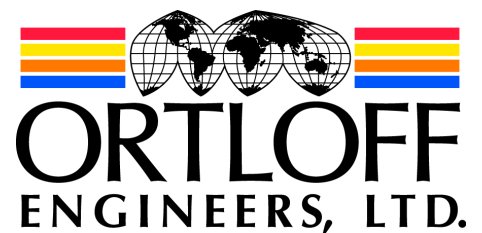


5TH GENERATION NGL / LPG RECOVERY TECHNOLOGIES FOR RETROFITS

Presented at the
96th Annual Convention
of the
GPA Midstream Association
April 11, 2017
San Antonio, Texas

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ABSTRACT

The majority of NGL/LPG recovery plants have been built in a traditional arrangement using conventional process equipment for performing the heat transfer and fractionation required within the plant. In recent years, Ortloff has developed new, more compact NGL/LPG recovery technology by integrating some of the cooling and fractionation steps within the gas plant for a more compact design and equal or better process performance (i.e. plant efficiency and high NGL/LPG recovery) than traditionally constructed 4th generation plants.

Through the use of integrated heat and mass transfer equipment, Ortloff's "bottle" technology offers a number of advantages over traditional NGL/LPG recovery retrofit arrangements. In addition to its compact, efficient design, the 5th generation designs utilize process technologies that improve plant flexibility, supporting operation over the range from 2% to over 98% ethane recovery while maintaining propane recovery at 99% and above.

These modular 5th generation retrofit units can be installed in an existing NGL/LPG recovery plant with minimal downtime and small footprint, with little change in the operation of the existing plant. This paper includes typical retrofit case study results indicating the performance improvements possible through use of the latest technology.

At a time when flexibility is important in order to efficiently recover or reject ethane without losing propane, the family of flexible 5th generation "bottle" technologies provides owner / operators a number of technology choices to meet their product recovery criteria and improve operating flexibility over open-art technologies to better adapt to changing market conditions.

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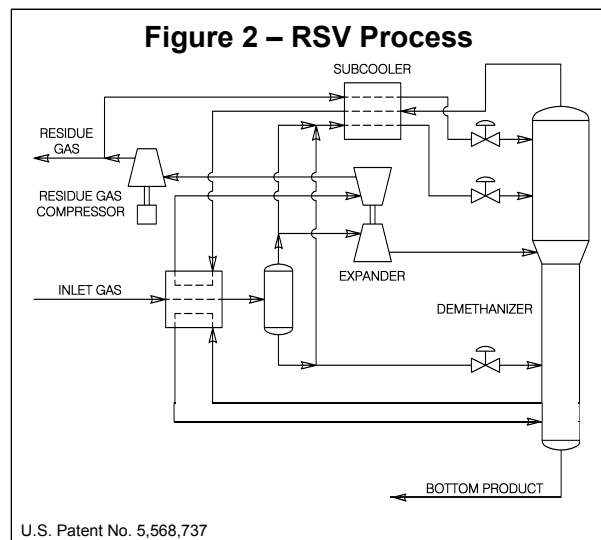
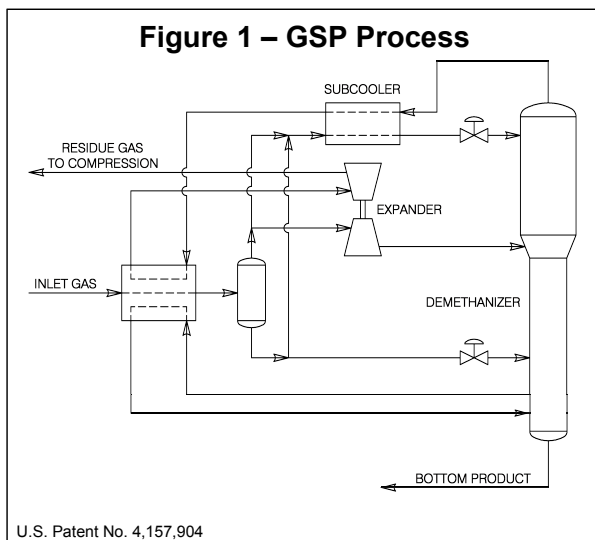
BACKGROUND

Since the early 1960's when the first expander-based NGL recovery plant was constructed, more than 1,000 cryogenic processing facilities have been installed. In the first designs, the expander discharge stream acted as the top reflux for the fractionation tower. Recovery was significantly improved over the prior Joule-Thompson processes, but the large vapor flow exiting the expander and flowing directly to the residue gas stream contained significant quantities of the desired products. Recoveries were typically less than 70% ethane and 90% propane, depending on the compression power applied.

In the late 1970's, Ortloff developed several new processes designed to improve product recovery, including the now well-known Gas Subcooled Process (GSP) (Figure 1). In all of these "2nd generation" processes a new reflux stream was fed to the top of the fractionation column, providing rectification for the vapor flowing up from the expander feed. Although the new processes required extra equipment, recoveries were significantly improved and the overall capital cost (including compression) was about 30% lower than the standard expander plant. Ethane recovery of up to about 94% was possible, depending on the feed gas composition.

For many years processes like GSP were considered the best available technology in cryogenic NGL and LPG recovery. But the 2nd generation processes definitely have their limitations. In particular, the GSP process utilizes a top column reflux with essentially the same composition as the feed gas. Any of the desired components in the vapor phase after the reflux flash are lost to the residue gas stream. Of greater concern was the inability to maintain high propane recovery while rejecting ethane. Typical GSP plants will lose between 5% and 15% of the propane when operating in full rejection mode.

In order to achieve ethane recovery greater than 98%, the "3rd generation" of process designs was developed.⁽¹⁾ For the ethane recovery designs, such as Ortloff's Recycle Split-Vapor (RSV) process (Figure 2), a leaner top reflux stream composed of condensed residue gas is fed to the



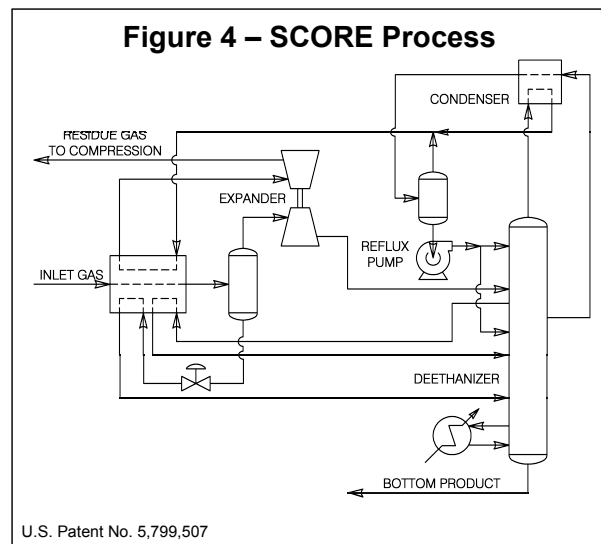
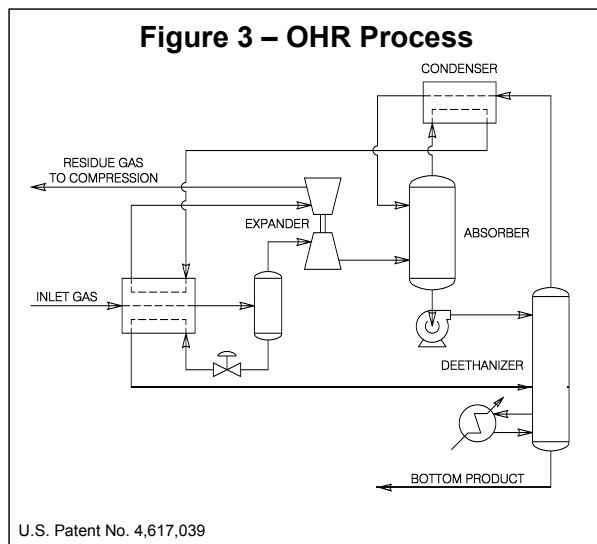
5TH GENERATION NGL / LPG RECOVERY TECHNOLOGIES FOR RETROFITS

Presented at the 96th Annual GPA Midstream Convention – April 11, 2017 – San Antonio, Texas

column to recover ethane not captured by the GSP process. Only a small amount of incremental compression is required to move from high to ultra-high ethane recoveries with RSV, well above what GSP can provide (even with unlimited compression).

Historically, recovering only propane was not of much interest in the United States. On the other hand, international projects generally treated ethane recovery as either unnecessary or only as a future option. For these propane recovery only projects, the 2nd generation OverHead Recycle process (OHR) (Figure 3) was much more effective than the GSP process. Very high propane recovery in excess of 99% is possible with significantly less power than GSP, but OHR requires two columns.

A 3rd generation propane recovery process was also developed to provide maximum recovery with minimum compression power. By combining the two separate columns required for OHR, and improving the heat integration, Ortloff's Single Column Overhead REcycle (SCORE) process (Figure 4) offered the highest efficiency for recovering 99+% of the propane. As with OHR, SCORE is only effective for propane recovery, and is limited to "incidental" ethane recovery up to about 30-40%.



MEETING MARKET DEMANDS

Although discussion of maximum product recoveries is important, selection of the best process also depends on the needs of the market. Product economics drive both the decision to build a plant and how the plant will be operated. The ability to recover ethane when margins make it valuable, and to reject ethane when it is not, allows a plant to respond to market demands. Many "dual-mode" plants that can be configured to either recover or reject ethane have been installed, although most of them cannot efficiently recover propane while rejecting ethane.

A 2nd generation process like GSP can be operated to reject ethane, but propane recovery will drop significantly compared to newer generation technologies. One alternative is to combine

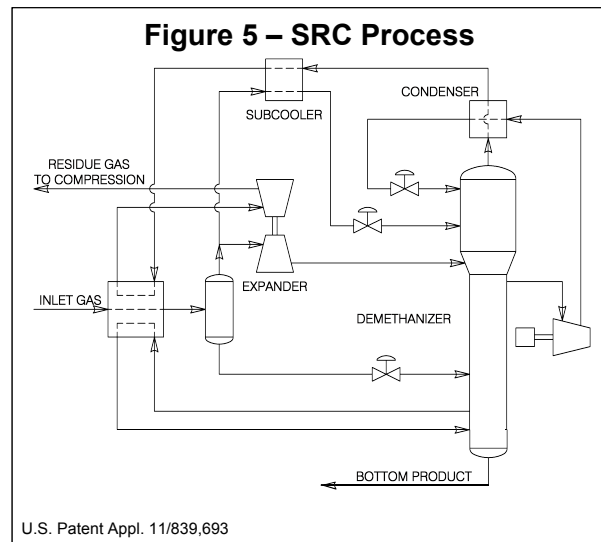
5TH GENERATION NGL / LPG RECOVERY TECHNOLOGIES FOR RETROFITS

Presented at the 96th Annual GPA Midstream Convention – April 11, 2017 – San Antonio, Texas

GSP with the SCORE process, which can effectively reject ethane while recovering propane. By switching a few valves, operation can be changed from one mode to the other. The RSV process, by itself, can also either recover or reject ethane while maintaining full propane recovery. It is capable of achieving higher ethane recovery than GSP, but requires significantly more compression than SCORE to reject ethane at the same propane recovery level. However, both of these process options may experience reduced propane recovery when operating at a moderate (40-70%) ethane recovery level.

For some projects, full flexibility is extremely important, including the ability to recover any level of ethane while always recovering essentially all of the propane. This requirement led to the development of a set of “4th generation” processes that Ortloff refers to as “rubber band plants.” Depending on the daily economics or downstream customer requirements, a 4th generation process can be easily adjusted to recover the desired amount of ethane without losing propane. Flexible operation is particularly valuable when supplying downstream customers with varying feedstock requirements. Although these processes were generally developed for international markets, the flexibility they provide is now needed in the U.S.

Ortloff offers several processes that provide this needed flexibility, including the Supplemental Rectification Process (SRP), Supplemental Rectification with reflux (SRX), Supplemental Rectification with Compression (SRC) (Figure 5), and Multiple Rectification and reflux (MRX). All of these 4th generation processes incorporate multiple reflux streams, including at least one reflux stream intended to ensure maximum propane recovery. They also tend to be more resistant to CO₂ freezing than GSP and have equal or better CO₂ tolerance than RSV when recovering ethane.



THE 5TH GENERATION

Each of the successive generations described above represents an improvement in either recovery efficiency or processing flexibility. The plants are of conventional construction, with separate equipment items for each service connected by piping. The next logical step is focused on improving the mechanical efficiency of the design and maximizing heat integration. This “5th generation” of technologies is targeted at reducing plot space, minimizing piping and flanges, improving delivery time, maximizing product recovery, and/or reducing plant cost.

The key feature of the 5th generation technologies is the compact equipment arrangement with the best process design for a given application incorporated into an efficient package. This

5TH GENERATION NGL / LPG RECOVERY TECHNOLOGIES FOR RETROFITS

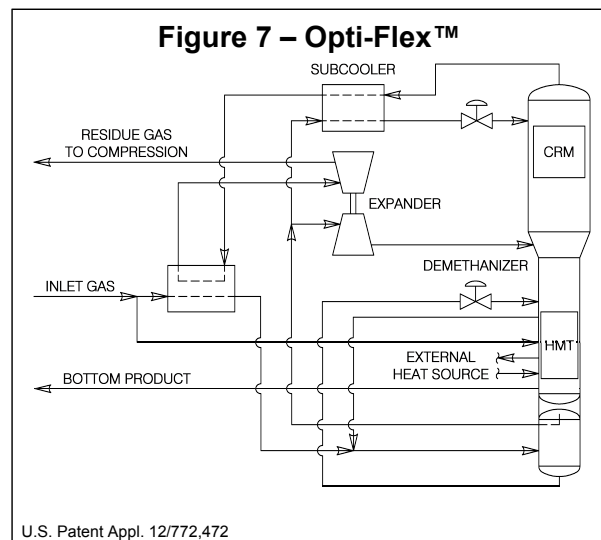
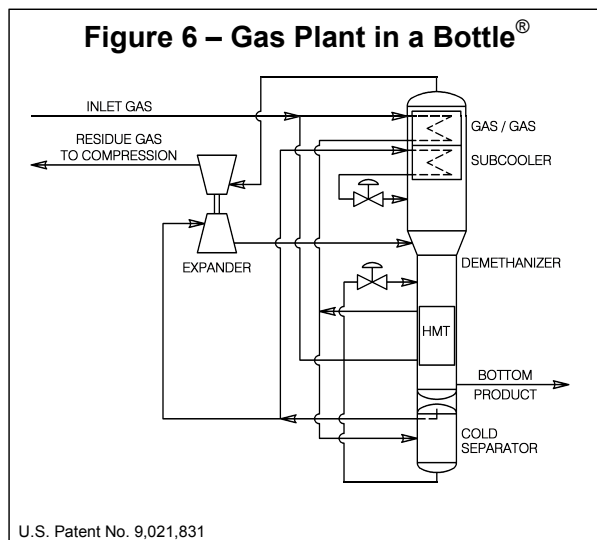
Presented at the 96th Annual GPA Midstream Convention – April 11, 2017 – San Antonio, Texas

packaging concept includes the innovative use of integrated heat and mass transfer equipment to improve process performance. It can be applied to new plant designs, or retrofit into an existing plant.

The first 5th generation design was Ortloff's Gas Plant in a Bottle[®] (GPB[™]).⁽²⁾ The primary feature of the GPB[™] technology (Figure 6) is the integration of a proprietary heat and mass transfer module (HMT) in the lower section of the demethanizer. The HMT replaces both the traditional side reboilers and the lower fractionation stages. From a process perspective, it is equivalent to having a side reboiler on every tray, thereby improving the heat integration while minimizing the tower height required. As an additional option, the gas/gas exchanger and subcooler can be located in the upper section of the column to provide efficient heat transfer while minimizing piping/flanges and plot space.

The first Gas Plant in a Bottle[®] application was commissioned in 2012 at Kinder Morgan's Houston Central Plant facility.⁽³⁾ The GPB[™] technology was chosen to retrofit their existing facility so it could process richer feed gas and improve recovery. Key factors driving this choice were a desire to minimize downtime and the limited plot space available for the new equipment.

Another 5th generation option for new plants is Ortloff's Opti-Flex[™] technology (Figure 7) which also incorporates simultaneous fractionation into the heat exchange section in the top of the column. Opti-Flex[™] was developed to provide maximum propane recovery regardless of the ethane recovery level. In addition to an HMT module in the lower section of the demethanizer, a Cold Refluxing Module (CRM) is located in the upper section of the column. Although the process configuration is similar to GSP, the CRM provides the ability to capture the unrecovered propane which would otherwise exit the top of a GSP column. The CRM can either be contained within the column or mounted external to the column. In either case, there are no thermal stress concerns for the heat exchanger because of the limited temperature differential. There is also no chance of leakage between streams since the pressure differential between streams is minimal. And like the GPB[™] technology, Opti-Flex[™] utilizes an HMT module, which replaces the



5TH GENERATION NGL / LPG RECOVERY TECHNOLOGIES FOR RETROFITS

Presented at the 96th Annual GPA Midstream Convention – April 11, 2017 – San Antonio, Texas

thermosiphon reboilers and eliminates the problems associated with their operation. The Opti-Flex™ design is a good option for new plants to provide full flexibility in recovering ethane as it is capable of maintaining 99+% propane recovery throughout the compression limited ethane recovery range.

However, as noted earlier, many facilities were constructed without consideration for optimizing propane recovery over the full range of ethane recovery. These plants do not have the flexibility to maximize profit in response to changing market conditions. Fortunately, the 5th generation packaging concept is ideally suited to the retrofit market.

RETROFITTING EXISTING PLANTS

During the U.S. shale gas boom, producers were rapidly developing new fields. Gas processing facilities were needed immediately to process all the new gas. In many cases, choosing the best process to meet the product specifications was not important. The first available GSP plant was “good enough” if it allowed the gas to be sent to market. To make matters worse, during this period of expansion the ethane margins dropped drastically, turning negative in many cases. Operators started to reject ethane to the residue gas if their plants would allow it. The numerous GSP plants that had just been commissioned were now losing a significant amount of propane (typically 5-15%) while operating in full ethane rejection mode. Some of them were forced into a “middle ground”, unable to reject all the ethane because of sales gas heating value specifications or the NGL pipeline requirements to produce some ethane. It became clear that a typical 2nd generation process like GSP was a compromise, at best.

Although some new U.S. plants have been constructed with full flexibility in mind,⁽⁴⁾ there are many more that would benefit from retrofitting to a newer, more flexible process. Reasons may include improving plant throughput, improving product recovery, or increasing operational flexibility to maximize profit. Retrofits may also be attractive when moving a plant from one location to another. A 2nd generation process can be upgraded to a 3rd or 4th generation process. In most cases, retrofitting an existing plant to newer technology can be accomplished for less capital and in a shorter time than building a new plant with a later generation process technology.

A standard RSV retrofit based on conventional construction, which has been performed at several facilities, could be considered for these GSP technology plants. The equipment required typically includes an absorber column, cold pumps for the absorber liquids, and additional parallel exchangers. Alternatively, the same mechanical integration of heat transfer and fractionation utilized in the Gas Plant in a Bottle® and Opti-Flex™ technologies can be applied to a retrofit design. The result is Ortloff's Retro-Flex™ package, a modular “bolt-on” solution that was developed to enhance flexibility by improving propane recovery from GSP plants in both ethane rejection and ethane recovery modes with minimal downtime and tie-ins and no additional residue gas compression.

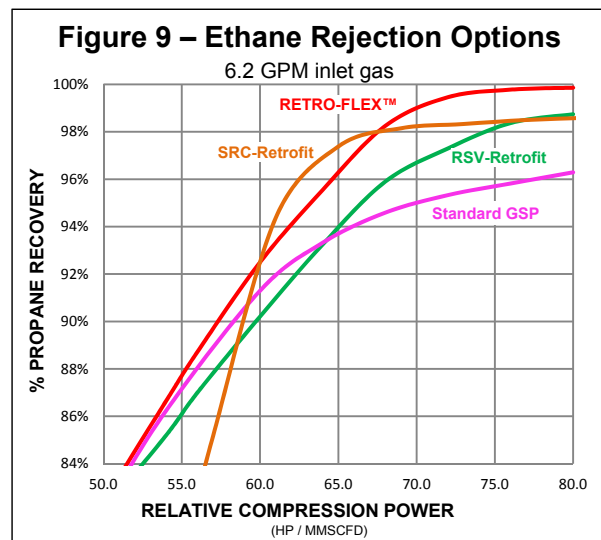
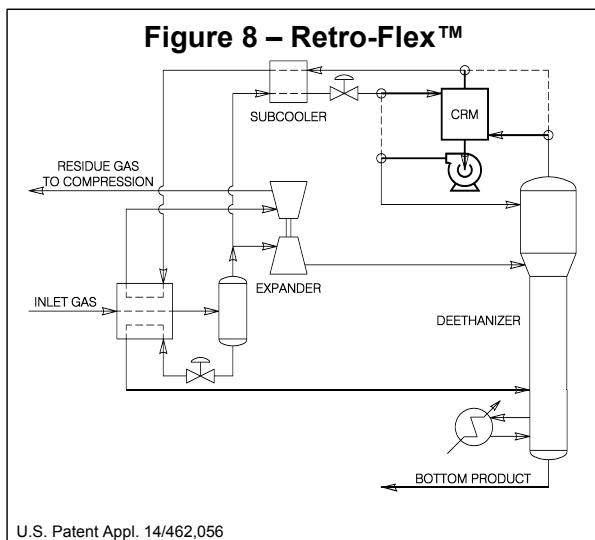
5TH GENERATION NGL / LPG RECOVERY TECHNOLOGIES FOR RETROFITS

Presented at the 96th Annual GPA Midstream Convention – April 11, 2017 – San Antonio, Texas

Figure 8 shows a Retro-Flex™ retrofit of a GSP process operating in ethane rejection mode. The cold flashed stream from the subcooler which normally feeds the top of the column (shown dashed) is instead routed to the Cold Refluxing Module for processing. The residue gas stream that normally flows from the column overhead directly to the subcooler (shown dashed) is instead routed to the CRM, and then subsequently routed to the subcooler. The resulting liquids are pumped to the top of the existing column as top reflux. For a standard GSP plant, the installation requires only four tie-in points, shown with circles in Figure 8. By installing appropriate isolation valves the installation downtime can be minimized, and the CRM module can be easily bypassed if desired, allowing the plant to revert back to the original GSP process. Typically, no modifications to the column or other existing equipment are required. The CRM and pumps are mounted on a single module for easy installation, and all equipment is accessible for monitoring and maintenance.

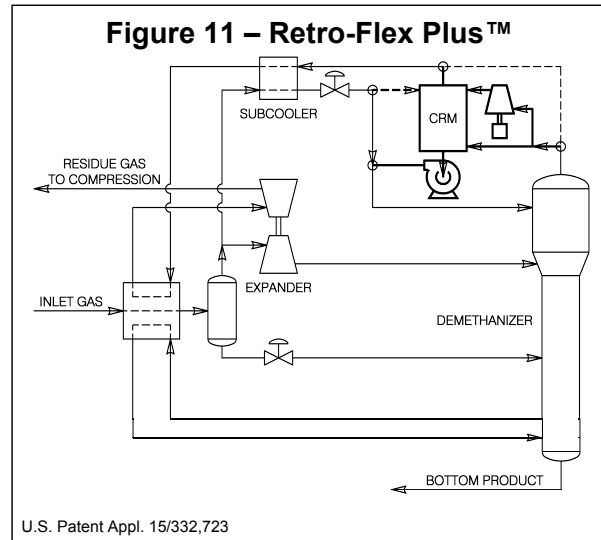
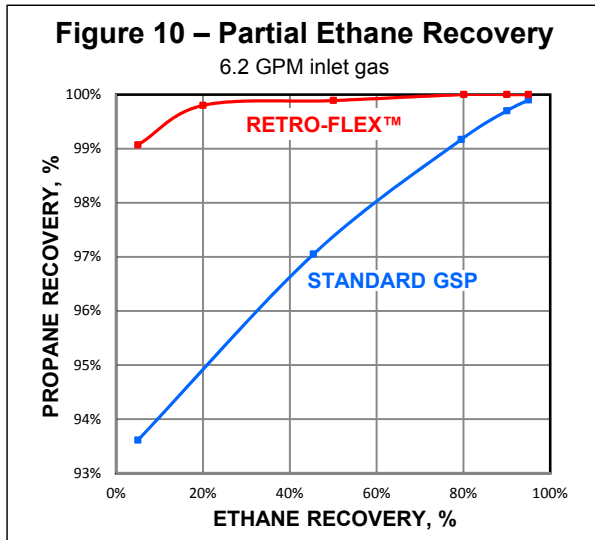
Retro-Flex™ provides a significant process performance improvement in ethane rejection compared to GSP and RSV. It can achieve essentially 100% propane recovery with lower compression requirements while rejecting almost all of the ethane. Figure 9 shows the performance of a Retro-Flex™ retrofit of a standard GSP plant (with fixed equipment) processing rich inlet gas while operating in ethane rejection mode compared to two alternative retrofits of the same plant. At a given compression power level, it is capable of recovering more of the propane than either RSV or SRC as a retrofit, and is the only process able to achieve 99% propane recovery reusing the existing equipment.

For variable ethane recovery operation, the Retro-Flex™ package ensures that essentially all of the propane is recovered whether rejecting any or all of the ethane. Figure 10 shows the propane recoveries at different ethane recovery levels for both a GSP plant and the same plant retrofitted with a Retro-Flex™ module. In ethane recovery operation (the far right side of the graph) the unit acts like a standard GSP plant, albeit with a small increase in propane recovery. As ethane recovery is reduced, however, the GSP plant's propane recovery starts to fall while the Retro-Flex™ plant propane recovery remains above 99%. At full ethane rejection the Retro-Flex™ plant continues to recover greater than 99% of the propane, significantly higher than the GSP process.



5TH GENERATION NGL / LPG RECOVERY TECHNOLOGIES FOR RETROFITS

Presented at the 96th Annual GPA Midstream Convention – April 11, 2017 – San Antonio, Texas



If ultra-high ethane recovery (greater than 98%) and 100% propane recovery is desired, Ortloff's Retro-Flex Plus™ technology option (Figure 11) should be considered for the retrofit. In this process, a small reflux compressor is added to the retrofit package. A portion of the column overhead vapor is compressed and then condensed in the CRM. The additional cooling and rectification this stream provides allows Retro-Flex Plus™ to capture more of the unrecovered ethane. In ethane rejection operation, the reflux compressor is shut down and the retrofit design reverts back to the Retro-Flex™ technology.

The Retro-Flex Plus™ retrofit also requires only four tie-in points, minimizing downtime for the upgrade. As an additional option, some plant owners may wish to defer purchase of the small compressor until such time as ethane economics justify the cost. Until then, the CRM operates like the Retro-Flex™ technology depicted in Figure 8. Compared to a retrofit with other processes such as RSV or SRC, either of the Retro-Flex™ technologies offers the smallest, most cost effective, and easiest option to upgrade an outdated plant process.

A Retro-Flex™ or Retro-Flex Plus™ upgrade can be installed in any GSP plant. However, each application will need review. Most importantly, the existing plant must have been designed with some means to reject ethane, even if only for partial ethane rejection. This includes an adequately sized external heat source reboiler (rather than inlet gas), and a column diameter that is large enough to handle the additional vapor and liquid traffic generated in rejection mode. There must also be adequate plot space near the column for the packaged module. Plants that do not meet these criteria can still likely be retrofitted with Retro-Flex™ or Retro-Flex Plus™, but the installation may require more equipment, or replacement of some of the existing equipment.

Although the Retro-Flex™ or Retro-Flex Plus™ technologies are targeted at retrofitting existing plants, they can also be applied in new plants. Many GSP plants offered by EPC companies are based on a standard design with fixed equipment sizes to minimize cost and delivery time. By incorporating a Retro-Flex™ or Retro-Flex Plus™ module into this standard plant during

5TH GENERATION NGL / LPG RECOVERY TECHNOLOGIES FOR RETROFITS

Presented at the 96th Annual GPA Midstream Convention – April 11, 2017 – San Antonio, Texas

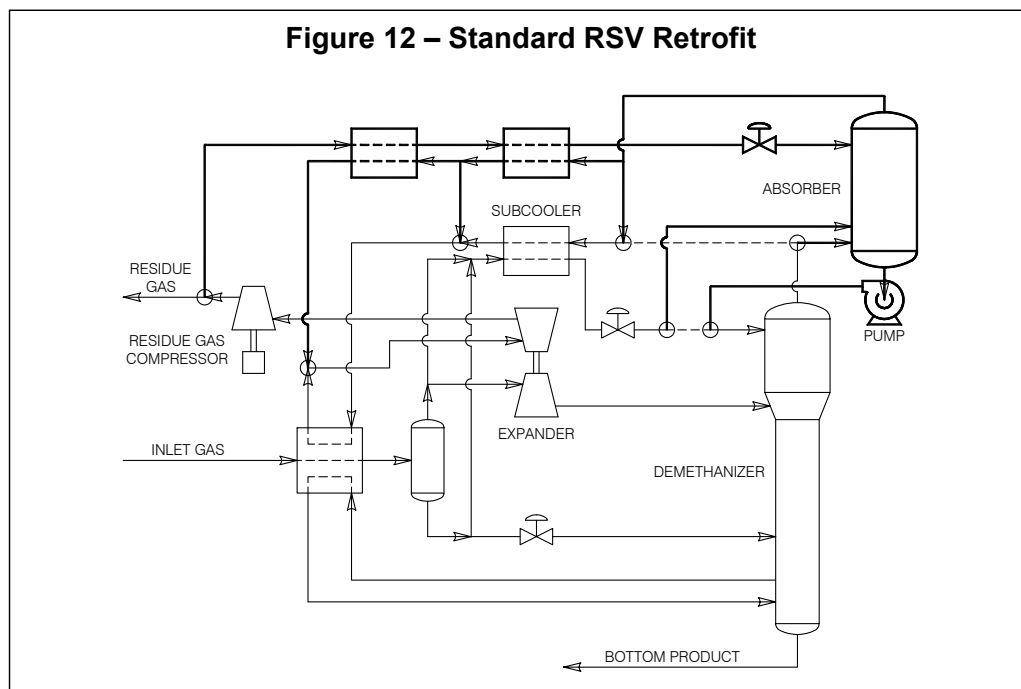
construction, higher product recoveries in either ethane rejection or ethane recovery modes can be achieved at first operation.

5TH GENERATION VERSUS STANDARD RETROFIT

As noted earlier, retrofits can certainly be accomplished with conventional equipment and construction. For example, an RSV type retrofit of a GSP plant may offer higher maximum ethane recovery and the ability to maintain full propane recovery while rejecting ethane. But such a retrofit would be significantly more complicated than a 5th generation retrofit, requiring more equipment and tie-ins, as well as longer downtime for installation.

Figure 12 shows what a typical RSV retrofit of a GSP process requires. New equipment and piping is shown in bold, and the tie-in points are indicated with circles. In addition to the seven tie-ins that are spread throughout the plant, the retrofit requires an absorber column the same diameter as the top of the existing demethanizer, two new heat exchangers parallel to the existing gas/gas exchanger and subcooler, and a set of pumps. A similar SRC retrofit would also involve adding a side vapor draw nozzle to the existing column and modification of the column internals.

Another option includes retrofitting the GSP process to operate as a SCORE process for the ethane rejection mode. This retrofit would be even more complex than the RSV retrofit, requiring a new condenser, an accumulator, a set of pumps, and significant column modifications. Specifically, the column would require several new nozzles and replacement of some of the internals to incorporate the vapor and liquid side draws and lower reflux feed. In comparison, the Retro-Flex™ technologies shown in Figures 8 and 11 can be connected with cuts on only two lines, offering a more compact and quicker retrofit that is easier to install.



5TH GENERATION NGL / LPG RECOVERY TECHNOLOGIES FOR RETROFITS

Presented at the 96th Annual GPA Midstream Convention – April 11, 2017 – San Antonio, Texas

CASE STUDIES

Two sample projects are presented to show how both the Retro-Flex™ and Retro-Flex Plus™ technologies can be applied

Client #1 – Retro-Flex™ Application

Client #1 has ordered a new standard 200 MMSCFD GSP design, including compression. The plant is expected to process rich inlet gas containing 7.4 gallons of ethane and heavier liquids per thousand standard cubic feet of gas (GPM). The client is interested in designing a dual-mode plant that would start up rejecting most of the ethane, and then convert to ethane recovery when it is economically advantageous. The plant must be designed to recover at least 90% of the ethane while operating in ethane recovery mode, which can be accomplished using GSP. However, the client also wants to recover at least 99% of the propane and heavier components while rejecting ethane, which cannot be done efficiently using GSP. Two retrofit options are considered: retrofitting the plant by installing the piping and equipment needed to operate the plant as an RSV design, or installing a Retro-Flex™ module. The client requires all the options be compared using fixed residue gas compression horsepower.

Table 1 compares the performance of the base GSP plant design with the performance of both RSV and Retro-Flex™ retrofit options, in both ethane recovery and ethane rejection modes. All cases are based on the client-specified residue gas compression and a standard propane refrigeration package. For all the ethane rejection cases, only 71% of the ethane can be rejected without exceeding the client’s heating value specification for the residue gas stream.

Table 1 - Client #1 Retrofit Plant Performance Comparison

Technology	GSP		RSV		Retro-Flex™		
	C ₂ Rec.	C ₂ Rej.	C ₂ Rec.	C ₂ Rej.	C ₂ Rec.	C ₂ Rej.	C ₂ Rej.
Operating Mode							
Inlet Gas GPM	7.4	7.4	7.4	7.4	7.4	7.4	7.4
Inlet Gas Flow, MMSCFD	200	200	200	200	200	200	218
Residue Gas Compression, HP	14,000	14,000	14,000	14,000	14,000	14,000	14,000
Propane Refrigeration, HP ⁽¹⁾	5,980	4,960	5,860	4,630	5,980	3,710	4,710
Ethane Recovery, %	92.1%	29.2%	94.0%	29.2%	91.5%	29.2%	29.2%
Propane Recovery, %	99.8%	96.9%	100.0%	98.6%	100.0%	100.0%	99.1%
Ethane Production, gal/D	676,224	214,128	689,760	214,128	671,314	214,128	233,280
Propane Production, gal/D	397,440	386,064	398,261	392,544	398,261	398,160	430,344
Incremental Ethane, gal/D	Base	Base	13,536	—	(4,910)	—	19,152
Incremental Propane, gal/D	Base	Base	821	6,480	691	12,096	44,280

Notes: 1) Propane refrigeration based on a nominal 6,000 HP compressor package.

5TH GENERATION NGL / LPG RECOVERY TECHNOLOGIES FOR RETROFITS

Presented at the 96th Annual GPA Midstream Convention – April 11, 2017 – San Antonio, Texas

Although the base GSP design can meet the client's desired ethane recovery, it is unable to meet the propane recovery requirement while rejecting ethane. Even the RSV design is unable to recover the required propane at this flow rate and specified compression power. By installing a Retro-Flex™ module, the propane recovery in ethane rejection mode can be maintained well above the desired 99% recovery level. As an additional benefit, the client has the option to increase plant throughput almost 10% above nameplate capacity and still remain above 99% propane recovery with the Retro-Flex™ module. This flow rate increase significantly improves the incremental ethane and propane production, reducing the payout time of the additional equipment.

As mentioned earlier, Table 1 confirms that Retro-Flex™ is capable of recovering 100% of the propane from the inlet gas stream in ethane recovery mode. It is important to note, however, that recovering all the propane may come at a small sacrifice to ethane recovery. When operating the Retro-Flex™ module in ethane recovery mode there is a limited amount of cooling available from the demethanizer overhead stream. A trade-off exists between ethane recovery and propane recovery. Retro-Flex™ utilizes the cooling to achieve 100% propane recovery, but the ethane recovery is about 0.7% lower. If higher ethane recovery is desired, the Client may opt to bypass the Retro-Flex™ module and operate the plant as the base GSP, foregoing the incremental 0.2% propane recovery. Product pricing will dictate which mode of operation is more advantageous.

By installing a Retro-Flex™ module into their standard GSP plant, Client #1 is able to meet the specified product recovery requirements in both modes of operation without any additional compression. As shown in Table 1, Client #1 will also be able to process almost 10% more gas when rejecting ethane, which is not possible using either GSP or RSV. The client could have installed additional compression to the RSV retrofit at significant cost, but the retrofit would be more involved than the Retro-Flex™ installation. The compact module design saves on plot space and reduces the number of fixed equipment pieces and the amount of piping compared to what is required for an RSV retrofit.

Client #2 – Retro-Flex Plus™

This client is currently operating a standard 200 MMSCFD GSP plant in ethane rejection mode to process rich shale gas (6.2 GPM) at a capacity 15% above nameplate capacity (230 MMSCFD). Like Client #1, they would like to improve their propane recovery while they are rejecting ethane. However, Client #2 also wants the ability to achieve ultra-high ethane recovery (greater than 98%) in the future while continuing to operate at the current plant throughput. Since the plant is in operation, they would also like to minimize downtime to install any retrofit.

In the current ethane rejection mode operation they can reject approximately 88% of the ethane while still remaining below the residue gas stream maximum heating value specification. At this 12% ethane recovery level, the current GSP plant can only recover about 92% of the propane. When the plant is operated to recover ethane, their GSP process is capable of recovering up to 95% of the ethane at the previously mentioned plant capacity, although they are losing about

5TH GENERATION NGL / LPG RECOVERY TECHNOLOGIES FOR RETROFITS

Presented at the 96th Annual GPA Midstream Convention – April 11, 2017 – San Antonio, Texas

0.4% of the propane. They are hoping to improve the propane recovery levels in both modes of operation, and also improve the ethane recovery above what GSP can offer when ethane margins are favorable.

A retrofit using Ortloff’s Retro-Flex Plus™ technology provides the ability to maximize ethane recovery while minimizing downtime and tie-ins. Since ethane is not currently a high value product, the client can first install the CRM and liquid transfer pumps as Phase 1 of the project to improve propane recovery while rejecting ethane. The capital cost required to improve ethane recovery would be deferred to a future date when it makes economic sense to upgrade (Phase 2). The required tie-ins would be included within the Retro-Flex Plus™ module to allow easy connection of the Phase 2 equipment without incurring any plant downtime.

Table 2 provides a summary of the plant performance comparing the current GSP design to a retrofit using Retro-Flex Plus™. The only additional compression required for the retrofit is for the reflux compressor, which is only required in ethane recovery mode.

Table 2 – Client #2 Retrofit Plant Performance Comparison

Technology	GSP		Retro-Flex Plus™	
	C ₂ Rec.	C ₂ Rej.	C ₂ Rec.	C ₂ Rej.
Operating Mode				
Inlet Gas GPM	6.2	6.2	6.2	6.2
Inlet Gas Flow, MMSCFD	230	230	230	230
Residue Gas Compression, HP ⁽¹⁾	14,110	13,800	15,120	14,220
Reflux Compression, HP	—	—	410	—
Propane Refrigeration, HP ⁽²⁾	3,580	3,400	3,720	3,670
Ethane Recovery, %	95.5%	12.0%	98.2%	12.0%
Propane Recovery, %	99.6%	91.8%	100.0%	99.1%
Ethane Production, gal/D	746,165	93,787	766,872	93,787
Propane Production, gal/D	285,869	261,634	286,978	284,285
Incremental Ethane, gal/D	Base	Base	20,707	—
Incremental Propane, gal/D	Base	Base	1,109	22,651

Notes: 1) Residue gas compression based on a nominal 16,500 HP compressor package and its actual volumetric flow limitations.

2) Propane refrigeration based on a nominal 4,500 HP compressor package.

The Retro-Flex Plus™ add-on significantly improves product recoveries in both modes of operation above the capabilities of GSP alone while still processing inlet gas at 15% above nameplate capacity. In ethane rejection mode, the small reflux compressor is taken out of service, and the Retro-Flex Plus™ module reverts back to the same operation as Retro-Flex™.

The compact modular design and minimal number of tie-in points makes this technology attractive for retrofitting an existing GSP plant to improve product recoveries. However, the

5TH GENERATION NGL / LPG RECOVERY TECHNOLOGIES FOR RETROFITS

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economic advantages of this type of investment must be evaluated for any given project. In this case, a Retro-Flex Plus™ retrofit provides Client #2 an economical option to maximize their profits by recovering essentially all of the desired liquid products from the inlet gas in both modes of operation.

CONCLUSIONS

Given today's NGL and sales gas markets, higher product recoveries and improved flexibility are more important than ever. Ortloff's 5th generation technologies offer an integrated and efficient modular option to improve standard process designs. These packaged designs can be incorporated into new plants, and can also be applied as retrofits to upgrade existing plants. Offering minimal downtime and few tie-ins, modular packages like Ortloff's Retro-Flex™ and Retro-Flex Plus™ offer an economical means for retrofitting older processes such as GSP to improve plant flexibility and economics by recovering all the propane regardless of the ethane recovery level.

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