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Author	Tony Wade

HYROLEC ADDITIVE INJECTION SYSTEMS.

As of May 1st 1995, Liquip Sales became the exclusive Australasian distributors of the "Hyrolec" range of additive injection and control products.

Hyrolec Ltd are an English company which excels in the design and manufacture of additive injection systems. Their range of equipment covers a very broad spectrum encompassing both mechanical and electronic solutions for Refinery, Terminal, Depot, Aviation, Marine, and On-truck applications.

Before we look at their product line we will first explore the application of additive injection.

What is additive injection ?

"Additive Injection" is a term which covers a wide range of practices in many facets of the petrochemical industry. Essentially it relates to the blending of two (or more) products in accurately controlled ratios.

These ratios can be fixed or variable dependent on operational requirements.

It is more usual for the additive injection rate to be a fixed pre-specified ratio, however this ratio may be manually adjusted from time to time.

Additive is usually supplied from an external source such as a bulk storage tank, palletised container or drum. The additive is supplied to the injection point by a positive displacement pump. There is usually one pump per additive, and in many instances a separate "stand by" pump for each additive.

The additive is introduced under pressure into a pipeline conveying a base product, (normally referred to as the primary flow)

For both safety and commercial reasons (see following section) it is imperative to ensure that the prescribed additive volume has actually been injected into the primary flow. With existing mechanical injection systems there is no real safe guard to ensure this.

With the advent of quality assurance standards, this issue has become more important, and typically highlights some of the shortfalls of less advanced equipment as currently used in most common applications.

Hyrolec have addressed this problem and offer a solution as detailed in the following sections.

Hyrolec / Liquip's approach to additive injection is as either component supplier to OEM's or as a supplier of completed skid mounted systems including pump sets, bulk storage tanks, additive injectors (piston, metering pump, or turbine) and electronic data capture and injection control systems.

Why is there a need for additive injection?

Additive injection is used in many applications, for various reasons in just about all process industries, where two or more liquids have to be mixed in accurate blends.

Applications range from chlorine injection in the water treatment industry to ingredient control in the food industry and just about every thing in between - the list is endless. At this stage however, we are interested in the petrochemical industry, so following are some brief examples, pertaining to our industry as we know it.

1.0 Tank Truck Loading Facilities (Terminals)

Just about all petroleum storage terminals, irrelevant of which oil company owns or operates them, receive gasoline and distillate products from a common pipeline linked to a wharf or refinery which serves a multitude of storage facilities, therefore the products received by each terminal is classed as common feedstock.

For Example, the Kurnel and Clyde refineries in Sydney feed Sydney Airport with Jet Fuel (1.8 billion litres per annum) and provide general products to all of the terminals in Botany, Banksmeadow, Silver Water, Auburn, Parramatta, and Newcastle, by pipeline. Many other seaboard terminals along the coast of Australia are serviced from Kurnel by marine tankers. The same scenario would exist at refineries in Brisbane, Melbourne, Port Augusta, and Kwinana,

Each oil company by virtue of it's advertising campaigns claim to have distinct product advantages over it's competitors, these advantages are in the form of special ingredients which are added to the base product as it is loaded into tank trucks for down stream distribution.

These ingredients known as additives are compounds designed to enhance performance, by improving octane, particularly with unleaded and premium unleaded gasoline's.

(These additives are particularly aggressive in concentrated form, and may contain cariogenic elements, extreme care should be exercised when handling these products or choosing sealing elastomers.)

Other additives are compounds which are introduced to enhance electrical continuity in Jet fuels and diesel's, anti-foaming agents foe diesel, or simple dyes to distinguish between certain grades of fuel.

In more recent times "exotic additives" have been introduced, such as oxygenates to help reduce smog levels. Alcohols derived from agricultural surplus are blended with gasoline and diesel as "fuel extenders" and again to act as oxygenating agents.

2.0 Marine Fuels

Marine fuel oils for commercial reasons are usually based on the heavy residue left after the refining process, these oils are usually referred to as “Black Oils” , can have an SG of up to 1.00 and a viscosity at 50 deg C of 380 cst.

Most oil burning coastal and ocean going vessels will specify the grade of fuel oil which they require. The bunkering facility will use the base “black oil” and cut it back with diesel to reach the required viscosity. As most vessels will take 50 - 200 tonnes of fuel oil, large blenders are required to achieve this mix.

An example of this is the bunkering facility at Gladstone in Queensland where they use large turbine meters to monitor the primary flow (black oil) and the additive (diesel). the blend ratio is accurately controlled by an electronic controller and in line flow control valves. This system is fully temperature corrected and cost in the region of \$.5M.

This is a typical application for a Hyrolec “turn key” system. Other similar applications exist on smaller scales. We are currently talking to the same customer for a similar installation using Hyrolec turbine injection system.

3.0 Wharf receiving lines.

Where fuels are received at a wharf for a dedicated purpose, ie, Jet Fuel, it is advantageous to apply additives at this point.

One example which we are currently working on is the injection of ant-static compound into jet fuel at the wharf. This prevents unprotected fuels being pumped at high velocity up the pipe line into large, empty, vapour filled tanks.

Again because of the high volumes, turbine injectors are being used to inject small amounts of additive enhancing compounds at frequent rates into the primary flow.

4.0 Refineries

Metering pumps can be supplied to accurately inject dyes into different grades of fuels, we are currently offering this method as an interim solution to a local refinery. Eventually they will use pipe line mounted turbine injectors to achieve the same thing as part of the standard production method.

5.0 Aviation

Piston injectors or turbine injectors can be used for adding anti-icing compounds to fuels.

6.0 Hyrolec Equipment - An overview

Hyrolec offer the following equipment, either in component (assembly) form to OEM's to include in their own turn key packages, or as completed solutions ready to go to work.

6.1 Components

Piston type additive injectors.

A stainless steel panel fitted with an adjustable displacement cylinder, 3- way solenoid control valve, slide valve, manifold, check valve, test point, manual calibration point, and isolating valves.

The unit is assembled using a minimum of joints and fittings (courtesy of the manifold) unlike it's competitors.

The unit is a direct replacement for "Gate City" and similar equipment.

One unit required per additive injection point.

The solenoid valve is "pulsed" by an external power source. Each pulse is of a fixed time span. The pulse is provided either directly or indirectly from the product flow meters, so therefore the duration of each pulse or pulses is directly proportional to the main product flow rate.

IE, Higher flow rate = more pulses = more additive.

The pulse energises the solenoid valve allowing the slide valve to move over and fill the displacement cylinder with a pre-set amount of additive, at the same time displacing a pre-set amount of additive from the top of the piston as induced on the previous pulse.

On the next series of pulses, the slide valve reverses allowing new additive to be drawn in to the top of the cylinder and the original charge of additive displaced from the bottom of the cylinder into the product pipeline at the correct ratio.

Pulses can be supplied from an intelligent Terminal Automation System (TAS) (which will receive raw pulses from a meter mounted pick off coil and pre-amplifier or electronic pulse transmitter).

Examples of TAS - EMAIL OMEGA, Smith ACCULOAD, Rosemount PETROCOUNT, Daniels DANTROL, Contrec 1010, Yokogawa, Spektratek, etc.

MPM System

Where a TAS is not used, the flow meter can be fitted with an electronic pulse transmitter which is then connected to a Hyrolec *MPM* (MULTI PULSE MONITOR).

This unit is a highly intelligent micro-processor which duplicates the TAS pulse control and provides a full range of auditing and monitoring functions.

- The *MPM* can be used in conjunction with TAS systems that do not provide additive monitoring and audit trail reporting as standard.

- This system can also be used to enhance existing “dumb” piston type additive injection systems to provide reporting functions in line with quality standard requirements.
- NOTE: MPM System is either CENELEC or UL approved at this stage.
- CENELEC housing is extra cost.

Turbine Injection System

This system is fairly unique (although the principle has been previously duplicated using PD pumps)

A cast steel housing with flanges and flow capacities ranging in size between 2” and 10” is fitted into the product pipe line. The housing contains a bearing mounted impeller, which is turned by the product flow, the speed at which the impeller turns is directly proportional to the flow rate. The impeller has a high torque drive shaft which protrudes through the housing. The drive shaft is used as a rotary output to drive small piston pumps through a gearbox. The displacement of the piston pumps is manually adjustable. The piston pumps are used to feed additive at a rate proportional to the product flow back into the pipe line, thus providing a **self powered additive injection facility**.

Metering pumps.

As the name suggests these pumps are designed to have very accurate displacements.

If the displacement per revolution is known and the drive RPM is known, an accurate injection rate can be calculated.

These pumps are diaphragm or plunger type pump heads. The diaphragm is reciprocated by a gearbox driven by an electric motor.

For toxic and aggressive applications a hydraulic diaphragm head can be supplied with appropriate elastomers.

All pumps are available with variable speed drives if required.

NOTE: SAA motors not available. Appropriate motors should be sourced in Australia.

6.2 Turn key systems

- Trailer mounted turbine injection systems for self powered applications.
- Skid mounted blending systems for high flow applications
- Containerised additive injection systems for terminals including tank, etc
- Skid mounted pump sets for additive supply to loading rack
- Variable speed systems for specialised applications.

7.0 Competition - Australian Market

Gate City - USA (Australian agents - EMAIL)

“Gate Pack” piston type injector, ABC monitor system.

(Gate Pack piston injector - \$ 4,300.00 net, Hyrolec \$ 3,800.00 net) (approx)

Piston injector - old technology, ABC system not used in Australia due to EMAIL marketing (clash of interest with OMEGA?)

Contrec 1200 system - Australia (Australian agents, Contrec / Trimec).

Electronic additive injection using Contrec 1020 electronic controller. Mechanical control by Trimec PD flow meter and proportional solenoid valve.

(Contrec for 4 points - \$ 20,000 net, Hyrolec \$ 22,000 net)

NOTE: Contrec system not proven in field. Not retro-fitable to existing piston injectors.

Meastrol - Australia (Australian agents, Meastrol)

Australian version of Gatepack - fitted at Ampol Botany terminal.

Price - approx \$ 3,900.00 - very agricultural - lots of joints and fittings.