Eaton YBV brake valves

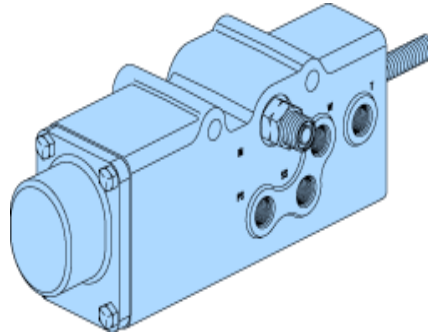**E·T·N**
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Brake valves

18 mL Brake Valve

40 mL Brake Valve

Description

- Three general types of brake valves:

  - Manual

  - Hybrid

  - Power, Load-Sensing

- Two identical brake valves mounted together in the same casting. Can be used together or separately for brake assist turning.

- Two modes these valves function in:
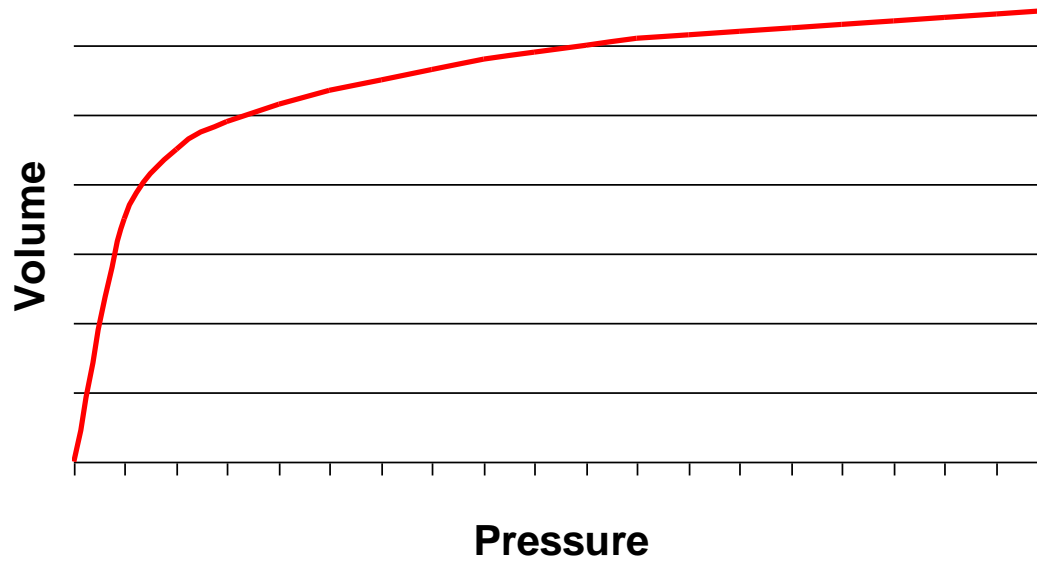
  - Power

  - Manual Back-up

Power mode

- Operates like a pressure reducing valve.

  - Force is applied to pedal.

  - Valve sends oil out to axles at a pressure that is proportional to the force applied.

  - Load sensing feeds pressure signal back to pump if more pressure is required.

  - Valve is rated for 3600 psi.

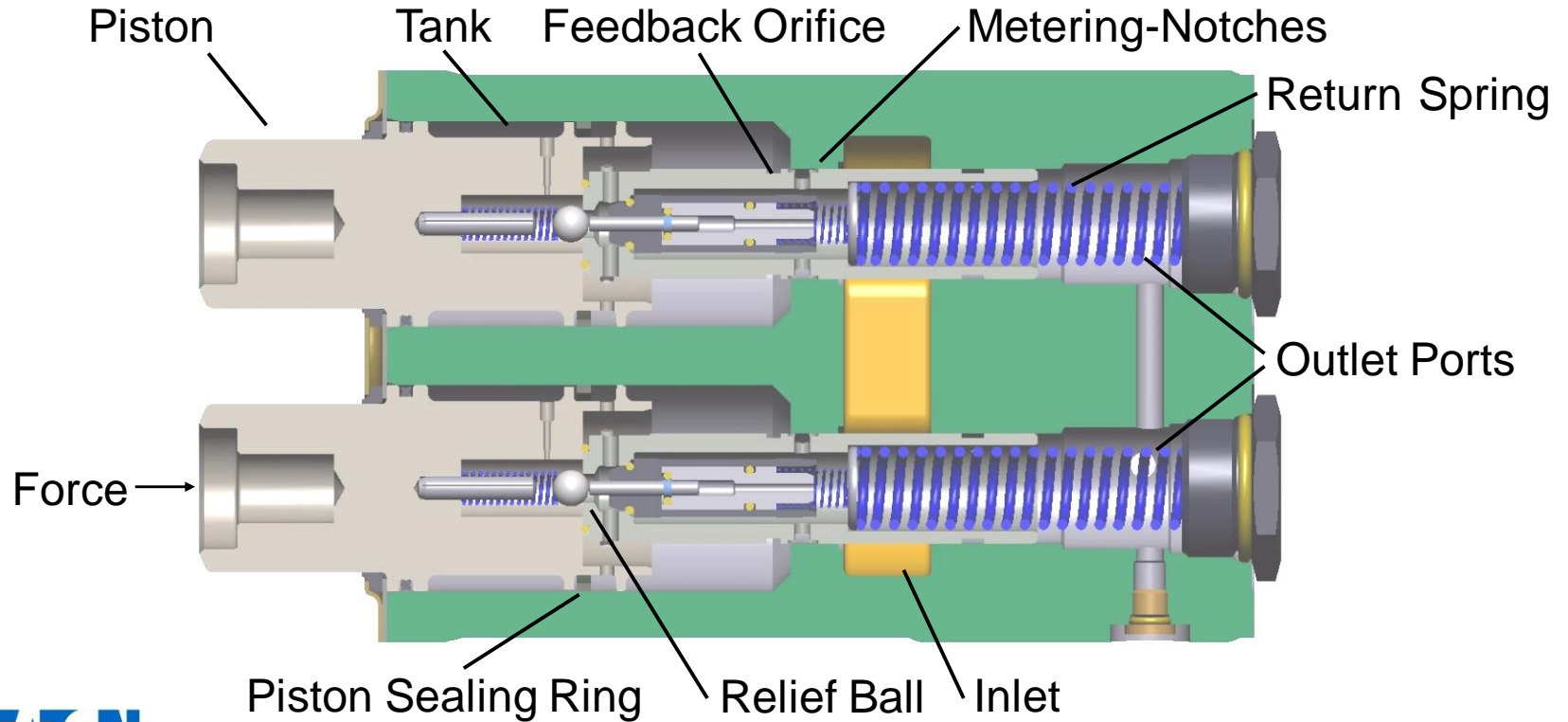 - Valve can not be used with brake fluid.

Manual mode

- First stage of brake valve pumps out a high volume of oil at low pressure.

- Transitions to second stage that pumps out a low volume of oil at high pressure.

- Pedal forces remain constant for manual and power modes.

- If pressure is lost at inlet to the brake valve or the pressure built in the brake valve is higher than the inlet pressure:

    - Inlet and load sensing functions are shut off.

    - The valve operates as a two stage pump.

Manual mode

Axle Pressure Vs Volume

Volume vs Pressure

Brake Valve - Y-BV

Piston | Tank | Feedback Orifice | Metering-Notches

Return Spring

Outlet Ports

Force

Piston Sealing Ring | Relief Ball | Inlet

Hybrid brake valve

- Combination of power and manual valves.

- Non load sensing.

- Can be operated on low system pressures.

- Large axle pre-fill volume is filled in power mode.

- Most standard braking is done in power mode.

- When pressure built up in the valve increases above inlet pressure, valve transitions into manual mode.

- Reduced cost from power valve.

Advantages

- Power braking.

- Unlimited emergency braking.

- No change in pedal effort between power and manual braking.

- Low cost system. Eliminates the need for accumulators, charging valves, and associated plumbing and electronics used for those types of systems.

- In dual pedal applications, brake valve includes equalizing function between the two sides of the valve.

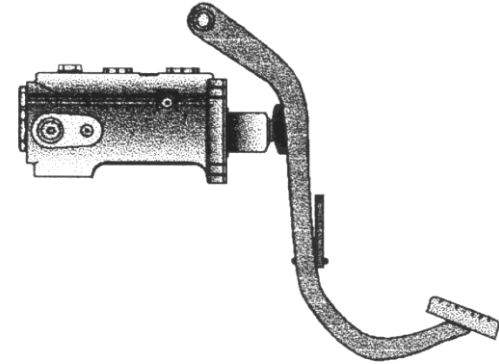- Self-bleeding function.

- Flange mounted for easy installation.

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Installation
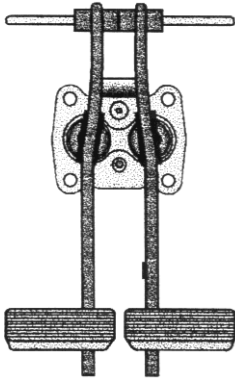
The brake valve can be actuated with separate left and right brake pedals for differential braking…
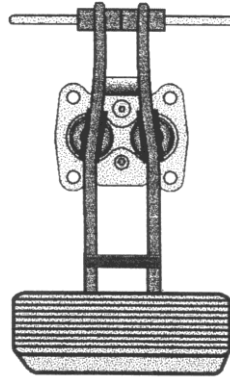
…or with one brake pedal actuating both sides.


Orientation should be from horizontal as shown or rotated up to 90° counter-clockwise with T port pointing up.

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Calculating actuation force

- To calculate the pedal force (Fp) required to actuate the brake valve.

- The calculation is true for either the power brake or emergency brake mode of the brake valve:

- $Fp = \dfrac{[\ Pb\ (psi)\ x\ 1.380\ (in^2)\ ] + 120\ (lb)}{Pr}$ ← This is the total force required to actuate both pedals at once.

- $Fp = \dfrac{[\ Pb\ (psi)\ x\ 0.690\ (in^2)\ ]\ +\ 58\ (lb)}{Pr}$ ← This is the force required to actuate only one side of the brake valve.

- Pb is the "max" pressure required for the customer's brake performance. In other words, the customer might need "Pb" brake pressure in order for his vehicle to stop in 10 feet at maximum speed.

Calculating pedal ratio

- Pr is the pedal ratio which is the mechanical advantage of the brake pedal, defined as A divided by B according to the drawing below. Typically, Pr is about 7. The angle of operation is negligible.
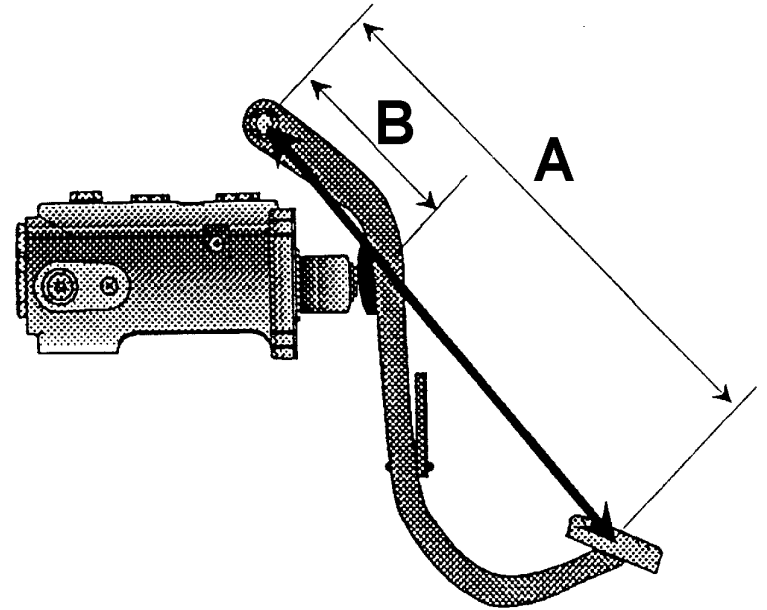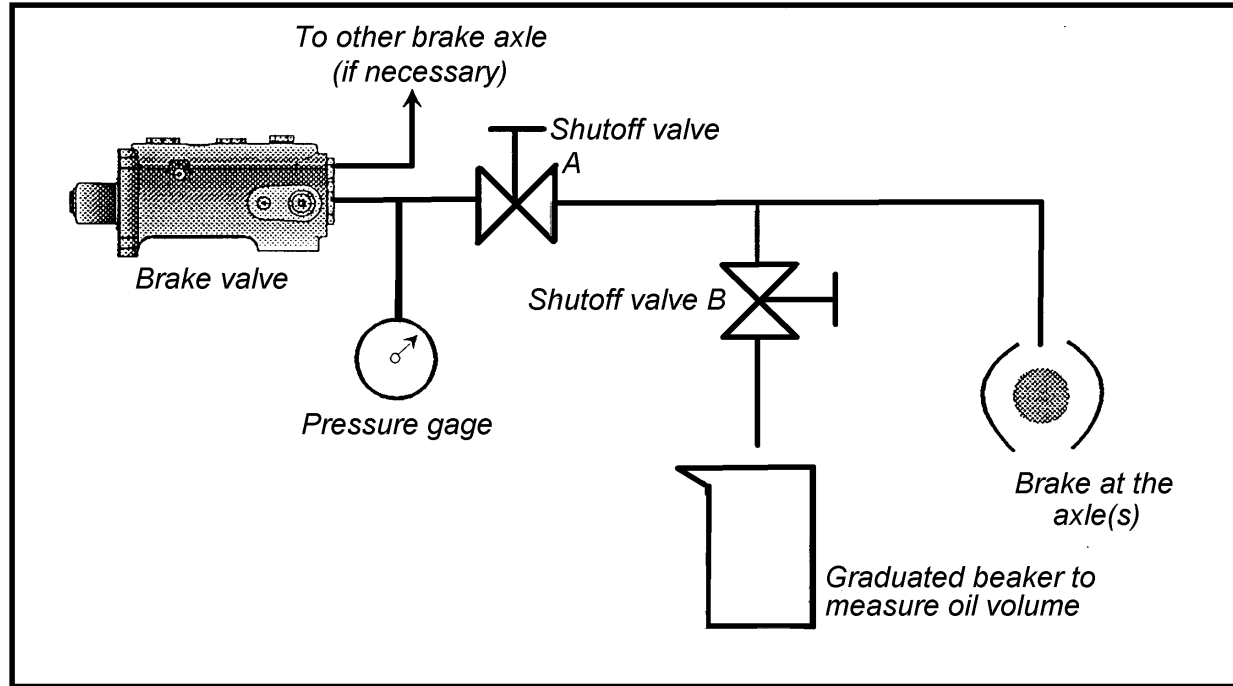
Calculating stroke

- The 18 mL brake valve has a stroke of 0.996 in. This gives a pedal stroke of 0.996 in times the pedal ratio.

- The 40 mL brake valve has a stroke of 1.291 in. This gives a pedal stroke of 1.291 in times the pedal ratio.

- Typically, the brake valve can be applied to vehicles from 50 to 500 hp.

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Calculating stroke

- Stroke = X_i (in) + $\dfrac{[V_r \text{ (in}^3)]}{A_p \text{ (in}^2)}$ + $[0.725 \times (V_p \text{ (in}^3) - V_r \text{ (in}^3))]$

- X_i = The initial stroke before pressure starts building. Either 0.321 in for the small brake valve or 0.144 in for the large brake valve.

- A_p = The area of the first stage of the valve. Either 3.896 in² for the small brake valve or 4.811 in² for the large brake valve.

- V_p = The volume of fluid that is displaced between the brake valve outlet and brake cylinder to achieve the maximum specified brake pressure. Test Procedure A on the next page identifies a test procedure which can roughly determine V_p.

- V_r = The volume of fluid that is displaced between the brake valve outlet and brake cylinder in order to reach either 176 psi (if using the small brake valve) or 79 psi (if using the large brake valve). Test Procedure A on the next page identifies a test procedure which can roughly determine V_r.

Testing for axle compliance

To other brake axle
(if necessary)

Shutoff valve
A

Brake valve

Shutoff valve B

Pressure gage

Brake at the
axle(s)

Graduated beaker to
measure oil volume

Testing for axle compliance

- This procedure should be performed for the left brake and the right brake (if applicable). Note that the Vr and Vp values used in the SER sizing calculations are the total Vr and Vp values. For example: Vr = Vr (left side) + Vr (right side).

  1. Install shutoff valves and a pressure gage in left and right brake line as close to the brake valve as possible. Left and right sides may be tested together or individually. Open shutoff valve(s) A and close shutoff valve(s) B.

  2. Apply brakes to develop 79 psi for the big brake valve or 176 psi for the small brake valve.

  3. Close shutoff valve(s) A. Open shutoff valve(s) B and record the volume of oil that comes out for both the left and right brakes. This volume of fluid is Vr.

  4. Close shutoff valve(s) B. Open shutoff valve(s) A. Repeat steps 2 and 3 at pressure Pb. Pb is defined in the SER as the "max" pressure required by the customer to meet the vehicle's braking requirements. The volume of fluid collected is Vp.

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Brake valve features & benefits

Customer needs	Product benefits	Product features
Operator productivity	Emergency backup capability	Transfer from powered to manual braking
	Improved efficiency	No accumulator needed
	Less braking force needed	Powered braking valve
Machine performance	Reduce number of components	Elimination of accumulator
	Vehicle does not stray when braking	Balancing feature built in
	Improved system safety	Valve acts as 2 stage pump

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