

# NASA TECH BRIEF



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## Solenoid Valve Performance Characteristics Studied

A method has been devised for determining the operating characteristics of solenoid valves. The current and voltage waveforms of the solenoid coil

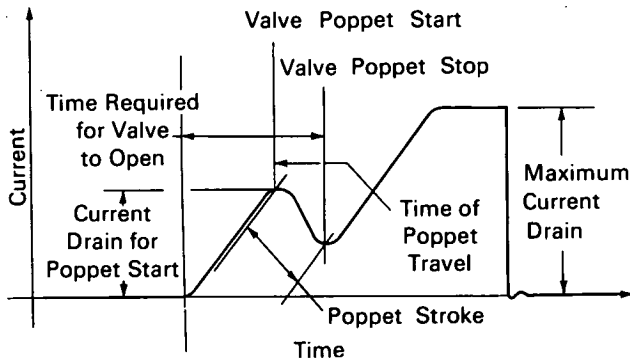


Figure 1. Current Trace

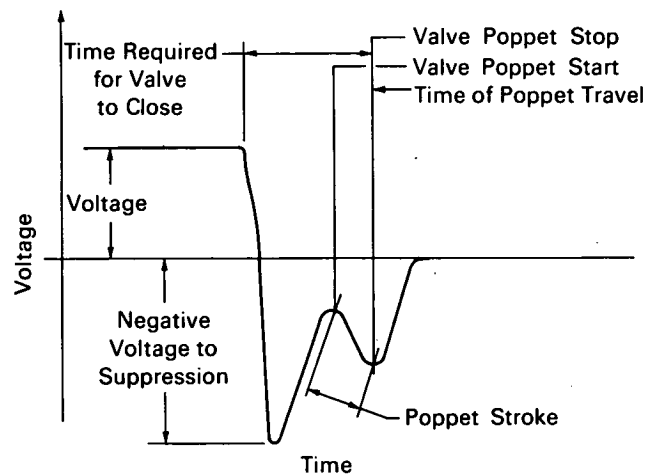


Figure 2. Voltage Trace

are recorded as the valve opens and closes. Analysis of the waveforms with respect to time and the particular phase of the valve cycle accurately describes the performance of the valve.

The recorded current trace (Fig. 1) of the energized solenoid coil increases linearly to a maximum current level; however, when the valve is energized, the motion of the poppet (slug) produces an induced back voltage that reduces the current flow. When the poppet stops at the completion of the opening cycle, the current continues to increase linearly and finally reaches a maximum holding level. Pictorially, the waveform shows a hill and valley interrupting the otherwise linear current function. The apex of the hill indicates the start of poppet motion and the base of the valley indicates the end.

Unfortunately, current waveforms cannot be used to evaluate solenoid characteristics since current

removal in the face of spring energy or other loading media is the method of valve closing. An additional voltage waveform (Fig. 2) is necessary to provide a record of the valve closure cycle. The analysis of this waveform is similar to the current waveform.

**Notes:**

1. Although the use of current and voltage waveforms in determining solenoid valve properties is not new, the application has been extended to provide a very accurate means of monitoring operations of a complete propellant control system.
2. Requests for further information may be directed to:

Technology Utilization Officer  
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(continued overleaf)

**Patent status:**

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: S. Blackburn and J. T. Abe of  
McDonnell Douglas Corporation  
under contract to  
Marshall Space Flight Center  
(MFS-12458)