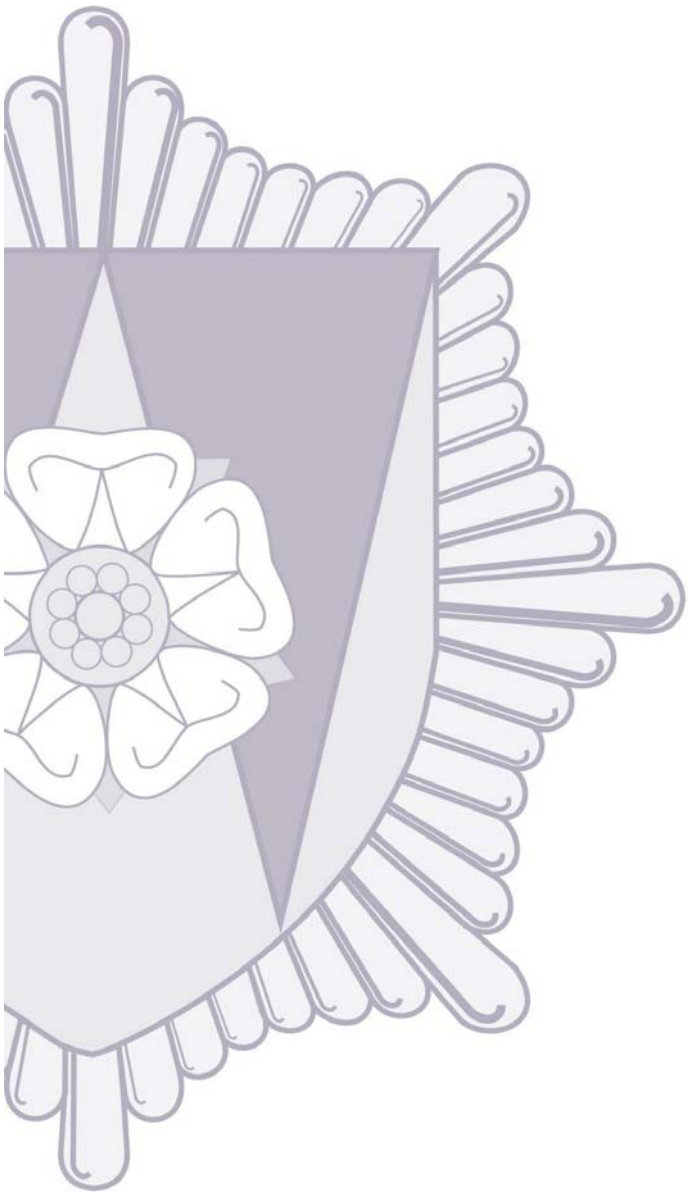
West Yorkshire Fire & Rescue Service

Fire Safety - Information Note FS-INF028

(Previously Supplementary Information Note No 14)

Petrol Filling Stations - Precautions To Avoid Inadvertent Ignition Of Petrol Vapors From Electrostatic Discharges



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1. INTRODUCTION

The following is an extract from the Institute of Petroleum's publication 'Guidelines for the Control of Hazards Arising from Static Electricity' which Petroleum Officers may wish to refer to when:-

- Advising on the design and construction of a petrol filling station,
- Advising on the safety precautions to be taken when dispensing petrol into vehicle fuel tanks and portable containers; and
- Investigating any fires at filling stations (in collaboration with Fire Investigation Officer).

Appendix 'A' to Specification No 19 will be amended in due course to make a brief reference to the IP Guidance for controlling electrostatic hazards at the design and construction stage of a filling station development.

The IP publication as a whole makes interesting reading insofar as it covers:-

- An explanation of how and why static electricity occurs;
- Road and rail loading and unloading;
- Product storage and transfer, including sampling and gauging;
- Ship and barge loading and unloading;
- Deliveries to customers;
- Service station operations;
- Barrel drum and container filling;
- Dust handling;
- Aircraft fuel handling

POs are welcome to borrow this and a range of other reference material from the FSHQ Fire Safety Library.

2. DELIVERIES TO SERVICE STATIONS

Deliveries to service stations take place in an environment, which is different from most other operations in the oil industry. The area is open to the public and consequently the situation is inherently difficult to control. Fortunately the delivery operation is straightforward and the risks due to static electricity are limited.

The introduction of Environmental Control legislation will require most service stations to install vapour balancing equipment. This does not change the basic delivery operation but requires one extra precaution as set out in the following tables. The risks from static electricity during service station delivery are:-

a) The delivery vehicle can become charged during its journey to the site. However, tyres of current design are sufficiently conductive to allow the charge to leak away quickly once movement has stopped, provided that the forecourt surface is not made of insulating material.

b) The flow of liquid from the delivery vehicle to the underground tank can generate a static charge.

c) Personnel involved in the operation may become charged with static electricity.

The precautions shown in table 1 should be taken.

3. FUELLING MOTOR VEHICLES (Forecourt Operations)

3.1 Equipment Design

3.1.1 *Forecourt Surfaces*

Forecourt surfaces should not have a high electrical resistance since it will inhibit the relaxation of charge from the vehicle via its tyres, or charge from the driver. The resistance of the surface to earth should not exceed 108 Ω and should preferably not be greater than 106 Ω. **High resistance surfaces that should be avoided are asphalt and those where the face has been sealed by an impervious, insulating film to contain spillages.**

3.1.2 Tanks, Pipework and Electrical Equipment

a) The metalwork of service station pumps/dispensers should be connected to the earthing terminal of the associated electrical installation.

b) Electrostatic earth bonding of tank/pipe metalwork should not be connected directly to the earthing system of an electrical installation because of the likelihood of introducing electrical system fault currents *etc* into the electrostatic protection earth bonding arrangements.

c) Isolated metal parts of nonconductive tanks/pipework should be electrically bonded together and connected directly to an earth electrode exclusive to those parts, for the purpose of dissipating electrostatic charge. Alternatively, an electrostatic discharge path may be provided by installing a plastics covered copper conductor of not less than 4mm ^{2} cross sectional area between the bonded isolated metal parts and the earthing arrangements of the petrol filling station electrical installation, via a resistor having a value in the range 105 Ω to 106 Ω and a power rating of not less than 2W (2 Watts).

d) Where well coated metal tanks/pipelines are employed, isolating joints *(eg* a plastics insert) should be provided in the pipelines near to each pump/dispenser connection to avoid providing a possible path for electrical fault currents. The tanks/pipework should be connected directly to an earth electrode exclusively for the purpose of dissipating electrostatic charge. Such isolating joints will, in any event, be required where tanks and pipework are provided with cathodic protection, which inherently provides a direct connection to the general mass of earth.

e) For isolated well coated metal tanks/pipework where cathodic protection is not employed, as an alternative to providing an exclusive earth electrode, the isolating joints may be sufficiency conductive to dissipate any electrostatic charge (ie having an electrical resistance in the range 105 Ω to 106 Ω. Alternatively, an electrostatic discharge path may be provided by installing a plastics covered copper conductor of not less than 4 mm ^{2} cross sectional area between the bonded isolated metal parts and the earthing arrangements of the petrol filling station electrical installation, via a resistor having a value in the range 105 Ω to 106 Ω and a power rating of not less than 2W.

f) Where installations having an existing integrated earthing system are to be segregated, care should be exercised to ensure that each of the segregated installations is within specification after the change.

g) Use conductive or static dissipating hose to connect nozzles to pumps/dispensers.

h) Ensure that the nozzle is in electrical contact with the hose.

i) Contact with the nozzle dissipates any charge left on the person filling the vehicle (eg that generated by sliding off a car seat) before any fuel is released and therefore before a flammable atmosphere is present. Consequently, it should be ensured that plastics components on the nozzle (covers etc) do not prevent adequate electrical contact between the person and the earthed metalwork of the nozzle. When operated normally, the resistance between a person's hand and the nozzle should be less than 108 Ω.

3.2 Fuelling Operations

3.2.1 Diesel Vehicles

Under normal ambient conditions diesel vapours are too lean to be ignited by electrostatic discharges. It is therefore considered that no special precautions need be observed as far as electrostatic hazards are concerned.

3.2.2 Petrol Engined Vehicles

Gasoline vapours contained within the fuel tanks of road vehicles are generally too rich[1] to ignite. However, there is a zone near the tank filler cap, which may be in the flammable range when the cap is removed. During fuelling, flammable atmospheres may exist externally around the filler orifice. Therefore the possibility of an ignition from electrostatic discharge has to be considered.

The flow rates and hose diameters used at service stations are usually small enough to ensure that dangerous levels of static charge are not built up in either the vehicle's fuel tank (provided the design is such that it is not highly insulated from the vehicle body) or on the surface of the filling hose. There is the possibility however that an insulated conductor involved in the operation, such as the filling nozzle, the vehicle itself, an insulated filler neck on the vehicle tank, or the person doing the filling, could accumulate a static charge. Any of these could produce a spark in the flammable zone around the filling inlet and cause an ignition.

Sound electrical design of the service station system is a key feature in reducing potential hazards to a very low level; see 3.1. **During the fuelling operation, customers should be encouraged to hold the nozzle in physical contact with the car fill pipe to provide adequate grounding (ie ensure the vehicle and the nozzle are at the same potential).**

There is little that the oil industry can do directly as far as the design of cars and tyres with respect to electrostatic effects is concerned. However, if an incident should occur that is thought to be attributable to static electricity, the car manufacturer or trade association should be advised and requested to check the design and materials used.

4. FILLING PETROL CONTAINERS

4.1 Small Containers

Small petrol containers (nominal capacity up to 5 litres) should be specially designed and constructed for the purpose of storing petrol and should be in accordance with local regulations, where applicable. They may be made of metal or, if regulations permit, plastics of a type that is impervious to, and not physically affected by, petrol.

When filling the container, it should be placed on the ground in firm, direct contact with the forecourt surface, whose electrical properties should comply with 3.1. The person filling the container should stand on the forecourt. Filling should be directly into the container and not via a funnel inserted in the neck. The container should be filled at a controlled, slow rate with the nozzle in contact with the container neck and inserted at least 10cm inside. Checking the dispenser reading will assist in identifying when the filling is nearing completion. The liquid level should be observed towards the end of the fill in order to ensure that overfilling and spillage are avoided. After returning the nozzle to its mounting on the pump/dispenser, the container should be securely sealed with its purpose designed closure.

4.1.2 Larger Containers

Containers larger than 5 litres nominal capacity should be of metal, not plastics, and should be purpose built for the storage of petrol or diesel fuel. The capacity of containers filled on forecourts should not exceed 25 litres [2] . It is important to ensure that the filling nozzle is maintained in contact with the metal container throughout the filling operation. It is recommended that facilities should be provided for bonding the can to the dispenser nozzle during filling. The site supervisor should check that this connection is in place before allowing filling to commence. The filling procedure is otherwise the same as described in 4.1.1.

It is important that the container is in contact with the ground during filling. **Filling a large portable container whilst it is in the back of a vehicle greatly increases the risk of an electrostatic ignition. It is highly hazardous if the container material is nonconducting.**

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[1] A flammable atmosphere may be produced inside the fuel tank at very low ambient temperatures if the gasoline is of low vapour pressure.

[2] Changes under consideration in UK legislation may permit plastics containers up to 10 litre capacity. The capacity limit for larger containers may be increased to 27 litres.

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Table 1 - Precautions to be Taken for Service Station Deliveries

Equipment Guidelines

1. All underground tanks should be properly earthed and also bonded to the delivery pipework. The resistance of an earth bonding path should not exceed 10Ù . Earth bonding conductors should be plastics covered and terminations should be protected against corrosion and mechanical damage.

2. Where vapour balancing equipment is installed, the steel pipework above ground must be bonded to the underground tanks and the delivery pipework, (note this will require special provisions in some cases where the underground vapour pipes are fabricated from nonconducting plastics).

3. All hoses used in the operation should be conductive. Their continuity should be checked regularly. Separate bonding wires are not required.

4. The delivery vehicle equipment should be checked regularly to ensure that it is suitably bonded. Continuity checks should be made between delivery equipment and wheel hubs/axles on the vehicle.

Operating Guidelines

The following guidelines deal with the precautions to be taken to minimise risks from static electricity hazards and should be incorporated into the road loading procedures and training of personnel:-

1. Delivery flow rates should not exceed 1800 litres/min for 100mm (4") pipework and 1300 litres/min for 75mm (3"). This will normally not be exceeded during gravity offloading but must be controlled if a pump is to be used.

2. If liquids contaminated with a second liquid or solid phase are being delivered, the flow velocity should not exceed 1 m/s. This is approximately 450 litres/min in 100mm (4") pipes or 250 litres/min in 75mm (3").

3. If vapour balancing is being carried out the correct procedures should be followed when the vapour hose is disconnected in order to avoid vapour release at ground level. There is a risk from static charges accumulated on the personnel involved in the delivery. **Use of antistatic footwear should be encouraged.**