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Air Liquide

Seven Orders with a value of 200.000 Euro in 2007

Air Liquide China was the main base for AG business. Thanks for the good relationship company Sergas we met Air Liquide high level people from purchasing and engineering. Compared with Linde construction Air Liquide used 3 pilot valves, 2 in using and 1 for stand by. In order to fulfill the requirement and make our pilot valve in price competitive we decide to provide PM/S with only one pilot. Through the joint effort with PROTEGO® Germany, we got competitive price and delivery time. The first contract with Air Liquide was signed on 30th January 2006. The great success in 2007 was that we got 7 Air Liquide orders with a value of 200.000 Euro.

PROTEGO® M.E.

Al Maktoum International Airport

PROTEGO® Floating Suction Units for a huge airport project

The Al Maktoum International Airport is the most prestigious and most talked about airport project in the World. The Utilities tender for this project was one of the 1st. we worked on from the Contractors bidding stage. The main prospect for this project was identified as Thermo Amak. The MD of Amana Pipelines, Mr. Nabil Helou was known to us and I arranged a presentation on our products in their office. The presentation not only covered our Tank Devices but also Tank Equipment. The immediate attention was on the Floating Suction Units. The requirement for this project was 2 x 24" FSU'S in Stainless Steel for each tank. At start there were 3 Tanks and hence the requirement was 6 x 24" FSU's. This was communicated to Germany and we started work on the proposal. At this stage we were not on the Vendor list of the Client (DCA) nor the Consultant (Penspen). When the Project was awarded to Thermo-Amak we were advised by Mr. Nabil that we will need to get our Plant Audited by a delegation of senior persons from DCA, Penspen, Dar Al Handesah and Thermo Amak.

This audit was conducted with precision under the co-ordination of Mr. Wolfgang Kirchner at BFG. We got immediate acceptance by the delegation. The Contract for the 1st. Six sets of 24" FSU's followed. Now, in November 2008 we have delivered and installed the 6 units and have delivered another 4 units. There are a number of units still to follow in the coming years as the number of tanks is approx. 34 which will be built over a period of 10 years.

PROTEGO® China

BASF-YPC

DA-SB reduces pressure loss on 8 mbar instead of Amal's flame arrester pressure drop of more than 100 mbar

BASF-YPC used in year 2004 Amal's detonation flame arrester with size 6" for its flare plant. Due to high pressure drop, more than 100 mbar, the plant worked unstable. BASF asked us to help them. After replacement with our DA-SB the pressure loss reduced on 8 mbar and the customer was very satisfied. Please see attached photo. We also managed to replace all of the flame arresters from Amal in this plant. Fact is higher than words this is a very good story for showing our technology advantage.

Bechtel/ Reliance Industries Limited

1. PROTEGO® India

Effective co-ordination between PROTEGO® teams leading to a large order from a prestigious customer

Requirement:

- 163 Flame arrestors & 52 Emergency vents
- Short delivery & Competitive pricing

Competition:

- Amal ,Marvac

Constraint:

- Pricing Pressure
- Competition aggressive
- Customer in London

Actions:

- Build customer relationship
- Utilize local PROTEGO® office
- Modifications done in some components
- Aggressive vendor commitments & final competitive pricing

Result:

- Largest order for PEPL to date
- Customer confidence
- Example of effective co-ordination

2. PROTEGO® UK

Good example of global team work with the PROTEGO® group

Bechtel London was awarded the contract for the Reliance Jamnager Export Refinery project in India. This was basically a repeat of an earlier project for the first Reliance refinery at Jamnager for which the flame arresters and breather valves were supplied by Amal and Marvac. For this project engineering control and specification

was by Bechtel London and commercial and purchase order placement by Reliance personal based in Bechtel London office.

For this project after consultation over strategy with BFG and PEPL it was decided that

PROTEGO® would have the best chance of success if PROTEGO® UK handled the technical evaluation and prepared the bid based on manufacture by PEPL. It was clear that to give Reliance the possibility to place an order directly on PEPL would be an advantage for PROTEGO® over Amal / Marvac but having PROTEGO® UK handle the technical evaluation by Bechtel personal would make acceptance of the bid easier.

Through close cooperation between PEPL and PROTEGO UK PROTEGO® was able to the win the contract and additional follow up orders were also secured using the same approach. This is a good example of global team work with the PROTEGO® group leading to success for the group.

BorsodChem Zrt.

Manufacturer of polyurethane raw materials and vynils

BorsodChem is an important chemical producer with two main product groups: polyurethane raw materials (MDI, TDI) and vynils (PVC resins and compounds, caustic soda etc.). The company is located not far from Miskolc.
The first MDI Plant was completed early in 90 years with application of some PROTEGO® devices, these were bought by foreign Contractor directly from Braunschweiger Flammenfilter GmbH. The BorsodChem was happy when we got into a contact and we added documentation in Hungarian language to the devices.
Later on was built up a TDI Plant. At this project we supported already the BorsodChem for engineering, selected the adequate devices, mainly pressure/vacuum relief valves, to the given processes.
Because BorsodChem was satisfied with quality and functionality of the PROT EGO® products as well as with our engineering and after sales service, at the MDI -2 Plant were installed PROTEGO® devices too. A new TDI -2 Plant is planned now, the realization early in the next year to be expected. Based on the good experiences as well as excellent relationships we could and can deliver PROTEGO® devices for the other plants of BorsodChem too. In this way BorsodChem is one of our most important partners.

Brasken Alagoas

Success through technical support

Due a long-term technical support, which included 4 technical visits of Francisco Siestrup, 8 visits of our local rep', testing of sample tantal-material in the installation for over 6 months, we finally managed to supply two Flame Arresters of 6 inches in Tantal and Hastelloy.

British Petroleum (BP)

Bottom up sales concept results in a contract with BP

The BP success story started with a visit to Dennis DeMichael at Dupont. We had a very brief meeting scheduled in which Dennis DeMichael only wanted to provide us with 5 minutes of his time. Dennis is the global Safety Relief expert on high pressure safety relief valves. We convinced Dennis with detailed thermodynamic and process knowledge that we are worthwhile to spend his time with. After the meeting Dennis asked PROTEGO® USA to hold a presentation for the API 2000 committee.

The presentation went extremely well and the committee decided that PROTEGO® USA should work on the committee. Through extensive committee work and the bringing of knowledge to the committee in the low pressure venting area, Ed Zamejc, (BP's global expert for high pressure relieving systems) provided us with the opportunity to get in-front of the people to negotiate a North American contract with BP.

In parallel we worked our "bottom up" sales concept and visited the Texas City plant extensively. PROTEGO® provided free of charge maintenance training.

We made BP a Key Account and helped them to manage their tank farm. We sponsored the BP barbeque cook out team, which are the guys who are responsible for the tank turnaround and analyzed who the gate keepers are at BP. Gate keepers are people who are sitting in strategic functions and decide, if someone is going to sell their product or not.

The contract was signed shortly after and it supported sales beyond the North American borders also in Europe.

After the contract was signed we took Christoph Leinemann along to show the commitment to BP which was taken.

Carbovac

How to create synergy with our customer

Historical story in France

After SIMEX shuttered, Carbovac was created by SIMEX's former workers with the financial support of ALMA. SIMEX has always worked with SID-PROTEGO and so does Carbovac.

Difficulty

However, the most difficulty was to work exclusively with Carbovac. We put in place annual contracts, fixed prices (so we do not have to do quotation every time) and financial attractive conditions for VD/TS valves and DA/SB flame-arresters.

Commercial process

Our commercial relations with Carbovac are based on mutual trust and an intensive relation (visit, phone…). As it was an important partner as well as a confident, we decided in 2008 to work more nearly with ALMA Services (Alma group): they are in charge of the service of our VRU with an internal training done by SID STEIBLE. The maintenance of these equipments is facilite due to the trapdoor and maintening-box of our device. So this creates a commercial exchange: Carbovac bought exclusively PROTEGO®'s products and ALMA Services is in charge of the equipments maintenance in France.

Success reasons

So this successful cooperation is based on an intensive business relation and the will to create synergy with our customer in order to become more than only customer: be a PARTNER!

Actually, we assist on a strong international competition. Moreover, Carbovac is located all around the World, so we invite you to get contact and propose them to develop synergy and contributed work as we've done!

CLH

Ausstattung des spanischen Logistik-Monopolisten für petrochemische Produkte

Unser größter Erfolg dieses Jahr war der Gewinn der ersten grossen Ausschreibung von CLH, dem spanischen Logistik Monopolisten für Petrochemische Produkte. Nach eigenen Aussagen hat man 2.200 Festdachtanks, die fast alle weder Ventile noch Flammenfilter besitzen.
Mit diesem Auftrag sind unsere Armaturen mit einem Schlag in allen 15 Tanklägern präsent.
Grundsätzlich sehe ich speziell 2 Hauptgründe für unseren Erfolg: Zum einen arbeiten wir fast ausschliesslich mit den Endkunden direkt, was die Kalkulation erleichtert und zum anderen, haben wir eine sehr flexible Preispolitik.

Herwig Toedt
Director
PROTEGO® España

ConocoPhillips / Costain

New project for a marine vapour recovery unit

In early 2005 through our contacts on site at the ConocoPhillips Teesside facility we became aware of a new project for a marine vapour recovery unit with EPC by Manchester based engineering house Costain Oil & Gas.
We were aware that one of the first such systems in the UK installed in the early 1990's at the ConocoPhillips Immingham terminal had used Westech 55 series detonation arresters due to the Westech experience with this type of application in the USA and the suitability of their devices due to their exceptionally low pressure drop which could not be matched by UK manufacturers such as Amal.
We were granted a short meeting with the project team at Costain during which they explained they required 6 detonation arresters in sizes 18" to 24" and that these arresters must be USCG accepted (as well as ATEX approved) as they believed USCG was the most exacting flame arrester standard available. Using our involvement in the development of EN12874 we presented the case that EN 12874 was in fact state of the art and at the end of the meeting Costain agreed that we would be given the opportunity to quote for EN12874 approved devices and that USCG approval was not necessary. On receiving the process data it was clear that PROTEGO® that did not currently have devices approved for the low pressure drop required and elevated operating pressure.
Nevertheless we felt we could develop and approve suitable devices within the project timeframe and a second meeting was arranged attended by Christoph Leinemann during which we presented our proposals. We were successful to convince Costain /ConocoPhillips about our capabilities and we received the order.

Cytec

Using a site survey report to convince the company

Cytec is one of the success stories where we used a site survey report to convince the plant to replace a lot of misapplied flame arresters from PROTECTOSEAL. Please review the attached report (Link: "Flame Arrester and Vent Safety Analysis for Cytec")

We also managed to create an opportunity for replacement in the UK, which David Long will most likely close in a short period of time.

Cytec was also worked on the corporate level and on the DIERS (Design Institute of Emergency Relief Systems) level. Cytec was offered many engineering solutions by PROTEGO® which other companies could not provide.

Through the corporate approach and excellent contacts to corporate engineering we supported PROTEGO® Spain to get into a good position to close an extensive order.

Diageo

A whiskey manufacturer equipped with PROTEGO® VD/TS

Whiskey manufacturer Diageo had a project to build a number of alcohol storage tanks requiring flame arresters and breather valves. Previously they were purchasing mainly from Elmac who were combining their flame arresters with separate breather valves from Motherwell Tank Protection. For this project Diageo selected the engineering house CEL for the EPC. This was a high profile project and CEL was tasked to build the tanks to 'state of the art'.
In discussions with CEL we proposed the VD/TS as an alternative to separate flame arresters and breather valves focussing on the advantages for ease of maintenance as well as our 10% full lift technology. CEL and Diageo were convinced of the advantages of the VD/TS and we were successful to receive the order for 15 pieces VT/TS- 300 valves.
We then provided training to the Diageo maintenance team. Since then we have become the preferred supplier to Diageo for flame arresters and have received further orders for tank applications and more recently flame arresters and in line valves for distillation applications as well.

Flare System Market UK

Flare systems for landfill biogas applications

Following the formation of PROTEGO® UK we wanted to develop regular OEM business with a number of UK companies manufacturing flare systems for landfill biogas applications. These companies were purchasing flame arresters on a regular basis mainly from the UK competitors Elmac and Amal but also from Kito and RMG. A number had previously bought very low cost elements from Elmac but ATEX requirements meant this was no longer possible.

Ny Lam took on the task to evaluate the market, finding the potential customers and identifying what they required. It became clear that these customers were looking for a competitively priced product but that good service and a low pressure drop were also vitally important. We decided that our FA-E was the best product to offer as it gave a better pressure drop than the Elmac equivalent and was available on short lead time. Ny developed a pricing strategy for this market and we were successful to convert the customers to PROTEGO®. Since then we have converted the market to our Group I approved variant as Elmac do not have a specific device for Group I.

The market requires short lead times and recently our longer lead times have caused some difficulties. However if we can get back to offering short and reliable lead times for these products we will continue to be successful in this market.

GlaxoSmithKline

Convincing the engineers of using PROTEGO® flame arresters

GlaxoSmithKline Ulverston site had a requirement to replace a large number of Knitmesh flame arresters that did not meet ATEX requirements. These had been in use for many years. More recently that site had standardised on Amal who were the current preferred supplier for the site. PROTEGO® had no history on site and was unknown to the site engineering community. However PROTEGO® had a very good record at GlaxoSmithKline in Cork, Ireland and using this recommendation we were able to arrange a 30 minute presentation to the site engineering team. During this presentation it became clear that ease of maintenance of flame arresters was a major issue for the customer and we focussed on the advantages of the FA-CN & DR/ES type devices.
We then held a second meeting with the site maintenance engineers during which they were given the opportunity for 'hands on' with the PROTEGO® devices. Following this we did a site evaluation for a section of the plant. Finally PROTEGO® was selected as the preferred supplier for the site instead of Amal. As a result of this success we were then asked to repeat the process at GlaxoSmithKline Irvine plant and again were selected as the preferred supplier for this site.

Granel-Odfjell

Preference for PROTEGO® devices in all south-American plants

We made some technical lectures about the technical/financial benefits of using PROTEGO®. Reliability was also explored. The lower overpressure, higher tightness, manufacturing flexibility (ER/VH for higher pressures) resulted in the preference for PROTEGO® devices in all south-American plants. They only buy PROTEGO®.

Horizon Terminal JAFZ

Convincing the storage facility for chemicals to go with a higer bidder

Horizon Terminals JAFZ, an ENOC Group venture is a storage facility for Chemicals. This terminal was constructed in three phases and comprises over 50 storage tanks. The terminal has an installation of a number of Breather Valves, Nitrogen Blanketing Valves and Rupture Disc for Emergency Venting. Our focus was to share our knowledge with the terminal Manager and Maintenance Manager on the 10% technology and low leakage rates of our Breather Valves. The client had in 2006 all Breather Valves from either Whessoe Varec or Shand & Jurs. We knew for certain these valves have a high leakage rate and we struck a cord with the terminal personnel on this issue. After a detailed presentation which was held in mid 2006 by Mr. Kirchner & Mr. Advani the Terminal Manager decided to indent for replacement of some of the installed Breather Valves.

The tender was issued to us and the above stated manufacturers. After technical scrutiny and another round of technical discussions the client decided to go with us though we were more expensive than the other manufacturers. This was one of the few times in the history of the Company (Semi- Government) to go with a Higher bidder. Since the first installation in late 2006 the client has replaced a number of Breather Valves. In the 1st. Quarter of 2008 the client again called on us to study their Nitrogen Blanketing system and offer replacements for the existing Anderson Greenwood Nitrogen Blanketing Valves. They then tendered for replacing 12 Nos. of the Nitrogen Blanketing Valves. At the final stage of ordering the Purchase Department reduced the number to only 4 Nos. on the same pretext that they were replacing with the existing ones with another Manufacturer and hence they should first place a trial order on PROTEGO®.

The ordered valves were then delivered and now have been installed and in operation for the last 3 months and the feedback we have from the client is that they are very satisfied with our devices and shall in the coming months to replace all the Nitrogen Blanketing Valves with PROTEGO® devices. As a result of this success, when the ENOC Group set up a Tank Terminal in another location in the Emirates, they gave us a Preferred Vendor status and the Contractor placed the Contract on us for the complete installation of Vents. This project is the ENOC IRM Tank Terminal Fujeirah UAE.

SID STEIBLE

Intertechnique

Getting into a new area: aernonautic

Historical story

INTERTECHNIQUE is a company specialized in aeronautic area and a member of Zodiac group. Our contacts with INTERTECHNIQUE started in 2002 with the senior buyers. At this time, INTERTECHNIQUE was working under contract till 2008 with another company.

Was this contract a brake for SID Steible? No, of course!

Commercial process

Since 2002, we intensified business relations with buyers in order to prove them our will to work with them, with INTERTECHNIQUE and naturally to have the opportunity to work in an another activity area: aeronautic! This patience work allow us to have the first order in 2007 (5 years later…)

INTERTECHNIQUE needs flame-arresters cartridge in order to protect the kerozen tank, located on the fly wings. Unfortunately, the specificity within the size, weight and performance were not compatible. But we didn't discourage us…

We worked with Dr Heidermann (PROTEGO®) on their specificity, realized technical plans, made technical tests on our test bed and developed a customized solution only for INTERTECHNIQUE. The objective was to find a balance between the weight, the pressure drop and the expected specificity. The challenge was taken! PROTEGO® has done it for SID STEIBLE.

Success'reasons

The technical collaboration, the availability and the know-how of our engineers has shown that patience, intensive business relation and developing customized solutions bring success. We are now, in 2009, the supplier for INTERTECHNIQUE flame-arresters cartridge.

Thanks to this project, SID Steible is now working in a dynamic area: aeronautic. This contract with INTERTECHNIQUE was a chance for us to develop contracts in the aeronautic area. As example, we are new working with Eurocopter. This collaborative work gives us the opportunity to have an interesting potential development.

Takreer – Belleli & Dodsal

Inter Refinery Pipeline

The IRP--Takreer Project was the most prestigious project in the UAE in 2006-07.
Takreer is the largest Refinery Company in the UAE and is part of the ADNOC Group.
The scope of the project was to interconnect by Pipelines the terminals of the Refinery in the UAE and comprised of New Tank Terminals at the various locations.
The PMC Company Tebodin was given an Approved Vendor List in 2005-06 and as we were still in the stage of getting registered at the Key End Users our name did not show up in the list. This made the situation even more difficult for us and when we got a copy of the Tank Data sheets it contained the Model Numbers of Whessoe Varec and Shand & Jurs. Fortunately for us they also stated "OR EQUIVALENT". The first thought that cam to our mind was that "What Equivalent", we are even better than our counter parts from the UK/USA. The task was defined and we went about the strategy for the Middle East market.
We got our Representative in Abu Dhabi to speed up the process of getting registered at Takreer. At the same time we used our good offices with Tebodin's Project Manager (Mr. Sen.) to acknowledge our technical superiority. The timings were perfect when we contacted the prospective bidders for the project and got involved at the Bidding stage itself. A complete package offer was made to the prospective Tank Contractors, this comprised of Rim Vents, Emergency Vents, Floating Suction Units and Gauge Hatches.The contract was awarded to Dodsal for the complete project and they Sub-contracted the Tanks to Belleli Energy Spa. By this time we had been approved by Takreer as a vendor.
The formal enquiry was quoted for and we had the rounds of technical discussions. Belleli had accepted our technical superiority and if PROTEGO® can provide Commissioning support then we shall get a preference. WE did get the contract for the supply of Floating Suction Units, Rim Vents and Gauge Hatches. The devices were commissioned by PME and the devices are in operation despite some hick-ups after commissioning.

Joint Operations – Kuwait & Saudi Arabia

Joint Operations is a Joint Venture Company of Kuwait Oil Company, Saudi Aramco & Chevron. The Company has large storage facilities in Saudi Arabia & Kuwait.

JO – Saudi Arabia:

The terminals in Saudi Arabia have a large number of Floating roof tanks and Fixed Roof Tanks. Our Representative in Saudi Arabia, M/s. Econosto went about the job in earnest and arranged a technical presentation at the JO Terminal in February 2007. The focus was to replace the existing Rim Vents of the Japanese competitors (NIKURA & KANEKO). We were very clear that we will need to introduce the client to the Integral Breather Valve & Flame Arrester Model VD/TS. During the presentation we demonstrated the cut-away of the device which immediately caught the attention of the Terminal Manager and the Terminal Maintenance team. The site visit was organized thereafter and we were asked to submit our technical offer.
Within a month we received a formal tender for 195 Nos. of VD/TS 150. Thereafter we secured the contract in April 07 to supply the 195 Nos. in 4 lots. The order was successfully executed and now the client is planning another replacement of the remaining Japanese devices. We are hopeful that by Mid-2008 the complete JO tank farm in Saudi Arabia will have PROTEGO® devices installed.

JO -- Kuwait:

The terminal in Kuwait was contacted via our Representative, Alghanim International. A Technical Presentation was arranged in mid 2007 which was conducted by Mr. Sanjiv Advani and Mr. Sven Zdun. During the discussions we were given to understand by the Terminal Superintendent that they have a number of Detonation Flame arresters supplied by Enardo & Tanktech in their Flare lines. The focus immediately was to highlight the issue of Pressure Drop and ease of maintenance of our devices. A site visit was arranged thereafter and we observed that the terminal had over 30 Detonation flame arresters of sizes varying from 6" to 24". The client was having problems with maintenance of the existing devices and they were asking for us to provide a solution. As the Budgets for the replacement of the existing devices was not in place the client decided to replace the Flame Arresters in phases. They started with the 24"devices as these were the ones giving them a lot of maintenance problems. JO being a Government Company can only award the contact to the lowest technically accepted bidder. Based on technical support we were given to understand that Tanktech got rejected and we were in only direct commercial competition with Enardo. The first order was received in February 2008 after we lost the 1st. tender to Enardo on price. Thanks to the support from BFG we were successful in the 2nd. tender due to receiving Entry level prices. Thereafter we have received the 2nd. Order for another 24" Detonation Arrester. This will continue as and when JO phases out the installed devices.

Linde

A two step approach resulting in the Capital Steel Project with a value of 150.000 Euro

Andersohn Greenwood (AG) was the absolute leader for cryogenic tank farm business in China before we cooperated with company Sergas in 2004. Even Linde specified AG as qualified vendor for pilot valve, not PROTEGO®.

At the first step we visited sub-contractor of Linde project and let them believe that our pilot valve opens immediately and completely without any significant increase in pressure (pop open characteristic) due to using permanent magnet pilot. At the second step we provided packet deal including NB/AP, PM/S and VD/SV with a competitive price. The result was that we got the first packet deal from Linde China. The biggest packet deal we got from sub-contractor of Linde was Capital Steel Project with a value of 150.000 Euro.

MaisonWorleyParsons

Our professional consultation and a good relationship ensures satisfaction of the largest international EPCM & EPC contractor in China

MaisonWorleyParsons (MWP) was founded in 2000 and is becoming the largest International EPCM & EPC Contractor in China. Its headquarter is in Beijing, and also offices in Shanghai, Tianjin, Nanjing, which employs over 700 local staff. When we started PROTEGO® China, MWP knew Amal better than PROTEGO® and gave Amal the completely contract for Degussa in Qingdao. We got the first contact with MWP through project Degussa in Shanghai. It was a very small order but had a great effort on the further projects. The engineers from MWP were satisfied with our technology, such as 10% overpressure, low pressure drop of flame arrester, and also our professional consultation.

It was totally different experience they got from Amal. Another very important point is that we visited constantly MWP and often invited the guys to dinner. Based on a good relationship and satisfying technical support we got orders Ashland, Cytec, Celanese, DuPont, Rohm & Haas, etc.

Merck Sharp and Dome (MSD)

A global contract through a bottom up concept and a safety seminar

When PROTEGO® USA Inc. started in June 2002 we decided that Merck Sharp and Dome should be a target account. The reason was that Dr. Halstrick has visited this company in the past on some business trips to the USA. We had some contacts and our representative knew the purchasing director for our product.

Our strategy concept decided that we need to get involved with the engineering director. Through this we assured that price cannot be the main driving force, if a global contract can be developed.

Dr. Halstrick didn't have success in the past with this account because we didn't have any FM approvals and MSD was fixed on unstable bidirectional Flame Arresters.

The PUSA team decided that it would take a high level technical approach to convince MSD to use EN 12874 approved arresters, as all of our competitors are arguing against that technology.

To convince Merck we decided to offer a global web conference meeting in which all of the Merck plants could decide to attend a safety seminar. As champion for this seminar we flew Dr. Hans Foerster to the USA. With Hubert Leinemann and David Long, Dr. Hans Foerster is the key guy who developed the EN 12874 Standard. Please, see his attached paper which we highly recommend to be read (Link: "Flame Arresters- The new standard and its consequences")

In parallel we applied our bottom up concept and sold both the maintenance guys and plant engineers on the benefits of our product.

This major effort and continuous follow up after the seminar put us in the position to negotiate a global contract. Globally, this contract boosted the PROTEGO® sales to MSD and was the basis for additional presentations in Europe, which also resulted in sales.

MOL Nyrt.

A Hungarian multinational oil company

When PROTEGO® Ungarn started in 1992 the idea was evident that MOL should be an important costumer for us.
MOL is a Hungarian multinational oil company, which has a refinery in Százhalombatta and some tank farms and other plants in Hungary.
One of our firm's founders Mr. Róbert Herter was high level specialist of the Olajterv. That is an engineering company which was active at that time first of all for MOL. With help of Mr. Herter we organized a seminar in the corporate headquarters of MOL in Budapest. Dr. Victor Halstrick held here an excellent presentation. Through this programme we managed to build up relationships with the suitable people of MOL and not only in the headquarters.
In the past years we delivered to MOL a lot of PROTEGO® flame arresters and pressure/vacuum relief valves as well as tank equipment for refinery, logistic depots and other plants.
In the last time we receive characteristically the purchase orders from the construction companies but MOL is unchanged a very important endcostumer for PROTEGO® Ungarn.

Paksi Atomerőmű Zrt.

Devices for hydrogen for the nuclear power plant in Hungary

There is one nuclear power plant in Hungary, which is located in the middle of the country, near the town of Paks. The four reactor units started to operate between 1982 and 1987. More than 40 percent of the electrical energy gener ated in Hungary is produced here.
After a long and solid preparation we delivered to this a large number of devices for hydrogen in the middle of nineties years. This power plant is a very exposed firm in Hungary. In the course of our activity we could to refer to this application and it was many times a very effective argument.
Now is planned a modernization, power enhancement modification and extension of the service life. To this will be need newer pieces of flame arresters, probably in the next year.

Petrobras UN-BC

Technical Support

We convinced Petrobras UN-BC to request in their data sheets for Flame Arresters the Certificate according to EN-12874, which no other approved supplier had at that moment.

MLVO:

Due to the inclusion of Protego-Leser do Brasil in Master Vendor List Offshore of Petrobras we have been awarded with the contracts of platforms P51, P52, P53, P54 and P56.

Petrojet Egypt

Way of getting along with one of the most difficult companies to deal with in the Middle East

The Petroleum Projects & Technical Consultants Co. (Petrojet) is one of the most difficult Companies to deal with in the M.E. the procedures of tendering, evaluation and then order execution can sometime be very bureaucratic. But we at PME & the Representative in Egypt, OTAK knew that if we manage to break in at Petrojet then we could get a lot of business. In the first 3 years of business with Petrojet we had a number of meetings and presentations with the key personnel at Petrojet. They were well aware of our technical superiority and wanted to give us orders but we were the most expensive bidder in many cases. The main competition was Tanktech, Knitmesh (Almac), Enerdo and Tanktech. We did secure some orders from Petrojet but of no significant value and a lot of execution problems. This was not taken well at BFG for the problems it created for shipping and accounting. Finally, we received a tender for 2 x 24" Detonation Flame Arresters for an ongoing project. They had initially confirmed the order to Enardo for Deflagration Flame arresters and when Enardo evaluated the technical after receiving the order they asked Petrojet to install Detonation Flame Arresters for their application. This created a problem and Petrojet cancelled the order on Enardo and issued a new tender for Detonation Flame Arresters. The tender was issued only to Enardo, Tanktech and PROTEGO®. During the technical evaluation they rejected Tanktech and we were once again in direct commercial competition with Enardo.
Fortunately, we had bid with a competitive price and caught Enardo offguard.

We were successful in securing the contract for the supply of the 2x 24" Detonation Flame Arresters. We are now working on the agenda to invite some key personnel from Petrojet to our plant and testing facility in Germany to get them to give us a preferred vendor status.

PetroChina

More than 100 sets of UB/SF are used in PetroChina storage tanks

PetroChina is the 7th biggest chemical company worldwide and it has 20 domestic Refineries, 21 domestic Petroleum fields and 4 Design Institute (DI). PetroChina used local products basically. The PetroChina success story started with a visit at PetroChina Daqing organized by our Agent Company Hongkong Leser Safety Controls LTD (called HKL) in 2004. Daqing is the main base of PetroChina, and there is a very freezing area. It happened often that the storage tanks damaged because breather valve failed due to frost problem. In order to keep the tank breathing the plant engineers sometimes had to remove the complete valve pallet. With the good relationship there, HKL organized a two-day seminar to introduce our UB/SF-0. The customers accepted our technology and signed a contract with 20 UB/SF-0. Right now more than 100 sets of UB/SF-0 are used there. PetroChina Daqing is totally satisfied with PROTEGO® Quality and made a support letter which is attached. Furthermore PetroChina in Lanzhou, Ulumuqi opened the door to us and already signed a contract with 6 UB/SF-G0, 16 pieces will be coming at the end of this year.

Report from PetroChina Daqing (translation):

We, PetroChina Daqing Refinery, have applied 10 pieces PROTEGO® frost protected Breather Valve, type UB/SF-0, and 5 pieces Nitrogen Blanketing Valve, type ZM/R, since October 2005. We confirmed that the PROTEGO® UB/SF make our Tank safety against frost during the winter. We are totally satisfied with the quality of PROTEGO®

Mr. Ma, Tiegang
The Managing Director of PetroChina Daqing Refinery
June, 2006

PetroChina: Application of UB/SF

Richter Gedeon Nyrt.

The largest pharmaceutical company in Hungary

Richter Gedeon is a Hungarian-controlled Central-Eastern European multinational pharmaceutical company, the largest in Hungary.
In the initial years of our activity we didn't have a relation with the pharmaceutical companies. The idea was obvious that we have to build up contacts with these firms.
The first step was that we held a presentation on the Conference on Safety Regulations of the HCS (Hungarian Chemistry Society). Here we had the occasion to get acquainted with important people of Hungarian pharmaceutical companies namely Richter Gedeon, EGIS, Chinoin (Sanofi Aventis), BIOGAL (TEVA).
In a second step we held presentations in smaller circles at these possible partners.
These actions gave a result and the pharmaceut icals are for PROTEGO® Ungarn one of the most important market segment s. The Richter Gedeon is especially important for us.
More serious projects were here accomplished in this year too.

Rohm and Haas

Operational excellence & effective team work

Requirement:

- Delivery of 2 Nos of ERVF 600 & 3 Nos ERVF 700 in 6 weeks as against final agreed delivery of 8 weeks
- The ERVs had to be installed as the delayed installation was leading to financial losses every day.

Competition:

- Shand & Jurs,Marvac & Groth

Constraint:

- Local material Availability
- No stock of imported springs…only possible in 10weeks
- Stage Inspection by customer (weekly & later daily)

Actions:

- Internal target set for 4 weeks
- Material requirement mapped & close monitoring till delivery at site
- Developed indigenous springs
- Tackled stage inspection systematically

Result:

- Delivery executed in 6 weeks
- Earned bonus & customer delight
- Confidence booster at PEPL

SID STEIBLE

Saverglass, ERFI

Successful use of flame-arresters in the glass industry

Historical story

In 2007, SAVERGLASS, an important glass industry has sent an invitation to tender in order to find a supplier for laying for the standards of all their heaters (with heavy fuel or natural gas). Following this invitation to tender, different installers, whose Erfi, contact us for an offer.

Commercial process

However, in order to stack the odd in one's favour for winning the contract, we informed us and contacted directly the final customer in order to explain them the importance to take a customized solution which is adapted at their heater, the part of flame-arresters (FA-CN + DR-ES) and to convince them to choose and use PROTEGO®'s devices.

The mission has been taken! SAVERGLASS choosed Erfi which recommend PROTEGO®'s devices.

Our good business feeling associated to an intensive business relation with Erfi has allowed us to put lobbying actions to Saverglass. SID-Protego has point up the good business cooperation with Erfi, which support our professionalism. In addition, this professional complicity has encouraged information transparency between SID-Protego and Erfi, staying up like this the compliance with standards the heaters.

Since 2 years, we equipped every year one heater. For 2009, the order is just arrived and for 2010, it will depend on 2009's economics results.

Success' reasons

In order to convince the final customer, our perseverance by every SAVERGLASS unit, one business feeling and an intensive lobbying (annual visits) has bring success! Moreover, another advantage which was determinative for the customer is the easy maintenance of the devices thanks to the visit doortrap.

Thanks to this customer, we have had the opportunity to discover this new activity sector. Today, this bring us to realise mailing actions, put information on the web and creating documents on this thematic. All these actions will increase our fame in the glass-world and take new contracts and businesses in companies like Five Stein, Saint-Gobain…

Samsung Engineering

Effective channel partner approach & PEPL co-ordination leading to a new customer

Requirement:

- One flame arrestor FA/I 16inches
- Four number breather valve

Competition:

- Amal, Marvac & a local korean company

Constraint:

- No reference to produce a large flame arrestor at PEPL
- Competition close to the final decision makers in Korea
- EIL approvals not yet cleared
- Customer not fully confident on PEPL

Actions:

- Necessary presentation made at Samsung Delhi
- Vendor registration
- Relationship building with Samsung Delhi by MSI & PEPL
- Pricing strategy between MSI & PEPL
- Competition mapping
- Consistent follow up

Result:

- Single largest order for Flame arrestor unit FA I
- Crucial order for entry at Samsung
- Appreciable price
- Excellent platform for Key account building

Shell

How to change Shell's belief that we have poor quality product

Shell was one of the most difficult sales for PROTEGO® USA Inc. PROTEGO® was not on Shells approved vendors list; Shell would only consider PROTEGO® for Detonation Arresters and not for vents as BFG had failed an inspection in the past.

So the question was how to approach that kind of customer who believes that we have a poor quality product. In this case we needed to work the US corporate headquarters of Shell Global Solutions in Westhollow, Texas. Through the extensive API committee and DIERS committee work we managed to get support from Brad Otis of Shell Global Solutions.

In a first step, we created a technical report, which is attached. In a second step, we proved to Shell that we had much more to offer technically than just valves and flame arresters and PROTEGO® USA conducted an engineering study for Shell in Canada; please see attached report (Link: "Determination of Vapor Emission Saving by Utilizing PROTEGO Full-lift Type Vent Technology").
The ground was set for a major presentation which was held at Shell in Westhollow. Brad Otis invited Shell plant engineers and we offered them to bring the best valves which they had in their repair shop. We tested these valves in comparison to the PROTEGO® valves right in front of Shells high level guys and plant engineers. The result was devastating for the competition and proved the PROTEGO® superiority.

The result was that we managed to get the first sales on vents and the support letter which is attached (Link: Support Letter). We asked Shell to make the support letter out to Sven Zdun as he was working on a project in Asia.

Furthermore Shell USA opened the door for us in The Hague but as we don't have any key account management concept at BFG at this point no one had time for continuous follow up and follows through. Shell is an account which can bring way more business than we are seeing at this point and needs to be worked at the headquarters in The Hague and the US in parallel.

VOPAK

Working on VOPAK's new safety guidelines

We met Dave Mercer (VOPAK Global Safety Manager) at the ILTA show in Houston, Texas. None of us knew who Dave was and we gave him the 1 minute technical speech on vents. For this we typically use the two attached flyers.

This caught Dave's attention and we mentioned our involvement on the technical committees (API, NFPA). Dave Mercer invited PROTEGO® USA to the VOPAK Global Safety Seminar in Rotterdam and allowed us to hold a full day seminar. The next year we were invited to a HAZOP training at the VOPAK global meeting which took part during the ILTA show.

We sold David Long as an expert of the EN 12874 and ISO 16852 committee. Dr. Halstrick came with as he has history with VOPAK. At that point PROTEGO® wasn't getting a lot of business with VOPAK and we learned that during the meeting many of the old people PROTEGO® has good relationships with in the past where already gone. A lot of VOPAK business was going to Groth at that point.

After the presentation PROTEGO® UK and PROTEGO® USA agreed to work on VOPAK's new safety guidelines and Dr. Halstrick supported the idea to make David Long VOPAK global key account manager. Through the joint effort with PROTEGO® Germany, PROTEGO® UK and PROTEGO® USA, we managed to bring PROTEGO® on the front line of VOPAK again.

We need to continue to push our corporate efforts next year to get even deeper involvement.

Engineering companies

Good relationship with most important Hungarian engineering companies

On the basis of my earlier activity the contact with some engineering companies was already given in the period of foundation of PROTEGO® Ungarn, partly with the high level people too. At first we organized presentations at these companies. Following this we built up the contact with other companies systematically. Now we have very good relationship with the most important Hungarian engineering companies for example:

Olajterv
Petrolterv
Pannon Mérnöki Iroda
for oil and gas industry, petrochemical projects

and

Nitroterv
Chemitechnik-Pharma
Europlan
Vegyterv
for chemical and pharmaceutical projects.

We visit constantly these companies, we try to give all of the information, and at newprojects we support them for the engineering.

Platforms

Technical Support: Good sales after checking whole installation

We stayed on the semi-submersible platform P15 for one week checking the whole installation in regard to the correct specification and installation of its flame arresters, following the recommendations of TRbF 20. This resulted in an extensive and complete report, which resulted in the substitution of all flame arresters of the platform. The same procedure was made for the fix-platform Garoupa, and also resulted in good sales.

Sicherung der Liefertreue und hoher Verfügbarkeit durch Bestandsmanagement

Kundensegment: OEM
Tätigkeit / Branche: Deponiegas
Anwendung: Gasfackeln
Eingesetzte Armaturen: FA/E

Der Kunde kauft seit Jahren die FA/E Explosionsgruppe IIA bei Ramseyer. Ramseyer hat für jede Nennweite einen Minimalbestand an Lager gelegt. Lieferengpässe von Braunschweiger Flammenfilter oder Express-Aufträge des Kunden können so aufgefangen werden.
Der Kunde machte 2007 einen Preisvergleich unter verschiedenen Anbietern, da dieser selber am Markt sehr stark unter Preisdruck geraten war. Ramseyer/PROTEGO® waren im Vergleich 10 bis 30% teuerer. Durch die Einführung der Explosionsgruppe I war es dann möglich, ein gleichwertiges, aber kostengünstigeres Produkt anzubieten. Nicht zu unterschätzen sind für den Kunden jeweils die Kosten für die Änderung seiner Dokumentation wie Zeichnungen, Stücklisten sowie Bedienungsund Wartungsanleitungen. Der Kunde hat auch Tochterunternehmungen in
Deutschland und versuchte, über diese an bessere Konditionen heranzukommen. Durch die Kommunikation zwischen Vertrieb Deutschland und Ramseyer konnte ein gegenseitiges Ausspielen durch den Kunden in diesem Moment vermieden werden.

Andre Ramseyer AG

Verstärkung der Kundenbindung durch Rahmenverträge/Standartisierung

Kundensegment: Endkunde Chemie
Tätigkeit / Branche: Halbfabrikate
Anwendung: Absicherung Reaktoren, Gasverbrennung
Eingesetzte Armaturen: BE/HK, BE/HR, DA-G, DR/ES, DA/SB, ...

Der Kunde kauft seit Jahren bei Ramseyer. Einige wenige Produkte wurden bei Mitbewerbern wie Kito und anderen eingekauft. Ramseyer berät die internen Ingenieure und macht die entsprechenden Auslegungen. Der Kunde machte 2007 ebenfalls einen grösseren Preisvergleich mit mehreren Anbietern. Der Gewinner kann davon ausgehen, dass seine Produkte in Zukunft eingesetzt werden. In den letzten Jahren wurden folgende Aktionen durchgeführt, die zur Kundenbindung beigetragen haben:

- Schulung in Braunschweig von 5 Ingenieuren (Standardisierungs-Kommission)
- Beratung und Mithilfe bei der Standardisierung der eingesetzten und zukünftigen Produkte (es sollen in Zukunft nur noch IIB3-Armaturen eingesetzt werden, auch wenn IIA genügen würde – Ersatzteilhaltung)
- Mithilfe bei der Erstellung von Dokumentationen von bestehenden und zum Teil alten Armaturen
- Mithilfe bei der Bereinigung der Stammdaten der Artikel im ERP-System
- Preisreduktion für Komplett-Armaturen (definierter Standard) und Ersatzteile
- Abschluss eines Kontraktes als Hauptlieferant
- Mithilfe beim Abschluss der Lizenzvereinbarung zwischen Braunschweiger Flammenfilter und Lonza für die Fabrikation von Tauchsicherungen in China (Nutzung von Schweizer Kontakten für das internationale Geschäft)

Andre Ramseyer AG

Verkaufsförderung durch Angebot einer diversifizierten und breiten Produktepallette

Kundensegment: Endkunde Chemie
Tätigkeit / Branche: Halbfabrikate
Anwendung: Absicherung Reaktoren
Eingesetzte Armaturen: BE/HK, BE/HR, DA-G, DR/ES, DA/SB, ...

Der Kunde plant einen Ausbau seiner Fabrikation Ende 2008 / Anfang 2009. Ramseyer ist mit seiner ganzen Produkte-Palette vertreten: Sicherheitsventile, Flammenfilter, Kondensatableiter, Rückschlagklappen,....
Die jungen Ingenieure der externen Firma haben noch keine Kompetenz bezüglich des Einsatzes von Flammensperren. Die Ingenieure und Aussendienst- Mitarbeiter von Ramseyer beraten die externe Planungs- und Engineering-Firma intensiv bei der Konzeption und Auslegung.
Diverse Varianten betreffend Armaturentyp und Materialbeschaffenheit werden
berechnet. Es wird nun ein Mix von rostfreiem Stahl und Hastelloy eingesetzt. Die Hauptkriterien für den Entscheid waren der Preis und die Lieferzeit. Bezüglich Lieferzeiten stehen Ramseyer/PROTEGO® schlecht da. Preislich wurde hingegen ein entsprechend hoher Projektrabatt gegeben, so dass wir konkurrenzfähig sind. Bei der Bestellung über die ganze Produkte-Palette von Ramseyer wurde ein Zusatzrabatt angeboten. Da die Palette relativ breit ist und kein Mitbewerber das ganze Spektrum abdecken kann, bekamen Ramseyer/PROTEGO® den Zuschlag.

Appendix

Flame Arresters – The new standard and its consequences

Hans Förster, Physikalisch-Technische Bundesanstalt, Braunschweig

1. Introduction

The new European Standard EN 12 874 ”Flame arresters – Performance requirements, test methods and limits for use”[1] has been applied as a pre-standard in Europe since the end of 1998 and was finally adopted in 2000. This standard has its roots in the two national European standards BS7244 [2] and the DIN draft ”Flammendurchschlagsicherungen” [3], which were published in 1990. It was also prepared in view of the North American standards ”Guidelines for Detonation Flame Arresters” and ”Standard Specification for Tank Vent Flame Arresters”, also published in 1990 in the Federal Register [4].

The need for such standardisation work was then seen on the one hand in the establishment of the Single European Market which required harmonisation of the relevant technical requirements and certification procedures as has meanwhile been established by the EC Directive 94/9/EC [5] covering flame arresters as ”protective systems”.
On the other hand the international discussion and the introduction of vapour recovery systems then placed flame arresters into the focus of interest. This discussion revealed a lot of diverging and unclear ideas about the benefits and drawbacks of and the performance requirements for flame arresters. So it was felt that technical clarifications were urgently needed and should be laid down in the form of a standard. In that situation the preparation of a mandated European Standard (CEN) was clearly given preference over an international standard (ISO).

2. Scope – general limitations

The standard takes account of all types of flame arresters presently known. It addresses manufacturers (performance requirements), Notified Bodies (test methods) and customers (limits for use).

It does not encompass applications for explosive mixtures which tend to self-decomposition, are chemically unstable, show more than atmospheric oxygen concentration or contain carbon disulphide.

Neither is external safety-related measurement and control equipment covered, which is required to keep the operating conditions within the established safe limits. This equipment includes sensors, electronic equipment, actuators, valves etc., which might have to comply with the requirements of Directive 94/9/EC and which have to be selected by the customer to have a complete safe system at his disposal.

3. Classifications and qualifications

Flame arresters are specifically built for a variety of flame loads (deflagration, detonation, stabilised burning), for substances of different reactivity (Explosion

groups) and they use different operating principles (quenching in gaps, gaseous counterflow, liquid seals). Classifications according to these aspects are given in the standard and are of great importance for the customer for the selection of a flame arrester most appropriate for a given application.

3.1 Installation

Flame arresters may be built and tested as **end-of-line flame arresters** (one pipe connection) or as **in-line flame arresters** (two pipe connections). The definition, testing and installation according to the new standard are exclusive, so an in-line type is not to be used in an end-of-line installation as was often observed in the past.

3.2 Load from propagating flames

As regards the different hazards from propagating flames, the standard considers deflagrations in unconfined situations and deflagrations as well as detonations in pipework. The hazards and the associated classifications are given in table 1.

Table 1: Hazards from propagating flames and flame arrester classification

Basic hazard situation (application)	Flame arrester classification
An unconfined deflagration propagates into an enclosure	End-of-line deflagration
A deflagration confined by an enclosure propagates to the atmosphere outside	Pre-volume deflagration
A deflagration confined by a pipe propagates into connecting pipework	In-line deflagration
A detonation confined by a pipe propagates into connecting pipework	In-line detonation

For in-line applications the customer has to check if the distance between potential ignition source and arrester is greater than 50 pipe diameters. In that case, he has to use a detonation arrester. If said distance is less than 50 pipe diameters, the customer may try to find a deflagration arrester on the market, which has been tested and approved for the required run-up length of the flame.

3.3 Load from stabilised flames

While the basic classification relates to hazards from propagating flames, there might be an additional hazard of flame transmission after stabilised burning. This could happen after an explosion when the explosive mixture continues to flow through the arrester. The associated heating-up of the whole device could result in delayed flame transmission.

Table 2 :Hazards from stabilised flames and flame arrester qualification

Basic hazard situation (application)	Flame arrester qualification
Stabilised burning at the arrester is detected and can be stopped within 30 seconds by emergency action (stopping, bypassing, diluting or inerting the flow)	Safe with respect to short time burning
Stabilised burning at the arrester cannot be stopped	Safe with respect to endurance burning

As regards the combustion loads, it has to be mentioned that deflagration arresting is an indispensable capability of any flame arrester. The capability of detonation arresting is an additional option which, when available, dominates technically and is reflected by the name: so every detonation arrester also has to prevent flame transmission from deflagrations.
In the same way, the capability of withstanding stabilised burning is an additional option: For example: An end-of line deflagration arrester can be endurance burn safe and then is often simply called an endurance burning flame arrester. In-line detonation arresters often offer short time burning safety (which in this case is not reflected by the name).

3.4 Reactivity of the mixture

With respect to flame transmission, the reactivity of the explosive mixtures is classified by the maximum experimental safe gap (MESG) and, accordingly, flame arresters are classified and marked with the most reactive explosion group for which – in the test - they showed to be capable of preventing flame transmission.
To provide just sufficient but not too much quenching capability, the new standard subdivides explosion group IIB as shown in table 3. This allows for appropriate flame arresting without inadequate narrow gaps (and accompanying high pressure losses).

Table 3: Subdivision of explosion group IIB

Explosion group (marking)	Maximum Experimental Safe Gap (MESG) of test mixture in mm
IIB1	≥ 0.85
IIB1	≥ 0.75
IIB3	≥ 0.65
IIB	≥ 0.50

3.5 Operating principle

The best known and most widespread flame arresters operate by quenching flames in narrow gaps. In the new standard they are specified as ”static” flame arresters since they do not use moving parts or material. Other operating principles like ”liquid” arresters and high-velocity vent valves have also been taken into account. During the development of the standard it was soon realised, that definitions, test procedures and limits of use had to be specifically addressed for the different operating principles. Table 4 gives an overview of the different operating principles, the name of the corresponding type and the prevailing field of application.

Table 4: Types of flame arresters according to the operating principle

Operating principle	Flame arrester type	Field of application
Quenching the flame in narrow gaps	Static flame arrester (in-line and end-of-line)	General use
Producing flow velocities above flame velocity by valve action	High velocity vent valve (end-of-line)	Tank venting
Producing and monitoring flow velocities above flame velocity by action of external equipment	Flow controlled aperture (end-of-line)	Burner injection, stacks
Forming a liquid seal (siphon) by liquid product in a product line	Liquid product flame arrester (in-line)	Liquid-filled lines
Breaking the flow of explosive mixture into discrete bubbles in a water column	Hydraulic flame arrester (in-line)	Gas-air mixtures loaded with particles (e.g. dust, droplets)

4. Limits for use

4.1 Pressure and temperature

Although the scope of Directive 94/9/EC is limited to atmospheric conditions, it was decided to extend the scope of the new standard beyond these limitations. This is because the transportation of gas requires or produces pressure losses which inevitably lead away from atmospheric pressure levels.
Gases in the process industry often show elevated temperatures and have to be safely piped or discharged without costly and energy-consuming cooling. These practically important pressures and temperatures above atmospheric mean mixtures with comparatively increased capability of flame transmission and therefore have been taken into account in the new standard. Conditions below atmospheric are not so important in practice and tend to the safe side, so they have not been considered.

For ”non-static” arresters and for ”static” end-of-line arresters, the new European standard provides testing and approval under atmospheric pressure conditions at least on one side of the arrester. The pressure on the other side may be slightly higher (maximum 0.2 bar – determined, for example, as the set pressure of a valve or the height of a water column) but essentially remain ”atmospheric”.
In the same sense, for the above-mentioned classes of flame arresters, the new standard provides testing and approval at atmospheric temperatures only.

For static in-line flame arresters, the new standard provides testing and approval for pressures up to 1.6 bar abs. and temperatures up to 150 C. These limits are wide enough to cover most practical applications. On the other hand, they are so close to atmospheric conditions that no essential changes of the characteristic safety data of the mixtures have to be expected (for example, the composition of the most dangerous mixture or the ignition temperature).

Indeed, elevated pressures mean a higher load for the flame arresters (safe gap and pressure of the mixture are related reciprocally). In some standards [2, 3, 4],

pressure venting is allowed during the in-line explosion testing by a bursting diaphragm. In the European draft standard such an unspecified relief is not included and the test set-up has to remain closed throughout the test. This closed system testing is certainly harder than test procedures with pressure relief.

The use of a closed test system with possibly elevated pressures creates a lot of technical problems. One problem which is still unsolved is that there are no test procedures for stabilised burning at elevated pressures in any standard available. So the use of in-line arresters with short time burning or endurance burning capability is presently limited to atmospheric pressure. The European certification under Directive 94/9/EC is not affected, since a formal and general limitation to atmospheric conditions exists.

4.2 Pipe installation

In-line deflagration arresters are tested with a certain run-up length between ignition source and arrester and consequently, in practical use the installed ”unprotected” pipe length must not exceed the pipe length tested (always less than 50 pipe diameters to avoid development of detonations). Experience shows that the reduction of the ”protected” pipe length (or confinement) is also of importance and stimulates transient pressure build-up and thus deflagration flame transmission. This was demonstrated at least for the closed system test set-up. In practice, limitations for the protected side installations are hardly acceptable. The said pressure build-up is therefore avoided by requiring installations in which an open end (minimum 10 % of the cross sectional area of the pipe) at the point of possible ignition immediately relieves any burnt gas expansion.
In-line detonation flame arresters are tested against deflagrations and detonations; there is no limitation of use as regards pipe installations like with deflagration arresters.

4.3 Special aspects

The ”non-static” operating principles require special limits for use. The most important limitations are as follows:
Hydraulic flame arresters are characterised by a maximum volume flow rate which must not be exceeded.
High-velocity valves and flow-controlled apertures require a minimum volume flow rate, which in the former case is maintained by the construction and the pressure setting and in the latter case, has to be ensured by external safety equipment.

5. Stable and unstable detonation arresters

The new European standard specifies stable and unstable detonation arresters. The background for this differentiation is the following:
In industrial practice, detonations in pipes may develop from deflagrations, which – after a flame path of about 100 pipe diameters - can undergo so-called deflagration to detonation transition (DDT) and then form an overdriven detonation which eventually ends in a stable detonation. The latter exhibits invariable velocity and pressure characteristics, the so-called Chapman-Jouguet values (pressure about 20 bar, velocity about 1800 m/s for most fuels).
The DDT is a highly local phenomenon occurring within a flame path of one or two pipe diameters and showing extremely high detonation pressures (up to 100 bar).

The overdriven phase - following DDT - may extend over a length of some 10 pipe diameters, within which pressures and velocities decline to the values of a stable detonation.
DDT and overdriven detonation – due to their transient and extreme characteristics – are specified as ”unstable detonation” and are a much higher load for a flame arrester than a stable detonation.
As regards risk assessment, worst-case testing and approval of detonation arresters via DDT would be desirable.
From a viewpoint of reliable testing and repeatable results, the unstable detonation phase is extremely difficult to handle. The reason for this has to be seen in the highly stochastic nature of extremely turbulent flame acceleration which eventually summits in the DDT - all test results show extreme scattering and so prevent an efficient and easy assessment of flame arresters with respect to unstable detonation testing.
Knowing these problems [6], in Germany, it was decided in the early sixties to test and approve detonation arresters for stable detonations only. Since these ”stable” detonation arresters are not tested for the worst case, redundant measures against flame transmission were required. The necessary redundancy is laid down in a risk assessment scheme [7] which takes into account the likelihood of explosive atmosphere (zone) and that of an ignition source (category within the meaning of the Directive 94/9/EC). The corresponding scheme is shown in table 5.

Table 5: Number of measures against flame transmission

Classification of area / Ignition source	Zone 0	Zone 1	Zone 2
Permanent, normal operation (no category)	3	2	1
Normal faults (category 3)	2	1	0
Rare faults (category 2)	1	0	0

This concept - based on ”stable” detonation arresters – has been used in Germany for decades without unfavourable safety records. In view of these considerations, it was therefore decided to include the testing and the approval of ”stable” detonation arresters in the new standard.

On the other hand, in Great Britain and North America, the national standards have ever since required unstable testing of detonation arresters. Taking account of this aspect, the new standard provides also the testing and approval of ”unstable” detonation arresters which then resemble the detonation arresters in those countries. This was done for reasons of competition and market access, neglecting the very serious problems posed by reproducible testing in that field (which are existing in all standards).

Having the choice between stable and unstable detonation arresters the customers clearly raise the question as to when what type should be used . When looking for an answer, one should bear the following facts in mind:

- It is not possible to predict or influence the location of DDT in practice, so unstable situations cannot be avoided by specific positioning of the arrester. In other words: If a detonation has to be reckoned with, there will always be a minor chance that a DDT could happen just on the arrester position.
- It is not disputed that unstable detonation arresters are superior to stable detonation arresters as regards the flame arresting capability. Nevertheless - due to the statistically insignificant testing in all known standards– available unstable detonation arresters do not at all provide 100 % safety with respect to flame transmission in unstable detonations.
- Unstable detonation arresters show higher pressure losses than stable ones. This might not only be an economic drawback but could also degrade the safety concepts by increasing pressures and creating a need for additional, potentially sparking equipment like blowers.

The schematic safety concept of table 5 stems from tank farms for flammable liquids and has a background of stable detonation arresters. It represents an accepted level of safety and stable detonation arresters ensuring this safety level will - also in future - be acceptable to German safety authorities. A general need for unstable detonation arresters cannot be seen here.
An idea suggesting itself is to replace two measures in the above scheme (e. g. a deflagration arrester and a stable detonation arrester) by a single unstable detonation arrester. In my view, this loss of redundancy is not compensated for by the higher performance flame arrester and therefore means a decrease in safety.

The Directive 1999/92/EC [8] requires mandatory risk assessment for hazardous workplaces. The resulting safety concepts certainly must allow for the cost aspects and national habits. A prerequisite for the decision whether stable or unstable detonation arresters should be used is a sound knowledge of the properties of the different types. It remains to be seen whether general guidance for this decision can be made available in Europe.

6. Remaining problems and future work
During the development and initial application of the standard, problems and open questions arose which should be solved before the next revision of the standard. In my view, the most important items are the following:

- The present procedure for unstable detonation testing does not comply with fundamental requirements for the reproducibility of tests. Future work will have to investigate the impact of that specific combustion process on flame transmission in arresters in order to enhance the significance of the test results.
- Experience shows that when the pipe size is in the order of the quenching distance, quenching effects in the run-up pipe are added to those in the arrester itself and the net result is extremely dependent on pipe installation, flow and ignition source. So for the testing of small-sized in-line arresters special procedures still have to be developed.
- External safety devices have not been included in the standard for the sake of flexibility. In order to achieve consistent safety concepts, general guidance for the selection of suitable devices should be given - for example with reference to the classes of operational reliability in EN 954-1 ”Safety related parts of control systems” [9].

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Flame Arrester and Vent Safety Analysis for Cytec

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1. Introduction

On January 26, 2005, PROTEGO (USA), Inc. and George Grant Company met with Michael Pulis in order to perform a safety analysis concerning protection of different plant areas with flame arresters and vents. The goal was to analyze if the plant is provided with sufficient safety in respect to flame arrester technology.

The selection and application of flame arresters is not as easy as it may seem. Engineers have to be able to differentiate the different combustion processes and need detailed knowledge and understanding of the test standards in order to make the right choice in the end. It is very common that a high amount of flame arresters and detonation arresters are misapplied, because the information describing the testing procedures and their limitations are not widely spread.

For a more detailed analysis of the safety level in the Cytec facility detailed P&ID's are needed and more process information has to be collected.

However, it is clear that a lot of arresters in the facility are clearly misapplied. End-of-line arresters are installed in inline applications. It is necessary check if all the headers and tanks are operated below the LEL at all times. If so, no flame arresters are needed. If this is not the case, all arresters in in-line applications should be upgraded.

If the result of the evaluation is based on the information provided and visually collected during the site survey. The result is a recommendation for upgrading the plant with state of the art flame arrester technology in order to reduce the risk of capital losses, which could occur from explosions resulting either from human or technical failure.

The report shows that probably all investigated plant areas need safety technical improvements.

At this point we are assuming that the devices had been installed correctly and probably later on a decision was made to install a vent header system which is routed to an incinerator.

Should any further support be needed please do not hesitate to contact the PROTEGO USA Team at any time.

2. Flame Arrester Fundamentals

To avoid the misapplication of **flame arresters** (flame arrester means **in-line flame arrester [in line deflagration arrester, in-line stable & unstable detonation arrester] end of line flame arrester [atmospheric deflagration, short time burning, endurance burning]**) it is important to understand the function of such a safety device. There are several different flame-arresting technologies on the market place. In the following, only the so-called static flame arresters shall be reviewed. Static flame arresters are independent of any kind of secondary energy supply and have no moving parts that could lead to malfunction. Therefore, they are a reliable high profile safety means if applied to the process in the right way.

In simplified terms, a static flame arrester is a heat exchanger that absorbs the heat from i.e. a deflagration or a detonation flame front, hereby extinguishes the flame and only allows the vapors to propagate through the arrester.

As already mentioned, selecting the correct flame arrester is one of the problems encountered in the flame arrester market today. The complexity involved in understanding the combustion process when selecting flame protection devices, leads to confusion and misapplications.

Equally important to understanding the combustion process is the clear understanding of the boundary conditions for proper installation. Many flame arresters are tested by an independent third party to obtain an approval which proves the arrester has passed specific test conditions and installation configurations. If the arrester is installed incorrectly, this approval is void because the arrester is likely to fail. The probably** most common misapplication of this kind in the US industry, is the installation of end of line flame arresters into in- line mode, as a result of EPA demanding to tie free venting tanks into vapor recovery or vapor destruction systems (Flares, Thermal Oxidizers) to reduce emission. In most cases the installation of the end of line flame arrester was perfectly safe but tied into a complex vent header system. The end of line flame arrester is now exposed to in line flame velocities and pressures, which exceed the test conditions by far and make the arrester fail.

For a better understanding the report explains the different processes of combustion in the following chapter.

2.1 Differentiating the Combustion Process

Flame arresters can only be installed correctly if engineers understand the combustion process and know under which conditions [(process pressure, temperature, oxygen

concentration, distance from ignition source, in line, end of line)] the flame arrester was tested.

For flame arrester applications, the combustion process can be differentiated in stabilized burning and explosion (**Figure 1**). Stabilized burning is a combustion process in which a steady flame occurs for a short time or a long time (endurance burning). These combustion processes can be present during the venting of tanks or reactors. Depending on the time during which a combustible gas mixture vents, short time or endurance burning can be present. A typical endurance-burning situation may occur during the filling process of a storage tank, which can take several hours or even up to 2 days in the petrochemical industry.

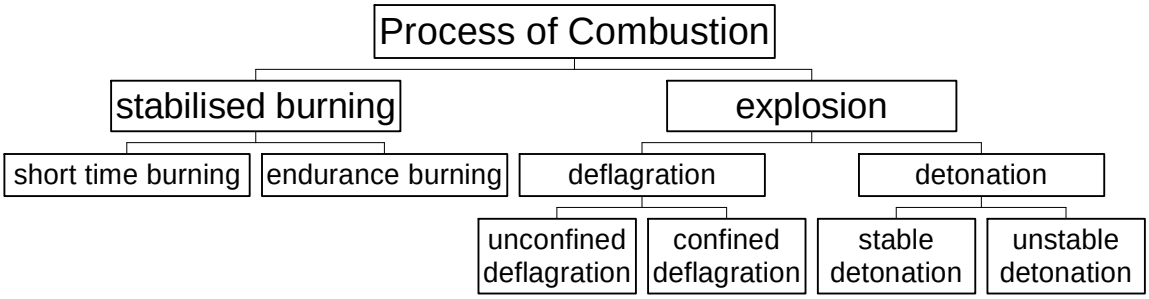

Figure 1: Differentiating the Process of Combustion

The combustion process concerning explosion can be differentiated into deflagration, with flame front velocities below the speed of sound and detonations with flame velocities above the speed of sound. For deflagrations, we have to distinguish between unconfined deflagration which mainly occurs end of line, i.e., at conservation vents on top of a tank or reactor during the out breathing process, and confined deflagration which occurs within piping systems leading to vapor recovery or vapor destruction units (i.e. incinerators or flares). For a better understanding of the confined deflagration process [compare with **figure 2**].

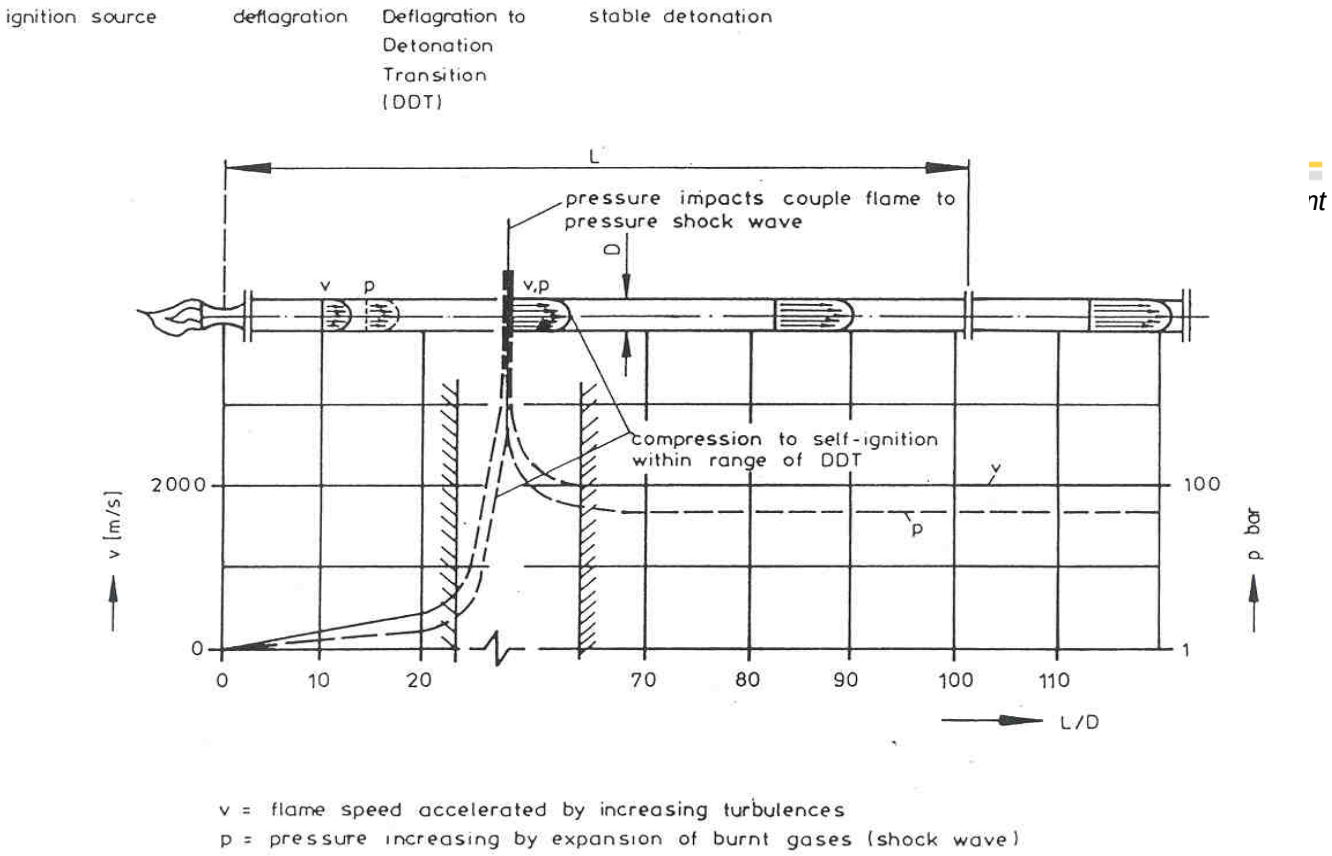

Figure 2: Flame Speed and Pressure Curve of a Confined Explosion Process

Figure 2 shows the velocity and pressure build-up in a confined piping system. The area in which the velocity build-up is below that of the speed of sound is called the confined deflagration range. Flame arresters tested to quench a flame within this range of combustion are called In-Line-Deflagration Arresters. It is extremely important that the test conditions comply with the process conditions. For example, if the arrester is tested to atmospheric conditions with slightly elevated pressures of 15 psia but the arrester is installed in process conditions at elevated temperatures and pressures of 30 psia, the arrester is going to fail.

During the confined explosion process, the flame velocity and pressure builds up over the pipe length. During ignition, the temperature increases which leads to an expansion of the vapor in front of the flame front. This causes the vapors to be pre-compressed, which again accelerates the combustion process. During the confined deflagration phase the pressure wave remains in front of the flame front. At the point of deflagration to detonation transition, the flame front and flame velocity increases to a maximum. Now it is above the speed of sound. This phase of combustion is also called unstable detonation. Due to thermodynamic effects the combustion process then stabilizes. At this point, the phase of so called stable detonation is reached. In this phase the velocity and pressure are relatively constant in respect to time. A consequence is that flame arresters can also be tested according to unstable and stable detonations.

2.2 Selecting the Correct Flame Arrester

In order to select the correct flame arrester we have to determine the location of the application, which can be:

A) End Of Line (Tank, Reactor, Free Vent..),

B) In Line (Vent header, Incinerator, Carbon Absorption…),

C) On Equipment (Blower, Dry Running Vacuum Pump)

A) There can be an arrester for:

A1) atmospheric deflagration only

A2) atmospheric deflagration + short time burning

A3) atmospheric deflagration + short time burning + endurance burning

B)

There can be an arrester for:

B1) In-Line Deflagration

B2) Stable Detonation

B3) Unstable Detonation

C) There can be an arrester for:

C1) type tested on equipment (vacuum pump, blower…)

Besides determining the location, we have to check the process conditions and evaluate if the arrester was tested within these conditions. This means the

- Process temperature
- Process pressure
- Oxygen concentration

have to be clearly addressed. In addition, the NFPA vapor group has to be determined. Here we distinguish between Group D,C,B and A vapors. If these parameters are clear and the independent third party approval has been checked and complies with the process conditions, the arrester can be selected.

3. Basics of Tank Venting and Tank Protection for Inerted Tanks

In storage tanks, pressure increases and pressure decreases occur depending on pump-in and pump-out rates and through thermal impact on the tank. Because storage tanks are not designed on the same basis as pressure vessels, the pressure increases and pressure decreases have to be kept within the design pressure of the tank. For this reason tanks, are equipped with breathing devices. When storage tanks are breathing into the environment, a permanent vapor loss occurs. For economic and environmental reasons, this vapor loss should be reduced to a minimum.

When inert gas blanketing is used, the venting should be reduced to a minimum to avoid excessive losses. The best measure is to set the vent as close as possible to the MAWP (maximum allowable working pressure) and operate as far as possible from the operating pressure.

It is a mistake to assume that if inert gas blanketing is used, flame arresters do not have to be installed on a storage tank. The TRbF 20 defines in detail those cases where the inert gas blanketing rate is sufficient to eliminate the need for a flame arrester.

3.1 Design and Operating Considerations for Inerted Tanks with Breathing Devices

1) The breathing device should only be designed as an emergency system, which opens according to extreme boundary conditions (failure of inert gas supply, extreme cooling according to weather changes, etc.)

2) The tanks can be equipped with a lower degree of safety measures if nitrogen blanketing is provided, so that the likelihood of explosive atmosphere is reduced and the requirements of point 3), 4) and 5) are fulfilled.

3) Before the first filling or refilling of the tanks (for instance after maintenance) the tank must be flushed with nitrogen so that the oxygen concentration in the tank atmosphere is 50 % below the oxygen boundary concentration. The first inerting period must be controlled by oxygen concentration detection.

4) Consideration must be given in the design process for a failure of the emergency blanketing control system. The venting device must have the capability to provide sufficient volume in case the pressure regulator of the inert system fails.

5) The tank breathing during pump-out or during thermal out breathing is performed via inert gas. For the inert gas supply, minimum values of the inert gas volume flow $\dot{V}_I$ and the stored inert gas supply volume V_I are requested. These requests are based on the maximum inbreathing and pump volume flow ($\dot{V}_{th,i}$, $\dot{V}_{p,o}$). When it comes to safety and control equipment the three different amount of nitrogen blanketing are technical safe.

1. Inert Stage 1

$$\dot{V}_I = 0.1 \cdot \dot{V}_{th,i} + \dot{V}_{p,o} \qquad [1]$$

$$V_I = 0.04 \cdot \dot{V}_A \qquad [2]$$

Consider that the volume of the Inert gas system piping should be evaluated additionally.

The inert gas system must be monitored by reliable measurement (i.e. tank pressure or oxygen concentration). If the set pressure of the inbreathing device is reached, an alarm system must be activated which shuts down the pump-out pump.

With this measure, the tank is safely protected when the in and out breathing side of the breathing device is protected with atmospheric deflagration proof flame arresters and endurance burning flame arresters. For endurance burning protection vapor group D flame arresters are sufficient. Recommended are arresters with independent third party approvals (FM, PTB or IBExU). Only then can it be assured that the arrester can be properly applied to the process conditions.

2. Inert Stage 2

$$\dot{V}_I = 0.2 \cdot \dot{V}_{th,i} + \dot{V}_{p,o} \qquad [3]$$

$$V_I = 0.08 \cdot \dot{V}_A \qquad [4]$$

For this amount of nitrogen supply, the breathing system only has to be equipped with atmospheric deflagration proof flame arresters tested for Group D vapors. Again it is highly recommended to install arresters with independent third party approvals (FM, PTB or IBExU).

3. Inert Stage 3

$$\dot{V}_I = 0.5 \cdot \dot{V}_{th,i} + \dot{V}_{p,o} \qquad [5]$$

$$V_I = 0.12 \cdot \dot{V}_A \qquad [6]$$

The tank pressure must be monitored by redundant measure. The inert gas supply must be controlled at positive pressure. Furthermore, the inert gas volume flow $\dot{V}_I$ must be reached at a pressure, as low as the minimum of the ambient pressure. The set pressure of the emergency vent (not emergency relief vent for fire case) has to be 5 mbar below this boundary pressure. The emergency vent should be installed at the inert gas supply line. If the boundary pressure is reached, an alarm system must be activated to shut down the pump-out pumps.

6) For this system flame arresters are not required. But still the engineering design measures of chapter 2.1 must be fulfilled.

4. Flame Arrester Evaluation

Most of the devices inspected are PROTECTOSEAL 4950 Series end- of- line vent pipe flame arresters for storage tanks. In a majority of the applications, these devices are installed in an in-line mode. As described in Chapter 2, theses devices will not withstand the impact of an in-line deflagration or even in-line detonation. We are assuming at this point that the devices had been specified for end-of- line use and then later on the decision was made route the vapors into an incinerator. This resulted in a misapplication.

However it should be checked if the vapor header line and the tanks are operated below LEL all the time, also during start up and shut down and especially during a nitrogen failure mode. If the nitrogen blanketing level is high enough the arresters are not needed. But if the result is that arresters are needed true independent third party tested in line flame arresters should be applied.

4.1 Tanks at loading facility

It is recommended that tank loading facilities which connect to tank trucks are equipped with detonation arresters or at least in line deflagration arresters if the tested L/D ratio is not exceeded. The T5101, T5102, T5103 and T 5105 are all equipped with end –of- line vent flame arresters of the Model PROTECTOSEAL 4952 Series. These end-of- line arresters are specifically tested for tank venting applications and not in- line applications. They will not withstand an in-line deflagration or an even detonation.

In addition the following remarks have to be made:

Tank 5101:

The stored product is Styrene, MESG > 0.9 mm

Tank 5102:

The stored product is N-Butyl-Acrylate, MESG = 0.88 mm

Tank 5103:

The stored product is N-Butyl-Meth-Acrylate, MESG = 0.94

Tank 5105:

The stored product is MAA, MESG = 0.85 – 0.89

4.2 Tanks 5210, 5211, 5212 and 5213

All these tanks have an interesting piping design. It is recommended safety practice to install flame or detonation arresters as close as possible to the vessel, which shall be protected. In this case the devices are installed relatively far away from Tank 5213, 5212.

Again a PROTECTOSEAL 4953F Series is applied. This device tied into a vent header system, which leads to an incineration system. The long run up distances provide a high risk level if the nitrogen system fails and detonation can occur in the header piping.

In addition we experienced an extreme leaking problem at the top of the tanks, which causes not only a health and safety risk but an impact on the environment.

Furthermore, it was investigated if the wash solvent tank 5601 and the recovery solvent tank were connected with tank T5211. In case of an explosion in one of the tanks, it would impact all the tanks that are connected. We should mention that the vent header of these tanks was open to atmosphere. During times where the vent header is below atmospheric pressure the air is sucked into the vent header system, which may increase the risk of an explosion.

Recommendation:

a) Check the nitrogen blanketing level and see if arresters are needed at all. If the nitrogen system can fail or is not redundant, use in line detonation flame arresters.

b) Replace, or at least repair/upgrade vents to avoid vapor losses and to reduce hazardous exposure of employees and reduce environmental impact.

c) Have a nitrogen blanketing gas regulator vent combination set up test performed to assure that there is no overlapping of set pressure and closing pressure of the conservation vent and nitrogen regulator.

d) Check the reason for the open vent header system

b) and c) should reduce vapor losses and nitrogen blanketing gas losses, which is a direct payback of the investment made.

4.3 Flame Arrester at Incinerator

Directly in front of the incinerator, a PROTECTOSEAL 4950 series device is installed. As already mentioned above, this device is for end-of- line applications only. The 4950 Series is not the correct design for the impact of an in-line deflagration.

Recommendation:

Check the L/D ration from the burner port to the flame arrester. If a device can be installed within L/D ratio of 50, an in- line deflagration arrester should be installed. If the L/D requirement cannot be fulfilled an in- line detonation arrester should be the choice.

4.4 T 5515 and sample station

This tank is installed with a PROTECTOSEAL 4952 F Series device. Again this is a misapplication. See remarks toward safety of 4.2.

The Sample station is also equipped with a 4950 Series device and vents into the atmosphere. Please check if the L/D ratio requirement is fulfilled.

Recommendation:

Request Third Party approval from Vendor and check the max. pipe distance, which is allowed to be installed and the vapor Group the device was tested for. The Vendor has to provide you with the test gas used. The test gas should have a lower or at least the same MESG as the vapor you are processing.

4.5 T 5702

The hot oil storage tank is not equipped with a flame arrester. It may be very likely that the stored product is stored way below the flash point, which then would not require a flame arrester. However the tank is tied into the vent header system.

Recommendation:

Install a flame arrester onto the tank for additional safety or monitor the piping leading to the tank and assure it operates below LEL all time, also during start up and shut down.

4.6 Vacuum Pumps type Sihi

All vacuum pumps are again equipped with 4950 end of line devices. The application clearly calls for in- line devices, either type tested or detonation arresters.

Recommendation:

PROTEGGO offers a special line of type tested flame arresters, which are tested in combination with the vacuum pumps. These are safe and independent third party approved.

Clarify if the lines operate below LEL all time. If this is fulfilled, no flame arresters are needed. Should flame arresters be seen as an additional safety measure, the correct in-line flame arresters are needed.

It is also recommended to install a temperature sensor at the flame arrester on the suction side of the vacuum pump, so detect a signal in the case of an endurance burning.

4.7 T 5240,T 5241,T 5120,T 5130,T 5230, T 5232, T5140, T5513

Again we have a Protectoseal 4950 Series end –of-line arrester installed in an in- line application

Recommendation:

The already mentioned recommendations apply. Check LEL and see if a flame arrester is needed. If so, use in- line detonation arresters.

4.8 T 5703

The Tank is connected to the vent header and again there is no flame arrester applied.

Recommendation:

Install a flame arrester at the tank for additional safety or monitor the piping leading to the tank and assure an operation below LEL all time, also during start up and shut down.

5. Final Remarks

It is proven that flashbacks can occur at any time in the processing areas of chemical plants, tank farms and other areas where explosive mixtures are handled and stored.

Flame arresters [-when properly installed -] are safety devices that protect man, environment and chemical plants against the effects of a flashback. Arresters need regular maintenance, so it should be the goal of every plant to reduce maintenance costs by investing in proven state of the art technology, which increases safety by reducing operating costs and hence, have the lowest cost of ownership.

For a more detailed analysis of the safety level in the Cytec facility detailed P&ID's are needed and more process information has to be gathered.

However it is clear that a lot of arresters in the facility are clearly misapplied. End- of-line arresters are installed in in-line applications. It has to be check if all the headers and tanks are operated below the LEL at all times. If so, no flame arresters are needed. Should this not be the case, all arresters in in-line applications should be upgraded.

As in most applications there are more than one safety solution, each offering a different level of protection. Through your Process Hazard Analysis program, you can appropriately determine the level of protection that is required for your plant. If you would like PROTEGO (USA), Inc. to participate in this process do not hesitate to contact us.

PROTEGO World Wide is committed to increase plant safety and offers any engineering necessary to provide the right engineering measures for safe plant operation.

Should any further assistance be needed please do not hesitate to contact us at any time.

Determination of Vapor Emission Saving by Utilizing PROTEGO "Full-lift Type" Vent Technology

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1. Introduction

On October 25, 2004, PROTEGO (USA), Inc. had the opportunity to show Brad Otis from Shell Global Solutions test results and calculation results comparing “full lift type” venting technology to standard technology available on the market.

During the presentation, calculation methods were shown for estimating the vapor losses of storage tanks using equations derived from live field testing. The official engineering guideline used for the calculation was the VDI 3479 standard. These validated equations show that vapor emissions can be reduced by using full-lift vent technology which can be set closer to the desired design pressure than with conventional designs. Higher set pressures reduce the opening cycles, and breathing losses are minimized. In this report calculations of the API 2516 standard are compared to those of the VDI 3479 standard. The resulting vapor emissions calculated based on the API 2516 standard are higher than those of the VDI 3479 standard. To achieve a conservative approach on showing the vapor saving potential the VDI 3479 standard shall be used. Both standards do not determine the differences in vent technology towards leak rate. API 2000 assumes that leakage may occur at 75% of the set pressure. In addition, it is stated that weight loaded vents have a 0% blow down. Both are not correct. In addition to all leak rate discussion in this report, it is recommended to check different vent designs and make sure that the reseating pressure (blow down) of the vent does not exceed the blanketing gas regulator pressure. Should the reseating pressure fall below the regulator set pressure, high blanketing gas losses may occur.

Driven by the German Clean Air Act, PROTEGO has developed a special vent test standard for conservation vents. This standard complies with the API 527 leak rate standard for high pressure safety relief vents. As a result, the PROTEGO standard leak rate is at least ten times better than the API 2521 standard which defines the allowable leak rates for conservation vents.

This report includes tests conducted in accordance with the API 2521 standard. PROTEGO can demonstrate that with its special sealing surfaces extremely low leak rates can be achieved and through the “full lift type” technology vapor losses can be minimized.

The goal of this report is to analyze PROTEGO’s superior vent technology and show vapor emission saving potential and have PROTEGO added to Shells approved global vendor list.

2. Theory of emission reduction by VDI 3479 standard

The VDI 3479 standard enables industry to determine overall emission losses in tank storage operations. The emission mass flows and concentrations in accordance with this standard are based on average values. These values are not applicable for explosion risk and the determination of corresponding safety precautions. Any safety rules or regulations will not be affected by this standard.

To demonstrate the conservative approach of the VDI 3479 standard results are compared to the API 2516 standard. The overall emission losses resulting from the API calculation model are in average 10% above the VDI standard [1].

The focus of this report is mainly on the breathing losses. In this case the results of the API standard are even more conservative as shown in chapter 2.1, even though the standard does not consider the losses resulting from pump out within the breathing losses.

2.1 Basic theory on vapor saving with pressure vacuum vents

Storage tanks are generally equipped with pressure-vacuum conservation vents to reduce vapor losses. The function of the P/V vent is to keep the vapor space closed during variations in gas volume changes that occur from changes in atmospheric pressure and/or temperature until set point is reached [2]. The goal is to avoid in-breathing of ambient air and out-breathing of hydrocarbons. The P/V vent mainly influences the thermal breathing losses. When the set pressure of the P/V vent is met during the filling process, the vent opens and releases the hydrocarbon/air mixture from the tank head space into the environment (filling loss).

Main influencing parameters for emission reduction of hydrocarbon air mixtures are:

a) set pressure and set vacuum

b) temperature difference within the vapor space of the tank

c) hydrocarbon concentration of hydrocarbon/air mixtures in the vapor space

d) vapor pressure of the stored product

The P/V vent has to be set in accordance with the maximum allowable operating pressure of the tank, which in some cases can be the Maximum Allowable Working Pressure (MAWP). This pressure should not be exceeded, otherwise tanks may explode or implode.

In industry, different technologies are in use for achieving this goal. The API 2000 document shows that most of the technologies require an 80% to 100% overpressure to reach full relieving capacity [3]. This results in very low set pressure and increased emission losses due to increased operating cycles. This can be reduced by using PROTEGO “full lift type” technology (10% overpressure) P/V vents.

To calculate the emission reduction through full lift type technology one has to understand that the emission mass flow of a tank consists of

$$\dot{m}_{\tan k} = \dot{m}_{withdrawal} + \dot{m}_{breathing} + \dot{m}_{filling} \tag{1}$$

The total breathing losses of a fixed roof tank without any P/V vents are defined as

$$\dot{m}_{A,a} = f_{A,S} \cdot 4{,}4 \cdot 10^{-8} \cdot p_T \cdot \overline{M} \cdot \frac{T_n}{p_n} \cdot \left(\frac{p}{T_{1,S}} - \frac{p}{T_{2,S}} \right) \cdot V_G \cdot d_S + f_{A,W} \cdot 4{,}4 \cdot 10^{-8} \cdot p_T \cdot \overline{M} \cdot \frac{T_n}{p_n} \cdot \left(\frac{p}{T_{1,W}} - \frac{p}{T_{2,W}} \right) \cdot V_G \cdot d_W \tag{2}$$

For receiving the reduced emission mass flow of a fixed roof tank using P/V vents the total breathing loss has to be multiplied by the efficiency factor

$$\eta_{VD} = 1 - \frac{f_{A,S} \cdot c_n \cdot d_s \cdot \dot{V}_{n,S(VD)} + f_{A,W} \cdot c_n \cdot d_W \cdot \dot{V}_{n,W(VD)}}{f_{A,S} \cdot c_n \cdot d_S \cdot \dot{V}_{n,S} + f_{A,W} \cdot c_n \cdot d_W \cdot \dot{V}_{n,W}} \tag{3}$$

In equation (3) the Volume flow in the summer and winter time is defined by equation

$$\dot{V}_{n,S(VD)} = \frac{T_n}{p_n} \cdot \left(\frac{p_1}{T_{1,S}} - \frac{p_2}{T_{2,S}} \right) \cdot V_G \cdot \frac{1}{t} \tag{4}$$

and

$$\dot{V}_{n,W(VD)} = \frac{T_n}{p_n} \cdot \left(\frac{p_1}{T_{1,W}} - \frac{p_2}{T_{2,W}} \right) \cdot V_G \cdot \frac{1}{t} \tag{5}$$

2.2 Calculated Pressure Vacuum Vent (P/V Vent) losses

To take a scientific approach, the calculation of most of the results of this chapter are based on the data published [1]. The parameters used are the results of the measurements of the DGMK research report 4590. The measured results of this report are typical data measured in a middle European climate.

2.1.1 Vapor breathing losses as a function of the vapor pressure

Diagram 1 shows the calculation results of the vapor losses in lbs/day as a function of the vapor pressure of API 2516 compared to the results of VDI 3479. The curves show the API results are more conservative, meaning higher vapor losses results for the same tank pressure and size.

For this calculation the Tank size was varied from API 1 = 6,290 barrels, API 3 = 18,869 barrels, API 5 = 31,449 barrels, to API 10 = 62,898 barrels, the vapor pressure was varied from 120 “wc to 260 “wc.

The expected results are that the increasing vapor pressure increases the tank breathing losses and that more vapor losses occur from tanks with greater storage volume. This also means that if the set pressure of a tank can be increased the vapor losses are reduced.

2.1.2 Vapor breathing losses as a function of the positive set pressure

The curves in **Diagram 2** are a clear indicator for the vapor emission loss reduction if tank set pressures can be increased. In this case the tank volume and positive set pressure was varied. Again the tank volume was varied from API 1 = 6,290 barrels, API 3 = 18,869 barrels, API 5 = 31,449 barrels, to API 10 = 62,898 barrels. The tank pressure was varied from 0 “wc to 60 “wc. For the negative tank pressure (vacuum) a value of 0.68 oz/sq inch was set constant.

For the VDI 3479 Guideline the gradient for vapor loss reduction through set pressure increase is steeper than for the API 2516 equations.

The VDI 3479 Guideline results show that from a set pressure of 40 “wc no vapor losses occur from breathing losses. One of the boundary condition to be fulfilled for this is a 0 leakage vent at 40 “wc.

2.1.3 Vapor breathing losses as a function of the negative set pressure

In **Diagram 3** the API 2516 standard does not show any significant vapor loss reduction potential in dependence of increasing the negative set pressure. The VDI 3479 Guideline shows an effect of the negative set pressure on the vapor losses reduction.

Considering that the VDI 3479 guideline includes the pump out saving in the breathing losses, this make sense, because according to the physical equilibrium a leaning of the vapor head space through inbreathing results into liquid turning into the vapor phase. So if the negative set pressure can be increased the breathing cycles are reduced, which should result in vapor saving.

2.1.4 Vapor Saving potential as function of 50%, 10% full lift type technology and increased MAWP and MAWV

Diagram 4 shows the vapor saving potential if 50% overpressure or 10% full lift type technology is used. In this diagram curve 50% tech low pressure shows the vapor mass saving potential per day for a tank with a MAWP of 1.0 oz/sq inch and a MAWV of 0.5 oz/sq inc. Curve 10% tech low pressure shows the vapor mass flow saving for the same MAWP and MAWV. The tank sizes have been varied from 6290 barrels to 62898 barrels. As assumed the vapor saving potential increases with increasing tank sizes.

In addition this diagram 4 also shows the vapor saving potential if the design pressure would be increased to MAWP = 4.54 oz/sq inch and MAWP = 2.27 oz/sq inch. It is very interesting to see that the vapor saving potential for the 50% technology is around 11% additional saving and for the 10% full lift type technology vent is 27%. It is even more interesting to see that the combined effect of 10% technology with increasing the MAWP and MAWV gives a total saving potential of 42%. This is one of the reasons why the German tank standard typically rates tanks on the vacuum side to 2.27 oz/sq inch and on the pressure side to 4.54 oz/sq inch.

It is recommended to do a life cycle analysis on tanks including the vapor loss reduction as a function of the set pressure. Furthermore, it should be considered that EPA regulations force Petrochemical companies into vapor balancing, recovery and destruction. Also in these cases greater tank design pressures are of advantage, because a higher energy reservoir can be utilized.

3. Vapor emissions loss testing

The VDI 3479 standard assumes that all vents have the same sealing characteristics. This is not the case. For this reason, it is necessary to perform emission loss tests. It is our recommendation that besides the test performed in our Charleston facility we test the PROTEGO technology in direct comparison against our competitors at the Shell facility.

With these real world test vapor saving potential can be determined if “full lift type” technology is used in comparison to our competition.

3.1 Leak Rate on the PROTEGO portable vent test rig

PROTEGO USA Inc. has developed a portable vent test stand. This test stand can be used to perform leak rate testing of vents in sizes up to 8”. The objective is to show PROTEGO’s superior sealing technology in comparison to the competition and to show the vapor saving potential if the 10% overpressure vent is used instead of older technology. To determine the real vapor losses over time, Shell would have to provide pressure data of the storage tanks. PROTEGO can then determine the leak rates based on these different pressures and total emission losses can be calculated in respect to time.

The test setup shown in **figure 1** is in compliance with API 2521. The wet meter is a high sensitive bubble counter for measuring very low leakages. Basically, the system is operated at the desired tank pressure and a flow meter (bubble counter or rotameter) measures the losses. To avoid any negative thermodynamic effect from the relative small storage volume the vent is fixed on an API type flange. To determine the overall losses the bubble meter is measured in front of the vent.

Diagram 5 shows the results of tests performed by PROTEGO USA Inc. comparing a PROTEGO 2” (PROTEGO Model VD/SV 2”), a Groth Model 2” (Groth Model 1220A-02-III-100) and a PROTECTOSEAL 2” (PROTECTOSEAL Model 18540).

The vertical line 75% to set (0.5 oz/sq inch) shows the leak rate at 75% of the set pressure for a set pressure of 0.5 oz/sq inch, which is the recommended point of leak rate measurement according to the API 2521 guideline.

The vertical line 75% to set (0.675 oz/sq inch) shows the leak rate at 75% of the set pressure for a set pressure of 0.9 oz/sq inch. This is important if comparing technology against technology, because the PROTEGO full lift design vent can be set 10% below the maximum allowable operating pressure.

The vertical line, point of full open, shows the pressure at which the PROTEGO full lift type vent set at 0.9 oz/sq inch and the Groth vent set at 0.5 oz/sq inch would reach their point of full open, which results in full performance. The PROTECOSEAL vent is fully open at less than 100% above the set pressure. Problems resulting from this shall be described later.

First series of tests, comparison of sealing technology (curves Groth, PROTECTOSEAL, PROTEGO)

A) PROTEGO compared to Groth

To compare the sealing technology all devices have been set at 0.5 oz./in^2. The Groth device started to open at 0.44 oz./ in^2 (true set pressure), which is within a tolerable range. Unfortunately, we were unable to verify the exact set point of the Groth device because the device had already shown excessive leakage before reaching 75% of set pressure (0.375 oz/ in^2).

At 75% of the set pressure the Groth device has a more than 10 times higher leak rate than the PROTEGO device. However the Groth device does meet the API 2521 requirements and the Groth certified test report **figure 2** show the same result as the PROTEGO leak rate test.

At 75% of set pressure (being 0.375 oz/ in^2) we were unable to measure the leakage rate because it exceeded the capacity of our bubble counter. We were able to measure a leak rate of 250 bubbles at 0.116 oz/ in^2, which is 23.2 % of the set pressure (0.116 oz/ in^2). To get a measurement of the leakage at higher pressures the bubble counter had to be replaced by a rotameter.

Additionally, our pressurized tank bled off to 0 psig within 55 seconds. This means that if all Groth vents perform the same you are likely to experience massive vapor losses through the other Groth vents that you have onsite. (This assumes our test vent was typical of their performance.)

B) PROTEGO compared to PROTECTOSEAL

The typical test procedure to measure leak rates is to increase the pressure to the set pressure of the device and then to let the pressure drop again to the 75% of set pressure and then measure the leak rate at this point. This was not possible to achieve with the PROTECTOSEAL design. It seems so that after the set pressure is reached the PROTECOSEAL vent has a very low reseating pressure compare (**diagram 5**). The PROTECOSEAL device reached a 0 gauge pressure after 1 min of testing.

The curves were then determined from increasing the pressure from 0 oz/sq inch to the set pressure. Still the PROTEGO device has a 3 times better leak rate.

PROTECOSEAL obviously achieves relatively good leak rates through over sizing their pallet. Through this, heavier vent pallets can be used for smaller vents sizes, which lead to better sealing but extremely high blow downs. Through the over sizing of the vent pallet PROTECOSEAL has created a vent, which has an extreme high blow down rate of up to 50%, diagram 6.

Second series of tests, comparison of overall performance (curves Groth, PROTECTOSEAL, PROTEGO 10%)

In this series of tests PROTEGO has tested a 2" and 6" vent by utilizing the full lift type vent technology. These curves (PROTEGO 10% and PROTEGO 10% 6") demonstrate the vapor saving potential compared to the Groth and PROTECTOSEAL venting technology. During the time when the PROTEGO devices are still shut the Groth and PROTECTOSEAL devices are already releasing vapors excessively. These curves clearly underline the theoretical saving potential calculated by the VDI 3479 standard.

In addition, the design advantages towards reseating pressure and higher operating pressures have to be considered. In many cases, especially, when blanketing gases are used for API 650 Tanks, PROTEGO may be the only solution for conserving blanketing gases if cost efficient weight loaded vents shall be used.

3.2 Nitrogen loss reduction through blow down consideration by utilizing fill lift type technology

Figure 3 shows PROTEGO's TUV certified flow test facility. This facility can be used for determining breathing losses by conducting tests to simulate the pressures measured in your storage tanks. For this, Shell would have to provide PROTEGO with measured tank data. The pressure curve over the entire day or average values over the year would be preferred.

In addition, PROTEGO uses this facility to conduct blow down test on our vents and do flow optimization studies for performance increase. Also, all flow performance (V(p)) curves are measured in this facility.

In several industry studies, which PROTEGO USA Inc. has performed, we could prove the blow down problem of weight loaded conservation vents. The API 2000 document states that weight loaded pressure vacuum conservation vents have a 0% blow down. This means, that these vents would open at the set pressure and also reseat at the same set pressure. Due to the increased surface area a vent has to reseat below the set pressure.

However, engineers globally use the API 2000 standard as an engineering basis assuming a 0% blow down but in many cases vents have reseating pressures below the

set pressure of the nitrogen blanketing valve set pressure. This results in blanketing gas bleeding losses, because if the vent has opened once it may not reseat again.

In studies PROTEGO has performed in our TUV certified test facility we have proved blow down rates up to 30 % on our own full lift type technology. The blow down issue is a complex interaction of pallet design and vent housing design. If 50% or higher vent technology is used (full lift type) it is important to understand the fluid dynamic effects to avoid so called floating pallets which never reseat after opening once.

Recent test performed with the PROTECTOSEAL vent technology showed a up to 50% blow down, **diagram 6**.

The PROTEGO full lift type technology has reseating pressures (blow down rates) above the set pressure of all competitors vents. Even if our competition uses 50% vent technology the PROTEGO design reseats above these set pressures. This means that our design can solve common nitrogen bleeding loss problems and lead to excessive savings.

4. Conclusion

This report proves the capability of “full lift type” vent technology to decrease vapor losses not only by the theoretical calculation model of the VDI 3479 standard but also by the leak rates testing results performed.

To fulfill the demands of the German clean air act, PROTEGO had to develop state of the art vent technology, with improved sealing capabilities and vapor reduction potential by also increasing the application range of the devices. This goal was met through vents which only need 10% overpressure before reaching full flow performance. Through this design feature vents can be set higher to the maximum allowable operating pressure and working cycles, which reduces vapor losses to a minimum.

In addition to the vapor loss reduction the new technology also reduces blanketing gas losses. In a lot of cases devices typically sold in the US market place need 100% overpressure to full lift. Some designs already feature 50% overpressure to full lift. However, in both case blow down does occur and if the blow down value is not known, especially in API 650 applications, the reseating pressure may fall below the set pressure of the blanketing gas regulator. In this case the blanketing gas regulator will not reseat and excessive blanketing as bleeding can be the result.

An additional design advantage of the “full lift type” technology is the higher flexibility in setting the vent closer to the set pressure of the emergency relief vents without forcing these into the chattering zone. It is our recommendation to achieve full performance from a conservation vent 10% to 20% below the set pressure of the emergency below vent.

PROTEGO is convinced that through our state of the art technology, exceptional research and development capabilities, special vent quality assurance program and well educated engineers we can be a beneficial asset to the Shell Corporation world wide.

It is the PROTEGO global commitment to provide our customers with state of the art technology and provide safety devices to protect the environment and industrial facilities. It is our goal to constantly develop new products in close corporation with our key customers for meeting the most conservative industry standards to constantly stay ahead of our competition.

5. Annex

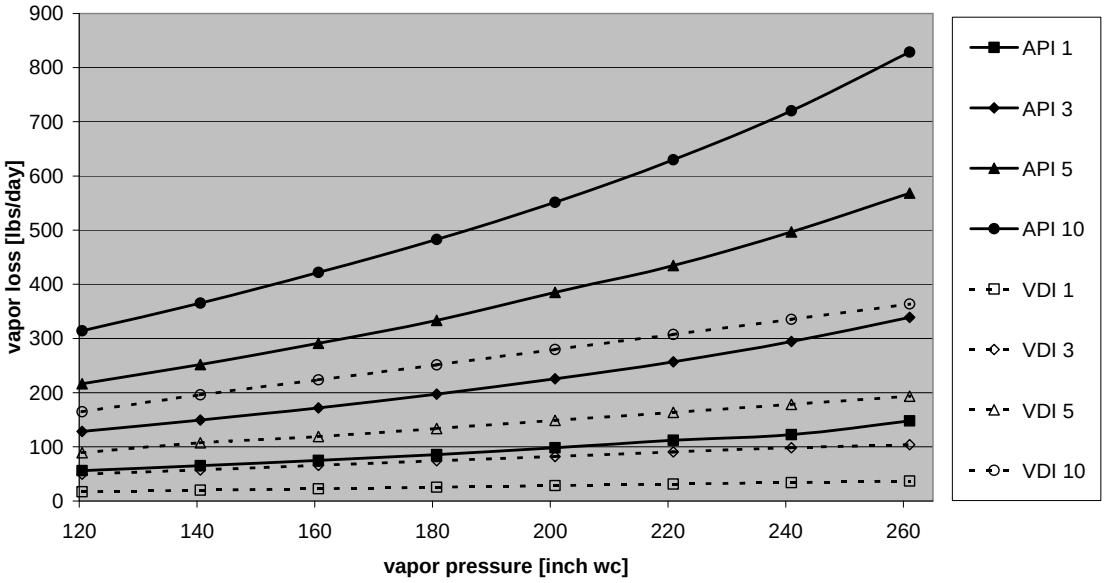


Diagram 1: Vapor losses as function of vapor pressure

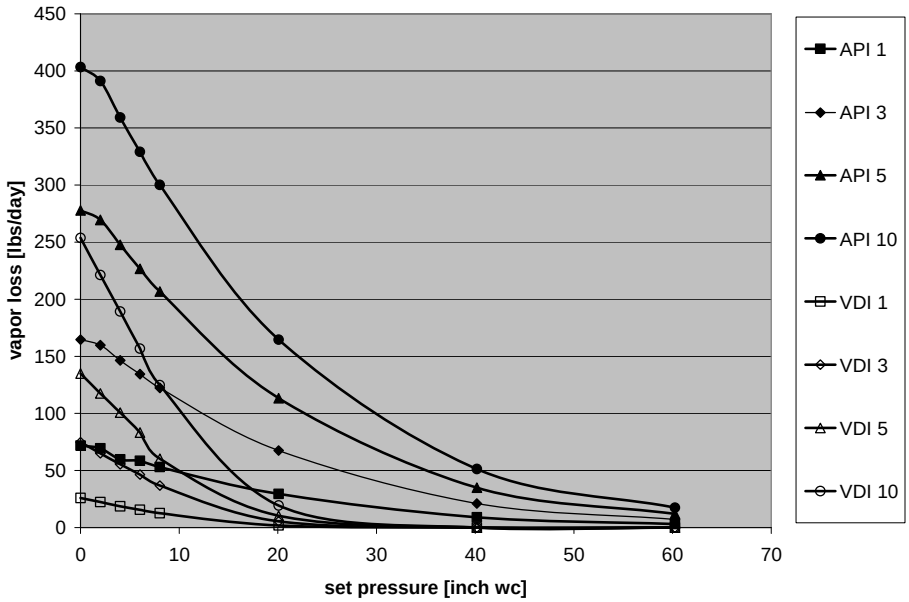


Diagram 2: Vapor losses as function of positive set pressure

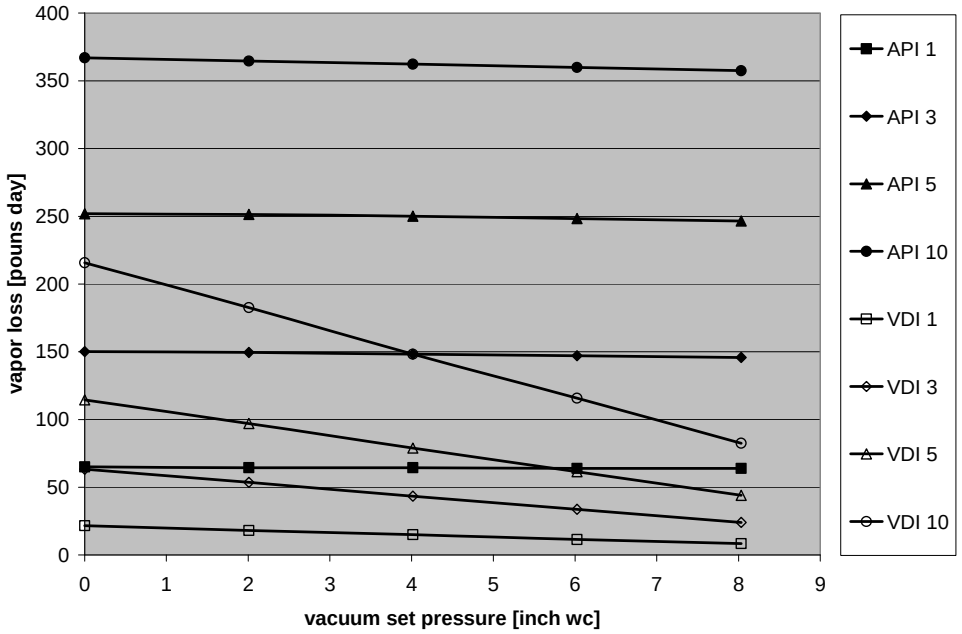


Diagram 3: Vapor losses as function of the negative set pressure

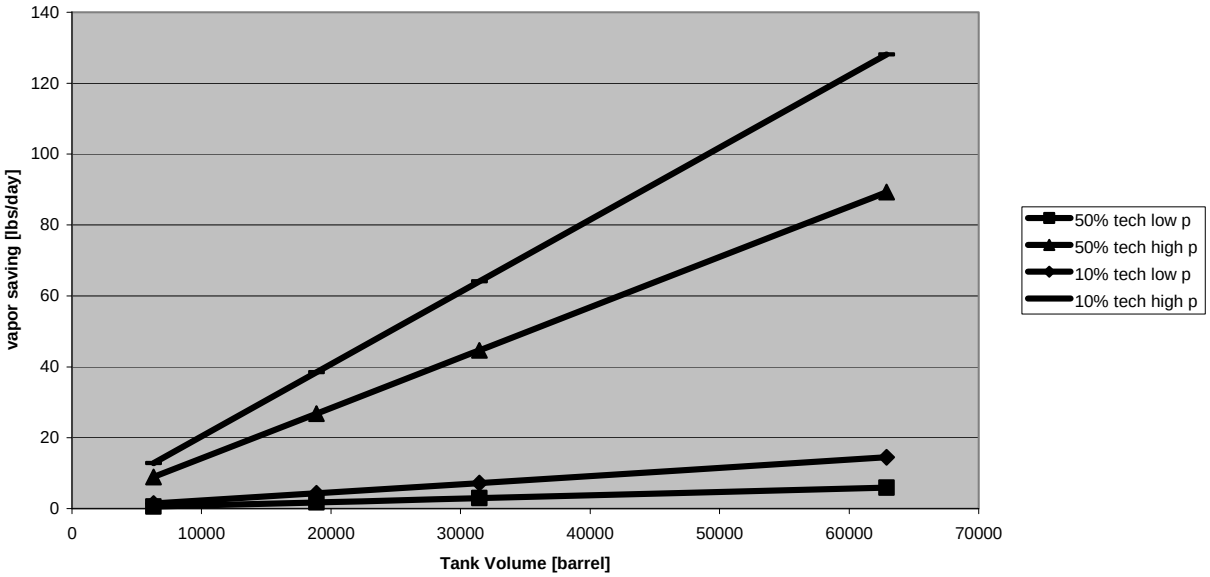


Diagram 4: Vapor Saving potential as function of 50%, 10% full lift type technology and increased MAWP and MAWV

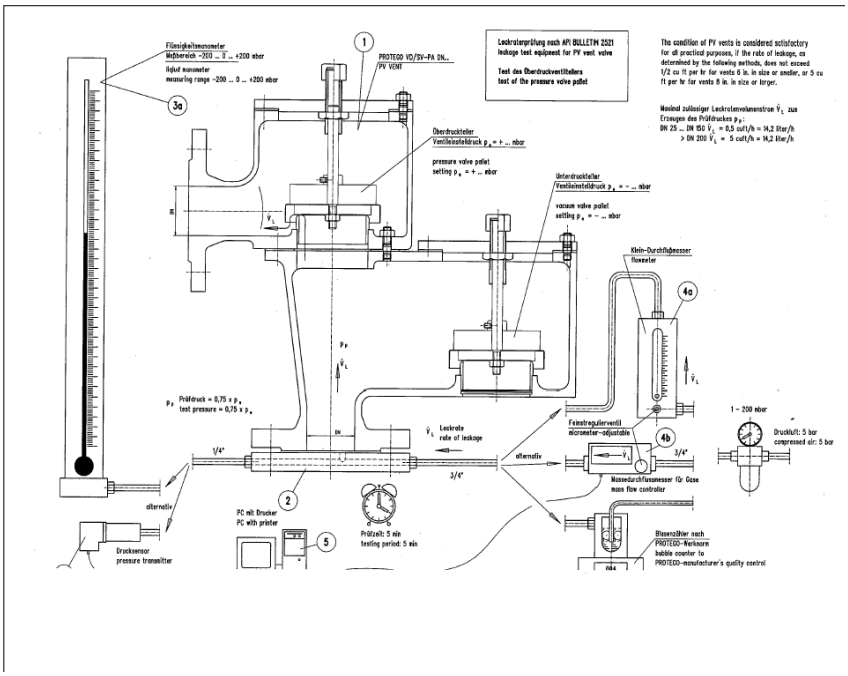


Figure 1: Vent leak rate test set up according to API 2521

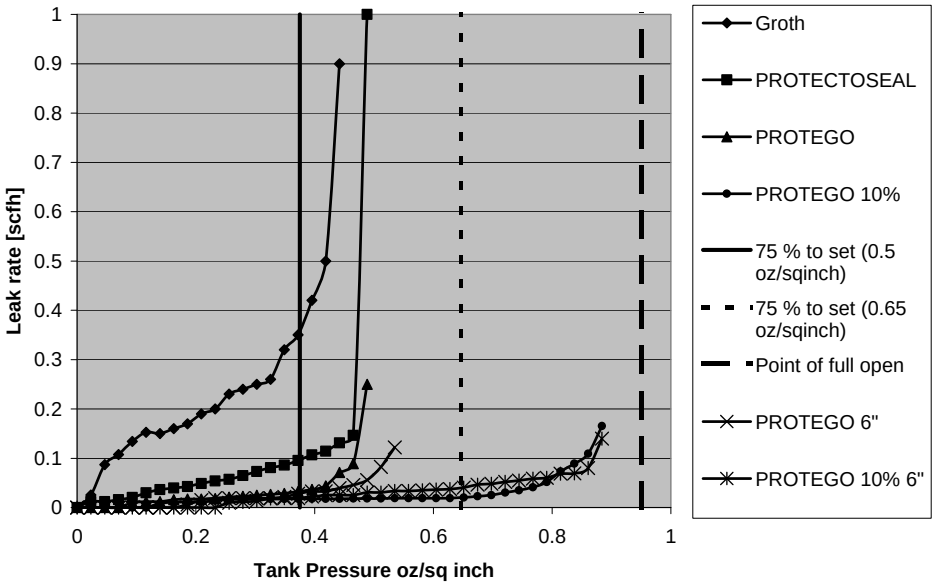
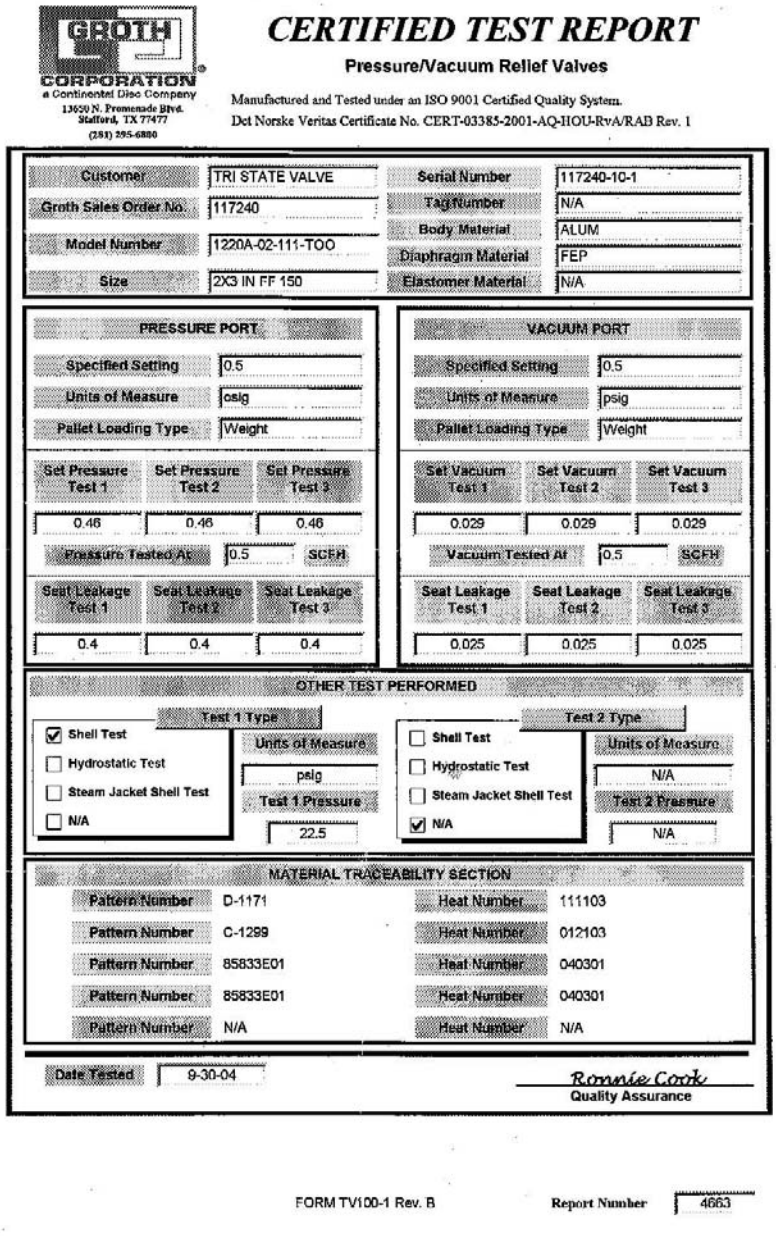


Diagram 5 Vapor losses as function of the negative set pressure



GROTH CORPORATION
a Continental Disc Company
13650 N. Promenade Blvd.
Stafford, TX 77477
(281) 295-6880

CERTIFIED TEST REPORT

Pressure/Vacuum Relief Valves

Manufactured and Tested under an ISO 9001 Certified Quality System.
Det Norske Veritas Certificate No. CERT-03385-2001-AQ-HOU-RvA/RAB Rev. 1

Customer	TRI STATE VALVE	Serial Number	117240-10-1
Groth Sales Order No.	117240	Tag Number	N/A
Model Number	1220A-02-111-TOO	Body Material	ALUM
Size	2X3 IN FF 150	Diaphragm Material	FEP
		Elastomer Material	N/A

PRESSURE PORT

Specified Setting	0.5
Units of Measure	osig
Pallet Loading Type	Weight

Set Pressure Test 1	Set Pressure Test 2	Set Pressure Test 3
0.46	0.46	0.46

Pressure Tested At: 0.5 SCFH

Seat Leakage Test 1	Seat Leakage Test 2	Seat Leakage Test 3
0.4	0.4	0.4

VACUUM PORT

Specified Setting	0.5
Units of Measure	psig
Pallet Loading Type	Weight

Set Vacuum Test 1	Set Vacuum Test 2	Set Vacuum Test 3
0.029	0.029	0.029

Vacuum Tested At: 0.5 SCFH

Seat Leakage Test 1	Seat Leakage Test 2	Seat Leakage Test 3
0.025	0.025	0.025

OTHER TEST PERFORMED

Test 1 Type	Units of Measure	Test 1 Pressure
☑ Shell Test ☐ Hydrostatic Test ☐ Steam Jacket Shell Test ☐ N/A	psig	22.5

Test 2 Type	Units of Measure	Test 2 Pressure
☐ Shell Test ☐ Hydrostatic Test ☐ Steam Jacket Shell Test ☑ N/A	N/A	N/A

MATERIAL TRACEABILITY SECTION

Pattern Number	D-1171	Heat Number	111103
Pattern Number	C-1299	Heat Number	012103
Pattern Number	85833E01	Heat Number	040301
Pattern Number	85833E01	Heat Number	040301
Pattern Number	N/A	Heat Number	N/A

Date Tested: 9-30-04

Ronnie Cook
Quality Assurance

FORM TV100-1 Rev. B

Report Number: 4663

Figure 2: Groth certified test report

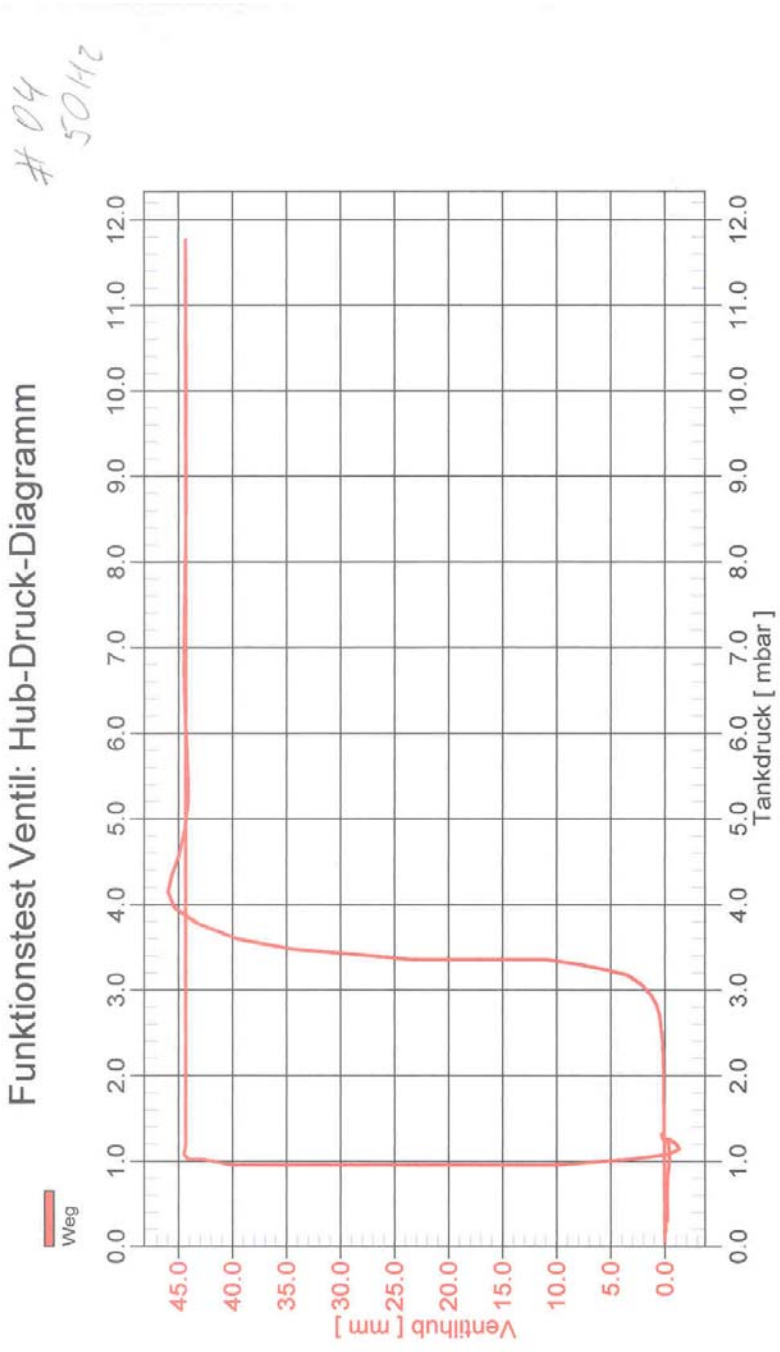


Diagram 6: Reseating pressure Test showing lift over tank pressure

Performance Data: (i.e. System 1 and 2)
p_{max} and p_{min} related to atmospheric pressure

System 1:
V_1= 0 – 423,800.00 scfh
p_{max} = + 76.00 inch wc
p_{min} = - 68.00 mbar

System 2:
V_2= 0 – 105,950.00 scfh
p_{max} = + 157.00 inch wc
p_{min} = - 149.00 inch wc

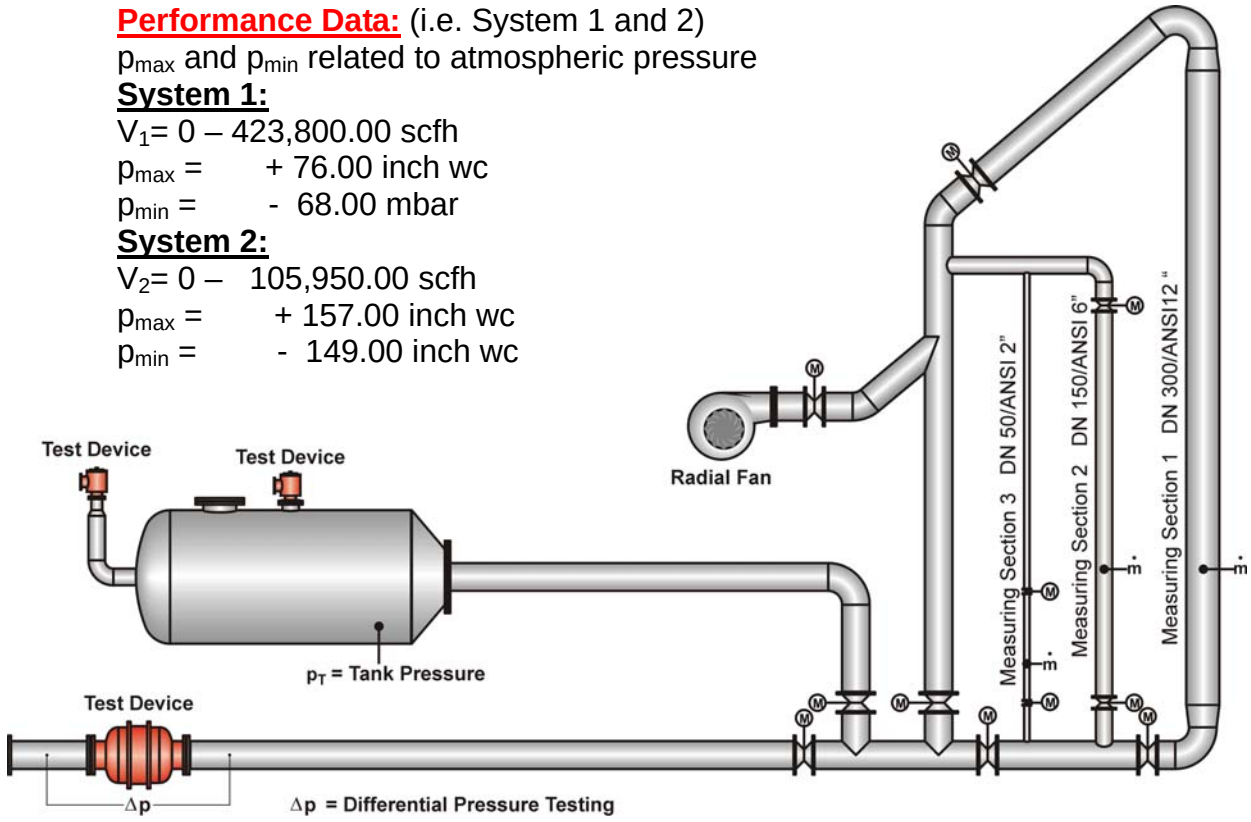


Figure 3: PROTEGO privately owned TUV certified flow test facility

6. Equation Parameters

c_n = saturation concentration of hydrocarbons in vapor phase

d_S = number of summer days per year

d_W = number of winter days per year

$f_{A,S}$ = saturation ratio in summer

$f_{A,W}$ = saturation ratio in winter

$\dot{m}_{tank}$ = emission mass flow for total tank

$\dot{m}_{withdrawal}$ = emission mass flow for withdrawal

$\dot{m}_{brteathing}$ = emission mass flow for breathing

$\dot{m}_{filling}$ = emission mass flow of filling

$\dot{m}_{A,a}$ = annual emission mass flow (withdrawal + breathing)

$\overline{M}$ = mean molar mass of hydrocarbons in vapor space

p = atmospheric pressure

p_T = vapor pressure of product

p_n = standard pressure

T_n = standard temperature

T_S = average temperature vapor space in summer

T_W = average temperature vapor space in winter

V_G = volume of vapor head space

$\dot{V}_S$ = average volume flow of summer days

$\dot{V}_W$ = average volume flow of winter days

t = reference time

7. References

[1] Forschungsbericht 225 “Kohlenwasserstoff – Emissionen aus Festdachtanks – Vergleich von Berechnungsformeln unter besonderer Beruecksichtigung der VDI Richtlinie 3479, Hamburg, February 1985

[2] VDI 3479 Guideline Emission Control Marketing Installation Tank Farms, VDI Handbuch Reinhaltung der Luft, Beuth Verlag GmbH Koeln, 1985

[3] API Standard 2000 “Venting Atmospheric and Low - Pressure Storage Tanks” Nonrefrigerated and Refrigerated, Fifth Edition, April 1998, API publishing Service Wahsington, DC 1998.

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For the attention of Mr. Sven Zdun
Braunschweiger Flammenfilter GmbH (PROTEGO)
Industriestrasse 11
D-38110 Braunschweig/Germany

EINGANG
23. Mai 2006
ABT. EKL

May 15, 2006

ref: PROTEGO breather valves

Shell Global Solutions (US) has evaluated the Protego breather valve (pressure/vacuum valve) designs and have determined that these are technically acceptable for our use. We are pleased to inform you that Protego breather valves have been added to the approved vendors list within Shell Global Solutions (US). This list, also know as the SMFL (Suggested Manufacturers and Fabricators List), is used by our Refineries, Chemical Plants, and Capital Projects Group in the United States.

Brad Otis

Technical Safety Specialist

18.11.2008

PROTEGO group meeting 2008 / Erfolgsgeschichten

PROTEGO Erfolgsgeschichte 1 1.TI.

Kunde: MAKPETROL AG / Skopje, Mazedonien,
größtes Unternehmen im Mineralöl- Raffineriebereich, Anlagen aus Jugoslawienzeit veraltet ohne zeitgemäß relevanter Tanklager-Sicherheitseinrichtungen.

- **ab Mitte 2005:**
  erste Kontakte über Prospektsendungen, e-mails, persönlich, Hr. Zottl über PA - Vorortvertretung

- **Juni bis August 2006:**
  Beratungen, vertrauensbildende Maßnahmen und Lösungsvorschläge für die einfache Absicherung von Dieseltanks (VD/TS)

- **Oktober 2006**:
  Alternative Angebotslegungen (VD/TS, P/EB) und intensive Preis-/ Lieferzeit-/ Zahlung-Verhandlungen
  Maßgebliche Wettbewerber: KITO/Hennlich, Protecoseal, Enereco/Italien

- **November 2006:**
  Auftragserhalt über ges. 16 Stk. VD/TS (DN 250,150,80), Auftragswert 53.330,00 €
  (K-01BFG194.04/2006, BFG AB K-E-06/5.949-rae)
  technisch-, terminlich- u. finanzielle Abwicklung bis :

- **März 2007:**
  planmäßige Auslieferung (kundenseitige Abholung) und Bezahlung

- **April 2007 bis Februar 2008:**
  weiteres After sale service, persönlich über PA Vorortvertretung , Nachfrage über weitere Modernisierungsschritte unter Beachtung der finanziellen Möglichkeiten

PROTEGO Erfolgsgeschichte 1 2.TI.

Kunde: MAKPETROL AG / Standort Beograd / Serbien

- **März 2008:**
  Neue Anfrage über den nächsten Modernisierungsschritt über Lagertankabsicherung mit verschieden großen VD/TS (Referenzwirkung der Erstlieferung)

- **März bis Mitte Juli 2008:**
  Alternative Angebotslegungen und intensive Preis-/ Lieferzeit-/ Zahlung- Verhandlungen
  Maßgebliche Wettbewerber: KITO/Hennlich mit Kampfpreisen
  Intensivberatung, besondere zu berücksichtigende Provisionsverrechnungen
  zusätzlicher interner Projektrabatt seitens BFG vereinbart

- **Ende Juli 2008:**
  Auftragserhalt über ges. 16 Stk. VD/TS (DN 150,80), Auftragswert 47.100,00 €
  (K-01BFG126.04/2008, BFG AB 008104862)
  technisch-, terminlich- u. finanzielle Abwicklung bis:

- **Oktober 2008:**
  seitens BFG leider verspätete Auslieferung um 2 Wochen. (kundenseitige Abholung).
  Bezahlung ok. Leichte Verstimmung wegen Lieferverzug

- **ab Oktober 2008:**
  weitere Kontaktpflege

PROTEGO Erfolgsgeschichte 2

Kunde: OMV Raffinerie Schwechat, größtes österr. Privatunternehmen, Global Player

- **Ende März 2008:**
  Projektspezifische Kundenberatung und Bestandsaufnahme vor Ort mit Leiter der Instandhaltung Ing. Reeh und Herr Hannes .
  Aufgabenstellung: Rekonstruktion von bereits stillgelegten Schwimmdachtanks.

- **Mitte April 2008:**
  Angebotserstellung über 15 Stück VD/TS 150-IIB3 in Werkstoff 1.0619
  Technische Besprechungen und Erläuterungen, Preis / Leistungsvorteile.

- **Mitte Mai 2008:**
  Erstellung des gemeinsamen Endverhandlungsprotokolles .
  Dabei gegenüber Mitbewerb (KITO) Sondernachlass von BFG erforderlich, um diesen Auftrag zu realisieren.

- **Ende Mai 2008:**
  Erhalt der Bestellung von OMV über 15 Stück VD/TS DN 150,
  Nettobestellwert PA 50.220,00 € , Auftrag K01BFG083.01/2008, BFG Auftrag 008103686
  Aufgrund von unvorhergesehenen Lieferschwierigkeiten bei BFG mussten 2 Teillieferungen vereinbart, (KW30 und KW37)

- **Mitte September 2008:**
  Gesamtlieferung abgeschlossen, Einbau der Armaturen :

- **Ende Oktober 2008:**
  Alle Armaturen eingebaut und in Betrieb.
  Weitere Kontaktpflege .

RESÜMEE:

Jeder Auftragserhalt hat seine eigene Erfolgsgeschichte. Es wäre sicher zu wenig, den Kunden wie so oft von manchen Firmen praktiziert, nur als Partner zu sehen.
Der Kunde ist und bleibt König.
Im Wettbewerb werden wir daher immer dann erfolgreich sein, wenn wir alle gemeinsam und jeder einzelne im Unternehmen für sich, auf die spezifischen Kundenwünsche eingehen und vor allem unter den prinzipiellen Marketing Grundaspekten agieren:

- **höchste Technologie**
- **marktgerechter Preis**
- **vernünftige Lieferzeit**

Gerade in der heutigen Zeit, in der auch die großen, finanzstarken und weltweit tätigen Unternehmen den Konjunkturrückgang und die Finanzkrise spüren, siehe OMV / Anlage, werden die genannten Gesichtspunkte noch mehr in den Vordergrund rücken, damit wir alle im gesamten global auftretenden BFG-Unternehmen weiterhin das wichtigste Ziel erreichen:

Auftragseingang