Report

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Frese Valve Tests

Report 18984/2
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Carried out for: **Frese Ltd**
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SUMMARY

This report details work carried out to determine the ability of Frese Alpha cartridges to meet the manufacturer's specifications in respect of flow control, together with an assessment of any noise generation during operation.

When tested, the ALPHA valves showed control of the flow within +/-5% of the average test flow for each valve.

The average flow for each valve/cartridge combination tested was between 3% and 8% higher than the nominal claimed flow rate. That is, the valves delivered more flow than claimed but maintained control of that flow within +/-5% band.

Fitment of a double swept bend upstream of a Model 1400 valve had no effect on flow control.

Minimum operating pressure differential was within +/-2kPa of the claimed value for nominal flows less 5%.

No discernible noise was detected during the ALPHA tests.

The EVA valve and cartridge combination did not show discernible increases in noise when pressure differential and actuator position were changed to give authority over the cartridge.

Full details of the test programme and results are included within the main body of this report.

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FIGURES

1 INTRODUCTION

This report details work carried out to determine the ability of Frese Alpha cartridges to meet the manufacturer's specifications in respect of flow control, together with an assessment of any noise generation. The work was carried out at Frese armatur A/S, Sorøvej 8, DK-4200, Slagelse during the period 14th-16th March 2005.

The work was conducted by: O Jørgensen for Frese
P Stonard for BSRIA

This report refers to the items tested and no others.

2 ITEMS TESTED

The items tested were selected at random from production stock by P.Stonard and consisted of the following pieces:

Cartridge type	Frese No	Flow (l/hr)	Min ΔP (bar)	Date code
10	49-11290	105	0.10	RO3
10	49-11400[1]	205	0.12	RO2
30	49-33107	1487	0.13	Q11

1. This item was tested in an ALPHA valve body and an EVA body.

All other cartridges were tested in ALPHA valve bodies.

Each test piece consisted of a cartridge, orifice and retaining clip. A type number and date code was stamped on the orifice and cartridge combination.

3 TEST FACILITY

The test facility was that used by Frese research and development department to validate valve performance. It consisted of a multi pump system fed from a pressurised tank. Test circuits of up to three different pipe sizes could be accommodated on common manifolds and separately valved off to allow flow through individual circuits.

Each circuit in use had a calibrated magnetic flow meter in-line, with a digital readout. Differential pressure was measured by means of three pressure transducers with analogue indicators covering the range 0-6 bar using the integral pressure tappings on the valves (Figures 1 & 2).

Differential pressure was changed by varying the selected pump speed using electronic inverter drives.

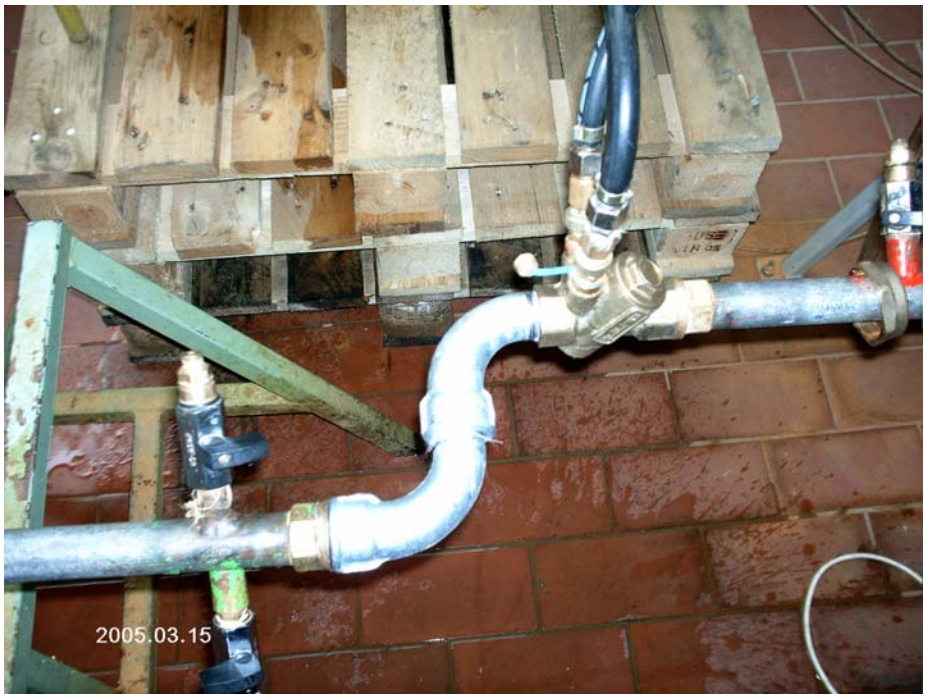
Type 10 cartridges were installed in a ¾ BSP pipe size with 500mm straight length upstream and 400mm downstream. A further test was carried out with a double swept bend immediately in front of the 11400 cartridge (Figure 3).

The Type 30 cartridge had 700mm of straight pipe upstream and 500mm downstream on 1¼ BSP pipe.

Figure 1 General view of test rig

Figure 2 View showing test lengths, flow meter and pressure transducers.

Figure 3 Type 10, model 49-11400 with double bend upstream



3.1 INSTRUMENTATION

Instrumentation consisted of the following calibrated items. Calibration certificates can be seen in Appendix A.

Instrument	Serial No.	Date calibrated
Siemens MAG1100/6000 DN25	(1100) 933807T304	19 July 2004
Siemens MAG1100/6000 DN10	(1100) 213604T481	12 August 2004
Siemens transducer 0-600 mbar	NSN Factory No.4	12 August 2004
Siemens transducer 0-3.2 bar	NSJ2871T	13 August 2004
Siemens transducer 0-6.0 bar	N8J7406T	13 August 2004

3.2 METHODOLOGY

The test method consisted of installing each cartridge in turn and raising the pressure in the following increments: 0.1, 0.25, 0.50, 1.0, 2.0 3.0 and 4.0 bar. The flow rate was noted at each pressure. The pressure was then reduced to zero in the same incremental steps to establish the extent of hysteresis.

The pressure was then slowly raised until the flow rate stabilised at the minimum specified value i.e. 5% less than the nominal claimed flow rate, and the pressure noted.

This was repeated for all ALPHA valves and different pipe configurations.

An assessment of noise was made using a stethoscope on the valve body.

In addition, when tested as an EVA valve, pressures were raised in 0.50, 2.0 and 4.0 bar with the motorised actuator full open (10volt). The motorised actuator was then driven to a point where it took authority over the cartridge and the applied pressure difference occurred across the actuator giving a high velocity across the valve seat, with the potential for noise generation.

An assessment of noise was then made using a stethoscope on the valve body.

4 RESULTS

The flow test results are tabulated overleaf, and the data plotted.

A subjective assessment of noise by means of a stethoscope did not detect any extraneous sounds above a slightly increased sound of rushing water at higher pressures and small EVA openings. No whistling or other high-pitched sounds were heard.

No noise at all was evident over the operating range without the use of a stethoscope.

4.1 MODEL 1290

Model:	1290		
DP	Flow		
kPa	l/hr	Min	Max
10	94	107.4	118.7
25	**114**	107.4	118.7
50	**115**	107.4	118.7
100	**115**	107.4	118.7
200	**117**	107.4	118.7
300	**120**	107.4	118.7
400	**116**	107.4	118.7
300	**111**	107.4	118.7
200	**109**	107.4	118.7
100	**109**	107.4	118.7
50	**109**	107.4	118.7
25	**109**	107.4	118.7
10	88	107.4	118.7
Nominal	104		
Average	113.1	-5%	5%
Av vs nominal		8.04 %	

Minimum control pressure 12.0kPa to achieve nominal flow value less 5%.

4.2 MODEL 1400

Model:	1400		
DP	Flow		
kPa	l/hr	Min	Max
10	174	200.5	221.6
25	**216**	200.5	221.6
50	**218**	200.5	221.6
100	**218**	200.5	221.6
200	**213**	200.5	221.6
300	**208**	200.5	221.6
400	**204**	200.5	221.6
300	**206**	200.5	221.6
200	**210**	200.5	221.6
100	**214**	200.5	221.6
50	**213**	200.5	221.6
25	**209**	200.5	221.6
10	170	201.1	222.3
Nominal	205		
Average	211.7	-5%	5%
Av vs nominal		3.18 %	

With double bends upstream of valve

Model:	1400		
DP	Flow		
kPa	l/hr	Min	Max
10	180	200.5	221.6
25	**216**	200.5	221.6
50	**218**	200.5	221.6
100	**218**	200.5	221.6
200	**213**	200.5	221.6
300	**208**	200.5	221.6
400	**204**	200.5	221.6
300	**206**	200.5	221.6
200	**210**	200.5	221.6
100	**214**	200.5	221.6
50	**213**	200.5	221.6
25	**209**	200.5	221.6
10	166	201.1	222.3
Nominal	205		
Average	211.7	-5%	5%
Av vs nominal		3.18 %	

Minimum control pressure 12.5kPa to achieve nominal flow value less 5%

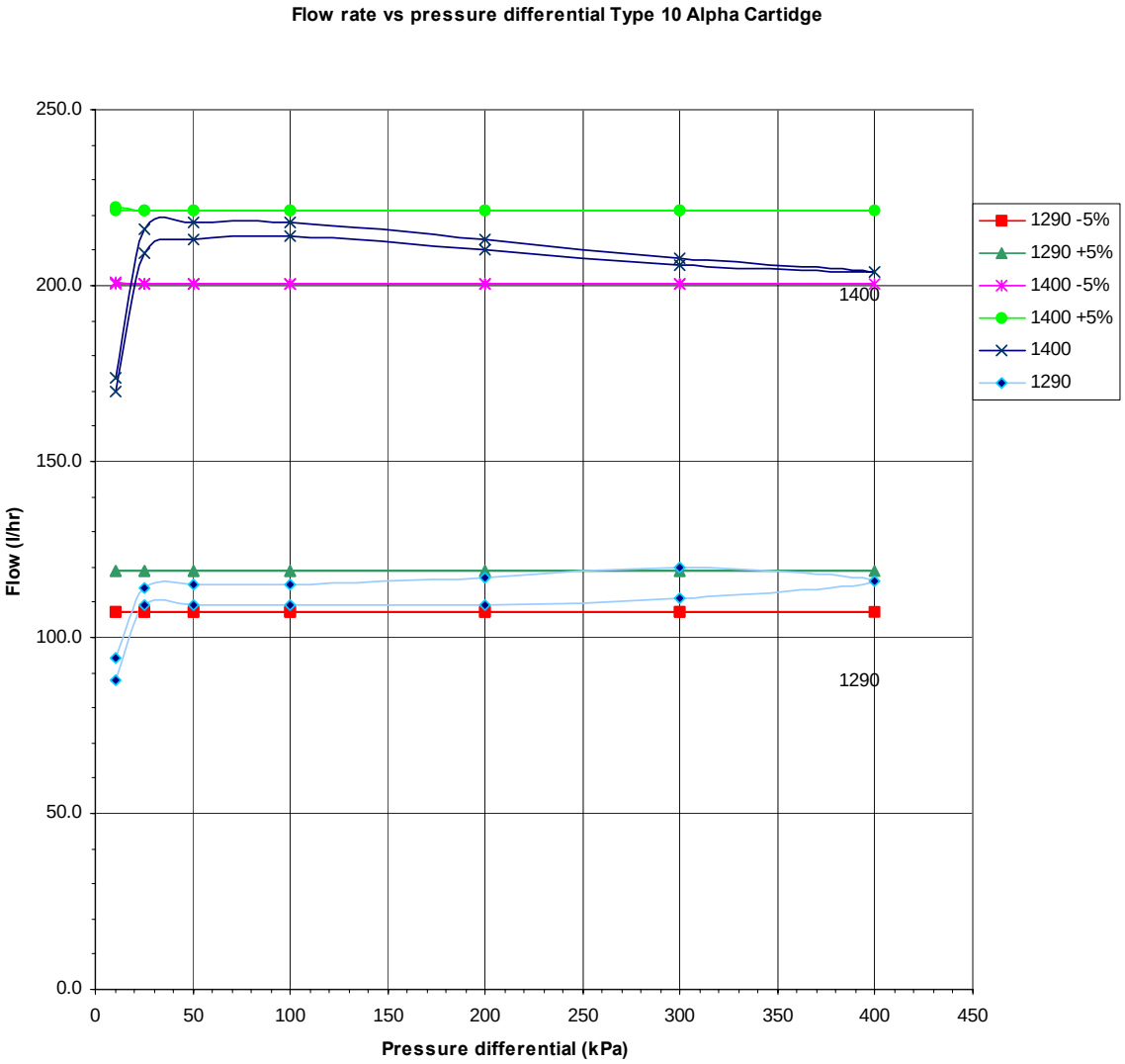
Note that data for the double bend tests was not plotted, as it exactly duplicated that obtained on the previous Model 1400 flow test using straight pipe lengths.

4.3 MODEL 3107

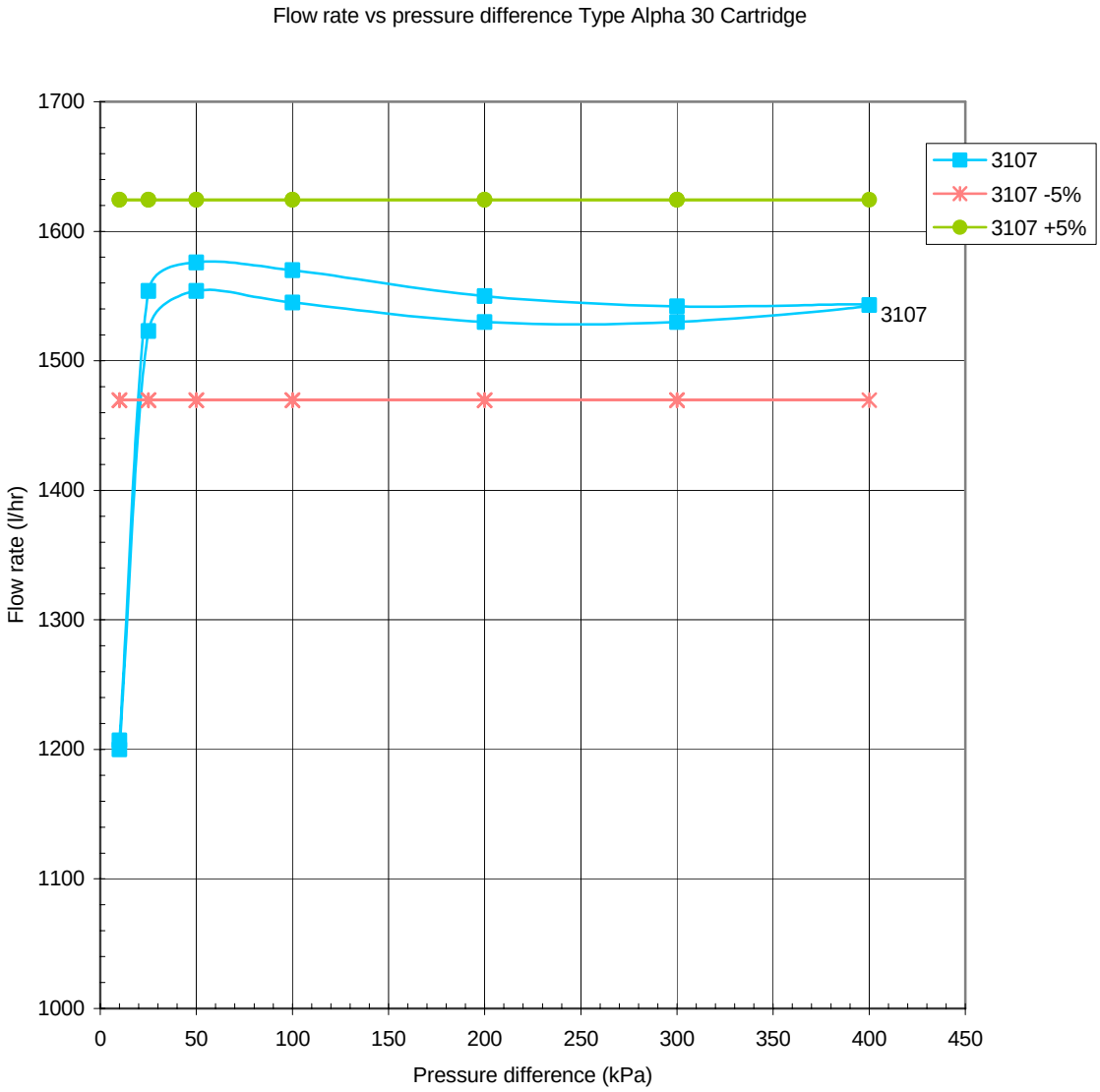
	Model:	3107(2)	
DP	Flow		
kPa	l/hr	Min	Max
10	1207	1469.7	1624.4
25	**1554**	1469.7	1624.4
50	**1576**	1469.7	1624.4
100	**1570**	1469.7	1624.4
200	**1550**	1469.7	1624.4
300	**1542**	1469.7	1624.4
400	**1543**	1469.7	1624.4
300	**1530**	1469.7	1624.4
200	**1530**	1469.7	1624.4
100	**1545**	1469.7	1624.4
50	**1554**	1469.7	1624.4
25	**1523**	1469.7	1624.4
10	1200	1469.7	1624.4
Nominal	1487		
Average	1547.00	-5%	5%
Av vs nominal		3.88 %	

Minimum control pressure 14kPa to achieve nominal flow value less 5%.

4.4 MODEL 1290 AND 1400 PLOTS



4.5 MODEL 3107 PLOTS



4.6 EVA VALVE WITH MODEL 1400 CARTRIDGE

Actuator Voltage	Differential Pressure kPa	Flow l/hr	Head pressure Bar
10.0 (cartridge authority)	50	214	0.5
4.0 (actuator authority)	50	81	0.5
10.0 (cartridge authority)	200	209	2.0
4.65 (actuator authority)	200	160	2.0
10.0 (cartridge authority)	400	200	4.0
4.25 (actuator authority)	400	154	4.0

No noise detected during operation.

5 CONCLUSIONS

When tested, the ALPHA valves showed control of the flow within +/-5% of the average test flow for each valve.

The average flow for each valve/cartridge combination tested was between 3% and 8% higher than the nominal claimed flow rate and +/- 5% claimed tolerance. That is, the valves delivered at least 3% more flow than claimed but maintained control of that flow within a +/-5% band.

Fitment of a double bend upstream of a Model 1400 valve had no effect on flow control.

Minimum operating pressure differential was within +/-2kPa of the claimed value for nominal flow less 5%.

No discernible noise was detected during the ALPHA tests.

The EVA valve and cartridge combination did not show discernible increases in noise when pressure differential and actuator position were changed to give authority over the cartridge.

5.1 COMMENTS/ANALYSIS

The valves tested were all new pieces selected from stock. The manufacturer’s view was that the average flow would be approximately 3% lower once the cartridge, and more specifically the EPDM diaphragm had been allowed to settle over a longer period than the 2 minutes between readings during the test. This may be the case, but was not included within the test programme.

The Model 1400 and 3107 valves both also maintained flows within a +0%+10% band based on the nominal flow. The Model 1290 fell just outside this band due to the valve hysteresis:- being ‘within’ with descending pressure, but ‘outside’ with increasing pressure. This is one of the smallest cartridge/orifice combinations made and consequently +/-5% variation involves a much smaller flow change than for other sizes.

The large format high visibility instrumentation indicators attached to the flow meters resolved to 1 l/hr, which equated to approximately 0.9% at typical flow values used for the Model 1290 tests. Use of the small integral screens on the flow meters, which resolve to 0.1 l/hr may give improved results at lower flows.

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Introduction to building services
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Constructing Excellence

Technical authoring

Committee facilitation and support

Research management

Expert witness work

Design

Design quality and process guidance

Design validation
Physical modelling
Thermal modelling
CFD
BREEAM assessments

Proof of performance testing
Standard & bespoke tests
(see list under manufacture)

Whole life costing
Life cycle analysis

Consultancy in:
Air tightness
Cooling of IT rooms

Sustainability
Grey water
Water conservation
Renewables
Control strategies

Specialist enclosure testing
Museum display cabinets

Construct

Site productivity improvement
Measurement
Lessons learned database
Modular training, feedback and toolbox talks
Pocket project handbooks

Management
KPIs
Publications
Consultancy and mentoring
Training

Approval inspections
Thermal imaging of fabric
Raised floor leakage test
Building envelope leakage test (for Part L)
Roof inspections
Fire stop testing
Offsite fabrication
Proof of performance and installability
(see also design)

Operate

Strategic Services
Maintenance strategy
Business focussed maintenance schedules
Building management systems
Procurement advice
O&M benchmarking
Health and safety audit

Energy efficiency assessments
Building MOTs
Energy audits
Control system surveys

Water and air quality

Internal environment monitoring
Comfort measurement
Sick building syndrome assessment
Indoor air quality
Pollution monitoring

Plant and system investigations
Troubleshooting
Performance checks
Maintenance tasks

Site surveys and condition monitoring
Plant condition surveys
Vibration and sound
Non-destructive testing
Magnetic field
Thermal imaging
(failures - electrical plant, damp, underfloor heating, chilled ceilings)
Ultrasonic pipe work testing
Power quality
Electrical surveys
Magnetic field survey
Lighting level and control survey
For due diligence and legal compliance

Manufacture

Testing and certification to recognised standards
Air cleaners
Air filters
Air handling units
Air heaters
Atomising oil nozzles
Axial fans
Blockwork porosity
Boilers
Chilled ceilings
Chillers
Coolers and condensers
Displacement ventilation
Ductwork
Expansion vessels
Fan coils
Fire valves
Flue lining systems
Fume cupboards
Louvres
Metal flues, chimneys, fittings and terminals
Radiators
Refrigeration equipment
Smoke and fume extraction fans

Testing thermal performance, emissions, EMC, MTBF, noise

Testing to client requirements

Energy labelling

Product failure analysis

Standards development
Writing
Evaluating
Publishing

Design of test facilities

Support for new product development

Management & Marketing

Business strategy
Strategic planning
Bespoke assignments, or one day consultancies
Procurement advice
Bid support
Business Performance Forum
Supply chain management

Partnering workshops

Marketing strategy - *confidential studies on:*
Market entry
Acquisition
New product development
Technical appraisal
Distributions and pricing strategy

Market research - size and structure of markets
Heating, air conditioning, plumbing and sanitaryware, controls, renewables, structured cabling, FM and contracting
Confidential studies
Published reports
Global studies annually
In depth studies
Statistics clubs

Attitudinal studies

Customer research
Customer satisfaction
Product acceptability
Understanding clients' needs

Market research techniques used:
Focus groups
Personal interview
Desk research
Telephone, fax and web surveys
Questionnaire design