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Caliper Disc Brakes

H

Description

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Technical Data and Selection Procedure

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225DP100 Caliper

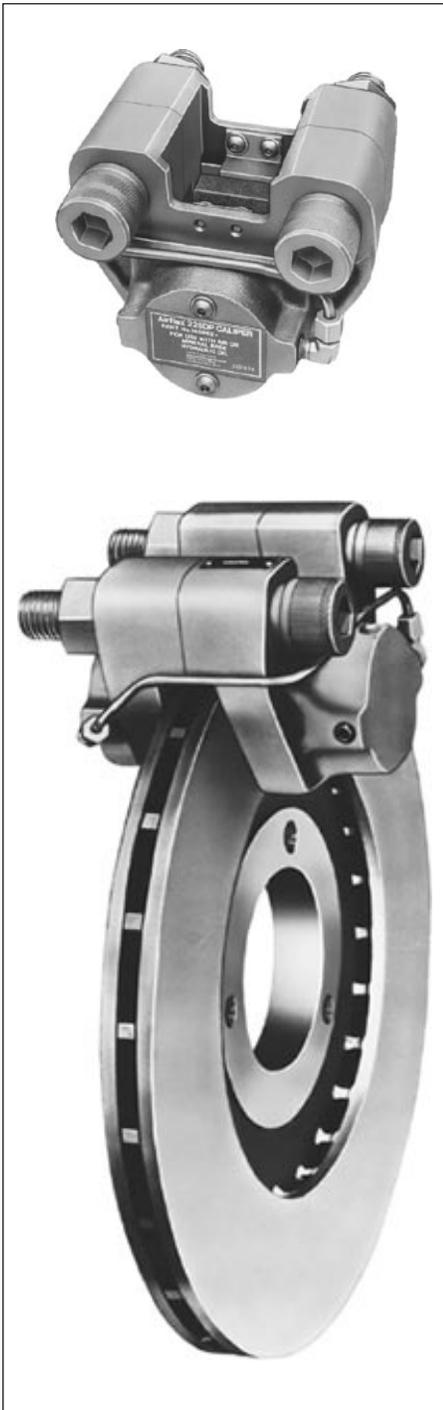
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HC3 and HD3 Calipers

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Air over Hydraulic Intensifier

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Description

Caliper disc brakes are ideally suited for most large torque, high energy stopping applications. By proper choice of actuating pressure, number of calipers per disc, number of discs and disc diameter a braking system can be custom designed for most applications.

The calipers are of the opposed piston design. This design permits fixed mounting of the caliper and the brake disc. Symmetrical split construction of the piston housings permits a center reaction mounting and the ability to accommodate brake discs of different thicknesses. Friction shoes attach to the caliper actuating pistons and are replaceable without disturbing the caliper mounting. Pressurizing the piston cylinders causes the piston mounted friction shoes to clamp the disc, developing the braking torque.

Caliper model 225DP100 is designed with self-adjusting retracting mechanisms which compensates for friction material wear and maintains a constant running clearance between the friction shoes and brake disc. They also maintain a constant displacement volume and hence a constant response time for each brake engagement.

Model HC-3 and HD-3 calipers are designed for very heavy duty braking service. The design automatically compensates for runout on large diameter brake discs. Because of this feature, they require manual adjustment to compensate for friction material wear and to maintain a constant volume displacement for actuation. Model HC-3 requires a mounting between the piston housings. Model HD-3 is used for side surface mounting.

Low coefficient friction shoes are available which permits the calipers to be used as tension brakes.

All three caliper models can be air or hydraulic actuated. The pressurizing media must be specified to insure proper piston seal compatibility. Two seals are available: one for air and mineral base fluids, and the other for vegetable base fluids.

Maximum allowable operating pressure is 1000 psi (69 bar). For those installations not equipped with a high pressure power source, a pressure intensifier can be used to provide the required pressure. This device multiplies a low air pressure input into a higher hydraulic pressure output.

Where Used:

- Conveyors
- Flywheel Brakes
- Mining Vehicle Brakes
- Railroad Maintenance Equipment
- Tension Brakes



Brake Disc Recommendations

Other than a 15 inch (381 mm) diameter ventilated disc, Airflex does not offer a line of standard discs. Because caliper braking systems are custom designed for an installation, it is more advantageous for the customer to provide his own disc or braking surface. For this reason the following disc guidelines are offered.

Rotational speed and thermal stresses must be considered when selecting disc material. Brake disc material should have high carbon content: for gray cast iron, minimum grade ASTM A48 class 50 (ISO 185 grade 35); for steel, minimum grade SAE 1040 (ISO 683/1 and 4 C40). Frictional surfaces should be finished machined to 125 micro (ISO N8) and have a Brinell hardness of 200.

General

Technical Section Y of the Catalog contains useful information pertaining to the selection, mounting, alignment and control of clutches and brakes in general. Formulas, symbols and units are also identified. It is recommended that Section Y be reviewed before attempting to size a specific product for an application.

Frictional Force Adjustment

Dynamic frictional force ratings F_r are given for calipers furnished with either standard or low coefficient friction linings. The ratings are based upon an effective pressure p_r of 1000 psi (69 bar) for standard linings and 100 psi (6,9 bar) for low coefficient linings. Low coefficient linings are intended for applications which slip continuously and as a result are not recommended for use at pressures over 100 psi (6,9 bar).

Friction force ratings must be adjusted for operating pressure p_o and the parasitic loss p_p which represents the pressure to overcome piston seal friction and friction shoe release springs. The effective friction force F_e is calculated from:

$$F_e = \frac{p_o - p_p}{p_r} \cdot F_r$$

Torque Calculations

Braking torque is calculated from:

$$M_e = 0.5 \cdot N \cdot F_e (D - C_t)$$

where M_e is the effective brake torque (lb·in or N·m)

N = number of calipers

F_e = effective frictional force (lb or N)

D = disc outside diameter (in or m)

C_t = disc constant

Parameter	225 DP 100		HC3 and HD3	
	English Units	SI Units	English Units	SI Units
Dynamic Frictional Force F_r	,			
Standard linings @ 1000 psi (69 bar)	2540 lb	11300 N	5300 lb	23600 N
Lo-co linings @ 100 psi (6,0 bar)	190 lb	845 N	400 lb	1780 N
Static Friction Force	,			
Standard linings @ 1000 psi (69 bar)	3170 lb	14100 N	6620 lb	29440 N
Parasitic Loss p_p	8 psi	0,6 bar	10 psi	0,7 bar
Disc Constants	,			
C_d	8.25	2095	10.21	2593
C_t	3.2	0,08	4.1	0,10
Minimum Disc Diameter	9.63 in	0,24 m	18.63 in	0,47 m
Friction Area	12.5 in ²	80 cm ²	39 in ²	252 cm ²
Typical Disc Running Clearance per Side	0.03 in	0,8	0.06 in	1,6
Displacement to Engagement	0.5 in ³	0,008 dm ³	1.1 in ³	0,018 dm ³
Cylinder Volume - Engaged	,			
New lining and disc	0.9 in ³	0,015 dm ³	3.5 in ³	0,06 dm ³
Worn lining and disc	4.0 in ³	0,07 dm ³	12.5 in ³	0,21 dm ³
Lining Thickness	,			
New	0.65 in	17 mm	0.56 in	14 mm
Worn	0.37 in	9 mm	0.06 in	1,5 mm
Weight/Mass	17 lb	7,7 kg	85 lb	39 kg

Example

What combinations of disc diameters and number of 225DP100 calipers will produce a dynamic torque of 5000 lb·in. Air pressure of 80 psi is available.

$$\begin{aligned}
 F_e &= \frac{p_o - p_p}{p_r} \cdot F_r \\
 &= \frac{80 - 8}{1000} \cdot 2540 \\
 &= 183 \text{ lb} \\
 M_e &= 0.5 \cdot N \cdot F_e (D - C_t) \\
 D &= \frac{M_e}{0.5 \cdot N \cdot F_e} + C_t \\
 &= \frac{5000}{0.5 \cdot 183 \cdot N} + 3.2 \\
 &= \frac{54.64}{N} + 3.2
 \end{aligned}$$

No. Calipers N	Disc Diameter (in)
One	58
Two	30.5
Three	21.5
Four	17

Thermal Capacity

Non-cyclic thermal capacity is determined by the caliper's friction area and/or the swept area of the braking disc. For good life, it is recommended that the peak thermal power not exceed 75 HP (56 kW) for the 225DP100 and 235 HP (175 kW) for the HC3 and HD3 calipers. Disc swept area loading should not exceed 0.3 HP/in² (0.035 kW/cm²). The swept area can be approximated from:

$$A_s = C_d \cdot (D - C_t)$$

where A_s = disc swept area in² (cm²)

C_d = disc constant

D = disc outside diameter in (m)

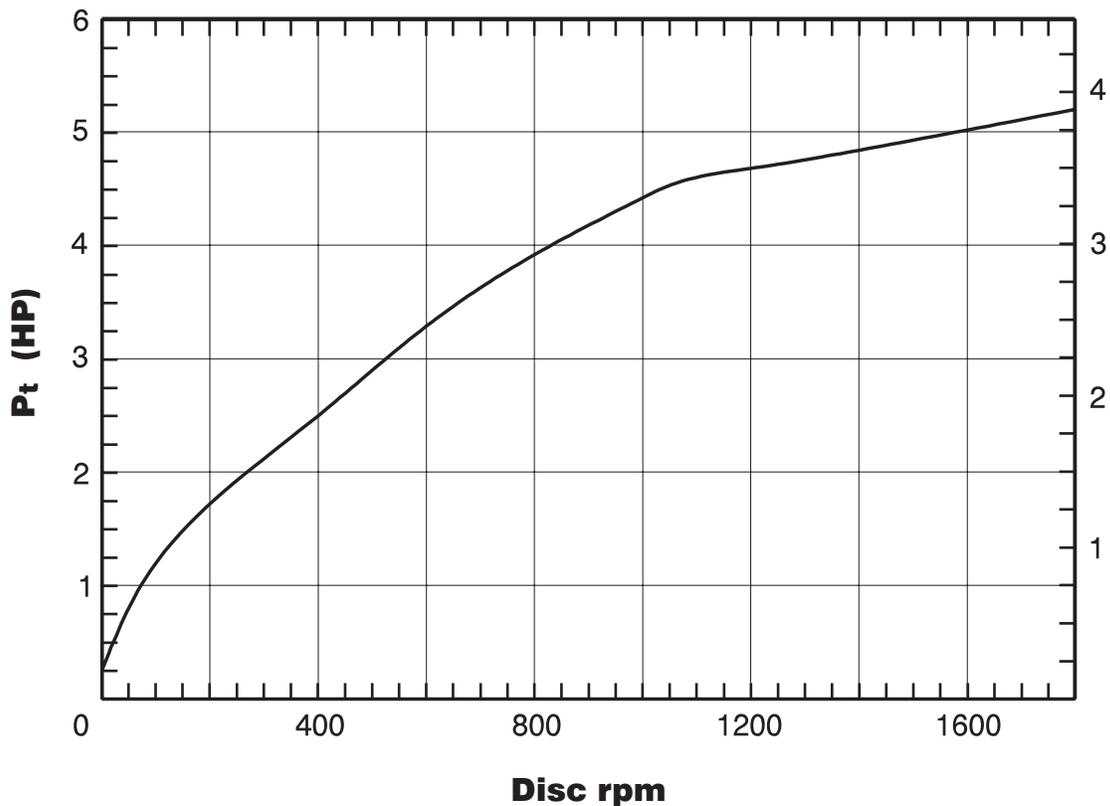
C_t = disc constant

The following graph illustrates the continuous thermal power dissipation for the 225DP100 caliper with low coefficient friction linings and a 15 inch (0.38 m) diameter ventilated disc.

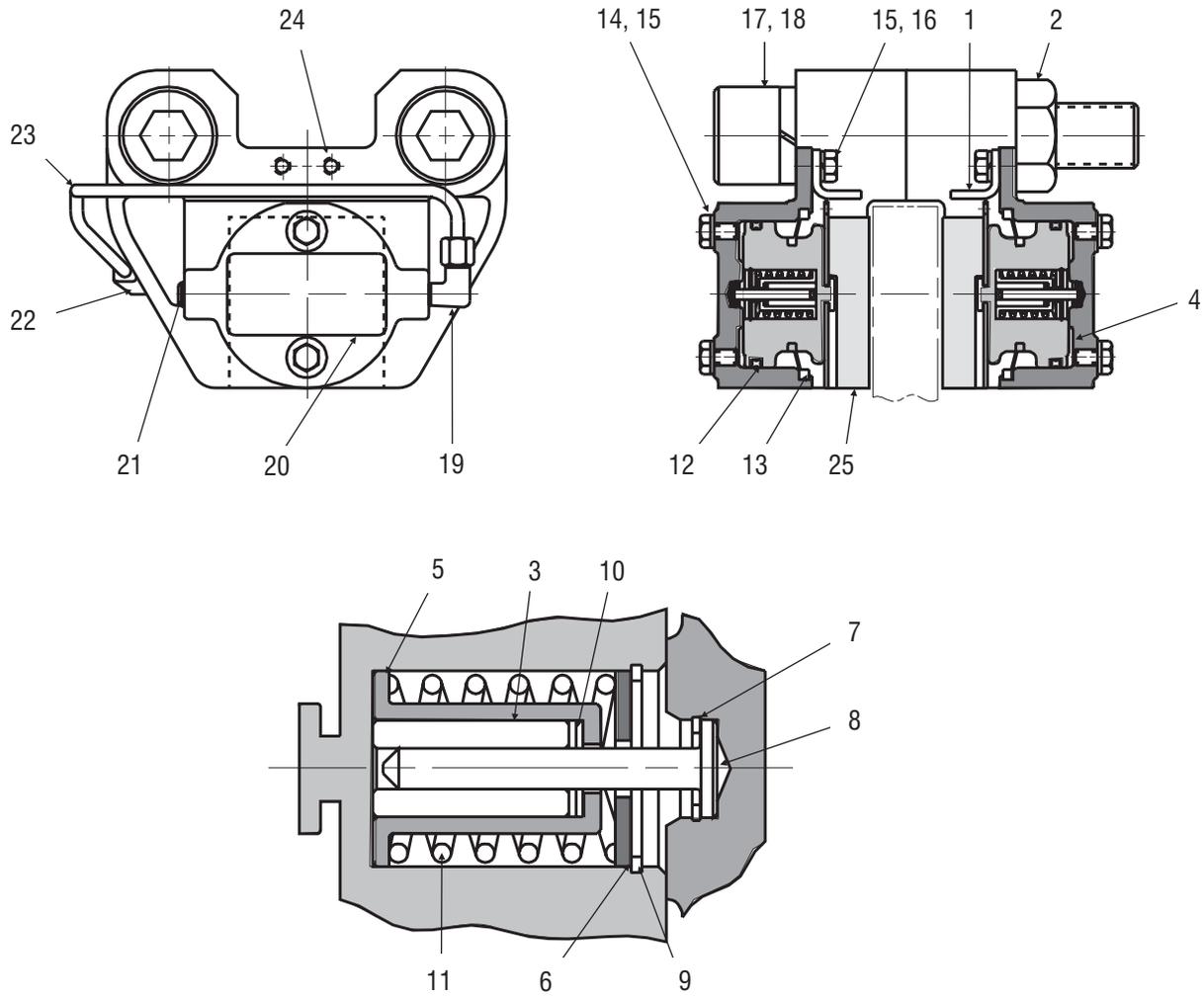
Example

A 1,5 m diameter disc will be used with a HC3 caliper. What is the disc's thermal capacity?

$$\begin{aligned} A_s &= C_d \cdot (D - C_t) \\ &= 2593 \cdot (1,5 - 0,10) \\ &= 3630 \frac{\text{kW}}{\text{cm}^2} \cdot 3630 \text{cm}^2 = 127 \end{aligned}$$



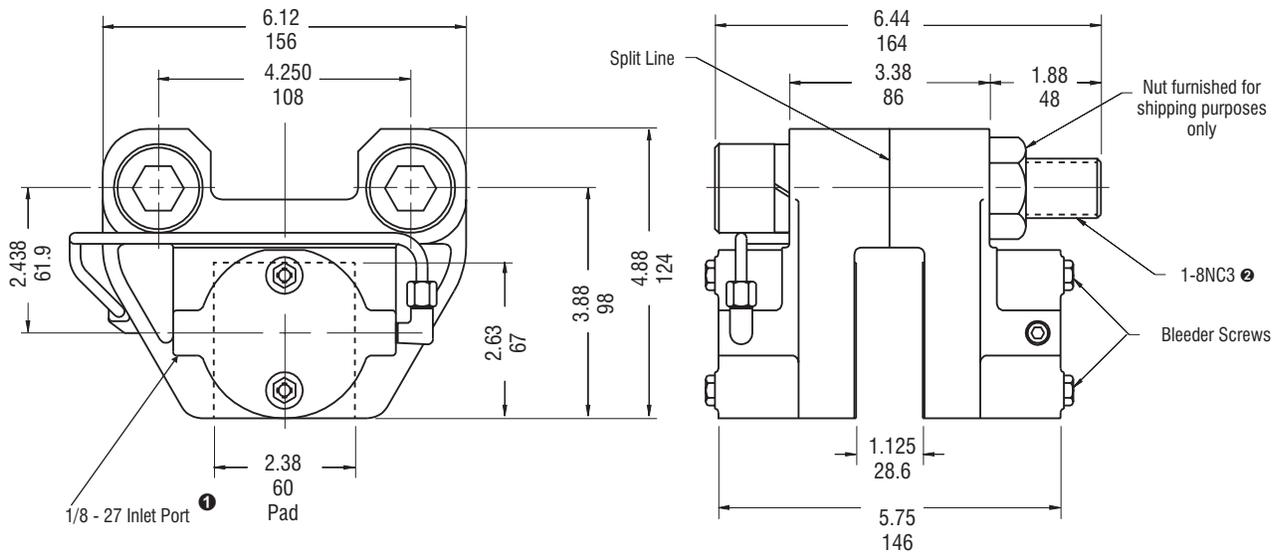
Airflex[®] 225DP100 Caliper Component Parts



Item	Description
1	Friction Shoe Retainer
2	Hex Nut
3	Sleeve
4	Piston
5	Spring Guide
6	Washer
7	Snap Ring
8	Pin
9	Snap Ring
10	Retaining Ring
11	Spring
12	Quad Ring

Item	Description
13	Boot
14	Dyna Seal
15	Hex Hd Cap Screw
16	Lockwasher
17	Socket Hd Screw
18	Lockwasher
19	Elbow
20	Decal
21	Pipe Plug
22	45° Elbow
23	Bridge Pipe
24	Cylinder Block
25	Friction Shoe Assy

Items	Kit Description	Part Number
12,13&25	Standard Lining and Vegetable Seal Kit	146258
3,4,5,6,9	Piston Replacement Kit:	
10,11,12 & 13	For Air and Mineral Base Fluid	145862X
	For Vegetable Base Fluid	145862Y



Caliper Description	Part Number
Caliper w/low coefficient linings and seals for mineral base fluids	142862C
Caliper w/standard linings and seals for vegetable base fluids	142862H
Caliper w/standard linings and seals for mineral base fluids	142862J

Notes:

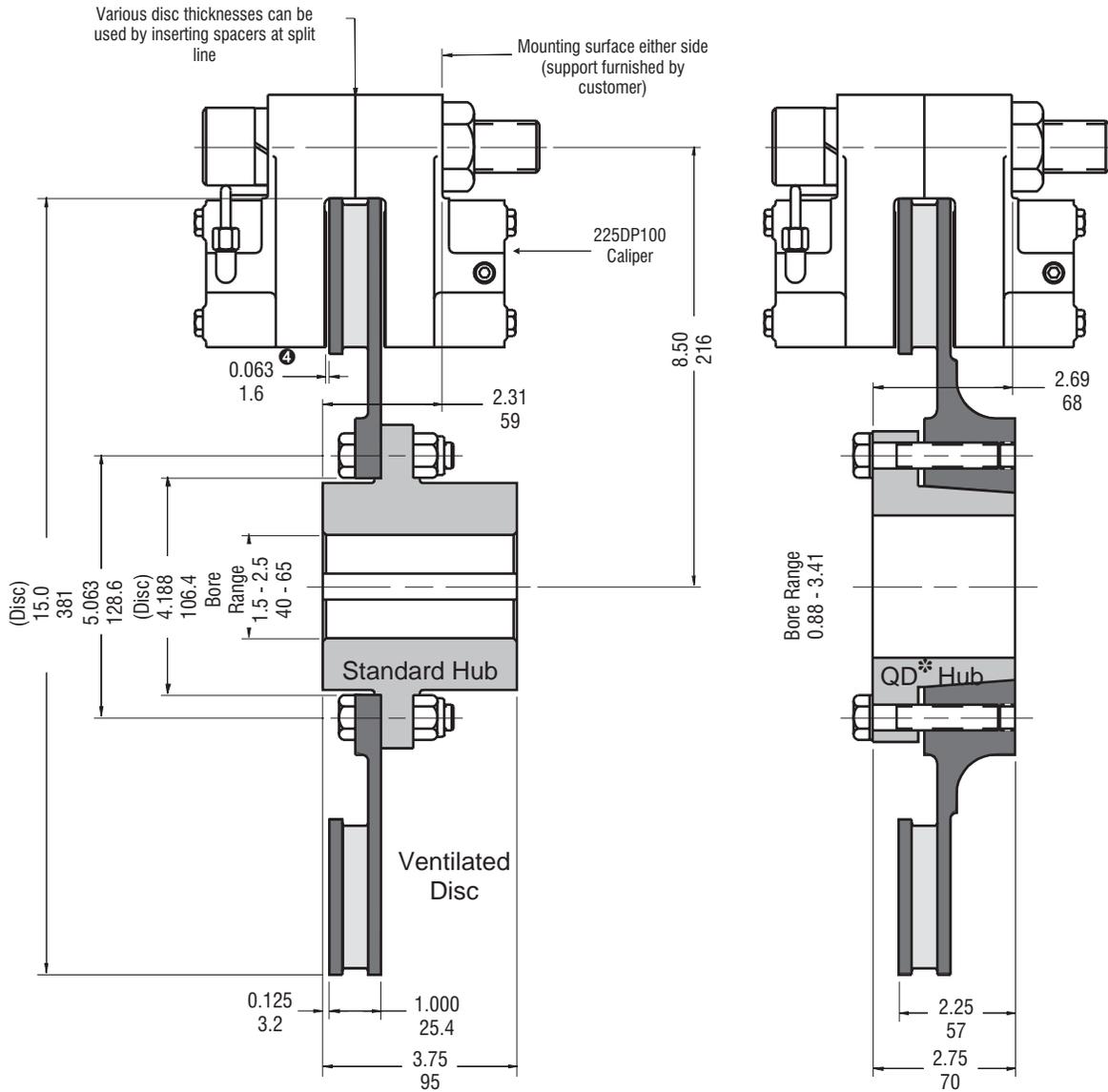
- ① American National Pipe Thread
- ② American National Standard for Unified Screw Threads.

Airflex[®] 225DP100 Caliper Brake Application



Form CA 1003

Dimensional Data

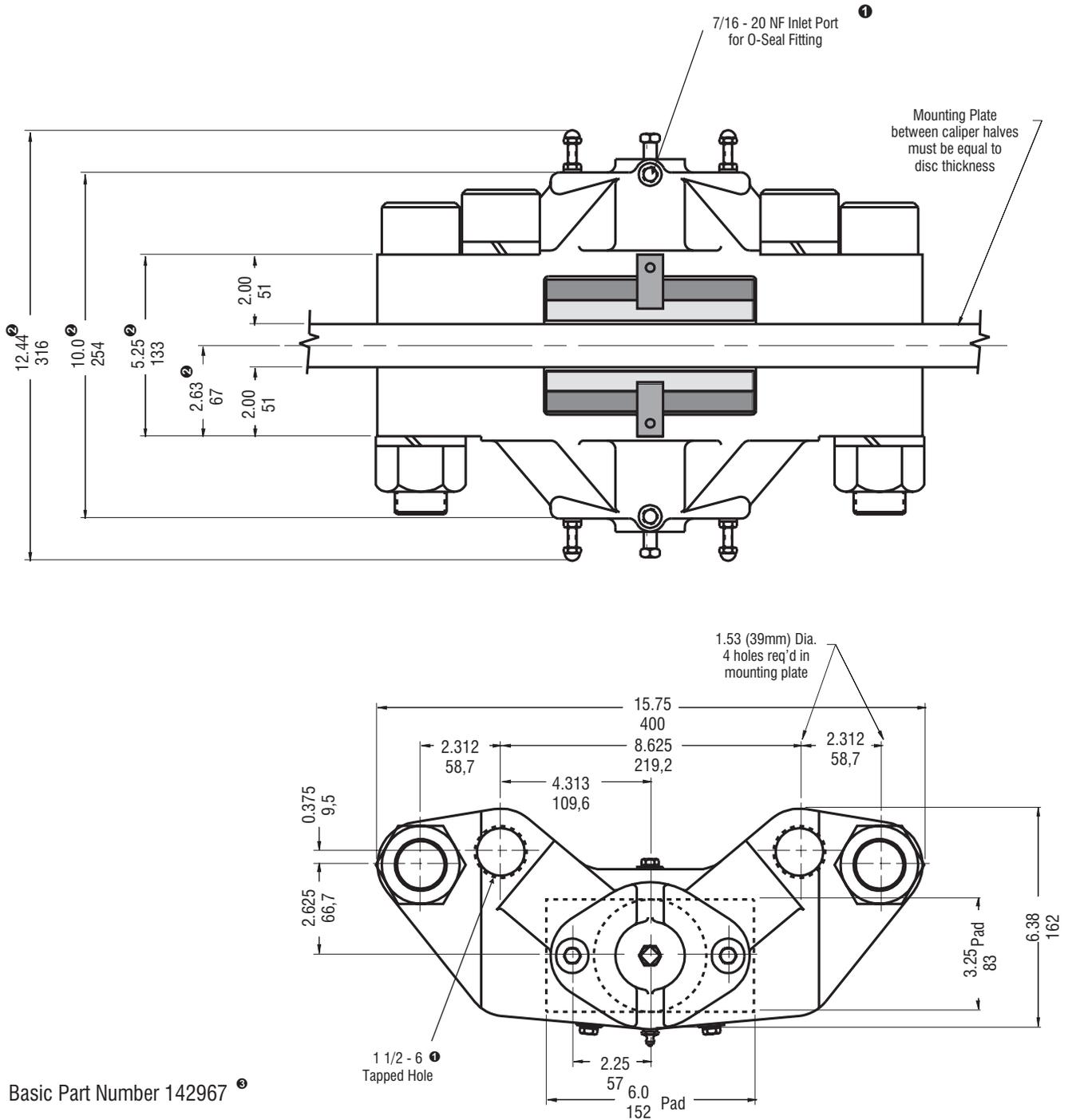


Component	Part Number	English Units		SI Units	
		Weight lb	Wk ² lb-ft ²	Mass kg	J kg-m ²
Caliper	142862 ①	17	N/A	7,7	N/A
Disc for standard hub	407936 ②	24	5.6	10,9	0,23
Disc for QD hub	410851 ②	25	5.7	11,3	0,24
Standard Hub	404351	13	0.3	5,9	0,01
QD Hub	304582 ②	12	0.2	5,4	0,01

* QD is a registered trademark of Emerson Electric Co.

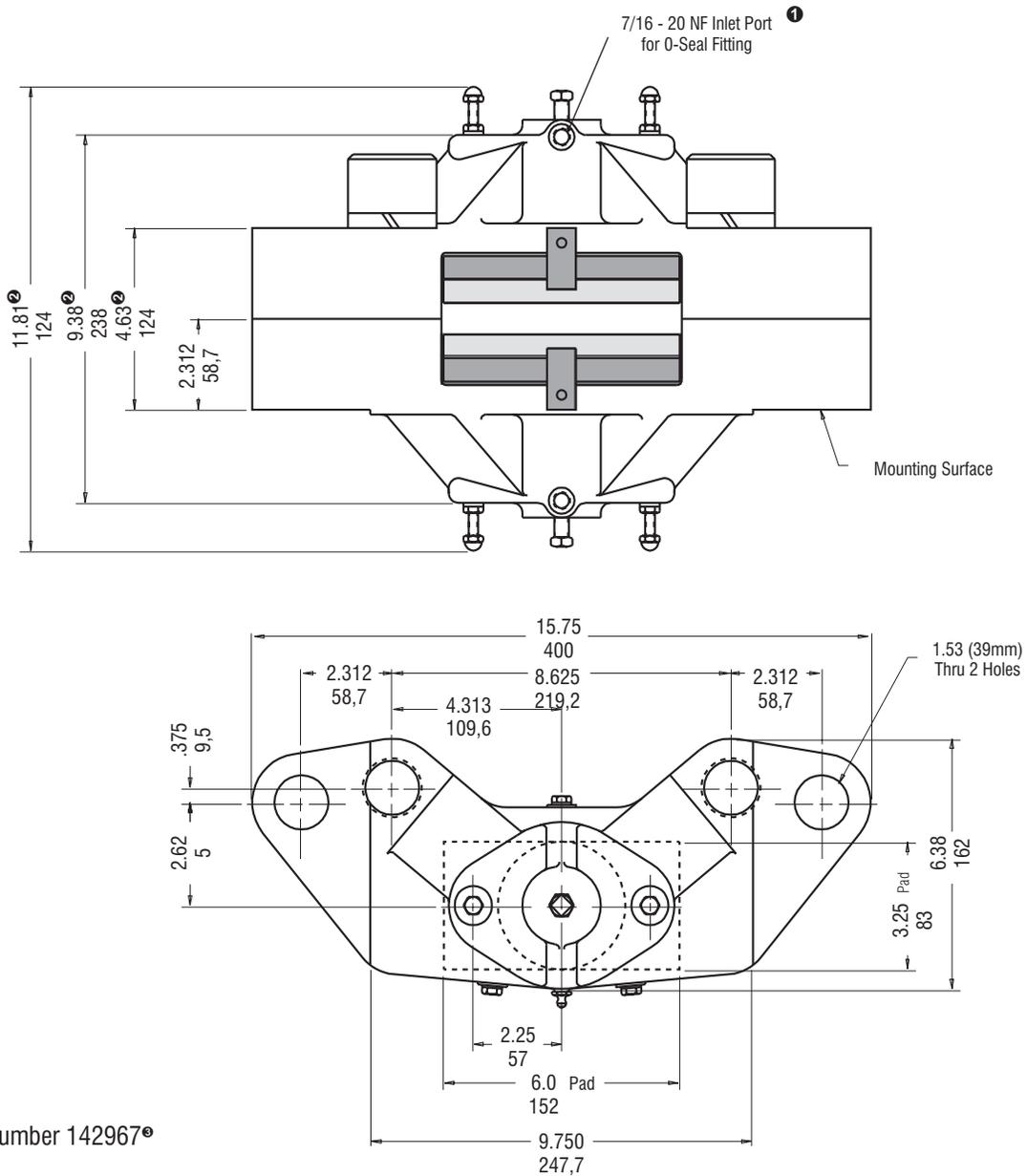
Notes:

- ① Basic part number only. Type of friction linings and actuating fluid must be specified.
- ② Basic part number only. Suffix must be added for specific bore.
- ③ Maximum speed is 1800 rpm.
- ④ Minimum gap during operations: 0.030" (0,8 mm) typical.



Notes:

- ① American National Standard for Unified Screw Threads.
- ② These dimensions based on a 1.25 in (32 mm) thick disc.
- ③ Suffix must be added to indicated type of friction lining and actuating fluid.

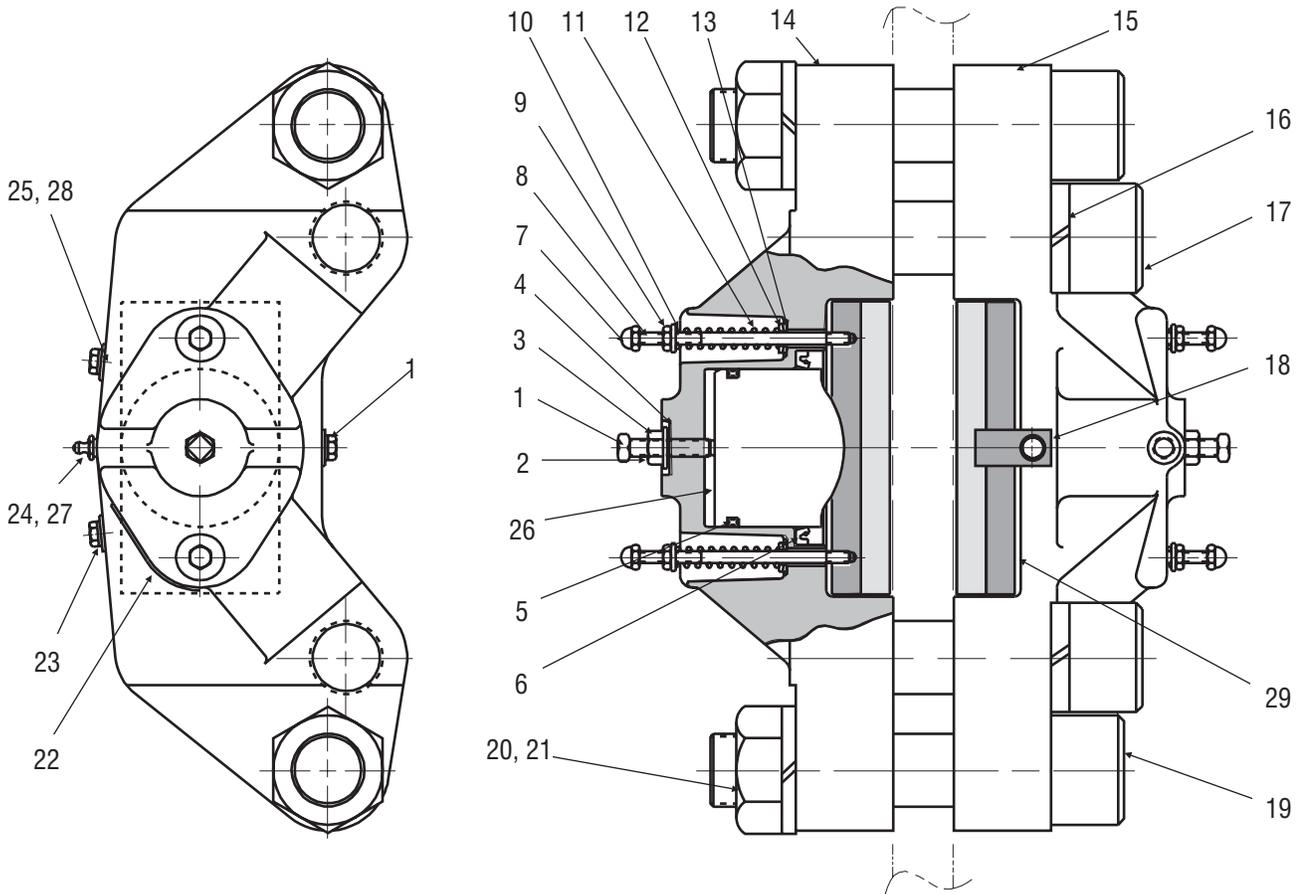


Basic Part Number 142967[®]

Notes:

- ① American National Standard for Unified Screw Threads.
- ② These dimensions based on a 0.63 in (6 mm) thick disc.
- ③ Suffix must be added to indicated type of friction lining and actuating fluid.

Component Parts



Item	Description
1	Set Screw
2	Hex Nut
3	Plain Washer
4	Thredseal
5	Quad Ring
6	Oil Seal
7	Acron Nut
8	Stud
9	Hex Nut
10	Washer
11	Compression Spring
12	Spherical Washer
13	Spherical Washer
14	Cylinder Block
15	Cylinder Block

Item	Description
16	Hi-Collar Lockwasher
17	Hex Socket Screw
18	Retaining Clip
19	Hex Socket Screw
20	Lockwasher
21	Hex Jam Nut
22	Label
23	Retaining Clip
24	Bleeder Fitting
25	Hex Hd Cap Scr
26	Piston
27	Steel Ball
28	Lockwasher
29	Friction Shoe Assy

Description

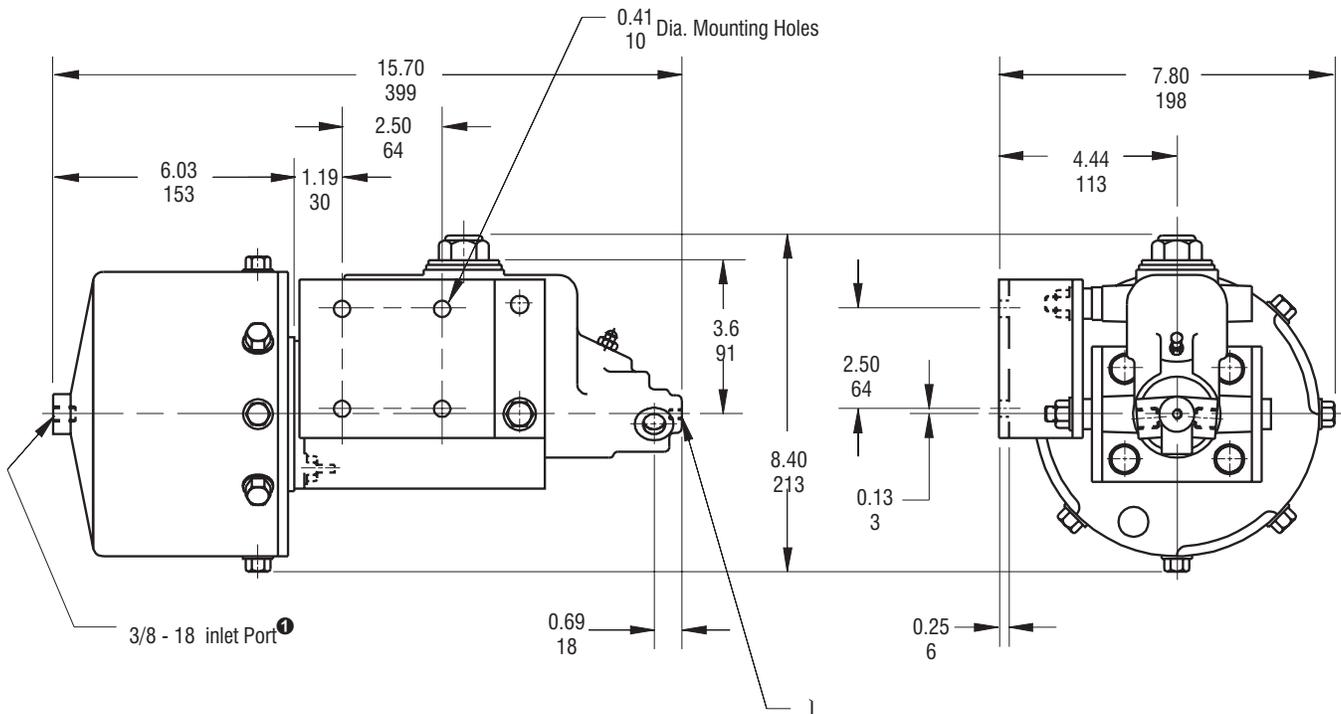
This intensifier is designed for industrial caliper brakes which require low initial hydraulic displacement prior to full pressure application and requires near zero residual system pressure. It is intended for single stop and low cyclic duty. It multiplies a low air pressure input into a higher hydraulic pressure output.

Hydraulic to air pressure ratio - 15:1

Maximum displacement - 4.7 in³ (0,08 dm³)

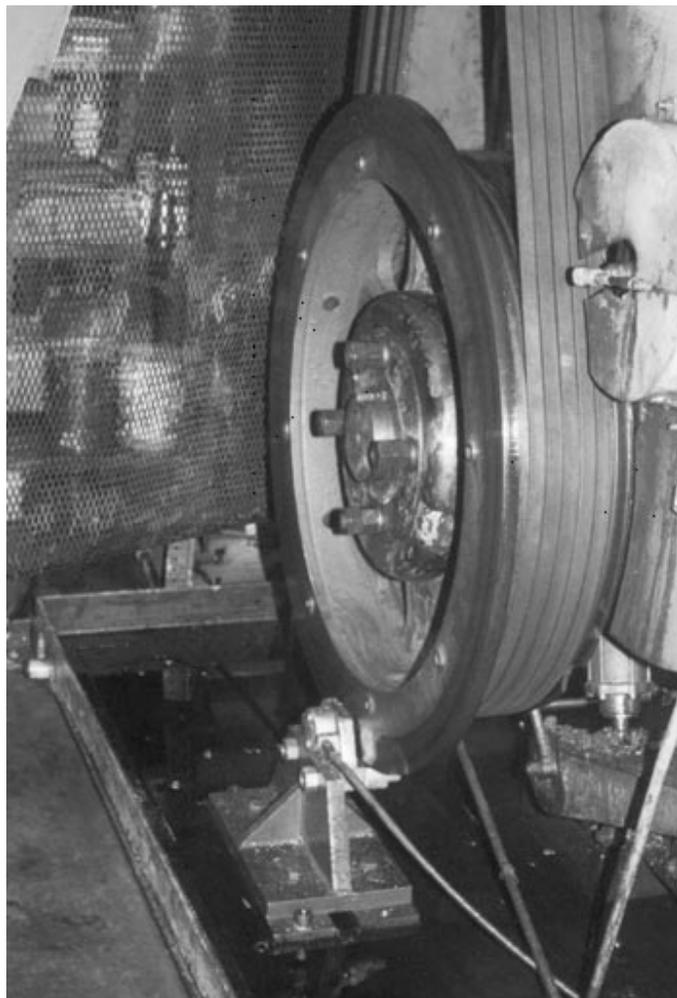
Actuating fluid - vegetable base only

Contact the factory for the appropriate intensifier to meet your application requirements.



Notes:

- ① American National Pipe Thread
- ② Three 1/2-20-2B female ports. Unit includes two 1/2-20-2B female ports. Unit includes two 1/2-20-2B plugs and two gaskets as well as one adapter fitting for 1/4-18-NPT female thread connection and gasket.



Direct drive application where the 225DP100 caliper is used to brake the flywheel of a 60 ton Header during the set-up process.