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DEFINITION OF BLAST PRESSURE IN AIR-OPERATED PEENING MACHINES

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ABSTRACT

Driving air pressure is an important parameter in air operated peening machines. Test measurements between several points in the flow system, under known loads, show the importance of establishing a clear engineering defination and specification for both system performance and air consumption.

KEYWORDS

Blast pressure definition.

FOREWORD

The information presented applies to positive pressure air-driven peening machines. Excluded are blast systems utilizing suction or hybrid (suction/positive pressure combination) arrangements for which technique entirely different rules apply.

INTRODUCTION

Elevated air pressure accelerates blast particles to high velocity to perform the desired and controllable action on the surface to be treated. Currently, there is no standardization worldwide for air pressure at specific system locations. Various definitions are possible. In communication, on work sheets, for approvals and tests, there is need to further define blast pressure to assure system performance understanding and subsequent demonstration.

SCOPE OF THIS TEST

Major interest is on three testpoint under two geometrical configurations and variations of the parameters "air pressure" and "media flow rate". Additionally the static pressure in the area of the smallest diameter of the nozzle was monitored. The test system used the following constants:

SYSTEM CONFIGURATION

Nozzle dia:	6.4 mm [1/4"], shape not optimized
Blast hose dia:	19mm [3/4"], 16mm [5/8"]
Pressure range:	1 to 4.5 bar [14 to 64 psi.g]
Flow rate:	0.7 to 5.0 kg/min [1.5 to 11 lbs/min]
Shot spec.:	S 110

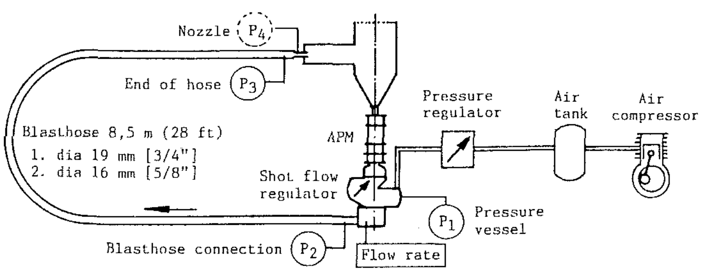

Fig. 1. System for measurement

Most of the peening machines are equipped with 19 mm [5/8"] dia. hoses using nozzles between 8 mm [5/16"] to nearly 12 mm or even 1/2". If nozzles below 6.5 mm [1/4" approx.] have to be used, depending on various effects, the system may become unstable and the outlet stream might flutter. In this case, the blast hose diameter has to be reduced and a combination using a 6.5 mm nozzle and a 16.0 mm [5/8"] dia. blast hose can be quite advisable. Due to limited air—supply test facilities, tests have been made with the geometrically smaller groups. But it does not affect the principal results.

TEST EQUIPMENT

Blast generator

Advanced Peening System (APS) including advanced peening module (APM) model 500 of ANVIL-DEVELOPMENTS with optional "Flow Monitor" as shown by Fig. 2.

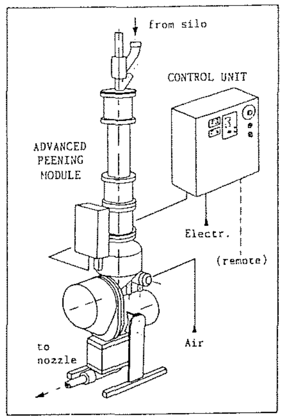

Fig. 2. Advanced peening system used in test

Accessories

Blast hose and nozzle outfit are common whereas the media reclaiming system was specially designed for this test series.

Test points are shown in Fig. 1. The pressure has been monitored by transducer and gauge reading 0.01 bar [0.7×10^{-3} psi.g]. For this simple test procedure, a manual control was adequate and no data acquisition or additional control equipment had to be used with the APS. Fig. 3. shows a test-connector for temporary use. Fig. 4. gives an idea of a durable "closed to nozzle" hose connection to be used under shop conditions.

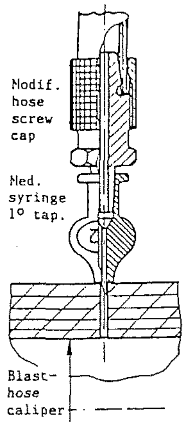

Fig. 3. Temporary test connector

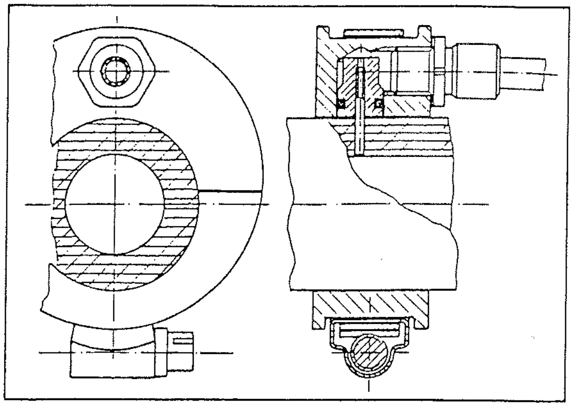

Fig. 4. Connector for operational use

TEST RESULTS

Fig. 5. and 6. show the results of the two test series made. They inform us about the pressure loss of a certain length of hoses at two different nozzle dia. / hose dia. ratios. They clearly show the relation between shot flow and pressure loss due to acceleration, volume reduction and friction caused by the particles and help to explain that with increasing shot flow the peening intensity might decrease (and inverse).

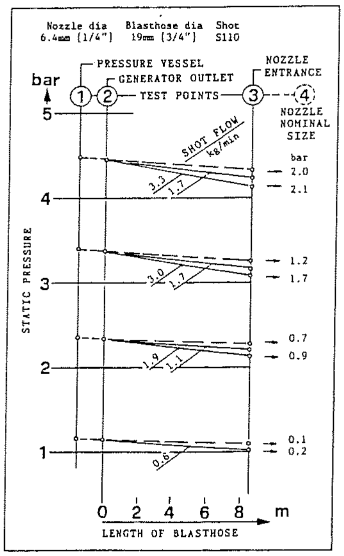

Fig. 5. Diagram result I

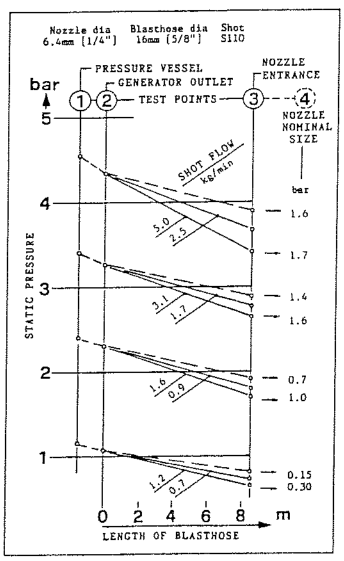

Fig. 6. Diagram result II

Fig. 7. shows a conversion of Fig. 6. and is meant for process engineering to give information about the pressure loss that can be expected under given conditions. This diagram applies to nozzle dia. / hose dia. -ratios of approximately 2. For other parameters similar diagrams can be created.

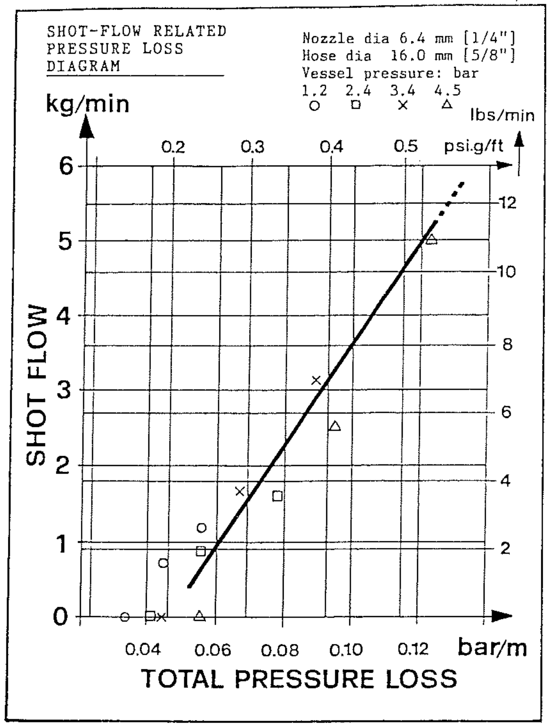

Fig. 7. Diagram for pressure loss determinations

CONCLUSION

The experiment shows the importance of clear definition of the test points in such processes. Normally, peening engineers mean point "1" in Fig. 1., simple to use but of little importance if the pressure loss within the hose cannot be determined and also if the shot flow varies. Point "3" says lot more about energetics just before the air-/mediastream enters the nozzle, but is more difficult to monitor in respect to pressure. From the technical point of view, a device according Fig. 3. or 4. could solve this problem. But this is the point for the determination of each individual nozzle's performance. It cannot be substituted by a general pressure taken e.g. from the pressure vessel.

Overall, the results show that for more scientific acquisition and control, the related status must clearly be defined.

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