Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

On the Dynamics of Discharge Processes[1] P. MARCUS WINROTH, CHRISTOPHER L. FORD, P. HENRIK ALFREDSSON, CCGEx, KTH Mechanics, Royal Institute of Technology, Stockholm — Low-order simulations of discharge processes are commonly used in for instance engine modelling. In such simulations the discharge of the engine cylinder is modelled using a discharge coefficient (C_D), that represents the effective area of the valve. Experiments to determine C_D are typically performed under steady conditions, assuming that the discharge processes can be regarded as quasi-steady. This assumption is experimentally investigated by comparing C_D obtained under both static and dynamic conditions. The static experiments were performed in a flow bench, with a maximum mass flow of 0.5 kg/s at pressures up to 500 kPa. The dynamic experiments consisted of discharging a pressurised 2 litre fixed volume cylinder with a movable exhaust valve to the atmosphere. The valve opening time was in the range 15-25 ms (equivalent to engines speeds ranging 800-1350 rpm) and the initial pressure was 300-500 kPa. The results show that C_D is a function of the valve opening speed and that static experiments results in elevated values of C_D. A measure of "steadiness" has been defined relating the relative change in flow conditions to the change in system geometry. This measure helps to explain why the process cannot be regarded as quasi-steady.

[1]Travel grant provided by Styffes Stiftelse is gratefully acknowledged.

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Date submitted: 17 Jul 2017 Electronic form version 1.4