ASSESSMENT REGARDING THE FLUID EQUATION

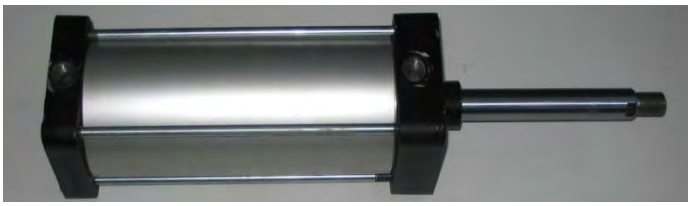
W = PV (WORK = PRESSURE x VOLUME)

AS IT RELATES

TO THE WORKING CAPABILITY OF PRESSURISED FLUIDS

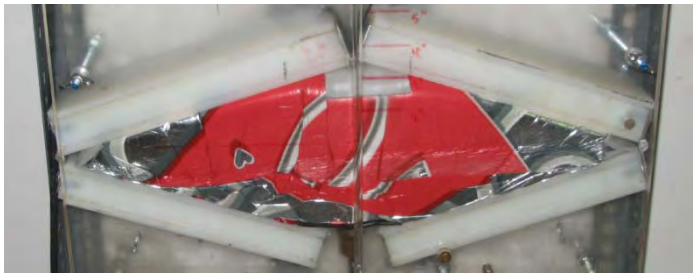
APPLIED IN

THE CONVENTIONAL PISTON ACTUATOR



AND

THE DIAMOND-SHAPED ACTUATOR



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EXECUTIVE SUMMARY

The fluid equation WORK = PRESSURE x VOLUME (W = PV) applies to the linear fluid performance regarding conventional piston actuators.

In these cases work input = work output (WI = WO).

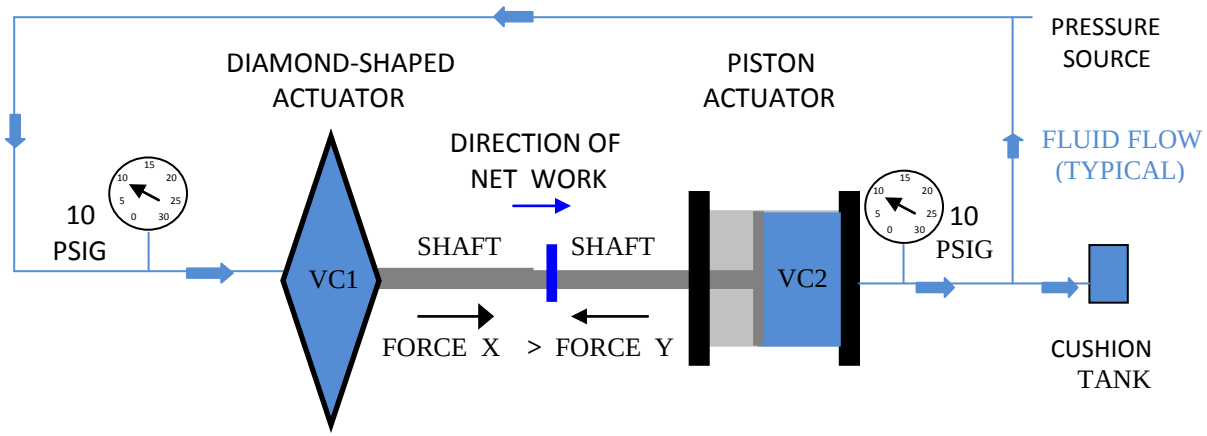
The fluid equation WORK = PRESSURE x VOLUME (W = PV) does **not** apply to the non-linear fluid performance regarding diamond-shaped actuators.

In the initial stages of the diamond-shaped actuators' stroke, work input is less than work output (WI < WO).

Many engineer/scientists have tested the physical model concluding this fact.

Diamond-shaped actuators are more efficient than conventional piston actuators in the early stages of the diamond-shaped actuators' stroke.

PATENTED APPLICATION CONCEPT



The diamond-shaped actuator expends 85% of its work potential generating its own source of fluid, pumping fluid from the piston actuator.

The remaining 15% of the diamond-shaped actuator's work potential may be extracted, addressing work requirements other than producing its own fluid source.

15% net work achieved = ((force "X" – force "Y") x travel)

VC1 (volume change one) < VC2 (volume change two)

REPORT'S PURPOSE

Present information illustrating:

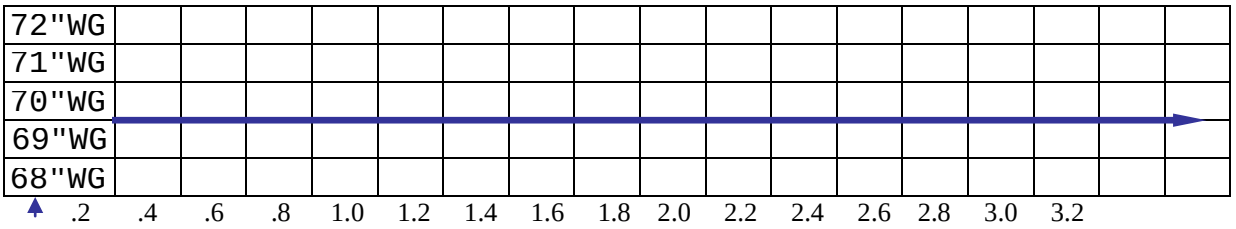
-1- The equation W = PV applies to the linear fluid performance in conventional piston actuators, but does **not** apply to fluid performance in diamond-shaped actuators.

-2- The diamond-shaped actuator performance is non-linear as it progresses through its stroke regarding the work/pressure/volume relationship.

-3- Diamond-shaped actuators are more efficient than conventional piston actuators in the early stages of the diamond-shaped actuators' stroke.

CONTENTS

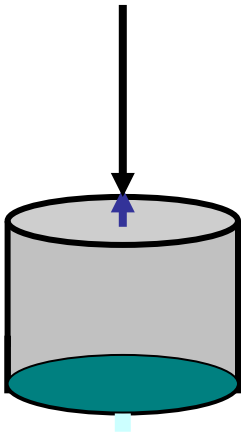
EQUILIBRIUM PRESSURE REGARDING
CONVENTIONAL PISTON ACTUATORS WITH BOUNDARY FACES OF 23.953 IN²
AND A CONSTANT LOAD OF 59.75 POUNDS



69.12"WG (2.494 PSI) PRESSURE APPLIED TO PISTON'S 23.953 IN² BOUNDARY FACE AT EQUILIBRIIUM

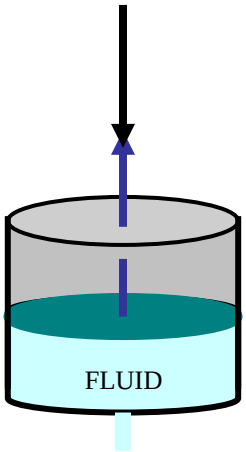
INCHES OF LIFT AT EQUILIBRIUM

LOAD 59.75#
PISTON FORCE < 59.75#
FULLY RETRACTED



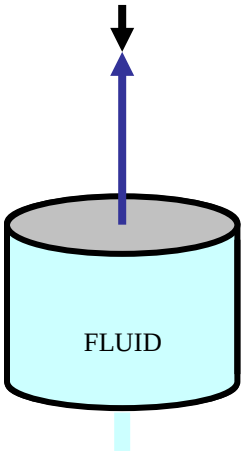
FLUID PRESSURE
< 69.12 " WG (2.494 PSI)
LOAD FORCES PISTON TO
PISTON'S MINIMUM STROKE

LOAD 59.75#
PISTON FORCE = 59.75#
EQUILIBRIUM



FLUID PRESSURE
= 69.12"WG (2.494 PSI)
ANY POINT IN PISTON'S
STROKING RANGE

LOAD 59.75#
PISTON FORCE > 59.75#
FULLY DRIVEN



FLUID PRESSURE
> 69.12"WG (2.494 PSI)
FLUID LIFTS LOAD TO
PISTON'S MAXIMUM STROKE

The above graph illustrates that a piston with a constant load of 59.75 pounds and a boundary face of 23.953 IN² requires a pressure of 69.12" WG (2.494 PSI), maintaining equilibrium at all points in its stroke.

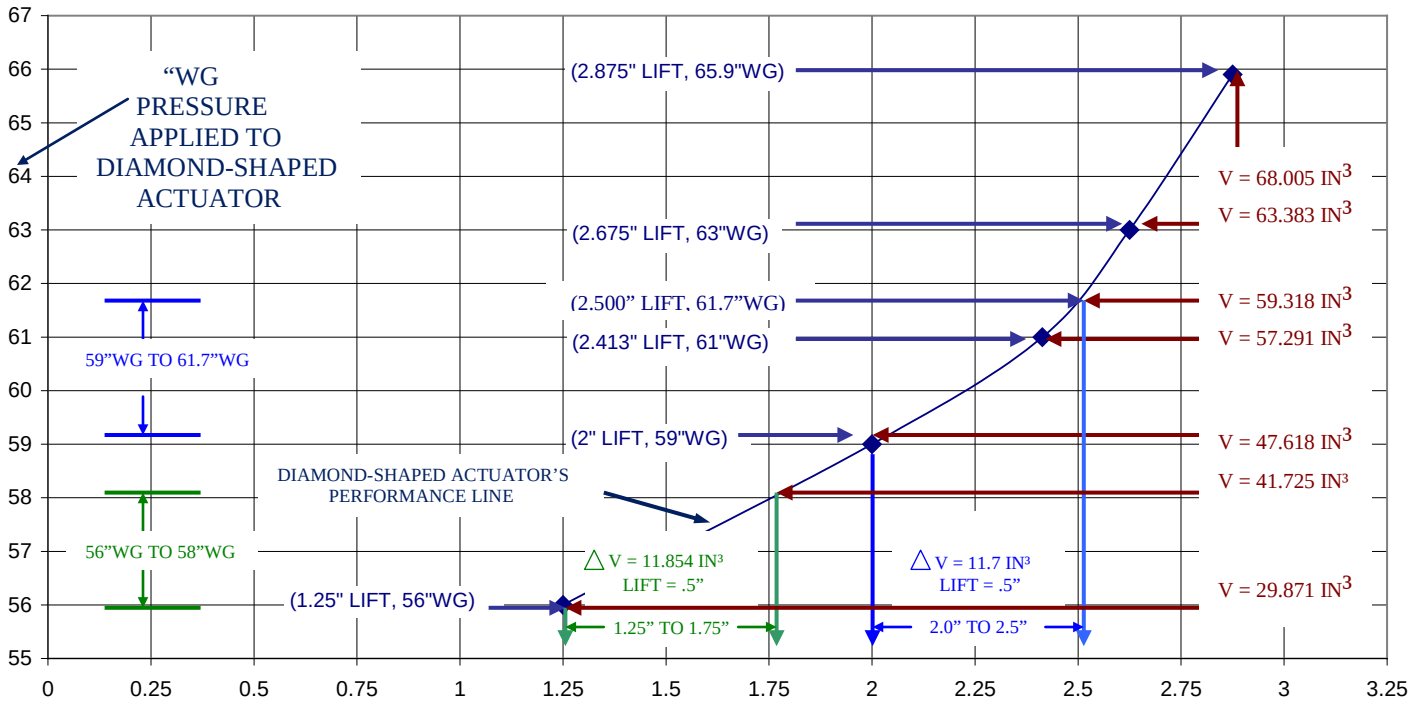
If another piston actuator receives an identical volume of fluid as the above example, with a boundary face twice as large (2 x 23.953 IN² = 47.906 IN²), its force is doubled; however, the stroke is one-half. Travelling one-half the distance of the above piston actuator, while producing double the force, generates exactly the same amount of work as the illustrated piston

The fluid equation W = PV applies to conventional piston actuators regarding work, pressure and volume. The relationship is linear.

The work input required for each .5" stroke for the illustrated piston is:

W = PV
= 2.494 PSI x (.5" x 23.953 IN²)
= 2.494 PSI x 11.9765 IN³
= 29.87 in/lb

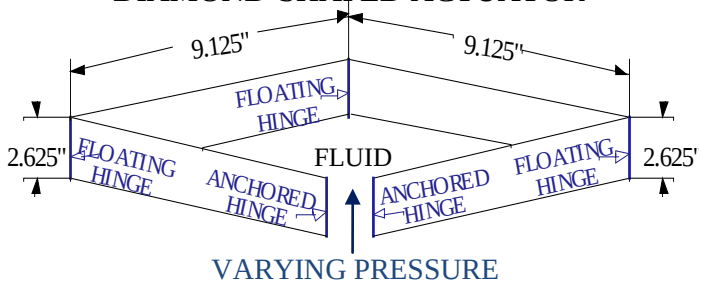
DIAMOND-SHAPED ACTUATOR EQUILIBRIUM POINTS
AT VARIOUS PRESSURES WITH A CONSTANT 59.75# LOAD



INCHES OF LIFT AT EQUILIBRIUM WITH A CONSTANT 59.75# LOAD

The above graph illustrates the equilibrium performance of our test model with a constant 59.75 pound load.

DIAMOND-SHAPED ACTUATOR



The table below presents data regarding two segments of travel: each being one half inch.

SEGMENT	TRAVEL	VOLUME CHANGE	LOAD	FLUID PRESSURE		
				LOW	HIGH	AVERAGE
1.25"-1.75"	.5"	11.854 IN³	59.75 lb	56" WG	58.0" WG	57.00" WG
2.00"-2.50"	.5"	11.700 IN³	59.75 lb	59" WG	61.7" WG	60.35" WG

The output is equal regarding both segments of travel, each lifting 59.75 lb through .5".

(W=FD) W = 59.75 lb x .5 in
= 29.87 in/lb

The input work for one segment from 1.25" to 1.75" is:

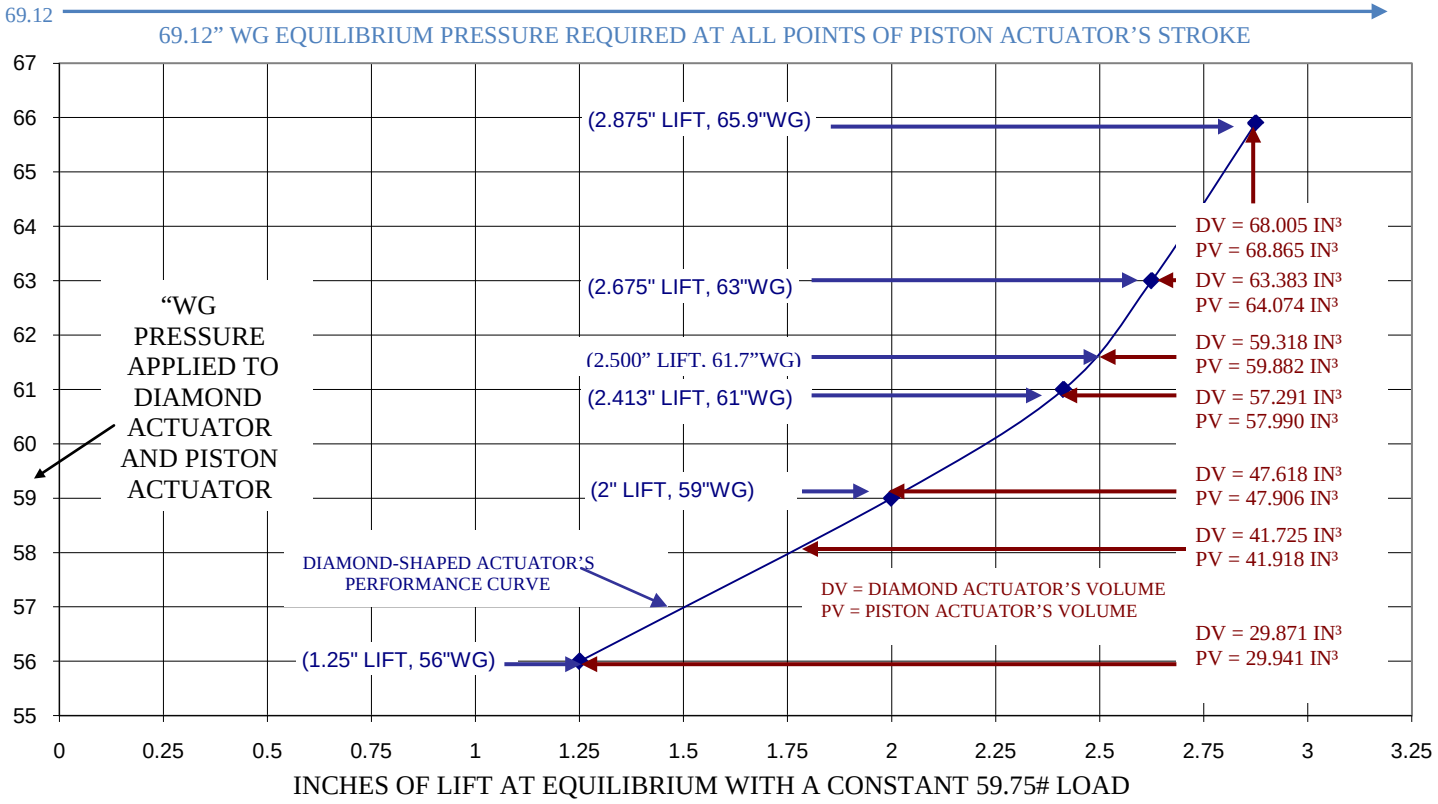
(W=PV) 57" WG (2.057 PSI) x 11.854 IN³ = 24.38 in/lb

The work input for the segment from 2.0" to 2.5" is:

(W=PV) 60.35" WG (2.178 PSI) x 11.7 IN³ = 25.48 in/lb

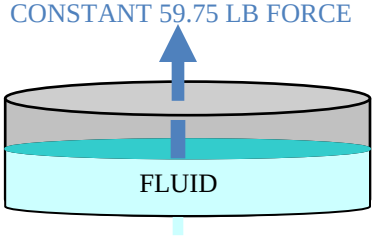
NOTE: The work output for both segments is equal (29.87 in/lb), maintaining equilibrium, but the work inputs are different (24.38 in/lb and 25.48 in/lb).

EQUILIBRIUM COMPARISON REGARDING THE DIAMOND-SHAPED ACTUATOR AND THE CONVENTIONAL PISTON ACTUATOR



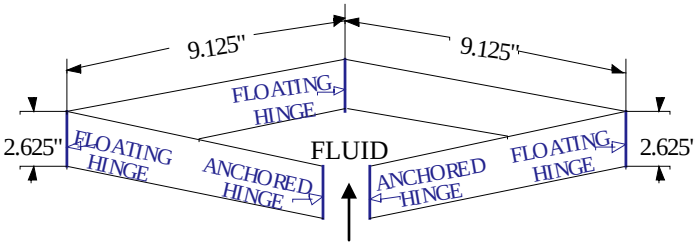
CONVENTIONAL PISTON ACTUATOR

CONSTANT 59.75 LB FORCE



CONSTANT PRESSURE OF 69.12"WG (2.494 PSI)

DIAMOND-SHAPED ACTUATOR



VARYING PRESSURE

The table below presents the efficiency comparison regarding equilibrium with an equal load of 59.75 pounds on both the piston actuator and the diamond-shaped actuator.

TRAVEL	PISTON ACTUATOR EQUILIBRIUM PRESSURE	DIAMOND EQUILIBRIUM PRESSURE	DIAMOND'S ADVANTAGE
1.250"	69.12" WG (2.4944 PSI)	56.0" WG	18.98%
1.750"	"	58.0" WG	16.08%
2.000"	"	59.0" WG	14.64%
2.413"	"	61.0" WG	11.75%
2.500"	"	61.7" WG	10.73%
2.675"	"	63.0" WG	8.85%
2.875"	"	65.9" WG	4.66%

NOTE:

The piston actuator requires the same pressure of 69.12" WG (2.494 PSI) at all points in its travel, maintaining the equilibrium force of 59.75 pounds to match the 59.75 pound load.

The diamond actuator requires varying pressures during its illustrated travel maintaining an equilibrium force of 59.75 pounds matching the 59.75 pound load.

SUMMARY

-1- The equation W = PV defines fluid performance regarding conventional piston actuators.

The work input for every .5" of the example conventional piston actuator's travel requires 29.87in/lb of work. The input work matches the output work of 29.87 in/lb. The relationship is linear.

-2- The equation W = PV does not define fluid performance regarding diamond-shaped actuators.

The two example .5" travel segments of our model produced identical work output of 29.87 in/lb, but their work input was different, being 24.38 in/lb and 25.48 in/lb.

Both the volume and pressure were different for each travel segment.

In this case W = W; however, PV for the first segment of travel ≠ PV for the second segment of travel.

WORK SUMMARY OF EXAMPLE ACTUATORS

ACTUATOR STYLE	TRAVEL RANGE	WORK RELATIONSHIP		
CONVENTIONAL PISTON	ANY .5" OF DRIVE	WORK IN (29.87 in/lb)	=	WORK OUT (29.87 in/lb)
DIAMOND-SHAPED	.5" (1.25" TO 1.75")	WORK IN (24.38 in/lb)	≠	WORK OUT (29.87 in/lb)
DIAMOND-SHAPED	.5" (2.00" TO 2.5")	WORK IN (25.48 in/lb)	≠	WORK OUT (29.87 in/lb)

-3- The diamond-shaped actuator achieves more work relative to a conventional piston actuator with identical fluid input, regarding both pressure and volume. This occurs only during the first portion of the diamond-shaped actuator's travel.

-4- The diamond-shaped actuator is more efficient than the conventional piston actuator, at varying magnitudes, depending on the angle variation of the diamond-shaped actuator's walls.

-5- This is the main corner stone regarding the patented invention "DIAMOND-SHAPED FLUID POWERED LINKAGE, SYSTEM AND ENGINE".

The efficiency differential produces a work differential, allowing the diamond-shaped actuator to attain its complete source of fluid via pumping the fluid from the conventional piston actuator. The diamond-shaped actuator expends approximately 85% of its work potential generating the total fluid requirement of that action. The diamond-shaped actuator experiences a surplus work potential of approximately 15% after generating its own total fluid requirement relating to each stroke.