

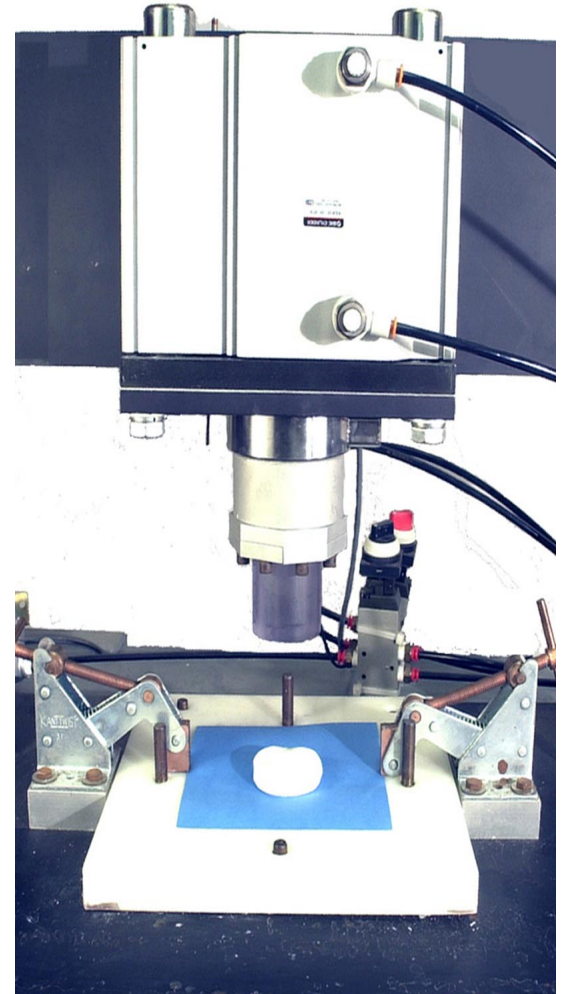


Squeeze Flow Rheometer

MODEL SF-A-1

Features and Benefits:

- Complete rheometer for the characterization of the shear viscosity material function of polymers and other complex fluids.
 - Designed to be mobile and configured as a bench top unit.
 - Can be used as a quality control tool on the factory floor to replace the “finger shearing” test used by the operators to evaluate the material being processed.
 - Can be run wireless, or through the internet.
 - A web camera can be integrated so that the squeeze test can be monitored remotely.
 - Additionally, the data collected can be downloaded to another location through the internet or using the wireless mode.
 - The computer interface is enabled through a touch screen monitor to initiate the test, to plot data and to initiate the analysis of the data.
 - Two sensors are provided; a load cell and a linear variable displacement transducer.
 - Comes with an embedded computer, which allows the force and displacement data to be collected and analyzed. The source code for the data analysis is burnt into the chip so that the data analysis is immediate.
 - Results are obtained quickly (within a minute), thus, solvent loss and temperature control problems are minimized.
 - The various components can be changed depending on the requirements of the testing.
 - The unit can be employed as a biaxial extensional rheometer for extensional viscosity determination upon the lubrication of the surfaces of the rheometer.
 - The current software allows the determination of the parameters of the Power Law model (generalized Newtonian fluid) to allow the determination of the flow curve (shear stress versus the shear rate). The software can be modified to allow more parameters to be determined, including those describing wall slip under certain conditions.
- The unit can be retrofitted for temperature control if desired.
- There is an explosion-proof version, which is being used in the propellant industry.



Material Processing & Research, Inc.

MP&R is a privately owned company, specializing in computer modeling/simulation and design of equipment for highly filled materials used in energetics, ceramics, magnetics, pharmaceutical, personal care, composites, polymers, rubber, batteries and food industries. Since 1992 MP&R has completed numerous government and commercial contracts to supply computer modeling, rheological characterization, design methodologies for dies and mixer/extruders for processing of highly filled materials. MP&R has also supplied custom equipment, including specialized continuous processors and parts, dies for extrusion and co-extrusion, rheometers and other related hardware.

MP&R's technology strengths include rheological characterization of complex fluids, computer modeling/simulation of continuous mixers/extruders and extrusion dies.

MP&R's *Universal* is a highly flexible 40mm extrusion system that incorporates co and counter rotation with single or twin screws.....on a common platform.

MP&R's *Mini* 7.5mm mixer/extruder is the world's smallest co-rotating twin screw.

MP&R also supplies on-line and off-line rheometers including the squeeze flow rheometer, capillary and slit rheometers.

All can be customized to meet specific customer requirements.

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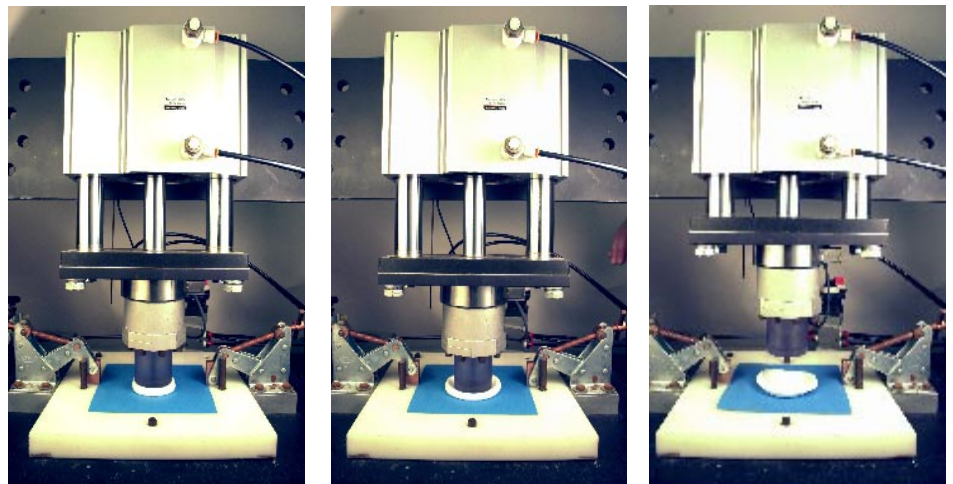
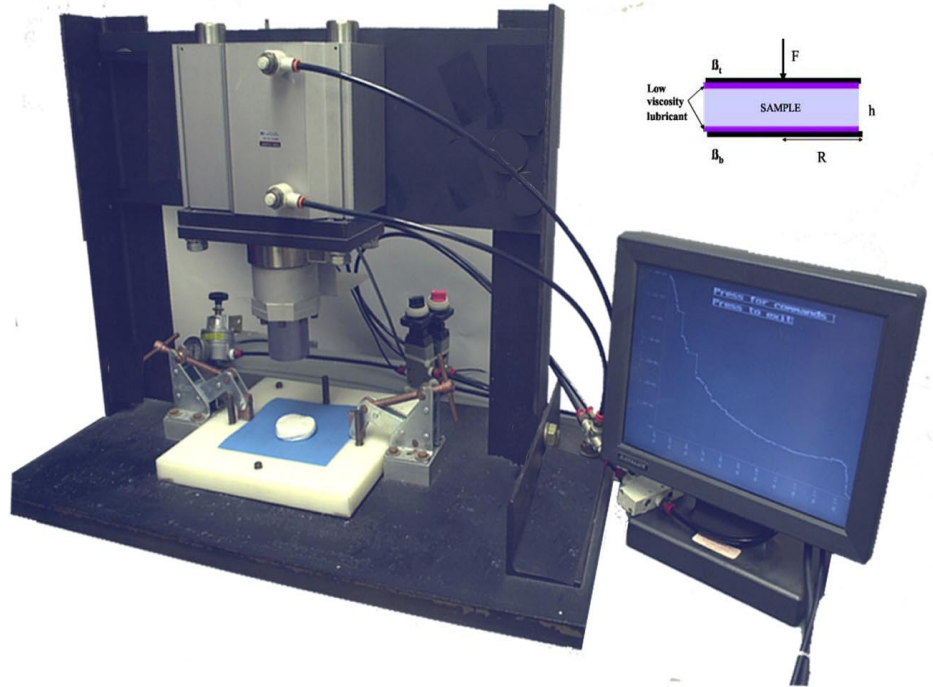
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Technical specifications:

MP&R's squeeze flow rheometer was designed and built especially for the characterization of various complex fluids, including highly filled materials used in many industries. The unit is comprised of a pneumatic cylinder, load cell, LVDT (linear variable differential transformer), thermocouple and host computer. As the pneumatic cylinder is energized by a command from the host computer, the ram head moves downward and squeezes a disk shaped specimen of material. During the squeeze the load cell measures the reaction force of the material against the ram head while the LVDT keeps track of the ram position as a function of time. A thin gauge thermocouple is inserted into the radial surface of the sample to measure temperature.

When the sample is fully squeezed within a minute the experiment is complete. The data collected is then fitted to a mathematical model and the system instantly outputs parameters of the shear viscosity material function, including characteristic "power law" parameters. A unique feature of this system is that the host computer is an embedded PC. This embedded system is comprised of a number of card modules that are stacked together to achieve the desired functionality. The embedded PC does not contain any moving parts and is thus largely maintenance free. The operating system, source code, and analysis program all reside on one of the card modules. Data may either be written to one of the modules or to a PCMCIA flash card, which can



be removed from the system with ease. A touch screen and Visual Basic interface are used for convenient control of the squeeze flow unit.

MP&R also has available an explosion-proof version of the squeeze flow rheometer, especially suitable for the energetics industry. The operator interface of the explosion-proof version consist of an intrinsically safe LCD display and three logic buttons for control. Historically, to test the consistency of propellants during

a batch mixing process, the operator would reach into the large batch mixer and take out a small quantity material. The operator would then work the material back and forth between his or her fingers (small amplitude oscillatory shear) and determine if the batch needed more solvent or if it should be mixed longer etc. The squeeze flow rheometer solves such quality control problems by giving the operator quantitative information to work with which can also be monitored by the supervisory staff.