Providing Complete Fluid Handling Solutions…

…Without Compromise

CRP Spikies® Earth Continuity Rings
To Suit ASME Class 150 Piping Systems

Preventing Static Electricity build up in PTFE Lined Piping Systems

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The Problem

Ever since the first large scale chemical and pharmaceutical plants were constructed there have been issues with earth continuity on process plant. In the broadest sense these problems arise as follows:

- A build up of an electrical charge on a piece of equipment occurs.
- The charge is discharged as a spark.
- If an explosive of flammable atmosphere is present when the spark is created, this can lead to a fire or an explosion.

Dealing with each of these in turn:

Electrical charge build up

This can occur for many reasons. In the extreme it can be caused by a lightning strike, but more common causes are things such as a fault on a piece of electrical equipment, or electrostatic charging due to the flow of a non-conducting fluid past a non-conducting surface, or the rubbing together of two non-conducting surfaces.

Creation of a spark

If two items with different electrical charges are brought into proximity of each other there is a tendency for the charges to try to balance out. If the items are conductors and they are in contact with each other then a current will flow from one to the other to balance the charge. However, if they are simply near to each other, if the charge difference is sufficiently great, this will result in a spark jumping between the two. The larger the charge difference, the greater the gap that can be jumped, and the larger the spark that can be created. Alternatively, with a fixed level of charge, as two items approach each other, eventually they will be sufficiently close together for a spark to be created. Please note that the shape of the items also has a bearing upon spark creation, but this is beyond the scope of these discussions.

Triggering of an explosion or fire

If the atmosphere in the vicinity of a spark contains the correct proportions of materials, and the spark is of sufficient energy, this can trigger a fire or an explosion. There are many combinations of gases and dusts that can cause an atmosphere to be flammable or explosive, but suffice to say that over the years, there have been many documented cases of explosions and fires ignited by electrical sparks in such atmospheres. The results of such occurrences vary from minor inconvenience all the way up to complete destruction of plant with multiple loss of life.

Legal and Standards Framework – ATEX Directives

On the 1st of July 2003, two new EU Directives known as the ATEX directives came into force. In the UK the “Dangerous Substances and Explosive Atmospheres Regulations 2002” (DSEAR) came into force too. These regulations implemented the safety aspects of the “Chemical Agents Directive (98/24/EC)”, known as CAD, and the “Explosive Atmospheres Directive (99/92/EC)”, known as **ATEX** 137. The requirements of these regulations built upon part 1 of the “Health and Safety at Work Act 1974”. DSEAR requires that the employer demonstrate that he has taken all technical and/or organisational measures to reduce the risk from dangerous substances, so far as is reasonably practicable. Where the nature of the activity precludes elimination of the risk, the employer should remove initiation events, such as sources of ignition, and install equipment to mitigate the detrimental effects of an explosion or other energetic event. Where necessary these measures should be combined and/or supplemented with measures to prevent the propagation of explosions.

While the above provides the legal framework for dealing with hazards arising from the build up of electrical charges on process equipment, “BS5958 Part 1 (1991) Code of Practice for Control of Undesirable Static Electricity – General Considerations. Section 4 – Earthing and Bonding” provides practical guidance to the plant operator on how best to earth pipework and other structures. In short the standard suggests that a maximum resistance from anywhere on a plant to earth should not exceed 10 Ohms.

Vanstone flared steel stub end and rotating flange fitted with Spikie earthing ring

Preventing Problems in PTFE Lined Piping Systems

If charge build up within pipework caused by the flow of non-conducting liquids (such as solvents) over virgin PTFE is a problem, the first step to solving the problem can be the use of antistatic PTFE liner. The details of this material and its properties are dealt with more fully elsewhere. For the purposes of this discussion, it should be said that the antistatic version of PTFE will allow static charge to slowly migrate from the inner surface of the PTFE to the outer surface of the PTFE, and from there it will contact the steel outer housing. However, the charge has not yet reached earth and could still prove to be lethal. Nb. Although antistatic lined piping components have two conductive flare faces between each component, these will not serve to provide a satisfactory earth path for static charge. The resistance to the flow of electrical current is too large for them to be effective.

Earthing of metallic piping components

The aim of any earthing system is to ensure that there is a path from the source of any electrical charge to earth of less than 10 Ohms. Typically this is achieved by producing an all metal route for the charge to follow. The means to achieve this varies from organisation to organisation, but typically if the pipework is all constructed of fixed flange items, it is acceptable to bolt these together using stud bolts and star washers. The star washers will bite through any paintwork on the flanges and will bite into the nuts on the studs. This provides an earth path from flange to flange. However, if rotating flanges are used, either using welded on stub ends or Conrac/Vanstone style ends, the star washer approach breaks down since it cannot guarantee earth continuity from flange to stub end. Traditionally, this problem has been tackled by welding on earthing lugs or studs onto each individual metal item. These studs of lugs are then all linked using copper earth straps. While effective, this approach is both time consuming and expensive..

Spikies

In order to address the issue of earthing rotating flanged components CRP has developed its range of Spikies®.

Spikies® are simply slipped into place between the loose flange and stub end on a pipe spool or fitting, and the joint made using star washers and studs as on a fixed flange joint. Once in place the centring lugs ensure that the raised points on the Spikies® are positioned to bite into the front of the flange face and the back of the stub end, thus providing earth continuity from rotating flange to fitting / spool.

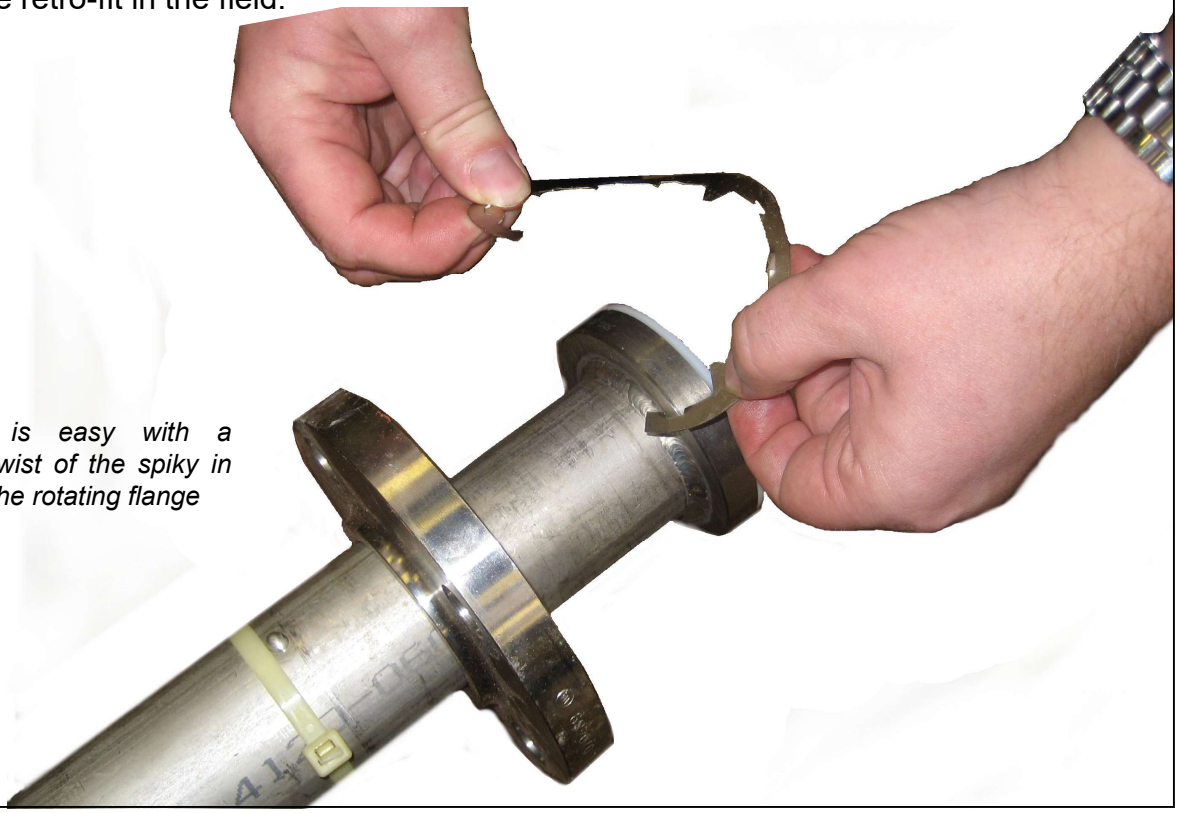
Development

The extensive design, development and testing programme for Spikies® has ensured that the optimum spring steel substrate and nickel corrosion protection coating materials have been used, along with a design that makes Spikies® a truly durable fit and forget solution to process plant pipework earth continuity issues.

nb. CRP recommends the replacement of Spikies® whenever a joint is split.

Cost and Reliability

The spiky provides a robust and cost effective solution to achieving earth continuity between the pipe body and a rotating flange. It can be supplied factory fitted or can easily be retro-fit in the field.



Retrofit is easy with a simple twist of the spiky in front of the rotating flange

CRP's Spikies User List - October 2007

Pharmaceutical API producer

Supplied on new pilot plant. Historically their engineers would build and commission the plant including hydrotest. Then the electrical and instrumentation engineers would spend several days or even weeks checking electrical continuity of joints and making good where necessary, a very time consuming and costly exercise.

The decision was made to move to Spikies because of their fool proof design, very quick installation and near 100% pass rate.

Multinational Pharmaceutical Manufacturer

This site had always used pipe spools with fixed welded flanges and star washers to maintain continuity, a comparatively expensive piping system. By offering a Vanstone rotating flange piping system with spikes fitted cost savings were passed on to the customer whilst not compromising their stringent earth continuity requirements.

Leading American Pharmaceutical Manufacturer

Maintenance workers were keen to utilise the spikes when repairing and replacing piping because of the very quick fitment meaning little down time and high cost savings in being able to quickly get the plant up and running, Continuity tests after were always well within specification.

Indian Intermediates Pharmaceutical Manufacturer

With the introduction of ATEX regulations new test regimes were introduced highlighting problems with existing earth continuity. CRP spikes were seen as a good solution being both low cost and quickly fitted, replacing the ageing Tenby style earth clamps. Initial workshop trials were carried out and continuity was found to be in place when bolts were only hand tightened. When properly tensioned the spikes worked very well. They are now site standard and replace all earth straps on new builds, when existing plant is modified the straps are removed and replaced with CRP Spikie washers.

leading Independent Manufacturer of Performance and Specialty Chemicals.

As part of site wide engineering improvement programme addressing the ATEX directives ensuring compliance, Their Engineers introduced the requirement to fit Spikie earthing washers. Their low cost and quick and easy fitment made them an Ideal solution to help with their earth continuity improvements,

Worldwide Oil Refiner

The Spikie washers are routinely supplied fitted to all rotating flanges through the onsite water management contractor. They provide services covering all aspects of cooling, process and waste water / effluent. Some of these can carry hydrocarbons and other flammable liquids, the spikes are used to ensure static cannot build up between piping joints to help prevent static build up.

Pharmaceutical Manufacturer

Reducing the possibility of arcing from equipment on site was very important, the Spikie washers were adopted as another line of defence reducing the possibility of any explosions on site,

Bulk Pharmaceutical Manufacturer

The Spikies simple installation and proven effectiveness soon caught the interest of the instrumentation engineers who had previously used rather time consuming earth bonding methods to maintain plant integrity. Both saving money and improving standards.

Leading Chemical Biocides Manufacturer

The instrumentation engineers had the job of checking the continuity on site. They had been previously using earthing clamps and strapping, Proving both expensive and unreliable. After some initial trials the spikes were adopted as site standard replacing the straps on all new build, giving savings over the cost of the earth straps, the fitting time and overall success rate of the joints.

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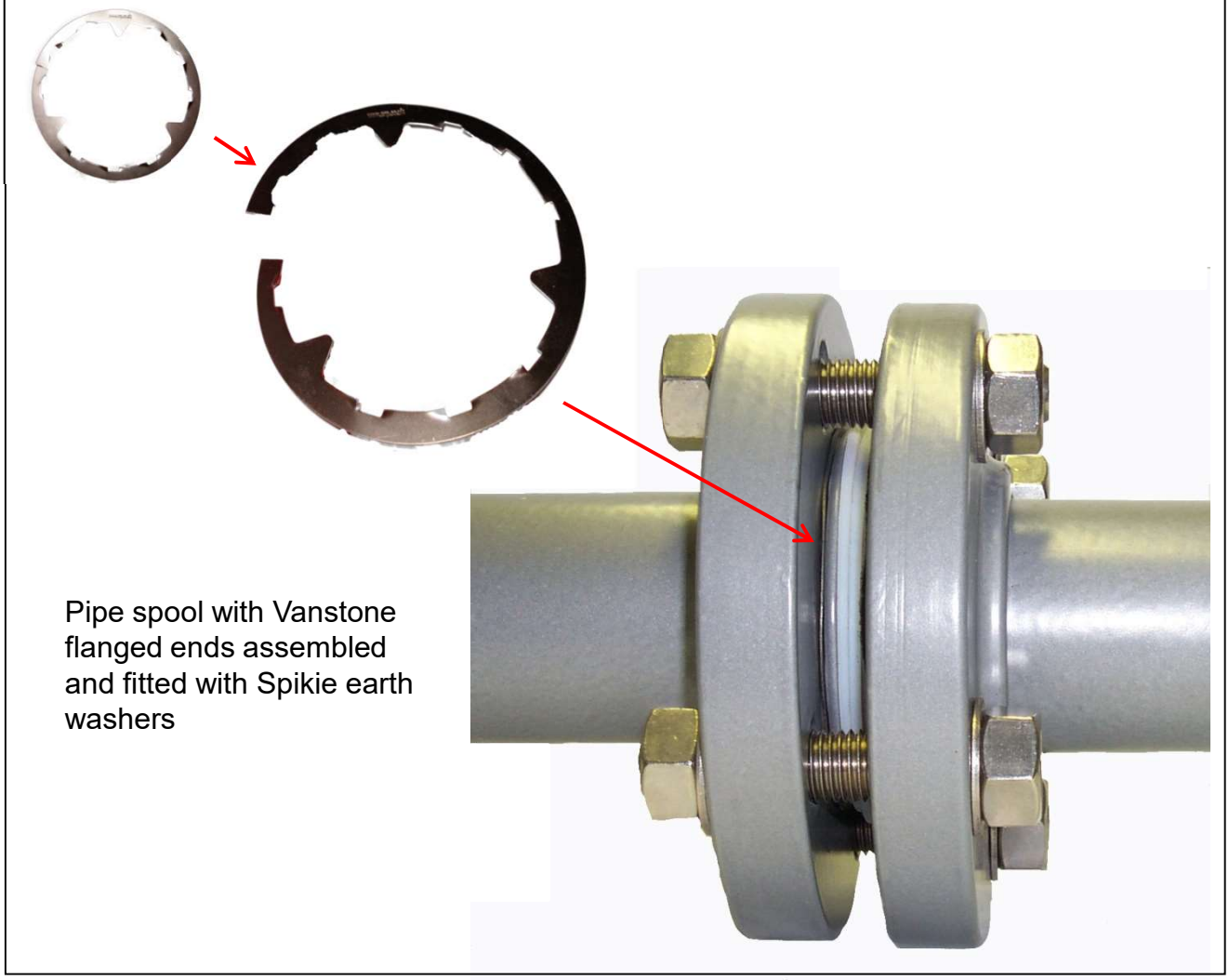
CRP's Spikies User List continued

Worldwide Chemical & Polymer Manufacturer

Spikies were adopted on site by the design team working on a new project, they were seen as a new and innovative safety product helping maintain the effect earth bonding of piping from the outset.

Global Pharmaceutical Manufacturer

Historically the site had used pipe spools with fixed welded flanges to minimise the static build up on piping. Utilising this type of piping was both expensive and caused difficulty with aligning pipe on site when constructing new systems. Project management on site approved the use of CRP's Vanstone construction of pipe spool offering significant cost savings over welded construction piping, The spikies were adopted to maintain the earthing continuity which was still required, giving an overall cost saving.



Pipe spool with Vanstone flanged ends assembled and fitted with Spikie earth washers