



African Explosives Limited

## TEST NOTE

<b>To:</b> Flip Kotze	<b>From:</b> C Vermaak
<b>Test Note Number:</b> E/015/05	
<b>Date:</b> 31 August 2005	
<b>Title:</b>	
<b>Material:</b> P100	
<b>Source:</b> CBEP	
<b>Authorised for release:</b> Mike Taylor	
<b>Signature:</b>	

## REPORT

### Jetmixer Nozzle Trial at CBEP

#### INTRODUCTION:

Current Pumping pressures on the ANS pumps feeding the Jetmixers at the CBEP are above the spec of the pumps (12-bar max.) and are resulting in high maintenance costs. It had been proposed to fit larger nozzles to the Jetmixers to try and lower the pressures at which the ANS pumps would operate. A trial using the larger nozzles was run at the plant while data and samples were taken over a range of production rates.

The samples were tested for viscosity, Microscopy and Rheology.

Results have indicated that the Plant could run production rates of the new nozzle between 357 Kg/min (ANS PR 330 Kg/min) and 368 Kg/min (ANS PR 340 Kg/min). These rates would then allow the ANS pump to run lower than 12 bar as is required (between 10.5 and 11.5 bar), as well as ensuring a similar emulsion manufactured compared to that of the current nozzles.

**cc:** Laboratory Records

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**Signed:**

## INVESTIGATION:

Six test runs were conducted at different production rates, as follows:

Test 1	P100 PR 288 Kg/min (ANS PR 266 Kg/min)
Test 2	P100 PR 314 Kg/min (ANS PR 290 Kg/min)
Test 3	P100 PR 333 Kg/min (ANS PR 310 Kg/min)
Test 4	P100 PR 357 Kg/min (ANS PR 330 Kg/min)
Test 5	P100 PR 368 Kg/min (ANS PR 340 Kg/min)
Test 6	P100 PR 378 Kg/min (ANS PR 350 Kg/min)

Samples of P100 were taken, both of product after the homogeniser and of the Pre-emulsions.

## RESULTS:

**Table 1. Production Rates and viscosities for the different samples:**

Test	Emulsion Production rate kg/min	ANS PR Kg/min	Oil PR Kg/min	Temp After Plate cooler (°C)	Viscosity Pre-Emulsion (cP)	Viscosity After Homogeiser (cP)
Old Nozzle	288	266	22	41	8640	19200
1	288	266.2	21.9	41	6640	20800
2	314	290	23.8	41	6640	20800
3	333	310	23.6	43	8000	20800
4	357	330	27.1	44	8720	20800
5	368	340	28.0	43	8800	20400
6	378	350	28.8	43	8880	21700

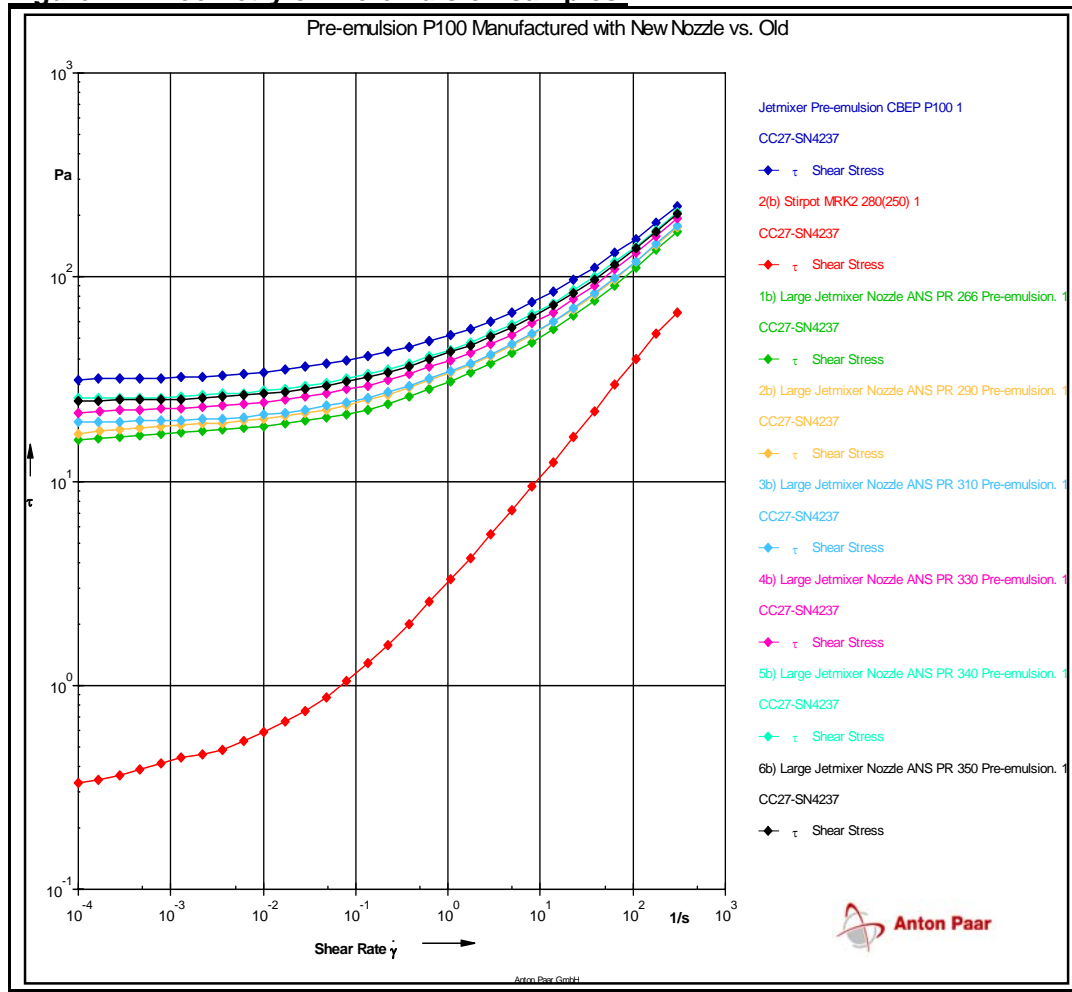
**Table 2. Pressures and outputs for the different samples:**

Test	Emulsion Pressure (bar)	ANS Pump pressure (bar)	Homog. Pressure (bar)	Homog. Pressure (guage)	ANS Pump Output (%)	Oil Pump Output (%)
1	10.4	7.0	3.6	12.0	47.5	29.4
2	10.7	8.3	3.6	11.5	53.1	31.9
3	13.1	9.6	4.1	11.5	58.3	34.3
4	11.2	10.5	3.8	11.5	64.1	36.4
5	11.5	11.5	3.8	11.2	67.0	37.4
6	10.8	12.2	3.8	12.0	70.7	38.4

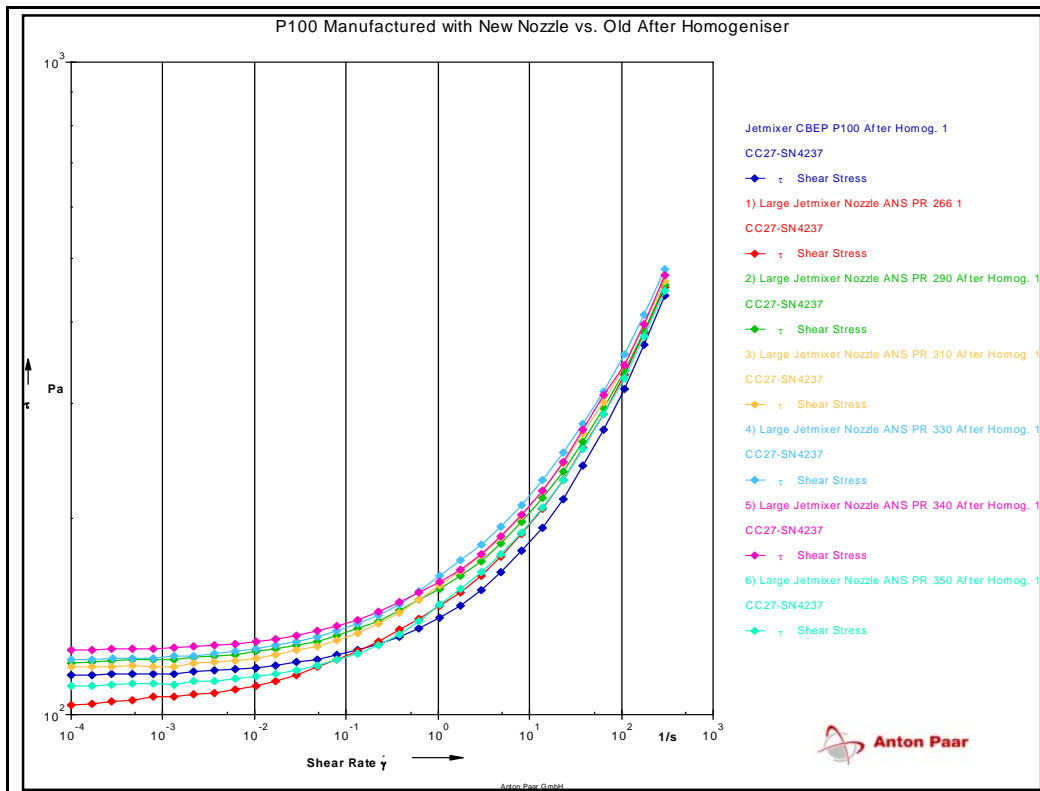
**Table 3. Shear Stress end points for the different samples:**

Test	Samples	Shear stress endpoint
	After Homogeniser	
	Old Nozzle	115
1	New Nozzle	103
2	New Nozzle	120
3	New Nozzle	118
4	New Nozzle	121
5	New Nozzle	126
6	New Nozzle	111
	Pre- Emulsion	
	Old Nozzle	31.5
1	New Nozzle	15.9
2	New Nozzle	17.1
3	New Nozzle	19.4
4	New Nozzle	21.7
5	New Nozzle	25.5
6	New Nozzle	24.8

**Figure 1.: Rheometry of Pre-emulsion samples:**



**Figure 2.: Rheometry of emulsion samples After Homogeniser:**



## DISCUSSION

Rheometry on the pre-emulsion showed that the product manufactured with the larger nozzle was similar to that manufactured with the smaller nozzle, with the profiles of tests 4,5 and 6 being very close to that of the standard.

The pre-emulsion viscosities of tests 1 and 2 were lower than the typical 8000cP to 10 000cP expected. With test 3 the pre-emulsion viscosity just reached 8000cP, however it is not recommended to run at this rate as the viscosity could fluctuate below 8000cP.

The ANS Pump pressure only exceeded the 12 bar mark on test 6.

It was also noted that the emulsion temperature after the plate cooler rose a few degrees to 44/43°C as the production rates increased.

Microscopy indicated that the droplets of both pre-emulsion and emulsion manufactured after the homogeniser were comparable to the standard product.

It was noted that the transfer pump was able to remove all product manufactured while Rig 1 ran at 378 kg/min and Rig 2 ran at 287 kg/min.

It is recommended to run production rates of the new nozzle between 357 Kg/min (ANS PR 330 Kg/min) and 368 Kg/min (ANS PR 340 Kg/min). These rates would allow the ANS pump to run between 10.5 and 11.5 bar while still producing a pre-emulsion well within the 8000 to 10 000cP range.