class III liquids are stored, handled or dispensed, the electrical equipment may be installed in accordance with the provisions of the California Electrical Safety Orders for nonclassified locations.

(b) All electrical equipment and wiring shall be of a type specified by and shall be installed in accordance with the California Electrical Safety Orders. All electrical equipment integral with the dispensing hose or nozzle shall be suitable for use in Division 1 locations.

(c) Table FL-9 shall be used to delineate and classify areas for the purpose of installation of electrical equipment under normal circumstances. A classified area shall not extend beyond an unpierced wall, roof or other solid partition.

(d) The area classifications listed in (c) shall be based on the premise that the installation meets the applicable requirements of these orders in all respects. (Title 24, T8-5574)

History

1. Amendment filed 7-16-76; effective thirtieth day thereafter (Register 76, No. 29).

Table FL-9
Electrical Equipment Classified Areas—Service Stations

Location	*Class I, Group D Division*	*Extent of Classified Area*
UNDERGROUND TANK		
Fill Opening	1	Any pit, box or space below grade level, any part of which is within the Division 1 or 2 classified area.
	2	Up to 18 inches above grade level within a horizontal radius of 10 feet from a loose fill connection and within a horizontal radius of 5 feet from a tight fill connection.
Vent Discharging Upward	1	Within 3 feet of open end of vent, extending in all directions
	2	Area between 3 feet and 5 feet of open end of vent, extending in all directions.
DISPENSING UNITS (except overhead-type)		
Pits	1	Any pit, box or space below grade level, any part of which is within the Division 1 or 2 classified area.

Table FL-9 (cont.)

Location	*Class I, Group D Division*	*Extent of Classified Area*
Dispenser	1	The area up to 4 feet vertically above the base within the enclosure, or up to a solid partition less than 4 feet above the base, located above the nozzle insertion level and above the level of any gasketed joint, hose or stuffing box.
	2	Within 18 inches horizontally in all directions from the Division 1 area within the enclosure.
Outdoor	2	Up to 18 inches above grade level within 20 feet horizontally of any edge of enclosure.
INDOOR		
with Mechanical	2	Up to 18 inches above grade or Venulation floor level within 20 feet horizontally of any edge of enclosure.
with Gravity Ventilation	2	Up to 18 inches above grade or floor level within 25 feet horizontally of any edge of enclosure.
DISPENSING UNITS, OVERHEAD TYPE	1	Within the dispenser enclosure and 18 inches in all directions from the enclosure where not suitably cut off by ceiling or wall. All electrical equipment integral with the dispensing hose or nozzle.
	2	An area extending 2 feet horizontally in all directionsbeyond the Division 1 area and extending to grade below this classified area.
	2	Up to 18 inches above grade level within 20 feet horizontally measured from a point vertically below the edge of any dispenser enclosure.
REMOTE PUMP—OUTDOOR	1	Any pit, box or space below grade level if any part is within a horizontal distance of 10 feet from any edge of pump.
	2	Within 3 feet of any edge of pump, extending in all directions. Also up to 18 inches above grade level within 10 feet horizontally from any edge of pump.
REMOTE PUMP—IN DOOR	1	Entire area within any pit.
	2	Within 5 feet of any edge of pump, extending in all directions. Also up to 3 feet above floor or grade level within 25 feet horizontally from any edge of pump.
LUBRICATION OR SERVICE ROOM WITH DISPENSING	1	Any pit within any unventilated area.
	2	Any pit with ventilation.
	2	Area up to 18 inches above floor or grade level and 3 feet horizontally from a lubrication pit.
DISPENSER FOR CLASS I LIQUIDS	2	Within 3 feet of any fill or dispensing point, extending in all directions.
LUBRICATION OR SERVICE ROOM—WITHOUT DISPENSING	2	Entire area within any pit used for lubrication or similar services where Class I liquids may be released.
	2	Area up to 18 inches above any such pit, and extending a distance of 3 feet horizontally from any edge of the pit.
SPECIAL ENCLOSURE INSIDE BUILDING PER SECTION 5567	1	Entire enclosure.
SALES, STORAGE AND REST ROOMS	non classified	If there is any opening to these class-rooms within the extent of a Division 1 area, the entire room shall be classified as Division 1.

§ 5575. Heating Equipment.

(a) Heating equipment may be installed in the conventional manner except as provided in (b), (c), (d), or (e).

(b) Heating equipment may be installed in a special room separated from an area classified as Division 1 or Division 2 in Table FL–9 by walls having a fire–resistance rating of at least one hour and without any openings in the walls within 8 feet of the floor into an area classified as Division 1 or Division 2 in Table FL–9. This room shall not be used for combustible storage, and all air for combustion purposes shall come from outside the building.

(c) Heating equipment using gas or oil fuel may be installed in the lubrication or service room where there is no dispensing or transferring of Class I liquids provided the bottom of the combustion chamber is at least 18 inches above the floor and the heating equipment is protected from physical damage.

(d) Heating equipment using gas or oil fuel listed for use in garages may be installed in the lubrication or service room where Class I liquids are dispensed provided the equipment is installed at least 8 feet above the floor.

(e) Electrical heating equipment shall conform to Section 5574. (Title 24, T8–5575)

History

1. Amendment filed 7–16–76; effective thirtieth day thereafter (Register 76, No. 29).

§ 5576. Fuel Delivery Nozzles.

(a) A listed manual or automatic–closing type hose nozzle shall be provided on dispensers used for the dispensing of Class I liquids.

(b) Overhead–type dispensing units shall be provided with a listed automatic–closing type hose nozzle valve without a latch–open device.

(1) A listed automatic–closing type hose nozzle valve with latch–open device may be used if the design of the system is such that the hose nozzle valve will close automatically in the event the valve is released from a fill opening or upon impact with a driveway.

(c) Dispensing nozzles used at marine service stations shall be of the automatic–closing type without a latch–open device.

(d) Manual–closing type valves shall be held open manually during dispensing. Automatic–closing type valves may be used in conjunction with an approved latch–open device.

Exception: Nozzles which are an integral part of a gasoline vapor recovery system, certified by the State Air Resources Board and the State Fire Marshal pursuant to the provisions of Sections 41954 through 41961, inclusive, of the California Health and Safety Codes.

Note: Authority and reference cited: Section 142.3, Labor Code.

History

1. Amendment filed 3–3–77; effective thirtieth day thereafter (Register 77, No. 10).
2. Amendment filed 5–12–83; effective thirtieth day thereafter (Register 83, No. 20).

§ 5577. Dispensing Into Portable Containers.

(a) No delivery of any Class I or Class II liquid shall be made into portable containers unless the container is constructed of metal or is approved for such use, has a tight closure and is fitted with spout or so designed that the contents can be poured without spilling.

Note: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

History

1. Repealer of subsection (b) filed 9–18–80; effective thirtieth day thereafter (Register 80, No. 38).

§ 5578. Attendance or Supervision of Dispensing.

(a) The provisions of Section 5566(a) shall not prohibit the temporary use of movable tanks in conjunction with the dispensing of flammable or combustible liquids into the fuel tanks of motor vehicles or other motorized equipment on premises not normally accessible to the public.

(b) The provisions of Section 5566(a) shall not prohibit the dispensing of Class I and Class II liquids in the open from a tank vehicle to a motor vehicle. Such dispensing shall be permitted provided:

(1) The dispensing is done on premises not open to the public.

(2) The dispensing hose does not exceed 50 feet in length.

(3) The dispensing nozzle is a listed automatic–closing type.

Note: Authority and reference cited: Section 142.3, Labor Code.

History

1. Amendment filed 5–12–83; effective thirtieth day thereafter (Register 83, No. 20).
2. Amendment filed 12–12–84; effective thirtieth day thereafter (Register 84, No. 50).

§ 5579. Drainage and Waste Disposal.

(a) Provision shall be made in the area where Class I liquids are dispensed to prevent spilled liquids from flowing into the interior of service station buildings. Such provision may be by grading driveways, raising door sills, or other equally effective means.

(b) Crankcase drainings and flammable or combustible liquids shall not be dumped into sewers, streams or adjoining property, but shall be stored in tanks or drums outside any building until removed from the premises.

§ 5580. Sources of Ignition.

In addition to the previous restrictions of this Article the following shall apply: There shall be no smoking or open flames in the areas used for fueling, servicing fuel systems for internal combustion engines, receiving or dispensing of Class I and Class II liquids. Conspicuous and legible signs prohibiting smoking shall be posted within sight of the customer being served. The motors of all equipment being fueled shall be shut off during the fueling operation except for emergency generators, pumps, etc., where continuing operation is essential.

§ 5581. Fire Control.

Each service station shall be provided with at least one fire extinguisher having a minimum classification of 5B, C located so that an extinguisher will be within 100 feet of each pump, dispenser, underground fill pipe opening, and lubrication or service room.

Article 145. Tank Storage

§ 5583. Materials.

(a) Tanks shall be built of steel except as provided in (b) through (d).

(b) Tanks may be built of materials other than steel:

(1) If required by the properties of the liquid stored. In case of doubt, the supplier, producer of the flammable or combustible liquid, or other competent authority should be consulted as to the suitability of the material of construction to be used;

(2) For installation underground;

(3) If used for the storage of Class IIIB liquids aboveground in areas not exposed to a spill or leak of a Class I or Class II liquid. If tanks storing Class IIIB liquids are located where they are exposed to a spill or leak of a Class I or Class II liquid, they shall be constructed in accordance with Section 5585; or

(4) If used for the storage of Class IIIB liquids inside a building protected by an approved automatic fire extinguishing system.

(c) Tanks built of materials other than steel shall be designed to specifications embodying principles recognized as good engineering design for the material used.

(d) Unlined concrete tanks may be used for storing flammable or combustible liquids having a gravity of 40 degrees API or heavier. Concrete tanks with special lining may be used for other services provided the design is in accordance with sound engineering practice.

(e) Special engineering consideration shall be required if the specific gravity of the liquid to be stored exceeds that of water or if the tanks are designed to contain flammable or combustible liquids at a liquid temperature below zero degrees F.

§ 5584. Fabrication.

(a) Tanks may be of any shape or type consistent with sound engineering design.

(b) Metal tanks shall be welded, riveted and caulked, or bolted, or constructed by use of a combination of these methods.

§ 5585. Atmospheric Tanks.

(a) Atmospheric tanks shall be built in accordance with approved standards of design. Atmospheric tanks may be built in accordance with:

(1) Underwriters' Laboratories, Inc., Standard For Steel Aboveground Tanks for Flammable and Combustible Liquids UL142–1972; Standard for Steel Underground Tanks for Flammable and Combustible Liquids, UL58–1972; or Standard for Steel Inside Tanks for Oil Burner Fuel, UL80–1968.

(2) American Petroleum Institute Standards No. 12A, Specification for Oil Storage Tanks with Riveted Shells, Seventh Edition, September 1951 or No. 650, Welded Steel Tanks for Oil Storage, Fifth Edition 1973.

(3) American Petroleum Institute Standards No. 12B, Specification for Bolted Production Tanks, Eleventh Edition, May, 1958 and Supplement I, April, 1962; No. 12D, Specification For Large Welded Production Tanks, Seventh Edition, August, 1957 and Supplement I, March, 1965; or No. 12F, Specification for Small Welded Production Tanks, Sixth Edition, March, 1968. Tanks built in accordance with these standards shall be used only as production tanks for storage of crude petroleum in oil-producing areas.

(b) Low pressure tanks and pressure vessels may be used as atmospheric tanks.

(c) Atmospheric tanks shall not be used for the storage of a flammable or combustible liquid at a temperature at or above its boiling point.

§ 5586. Low Pressure Tanks.

(a) The normal operating pressure of the tank shall not exceed the design pressure of the tank.

(b) Low pressure tanks shall be built in accordance with approved standards of design. Low pressure tanks may be built in accordance with:

(1) American Petroleum Institute Standard No. 620, Recommended Rules for the Design and Construction of Large, Welded, Low-Pressure Storage Tanks, Fifth Edition 1973.

(2) The principles of the Code for Unfired Pressure Vessels, Section VIII, Division I of the ASME Boiler and Pressure Vessels Code, 1971 Edition.

(c) Atmospheric tanks built according to Underwriters' Laboratories, Inc. requirements in Section 5585(a) may be used for operating pressures not exceeding 1 psig and shall be limited to 2.5 psig under emergency venting conditions.

(d) Pressure vessels may be used as low pressure tanks.

§ 5587. Pressure Vessels.

(a) The normal operating pressure of the vessel shall not exceed the design pressure of the vessel.

(b) Storage tanks designed to withstand pressures above 15 psig shall meet the requirements of the Unfired Pressure Vessel Safety Orders.

§ 5588. Provisions for Internal Corrosion.

When tanks are not designed in accordance with the American Petroleum Institute, American Society of Mechanical Engineers or the Underwriters' Laboratories, Inc. Standards, or if corrosion is anticipated beyond that provided for in the design formulas used, additional metal thickness or suitable protective coatings or linings shall be provided to compensate for the corrosion loss expected during the design life of the tank.

§ 5589. Installation of Outside Aboveground Tanks.

(a) Every aboveground tank for the storage of Class I, Class II or Class IIIA liquids, except those liquids with boil-over characteristics and unstable liquids, operating at pressures not in excess of 2.5 psig and designed with a weak roof-to-shell seam or equipped with emergency venting devices which will not permit pressures to exceed 2.5 psig, shall be located in accordance with Table FL-10.

(1) For the purpose of this Section, a floating roof tank is one which incorporates a pontoon or double deck roof in an open top tank in accordance with API Standard 650, or one which incorporates an internal all-metal (except for seals) floating cover with a fixed metal roof with adequate ventilation at the eaves of the roof. Tanks with internal floating covers incorporating nonmetallic construction, such as plastics, shall be treated as cone roof tanks.

(b) Every aboveground tank for the storage of Class I, Class II or Class IIIA liquids, except those liquids with boil-over characteristics and unstable flammable or combustible liquids, operating at pressures exceeding 2.5 psig or equipped with emergency venting which will permit pressures to exceed 2.5 psig shall be located in accordance with Table FL-11.

(c) Every aboveground tank for the storage of Class I, Class II or Class IIIA liquids with boil-over characteristics shall be located in accordance with Table FL-12.

(d) Every aboveground tank for the storage of unstable liquids shall be located in accordance with Table FL-13.

(e) Every aboveground tank for the storage of Class IIIB liquids, excluding unstable liquids, shall be located in accordance with Table FL-14 except when located within a diked area or drainage path for a tank or tanks storing a Class I or Class II liquid. When a Class IIIB liquid storage tank is within the diked area or drainage path for a Class I or Class II liquid, (a) or (b) shall apply.

(f) Reference minimum distances for use in Tables FL-10 to FL-13, inclusive.

(g) Where end failure of horizontal pressure tanks and vessels may expose property, the tank shall be placed with the longitudinal axis parallel to the nearest important building.

Table FL-10

Type of Tank	*Protection*	*Minimum Distance in Feet From Property Line Which May Be Built Upon, Including the Opposite Side of a Public Way and Shall Be Not Less Than Five (5) Feet*	*Minimum Distance in Feet From Nearest Side of Any Public Way or From Nearest Important Building and Shall Be Not Less Than Five (5) Feet*
Floating Roof	Protection for Exposures	⅙ times diameter of tank but need not exceed 90 feet	⅙ times diameter of tank but need not exceed 30 feet
	None	Diameter of tank but need not exceed 175 feet	⅙ times diameter of tank but need not exceed 30 feet
Vertical with Weak Roof to Shell Seam	Approved foam or inerting system on the tank	⅙ times diameter of tank but need not exceed 90 feet	⅙ times diameter of tank but need not exceed 30 feet
	Protection for Exposures	Diameter of tank but need not exceed 175 feet	⅙ times diameter of tank but need not exceed 60 feet
	None	2 times diameter of tank but need not exceed 350 feet	⅙ times diameter of tank but need not exceed 60 feet
Horizontal and Vertical, with Emergency Relief Venting to Limit Pressures to 2.5 psig	Approved inerting system on the tank or approved foam system on vertical tanks	⅙ times Table FL-13	⅙ times Table FL-13
	Protection for Exposures	Table FL-13	Table FL-13
	None	2 times Table FL-13	Table FL-13

Table FL-11

Type of Tank	*Protection*	*Minimum Distance in Feet From Property Line Which May Be Built Upon, Including the Opposite Side of a Public Way*	*Minimum Distance in Feet From Nearest Side of Any Public Way or From Nearest Important Building*
Any Type	Protection for Exposures	1½ times Table FL-15 but shall not be less than 25 feet	1½ times Table FL-15 but shall not be less than 25 feet
	None	3 times Table FL-15 but shall not be less than 50 feet	1½ times Table FL-15 but shall not be less than 25 feet

Table FL-12

Type of Tank	*Protection*	*Minimum Distance in Feet From Property Line Which May Be Built Upon, Including the Opposite Side of a Public Way*	*Minimum Distance in Feet From Nearest Side of Any Public Way or From Nearest Important Building*
Floating Roof	Protection for Exposures	¼ times diameter of tank but need not exceed 90 feet	¼ times diameter of tank but need not exceed 30 feet
	None	Diameter of tank but need not exceed 175 feet	¼ times diameter of tank but need not exceed 30 feet
Fixed Roof	Approved foam or inerting system	Diameter of tank but need not exceed 175 feet	⅙ times diameter of tank but need not exceed 60 feet
	Protection for Exposures	2 times diameter of tank but need not exceed 350 feet	⅔ times diameter of tank but need not exceed 120 feet
	None	4 times diameter of tank but need not exceed 350 feet	⅔ times diameter of tank but need not exceed 120 feet

Table FL-13

Type of Tank	*Protection*	*Minimum Distance in Feet from Property Line Which May Be Built Upon, Including the Opposite Side of a Public Way*	*Minimum Distance in Feet from Nearest Side of Any Public Way or From Nearest Important Building*
Horizontal and Vertical Tanks With Emergency Relief Venting to Permit Pressure Not in Excess of 2.5 psig	Tank protected with any one of the following: Approved water spray, Approved inerting, Approved insulation and refrigeration, Approved barricade	Table FL-15 but not less than 25 feet	Not less than 25 feet
	Protection for Exposures	2½ times Table FL-15 but not less than 50 feet	Not less than 50 feet
	None	5 times Table FL-15 but not less than 100 feet	Not less than 100 feet
Horizontal and Vertical Tanks With Emergency Relief Venting to Permit Pressure Over 2.5 psig	Tank Protected With Any One of the Following: Approved water spray, Approved inerting, Approved insulation and refrigeration, Approved barricade	2 times Table FL-15 but not less than 50 feet	Not less than 50 feet
	Protection for Exposures	4 times Table FL-15 but not less than 100 feet	Not less than 100 feet
	None	8 times Table FL-15 but not less than 150 feet	Not less than 150 feet

Table FL-14

Capacity Gallons	Minimum Distance in Feet from Property Line Which May Be Built Upon, Including the Opposite Side of a Public Way	Minimum Distance in Feet from Nearest Side of Any Public Way or from Nearest Important Building
12,000 or less	5	5
12,001 to 30,000	10	5
30,001 to 50,000	10	10
50,001 to 100,000	15	10
100,001 or more	15	15

Table FL-15

Capacity Tank Gallons	Minimum Distance in Feet from Property Line Which May Be Built Upon, Including the Opposite Side of a Public Way	Minimum Distance in Feet from Nearest Side of Any Public Way or from Nearest Important Building
275 or less	5	5
276 to 750	10	5
751 to 12,000	15	5
12,001 to 30,000	20	5
30,001 to 50,000	30	10
50,001 to 100,000	50	15
100,001 to 500,000	80	25
500,001 to 1,000,000	100	35
1,000,001 to 2,000,000	135	45
2,000,001 to 3,000,000	165	55
3,000,001 or more	175	60

NOTE: Authority cited: Section 142.3, Labor Code.

HISTORY

1. Amendment of subsection (e) and Table FL-11 filed 12-19-78; effective thirtieth day thereafter (Register 79, No. 1).

§ 5590. Spacing (Shell-to-Shell) Between Aboveground Tanks.

(a) The distance between any two flammable or combustible liquid storage tanks shall not be less than three feet.

(b) Except as provided in (c), the distance between any two adjacent tanks any one of which stores Class I, Class II or Class IIIA liquids shall not be less than one-sixth the sum of their diameters, except when the diameter of one tank is less than one-half the diameter of the adjacent tank, the distance between the two tanks shall not be less than one-half the diameter of the smaller tank. Tanks used only for storing Class IIIB liquids may be spaced as provided in (a) unless within a diked area or drainage path for a tank storing a Class I or Class II liquid.

(c) Crude petroleum tanks at production facilities in isolated locations having capacities not exceeding 126,000 gallons (3,000 barrels), need not be separated by more than three feet.

(d) For unstable flammable or combustible liquids, the distance between such tanks shall not be less than one-half the sum of their diameters.

(e) When tanks are in a diked area containing Class I or Class II liquids, or in the drainage path of Class I or Class II liquids, and are compacted in three or more rows or in an irregular pattern, greater spacing or other means shall be provided to make inside tanks accessible for fire fighting purposes.

(f) The minimum separation between a liquefied petroleum gas co - tainer and a flammable or combustible liquid storage tank shall be 20 fe - except in the case of flammable or combustible liquid tanks operating t pressures exceeding 2.5 psig or equipped with emergency venting whi will permit pressures to exceed 2.5 psig in which case the provisions f (a) and (b) shall apply. Suitable means shall be taken to prevent the acc - mulation of flammable or combustible liquids under adjacent liquefi petroleum gas containers such as by diversion curbs or grading. Wh flammable or combustible liquid storage tanks are within a diked ar the liquefied petroleum gas containers shall be outside the diked area a at least 10 feet away from the center line of the wall of the diked area. T foregoing provisions shall not apply when liquefied petroleum gas co - tainers of 125 gallons or less capacity are installed adjacent to fuel oil su - ply tanks of 660 gallons or less capacity.

§ 5591. Location of Outside Aboveground Tanks with Respect to Important Buildings on Same Property.

Every outside aboveground tank shall be separated from import buildings on the same property by distances not less than those specifi in Section 5589(a) through (e), whichever is applicable. The appropri distance column in Tables FL-10 through 15 that shall be used shall the one reading: "Minimum Distance in Feet from Nearest Side of a Pu lic Way or from Nearest Important Building."

NOTE: Important buildings are those buildings containing employees, flammab or explosives.

§ 5592. Normal Venting for Aboveground Tanks.

(a) Atmospheric storage tanks shall be adequately vented to prevent the development of vacuum or pressure sufficient to distort the roof of a cone roof tank or exceeding the design pressure in the case of other atmospheric tanks, as a result of filling or emptying, and atmospheric temperature changes.

(b) Normal vents shall be sized either in accordance with the American Petroleum Institute Standard No. 2000, Venting Atmospheric and Low-Pressure Storage Tanks, 1968, or other accepted standard, or shall be at least as large as the filling or withdrawal connection, whichever is larger but in no case less than 1 1/4-inch nominal inside diameter.

(c) Low-pressure tanks and pressure vessels shall be adequately vented to prevent development of pressure or vacuum, as a result of filling or emptying and atmospheric temperature changes, from exceeding the design pressure of the tank or vessel. Protection shall also be provided to prevent overpressure from any pump discharging into the tank or vessel when the pump discharge pressure can exceed the design pressure of the tank or vessel.

(d) If any tank or pressure vessel has more than one fill or withdrawal connection and simultaneous filling or withdrawal can be made, the vent size shall be based on the maximum anticipated simultaneous flow.

(e) The outlet of all vents and vent drains on tanks equipped with venting to permit pressures exceeding 2.5 psig shall be arranged to discharge in such a way as to prevent localized overheating of or flame impingement on any part of the tank, in the event vapors from such vents are ignited.

(f) Tanks and pressure vessels storing Class IA liquids shall be equipped with venting devices which shall be normally closed except when venting to pressure or vacuum conditions. Tanks and pressure vessels storing Class IB and IC liquids shall be equipped with venting devices which shall be normally closed except when venting under pressure or vacuum conditions, or with approved flame arresters. Tanks of 3,000 bbls. capacity or less containing crude petroleum in crude-producing areas; and, outside aboveground atmospheric tanks under 1,000 gallons capacity containing other than Class IA flammable liquids may have open vents. (See Section 5594(b).)

(g) Flame arresters or venting devices required in (f) may be omitted for IB and IC liquids where conditions are such that their use may, in case of obstruction, result in tank damage. Liquid properties justifying the omission of such devices include, but are not limited to, condensation, corrosiveness, crystallization, polymerization, freezing or plugging. When any of these conditions exist, consideration may be given to heating, use of devices employing special materials of construction, the use of liquid seals, or inerting.

§ 5593. Emergency Relief Venting for Fire Exposure for Aboveground Tanks.

(a) Except as provided in (b), every aboveground storage tank shall have some form of construction or device that will relieve excessive internal pressure caused by exposure fires.

(b) Tanks larger than 12,000 gallons capacity storing Class IIIB liquids and not within the diked area or the drainage path of Class I or Class II liquids do not require emergency relief venting.

(c) In a vertical tank the construction referred to in (a) may take the form of a floating roof, lifter roof, a weak roof-to-shell seam, or other approved pressure relieving construction. The weak roof-to-shell seam shall be constructed to fail preferential to any other seam.

(d) Where entire dependence for emergency relief is placed upon pressure relieving devices, the total venting capacity of both normal and emergency vents shall be enough to prevent rupture of the shell or bottom of the tank if vertical, or of the shell or heads if horizontal. If unstable liquids are stored, the effects of heat or gas resulting from polymerization, decomposition, condensation, or self-reactivity shall be taken into account. The total capacity of both normal and emergency venting devices shall be not less than that derived from Table FL-16 except as provided in (f) or (g). Such device may be a self-closing manhole cover, or one using long bolts that permit the cover to lift under internal pressure, or an additional or larger relief valve or valves. The wetted area of the tank shall be calculated on the basis of 55 percent of the total exposed area of a sphere or spheroid, 75 percent of the total exposed area of a horizontal tank and the first 30 feet above grade of the exposed shell area of a vertical tank.

(e) For tanks and storage vessels designed for pressures over 1 psig, the total rate of venting shall be determined in accordance with Table FL-16, except that when the exposed wetted area of the surface is greater than 2,800 sq. ft., the total rate of venting shall be in accordance with Table FL-17 or calculated by the following formula:

$$CFH = 1{,}107\ A^{0.82}$$

Where:

CFH = venting requirement, in cubic feet of free air per hour.

A = exposed wetted surface, in square feet.

The foregoing formula is based on $Q = 21{,}000\ A^{0.82}$

(f) The total emergency relief venting capacity for any specific stable liquid may be determined by the following formula:

$$\text{Cubic feet of free air per hour} = V\ \frac{1337}{L\sqrt{M}}$$

V = cubic feet of free air per hour from Table FL-16.

L = latent heat of vaporization of specific liquid in BTU per pound.

M = molecular weight of specific liquids.

Table FL-16

Wetted Area Versus Cubic Feet Free Air Per Hour *
(14.7 psig and 60°F.)

Sq. Ft.	CFH	Sq. Ft.	CFH	Sq. Ft.	CFH
20	21,100	200	211,000	1,000	584,000
30	31,600	250	239,000	1,200	557,000
40	42,100	300	265,000	1,400	587,000
50	52,700	350	288,000	1,600	614,000
60	63,200	400	312,000	1,800	639,000
70	73,700	500	354,000	2,000	662,000
80	84,200	600	392,000	2,400	704,000
90	94,800	700	426,000	2,800	742,000
100	105,000	800	462,000	see (e)	
120	126,000	900	493,000		
140	147,000	1,000	524,000		
160	168,000				
180	190,000				
200	211,000				

* Interpolate for intermediate values.

Table FL-17

Sq. Ft.	CFH	Sq. Ft.	CFH
2,800	742,000	9,000	1,900,000
3,000	786,000	10,000	2,110,000
3,500	892,000	15,000	2,940,000
4,000	996,000	20,000	3,780,000
4,500	1,100,000	25,000	4,470,000
5,000	1,250,000	30,000	5,190,000
6,000	1,390,000	35,000	5,900,000
7,000	1,570,000	40,000	6,570,000
8,000	1,760,000		

(g) For tanks containing stable liquids, the required air-flow rate of (d) or (f) may be multiplied by the appropriate factor listed in the following schedule when protection is provided as indicated. Only one factor may be used for any one tank.

.5 For drainage in accordance with Section 5595(b) for tanks over 200 square feet of wetted area.

.3 For approved water spray in accordance with Standard for Water Spray Fixed Systems for Fire Protection, NFPA No. 15, and drainage in accordance with Section 5595(b).

.3 For approved insulation in accordance with (g)(1).

.15 For approved water spray with approved insulation in accordance with (g)(1) and drainage in accordance with Section 5595(b).

(1) Insulation systems for which credit is taken shall meet the following performance criteria and shall be subject to approval of the authority having jurisdiction:

(A) Remain in place under fire exposure conditions.

(B) Withstand dislodgment when subjected to hose stream impingement during fire exposure. This requirement may be waived where use of solid hose streams is not contemplated or would not be practical.

(C) Maintain a maximum conductance value of 4.0 Btu's per hour per square foot per degree °F (Btu/hr./sq.ft./ °F) when the outer insulation jacket or cover is at a temperature of 1,660° F and when the mean temperature of the insulation is 1,000° F.

(h) The outlet of all vents and vent drains on tanks equipped with emergency venting to permit pressures exceeding 2.5 psig shall be arranged to discharge in such a way as to prevent localized overheating of or flame impingement on any part of the tank, in the event vapors from such vents are ignited.

(i) Each commercial tank venting device shall have stamped on it the opening pressure, the pressure at which the valve reaches the full open position and the flow capacity at the latter pressure. If the start to open pressure is less than 2.5 psig and the pressure at full open position is greater than 2.5 psig, the flow capacity at 2.5 psig shall also be stamped on the venting device. The flow capacity shall be expressed in cubic feet per hour of air at 60 F. and 14.7 psia.

(1) The flow capacity of tank venting devices under 8 inches in nominal pipe size shall be determined by actual test of each type and size of vent. These flow tests may be conducted by the manufacturer if certified by a qualified impartial observer, or may be conducted by a qualified impartial outside agency. The flow capacity of tank venting devices 8 inches nominal pipe size and larger, including manhole covers with long bolts or equivalent, may be calculated provided that the opening pressure is actually measured, the rating pressure and corresponding free orifice area are stated, the word "calculated" appears on the nameplate, and the computation is based on a flow coefficient of 0.5 applied to the rated orifice area.

(2) A suitable formula for this calculation is:

$$CFH = 1.667\ C_f A\sqrt{(P_t - P_a)}$$

where CFH = venting requirement in cubic feet of free air per hour
C_f = 0.5 (the flow coefficient)
A = the orifice are in sq. in.
P_t = the absolute pressure inside the tank in inches of water
P_a = the absolute atmospheric pressure outside the tank in inches of water

§ 5594. Vent Piping for Aboveground Tanks.

(a) Vent piping shall be constructed in accordance with Article 146.

(b) Where vent pipe outlets for tanks storing Class I liquids are adjacent to buildings or public ways, they shall be located so that the vapors are released at a safe point outside of buildings and not less than 12 feet above the adjacent ground level. In order to aid their dispersion, vapors

shall be discharged upward or horizontally away from closely adjacent walls. Vent outlets shall be located so that flammable vapors will not be trapped by eaves or other obstructions and shall be at least five feet from building openings.

(c) The manifolding of tank vent piping shall be avoided except where required for special purposes such as vapor recovery, vapor conservation or air pollution control. When tank vent piping is manifolded, pipe sizes shall be such as to discharge, within the pressure limitations of the system, the vapors they may be required to handle when manifolded tanks are subject to the same fire exposure.

(d) Vent piping for tanks storing Class I liquids shall not be manifolded with vent piping for tanks storing Class II or Class III liquids unless positive means are provided to prevent the vapors from Class I liquids from entering tanks storing Class II or Class III liquids, to prevent contamination and possible change in classification of the less volatile liquid.

§ 5595. Drainage, Dikes and Walls for Aboveground Tanks.

(a) The area surrounding a tank or group of tanks storing Class I, Class II or Class IIIA liquids shall be provided with drainage as in (b), or shall be diked as provided in (c), to prevent accidental discharge of liquid from endangering employees or facilities. Tanks storing Class IIIB liquids do not require drainage or dikes.

(b) Where protection is by means of a natural or man-made drainage system, such systems shall comply with the following:

(1) A slope of not less than 1 percent away from the tank toward the drainage system shall be provided.

(2) The drainage system shall terminate in vacant land or other area or in an impounding basin having a capacity not smaller than that of the largest tank served. This termination area and the route of the drainage system shall be so located that, if the flammable or combustible liquids in the drainage system are ignited, the fire will not seriously expose tanks or adjoining property.

(3) The drainage system, including automatic drainage pumps, shall not discharge to adjoining property, natural watercourses, public sewers, or public drains unless the discharge of flammable or combustible liquids would not constitute a hazard, or the system is so designed that it will not permit flammable or combustible liquids to be released.

(c) Where protection is accomplished by retaining the liquid around the tank by means of a dike, the volume of the diked area shall comply with the following requirements:

(1) The volumetric capacity of the diked area shall not be less than the greatest amount of liquid that can be released from the largest tank within the diked area, assuming a full tank. To allow for volume occupied by tanks, the capacity of the diked area enclosing more than one tank shall be calculated after deducting the volume of the tanks, other than the largest tank, below the height of the dike.

(2) Walls of the diked area shall be of earth, steel, concrete or solid masonry designed to be liquid-tight and to withstand a full hydrostatic head. Earthen walls 3 feet or more in height shall have a flat section at the top not less than 2 feet wide. The slope of an earthen wall shall be consistent with the angle or repose of the material of which the wall is constructed. Diked areas for tanks containing Class I liquids located in extremely porous soils may require special treatment to prevent seepage of hazardous quantities of liquids to low lying areas or waterways in case of spills.

(3) Except as provided in (4) below, the walls of earthen dikes shall be restricted to an average interior height of six feet above interior grade.

(4) Dikes may be higher than an average of six feet above interior grade where provisions are made for normal and necessary emergency access to tanks, valves and other equipment, and safe egress from the diked enclosure.

(A) Where the average height of the dike containing Class I liquids is over 12 feet high, measured from interior grade, or where the distance between any tank and the top inside edge of the dike wall is less than the height of the dike wall, provisions shall be made for normal operation of valves and for access to tank roof(s) without entering below the top of the dike. These provisions may be met through the use of remote operated valves, elevated walkways or similar arrangements.

(B) Piping passing through dike walls shall be designed to prevent excessive stresses as a result of settlement or fire exposure.

(C) The minimum distance between tanks and toe of the interior dike walls shall be five feet.

(5) Where provision is made for draining water from diked areas, drainage shall be provided at a uniform slope of not less than one percent away from tanks toward a sump, drainbox or other safe means of disposal located at the greatest practical distance from the tank. Such drains shall normally be controlled in a manner so as to prevent flammable or combustible liquids from entering natural water courses, public sewers, or public drains, if their presence would constitute a hazard. Control of drainage shall be accessible under fire conditions and outside the dike.

(6) No loose combustible material, empty or full drum or barrel, shall be permitted within the diked area.

(7) Each diked area containing two or more tanks shall be subdivided preferably by drainage channels or at least by intermediate curbs in order to prevent spills from endangering adjacent tanks within the diked area as follows:

(A) When storing normally stable liquids in vertical cone roof tanks constructed with weak roof-to-shell seam or approved floating roof tanks or when storing crude petroleum in producing areas in any type of tank, one subdivision for each tank in excess of 10,000 bbls. and one subdivision for each group of tanks (no tank exceeding 10,000 bbls. capacity) having an aggregate capacity not exceeding 15,000 bbls.

(B) When storing normally stable flammable or combustible liquids in tanks not covered in subparagraph (1), one subdivision for each tank in excess of 100,000 gallons (2,500 bbls.) and one subdivision for each group of tanks (no tank exceeding 100,000 gallons capacity) having an aggregate capacity not exceeding 150,000 gallons (3,570 bbls.).

(C) When storing unstable liquids in any type of tank, one subdivision for each tank except that tanks installed in accordance with the drainage requirements of the Standard for Water Spray Fixed Systems for Fire Protection, NFPA No. 15-1973, shall require no additional subdivision. Since unstable liquids will react more rapidly when heated than when at ambient temperatures, subdivision by drainage channels is the preferred method.

(D) The drainage channels or intermediate curbs shall be located between tanks so as to take full advantage of the available space with due regard for the individual tank capacities. Intermediate curbs, where used, shall be not less than 18 inches in height.

§ 5596. Tank Openings Other Than Vents for Aboveground Tanks.

(a) Connections for all tank openings shall be vapor-tight and liquid-tight.

(b) Openings for gaging on tanks storing Class I liquids shall be provided with a vaportight cap or cover. Such covers shall be closed when not gaging.

(c) For Class IB and Class IC liquids other than crude oils, gasolines and asphalts, the fill pipe shall be so designed and installed as to minimize the possibility of generating static electricity. A fill pipe entering the top of a tank shall terminate within six inches of the bottom of the tank and shall be installed to avoid excessive vibration.

(d) Filling and emptying connections for Class I, Class II and Class IIIA liquids which are made and broken shall be located outside of buildings at a location free from any source of ignition and not less than five feet away from any building opening. Such connections for any liquid shall be closed and liquid-tight when not in use and shall be properly identified.

Note: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

History

1. Repealer of subsections (b) and (c) and consecutive relettering of subsections (d)-(f) filed 9-18-80; effective thirtieth day thereafter (Register 80, No. 38).

§ 5597. Installation of Underground Tanks.

(a) Excavation for underground storage tanks shall be made with due care to avoid undermining of foundations of existing structures. Underground tanks or tanks under buildings shall be so located with respect to existing building foundations and supports that the loads carried by the latter cannot be transmitted to the tank. The distance from any part of a tank storing Class I liquids to the nearest wall of any basement or pit shall be not less than one foot, and to any property line that may be built upon, not less than three feet. The distance from any part of a tank storing Class II or Class III liquids to the nearest wall of any basement, pit or property line shall be not less than one foot.

(b) Underground tanks shall be set on firm foundations and surrounded with at least six inches of noncorrosive, inert materials such as clean sand, earth or gravel well tamped in place. The tank shall be placed in the hole with care since dropping or rolling the tank into the hole can break a weld, puncture or damage the tank or scrape off the protective coating of coated tanks. Tanks shall be covered with a minimum of two feet of earth, or shall be covered with not less than one foot of earth, on top of which shall be placed a slab of reinforced concrete not less than four inches thick. When underground tanks are, or are likely to be, subjected to traffic, they shall be protected against damage from vehicles passing over them by at least three feet of earth cover, or 18 inches of well-tamped earth, plus six inches of reinforced concrete or eight inches of asphaltic concrete. When asphaltic or reinforced concrete paving is used as part of the protection, it shall extend at least one foot horizontally beyond the outline of the tank in all directions.

(c) Corrosion protection for the tank and its piping shall be provided by one or more of the following methods:

(1) Use of protective coatings or wrappings;

(2) Cathodic protection; or

(3) Corrosion resistant materials of construction.

Selection of the type of protection to be employed shall be based upon the corrosion history of the area and the judgment of a qualified engineer.

§ 5598. Vents for Underground Tanks.

(a) Vent pipes from underground storage tanks storing Class I liquids shall be so located that the discharge point is outside of buildings, higher than the fill pipe opening, and not less than 12 feet above the adjacent ground level. Vent pipes shall not be obstructed by devices that will cause excessive back pressure. Vent outlets shall be so located and directed that flammable vapors will not accumulate or travel to an unsafe location, enter building openings or be trapped under eaves. Tanks containing Class IA liquids shall be equipped with pressure and vacuum venting devices which shall be normally closed except when venting to pressure or vacuum conditions. Tanks storing Class IB or Class IC liquids shall be equipped with pressure-vacuum vents or with approved flame arresters. Tanks storing gasoline are exempt from the requirements for pressure and vacuum venting devices or flame arresters provided the vent does not exceed 3 inches in nominal inside diameter.

(b) Each tank shall be vented through piping adequate in size to prevent blow-back of vapor or liquid at the fill opening while tank is being filled. Vent pipes shall be not less than 1 1/4-inch nominal inside diameter. The vent size depends upon the filling or withdrawal rate whichever is larger, the vent line length and the tank design pressure. Vent piping sized in accordance with Table FL-18 will prevent the pressure in the tank from exceeding 2.5 psig.

Table FL-18
Vent Line Diameters

Maximum Flow GPM	Pipe Length * 50 Feet	100 Feet	200 Feet
100	1 1/4-inch	1 1/4-inch	1 1/4-inch
200	1 1/4-inch	1 1/4-inch	1 1/4-inch
300	1 1/4-inch	1 1/4-inch	1 1/2-inch
400	1 1/4-inch	1 1/2-inch	2-inch
500	1 1/2-inch	1 1/2-inch	2-inch
600	1 1/2-inch	2-inch	2-inch
700	2-inch	2-inch	2-inch
800	2-inch	2-inch	3-inch
900	2-inch	2-inch	3-inch
1,000	2-inch	2-inch	3-inch

* Vent lines of 50 feet, 100 feet, and 200 feet of pipe plus 7 ells.

(c) Vent pipes from tanks storing Class II or Class III liquids shall terminate outside of building and higher than the fill pipe opening. Vent outlets shall be above normal snow level. They may be fitted with return bends, course screens or other devices to minimize ingress of foreign material.

(d) Vent piping shall be constructed in accordance with Article 146. Vent pipes shall be so laid as to drain toward the tank without sags or traps in which liquid can collect. They shall be located so that they will not be subjected to physical damage. The tank end of the vent pipe shall enter the tank through the top.

(e) When tank vent piping is manifolded, pipe sizes shall be such as to discharge, within the pressure limitations of the system, the vapors they may be required to handle when manifolded tanks are filled simultaneously.

(f) Vent piping for tanks storing Class I liquids shall not be manifolded with vent piping for tanks storing Class II or Class III liquids unless positive means are provided to prevent the vapors from Class I liquids from entering tanks storing Class II or Class III liquids, to prevent contamination and possible change in classification of the less volatile liquid.

§ 5599. Tank Openings Other Than Vents for Underground Tanks.

(a) Connections for all tank openings shall be liquid-tight.

(b) Openings for manual gaging, if independent of the fill pipe, shall be provided with a liquid-tight cap or cover. Covers shall be kept closed when not gaging. If inside a building, each such opening shall be protected against liquid overflow and possible vapor release by means of a spring loaded check valve or other approved device.

(c) Fill and discharge lines shall enter tanks only through the top. Fill lines shall be sloped toward the tank.

(d) For Class IB and Class IC liquids other than crude oils, gasolines and asphalts, the fill pipe shall be so designed and installed as to minimize the possibility of generating static electricity by terminating within six inches of the bottom of the tank.

(e) Filling and emptying connections for Class I, Class II or Class IIIA liquids which are made and broken shall be located outside of buildings at a location free from any source of ignition and not less than five feet away from any building opening. Such connection for any liquid shall be closed and liquid-tight when not in use and shall be properly identified.

§ 5600. Installation of Tanks Inside of Buildings.

(a) Location. Tanks shall not be permitted inside of buildings except as provided in Articles 142, 143, 144 or 148.

(b) Vents. Vents for tanks inside of buildings shall be as required in Sections 5592, 5593, 5594(b) and 5598 except that emergency venting by the use of weak roof seams on tanks shall not be permitted. Automatic sprinkler systems designed in accordance with the requirements of the Standard for the Installation of Sprinkler Systems, NFPA No. 13–1974 may be accepted as equivalent to approved water spray systems for purposes of calculating the required air flow rates for emergency vents in Section 5593(g). Except for tanks containing Class IIIB liquids, vents shall terminate outside the buildings.

(c) Vent Piping. Vent piping shall be constructed in accordance with Article 146.

§ 5601. Tank Openings Other Than Vents for Tanks Inside Buildings.

(a) Connections for all tank openings shall be liquid–tight.

(b) Each connection to a tank inside of buildings through which liquid can normally flow shall be provided with an internal or an external valve located as close as practical to the shell of the tank.

(c) Flammable or combustible liquid storage tanks located inside of buildings, except in one–story buildings designed and protected for flammable or combustible liquid storage, shall be provided with an automatic–closing heat–actuated valve on each withdrawal connection below the liquid level, except for connections used for emergency disposal, to prevent continued flow in the event of fire in the vicinity of the tank. This function may be incorporated in the valve required in (b), and if a separate valve, shall be located adjacent to the valve required in (b).

(d) Openings for manual gaging of Class I or Class II liquids, if independent of the fill pipe, shall be provided with a vaportight cap or cover. Openings shall be kept closed when not gaging. Each such opening for any liquid shall be protected against liquid overflow and possible vapor release by means of a spring loaded check valve or other approved device. Substitutes for manual gaging include, but are not limited to, heavy–duty flat gage glasses, magnetic, hydraulic or hydrostatic remote reading devices and sealed float gages.

(e) For Class IB and Class IC liquids other than crude oils, gasolines and asphalts, the fill pipe shall be so designed and installed as to minimize the possibility of generating static electricity by terminating within six inches of the bottom of the tank.

(f) The fill pipe inside of the tank shall be installed to avoid excessive vibration of the pipe.

(g) The inlet of the fill pipe for Class I, Class II and Class IIIA liquids shall be located outside of buildings at a location free from any source of ignition and not less than five feet away from any building opening. The inlet of the fill pipe for any liquid shall be closed and liquid–tight when not in use, and the fill connection shall be properly identified.

(h) Tanks storing Class I, Class II and Class IIIA liquids inside buildings shall be equipped with a device, or other means shall be provided, to prevent overflow into the building. Suitable devices include, but are not limited to, a float valve, a preset meter on the fill line, a valve actuated by the weight of the tank contents, a low head pump which is incapable of producing overflow, or a liquid–tight overflow pipe at least one pipe size larger than the fill pipe discharging by gravity back to the outside source of liquid or to an approved location.

§ 5602. Supports, Foundations and Anchorage for All Tank Locations.

(a) Tanks shall rest on the ground or on foundations made of concrete, masonry, piling of steel. Tank foundations shall be designed to minimize the possibility of uneven settling of the tank and to minimize corrosion in any part of the tank resting on the foundation.

(b) When tanks are supported above from the foundations, tank supports shall be installed on firm foundations. Supports for tanks storing Class I, Class II or Class IIIA liquids shall be of concrete, masonry or protected steel. Single wood timber supports (not cribbing) laid horizontally may be used for outside aboveground tanks if not more than 12 inches high at their lowest point.

(c) Steel supports or exposed piling for tanks storing Class I, Class II or Class IIIA liquids shall be protected by materials having a fire resistant rating of not less than two hours, except that steel saddles need not be protected if less than 12 inches high at their lowest point. Water spray protection or its equivalent may be used in lieu of fire–resistive materials to protect supports.

(d) The design of the supporting structure for tanks such as spheres shall requires special engineering consideration.

(e) Every tank shall be so supported as to prevent the excessive concentration of loads on the supporting portion of the shell.

(f) In areas subject to earthquakes, the tank supports and connections shall be designed to resist damage as a result of such shocks.

§ 5603. Sources of Ignition.

In locations where flammable vapors may be present, precautions shall be taken to prevent ignition by eliminating or controlling sources of ignition. Sources of ignition may include open flames, lightning, smoking, cutting and welding, hot surfaces, frictional heat, sparks (static, electrical and mechanical), spontaneous ignition, chemical and physical–chemical reactions and radiant heat.

§ 5604. Testing.

(a) All tanks, whether shop–built or field–erected, shall be tested before they are placed in service in accordance with the applicable paragraphs of the Code under which they were built. The ASME Code stamp, API monogram, or the Listing Mark of Underwriters' Laboratories, Inc., on a tank shall be evidence of compliance with this test. Tanks not marked in accordance with the above Codes shall be tested before they are placed in service in accordance with good engineering principles and reference shall be made to the sections on testing in the Codes listed in Sections 5585, 5586(b) or 5587(b).

(b) When the vertical length of the fill and vent pipes is such that when filled with liquid the static head imposed upon the bottom of the tank exceeds 10 pounds per square inch, the tank and related piping shall be tested hydrostatically to a pressure equal to the static head thus imposed.

(c) In addition to the test called for in (a) and (b), all tanks and connections shall be tested for tightness. Except for underground tanks, this tightness shall be made at operating pressure with air, inert gas or water prior to placing the tank in service. In the case of field–erected tanks the test called for in (a) or (b) may be considered to be the test for tank tightness. Underground tanks and piping, before being covered, enclosed, or placed in use, shall be tested for tightness hydrostatically, or with air pressure at not less than three pounds per square inch and not more than five pounds per square inch. (See Section 5612 for testing pressure piping).

(d) Before the tank is initially placed in service, all leaks or deformations shall be corrected in an acceptable manner. Mechanical caulking is not permitted for correcting leaks in welded tanks except pin hole leaks in the roof.

(e) Tanks to be operated at pressures below their design pressure may be tested by the applicable provisions of (a) or (b) based upon the pressure developed under full emergency venting of the tank.

§ 5605. Protection of Tanks in Locations That May Be Flooded.

Where a tank is located in an area that may be subjected to flooding, installation shall be in accordance with the provisions of NFPA No. 30–1973.

Article 146. Piping, Valves and Fittings

§ 5606. General.

(a) The design, fabrication, assembly, test and inspection of piping systems containing flammable or combustible liquids shall be suitable for the expected working pressures and structural stresses. Conformity with the applicable sections of ANSI B31 American National Standard Code for Pressure Piping, and the provisions of this chapter, shall be con-

APPENDIX C.5

CALIFORNIA FIRE MARSHAL REQUIREMENTS

§ 1584.4. Packaging.

No provisions of these regulations nor the standards referenced herein shall allow any person to repackage any compound from the original manufacturer's packaging unit. The manufacturer of plosophoric compounds shall package and ship only in units which have been determined to meet the standards for shipping of hazardous

Chapter 11. Transportation of Flammable Liquids in Cargo Tanks on Highways

NOTE: Authority cited: Section 34020, Vehicle Code. Reference: Sections 34001 to 34102, Vehicle Code.

HISTORY

1. Repealer of Subchapter 11 (§§ 1600 through 1828) and new Subchapter 11 (§§ 1600–1605, 1605.1, 1605.2, 1608, 1609, 1609.1, 1610–1612, 1620–1626, 1630–1634, 1640–1655, 1670–1680, 1700–1719, 1750–1754, 1775–1779, 1790–1796, 1800–1803, 1825–1830, 1850–1857, 1870–1875, 1880–1882, 1890–1908, 1910–1917) filed 7–1–70; effective thirtieth day thereafter (Register 70, No. 27). For prior history see Register 62, No. 17. (Ed. note—original regulations filed 8–22–62, designated effective 8–23–62.)
2. Repealer of Subchapter 11 (Articles 1–18, Sections 1600–1917, not consecutive) filed 7–11–85; effective thirtieth day thereafter (Register 85, No. 28). For prior history, see Registers 80, No. 46; 79, No. 19; 79, No. 11; 79, No. 9; 79, No. 4; 77, No. 45; 76, No. 26; 75, No. 47; 72, No. 52; 71, No. 41; and 71, No. 27.

Chapter 11.5. Gasoline Vapor Control Systems

Article 1. Administration

§ 1918. Title.

NOTE: Authority cited: Section 11349.1, Government Code. Reference: Sections 41954–41961, Health and Safety Code.

HISTORY

1. New Subchapter 11.5 (Sections 1918–1918.84, not consecutive) filed 4–18–77 as an emergency; effective upon filing (Register 77, No. 17).
2. Repealer of Subchapter 11.5 (Sections 1918–1918.84, not consecutive) and new Subchapter 11.5 (Sections 1918–1918.84, not consecutive) filed 8–12–77 as an emergency; designated effective 8–16–77. Certificate of Compliance included (Register 77, No. 33).
3. Editorial correction (Register 77, No. 51).
4. Repealer filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.1. Purpose.

These regulations establish minimum standards of fire safety for vapor recovery systems or components.

Any protective device or devices, including but not limited to impact valves, shear sections, flame arrestors or automatic fire checks may be required in addition to the components specified in these regulations, if in the judgement of the State Fire Marshal such additional means of protection from fire and explosion are necessary.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956 and 41958, Health and Safety Code.

HISTORY

1. Amendment filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.2. Scope.

These regulations shall apply to all gasoline dispensing equipment containing a gasoline vapor control system when such system is required by the California Air Resources Board or any air pollution control agency having jurisdiction. The design, construction and installation requirements of such systems shall be applied uniformly throughout the State.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41950 and 41960, Health and Safety Code.

HISTORY

1. Amendment filed 11–13–80; effective thirtieth day thereafter (Register 80, No. 46).
2. Amendment of NOTE filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.3. Authority.

NOTE: Authority cited: Section 11349.1, Government Code.

HISTORY

1. Repealer filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.4. Validity.

NOTE: Authority cited: Section 11349.1, Government Code.

HISTORY

1. Repealer filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41)

§ 1918.5. Local Ordinances.

NOTE: Authority cited: Section 11349.1, Government Code.

HISTORY

1. Repealer filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41)

§ 1918.6. Order of Precedence.

NOTE: Authority cited: Section 11349.1, Government Code.

HISTORY

1. Repealer filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41

§ 1918.7. Violations.

NOTE: Authority cited: Section 11349.1, Government Code.

HISTORY

1. Repealer filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41

Article 2. Definitions

§ 1918.10. "A" Definitions.

(a) ARB. "ARB" means Air Resources Board (of California).

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41954, 41950 and 41962, Health and Safety Code.

HISTORY

1. Renumbering and amendment of former Section 1918.10 to Section 1918.2 , and renumbering and amendment of former Section 1918.20(a) to Sect 1918.10 filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41 .

§ 1918.11. "D" Definitions.

(a) Dispensing Device. A unit assembly approved for installation co - sisting of a power–operated pumping unit, strainers, metering device , valves, dispensing outlet(s) for hoses and dispensing nozzles designed o stop the discharge of liquid automatically when the control level of t e dispensing nozzle is released.

(b) Dispensing Nozzle. A regulating mechanism with spout approv d for installation in conjunction with a "dispensing device" which contr s the flow of gasoline into fuel tanks, and returns vapors to an undergrou d tank.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: S :- tions 41954, 41950 and 41962, Health and Safety Code.

HISTORY

1. Renumbering and amendment of former Section 1918.11 to Section 1918. 1, and renumbering and amendment of former Section 1918.20(d) to Sect n 1918.11 filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 4).

§ 1918.12. "F" Definitions.

(a) Flame Arrestor. A device approved for installation in piping car y- ing a flammable vapor/air mixture, to prevent flame travel beyond t e point of installation of the device.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: S c- tions 41956, 41950 and 41962, Health and Safety Code.

HISTORY

1. Renumbering and amendment of former Section 1918.12 to Section 1918. 2, and renumbering and amendment of former Section 1918.20(f) to Sect on 1918.12 filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 4 1).

§ 1918.13. "G" Definitions.

(a) Gasoline. See Section 41950(c), Health and Safety Code.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956, 41950 and 41962, Health and Safety Code.

HISTORY

1. Renumbering and amendment of former Section 1918.13 to Section 1918.23, and renumbering and amendment of former Section 1918.20(g) to Section 1918.13 filed 9-27-85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.14. "I" Definitions.

(a) Impact Valve. A device approved for installation in piping which automatically closes by the activation of a fusible link through exposure to fire or severe physical impact, or both.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956, 41950 and 41962, Health and Safety Code.

HISTORY

1. Renumbering and amendment of former Section 1918.14 to Section 1918.24, and renumbering and amendment of former Section 1918.20(i) to Section 1918.14 filed 9-27-85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.15. "L" Definitions.

(a) Labeled. "Labeled" shall mean Systems or components bearing the label, symbol, or other identifying mark of a testing laboratory approved by the State Fire Marshal, or the label of the State Fire Marshal.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956, 41950 and 41962, Health and Safety Code.

HISTORY

1. Renumbering and amendment of former Section 1918.15 to Section 1918.25, and renumbering and amendment of former Section 1918.20(l) to Section 1918.15 filed 9-27-85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.16. "N" Definitions.

(a) Nozzle. See dispensing nozzle.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41954, 41950 and 41962, Health and Safety Code.

HISTORY

1. Renumbering of former Section 1918.16 to Section 1918.26, and renumbering and amendment of former Section 1918.20(n) to new Section 1918.16 filed 9-27-85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.17. "U" Definitions.

(a) Uniform Fire Code. The 1982 edition of the Uniform Fire Code. Copies available from I.C.B.O., 5360 South Workman Mill Road, Whittier, CA 90601.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Section 41956, Health and Safety Code.

HISTORY

1. New section filed 9-27-85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.18. "V" Definitions.

(a) Vapor Recovery System. See Section 41952, Health and Safety Code.

(b) Vapor Balance System. A system designed to capture and retain, solely by means of displacement with or without processing, gasoline vapors emitted during dispensing operations.

(c) Vapor Assist System. A system whereby mechanical and/or chemical means are used to capture and retain, with or without processing, gasoline vapors emitted during dispensing operations.

(d) Vapor Processing Unit. Vapor Processing Equipment in one contiguous unit. Vapor processing unit shall not be construed interpreted to include inline flame arrestors, inline fire checks, pressure vacuum valves, inline check valves, and dispenser flow regulators.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41954, 41950 and 41962, Health and Safety Code.

HISTORY

1. Renumbering and amendment of former Section 1918.20(v) to Section 1918.18 filed 9-27-85; effective thirtieth day thereafter (Register 85, No. 41).

Article 3. Application for Certification

§ 1918.20. Application.

(a) Original. Any manufacturer desiring the certification and listing of any gasoline vapor recovery system or component part shall submit a completed application for evaluation and certification to the State Fire Marshal on forms provided by him. Such form shall be accompanied by the fee for evaluation and certification as prescribed in Section 1918.25.

(b) Revision. Any manufacturer desiring a revision to be made to the original certified system or component shall submit a completed application for revision to the State Fire Marshal on forms provided by him. Such form shall be accompanied by the fee for evaluation and certification as prescribed in Section 1918.25.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41955, 41958, Health and Safety Code.

HISTORY

1. Renumbering and amendment of former Section 1918.20(a) to Section 1918.10, Section 1918.20(d) to Section 1918.11, Section 1918.20(f) to Section 1918.12, Section 1918.20(g) to Section 1918.13, Section 1918.20(i) to Section 1918.14, Section 1918.20(l) to Section 1918.15, Section 1918.20(n) t Section 1918.16 and Section 1918.20(v) to Section 1918.18, and renumbering and amendment of former Section 1918.10 to Section 1918.20 filed 9-27-85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.21. Required Submissions for Certification.

(a) In addition to the application and fee required by this subchapter the State Fire Marshal may require that sample specimens, taken from regular production, be submitted to him for evaluation. The State Fire Marshal may require the assembly or erection of a sample specimen for evaluation purposes.

The applicant shall assume all responsibility relating to the assembly or erection of such specimen, including but not limited to the cost, liability and removal thereof. The applicant shall arrange for the removal of any specimen submitted to the State Fire Marshal or which has been assembled or erected pursuant to this section, within 60 days of notification by the State Fire Marshal. The State Fire Marshal may, at his discretion, dispose of any specimen submitted to him following the 60 day notification.

(b) Every application for evaluation and certification of a gasoline vapor recovery system or component part which is required by these regulations to be tested, shall be accompanied by a test report issued by an approved testing organization. Technical data shall be submitted with any application when required by the State Fire Marshal. Each application for an evaluation and certification of a gasoline vapor recovery system or component shall be accompanied by black-line drawings suitable for reproduction.

(c) Specimens submitted to laboratories for testing shall be from regular production. Acceptance for certification will not be considered on the basis of any examination of hand made equipment or products.

(d) The State Fire Marshal reserves the right to publish all or any part of any test report or technical data submitted to him and relating to a gasoline vapor recovery system or component. Manufacturing processes, ingredients or compounds of materials or equipment shall not be matters of public record.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41955 and 41958, Health and Safety Code.

HISTORY

1. Renumbering and amendment of former Section 1918.11 to Section 1918.21 filed 9-27-85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.22. Labels.

(a) Every gasoline vapor recovery system or component which is certified by the State Fire Marshal, shall bear a label conforming to the provisions of this section. Labels shall be placed in a conspicuous location and shall be attached by the manufacturer during production or fabrication.

EXCEPTIONS:

(1) Systems or components which bear the label of an approved testing organization provided such organization conducts factory inspections of the material and workmanship during fabrication and assembly.

(2) Upon written request, the State Fire Marshal may exempt specified systems or components from the labeling requirement provided he finds such labeling impractical or impossible. In such cases however sufficient evidence shall be furnished indicating the means by which said systems or components may be reasonably identified.

(b) Labels shall be of sufficient size to render all data specified thereon, clear and legible.

(c) Labels shall be of a contrasting color to the material or equipment to which it is attached.

(d) Labels shall be produced or obtained by the manufacturer and such label shall be of the following configuration:

(1) Insert in the top scroll the name and address of the manufacturer.

(2) In the first bottom scroll insert the certification number issued by the State Fire Marshal and all other data as may be specified by the State Fire Marshal dependent upon its intended use.

(3) Insert in the bottom scroll the item certified. Examples: "Flame Arrestor"—"Impact Valve."

(e) Labels may be of any durable material and shall be attached to the certified systems or component in such a manner that any removal will cause destruction of the label.

(f) Prior to the use of any label, the manufacturer shall submit to the State Fire Marshal a sample of each label intended to be used with any certified system or component. Labels shall not be used until written approval has been received from the State Fire Marshal.

(g) No person shall attach any label conforming to the provisions of this section to any system or component which is not certified by the State Fire Marshal.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41958 and 41960, Health and Safety Code.

HISTORY

1. Renumbering and amendment of former Section 1918.12 to Section 1918.22 filed 9-27-85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.23. Approved Testing Organization.

(a) For the purposes of this article, an approved testing organization shall mean any person, firm, corporation or association which conforms to all of the following:

(1) Equipped or has access to facilities which are equipped to perform tests in accordance with required test procedures.

(2) Employment of personnel who are qualified for testing. Evidence of such qualifications may include persons possessing registration as a Professional Engineer.

(3) Approved by the State Fire Marshal. Persons, firms, corporations, or associations desiring approval as a testing organization may initiate a request and present to the State Fire Marshal evidence of their qualifications which in the judgment of the State Fire Marshal is sufficient to grant approval.

Approval as a testing organization shall not be granted to any person, firm, corporation, or association for the purpose of conducting tests of materials or equipment manufactured, sold, or similarly processed or handled by such person, firm, corporation or association.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Section 41958, Health and Safety Code.

HISTORY

1. Renumbering and amendment of former Section 1918.13 to Section 1918.23 filed 9-27-85; effecuve thirtieth day thereafter (Register 85, No. 41).

§ 1918.24. Testing Equipment.

(a) Testing equipment used or intended to be used to determine a gasoline vapor recovery system or component's compliance with State Fire Marshal vapor recovery requirements shall be inspected and evaluated by the State Fire Marshal to determine conformance with required conditions for such testing equipment as set forth in the appropriate test standard.

(b) All testing equipment shall be maintained in good repair devoid of any defect which would affect the certification of any system or component to be tested.

(c) Any testing organization which desires State Fire Marshal approval shall be liable for the necessary advance arrangements for all costs incurred by one representative of the State Fire Marshal in conducting any service rendered under Section (a) above.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Section 41958, Health and Safety Code.

HISTORY

1. Renumbering and amendment of former Section 1918.14 to Section 1918.24 filed 9-27-85; effecuve thirtieth day thereafter (Register 85, No. 41).

§ 1918.25. Fees.

Each application for certification shall be accompanied by fees established by this section.

(a) The fee for evaluating any system and component shall be as follows:

(1) System (with or without processing including processing equipment, i.e., incinerator, refrigeration unit, carbon canisters, electrical controls)—$100.00.

(2) Components (flame arrestors, pressure/vacuum valves, impact valves, dispensing nozzles, automatic fire checks, and similar devices)—$50.00.

(b) Certification Fees. The fee for certification of systems or components—$35.00.

(c) Evaluation and certification fees shall be submitted with each application for evaluation and certification. If the system or component is not found to be in conformance with the provisions of these regulations, the certification fee will be returned to the applicant. The evaluation fee will be retained by the State Fire Marshal to offset the costs incurred for evaluation of the submitted system or component.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Section 41961, Health and Safety Code.

HISTORY

1. Renumbering and amendment of former Section 1918.15 to new Section 1918.25 filed 9-27-85; effective thirtieth day thereafter (Register 85, No. 4).

§ 1918.26. Violations.

No person, firm, corporation or association shall knowingly or intentionally represent any system or component as being certified by the State Fire Marshal when such system or component is not so certified.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Section 41958, Health and Safety Code.

HISTORY

1. Renumbering and amendment of former Section 1918.16 to new Section 1918.26 filed 9-27-85; effective thirtieth day thereafter (Register 85, No. 4).

Article 4. Installation—Vapor Recovery

§ 1918.30. Dispensing Nozzles.

Dispensing nozzles shall be tested in accordance with applicable provisions of this subchapter.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956 and 41958, Health and Safety Code.

HISTORY

1. Amendment filed 9-27-85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.31. Vapor Check Valves.

Vapor check valves shall be provided in the vapor return line from each dispensing outlet to prevent the discharge of vapors when the hose nozzle valve is in its normal non-dispensing position. Such vapor check valves shall be tested in accordance with applicable provisions of this subchapter.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956 and 41958, Health and Safety Code.

HISTORY

1. Amendment filed 9-27-85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.32. Fuel Shut Down.

Means shall be provided to shut down fuel dispensing in the event the vapor return line becomes blocked in any manner that can cause a forceful ejection of liquid.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956 and 41958, Health and Safety Code.

HISTORY

1. Amendment filed 9-27-85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.33. Shear Sections.

Where vapor return piping is inside the dispenser enclosure or where it may impair the effective operation of an impact valve in the liquid pipe, a shear section shall be properly installed in the vapor return piping at the base of each dispenser. Properly installed means the shear section is mounted flush (plus/minus 3/4") with the top of the surface upon which the dispenser is mounted. Shear sections shall be tested in accordance with applicable provisions of this subchapter.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956 and 41958, Health and Safety Code.

HISTORY

1. Amendment filed 9-27-85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.34. Impact Valves.

Impact valves shall be tested in accordance with the applicable provisions of this subchapter. Impact valves shall be properly installed in all gasoline carrying piping when supplied by a remote pump and rigidly mounted at the base of each dispenser. Properly installed means that the shear section of the impact valve is mounted flush (plus/minus 3/4") with the top of the surface upon which the dispenser is mounted.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956 and 41958, Health and Safety Code.

HISTORY

1. Amendment filed 9-27-85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.35. Piping.

Piping shall comply with the following:

(a) Non-metallic piping, if used, shall be installed in accordance with the manufacturer's installation instructions.

(b) All vapor return piping and tank vents shall be installed so as to drain toward the gasoline storage tanks. There shall be no sags or traps in the vapor return piping in which any liquid may become trapped. Condensate tanks, if utilized, shall be installed and maintained so as to preclude the blocking of the vapor return lines by liquid.

(c) All vapor return and vent piping shall be provided with swing joints or any other State Fire Marshal approved connector at the base of the riser to each dispensing unit, at each tank connection, and at the base of the vent riser where it fastens to a building or other structure. When a swing joint is used in a riser containing a shear section, the riser must be rigidly supported.

(d) Tank vent pipes two inches or less in nominal inside diameter shall not be obstructed by any device unless the tank and its associated piping and other equipment is protected to limit back pressure development to less than the maximum working pressure of the tank, its associated piping and other equipment. Protection shall be afforded by the installation of one of the following approved items: Pressure/vacuum vents, rupture disks or other tank venting devices installed in the tank vent pipes.

(e) Tank vent pipes shall terminate into the open atmosphere and shall be at least 12 feet above the adjacent ground level. The outlet shall vent upward or horizontally and be located so as to eliminate the possibility of vapors accumulating or traveling to a source of ignition or entering adjacent buildings.

(f) Vent pipes from tanks storing the same class of liquids may be connected into one outlet pipe. The vapor discharge capacity of manifolded vent piping shall be sufficient to limit back pressure development to less than the maximum working pressure of tanks, associated piping and other equipment when two tanks are filled simultaneously.

(g) Vent pipes shall be adequately supported throughout their length. When they are supporting weights in addition to their own, additional supports may be required.

(h) Piping systems servicing vapor balance recovery systems, installed after September 1, 1977 shall be pneumatically tested to 75 psig. Test pressure shall be maintained for at least 30 minutes, with the system sealed, and with a pressure loss not to exceed 3 psig.

(j) When there is any indication of a leak in an existing underground storage tank or piping system, the system shall be tested in accordance with and shall meet the criteria of Section 79.605 of the 1982 Uniform Fire Code.

(k) Vapor pipes shall enter tanks only through the top of the tank. The end of vapor pipes shall not extend into the tank more than one inch. Float check valves attached to such vapor pipes may extend into the tank without distance restrictions.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956 and 41958, Health and Safety Code.

HISTORY

1. Amendment of subsection (j) filed 11-13-80; effective thirtieth day thereafter (Register 80, No. 46).
2. Amendment filed 9-27-85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.36. Tank Openings.

All tank openings, other than vent pipe openings, shall comply with the following:

(a) Vapor recovery openings shall be protected against vapor release by means of either a spring-loaded check valve, dry-break connection or other approved device. Combination fill and vapor recovery openings shall be protected against vapor release unless connection of the liquid delivery pipe to the fill pipe simultaneously connects the vapor recovery pipe. Tank vent pipes shall not be obstructed by any device which will allow back pressure development in the storage tanks.

(b) All connections, which are made and broken, shall be located outside of buildings at a location free from any source of ignition and at least ten feet from any building openings. Such connections shall be closed, liquid and vapor tight when not in use and each opening shall be properly identified as to its function.

(c) Separate fill pipe openings and vapor recovery openings shall be of different sizes, or the hose connection utilized shall be incompatible so as to eliminate the possibility of cross connections.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956 and 41958, Health and Safety Code.

HISTORY

1. Amendment filed 9-27-85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.37. Gasoline Storage Tanks.

Gasoline storage tanks used in conjunction with vapor recovery systems shall comply with Sections 79.601 through 79.605 of the Uniform Fire Code, 1982 Edition.

EXCEPTIONS: Specific requirements set forth in this subchapter shall take precedence over requirements set forth in the Uniform Fire Code. See Section 1918.6.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956 and 41958, Health and Safety Code.

HISTORY

1. Amendment filed 9-27-85; effective thirtieth day thereafter (Register 85, No. 41).

Article 4.5. Installation—Vapor Balance Systems—With Processing

NOTE: Authority cited: Section 11349.1, Government Code.

HISTORY

1. Repealer of Article 4.5 (Section 1918.40) filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41).

Article 5. Installation—Vapor Recovery Systems—With Processing

§ 1918.60. General.

In addition to the requirements set forth in Article 4, Vapor Recovery Systems—With Processing shall install the following equipment and shall comply with the requirements set forth for equipment location, mounting and protection.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956 and 41958, Health and Safety Code.

HISTORY

1. Repealer of former Article 5 (Sections 1918.50–1918.58), including renumbering of Section 1918.55 to Section 1918.61, and renumbering of former Article 5.5 (Sections 1918.60–1918.64) to new Article 5 (Sections 1918.60–1918.65) filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.61. Flame Arrestors.

If the operation of the system will produce a flammable mixture in the piping which will carry it to the storage tanks, an approved flame arrestor, tested in accordance with the applicable provisions of Article 7, shall be properly installed in vapor return piping between the shear section and the storage tank.

EXCEPTION: An approved automatic fire check may be installed in lieu of an approved flame arrestor.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956 and 41958, Health and Safety Code.

HISTORY

1. Renumbering and amendment of former Section 1918.61 to Section 1918.62, and renumbering of former Section 1918.55 to Section 1918.61 filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.62. Automatic Fire Checks.

Positive means of automatic isolation of tanks may be required in vapor return piping to prevent flashback from reaching the tanks.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956 and 41958, Health and Safety Code.

HISTORY

1. Renumbering of former Section 1918.62 to Section 1918.63, and renumbering and amendment of former Section 1918.61 to Section 1918.62 filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.63. Equipment Mounting.

Vapor processing units shall be securely mounted on concrete, masonry or structural steel supports or other noncombustible foundations.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956 and 41958, Health and Safety Code.

HISTORY

1. Renumbering of former Section 1918.63 to Section 1918.64, and renumbering of former Section 1918.62 to Section 1918.63 filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.64. Processing Equipment Location.

(a) All ignition sources of vapor processing equipment shall be located not less than 18 inches above any tank fill opening, the top of the dispenser island, or grade, whichever is highest. The equipment shall also be located not less than 50 feet from any fuel transfer area and not less than 10 feet from the nearest building or property line which may be built upon.

EXCEPTIONS:

(1) Nothing in this section shall prohibit roof mounted equipment.

(2) When reduction of the required 50 feet clearance from the fuel transfer area is necessary, as determined by the enforcing authority, ignition sources of vapor processing units shall be installed in conformance with the following table:

Clear Distance Available (Ft)	*Required Height Above grade (Inches)*
50	18
40	30
30	42
20	48

When the minimum 20 feet required distance, as specified in the above table, cannot be obtained because of site configuration a minimum height of 12 feet from any ignition source shall be provided for the equipment or construction enclosure requirements as set forth in (c) of this section shall apply.

In no instance shall any cargo tank be permitted within the minimum 20 foot clearance during delivery operations.

(b) When the processing unit location site is lower than the tank fill opening or the top of the dispenser island, the difference in elevation shall be added to the elevation requirements set forth in (a) of this section.

(c) When the required 10 foot distance to an adjacent property line which may be built upon cannot be obtained, an open–top enclosure of not less than 2–hour noncombustible fire–resistive construction which shall extend from the mounting base or slab to an elevation not less than 18 inches higher than the highest elevation of the processing equipment shall be provided on the property line side. Doors installed in the enclosure walls shall be of noncombustible construction including the door frames. Ventilation openings, except in the property line wall, shall be provided at slab level to eliminate the accumulation of flammable vapors within the enclosure as deemed necessary by the enforcing authority having jurisdiction.

(d) Where site configuration makes adherence to equipment location elevation requirements impossible or impracticable and the equipment is located below grade or within roofed enclosures, such below grade or roofed area shall be provided with mechanical ventilation providing not less than 6 complete air changes per hour at all times. All such equipment shall meet Class 1, Division 1 requirements as set forth in Part 3, Title 2, CAC.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956 and 41958, Health and Safety Code.

HISTORY

1. Renumbering and amendment of former Section 1918.64 to Section 1918.65, and renumbering of former Section 1918.63 to Section 1918.64 filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.65. Vapor Processing Unit Protection.

Fences, bumper posts and other control measures, as determined by the authority having jurisdiction, shall be provided to protect vapor processing unit installations against tampering, trespassing, and vehicular traffic. The area shall be kept clear of combustible materials of any nature within 10 feet of the vapor processing unit installation unless the unit is enclosed as specified in (c) of Section 1918.64.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956 and 41958, Health and Safety Code.

HISTORY

1. Renumbering and amendment of former Section 1918.64 to Section 1918.65 filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41).

Article 6. Electrical

§ 1918.70. Electrical Requirements.

(a) General. All electrical equipment and wiring shall comply with the requirements set forth in Part 3, Title 24, California Administrative Code.

(b) Emergency Pump Cut–Off. All electrically energized vapor collection equipment shall be directly connected to, and controlled by, an emergency pump cut–off switch.

(c) Cut–Off Switch Location. The emergency pump cut–off switch shall be located in a readily accessible and clearly visible location, outside of any enclosure, within 75 feet of but no closer than 15 feet to any gasoline dispenser.

(d) Labeling. The emergency pump cut–off switch shall be clearly and legibly labeled as to its function.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956 and 41958, Health and Safety Code.

HISTORY

1. Amendment filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41).

Article 7. Standards for the Certification of Gasoline Vapor Recovery Equipment

§ 1918.80. Scope.

This standard article represents the minimum basic requirements for the construction and operating performance standards of gasoline vapor recovery equipment for purposes of approval and certification by the State Fire Marshal. The minimum design, construction and operating performance standards set forth herein are those deemed as necessary to provide a reasonable degree of safety from fire and explosion in conformance to the regulations adopted by the State Fire Marshal pursuant to Section 41954 through 41961, inclusive, Health and Safety Code, and when applicable shall be reported on in their entirety by approved testing laboratories.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956 and 41958, Health and Safety Code.

HISTORY

1. Amendment filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.81. Test Reports.

The report shall include failure analysis engineering data, wiring diagrams, operating and maintenance manuals and photographs, together with the tests performed and the results thereof.

The reports shall include the catalog number or other readily identifiable marking, the laboratory test report number and date. Such individually tested components of a system when installed in combination with other components shall be subjected to the performance standard tests to determine their suitability for use in combination with other component parts or equipment.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956 and 41958, Health and Safety Code.

HISTORY

1. New NOTE filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.82. Equipment Standards.

(a) General. Equipment utilized in gasoline vapor recovery shall be tested according to the requirements set forth in the following applicable standards.

(1) Flame Arrestors. Flame Arrestors to be installed in either fuel, vapor, or vent lines shall be tested in accordance with the requirements of U.L. Standard 525, available from Underwriters Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL 60062, and as approved by the State Fire Marshal.

(2) Hose Nozzle Valves. Hose nozzle valves used in conjunction with gasoline vapor recovery systems shall be tested in accordance with the requirements of U.L. Standard 842, available from Underwriters Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL 60062, and as approved by the State Fire Marshal.

(3) Carbon/Charcoal Canisters. Carbon/charcoal canisters utilized in gasoline vapor recovery systems shall withstand, without failure, a test pressure of plus or minus 150% of the maximum operating pressure. The canister material shall also be able to withstand temperatures created by the materials contained therein.

(4) Pressure Regulators. Gasoline vapor pressure regulators utilized in a vapor recovery system shall be approved for the intended use.

(5) Ignition Controls. Ignition controls including, but not limited to, such devices as flame detectors, flame sensors, ignition transformers, electrical control units, alarms, flame indicators, utilized as a component of a gasoline vapor recovery system shall be approved by the State Fire Marshal for its intended use.

(6) Refrigeration Units. Refrigeration units utilized in processing vapors in gasoline vapor recovery systems shall be approved for their intended use.

(7) Pressure/Vacuum Valves. Pressure/vacuum valves utilized in gasoline vapor recovery systems shall be approved by the State Fire Marshal for their intended use.

(8) Internal Explosion/Ignition Test. The processing unit shall be subjected to a series of internal explosion/ignition tests, during performance/operation safety testing, such that ignition of an explosion air/gasoline vapor mixture occurs within the confines of the processing unit piping. The explosion shall not propagate beyond the inlet Flame Arrestor(s). The processing unit and Flame Arrestors shall provide a degree of isolation between other installation components and the processing unit, and between the processing unit and the remainder of the installation, and between the processing unit and the storage tank. The operating function of the unit, shall not be impaired as a result of such tests. Adequate sensors shall be utilized to insure that: (1) an explosive gasoline/air vapor mixture was present; (2) that an ignition of the vapor mixture did occur, and (3) that the safeguards installed in the processing unit did function.

(9) Other Equipment. Such other equipment which may be utilized in gasoline vapor control systems shall also be tested to applicable standards as may be determined necessary by the State Fire Marshal.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956 and 41958, Health and Safety Code.

HISTORY

1. Amendment filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.83. Structural Integrity.

(a) Wind Loads. The completely assembled vapor processing unit shall be subjected to a wind loading velocity of not less than 60 MPH for a period of not less than 10 minutes. At the conclusion of this test there shall be no evidence of damage to the unit or its function.

(b) Dead Load Test. All portions of the assembled vapor processing unit, which may be stepped upon, shall be subjected to a dead load test of not less than 200 pounds. At the conclusion of such loading there shall be no evidence of damage to the unit, platform, structural frame or plumbing or their function.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956 and 41958, Health and Safety Code.

HISTORY

1. New NOTE filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41).

§ 1918.84. Drop Test.

The complete processing unit and its platform (base) shall be subjected to four drop tests. The drop tests shall consist of sequentially raising each side of the base not less than 6 inches and allowing the base to drop freely. The operating function of the unit shall not be impaired as the result of such tests.

NOTE: Authority cited: Section 41956, Health and Safety Code. Reference: Sections 41956 and 41958, Health and Safety Code.

HISTORY

1. New NOTE filed 9–27–85; effective thirtieth day thereafter (Register 85, No. 41).

Certification Number GVRC 005:007:031

COAXIAL EMERGENCY BREAKAWAY COUPLING

LISTEE-------- Emco Wheaton, Inc., 4001 Weston Parkway, Cary, NC 27513

DESIGN-------- Emco Wheaton Model A4019 Coaxial Safebreak Coupling is intended for use with gasoline dispensing devises having vapor recovery capabilities. It is used between two [2] hose assemblies to safeguard against excessive pull force on the hose assembly and dispenser.

The assembly consists of an internal male and female connectors with integral check valves in each component. These parts are assembled within a female and male outer body which are slipped together and held in place with a outer shell. When the coupling and connecting hose assemblies are subjected to a pull force not exceeding 250 pounds, the outer shell expands causing separation of the coupling halves relieving pull force on the hose assembly and dispenser. The check valves prevent the escape of liquid from the hose lines. Coupling can be reassembled in the field following separation.

The inlet and outlet connections consist of a 1 7/8 inch 12 female thread (vapor line) and a concentric 11/16 inch bore (liquid line) with two (2) integral O-rings.

Each assembly is tested by the manufacturer for electrical continuity with resistance less than 0.5 megohms.

APPLICATION--- Intended for installation between two (2) coaxial hose assemblies where the working pressure does not exceed 50 psi.

INSTALLATION--- To be installed in conformity with the manufacturer's instructions and all applicable codes.

MARKING------- Listee's name and coupling model number shall be molded on the outer shell, cast on body half, and silk-screened on scuff guard.

Maximum break force of the coupling shall be cast on body half and silk-screened on scuff guard.

A tag is to be wired to each coupling warning that prior to installation, it shall be determined that the pull force required to separate the emergency breakaway feature will not damage the hose assembly or dispensing devise.

CERTIFICATION- Certified for use with approved coaxial hose assemblies where breakaway protection is desired.

This coupling is approved for use with leaded or unleaded gasoline and 15 percent ASTM Fuel C/85 percent methanol.

THIS CERTIFICATION IS MADE PURSUANT TO THE AUTHORITY GRANTED TO THE CALIFORNIA STATE FIRE MARSHAL AS CONTAINED IN SECTION 41955 THROUGH 41960 INCLUSIVE, CALIFORNIA HEALTH AND SAFETY CODE.

A CSFM REPORT IS NOT TO BE CONSTRUED AS REPRESENTING AESTHETICS OR ANY OTHER ATTRIBUTES NOT SPECIFICALLY ADDRESSED NOR AN ENDORSEMENT OR RECOMMENDATION FOR USE OF THE SUBJECT REPORT.

THIS CERTIFICATION IS BASED UPON INDEPENDENT TEST OR OTHER TECHNICAL DATA SUBMITTED BY THE APPLICANT. THE CSFM TECHNICAL STAFF HAS REVIEWED THE TEST RESULTS AND/OR OTHER DATA, BUT DOES NOT POSSESS TEST FACILITIES TO MAKE AN INDEPENDENT VERIFICATION.

Date Issued: April 16, 1991 By: _____
Deputy State Fire Marshal

STATE FIRE MARSHAL

Application for evaluation and certification or revision of vapor recovery

Do not write in this space	Do not write in this space
Subject No._____	Ck.- M.O._____
Company No._____	Date_____
Item No. _____	$_____
	ROC No._____

MANUFACTURER ADDRESS

CITY STATE ZIP CODE

Application is hereby made for evaluation and certification of a gasoline vapor recovery system☐ or component☐ . A brief description of the item covered by this application including model number, shall be provided on the reverse side.

All applications shall be accompanied by an evaluation fee and a certification fee, except that applications for revisions which do not require evaluation of a test report or technical data may be accompanied by a revision fee only.

FEE SCHEDULE

SYSTEM EVALUATION-$100.00 (PLEASE MARK APPROPRIATE BOXES)
☐ BALANCE W/O PROCESSING ☐BALANCE WITH PROCESSING ☐ASSIST W/O PROCESSING
☐ ASSIST WITH PROCESSING ☐OTHER (DESCRIBE)

COMPONENT EVALUATION-$50.00
☐ DISPENSING NOZZLE ☐FLAME ARRESTOR ☐FIRE CHECK (AUTOMATIC)
☐ IMPACT VALVE ☐PRESSURE/VACUUM VALVE ☐OTHER (DESCRIBE)

CERTIFICATION-$35.00
☐SYSTEM ☐COMPONENT

REVISION
☐SYSTEM ($50.00) ☐COMPONENT ($25.00)

We hereby waive any rights and immunities reserved for confidential information in-so-far as publication by the State Fire Marshal of qualifying test results are concerned.

SIGNATURE (REGISTERED OWNER, RESPONSIBLE COMPANY OFFICER OR AUTHORIZED AGENT)

Date_____

(Rev. 12/86)

APPENDIX D
CALIFORNIA AIR RESOURCES BOARD EXECUTIVE ORDERS

As discussed in Chapter 4, if a system is "certified" by CARB, an Executive Order is written. The Order specifies the conditions which must be met by any system installed under the certification. These specifications may include the plumbing system, an equipment list, the vapor hose configuration, and the maximum allowable pressure drop through the system. This appendix contains a summary of the requirements of Stage II (Phase II) CARB Executive Orders as well as examples of actual Executive Orders. The Sections of this appendix are as follows:

Section D.1	Executive Order Summary from the California Air Resources Board's "Gasoline Facilities Phase I & II" Technical Manual compiled under the Compliance Assistance Program.
Section D.2	List of all CARB Phase II Executive Orders.
Section D.3	Example CARB Executive Orders.

The CARB Technical Manual, "Gasoline Facilities Phase I & II" may be obtained from:

CARB Compliance Assistance Section
1101 R. Street
P.O. Box 2815
Sacramento, CA 95812

APPENDIX D.1

EXECUTIVE ORDER SUMMARY FROM THE CALIFORNIA AIR RESOURCES BOARD'S "GASOLINE FACILITIES PHASE I & II" TECHNICAL MANUAL COMPILED UNDER THE COMPLIANCE ASSISTANCE PROGRAM

603.2 PHASE II VAPOR RECOVERY

Phase I vapor recovery refers to the control of vapor from storage tank fueling operations. In Phase II, three types of vapor recovery systems have been certified by the California Air Resources Board (CARB) for use in the districts: Balance, Vacuum-Assist, and Aspirator-Assist.

603.2.1 Balance System

The balance system is a "no seal, no flow" system that uses a nozzle with a bellows to recover gasoline vapors displaced by incoming gasoline. Gasoline will not flow unless there is a tight seal between the faceplate and the motor vehicle fillpipe. There are many balance systems currently certified by ARB Executive Orders (see Appendix D). All approved balance systems are based on the same principle. Displaced vapors in a the vehicle fuel tank are forced, and to a slight degree pulled, into aboveground or underground storage tanks through vapor return plumbing.

The various approved balance systems do not differ in operating principle, but differ in plumbing configuration, size and equipment. All of the systems have been tested to achieve at least 95% vapor recovery efficiency with all types and models of balance product dispensers, hoses, and nozzles in various approved configurations.

To facilitate the approval and inspection process for balance vapor recovery systems, one Executive Order, G-70-52, has been developed. This order provides tables showing most of the dispenser, hose, and nozzle combinations approved for use with various approved balance systems. Executive Order G-70-52 has been amended and updated many times. The latest version, G-70-52 AK, is included in Appendix D of this manual. In addition, this manual provides Tables 603.2 and 603.3 which show, in simplified form, the various approved nozzles outlined in G-70-52 AK. Because new installations allow only coaxial vapor recovery hoses and nozzles, these tables are separated based on whether the balance system uses dual or coaxial hoses. I t is important to note that these table are simplications of what is contained in the Executive Orders. If more detail is needed, consult the appropriate Executive Order.

Table 603.2
Nozzle Requirements For Dual Hose Balance System*

Nozzles	Latch Device	Spring in Bellows	Inter-Lock	High Pressure Shutoff	Vapor Check Valve
EW A3003	BAR	YES	YES	YES	INTERNAL
EW RA3003	BAR	YES	YES	YES	INTERNAL
EW A4000	RING	NO	YES	YES	REMOTE
EZ 4000**	RING	NO	YES	YES	REMOTE
EZ 3003	BAR	YES	YES	YES	INTERNAL
RPP RA3003	BAR	YES	YES	YES	INTERNAL
OPW 11VSC	RING	YES	YES	YES	INTERNAL
OPW 11VSF	RING	NO	YES	YES	INTERNAL
EZ 11VF**	RING	NO	YES	YES	INTERNAL

* Coaxial hose nozzles may be used with dual hoses if an appropriate coaxial-dual adaptor is used.
** Boot protectors prohibited.

Figure 603.7 Emco Wheaton Dual Balance Nozzle

603.2.1.1 Dual Hose Balance System

The requirements for the dual balance system are as follows:

Nozzles - Emco Wheaton and OPW manufacture nozzles certified by CARB Executive Orders for use with the dual balance system. In addition to Emco wheaton and OPW, E-Z Flo and Rainbow Products manufacture rebuilt nozzles that have been certified by CARB. The requirements for these nozzles are shown in Table 603.6. A dual balance nozzle is shown in figure 603.7.

Flow Limiter- A flow limiter is required on dispensers that allow a maximum flow rate in excess of 10 gpm. A flow limiter may be required on all dispensers at the option of the local air pollution control district.

Swivels - Nozzle end swivels on the dual Balance system must be multi-plane. Dispenser end swivels must be Fire Marshal approved with 90 degree stops. See specific Executive Order exhibit for swivel requirements.

Hoses - The Dual Balance system requires a long length double hose that is overhead retractor mounted. The vapor hose must be a minimum of 5/8 inches inside diameter.

Latching Device and Interlock - The Balance System requires that bellows fit snugly against the motor vehicle fillpipe. A latching device is required to help hold the nozzle spout inside the motor vehicle fillpipe during fueling. An interlock mechanism prevents dispensing and/or shuts off the nozzle unless the bellows is depressed.

Check Valve - A check valve is required to prevent vapor backflow. All dual hose EW 4000 series nozzles must have approved remote vapor check valves.

Vent Pipes - Each underground storage tank must have a vapor vent pipe. Above ground vent pipes for the Balance system can be open to the atmosphere or may have an optional pressure/vacuum valve if allowed for the specific installation.

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Gasoline Facilities Phase I And II | LEGAL REQUIREMENTS

Table 603.3
Nozzle Requirements For
Coaxial Hose Balance System

Nozzles	Latch Device	Spring in Bellows	Inter-lock	High Pressure Shutoff	Vapor Check Valve
EW A3005	BAR	YES	YES	YES	INTERNAL
EW RA3005	BAR	YES	YES	YES	INTERNAL
EZ 3005	BAR	YES	YES	YES	INTERNAL
RPP RA3005	BAR	YES	YES	YES	INTERNAL
EW A4001*	RING	NO	YES	YES	REMOTE
EZ 4001*	RING	NO	YES	YES	REMOTE
EW RA400I*	RING	NO	YES	YES	REMOTE
EW A4005*	RING	NO	YES	YES	INTERNAL
EZ 4005*	RING	NO	YES	YES	INTERNAL
OPW 11VC**	RING	YES	YES	YES	INTERNAL
OPW 11VF	RING	NO	YES	YES	INTERNAL
EZ 11VF*	RING	NO	YES	YES	INTERNAL
OPW 111VF	RING	NO	YES	YES	INTERNAL
Husky V	RING	YES	YES	YES	INTERNAL

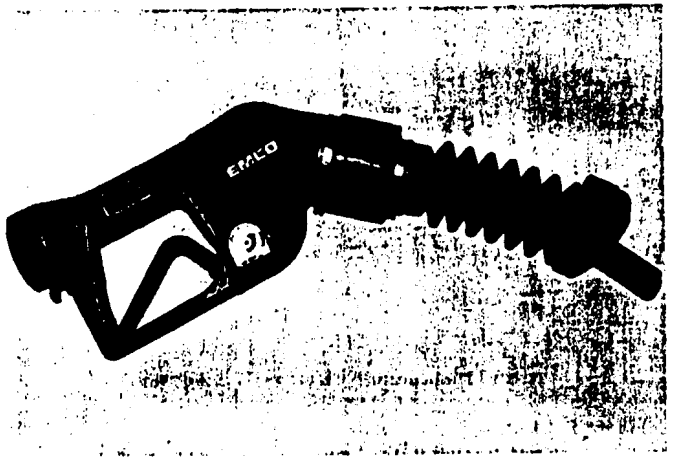

Figure 603.8 Emco Wheaton Coaxial Balance Nozzle

D.1-4

603.2.1.2 Coaxial Hose Balance System

The requirements for the coaxial hose balance system are as follows:

Nozzles - OPW, Emco Wheaton, and Husky manufacture nozzles certified by CARB Executive Orders for use with the coaxial balance system. In addition to the above, EZ Flow and Rainbow Petroleum Products manufacture rebuilt nozzles certified by CARB. The requirements for these nozzles are shown in Table 603.7. A Husky balance nozzle is shown in Figure 603.9; an OPW balance nozzle is shown in Figure 603.10.

Flow Limiter- A flow limiter is required on dispensers that allow a maximum flow rate in excess of 10 gpm. A flow limiter may be required on all dispensers at the option of the local air pollution control district.

Swivels - Nozzle end swivels on the coaxial Balance system must be installed in accordance with the appropriate ARB Executive Order. Dispenser end swivels must also be installed in accordance with the Executive Orders.

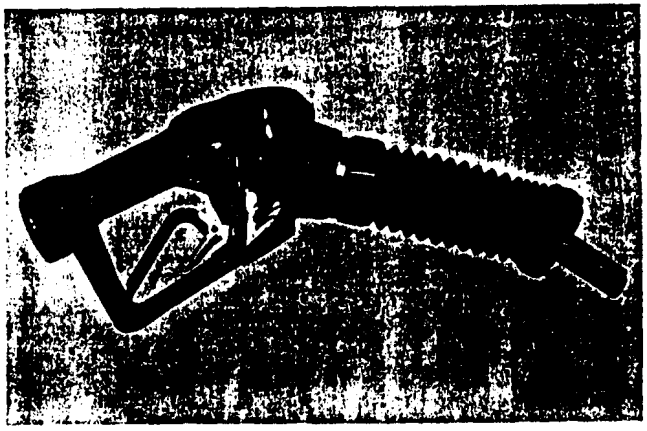

Figure 603.9 Husky Coaxial Balance Nozzle

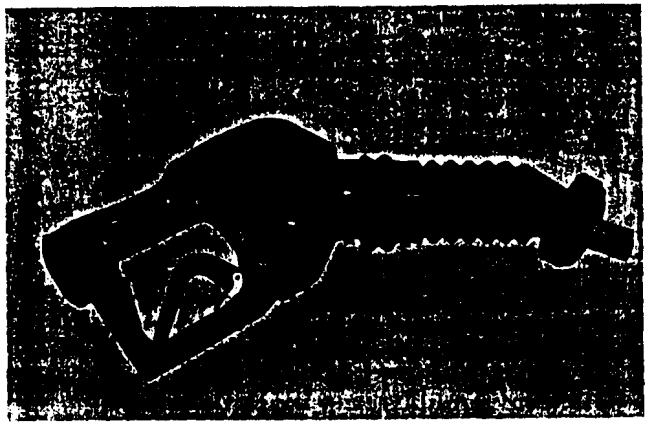

Figure 603.10 OPW Coaxial Balance Nozzle

Hoses - The coaxial Balance system requires a high hang coaxial hose with or without retractor. The hoses must be certified as indicated in the current version of Executive Order G-70-52.

Latching Device Interlock- The Balance System requires that the bellows fits snugly against the motor vehicle fillpipe. A latching device is required to help hold the nozzle spout inside the motor vehicle fillpipe during fueling. An interlock mechanism either prevents dispensing or shuts off the nozzle unless the bellows is depressed.

Check Valve - A check valve is required to prevent vapor backflow.

Vent Pipes - Each underground storage tank may be manifolded to a vapor vent pipe. Above ground, vent pipes for the coaxial hose balance system can be open to the atmosphere.

603.2.2 Vacuum-Assist

The vacuum-assist vapor recovery systems are manufactured by Hasstech and Hirt.

603.2.2.1 Hasstech System

The Hasstech system is a vacuum-assist system that uses a vacuum collecton unit to discharge gasoline vapors to the underground storage tank, and an incinerator to burn excess vapors. A summary of the ARB Executive Order requirements for this system are as follows:

Nozzles - The requirements of the three nozzles currently certified by CARB Executive Orders for the Hasstech system are shown below in Table 603.4. A vacuum-assist nozzle is shown in figure 603.11. No rebuilders are cerified for Hasstech nozzle systems.

Bellows - The Hasstech logo must be Imprinted on the bellows of HP-1, HP2, and HP-11 nozzles.

Spring and Latching Device - Neither an Internal bellows spring nor a latching device is required for the Hasstech system, but either one may be present. If a latch spring is present, it must not extend more than 1/4" past the faceplate.

Table 603.4
Nozzle Requirements For Hasstech
Vacuum-Assist System

Nozzles	Swivel Hose-Disp	Latch Device	Spring in Bellows	Inter-lock	High Pressure Shutoff	Vapor Check Valve
OPW 7VH	None	OPT	NO	NO	YES	NO
OPW HP1	None	OPT	NO	NO	YES	NO
OPW HP11	None	OPT	NO	NO	YES	NO
HUSKY HP2	1*	OPT	NO	NO	YES	NO

* Not requred to be a multi-plane swivel.

Figure 603.11 Hasstech Vacuum-Assist Nozzle

Flow Control Valve - A vapor flow control valve, or "proportioning valve," must be installed inside the dispenser to regulate the amount of hydrocarbon and air vapor mixture collected, and to protect against venting of the underground tank. A vapor screen must also be present, to filter debris.

Hoses - The Hasstech system is certified to have any length hoses. Retractors and swivels are optional. The vapor hose must have a minimum inside diameter of 1/2 inch.

Collection Unit - The collection unit must start up whenever a nozzle at a dispenser is switched on, and should stop when all dispensing nozzles shut off.

Processing Unit - The processing unit must operate properly.

Control Panel - The entire Hasstech system is operated and controlled from a single control panel that receives its power from a separate circuit breaker on the main electrical panel in the station. This panel must operate properly.

Tank Collection Guage - An optional tank correction gauge (or "magnahelic gauge," may be mounted near the vent pipes. This gauge normally indicates from -1 to -5 water column inches (although a reading between 0 and -1 inches of water column may occur during light traffic).

603.2.2.2 Hirt System

The Hirt System is a vacuum-assist system that uses a vapor pump unit or a vacuum turbine unit to draw gasoline vapors to the underground storage tanks, and an incinerator to burn excess vapors. Hirt manufactures a dual and coaxial vacuum-assist system.

Dual

The requirements for the Hirt dual vacuum-assist system are as follows:

Nozzles - The requirements of the six nozzles currently certified by CARB Executive Orders for the Hirt vacuum-assist system are shown below in Table 603.5. A Hirt dual vacuum-assist nozzle is shown in figure 603.12. Rainbow Petroleum Products (RPP) does not make bellows for its rebuilt EW A3006 nozzle.

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Table 603.5
Nozzle requirements for Dual Hirt Vacuum-Assist System

Nozzles	Latch Device	Spring in Bellows	Inter-lock	High Pressure Shutoff	Vapor Check Valve
EW 3003	BAR	YES	YES	YES	INTERNAL
EZ 3003	BAR	YES	YES	YES	INTERNAL
EW RA3003	BAR	YES	YES	YES	INTERNAL
RPP RA3003	BAR	YES	YES	YES	INTERNAL
EW A3006	BAR	YES	YES	YES	REMOTE
EW RA3006	BAR	YES	YES	YES	REMOTE
RPP RA3006	BAR	YES	YES	YES	REMOTE
EZ 3006	BAR	YES	YES	YES	REMOTE
EW A4000	RING	NO	YES	YES	REMOTE
EW A4002	RING	NO	NO	YES	REMOTE
EZ 4002**	RING	NO	NO	YES	REMOTE
OPW 7VE	SPRING	YES	NO	YES	REMOTE
OPW 7VH	SPRING	YES	NO	YES	REMOTE
OPW 11VSC*	RING	YES	YES	YES	INTERNAL
OPW 11VSF	RING	NO	YES	YES	INTERNAL
EZ 11VF**	RING	NO	YES	YES	INTERNAL
EZE 8	SPRING	YES	YES	YES	REMOTE

*OPW 11VE nozzle body may use EZFlo ESBL & ESBU bellows & spout.
** Boot protector prohibited.

Ball Check Valve - A ball check valve must be installed in all Hirt Systems between the vapor port of the nozzle and the vapor recovery hose. The check valve is designed to open the vapor path when a nozzle is tipped for use. (Optional: A solenoid valve may be installed to replace ball check valve, Hirt Certification G-70-33-AA.

Hoses - The Hirt dual vacuum-assist system requires a long length double hose that is overhead retractor mounted. The vapor hose must have a minimum inside diameter of 5/8 inches.

Swivels - Nozzle end swivels on the Hirt system must be multi-plane. Dispenser end swivels must be Fire Marshal approved.

Vacuum Gauge - Hirt systems installed after August 13, 1980, are required to have a vacuum gauge installed inside the dispenser that is farthest away from the processing unit. The gauge range is from -1.0 inches to +1.0 inches of water column. If the sytem is operating properly, it should indicate approximately -.5 inches of water column.

Processing Unit - The processing unit must operate properly.

Control Panel - The control panel must operate properly.

Air Compressor - The air compressor must operate properly.

Vent Pipes - Each underground storage tank may be manifolded to a vapor vent pipe. Above gound, vent pipes for the Hirt system must be manifolded together to a single riser with a pressure/vacuum relief valve.

Pressure/Vacuum Relief Valve - The valve must operate properly, and be certified for the Hirt system.

Coaxial

The requirements for the Hirt coaxial vacuum-assist system are as follows:

Nozzles - The requirements of the five nozzles currently certified by CARB Executive Orders for the Hirt coaxial vacuum-assist system are shown below in Table 603.6. A Hirt coaxial nozzle is shown in figure 603.13. Rainbow

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Table 603.6
Nozzle Requirements For Coaxial HirtVacuum-Assist System

Nozzles	Latch Device	Spring in Bellows	Inter-lock	High Pressure Shutoff	Vapor Check Valve
EW A3005	BAR	YES	YES	YES	INTERNAL
EW RA3005	BAR	YES	YES	YES	INTERNAL
EW A3007	BAR	YES	YES	YES	REMOTE
EW RA3007	BAR	YES	YES	YES	REMOTE
EZ 3007	BAR	YES	YES	YES	REMOTE
EW A4001**	RING	NO	YES	YES	REMOTE
EZ 4001**	RING	NO	YES	YES	REMOTE
EW A4003**	RING	NO	NO	YES	REMOTE
EZ 4003**	RING	NO	NO	YES	REMOTE
RPP RA3007	BAR	YES	NO	YES	REMOTE
OPW 11VE*	RING	YES	YES	YES	INTERNAL
OPW 11VF	RING	NO	YES	YES	INTERNAL
EZ 11VF**	RING	NO	YES	YES	INTERNAL
OPW 11VC	RING	YES	YES	YES	INTERNAL
OPW 111V	RING	YES	YES	YES	INTERNAL
HUSKY V	RING	YES	YES	YES	INTERNAL
EW A4005	RING	NO	YES	YES	INTERNAL
EZ 4005	RING	NO	YES	YES	INTERNAL

* OPW 11VE nozzle body may use EZFlo ESBL & ESBU bellows & spouts.
** Boot protectors prohibited.

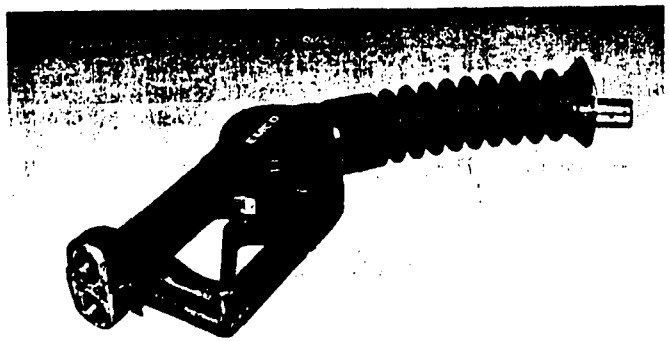

Figure 603.12 Hirt Dual Vacuum-Assist Nozzle.

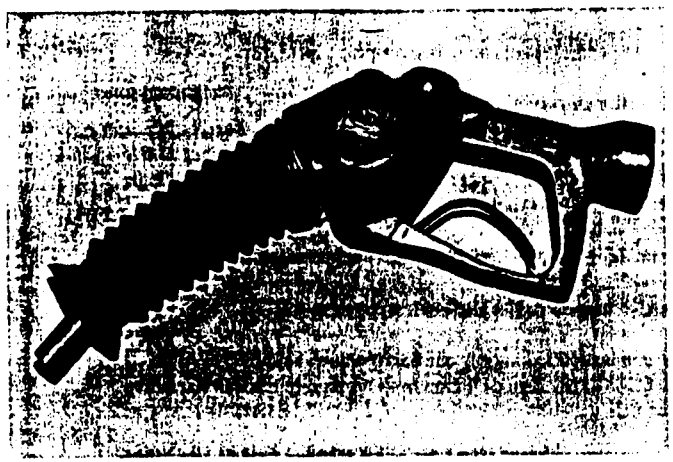

Figure 603.13 Hirt Coaxial Vacuum-Assist Nozzle

Petroleum Products (RPP) does not make bellows for its rebuilt EW A3006 nozzle.

Vapor Check Valve - A vapor check valve must be installed in all Hirt Systems. The vapor check valve is designed to open the vapor path when a nozzle is used.

Hoses - The Hirt coaxial vacuum-assist system requires a high hang coaxial hose. The hoses must be certified as indicated in the current version of Executive Order G-70-52.

Swivels - Nozzle end swivels on the Hirt system must be installed in accordance with the appropriate ARB Executive Order. Dispenser end swivels must be Fire Marshal approved.

Vacuum Gauge - Hirt systems installed after August 13, 1980, are required to have a vacuum gauge installed inside the dispenser that is farthest away from the processing unit. The gauge range is from -1.0 inches to +1.0 inches of water column. If the sytem is operating properly, it should indicate approximately -.5 inches of water column.

Processing Unit - The processing unit must operate properly.

Control Panel - The control panel must operate properly.

Air Compressor - The air compressor must operate properly.

Vent Pipes - Each underground storage tank must have a vapor vent pipe. Above ground, vent pipes for the Hirt system must be manifolded together to a single riser with a pressure/vacuum relief valve.

Pressure/Vacuum Relief Valve - The valve must operate properly and not leak.

603.2.2A Amoco Vacuum Assist (Bellowless) System

The Amoco system is certified in only one configuration as shown in ARB Executive Order G-70-118. Any deviation from the requirements in Executive Order is not certified.

The requirements for the Amoco vacuum system are as follows:

Table 603.7
Nozzle Requirements for Amoco
Vacuum Assist (Bellowless) System

Nozzles	Latch Device	Spring in Bellows	Inter-lock	High Pressure Shutoff	Vapor Check Valve
OPW 11-VJ-51	SPRING	NO BELLOWS	NO	NO	INTERNAL
OPW 11-VJ-61	SPRING	NO BELLOWS	NO	NO	INTERNAL

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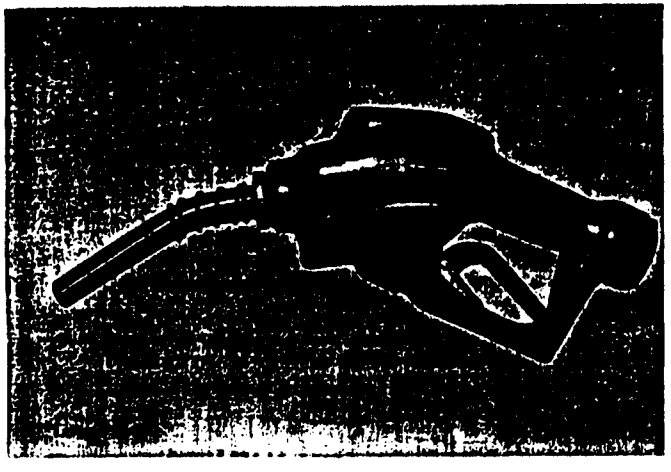

Figure 603.14 Amoco Vacuum Assist
(Bellowless Nozzle)

Nozzle-OPW 11-V J-51

See Table 603.7 for nozzle requirements and Figure 603.14 for a picture of the nozzle.

Vapor Pump-Blackmer Model VR-34.

Coaxial Hoses- Dayco Petroflex Model 7574 with liquid pick-up.
Goodyear Maxxim with Gilbarco liquid removal system.

Dispenser- Dresser Wayne Model 390-IL installed as shown in ARB Executive Order G-70-52-AI, Exhibit 10.

Pressure Vacuum Vent- OPW 523 (2") or
OPW 523-S (2") set at 8 oz. pressure, 1/2 oz. vacuum.

603.2.3 Aspirator-Assist System

Aspirator-Assist systems use an aspirator to discharge gasoline vapors to the underground storage tanks. Aspirator-Assist systems are manufactured by Healy and Red Jacket.

603.2.3.1 Healy System

The Healy System is an aspirator-assist system that uses an aspirator jet pump to discharge gasoline vapors to the underground stroage tanks. The requirements for the Healy system are as follows:

Nozzles - The requirements for the one nozzle currently certified by CARB Executive Orders for the Healy system is shown below in Table 603.8. A Healy aspirator-assist nozzle is shown in figure 603.15. No rebuilders are certified for the Healy nozzle system.

Facecone - The facecone used with the Healy system should make contact with the motor vehicle fill pipe, but does not require a perfect seal, since it is vacuum assisted. Gasoline vapors are collected from the gap betwen the nozzle and the fuel tank.

Latching Device - Only a latch spring to help hold the nozzle spout inside the motor vehicle fillpipe during fueling is required for the Healy system.

Table 603.8
Nozzle Requirements For Healy
Aspirator-Assist System

Nozzles	Latch Device	Spring in Bellows	Inter-lock	High Pressure Shutoff	Vapor Check Valve
HEALY 200	SPRING	NO	NO	YES	INTERNAL

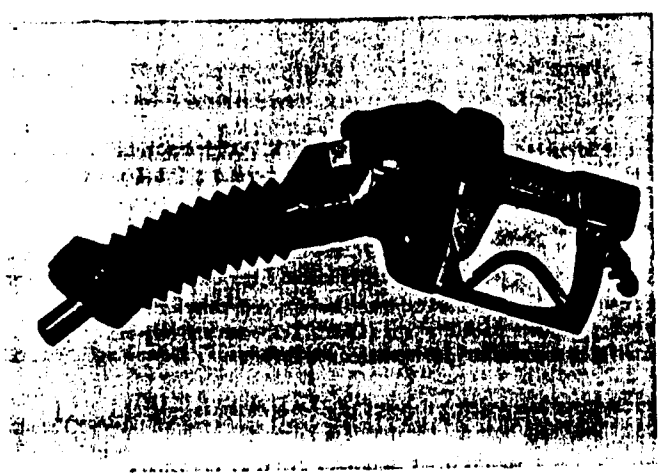

Figure 603.15 Healy Aspirator-Assist Nozzle

G-70-70 for specific configurations.

Hoses - Two hose configurations are certified by CARB Executive Orders for the Healy system, depending on the type of dispenser. See Executive Order

Vent Pipes - Each underground storage tank must be vented (Fire Marshal requirements). Above ground, vent pipes for the Healy system may be open to the atmosphere or manifolded together. And depending on whether the individual of central jet pumps are used, the system may or may not be required to have a pressure/vacuum valve; see Executive Order G-70-70 for specific requirements.

Jet Pump - For the Healy system to operate properly, an aspirater (jet pump) must be present and correctly installed inside each dispenser, or a centrally mounted multijet unit must be present..

603.2.3.2 Red Jacket System

Red Jacket manufactured, until 1982, a dual and coaxial aspirator-assist system.

Dual

The requirements for the Red Jacket aspirator-assist system are as follows:

Nozzles - The requirements for the eight nozzles certified by CARB Executive Orders for use with the Red Jacket aspirator-assist system are shown below in Table 603.9. A Red Jacket dual aspirator-assist nozzle is shown in figure 603.16. Rainbow Petroleum Products (RPP) does not make bellows for its rebuilt EW A3006 nozzle.

Swivels - nozzle end swivels on the dual aspirator-assist system must installed according with the appropriate ARB Executive Order. Dispenser end swivels must also be installed in accordance with the Executive Orders.

Hoses - The dual aspirator-assist system requires a double hose that is overhead retractor mounted. The vapor hose must be 5/8" inside diameter.

Vent Pipes - Each underground storage tank must have a vapor vent pipe. Above ground, vent pipes for the dual aspirator-assist system can be individual or manifolded together, see Executive Order G-70-70 for specific requirements.

Table 603.9
Nozzle Requirements For Red Jacket Dual Aspirator-Assist System

Nozzles	Latch Device	Spring in Bellows	Inter-lock	High Pressure Shutoff	Vapor Check Valve
EW A3006	BAR	YES	NO	YES	REMOTE
EW RA3006	BAR	YES	NO	YES	REMOTE
EZ 3006	BAR	YES	NO	YES	REMOTE
RPP RA3006	BAR	YES	NO	YES	REMOTE
OPW 7VE	SPRING	YES	NO	YES	REMOTE
EZ E-8	SPRING	YES	NO	YES	REMOTE
OPW 11VSE	RING	NO	NO	YES	REMOTE
EW A4002	RING	NO	NO	YES	REMOTE
EZ A4002*	RING	NO	NO	YES	REMOTE
EZ 11VE	RING	YES	NO	YES	REMOTE

* Boot protector prohibited.

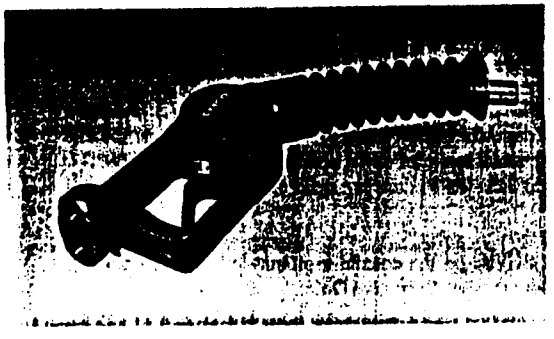

Figure 603.16 Red Jacket Dual Aspirator-Assist Nozzle

Aspirator - Must be present, correctly installed inside the dispenser, and operating properly.

Modulating Valve - Must be present, correctly installed inside the dispenser, and operating properly.

Vapor Check Valve - Must be present, correctly installed inside the dispenser, and operating properly.

Facecone - The facecone used with the Red Jacket system should make contact with the motor vehicle fill pipe, but does not require a perfect seal, since it is vacuum assisted.

Flow Limiter - A flow limiter may be required on Emco Wheaton installations.

Calibration - The dual aspirator-assist system must be calibrated annually if required. The owner/operator should have either a sticker (inside the dispenser) or a calibration sheet as proof of calibration.

Latching Device - A latch bar or latch spring to help hold the nozzle spout inside the motor vehicle fillpipe during fueling is required for the Red Jacket System.

Coaxial

The requirements for the Red Jacket coaxial system are as follows:

Nozzles - The requirements for the six nozzles certified by CARB Executive Orders for use with the coaxial aspirator-assist system are shown below in Table 603.10. A Red Jacket coaxial aspirator-assist nozzle is shown in figure 603.17. Rainbow Petroleum Products (RPP) does not make bellows for its rebuilt EW A3007 nozzle.

Swivels - nozzle end swivels on the coaxial aspirator-assist system must be installed according with the ARB Executive Order.

Hoses - The coaxial aspirator-assist system requires a high hang coaxial hose with or without a retractor.

Table 603.10
Nozzle Requirements For Red Jacket Coaxial Aspirator-Assist System

Nozzles	Latch Device	Spring in Bellows	Inter-lock	High Pressure Shutoff	Vapor Check Valve
EW A3007	BAR	YES	NO	YES	REMOTE
EW RA3007	BAR	YES	NO	YES	REMOTE
EZ 3007	BAR	YES	NO	YES	REMOTE
RPP RA3007	BAR	YES	NO	YES	REMOTE
OPW 11VF	RING	YES	NO	YES	REMOTE
OPW 7VE	RING	YES	NO	YES	REMOTE
EZ 11VF	RING	NO	NO	YES	REMOTE
EW A4003	RING	NO	NO	YES	REMOTE
EZ 4003*	RING	NO	NO	YES	REMOTE

* Boot protector prohibited.

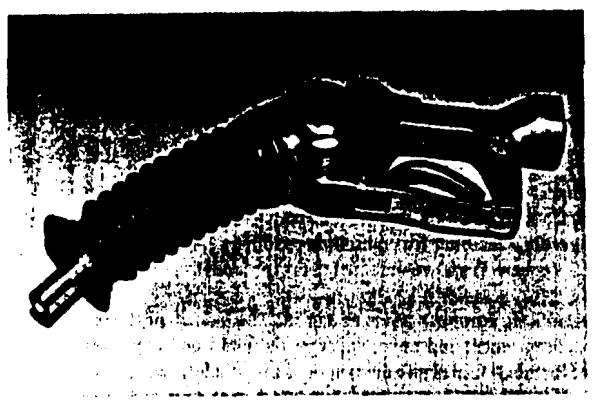

Figure 603.17 Red Jacket Coaxial Aspirator-Assist Nozzle

D.1-12

Vent Pipes - Each underground storage tank must be vented (Fire Marshal requirement). Above ground, vent pipes for the coaxial aspirator-assist system can be individual or manifolded together.

Aspirator - Must be present, correctly installed inside the dispenser, and operating properly.

Modulating Valve - Must be present, correctly installed inside the dispenser, and operating properly.

Vapor Check Valve - Must be present, correctly installed inside the dispenser, and operating properly.

Facecone - The facecone used with the Red Jacket system should make contact with the motor vehicle fill pipe, but does not require a perfect seal, since it is vacuum assisted.

Flow Limiter - A flow limiter may be required on Emco Wheaton installations only.

Calibration - The dual aspirator-assist system must be calibrated annually by a CARB-approved contractor to remain certified. The owner/operator should have either a sticker (inside the dispenser) or a calibration sheet as proof of calibration.

Latching Device - A latch bar to help hold the nozzle spout inside the motor vehicle fillpipe during fueling is required for the Red Jacket System.

604 EQUIPMENT CERTIFICATION

The following certification procedures are adopted pursuant to Section 41954 of the Health and Safety Code. These requirements are applicable to vapor recovery systems installed at gasoline facilities for controlling gasoline vapors during the *filling of storage tanks (phase I) and vehicle fuel tanks (phase II).*

Vapor recovery systems are complete systems and shall include all necessary piping, nozzles, couplers, processing units, underground tanks and any other equipment necessary for the control of gasoline vapors during fueling operations.

605 LOCAL REQUIREMENTS

This place has been provided for you to place any additional requirements or policies your district may have concerning vapor recovery regulations. The ARB will not provide any amendments to this section for obvious reasons, so it is up to you to keep current.

APPENDIX D.2

LIST OF ALL CARB PHASE II EXECUTIVE ORDERS

Phase II

Certification of the Hasstech Model VCP-2 and VCP-2A Phase II Vapor Recovery Systems.	**G-70-7-AB**
Recertification of the Red Jacket Aspirator Assist Phase II Vapor Recovery System.	**G-70-14-AA**
Relating to Modification of Certification of the Emco Wheaton Balance Phase II Vapor Recovery System.	**G-70-17-AB**
Relating to the Modification of the Certification of the Shell Model 75B1 and 75B1-R3 Service Station Phase II Vapor Recovery Systems.	**G-70-18-C**
Recertification of the Exxon Balance Phase II Vapor Recovery System.	**G-70-23-AB**
Recertification of the Atlantic Richfield Balance Phase II Vapor Recovery System.	**G-70-25-AA**
Certification of the Modified Hirt VCS-200 Vacuum Assist Phase II Vapor Recovery System.	**G-70-33-AB**
Relating to Modification of Certification of the OPW Balance Phase II Vapor Recovery.	**G-70-36-AC**

Relating to the Modification of the Certification of the Chevron Balance Phase II Vapor Recovery System with OPW Nozzles for Service.	**G-70-37-B**
Recertification of the Texaco Balance Phase II Vapor Recovery System.	**G-70-38-AB**
Recertification of the Mobil Oil Balance Phase I Vapor Recovery System.	**G-70-48-AA**
Recertification of the Union Balance Phase II Vapor Recovery System.	**G-70-49-AA**
Certification of components for Red Jacket, Hirt, and Balance Phase II Vapor Recovery	**G-70-52-AL**
Recertification of the Chevron Balance Phase II Vapor Recovery System.	**G-70-53-AA**
Order Suspending Certification of OPW Balance Phase II Vapor Recovery System.	**G-70-67**
Relating to the Certification of the Healy Phase II vapor Recovery System for Service Stations.	**G-70-70-AB**
Relating to the Certification of the OPW Repair/Replacement Parts and Modification of the Certification of the OPW Balance Phase II Vapor Recovery System.	**G-70-77**
Certification of E-Z Flo Nozzle Company Rebuilt Vapor Recovery Nozzles and Vapor Recovery Nozzle Components.	**G-70-78**
Certification of E-Z Flo Nozzle Model 3006 and Model 3007 Vapor Recovery Nozzles and Use of E-Z Flo Components with OPW Models 11VC and 11VE Vapor Recovery Nozzles.	**G-70-101-B**
Certification of Rainbow Petroleum Products Model RA3003, RA3005, RA3006 and RA3007 Vapor Recovery Nozzles and Vapor Recovery Components.	**G-70-107**
Certification of Stage I and II Vapor Recovery Systems for Methanol Fueling Facilities.	**G-70-110**
Certification of ConVault Incorporated Aboveground Tank Filling/Dispensing Vapor Recovery System	**G-70-116-A**

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Certification of the Amoco V-1 Vapor Recovery System	**G-70-118**
Certification of the Husky Model V Phase II Balance Vapor Recovery Nozzle	**G-70-125**
Certification of the OPW Model 111-V Phase II Balance Vapor Recovery Nozzle	**G-7-127**
Certification of the Bryant Fuel Systems Aboveground Tank Filling/Dispensing Vapor Recovery System	**G-70-128**
Certification of the BRE Products, Inc. Enviro-Vault Aboveground Tank Filling/Dispensing Vapor Recovery System	**G-70-129**
Certification of Sannipoli Corporation Petro Vault Aboveground Tank Filling/Dispensing Vapor Recovery System	**G-70-130**
Certification fo Hallmark Industries Tank Vault Aboveground Tank Filling/ Dispensing Vapor Recovery System	**G-70-131**
Certification of Trusco Tank, Inc. Supervault Aboveground Storage Tank Filling/Dispensing Vapor Recovery System	**G-70-132**
Certification of LRS., Inc. Fuelmaster Aboveground Storage Tank Filling/ Dispensing Vapor Recovery System	**G-70-133**
Certification of the EZ-Flo Rebuilt A4000-Series and 11V-Series Vapor Recovery Nozzles	**G-70-134**

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APPENDIX D.3

EXAMPLE CARB EXECUTIVE ORDERS

This section contains the following Executive Orders

State of California
AIR RESOURCES BOARD

Executive Order G-70-52-AM
Certification of Components for Red Jacket, Hirt, and Balance
Phase II Vapor Recovery Systems

WHEREAS, the Air Resources Board (the "Board") has established, pursuant to Sections 39600, 39601, and 41954 of the Health and Safety Code, certification procedures for systems designed for the control of gasoline vapor emissions during motor vehicle fueling operations ("Phase II vapor recovery systems") in its "Certification Procedures for Gasoline Vapor Recovery Systems at Service Stations" as last amended December 4, 1981 (the "Certification Procedures"), incorporated by reference in Section 94001 of Title 17, California Code of Regulations;

WHEREAS, the Board has established, pursuant to Sections 39600, 39601, and 41954 of the Health and Safety Code, test procedures for determining compliance of Phase II vapor recovery systems with emission standards in its "Test Procedures for Determining the Efficiency of Gasoline Vapor Recovery Systems at Service Stations" as last amended September 1, 1982 (the "Test Procedures"), incorporated by reference in Section 94000 of Title 17, California Code of Regulations;

WHEREAS, the certification for use with Phase II vapor recovery systems has been applied for as specified in Attachment A of this Executive Order;

WHEREAS, Section VIII-A of the Certification Procedures provides that the Executive Officer shall issue an order of certification if he or she determines that a vapor recovery system conforms to all of the requirements set forth in Sections I through VII;

WHEREAS, I find that the equipment specified in Attachment A of this Executive Order, when used on Phase II balance and assist vapor recovery systems, conforms with all the requirements set forth in Sections I through VII of the Certification Procedures and will not compromise the efficiency of the Phase II vapor recovery systems on which they will be installed;

NOW THEREFORE, IT IS HEREBY ORDERED that the certification, Executive Order G-70-52-AL, is hereby modified to add vapor recovery equipment listed in Attachment A and to incorporate the requirements and conditions specified in the Exhibits of this Order for use on Phase II vapor recovery systems;

IT IS FURTHER ORDERED that the equipment listed in Attachment A of this Executive Order is certified as shown in Exhibits 4 through 11. A reference identifying the vapor recovery systems for which the hose configurations are approved is contained in Exhibit 1. Certified components for the systems are listed in Exhibit 2. A cross reference identifying which vapor recovery nozzle is approved for each vapor recovery system is shown in Exhibit 3. The systems shall otherwise comply with all the certification requirements in the latest applicable Phase II vapor recovery system certification.

IT IS FURTHER ORDERED that where a balance type vapor recovery system is to be installed at a new installation only the balance type coaxial vapor recovery nozzles and coaxial hose configurations may be used.

IT IS FURTHER ORDERED that nozzle bellows covers, hereinafter refered to as "boot protectors" may not be used on any nozzles after July 26, 1992, and that they are prohibited prior to that date on certain nozzles as specified in Exhibits 2 and 3 of this Order.

IT IS FURTHER ORDERED that the compliance with the applicable certification requirements and rules and regulations of the Division of Measurement Standards, the Office of the State Fire Marshal, and the Division of Occupational Safety and Health of the Department of Industrial Relations are made a condition of this certification.

IT IS FURTHER ORDERED that the components and alternative hose configurations certified hereby shall perform in actual use with the same effectiveness as the certification test system.

IT IS FURTHER ORDERED that any alteration of the equipment, parts, design, or operation of the configurations certified hereby, is prohibited, and deemed inconsistent with this certification, unless such alteration has been approved by the undersigned or the Executive Officer's designee.

IT IS FURTHER ORDERED that all nozzles approved for use with the Phase II vapor recovery systems specified in this Executive Order shall be 100 percent performance checked at the factory including checks of proper functioning of all automatic shutoff mechanisms.

Executed at Sacramento, California this 4 day of October, 1991.

James D. Boyd
Executive Officer

Executive Order G-70-52-AM
Attachment A

Gasoline Vapor Recovery Equipment Added to Exhibit 2

Dresser Division/Wayne Industries
- 590 Blending Dispenser
- 390Dx-GQU Dispenser

Emco Wheaton A4019 coaxial hose breakaway coupling

Gates Kleanaire coaxial hose

Gilbarco Advantage motor fuel dispenser

Goodyear Maxxim coaxial hose with green outer hose

High retractor dispenser - coaxial hose configuration with liquid removal system (Exhibit 8c)

OPW Division/Dover Corporation
- 66-CL coaxial hose breakaway coupling
- 43-CRT elbow swivel

Exhibit 1

Executive Order G-70-52-AM

Phase II Vapor Recovery Systems

Certified for Hose Configurations Shown in Exhibits 4-11

Executive Order G-70-	Vapor Recovery System Name
14	Red Jacket
17	Emco Wheaton Balance
23	Exxon Balance
25	Atlantic Richfield Balance
33	Hirt
36	OPW Balance
38	Texaco Balance
48	Mobil Balance
49	Union Balance
53	Chevron Balance

Additional Executive Orders Pertaining to

Vapor Recovery Nozzles Not Listed in the Above Orders

Executive Order G-70-	Vapor Recovery System Name
78	EZ-flo rebuilts
102	EZ-flo rebuilts
107	Rainbow rebuilts
125	Husky Model V
127	OPW 111V
134	EZ-flo rebuilts

Exhibit 2

Executive Order G-70-52-AM
Component[1] List for Red Jacket, Hirt, or Balance
Phase II Vapor Recovery Systems

Manufacturer/Item and Model Number	SFM ID Number	Exhibits 4	5	6	7	8a,b,c	9a,b,c	10	11	11a	Exhibit 3 X-Reference
Nozzles (new or rebuilt by original manufacturer)[2]											
Emco Wheaton A3003, RA3003[7]	001:007:005	X		X	X						1
Emco Wheaton A3005, RA3005	005:007:006	X	X	X	X	X	X	X	X	X	2
Emco Wheaton A3006, RA3006	005:007:020	X		X	X						3
Emco Wheaton A3007, RA3007	005:007:025	X	X	X	X	X	X	X	X	X	4
Emco Wheaton A4000, RA4000[7/8]	005:007:022	X		X	X						5
Emco Wheaton A4001, RA4001[8]	005:007:023	X	X	X	X	X	X	X	X	X	6
Emco Wheaton A4002[8]	005:007:022	X		X	X						7
Emco Wheaton A4003[8]	005:007:023	X	X	X	X	X	X	X	X	X	8
Emco Wheaton A4005, RA4005[8]	005:007:025	X	X	X	X	X	X	X	X	X	9
OPW 7V-E (34,36,47,49)	002:008:014-17	X		X	X						10
OPW 11V-C (22,24,47,49)	005:008:030	X	X	X	X	X	X	X	X	X	11
OPW 11VS-C (22,24,47,49)[7]	005:008:039	X		X	X						12
OPW 11V-E (34,36,47,49)	005:008:033	X	X	X	X	X	X	X	X	X	13
OPW 11VS-E (34-36,47,49)	005:008:035	X		X	X						14
OPW 11V-F (22,24,47,49)	005:008:037	X	X	X	X	X	X	X	X	X	15
OPW 11VS-F (22,24,47,49)[7]	005:008:038	X		X	X						16
OPW 111-V (22,24,47,49)[8]	005:008:045	X	X	X	X	X	X	X	X	X	17
Husky Model V[8]	005:021:005	X	X	X	X	X	X	X	X	X	18

Executive Order G-70-52-AM
Component[1] List for Red Jacket, Hirt, or Balance Phase II Vapor Recovery Systems

Manufacturer/Item and Model Number	SFM ID Number	Exhibits 4	5	6	7	8a,b,c	9a,b,c	10	11	11a	Exhibit 3 X-Reference
Rebuilt Nozzles (rebuilt by other than original manufacturer)[2]											
EZ-flo 3003[7][9]	005:029:003	X		X	X						1
EZ-flo 3005[9]	005:029:004	X	X	X	X	X	X	X	X	X	2
EZ-flo 3006[9]	005:029:004	X		X	X						3
EZ-flo 3007[9]	005:029:005	X	X	X	X	X	X	X	X	X	4
EZ-flo A4000[7][8]	005:029:006	X		X	X						5
EZ-flo A4001[8]	005:029:006	X	X	X	X	X	X	X	X	X	6
EZ-flo A4002[8][9]	005:029:006	X		X	X						7
EZ-flo A4003[8][9]	005:029:006	X	X	X	X	X	X	X	X	X	8
EZ-flo A4005[8][9]	005:029:006	X	X	X	X	X	X	X	X	X	9
EZ-flo EZE 8 (22,24,47,49)[10]	005:029:002	X		X	X						10a
EZ-flo 11VS (coaxial)[8]	005:029:007	X	X	X	X	X	X	X	X	X	15
EZ-flo 11VS (dual)[7][8]	005:029:007	X		X	X						16
EZ-flo 11VE (coaxial)[8]	005:029:007	X	X	X	X	X	X	X	X	X	13
EZ-flo 11VE (dual)[8]	005:029:007	X		X	X						14
Rainbow RA3003[7][11][16]	005:035:002	X		X	X						1
Rainbow RA3005[11][16]	005:035:003	X	X	X	X	X	X	X	X	X	2
Rainbow RA3006[11]	005:035:004	X		X	X						3
Rainbow RA3007[11]	005:035:005	X	X	X	X	X	X	X	X	X	4
Rainbow RPP (34,36,47,49)	005:035:006	X		X	X						10b
Nozzle Bellows											
Daystar[13]		X	X	X		X	X	X	X		

Executive Order G-70-52-AM
Component[1] List for Red Jacket, Hirt, or Balance
Phase II Vapor Recovery Systems

Manufacturer/Item and Model Number	SFM ID Number	Exhibits 4	5	6	7	8a	8b	8c	9a	9b	9c	10	11	11a
High-Retractor Hose Configurations[3]														
Overhead Hose Retractors														
CNI Series 9900, 9910 and 9930		X	X						X	X	X			X
Dresser Wayne 360-series		X	X											
Gasboy Model 90-750-2		X	X											
Gilbarco									X	X	X			
OPW 55 (coax)			X											
OPW 56 (dual)		X												
Petro-Vend PV-8		X	X											
Pomeco 100A, B, C and 102		X	X								X			X
Radikae		X	X								X			X
Red Jacket		X	X								X			X
Ruskon		X	X								X			X
Topmaster		X	X								X			X
Universal Valve #880		X	X								X			X
High Retractor Dispensers[4]														
Bennett Pump 6012, 6013, 6022, 6024, 6025, 6027			X											
Dresser Wayne Series 370/380				X										
Dresser Wayne DecadeMarketer Series 310/320					X									
Gasboy Series 50		X	X											
Tokheim Series 162		X	X											
Tokheim 262 [19]		X	X											
Tokheim 242 and 244			X											
Tokheim 330A and 333A MMD					X									
Tokheim retrofit 222 and 333												X		
Low Retractor Dispensers[4]														
Tokheim TCS 311, 312, 322, 324, 413, 426, 614, 628													A	A

Executive Order G-70-52-AM
Component[1/] List for Red Jacket, Hirt, or Balance
Phase II Vapor Recovery Systems

Manufacturer/Item and Model Number	SFM ID Number	Exhibits												
		4	5	6	7	8a	8b	8c	9a	9b	9c	10	11	11a
High-Hang Hose Dispensers[3/]														
Bennett Pump 7012, 7024, 8022, 8024, 8033											X	X		
Bennett Pump 8036, 9036, 9048											X	X		
Dresser Wayne 390					X	X	X	X	X	X	X	X		
Dresser Wayne 490						X	X	X				X		
Dresser Wayne 390Dx-GQU									X	X	X	X		
Gilbarco MPD									X	X	X	X		
Gilbarco Advantage									X	X	X	X		
Koppens Calcutrim											X	X		
Southwest 2300 and 2400 MPD											X	X		
Tokheim High-discharge TCS H311, H312, H322, H324, H413, H426, H614, H628											X	X		
Product Blending Dispensers[18/]														
Dresser Wayne 395-1L Blender												X		
Dresser Wayne 375 Blender												X		
Dresser Wayne 585 Blender												X		
Dresser Wayne 590 Blender												X		
Gilbarco SalesMaker (SMK) Blender												X		
Gilbarco Multi-Product (MPD) Blender												X		
Tokheim 262 with blend valves[19/]			X											
Tokheim 426 TCS with blend valves												X	X	X
Coaxial Hose Assembly[16/]														
B.F. Goodrich Coax	005:014:001		X	X		X			X			X		
B.F. Goodrich Super II Coax	005:014:001		X	X		X			X			X		
Dayco Petroflex 2000 Mdl 7574	005:033:001		X	X		X	X	X	X	X	X	X	X	X
Dayco Petroflex 2000 Mdl 7573	005:033:002		X	X		X	X	X	X	X	X	X	X	X
Dayco Petroflex 3000 Model 7575 Blending Hose	005:033:006											X		
Gates Kleanaire	005:045:001		X	X		X	X	X	X	X	X	X	X	X

(continued next page)

Executive Order G-70-52-AM
Component[1/] List for Red Jacket, Hirt, or Balance
Phase II Vapor Recovery Systems

Manufacturer/Item and Model Number	SFM ID Number	Exhibits												
		4	5	6	7	8a	8b	8c	9a	9b	9c	10	11	11a
Coaxial Hose Assembly [16/] (continued from previous page)														
Goodyear Maxxim (black or green) (1/2" or 5/8" inner hose)	005:036:001		X	X		X	X	X	X	X	X	X	X	X
Thermoid Superlite (HPD Industries) (1/2" or 5/8" inner hose)	005:037:001		X	X		X	X	X	X	X	X	X	X	X
Vapor Systems Technologies	005:044:001		X	X		X	X	X	X	X	X	X	X	X
Liquid Removal Systems														
Gilbarco Venturi CoVent (1/2")	005:026:011							X			X	X		
Gilbarco CoVent-2 (5/8")	005:026:012							X			X	X		
Wayne Purge System												X		
Coaxial Hose Assemblies with Liquid Removal Systems [22/]														
Dayco Petroflex 7573 (1/2")	005:033:003							X			X	X	X	
Dayco Petroflex 7574 (5/8")	005:033:004							X			X	X	X	
Goodyear Maxxim Plus (5/8")	005:036:001							X			X	X	X	
Thermoid Superlite "V"	005:037:002							X			X	X	X	
Coaxial Hose Fittings														
OPW 38-C [14/]	005:008:041		X	X										
OPW 38-CS [14/]	005:008:041		X	X										
OPW 38-CX [14/]	005:008:041		X	X										
Emco Wheaton 4041 [14/]	005:007:029		X	X										
Emco Wheaton 4042 [21/]	005:007:030		X	X					X	X	X	X		
Hose Breakaway Fittings - Dual Hose Systems Only														
Enterprise Brass Works 697-V	005:034:001	X		X	X									
Husky Safe-T-Break	005:021:003	X		X	X									
Richards R85 Safe-T-Gard	005:031:003	X		X	X									

Executive Order G-70-52-AM
Component[1/] List for Red Jacket, Hirt, or Balance
Phase II Vapor Recovery Systems

Manufacturer/Item and Model Number	SFM ID Number	Exhibits												
		4	5	6	7	8a	8b	8c	9a	9b	9c	10	11	11a
Coaxial Hose Breakaway Fittings - Factory or Kit Repairable Only														
Catlow C-200	005:030:003		X	X		X	X	X	X	X	X	X	X	X
Dayco C-200	005:033:005		X	X		X	X	X	X	X	X	X	X	X
Enterprise Brass Works 897	005:034:002		X	X		X	X	X	X	X	X	X	X	X
Husky 2730 Safe-T-Break	005:021:004		X	X		X	X	X	X	X	X	X	X	X
Richards Industries CXE-39	005:031:005		X	X		X	X	X	X	X	X	X	X	X
Coaxial Hose Breakaway Fittings - Designed to be Recoupled Without Repair Kit														
Catlow 2.N.1 (Nozzle end[20/] installation prohibited)	005:030:004											X		
Emco Wheaton A4019	005:007:031		X	X		X	X	X	X	X	X	X	X	X
Husky 3030 Safe-T-Break	005:021:004		X	X		X	X	X	X	X	X	X	X	X
Richards Industries CX-40	005:031:004		X	X		X	X	X	X	X	X	X	X	X
Richards Insustries RCX-40	005:031:004		X	X		X	X	X	X	X	X	X	X	X
OPW 66-C (w/ pigtail)	005:008:044											X		
66-CL (w/o pigtail)	005:008:047		X	X		X	X	X	X	X	X	X	X	X
Vapor Check Valves														
Emco Wheaton														
A225	005:007:23	X		X										
A225-003	005:007:23	X		X	X									
A226	005:007:23		X											
A227	005:007:23		X[19/]						X	X	X	X		
A228-001	005:007:024		X	X		X	X	X	X	X	X	X	X	X
Red Jacket systems only may also use:														
Red Jacket 104-184	002:001:003	X	X	X	X	X			X			X		
Hirt systems only may also use:														
Hazlett HC-2 ball check valve		X		X	X									
Hirt 3/4" NPT solenoid valve		X		X	X									

Executive Order G-70-52-AM
Component[1] List for Red Jacket, Hirt, or Balance
Phase II Vapor Recovery Systems

Manufacturer/Item and Model Number	SFM ID Number	Exhibits 4	5	6	7	8a	8b	8c	9a	9b	9c	10	11	11a
Swivels[5]														
Nozzle Swivels														
Emco Wheaton														
A4110-001(45°)	005:007:31		X			X	X		X	X		X		
A4113-001(90°)	005:007:31					X			X					
Husky I+VI	005:021:2	X		X	X									
Husky I+VI F	005:021:2	X		X	X									
OPW 43	005:008:6	X		X	X									
OPW 43-C[6]/ (30°)	005:008:27		X			X	X		X	X		X		
OPW 43-CF-(45°)	005:008:040		X			X	X		X	X		X		
OPW 43-T[6]/ with 3/4" or 1" fuel line	005:008:31	X		X	X									
OPW 43-CR(90°)	005:008:46		X			X			X					
OPW 43-CRT(90°)	005:008:46		X			X			X					
Pomeco Model 7	005:025:2	X		X	X									
RCR 3 D	005:031:002	X		X	X									
Island Swivels														
Emco Wheaton A93-001	005:007:13		X											
OPW 36-CE	005:008:28		X											
Dispenser Swivels														
Emco Wheaton														
A4113-001 (90°)	005:008:31		X			X	X	X	X	X	X	X		
A92-001	005:007:11		X											
Wedgon PS 3445 VRM	005:013:2	X		X										
OPW 43-CR(90°)	005:008:46		X			X	X	X	X	X	X	X		
OPW 43-CRT(90°)	005:008:46		X			X	X	X	X	X	X	X		
Retractor Swivel														
Searle Leather & Packing B-1399 or State Fire Marshal approved equivalent			X											

Executive Order G-70-52-AM
Component[1/] List for Red Jacket, Hirt, or Balance
Phase II Vapor Recovery Systems

Manufacturer/Item and Model Number	SFM ID Number	Exhibits												
		4	5	6	7	8a	8b	8c	9a	9b	9c	10	11	11a
Flow Limiter														
Emco Wheaton A-10	001:007:1	X	X	X	X	X	X	X	X	X	X	X	X	X
or State Fire Marshal approved equivalent														
Recirculation Traps (Existing Installations only) [17/]														
Emco Wheaton A008-001	001:007:4	X	X	X	X									
Emco Wheaton A94-001	005:007:8	X	X	X	X									
Emco Wheaton A95-001	005:007:9	X	X	X	X									
OPW 78, 78-S, 78-E, 78-ES	001:008:13													
	002:008:12	X	X	X	X									

Executive Order G-70-52-AM
Footnotes to Component 1/ List for Red Jacket, Hirt, or Balance
Phase II Vapor Recovery Systems

1/ Specific components for the Red Jacket system are listed in the latest version of Executive Order G-70-14. Specific components for the Hirt system are listed in the latest version of Executive Order G-70-33.

2/ See Exhibit 3 for a Nozzle/System Cross-Reference.

3/ High-hang or high-retractor hose configurations are required on all existing Balance, Red Jacket and Hirt stations by July 26, 1986, except for dispensers in compliance with Exhibit 11.

4/ Other dispensers are in compliance with ARB requirements if they are approved by the Division of Measurement Standards and are applicable to any of the configurations shown by Exhibits 4,5,6, & 7 in this Executive Order.

5/ Other nozzle multiplane swivels and island single plane swivels may be used if approved by California State Fire Marshal. Nozzle multiplane swivels and island single plane swivels are required on all existing twin hose dispensers by July 26, 1986.

6/ 43-T swivel not allowed with Hirt ball check valve.

7/ Dual-port nozzles not permitted on new installations utilizing a balance type Phase II vapor recovery system.

8/ Boot protectors are prohibited on Emco Wheaton A4000-series nozzles, EZ-flo 4000-series and 11V-series nozzles and OPW 111V and Husky Model V nozzles.

9/ Specific components for EZ-flo rebuilt 3000-series vapor recovery nozzles are listed in the latest version of Executive Order G-70-101. Specific components for EZ-flo rebuilt A4000-series and 11V-series vapor recovery nozzles are listed in the latest version of Executive Order G-70-134.

10/ Specific components for the EZ-flo Rebuilt OPW 7V-E vapor recovery nozzle are listed in the latest version of Executive Order G-70-78.

11/ Specific components for the Rainbow Rebuilt Emco Wheaton A3003, A3005, A3006, and A3007 vapor recovery nozzles are listed in the latest version of Executive Order G-70-107.

12/ Emco Wheaton red and gray bellows for A3000-type nozzles may not be used after July 26, 1989. (Bellows discolor in use and may appear tan rather than red or gray.)

13/ The boot must be used with Daystar Spacer (Daystar part number F00232-NL-00), and is only approved for use on Emco Wheaton 3003- and 3005-type nozzles.

14/ Appropriate certified swivels must be used to prevent closure of vapor passage due to kinking.

15/ Use of Rainbow Petroleum Products RA3003/RA3005 Blow Molded Gasoline Vapor Recovery Bellows approved.

16/ Coaxial hose assemblies which do not contain liquid removal systems may be used on Exhibits which are not indicated provided they are used with a certified liquid removal system (such as the Gilbarco Co-Vent) which is certified for that Exhibit.

Executive Order G-70-52-AM
Footnotes to Component[1/] List for Red Jacket, Hirt, or Balance
Phase II Vapor Recovery Systems

17/ Recirculation traps are permitted on existing installations only. Removal of internal assembly from existing recirculation traps is recommended whenever possible to reduce pressure drop.

18/ Any installation of blended product dispensers must be plumbed to allow the return of vapors from any product produced by blending to all tanks from which the component fuels may be withdrawn.

19/ The Emco Wheaton A227 vapor check valve may be installed in a vertical position (manufacturer's instructions specify installation within five degrees of horizontal) in Tokheim 262 dispensers manufactured before 1/1/90.

20/ Installation of the Catlow 2.N.1 breakaway at the nozzle end of the hose is prohibited.

21/ The Emco Wheaton A4042 fitting is to be marketed in combination with a gray scuff guard which clearly identifies it as an A4042 fitting. This gray scuff guard is not to be installed on A227 vapor check valves, and the use of the black scuff guard with which the A227 valve is marketed is prohibited with the A4042. Emco Wheaton A227 valves modified by removing poppets in an attempt to create A4042 fittings are considered uncertified equipment.

22/ Coaxial hoses with liquid removal systems are approved as indicated for Exhibits which require liquid removal systems. The use of hoses containing liquid removal systems is not prohibited on other Exhibits provided all requirements of the Exhibits, including hose loop specifications, are met.

Exhibit 3
Executive Order G-70-52-AM

Phase II Vapor Recovery System/Nozzle Cross-Reference
(Red Jacket and Hirt Assist Systems or Balance Systems)

Nozzle [1]	Dispensing Rate Systems Using Nozzles [2]	GPM Not To Exceed	Comments and Exhibit 2 Cross-Reference Number
Emco Wheaton A3003, RA3003 EZ-flo 3003 Rainbow RA3003	Hirt Balance	10 [3] 10	Soft, tight-fitting faceplate Insertion interlock Dual-hose passageways Secondary (pressure) shutoff mechanism [4] Vapor check valve in nozzle |1|
Emco Wheaton A3005, RA3005 EZ-flo 3005 Rainbow RA3005	Hirt Balance	10 10	Same as A3003 except coaxial Insertion interlock Soft, tight-fitting faceplate Secondary (pressure) shutoff mechanism [4] Vapor check valve in nozzle. |2|
Emco Wheaton A3006, RA3006 EZ-flo 3006 Rainbow RA3006	Hirt Red Jacket	10 [3] 10	Loose-fitting gaslet-type facecone. No insertion interlock. Secondary (pressure) shutoff mechanism [4] Slim handle. Dual-hose passageways Remote vapor check valve required. |3|
Emco Wheaton A3007, RA3007 EZ-flo 3007 Rainbow RA3007	Hirt Red Jacket	10	Same as A3006 except coaxial passageways Loose-fitting gaslet-type facecone Secondary (pressure) shutoff mechanism [4] Remote vapor check valve required. |4|
Emco Wheaton A4000 [5] RA4000 [5] EZ-flo 4000 [5] [7]	Hirt Balance	10 [3] 10	Soft, tight-fitting faceplate Insertion interlock Secondary (pressure) shutoff mechanism [4] Remote vapor check valve required Dual-hose passageways |5|
Emco Wheaton A4001 [5] RA4001 [5] EZ-flo 4001 [5]	Hirt Balance	10 10	Same as A4000 except coaxial. Insertion interlock. Soft, tight-fitting faceplate. Secondary (pressure) shutoff mechanism [4] Remote vapor check valve required |6|

Exhibit 3 (continued)
Executive Order G-70-52-AM

Phase II Vapor Recovery System/Nozzle Cross-Reference
(Red Jacket and Hirt Assist Systems or Balance Systems)

Nozzle [1]	Dispensing Rate Systems Using Nozzles [2]	GPM Not To Exceed	Comments and Exhibit 2 Cross-Reference Number
Emco Wheaton A4002 [5] [7] EZ-flo 4002 [5]	Hirt	10 [3]	Loose-fitting assist-type facecone. No insertion interlock. Secondary (pressure) shutoff mechanism [4] Dual-hose passageways Remote vapor check valve required. [7]
Emco Wheaton A4003 [5] EZ-flo 4003 [5] [7]	Hirt	10	Same as A4002 except coaxial passageways Loose-fitting assist-type facecone Secondary (pressure) shutoff mechanism [4] Remote vapor check valve required. [8]
Emco Wheaton A4005 [5] RA4005 [5] EZ-flo 4005 [5] [7]	Hirt Balance	10 10	Vapor check valve in nozzle. Insertion interlock. Soft, tight-fitting faceplate. Secondary (pressure) shutoff mechanism [4] Coaxial passageways [9]
OPW 7V Model E [6] -34 (unleaded, with clip) -36 (leaded, w/out clip) -47 (unleaded, with clip) -49 (unleaded, w/out clip -60 (leaded, with clip) -61 (unleaded, with clip) -62 (leaded, w/out clip) -63 (unleaded, w/out clip)	Hirt Red Jacket	10 [3] 10	No insertion interlock. Loose-fitting assist-type facecone. Remote vapor check valve required. Dual passageways No new 7V nozzles being made by OPW. Secondary (pressure) shutoff mechanism [4] [10]
E-Z Flo EZE8 -34 (leaded, with clip) -36 (leaded, w/out clip) -47 (unleaded, with clip) -49 (unleaded, w/out clip)	Hirt Red Jacket	10 [3] 10	Rebuilt OPW 7V Model E nozzles. Loose-fitting assist-type facecone. No interlock, dual passageways. Remote vapor check valve required. Secondary (pressure) shutoff mechanism [4] [10a]
Rainbow Petroleum Products RPP-34 (leaded, w/ clip) RPP-36 (leaded, w/out clip) RPP-47 (unleaded, with clip) RPP-49 (unleaded, w/out clip)	Hirt Red Jacket	10 [3] 10	OPW 7V Model E nozzle with Rainbow boot. No insertion interlock. Secondary (pressure) shutoff mechanism [4] Loose-fitting assist-type facecone. Remote vapor check valve required. [10b]

Exhibit 3 (continued)
Executive Order G-70-52-AM

Phase II Vapor Recovery System/Nozzle Cross-Reference
(Red Jacket and Hirt Assist Systems or Balance Systems)

Nozzle [1]	Dispensing Rate Systems Using Nozzles [2]	GPM Not To Exceed	Comments and Exhibit 2 Cross-Reference Number
OPW 11V Model C -22 (leaded, with clip) -24 (leaded, w/out clip) -47 (unleaded, with clip) -49 (unleaded, w/o clip)	Hirt Balance	10 10	Coaxial passageways. Insertion interlock. Soft, tight-fitting faceplate Secondary (pressure) shutoff mechanism [4] Vapor check valve in nozzle No new Model C nozzles being made by OPW |11|
OPW 11VS Model C -22 (leaded, with clip) -24 (leaded, w/out clip) -47 (unleaded, with clip) -49 (unleaded, w/o clip)	Hirt Balance	10 [3] 10	Same as 11V except dual passageways. Insertion interlock. Soft, tight-fitting faceplate. Secondary (pressure) shutoff mechanism [4] Vapor check valve in nozzle No new Model C nozzles being made by OPW. |12|
OPW 11V Model E -34 (leaded, with clip) -36 (leaded, w/out clip) -47 (unleaded, with clip) -49 (unleaded, w/out clip) EZ-flo 11V-E (coaxial) [5]	Hirt Red Jacket	10 10	Coaxial passageways. Loose fitting assist-type facecone. No insertion interlock. Remote vapor check valve required. Secondary (pressure) shutoff mechanism [4] |13|
OPW 11VS Model E [5] -34 (leaded, with clip) -36 (leaded, w/out clip) -47 (unleaded, with clip) -49 (unleaded w/out clip) EZ-flo 11V-E (dual) [5]	Hirt Red Jacket/	10 [3] 10	Same as 11V E except dual passageways. Loose fitting assist-type facecone. No insertion interlock. Remote vapor check valve required. Secondary (pressure) shutoff mechanism [4] |14|
OPW 11V Model F -22 (leaded, with clip) -24 (leaded, w/out clip) -47 (unleaded, with clip) -49 (unleaded, without clip) EZ-flo 11V-F (coaxial) [5]	Hirt Balance	10 10	Vapor check valve in nozzle. Insertion interlock. Secondary (pressure) shutoff mechanism [4] Soft, tight-fitting faceplate. Coaxial passageways. |15|

Exhibit 3 (continued)
Executive Order G-70-52-AM

Phase II Vapor Recovery System/Nozzle Cross-Reference
(Red Jacket and Hirt Assist Systems or Balance Systems)

Nozzle [1]	Dispensing Rate Systems Using Nozzles [2]	GPM Not To Exceed	Comments and Exhibit 2 Cross-Reference Number	
OPW 11VS Model F -22 (leaded, with clip) -24 (leaded, w/out clip) -47 (unleaded, w/ clip) -49 (unleaded, w/o clip) EZ-flo 11V-F (dual) [5]	Hirt Balance	10 [3] 10	Same as 11V F except dual passageways. Vapor check valve in nozzle. Secondary (pressure) shutoff mechanism [4] Insertion interlock. Soft, tight-fitting faceplate.	[16]
OPW 111V [5] -22 (leaded, with clip) -24 (leaded, w/out clip) -47 (unleaded, with clip) -49 (unleaded, without clip)	Hirt Balance	10 10	Vapor check valve in nozzle. Insertion interlock. Secondary (pressure) shutoff mechanism [4] Soft, tight-fitting faceplate. Coaxial passageways.	[17]
Husky Model V [5]	Hirt Balance	10 10	Vapor check valve in nozzle. Insertion interlock. Secondary (pressure) shutoff mechanism [4] Soft, tight-fitting faceplate. Coaxial passageways.	[18]

1/ Spout and bellows may be changed from leaded to unleaded, or vice versa, when products in storage tanks are changed accordingly.

2/ The Executive Orders pertaining to Balance Phase II vapor recovery systems are listed in Exhibit 1.

3/ Flow rate of 12 gpm permitted only on dual Hirt systems which use 3/4" vapor hose.

4/ Secondary (pressure) shutoff mechanism at or below 10" water column (between 6" and 10", not over 10").

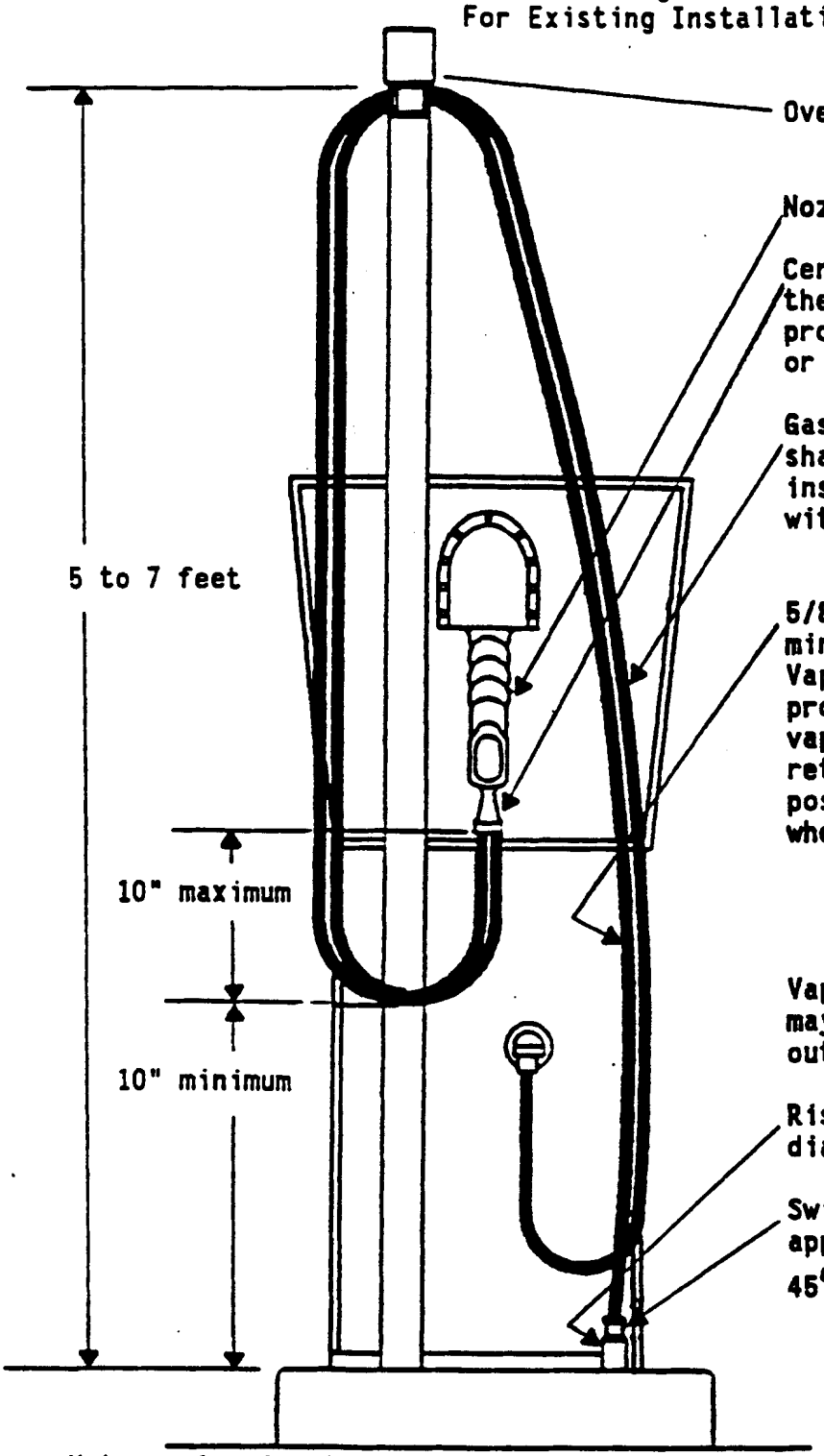
5/ Boot protectors are prohibited on Emco Wheaton A4000-series nozzles, EZ-flo 4000-series and 11V-series nozzles and OPW 111V and Husky Model V nozzles.

6/ OPW 7V Model E nozzle with OPW 7V Model H bellows/faceplate is acceptable.

7/ EZ-flo rebuilt nozzle bodies may be certified only with Emco Wheaton "front end" parts. Refer to the latest version of Executive Order G-70-134 for a listing of the approved combinations.

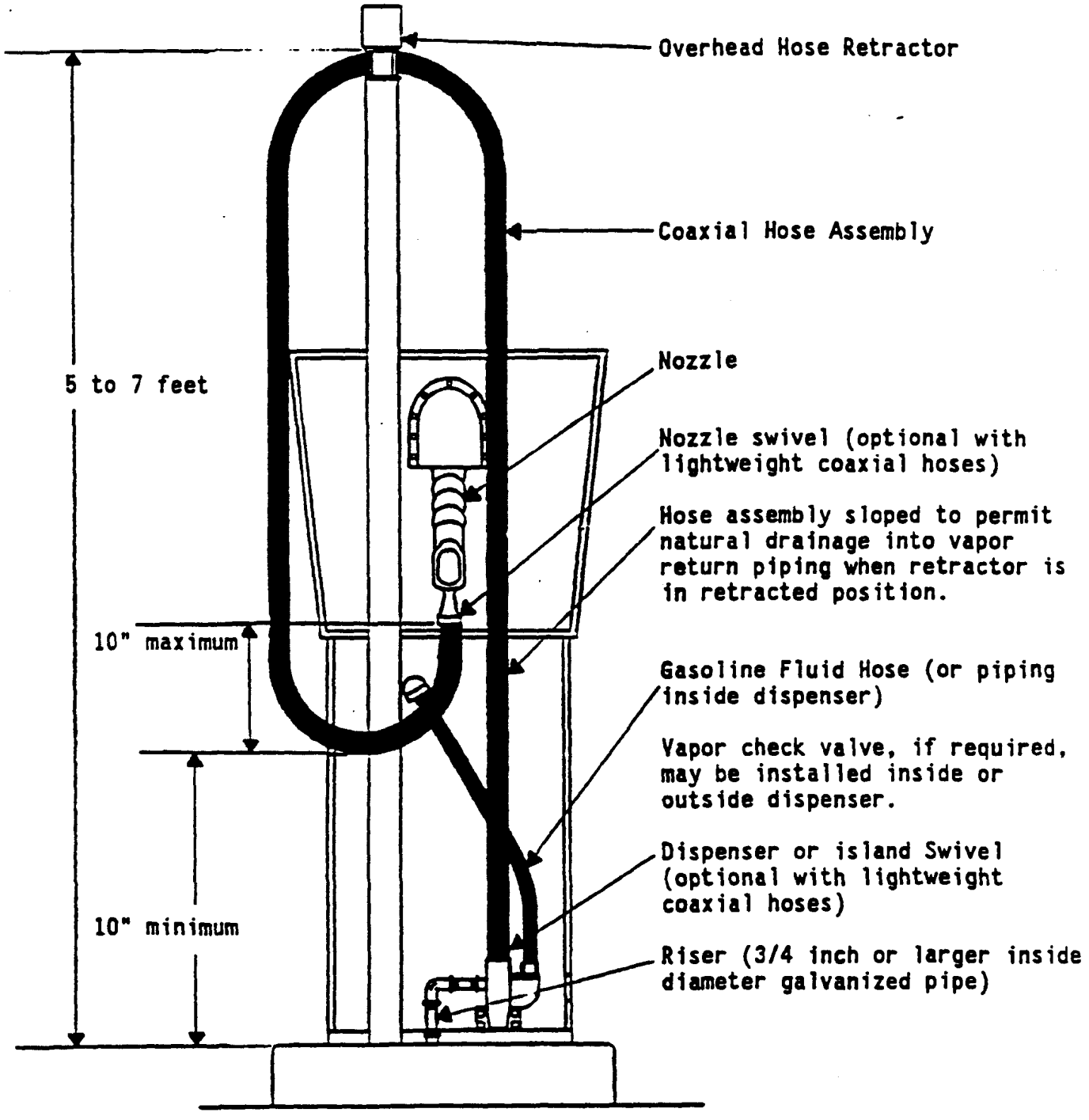
EXHIBIT 4
Executive Order G-70-52-AM

Dual Hose Side Mount High-Retractor Configuration
For Existing Installations Only



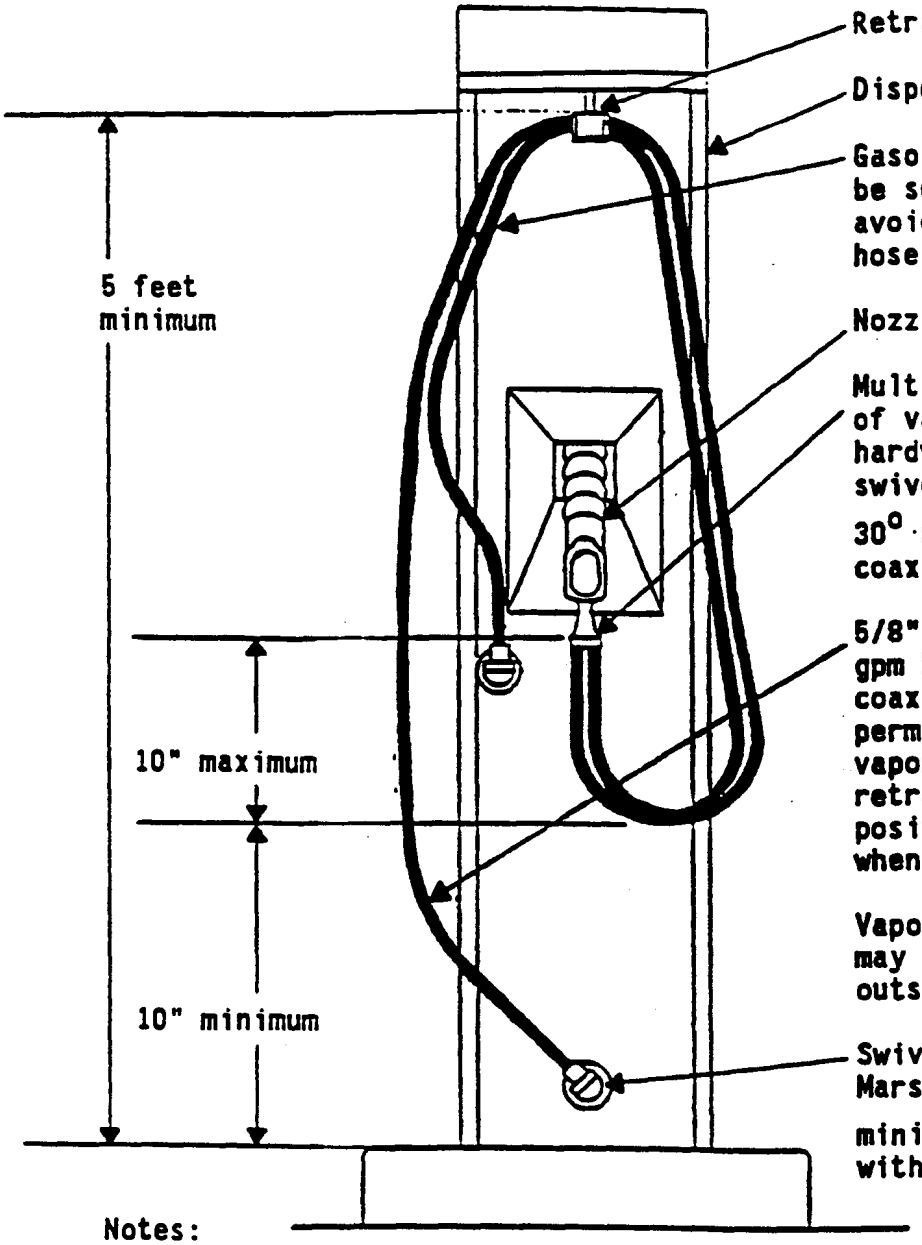
Notes:
1. See Exhibit 2 for the component list.
2. A flow limiter is required on dispensers that have a maximum flowrate in excess of 10 gpm. (A maximum flow rate of 12 gpm is permitted with the Hirt system provided vapor hoses are 3/4" ID.)
3. Use appropriate hose ties.
4. Vapor return piping may be installed on the inside or the outside of the dispenser cabinet.
5. The Emco Wheaton and EZ-flo A4000 and A4002 nozzles are permitted only when used in conjunction with certified vapor check valves.

EXHIBIT 5
Executive Order G-70-52-AM
Coaxial Hose Side-Mount High-Retractor Configuration
For New and Existing Installations



Notes:
1. See Exhibit 2 for the component list.
2. A flow limiter is required on dispensers that have a maximum flowrate in excess of 10 gpm. A flow limiter may be required on all gasoline dispensers at the option of the local air pollution control district.
3. Vapor return piping may be installed on the inside or on the outside of the dispenser cabinet.
4. The Emco Wheaton and EZ-flo A4001 and A4003 nozzles are permitted only when used in conjunction with approved vapor check valves.
5. Nozzle and dispenser or island swivels are required with hardwall coaxial hoses, and are optional with lightweight coaxial hoses.

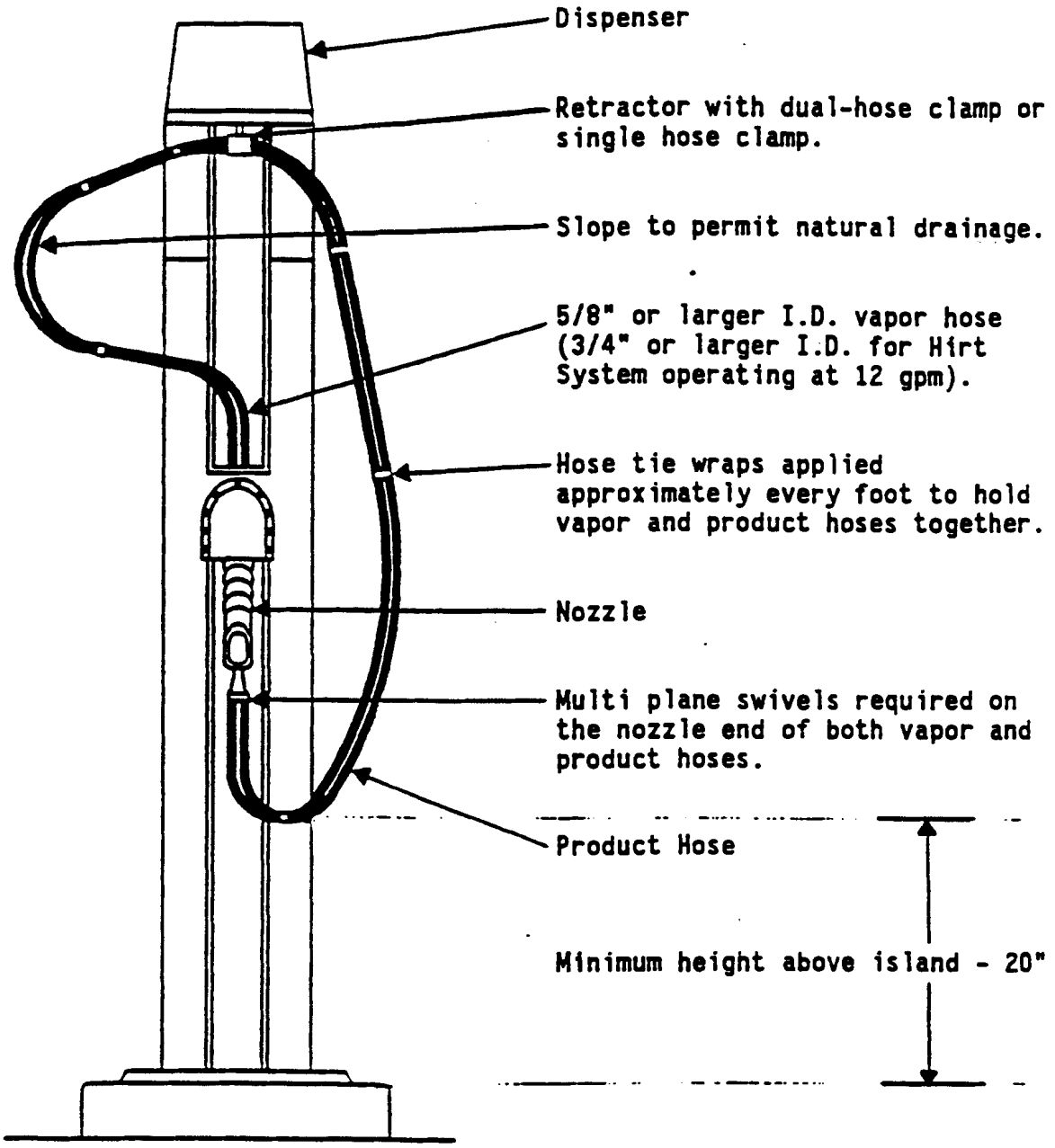
EXHIBIT 6
Executive Order G-70-52-AM
Dual and Coaxial Hose Dispenser-Mount High-Retractor Configuration



Notes:

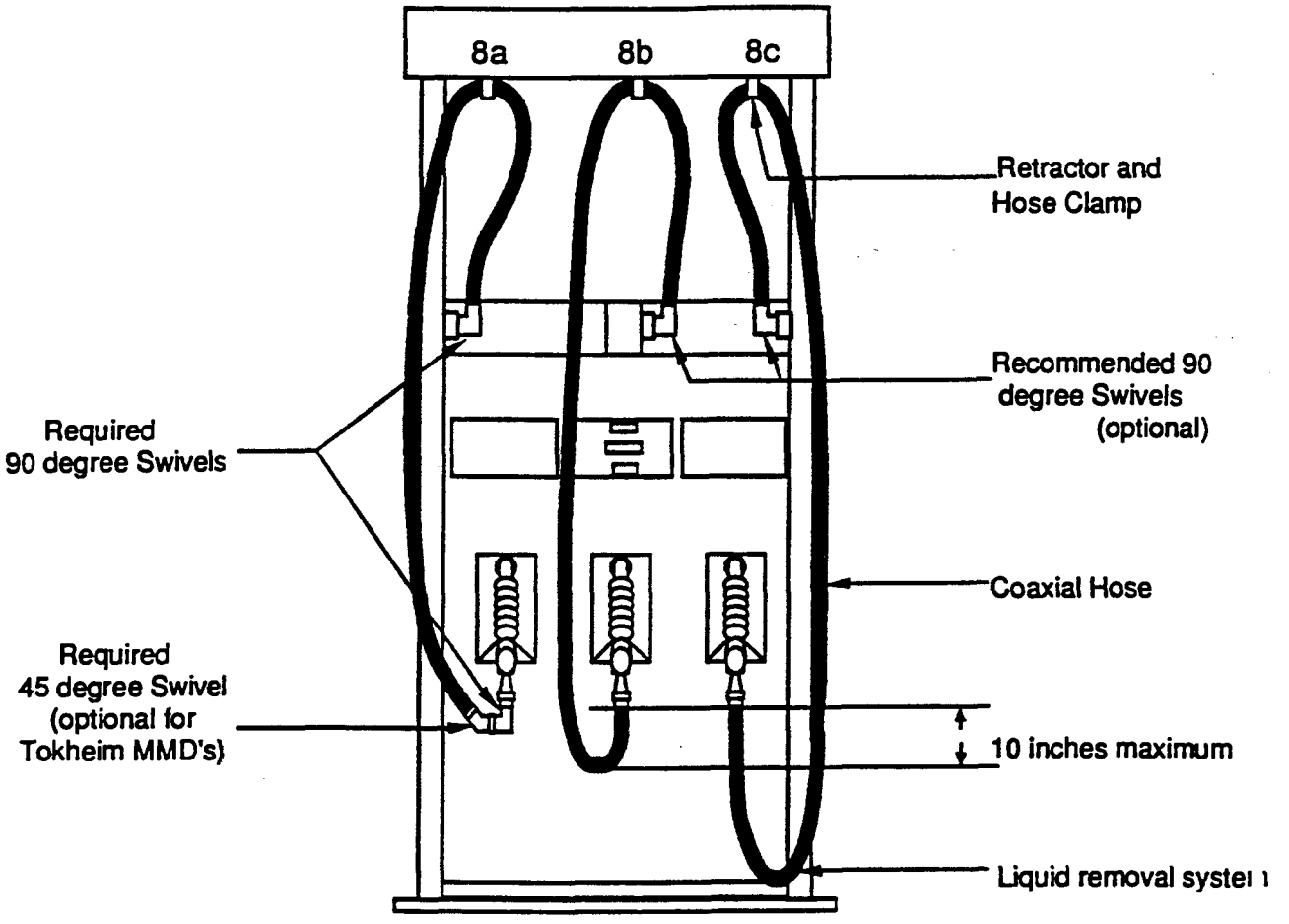
1. See Exhibit 2 for the component list.
2. A flow limiter is required on dispensers that have a maximum flowrate in excess of 10 gpm (12 gpm for dispensers with the Hirt system provided that 3/4" ID vapor hoses are used), and may be required on any gasoline dispenser at the discretion of the local air pollution control district.
3. Use appropriate hose ties.
4. Vapor return piping may be installed inside or outside dispenser cabinet.
5. Riser shall be 3/4 inch or larger inside diameter galvanized pipe.
6. The Emco Wheaton and EZ-flo A4000, A4001, A4002 and A4003 nozzles are permitted only when used in conjunction with approved vapor check valves.
7. The coaxial hose dispenser-mount high-retractor configuration can be used for all new and existing installations. The dual hose dispenser-mount high-retractor configuration may not be used for new installations.
8. Nozzle and dispenser swivels are required with dual hoses and with hardwall coaxial hoses, and are optional with lightweight coaxial hoses.

EXHIBIT 7
Executive Order G-70-52-AM
Dual Hose Dispenser-Mount High-Retractor Configuration
For Existing Installations Only



Notes:
1. See Exhibit 2 for the component list.
2. A flow limiter is required on dispensers that have a maximum flowrate in excess of 10 gpm (12 gpm for dispensers for the Hirt System).
3. Hose swivels not required at dispenser end of hoses.
4. Riser must be 3/4 inch or larger inside diameter galvanized pipe.
5. Dual hose dispenser-mount high-retractor configuration not permitted on new installations.
6. The Emco Wheaton and EZ-flo A4000 and A400[illegible] nozzles are permitted only when used in conjunction with certifi[illegible]apor check valves.

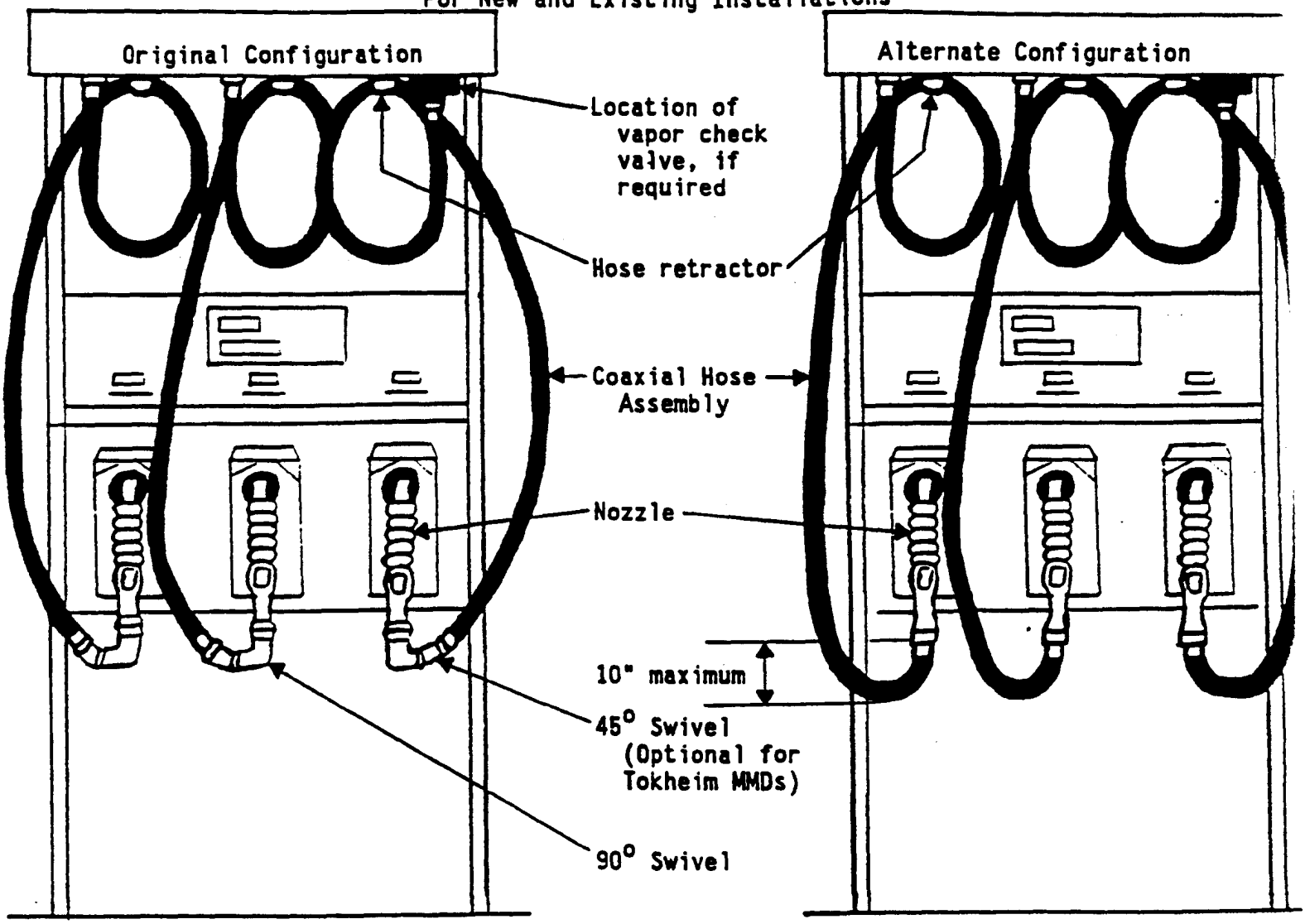
EXHIBIT 8
Executive Order G-70-52-AM
High-Retractor Dispenser - Coaxial Hose Configurations
For New and Existing Installations



Notes:

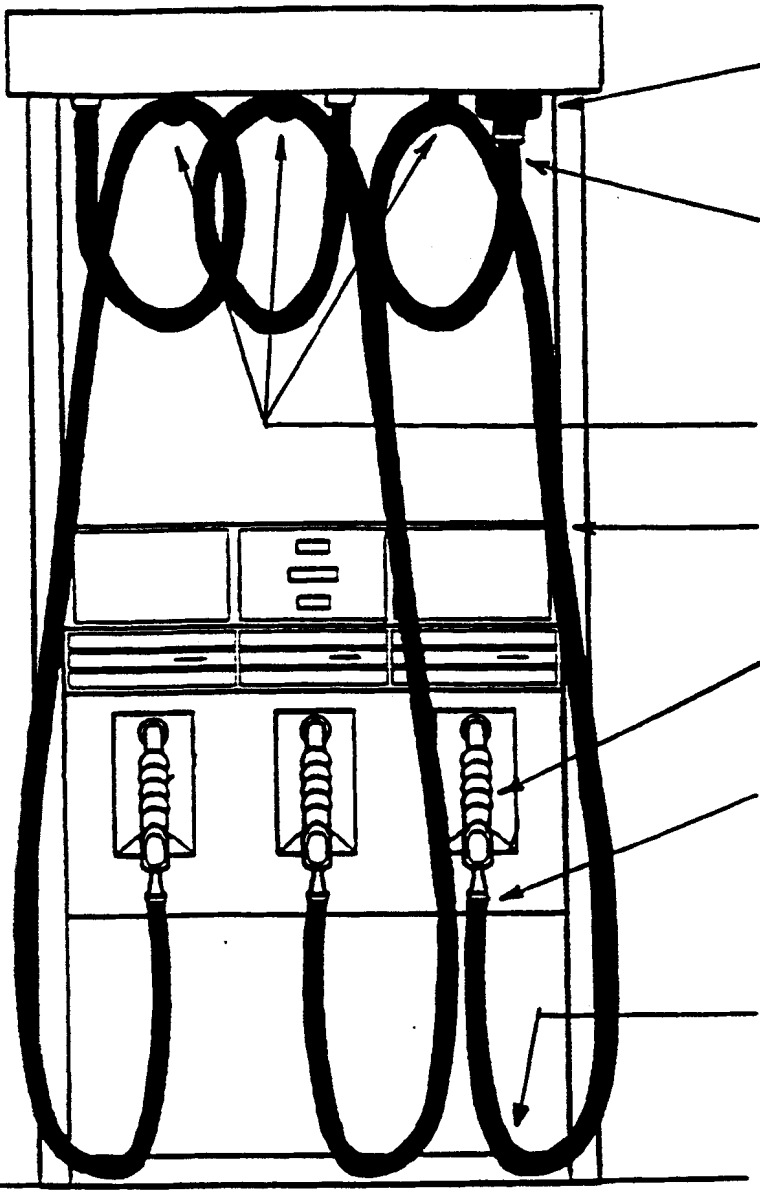
1. Use a 1 inch or larger diameter galvanized pipe for riser.
2. A flow limiter is required on dispensers that have a maximum flowrate in excess of 10 gpm. A flow limiter may be required on any gasoline dispenser at the option of the local air pollution control district. Flow limiters are not recommended for configurations requiring liquid removal systems if flowrates are10 gpm or less for all nozzles.
3. For configuration 8a only, the maximum length of the hose assembly is 9 feet. For dispenser islands greater than 4 feet in width, the maximum length of the hose assembly shall not exceed the sum of one-half the dispenser width, in feet, plus 7 feet.
4. Retractor must retract coaxial hose to top of dispensers when not in use and hose must slope downward to dispenser to provide natural drainage from the retractor to the dispenser. Tension on retractor hose clamp must not be in excess of that required to return hose to top of dispenser.
5. For configuration 8c, the hose may not touch the island or the ground when not in use. In the case of a dogbone island where the wider ends protect the hose from damage by vehicle tires, the hose may touch the vertical face of the dogbone island at the option of the local air pollution control district.
6. The Emco Wheaton and EZ-flo A4001 and A4003 nozzles are permitted only when used in conjunction with approved vapor check valves.
7. Configuration 8a with swivels is required with hardwall coaxial hoses.
8. Liquid removal system is required with configuration 8c and shall be located so that the liquid pickup is in the bottom of the hose loop during vehicle fuelings.

Exhibit 9 (a and b)
Executive Order G-70-52-AM
High-Hang Coaxial Hose Configuration with Retractor
For New and Existing Installations



Notes:
1. Use a 1 inch or larger inside diameter galvanized pipe for riser.
2. A flow limiter is required on dispensers that have a maximum flowrate in excess of 10 gpm. A flow limiter may be required on all gasoline dispensers at the option of the local air pollution control district.
3. For dispenser islands less than 4 feet in width, the maximum length of the hose assembly is 9-1/2 feet. For dispenser islands greater than 4 feet in width, the maximum length of the hose assembly shall not exceed the sum of one-half the dispenser island width, in feet, plus 7-1/2 feet.
4. Retractor must retract coaxial hose to top of dispensers when not in use.
5. Tension on retractor hose clamp must not be in excess of that required to return hose to top of dispenser.
6. Original configuration required with hardwall hoses.
7. 90 degree swivel is not required if hose stiffener assembly is 24" in length (Hose stiffeners pertain only to B.F. Goodrich hoses).
8. The Emco Wheaton and EZ-flo A4001 and A4003 nozzles are permitted only when used in conjunction with approved vapor check valves.

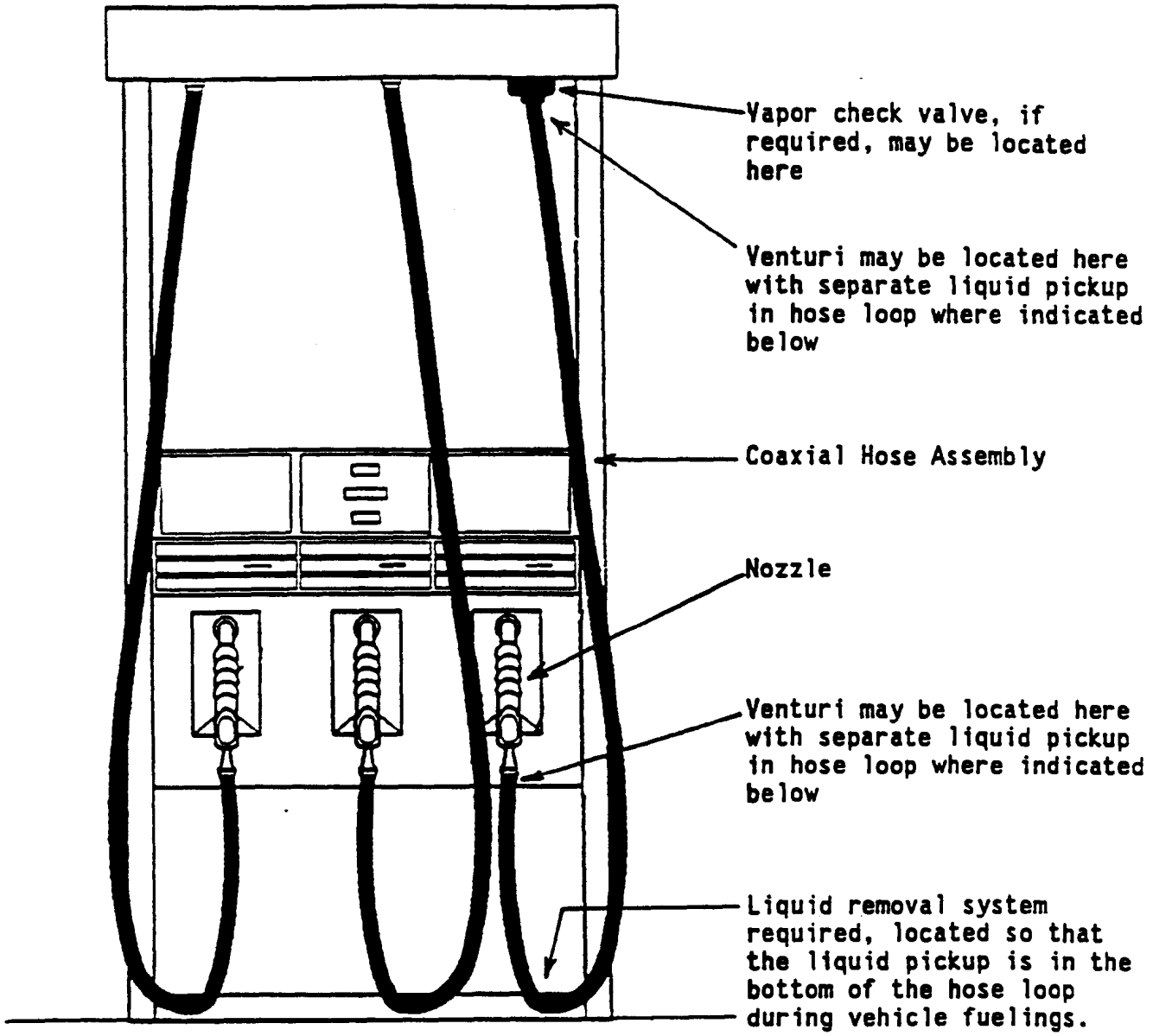
Exhibit 9c
Executive Order G-70-52-AM
High-Hang Coaxial Hose Configuration With Liquid Removal System
For New and Existing Installations



Notes:

1. Use 1 inch or larger inside diameter galvanized pipe for riser.
2. The maximum length of the hose assembly, including any breakaway valve, vapor check valve or pigtail hose, shall not exceed 13 feet.
3. An ARB certified liquid removal system must be installed and maintained according to the manufacturer's current specifications.
4. A flow limiter is required on all dispensers that have a maximum flowrate in excess of 10 gpm. A flow limiter may be required on all gasoline dispensers at the option of the local air pollution control district.
5. The Emco Wheaton and EZ-flo A4001 and A4003 nozzles are permitted only when used in conjunction with approved vapor check valves.
6. The hose may not touch the island or the ground when not in use. In the case of a dogbone island where the wider island ends protect the hose from damage by vehicle tires, the hose may touch the vertical face of the dogbone island at the option of the local air pollution control district.
7. Retractor must retract coaxial hose to top of dispensers when not in use.
8. Tension on hose clamp must not be in excess of that required to return hose to top of dispenser.

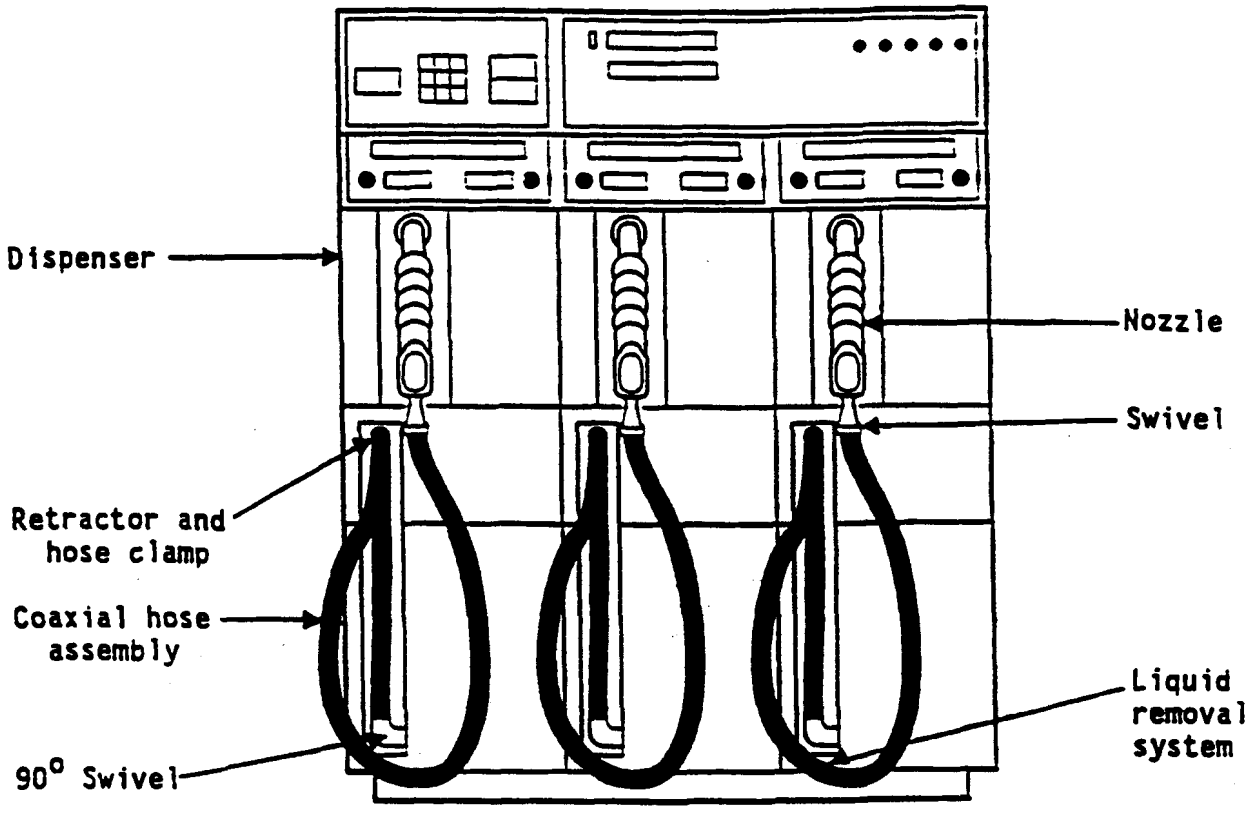
EXHIBIT 10
Executive Order G-70-52-AM
High-Hang Coaxial Hose Configuration With Liquid Removal System
For New and Existing Installations



Notes:

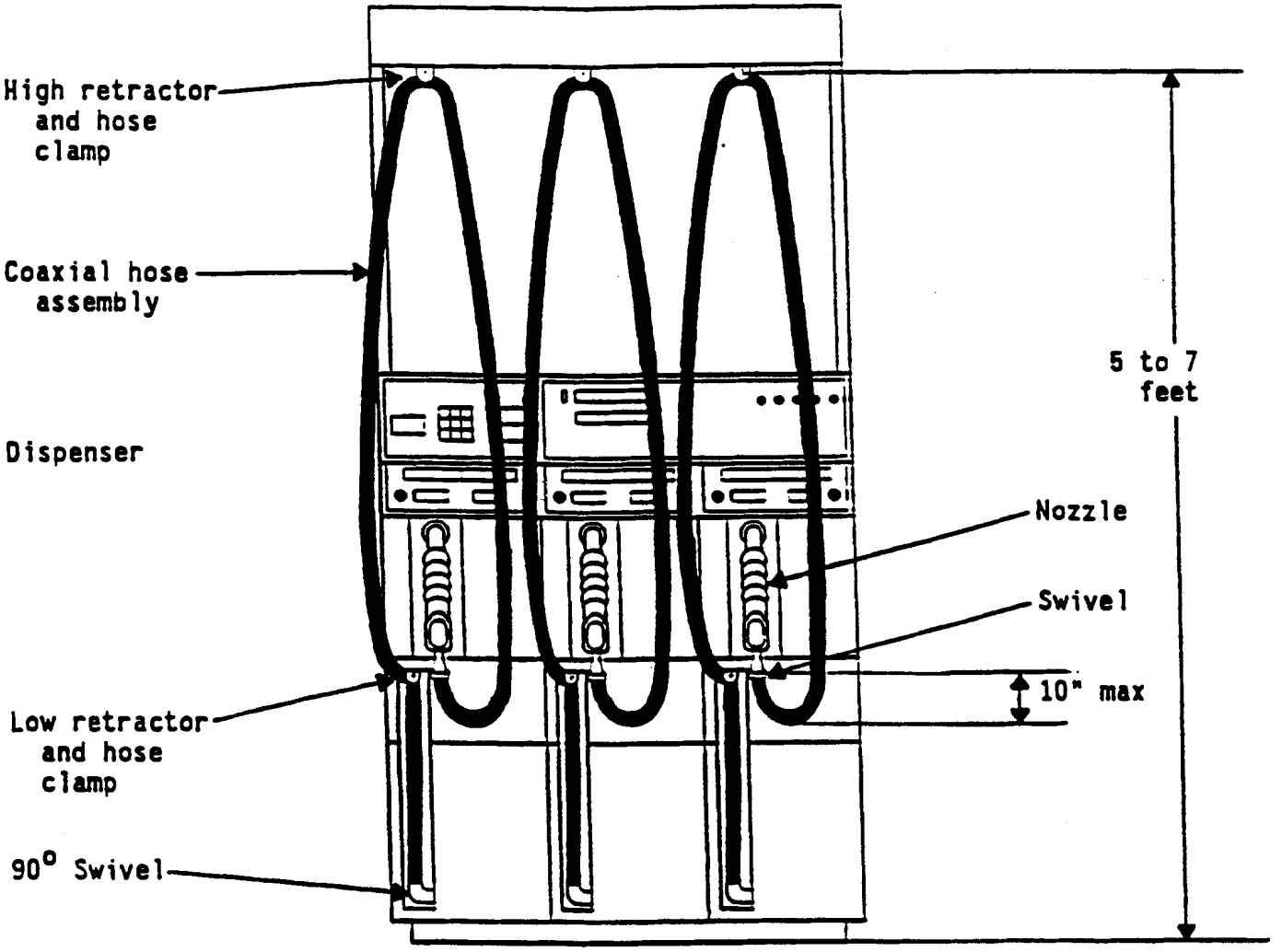
1. Use 1 inch or larger inside diameter galvanized pipe for riser.
2. The maximum length of the hose assembly is 10-1/2 feet.
3. An ARB certified liquid removal system must be installed and maintained according to the manufacturer's current specifications.
4. A flow limiter is required on all dispensers that have a maximum flowrate in excess of 10 gpm. A flow limiter may be required on all gasoline dispensers at the option of the local air pollution control district.
5. The Emco Wheaton and EZ-flo A4001 and A4003 nozzles are permitted only when used in conjunction with approved vapor check valves.
6. The hose may not touch the island or the ground when not in use. In the case of a dogbone island where the wider island ends protect the hose from damage by vehicle tires, the hose may touch the vertical face of the dogbone island at the option of the local air pollution control district.

EXHIBIT 11
Executive Order G-70-52-AM
Low-Profile Dispenser with Retractor and Liquid Removal System
For New and Existing Installations



Notes:
1. Use 1 inch or larger inside diameter galvanized pipe for riser.
2. A flow limiter is required on dispensers that have a maximum flowrate in excess of 10 gpm. A flow limiter may be required on all gasoline dispensers at the option of the local air pollution control district.
3. An ARB certified liquid removal system must be installed and maintained according to manufacturer's specifications.
4. Retractor must retract coaxial hose to dispenser when not in use The hose must fit snugly against the dispenser from the low retractor to the 90° swivel.
5. Tension on retractor hose clamp must not be in excess of that required to return hose to dispenser.
6. The Emco Wheaton and EZ-flo A4001 and A4003 nozzles are permitte only when used in conjunction with approved vapor check valves.
7. The hose may not touch the island or the ground when not in use. In the case of a dogbone island where the wider island ends protect the hose from damage by vehicle tires, the hose may touc the vertical face of the dogbone island at the option of the loc air pollution control district.

EXHIBIT 11a
Executive Order G-70-52-AM
Low-Profile Dispenser with Retractors
For New and Existing Installations



Notes:
1. Use 1 inch or larger inside diameter galvanized pipe for riser.
2. A flow limiter is required on dispensers that have a maximum flowrate in excess of 10 gpm. A flow limiter may be required on all gasoline dispensers at the option of the local air pollution control district.
3. Low retractor must be present and must retract hose to dispenser when not in use. Hose must fit snugly against dispenser from low retractor to 90 degree swivel.
4. High retractor must retract hose fully when hose is not in use and must provide natural drainage from high retractor to the 90° swivel.
5. Tension on retractor hose clamp must not be in excess of that required to return hose to dispenser.
6. The Emco Wheaton and EZ-flo A4001 and A4003 nozzles are permitted only when used in conjunction with approved vapor check valves.

State of California
AIR RESOURCES BOARD

Executive Order G-70-70-AB

Relating to the Certification of the
Healy Phase II Vapor Recovery System
for Service Stations

WHEREAS, the Air Resources Board (the "Board") has established, pursuant to Sections 39600, 39601, and 41954 of the Health and Safety Code, certification procedures for systems designed for the control of gasoline vapor emissions during motor vehicle fueling operations ("Phase II vapor recovery systems") in its "Certification Procedures for Gasoline Vapor Recovery Systems at Service Stations" as last amended September 1, 1982 (the "Certification Procedures") incorporated by reference in Section 94001 of Title 17, California Administrative Code;

WHEREAS, the Board has established, pursuant to Sections 39600, 39601, and 41954 of the Health and Safety Code, test procedures for determining compliance of Phase II vapor recovery systems with emission standards in its "Test Procedures for Determining the Efficiency of Gasoline Vapor Recovery Systems at Service Stations" as last amended September 1, 1982 (the "Test Procedures"), incorporated by reference in Section 94000 of Title 17, California Administrative Code;

WHEREAS, James W. Healy of Cambridge Engineering, Inc. has applied for certification of the Healy Phase II Vapor Recovery System modified to use a single, centrally located Cambridge Engineering Multi-Jet Pump for both multi-product and individual dispensers;

WHEREAS, the modified Healy Phase II Vapor Recovery System installed with Cambridge Engineering's centrally located Multi-Jet Pump has been evaluated pursuant to the Board's Certification Procedures and Test Procedures;

WHEREAS, Section VIII.A. of the Certification Procedures provides that the Executive Officer shall issue an order of certification if he or she determines that a vapor recovery system conforms to all of the requirements set forth in Sections I through VII; and

WHEREAS, I find that the Healy Phase II Vapor Recovery System modified to use a single, Cambridge Engineering Multi-Jet Pump, conforms with all of the requirements set forth in Sections I through VII of the Certification Procedures and is at least 95 percent effective for attendant and/or self-service use at gasoline service stations when used in conjunction with Phase I vapor recovery systems that have been certified by the Board.

NOW THEREFORE, IT IS HEREBY ORDERED that the Executive Order G-70-70-AA issued on December 16, 1983 is hereby modified to add the use of the Healy Phase II Vapor Recovery System which incorporates Cambridge Engineering's Multi-Jet Pump with both multi-product and individual dispensers.

IT IS FURTHER ORDERED that this system is certified to be at least 95 percent effective in self-serve and/or attendant use at gasoline service stations when used with a Board certified Phase I vapor recovery system. A typical piping arrangement for the Healy Phase II Vapor Recovery System without multi-product dispensers is shown in Exhibit 1. A schematic of a typical installation of dispenser components for Healy Phase II Vapor Recovery Systems not incorporating the Multi-Jet Pump is shown in Exhibit 2. A typical piping arrangement for the Healy Phase II Vapor Recovery System when used with multi-product dispensers is shown in Exhibit 3. A typical piping arrangement for the Healy Phase II Vapor Recovery System when used with the Multi-Jet Pump and multi-product dispensers is shown in Exhibit 4. A listing of certified Healy Phase II Vapor Recovery System components is presented in Exhibit 5. Notes applicable to underground vapor return lines for the Healy Phase II Vapor Recovery System are listed in Exhibit 6.

IT IS FURTHER ORDERED that compliance with the applicable certification requirements and rules and regulations of the Division of Measurement Standards, the State Fire Marshal's Office, and the Division of Occupational Safety and Health of the Department of Industrial Relations is made a condition of this certification.

IT IS FURTHER ORDERED that the system certified hereby shall perform in actual use with the same effectiveness as the certification test system. Compliance with this performance criterion shall be a condition of this certification, and failure to meet this criterion shall constitute grounds for revocation, suspension, or modification of this certification.

IT IS FURTHER ORDERED that any alteration to the equipment, parts, design, or operation of the system certified hereby, is prohibited, and deemed inconsistent with this certification, unless such alteration has been approved by the undersigned or the Executive Officer's designee.

IT IS FURTHER ORDERED that the certified Healy Phase II Vapor Recovery System shall, at a minimum, be operated in accordance with the manufacturer's recommended maintenance intervals and shall use the manufacturer's recommended operation, installation, and maintenance procedures.

IT IS FURTHER ORDERED that the Healy Phase II Vapor Recovery System nozzle, jet pump, control valve and Multi-Jet Pump shall be 100 percent performance checked at the factory including checks of proper operation in all aspects of performance.

IT IS FURTHER ORDERED that the certified Healy Phase II Vapor Recovery Syste shall be performance tested during installation for ability to dispense gasoline and collect vapors without difficulty in the presence of the statio manager or other responsible individual. The station manager, owner or operator shall also be provided with instructions on the proper use of the Healy Phase II Vapor Recovery System, its repair and maintenance, and where system replacement and system components can be readily obtained. A copy of the Healy Phase II Vapor Recovery System warranty shall be made available to the station manager, owner or operator.

Executed at Sacramento, California this 2 day of October, 1986.

James D. Boyd
Executive Officer

Exhibit 1
Executive Order G-70-70-AB
Typical Phase II Vapor Recovery System with Individual Vapor Return Lines Adaptable to the Healy Phase II Vapor Recovery System

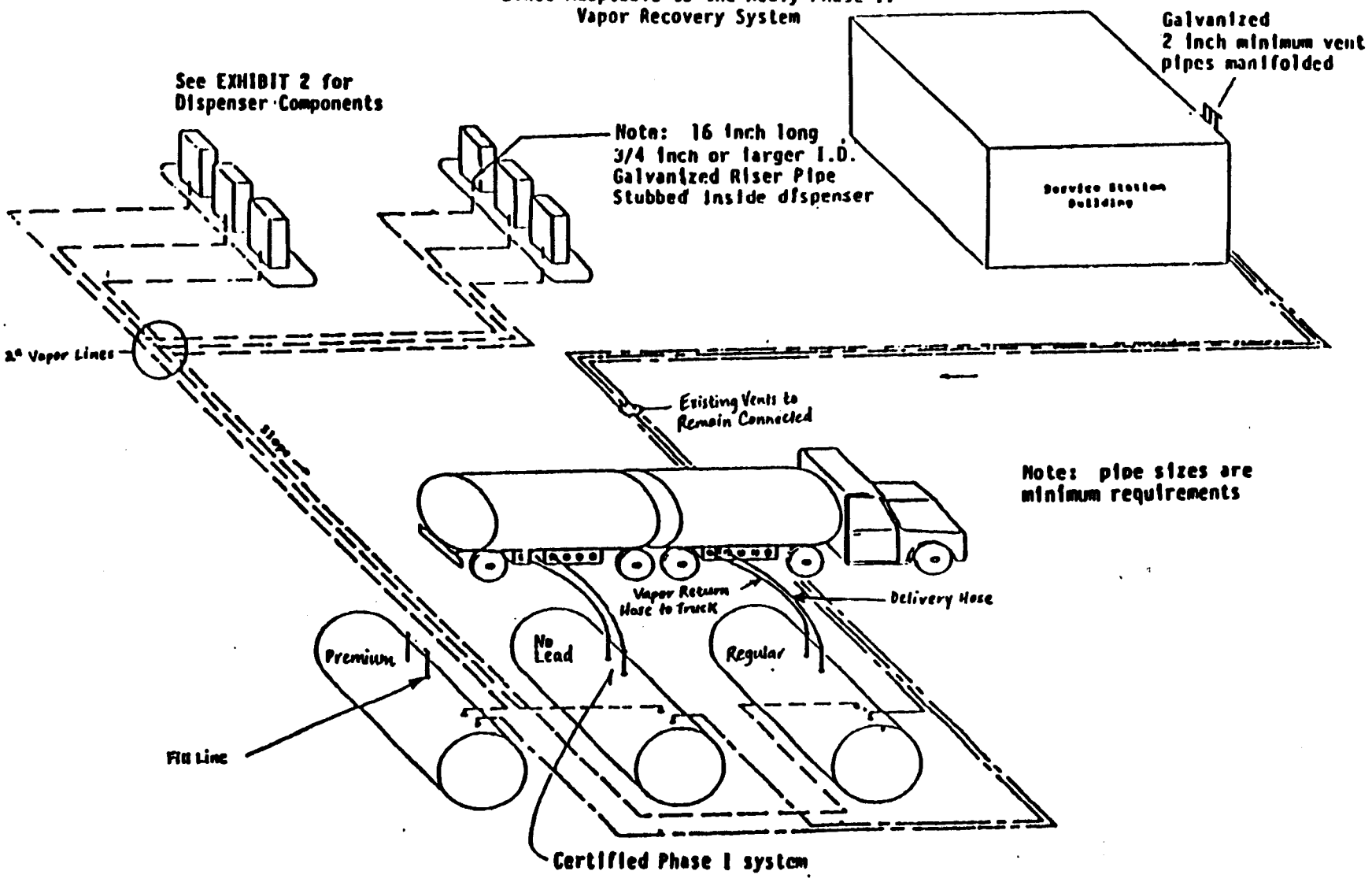
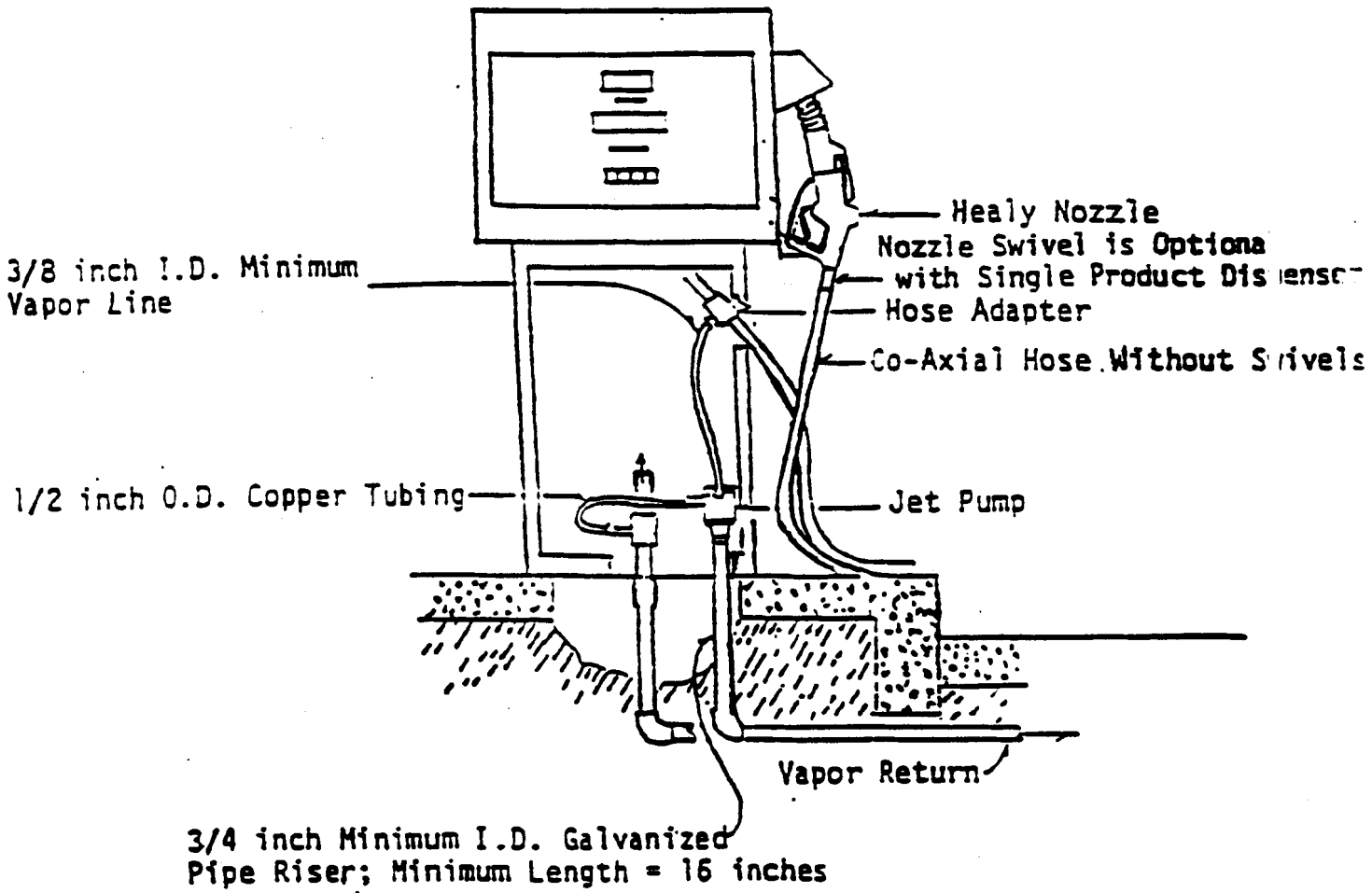


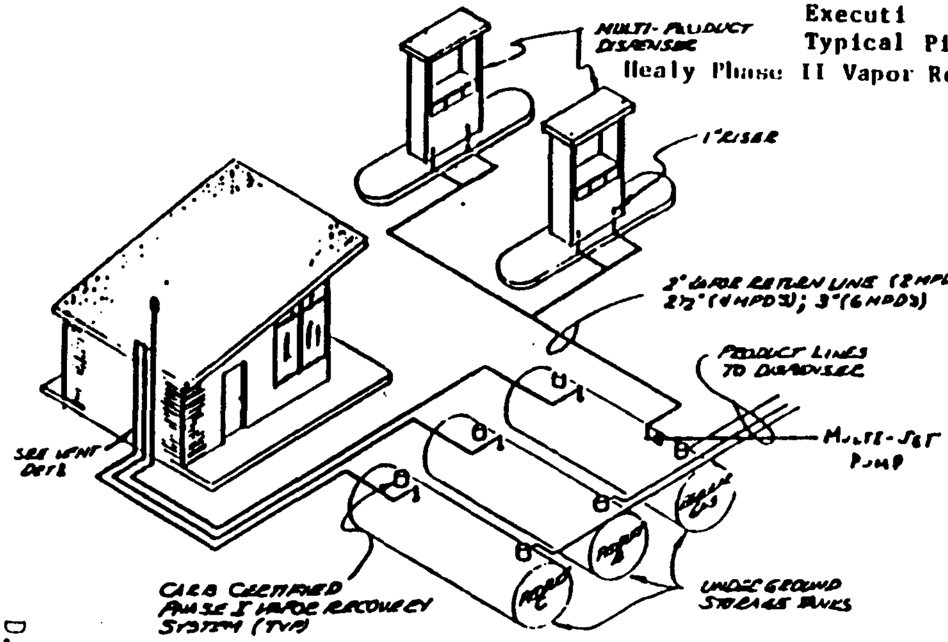
EXHIBIT 2

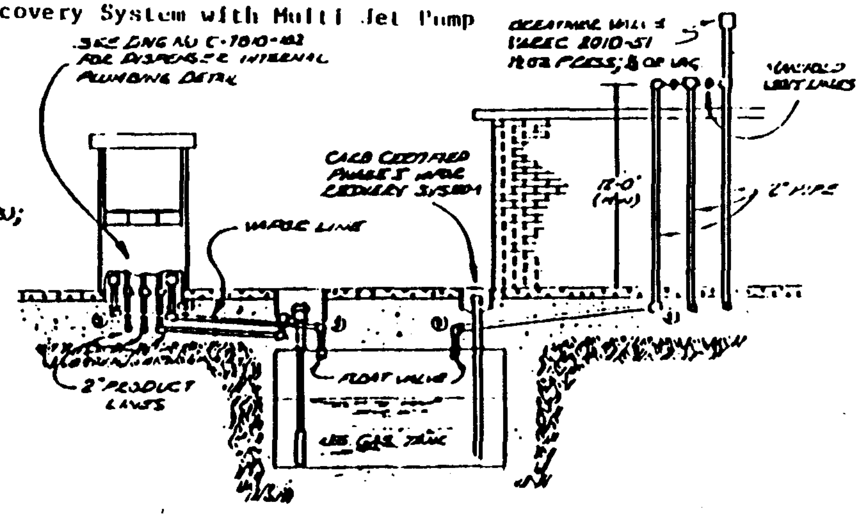
Executive Order G-70-70-AB

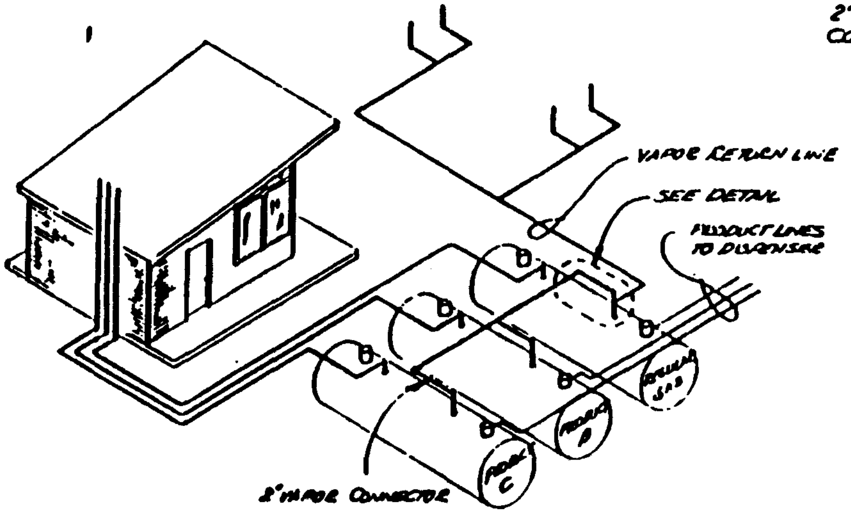
Healy Vapor Recovery System
Typical Installation
of Dispenser Components



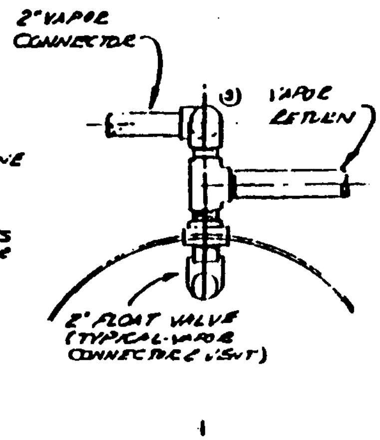
Executive Order G-70-70-AB
Typical Piping Arrangement
Healy Phase II Vapor Recovery System with Multi Jet Pump







ALTERNATE VAPOR PLUMBING



VAPOR CONNECTOR DETAIL

NOTES

1. THIS DRAWING IS FOR ILLUSTRATIVE PURPOSES ONLY. THIS PLAN SHOWS A GENERAL ARRANGEMENT AND IS INTENDED AS A GUIDELINE FOR A TYPICAL MULTI-PRODUCT VAPOR RECOVERY INSTALLATION. THE GENERAL ARRANGEMENT SHALL BE MODIFIED TO SUIT INDIVIDUAL INSTALLATION AND CONDITIONS AND IS NOT TO BE USED FOR ACTUAL DESIGN AND INSTALLATION.
2. INSTALLATION SHALL BE DONE IN COMPLIANCE WITH THE REQUIREMENTS SPECIFIED HEREIN; CALIFORNIA AIR RESOURCES BOARD REGULATIONS, CALIFORNIA STATE FIRE MARSHAL REGULATIONS, SUB-CHAPTER 11.3 AND LOCAL APCD RULES.
3. ALL PIPING AND FITTINGS SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS AND SPECIFICATIONS. METAL PIPE SHALL BE MINIMUM SCHEDULE 40 WELDED OR SEAMLESS STEEL PIPE PER ASTM A-53, GALVANIZED, AND FITTINGS SHALL BE 150# SCREWED MALLEABLE IRON, GALVANIZED. ALL NON-METALLIC PIPE AND FITTINGS SHALL BE U/L APPROVED.
4. (3) DENOTES SWING JOINTED PIPE.
5. VAPOR RETURN LINES AND VENT LINES TO BE 3" DIAMETER PIPE UNLESS OTHERWISE NOTED. SLOPE MUST BE MINIMUM 1/8" PER FOOT, WITHOUT SAGS OR TRAPS, DRAINING CONTINUOUSLY TOWARD PRODUCT STORAGE TANK.
6. VAPOR RETURN LINE MUST RETURN TO REGULAR GASOLINE TANK
7. VENT LINES MUST BE SEPARATED BY PRODUCT.
8. ALL VAPOR PIPING TRENCHING MUST BE COMPACTED TO [illegible] BEFORE THE PIPES ARE INSTALLED AND BACKFILLED WITH SAND AT LEAST SIX INCHES BELOW AND ABOVE THE PIPING.
9. THE VAPOR RETURN PIPE SHOULD ENTER A SEPARATE UNDERGROUND TANK OPENING FROM THAT CONNECTED TO THE VENT PIPE OR STAGE I PIPING.
10. FLOW RESTRICTING DEVICES SHALL NOT BE INSTALLED ON VENT PIPE.
11. GROOVE 1" RISER WITH PIPE CUTTER; LEAVE 1/32" TO 3/64" RADIAL WALL AS SHEAR SECTION. LOCATE @ 3/4" TO GROUND LINE.
12. 1/2" COPPER TUBING OR FIRE MARSHAL APPROVED HOSE WITH BARBS AND HOSE CLAMPS MAY BE USED AS INDICATED ON DWG. NO. C-7010-181.
13. MIXING TUBE AND MEDIUM TUBE EXTENSION MAY BE [illegible] FROM JET PUMP BASE FOR INSERTION INTO 1" VAPOR RISER. [illegible] SHEAR SECTION AS INDICATED.

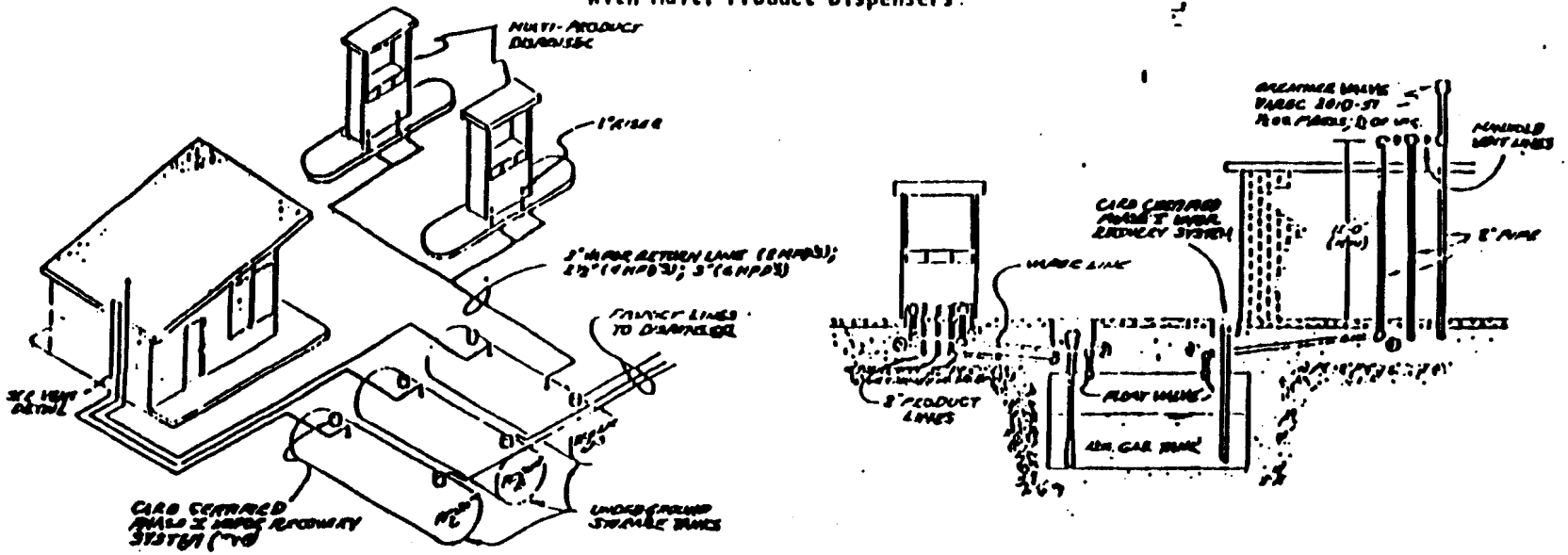
DO NOT SCALE THIS DRAWING

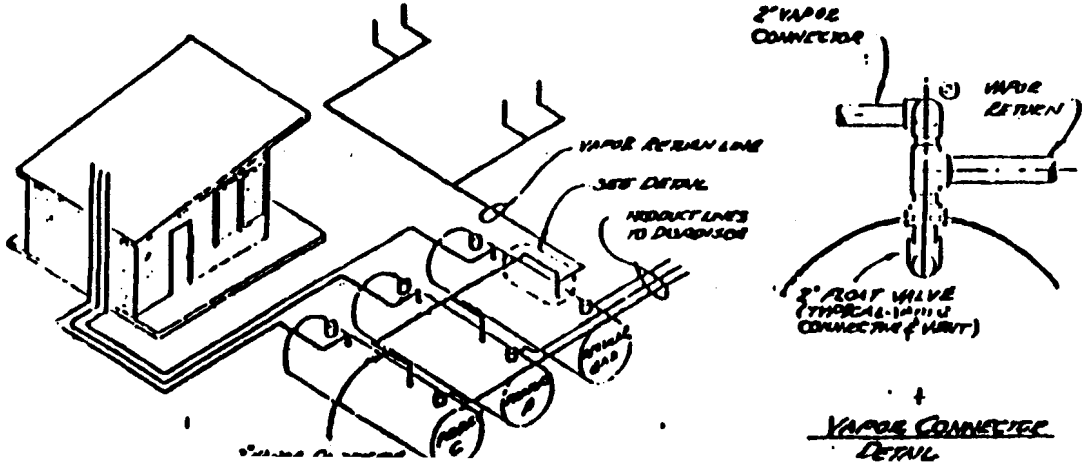
TYPICAL INSTALLATION
HEALY PHASE II
(MULTI-PROD. DISPENSER)

C-7010-183

EXHIBIT 3

Executive Order G-70-70-AB
Typical Piping Arrangement
Healy Phase II Vapor Recovery System
with Multi-Product Dispensers.





Alternate Vapor Plumbing

Vapor Connector Detail

Exhibit 5

Executive Order G-70-70-AB

List of Components for Healy Phase II
Vapor Recovery System

	Item	Model	State Fire Marshal Identification No.
1.	Nozzle	Healy Model 200	005:024:002
	Notes:	Leaded and unleaded spouts are interchangeable. Nozzle must shut off at -10 inches H_2O or less and +10 inches H_2O or greater. Flow rate is limited to 10 gallons or less per minute.	
2.	Riser		
	Notes:	Riser must be 16 inches or longer and have an inside diameter of no less than 3/4 inches. One inch inside diameter riser required with multi-product dispenser.	
3.	Jet pump	Healy Model 100	005:024:004
	Notes:	A single jet pump may not be connected to more than one vapor/ liquid hose where more than one hose can be dispensing gasoline simultaneously. Gasoline that flows through the jet pump and components of the jet pump must first be strained by the dispenser filter or by a filter approved by the manufacturer.	
4.	Hose Adapter	Healy Model CX-6	005:024:005
5.	Vapor Line		
	Notes:	The vapor line connecting the jet pump with the coaxial hose adapter shall consist of durable material listed for use with gasoline. It shall be no less than 3/8 inch inside diameter and shall be installed unobstructed. The vapor tube at the top of each side of a multi-product dispenser must be manifolded such that liquid that is taken from either vapor hose cannot enter the vapor path of another hose. The vapor tube extending from top to bottom of a dispenser must be 5/8 inch or greater inside diameter. The vapor tube from the bottom of the 5/8 inch or greater line to the jet pump shall be 3/8 inch inside diameter.	

Exhibit 5 (Continued)

Executive Order G-70-70-AB

List of Components for Healy Phase II
Vapor Recovery System

Item	Model	State Fire Marshal Identification No.
6. Vapor/Liquid Coaxial Hose	Healy Model CX	005:024:003
Notes: The coaxial hose shall not exceed a hose length of 13 ft. The hose must clear the island when the nozzle is in place on a multi-product dispenser.		
7. Nozzle Swivel	Healy Model S	
Notes: Swivel required on nozzle end of coaxial hose when used with multi-product dispensers. Swivel optional on nozzle end of coaxial hose when used with other dispensers.		
8. Control Valve	Healy Model 143	
Notes: Healy Model 143 control valve required on systems installed with multi-product dispenser.		
9. Multi-Jet Pump		
Notes: Gasoline that flows through Multi-Jet Pump and Components of the Multi-Jet Pump must first be strained by a filter approved by the manufacturer.		
10. Pressure Vacuum Valve	VAREC 2010-811-2 Hazlett H-PVB-1	
Notes: Pressure vacuum valve must have a release pressure setting equal to 1.0 inch of water column.		

Exhibit 6

1. Vent pipes shall be adequately supported throughout their length and when they are supporting weights in addition to their own, additional supports may be required; anchor to building or other structure.

2. Tank vent pipes shall not be obstructed.

3. On Healy systems not incorporating the Multi-Jet Pump, tank vent pipes shall terminate into the open atmosphere and the vent outlet shall be not less than 12 feet above the adjacent ground level. The outlet shall vent upward or horizontally and be located to eliminate the possibility of vapors accumulating or traveling to a source of ignition or entering adjacent buildings.

4 On Healy systems incorporating the Multi-Jet Pump, tank vent pipes shall be manifolded into a single vent pipe to which a pressure vacuum valve is attached. The pressure vacuum valve shall be approved by the State Fire Marshal and have a release pressure equal to 1.0 inch of water column. The vent outlet shall be not less than 12 feet above the adjacent ground level. The pressure vacuum valve outlet shall vent upward and be located to eliminate the possibility of vapors accumulating or traveling to a source of ignition or entering adjacent buildings.

5. All vapor return and vent piping shall be provided with swing joints at each tank connection, and at the base of the vent riser where it fastens to a building or other structure.

6. Locate 1" riser with double swing connection to 2" run for best mounting position inside multi-product dispenser. Allow for 1/2" O.D. copper gasoline tie-in to regular (leaded) riser. When a swing joint is used in a riser containing a shear section, the riser must be rigidly supported.

7. On Healy Phase II Vapor Recovery Systems not incorporating Cambridge Engineering's Multi-Jet Pump, all horizontal lines to be sloped 1/8" per foot minimum.

8. On Healy Phase II Vapor Recovery Systems not incorporating Cambridge Engineering's Multi-Jet Pump, all horizontal lines must be sized to freely drain up to 2 gpm from each jet pump.

State of California
AIR RESOURCES BOARD

Executive Order G-70-7-AB

Certification of the Hasstech Model VCP-2 and VCP-2A
Phase II Vapor Recovery Systems

WHEREAS, the Air Resources Board (the "Board") has established, pursuant to Sections 39600, 39601, and 41954 of the Health and Safety Code, certificatio procedures for systems designed for the control of gasoline vapor emissions during motor vehicle refueling operations ("Phase II Vapor Recovery Systems" in its "Certification Procedures for Gasoline Vapor Recovery Systems at Service Stations" as last amended December 4, 1981 (the "Certification Procedures"), incorporated by reference in Section 94001 of Title 17, California Administrative Code;

WHEREAS, the Board has established, pursuant to Sections 39600, 39601, and 41954 of the Health and Safety Code, test procedures for determining compliance of Phase II vapor recovery systems with emission standards in its "Test Procedures for Determining the Efficiency of Gasoline Vapor Recovery Systems at Services Stations" as last amended December 4, 1981 (the "Test Procedures"), incorporated by reference in Section 94000 of Title 17, California Administrative Code;

WHEREAS, Hasstech has applied for certification of the Hasstech Model HP-11 vapor recovery nozzle for use with the Hasstech Phase II vapor recovery systems;

WHEREAS, the Hasstech Model HP-11 vapor recovery nozzle has been evaluated when used with the Hasstech Phase II vapor recovery systems pursuant to the Board's Certification Procedures and Test Procedures;

WHEREAS, Section VIII.A of the Certification Procedures provides that the Executive Officer shall issue an order of certification if he or she determines that a vapor recovery system conforms to all of the requirements set forth in paragraphs I through VII;

WHEREAS, I find that the Hasstech Phase II vapor recovery systems, modified to use the Hasstech Model HP-11 vapor recovery nozzle, conform with all the requirements set forth in paragraphs I through VII of the Certification Procedures and are at least 95 percent effective for attendant and/or self-serve use at gasoline service stations when used in conjunction with Phase I vapor recovery systems that have been certified by the Board.

NOW, THEREFORE, IT IS HEREBY ORDERED that the certification, Executive Order G-70-7-AA issued on December 3, 1982 for the Hasstech VCP-2 and VCP-2A Phase II vapor recovery systems is hereby modified to include the Hasstech Model HP-11 vapor recovery nozzle. The maximum dispensing rate for the Hasstech Model HP-11 vapor recovery nozzle shall be 12 gallons per minute.

IT IS FURTHER ORDERED that the systems are certified to be at least 95 percent effective in the self-serve and/or attendant use at gasoline service stations when used with Board-certified Phase I vapor recovery systems. These systems are described in Exhibit I. All certified components are listed in Exhibit 2.

IT IS FURTHER ORDERED that compliance with the applicable certification requirements and rules and regulations of the Division of Measurement Standards, and the State Fire Marshal's Office is made a condition of this certification.

IT IS FURTHER ORDERED that the systems certified hereby shall perform in actual use with the same effectiveness as the certification test systems. Compliance with this performance criterion shall be a condition of this certification, and failure to meet this criterion shall constitute grounds for revocation, suspension or modification of this certification.

IT IS FURTHER ORDERED that any alteration of the equipment, parts, design, or operation of the configurations certified hereby, is prohibited, and deemed inconsistent with this certification, unless such alteration has been approved by the undersigned or the Executive Officer's designee.

IT IS FURTHER ORDERED that all nozzles approved for use with these systems shall be 100 percent performance checked at the factory including checks of proper functioning of all automatic shut-off mechanisms.

IT IS FURTHER ORDERED that the certified Phase II vapor recovery systems shall, at a minimum, be operated in accordance with the manufacturer's recommended maintenance intervals and shall use the manufacturer's recommended operation, installation, and maintenance procedures, if available.

IT IS FURTHER ORDERED that the certified Phase II vapor recovery system selected for installation shall be performance tested during installation for ability to dispense gasoline and collect vapors without difficulty in the presence of the station manager or other responsible individual. The station manager, owner, or operator shall be provided with instructions on the proper use, maintenance, and repair of the system, and where system components can be readily obtained. A copy of the system warranty shall also be made available to the station manager, owner, or operator.

Executed at Sacramento, California this 22 day of [illegible], 1985.

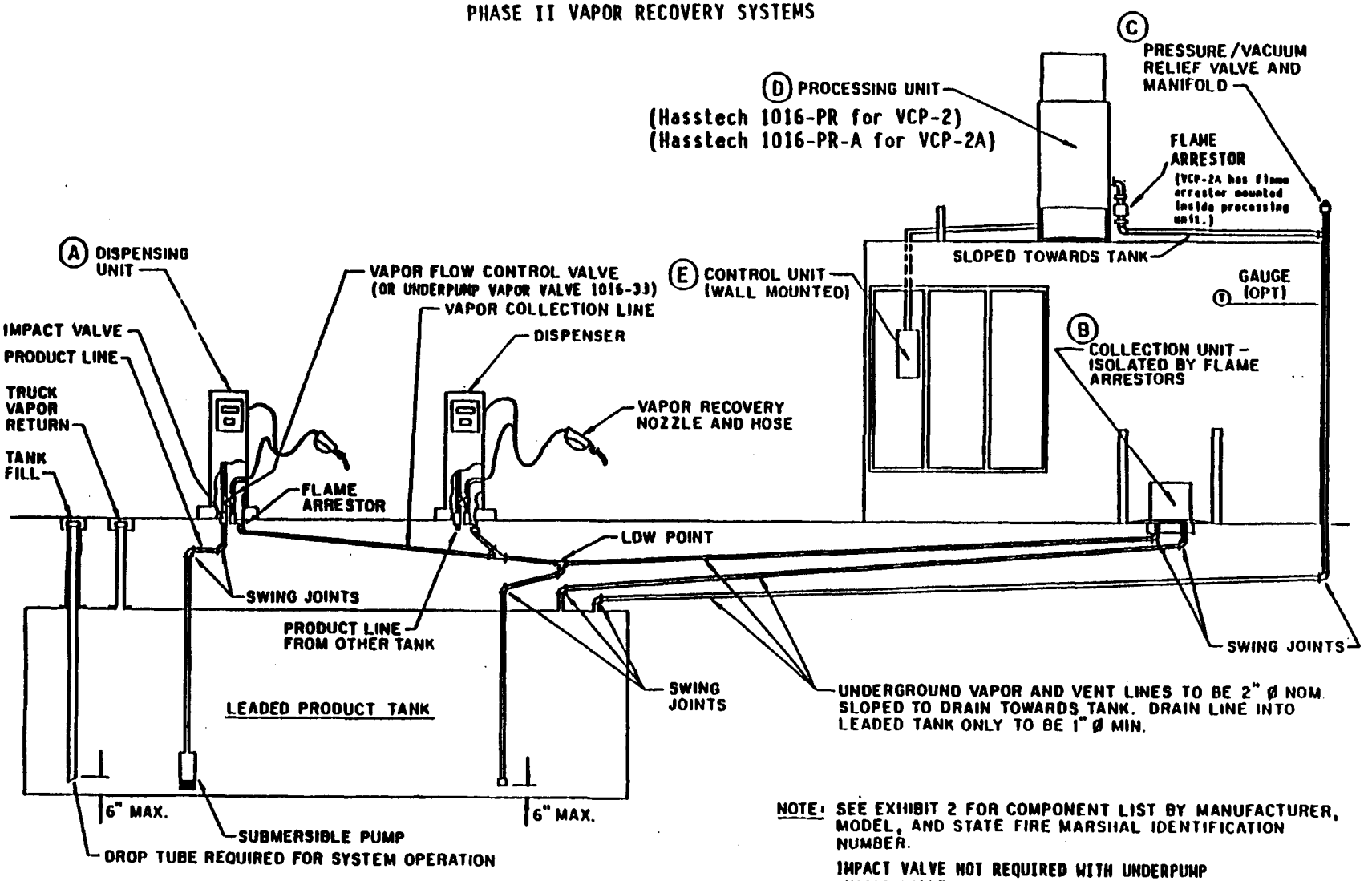
James D. Boyd
Executive Officer

EXHIBIT 1

EXECUTIVE ORDER G-70-7-AB

Hasstech Models VCP-2 and VCP-2A

PHASE II VAPOR RECOVERY SYSTEMS



NOTE: SEE EXHIBIT 2 FOR COMPONENT LIST BY MANUFACTURER, MODEL, AND STATE FIRE MARSHAL IDENTIFICATION NUMBER.

IMPACT VALVE NOT REQUIRED WITH UNDERPUMP VAPOR VALVE, HASSTECH COMPONENT 1016-33.

EXHIBIT 2

Executive Order G-70-7-AB

Hasstech Models VCP-2 and VCP-2A
Phase II Vapor Recovery Systems
Components List

Item		Manufacturer and Model	State Fire Marshal Identification Number	Substitute Equipment: Manufacturer and Model	Substitute Equipment: State Fire Marshal Identification Number
A.	Dispenser Unit				
1.	Nozzle	HP-1, HP-11	1016-1	Husky HP-2	1016-1
2.	Vapor Hose 1/2 inch or Greater I.D.	Hasstech	1016-2		
3.	Flow Control Valve	ITT-General Control SF1FE01A101H or SF1FE01A102	1016-3		
4.	Impact Valve	A. Y. McDonald 9760176	1016-4	Hasstech	1016-33
5.	Flame Arrestor	Hasstech 1025-3/4"	1016-5		
6.	Hose Swivels	State Fire Marshal Approved			
B.	Collection Unit				
1.	Pump Inlet Flame Arrestor	Protectoseal SP 4951 (1 1/4")	1016-6		
2.	Collection Pump	Rotron D313 or D 312	1016-7		
3.	Pump Outlet Flame Arrestor	Protectoseal SP 4951 (1 1/4")	1016-8		
C.	Safety Relief				
1.	P/V Valve	Varec 2010-811-2	1016-9		
1.	Processing Unit	Hasstech	1016-PR (for VCP-2) or 1016-PR-A (for VCP-2A)		

EXHIBIT 2 (Continued)

Executive Order G-70-7-AB

Hasstech Models VCP-2 and VCP-2A
Phase II Vapor Recovery Systems
Components List

Item	Manufacturer and Model	State Fire Marshal Identification Number	Substitute Equipment	
			Manufacturer and Model	State Fire Marshal Identification Number
E. Control Unit	Hasstech	1016-CP		
F. Optional Components				
1. In-Tank Drain Check	Hasstech 1044	1016-31		
2. Out-of-Tank Drain Check	Hasstech 1042	1016-32		

State of California
AIR RESOURCES BOARD

Executive Order G-70-118

Certification of the Amoco V-1
Vapor Recovery System

WHEREAS, the Air Resources Board (the "Board") has established, pursuant to Sections 39600, 39601, and 41954 of the Health and Safety Code, certification procedures for systems designed for the control of gasoline vapor emissions during motor vehicle fueling operations. ("Phase II vapor recovery systems") in its "Certification Procedures for Gasoline Vapor Recovery Systems at Service Stations," adopted March 30, 1976 and amended August 25, 1977 and December 4, 1981 (the "Certification Procedures"), incorporated by reference in Section 94001 of Title 17, California Administrative Code; Code of Regulations.

WHEREAS, the Board has established, pursuant to Sections 39600, 39601, and 41954 of the Health and Safety Code, test procedures for determining compliance of Phase II vapor recovery systems with emission standards in its "Test Procedures for Determining the Efficiency of Gasoline Vapor Recovery Systems at Service Stations," adopted on December 9, 1975 and amended on March 30, 1976, August 9, 1978, December 4, 1981 and September 1, 1982 (the "Test Procedures"), incorporated by reference in Section 94000 of Title 17, California Administrative Code; Code of Regulations.

WHEREAS, the Amoco Oil Company, has applied for certification of its Amoco V-1 Vapor Recovery System;

WHEREAS, the Amoco V-1 Vapor Recovery System has been evaluated pursuant to the Air Resources Board's Certification Procedures and Test Procedures;

WHEREAS, Section VII-A of the Certification Procedures provides that the Executive Officer shall issue an order of certification if he or she determines that a vapor recovery system conforms to all of the requirements set forth in Sections I through VII of the Certification Procedures;

WHEREAS, I find that the Amoco V-1 Vapor Recovery System conforms with all of the requirements set forth in Sections I through VII of the Certification Procedures as amended on December 4, 1981, and would result in a vapor recovery system that is at least 95 percent effective for attendant and/or self-serve use at gasoline service stations when used in conjunction with Phase I vapor recovery systems that have been certified by the Board;

NOW, THEREFORE, IT IS HEREBY ORDERED that the Amoco V-1 Vapor Recovery System is hereby certified to be at least 95 percent effective in the self-serve and/or attendant use at gasoline service stations when used with a Board certified Phase I vapor recovery system. A typical piping arrangement for this system is described in Exhibit 1. A typical gasoline dispenser configuration showing the vapor pump and nozzle is shown in Exhibit 2. Certified components are listed in Exhibit 3.

IT IS FURTHER ORDERED that compliance with the applicable certification requirements and rules and regulations of the Division of Measurement Standards, the State Fire Marshal's Office and the Division of Occupational Safety and Health of the Department of Industrial Relations is made a condition of this certification.

IT IS FURTHER ORDERED that the Amoco V-1 Vapor Recovery System certified hereby shall perform in actual use with the same effectiveness as the certification test system. Compliance with this performance criterion shall be a condition of this certification, and failure to meet this criterion shall constitute grounds for revocation, suspension or modification of this certification.

IT IS FURTHER ORDERED that any alteration of the equipment, parts, design, or operation of the configurations certified hereby, is prohibited, and deemed inconsistent with this certification, unless such alteration has been approved by the undersigned or the Executive Officer's designee.

IT IS FURTHER ORDERED that the certified Phase II vapor recovery system shall, at a minimum, be operated in accordance with the manufacturer's recommended maintenance intervals and shall use the manufacturer's recommended operation, installation, and maintenance procedures, if available.

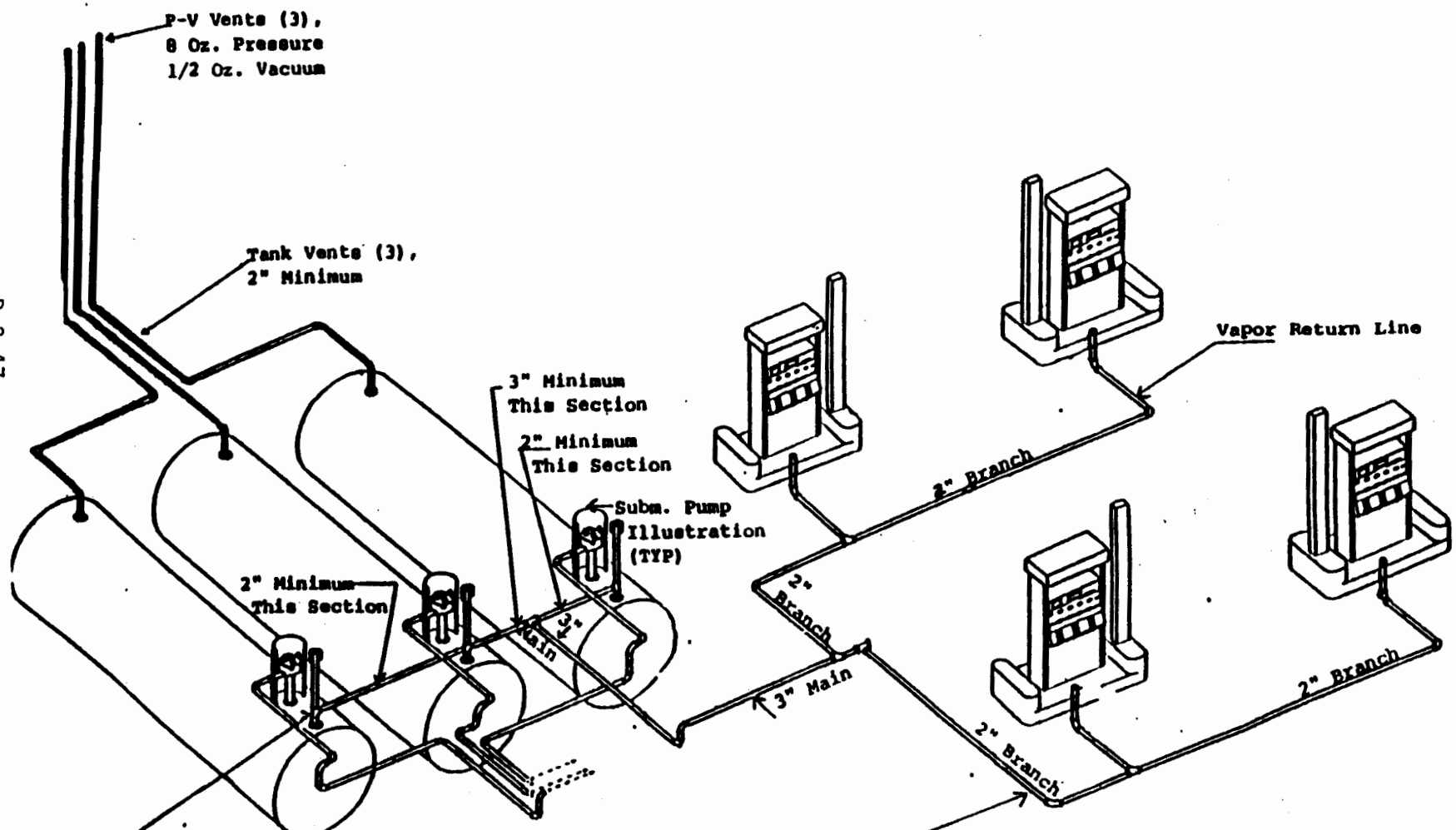
IT IS FURTHER ORDERED that the certified Phase II vapor recovery system shall be performance tested during installation for ability to dispense gasoline and collect vapors without difficulty in the presence of the station manager or other responsible individual. The station manager, owner, or operator shall be provided with instructions on the proper use, maintenance, and repair of the system, and where system components can be readily obtained. A copy of the system warranty shall also be made available to the station manager, owner, or operator.

Executed at Sacramento, California this 24th day of March 1988.

James D. Boyd
Executive Officer

Executive Orde_ G-70-118
Amoco Oil Company Phase II
Vapor Recovery System

(See Exhibit 2 and latest revision of Executive Order G-70-52 for Component List by Manufacturer, Model, and State Fire Marshal Identification Number.)



Air Resources Board approved coaxial or two-point Phase II systems are acceptable.

If individual vapor return lines are used, they shall be a minimum of 2".

EXECUTIVE ORDER G-70-118
NOTES TO ACCOMPANY EXHIBIT 1

1. For non-retail outlets which fuel special vehicles, the installation of vapor recovery hoses longer than specified in the latest version of Executive Order G-70-52 are allowed if the following conditions are met:

   a. The non-retail outlet fuels special vehicles such as large trucks, large skip loaders, off-the-road equipment, etc. where reaching the fill pipe requires longer hoses.

   b. The vapor return hoses are arranged to be self-draining or provisions are made to drain the hoses after each refueling or the system incorporates an approved liquid blockage detection system arranged to cease dispensing when a blockage occurs.

   c. The Executive Officer of the Air Resources Board or his/her designee has approved the plans for compliance with condition b.

2. The vent pipes and vent manifold shall be adequately supported throughout their length and when they are supporting weights in addition to their own, additional supports may be required, such as anchoring to a building or other structure.

3. All vapor return and vent piping shall be equipped with swing joints at the base of the riser to each dispensing unit, at each tank connection, and at the base of the vent riser where it fastens to a building or other structure. When a swing joint is used in a riser containing a shear section, the riser must be rigidly supported.

4. On new installations, float check valves (or alternate equipment, design, or operating procedures acceptable to the Air Resources Board) are required for all underground manifolded piping to prevent contamination of unleaded gasoline with leaded gasoline, via vapor recovery piping, during underground storage tank loading or overfill.

Exhibit 2

Executive Order G-70-118
Hasco V-1 Vapor Recovery System
Typical Dispenser Schematic

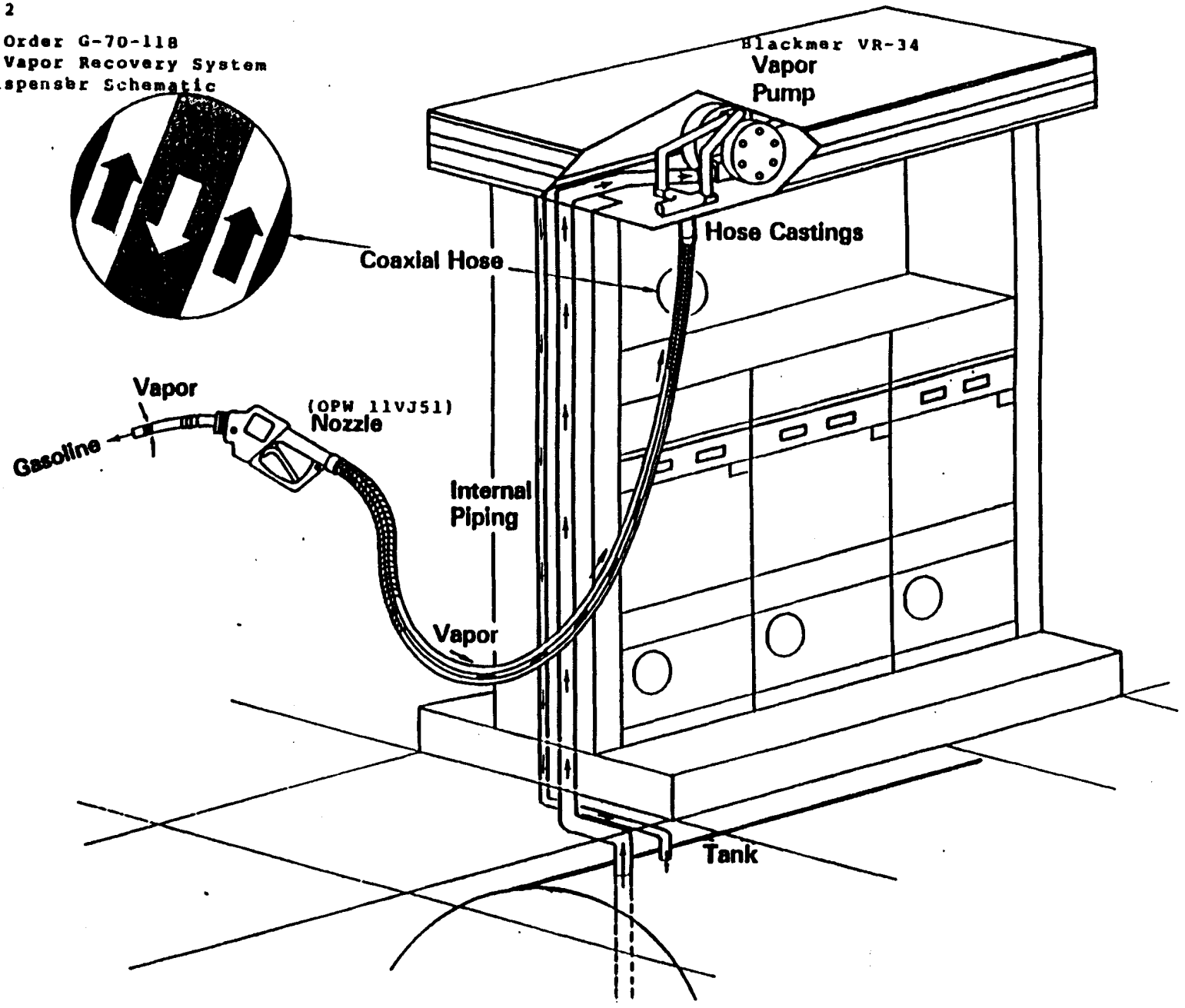


Exhibit 8

Executive Order G-70-118

Amoco V-1 Vapor Recovery System

Component List

Item	Manufacturer/Model	State Fire Marshal Identification No.
Vapor Recovery Coaxial Nozzle	OPW 11-V J-81	005:008:043
Vapor Pump	Blackmer Model VR-34	001:039:001
Coaxial Hose	Dayco Petroflex 2000 Model 7574 with venturi pickup	005:033:004
	Goodyear Maxxim with	005: 36:001
	Gilbarco Venturi Liquid Removal System	005:026: 11
Dispenser	Dresser Wayne 1/ Model 390-IL	
Pressure Vacuum Vents	OPW 823(2") or 823-S(2") set at 8 oz. pressure 1/2 oz. vacuum	

1/ The dispenser must be installed in with the hose configuration shown in Air Resources Board Executive Order G-70-82 AI, Exhibit 10.

State of California
AIR RESOURCES BOARD

Executive Order G-70-36-AC
Relating to Modification of Certification
of the OPW Balance Phase II
Vapor Recovery System

WHEREAS, the Air Resources Board (the "Board") has established, pursuant to Sections 39600, 39601, and 41954 of the Health and Safety Code, certification procedures for systems designed for the control of gasoline vapor emissions during motor vehicle fueling operations ("Phase II vapor recovery systems") in its "Certification Procedures for Gasoline Vapor Recovery Systems at Service Stations" as last amended December 4, 1981 (the "Certification Procedures"), incorporated by reference in Section 94001 of Title 17, California Administrative Code;

WHEREAS, the Board has established, pursuant to Sections 39600, 39601, and 41954 of the Health and Safety Code, test procedures for determining compliance of Phase II vapor recovery systems with emission standards in its "Test Procedures for Determining the Efficiency of Gasoline Vapor Recovery Systems at Service Stations" as last amended September 1, 1982 (the "Test Procedures"), incorporated by reference in Section 94000 of Title 17, California Administrative Code;

WHEREAS, on February 20, 1983 the Dover Corporation/OPW Division ("OPW") received certification in Executive Order G-70-36-AB for the OPW 11V Model F vapor recovery nozzle, used in conjunction with an external vapor check valve, for use with the Balance Phase II vapor recovery systems.

WHEREAS, on August 6, 1986, OPW requested certification of a vapor recovery nozzle for use with Balance Phase II vapor recovery systems which is to be designated as the OPW 11V Model F and which is identical to the previously certified OPW 11V Model F except that it incorporates an internal check valve rather than an external check valve;

WHEREAS, Section VIII-A of the Certification Procedures provides that the Executive Officer shall issue an order of certification if he or she determines that a vapor recovery system conforms to all of the requirements set forth in Sections I through VII of the Certification Procedures;

WHEREAS the OPW IIV Model F vapor recovery nozzle incorporating an internal check valve no longer necessitates use of the Model 119A vapor valve actuator and Model 119B vapor check valve external components;

WHEREAS, I find that the OPW 11V Model F coaxial vapor recovery nozzle incorporating an internal check valve, when used with the Balance Phase II vapor recovery system at all new and existing installations, conforms with all the requirements set forth in Sections I through VII of the Certification Procedures;

NOW THEREFORE, IT IS HEREBY ORDERED that Executive Order G-70-36-AB is hereby modified to replace the previously identified configuration with the OPW 11V Model F vapor recovery nozzle incorporating an internal check valve, for use with the OPW Balance Phase II vapor recovery system.

IT IS FURTHER ORDERED that where an OPW balance type vapor recovery system is to be installed at a new installation only the OPW balance type coaxial vapor recovery nozzles and coaxial hose configurations may be used.

IT IS FURTHER ORDERED that this system is certified to be at least 95 percent effective in the self-serve and/or attendant use at gasoline service stations when used with a Board certified Phase I vapor recovery system. Typical piping arrangements for this system are described in Exhibits 1 and 2. All certified components are listed in the latest revision of Executive Order G-70-52.

IT IS FURTHER ORDERED that the OPW 11V Model F vapor recovery nozzle shall be installed as shown in Exhibit 3.

IT IS FURTHER ORDERED that compliance with the applicable certification requirements and rules and regulations of the Division of Measurement Standards, the Office of the State Fire Marshal, and the Division of Occupational Safety and Health of the Department of Industrial Relations is made a condition of this certification.

IT IS FURTHER ORDERED that the components certified hereby shall perform in actual use with the same effectiveness as the certification test system.

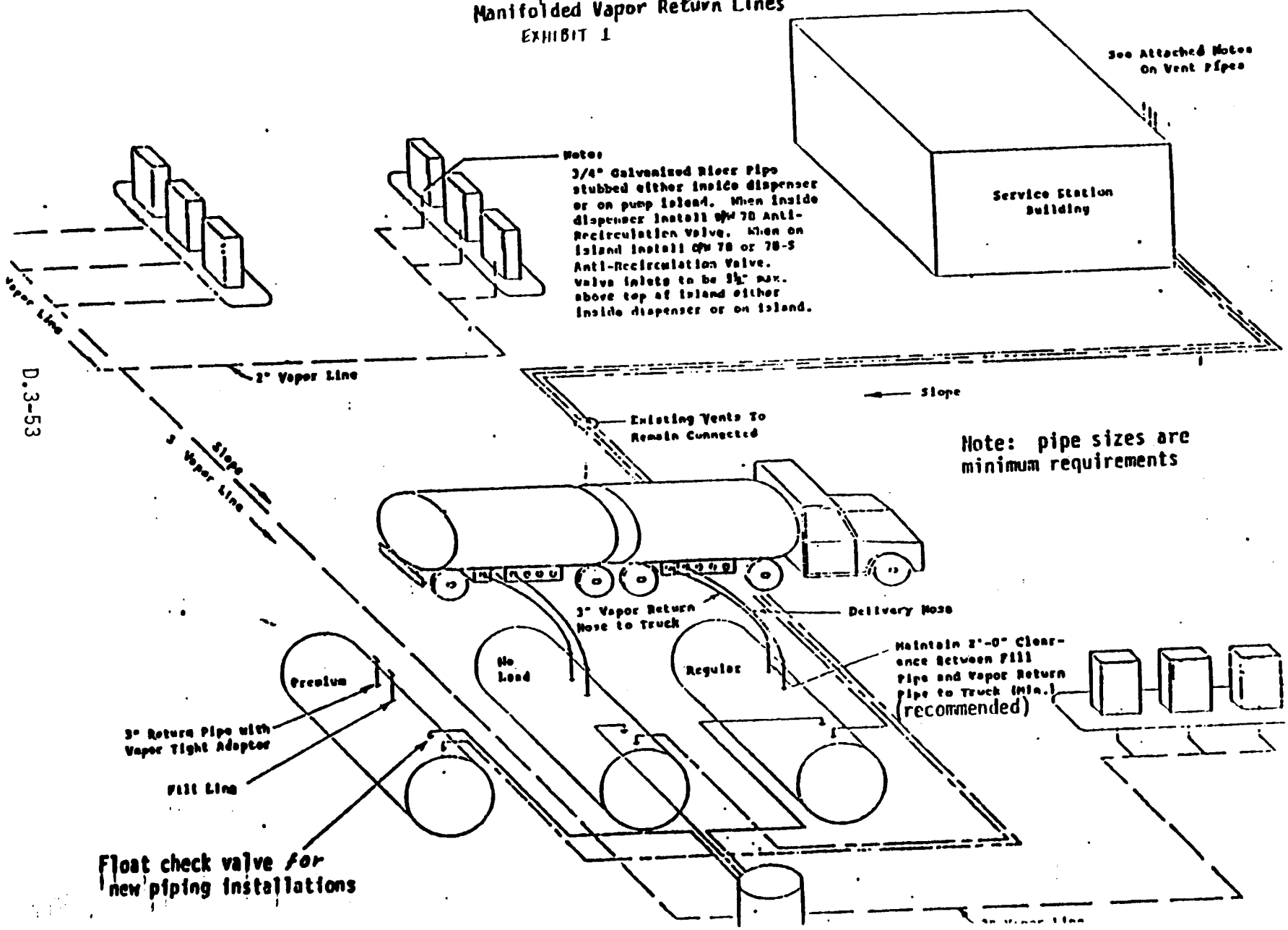
IT IS FURTHER ORDERED that any alteration of the equipment, parts, design, or operation of the configurations certified hereby, is prohibited, and deemed inconsistent with this certification, unless such alteration has been approved by the Executive Officer or his/her designee.

IT IS FURTHER ORDERED that all nozzles approved for use with the Phase II vapor recovery systems specified in this Executive Order shall be 100 percent performance checked at the factory including checks of proper functioning of all automatic shut-off mechanisms.

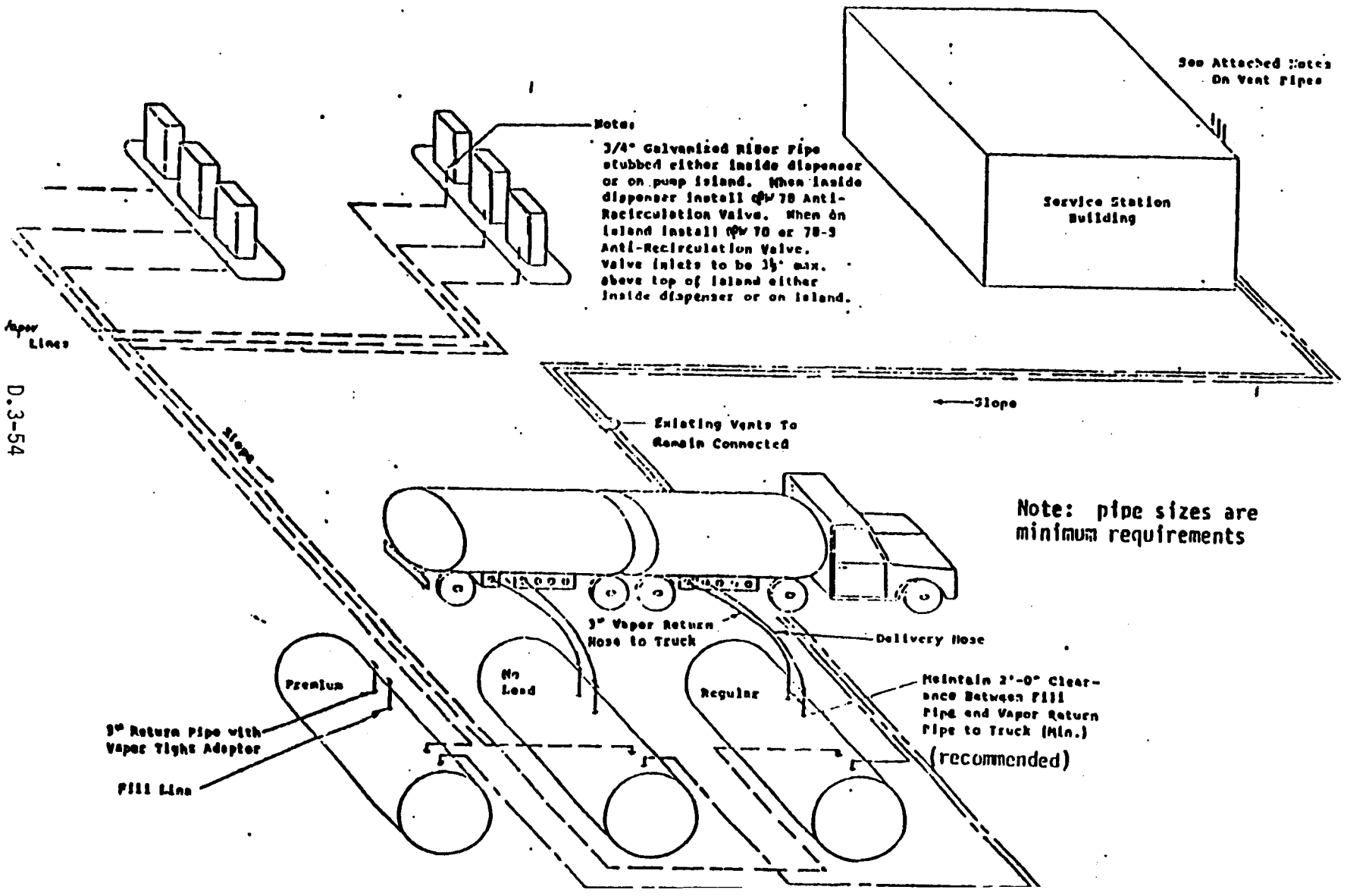
Executed at Sacramento, California this 24th day of December, 1986.

James D. Boyd
Executive Officer

OPW Balanc hase II
Vapor Recovery System
Manifolded Vapor Return Lines
EXHIBIT 1



OPW Balance Phase II
Vapor Recovery System
Individual Vapor Return Lines



EXECUTIVE ORDER G-70-36-AC

NOTES TO ACCOMPANY EXHIBITS 1 AND 2

1. For non-retail outlets which fuel special vehicles, the installation of vapor recovery hoses longer than specified in the latest version of Executive Order G-70-52 are allowed if the following conditions are met:

   a. The non-retail outlet fuels special vehicles such as large trucks, large skip loaders, off-the-road equipment, etc., where reaching the fill pipe requires longer hoses.

   b. The vapor return hoses are arranged to be self-draining or provisions are made to drain the hoses after each refueling or the system incorporates an approved liquid blockage detection system arranged to cease dispensing when a blockage occurs.

   c. The Executive Officer of the Air Resources Board or his/her designee has approved the plans for compliance with condition b.

2. The maximum allowable pressure drop through a system including nozzle, vapor hose, swivels, and underground piping is:

   a. 0.15 inch water at a flow of 20 CFH;

   b. 0.45 inch water at a flow of 60 CFH;

   c. 0.95 inch water at a flow of 100 CFH.

   A pressure drop test must be conducted with the drybreak to the underground tank open.

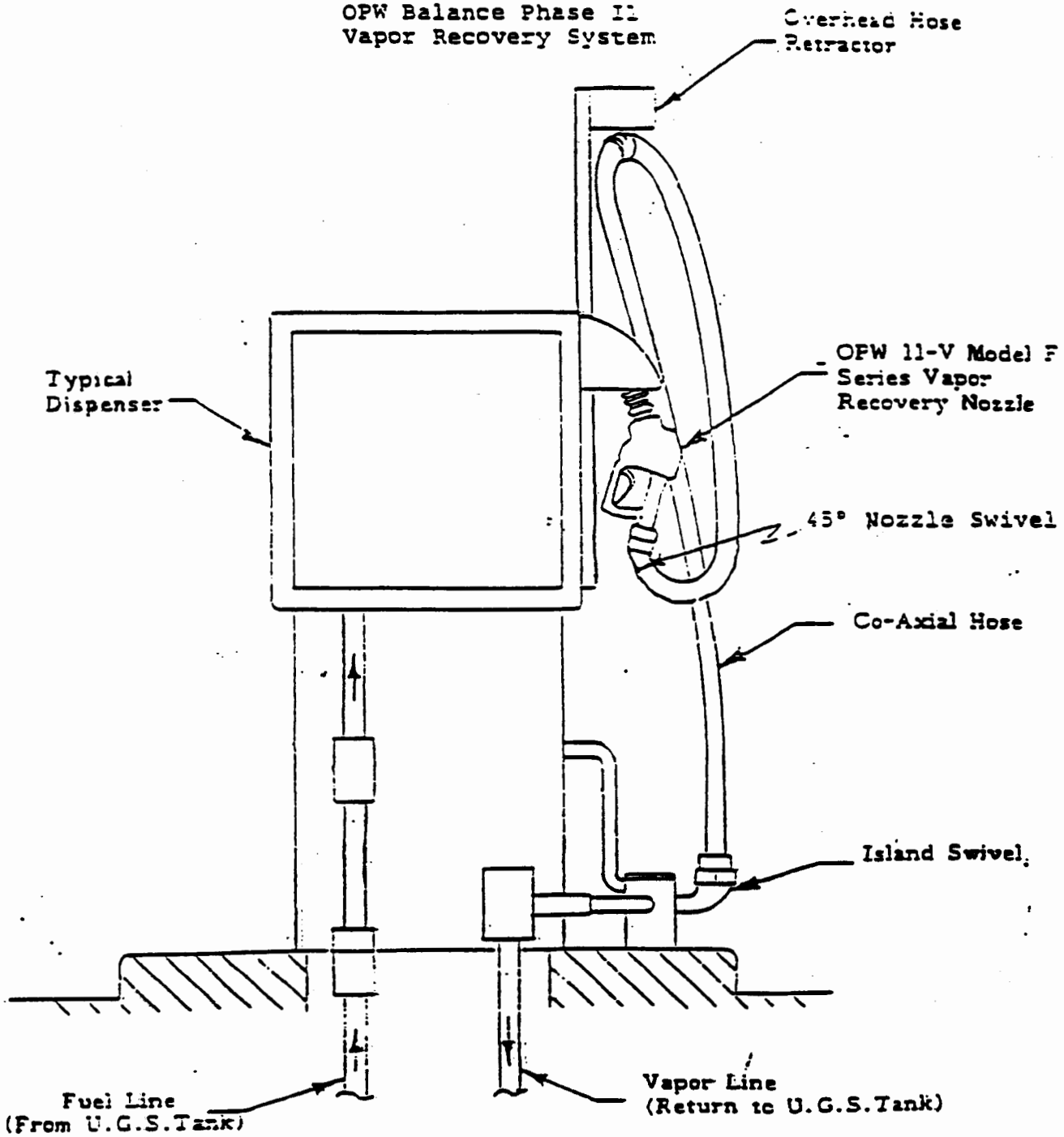
3. The vent pipes and vent manifold shall be adequately supported throughout their length and when they are supporting weights in addition to their own, additional supports may be required, such as anchoring to a building or other structure.

4. All vapor return and vent piping shall be equipped with swing joints at the base of the riser to each dispensing unit, at each tank connection, and at the base of the vent riser where it fastens to a building or other structure. When a swing joint is used in a riser containing a shear section, the riser must be rigidly supported.

5. Float check valves (or alternate equipment, design, or operating procedures acceptable to the Air Resources Board) are required for all underground manifold piping to prevent contamination of unleaded gasoline with leaded gasoline, via vapor recovery piping, during underground storage tank loading or overfill.

EXHIBIT 3

Executive Order G-70-36-AC
OPW Balance Phase II
Vapor Recovery System



State of California

AIR RESOURCES BOARD

Executive Order G-70-37-B

Relating to the Modification of the Certification of the Chevron Balance Phase II Vapor Recovery System with OPW Nozzles for Service Stations

Pursuant to the authority vested in the Air Resources Board (ARB) by Health and Safety Code Section 41954; and

Pursuant to the authority vested in the undersigned by Health and Safety Code Sections 39515 and 39516;

IT IS ORDERED AND RESOLVED: That the certification Executive Order G-70-37-A issued on November 15, 1979, for the Chevron balance Phase II vapor collection and disposal system is hereby modified to specify at least 95 percent effectiveness during self-serve use. The system is hereby certified to be at least 95 percent effective in self-serve and/or attendant use at gasoline service stations in conjunction with Phase I vapor recovery systems which have been certified by the Air Resources Board. The system is described in Exhibits 1, 2, and 3 attached hereto.

IT IS FURTHER ORDERED AND RESOLVED: That compliance with the applicable certification requirements and rules and regulations of the Division of Measurement Standards, the State Fire Marshal's Office, and the Division of Industrial Safety of the Department of Industrial Relations is made a condition of this certification.

IT IS FURTHER ORDERED AND RESOLVED: That the system certified hereby shall perform in actual use with the same effectiveness as the certification test system. Compliance with the applicable performance criterion shall be a condition of this certification, and failure to meet this criterion shall constitute grounds for revocation, suspension, or modification of this certification.

IT IS FURTHER ORDERED AND RESOLVED: That any alteration to the equipment, parts, design, or operation of the system certified hereby, is prohibited, and deemed inconsistent with this certification, unless such alteration has been approved by the undersigned.

IT IS FURTHER ORDERED AND RESOLVED: That the OPW-7VC nozzles shall be 100 percent performance checked at the factory including checks of proper functioning of all automatic shut-off mechanisms.

IT IS FURTHER ORDERED AND RESOLVED: That during installation of the OPW-7VC nozzles they shall be performance tested for ability to dispense gasoline without difficulty in the presence of the station manager or other responsible individual. The station manager, owner or operator shall also be provided with instructions on the proper use of the nozzles, their repair and maintenance, and where nozzle replacements and nozzle components can be readily obtained. A copy of the nozzle warranty shall be made available to the station manager, owner or operator.

IT IS FURTHER ORDERED AND RESOLVED: That in order for vapor return hoses longer than specified in this certification to be used the system shall incorporate a liquid blockage detector which is acceptable to the undersigned

Executed at Sacramento, California this 22nd day of January, 1980.

Thomas C. Austin
Executive Officer

EXHIBIT 2
Executive Order G-70-37-B
Chevron Balance Phase II

Vapor Recovery System
Individual Vapor Return Lines

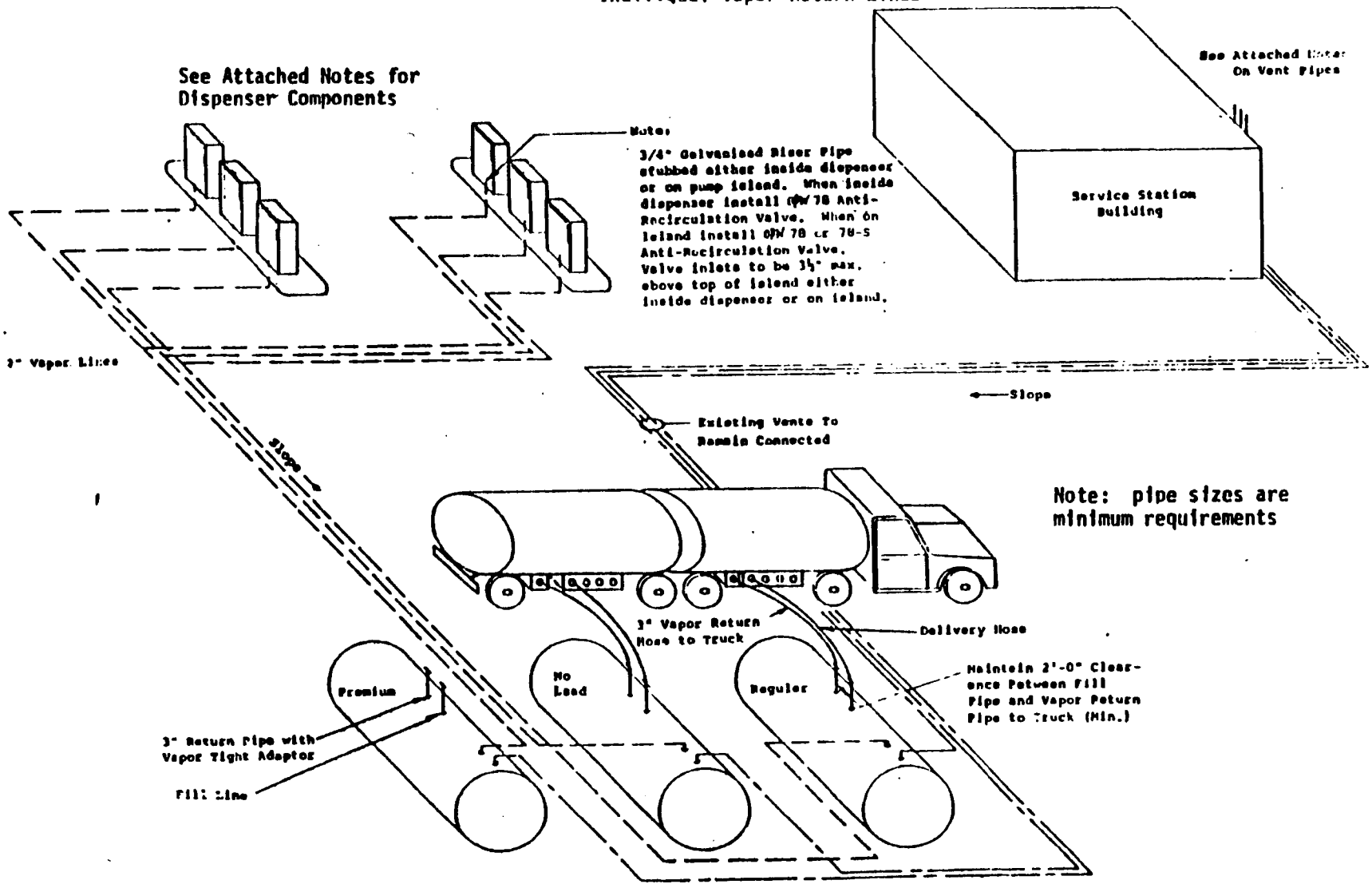
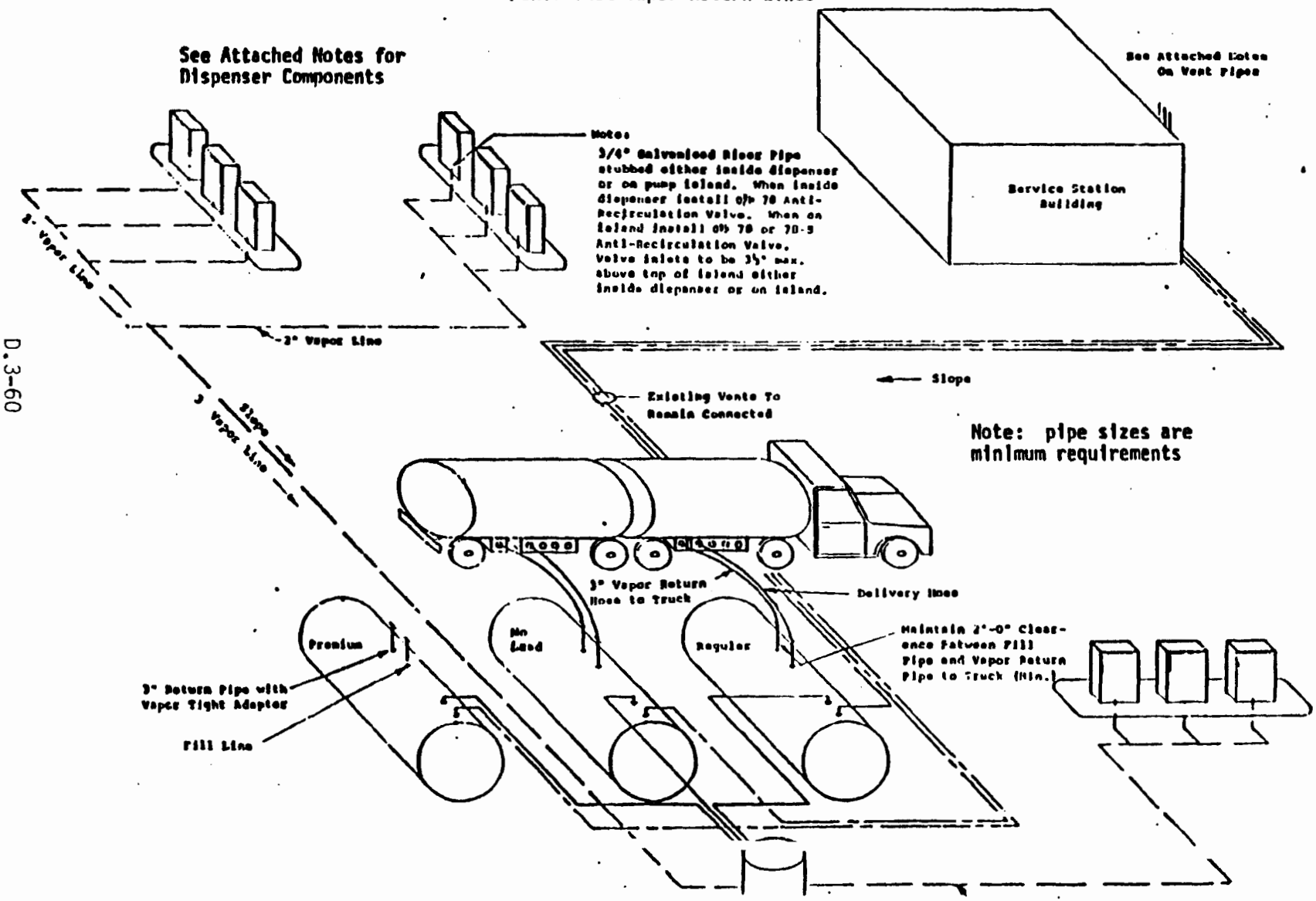


EXHIBIT 1
Executive Order G-70-37-B
Chevron Balance Phase II
Vapor Recovery System
Manifolded Vapor Return Lines



E xhibit 3
Executive Order G-70-37-B
Chevron Balance Phase II Vapor Recovery System with OPW Nozzles
for Service Stations

Component List

Item	Manufacturer and Model	State Fire Marshal Identification Number	Substitute Equipment	
			Manufacturer and Model	State Fire Marshal Identification Number
1a. Nozzle, leaded fuel	OPW 7-V Model C-22 OPW 7-V Model C-24	GVRC 001:008:18		
1b. Nozzle, unleaded fuel	OPW 7-V Model C-47 OPW 7-V Model C-49	GVRC 001:008:19		
2. Vapor hose	3/4 inch I.D. X 8 feet		5/8 inch I.D. X 8 feet	
3. Riser	3/4 inch or larger diameter Galvanized Pipe			
4. Anti-Recirculation Valve	OPW 78, 78-S, 78-E, or 78-ES	GVRC 001:008:13	Emco Wheaton A008-001	GVRC 001:007:4
5. Nozzle Swivel	State Fire Marshal approved 0.495 in. I.D. minimum			
6. Island Swivel	State Fire Marshal approved 0.495 in. I.D. minimum			

Pressure Drop Through the System[4]

(Includes Nozzle, Anti-Recirculation Valve, Vapor Hose, *Swivels*, and Underground Piping)

Flow (CFH)	Pressure Drop (inches H_2O)
20	~~0.2~~ *less than 0.15*
60	~~0.4~~ *less than 0.45*
100	~~0.9~~ *less than 0.95*

[4]*Pressure drop test to be conducted with drybreak to underground tank open.*

Executive Order G-70-37-B

Notes to Accompany Exhibits 1, 2 and 3

1. Vent pipes shall be adequately supported throughout their length and when they are supporting weights in addition to their own, additional supports may be required - anchor to building or other structure.
2. Tank vent pipes two inches or less in nom. inside diameter shall not be obstructed by any device unless the tank and its associated piping and other equipment is protected to limit back pressure development to less than the maximum working pressure of the tank, piping and other equipment by the installation of an approved pressure/vacuum vent, rupture disc or other venting devices installed in the tank vent pipes.

3. Tank vent pipes shall terminate into the open atmosphere and shall be not less than 12 feet above the adjacent ground level. The outlet shall vent upward or horizontally and be located to eliminate the possibility of vapors accumulating or traveling to a source of ignition or entering adjacent buildings.

4. All vapor return and vent piping shall be provided with swing joints at the base of the riser to each dispensing unit, at each tank connection, and at the base of the vent riser where it fastens to a building or other structure. When a swing joint is used in a riser containing a shear section the riser must be rigidly supported.

5. Each vapor hose shall be located such that the center line of the hose fitting, at the anti-recirculation valve (if externally mounted) or at the dispenser cabinet swivel mounting (if valve is internally mounted), is not

more than 3-1/2 inches above the top surface of the island and is as close as possible to the top surface of the island.

6. For dispenser islands greater than 5 feet in width, each vapor hose length shall not be longer than the sum of one-half the dispenser island width, in feet, plus 6 feet.

7. For only those non-retail outlets which fuel special vehicles, the installation of vapor recovery hoses longer than eight feet are allowed provided the following conditions are met:

   a. The non-retail outlet fuels special vehicles such as large trucks, large skip loaders, off-the-road equipment, etc. where reaching the fill pipe requires longer hoses.

   b. The vapor return hose length is no longer than required.

   c. The vapor return hoses are arranged to be self-draining or provisions are made to drain the hoses after each refueling or the system incorporates an approved liquid blockage detection system arranged to cease dispensing when a blockage occurs.

   d. The Executive Officer of the Air Resources Board has approved the plans for compliance with conditions b and c.

8. State Fire Marshal approved swivels (and offsets if necessary) for this system shall be selected and installed on hoses to prevent hose kinking.

9. Product hose length shall be selected for each dispenser to provide for full extension of the vapor return hose.

10. If any OPW 78 series anti-recirculation valve is internally mounted in any dispenser, the top of the anti-recirculation valve shall not be higher than the top surface of the dispenser island and a vapor recovery piping shear section which meets State Fire Marshal requirements shall be installed.

11. For those dispensers classified as non-commercial by the Division of Measurement Standards and are not required to be tested and sealed by Weights and Measured officials, the use of anti-recirculation valves is optional. However, the use of anti-recirculation valves is recommended by the Division of Measurement Standards in any installation where the user utilizes the gallonage figures.

State of California
AIR RESOURCES BOARD

Executive Order G-70-132

Certification of Trusco Tank, Inc.
Supervault Aboveground Storage Tank
Filling/Dispensing Vapor Recovery System

WHEREAS, the Air Resources Board (the "Board") has established, pursuant to Sections 39600, 39601, and 41954 of the Health and Safety Code, certification procedures for systems designed for the control of gasoline vapor emissions displaced during the filling of storage tanks at service stations ("Phase I vapor recovery systems") and for the control of gasoline vapor emissions from motor vehicle fueling operations ("Phase II vapor recovery systems") in its "Certification Procedures for Gasoline Vapor Recovery Systems at Service Stations" as last amended December 4, 1981 (the "Certification Procedures"), incorporated by reference in Section 94001 of Title 17, California Administrative Code;

WHEREAS, the Board has established, pursuant to Sections 39600, 39601, and 41954 of the Health and Safety Code, test procedures for determining compliance of Phase I and Phase II vapor recovery systems with emission standards in its "Test Procedures for Determining the Efficiency of Gasoline Vapor Recovery Systems at Service Stations" as last amended September 1, 1982 (the "Test Procedures"), incorporated by reference in Section 94000 of Title 17, California Administrative Code;

WHEREAS, Trusco Tank, Inc., has applied for certification of the Supervault aboveground storage tank for balance Phase I and Phase II operation;

WHEREAS, Section VIII-A of the Certification Procedures provides that the Executive Officer shall issue an order of certification if he or she determines that a vapor recovery system conforms to all of the requirements set forth in Sections I through VII; and

WHEREAS, I find that the Trusco Tank, Inc., Supervault aboveground storage tank system, when used with ARB Certified Phase I and Phase II vapor recovery components, conforms with all the requirements set forth in Sections I through VII of the Certification Procedures;

NOW, THEREFORE, IT IS HEREBY ORDERED that this certification applies to the Trusco Tank, Inc., Supervault aboveground storage tanks of 2,000 gallons or less capacity. The system certified hereby is shown in Exhibit 1 attached. Air Resources Board certified Phase I components from Exhibits 1 thru 3 of Executive Order G-70-97-A and certified Phase II components from Executive Order G-70 series are to be used.

IT IS FURTHERED ORDERED that any emergency vent installed on the tanks be leak free at the operating pressure of the tank when tested in accordance with ARB Method 2-6, "Test Procedures for Gasoline Vapor Leak Detection Using Combustible Gas Detector" as last amended September 1, 1982 (the "Test Procedures"), incorporated by reference in Section 94000 of Title 17, California Administrative Code.

IT IS FURTHER ORDERED that the threaded stem normally used with the Bobtail truck bulk delivery nozzle be replaced with an OPW 633 BA coupling/adaptor along with an OPW 633 BD reducing coupler (or an equivalent arrangement that allows for no leakage of gasoline) to connect the Bobtail truck bulk delivery nozzle with the storage tank fill adaptor during transfer of gasoline from the delivery truck to the storage tank. An OPW 633 A or 633 F adaptor coupled with 633 B or 633 D adaptors or equivalent may be used for interchangeability of the nozzle stem and 633 BD reducing coupler.

IT IS FURTHER ORDERED that the general exterior of the storage tanks be painted white or off-white.

IT IS FURTHER ORDERED that compliance with the rules and regulations of the local air pollution control district and local fire officials with jurisdiction where the installed system is located, shall be made a condition of this certification.

IT IS FURTHER ORDERED that the use of a PV valve shall require the prior approval of the local fire chief, and that the tanks and piping shall comply with the appropriate General Industry Safety Orders and in particular the provisions of articles 144, 145, and 146 thereof.

IT IS FURTHER ORDERED that compliance with all applicable certification requirements and rules and regulations of the Division of Measurement Standards, the Office of the State Fire Marshal, and the Division of Occupational Safety and Health of the Department of Industrial Relations shall be made a condition of this certification.

IT IS FURTHER ORDERED that any alteration of the equipment, parts, design, or operation of the configurations certified hereby, is prohibited, and deemed inconsistent with this certification, unless such alteration has been approved by the undersigned or the Executive Officer's designee.

Executed this 16TH day of OCTOBER 1990, at Sacramento, California.

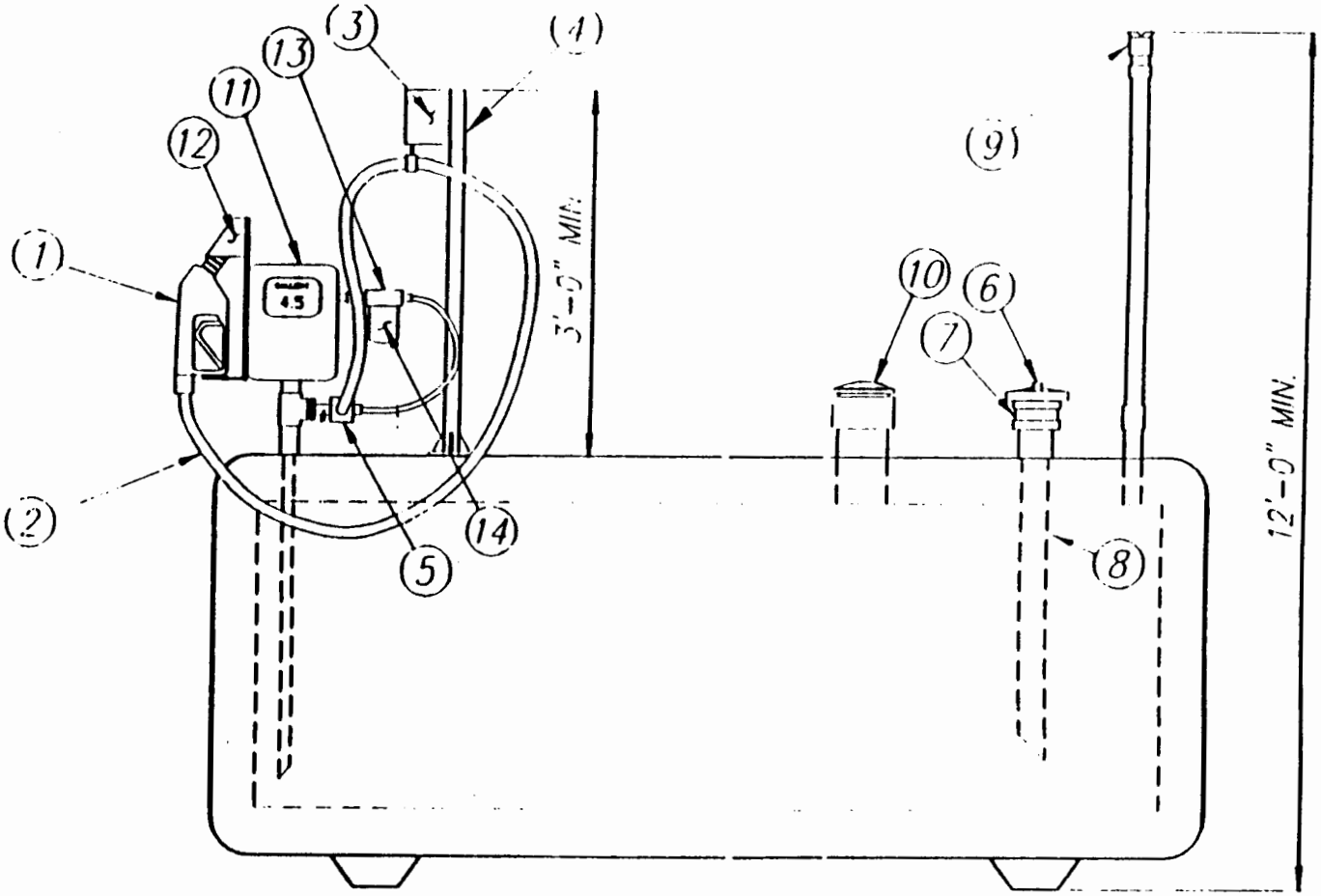
William W Sylte

James D. Boyd
Executive Officer

Exhibit I

Executive Order G-70-132

SUPERVAULT



COMPONENT DESCRIPTION

1. VAPOR RECOVERY NOZZLE
2. COAXIAL HOSE ASSEMBLY
3. OVERHEAD HOSE RETRACTOR
4. HOSE RETRACTOR BASE
5. COAXIAL ADAPTOR
6. FILL CAP
7. FILL ADAPTOR
8. COAXIAL DROP TUBE
9. PRESSURE/VACUUM VENT VALVE
10. EMERGENCY VENT
11. PUMP
12. NOZZLE HOOK & PROTECTIVE HOO
13. FILTER ADAPTOR
14. FILTER ELEMENT

Notes:

See Executive Order G-70-97-A (Exhibits 1,2 &3) for listing of ARB certified Phase I two-point and coaxial vapor recovery equipment and pressure/vacuum valves for storage tanks.

See Executive Order G-70 series for ARB certified Phase II vapor recovery equipment.

State of California
AIR RESOURCES BOARD

Executive Order G-70-133

Certification of LRS., Inc.
Fuelmaster Aboveground Storage Tank
Filling/Dispensing Vapor Recovery System

WHEREAS, the Air Resources Board (the "Board") has established, pursuant to Sections 39600, 39601, and 41954 of the Health and Safety Code, certification procedures for systems designed for the control of gasoline vapor emissions displaced during the filling of storage tanks at service stations ("Phase I vapor recovery systems") and for the control of gasoline vapor emissions from motor vehicle fueling operations ("Phase II vapor recovery systems") in its "Certification Procedures for Gasoline Vapor Recovery Systems at Service Stations" as last amended December 4, 1981 (the "Certification Procedures"), incorporated by reference in Section 94001 of Title 17, California Administrative Code;

WHEREAS, the Board has established, pursuant to Sections 39600, 39601, and 41954 of the Health and Safety Code, test procedures for determining compliance of Phase I and Phase II vapor recovery systems with emission standards in its "Test Procedures for Determining the Efficiency of Gasoline vapor Recovery Systems at Service Stations" as last amended September 1, 1982 (the "Test Procedures"), incorporated by reference in Section 94000 of Title 17, California Administrative Code;

WHEREAS, LRS, Inc., has applied for certification of the Fuelmaster aboveground storage tank for balance Phase I and Phase II operation;

WHEREAS, Section VIII-A of the Certification Procedures provides that the Executive Officer shall issue an order of certification if he or she determines that a vapor recovery system conforms to all of the requirements set forth in Sections I through VII; and

WHEREAS, I find that the LRS, Inc., Fuelmaster aboveground storage tank system, when used with ARB Certified Phase I and Phase II vapor recovery components, conforms with all the requirements set forth in Sections I through VII of the Certification Procedures;

NOW, THEREFORE, IT IS HEREBY ORDERED that this certification applies to the LRS, Inc., Fuelmaster aboveground storage tanks of 6,000 gallons or less capacity. The system certified hereby is shown in Exhibit 1 attached. Air Resources Board certified Phase I compoonents from Exhibits 1 thru 3 of Executive Order G-70-97-A and certified Phase II components from Executive Order G-70 series are to be used.

IT IS FURTHERED ORDERED that any emergency vent installed on the tanks be leak free at the operating pressure of the tank when tested in accordance with ARB Method 2-6, "Test Procedures for Gasoline Vapor Leak Detection Using Combustible Gas Detector" as last amended September 1, 1982 (the "Test Procedures"), incorporated by reference in Section 94000 of Title 17, California Administrative Code.

IT IS FURTHER ORDERED that the threaded stem normally used with the Bobtail truck bulk delivery nozzle be replaced with an OPW 633 BA coupling/adaptor along with an OPW 633 BD reducing coupler (or an equivalent arrangement that allows for no leakage of gasoline) to connect the Bobtail truck bulk delivery nozzle with the storage tank fill adaptor during transfer of gasoline from the delivery truck to the storage tank. An OPW 633 A or 633 F adaptor coupled with 633 B or 633 D adaptors or equivalent may be used for interchangeability of the nozzle stem and 633 BD reducing coupler.

IT IS FURTHER ORDERED that the general exterior of the storage tanks be painted white or off-white.

IT IS FURTHER ORDERED that compliance with the rules and regulations of the local air pollution control district and local fire officials with jurisdiction where the installed system is located, shall be made a condition of this certification.

IT IS FURTHER ORDERED that the use of a PV valve shall require the prior approval of the local fire chief, and that the tanks and piping shall comply with the appropriate General Industry Safety Orders and in particular the provisions of Articles 144, 145, and 145 thereof.

IT IS FURTHER ORDERED that compliance with all applicable certification requirements and rules and regulations of the Division of Measurement Standards, the Office of the State Fire Marshal, and the Division of Occupational Safety and Health of the Department of Industrial Relations shall be made a condition of this certification.

IT IS FURTHER ORDERED that any alteration of the equipment, parts, design, or operation of the configurations certified hereby, is prohibited, and deemed inconsistent with this certification, unless such alteration has been approved by the undersigned or the Executive Officer's designee.

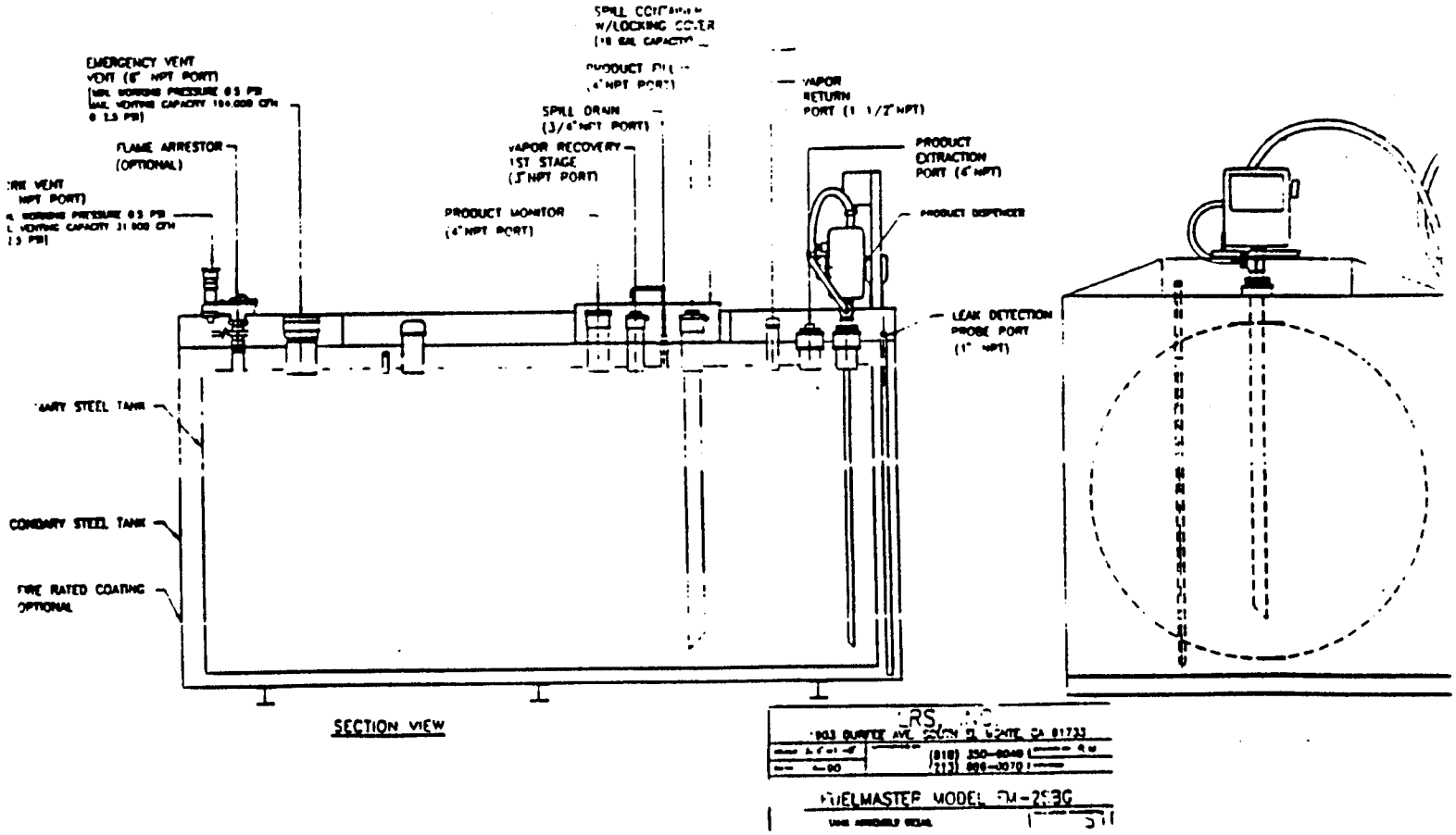
Executed this 16th day of OCTOBER 1990, at Sacramento, California.

William W Sylte

James D. Boyd
Executive Officer

Exhibit 1

Executive Order G-70-133



Notes:

See Executive Order G-70-97-A (Exhibits 1, 2, & 3) for listing of ARB certified Phase I two-point and coaxial vapor recovery equipment and pressure/vacuum valves for storage tanks.

See Executive Order G-70 series for ARB certified Phase II vapor recovery equipment.

APPENDIX E

ILLUSTRATIVE EXAMPLE OF IN-USE EFFICIENCY CALCULATION PROCEDURES

As discussed in Chapter 4 (Section 4.4.2) of this document, in-use efficiency calculation procedures to be used to estimate actual efficiency of Stage II equipment after installation. The purpose of this Appendix is to provide an illustrative example of how these calculations are made. The example is based upon relatively recent inspections conducted in the Bay Area (San Francisco), South Coast (Los Angeles), and San Diego Areas of California.[1] The defect database used to determine frequency of defects was based upon the inspections of about 12,000 nozzles in the subject areas. Data were also available by nozzle type that allowed a comparison between older and newer equipment. As stated in Chapter 4, semi-annual inspections would best represent the enforcement scenarios in the areas where inspections took place. Summaries of the inspection results were available that were adequate to determine in-use efficiency. However, more detailed inspection data could be obtained by an agency conducting their own in-use efficiency study.

E.1 CALCULATION PROCEDURES

To illustrate the calculation procedures provided in Chapter 4, the data found in the California survey of Stage II balance systems is summarized in Table E-1. Data are separated for all nozzles and for old and new equipment. The discussion includes correlation of efficiency decreases presented in Table 4-2 and the defects presented in Table E-1. The efficiency decreases associated with each defect listed in Table E-1 are presented in Table E-2. The following describes each defect found in this study and how the data were analyzed to determine in-use efficiency. This

TABLE E-1. BALANCE SYSTEM DEFECT FREQUENCY FROM ACTUAL STAGE II INSPECTION SURVEY[a]

Defect	Number of Defects			Percent of All Nozzles		
	Old	New	Total	Old	New	Total
Defective Faceplate	125	17	142	1.1	1.7	1.2
Improper Faceplate	75	1	76	0.7	0.1	0.6
Missing Faceplate	30	1	31	0.3	0.1	0.3
Defective Nozzle Boot	168	9	177	1.5	0.9	1.5
Improper Nozzle Boot	514	17	531	4.7	1.7	4.5
Leaking Nozzle Boot	1	0	1	0.01	0	0.01
Missing Nozzle Boot	4	0	4	0.04	0	0.03
Uncertified Nozzle Boot	1	0	1	0.01	0	0.01
Defective Nozzle Body	3	2	5	0.03	0.2	0.04
Leaking Nozzle Body	20	2	22	0.2	0.2	0.2
Missing Nozzle Body	2	0	2	0.02	0	0.02
Uncertified Nozzle Body	3	0	3	0.03	0	0.03
Defective Check Valve	476	1	477	4.4	0.1	4.0
Improper Check Valve	61	0	61	0.6	0	0.5
Missing Check Valve	5	0	5	0.05	0	0.04
Kinked Hoses	37	4	41	0.3	0.4	0.3
Leaking Hoses	4	1	5	0.04	0.1	0.04
Wrong Hose Length	111	10	121	1.0	1.0	1.0
Torn/Punctured Hoses	24	2	26	0.2	0.2	0.2
Defective Retractor	44	12	56	0.4	1.2	0.5
Improper Retractor	486	13	499	4.5	1.3	4.2

[a] Total nozzles inspected - 10,907 old nozzles, 1,023 new nozzles, 11,930 total nozzles.

TABLE E-2. EFFICIENCY DECREASES ASSOCIATED WITH STAGE II BALANCE SYSTEM DEFECTS

Defect	Deficiency Decrease Assigned (Percent)
Defective Faceplate	10
Improper Faceplate	0
Missing Faceplate	22
Defective Nozzle Boot	30
Improper Nozzle Boot	5
Leaking Nozzle Boot	30
Missing Nozzle Boot	100
Uncertified Nozzle Boot	0
Defective Nozzle Body	22
Leaking Nozzle Body	22
Missing Nozzle Body	100
Uncertified Nozzle Body	0
Defective Check Valve	30
Improper Check Valve	30
Missing Check Valve	30
Kinked Hoses	30
Leaking Hoses	10
Wrong Hose Length	5
Torn/Punctured Hoses	10
Defective Retractor	5
Improper Retractor	5

is an example of the analysis procedures, and provides information on a semi-annual enforcement scenario. This example analysis pertains only to balance systems since that was the vast majority of the data contained in the data base. This same approach could be used for hybrid or vacuum assist systems.

- Defective Faceplate. The faceplate was considered defective when the capability to achieve a seal at the fillpipe interface was affected for one fourth of the circumference of the faceplate. This was identical to the torn faceplate definition used in previous studies.[2] Therefore the efficiency decrease of 10 percent was again assigned.

- Improper Faceplate. This applied to instances when the faceplate was not attached correctly. No other information describing this defect was given. Because of this lack of information, no efficiency decrease was assigned to this defect.

- Missing Faceplate. This defect was assigned when the faceplate was missing altogether. This was identical to the "face seal only to installed" defect presented in Table 4-2. Therefore, the same efficiency decrease was assigned (22 percent).

- Defective Nozzle Boot. A defective nozzle boot resulted from a triangular shaped tear 1/2 inch or more on a side, a slit at least one inch long, or a hole 1/2 inch or more in diameter. This fit the definition of the "torn boot" defect in Table 4-2 so the efficiency decrease (30 percent) was used.

- Improper Nozzle Boot. This defect was assigned when the boot was not securely clamped to the nozzle or if the inside support spring was missing. It was unclear how insecure the boot assembly was and how this would affect emissions capture. However, it was felt that some minor emissions decrease would be associated with this defect, so an efficiency decrease of 5 percent (half of the defective faceplate value) was assigned.

- Leaking Nozzle Boot. A leaking nozzle boot was defined in the inspectors instructions. However, it was assumed this meant the same as a torn or defective nozzle boot. Consequently, the efficiency decrease of 30 percent used for defective nozzle boots was assigned to this defect also.

- Missing Nozzle Boot. This applied when no nozzle boot was present. No vapor collection can occur without the nozzle boot, therefore, an efficiency decrease of 100 percent was assigned (as was assigned in Table 4-2).

- Uncertified Nozzle Boot. This defect was noted when the wrong boot was used with the wrong system. This did not mean the boot was defective, so it was unclear what affect this would have on emissions capture. Since no additional information was available, no efficiency decrease was assigned to this defect.

- Defective Nozzle Body. This defect was noted when the nozzle shut off was not working. This would be similar to "nozzle damage" presented in Table 4-2 and an efficiency decrease of 22 percent was assigned.

- Leaking Nozzle Body. This was assigned when gasoline leaked anywhere from the nozzle body. This again was similar to the "nozzle damage" category presented in Table 4-2, and, therefore, an efficiency decrease of 22 percent was assigned.

- Missing Nozzle Body. This defect was assigned when the nozzle was missing and the vapor hose was left open to the atmosphere. This obviously would be a 100 percent decrease in efficiency.

- Uncertified Nozzle Body. This was noted when a decertified nozzle was used. This does not imply that there was anything wrong with the nozzle, only that it was not certified. No efficiency decrease was assigned to this defect.

- Defective Check Valve. This defect was used when the vapor check valve does not work (i.e., the valve was stuck open). If the vapor check valve is stuck open, vapors can be collected during refueling, but some vapors may be released again during times when the nozzle was idle. No additional information was provided but it was felt that some efficiency reduction should be applied to this defect. This decrease could range from 10 to 100 percent but for calculation purposes a value of 30 percent was assumed (equal to that of a defective nozzle boot).

- Improper Check Valve. An improper check valve meant the valve was installed in the wrong place or installed backwards. If the valve were installed backwards, vapors could not pass the valve and be collected, therefore, the efficiency decrease would

be 100 percent. If the valve were installed in the wrong place there could possibly be no affect on efficiency. To compromise, an efficiency decrease of 30 percent, equal to a defective check valve, was assumed.

- Missing Check Valve. This defect meant that a required check valve was missing. This would be the same as a check valve stuck open and, as a result, would have an efficiency decrease equivalent to the defective check valve (30 percent).

- Kinked/Flattened Hoses. Kinked hoses were noted when there was one or more kinks found that would not unkink when the hose was stretched to fill a fuel tank. A flattened hose was a hose that had 3 or more feet of accumulated length flattened. Each of these defects has the potential to essentially eliminate vapor flow and therefore vapor capture. However, the study did not indicate that the defect was severe enough to completely halt vapor collection. Therefore an efficiency decrease of 30 percent was assumed.

- Leaking Hoses. This defect was noted when the inspector was sure that a leak was present. The efficiency for "torn hoses" from Table 4-2 was assigned to this defect since it was unclear what was causing the leak, but that a leak was noted.

- Wrong Hose Length. This defect was assigned when the vapor hose was the wrong length based on certification requirements. This may mean loops in hoses that reached allowable certification requirements. This would have the same affect as a broken retractor that allows vapor hoses to droop. Therefore the 5 percent efficiency decrease assigned to "retractor broken" reported in Table 4-2 was also used for this defect.

- Torn/Punctured Hoses. A torn hose was a hose torn, usually at the swivel ends. A punctured hose was noted when any hole was found in the vapor hose that went all the way through the wall and allowed vapors to escape. This was the intent of the "Torn vapor hose" category in Table 4-2, therefore, this same efficiency decrease (10 percent) was assigned.

- Defective Retractor. A defective retractor was one that did not work at all or the cord was broken. This fit the description of "retractor broken" in Table 4-2 and the 5 percent efficiency decrease was assigned to this defect.

- Improper Retractor. This defect was noted when the retractor would not retract all the way back to the full retracted position and would not allow proper hose configuration. The efficiency decrease used both for "wrong hose length", and "defective retractor" (5 percent) was considered appropriate for this defect, since, as with these other defects, the proper hose configuration could not be achieved.

E.2 SAMPLE CALCULATIONS

Using the equation discussed in Chapter 4 and the data in Tables E-1 and E-2, the actual in-use efficiency for a Stage II system (assuming all equipment installed) could be calculated as follows:

$$
\begin{aligned}
\text{Average In-use Efficiency (Old equipment)} &= (0.95)\,[(1.00-(0.011)(0.10))\\
&\quad (1.00-(0.003)(0.22))\\
&\quad (1.00-(0.015)(0.30))\\
&\quad (1.00-(0.047)(0.05))\\
&= (1.00-(0.0001)(.30))\\
&\quad (1.00-(0.0004)(1.00))\\
&= (1.00-(0.0003)(0.22))\\
&\quad (1.00-(0.0002)(0.22))\\
&\quad (1.00-(0.0002)(1.00))\\
&\quad (1.00-(0.044)(0.30))\\
&\quad (1.00-(0.006)(0.30))\\
&\quad (1.00-(0.0005)(0.30))\\
&\quad (1.00-(0.003)(0.30))\\
&\quad (1.00-(0.0004)(0.10))\\
&\quad (1.00-(0.01)(0.05))\\
&\quad (1.00-(0.002)(0.10))\\
&\quad (1.00-(0.004)(0.05))\\
&\quad (1.00-(0.045)(0.05))\\
&= 0.922\\
&= 92.2 \text{ percent}
\end{aligned}
$$

Using the same calculation procedures for new equipment would yield an inuse efficiency of 94.1 percent, and for all nozzles tested 92.5 percent.

E.3 REFERENCES

1. Inspection summaries of California Air Resources Board Phase II Vapor Recovery Inspections. August 1986 through October 1987. Received from Laura McKinney, October 1991.

2. Draft Regulatory Impact Analysis: Proposed Refueling Emission Regulations for Gasoline-Fueled Motor Vehicles -- Volume I - Analysis of Gasoline Marketing Regulatory Strategies. U.S. Environmental Protection Agency. Office of Air Quality Planning and Standards and Office of Mobile Sources. EPA-450/3-87-001a. July 1987.

APPENDIX F
STAGE II PROGRAM SUMMARIES

This appendix is intended to provide brief summaries of several Stage II programs throughout the country. These programs range from areas such as San Diego which has almost 20 years experience with Stage II to areas such as Massachusetts and Dade County, Florida with programs only recently adopted. The following is an outline of the individual program summaries.

STAGE II PROGRAM SUMMARY OUTLINE

I. Reason for Initiating Program

II. Major Public Comments

III. Number of Service Stations

IV. Regulations

- A. Exemption levels
- B. Phase-In/Compliance schedule

V. Identification of Sources

- A. Identifying sources
- B. Contacting Sources
- C. Follow-up

VI. Permit application process

VII. Procedure after permit application received

VIII. Approved or "certified" systems for that State

IX. Enforcement

- A. Number of Inspectors
- B. Inspector Training
- C. Frequency of inspections per year

D. Inspection procedures
E. Handling of Violations

X. Miscellaneous Aspects of Program

XI. Problems encountered and Suggestions to other Agencies

The programs discussed are as follows:

Long term programs

San Diego

Bay Area

South Coast

District of Columbia

St.Louis

Programs in "mid" enforcement stages

New Jersey

New York

Programs in initial enforcement stages

Dade County, FL

Massachusetts

Pennsylvania/Philadelphia

PROGRAM REGULATORY AGENCY INFORMATION

Name of Agency:	San Diego Air Pollution Control District [DRAFT: PENDING DISTRICT REVIEW]
Address:	San Diego, CA
Telephone:	(619) 694-3307
Stage II Contact:	Barney McEntire San Diego Air Pollution Control District

REASON FOR INITIATING PROGRAM

Stage II controls were implemented for VOC control as the entire San Diego area has been classified as a non-attainment area for the criteria pollutant ozone.

MAJOR PUBLIC COMMENTS

NUMBER OF SERVICE STATIONS

Stage II affects approximately 1,200 retail and 600 private gasoline dispensing facilities in the San Diego district.

REGULATIONS

San Diego Air Pollution Control Rule number 61.4 on the Transfer of Volatile Organic Compounds into Vehicle Fuel Tanks applies to any retail service station where VOC's are dispensed into motor vehicle tanks with a capacity of 260 gallons or more or any non-retail service station where VOC's are dispensed into motor vehicle tanks from any stationary storage tank with a capacity greater than 550 gallons and where more than 2000 gallons of VOC's are transferred into motor vehicle tanks in any calendar month. San Diego has several exemption levels:

(1) VOC's into motor vehicle fuel tanks from any intermediate refueler provided VOC's are not sold directly from the intermediate refueler; or

(2) Natural gas or propane when not mixed with any other VOC; or

(3) VOC's into any vehicles performing emergency work necessary to restore property to a safe condition following a public calamity or work required to protect persons or property from imminent exposure to danger or damage.

(4) VOC's from any stationary storage tank that:

(i) Is used primarily in the fueling of aircraft and/or intermediate aircraft refuelers, or boats; or

(ii) Is used exclusively in the filling of tanks with a capacity if 5 gallons (18.93 liters) or less; or

(iii) Is located on the parcel of land on which not more than 2000 gallons (7570 liters) are transferred into motor vehicles during any calendar month, provided that the facility is not a retail service station where:

(A) no stationary storage tank with a capacity of 260 gallons (984 liters) or more is added, installed, or replaced at the facility after March 14, 1989; and

(B) no modification, replacement or repair of any underground liquid VOC piping from the stationary storage tank to the dispensers occurs at the facility after March 14, 1989; and

(C) the retail service station does not exceed a VOC throughput of 480,000 gallons (1817 kiloliters) in any calendar year after March 7, 1990; or

(iv) is located in the desert portion of San Diego County at any dispensing facility other than a retail service station; or

(v) has a capacity of less than 260 gallons (984 liters).

IDENTIFICATION OF SOURCES

Stage II in San Diego was first implemented in August of 1972. The initial stations were identified primarily through the phone book and through past facility inspections.

PERMIT APPLICATION PROCESS

Each facility is required to complete a permit application with a planned layout of the system to be installed. After the application has been received, a "plan check" is run on as built drawings. If the facility is approved, then the authority to construct is granted. After construction, tests are required. Permission to operate ensues as soon as the results are approved as being in compliance and a permit is sent to the facility.

PROCEDURE AFTER PERMIT APPLICATION IS RECEIVED

Tests on the new system are conducted by hired consultants. The tests performed are pressure decay, liquid blockage, and pressure versus flow. The district must be notified before tests can be conducted. In most instances, a representative from the district is present during testing. If the tests are passed, the station is granted a start-up authorization. Testing is not repeated unless reconstruction is done to the facility which would increase emissions which would affect emissions.

APPROVED OR CERTIFIED SYSTEMS

The San Diego District uses only CARB certified Stage II vapor recovery equipment.

ENFORCEMENT

Number of Inspectors

The exact number of inspectors that the San Diego District currently has is unknown. These inspectors' duties are not exclusive to the Stage II program.

Inspector Training

The inspectors are trained within the district and do not attend ARB training courses. In addition they have an inspection manual which was developed in the district.

Frequency of Inspections Per Year

The inspection program is not specific to Stage II as the inspectors are not dedicated to Stage II. The inspection frequency is once per year for private facilities and 2 or 3 per year for retail service stations. They have a computer system which indicates which stations are due for their next inspection.

Inspection Procedures

Inspections generally concentrate on equipment defects, and have additional defects identified by the district in addition to the ARB defects.

Handling of Violations

Any violations discovered are subject to fines. San Diego does, however have a tag-out list with specific offenses spelled out in the State laws.

MISCELLANEOUS ASPECTS OF PROGRAM

The San Diego is proud of Stage II program, specifically in the areas of permitting and testing of systems. Most of their effort has been concentrated on their underground piping, as most of their problems occur in that area.

PROBLEMS ENCOUNTERED AND SUGGESTIONS TO OTHER AGENCIES

It is believed that the single most important element to a Stage II program is to ensure that the systems are initially installed correctly. It is estimated that over 50 percent of the stations would only get 50-60 percent recovery without a rigid testing program to identify improper systems.

The inspection program should be considered closely to avoid creating a situation where inspectors are in effect performing the maintenance program for the service stations.

PROGRAM REGULATORY AGENCY INFORMATION

Name of Agency: Bay Area Air Quality Management District
[DRAFT: PENDING DISTRICT REVIEW]

Address: San Francisco, CA

Telephone: (415) 771-6000

Stage II Contact: Gale Karels
Bay Area Air Quality Management

REASON FOR INITIATING PROGRAM

The Bay Area AQMD was the first District in the country to require Stage II controls (see enclosed Board of Directors Resolution Number 764 - January 3, 1973). These

Stage II controls were implemented as an ozone reduction measure.

MAJOR PUBLIC COMMENTS

NUMBER OF SERVICE STATIONS

Stage II controls currently affect 2,027 retail gasoline dispensing facilities (GDF) and 738 non-retail GDF for a total Stage II nozzle population of 28,300 nozzles. There are 424 GDF exempt from Stage II requirements.

APPROVED OR "CERTIFIED" SYSTEMS

The Bay Area only uses California Air Resources Board (CARB) certified and tested Stage II recovery equipment.

ENFORCEMENT

Number of Inspectors

Bay Area presently has approximately six GDF inspectors who report to one GDF supervisor.

Inspector Training

The GDF inspectors currently undergo a 24 hour training course followed by a week working with an experienced inspector. They are also required to attend the CARB Uniform Training Course #232 (GDF Vapor Recovery). On a quarterly basis the inspectors attend in-service training to learn of any new requirements or inspection techniques.

Frequency of Inspections Per Year

The Bay Area inspects each retail facility at least twice per year. For thise facilities with a poor compliance record, the inspections may be conducted every three months.

A list of GDF to be inspected each month is generated by our computer. All inspection data is entered into our Data Bank.

Inspection Procedures

Inspection procedures usually focus on general equipment defects such as bellows, etc.

Handling of Violations

The Bay Area AQMD uses both the "Out of Order" program and Notices of Violations depending on the severity of the defects. The settlement costs of first time violation notices usually range from $100 to $313.

MISCELLANEOUS ASPECTS OF PROGRAM

The Bay Area AQMD has adopted a Manual of Procedures (MOP) for Permitting Gasoline Dispensing Facilities. Enclosed is a copy of the Permitting Handbook.

The Bay Area has, according to CARB, the finest computer tracking system for GDF. Enclosed are copies of the Data Bank Files used by our District. A functional computer tracking system is a definite requirement for effective enforcement and permitting programs.

PROBLEMS ENCOUNTERED AND SUGGESTIONS TO OTHER AGENCIES

It was felt that service stations are using the tagging out of service program as a maintenance program. Facilities tend not to replace equipment unless a violation is found by an inspector.

Several recommendations were given that may aide areas in implementation of Stage II controls. An effective

training program is essential to successful maintenance of Stage II controls.

Many suggestions were regarding permitting. The development of standard permit conditions and recommended practices for each type of system would help insure a well-rounded program. These conditions would include stringent testing requirements.

PROGRAM REGULATORY AGENCY INFORMATION

Name of Agency: South Coast Air Quality Management District
[DRAFT: PENDING DISTRICT REVIEW]

Address: El Monte, CA

Telephone: (213) 403-3450

Stage II Contact: Lou Roberto
South Coast Air Quality Management

REASON FOR INITIATING PROGRAM

Stage II controls were implemented for VOC control as the entire South Coast area has been classified as a non-attainment area for the criteria pollutant ozone.

MAJOR PUBLIC COMMENTS

NUMBER OF SERVICE STATIONS

Stage II affects approximately 6,000 retail service stations. The exact number of non-retail facilities is not known.

REGULATIONS

Essentially, South Coast does not have any exemption levels outside of stationary tanks exclusively for fueling agricultural wind machines. These facilities are located in the dessert.

The compliance schedule can be found in Rule 461. Gasoline Transfer and Dispensing (e)(1)2(2) & (3).

(1) The owner or operator of a new facility must comply at the time gasoline receiving and/or dispensing is initiated.

(2) Any owner/operator of any altered facility who was previously exempted from the provisions of this rule now must comply.

(3) Any owner/operator of any other existing facility, who was previously exempt from the rule, who has not earlier been required to come into compliance, must achieve compliance by March 4, 1990.

IDENTIFICATION OF SOURCES

South Coast utilized their operating permit database to identify which sources were subject to the changes. This database contains a list of manufacturers' code which is capable of distinguishing those types of service stations.

PERMIT APPLICATION PROCESS

A permit to construct must be issued to the facility in order to begin the permit process. After this step, the equipment is installed and the equipment is tested. The inspectors to the backfill and the back pressure test themselves. Once the inspection is complete and all subsequent tests are passed, a permit is issued.

PROCEDURE AFTER PERMIT APPLICATION RECEIVED