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Autogas Station Design

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Autogas stations have come a long way since what many of us remember just five years ago, let alone 20-30 years ago or more. And today in our industry many are looking for new markets where we have an opportunity to increase gallons (as opposed to the gallon shrinkage of many market sectors) as well as develop new markets where the gallons are more year round, helping to not only increase sales with incremental growth, but to also take the peaks and valleys out of seasonal sales. Thus Autogas stations are getting more attention than ever. But there are challenges also. While all of us have experience in traditional filling sales, for cylinders, RV's, forklifts, etc., with limited Autogas sales, not everyone has the experience to understand, design, build and operate the type of stations that our customers in this growing market of great promise, will expect. To paraphrase the old Oldsmobile commercial: This is not your father's Autogas market.

Autogas was invented here, in the United States, and has grown over the last century to be a worldwide alternative. Sadly, it is the rest of the world who in many respects, has advanced and somewhat left us behind. As the fastest growing and most common alternative fuel to gasoline and diesel, third in sales worldwide, stations are being built around the globe. In many cases, countries which we tend to think of as being behind the U.S. in technology are in the case of Autogas, well ahead. One can find today in India, Russia, Chile, Central America, and Asia, stations which you would be challenged to tell that they were not gasoline stations, as they are built so similar. Fore-courts with canopies, multi hose dispensers, card payment systems, buried storage, and fully automated station operations are in many cases the norm. In Europe and Australia, where the market is very advanced, the stations are exactly the same as their traditional counterparts, or in fact, combined, with Autogas dispenser right on the island under the canopy with gasoline and diesel.

So what do they know different than us? Well basically … nothing. It is what they do that is different and how they view the market that drives the growth, and widespread public acceptance. These markets see that Autogas, while being typically a lower margin sale, is incremental to existing higher margin sales, and not a segment that merely dilutes margins. New gallons that one did not have before. They see the potential for stable and growing year round sales and so they invest in better, nicer and more capable stations, ones which the driving public will accept, as a simple and comfortable change in fueling experience. Where this most stands out apart from us is the understanding of public access and self-fueling, and how the liability in these applications, dictates not only better appearance, convenience and comfort than our traditional "cabinet dispensers" but also a different level of safety integration as well.

When considering safety and liability there are effectively three categories of Autogas stations under which you can classify your project, for the purposes of risk assessment and liability. This should guide you in the design and what level of safety and automation is best to integrate into that design. It only takes one very public accident to shut down the whole industry in a city, state or other area, and either lose customers, or slow growth in a great new market for us. While we are all competitors, it behooves us to think of this, and build stations which will minimize any chance of accidents, so that the whole industry maintains a good reputation and we all benefit.

Category 1 – Stations on your company property, for refueling of all applications, secured inside a fenced area, operated for limited hours a day, and always operated by trained professionals who conduct operations every day, your employees. These are the types of stations which many of us are used to. We build these to meet the standards of NFPA 58 and any applicable state codes. We typically build them to comply with the minimum safety requirements, and there is nothing really wrong with that. We own them and operate them, and it is routine. We understand the liability and the refueling of all types is very controlled. They are rarely dedicated Autogas stations, and thus most of us never consider the requirements of NFPA 30A and other applicable codes. These stations had traditionally used domestic/industrial design tanks, with a single 1-1/4" liquid outlet on the bottom at the end of the tank, and either a combination valve on top of the tank, or possibly an additional 3/4" vapor opening. The internal valve usually has a fixed open cable pull to release, internal valve, and a remote circuit breaker or other switch for the required “Emergency Shut Down”. Often the bypass valve (if equipped) and the meter vapor return share the same vapor connection. This has been proven to work for many years in traditional applications of fueling. But it is not always the best for newer Autogas vehicles. In many cases, apart from meeting safety minimums, it may not actually fill, or completely fill an LPI equipped Autogas vehicle.

Category 2 – These are stations which we build at the fleet operator’s site, also typically in a secured area, not directly adjacent to vehicular traffic or accessible to the general public. These are operated by the fleet customer with training, and while they are still a lower liability consideration than a full self-serve retail site, they are not on our premises under our direct supervision, and are not operated by seasoned professionals. These stations, which tend to have a somewhat higher accident rate, should be looked at with more scrutiny. Often they are built either in the vicinity of, or mixed in on the refueling islands, with other fuels such as gasoline or diesel. These stations must not only meet NFPA 58, but also NFPA 30A, and National Electrical Code. Many states such as Texas require an inspection for compliance with these standards to be put into service. You should consult the authority having jurisdiction in your area as to what standards and regulations will apply, but assume that 58, 30A and NEC will apply. Many states such as California, Pennsylvania and others, now require that Autogas dispensers be listed to UL495/1238 and 1203. Listing of dispensers can be done by any “recognized testing laboratory”, such as UL, ETL, FM and others. When building these stations additional safety equipment integration is strongly advised.

Category 3 – These are retail, self-service stations, frequently installed at convenience stores or other open and public access sites. They are frequently in close proximity to very public roads with heavy and often fast moving traffic. Additionally, they are more accessible to tampering, vandalism and inherent wear. These sites are sometimes manned as much as 24 hours, but not by industry veterans and professionals. Often those at the site can be barely aware that there is even an Autogas station there, as it does not involve their normal operations. Naturally, these sites have the highest potential for accidents, and thus much greater liability. Sound judgment dictates that these sites should have the highest level of safety integration. Therefore, it is often unwise to put our traditional station solution into these type applications. We should install much more in line with the standards, appearance and safety designs of public gasoline stations and C-stores. Not only will this make for a far superior public impression of our industry, and thus more widespread acceptance, but also make for a safer and more comfortable refueling experience for the driver.

So what should we consider in these cases. There are many levels of safety equipment for each application. Personally, I always recommend to my customers to simply standardize on the highest level of safety for ALL categories, but of course there are often many issues to consider, not least of which is economics. So I will try to categorize some of the general areas for improvement.

Internal Valves – Aside from the fact that a 1-1/4" internal valve will limit the performance of a high differential pump with a 1-1/2" or 2" inlet (though proper hydraulic design can overcome this somewhat), the traditional “pull cable and fusible link” emergency shutdown we have used is not the best solution. All the internal valve manufacturers offer valve options for pneumatic actuators. A pneumatic actuator, with a pressurized gas source, controlled by a three-way solenoid valve, will allow for a single “Emergency Shutdown Device” preferably of the petroleum industry standard design, which will both close the tank valve(s) and shutdown the power to the site, with a single action. This is

a requirement of NFPA 30A, and is also required in almost every other country with a developed Autogas market. Additionally, using pneumatic actuators allows for the option to keep the internal valves CLOSED, when the dispenser is not being used, and opened on command in a start sequence, controlled by an integrated central electrical control panel, to open only when the dispenser is in use, and be shut down in an emergency when not in use.

Pneumatic Actuators – Traditionally when we have used pneumatics, we rely on the pressurized vapor in the tank to open the valves. This is not a good idea for several reasons. Naturally, this is a flammable gas, so in the event of a fire, which the fusible link should close the valve, there is a low melting point regulator and a fixed opening for the vapor source, which can result in a blow torch to be confronted by fire fighters. Next, these are harmful emissions every time the valves are closed. Approximately 100 cycles of internal valves is a gallon of LPG released into the air, and done so by our industry, which is promoting "clean fuels." I think we can all agree that this does not make good sense. Many states now do not permit this practice. It is a waste of money. Gas is not cheap. For a large fleet such as a school district, which may conduct as many as several hundred transactions a day, over the course of a month, this can cost hundreds of dollars, and leave the customer not very happy with their alt fuel, which is supposed to save them money. Lastly, consider that most pneumatic actuators require 25-60 psi of pressure to open. When the temperature is below 20 degrees F, (as much of the country saw throughout last winter) there can often be insufficient pressure to even open the valve, or hold it fully open. So the use of either compressed air or compressed nitrogen is a much better application. There are now available in the market, compact and maintenance free compressor packages specifically designed for this purpose. While they may not be the cheapest upfront solution, they are always the least expensive and most reliable in the long term.

Crash Protection – Most stations today are built to the NFPA 58 minimum standard, unless the state or local authority has a more stringent standard. This basically calls for 3" schedule 40 pipe, placed in the ground a minimum of 36" from the tank wall, and usually 36" of separation between bollards. This is an acceptable practice in design for a Category 1 station, or perhaps even some Category 2 stations, but is not good practice for a Category 3 retail station. A vehicle moving at only 5-10 miles per hour will roll right over as many as two of these. There are simple ways to improve the crash protection. Most important, is to have a "cap-rail" or "tied-rail system" in this design, all of the bollards are connected together, with a properly welded top or cap rail of equal or greater diameter to the individual bollards, or with a crash rail bolted to each individual bollard. In both cases, this connected system makes for a much more effective barrier, at minimal additional cost. When one bollard is impacted, the interconnecting rails distribute the impact energy among ALL the bollards, and thus require much greater impact force to breach the barrier and impact the station system.

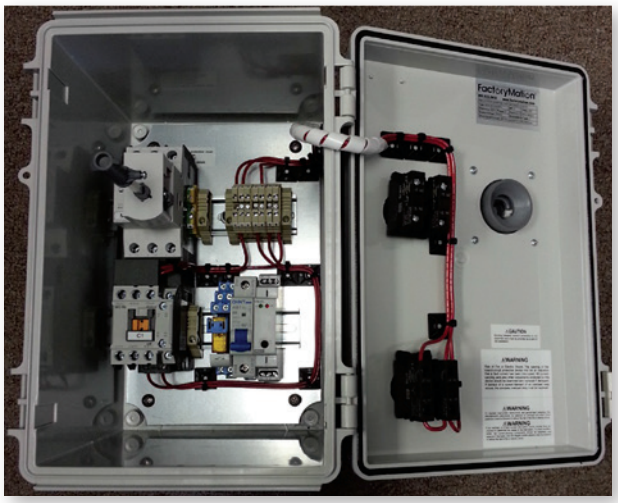
Knock-Over Protection – At more public fueling sites, especially those in either high traffic fleet yards, or in close proximity to road traffic, vehicular impact is a much greater possibility, even with enhanced crash protection. Especially with dispensers mounted remotely on islands, with minimal barriers. This can result in the complete dispenser assembly being "knocked-over" from its mounting position. In fact the mounting requirements and cabinet design specifications of UL-495 are such to essentially facilitate this. Also, pull-away devices, which are improperly installed, can fail to separate, and a drive off with nozzle connection can actually "pull-over" a dispenser. Hard to believe, but both have happened and more than you think. ALL gasoline and diesel, E-85, CNG, and biodiesel dispensers — every type except for Autogas LPG — is required by code to have

a “shear valve assembly” or knock-over protection under the dispenser. In Texas, regulated by the Railroad Commission, this is a requirement for all public retail self-serve dispensers. It is a feature that should be used in all these applications. Again, not a significant incremental cost, but excellent insurance. These systems, installed properly in both the liquid supply and vapor return under the dispenser, can prevent catastrophic loss of fuel when the dispenser in knocked over and the lines break. I have seen at least one example where almost 400 gallons was released before someone found the not so obvious E-Stop button and shut down the system. Improperly sized excess-flow valves did not function. Fortunately, there was not subsequent accident, but the site was very lucky. With knock-over protection, the devices will yield or break and separate when the cabinet tilts at a minimal angle, and the piping on both sides of the connection will immediately close with zero or minimal loss of fuel. These systems are available in the U.S., and can be found in both re-connectable designs and sacrificial designs (one time use). You may never see one need to be used, but if it is needed just one time, everyone will wish it had been there!

Hose Separation Protection – Commonly referred to as “break-aways” or “pull-aways,” they have long been a requirement, and as a whole, our industry has been very good about using them. However, they seem to be widely misunderstood. The most common in the U.S. are the type which will separate (if properly maintained and serviced) when there is load applied to the delivery hose, which pulls against the device secured to a shorter “whip-hose” section. However, these devices will ONLY work properly when the pulling force is applied in an in-line fashion, with no more than a couple of degrees of angle applied to the device. Therefore, if the device is mounted recessed into a cabinet, or rigidly in a vertical position to the outside of a cabinet, or positioned where the device cannot swivel or rotate in a minimum of 180 degrees horizontally, the device will most likely NOT separate, and either the dispenser will be pulled over, or the hose will separate from the hose end. Unfortunately, this is all too common the case, especially in traditional skid systems or cabinet dispensers, where the station assembly may be relocated many times over its service life. Yes, the fact that it exists makes it compliant with the requirement for it to be there. But mere compliance should not relieve us of the responsibility to ensure that it will work properly. It must be properly installed and regularly serviced to ensure it will operate as designed when needed. This not only protects our customers and employees, but also the liability of our company.

Good installation,
with freedom of rotation

Poor installations, with restricted movement in direction of traffic



Electrical Control Panels – Most Autogas stations have some type of electrical control panel (or combination of boxes) which comprises the minimum elements of control and safety. This includes motor starter relay, E-Stop button, circuit breakers, etc. However most electricians are not familiar with the specifics of both code and good practices for Autogas stations. One should always make sure to verify that the installing electrician has VERIFIED experience in Class 1, Division 1 & 2 hazardous locations, specifically for vehicle refueling stations. This experience will be a very good start. Many if not most of us have experienced the tremendous cost and frustration of picking the "low-bid" electrician. The old sayings of "you get what you pay for" and "if you can't afford to do it right the first time, you surely won't be able to afford to do it a second time" always apply. In fact, among station equipment manufacturers and station builders and installers alike, when discussing problems and areas for improvement, the number ONE frustration and source of commissioning problems is ALWAYS… the electrician and electrical issues. The benefits of using a central and integrated control panel are numerous. First and foremost, it is integrated. This means that all the required functions of starter, E-Stop, and breakers are combined with all the recommend safety features as well, including isolation relays for multiple dispensers, Lock-out-Tag-out switch, time delay relay for the motor-starter circuit, disconnect relays for data lines, and combined electrical and pneumatic control E-Stop. These panels are typically built specific for each site, and are usually considerably less expensive than having a different electrician build a different setup for each of your stations. Uniformity and consistency in design means improved safety, user recognition and ease of serviceability.

Conclusion:

There is much more to the subject than just what is presented here. And there are many more areas of enhanced safety and security that could be discussed, including remote monitoring, security lighting, fire safety analysis, and more. Not to mention the necessity of listed equipment for verifiable safety and the critical requirement, especially in retail applications, of fully weights and measures certified dispensers. But these are some of the most critical elements, and those which are often either overlooked or simply misapplied. All of us are in this business to grow and make a stable and sustainable market. Many of us with businesses which pass from one generation to another, all of us with a responsibility to both our customer and employee's safety, and to our share-holders and the bottom line. Together, all of us can use and encourage the use among our peers, of better equipment, and better safety, together building a safe, convenient and customer-accepted market for today and well into the future.