FLOQUIP™

Equipment

SNF FLOERGER

FLOQUIP HPV

High Pressure Viscometer

Monitoring the viscosity is a key parameter of polymer solution injection during a polymer flood. In order to fulfill customer demands of product consistency and quality, viscosity measurement is requested.

Viscosity is the resistance to flow. Numerous technologies have been developed and used to measure the resistance. Those are spindle-rotation, vibrating, acoustic, falling ball, and glass capillaries to name a few. These methods simply give *index* rather than measuring the *true viscosity* for non-Newtonian liquids like polymer solutions for which viscosity changes with flow rate. This is mainly because most of these technologies are designed for simple Newtonian liquids.

Limited shear rate accessibility from these viscometers makes it impossible to characterize properly the liquid flow behavior under high pressure during fast processes such as polymer flooding.

The FLOQUIP HPV 20 is the viscometer that measures *true viscosity*. Its measurement principle is based on pressure drop measurement of a flow in a pipe : the principle is well described in numerous rheology books (ie: Fluid flow for Chemical Enginners, from A. Holland,R. Bragg). Liquid flow through the pipe generates resistance, which in turns generates pressure drop. By measuring the pressure drop at a known flow rate, viscosity is calculated.

Shear rate determination is the key point for measuring the viscosity of a non Newtonian fluid. From the literature, the calculation in a pipe is as follows, where

v is the velocity of fluid in meters/second
Q is the flow rate in m^3/ second
D is the diameter of the pipe in meters
n consistency index from the power law model.

For a newtonian fluid

$$\dot{\gamma} = \frac{8 \cdot v}{D} \quad \text{or} \quad \dot{\gamma} = \frac{4 \cdot Q}{\pi \cdot R^3}$$

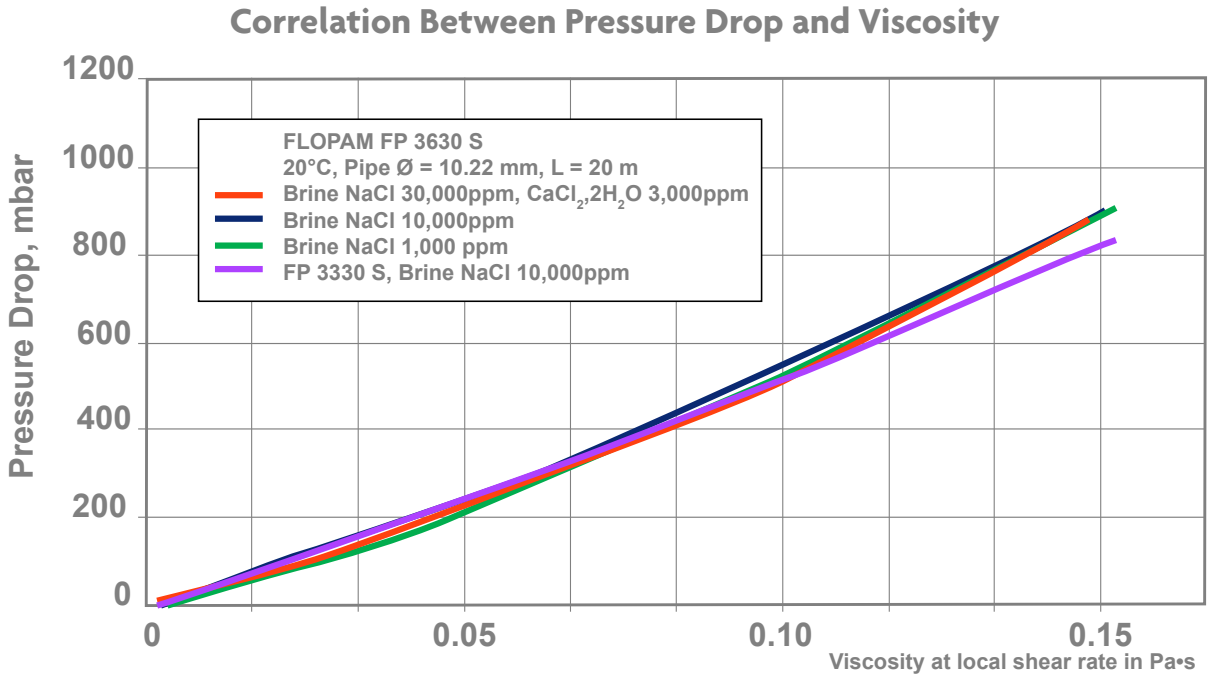
For a power law fluid

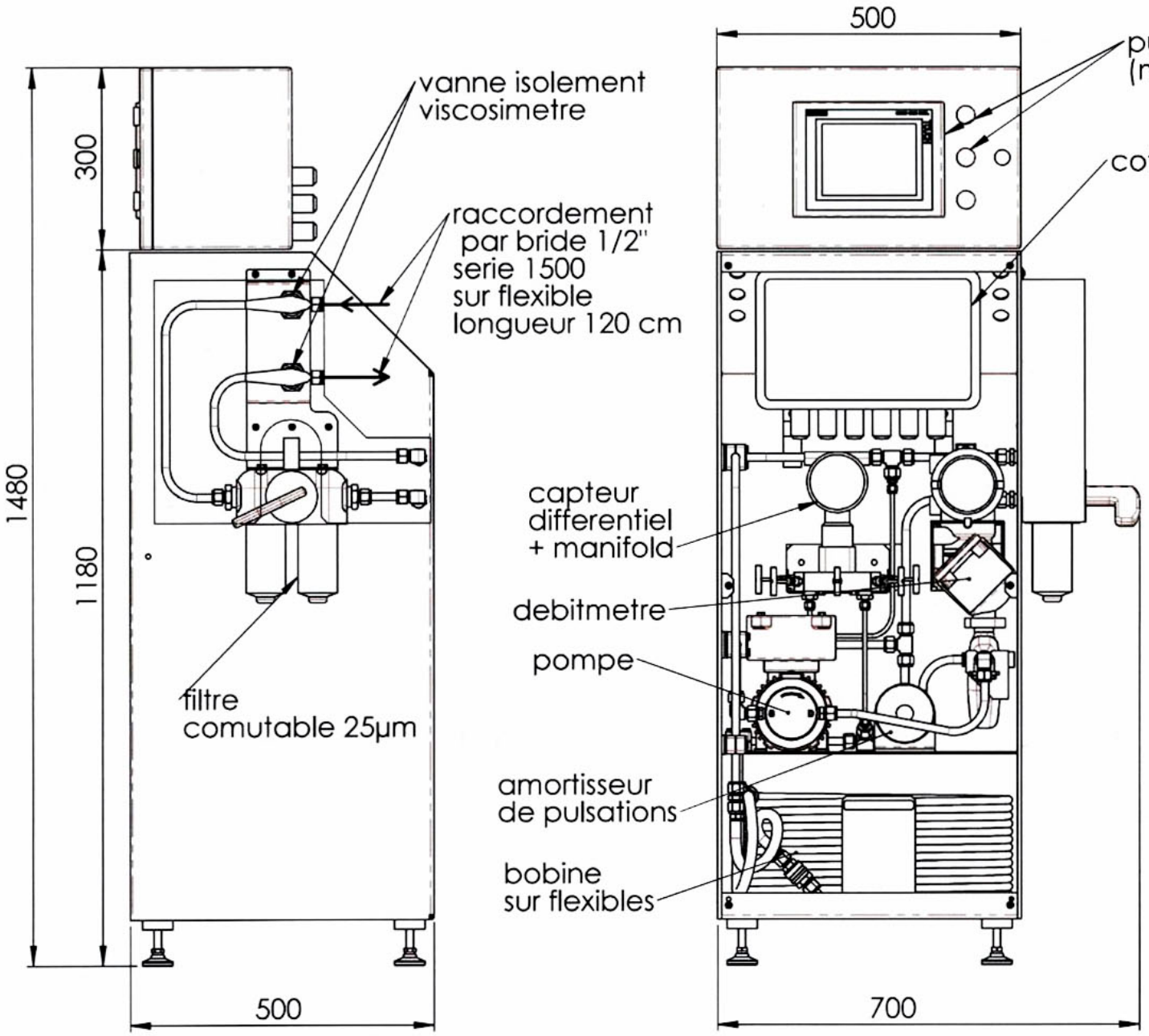
$$\dot{\gamma} = \frac{8 \cdot v}{D} \cdot \frac{(3n+1)}{4n}$$

$$\text{or} \quad \dot{\gamma} = \frac{Q}{\pi \cdot R^3} \cdot \frac{(3n+1)}{n}$$

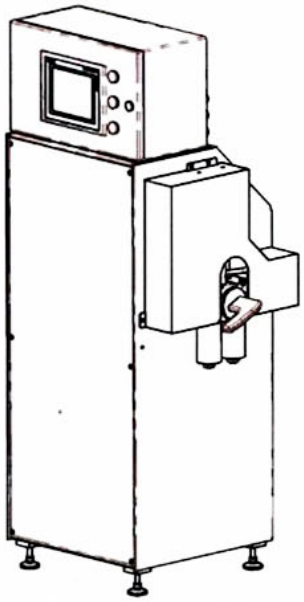
From a rotational viscometer the viscosity profile versus shear rate of the polymer solution is determined, so that can be compared with the pressure drop given by the FLOQUIP HPV 20 viscometer.

A direct relationship gives the *true viscosity* of the fluid solution flowing in the pipe.

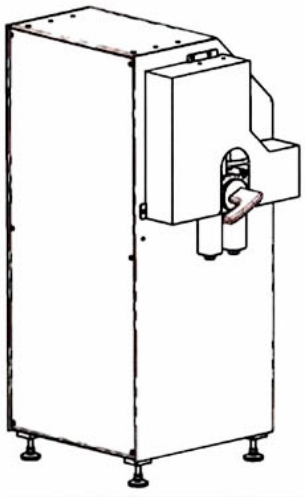


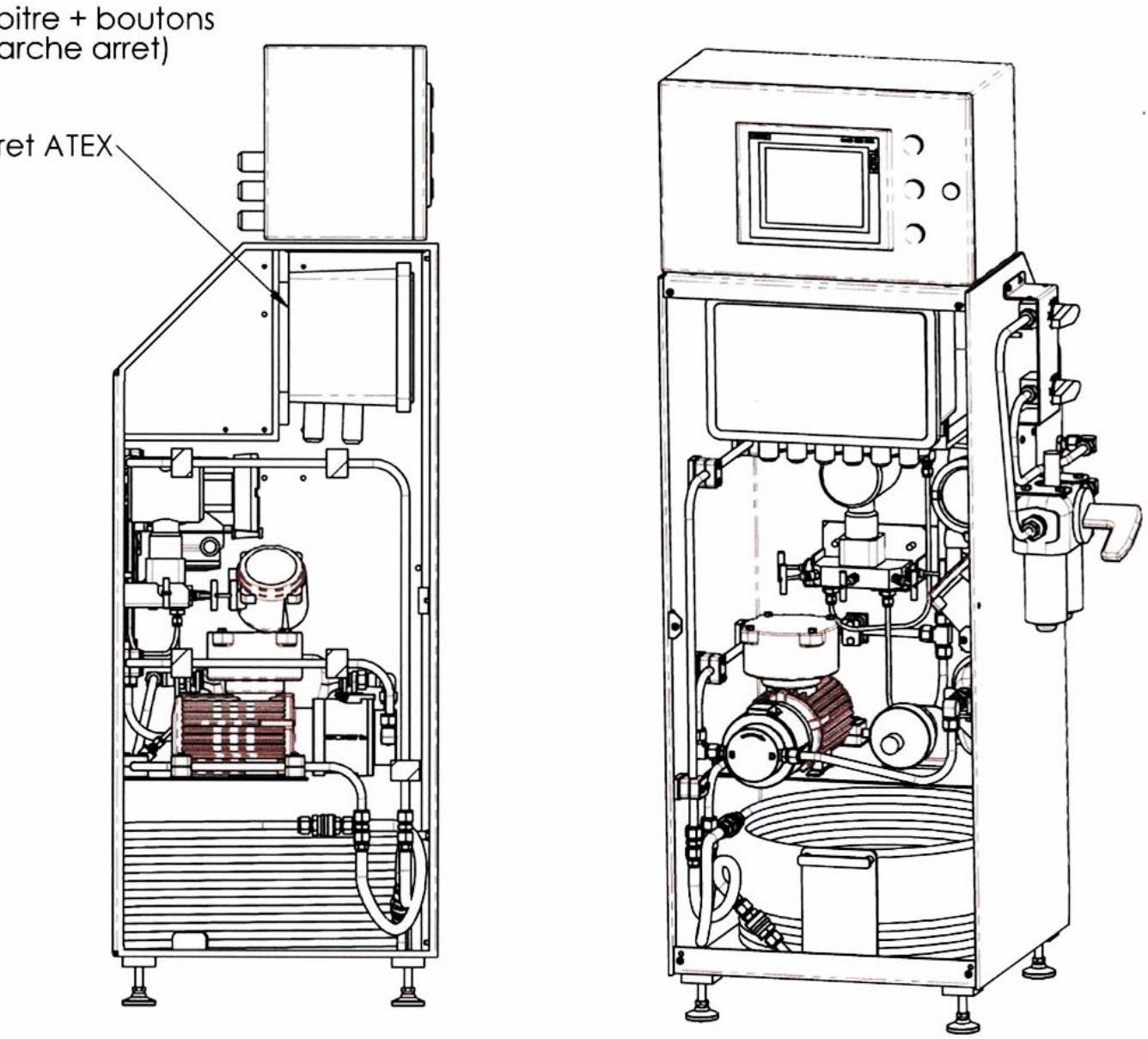


avec pupitre
milieu non ATEX



pupitre déporté
milieu ATEX





ISSUE	DATE	MODIFICATIONS	DRAWING	CHECKING
A	23/01/2012	Première création	pbourge	pbourge

-	-	ASSEMBLY : VISCOSIMETRE EVO 2
SCALE 1:10		PART : ENSEMBLE VISCOSIMETRE
		ITEM: - / QTY: 1

SNF SAS

WEIGHT (kg) 267.62

EP MECA

12 200 0001

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SHEET	DWG SIZE
1/1	A3.

viscosimetre

Tube SWAGELOK 1/4"
Tube SWAGELOK 1/2"

Désignation		
10	Bride 1/2" serie 1500 taraudée 1/2 NPT (tampon usiné 1/2NPT)	
11	flexible 1/2" embout 1/2NPT tube 1/2" L=1200mm	SS-XT8 TA8 PM8-120
12	Vanne à boisseau sphérique série 40 en acier inoxydable,raccords pour tubes Swagelok 1/2 "	SS-45S8
13	Filtre double avec by-pass MAHLE	PI 3705-12
14	Adaptateur 1" ISO-BSP tube 1/2"	
15	Union coudé 90° tube 1/2"	SS-810-9
16	Passage de cloison tube 1/2"	SS-810-R1-8
17	Passage de cloison 1/2 NPT tube 1/2"	SS-810-11-8
18	Amortisseur de pulsation	WI-1917
19	Adaptateur 3/8 NPT tube 1/2"	SS-8-TA-1-6
20	Pompe a engrenages	mzr-11557
21	connecteur male 3/8" tube 1/2"	SS-810-1-6
22	flexible 1/2" embout tube 1/2" L=37cm	SS-XT8 TA8 TA8-37cm
23	Coude 90° male 1/2 NPT tube 1/2"	SS-810-2-8
24	Debitmetre	CMFSO10M319N2FZFCZZ
25	Transmetteur	C1700R12AFFFZZZ
26	Té union tube 1/2"	SS-810-3
27	Adaptateur 1/2 NPT tube 1/4"	SS-400-1-8
28	Capteur differentiel	2051CD3A02A1ASK1D4Q4
29	Manifold	0305RC52B11B4L4
30	Réducteur tube 1/2" - 1/4"	SS-400-R-8
31	Raccord union 1/2"	SS-810-6
32	Raccord rapide	SS-QF8-B-810
33	Raccord rapide	SS- QF8-S-810
34	Bobine cintrée 1/2" 20m