POWER BRAKE SYSTEM

HYDROMAX
MINI-MASTER CYLINDER

HYDRAULIC BOOSTER

FEATURES:

- o LIGHT WEIGHT ALUMINUM HOUSING
- o ELECTRIC MOTOR PUMP "BACKUP SYSTEM"
- o DASH PANEL MOUNTING STANDARD WITH REMOTE LOCATION CAPABILITY
- o MULTIPLE POWER SOURCE CAPABILITY
  - PRIMARY POWER STEERING PUMP
  - SEPARATE PUMP

(FOR MORE DETAILS - SEE BCBCD 3148 TECHNICAL MANUAL)

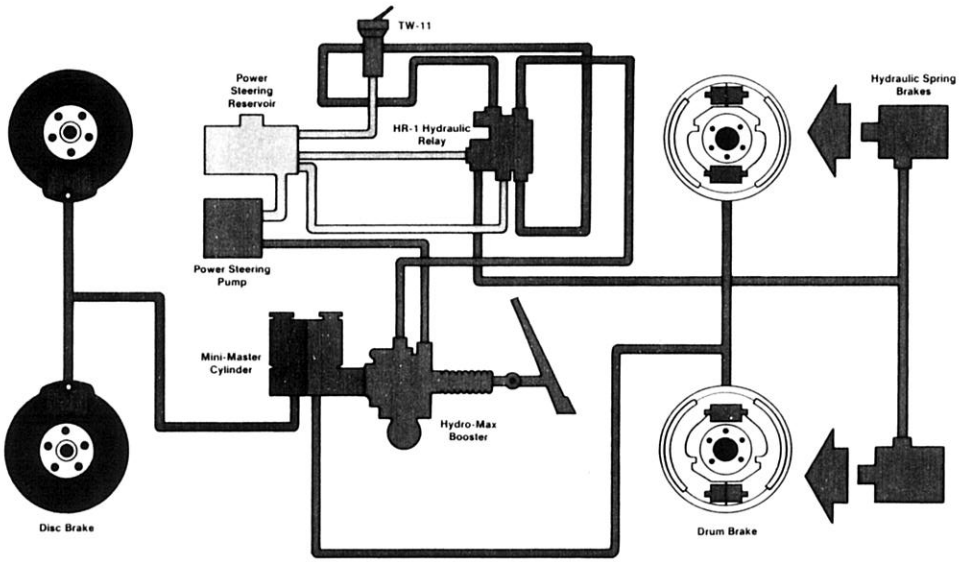
MINI MASTER CYLINDER

FEATURES:

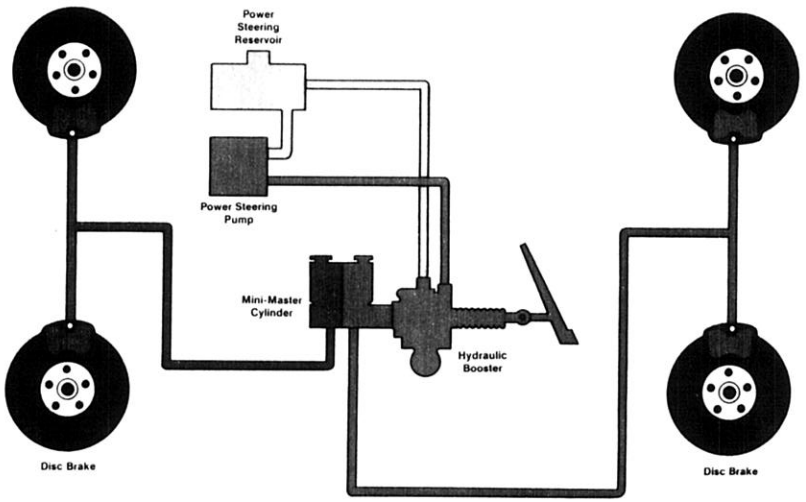
- 1-3/4 AND 2.0" DIAMETERS IN PRODUCTION
- COMPACT DESIGN
- TILT COMPENSATING VALVES
- ATTACHED OR REMOTE NYLON RESERVOIR
  - 50 IN^3
  - 80 IN^3
- INTEGRAL DELPA 'P' AND FLUID LEVEL INDICATOR AVAILABLE

Power Hydraulic Brake Systems

FORD POWER HYDRAULIC SYSTEM



GM OR NAVISTAR POWER HYDRAULIC SYSTEM



Primary Brake Circuit
Secondary Brake Circuit
Parking System Circuit
Power Steering Supply
Power Steering Return

CAUTION: Use Brake Fluid for Primary and Secondary Circuits.
Use Power Steering Fluid for Power and Parking Circuits.

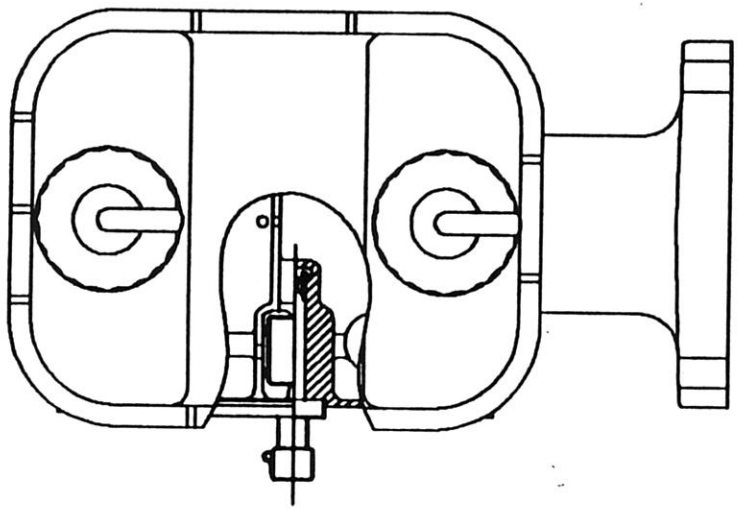
Bendix

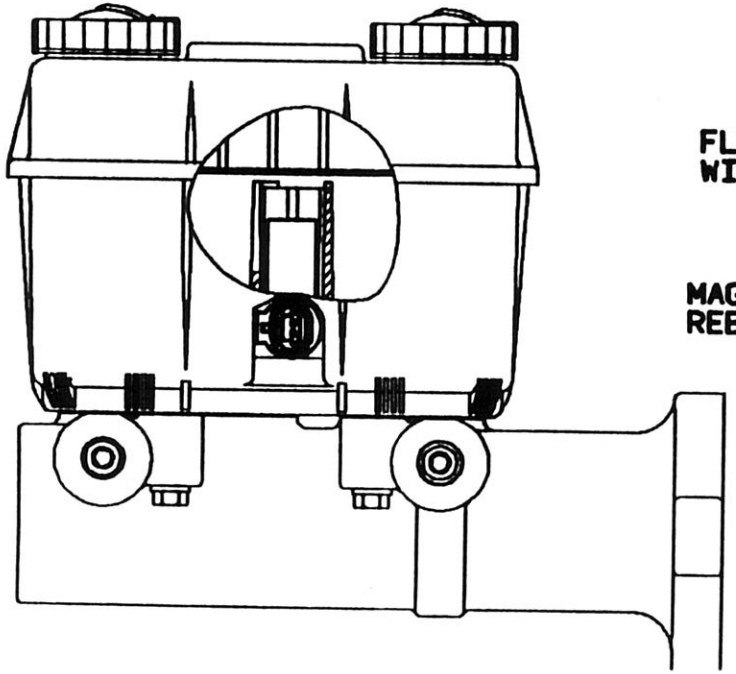
and hydraulic

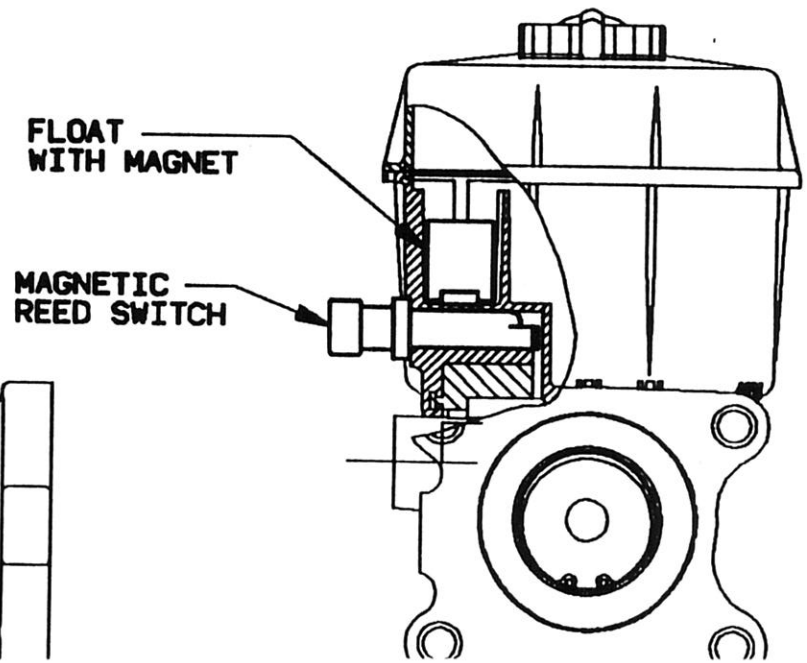
The air brake experts.

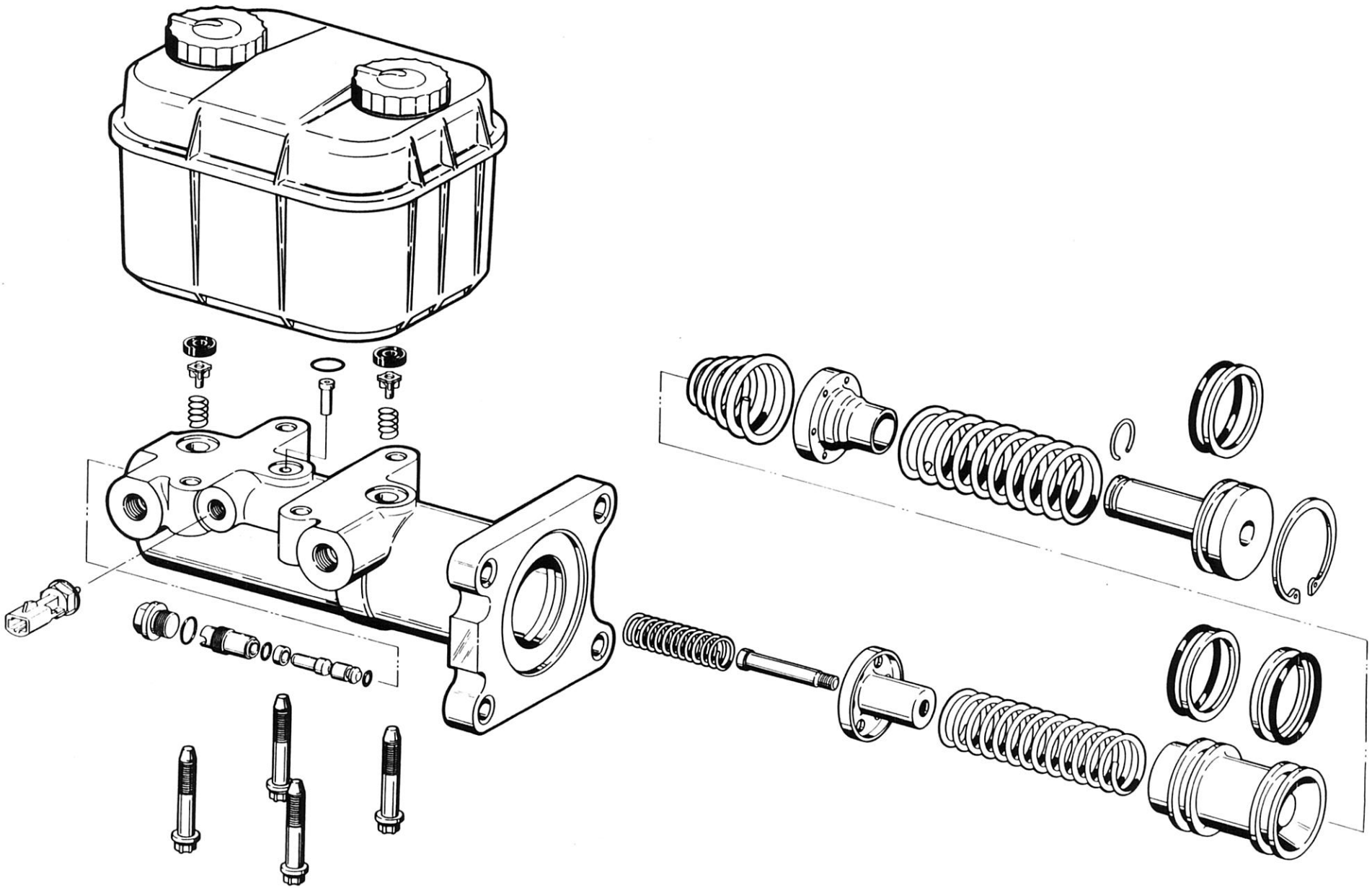
Printed in U.S.A.

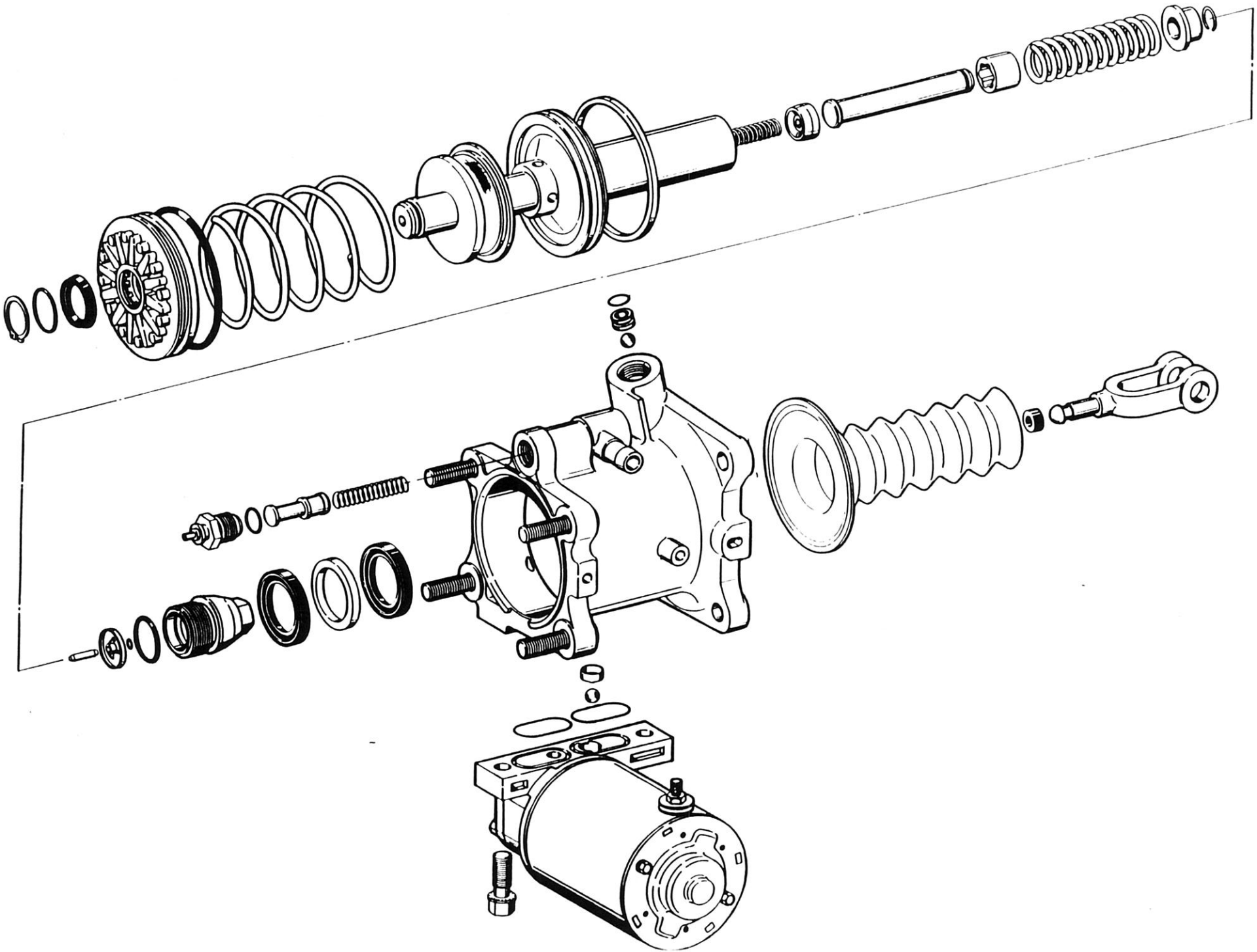
BENDIX MASTER CYLINDER WITH FLUID LEVEL INDICATOR











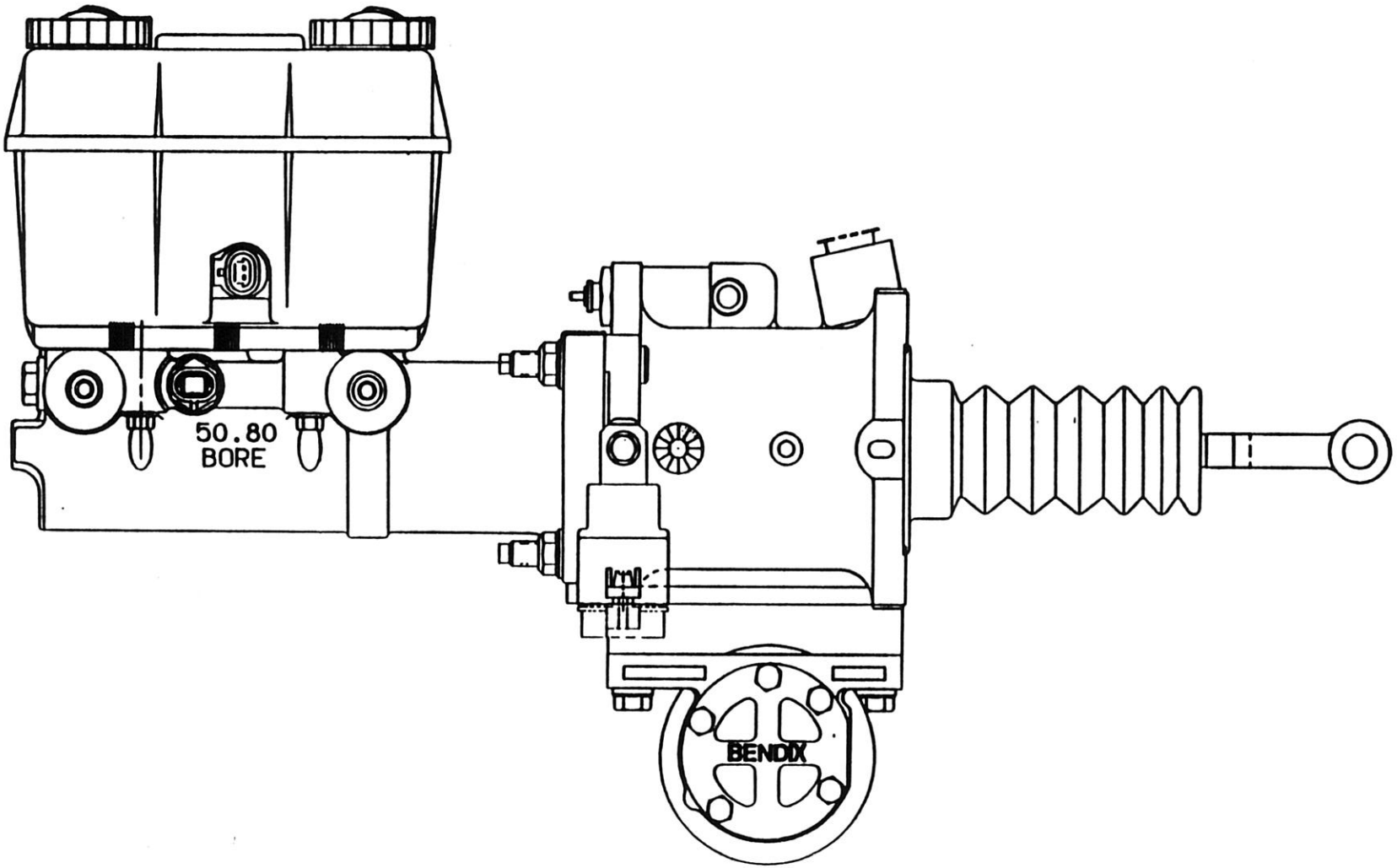
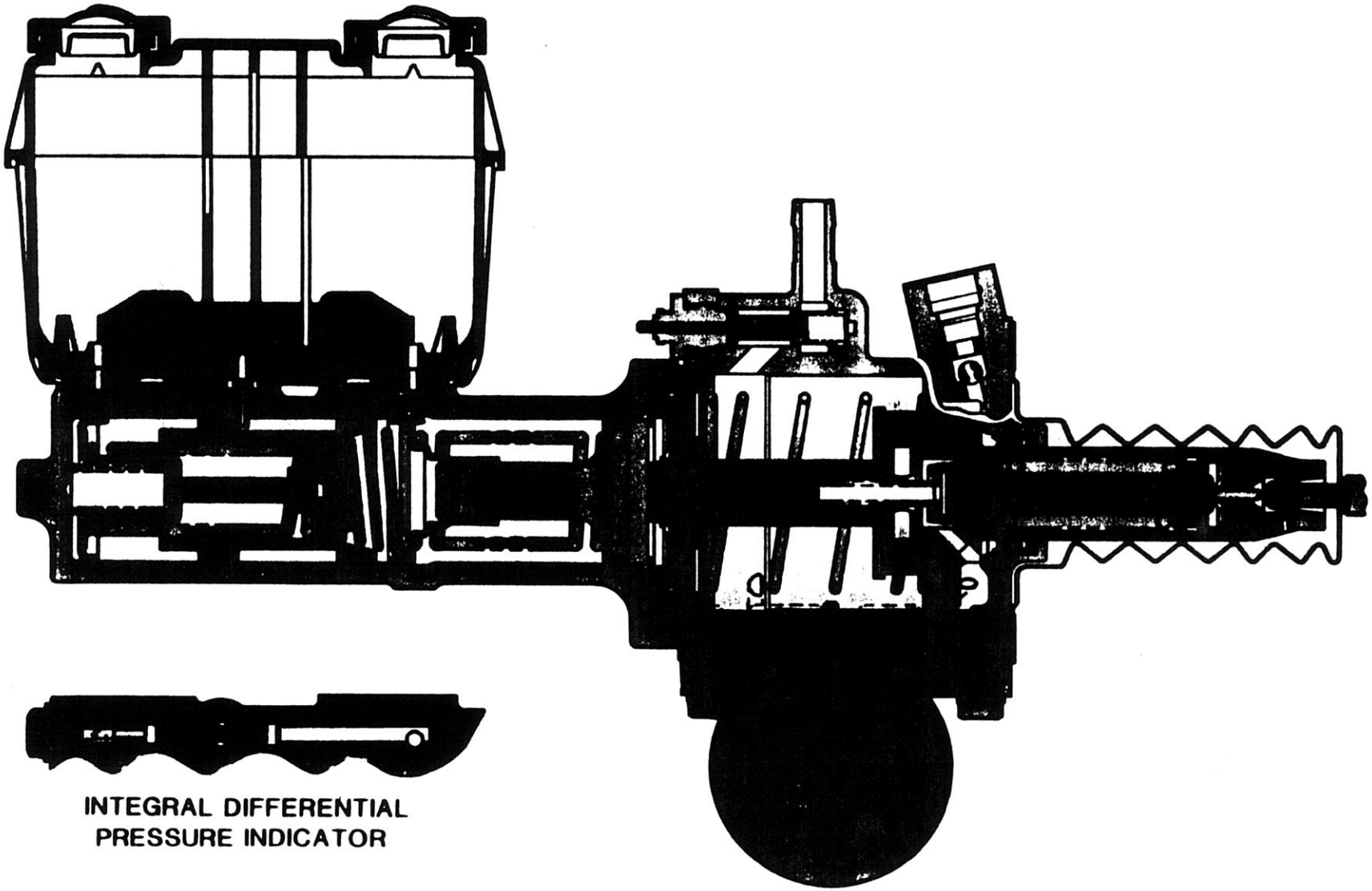

50.80
BORE
BENDIX

PHOTO #26282 H

HYDROMAX II BOOSTER & MINI MASTER CYLINDER
80 CU. IN. RESERVOIR/2.00 IN. MASTER CYLINDER BORE



INTEGRAL DIFFERENTIAL
PRESSURE INDICATOR

BRAKE ACTUATION FUNDAMENTALS

- MASTER CYLINDER SUPPLIES HIGH PRESSURE BRAKE FLUID TO THE FOUNDATION BRAKES.

- BOOSTER SUPPLIES FORCE TO THE MASTER CYLINDER.

  - THE BOOSTER MERELY AMPLIFIES THE FORCE OF THE DRIVER'S FOOT AGAINST THE BRAKE PEDAL. DRIVER EFFORT ALONE IS INSUFFICIENT TO ACHIEVE DESIRED STOPPING PERFORMANCE IN A MEDIUM TRUCK.

HYDRO-MAX II AND MINI MASTER CYLINDER
FUNCTIONAL DESCRIPTION

- BOOSTER

  - NORMAL MODE OPERATION - ENGINE RUNNING AND BOOSTER HYDRAULIC SUPPLY OKAY.

    -- WITH THE BRAKE PEDAL RELEASED, THE POWER STEERING PUMP SENDS FLUID THROUGH THE BOOSTER UNRESTRICTED. THE FLUID EXITS THE HYDRO-MAX AND RETURNS TO THE PUMP RESERVOIR.

    -- WHEN THE PEDAL IS APPLIED, THE THROTTLING VALVE IN THE BOOSTER RESTRICTS HYDRAULIC FLOW WHICH INCREASES THE PRESSURE ON THE BACKSIDE OF THE POWER PISTON. THIS PRESSURE CAUSES THE PISTON TO STROKE, WHICH THEN MOVES THE PRIMARY PISTON IN THE MASTER CYLINDER. THE DRIVER FEELS A FEEDBACK FORCE THAT IS PROPORTIONAL TO THE BRAKE PRESSURE, BECAUSE THE BOOSTER PRESSURE PUSHES ON A DESIGNED-IN REACTION AREA IN THE THROTTLING VALVE MECHANISM. THIS FEEDBACK ENABLES THE OPERATOR TO EASILY MODULATE THE VEHICLE DECELERATION. THE MAXIMUM BOOST IS LIMITED BY AN INTERNAL RELIEF VALVE THAT LIMITS MAXIMUM BRAKE PRESSURE TO APPROXIMATELY 2100 PSI. WHEN THE DRIVER REMOVES THE PEDAL EFFORT, THE THROTTLING VALVE OPENS UP AND RELEASES THE BOOSTER PRESSURE. THE BRAKE PRESSURE AND RETURN SPRINGS PUSH THE MASTER CYLINDER BACK, WHICH IN TURN PUSHES THE BOOSTER POWER PISTON BACK TO THE RELEASED POSITION.

HYDRO-MAX II AND MINI MASTER CYLINDER
FUNCTIONAL DESCRIPTION (CON'T)

- RESERVE MODE - HYDRAULIC SUPPLY TO BOOSTER INTERRUPTED

  - AN INTERRUPTION OF HYDRAULIC FLOW THROUGH THE BOOSTER IS DETECTED BY THE FLOW SENSOR. THE SENSOR MAKES AN ELECTRICAL GROUND WHICH TRIGGERS THE RELAY TO TURN ON THE ELECTRIC MOTOR PUMP (EMP). THIS PUMP PROVIDES ENOUGH PRESSURE TO GENERATE APPROXIMATELY 60% OF THE NORMAL MAXIMUM BOOST, AND IS AVAILABLE AS LONG AS THE VEHICLE BATTERY IS CHARGED. IN THIS MODE, THE BOOSTER AND MASTER CYLINDER OTHERWISE FUNCTION THE SAME AS IN THE NORMAL MODE.

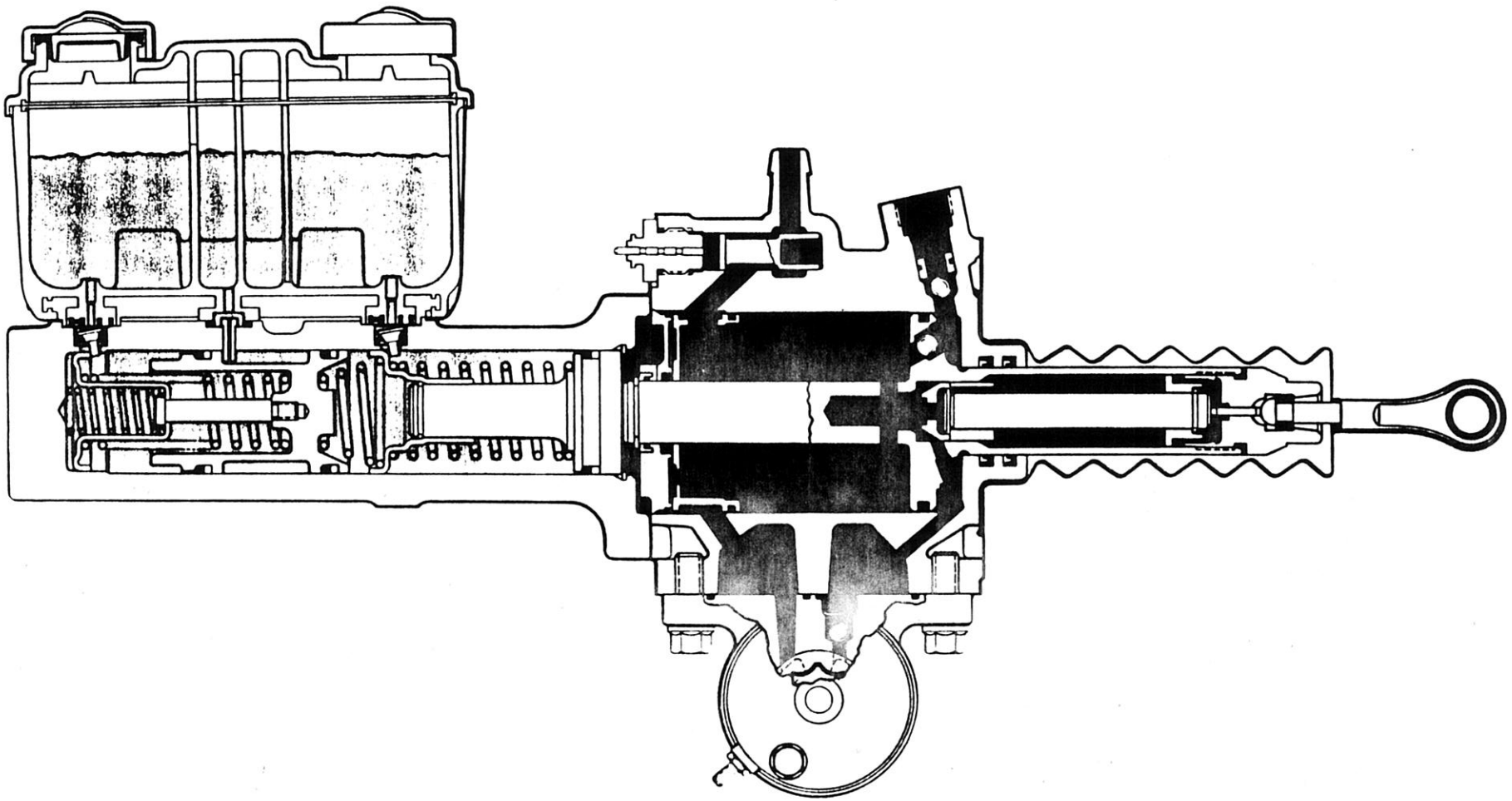
- MANUAL MODE

  - THE PEDAL ROD FORCE TRANSMITS THROUGH THE BOOSTER TO THE MASTER CYLINDER IF THE HYDRAULIC SUPPLY IS INTERRUPTED AND THE RESERVE SYSTEM IS INOPERATIVE.

- GRADUATION CURVE (SEE FIGURE)

BENDIX HYDRO-MAX

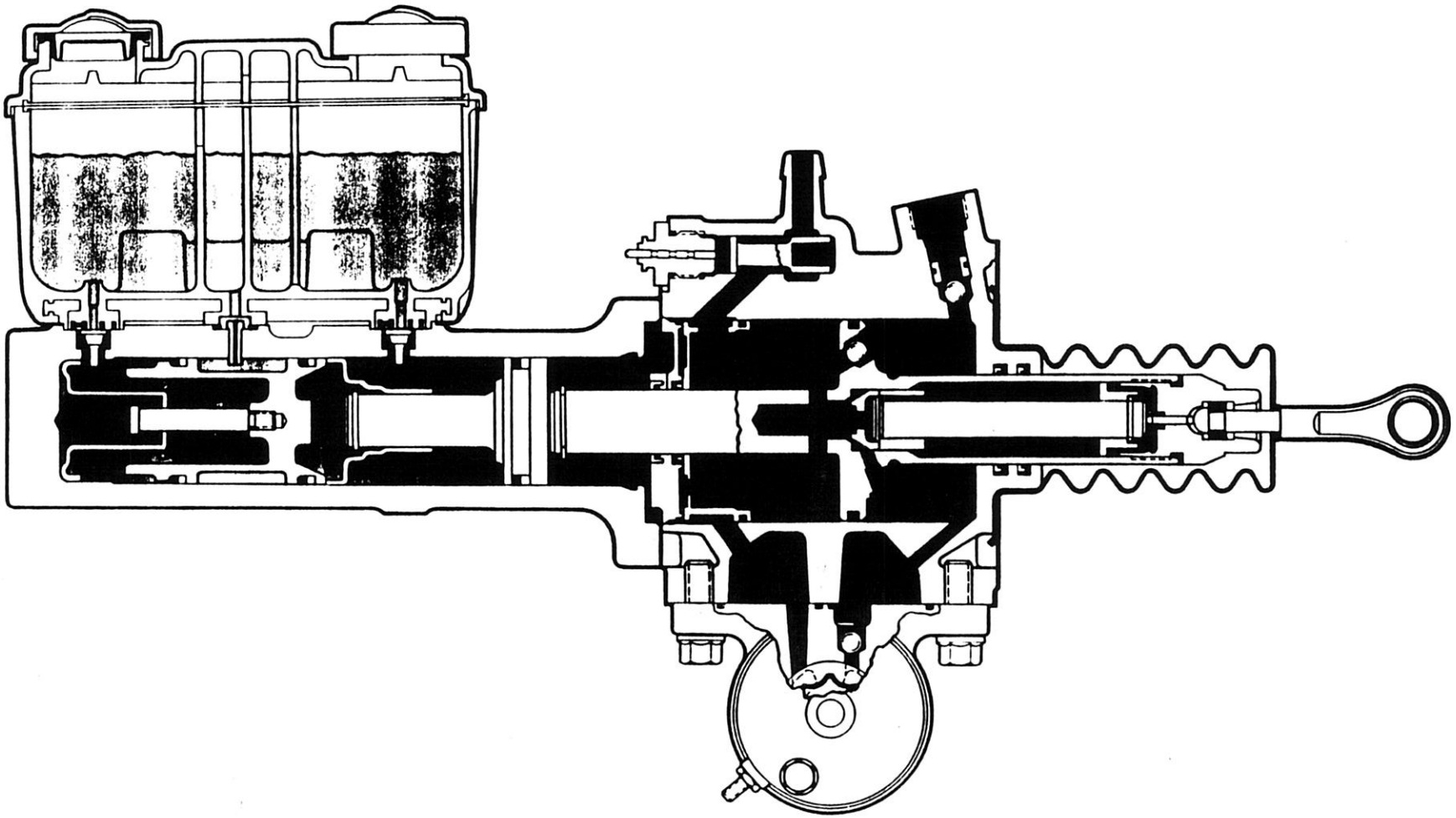
RELEASED MODE



BENDIX HYDRO-MAX

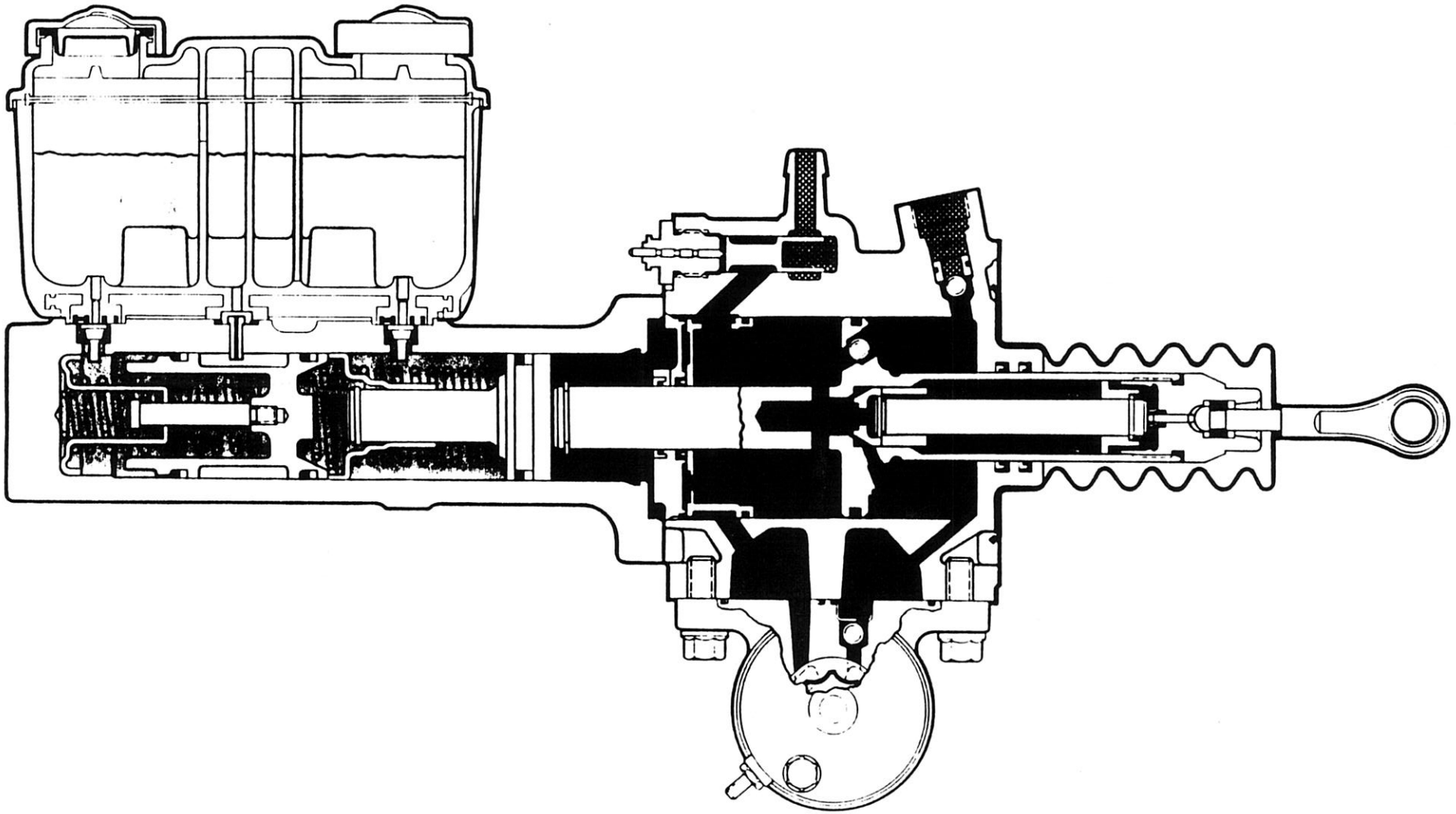
NORMAL OPERATING MODE

BRAKES APPLIED



BENDIX HYDRO-MAX

RESERVE OPERATING MODE



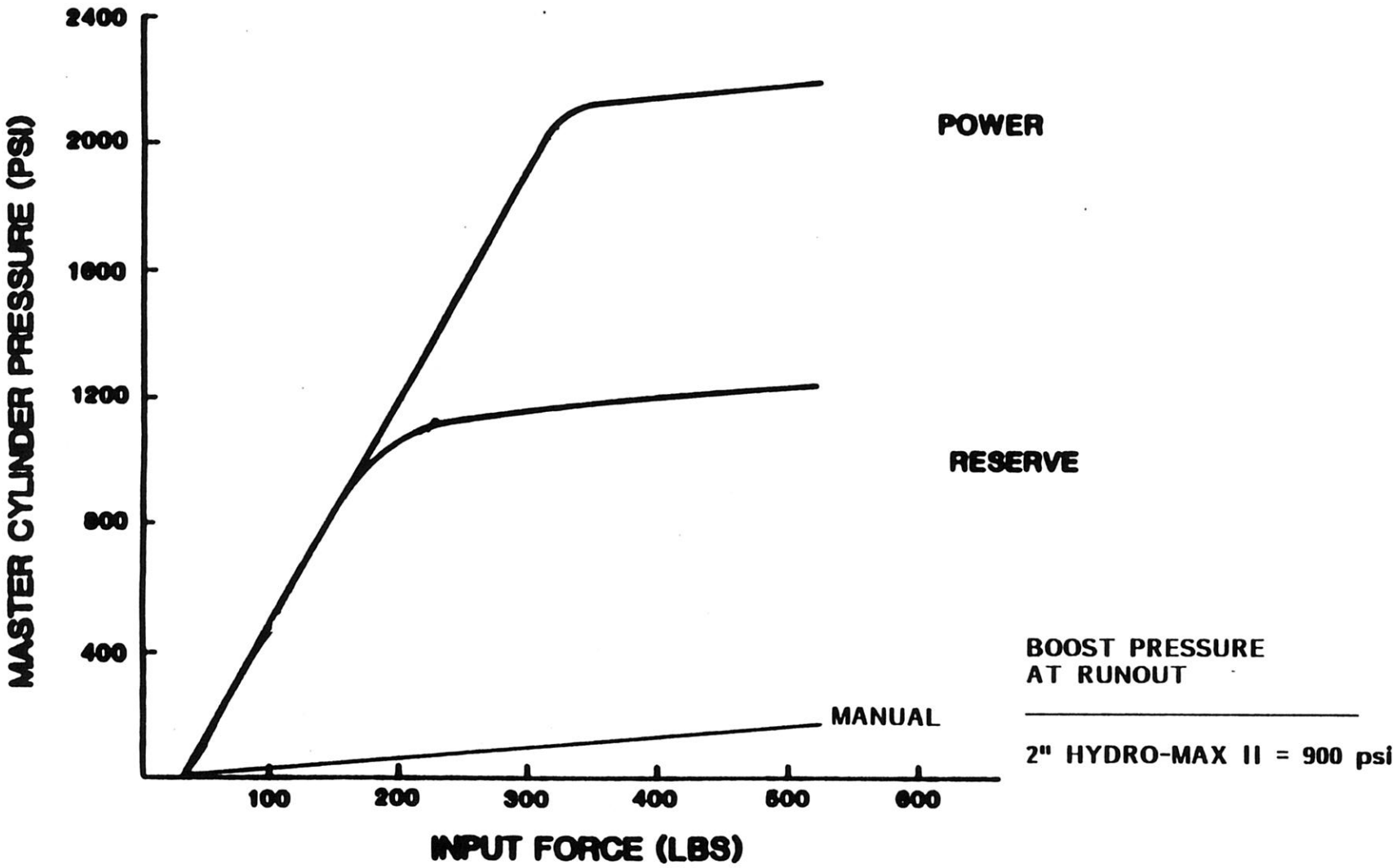
HYDRO-MAX II AND MINI MASTER CYLINDER
FUNCTIONAL DESCRIPTION (CON'T)

- MASTER CYLINDER

  - WHEN THE PRIMARY PISTON BEGINS TO TRAVEL, IT ALLOWS THE COMPENSATION OR TILT VALVE TO SEAL OFF THE PRIMARY CHAMBER FROM THE RESERVOIR. AS THE PISTON CONTINUES, IT SQUEEZES THE FLUID, GENERATING PRESSURE WHICH PUSHES ON THE SECONDARY PISTON. THE SECONDARY PISTON THEN STARTS TO MOVE AND THE SECONDARY COMPENSATION VALVE CLOSES. AS IT CONTINUES, PRESSURE DEVELOPS IN THE SECONDARY CHAMBER. THE PRESSURES ARE COMMUNICATED TO THE BRAKES VIA THE BRAKE LINES.

  - THE BRAKES COULD BE OPERATED FROM A SINGLE SYSTEM MASTER CYLINDER, BUT THE DUAL SYSTEM INCREASES SAFETY. IF ONE SYSTEM (I.E., LEAKS) THE OTHER IS STILL FUNCTIONAL LEAVING THE VEHICLE WITH HALF OF THE BRAKES STILL WORKING.

  - ADDITIONAL SAFETY FEATURES INCLUDE: (1) A PRESSURE DIFFERENTIAL SENSOR THAT WILL ACTIVATE A WARNING LIGHT IF IT DETECTS AN EXCESSIVE DIFFERENCE (70 -> 225 PSI) BETWEEN THE PRIMARY AND SECONDARY PRESSURES. THIS WARNING WILL LATCH ON UNTIL THE DIFFERENTIAL IS ELIMINATED. IT WILL THEN RESENT AUTOMATICALLY. (2) A RESERVOIR FLUID LEVEL SENSOR THAT ACTIVATES A WARNING LIGHT IF THE FLUID LEVEL IS LOW. THE WARNING MUST BE ON WITH NO LESS THAN 25% OF AVAILABLE VOLUME.



HYDRO-MAX II PERFORMANCE TYPICAL GRADUATION CURVES

HYDRO-MAX II AND MINI MASTER CYLINDER
SERVICEABLE ITEMS

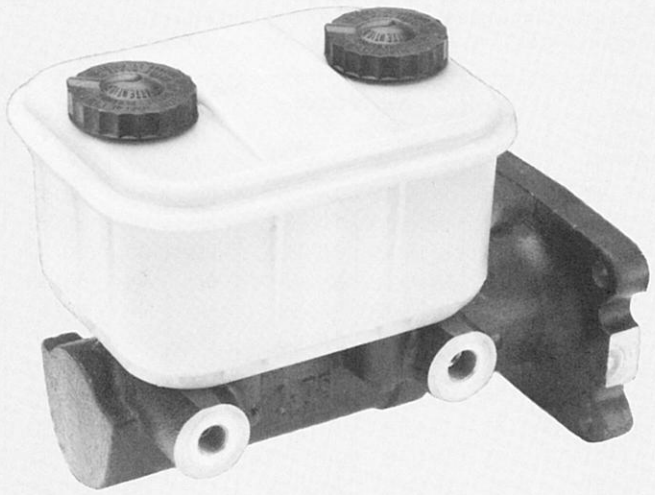
PART NUMBER	DESCRIPTION
2771552	ASSEMBLY - SERVICE BOOSTER
2771544	ASSEMBLY - SERVICE PUMP AND MOTOR
2771566 P/L	BOOSTER SERVICE KIT - SEAL
2771588 P/L	BOOSTER SERVICE KIT - END CAP
2233023 P/L	REPAIR KIT - MASTER CYLINDER

Bendix Heavy Vehicle Systems

Bendix Hydraulic Catalog

CATALOG 20-H-5

MINI-MASTER CYLINDER



MAY 1990

CATALOG
20-H-6

MINI-MASTER CYLINDER

SERVICE REPLACEMENT

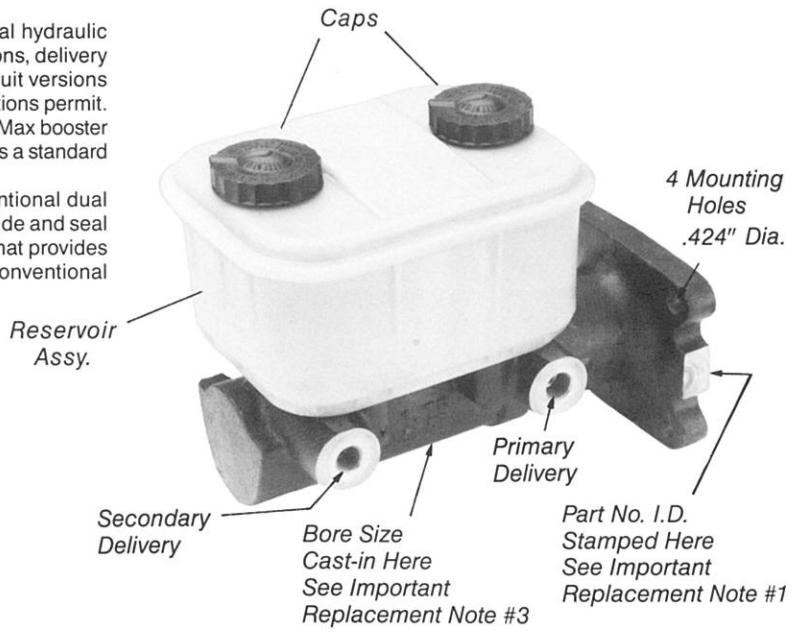
The Mini Master cylinder was designed for use in split or dual hydraulic brake systems and utilizes separate primary and secondary pistons, delivery ports and fluid volumes for the front and rear brakes. Single circuit versions of the Mini Master cylinder are also available for use where regulations permit. Most commonly used in conjunction with either the Bendix Hydro Max booster or the GM "HY-POWER" booster the Mini Master can also serve as a standard master cylinder.

The Mini Master cylinder is substantially shorter than conventional dual master cylinders. The reduction in length is achieved by using glide and seal rings rather than cups and through the incorporation of a valve that provides the same functions as the fill port and compensating port on conventional master cylinders.

Device Code – 6607
Approx. Wt. – 12 lbs.
Maintenance Kit – 22346 (2.00" DIA. BORE)
22386 (1.75" DIA. BORE)
VMRS No. – 13-006-013

TECHNICAL INFORMATION

	1.75" DIA. M.C.	2.00" DIA. M.C.
Max. Usable Stroke	2.127"	2.131"
Total Displacement	5.12 CU. IN.	6.70 CU. IN.



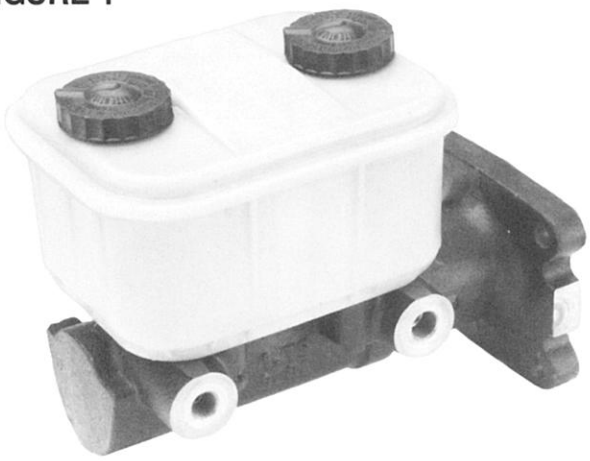
IMPORTANT REPLACEMENT NOTES

1. For POSITIVE IDENTIFICATION of part number, note the second row of four digits stamped in flat area on edge of mounting flange. Digits correspond to last four numbers of O.E. assy. Pc. No. ie; 6171 identifies unit as 2236171 which is serviced with 11990.
2. Use **BRAKE FLUID ONLY** in Mini Master cylinder.
3. Master cylinder bore size is cast on cylinder body (1.75 BORE–2.00 BORE).
4. All master cylinders furnished with tube seats installed except as noted.
5. DETAIL components NOT AVAILABLE unless part number shown.

Mini Master Cyl. O.E. Pc. No.	Service & Reman. Replcmt.	Bore Dia. (Inches)	Port Thrd. Size		Resid. Check Vlv. Note 4	Res. Size C.I.	Circuit Split Prim./Sec.	Comments	Fig. No.	Maint. Kit Pc. No.	Del. Port Tube Seat Pc. No. (Less Caps)	Res. Assy. Pc. No.	Res. Cap Pc. No.
			Prim.	Sec.									
223 2857	223 2857	1.75	9/16-18	1/2-20	No	80	50/50	—	2	22386	2228139	2232868	2231937
223 2914	223 2914	2.00	9/16-18	1/2-20	No	80	50/50	—	3	22346	2228139	2233852	2231937
223 3590	11892	1.75	9/16-18	1/2-20	No	30	60/40	—	1	22386	2228139	—	—
223 3863	223 3863	1.75	9/16-18	3/8-18	No	NA	50/50	—	5	22386	2228139	NA	NA
223 3864	223 3864	1.75	9/16-18	3/8-18	No	NA	60/40	—	5	22386	2228139	NA	NA
223 3865	223 3865	2.00	9/16-18	3/8-18	No	NA	60/40	—	5	22346	2228139	NA	NA
223 3866	223 3866	2.00	9/16-18	3/8-18	No	NA	50/50	—	5	22346	2228139	NA	NA
223 3868	223 3868	1.75	9/16-18	7/16-24	No	NA	60/40	—	5	22386	2228139	NA	NA
223 6171	11990	1.75	3/4-18	11/16-18	Yes	50	50/50	note #4	1	22386	2230555	2233851	2231937
223 6172	11912	1.75	3/4-18	11/16-18	No	50	50/50	—	1	22386	2230555	2233851	2231937
223 6173	11909	1.75	3/4-18	Plugged	Yes	50	Single	notes #3 & 4	1	22386	2230555	2233851	2231937
223 6174	11992	1.75	3/4-18	11/16-18	No	50	60/40	—	1	22386	2230555	2233851	2231937
223 6175	11993	1.75	9/16-18	1/2-20	No	80	50/50	—	1	22386	2228139	2233852	2231937
223 6177	11999	1.75	9/16-18	1/2-20	No	50	60/40	note #1	4	22386	—	2233851	2231937
223 6179	11910	1.75	3/4-18	11/16-18	Yes	50	60/40	note #4	1	22386	2230555	2233851	2231937
223 6180	11892	1.75	9/16-18	1/2-20	No	50	60/40	note #2	1	22386	2228139	2233851	2231937
223 6181	11998	1.75	9/16-18	1/2-20	No	80	50/50	—	1	22386	2228139	2233852	2231937
223 6191	11908	2.00	3/4-18	11/16-18	No	50	50/50	—	1	22346	2230555	2233851	2231937
223 6192	11991	2.00	3/4-18	11/16-18	No	50	50/50	—	1	22346	2230555	2233851	2231937
223 6193	11994	2.00	9/16-18	1/2-20	No	80	50/50	—	1	22346	2228139	2233852	2231937
223 6194	11995	2.00	9/16-18	1/2-20	No	50	50/50	note #1	4	22346	—	2233851	2231937
223 6195	11997	2.00	9/16-18	1/2-20	No	80	50/50	—	1	22346	2228139	2233852	2231937
223 6196	11898	2.00	3/4-18	11/16-18	Yes	50	50/50	note #4	1	22346	2230555	2233851	2231937
223 6198	11885	2.00	9/16-18	1/2-20	No	50	70/30	—	1	22346	2228139	2233851	2231937

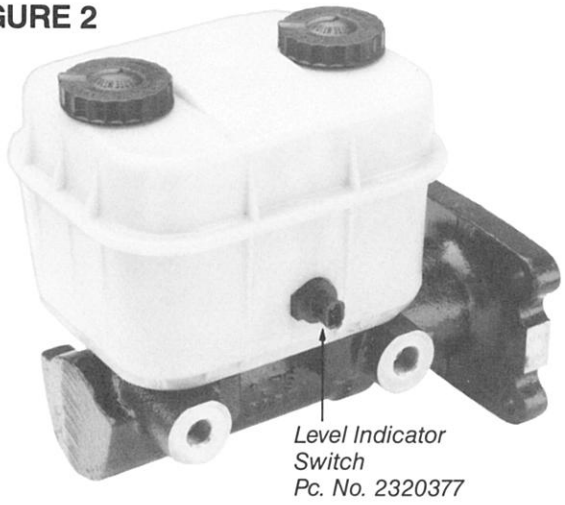
Note 1 – Ford application with externally mounted differential pressure switch, supplied with 4 seal bushings & 2 tube seats.
Note 2 – Unit supplied with 1-95001 & 1-95002 delivery port adapter (not installed).
Note 3 – Single circuit unit–no sec. del.–Max. stroke 1.279"–Prim. Displcmt. 3.08 CU. IN.
Note 4 – When specified, residual check valves are installed in **both** prim. & sec. delivery ports.

FIGURE 1



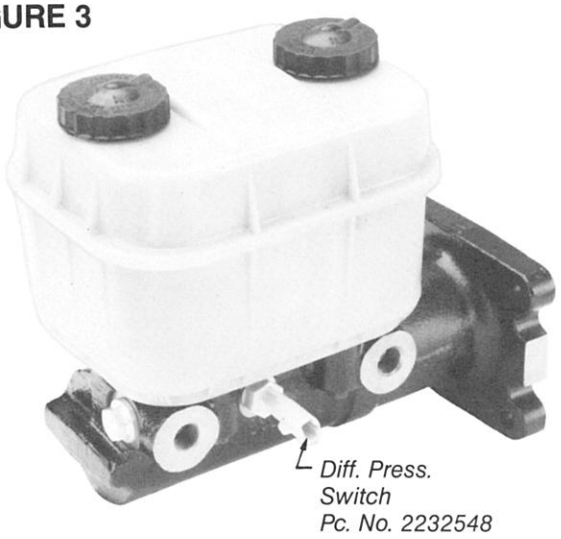
MINI-MASTER CYLINDER

FIGURE 2



WITH RESERVOIR LEVEL SWITCH

FIGURE 3

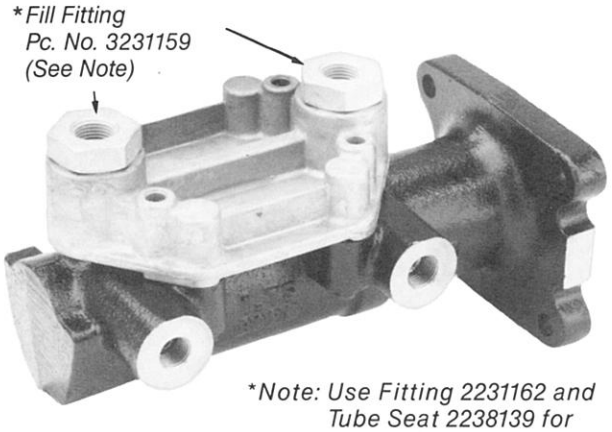


WITH INTERGRAL DIFFERENTIAL SWITCH

FIGURE 4

WITH EXTERNAL DIFFERENTIAL SWITCH

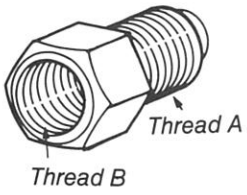
FIGURE 5



*Note: Use Fitting 2231162 and
Tube Seat 2238139 for
Master Cyl. Pc. No. 2233868

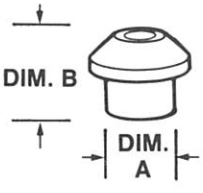
REMOTE MOUNT RESERVOIR

DELIVERY PORT ADAPTERS



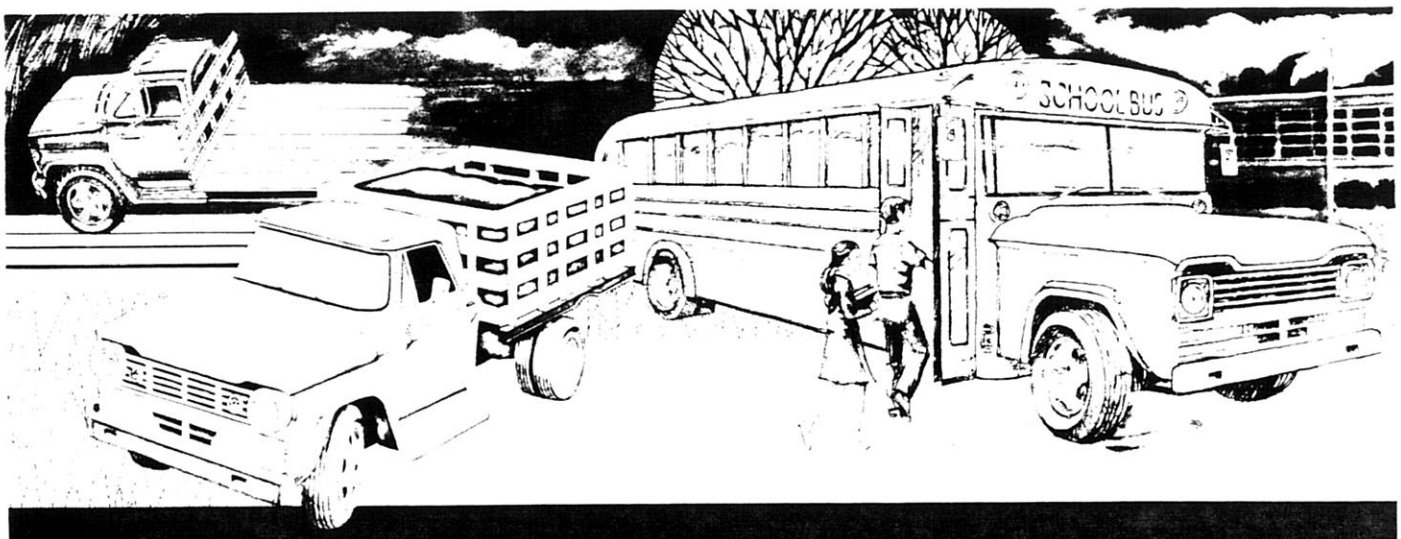
Pc. No.	Thrd. A	Thrd B
95001	9/16-18	1/2-20
95002	1/2-20	9/16-18

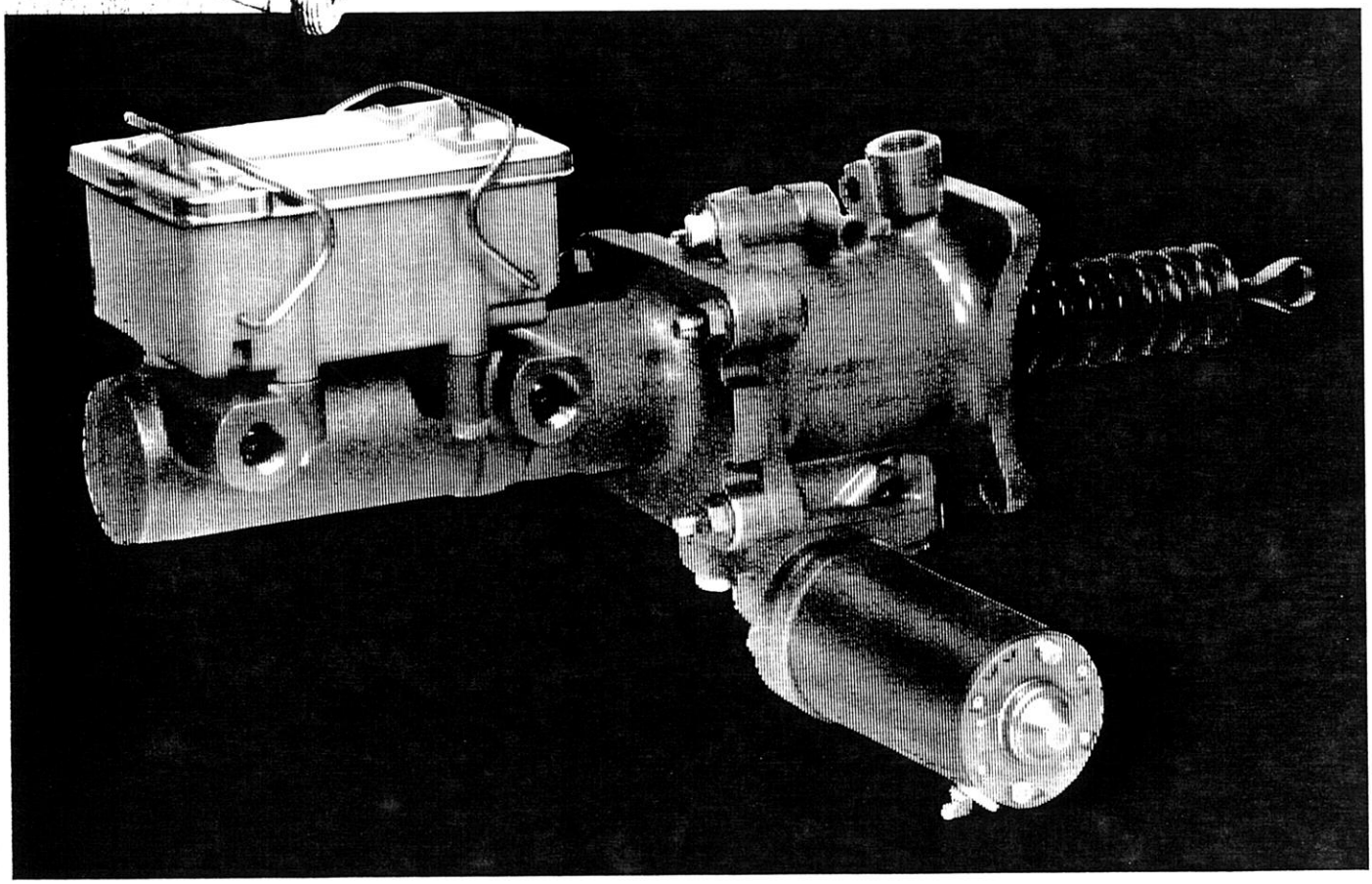
DELIVERY PORT TUBE SEATS



Pc. No.	A Dimsn.	B Dimsn.
2230555	.564	.575
2228139	.277	.320

Bendix Hydro-Max Power Brake





Bendix

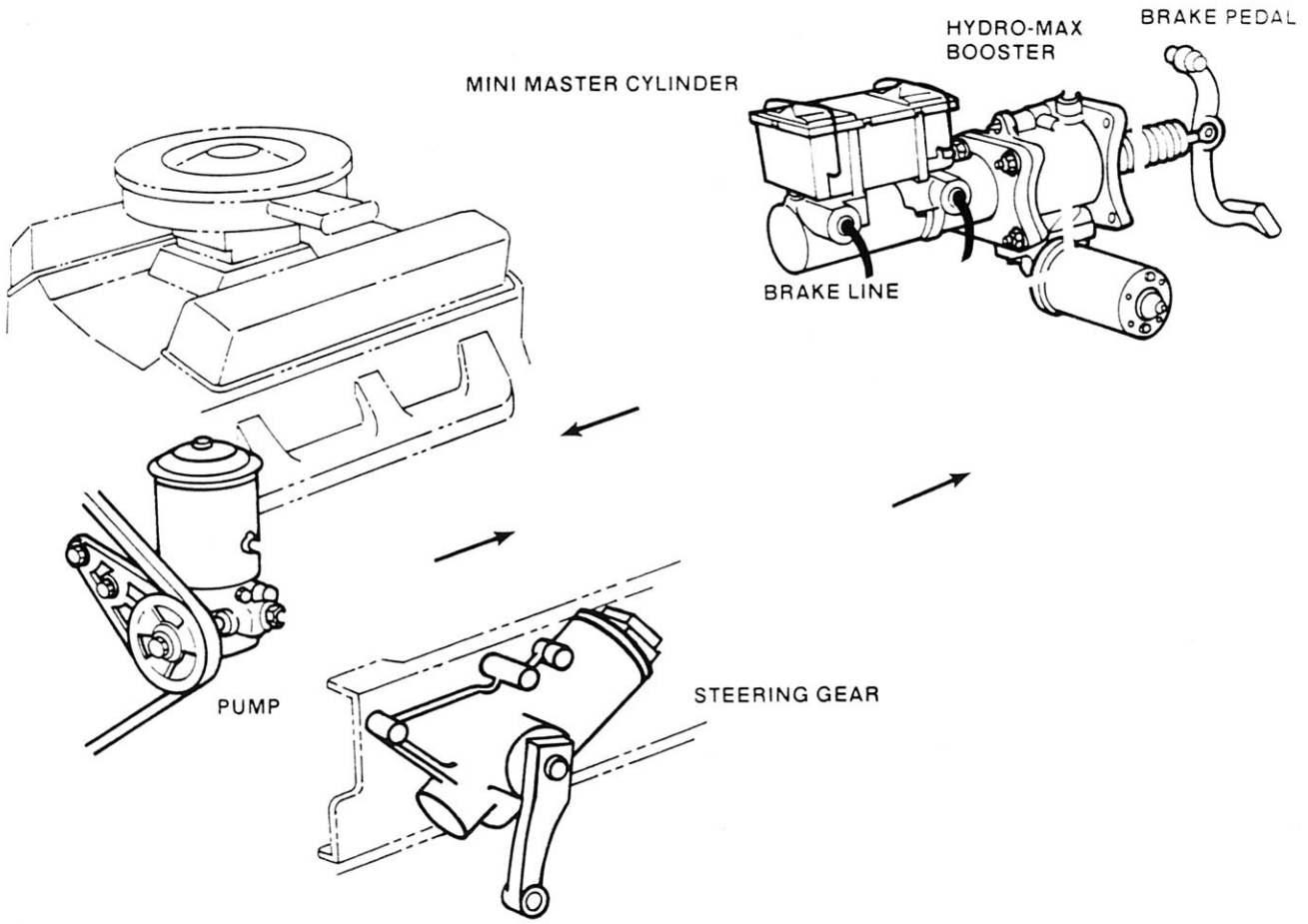
Bendix Hydro-Max Power Brake

From Bendix, the world's pioneer of power brake boosters, comes Hydro-Max—a unit designed specifically for the future requirements of the Medium Heavy Truck Industry—a unit which replaces today's engine vacuum power with the power of hydraulics.

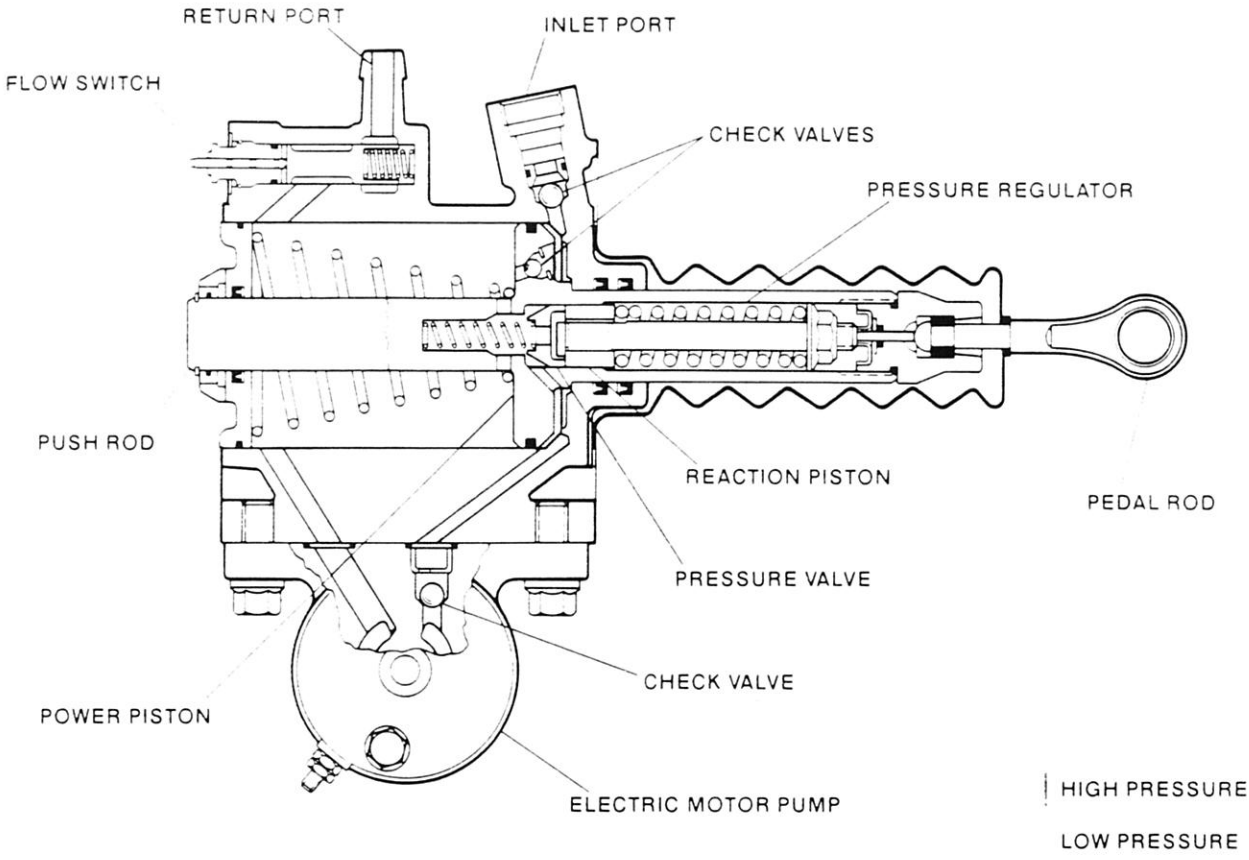
The patented Hydro-Max booster is cost effective, especially on diesel engine vehicle applications. In combination with the Bendix Mini Master Cylinder, the Hydro-Max booster provides fluid displacement for most vehicles through 46,000 GVW. The compact design provides easy mounting, but still supplies the high output pressure required in tomorrow's brake systems. In addition, the Hydro-Max booster is lighter, permits lower pedal height and is generally faster acting than current vacuum systems.

Since 1969, Bendix has worked with electric motor pump systems to provide reserve pressure for braking systems. With the Hydro-Max booster, if the primary source of boost pressure is lost, an attached electric motor pump provides virtually unlimited reserve stop capability.

TYPICAL HYDRO-MAX BOOSTER INSTALLATION DIAGRAM



Hydro-Max Booster Operation



Hydro-Max Booster Power Operation

Normal flow from the power steering system enters the inlet port of the Hydro-Max booster, flows through the pressure valve and power piston, the flow switch, and exits from the return port.

Force applied to the pedal rod by the vehicle operator, activates a pressure valve restricting flow through the power piston. The resulting pressure acting on the power piston applies a force to the master cylinder. The reaction piston provides the operator with the desired "feel" during an application of force to the pedal rod.

The pressure regulating device limits the maximum internal boost pressure developed during a full application thereby retaining pressure for steering functions.

Fluid flow through the flow switch "opens" the reserve motor pump electrical circuit during normal power operation. A separate check valve in the motor pump prevents backflow through the motor pump during normal power applications.

Hydro-Max Booster Reserve Operation

In the event normal flow from the power steering pump is interrupted, the electric motor pump provides the power for reserve stops. Upon flow interruption, the integral flow switch "closes" energizing a power relay, thereby providing electrical power to the motor pump.

During reserve operation, fluid is retained within the booster by the inlet port check valve. The motor pump recirculates fluid within the booster assembly with pressure built on demand via the pressure valve. The number of applications is limited only by the electrical capacity of the vehicle.

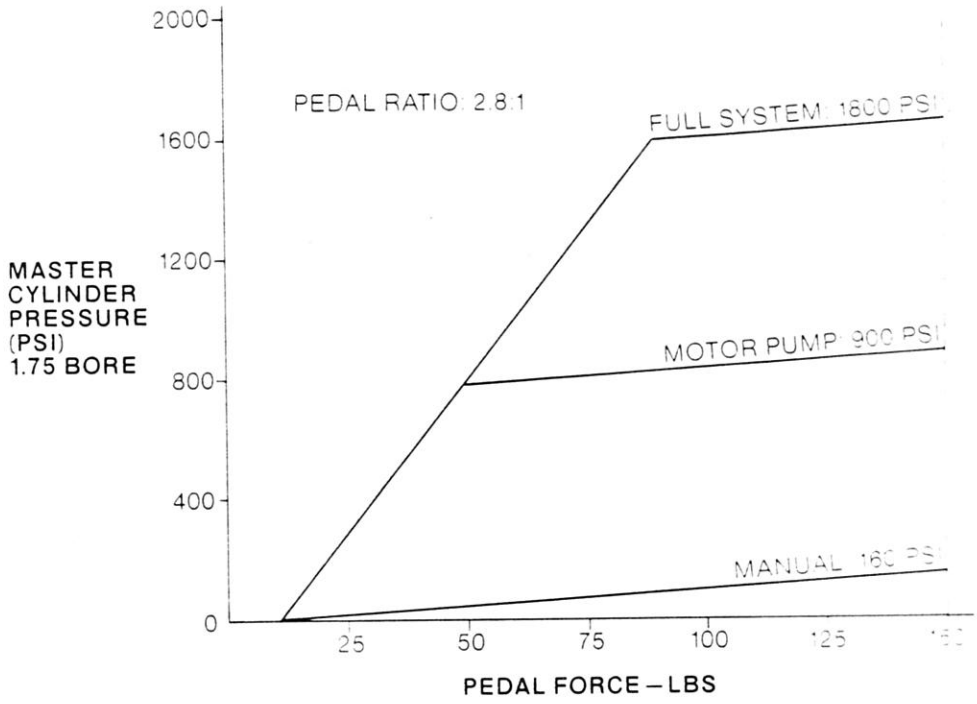
Manual braking is also available in the event both the power and reserve systems are inoperative.

System Performance

Bendix has been the world's leading supplier of passenger car, light truck and medium/heavy truck vacuum powered hydraulic brake systems since 1928. In 1974, the first hydraulic powered booster system was introduced by Bendix for passenger cars and light trucks. *And now*—Bendix uses this extensive expertise to introduce a hydraulic powered booster for Medium/Heavy Truck—*Hydro-Max*.

Specifications

Weights	—21 pounds including M/C —9 pounds booster only
MINI M/C	Bore—1.75" Diameter Stroke—2.25" Fluid Displacement—4.9 cubic inches



Bendix **Automotive Control Systems Group-North America**

401 N. Bendix Drive
P.O. Box 4001
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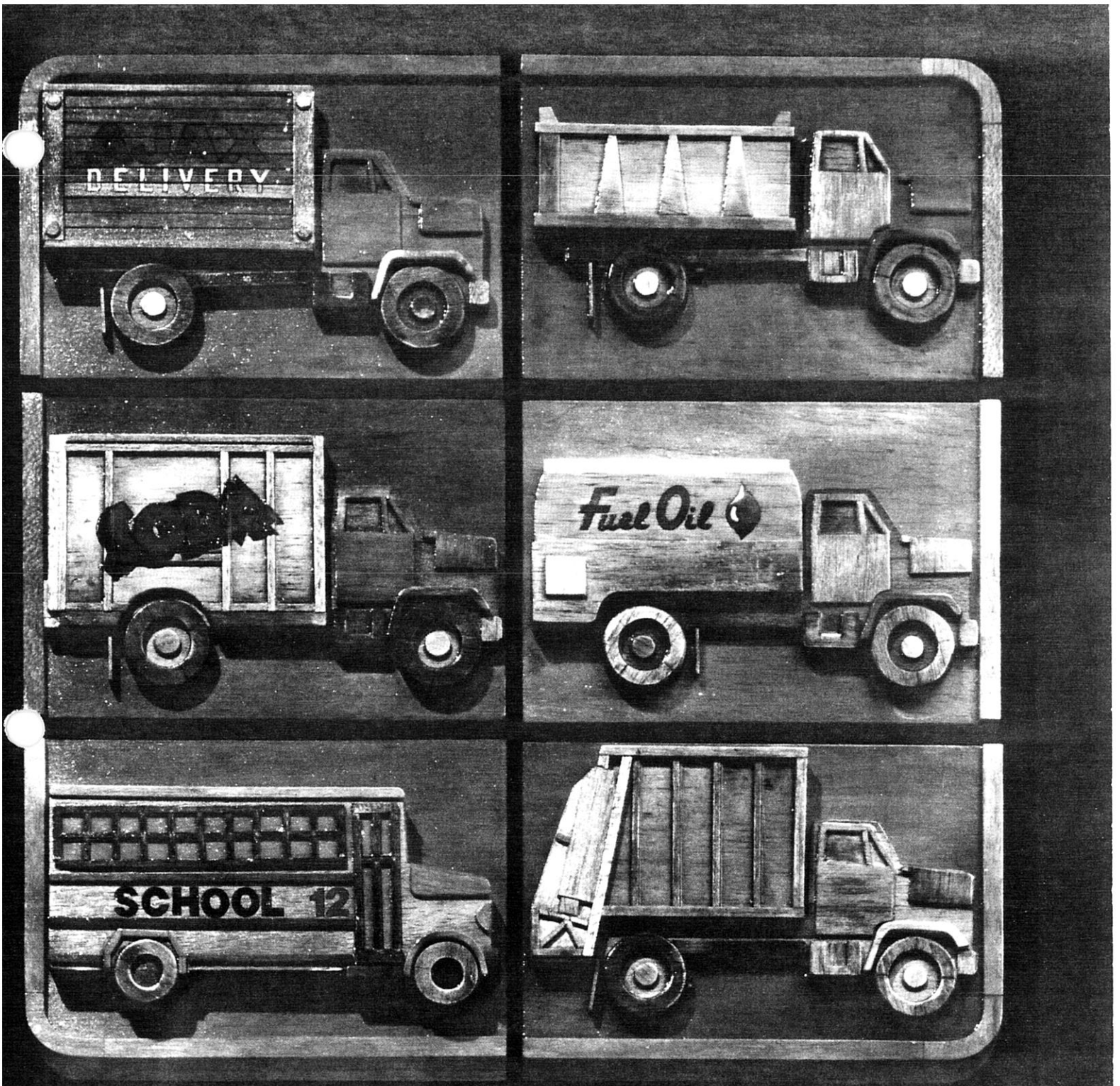
Phone: (219) 237-2100.



GET A BIGGER PIECE OF THE ACTION.

Bendix

BENDIX DISC BRAKES GIVE YOUR CUSTOMERS 10 IMPORTANT BENEFITS.

1. LONGER LINING LIFE

Replacing linings on drum brakes can be a major operator expense. In on-road tests conducted by Bendix, vehicles equipped with Bendix 4-wheel disc brakes demonstrated up to 1-1/2 times the lining life of drum brake linings.

2. LONGER ROTOR LIFE

Because we offer a wide range of friction materials, we can match materials to application so your customers can avoid frequent and expensive maintenance necessary with drum brakes. Bendix tests have logged upwards of 100,000 miles per rotor.

3. EASIER INSPECTION

Operators can save time and money when it comes to inspecting Bendix disc brakes. It doesn't even have to be done in a garage — no hoist, no disassembly, no wasted man-hours. All your customers need to inspect Bendix disc brakes is a mechanic, a mirror and a few minutes.

4. FASTER RELINING REDUCES DOWNTIME

Because calipers, shoes and linings are readily accessible for easy removal and replacement, over an hour per wheel can be saved in relining Bendix disc brakes compared to doing the same job on drum brakes. Bendix disc brakes help keep your customers' trucks out on the road working.

5. LOWER MAINTENANCE COSTS

This was demonstrated in Bendix studies at key locations from Indiana to South Carolina. Based on the respective lining life, rotor and drum life, cost of materials and average labor rates, Bendix disc brakes could save your customers as much as $1,600 per 100,000 miles of operation compared to drum brakes.

6. TROUBLE-FREE AUTOMATIC ADJUSTMENT

This feature is inherent in Bendix disc brakes. Drum brakes require the addition of expensive extra parts to provide the same feature. What's more, Bendix disc brakes cannot over-adjust!

7. IMPROVED STEERING ABILITY

During severe stopping situations, test vehicles equipped with Bendix disc brakes required only 1/4 the steering effort compared to drum equipped vehicles to keep the vehicle under control.

8. IMPROVED PEDAL FEEL

The first feature drivers notice is that they feel "in control" of Bendix disc brakes. This is because braking force stays proportional to the force applied to the brake pedal. There is no unwanted self-energizing action, and no return springs to overcome.

9. BETTER FADE RESISTANCE

Another inherent feature of Bendix disc brakes. Bendix disc brakes are much more resistant to the deterioration of braking capability under severe braking conditions. And they hold stopping capability nearly constant and longer than drums.

10. REDUCED NOISE LEVELS

This feature is substantiated by Bendix road tests and is sure to be noticed by drivers. Most drivers like the feeling of quiet efficiency that comes with Bendix disc brakes on all four wheels.

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HERE'S WHAT SCHOOL BUS DRIVERS AND MECHANICS SAY ABOUT BUSES EQUIPPED WITH BENDIX DISC BRAKES ON ALL FOUR WHEELS.

KOKOMO, INDIANA *DRIVER.*

"There was no brake pull at all. And no noise. The performance was good, better than drum brakes. On icy roads I experienced no lock-up on either front or rear wheels. When I really needed the brakes on several emergency stops, THEY WERE THERE!"

PORTLAND, INDIANA *DEALER-OPERATOR.*

"Drum life on standard brakes is terrible. I am happy with the Bendix disc brakes because they delivered 17,000 miles minimum. Drum brakes also give me large variations in lining wear. One brake on a bus will be completely worn so I have to replace all four. With Bendix disc brakes I do not have that problem."

COLUMBIA, SOUTH CAROLINA *MECHANIC.*

"I was amazed at the rotor life these Bendix brakes delivered. I found that a brake reline takes less than one-half the time with these disc brakes than with drum brakes."

IN THE MEDIUM TRUCK MARKET, BENDIX DISC BRAKES ON ALL FOUR WHEELS WILL HELP YOU GET A BIGGER PIECE OF THE ACTION.

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