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3” Valve Comparison Test Report

Date: 13/12/06

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1. Scope

Goyen Controls has undertaken and completed comparative reverse pulse jet valve performance. The Goyen 76MM, Turbo 3" MM style and Mecair 3" Full Immersion 524 valves were tested. This report contains the test setup, execution, detailed results and associated discussion.

2. Test Setup

2.1. Equipment Description and Setup

The testing configuration consisted of:

- Header: The Goyen lab is equipped with a variable capacity header which was configured to hold 218L (7.73 ft^3) for this testing.

- Header Pressure: 80psi

- Piloting: All three valves were directly piloted.

- Blowtube: The standard laboratory Goyen 3" schedule 40 blowtube was used for this testing. The nozzle sizes were chosen so that the total nozzle area (An) is approximately equal to the total flow area of the pipe (Ap). Goyen refer to this as the An/Ap ratio. The actual An/Ap ratio for this blowtube is 0.93 which is in the middle of blowtube configurations commonly used in industry. Typical An/Ap range is from around 0.4 to 1.3 for the larger valves.

    - Material: 3"NB Schedule 40 pipe
    - Length: 118" (3000mm).
    - Number of outlets: 8
    - Outlet size: 26.6mm
    - Outlet Type: Plain – no nozzles were fitted.
    - Pitch Spacing: 9" (230mm)

- Electrical On Time: 50ms, 100ms and 150ms
- Temperature: The average temperature during the testing was 19.2°C.

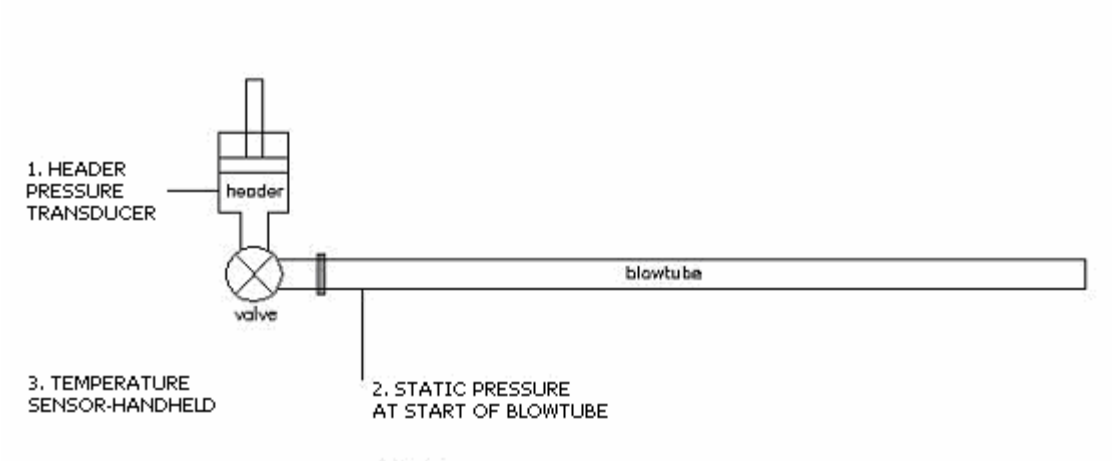
2.2. Instrumentation Configuration and Diagram

The following data measurements were recorded:

Location	Transducer
1. Header Pressure	Lucas Schaevitz PS3363 0-250psi 0-5V output transducer
2. Static Pressure at start of Blowtube	Lucas Schaevitz PS3363 0-250psi 0-5V output transducer
3. Ambient Temperature	Vaisala HM34 Humidity and Temperature Meter

Goyen uses a National Instruments PCI-MIO-16XE-50 multi function I/O board for data acquisition. An internally developed custom program in Labview 6i controls the testing procedure and acquisition.

Figure 1: Instrumentation Diagram



NOTE: The static pressure was recorded at the beginning (or valve end) of the blowtube. This has been a testing convention at Goyen for many years. One of the reasons for this is that the total pressure (or dynamic or velocity pressure) can also be measured at this point.

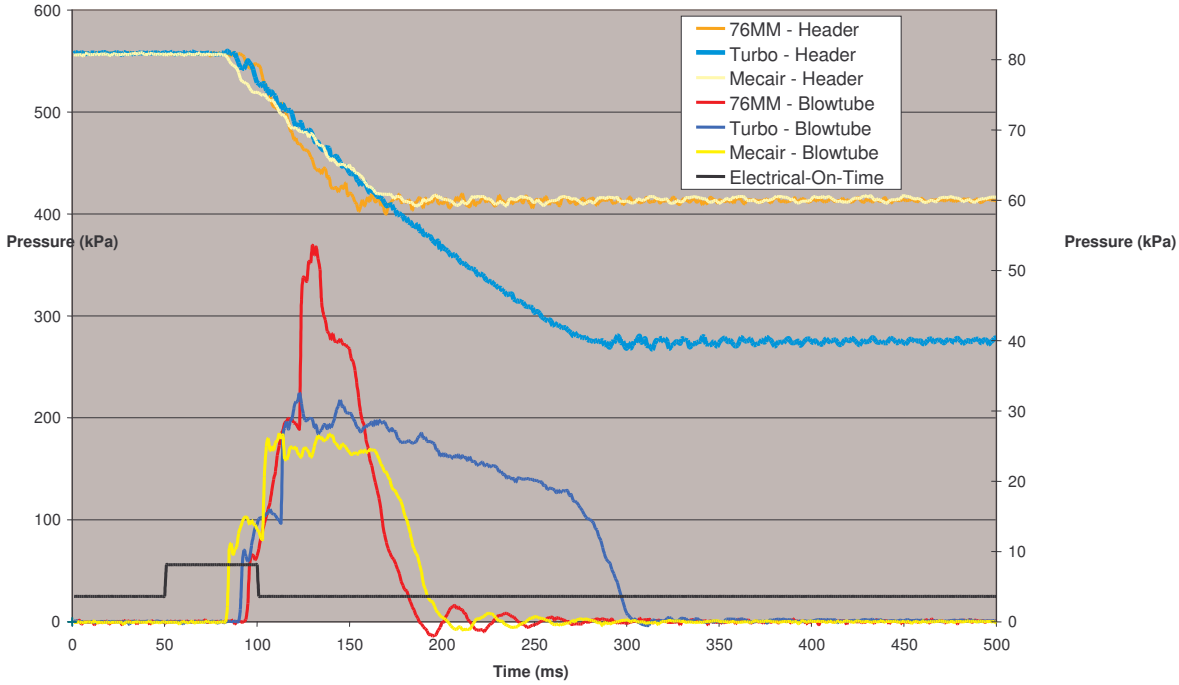
2.3. Calibration Procedure

Once the equipment was assembled and setup, a thorough calibration procedure was followed. Goyen employs a calibration methodology where each transducer is calibrated prior to every main batch of testing (rather than periodic calibration). This calibration is made against either a water column or certified standalone pressure measurement equipment (depending on range of transducer). Numerous data points are recorded and a linear regression provides the calibration constants used in the Labview program.

3. Results

3.1. 50ms Electrical-On-Time

Figure 2: Header and Blowtube Pressure – 50ms EOT

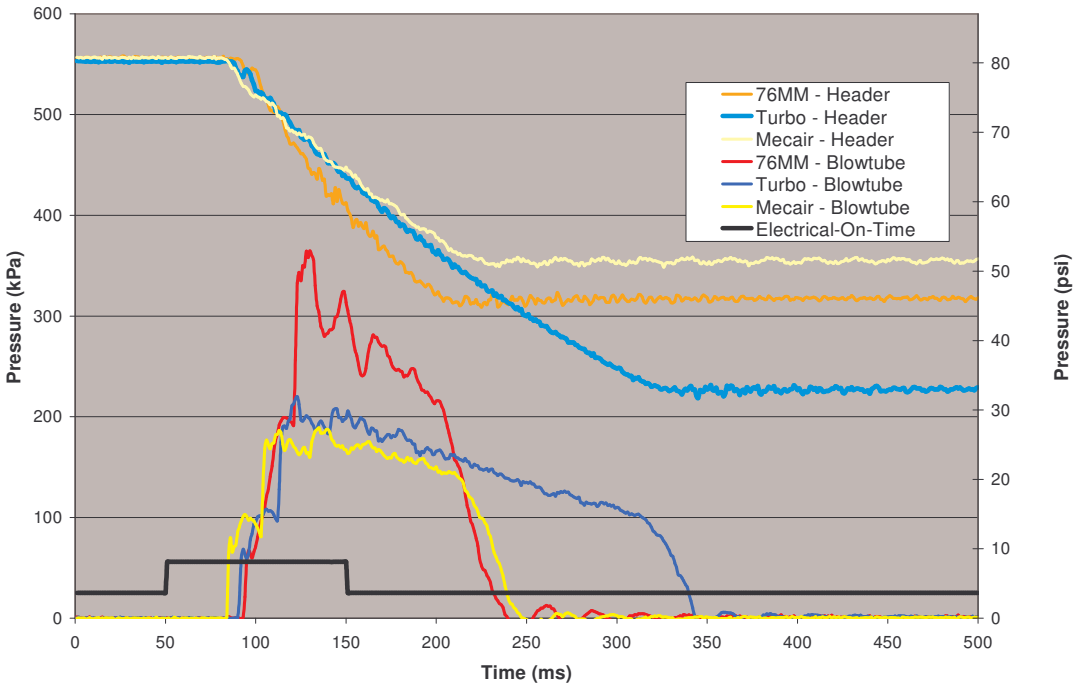


- Figure 2 shows that the 76MM outperforms the other two valves in peak pressure by a significant margin. The 76MM recorded a 76% greater peak pressure delivery in the blowtube.

- The 76MM has the shortest Mechanical-On-Time (MOT) at around 70ms, which is only 20ms more than the Electrical-On-Time (EOT). The Mecair valve also responds well with a MOT of around 85ms. The Turbo valve has a long MOT of around 180ms. The impact on the air consumption is clear, with the Turbo valve depleting the header to around 50% of the original pressure, while the Mecair and 76MM valve complete the pulse with around 75% of the starting pressure.

3.2. 100ms Electrical-On-Time

Figure 3: Header and Blowtube Pressure – 100ms EOT



- The trends displayed in the 50ms plot are evident in the 100ms case.

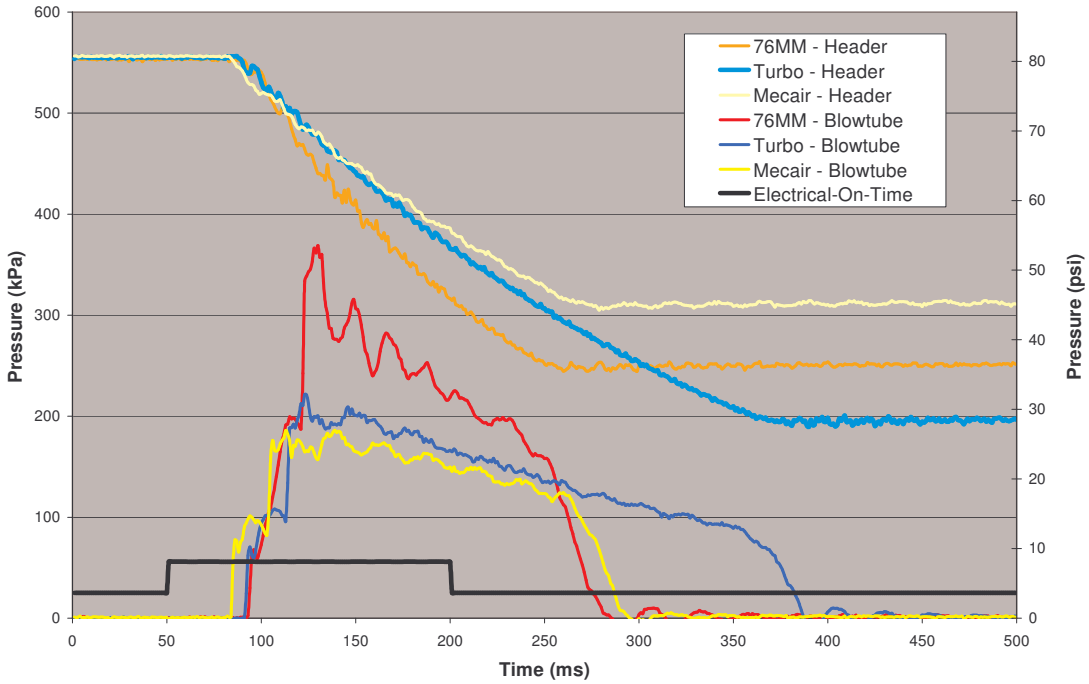
- Again the Turbo valve displays a long MOT. The peak pressure is slightly greater than the Mecair valve.

- The flow performance is also observable in the header decay rates. The gradient of the header decay rate is a clear indicator of the actual outflow achieved by each valve.

- NOTE: At 100ms, 76MM valve consumes less air than the Turbo valve at 50ms even though a much greater peak pressure is achieved with the Goyen 76MM. The additional air consumed by the Turbo valve does not contribute to increase blowtube or in-filter cleaning pressures. The significantly faster response of the Goyen valve allows excellent control of air consumption.

3.3. 150ms Electrical-On-Time

Figure 4: Header and Blowtube Pressure – 150ms EOT



- As per the two previous charts, the Mecair and 76MM valve exhibit MOT's which are only slightly longer than the EOT. The Turbo valve on the other hand has a MOT of approximately 270ms, around 120ms longer than the EOT.

- With the longer opening time, the air consumption of the 76MM moves closer to that of the Turbo valve. However the air used by the Goyen 76MM valve is effective at developing peak pressures significantly superior to the Turbo valve. In fact, the static blowtube pressure at the end of the pulse for the 76MM is only slightly lower than the Turbo valves' peak pressure.

3.4. Air consumption

Figure 5: Air Consumption @ STP

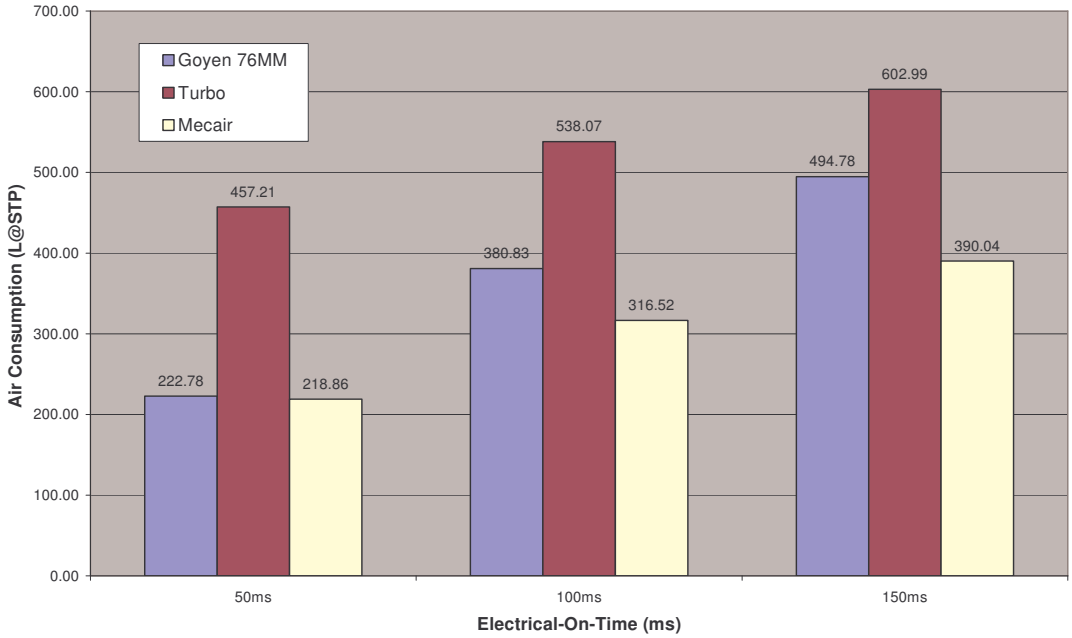


Table 1: Air Consumption

	50ms		100ms		150ms	
	L	cu.ft	L	cu.ft	L	cu.ft
Goyen 76MM	222.78	7.87	380.83	13.45	494.78	17.47
Turbo	457.21	16.15	538.07	19.00	602.99	21.29
Mecair	218.86	7.73	316.52	11.18	390.04	13.77

Figure 7 and Table 1 clearly illustrate the significant difference in the air consumption between the three valves.

When considering that the 76MM offers significantly lower air consumption than the Turbo but around a 75% greater peak blowtube pressure, the difference in potential cleaning power is readily apparent. The additional air delivered by the Turbo is of no advantage as it is achieved solely through longer mechanical pulse times rather than through actual increased pressure delivery. This wasted air usually represents an increase in cost of the dust collector operation.

4. Conclusion

The 76MM consistently developed 160kPa (23psi) greater peak pressure than the Turbo valve. This is a significant margin which has a direct impact on in filter cleaning pressures. The peak blowtube static pressure was up to 65% of the initial header pressure, while the Turbo yielded only 38%.

The Mecair and 76MM valves were very responsive, recording mechanical on times only slightly longer than the electrical on time. The Turbo valve was very slow to open and close leading to longer mechanical on times and therefore greater air consumption at lower peak pressures.

At 150ms EOT, the air consumption of the Mecair valve was lower than that of the Turbo valve with an EOT of 50ms.

The 76MM offers greater peak pressure for the entire duration of the pulse. It has been demonstrated in this testing that this is achieved in a highly controllable manner, with a mechanical on time closely matching the electrical on time. This provides the ideal pulse profile of maximum peak pressures, with extremely quick opening and closing phases, ensuring that the air consumed is used efficiently for the purposes of providing cleaning power. These points illustrate that a significantly more powerful **and** very responsive valve can provide the system designer with more flexibility to achieve an optimal design. The end result is a system with ample cleaning power which is produced in a highly efficient manner.

While it would not be possible for the Turbo valve to match the peak performance of the 76MM, it is important to note that the 76MM can develop equivalent pulse pressures but at around 20 psi lower stored compressed air pressure. Simply extending the electrical on time would extend the mechanical on time.

While the Turbo valve offers a marginal peak pressure advantage over the Mecair valve, it does so with significantly worse air consumption. This air consumption is wasted energy. The Turbo valve can not be operated with the same air efficiency of the Mecair valve.

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