

One for all and all for one? How Stage II VR Translates in the European Community

Vapor Recovery in Europe, Asia and the U.S.

Vapour Recovery Stage II was introduced in California in 1972 and brought to Europe in the late 1980s, first in Sweden and then in Switzerland.

Initially, Stage II was not adopted and enforced by national laws but rather by local governments in the communities of Gothenburg, Malmo and Stockholm. In the German cities of Munich, Stuttgart and Bremen, the Stage II movement has also come from the local authorities.

When officials at the federal level of government in both countries became aware of this development, they decided to adopt these requirements nationally.



EU Commission gets involved

Headquartered in Brussels, the EU Commission is the administrative body of the Common Market (EU) Organization. The EU Commission makes proposals and drafts directives that must be accepted by the governments of the member countries. Once a directive is in force, the member countries are obliged to make national laws according to that directive. Laws that influence the situation in the whole of Europe (for instance, the requirement for ORVR systems in cars) cannot be made nationally but only on the basis of an EU directive. Other laws with only a regional influence (for instance, the requirements for Stage II) can be made nationally as long as the matter has not been enacted upon by the EU Commission.

When Germany decided to mandate for Stage II at a federal level in 1992, the EU Commission expressed the concern that too many member countries were making environmental legislation independently, without reference to EU's Brussels headquarters. EU therefore decided to prepare a draft directive on vapour recovery, which was finalized in July 1993.

According to the draft, there are two phases. In phase one, all stations with more than 2.5 million litres turnover must be equipped with Stage II. The required efficiency is 70 percent. In phase two, after 10 years all cars must be equipped with harmonized fill pipes that allow a sealing of the nozzle and therefore achieve 95 percent efficiency.

The EU's present commissioner is emphasizing the reformulation of different fuel types and has expressed in public that he does not see much need for the Stage II directives.

So, it is not likely that the finalized draft will become a directive in the next few years. Maybe the next Commissioner will take a different position.

Laws on vapour recovery

There are now laws requiring Stage II Vapour Recovery in Sweden, Switzerland, Germany, Denmark, Holland, Luxembourg, Austria, the Netherlands, Italy and France with retrospective programs in place to convert existing stations. Some of the eastern European countries such as Poland, the Slovak Republic, Hungary and parts of Russia have followed suit and made laws regulating Stage II; or they offer fiscal incentives for the installation of Stage II. Fiscal incentives are also granted in Denmark.

In the UK, the Department of Environment, Transport & Regions published a comprehensive report on Stage II in March 1998 (“Design of a Scheme to Control Evaporative Emissions for Petrol Vehicle Refueling”). This report is expected to be the basis of a regulation in the near future. The report recommends that stations with a turnover of more than one million liters of petrol per year must be retrofitted within three years, from 1999 on. For a copy of the report contact: Entec, Windsor House, Gadbrook Business Centre, Gadbrook Road, Northwick, Cheshire CW9 7TN, England; telephone, 011 44 01606 49077; fax 011 44 01606 49194.

Technical equipment used

In Europe today the vast majority of systems being used are active systems. Although there are still some passive balance systems on the market from the early days of Stage II in Sweden and Switzerland, these systems are being phased out step by step.

As you will see in more detail later, the efficiency requirements in Europe are moderate (mostly between 75 and 80 percent) compared to 95 percent in the U.S. In Europe, it is therefore possible to use nozzles without rubber or plastic bellows. The hoses are of a co-axial style like those in the U.S.

The heart of the vapour recovery system is the device used to control the volume of vapor recovered relative to the liquid dispensed. For new pumps, electronic systems are most often used for the control device. The majority of the pump builders in Europe have opted for separate proportional valves, but speed controlled vacuum pumps are increasingly being used as well. The vacuum pumps used are mostly piston or diaphragm pumps.



Pictured here is a typical European vapour recovery MPD pump (model: Wayne, Switzerland)



Efficiency requirements for vapour recovery range between 75 and 80 percent in Europe, compared to 95 percent in the U.S.

The future of ORVR systems

In Europe we combine small carbon canisters by which we collect the running losses and Stage II for the recovery of vapor during the fueling. Running losses are hydrocarbon (HC) emissions that occur during driving and parking of cars. Starting in January 1998, European car exports to the U.S. must have ORVR systems (large carbon canisters). Nevertheless, it is unlikely this new situation will greatly influence the development of Stage II in Europe—mainly because the procedure of making laws in the EU is very complicated.

It takes nearly 10 years to establish both an EU directive and the national laws necessary to enforce the directive; and another 10 to 15 years for the existing generation of cars to be phased out of the market. It is unlikely that politicians would wait that long for vapour recovery to become operational in their respective countries. Nor would politicians be likely to vote for a combination of Stage II and ORVR (as done in the U.S. Clean Air Act). In contrast to the U.S., the European regulations are nationwide for all petrol stations over a certain turnover and are not restricted to “non-attainment areas.” So there is comparatively little need for ORVR systems.

European checks and balances

Throughout Europe, an efficiency test is done one time as a “type approval” test of the vapor recovery system. The type approval efficiency test sets all the parameters under which the system must comply—in particular, with the requirement for efficiency. In Germany, to allow for product innovation and development, the law says that the systems must operate according to the current “state of the art.” Sweden and the UK (according to the recommendations of the report, “Design of a Scheme to Control Evaporative Emissions for Petrol Vehicle Refueling”) call for 75 percent vapor recovery under normal conditions and 85 percent under controlled conditions. In France, the requirement is 80 percent and in Switzerland, 90 percent.

With the introduction of Stage II vapour recovery in Europe, many questions have been raised as well as problems encountered on how to establish a credible test regime for vapour recovery. European independent test authorities—TUV Rheinland in Germany, SP in Sweden and EMPA in Switzerland—all have had the same results when testing American Stage II systems: an efficiency rate of about 75 percent. On the basis of the European test method, EMPA conducted an extensive comparative test between the U.S. and the European vapour recovery systems.

The European efficiency test is similar to the CARB approved test. It is based on weighing the hydrocarbon emission with and without the Stage II system in comparison. EMPA's tests confirmed the 75 percent rates for the U.S. system. The European systems have been tested in a similar range of efficiency (about 80 percent) as those from the United States. In Switzerland, where it is permissible to precondition the car by heating up the engine, efficiency values of just over 90 percent were achieved with European vapour recovery systems.

The efficiency of the system depends greatly on the configuration of the fill pipe of the car, and these configurations vary. Most tanks today have a ventilation line that is positioned at the top of the tank and may lead above or beneath the fill restrictor. The car manufacturers today are aware of the problem and are working on optimizing fill pipe designs for the existing nozzles.

Throughout Europe, the efficiency tests are carried out with a representative number of vehicle types and models. In Germany, Sweden and Switzerland, it is necessary to test the best sold car types (only 30 per country). The efficiency figures mentioned above are average values. Due to the different fill pipes, the results vary from 55 to 95 percent.

The approval process

Unfortunately, it is rather complicated to get approvals in most of Europe. In Sweden, Switzerland, Germany, the Netherlands, Austria, France and Italy, separate national approvals are necessary. In the other European countries, approvals from the acknowledged institutes—TUV, SP and EMPA—are accepted. The approvals only refer to the hydrocarbon efficiency. Much like in the U.S., where only UL-approved systems are accepted for CARB tests, systems in Europe can only be submitted for efficiency testing that are already type-approved under established safety standards, as they are determined within each country.

In most countries the type approvals are granted for the different types of dispensers equipped with a vapor recovery system. So it is the responsibility of the pump manufacturers to be certified. This is comparable to the CARB approach in the U.S. In Germany and Switzerland, however, the Stage II systems—consisting of nozzle, hose, control system and vacuum pump—are approved as such without the dispenser. The efficiency test is done with a basic system consisting of the above mentioned four components. If someone just wants to have another hose or vacuum pump, he only has to pass an additional function test and not the whole type approval procedure.



This mobile filling station in Nantes, France has Stage I vapour recovery.

The “Dry Test”

The regulations for routine tests differ from country to country. In Switzerland, service companies must test the systems every six months; in Austria, Germany and the UK, this testing must be done every 12 months. Official government inspections are done at longer intervals, mostly three to five years.

All these routine tests are carried out as volumetric tests with air sucked in. A great deal of work has gone into developing a simple environmentally friendly test method known as the “Dry Test.” This method is now used in most of the European countries with vapor recovery systems. The electronic system simulates the fuel flow by reading the data from the dispenser with a type-approved handset, precalibrated with the relevant parameters. If the test shows the system is outside of its tolerance, the system can be reset by pushing a few buttons on the handset. The method checks the volumetric recovery rate without dispensing fuel. Only the measured air volume recovered is calculated. As the viscosity of air is different from hydrocarbon vapor, a so-called correction factor must be established in the type approval test. This correction factor says, for instance, that with the tested system, 107 percent air corresponds to 100 percent vapour. In this case the correction factor would be 0.07.

So, all in all, things in Europe are a little more complicated than one might expect. The UK report recommends an EU directive for the whole of Europe regarding the type approval and routine tests. This indeed would be a step forward.

The author Dr. Harald Falckenberg is President of ELAFLEX Tankstellentechnik, Hamburg, Germany.