Airflex® Caliper Disc Brakes

Technical Information Section H

ENGINEERING TOMORROW

Caliper Description 02

225DP100 Caliper 03

DPA Caliper 06

HC3 and HD3 Caliper 09

Air Over Hydraulic Intensifier 12

Technical Data and Selection Procedure 13

VICKERS by Danfoss

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Airflex

Caliper Description

Section H

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.

Caliper model DPA is a symmetrical opposed piston caliper brake design that is well suited for most high torque, high energy stopping applications. Model HC-3 and HD-3 calipers are designed for very heavy duty braking service. The design automatically compensates for run out 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 coefficent 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 high hydraulic pressure output.

Where used:

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



Features:

Split construction

Accommodates discs of different thicknesses and diameters to meet a wide array of customer requirements.

Air or hydraulic operation

The DP and H calipers can be actuated with either air or hydraulic fluid to accommodate existing systems and provide a wide range of torque capabilities.

Large piston area

The large piston area coupled with high actuating pressure gives high braking torque.

Ventilated disc

Ventilated brake disc improves cooling capabilities and improves friction material life to minimize downtime and maintenance costs.

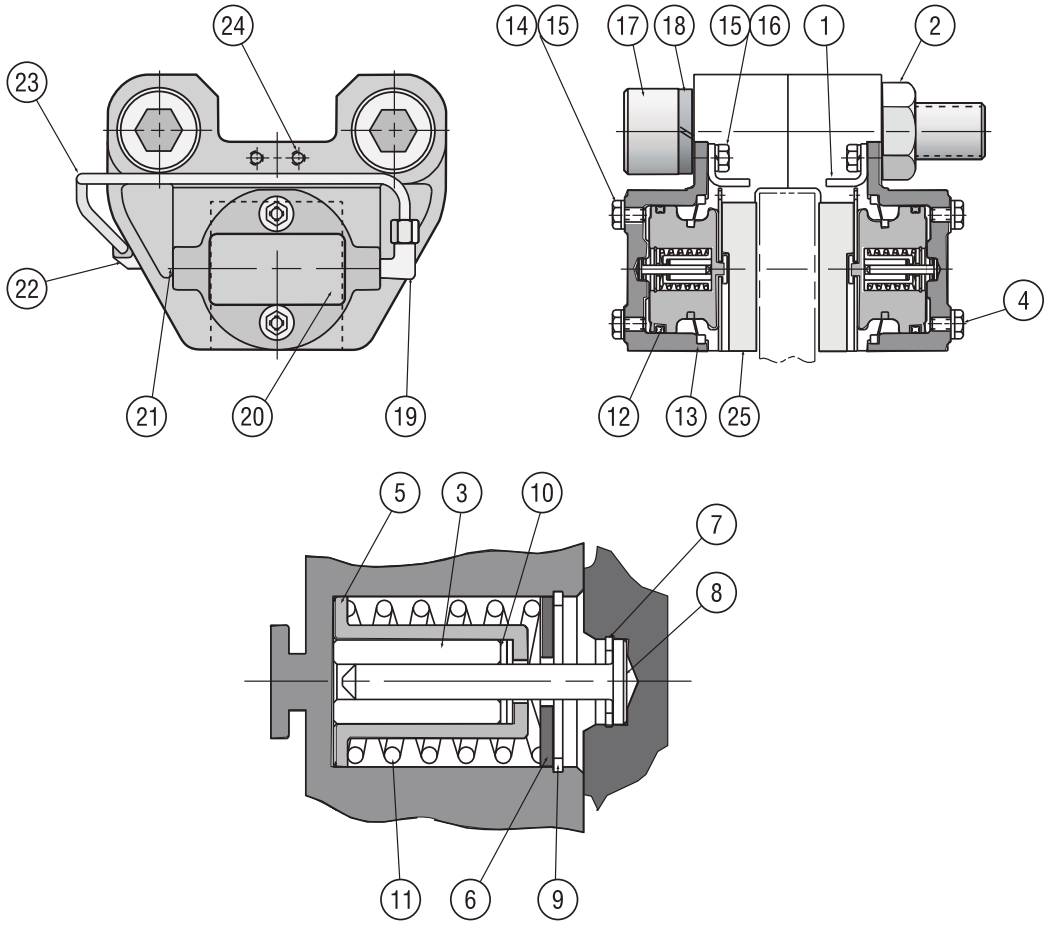
Ease of maintenance

Friction pads can be easily replaced without disturbing caliper mounting. The friction pads

225DP100 Caliper

ComponentParts

Section H



Item Number	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

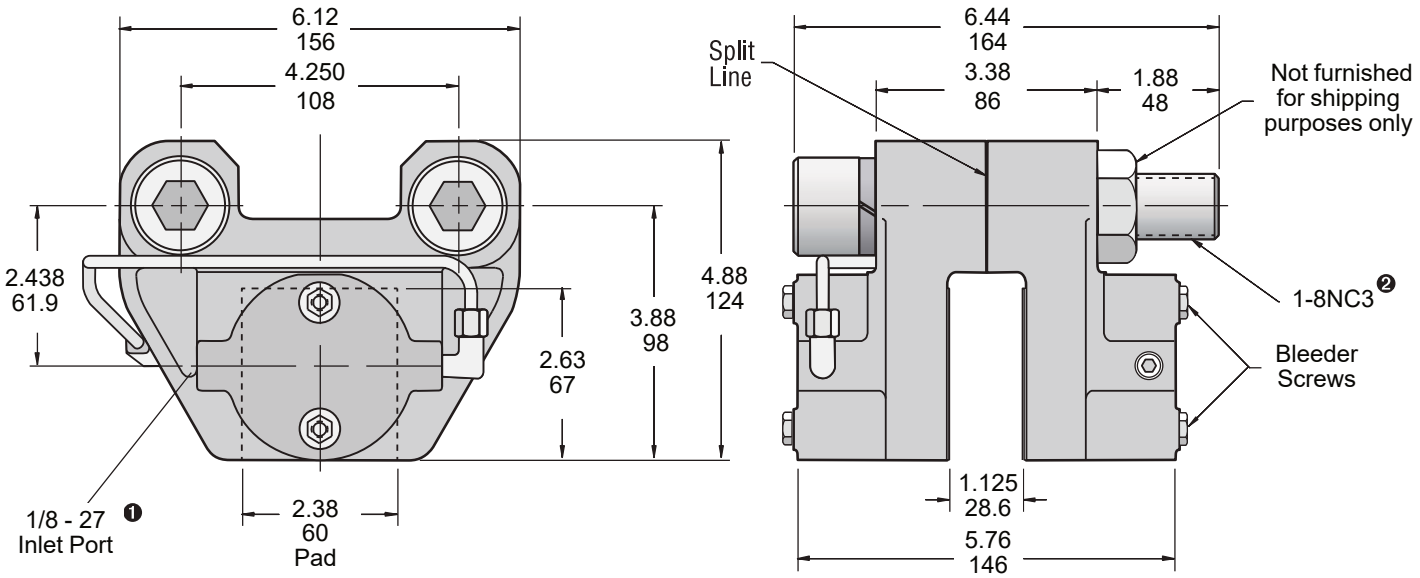
Item Number	Description
13	Boot
14	Dyna Seal
15	Hex Hd Cap Screw
16	Lockwasher
17	Socket Hd Screw
18	Lockwasher
19	Elbow
20	Decal
21	Pipe Plug
22	45° Elbow
23	Bridge Pipe
24	Cylinder Block
25	Friction Shoe Assy

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

225DP100 Caliper

Dimensional Data

Section H



Caliper Description	Part Number
Calilper w/low coefficient linings and seals for vegetable base fluids	**142862AD**
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:

❶ American National Pipe Thread

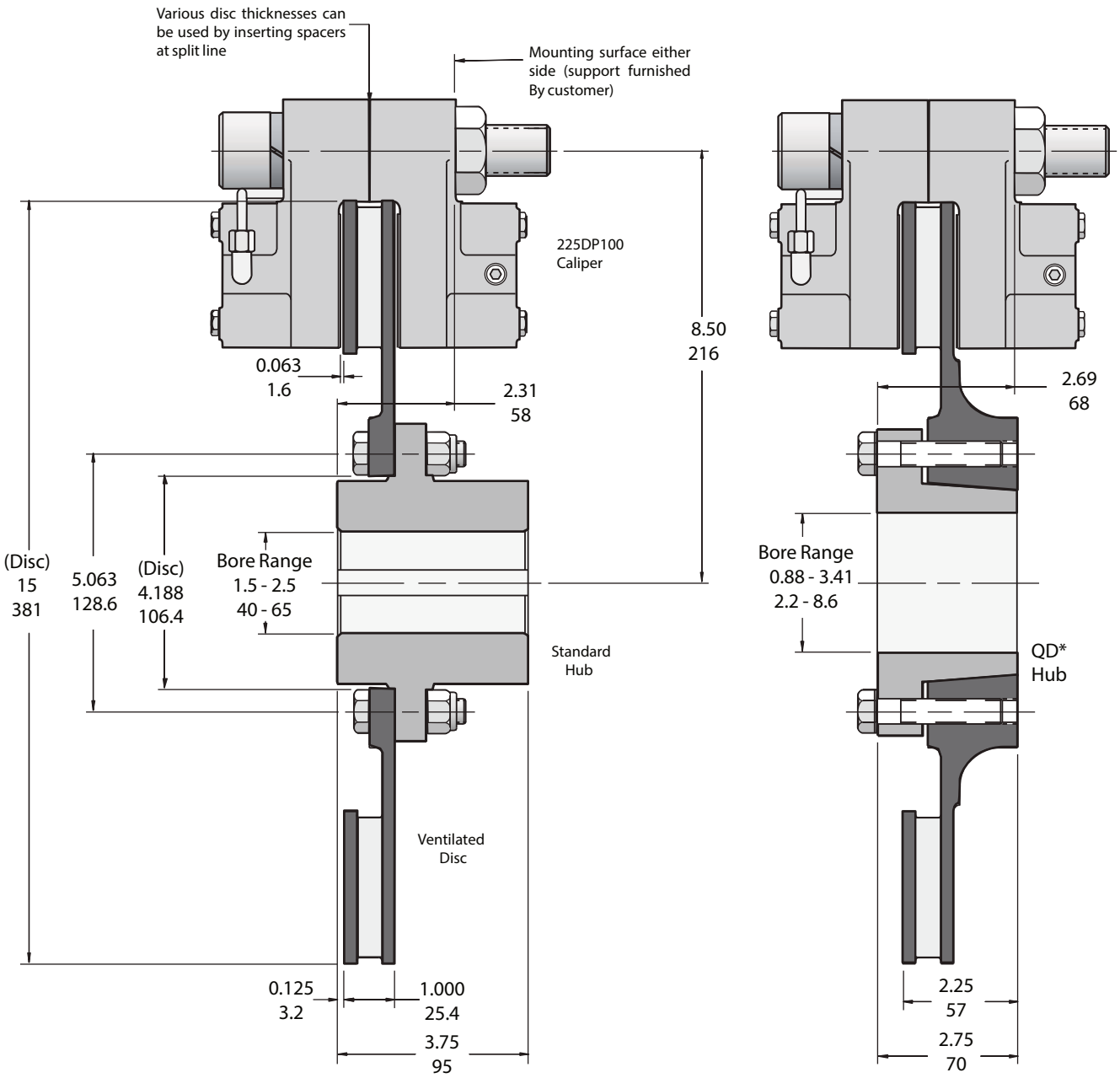
❷ American National Standard for Unified Screw Threads.

*Data shown is subject to change. Please consult factory for current dimensional data.

225DP100 Caliper

Dimensional Data

Section H



Component	Part Number	English Units		SI Units	
		Weight lb	Wk^2 $lb.ft^2$	Mass Kg	J $Kg.m^2$
Caliper	142862 ❶	17	N/A	7,7	N/A
Dics for standard hub	407936 ❸ ❺	24	5.6	10,9	0,23
Dics for QD hub	410851 ❸ ❺	25	5.7	11,3	0,24
Standard hub	404351 ❷	13	0.3	5,9	0,01
QD hub	304582 ❷	12	0.2	5,4	0,01

*QD is a registered trademark of Emerson Electric Co.

Notes:

❶ Basic part number only. Type of friction linings and actuating fluid must be specified.

❷ Basic part number only. Suffix must be added for specific bore.

❸ Maximum speed is 1800 rpm.

❹ Minimum gap during operations: 0.030" (0,8 mm) typical.

❺ Contact factory for non-standard disc requirements.

*Data shown is subject to change. Please consult factory for current dimensional data.

Airflex Type DPA Caliper

Section H



The Danfoss Airflex Type DPA is a symmetrical opposed piston caliper brake design that is well suited for most high torque, high energy stopping applications.

Engineered for hydraulic actuation, the Airflex DPA is a robust design able to withstand the tough operating conditions associated with industrial applications. Standard features include

- A large piston area and 2000 psi operating pressure range give high frictional force resulting in more torque
- Base or split mounting for flexibility of mounting and accommodation of different disc thicknesses or diameters to meet diverse customer requirements
- Guide pins transmit torque from friction shoes which prevents piston seal leakage that could result from misalignment between the friction shoe and disc
- Large friction area for long life and reduced maintenance due to friction material wear
- Automatic friction shoe wear adjustment with each engagement
- Solid or ventilated discs to optimize performance and lining life

Common Applications

- Conveyors
- Flywheel brakes
- Inertia brakes
- Mining Equipment
- Parking brakes
- Rotary brakes
- Tension brakes
- Top Drive brakes
- Wind Turbine brakes

Why the Airflex DPA

- High quality
- High performance
- Low cost of ownership
- Low maintenance
- Long lining life

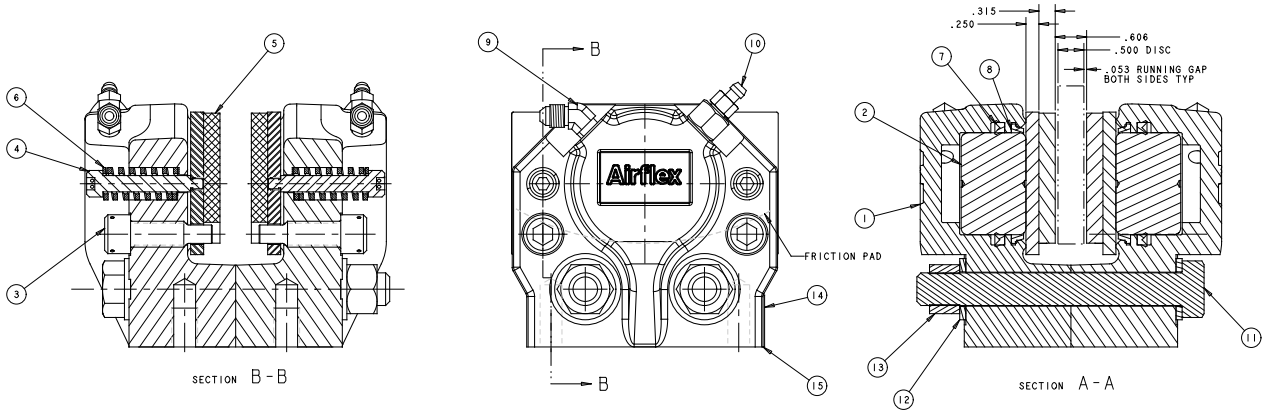
Parameter	200DPA		250DPA	
	English Units	SI Units	English Units	SI Units
Dynamic frictional Force Fr				
Standard linings @ 2000 psi	5700 lb	25354 N	9700 lb	43165 N
Static Friction Force				
Standard linings @ 2000 psi	6300 lb	28023 N	10600 lb	47170 N
Parasitic Loss Pp	75 psi	5 bar	70 psi	4.8 bar
Disc Constants				
Cd	7.73	196.3	9.89	251.2
Ct	2.76	70.1	3.15	80.0
Minimum Disc Diameter	12 in	305 mm	13 in	330 mm
Friction Area	23.3 in^2	150 cm^2	37.5 in^2	242 cm^2
Typical Disc Running Clearance per Side	.053 in	1.35 mm	.053 in	1.35 mm
Cylinder Volume - Engaged				
New lining and disc	.324 in^3	0.01 dm^3	.55 in^3	0.02 dm^3
Worn lining and disc	1.637 in^3	0.03 dm^3	2.77 in^3	0.05 dm^3
Lining Thickness				
New	.315 in	8 mm	.315 in	8.0 mm
Worn	0.10 in	2.5 mm	0.100 in	2.5 mm
Weight/Mass	23 lb	10 kg	40 lb	18 kg

Part Number	Description
146505	200DPA Caliper Assy
146505X	200DPA Caliper Seal Kit
146505Y	200DPA Caliper Rebulid Kit
11344946	250DPA Caliper Assy
11356804	250DPA Caliper Seal Kit
11356805	250DPA Caliper Rebulid Kit

DPA Caliper

Components Parts

Section H



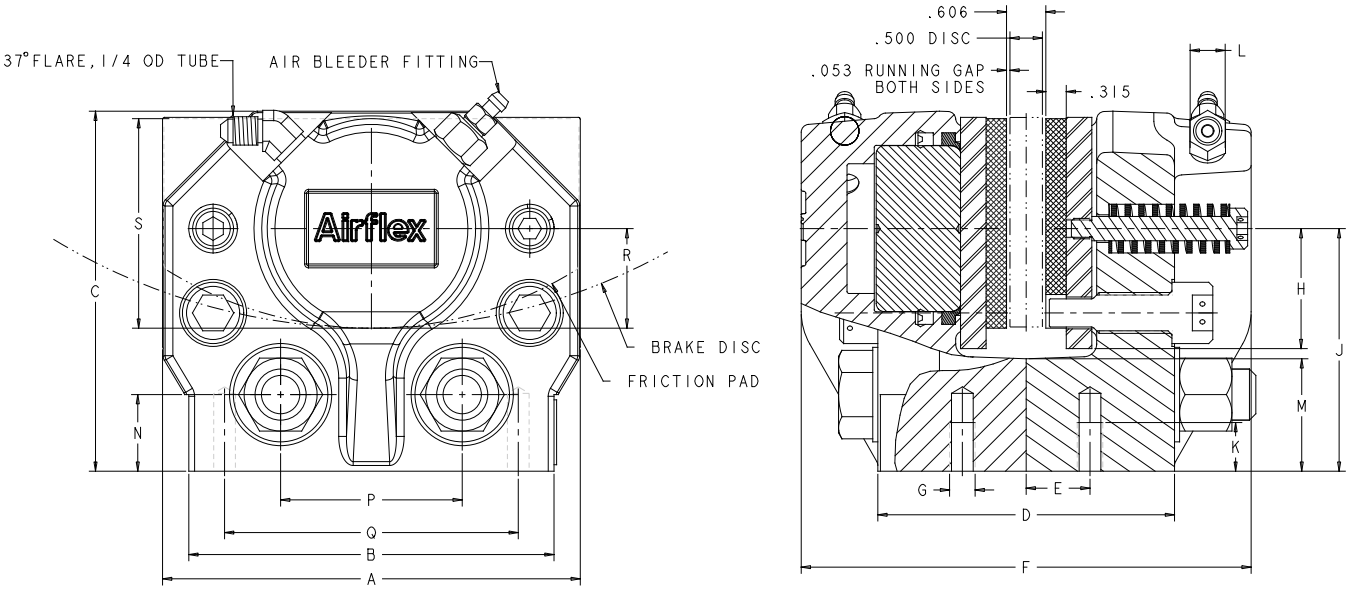
Bill of Materials

Item	Description	Quantity
1	Cylinder	2
2	Caliper Pistion	2
3	Caliper Guide Pin	4
4	Friction Shoe Assembly Shoulder Srew	4
5	Caliper Friction Shoe Assembly	2
6	Return Spring	4
7	U Seal	2
8	Rod Wiper	2
9	45 DEG Elbow	2
10	Air bleeder	2
11	Hex Head Screw	2
12	Flat Washer	4
13	Hexagon Nut	2
14	Name Plate	1
15	Warning Plate	1

DPA Caliper

Dimensions Data

Section H

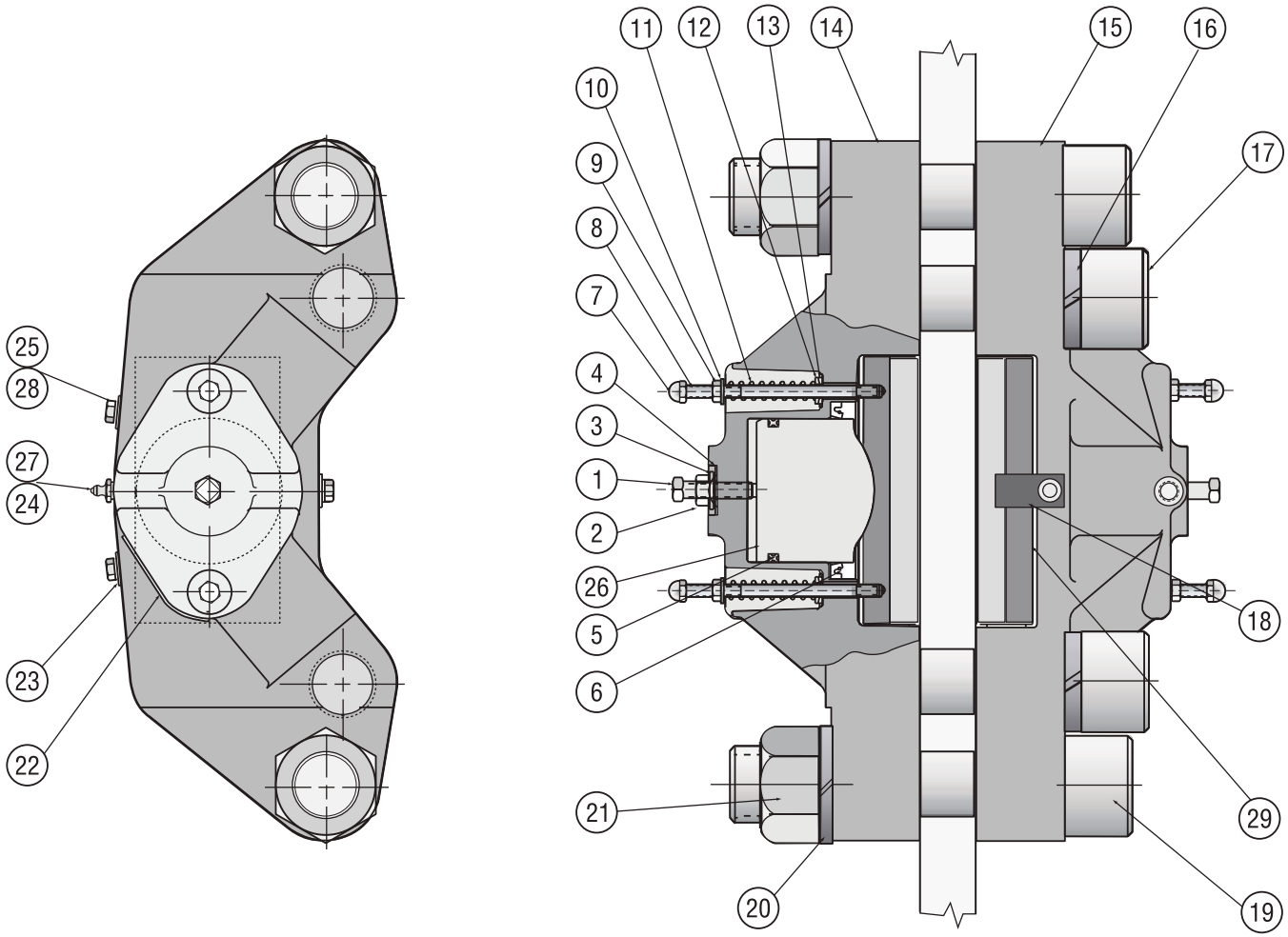


Dimensions	Type	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S
English Units in [in]	200DPA	5.14	4.56	4.69	4.17	0.98	5.82	4-M12	1.37	3.15	0.75	NPT 1/8	1.58	1.10	2.30	3.62	1.15	2.51
	250DPA	6.42	5.63	5.55	4.57	0.98	6.94	6-M12	1.85	3.74	0.75	NPT 1/4	1.73	1.10	2.80	4.53	1.54	3.25
SI Units in [mm]	200DPA	131	116	119	106	25	148	4-M12	35	80	19	NPT 1/8	40	28	58	92	29	64
	250DPA	163	143	141	116	25	176	6-M12	47	95	19	NPT 1/4	44	28	71	115	39	83

HC3 and HD3

Component Parts

Section H



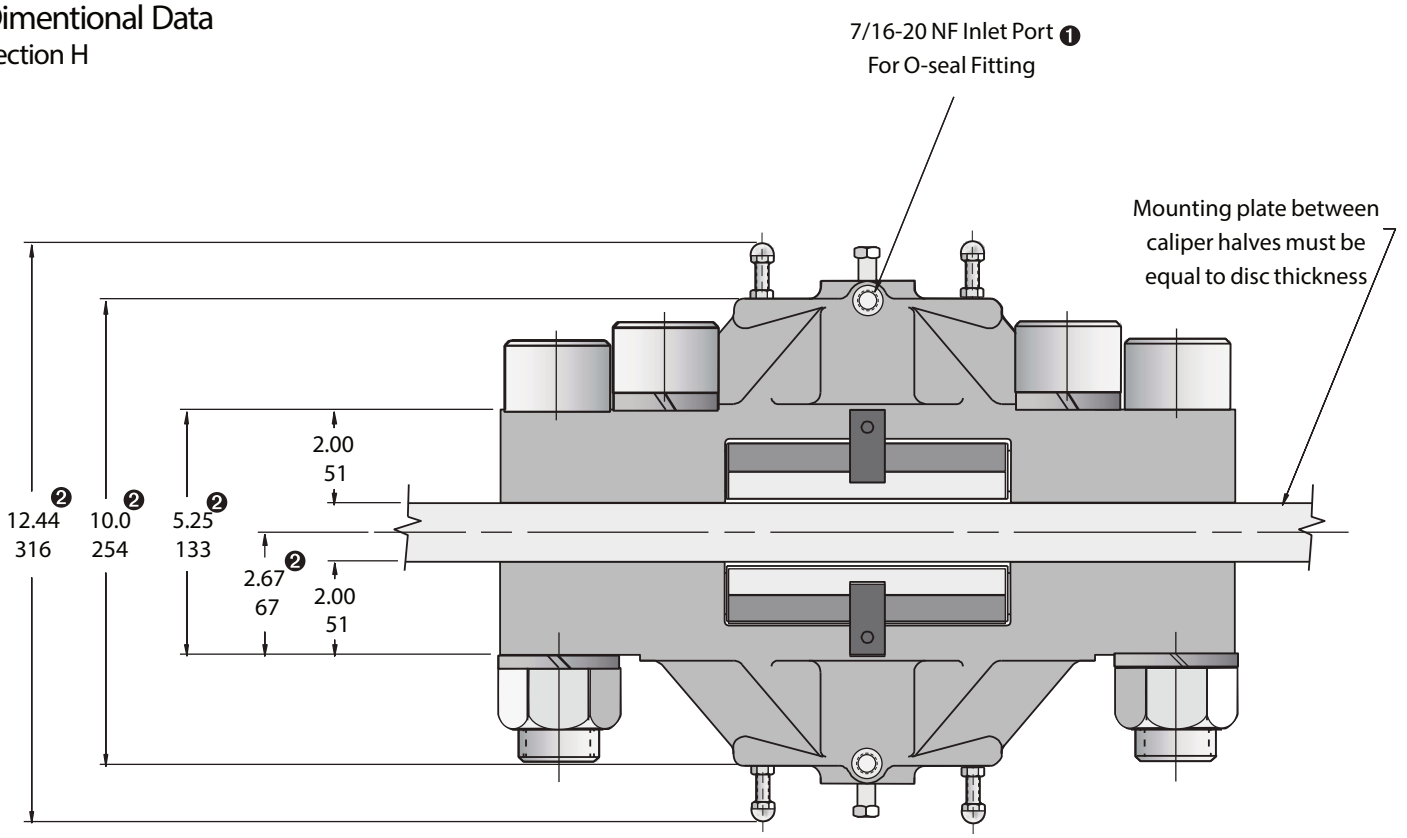
Item Number	Description
1	Set Screw
2	Hex Nut
3	Plain Washer
4	Thredseal
5	Quad Ring
6	Oil Seal
7	Acron Nut
8	Stud
9	Hex Nut
10	Washer
11	Compression Spring
12	Spherical Washer
13	Spherical Washer
14	Cylinder Block
15	Cylinder Block

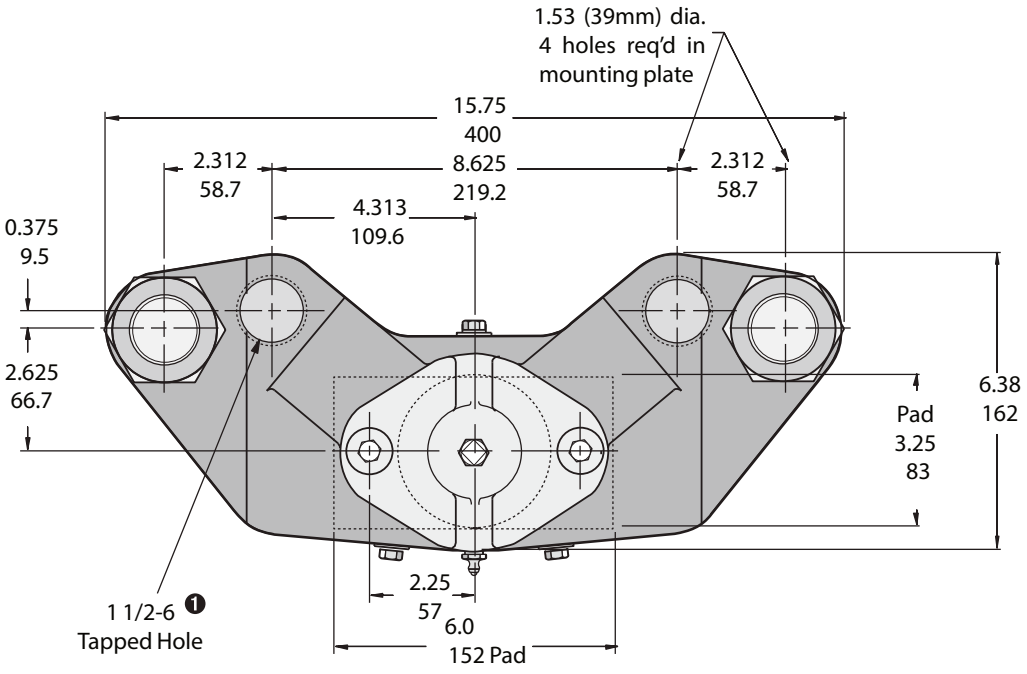
Item Number	Description
16	Hi-Collar Lockwasher
17	Hex Socket Screw
18	Retaining Clip
19	Hex Socket Screw
20	Lockwasher
21	Hex Jam Nut
22	Label
23	Retaining Clip
24	Bleeder Fitting
25	Hex Hd Cap Scr
26	Piston
27	Steel Ball
28	Lockwasher
29	Friction Shoe Assy

HC3 Caliper Form CA 1002

Dimentional Data

Section H





Notes:

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

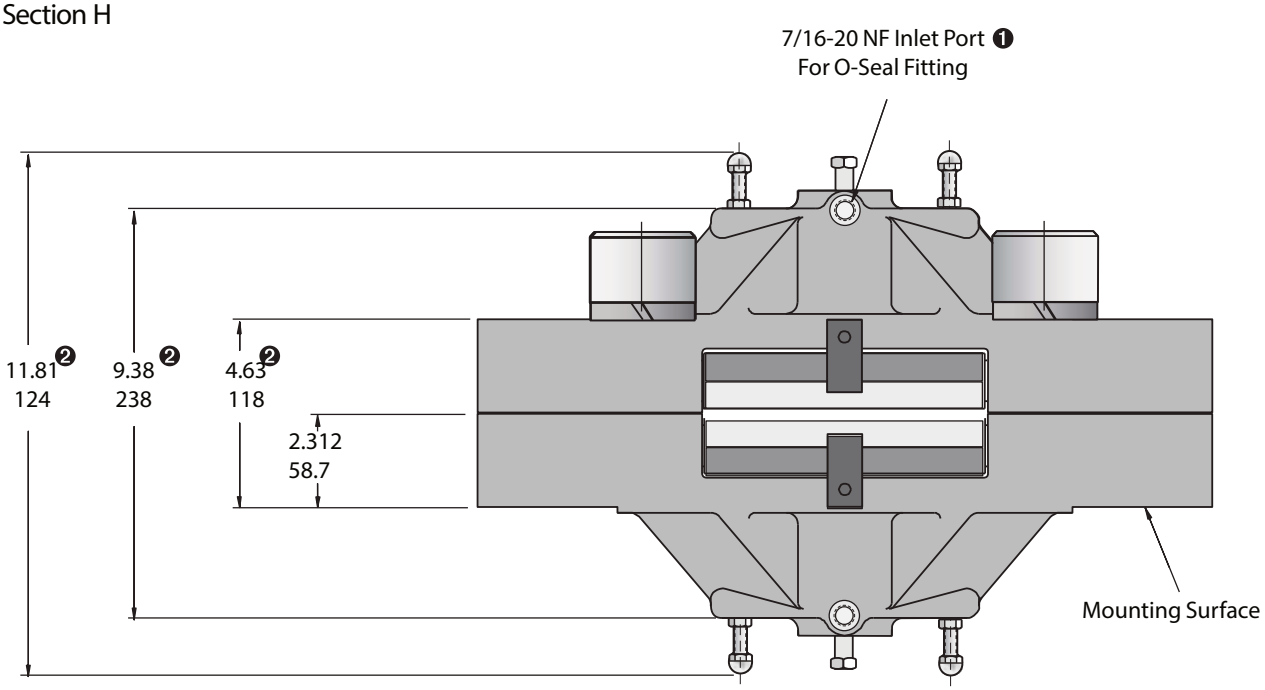
*Data shown is subject to change. Please consultfactory for current dimensional data.

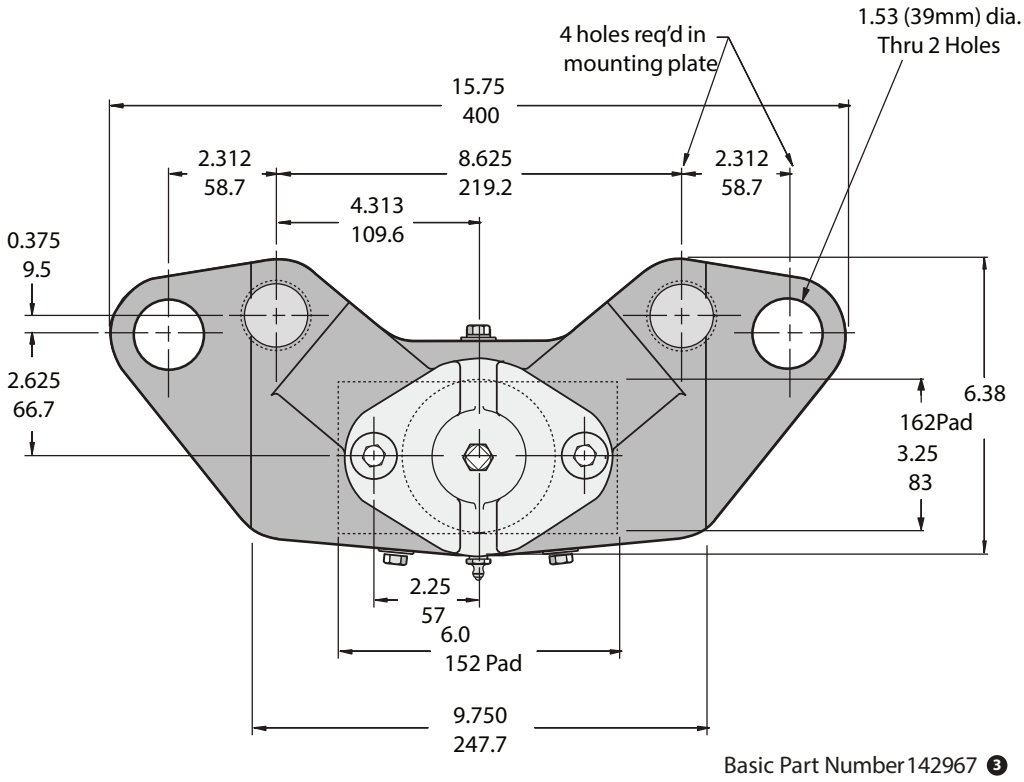
❸ Basic Part Number 142967

HD3 Caliper Form CA 1002A

Dimentional Data

Section H





Basic Part Number 142967 ❸

Notes:

❶ American National Standard for Unified Screw Threads.

❷ These dimensions based on a 0.63 in. (16 mm) thick disc.

❸ Suffix must be added to indicated type of friction lining and actuating fluid.

*Data shown is subject to change. Please consult factory for current dimensional data.

Air Over Hydraulic Intensifier

Section H

Description

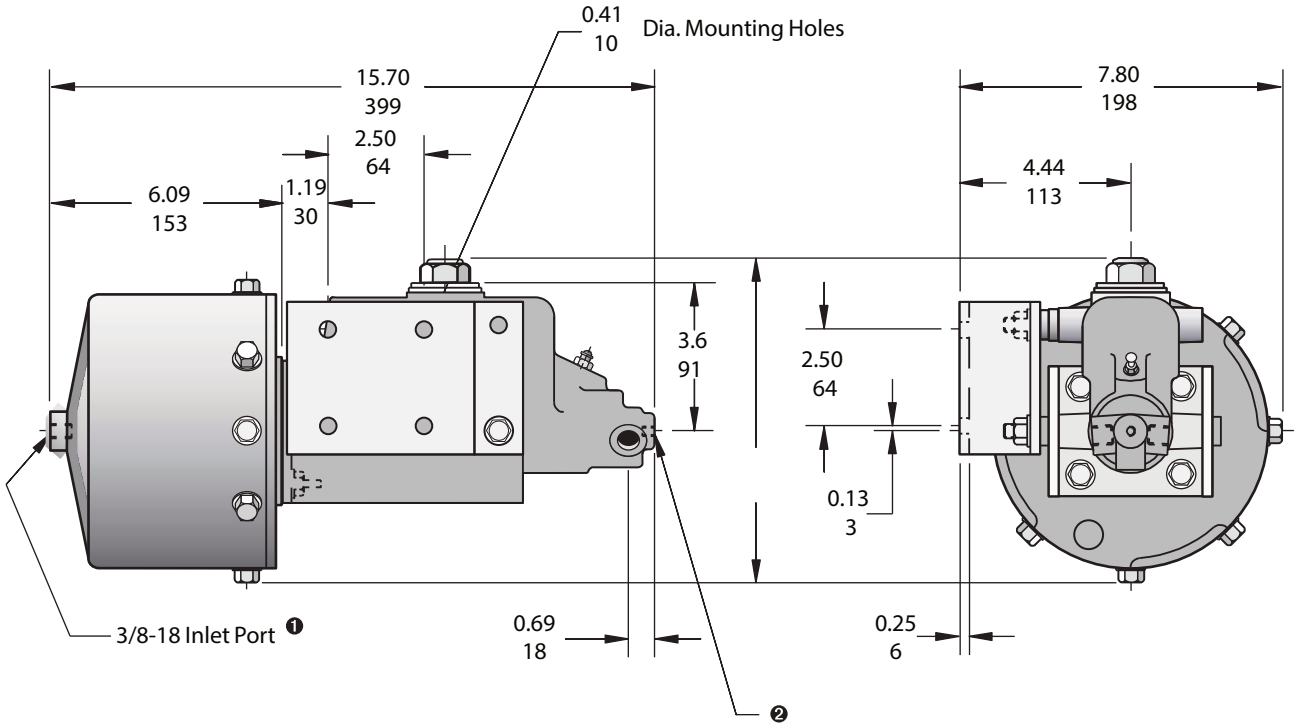
This intensifier is designed for industrial caliper brakes which require low initial hydraulic displacement prior to full pressure application and requires near zero residual system pressure. It is intended for single stop and low cyclic duty. It multiplies a low air pressure input into a higher hydraulic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

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

Hydraulic to air pressure ratio – 15:1

Maximum displacement – 4.7 in^3 (0,08 dm^3)

Actuating fluid – vegetable base only



Notes:

❶ American National Pipe Thread.

❷ Three 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.

Part Number	Description
000153X0772	Hydraulic Intensifier Assembly
000153X0761	Hydraulic Intensifier Repair Kit

Frictional Force Adjustment

Dynamic frictional force ratings $\mathbf{F_r}$ are given for calipers furnished with either standard or low coefficient friction linings. The ratings are based upon an effective pressure $\mathbf{p_r}$ 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 $\mathbf{p_o}$ and the parasitic loss $\mathbf{p_p}$ which represents the pressure to overcome piston seal friction and friction shoe release springs. The effective friction force $\mathbf{F_e}$ is calculated from:

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

Torque Calculations

Braking torque is calculated from:

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

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 Fr				
Standard linings @ 1000 psi (69 bar)	2540 lb	11300 N	5300 lb	23600N
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	14100N	6620 lb	29440 N
Parasitic Loss pp	8 psi	0,6 bar	10 psi	0,7 bar
Disc Constants				
Cd	8.25	2095	10.21	2593
Ct	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 in²	80 cm²	39 in²	252 cm²
Typical Disc Running Clearance per Side	0.03 in	0,8 mm	0.06 in	1,6mm
Displacement to Engagement	0.5 in³	0,008 dm³	1.1 in³	0,018 dm³
Cylinder Volume - Engaged				
New lining and disc	0.9 in³	0,015 dm³	3.5 in³	0,06 dm³
Worn lining and disc	4.0 in³	0,07 dm³	12.5 in³	0,21 dm³
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.

$$Fe = \frac{p_o - p_p}{p_r} \cdot Fr$$

$$= \frac{80 - 8}{1000} \cdot 2540$$

$$= 183 \text{ lb}$$

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

$$D = \frac{M_e}{0.5 \cdot N \cdot F_e} + C_t$$

$$= \frac{5000}{0.5 \cdot 183 \cdot N} + 3.2$$

$$= \frac{54 \cdot 64}{N} + 3.2$$

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/in^2 (0.035 kW/cm^2). The swept area can be approximated from:

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

where A_s = disc swept area in^2 (cm^2)

C_d = disc constant

D = disc outside diameter in (m)

C_t = disc constant

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

Example

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

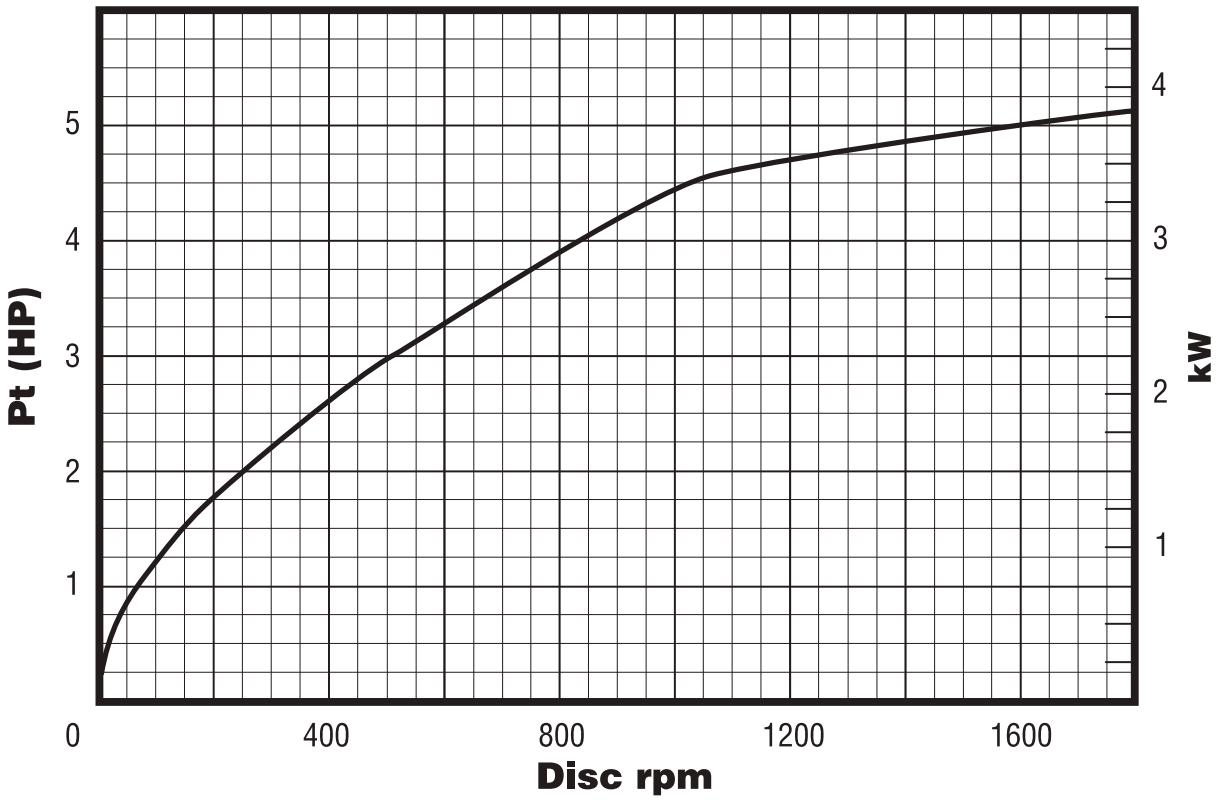
$As = C_d \cdot (D\text{-}C_1)$

$As = 2593 \cdot (1{,}5 - 0{,}10)$

$As = 3630\ cm^2$

The peak thermal power = 0.035 KW/cm^2 x 3630 cm^2

= 127 KW



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