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WHEELS AND TIRES

- REAR AXLE
- DRIVE SHAFT AND CLUTCH
- MANUAL SHIFT TRANSMISSION
- AUTOMATIC TRANSMISSION

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CATIONS

1968
MICHIGAN

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**SPECIFICATIONS AND SPECIAL SERVICE TOOLS
AT END OF EACH GROUP**

FOREWORD

The three volumes of this shop manual provide the Service Technician with complete information for the proper servicing of all 1968 Ford Trucks except Bronco, Econoline Van and Ranchero.

The maintenance schedule and procedures for maintenance operations are published in the 1968 Truck Maintenance and Lubrication Manual.

The information is grouped according to the type of work being performed, such as diagnosis and testing, frequently performed adjustments and repairs, in-vehicle adjustments, overhaul, etc. Specifications, maintenance information and recommended special tools are included.

Refer to the opposite page for important vehicle identification data.

The descriptions and specifications in this manual were in effect at the time this manual was approved for printing. Ford Motor Company reserves the right to discontinue models at any time, or change specifications or design, without notice and without incurring obligation.

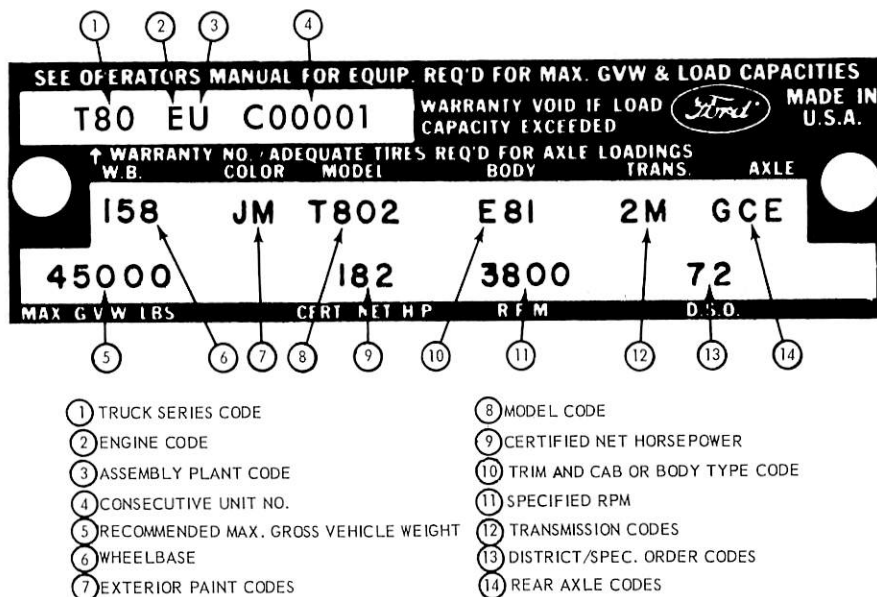


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Vehicle Identification

GROUP
1



P1116-E

FIG. 1—Typical Truck Rating Plate



P1182-A

FIG. 2—Truck Vehicle Identification Number (VIN) Tab

RATING PLATE

Figure 1 illustrates a typical truck Rating Plate. The Rating Plate is riveted to the rear (lock) face of the left front door on Conventional Cabs, 89 inch BBC (bumper-to-back of cab) and Tilt Cab Trucks. On cowl and windshield units, the Rating Plate is mounted on the upper cowl panel in the engine compartment.

VEHICLE WARRANTY NUMBER

The Warranty Number is the first line of numbers and letters appearing on the Rating Plate (Fig. 1). The first letter and two numbers indicate the truck model and series (the letter prefix identifies the type of body or cab and the numbers are the first two numbers of a truck series). The letter following the truck series code designates the engine identification code. The letter following the engine identification code indicates the assembly plant at which the vehicle was built. The remaining numbers indicate the consecutive unit number. The charts that follow list the various vehicle warranty number codes.

VEHICLE DATA

The Vehicle Data appears on the Rating Plate on the two lines following the Warranty Number. The first three digits under W.B. designate the wheel-

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(1) for title and registration (Fig. 2) that will be riveted in the passenger side of

base in inches. The one or two letters under COLOR identify the exterior paint color (two letters designate a two-tone). The letter and three digits under MODEL designate the truck model within a series. The letter and numerals under BODY designate the interior trim and body type (the letter identifies the interior trim scheme and the numerals identify the body or cab type). The transmission installed in the vehicle is identified under TRANS by either a numeric or alphabetical code (if two symbols appear, the first identifies the auxiliary transmission, if so equipped, and the second symbol identifies the main transmission). A letter and a number or two numbers under AXLE identify the rear axle ratio (when required, a letter is also stamped behind the rear axle code to identify the front axle capacity). The maximum gross vehicle weight in pounds is stamped under MAX. G.V.W. Following MAX. G.V.W., the horsepower rating of the engine with which the vehicle is equipped is stamped under CERT. NET H.P. and the rpm required to develop the given horsepower is stamped under R.P.M. A two-digit number is stamped under D.S.O. to identify the district which ordered the vehicle. If the vehicle is built to special order (Domestic Special Order, Foreign Special Order, Limited Production Option, or other special order), the complete order number will also appear under D.S.O. The charts that follow list the various vehicle data codes.

W.B. (Wheelbase)

The wheelbase in inches is entered in this space.

MAX. G.V.W. Lbs.

The maximum gross vehicle weight in pounds is recorded in this space.

CERT. Net H.P. R.P.M.

The certified net horsepower at specified rpm is marked at this location.

D.S.O.

If vehicle is built on a D.S.O., F.S.O., L.P.O. (special orders) the complete order number will be reflected under the DSO space including the District Code Number.

ASSEMBLY PLANT CODES

Code Letter	Assembly Plant	Code Letter	Assembly Plant
C	Ontario	N	Norfolk
D	Dallas	P	Twin Cities
E	Mawah	R	San Jose
H	Lorain	S	Pilot Plant
K	Kansas City	U	Louisville
L	Michigan Truck		

MODEL CODE PREFIX

Prefix	Type
B	School Bus Chassis—Gas
C	Tilt Cab 2 Axle—Gas
D	Tilt Cab 2 Axle—Diesel
F	Conventional 2 Axle—Gas
K	Conventional 2 Axle—Diesel
L	Tilt Cab Tandem Rear Axle—Gas
N	.89" BBC Conventional 2 Axle—Gas
	Parcel Delivery
	Tilt Cab Tandem—Diesel
	Conventional 2 Axle—Diesel
	Tandem Rear Axle—Gas
	Tandem Rear Axle—Gas
	Tandem Rear Axle—Diesel
	Box Chassis—Diesel
	Tandem Rear Axle—Diesel
	Tandem Rear Axle—Diesel
	Box 2 Axle—Diesel

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The uniform sequential serial and numbering system for the 1968 model truck program is as follows:

1967 (calendar year)	
Aug.—1968 Model	C00,000 thru C13,999
Sept	C14,000 thru C27,999
Oct	C28,000 thru C41,999
Nov	C42,000 thru C55,999
Dec	C56,000 thru C69,999
1968 (calendar year)	
Jan	C70,000 thru C83,999
Feb	C84,000 thru C97,999
Mar	C98,000 thru D11,999
Apr	D12,000 thru D25,999
May	D26,000 thru D39,999
June	D40,000 thru D53,999
July	D54,000 thru D67,999
Aug	D68,000 thru D81,999

INTERIOR TRIM CODES

Code	Trim Scheme
1	Gray Block Weave & Crush Vinyl
2	Med. Blue Ladder & Crush Vinyl
3	Med. Beige Ladder & Crush Vinyl
4, 43	Black Ladder & Crush Vinyl
5	Red Ladder & Crush Vinyl
14, A4, J4	Parchment Rosette and Crinkle Vinyl
23, B	Med. Blue Woven Plastic & Crush Vinyl
24, B4, K4	Dk. Blue Rosette & Crinkle Vinyl
33, C	Med. Beige Woven Plastic & Crush Vinyl
43, D	Black Woven Plastic & Crush Vinyl
44, D4, M4	Black Rosette & Crinkle Vinyl
53, E	Red Woven Plastic & Crush Vinyl
54, E4, N4	Red Rosette & Crinkle Vinyl
A, 13	Gray Twill Stripe Vinyl & Multicolor Woven Plastic
J	Parchment Granada & Crinkle Vinyl
K	Med. & Dk. Blue Granada & Crinkle Vinyl
M	Black Granada & Crinkle Vinyl
N	Red & Dk. Red Granada & Crinkle Vinyl

The following codes are all Black Leather Grain Vinyl with the indicated component color, differentiated only by seat types.

4E, 4F, 4N, 4Q, 4P, 4V, 4W
2B, 2C, BB, BE, BF, BN, BQ, BP, BV, BW (W/Blue)
3B, 3C, CB, CE, CF, CN, CQ, CP, CV, CW (W/Beige)
4B, 4C, DB, DE, DF, DN, DQ, DP, DV, DW (W/Black)
5B, 5C, EB, EE, EF, EN, EQ, EP, EV, EW (W/Red)

EXTERIOR PAINT COLOR CODES

Code	M-30J/M-32J Spec. Number ©	Color
A	1724-A	Black
B	3059-A	Royal Maroon
C	1525-A	White
D	1638-A	Peacock Blue
E	1906-A	Lt. Blue
G	1526-A	Chrome Yellow
J	1515-A	Red
L	1237-A	Dark Green
M	1619-A	White
O	3286-A	Dk. Blue
P	3150-A	Boxwood Green
U	2097-A	Med. Green
W	3120-A	Yellow
3	1635-A	Gold
6	1631-A	Lt. Beige
7	2098-A	Dk. Blue

© M-32J Acrylic Enamel Alternate with M-30J Alkyd.

DISTRICT CODES

Code	District	Code	District
11	Boston	51	Denver
13	New York	52	Des Moines
15	Newark	53	Kansas City
16	Philadelphia	54	Omaha
17	Washington	55	St. Louis
21	Atlanta	61	Dallas
22	Charlotte	62	Houston
24	Jacksonville	63	Memphis
25	Richmond	64	New Orleans
27	Cincinnati	65	Oklahoma City
28	Louisville	71	Los Angeles
32	Cleveland	72	San Jose
33	Detroit	73	Salt Lake City
34	Indianapolis	74	Seattle
35	Lansing	75	Phoenix
37	Buffalo	83	Government
38	Pittsburgh	84	Home Office Reserve
41	Chicago	85	American Red Cross
42	Fargo	89	Transportation
43	Milwaukee	90's	Export
44	Twin Cities		
45	Davenport		
Ford of Canada			
B1	Central	B4	Midwestern
B2	Eastern	B6	Western
B3	Atlantic	B7	Pacific
I1 thru I7			Export

GASOLINE ENGINE CODES

Code	Engine
A	6 Cyl. 240 CID 1V
B	6 Cyl. 300 CID 1V LD
B	6 Cyl. 300 CID 1V HD
C	8 Cyl. 330 CID 2V MD
D	8 Cyl. 330 CID 2V HD
E	8 Cyl. 361 CID 2V
F	8 Cyl. 391 CID 4V
H	8 Cyl. 390 CID 2V
H	8 Cyl. 401 CID 4V
K	8 Cyl. 477 CID 4V
L	8 Cyl. 534 CID 4V
U	8 Cyl. 330 CID 2V ⊕
W	8 Cyl. 361 CID 2V ⊕
Y	8 Cyl. 360 CID 2V
1	6 Cyl. 240 CID 1V ⊕
2	6 Cyl. 300 CID 1V ⊕
3	8 Cyl. 330 CID 2V MD ⊕
4	8 Cyl. 330 CID 2V HD ⊕
5	8 Cyl. 361 CID 2V ⊕
8	8 Cyl. 360 CID 2V ⊕
9	8 Cyl. 534 CID 4V ⊕

⊕ Low propane gas
⊕ Low compression

DIESEL ENGINE CODES

Code	Engine Model No.	C.I.D. (Cu. in.)
U	V-150 Caterpillar (#1140)	522
V	V-175 Caterpillar (#1145)	522
4	V-200 Caterpillar (#1150)	573
C	V-225 Caterpillar (#1160)	636
K	1673-B Caterpillar (225 HP)	525
L	1673-B Caterpillar (245 HP)	525
Z	C-160 Cummins	464
Y	C-180 Cummins	464
X	CF-160 Cummins	464
B	V6E-195 Cummins	588
D	NHE-195 Cummins	743
E	NH-220 Cummins	743
F	V8E-235 Cummins	785
G	V8-265 Cummins	785
A	NHC-250 Cummins (225 HP)	855
J	NHC-250 Cummins (250 HP)	855
M	NTC-335 Cummins (260 HP)	855
N	NTC-335 Cummins (280 HP)	855
P	NTC-335 Cummins (300 HP)	855
Q	NTC-335 Cummins (320 HP)	855
R	NTC-335 Cummins (335 HP)	855
1	NH-230 Cummins	855
8	6V-53N Detroit	318
S	6-71N Detroit (218 HP)	426
2	6-71N Detroit (238 HP)	426
9	6-71NE Detroit	426
6	8V-71N Detroit (290 HP)	568
	8V-71N Detroit (318 HP)	568
		568
		242
		363

FRONT AXLE CODES

Code	Capacity
B	5.5M ⊕
C	6M ⊕
D	7M ⊕
E	9M ⊕
F	12M ⊕
G	12M ⊕
H	15M ⊕
I	18M ⊕
K	3.5M ⊕
L	6M ⊕ ⊕

⊕ Pounds Capacity in Thousands.
⊕ Heavy Duty Front Brakes.

TRANSMISSION CODES -100 -600 SERIES

Code	Description
A	4-Speed New Process
B	3-Speed O/Drive
C	3-Speed Ford L. D.
D	3-Speed Warner M. D.
E	3-Speed Warner H. D.
F	4-Speed Syn. Warner
G	Automatic (C-4)
M	5-Speed Clark 285-V Dir.
O	5-Speed New Process 541-F Dir.
P	4-Speed Warner
T	5-Speed New Process 541-FO O/Dr.
2	5-Speed Clark 282-V Dir.
4	5-Speed Clark 280-VO O/Dr.
9	5-Speed New Process 541-FD Dir.

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AUXILIARY TRANSMISSION CODES

Code ①	Type	Ratio
1	3 Speed Spicer.....5831-C	1.27 / .85
2	3 Speed Spicer.....5831-D	2.0 / .85
3	3 Speed H. D. Spicer.....7231-B	1.24 / .86
4	3 Speed H. D. Spicer.....7231-D	2.14 / .86
5	4 Speed Spicer.....8341-C	2.40 / 1.29 / .84
6	3 Speed Spicer.....8031-C	2.59 / .79
7	3 Speed Spicer.....8031-P	1.19 / .84
8	4 Speed Spicer.....7041	2.31 / 1.21 / .83
9	3 Speed Fuller.....3D65	2.221 / .804
A	3 Speed Fuller.....3J65	1.17 / .86
B	3 Speed Fuller.....4C75	2.22 / 1.18 / .85

NOTE: When required, the auxiliary transmission code will be stamped directly in front of the transmission code.

① If the "New Process" transmission is installed, the auxiliary transmission code will bear the suffix "N".

REAR AXLE CODES

F-B-P-100 thru 600

Code	Ratio and Rating
05 ... Ford.....	4.11-3.3MⓄ
08 ... Ford.....	3.50-3.3MⓄ
09 ... Ford.....	3.70-3.3MⓄ
17 ... Ford.....	3.25-3.3MⓄ
22 ... Dana #70.....	4.88-7.4MⓄ
23 ... Dana #70.....	5.13-7.4MⓄ
24 ... Dana #60.....	4.10-5.2MⓄ
25 ... Dana #60.....	4.56-5.2MⓄ
27 ... Dana #70.....	4.10-7.4MⓄ
28 ... Dana #70.....	4.56-7.4MⓄ
30 ... Rockwell C-100.....	5.29-11MⓄ
32 ... Rockwell C-100.....	6.20-11MⓄ
34 ... Rockwell C-100.....	6.80-11MⓄ
36 ... Dana #70.....	3.73-7.4MⓄ
37 ... Dana #60.....	3.54-5.2MⓄ
38 ... Dana #60.....	3.73-5.2MⓄ
41 ... Rockwell D-100W.....	5.83-13MⓄ
42 ... Rockwell D-100N.....	6.20-13MⓄ
44 ... Rockwell D-100N.....	6.80-13MⓄ
52 ... Rockwell H-170.....	5.86-17.5MⓄ
53 ... Rockwell H-170.....	6.14-17.5MⓄ
54 ... Rockwell H-170.....	6.83-17.5MⓄ
55 ... Rockwell H-170.....	7.17-17.5MⓄ
62 ... Rockwell F-106.....	6.20-15MⓄ
64 ... Rockwell F-106.....	6.80-15MⓄ
66 ... Rockwell F-106.....	7.20-15MⓄ
71 ... Rockwell H-140.....	5.83-17MⓄ
74 ... Rockwell H-140.....	6.80-17MⓄ
76 ... Rockwell H-140.....	7.20-17MⓄ
A8 ... Dana #44.....	3.54-3.3MⓄⓄ
B4 ... Dana #60.....	4.10-5.2MⓄⓄ
B5 ... Dana #60.....	4.56-5.2MⓄⓄ
C1 ... Dana #44-3.....	3.31-3.3MⓄⓄ
C2 ... Dana #44-3.....	3.73-3.3MⓄⓄ
C4 ... Dana #44-3.....	4.09-3.3MⓄⓄ
C5 ... Dana #60-2.....	4.10-3.3MⓄⓄ
C7 ... Dana #60.....	3.54-5.2MⓄⓄ
C8 ... Dana #60.....	3.73-5.2MⓄⓄ
D2 ... Dana #70.....	4.88-7.4MⓄⓄ
D6 ... Dana #70.....	3.73-7.4MⓄⓄ
D7 ... Dana #70.....	4.10-7.4MⓄⓄ
D8 ... Dana #70.....	4.56-7.4MⓄⓄ
E1 ... Eaton 16244.....	5.57/7.75-17.5MⓄ
E2 ... Eaton 16244.....	6.17/8.58-17.5MⓄ
E3 ... Eaton 16244.....	6.50/9.04-17.5MⓄ
E5 ... Dana #60-3.....	4.10-3.6MⓄⓄ
E9 ... Dana #60-3.....	3.54-3.6MⓄⓄ
F1 ... Eaton 15201.....	5.14/7.17-15MⓄ
F2 ... Eaton 15201.....	5.83/8.17-15MⓄ
F3 ... Eaton 15201.....	6.33/8.81-15MⓄ
F7 ... Eaton 13802.....	5.83/8.12-15MⓄ
F8 ... Eaton 13802.....	6.33/8.81-15MⓄ
G2 ... Eaton 16802.....	5.57/7.75-17MⓄ
G3 ... Eaton 16802.....	6.50/9.04-17MⓄ
G4 ... Eaton 16802.....	6.14/8.55-17MⓄ

Ⓞ Pounds Capacity in Thousands.

Ⓞ Locking.

TRANSMISSION CODES -700-1000-N500-N600

NC550-C600 SERIES

Code	Description
A.....	4-Speed New Process 435
B.....	10-Speed Fuller R-96 DirectⓄ
C.....	10-Speed Fuller RT 510 DirectⓄ
D.....	5-Speed Clark 387V DirectⓄ
E.....	5-Speed Fuller 5H74 DirectⓄ
F.....	Fuller 5HA74 (Aluminum)Ⓞ
F.....	4-Speed Warner T-18
G.....	5-Speed Clark 380 V∅ O/DriveⓄ
H.....	5-Speed Clark 305V DirectⓄ
I.....	5-Speed Clark 307V DirectⓄ
J.....	5-Speed Clark 264 V∅ O/DriveⓄ
K.....	5-Speed Spicer 6453A DirectⓄ
L.....	5-Speed Clark 2653V1 DirectⓄ
M.....	5-Speed Clark 285V DirectⓄ
N.....	5-Speed Spicer 6352 DirectⓄ
∅.....	5-Speed Fuller T905B DirectⓄ
∅.....	5-Speed New Process 541FL Direct
P.....	4-Speed Warner T-19Ⓞ
Q.....	5-Speed Spicer 5652 DirectⓄ
R.....	5-Speed Clark 2622V1 DirectⓄ
S.....	5-Speed Spicer 5756B DirectⓄ
T.....	5-Speed New Process 541F∅ O/Drive
U.....	5-Speed Spicer 6852G DirectⓄ
V.....	10-Speed Fuller RT 910 DirectⓄ
W.....	5-Speed Spicer 6352B DirectⓄ
X.....	6-Speed Transmatic MT30
X.....	5-Speed Fuller T905A DirectⓄ
Y.....	6-Speed Transmatic MT40
Y.....	6-Speed Transmatic MT41Ⓞ
Z.....	DSO Transmission
1.....	5-Speed Spicer 8552A DirectⓄ
1.....	6-Speed Transmatic MT42
.....	5-Speed Clark 282V DirectⓄ
.....	5-Speed Spicer 5852 DirectⓄ
.....	5-Speed Clark 290V∅ O/DriveⓄ
T∅ 910 O/DriveⓄ	
T∅ 915 O/DriveⓄ	
V DirectⓄ	
312 O/DriveⓄ	
ss 541FD DirectⓄ	



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REAR AXLE CODES -700 -1000 SERIES, N-500-600, C-550-600

Code	Ratio
------	-------

ROCKWELL C-100 – 11M ⊕

32.....	6.20
34.....	6.80

ROCKWELL D-100 – 13M ⊕

41.....	5.83
42.....	6.20
44.....	6.80

ROCKWELL F-106 – 15M ⊕

62.....	6.20
64.....	6.80
66.....	7.20

EATON 13802 – 15M ⊕

F7.....	5.83/8.12
F8.....	6.33/8.81

EATON 15201 – 15M ⊕

F1.....	5.14/7.17
F2.....	5.83/8.12
F3.....	6.33/8.81

ROCKWELL H-140 – 17M ⊕

71.....	5.83
74.....	6.80
76.....	7.20
77.....	4.63
78.....	5.29
79.....	6.20

EATON 16802-3 – 17M ⊕

G2.....	5.57/7.75
G3.....	6.50/9.04
G4.....	6.14/8.55

ROCKWELL H340 – 17M

81.....	5.41/7.17
82.....	6.16/8.48

ROCKWELL H170 – 17.5M ⊕

51.....	5.38
52.....	5.86
53.....	6.14
54.....	6.83

Code	Ratio
------	-------

ROCKWELL L-146 – 17.5M ⊕

91.....	5.83
92.....	6.50

EATON 1790-A-18.5 M ⊕

1Q.....	4.33
2Q.....	4.56
3Q.....	4.88
4Q.....	5.29
5Q.....	5.57
6Q.....	6.14
7Q.....	6.50
8Q.....	7.17
9Q.....	7.67

EATON 17800 – 18.5M ⊕

1H.....	4.33/5.91
2H.....	4.56/6.21
3H.....	4.88/6.65
4H.....	5.29/7.21
5H.....	5.57/7.60
6H.....	6.14/8.38
7H.....	6.50/8.87
8H.....	7.17/9.77

EATON 17101 – 18.5M ⊕

AQ.....	4.33
BQ.....	4.56
CQ.....	4.88
DQ.....	5.29
EQ.....	5.57

EATON 17121 – 18.5M ⊕

FQ.....	6.14
GQ.....	6.50
HQ.....	7.17
IQ.....	7.60

EATON 17201 – 18.5M ⊕

AH.....	4.35/5.90
BH.....	4.56/6.21
CH.....	4.88/6.65
DH.....	5.29/7.21
EH.....	5.57/7.60

EATON 17221 – 18.5M ⊕

FH.....	6.14/8.38
GH.....	6.50/8.87
HH.....	7.17/9.77

ROCKWELL L-346 – 18.5M ⊕

Q1.....	4.92/6.76
Q2.....	5.63/7.73
Q3.....	6.00/8.24
Q4.....	6.39/8.78
Q5.....	6.65/9.13
Q6.....	7.10/9.76

Code	Ratio
------	-------

EATON 8802 – 22M ⊕

1J.....	5.91
2J.....	6.21
3J.....	6.65

EATON 18301 – 22M ⊕

AJ.....	5.91
BJ.....	6.21
CJ.....	6.65

EATON 1880 – 22M ⊕

1K.....	4.88
2K.....	5.57
3K.....	6.14
4K.....	6.50
5K.....	7.17
6K.....	5.29

EATON 18101 – 22M ⊕

AK.....	4.88
FK.....	5.29
BK.....	5.57

EATON 18121 – 22M ⊕

CK.....	6.14
DK.....	6.50
EK.....	7.17

ROCKWELL Q246 – 22M ⊕

L1.....	4.92
L2.....	5.63
L3.....	6.04
L4.....	6.39
L5.....	7.27

EATON 18802 – 22M ⊕

1B.....	4.33/5.91
2B.....	4.56/6.21
3B.....	4.88/6.65
4B.....	5.57/7.60
5B.....	6.14/8.38
6B.....	6.50/8.87
7B.....	7.17/9.77
8B.....	5.29/7.21

EATON 18201 – 22M ⊕

AB.....	4.33/5.91
BB.....	4.56/6.21
CB.....	4.88/6.65
HB.....	5.29/7.21
DB.....	5.57/7.60

⊕ Pounds Capacity in Thousands

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REAR AXLE CODES -700 -1000 SERIES, N-500-600, C-550-600 (Cont'd.)

Code	Ratio
------	-------

EATON 18221 – 22M ⊕

EB.....	6.14/8.38
FB.....	6.50/8.87
GB.....	7.17/9.77

ROCKWELL Q346 – 22M ⊕

T1.....	4.92/6.76
T2.....	5.63/7.73
T3.....	6.00/8.24
T4.....	6.39/8.78
T5.....	7.33/10.07

EATON 1918 – 23M ⊕

1G.....	4.11
2G.....	4.33
3G.....	4.88
4G.....	5.43
5G.....	6.17
6G.....	6.67
7G.....	3.70
8G.....	4.56

EATON 19121 – 23M ⊕

GG.....	3.70
AG.....	4.11
BG.....	4.33
HG.....	4.56
CG.....	4.88
DG.....	5.43
EG.....	6.17
FG.....	6.67

EATON 9502 – 23M ⊕

1X.....	5.90
2X.....	6.64

EATON 19301 – 23M ⊕

AX.....	5.89
BX.....	6.64

ROCKWELL RT 241 – 23M ⊕

P1.....	4.62
P2.....	4.99
P3.....	5.46
P4.....	6.10
P5.....	7.21

ROCKWELL R-171 – 23M ⊕

.....	4.11
.....	4.33

Code	Ratio
------	-------

EATON 19800 – 23M ⊕

1P.....	4.33/5.89
2P.....	4.88/6.63
3P.....	5.43/7.39
4P.....	6.17/8.40
5P.....	6.67/9.08
6P.....	3.70/5.04
7P.....	4.11/5.60
8P.....	4.56/6.21

EATON 19221 – 23M ⊕

FP.....	3.70/5.04
GP.....	4.11/5.60
AP.....	4.33/5.90
HP.....	4.56/6.21
BP.....	4.88/6.64
CP.....	5.43/7.39
DP.....	6.17/8.40
EP.....	6.67/9.08

ROCKWELL RT-341 – 23M ⊕

X1.....	4.68/5.88
X2.....	5.06/6.35
X3.....	5.34/6.71
X4.....	6.18/7.76
X5.....	7.01/8.80

ROCKWELL R-302 – 23M ⊕

Y1.....	4.41/5.64
Y2.....	4.89/6.23
Y3.....	5.54/7.09
Y4.....	6.42/8.38
Y5.....	7.09/9.07

ROCKWELL SHHD – 30M ⊕

W1.....	5.29
W2.....	5.83
W3.....	6.17
W4.....	6.80
W5.....	7.20
W6.....	7.80

EATON 30 DS – 32M ⊕

1C.....	4.62
2C.....	4.88
3C.....	5.57
4C.....	6.14
5C.....	6.50
6C.....	7.17
7C.....	7.60
8C.....	6.43

Code	Ratio
------	-------

EATON 30 DSC – 32M ⊕

AC.....	4.62
BC.....	4.88
CC.....	5.57
DC.....	6.14
EC.....	6.50
FC.....	7.17
GC.....	7.60
HC.....	6.43

EATON 30 DP – 32M ⊕

1D.....	6.43
2D.....	6.78
3D.....	7.75
4D.....	8.55

EATON 30 DPC – 32M ⊕

AD.....	6.43
BD.....	6.78
CD.....	7.75
DD.....	8.85

EATON 30 DTA – 32M ⊕

1L.....	4.62/6.43
2L.....	4.88/6.78
3L.....	5.57/7.75
4L.....	6.14/8.55
5L.....	6.50/9.04
6L.....	7.17/9.77

EATON 30 DTC – 32M ⊕

AL.....	4.63/6.43
BL.....	4.88/6.78
CL.....	5.57/7.75
DL.....	6.14/8.55
EL.....	6.50/9.04
FL.....	7.17/9.97

EATON 30 D-3 – 32M ⊕

3S.....	4.63/5.53/6.43
4S.....	4.88/5.83/6.78
5S.....	5.57/6.66/7.75
6S.....	6.14/7.35/8.55
7S.....	6.50/7.77/9.04

EATON 30 DTC (3 Spd.) – 32M ⊕

CS.....	4.63/5.53/6.43
DS.....	4.88/5.83/6.78
ES.....	5.57/6.66/7.75
FS.....	6.14/7.35/8.55
GS.....	6.50/7.77/9.04

⊕ Pounds Capacity in Thousands

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REAR AXLE CODES -700 -1000 SERIES, N-500-600, C-550-600 (Cont'd.)

Code	Ratio
------	-------

EATON 34 DS – 34M ⊕

1F.....	4.11
2F.....	4.33
3F.....	4.56
4F.....	4.88
5F.....	5.29
6F.....	5.57
7F.....	6.14
8F.....	6.50
9F.....	7.17
0F.....	7.60
AF.....	3.70

EATON 34 DSE – 34M ⊕

GF.....	6.14
HF.....	6.50
IF.....	7.17
KF.....	7.60

EATON 34 DSC – 34M ⊕

LF.....	3.70
JF.....	4.11
BF.....	4.33
CF.....	4.56
DF.....	4.88
EF.....	5.29
FF.....	5.57

EATON 34 DP - 34M ⊕

1N.....	5.05
2N.....	5.60
3N.....	5.91
4N.....	6.21
5N.....	6.65
6N.....	7.60
7N.....	8.38

EATON DFE – 34M ⊕

GN.....	8.38
---------	------

EATON 34 DPC-34M ⊕

AN.....	5.05
BN.....	5.60
CN.....	5.91
DN.....	6.21
EN.....	6.65
FN.....	7.60

Code	Ratio
------	-------

EATON 34 DTA – 34M ⊕

1W.....	4.11/5.61
2W.....	4.33/5.91
3W.....	4.56/6.21
4W.....	4.88/6.65
5W.....	5.57/7.60
6W.....	6.14/8.38
7W.....	6.50/8.86
8W.....	7.17/9.77
9W.....	3.70/5.05
0W.....	5.29/7.21

EATON 34 DTC - 34M ⊕

IW.....	3.70/5.05
AW.....	4.11/5.61
BW.....	4.33/5.91
CW.....	4.56/6.21
DW.....	4.88/6.65
KW.....	5.29/7.21
EW.....	5.57/7.60

EATON 34 DTE – 34M ⊕

FW.....	6.14/8.38
GW.....	6.50/8.87
HW.....	7.17/9.77

EATON 34 D-3 – 34M ⊕

1T.....	4.11/4.86/5.61
2T.....	4.33/5.12/5.91
3T.....	4.56/5.39/6.21
4T.....	4.88/5.77/6.65
5T.....	5.57/6.59/7.60
6T.....	6.14/7.26/8.38
7T.....	6.50/7.68/8.86
8T.....	3.70/4.37/5.05
9T.....	5.29/6.25/7.21

ROCKWELL SLDD – 34M ⊕

N1.....	4.88
N2.....	5.09
N3.....	5.56
N4.....	5.90
N5.....	6.41
N6.....	7.67
N7.....	8.44
N8.....	6.70

ROCKWELL SLHD – 34M ⊕

B1.....	4.11
B2.....	4.44
B3.....	4.63
B4.....	4.88
B5.....	5.29
B6.....	5.83
B7.....	6.17
B8.....	6.83
B9.....	7.80
B0.....	8.60
BA.....	3.55

Code	Ratio
------	-------

ROCKWELL SLHD(Lt.wt.) – 34M ⊕

K1.....	4.11
K2.....	4.44
K3.....	4.63
K4.....	4.88
K5.....	5.29
K6.....	5.83
K7.....	6.17
K8.....	6.83
K9.....	7.80
K0.....	8.60
KA.....	3.55

EATON 38 DS – 38M ⊕

1I.....	4.56
2I.....	4.88
3I.....	5.57
4I.....	6.14
5I.....	6.50
6I.....	4.11
7I.....	4.33
8I.....	5.29

EATON 38 DSC – 38M ⊕

FI.....	4.11
GI.....	4.33
AI.....	4.56
BI.....	4.88
HI.....	5.29
CI.....	5.59

EATON 38 DSE – 38M ⊕

DI.....	6.14
EI.....	6.50

EATON 38 DP – 38M ⊕

1R.....	5.05
2R.....	5.60
3R.....	5.91
4R.....	6.21
5R.....	6.65
6R.....	7.60
7R.....	8.38

EATON 38 DPC – 38M ⊕

AR.....	5.05
BR.....	5.61
CR.....	5.91
DR.....	6.21
ER.....	6.65
FR.....	7.60

⊕ Pounds Capacity in Thousands

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REAR AXLE CODES -700 -1000 SERIES, N-500-600, C-550-600 (Con'd.)

Code	Ratio
------	-------

EATON 38 DPE – 38MⓈ

GR.....	8.38
---------	------

ROCKWELL SQHD – 38 MⓈ

D1.....	4.11
D2.....	4.44
D3.....	4.63
D4.....	5.29
D5.....	5.83
D6.....	6.83
D7.....	7.80
D8.....	8.60
D9.....	3.55
D0.....	4.88
DA.....	6.17

ROCKWELL SQHD (Lt.Wt.) – 38MⓈ

M1.....	4.11
M2.....	4.44
M3.....	4.63
M4.....	5.29
M5.....	5.83
M6.....	6.83
M7.....	7.80
M8.....	8.60
M9.....	3.55
M0.....	4.88
MA.....	6.17

Code	Ratio
------	-------

ROCKWELL SQDD – 38MⓈ

Z1.....	7.54
Z2.....	8.31

EATON 38 D-3 – 38MⓈ

1Z.....	4.11/4.86/5.61
2Z.....	4.33/5.12/5.91
3Z.....	4.56/5.39/6.21
4Z.....	4.88/5.76/6.65
5Z.....	5.57/6.59/7.60
6Z.....	6.14/7.26/8.38
7Z.....	6.50/7.68/8.86

EATON 38 DTC – 38MⓈ

AZ.....	4.11/4.86/5.61
BZ.....	4.33/5.12/5.91
CZ.....	4.56/5.39/6.21
DZ.....	4.88/5.77/6.65
EZ.....	5.57/6.59/7.60

EATON 38DTE – 38MⓈ

FZ.....	6.14/7.29/8.38
GZ.....	6.50/7.68/8.86

Code	Ratio
------	-------

EATON 42 DP – 44MⓈ

1V.....	7.60
2V.....	8.38

Ⓢ Pounds Capacity in Thousands

SERIES, MODEL CODES, AND GROSS VEHICLE WEIGHTS (G.V.W.)- -350 AND P SERIES

Series	Model Code	Rating G V W (lbs)
F-100	F-100	5,000
	F-101	4,200
	F-102	5,000
	F-103	4,500
	F-104	4,800
F-100 (4x4)	F-110	5,600
	F-111	5,000
	F-112	5,600
	F-113	4,600
F-250	F-250	7,500
	F-252	7,500
	F-253	6,100
	F-254	6,900
	F-255	6,100
	F-256	6,900
		F-260
	F-262	7,700

Series	Model Code	Rating G V W (lbs)	
F-350	F-350	10,000	
	F-351	8,000	
	F-352	8,000	
	F-353	6,600	
	F-354	8,300	
	F-355	9,000	
P-350	P-350	8,000	
	P-351	6,100	
	P-352	6,500	
P-350	P-353	8,000	
	P-400	P-400	10,000
		P-401	7,700
P-402		8,000	
P-403		7,000	
P-500	P-500	15,000	
	P-501	10,000	
	P-502	8,000	

Series	Model Code	Rating G V W (lbs)
P-600	P-600	17,000
	P-601	15,000
P-3500	G-350	8,000
	G-351	6,100
	G-352	6,500
P-4000	G-400	10,000
	G-401	7,700
	G-402	8,000
	G-403	7,000
P-5000	G-500	15,000
	G-501	10,100
	G-502	8,000
P-6000	G-600	17,000
	G-601	15,000

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SERIES, MODEL CODES, AND GROSS VEHICLE WEIGHTS (G.V.W.) -500 -800 SERIES

Series	Model Code	Rating G V W (lbs)
B-500	B-500	15,000
	B-501	10,000
	B-502	16,000
	B-503	17,000
	B-504	18,000
	B-505	20,000
B-600	B-600	19,500
	B-601	15,000
	B-602	20,000
	B-603	17,000
	B-610	21,000
	B-611	22,000
	B-612	23,000
	B-613	24,000
	B-614	19,700
	B-6000	J-600
J-601		15,000
J-602		19,500
J-603		17,000
B-700	B-700	20,500
	B-701	17,000
	B-702	21,000
	B-703	22,500
	B-704	23,000
	B-705	24,000
	B-706	25,500
	B-707	23,000
	B-708	23,000
	B-709	22,000
B-7000	J-700	20,500
	J-701	17,000
	J-702	21,000
	J-703	22,500
	J-704	23,000
	J-705	24,000
	J-706	25,500
	J-707	23,000
	J-708	23,000
	J-709	22,000
B-750	B-750	22,500
	B-751	17,000
	B-752	23,000
	B-753	24,000
	B-754	25,500
	B-756	23,000
C-550	C-550	15,000
	C-551	10,000
	C-552	17,000
	C-553	19,000
	C-554	20,000
C-600	C-600	20,000
	C-601	15,000
	C-610	21,000
	C-611	22,000
	C-612	23,000
	C-613	23,000
	C-614	23,000
	C-615	19,700

Series	Model Code	Rating G V W (lbs)	
C-700	C-700	24,000	
	C-701	17,000	
	C-702	25,500	
	C-703	25,500	
	C-704	25,500	
C-7000	D-700	24,000	
	D-701	17,000	
	D-702	25,500	
	D-703	25,500	
C-750	C-750	24,000	
	C-751	17,000	
	C-752	25,500	
	C-753	25,500	
	C-754	25,500	
	C-755	27,500	
	C-756	27,500	
	C-800	C-800	27,000
		C-801	20,000
		C-802	27,500
C-803		27,500	
C-804		27,500	
C-805		27,500	
C-8000	D-800	27,000	
	D-801	20,000	
	D-802	27,500	
	D-803	27,500	
	D-804	26,000	
	D-805	24,000	
CT-800	L-800	43,000	
	L-801	27,000	
	L-802	39,000	
	L-803	45,000	
	L-805	41,000	
CT-8000	Q-800	43,000	
	Q-801	27,000	
	Q-802	39,000	
	Q-803	45,000	
	Q-805	51,000	
F-500	F-500	15,000	
	F-501	10,000	
	F-502	16,000	
	F-503	17,000	
	F-504	18,000	
	F-505	20,000	
F-600	F-600	19,500	
	F-601	15,000	
	F-602	20,000	
	F-603	17,000	
	F-610	21,000	
	F-611	22,000	
	F-612	23,000	
	F-613	23,000	
	F-614	23,000	
	F-615	24,000	
	F-616	19,700	
F-6000	K-600	20,000	
	K-601	15,000	
	K-602	19,500	
	K-603	17,000	
	K-610	21,000	
	K-611	22,000	
	K-612	23,000	
	K-613	23,000	
	K-614	23,000	
	K-615	24,000	
	K-616	19,700	

Series	Model Code	Rating G V W (lbs)
F-700	F-700	22,000
	F-701	17,000
	F-702	23,000
	F-703	24,000
	F-704	25,500
	F-705	23,000
	F-706	23,000
	F-707	25,500
F-7000	K-700	22,000
	K-701	17,000
	K-702	23,000
	K-703	24,000
	K-704	25,500
	K-705	23,000
	K-707	25,500
F-750	F-750	22,500
	F-751	17,000
	F-752	23,000
	F-753	24,000
	F-754	25,500
	F-755	23,000
	F-756	25,500
	F-757	23,000
	F-758	27,500
	F-759	28,000
F-800	F-800	23,000
	F-801	17,000
	F-802	24,000
	F-803	25,500
	F-804	27,500
	F-805	23,600
	F-806	25,500
	F-807	27,500
	F-808	27,500
	F-810	30,000
F-8000	K-800	24,000
	K-801	20,000
	K-802	25,500
	K-803	27,500
	K-804	27,500
	K-805	27,500
	K-807	24,500
N-500	N-500	15,000
	N-501	10,000
	N-502	16,000
	N-503	17,000
	N-504	18,000
	N-505	20,000
N-600	N-600	19,500
	N-601	15,000
	N-602	20,000
	N-603	17,000
	N-610	21,000
	N-611	22,000
	N-612	23,000
	N-613	23,000
	N-614	23,000
	N-615	24,000
	N-616	19,700
N-6000	R-600	20,000
	R-601	15,000
	R-610	21,000
	R-611	22,000
	R-612	23,000
	R-613	23,000
	R-614	23,000
	R-615	24,000

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SERIES, MODEL CODES, AND GROSS VEHICLE WEIGHTS (G.V.W.) -500 -800 SERIES (Cont'd.)

Series	Model Code	Rating G V W (lbs)
N-700	N-700	22,000
	N-701	17,000
	N-702	23,000
	N-703	24,000
	N-704	25,500
	N-705	23,000
	N-706	23,000
	N-707	25,500
	N-708	25,500
	N-7000	R-700
R-701		17,000
R-702		23,000
R-703		24,000
R-704		25,500
R-705		23,000
R-706		23,000
N-750	N-750	22,500
	N-751	17,000
	N-752	23,000
	N-753	24,000
	N-754	25,500
	N-755	23,000
	N-756	25,500
	N-757	23,000
	N-758	25,500

Series	Model Code	Rating G V W (lbs)
N-8000	R-800	25,000
	R-801	20,000
	R-802	25,000
	R-803	27,000
	R-804	27,000
	R-805	27,000
	R-806	25,500
	R-807	27,500
	R-808	25,500
	R-809	34,000
	R-810	28,000
	R-811	29,000
	R-812	30,000
	R-813	31,000
	R-814	32,000
	R-815	32,000
R-816	33,000	
NT-8000	W-800	39,000
	W-801	27,000
	W-802	41,000
	W-803	43,000
	W-804	43,000
	W-805	45,000
	W-806	49,000
	W-807	43,000
	W-808	45,000
	W-809	51,000

Series	Model Code	Rating G V W (lbs)
T-800	T-800	43,000
	T-801	27,000
	T-802	45,000
	T-803	49,000
	T-804	43,000
	T-805	36,000
	T-806	37,000
	T-807	39,000
	T-808	41,000
	T-809	29,000
T-8000	U-800	39,000
	U-801	27,000
	U-802	41,000
	U-803	43,000
	U-804	45,000
	U-805	49,000
	U-806	56,000
	U-807	62,000
	U-808	53,000
U-809	59,000	

SERIES, MODEL CODES, AND GROSS VEHICLE WEIGHTS (G.V.W.) -850 -1000 SERIES

Series	Model Code	Rating G V W (lbs)
C-850	C-850	27,000
	C-851	20,000
	C-852	27,000
	C-853	27,000
	C-854	27,000
	C-855	27,500
	C-856	27,500
	CT-850	L-850
L-851		27,000
L-852		41,000
L-853		43,000
L-854		45,000
L-855		49,000
C-950	C-950	30,000
	C-951	24,000
	C-952	30,000
	C-953	32,000
	C-954	32,000
	C-955	34,000
	C-956	34,000
	C-957	31,000
	C-958	33,000
	CT-950	L-950
L-951		30,000
L-952		49,000
L-953		51,000

Series	Model Code	Rating G V W (lbs)	
F-850	F-850	25,000	
	F-851	20,000	
	F-852	25,000	
	F-853	27,000	
	F-854	27,000	
	F-855	27,000	
	F-856	25,500	
	F-857	27,500	
	F-858	25,500	
	F-859	32,000	
	F-950	F-950	28,000
		F-951	24,000
		F-952	30,000
		F-953	30,000
F-954		32,000	
F-955		32,000	
F-956		34,000	
F-957		29,000	
F-958		31,000	
F-959		33,000	
F-950-D	K-950	28,000	
	K-951	24,000	
	K-952	30,000	
	K-953	30,000	
	K-954	32,000	
	K-955	32,000	
	K-956	34,000	
	K-957	29,000	
	K-958	31,000	
	K-959	33,000	
	K-960	25,500	
	K-961	27,500	

Series	Model Code	Rating G V W (lbs)
F-1000	F-000	32,000
	F-001	26,000
	F-002	34,000
	F-003	36,000
F-1000-D	K-000	32,000
	K-001	26,000
	K-002	34,000
	K-003	36,000
N-850	N-850	25,000
	N-851	20,000
	N-852	25,000
	N-853	27,000
	N-854	27,000
	N-855	27,000
	N-856	25,500
	N-857	27,500
	N-858	25,500
NT-850	S-850	39,000
	S-851	27,000
	S-852	41,000
	S-853	43,000
	S-854	43,000
	S-855	45,000
	S-856	49,000
	S-857	43,000
S-858	45,000	
NT-850-D	W-850	43,000
	W-851	27,000
	W-852	39,000
	W-853	41,000
	W-854	45,000
	W-855	45,000
	W-856	49,000
	W-857	49,000

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SERIES, MODEL, CODES, AND GROSS VEHICLE WEIGHTS (G.V.W.) — 850-1000 SERIES (Cont'd.)

Series	Model Code	Rating G V W (lbs)
N-950	N-950	28,000
	N-951	24,000
	N-952	30,000
	N-953	30,000
	N-954	32,000
	N-955	32,000
	N-956	34,000
	N-957	29,000
	N-958	31,000
	N-959	33,000
NT-950	S-950	47,000
	S-951	30,000
	S-952	49,000
	S-953	51,000
NT-950-D	W-950	47,000
	W-951	30,000
	W-952	49,000
	W-954	51,000
N-1000	N-000	32,000
	N-001	26,000
	N-002	34,000
	N-003	36,000

Series	Model Code	Rating G V W (lbs)
N-1000-D	R-000	32,000
	R-001	26,000
	R-002	34,000
	R-003	36,000
	R-004	27,500
T-850	T-850	39,000
	T-851	27,000
	T-852	41,000
	T-853	43,000
	T-854	43,000
	T-855	45,000
	T-856	49,000
	T-857	43,000
	T-858	45,000
	T-859	51,000
T-850-D	U-850	39,000
	U-851	27,000
	U-852	41,000
	U-853	43,000
	U-854	45,000
	U-855	49,000
	U-856	51,000

Series	Model Code	Rating G V W (lbs)
T-950	T-950	47,000
	T-951	30,000
	T-952	49,000
	T-953	53,000
	T-954	55,000
	T-955	59,000
	T-956	65,000
	T-957	75,000
	T-958	78,000
T-950-D	U-950	47,000
	U-951	30,000
	U-952	49,000
	U-953	53,000
	U-954	56,000
W-1000	Z-000	32,000
	Z-001	26,000
	Z-002	34,000
	Z-003	36,000
WT-1000	X-000	41,000
	X-001	32,000
	X-002	45,000
	X-003	49,000

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Brakes

GROUP

2

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1 DIAGNOSIS AND TESTING

Hydraulically operated service brakes are standard equipment on all 100 through 800 Series and on some 850 and 950 Series Ford trucks.

Automatic brake shoe adjusters are used on all 500 through 950 Series Ford trucks with hydraulic brakes.

A dual-master cylinder brake system is used as standard equipment on F-100 through F-350 and P-350-400-3500-4500 vehicles. The dual-master cylinder is also used with the Split Hydraulic brake system of the B-500 -750 Series vehicles.

Front disc brakes are standard on F-250 vehicles equipped with 390 CID engines and are optional on the other

The full air brake system, optional on some models and standard on most 850 through 1000 models, is covered in Part 2-6. Automatic brake shoe adjusters are also included on some air brake systems.

BRAKE SYSTEM TESTS

HYDRAULIC BRAKE FLUID LEVEL AND HYDRAULIC SYSTEM

1. Always check the fluid level in the brake master cylinder reservoir(s) before performing the test procedures. If the fluid level is not within 1/4 inch of the top of the master cylinder reservoirs, add Ford Brake Fluid—Super-Heavy Duty—Part Number B7AZ-19542-A, B7A-19542-B or C.

DUAL-MASTER CYLINDER BRAKE SYSTEM

1. Turn the ignition switch to the ACC or ON position. If the light on the brake warning lamp remains on, the condition may be caused by a shorted or broken switch, grounded switch wires or the differential pressure valve is not centered. Centralize the differential pressure valve as outlined under Hydraulic System Bleeding and Centralizing of the Differential Valve in this section of the manual. If the warning light remains on, check the switch connector and wire for a grounded condition and repair or replace the wire assembly. If the condition of the wire is good, replace the brake warning lamp switch.

2. Turn the ignition switch to the start position. If the brake warning lamp does not light, check the light

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and wiring and replace or repair wiring as necessary.

When both brake systems are functioning normally, the equal pressure at the pressure differential valve during brake pedal application keeps the valve centered. The brake warning light will be on only when the ignition key is in the **START** position.

3. If the brake warning lamp does not light when a pressure differential condition exists in the brake system, the warning lamp may be burned out, the warning lamp switch is inoperative or the switch to lamp wiring has an open circuit. Check the bulb and replace it, if required. Check the switch to lamp wires for an open circuit and repair or replace them, if required. If the warning lamp still does not light, replace the switch.

The trouble-diagnosis symptoms, causes, and corrections given under Diagnosis Guide-Standard Hydraulic Brakes, apply to all truck hydraulic brakes including those with a dual brake system or a vacuum booster system.

PRELIMINARY CHECKS

Push the brake pedal down as far as it will go. If the pedal travels more than halfway between the released position and the floor, adjust the brakes. If the vehicle is equipped with automatic brake adjusters, several sharp brake applications while backing up may be necessary to adjust the brakes.

Road test the vehicle and apply the brakes at a speed of about 20 mph to see if the vehicle stops evenly. If not, the brakes should be adjusted. **Perform the road test only when the brakes will apply and the vehicle can be safely stopped.**

PRELIMINARY TESTS—POWER BRAKES

With the engine stopped, eliminate vacuum from the system by pumping the brake pedal several times.

With the brake pedal still pushed down, start the engine. If the vacuum system is operating properly, the pedal will move downward. If the pedal position does not change, the vacuum system is not operating properly and should be checked by a vacuum test.

VACUUM TESTS

CHECK VALVE TEST

Disconnect the line from the bottom of the vacuum check valve, and connect a vacuum gauge to the valve. Start the engine, run it at idle speed, and check the reading on the vacuum gauge.

The gauge should register 17-19 inches with standard transmission and 14-15 inches in Drive range if equipped with an automatic transmission. Stop the engine and note the rate of vacuum drop. If the vacuum drops more than one inch in 15 seconds, the check valve is leaking. If the vacuum reading does not reach 18 inches or is unsteady, an engine tune-up is needed.

Remove the gauge and reconnect the vacuum line to the check valve.

BOOSTER TEST—BENDIX PISTON TYPE

Disconnect the vacuum line from the booster end plate. Install a tee fitting in the end plate, and connect a vacuum gauge (No. 1) and the vacuum line to the fitting. Install a second vacuum gauge (No. 2) in place of the pipe plug in the booster control valve body.

Start the engine, and note the vacuum reading on both gauges. If both gauges do not register manifold vacuum, air is leaking into the vacuum system. If both gauges register manifold vacuum, stop the engine and note the rate of vacuum drop on both gauges. If the drop exceeds one inch in 15 seconds on either gauge, air is leaking into the vacuum system. Tighten all vacuum connections and repeat the test. If leakage still exists, the leak may be localized as follows:

1. Disconnect the vacuum line and gauge No. 1 from the booster.

2. Connect vacuum gauge No. 1 directly to the vacuum line. Start the engine and note the gauge reading. Stop the engine and check the rate of vacuum drop. If gauge No. 1 does not register manifold vacuum, or if the vacuum drop exceeds 1 inch in 15 seconds, the leak is in the vacuum line or check valve connections.

3. Reconnect vacuum gauge No. 1 and the vacuum line to the tee fitting. Start the engine, and run it at idle speed for one minute. Depress the brake pedal sufficiently to cause vacuum gauge No. 2 to read from zero to 1 inch of vacuum. Gauge No. 1 should register manifold vacuum of 17-19 inches with standard transmission and 14-16 inches in Drive range if equipped with an automatic transmission. If the drop of vacuum on gauge No. 2 is slow, the air cleaner, or air cleaner line, may be plugged. Inspect and if necessary, clean the air cleaner.

4. Release the brake pedal and observe the action of gauge No. 2. Upon releasing the pedal, the vacuum gauge must register increasing vacuum until manifold vacuum is reached. The rate of increase must be smooth, with no lag or slowness in the return to manifold vacuum. If the gauge readings are not as outlined, the booster is not operating properly and should be removed and overhauled.

BOOSTER TEST—MIDLAND DIAPHRAGM TYPE (FRAME-MOUNTED) P-500, 5000

Remove the pipe plug from the rear half of the booster chamber, and install a vacuum gauge. Start the engine and run it at idle speed. The gauge should register 18-21 inches of vacuum.

1. With the engine running, depress the brake pedal with enough pressure to show a zero reading on the vacuum gauge. Hold the pedal in the applied position for one minute. Any downward movement of the pedal during this time indicates a brake fluid leak. Any kickback (upward movement) of the pedal indicates brake fluid is leaking past the hydraulic piston check valve.

2. With the engine running, push down on the brake pedal with sufficient pressure to show a zero reading on the vacuum gauge. Hold the pedal down, and shut the engine off. Maintain pedal position for one minute. A kickback of the pedal indicates a vacuum leak in the vacuum check valve, in the vacuum line connections, or in the booster.

HYDRAULIC PRESSURE TEST

Connect a 2000-psi hydraulic pressure gauge to a bleeder screw opening at one of the brake cylinders. **Bleed the air from the hydraulic system at the point of attachment of the gauge.**

Remove the pipe plug from the rear of the booster body or the trailer brake control line port, and connect a vacuum gauge at this point. With the engine running, apply the brakes enough to obtain a zero reading on the vacuum gauge. Then, note the reading on the pressure gauge. The minimum hydraulic pressure for each type and side of vacuum booster is given in the Specifications, Part 2-8. **If the engine vacuum is higher or lower than 20 inches Hg, the vacuum booster hydraulic pressure will be proportionately higher or lower than the pressure given in Part 2-8.**

Hold the brakes in the fully-applied position for at least one minute, and note the reading on the pressure gauge. The hydraulic system should hold pressure for at least one minute without losing pressure. A low pressure reading or a drop in pressure, indicates leakage in the booster or in the hydraulic system.

AIR SUPPLY SYSTEM

The air supply system is used with the full air brake system (Part 2-7). In the full air system, air pressure is applied directly to the shoes through a diaphragm and mechanical linkage.

If the brake system is not operating properly, the air supply system should be checked first.

OPERATING TESTS

Before performing any of the following tests, operate the engine until the air pressure builds up to 90 psi. With the air brake system charged, open the drain cocks in each reservoir. Close the drain cocks after all moisture is drained from the reservoirs. Some models have automatic moisture ejector valves and do not require manual draining.

Low Pressure Indicator

Exhaust the brake system pressure and observe the pressure at which the warning buzzer sounds. The contacts in the indicator should close the circuit to the buzzer, when reservoir pressure is between 58 psi minimum and 65 psi maximum. If the buzzer

Reservoir Safety Valve

To determine if the safety valve is operative, pull the exposed end of the valve stem. If the safety valve does not blow off when the stem is pulled, the valve ball is probably stuck in its seat. In such a case, remove and disassemble the valve for cleaning.

Governor

With the engine running, build up air pressure in the system, and observe at what pressure reading on the dash gauge the pressure stops climbing. This is the point of governor cutout which should be between 118 and 125 pounds.

With the engine still running, slowly reduce the air pressure in the system by applying and releasing the brakes. Observe the pressure reading on the dash gauge at the point where the pressure starts to build up again. This is the point of governor cut-in which should be between 98 and 104 pounds.

If the governor does not cut the compressor in and out according to these specifications, adjust the governor pressure settings. Before adjusting the governor, check the accuracy of the dash gauge with a test gauge.

Check Pressure Build-Up

With the engine running at fast idle speed, observe the time required to raise system pressure from 50 to 90 pounds. If more than five minutes is required, perform the leak tests as outlined in the following paragraphs.

Also check for no unloading valve clearance, low engine idle speed, a slipping compressor drive belt, excessive carbon in the compressor cylinder head, or a worn out air compressor.

LEAK TESTS

Compressor

With the engine stopped, discharge valve leakage can be detected by carefully listening at the compressor for the sound of escaping air. With air pressure applied to the unloader cavity (with governor cut-out), remove the air filter or the air pick up tube on SD V-8 engines and check for air leaks by squirting oil around the unloader plunger and stem. If excessive air leaks are found, replace the piston seal.

Governor

With the governor in the cutout position, test for leakage at the exhaust

valve by applying soap suds to the exhaust vent in the body.

With the governor in the cut-in position, test for leakage of the inlet valve by applying soap suds to the exhaust vent in the body.

In either of the foregoing tests, leakage in excess of 1-inch soap bubble in three seconds indicates the governor should be replaced.

Coat the entire governor with soap suds to detect diaphragm, gasket, and cap screw leakage. No leakage is permissible.

Reservoir Safety Valve

Coat the end of the safety valve with soap suds. Leaks causing not more than a 3-inch soap bubble in three seconds are permissible.

AIR BRAKES

Some of the air brake system components vary slightly from one vehicle model to another in design or location. However, all components are essentially the same in principle and service procedure.

First make the trouble diagnosis checks outlined under Air Supply System, and then perform the tests outlined in the following paragraphs.

OPERATING TESTS

Check Stop Light Switch

With all air pressure exhausted from the air brake system, start the engine and move the brake valve to the applied position. Stop lights should light before the dash gauge registers 10 psi pressure. Release the brakes.

Quick Release Valve and Relay Valve

With the air brake system fully charged, apply the brakes. Inspect the brake action on the wheels controlled by the quick release valve or relay valve in question. The brakes should apply promptly. Release the brakes and inspect to be sure that the air pressure is exhausted rapidly from the exhaust port. Be sure the exhaust port is not restricted.

LEAK TESTS

With the engine stopped and the brakes fully applied, watch the rate of

drop in air pressure as registered by the dash gauge. With the engine stopped and the reservoirs charged to the governor cutout pressure (118-125 psi), the rate of drop should not exceed 2 psi per minute. The rate of drop should also not exceed 3 psi per minute after the initial drop with brakes fully applied. If the pressure drops faster than specified, check the items outlined in the following paragraphs.

Brake Valve

With the pedal fully released, coat the exhaust port with soap suds to check for leaks. With the pedal fully applied, coat the exhaust port with soap suds and check for leaks. Leaks causing not more than a three inch soap bubble in three seconds are permissible.

Brake Chambers

With the brakes fully applied, coat the clamp ring and bolt flanges holding the diaphragm in place with soap suds. No leaks are permissible.

Quick Release Valve

With brakes applied, coat the exhaust port with soap suds to detect

leakage. Leakage in excess of a 3-inch soap bubble in three seconds is not permissible.

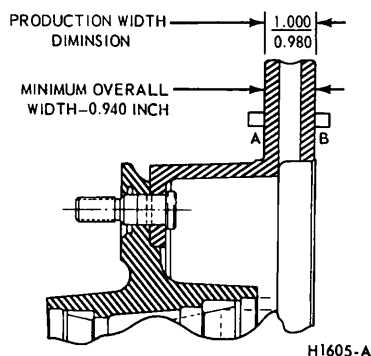


FIG. 1—Disc Brake Rotor Service Limits

Relay Valve

With the brakes released, coat the exhaust port with soap suds and observe the leakage.

With the brakes fully applied, coat the exhaust port with soap suds and observe the linkage.

Leakage in either of the foregoing tests should not exceed a 3 inch soap bubble in three seconds.

DISC BRAKE ROTOR RESURFACING

Normal concentrically grooved rotors are acceptable for running with

new replacement shoe and lining assemblies. Damaged rotors may be turned removing equal amounts off each side to the minimum rotor width of .940 inches.

Inspect the rotor and replace the hub and rotor assembly if the rotor is cracked or if the machining requirements to resurface the rotor exceed the specified limits.

The disc brake rotor may be resurfaced using dealer available tools. The following specifications must be maintained when resurfacing the brake rotor. Refer to Fig. 1.

1. A maximum of .020 inch material may be machined equally off each surface (A and B), maintaining the .940 inch as an absolute minimum overall width.

2. After machining, the thickness variation between surfaces A and B must not exceed .001 inch measured at equally spaced points on the rotor. Brake roughness or vehicle shudder can be induced if the rotor thickness variation exceeds .001 inch. The wheel stud locations can be used to determine the equally spaced areas for checking the rotor thickness.

3. Surface B must be flat within .010 inch total indicator reading.

4. The surface finish on surface A and B must be within 15-80 R.M.S.

2 COMMON ADJUSTMENTS AND REPAIRS

AIR CHECK OF BOOSTER PUSH ROD ADJUSTMENT— MIDLAND ROSS BOOSTER (DASH MOUNTED—HEAVY TRUCKS ONLY)

Whenever the master cylinder or booster has been repaired or replaced, the brake system must be checked for proper return flow of hydraulic brake fluid from the wheel cylinders to the reservoir of the master cylinder. This check will assure that the brake booster master cylinder push rod is

cylinder hydraulic line connection is made and the reservoir is filled with brake fluid.

1. Connect the brake vacuum line to the vacuum booster, if required. Start the engine.

2. Position the nozzle of an air hose to the master cylinder discharge port. Place a hand over the master cylinder reservoir and apply air pressure through the air hose nozzle.

If free passage air pressure is felt on the hand located over the master cylinder reservoir, the brake booster push rod is properly adjusted.

If no air pressure is felt on the hand located over the reservoir, the master cylinder must be removed and the push rod length shortened. To shorten the push rod length, turn the acorn-type screw on the brake booster push rod inward, one turn at a time, until the air check shows the brake master cylinder compensating valve is open.

BRAKE PEDAL ADJUSTMENT

On dual-brake master cylinder or dash mounted vacuum booster equipped vehicles, the brake systems are designed to permit full stroke of the master cylinder when the brake pedal is fully depressed. A brake pedal clearance adjustment is not required.

In order to release the brakes, fluid in a hydraulic brake system must flow back to the master cylinder when pedal pressure is released. A port is provided in the master cylinder to allow this flow, but the piston must move back far enough to expose the return port. To be sure that this will always happen, free-travel is built into the pedal linkage on standard and on frame-mounted booster systems. This free-travel prevents the piston from becoming trapped in a partially released position. Pedal free travel is not always perceptible in dash-

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mounted booster systems, however, because the operating clearance for the piston is adjusted at the booster push-rod, rather than the pedal linkage. (Refer to Part 2-5 for instructions on dash-mounted booster push-rod adjustments).

Pedal free travel is not adjustable on 500-1000 series trucks with a dash-mounted booster and a single or dual system or units with a dual system and a frame-mounted booster.

If the pedal free travel in a standard hydraulic brake system or frame mounted hydraulic booster system is less than 3/16 inch or more than 3/8 inch (Fig. 1), the pedal should be adjusted.

To adjust free-travel:

1. Push the brake pedal down by hand pressure, and check the free travel.

2. Loosen the lock nut on the eccentric bolt, and rotate the eccentric bolt until the free travel is within 3/16-3/8 inch.

On a P-Series truck turn the hex head of the push rod to obtain the required free-travel.

3. Hold the bolt securely, and torque the lock nut to 30-35 ft-lbs.

4. Recheck the pedal free-travel to make sure that the adjustment did not change when the lock nut was tightened.

FRONT DISC BRAKES F-250 AND F-350

The front disc brake assembly is designed so that it is inherently self-adjusting. Refer to Part 2-2, Removal and Installation, Section 3 or Major Repair Operations, Section 4 for the required service procedures.

BRAKE DRUM REPAIR 250 THROUGH 1000 SERIES EXCEPT 4-WHEEL DRIVE- FRONT

The service procedures covered here apply to both hydraulic and air brakes. Since the F-100, 250 and 350 or the P-350, 400, 3500 and 4000 (front and rear) and the 4-wheel drive front brake drum procedures apply to hydraulic brakes only, they are covered in Section 3 of Part 2-2.

the shoes do not contact the brake drum. Remove the grease cap and the gasket (if so equipped) from the hub.

2. With 4,000 through 7,000 lb. and 18,000 lb. front axles, remove the cotter pin, adjusting nut and flat washer from the spindle.

On trucks with a 9,000 lb. or 11,000 or 15,000 lb. axle, remove the lock nut, the dimpled washer, the locking ring and the adjusting nut and pin assembly.

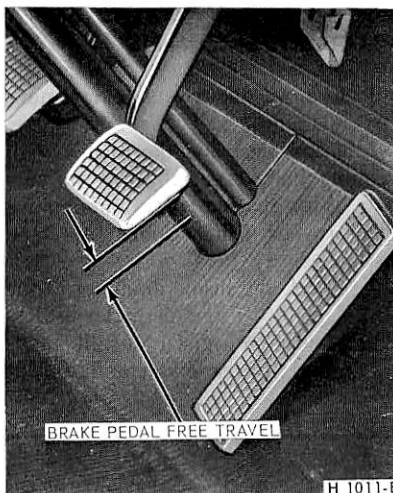


FIG. 2—Pedal Free Travel Check

3. Remove the outer bearing cone and roller. Pull the hub and drum assembly off the wheel spindle.

4. Remove the front wheel to hub retaining nuts or rim and tire attaching nuts. Remove the wheel or rim and tire from the hub and drum.

5. Remove the brake drum retainers and attaching bolts, screws, or bolts and nuts.

6. Remove the brake drum from the hub.

7. Check the drum for damage or wear, and repair or replace as necessary. If a new drum is to be installed, be sure to remove the protective coating with a suitable degreaser.

New grease retainer seals should be installed whenever a wheel and hub is removed.

8. Place the brake drum to the hub and install the retainers and retaining bolts, screws, or bolts and nuts.

9. Install the hub and drum on the wheel spindle. **Keep the hub centered on the spindle to prevent damage to the grease retainer or the spindle threads.**

10. With 4,000 through 7,000 lb. and 18,000 lb. front axles, install the outer bearing cone and roller and the flat washer on the spindle, then install the adjusting nut. With front axles of

9,000 lbs., 11,000 or 15,000 lbs. capacity, install the outer bearing cone and roller and the bearing adjusting nut and pin assembly.

11. Install the wheel and tire on the hub, then install the clamps (if applicable) and the wheel stud nuts.

12. Torque the adjusting nut to specifications while rotating the wheel. Refer to Group 3 for the wheel bearing adjustment procedure.

Install the dimpled washer with the dimple indexed in one of the holes in the adjusting nut. Install the lock nut and torque to specifications. Bend the dimpled washer over a flat of the lock nut.

13. Install the gasket (if so equipped) and the grease cap, and torque the wheel stud nuts to specifications. Install the hub cap if so equipped, and adjust the brakes.

REAR BRAKE DRUM

1. Raise the truck and install stands.

2. Remove the wheel and tire as an assembly. Then back off the rear brake shoe adjustment.

3. Remove the rear axle shaft retaining nuts, adapters, axle shaft, and grease seal.

4. Remove the wheel bearing locknut, lock washer, and adjusting nut.

5. Remove the hub and drum from the axle.

6. Remove the brake drum to hub retaining screws, bolts, or bolts and nuts. Then remove the brake drum from the hub.

7. Check the drum for damage or wear, and repair or replace as necessary. If a new drum is to be installed, be sure to remove the protective coating with a suitable degreaser.

New grease retainer seals should be installed whenever a wheel and hub is removed.

8. Position the brake drum to the hub and install the attaching screws, bolts, or bolts and nuts.

9. Position the hub and drum as an assembly on the axle and start the adjusting nut.

10. Adjust the wheel bearing nut and then install the wheel bearing lock washer and locknut.

11. Install a new rear axle oil seal, axle shaft and gasket, stud adapters, and attaching nuts.

12. Install the wheel and tire as an assembly.

13. Adjust the brake shoes and then remove the stand and lower the truck.

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BRAKE DRUM REFINISHING

Minor scores on a brake drum can be removed with fine emery cloth, provided the emery is thoroughly cleaned off the drum after the operation.

A badly scored, rough, or out-of-round drum should be ground or turned on a drum lathe. Do not remove any more material from the drum than is necessary to provide a smooth surface for the brake shoe contact. Brake drums up to and including 14 1/8 inches nominal diameter are considered unsatisfactory for further service use if the original inside diameter has increased more than .090 inch. These drums should not be machined to more than .060 inch beyond the original diameter or allowed to wear more than an additional 50%.

Brake drums larger than 14 1/8 inches nominal diameter are considered unsatisfactory for further service

use if the original inside diameter has increased more than .120 inch. These drums should not be machined to more than .080 inch beyond the original diameter or allowed to wear more than an additional 50%.

If the diameter of the drum is less than .030 inch oversize after refinishing, install standard linings on the brake assemblies. If the diameter is over 0.030 inch, install oversize or shimmed linings.

BRAKE SHOE RELINING

1. Remove the rivets and remove the old lining.

2. Clean the shoe thoroughly with cleaning fluid, especially the rim surface. Wipe the shoe dry and remove all burrs or rough spots from the shoe.

3. Check the inside diameter of the brake drum. If the diameter is less than 0.030 inch oversize, install standard linings. If the diameter is 0.030-

0.060 inch oversize, install oversize or shimmed linings.

4. Position the new lining on the shoe and install new rivets, beginning with the rivet holes near the center of the shoe. On some vehicles, the primary lining is shorter than the secondary lining. If this condition exists, position the shorter (primary) lining to line up with the heel end of the shoe. **Do not let brake fluid oil or grease touch the brake lining. If a brake lining kit is used to replace the worn linings, install all the parts supplied in the kit.**

5. Check the clearance between the lining and shoe rim. The lining must seat snugly against the rim with not more than 0.005 inch separation midway between any two rivets. If only the linings are replaced on duo-servo single anchor brakes with fixed anchor pins, the brake linings must be cam ground 0.010 inch at the ends after the linings are riveted to the brake shoe.

3 CLEANING AND INSPECTION

FRONT DISC BRAKES

1. Remove the wheel and tire, brake shoe retainers, and the shoe and linings as outlined in Part 2-2, Section 3.

2. Make three thickness measurements with a micrometer across the middle section of the shoe and lining. Take one reading at each side and one in the center. If the assembly has worn to a thickness of 0.350 inch (Shoe and lining together) at any one of the three measuring locations, or if the lining shows evidence of brake fluid or oil contamination that is causing a brake pull, replace the shoe and lining assemblies. Replace all (4) shoe and lining assemblies if the linings are worn more than 0.030 inch from the specified nominal shoe and lining thickness of 0.380 inch.

3. Check caliper to spindle attaching bolt torque. Torque them to specification if required.

4. Check rotor runout, first

rotor at a point approximately 1 inch from the outer edge. Rotate the rotor and take an indicator reading. If the reading exceeds 0.002 inch total lateral runout on the indicator, replace or resurface the disc brake rotor. **The following requirements must be met when resurfacing disc brake rotors:**

Rotunda Disc Brake Attachment FRE-2249-2 is the **only approved** tool to be used to refinish the disc brake rotors. The step-by-step resurfacing procedure provided with the tool must be adhered to.

The finished braking surfaces of the rotor must be flat and parallel within 0.0007 inch; lateral runout must not exceed 0.002 inch total indicator reading, and the surface finish of the braking surfaces are to be 15-80 micro inches.

When the runout check is finished, be sure to adjust the bearings as outlined in Group 3, in order to prevent bearing failure.

6. Check the rotor for scoring. Minor scores can be removed with a fine emery cloth. If the rotor is excessively scored, refinish it as outlined in step 5 or replace the rotor if required.

7. Visually check the caliper. If it is cracked or if any leakage is evident, it

should be replaced. Any leakage around the dust boot indicates the need for removal and disassembly.

8. Check brake hoses for signs of cracking, leaks, or abrasion. Replace if necessary.

BRAKE CYLINDER

1. Clean all brake cylinder parts in clean isopropyl alcohol. Inspect all parts for wear or damage. Check the cylinder bore for rust, scores, or other damage. Be sure that the bleeder screw passage is clean and open. Replace all parts that are worn or damaged.

2. If dirt is found in any part of the hydraulic system, flush the entire system with clean isopropyl alcohol.

MASTER CYLINDER

1. Clean all master cylinder parts in clean isopropyl alcohol, and inspect the parts for wear or damage, replacing them as required. **When a master cylinder repair kit is used, install all of the parts supplied in the kit.**

2. Check the ports and vents in the master cylinder to make sure that all are open and free of foreign matter.

3. On a single brake system master cylinder, check to see if the spring valve (riveted to the front end of the piston) is loose or has moved so that the piston ports are open, replace the piston.

4. Inspect the cylinder walls for scores or rust, and recondition them if necessary. Hone the cylinder walls no more than necessary (0.003 inch maximum), either to remove scores and rust, or to obtain a smooth wall surface. Remove any burrs or loose metal that may have resulted from the honing operation, and clean the cylinder with clean isopropyl.

BRAKE DRUMS AND LININGS

1. After removing one front wheel and drum and one rear wheel and drum from the vehicle, inspect the drums and brake shoe linings for wear or damage that would affect brake operation. **Do not let brake fluid, oil or grease touch the drum or linings.**

2. A brake shoe should be relined when the lining face is worn to within 1/32 inch of any rivet head, or when the lining has been soaked with brake fluid, oil or grease. If a worn lining is not replaced, the brake drum may become severely damaged. **Always replace the primary and secondary brake shoe lining assemblies on both front or both rear brake assemblies at the same time.**

3. Before relining a brake shoe, inspect the shoe for distortion, cracks, or looseness between the rim and web. If one of these conditions exists, replace the shoe. **Do not attempt to repair a damaged brake shoe.**

4. If the drum and linings are in good condition, install the wheel and drum. **The condition of the drums and linings of the opposite wheel will usually be about the same as that found at the wheel that was removed.**

5. Add enough super-heavy-duty brake fluid to the master cylinder reservoir to bring the level to within 1/4 inch of the top of the filler neck.

6. Check to be sure that the parking brake handle is fully released before making any brake adjustment.

7. Check the front brake anchor pin nut with a wrench (on brake

assemblies with an adjustable anchor pin). If the bolt is loose, torque it to 80-100 ft-lbs.

BRAKE BOOSTER

1. After disassembly, immerse all metal parts in a suitable cleaning solvent and dry them with compressed air. Use only isopropyl alcohol on rubber parts or parts containing rubber. After the parts have been thoroughly cleaned and rinsed in cleaning solvent, the metal parts which come in contact with hydraulic brake fluid should be rewashed in clean isopropyl alcohol before assembly. Use an air hose to blow dirt and cleaning fluid from the recesses and internal passages. When overhauling a power booster, use all parts furnished in the repair kit. **Discard all old rubber parts.**

2. Inspect all other parts for damage or excessive wear. Replace damaged or excessively worn parts. If the inside of the booster body is rusted or corroded, polish it with steel wool or fine emery cloth. Replace the body shell when scored. Inspect the master cylinder bore for signs of scoring, rust, pitting or etching. Any of these conditions will require replacement of the cylinder.

CAM-TYPE AIR BRAKES

1. Inspect the camshaft bushings and replace if worn or damaged.

2. Check the anchor pins and shoe-to-cam rollers for wear or damage, and replace, if required.

3. Check thickness of the brake lining at the center of the shoe, and replace, if necessary.

4. Clean, inspect, and replace worn or damaged parts. Coat the anchor pins and cam lobes with Lubriplate before installing the shoes.

BENDIX WEDGE-TYPE AIR BRAKES

Clean the metal parts in a non-oily cleaning solvent. **Replace the rubber parts whenever the brake is disassembled.** Replace damaged or worn metal parts. **Do not use gasoline or hot water solutions on metal parts.**

Inspect the following parts and replace defective pieces:

WEDGE

Check rod and wedge surfaces for scoring. The wedge angle, 10 degrees, 14 degrees or 18 degrees, is stamped on the side of the wedge. If the wedge assembly must be replaced, use an assembly with the same wedge angle.

PISTONS

Check the outside surface for scoring. On anchoring pistons, check shoe web slot for roughness.

ADJUSTING SCREW AND NUT

Check for sheared threads. Check adjuster ring teeth for wear. Make sure that screw turns easily in nut.

LINK

Check shoe web slot for roughness and cracks.

ROLLERS

Check for score marks, cracks or flat spots.

SPRING CLIP

Check clip for fatigue cracks.

AUTOMATIC ADJUSTMENT LEVER AND SPRING

Inspect for broken spring. Check lever for fatigue cracks and distortion.

ACTUATOR CASTING (TORQUE SPIDER)

Inspect machined bores for roughness. Use emery cloth to remove any rough areas which interfere with plunger movement. Check automatic adjuster pin for corrosion or distortion. Check the shoe guide bosses and steady rest for roughness on the rubbing surfaces. Inspect the mount-ring and holes of torque spider for cracks.



TROUBLE SYMPTOMS																	
POSSIBLE CAUSES OF TROUBLE	One Brake Drags	All Brakes Drag	Hard Pedal	Spongy Pedal	Car Pulls to One Side	One Wheel Locks	Brakes Chatter	Excessive Pedal Travel	Pedal Gradually Goes to Floor	Brakes Uneven	Shoe Click After Release	Noisy or Grabbing Brakes	Brakes Do Not Apply	Brakes for the respective system do not apply.	Warning lamp stays lit.	Pedal gradually moves toward floor or dash panel.	Warning lamp does not light
Mechanical Resistance at Pedal or Shoes		X	X														
Brake Line Restricted	X	X	X		X												
Leaks or Insufficient Fluid				X				X	X				X			X	
Improper Tire Pressure					X					X							
Distorted or Improperly Adjusted Brake Shoe		X	X		X	X		X				X					
Weak Retracting Spring	X				X												
Drum Out of Round	X				X		X										
Lining Glazed or Worn			X		X	X	X	X				X	X				
Oil or Grease on Lining					X	X	X			X		X	X				
Loose Backing Plate	X					X	X										
Loose Lining							X										
Scored Drum									X		X						
Dirt on Drum Lining Surface											X						
Brake Cylinder Needs Repair	X				X	X					X						
Dirty Brake Fluid	X	X							X			X					
Master Cylinder Needs Repair		X						X	X			X				X	
Air in Hydraulic System	X			X				X				X					
Self-Adjusters Not Operating					X			X									
Insufficient Shoe to Backing Plate Lubrication	X									X	X						
Tire Tread Worn						X											
Poor Lining to Drum Contact							X										
Loose Front Suspension							X										
Threads Left by Drum Turning Tool Pulls Shoes Sideways										X							
Cracked Drum								X									
One Section Dual Brake System Is Inoperative													X	X			
Differential Pressure Valve Is Not Centered														X			
Wiring To Warning Lamp Switch Is Grounded															X		
Warning Lamp Switch Is Grounded															X		
Warning Lamp Is Burned Out																	X
Warning Lamp Circuit																	X

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POSSIBLE CAUSES OF TROUBLE	TROUBLE SYMPTOMS												
	Excessive Pedal Travel	Brake Roughness or Chatter (Pedal Pumping)	Excessive Pedal Effort	Pull	Rattle	Brakes Heat Up During Driving and Fail to Release	Leaky Wheel Cylinder	Grabbing or Uneven Braking Action	No Braking Effect When Pedal Is Depressed	Brakes for the Respective System Do Not Apply	Pedal Gradually Moves Toward Floor or Dash Panel	Warning Lamp Stays Lit.	Warning Lamp Does Not Light
Shoe and Lining Knock-back after Violent Cornering or Rough Road Travel	X												
Shoe and Lining Assembly not Properly Seated or Positioned	X					X			X				
Leak or Insufficient Fluid in System or Caliper	X		X						X		X		
Loose Wheel Bearing Adjustment	X			X									
Damaged or Worn Caliper Piston Seal	X						X		X				
Improper Master Cylinder Push Rod Adjustment	X												
Excessive Rotor Runout or Out of Parallel		X											
Incorrect Tire Pressure				X				X					
Frozen or Seized Pistons			X	X		X		X					
Brake Fluid, Oil or Grease on Linings		X	X	X				X					
Shoe and Lining Worn Below Specifications			X										
Proportioning Valve Malfunction			X					X					
Booster Inoperative			X										
Caliper Out of Alignment with Rotor				X				X					
Loose Caliper Attachment	X	X		X	X			X					
Metering Valve Seal Leaks								X					
Excessive Clearance Between Shoe and Caliper or Between Shoe and Splash Shield					X								
Shoe Hold Down Clips Missing or Improperly Positioned					X								
Operator Riding Brake Pedal						X							
Scores in the Cylinder Bore							X						
Corrosion Build-Up in the Cylinder Bore or on the Piston Surface			X	X			X						
Bleeder Screw Still Open								X		X			
Caliper Out of Parallel with Rotor				X									
One Section Dual Brake System Is Inoperative									X		X		
Differential Pressure Valve Is not Centered												X	
Wiring to Warning Lamp Switch Is Grounded												X	
Warning Lamp Switch Is Grounded												X	
Warning Lamp Is Burned Out													X
Warning Lamp Switch Has an Open Circuit													X
													X
													X



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Brake Trouble Symptoms and Possible Causes

<p>BOOSTER INOPERATIVE— HARD PEDAL</p>	<p>The trouble may be caused by vacuum leakage. Disconnect the vacuum line at the booster, remove the vacuum manifold and check valve assembly, and look for a sticking or damaged check valve. Check all vacuum connections for leakage or obstruction. Check all hoses for a leaking or collapsed condition. Repair or replace parts as necessary.</p> <p>If the foregoing procedure does not eliminate the trouble, remove the</p>	<p>booster from the car. Separate the front shell from the rear shell, and check the valve and rod assembly reaction disc, diaphragm plate, and diaphragm assembly for damage that would cause leaks. When assembling, be sure that the diaphragm assembly is properly positioned. Improper location could cause leakage between the vacuum and atmospheric sides of the diaphragm.</p>
<p>BRAKES DRAG OR GRAB</p>	<p>The condition is probably caused by a sticking valve plunger assembly. Remove and disassemble the booster.</p>	<p>Clean, inspect, and replace parts as necessary.</p>
<p>SELF APPLICATION OF BRAKES WHEN ENGINE STARTS</p>	<p>Remove and disassemble the booster. Check for a leak in the rear shell. Check the diaphragm for being out of locating radii in the housing. Check for a sticking or unseated valve pop-</p>	<p>pet. Clean, inspect, and replace parts as necessary. Be sure that the diaphragm is properly located when assembling.</p>

FIG. 5—Diagnosis Guide—Power Brakes Vacuum Booster—Bendix Dash Mounted

<p>BOOSTER INOPERATIVE HARD PEDAL</p>	<p>Check as follows to see if the power unit is operating: With the engine stopped, depress the brake pedal several times to eliminate all vacuum from the system. Apply the brakes, and while maintaining pressure on the pedal, start the engine. If the unit is operating, the brake pedal will move forward slightly when engine vacuum power is added to the foot pressure on the pedal. If the unit is not operating, there will be no pedal action.</p> <p>If this check shows that the unit is not operating, check for the following: Brake pedal linkage sticking.</p>	<p>Vacuum check valve not operating properly. Collapsed or leaking vacuum hose. Plugged vacuum fittings. Leaking vacuum chamber. Vacuum check valve stuck in closed position. Leak in bellows assembly. Diaphragm assembly out of place in housing locating radii: Vacuum leak in automatic transmission T.V. vacuum line connection or fitting. Vacuum leak in forward, vacuum housing.</p>
<p>BRAKES DRAG</p>	<p>Sticking Valve Plunger.</p>	
<p>BRAKES GRAB</p>	<p>Sticking actuating valve assembly.</p>	
<p>SELF APPLICATION OF BRAKES WHEN ENGINE</p>	<p>Leak in rear housing. Diaphragm out of locating radii in housings and allowing atmospheric</p>	<p>pressure into rear chamber. Sticking or unseated atmospheric valve.</p>

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BRAKE PEDAL KICKS BACK WHEN APPLIED	This condition may be caused by a malfunctioning hydraulic piston check valve or slave cylinder piston cup. Re-	place the slave cylinder piston and/or piston cup.
ROUGE ENGINE IDLE WITH BRAKES RELEASED	Check for vacuum leaks in the vacuum line, loose hose connections, a loose body clamp, or a weak control valve piston return spring. Check all connections and tighten them or replace damaged parts as required. This	condition may also be caused by vacuum leaks at the control valve diaphragm, at the valve piston assembly, or at the power diaphragm. Remove and overhaul the booster assembly.
ROUGH ENGINE IDLE OR STALL AND HARD PEDAL WITH BRAKES APPLIED	Check the condition of the air cleaner. If it is clogged with dirt, replace the air cleaner felt. A sticking control valve piston, leaks at the control valve diaphragm or atmospheric valve seal, dirt on the control valve	plate, or the control valve piston not seating properly on the plate may also cause this condition. In addition, the booster diaphragm may be damaged. Remove and overhaul the booster assembly.
INTERMITTENT HARD BRAKE PEDAL	Check for an obstructed air cleaner, an inoperative vacuum check valve, or a slave cylinder piston sticking in the bore due to dirt or inferior hydraulic	fluid. Clean or replace damaged parts, refill the hydraulic system with new heavy-duty type brake fluid, and bleed the system.
HARD PEDAL—BOOSTER DIAPHRAGM RUPTURED	When a ruptured diaphragm is found, check for gasoline odor on the diaphragm. Gasoline will deteriorate the diaphragm and cause a premature failure.	Gasoline can get on the diaphragm from the intake manifold if the vacuum check valve is not operating properly or if hoses are not routed correctly.
BRAKES DO NOT RELEASE	Check the rear of the vacuum chamber for damage. This condition may also be caused by a sticking control valve piston, a damaged slave cylinder piston check valve, dirty brake fluid, a sticking slave cylinder piston, a sticking push rod, or an inoperative check valve in the end cap. Remove and overhaul the booster.	In case of emergency, if a sticking control valve piston holds the brakes in an applied position, disconnect the booster vacuum line from the vacuum check valve and install a pipe plug in the check valve opening. This permits the brakes to release. Manual application of brakes may then be made without assistance from the booster.

FIG. 7—Diagnosis Guide—Power Brakes Vacuum Boosters—Frame Mounted

AIR PRESSURE BELOW NORMAL	Air gauge not reading properly. Compressor worn out. Compressor discharge valve leakage. Slipping compressor drive belt. Open reservoir drain cock. Excessive leakage at lines and fittings to reservoir tank.	Low engine speed. Excessive carbon in the compressor head or discharge line. Clogged compressor air strainer. Damaged or improperly adjusted governor. Compressor inlet valves stuck closed.
AIR PRESSURE RISES ABOVE NORMAL	Damaged or improperly adjusted governor. Compressor unloading valves stuck closed. Restriction in the passage between the governor and the compressor unloading mechanism. Air gauge not operating properly.	Excessive clearance at the compressor unloading valves. Leak at compressor unloading piston seal. Carbon deposits in cavities beneath unloading piston and passages in the compressor cylinder head.
CONTINUOUS OR INTERMITTENT COMPRESSOR KNOCKS	Loose drive pulley. Worn or burned out compressor bearings.	Excessive carbon deposits in the compressor cylinder head.
	Governor cut-out setting adjusted too high. Above normal system pressure.	Damaged or improperly adjusted safety valve.
	Failure to drain the reservoirs at regular intervals.	Worn compressor piston rings. Dirty compressor air filter.

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<p>BRAKES WILL NOT APPLY</p>	<p>Compressor not operating. Broken or disconnected air line. Inoperative brake applying valve in truck or in towing vehicle.</p>	<p>Inoperative emergency relay valve. (If trouble is in trailer brakes only.) Punctured diaphragm in air chamber.</p>
<p>BRAKES APPLY BUT BRAKING IS NOT ADEQUATE</p>	<p>Vehicle is overloaded. Compressor drive belt is slipping. Low air pressure in brake system due to leak in lines or fittings. Leak at the air chambers.</p>	<p>Glazed linings in the wheel brakes. Brakes not properly adjusted. Brake drum broken or cracked. Improper brake blocks.</p>
<p>BRAKES APPLY TOO SLOWLY</p>	<p>Low air pressure in system. Restricted air hose or tubing. Excessive air leakage in system. Inoperative brake applying valve in truck or in towing vehicle.</p>	<p>Inoperative emergency relay valve. (If trouble is in trailer brakes only.) Leak at air chambers. Ice from condensed water in air tanks or hose.</p>
<p>BRAKES WILL NOT RELEASE</p>	<p>Defective brake applying valve in truck or towing vehicle. Two-way hand valve in towing vehicle is in emergency position. (If trouble is in trailer brakes only.) Broken wedge return spring in brake actuator housing.</p>	<p>Brake shoes adjusted too close to brake drum. Atmospheric vent on air chamber plugged. Insufficient air pressure to release spring brakes.</p>
<p>BRAKES RELEASE TOO SLOWLY</p>	<p>Inoperative brake applying valve in truck or towing vehicle. Restricted air line. Weak or broken brake shoe-to-shoe springs. Weak wedge return spring in actuator.</p>	<p>Shoe guide ledges dry or corroded. Binding of wedge actuating mechanism because of inadequate lubrication. Plungers corroded and frozen in cylinder bore.</p>
<p>GRABBY BRAKES OR UNEVEN BRAKING</p>	<p>Inoperative brake apply valve in vehicle or towing vehicle. Inoperative emergency relay valve. (If trouble is in trailer brakes only.) Grease on linings. Scored or broken brake drum. Distorted brake shoes.</p>	<p>Lining loose on shoes. Loose wheel bearing. Brake drum out-of-round. Binding of wedge actuating mechanism because of inadequate lubrication.</p>



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problems may originate in many parts of the air brake system other than

the basic wheel brakes.



<p>LEAKING SPRING BRAKE (Air Pressure Loss)</p>	<p>Check air lines and connections. If air exhausts constantly from service brake port when spring brake has been charged with air, replace pushrod seal. If air exhausts constantly from</p>	<p>breather cap opening when spring brake has been charged with air, replace main seal. If air bubbles appear from under release bolt head, replace collar seal.</p>
<p>NO PARKING BRAKE</p>	<p>Spring brake is manually released. Screw in release bolt. Spring failure. Disassemble unit and replace spring. Service brake chamber piston rod not mated with wedge shaft.</p>	<p>Improper adjustment of wedge brakes. Check automatic adjuster mechanism for correct assembly and operation. Damaged or incorrectly assembled wedge brake. Check mechanism.</p>
<p>LEAKING SERVICE BRAKE AIR CHAMBER (Air Pressure Loss)</p>	<p>Check all lines and connections. Charge service brake chamber with air. Soap or oil test clamp ring. If bubbles appear, tighten clamp ring. If bubbles persist, replace diaphragm. If air exhausts constantly from</p>	<p>spring brake port when service brake chamber has been charged with air, replace pushrod seal. Examine diaphragm for wear, cracks or rupture. Replace, if necessary.</p>
<p>SPRING BRAKE WILL NOT RELEASE WITH AIR</p>	<p>Check air lines and connections. Insufficient air pressure being delivered to spring brake. Check pres-</p>	<p>sure at end of air line. Damaged or incorrectly assembled wedge brake. Check mechanism.</p>

FIG. 10—Diagnosis Guide—Air Parking and Safety Brake



INSUFFICIENT BRAKING ACTION	<p>Low reservoir pressure. Brakes need lubrication, adjustment, or relining. Foot control valve delivery pres-</p>	<p>sure too low due to a malfunction in the valve or incorrect adjustment of the treadle linkage.</p>
SLOW BRAKE ACTION	<p>SLOW APPLICATION</p> <p>Lack of lubrication at brake shoe camshafts. Low reservoir pressure. Excessive leakage during brake application. Restricted or damaged pipes or hoses. Foot control valve and treadle linkage sticking or damaged.</p>	<p>SLOW RELEASE</p> <p>Restricted port, weak return spring, or other wear damage in foot control valve. Brakes require lubrication or adjustment. Restricted or damaged pipes or hoses. Damaged or restricted quick release valve or relay valve. Broken retraction springs or binding hold pins.</p>
BRAKES INOPERATIVE	<p>BRAKES DO NOT RELEASE</p> <p>Restricted brake lines. Weak return spring or other wear or damage in foot control valve. Broken brake shoe retracting springs or rusted front anchor pins.</p>	<p>BRAKES DO NOT APPLY</p> <p>Low reservoir pressure. Restricted or broken pipes or hoses. Defective foot control valve.</p>
UNEVEN OR GRABBING BRAKES	<p>Grease on brake linings. Out-of-round brake drums. Bind in brake shoe mountings. Foot control valve worn or damaged. Wet brakes.</p>	<p>Brakes need adjustment, lubrication, or relining. Leaking brake chambers. Broken brake chamber piston return spring.</p>
QUICK AIR PRESSURE DROP WITH ENGINE STOPPED	<p>BRAKES RELEASED</p> <p>Excessive leakage at foot control valve, governor, compressor discharge valve, or at other points in the system.</p>	<p>BRAKES APPLIED</p> <p>Excessive leakage in brake chambers, brake chamber diaphragms, tube and hose connections, or foot control valve.</p>

FIG. 11—Diagnosis Guide—Cam-Type Air Brakes



PART 2-2— Hydraulic Brakes

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Dual Brake Master Cylinder—Power			

1 DESCRIPTION AND OPERATION

SPLIT HYDRAULIC BRAKE SYSTEM

The standard brake system on all B-500-750 Series vehicles is a split hydraulic system (Fig. 1) with automatic brake adjusters at all the wheels.

With the split hydraulic system, each of the two lines from the dual-master cylinder actuates one brake cylinder at each wheel (front and rear) vehicles with 15 by 3-inch front

rear wheel. Power boosters are dash-mounted on vehicles with duo-servo front brakes and rear axle capacities up to 15,000 pounds (21,000 pounds GVW). Other vehicles (above 21,000 pounds GVW) have frame-mounted boosters.

DUAL-MASTER CYLINDER BRAKE SYSTEM

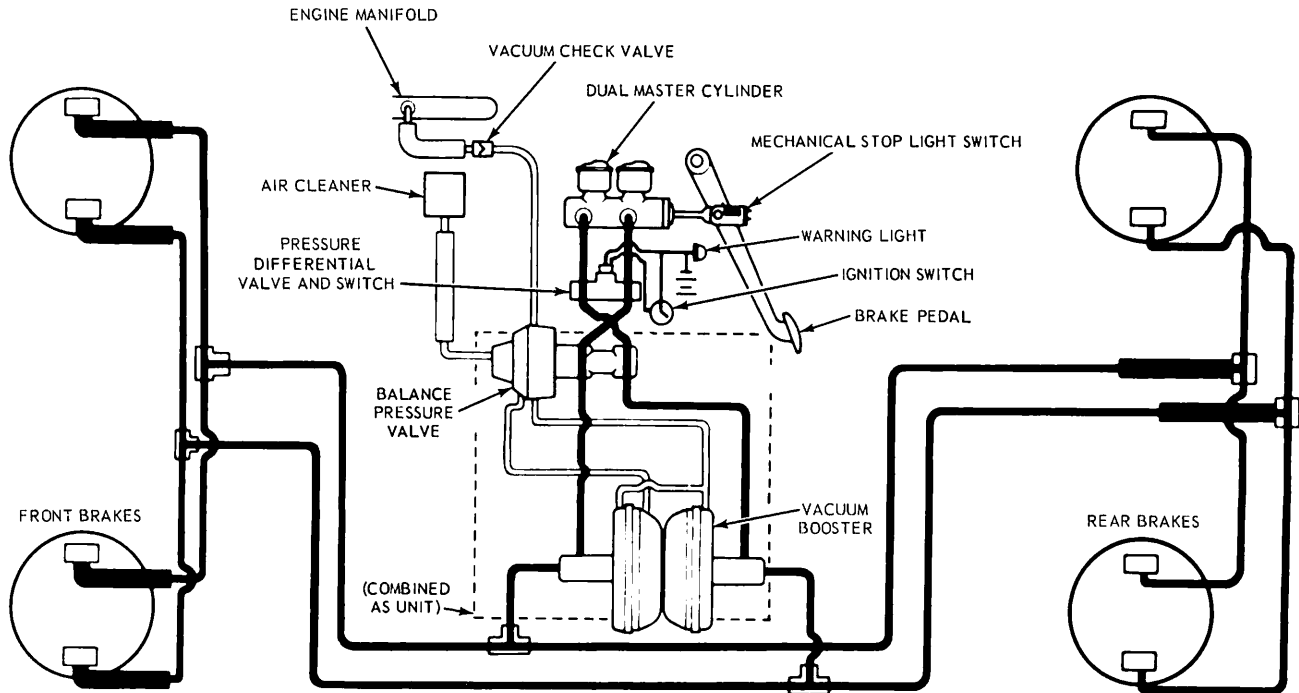
A dual-master cylinder brake system (Fig. 2) is used as standard equipment on F-100 through 350 and P-350-400-3500-4000 and B-500-750 Series Models.

A code letter is stamped on the end of each dual-master cylinder body casting for easy service identification.

The truck models, type of brakes and the identification code letters are shown on the dual-master cylinder identification chart (Fig. 3).

The dual, master cylinder contains a double hydraulic cylinder with two fluid reservoirs, two hydraulic pistons (a primary and secondary) and two residual check valves, located in the outlet ports (Fig. 4). On all vehicles except the F-350 Series, the master cylinder secondary systems outlet port is connected to the rear brakes and the primary system brake outlet port is connected to the front brakes. On the F-350 Series truck models, the master cylinder front outlet port is connected to the front brakes and the rear outlet port is connected to the rear brakes.

The master cylinder primary and



H1617-A

FIG. 1 — Split Hydraulic Brake System Schematic B-Series

secondary pistons function together when the primary and secondary systems are fully operative.

With the master cylinder and front and rear brake systems filled and bled, a solid column of fluid is located on both the primary and secondary pistons. Upon application of the brakes at the brake pedal, fluid is displaced by the piston into the wheel cylinders or calipers (if applicable) to activate both the front and rear brakes. Upon release of brake application, the brake fluid returns from the wheel cylinders or calipers (if applicable), through the front and rear brake lines and residual check valves to the master cylinder bore.

Failure in either the front or rear brake system does not result in failure of the entire hydraulic brake system. For example:

Should hydraulic failure occur in the rear brake system, the hydraulic pressure from the primary piston actuates the front brakes on all

trucks to be displaced by the front brake (primary) system allowing braking at the front wheels.

Should a failure occur in the primary (front brake) hydraulic system, the initial brake pedal stroke would cause the unresisted primary piston to bottom out on the secondary piston. Continued pedal stroke will move both pistons and the fluid under pressure applied by the secondary piston will apply the rear brakes.

As noted in the aforementioned description and the example above, the brake systems for the F-350 Series trucks are the reverse of the systems in the example. However, the operating principle for the F-350 Series trucks is the same.

Failure in one independent hydraulic system does not affect the hydraulic fluid displacement of the other independent system. In addition, hydraulic output pressure remains basically the same for the same pedal effort.

The increased pedal travel and pedal effort required to compensate for the loss of the failed portion of the brake hydraulic system provides adequate warning that partial brake failure has occurred. With the ignition switch turned on, a dual brake warning light on the instrument panel will

also indicate a brake hydraulic system failure.

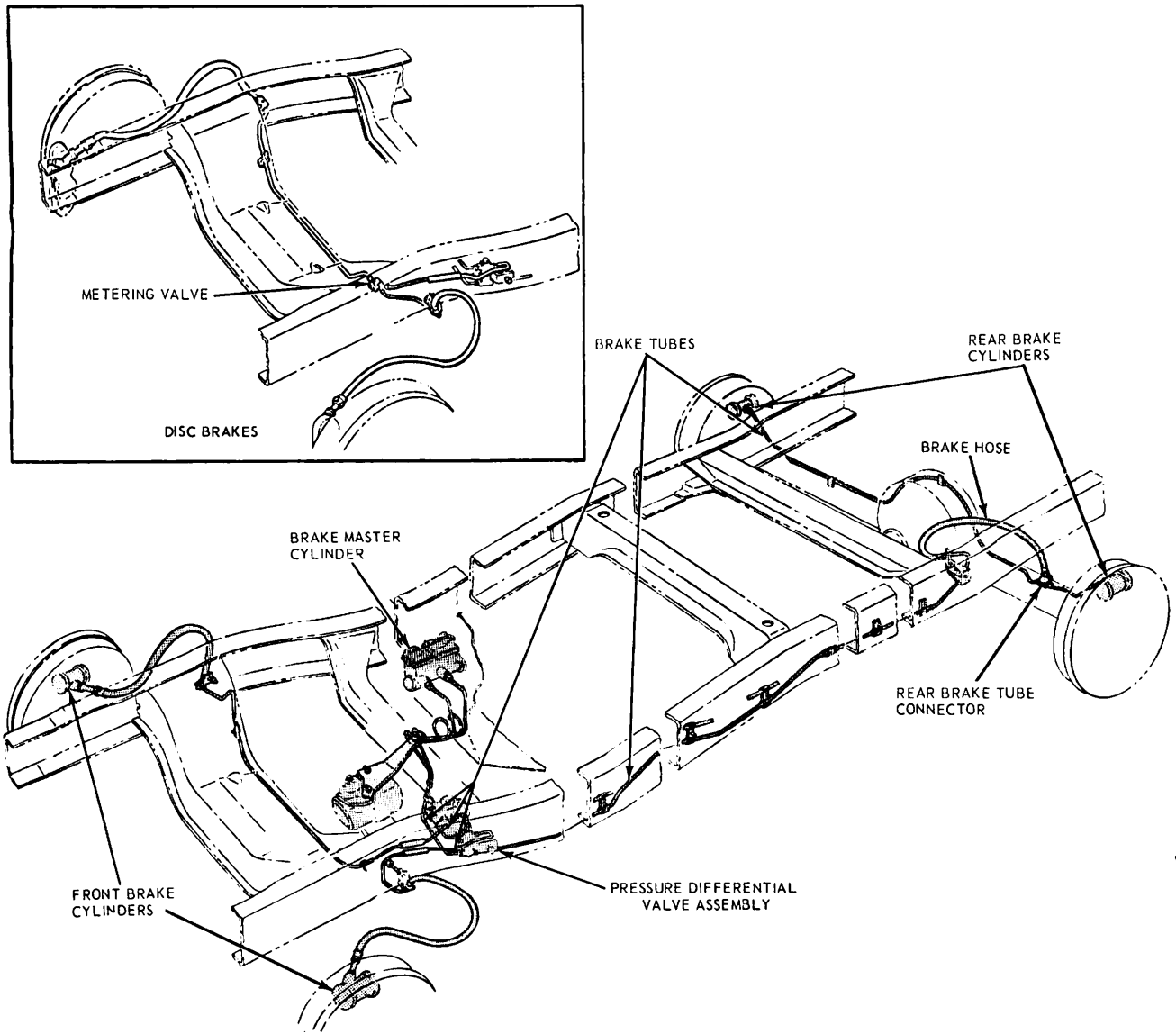
Brake lines (tubes) are connected from the brake master cylinder primary and secondary system outlet ports to the pressure differential valve assembly (Fig. 5). The electrical brake warning switch, and the brake lines (tubes) leading from the differential valve assembly to the front and rear wheel brake cylinders or front brake calipers (disc brakes) are also shown in Fig. 5.

The brake system hydraulic pressure differential valve assembly and the mechanically operated electrical switch warning light. The spring loaded switch plunger contacts the bottom of a tapered shoulder groove in the center of the differential valve. O-ring seals are used in the seal ring lands near each end of the valve (Fig. 5).

As noted previously, the brake systems for the F-350 and P-350-400-3500-4000 Series trucks are the reverse of the F-100, and F-250 Series trucks. However, the operating principles of the differential valve are the same as noted in the following example:

Should a failure of the rear brake hydraulic system occur, hydraulic fluid pressure in the rear brake (sec-





H1565-B

FIG. 2 — Typical Hydraulic Brake System—Dual Brake Master Cylinder F-100-350

secondary system on all except F-350 and P-350-400-3500-4000 Series trucks) system would drop. During brake pedal operation, the fluid pressure build up of the front brake system (primary system—on all except F-350 and P-350-400-3500-4000 Series trucks) would force the differential valve toward the low pressure area (secondary system outlet port). Movement of the differential valve forces the switch plunger upward over the tapered shoulder to close the switch

brake warning switch mechanism in the same manner as described above.

The standard hydraulic brake system on some trucks is assisted by a vacuum booster which may be installed as either standard or optional equipment.

The master cylinder converts physical force from the brake pedal and booster into hydraulic pressure against the pistons in the wheel cylinders or calipers. The wheel cylinder or caliper pistons in turn convert hydraulic pressure back into physical force at the brake shoes.

All Ford truck models have internal expanding shoes, except the F-250 and F-350 which may have front disc brakes. The different types of brake assemblies vary in the way that the shoes are anchored, in the number of

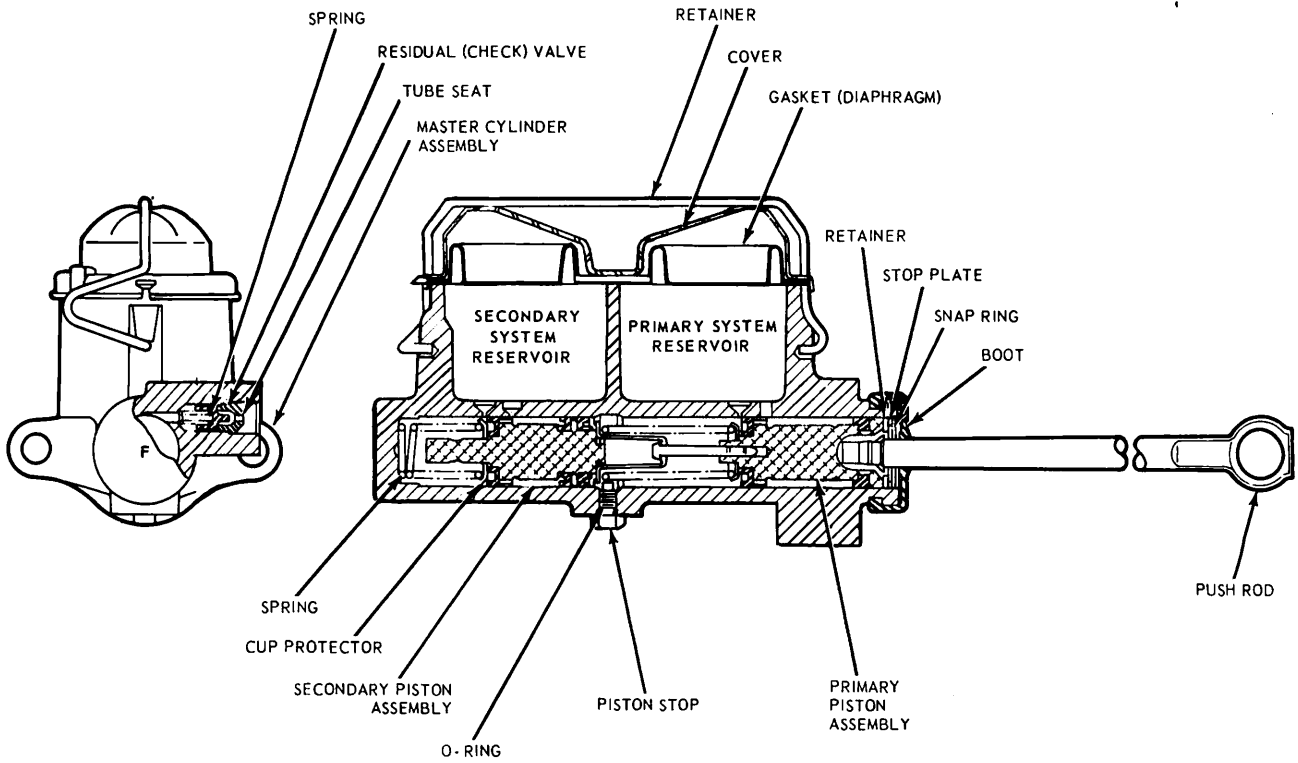
Truck Model	Master Cylinder Identification Code
F-100 (4x4)	C
F-100-250 (4x2)	A
F-250 (4x4)	A
F-350	B
P-350-400-3500-4000	Z
B-Series w/14x2½ inch Front Brake	TB
B-Series w/15x3 inch Front Brake	TD

FIG. 3 — Dual Master Cylinder Identification Chart

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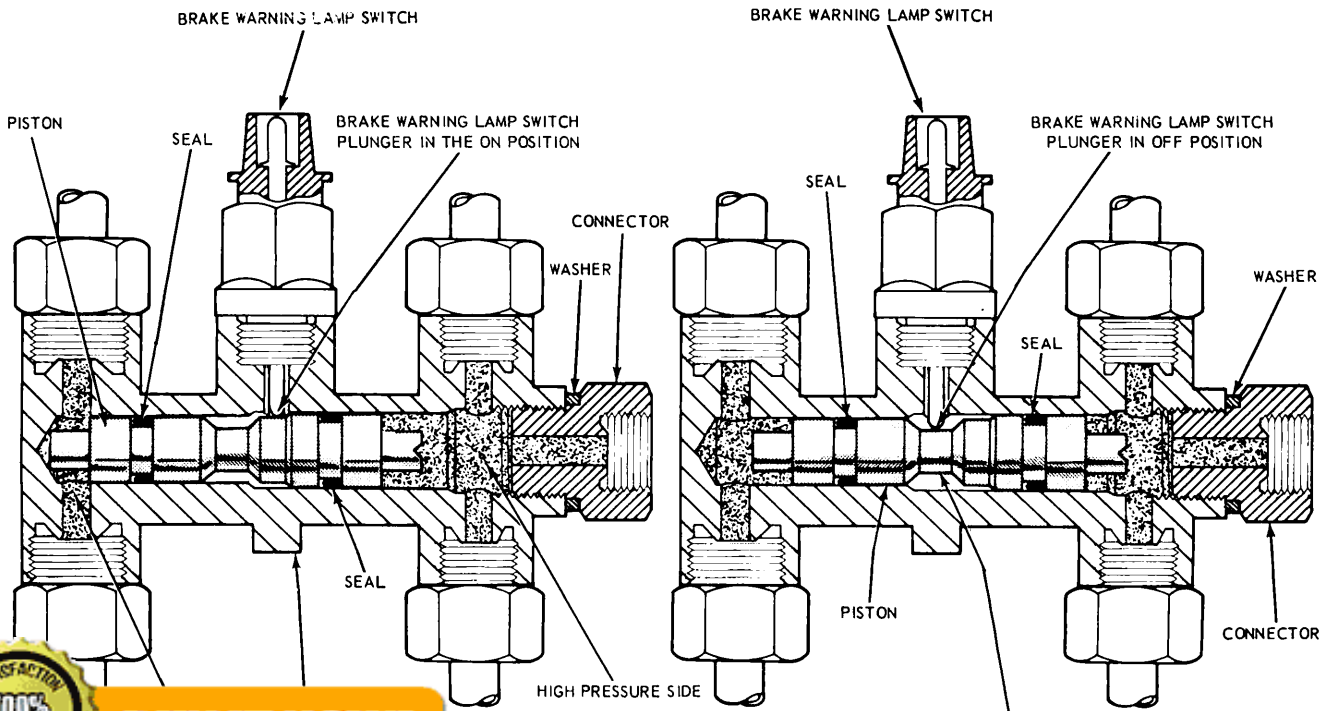
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H 1503 - A

FIG. 4 — Dual Master Cylinder — P and F-Series — Typical



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SEAL AREA. BRASS FINISHED, P

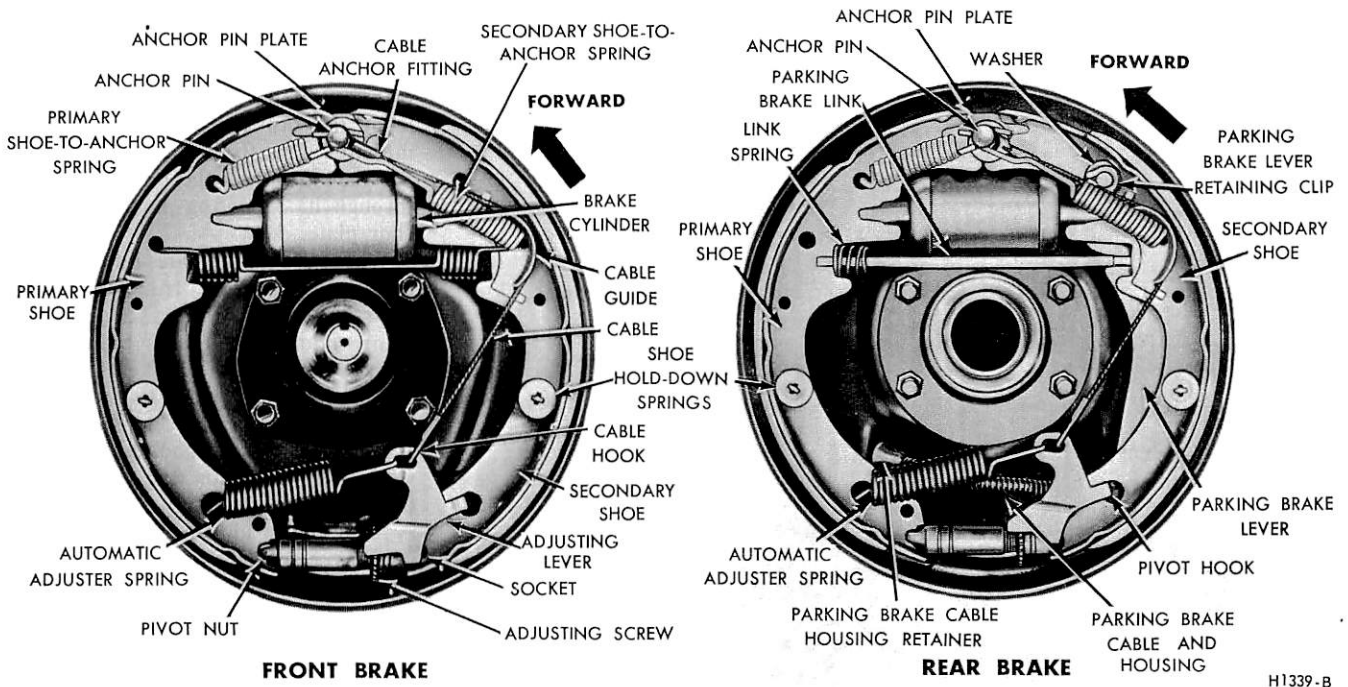
BRAKE FLUID

VALVE PISTON IS CENTRALIZED. PRIMARY AND SECONDARY SYSTEM PRESSURES ARE EQUALIZED

H1471-B

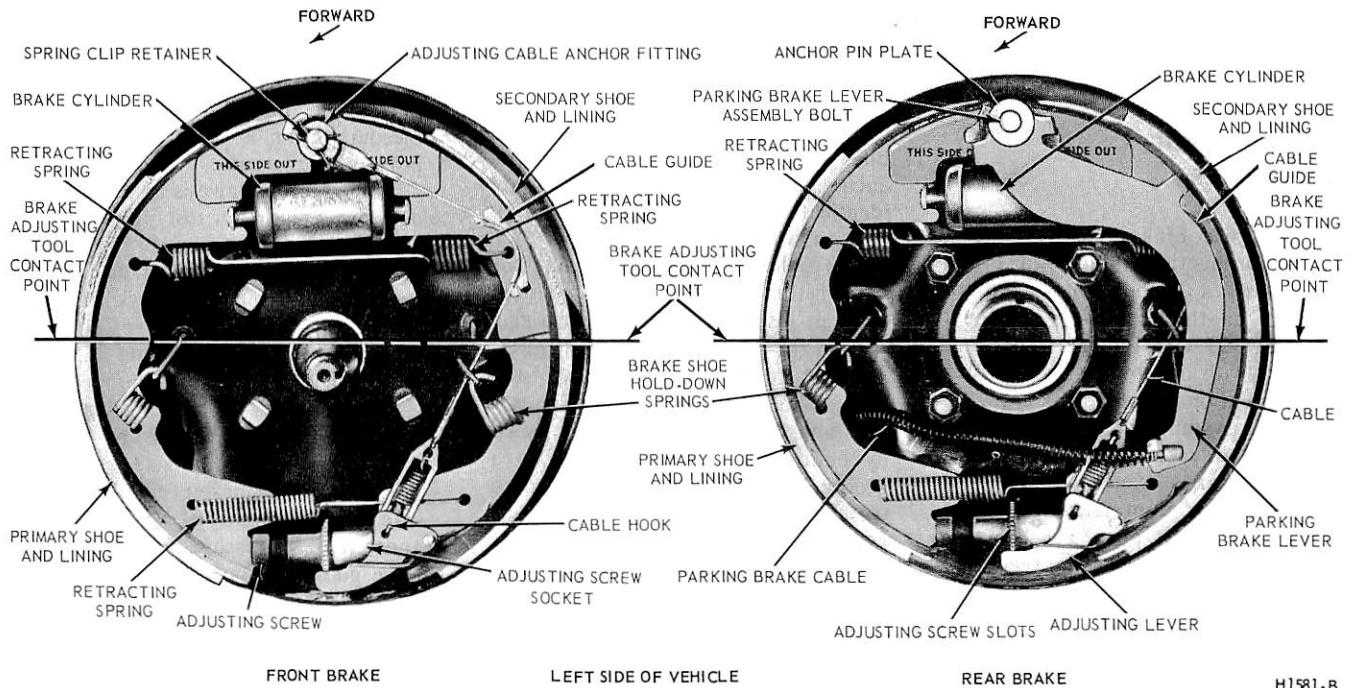


Typical



H1339-B

FIG. 6 — Self Adjusting Brake Assemblies—F-100 Series



H1581-B

FIG. 7 — Self Adjusting Brake Assemblies — F-250 Series

wheel cylinders used at each wheel, and in the number of pistons in the wheel cylinder.

against the upper end of the secondary shoe (Figs. 6 and 7).

one shoe; the piston in the other cylinder exerts force against one end of one shoe; the piston in the other cylinder exerts force against the opposite end of the other shoe.

In the double anchor type, each shoe is mounted to a separate anchor. The shoes are actuated by one duo-servo (two piston) cylinder at the upper end.

The rear wheels of some vehicles are equipped with two cylinders, each having two pistons (four pistons total). Each of the four pistons exert force against one end of one shoe (Fig. 24).

The front wheels of some trucks are equipped with two cylinders, each having one piston. The piston in one cylinder exerts force against one end of

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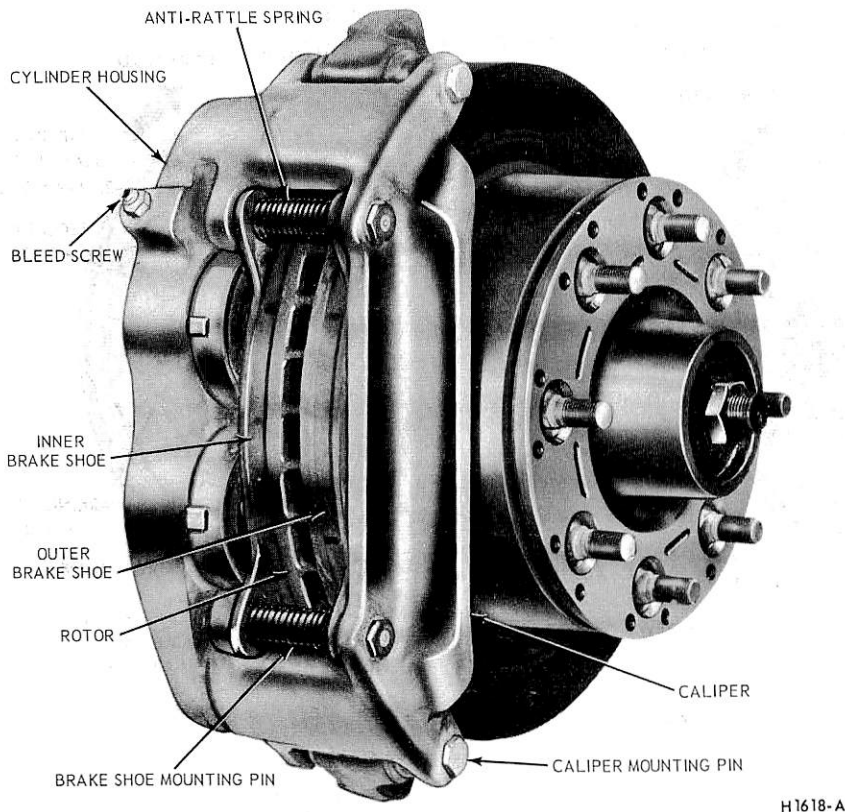


FIG. 8 — Floating Caliper Disc Brake

FLOATING CALIPER DISC BRAKES

Power disc brakes (Fig. 8) are a regular production option on F-250 and F-350 4 x 2 model trucks and are standard on the F-250 4 x 2 Model with the 390 CID engine. They are equipped with disc brakes in the front and conventional drum brakes in the rear. The system has a dual master cylinder and vacuum booster similar to drum brakes except the residual check valve is eliminated from the front brake outlet port. The pressure differential valve is the same type used with drum brakes. A metering valve is added in the front brake line between the pressure differential valve and the calipers.

RELATION AND FUNCTION OF COMPONENT PARTS

disc brake is the floating caliper

Two brake shoe and lining assemblies are used in each caliper, one on each side of the rotor. The shoes are identical and are attached to the caliper with two mounting pins.

The cylinder housing contains the two pistons. The pistons are fitted with an insulator on the front and a seal on the back lip. A friction ring is attached to the back of the piston with a shouldered cap screw. The pistons and cylinder bores are protected by boot seals which are fitted to a groove in the piston and attached to the cylinder housing with clamps. The cylinder assembly is attached to the caliper with two cap screws and washers.

The anchor plate is bolted directly to the spindle. It positions the caliper assembly over the rotor forward of the spindle.

Refer to Fig. 8.

When the brakes are applied, the hydraulic pressure from the master cylinder is applied to the cylinders. The seal, which is fitted on the inner lip of the piston, contacts the cylinder bore to seal the hydraulic pressure. The pressure moves the pistons and inner brake shoe lining assembly outward against the inner surface of the rotor. The hydraulic pressure in the cylinder then moves the caliper assembly and outer brake shoe lining as-

sembly inward on the caliper mounting pins. This forces the outer brake lining against the outer surface of the rotor. Braking torque is transferred from the brake shoes through their mounting pins to the caliper. The caliper then transfers the braking torque through its mounting pins to the anchor plate.

When the brakes are released, all pressure is removed from the cylinders. As the rotor rotates, the inherent rotor runout and road vibration are utilized to move the brake shoes and pistons back and maintains sufficient lining to rotor clearance.

Excessive piston knock back is prevented by the friction ring mounted on the back of the piston.

Automatic adjustment for lining wear is achieved by the piston and friction ring sliding outward in the cylinder bore. The piston assumes a new position in the cylinder and maintains the correct adjustment.

The metering valve is located on the crossmember in the front brake line. It is a delay valve which prevents the front brakes from applying until the master cylinder pressure reaches about 120 psi. This delay prevents the front brakes from performing all the braking action on low speed stops. A bleeder button is built into the lower portion of the valve.

The metering valve is a spring loaded valve and in its rest position permits flow from the front brakes to the master cylinder (Fig. 9). During light brake application the check valve is seated and seals the flow of fluid to the front brakes. At about 120 psi master cylinder pressure, the metering valve becomes a balanced valve. It maintains a lower pressure in the front brakes than master cylinder pressure, until master cylinder pressure reaches about 500 psi. At 500 psi and greater pressures, the metering valve goes wide open and stays there. At these higher pressures, the front brake pressure is the same as master cylinder pressure. When the brakes are released, the check valve in the metering valve permits an unrestricted flow from the front disc brakes to the master cylinder.

SELF ADJUSTING DRUM BRAKES

Single anchor duo servo type brake assemblies equipped with a self adjusting mechanism are used front and rear on F-100-250-350 and P-350-400-3500-4000 series trucks. The F-250 self-adjusting brake differs from

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