cannon
polyurethane technology

Multi EasyFroth™

EasyFroth™
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EasyFroth™/Multi EasyFroth™: Cannon solutions for the substitution of hard CFCs in Polyurethane foams

The gradual but consistent elimination of "hard CFCs", such as CFC 11 and 12, sanctioned by the 1987 Montreal Protocol and the subsequent London and Copenhagen Conferences, has driven the Polyurethane industry to find alternative methods for the expansion of urethane foams.

The refrigerator industry, in particular, quickly needed to find industrial solutions for replacing CFCs (used as the expanding agents in insulation foams) with alternative products which must be both harmless to the stratospheric Ozone layer and good insulators.

The solutions which have so far been taken into consideration are HCFC 141b, the blend HCFC 22/142b, HFC 134a and more recently Cyclopentane.

The specific chemical/physical properties of each blowing agent require different approaches and with this in mind, Cannon offer a dedicated blending unit able to guarantee excellent processing of all these solutions in an industrial environment.

More specifically, to meter and mix the LBBAs (Low Boiling-point Blowing Agents) such as HCFC 22, HCFC 142b and HFC 134a, Cannon has developed **EasyFroth™**, for precise metering and careful mixing of expanding agents which evaporate off at room temperature; the **Multi EasyFroth™** version, now also available, allows the use of both gaseous and potentially explosive agents, such as Cyclopentane.

A significant number of **EasyFroth™** and **Multi EasyFroth™** units are currently in operation throughout the Refrigerator Industry, all over the world, where their efficiency in mixing and their great reliability are particularly appreciated.

EasyFroth™

Advantages

The advantages of these premixing units can be summarised as follows:

- **ability to mix and meter a wide range of expanding agents,** such as Low Boiling-point Blowing Agents, Liquid Carbon Dioxide (CO_2), Cyclopentane;
- **excellent mixing efficiency** resulting in high percentages of expanding agent dissolving rapidly into the Polyols;
- **minimal overall dimensions,** facilitating easy installation anywhere;
- **automatic functioning;**
- **operation sequence control** through a dedicated mini-computer which assures a constant mixing ratio.

Possible alternatives to CFCs

Expanding agents	CFC 11	HCFC 141b	HCFC 22	HFC 134a	HCFC 142b	HFC 152a	Cyclo Pentane
Formula	CCl_3F	CCl_2F CH_3	$CHCl$ F_2	CF_3 CH_2F	CH_3 $CClF_2$	CH_3 CHF_2	C_5H_{10}
Molecular weight	137.4	117.0	86.5	102.0	100.5	66	70
Boiling point (°C) at 1 bar	23.8	32	-40.8	-26.5	-9.2	-24.7	49
Vapour thermal conductivity (W/m°K) at 25°C	0.0078	0.0087	0.0109	0.0145	0.0129	0.0147	0.012
Liquid density at 25°C (g/cc)	1.48	1.23	1.19	1.20	1.12	0.91	0.75
ODP (Ozone Depletion Potential)	1	0.15	0.05	0	0.06	0	0
GWP (Global Warming Potential)	1	0.15	0.34	0.26	0.36	0.03	0.00045

EasyFroth™

EasyFroth™ 's main function is to blend a formulated Polyol, fed from a day tank, with an environmentally friendly blowing agent, according to the percentage stipulated in the formulation used.

Some blowing agents being considered are gaseous at atmospheric conditions. These are kept in a liquid state by means of a pneumatic booster installed on the **EasyFroth™** unit.

This liquid is then metered by a double acting hydraulic cylinder and mixed with the Polyol in a high efficiency static mixer, using pressures higher than the blowing agent's critical pressure. This process allows continuous transfer of a Polyol/blowing agent blend to the run tank. Filling of the Polyol run tank is controlled by the usual auto tank filling methods.

The careful design of all its components allows **EasyFroth™** to optimise the blending process, dramatically reducing the time usually required to dissolve the blowing agents into the Polyols. This quick solubility avoids the build-up of pressure peaks in the tank, a common defect of slow, direct injection methods.

At the end of the blending process, the resulting tank pressure will be equivalent to the equilibrium pressure, which is a function of the solubility of the expanding agent into the Polyol.

Minicomputer control panel for setting and visualisation of the process parameters.

EasyFroth™ consists of the following components:

- Polyol circuit, complete with high pressure piston pump and flow transducer;
- blowing agent circuit, complete with pneumatic booster, double acting cylinder pump for dosing and flow transducer;
- hydraulic unit to operate double acting blowing agent cylinder pump;
- control unit with digital display for the control and monitoring of the complete process.

The control system, based on a mini-computer with dedicated software, allows monitoring of the Polyol and blowing agent flowrates, the ratio and total consumption of both components with relative alarms for the deviation from set values.

An RS232 serial output port is available for the connection of a printer or computer for data collection.

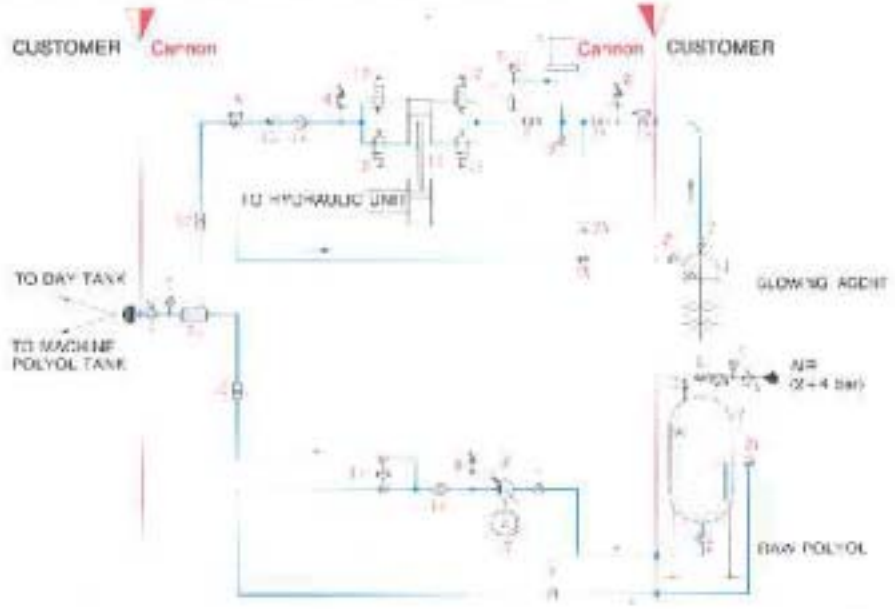
The output capabilities of the **EasyFroth™** unit are maximum of 40 l/min of Polyol and 4 l/min of blowing agent. Both flowrates are fully adjustable. The maximum percentage of blowing agent in solution is 35% of the Polyol.

EasyFroth™ can easily be interfaced with existing metering machines. It is also possible, depending on the application, to supply several metering units or day tanks from one **EasyFroth™** unit.

Although **EasyFroth™** is most commonly used for insulation applications, it can also be successfully used in other Polyurethane Industry fields, particulary where blowing agents are mixed with the main chemicals to achieve a high quality product (integral skin).

EasyFroth™ unit used for the production of integral skin foams for automotive industry.

EasyFroth™/Multi EasyFroth™ component circuit



1 Blowing Agent tank
2 Ball valve
3 Raw Polyol tank
4 Pressure regulator valve
5 Pressure gauge
6 Fast discharge valve
7 Safety valve
8 Pressure switch
9 Pneumatic booster
10 Non-return valve
11 Accumulator
12 On-Off valve
13 Double acting piston pump
14 Flow transducer
15 Manual counter-pressure valve
16 3-way valve
17 Double stream distributor
18 Peloria pump
19 Motor
20 Static mixer
21 Manual three-way valve
22 Non-return valve
*23 Shut-off valve "fail-safe"
*24 Non-return valve
*25 Manual three-way valve

* **Multi EasyFroth™** only

Multi EasyFroth™

The search for a good expanding agent with an ODP (Ozone Depletion Potential) equal to zero and low GWP (Global Warming Potential) has brought Cyclopentane to light as an ideal blowing agent for insulation foams in the Refrigerator Industry.

Such a substance, whilst enjoying some very interesting aspects (low cost, low thermal conductivity), on the other hand has a negative point, its high flammability and the associated explosion risk.

It is evident that the premixing station where Polyol is mixed with the expanding agent will be a hazardous area, also when you consider that in this area, Cyclopentane is used in its pure state.

Reducing the risk means reducing the quantity of Polyol/Cyclopentane blend present in the area. For this reason a continuous premix is strongly recommended instead of a batch premix.

When using a Polyol/Cyclopentane blend, the **EasyFroth™** unit duly modified and marketed under the name of **Multi EasyFroth™**, has proved to be the ideal solution for metering and mixing the pure Polyol with the expanding agent. The method ensures that Cyclopentane is dissolved into the Polyol successfully and under extremely safe conditions.

Multi EasyFroth™ is practically identical to the **EasyFroth™** unit (see the components circuit), but is characterized by a different layout with the premixing station well separated from the rest of the unit. In a transparent box, ventilated from the bottom, the following parts are located in close contact with Cyclopentane: double action piston pump, three-way valve for the blowing agent recycle and calibration, blowing agent flow transducer, static mixer.

Multi EasyFroth™ premixing station

The electrical components and instruments inside the box are intrinsically safe.

The non-hazardous parts, such as Polyol motor-pumping group with relevant flow transducer, hydraulic pack to drive the piston pump, and the electric control panel are mounted on a free-standing frame.

A gas detector, supplied with the **Multi EasyFroth™** unit on request, must be installed inside the ventilated box. This sensor will detect an over-concentration of flammable vapours, signal the dangerous situation and, at worst, cut the power off.

Another significant advantage of **Multi EasyFroth™** is the ability to process, in addition to Cyclopentane, the Low Boiling-point Blowing Agents: this is a real plus for manufacturers forced to switch from one expanding agent to another according to different production requirements.

Refrigerator plants with Cyclopentane technology

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