

ETHANOL FUEL DISPENSING OPERATIONS IN BRAZIL



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Foreword

Fuels with high percentages of ethyl alcohol derived from sugar cane have been used in Brazil since the 1970s. Levels of ethanol fuel consumption have varied over the last 30 years, with a resurgence in consumption beginning in 1999.

Today, ethanol dispensing is very common in Brazil and is readily available at a large majority of Brazil's 30,000 refueling stations. Ethanol fuel is dispensed at a nearly pure concentration of 92.6% ethanol/7.4% water. Gasoline fuel is dispensed in a 75% gasoline/25% ethanol blend.

Objective

The objective of this activity was to obtain information on ethanol fuel dispensing equipment in use in Brazil today, as well as anecdotal information on the steps taken in the past to address corrosion concerns with alcohol based fuels. Technical staff from the UL Regulatory Services Department visited several Brazilian fuel dispenser equipment manufacturers and five refueling stations. All refueling station visits were conducted with the manufacturer representatives of the dispensers that were installed. No Brazilian regulatory authorities were present during the visits. The purpose of these visits was to conduct the following activities related to dispensing ethanol fuel in Brazil:

- Review Brazilian regulations and requirements related to ethanol fuel dispensing
- Review field installation processes
- Identify dispensing and accessory equipment being used
- Review typical field maintenance and inspection processes
- Review leak detection methods and equipment
- Conduct visual examination of equipment
- Qualitatively compare condition of equipment used to dispense ethanol fuel versus gasoline and diesel fuels

Observations

Site Information

Five service stations in Rio de Janeiro and Sao Paulo, Brazil were visited, with varying histories of dispensing ethanol fuel and various rates of dispensing. Station operators did not report any significant problems in dispensing ethanol fuel. Leak detection at the sites was provided either by means of inventory measurement or electronic monitoring. Most, but not all, of the installations had secondary containment in dispenser sumps. The norm for Brazilian refueling stations is to have an attendant in constant attendance at each operating dispenser, providing an additional level of operational surveillance. No customer self service for fuel dispensing is permitted in Brazil.

Detailed information on the dispensing equipment involved in this survey is tabulated below:

Site	Average volume of ethanol fuel dispensed per week, liters (gallons)	Volume of ethanol fuel dispensed over product life, liters (gallons)	Year dispenser installed on site
1	1000 (264)	Not available	2000
2	3000 (793)	1,444,000 (381,464)	1997
3	1750 (462)	110,000 (29,059)	2005
4	1500 (396)	150,000 (39,626)	2004
5	12,000 (3170)	756,000 (199,714)	2005

Review of Dispensing Equipment & Collection of Samples

There are three prominent Brazilian fuel dispenser equipment manufacturers: Wayne/Dresser (Brazilian subsidiary of Wayne/Dresser US), Gilbarco-Veeder Root (GBR) and Stratema. These manufacturers produce nearly all dispensers installed in Brazil.

It was reported that all dispensers are of the suction type (with on-board suction pumping units), which requires a significantly different system design than those typically used in the U.S. It was also indicated that once the dispenser was designated to dispense ethanol, it remained as an ethanol fuel dispenser over its life. No fuel dispensers that perform blending within the dispenser were observed.

Some ethanol dispenser hydraulic components (e.g., strainer, pump, meter, etc.) were confirmed to be identical to those used for dispensing Brazilian gasoline fuel (25% ethanol/75% gasoline) in Brazil. Additionally, the hydraulic components used in the Brazilian dispensers are reported to be the same as those used in dispensers manufactured for use in the U.S. market by those manufacturers that sell in both markets.

Samples of dispenser components, including a check valve, hydraulic assembly, meters, inlets (including the strainer, check valve and union), hose nozzles and hose assemblies were tagged in the field and sent to UL for examination.

Material Compatibility

The Brazilian dispenser manufacturers noted that some material compatibility issues have been identified during the thirty years of ethanol use in Brazil. These manufacturers commented that dynamic synthetic rubber components, such as nitrile rubber, would experience excessive swelling or deteriorate. Manufacturers indicated that such materials were replaced with those more resistant to degradation from alcohols like fluoroelastomers. It was reported that in many cases no modifications were made to static seals.

Regarding corrosion issues, manufacturers indicated that early experience with alcohol fuel exposures showed some minor corrosion and a build-up of bio residue in hydraulic

components. Manufacturers reported addressing these issues with some of the following best practices:

1. Eliminating the use of zinc alloys.
2. Keeping fluid-confining cavities “full” - Keeping these parts full of fuel keeps the materials wet and eliminates the introduction of air. This is important as air may accelerate corrosion and bio residue growth on parts and materials that have been exposed to ethanol. Redundant check valves are used to keep the hydraulic trees primed and to eliminate air gaps.
3. Redesigning meters to keep them “flushed” - “Flushing” of meters is accomplished by redesigning the meter in such a way that the flow of fuel is directed to enter through the top of the meter and leave through the bottom. This is in contrast to typical meter designs that have fluids coming in and out of the bottom of the meter; which may promote leaving an air space at the top of the meter.

It was indicated or observed that aluminum (plated and unplated), iron, steel, brass and copper dispenser parts are in use in Brazil in ethanol fuel dispensers.

Requirements and Regulations

Presently, Brazilian requirements do not require dispensers to be third party certified. Brazilian standards exist, and are enforced, for the dispenser electronics and gasoline hose. Some Brazilian standards for fuel equipment reference UL or ASTM standards. However, it is important to note that the Brazilian standards do not specifically address material compatibility of the manufactured dispensing equipment with the ethanol fuel.

Installation codes exist in Brazil, however inspection by a regulatory authority is not required. Brazil’s national petroleum company, Petrobras, enforces these specifications. Since approximately 2004, mandatory leak detection has been a requirement for new installations only. Leak detection requirements for existing installations are under consideration. Active electronic leak detection was not present in the majority of installations that were observed.

Brazilian Law – Resolution ANP (National Agency of Petroleum) No. 5, effective Feb. 25, 2005 controls the content of ethanol fuel. The ethanol concentration of the fuel is verified at all ethanol fuel dispensers with a visual indicator density meter, as required by Brazilian National Standard NBR 5592. It was reported that this visual indication was implemented as an additional check to help minimize the risk of dispensing fuels with inappropriate components to simulate ethanol. Brazilian Law – Resolution ANP No. 6, effective Feb 25, 2005 controls the content of gasoline fuel at a ratio of 75% gasoline/25% ethanol.

Summary

The initial results of this limited survey did not indicate significant safety or maintenance problems associated with ethanol fuel dispensers currently in use in Brazil. In the service stations that UL staff visited there appeared to be no visual signs that ethanol alcohol dispensing components degraded significantly more compared with the same components used in dispensers for the gasoline/ethanol blend (with higher ethanol content than U.S. gasoline).

The survey focused primarily on visual observations of several stations, and on verbal feedback. Except for some limited, ongoing assessments of several harvested products, the survey did not include a detailed examination of dispenser components. The Brazilian ethanol blend, regulatory structure, dispenser designs and usage patterns are each different from those of the United States. As a result, it is not realistic to use the results of this survey to draw definitive conclusions about the degrading effects high percentage ethanol fuel may have on dispenser components.