GUIDANCE NOTE No. 60

SAFE USE AND HANDLING OF HOSES AND FLEXIBLE CONNECTIONS IN THE SOLVENTS INDUSTRY

1. Introduction

The Solvents Industry Association has issued this Guidance Note because of the specific risks when using connection hoses to transfer solvents and therefore covering the maintenance involved in the hoses and flexible connections. This Guidance Note is limited to scenarios associated with the maintenance of connection hoses used with solvents. It is widely recognised that connection hose assemblies should only be used in hazardous duties where permanent piped solutions are not suitable or do not offer a safer alternative solution. However, connection hoses are used in a number of different operations within the solvent industry, most commonly in the transfer of solvent to or from bulk vehicles, transfer of solvents around storage tanks, closed loop systems for liquid or vapour or transfer of solvents to or from packs (drums, IBCs, etc.). The major hazard involved with the transfer of solvents through a connection hose is the build up of static electricity due to a charge separation with potential of discharge resulting in fire and subsequent loss of containment. In addition to this Guidance Note, the SIA have produced the film, 'Solvents and Static Electricity' and the Guidance Note, 'Flammable Solvents and the Hazard of Static Electricity'. Both are available for download via the website www.solvents.org.uk.

There is no one specific regulation controlling maintenance of connection hoses, however a list of associated regulations, standards and guidance is given in the references. This Guidance Note does not replace these legal documents, but highlights the specific risks associated with solvents.

2. Selection of Connection Hose

The following factors need to be taken into account when selecting a connection hose;

- Compatibility of the inner liner material with the solvent to be carried
- Compatibility of the outer cover with working environment
- Flow requirements
- Pressure and temperature range
- The operational environment - length, flexibility and bend radius
- Weight, compactness and support requirements
- Volumetric expansion, movement under loading
- Compatibility of hose with end fittings, and fitting compatibility with media and operational environment
- The seals used in the end of the hoses should be suitable for the product being discharged (PTFE is a universally used seal, however may not be compatible with all solvents)

All connection hoses used for solvents should have the following features;

- Where velocities exceed 1m/s, hoses should be made of conductive material or non-conductive material with embedded fine wire mesh. The mesh should be bonded to the metal flanges or coupling of the hose
- All end connections must be metallic and have electrical continuity bonding in the form of a continuous galvanised steel wire with an overall electrical resistance of <10 ohms
- If a metal hose with a liner is employed, the metal mantle and flanges or couplings must be bonded to each other
- The electrical resistance between the two couplings must not be higher than 10^6 ohms. This resistance is to be measured at regular intervals

There are a number of variants of transfer hoses with various connections on the market, however logistics providers in the solvent industry predominantly standardise on hoses that

conform to BS5842:1980, BS3492:1987, BS EN13765:2010 Type 3 and are made of composite materials.

Composite hoses are manufactured from multiple layers of polypropylene fabrics and films. The inner wire helix can be polypropylene coated carbon steel or stainless steel 316. The outer wire helix can be galvanised steel or stainless steel 316.

The common coupling used is the BSP fastening, and the size of the coupling ranges from 1.5" to 3". Other methods of fastening are used, such as cam lock fittings. API road tankers are fitted with a 6" API female.

Non-conducting tape should not be used on screw joints as it can break the continuity of the metal-to-metal connection in the pipework.

3. Maintenance of Connection Hoses

All connection hoses used in solvent service applications should be examined on a regular basis to assess their suitability for continued service. Inspection frequency and criteria should be developed from site / company specific risk assessment. Some companies do not allow maintenance to be carried out on flexible connections and hoses as they do not have qualified personnel and therefore test certificates or insurance may be invalidated. The competency of personnel carrying out maintenance should be considered as part of the risk assessment.

Prior to use, ideally on a daily basis, connection hoses and their fittings should be visually examined for physical damage such as;

- Blisters or bulges, dents
- Looseness of the outer cover
- Excessive softening or hardening of the hose (any of these three points may indicate fractured or displaced reinforcement or a leaking liner)
- Kinks, twists (poor installation)
- Abrasion, cuts, excessive elongation under load or test
- End coupling integrity (thread damage, distorted, oval, fractured, etc.)
- Corrosion of outer wires (reduced wire diameter by chemical attack, rusting, etc.)
- Scuffing of outer wires

- Serious displacement of outer wires
- Collapse of outer wire
- Collapse of inner wire
- Serious scuffing of outer cover (through to inner reinforcing fabrics)
- Severe impact damage to hose body
- Damage or deformity to the seal
- An in-date tag

Any hose exhibiting cover cracks, cuts or bulges should be removed from service, examined and re-tested as necessary. Any hose with reinforcement exposed should be removed from service and replaced if the extent of the damage exceeds manufacturer recommended limits. If in doubt, hoses displaying visible faults should be replaced.

An electrical continuity test should be performed periodically with the industry standard being every 12 months. This test is carried out by obtaining a circuit through an electrical resistance meter and observing the reading. In general, standard readings must be less than 10 Ohms per metre. However, much will depend on each manufacturers hose construction / material specification. It is recommended to take into account manufacturers' recommendations and the standard states it should be less than 100 Ohms per assembly. The test must be carried out on a dry non-conductive surface. If the hose fails the electrical resistance test then the pressure test cannot be carried out and the failure must then be repaired.

In addition to the electrical continuity test, pressure testing should be carried out in compliance with relevant vendor's procedure. Records of visual examination should be kept, recording the condition of the hose on a particular date and the date of next inspection. The hose should be tagged with the latest inspection date and the date of next inspection.

Any connection hose failing the visual inspection, electrical continuity test or pressure test should be removed from service and ideally destroyed to prevent unintentional use.

It is good practice to keep an asset register of all connection hoses, showing the following information;

- Unique tag list
- Suppliers name and material certification
- Pressure test certificate
- Electrical continuity test certificate
- Date of manufacture

4. Management Systems

Duty holders should ensure that the integrity of any connection hose used on solvent duty is addressed within their management system. Elements should include consideration of design, risk assessment, construction, installation, commissioning, operation, maintenance, testing, modification and decommissioning.

Persons responsible for hose selection, maintenance or use should be suitably competent and aware of safety critical factors affecting connection hose integrity through an understanding of hose constructional elements and their function in maintaining integrity, failure modes, failure criteria, etc.

When connection hoses are used for bulk transfer of solvents, the Duty holder should employ a bulk loading and offloading procedure. This should include written instruction that state when offloading flammable liquids, the driver must first connect the tanker to the earthing connection at the off-loading point. The electrically conducting discharge hose can then be connected to the liquid intake point on the storage. The electrical resistance between the two couplings on a flexible hose must not be higher than 10^6 ohms.

All records associated with maintenance and testing of connection hoses should be held.

5. References

Management of Health and Safety at Work Regulations 1999

Dangerous Substances and Explosive Atmospheres Regulations 2002

Provision and Use of Work Equipment Regulations 1998

Guidance Note 47 Flammable Solvents and the Hazard of Static Electricity, SIA

Institute of Petroleum / Oil and Gas UK 'Guidelines for the Management, Design, Installation and Maintenance of Small Bore Tubing Systems' (ISBN 0 85293 275 8)

Guidelines for the management of flexible hose assemblies – The Energy Institute 2nd Edition 2011

HS(G)176 The storage of flammable liquids in tanks, HSE, 2015

HS(G)140 Safe use and handling of flammable liquids, HSE, 2015

BS 3492:1987 Specification for electrically bonded road and rail tanker hose and hose assemblies for petroleum products, including aviation fuels, British Standards Institution.

BS 5842:1980 Specification for thermoplastic hose assemblies for dock, road and tanker use

BS 3492:1987 Specification for road and rail tanker hoses and hose assemblies for petroleum products, including aviation fuels

BS EN 13765:2010 Thermoplastic multi-layer (non-vulcanized) hoses and hose assemblies for the transfer of hydrocarbons, solvents and chemicals. Specification

BS EN ISO 15465:2004 Pipework. Stripwound metal hoses and hose assemblies

BS EN 14420 Hose fittings with clamp units: Various parts (eg flange, threaded, cam-lock etc)

BS ISO 15348:2002 Pipework. Metal bellows expansion joints

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