MAC'S ADVANTAGE
Valves that don't stick

- Balance
- High shifting forces
- Wiping action
- Minimal friction
Let us show you via high performance demonstration kits and animated software,

**HOW MAC’S PERFORMANCE ADVANTAGES HELP MAKE YOUR EQUIPMENT MORE RELIABLE - FASTER - MORE REPEATABLE.**

**TLD/PLD**

The TLD function (Traveling Lab Demonstration) measures critical valve performance characteristics - Shifting forces, Response Time, Speed, Repeatability and Flow. The PLD function (Proportional Lab Demonstration) measures critical proportional regulation characteristics - Response Time, Accuracy, Hysteresis, Repeatability and Flow.

**Animation**

Animated Software shows inner workings of various Air Valve Designs - Powerful educational tool for learning about how air valves function.
Valves that don’t stick

Consult our manual for the use, installation and maintenance of our Mac Valves (see general catalog).
Sequence of events

(A) - Solenoid is de-energized
(B) - Solenoid is energized
- Armature is attracted magnetically downwards, extending push pin which shifts poppet from upper to lower seat.
- Movable pole piece is attracted magnetically upwards to meet the armature which compensates for difference between solenoid stroke and shorter valve stroke. Armature and pole piece therefore close regardless of valve position.

ADVANTAGES

- Short stroke solenoid produces high energization shifting force.
- High force return spring due to high force solenoid, maximizes both energization and de-energization shifting forces.
- Built-in wear compensation - valve stroke is shorter than solenoid stroke.
- Solenoid closes regardless of position of valve, virtually eliminating coil burnout on AC service.

Short stroke = High force = Valves that don’t stick
Short Stroke - Oval Shaped Armature

Typical solenoid force curve

**SHORT STROKE**
- Short Stroke = High solenoid force
- Short Stroke = High return spring force
- Short Stroke = Low current to shift solenoid

**OTHERS: LONG STROKE**
- Long Stroke = Low solenoid force (off seat)
- Long Stroke = Low return spring force
- Long Stroke = High current to shift solenoid

**OVAL SHAPE ARMATURE**
- Oval shape armature = Increased coil winding
- Oval shape armature = Increased coil iron volume
- Oval shape armature = Higher shifting forces

**OTHERS: ROUND ARMATURE**
- Round armature = Less coil winding
- Round armature = Less coil iron volume
- Round armature = Lower shifting forces

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TYPICAL UNBALANCED POPPET 3-WAY AIR VALVE

SKINNER TYPE

- Pole piece
- Exhaust port
- Restricted exhaust through pole piece
- Shading coil
- Long stroke solenoid (GAP)
- Exhaust poppet seal
- Armature
- Weak return spring
- Inlet poppet seal
- Poppet seat

ASCO TYPE

- Pole piece
- Shading coil
- Long stroke solenoid (GAP)
- Weak return spring
- Armature
- Inlet poppet seal
- Restricted exhaust port
- Exhaust poppet seal
- Weak return spring

UNBALANCED POPPET = INCONSISTENT LOW SHIFTING FORCES

- Spring force (holding poppet on seat) is constant.
- Inlet air pressure acts upon a single sealing area.
- Inlet pressure X sealing area creates a force that opposes return spring shifting force.
- Force created by inlet air pressure on inlet poppet seal varies as inlet air pressure varies.
- Changing inlet pressures therefore affect energizing and de-energizing shifting forces.

DISADVANTAGES

- Normal pressure fluctuations cause inconsistent shifting forces
- Air pressure fights return spring, reducing shifting forces
- Weak return spring force
- Exhaust contaminants pass through operating solenoid parts causing sticking and coil burnout (SKINNER type)
- When air pressure rating is increased, the inlet and exhaust orifice must be reduced thereby decreasing flow through the valve
- Multiple models to cover range of vacuum to 10 Bar, 150 PSI, each with separate flow rating
- Pilot valves rated for 10 Bar, 150 PSI have very low flow
- Exhaust, located in pole piece, is restricted due to core iron requirements (SKINNER type)
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SMALL DIRECT SOLENOID POPPET VALVE

ADVANTAGES

- 4 balanced poppets on a one-piece valve stem
- End poppets seal first on conical seats and cushion inlet poppet, eliminating cutting
- Exhaust seals are not under inlet pressure thus reducing friction
- Integral non-rising flow controls available
- Short stroking balanced poppet allows for direct solenoid operation with high shifting forces, minimized friction, fast response and high flow in a small package

Valves that don’t stick
4-WAY PILOT OPERATION

DIRECT OPERATED

**ADVANTAGE:**
No minimum operating pressure.

**DISADVANTAGE:**
Sticking due to low shifting forces in both directions on long stroke valves.

3-WAY PILOT OPERATED (Spring Only Return)

**ADVANTAGE:**
High shifting force in one direction.

**DISADVANTAGE:**
Sticking due to low return shifting force. Must be able to operate at low pressure. Therefore, return spring force is low.

3-WAY PILOT OPERATED (Air and Spring Return)

**ADVANTAGE:**
High shifting forces in both directions.

**DISADVANTAGE:**
Resistance to energizing shifting forces from air/spring return.

4-WAY PILOT OPERATED (Air Return)

**ADVANTAGE:**
Highest shifting forces in both directions. No resistance to shifting force in either direction. Full return piston area is utilized.

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3-WAY
Solenoid Pilot Operated Large Valve

Small direct 3-way solenoid operated valve

SHIFTING FORCES unaffected by changing air pressure (IN/EXH)
- BALANCE -

SHIFTING FORCES virtually unaffected by typically contaminated air
- WIPING ACTION -

Low friction minimizes resistance to SHIFTING FORCES
- MINIMAL FRICTION -

Valves that don’t stick
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SPOOL PLUS BORE = WIPING ACTION = VALVES THAT DON’T STICK

MAXIMIZES ABILITY TO OPERATE UNDER CONTAMINATED CONDITIONS, WHILE MINIMIZING FRICTION

- Large minimum piston area (3 cm²) provides high shifting force even at minimum operating pressure
- Air/Spring assures maximum return shifting force
- Precision ground bonded spool controls compression - wipes contaminants away with minimum friction
- Chemically hardened seals eliminate creep, reduce friction and increase life
- Lubricant in rubber reduces friction - enhances nonlube service
- Two seals each controlling a single orifice provide a short stroke, less wear, minimum friction and high flow in a small package
- Patented centering seals ensure spool alignment for minimum wear
- Bore is machined, roller burnished and polished for hard smooth surface and glasslike finish - minimum friction, minimum wear and long life
- Lightweight aluminium spool allows for fast response
- One piece spool - simple construction and easy maintenance

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PILOT SYSTEM

ADVANTAGES

HIGH, CONSISTENT SHIFTING FORCES IN BOTH DIRECTIONS

CHECKED ACCUMULATOR

- Accumulator stores several times volume of air required to shift valve
- Accumulator (not direct inlet) feeds air spring and pilot
- Check valve protects accumulator from inlet pressure fluctuations
- Accumulator bleeds to atmosphere when inlet pressure is removed

AIR & SPRING RETURN

- Spring provides consistent shifting force at low pressure
- Air provides maximum shifting forces at both higher and lower pressures
- Air spring counterbalances air pilot pressure for consistent operation
- Spring provides memory

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THINK GLOBAL  ACT LOCAL
Our global distribution network is keeping your machines running around the clock around the world