Financial Benefits of the

N-Seal Adaptor for Chemical Injection Pumps -

Propane Gas Driven Pumps in Sour Gas Applications

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1 Executive Summary

1.1 *Overview*

Pipeline injection of various production enhancement chemicals is crucial to an uninterrupted flow of product to market. Industries worldwide have benefited from system performance improvements through evolution and innovation. This is equally true of positive displacement Chemical Injection Pump technology for the oil and gas industry.

Responsible stewardship of our Planet is front and centre. In the past, operations could result in chemical leaks, drive gas venting and surplus chemical injection. Today these environmental concerns can be greatly reduced or eliminated with the deployment of currently available and field proven technology.

The addition of an N-Seal Adaptor to one existing Chemical Injection Pump can save thousands of dollars per year, reduce environmental discharging, increase chemical delivery performance and pay for their implementations within weeks. Further the savings are cumulative amounting to $100,000s over the life of each well.

2 Introduction

2.1 History

Remote oil and gas pump locations in Canada offer numerous technical challenges for pneumatic positive displacement Chemical Injection (CI) Pump technology. Powering the pumps with conventional electricity is very often unfeasible or prohibitively expensive. Pump design has been equally challenging. Historically the use of a V-packing seal or compression packing, designed to seal the metering plunger and prevent chemical leaks, results in many reoccurring problems.

Traditionally sweet gas wells provide the pneumatic “drive gas” to power chemical injection pumps. Generally, in sour gas well applications, sweet gas is piped in or propane is imported to site, at considerable added cost, to power the pumps. In all cases the drive gas is then vented directly to the atmosphere. Historically these drive gas solutions were readily available, cost effective and technically sound. However heightened environmental concerns and technological innovations have made these practices questionable.

Conventional compression packing results in ongoing maintenance, chemical leaks and pump stalls. Operators have learned to cope with these inherent negative traits. However they do result I an overall decrease in effective time management resulting in a decreased focus on other maintenance tasks.

3 The Task – Innovate Field Operations

The pneumatic positive displacement Chemical Injection (CI) pump incorporates a conventional "plunger shaft" seal called compression V-packing. Inherently V-packing's compression on the shaft causes friction creating heat and resulting in wear. The worn seal begins to leak the production enhancement chemical into the environment. To prevent the leaking the V-packing gland nut is tightened causing additional friction and, naturally, more wear. V-packing reduces CI pump reliability by increasing the likelihood of stalling, increases the emission of production enhancement chemical and drive gas, increases operational maintenance costs and increases drive gas consumption. All these characteristics result in the needless wasting of tens of thousands of dollars per well, per year.

3.1 Conventional CI pumps require a mechanical driving force to actuate the plunger and deliver the measured chemical. Traditionally this is provided by electricity, where available, sweet gas from the pipeline, or, in the case of sour gas wells, compressed air, piped sweet gas or propane trucked to site. Unfortunately the drive gas, once used, is vented directly to atmosphere.

- The environmental cost of venting gas directly to the atmosphere will be debated by scientists and politicians for years. However there will be some absolutely irrefutable conclusions: i) industry will be blamed, ii) industry will be charged with the responsibility to create the very best alternative solution and iii) industry will be penalize for noncompliance.
- The financial cost of venting drive gas is easily quantified. In the case of a Texsteam 5100 style gas-driven CI pump using propane, excluding the transportation to site cost, the consumption rate can be as much as 1.0 mmcf per year for each non-optimized pump. Assuming a propane price of $0.60 CND per litre (1L = 10 scf) this will result in an operating cost, per pump, of **$60,000 per year**.

Piston Size	Strokes per Minute	Litres of Methanol per Day	Scf Required per Litre	Scf per Day	Cost of Propane per Day	Cost of Propane per Year
1/4 "	6	8	66	546	$ 32.76	$ 11,957
	12	11	66	744	$ 44.64	$ 16,293
	18	17	66	1116	$ 66.96	$ 24,440
	24	23	66	1488	$ 89.28	$ 32,587
	30	26	66	1736	$ 104.16	$ 38,018
3/8 "	6	11	39	444	$ 26.64	$ 9,723
	12	23	39	888	$ 53.28	$ 19,447
	18	38	39	1480	$ 88.80	$ 32,412
	24	53	39	2072	$ 124.32	$ 45,376
	30	62	39	2442	$ 146.52	$ 53,479
1/2 "	6	23	15	342	$ 20.54	$ 7,497
	12	47	15	713	$ 42.78	$ 15,614
	18	68	15	1026	$ 61.56	$ 22,469

Cost of operation assumes a propane cost of $0.60 CDN per 1L. Additionally, 1L of propane equals 10 scf.
Calculations based on 1" stroke at 500 psi injection pressure and an optimized pump.
Analysis based on Texsteam brochure (7.07) and converted to propane.

Table 1 – Texsteam 5100 Series **PROPANE** Consumption Cost Analysis

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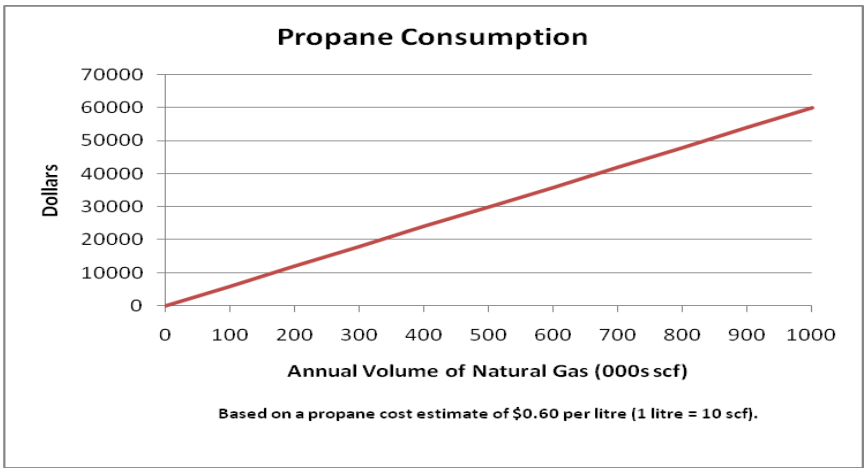


Chart 1 – Annual propane consumption versus cost.

- Natural gas or propane powered compressed air can be used onsite to provide the pneumatic drive force for CI pumps. However the environmental and financial costs of this method must be considered in accessing the overall fitness of compressed air.

3.2 Compression V-packing is employed to prevent the flow of production enhancement chemical outside the closed loop injection system. There are a number of inherent shortcomings with this design:

- A compression seal cannot provide constant pressure. Over time the seal pressure is reduced on the plunger resulting in chemical leaks. Generally additional maintenance is employed in one of two leak prevention methods: i) when leaks are physically evident the compression ring is tightened, or ii) the compression ring is tightened on a regular basis without evidence of leakage. In either case, when properly adjusted, packing seals can leak upwards of 50 litres (125mL per day) of chemical per year. Wear caused by friction through normal use will allow substantially more to escape as “leakage.” The overall cost of discarding production chemicals will vary depending upon your commitment to environmental stewardship.

- To overcome the additional fiction, as a result of the over compressed packing, the stroke rate is increased in an effort to reduce the likelihood of “stalling.” The resulting increased stroke rate delivers more chemical than required thereby increasing costs. A conservative estimate is 1 litre of additional chemical per day. Chemical costs vary widely but an average cost of $2 per litre is conservative. The resulting added cost is over **$600 per year**. Again, the overall cost of injecting excess production chemicals into the pipeline will vary depending upon your commitment to environmental stewardship.

- In less than ideal cases the over tightened ring can stop, or stall, the pump entirely. The loss of production enhancement chemical will result in corrosion, increased deposit formation, increase unscheduled maintenance and, eventually, stop the flow of product to market entirely.

- CI pumps will leak toxic chemicals through the compression packing creating unsafe working environments and increased maintenance costs.

3.3 Primary seal technologies (packing, O-ring, etcetera) will leak over time. This is consistent throughout the industry. Pump pressure exerts tremendous pressure on the seal, hundreds or thousands of pounds per square inch. However, of critical importance is how the technology recovers this leak.

- Leaking pumps will: i) inaccurately deliver production enhancers potentially shutting down the flow of product, ii) waste chemicals thereby increasing costs, iii) pollute confined working environment endangering operators, and iv) increase maintenance costs through leak/ spill cleanup. These issues will result in several hundred to thousands of dollars in additional operating cost.

- Without a leak containment system, leaking CI pumps may be subject to intervention by the Oil & Gas Commission.

4 The Solution – Technological Advancement

Modern advancements in pneumatic positive displacement Chemical Injection (CI) pumps lead to the elimination of compression V-Packing. Our goal was reduced drive gas consumption, reduced production enhancement chemical emission and increased reliability. The result is N-Seal technology.

4.1 Vented gas from one propane gas-driven chemical injection (CI) pump can account for tens of thousands of dollars in operating cost per year (see Table 1, page 4). Responsible oil and gas corporations have been the driving force in developing solutions. Industry willingness to adopt innovated technologies resulted in the solar-electric CI pump. In many respects this technology is ideal – total elimination of drive gas. However there is an alternative solution that does not eliminate drive gas consumption but does reduce it by 50% - the N-Seal Adaptor.

4.2 Compression packing will add thousands of dollars in unnecessary annual costs per CI pump – chemical over injection and leaks, added drive gas consumption due to excessive plunger friction, and unscheduled maintenance (leak containment/ cleanup, compression ring tightening, packing replacement, and chemical tank recharging).

- MCI Solutions has developed and patented unique plunger seal technology that entirely eliminates compression packing – the N-Seal. The cost reducing benefits to the oil and gas industry from this proprietary technology are clear:
  i) Virtually zero chemical leaking to the environment,
  ii) Reduced drive gas emission to operate due to 90% less friction than conventional packing, and
  iii) Zero unscheduled maintenance.

  - Ideally an adjustable compression ring keeps the packing at a pressure sufficient to maintain the seal without adding excess resistive force to the plunger. In practice, often, the ring is grossly over tightened to prevent chemical leaking. The resultant increased friction on the plunger restricts its movement. Additional force is then required to operate the pump – increased drive gas consumption, added cost.

    - For example, consider two identically configured CI pumps. One set to operate at 5 psi and one at 25 psi drive gas pressure. When we adjust them for atmospheric pressure (14.7psi) we can see that there

is a 50% reduction in operating consumption. Taking an average annual gas consumption of 0.50 mmcf (1370scf / day) at $0.60 CND per 1 litre of propane (1L = 10scf) we see a total **annual savings over $15,000**.

- N-Seal technology is integrated into all MCI CI pump solutions. Additionally **conventional gas-drive pumps (Arrow, Bruin, Texsteam, etc) can be field retrofitted with N-Seal adaptors resulting in the same benefits listed above**. Under normal conditions N-Seal will pay for itself in weeks.

4.3 CI pumps employ a primary seal – compression packing. It is a physical barrier to ensure that pressurized chemical does not escaping to the environment. Unfortunately its containment characteristics are limited. Once the primary seal is breached chemical leaks occur.

- The MCI Solutions' N-Seal uses reliable, long-lasting, spring energized chemical seal technology to offer a true containment solution. A small amount of primary (high pressure) seal chemical bypass is expected throughout the life of the seal. N-Seal integrates the industry's first *secondary containment seal*. Bypassing chemical is captured in the low pressure chamber. From there it is reintroduced into the injection system. This process virtually eliminates all environmental concerns surrounding CI pumps.

5 The Financial Analysis

5.1 Capital cost investment requires sound financial support to guarantee the requested funds are beneficially utilized. Initial investment payback per single well site is nearly immediate in most cases. Using conservative propane consumption data and varying the chemical injection volume the **payback potential for the N-Seal ranges from 2 to 4 weeks** (see Appendix A – Table 3, N-Seal Adaptor Payback).

5.2 N-Seal reduces drive gas consumption by 50%. The average volume of drive gas used to inject 40L of methanol per day into a 500psi using a ½" plunger results in a 4 week payback. To inject the same 40L using a 3/8" plunger would result in a payback of 12 days. Further the resulting financial savings that are applied to pay for the initial capital expenditure of the N-Seal continue to accummulate over the life of the product (see Appendix A – Table B, N-Seal Adaptor Installation – Accumulating Monthly Savings).

6 Recommendation

6.1 Annual propane costs to operate one gas driven CI pump vary widely - $1,500 to over $30,000. The quick reference chart below illustrates the tremendous financial incentive to establishing a CI pump upgrade program.

	Total Wells	***10***	***20***	***30***	***40***	***50***
Annual Cost Per Pump	$1,500	$15,000	$30,000	$45,000	$60,000	$75,000

$30,000	$300,000	$600,000	$900,000	$1,200,000	$1,500,000

Table 2 – Annualized Cost Per Well

The implementation of any effective technology is a fiscally justifiable, environmentally responsible and industry leading business decision. Corporate vision determines your fitness for tomorrow. With fluctuating commodity prices it has never before been so important to pioneer innovative solutions for the long-term wellness of your business.

6.2 MCI offers the N-Seal technology in a field retrofittable adaptor package for most commonly applied pneumatic CI pumps.

	1200 Series	4300 Series	5100 Series
Arrow	10 Series	430 Series	510 Series
Bruin	BR1200 Series	BR4300 Series	BR5100 Series
CVS		4300 / 4400 Series	51 Series
Flomore	1300 Series	Ecomax Pump	5300 Series
Texsteam	1200 Series	4300 Series	5100 Series

Table 3 – N-Seal Compatibility Schedule

Installing the N-Seal adaptor on your CI pump will decrease your drive gas consumption by 50%. With a capital investment payback ranging between 2 to 4 weeks, in most cases, the adaptor is perfectly suited to assist your company in moving forward towards a zero emissions future.

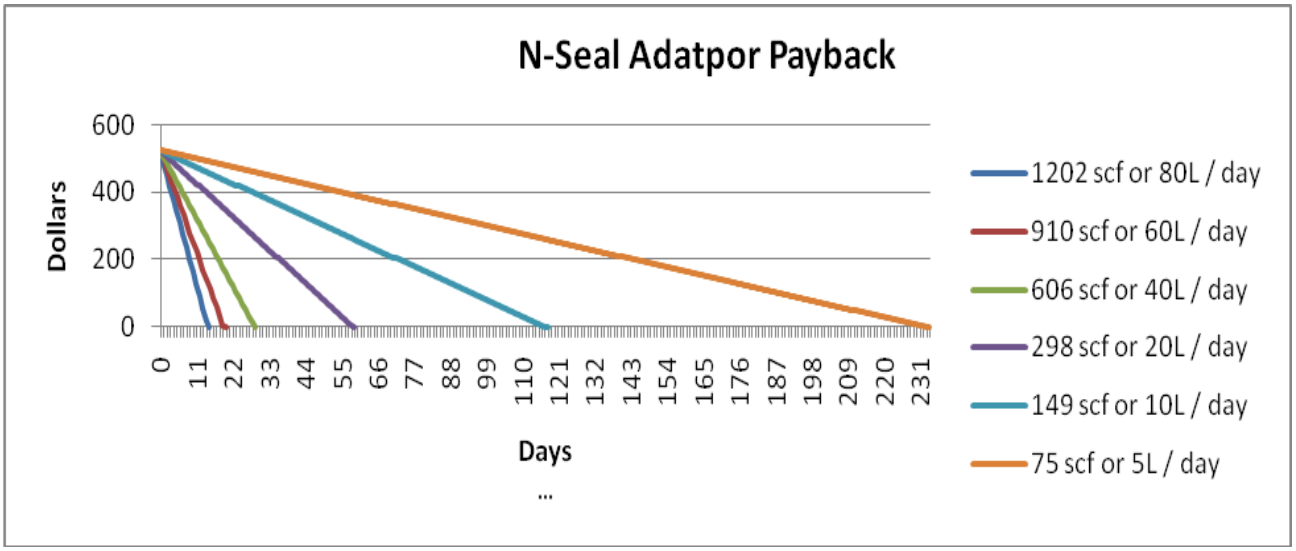
7 Implementation

7.1 All MCI Solutions' products are easily installable by site personel. The N-Seal adapter, installed on pneumatic chemical injection pumps, can be installed in 30 minutes.

7.2 History indicates that the plug and play system design is virtually impossible to undermine. However MCI Solutions can provide complete system installation, onsite technical assistance, or telephone support to aid in the trouble free installation and commissioning of its products.

7.3 MCI Solutions is a customer centric manufacturer with a demanding vision – "exceed our customer's expectations by providing innovative industry leading technology, unparalleled customer service, and a dedication to superior quality." While special circumstances require varied measures MCI is committed to maintaining our 7 – 10 day delivery lead-time on standard orders.

APPENDIX A



Note:

1) Data based on an optimized Texsteam 5100 propane drive-gas pump with a 1/2" plunger at 500 psi. Propane drive-gas cost estimate of $0.60 per litre (1 litre = 10 scf).

Table 3 – N-Seal Adaptor Payback

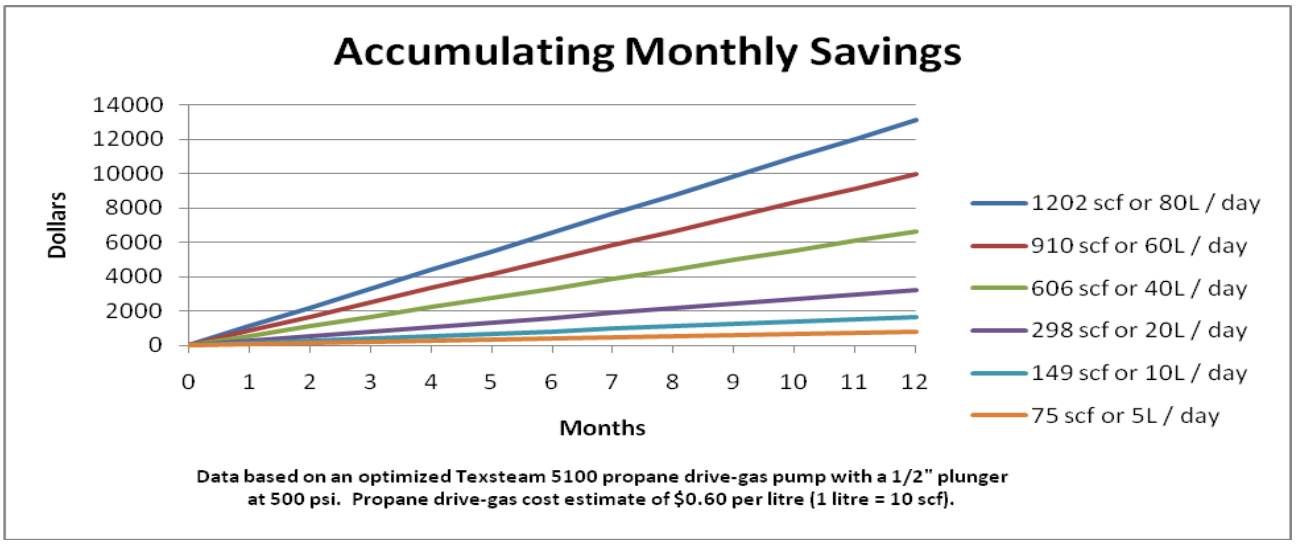


Table 4 – N-Seal Adaptor Installation – Accumulating Monthly Savings