

# CALIPER DISC BRAKES

For applications requiring static and/or dynamic braking



Spring Apply, Hydraulic Apply,  
and Mechanical Apply Brakes



ZF Off-Highway Solutions Minnesota Inc. designs, manufactures, and markets hydraulic components, controls, and brake systems, primarily for off-highway markets.

Many of the world's largest Off-Highway OEMs value the knowledgeable staff at ZF Off-Highway Solutions Minnesota Inc. and work with us to make their products better. Our custom-engineered products are designed with the customer requirements as the primary driver.

## Caliper Disc Brakes

Caliper Disc Brakes are extensively tested to assure that our customers are receiving a high quality product. We use only high grade materials in the construction of caliper disc brakes. Computer technology is employed in the analysis and selection of component parts.

The caliper disc brake line is divided into the following series:

515 Series are a floating caliper type and are available in spring apply, hydraulic apply or mechanical apply models.

520 Series are fixed caliper disc brakes, hydraulic apply with opposed piston.

530 Series are a floating caliper type and are available in spring apply or hydraulic apply models.

The 515 Series caliper brakes can be used for limited dynamic or service braking as well as static or parking brake applications. The Spring Apply/Hydraulic Release designs use a stack of belleville springs to apply the brake and hydraulic pressure from a source such as a master cylinder to release the brake. The Mechanical Apply designs use a mechanical lever and cam system to apply and release the brake.

The 520 Series caliper brakes are used in service braking applications. The Hydraulic Apply Caliper Brakes use a modulated hydraulic pressure source, such as a master cylinder, to control brake torque. These brakes are available with various diameter actuation pistons. The larger the piston the greater the capacity for clamping force.

It is our intent to help customers build their systems with our expertise in hydraulic components, braking systems, and controls. Our goal is to meet or exceed our customers' expectations in every aspect of our business.

ZF Off-Highway Solutions Minnesota Inc. continuously strives for improvement, while remaining a quality leader in our field. We are a successful, customer driven business. We look forward to working with you!

The 530 Series Spring Apply/Hydraulic Release Caliper Brakes are used in parking brake applications. They use a stack of belleville springs to apply the brake and hydraulic pressure to release the brake. Designed to be either on-or-off, conventional master cylinder actuation is not recommended to hydraulically release the brake. For hydraulic release actuation, refer to the ZF Off-Highway Hydraulic Remote Actuators catalog (form no. 84-460-001). The 530 Series Hydraulic Apply Caliper Brakes are designed for use in dynamic or service braking and use a modulated hydraulic pressure source, such as a master cylinder.

Most types of ZF Off-Highway Caliper Disc Brakes are available with seals and rubber components for use with automotive brake fluids, mineral base hydraulic oil, or special fluids. Consult Zf Off-Highway Solutions Minnesota Inc. for recommendations. All lining material used in the caliper disc brakes is non-asbestos and lead free.

This catalog is designed to assist you in making an initial selection of a caliper disc brake suited to your requirements. Complete the appropriate Application Data Sheet online, [www.mico.com](http://www.mico.com), and submit to [sh-applications.NMN@ZF.com](mailto:sh-applications.NMN@ZF.com). The ZF Off-highway Solutions Minnesota Inc. Applications Department will analyze your specifications and based on your input recommend a caliper disc brake suitable for your requirements.

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You will find the current edition at [www.mico.com](http://www.mico.com)

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## NOTE

Torque curves and torque formulas in this catalog are based on static and dynamic lining coefficients of friction under properly adjusted, fully burnished, lining conditions and are theoretical in nature. Maximum torque will be achieved only after the brake has been properly burnished. Consult ZF Off-Highway Solutions Minnesota Inc. for Technical Notice (form no. 81-950-016).

## Recommended Disc Material

High quality brake discs should be used in conjunction with Caliper Disc Brakes. Depending on strength and performance requirements, low to medium carbon steel is generally recommended. Fabrication procedures are as follows:

1. Flame cut or machined to required outside diameter with inside diameter machined to size.
2. Stress relieved after all machining operations.
3. Blanchard ground to a surface finish of 54 Ra to 72 Ra with a visible crosshatch pattern.
4. Surfaces to be parallel within 0.002 inch.
5. Surfaces to be flat within 0.005 inch.

## Applications



Forestry Equipment



Agricultural Equipment



Heavy Construction Equipment



Swing Boom Equipment



Mining Equipment



In-Plant & Warehouse Equipment



Airport Support Vehicles



# 515 Series Caliper Disc Brake

(spring apply)

## Model Numbers

### Brake Fluid

02-515-005  
\* 02-515-119

### Hydraulic Oil

02-515-002  
02-515-004  
02-515-006  
02-515-008  
\* 02-515-012  
\* 02-515-020  
\*\* 03-515-014  
\*\* 03-515-016  
\*\* 03-515-018

## DESCRIPTION

Floating caliper type brake, spring applied, hydraulic release. Spring apply brakes are independent of outside energy sources such as air, hydraulic or mechanical forces. The stored energy is provided by a series of Belleville springs.

Under normal conditions, the brake is installed independent of the service brake system. Ideal for industrial machines and mobile equipment applications.

These brakes are designed to operate as parking and/or emergency brakes. If your application requires rapid cycling consult ZF Off-Highway Solutions Minnesota Inc. for recommendations and other model numbers.

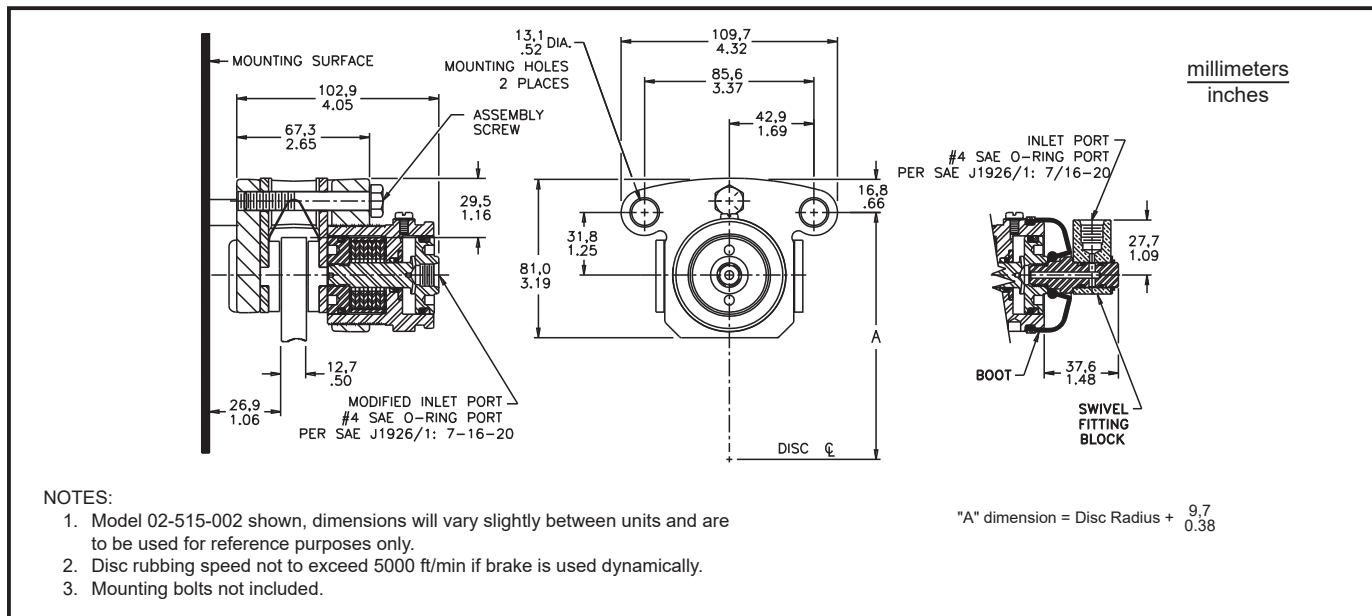
See page 5 for disc diameter-vs-brake torque ratio charts.

\* Includes a rubber boot

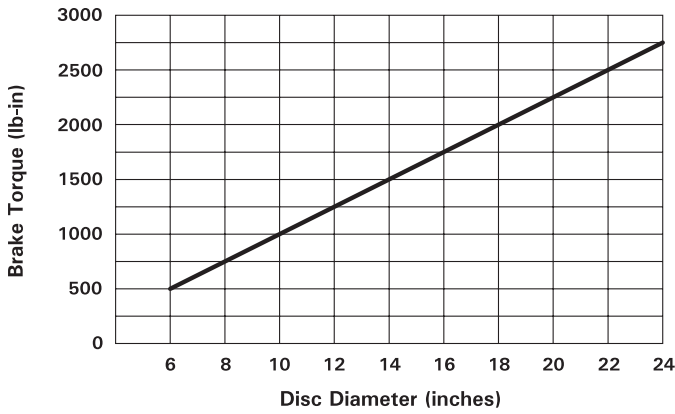
\*\* Includes a rubber boot and no. 4 SAE o-ring boss swivel fitting.

## SPECIFICATIONS

- **Disc diameter:** 6 inch to unlimited
- **Disc thickness:** 0.50 inch - for other disc thicknesses contact ZF Off-Highway
- **Total lining contact area:** 6.36 in<sup>2</sup>
- **Continuous duty pressure:** 2000 PSI
- **Intermittent duty pressure:** 2500 PSI
- **Full retraction volume:** 0.20 in<sup>3</sup> maximum
- **Caliper material:** ductile iron
- **Caliper finish:** zinc chromate yellow
- **Lining thickness:** 0.22 inch
- **Usable lining thickness:** 0.22 inch
- **Lining material:** non-asbestos, lead free
- **Porting:** No. 4 SAE o-ring port per SAE J1926/1: 7/16-20
- **Approximate weight:** 4.2 lb



**Model: 02-515-002**

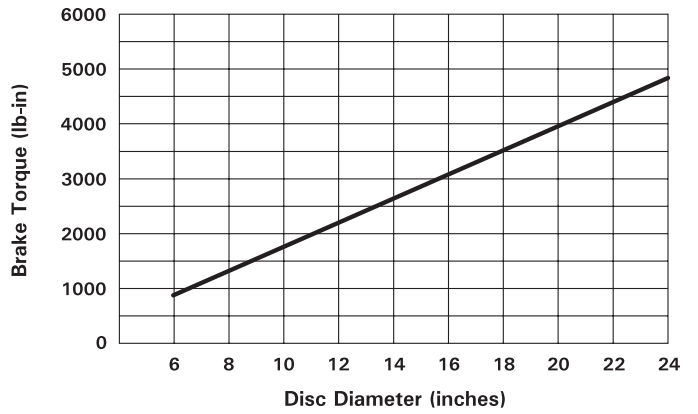


**TORQUE FORMULA** (Bt = Brake Torque)

$Bt = 250 \times (\text{Disc Radius} - 1.00)$

Complete Retraction Pressure: 300 PSI

**Models: 02-515-004, 03-515-014**

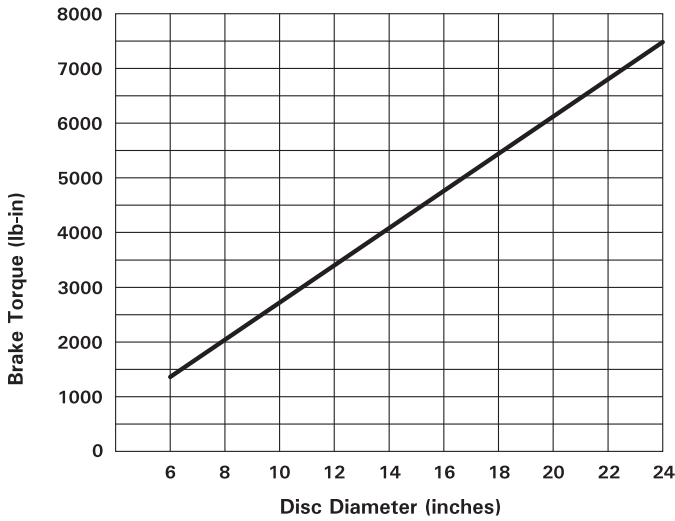


**TORQUE FORMULA** (Bt = Brake Torque)

$Bt = 440 \times (\text{Disc Radius} - 1.00)$

Complete Retraction Pressure: 600 PSI

**Models: 02-515-012, 02-515-119**

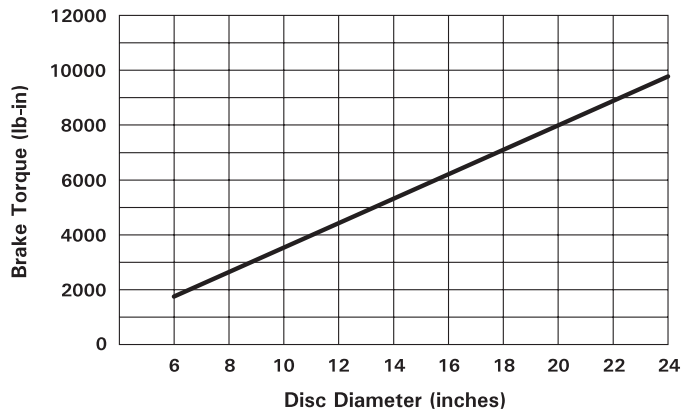


**TORQUE FORMULA** (Bt = Brake Torque)

$Bt = 680 \times (\text{Disc Radius} - 1.00)$

Complete Retraction Pressure: 700 PSI

**Models: 02-515-008, 02-515-020, 03-515-018**

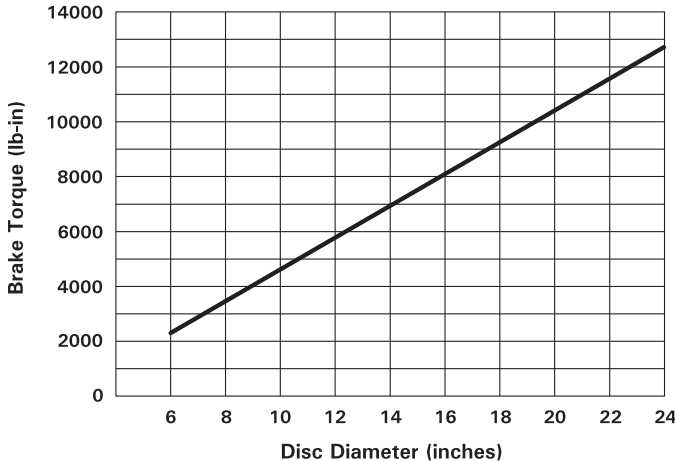


**TORQUE FORMULA** (Bt = Brake Torque)

$Bt = 900 \times (\text{Disc Radius} - 1.00)$

Complete Retraction Pressure: 1200 PSI

**Models: 02-515-005, 02-515-006, 03-515-016**



**TORQUE FORMULA** (Bt = Brake Torque)

$Bt = 1150 \times (\text{Disc Radius} - 1.00)$

Complete Retraction Pressure: 1700 PSI

**NOTE:** Maximum torque achieved only after brake has been properly adjusted and burnished, see Technical Notice (form no. 81-950-016).



# 515 Series Caliper Disc Brake

(mechanical apply)

## Model Numbers

02-515-148  
02-515-150

## SPECIFICATIONS

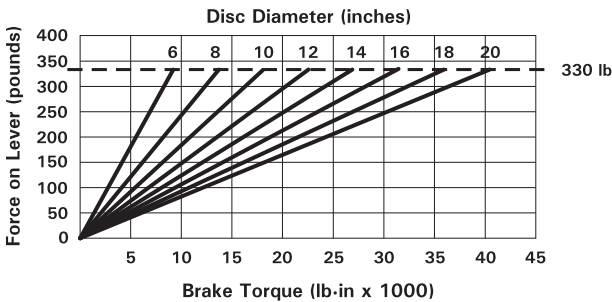
- **Disc diameter:** 6 inch to unlimited
- **Disc thickness:** 0.50 inch - for other disc thicknesses contact ZF Off-Highway
- **Total lining contact area:** 6.36 inch<sup>2</sup>
- **Caliper material:** ductile iron
- **Caliper finish:** zinc chromate yellow
- **Lining thickness:** 0.22 inch
- **Usable lining thickness:** 0.22 inch
- **Lining material:** non-asbestos, lead free
- **Lever movement:** 40° either direction
- **Lever pull:** limited to 330 lb at hole  $\nabla 2$   
limited to 420 lb at hole  $\nabla 1$
- **Approximate weight:** 4.7 lb

## DESCRIPTION

Floating caliper type brake, mechanically applied. One piece carrier. Once brake is adjusted, the lever can be mounted in any position. Ideal for secondary, emergency, and industrial applications.

Consult ZF Off-Highway Solutions Minnesota Inc. Applications Department for other models.

Chart is based on using hole  $\nabla 2$

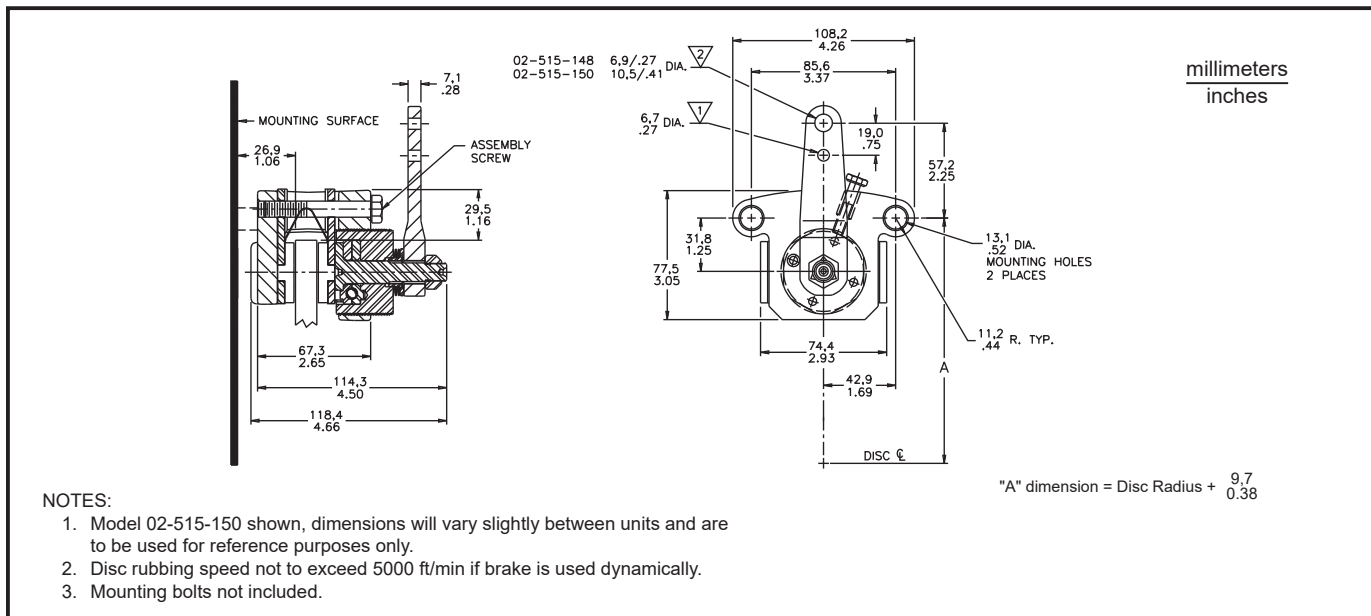


## TORQUE FORMULA (Bt = Brake Torque)

Bt = 10.69 x Lever Pull x (Disc Radius - 1.00) for hole  $\nabla 1$

Bt = 13.61 x Lever Pull x (Disc Radius - 1.00) for hole  $\nabla 2$

**NOTE:** Maximum torque achieved only after brake has been properly adjusted and burnished, see Technical Notice (form no. 81-950-016).





# 515 Series Caliper Disc Brake

(hydraulic apply)

## Model Numbers

**Brake Fluid**  
02-515-025

**Hydraulic Oil**  
02-515-030

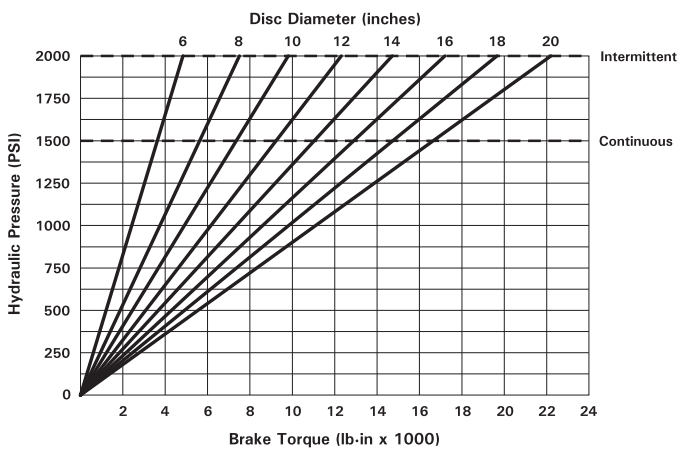
## SPECIFICATIONS

- **Disc diameter:** 6 inch to unlimited
- **Disc thickness:** 0.50 inch - for other disc thicknesses contact ZF Off-Highway
- **Total lining contact area:** 6.36 inch<sup>2</sup>
- **Continuous duty pressure:** 1500 PSI
- **Intermittent duty pressure:** 2000 PSI
- **Actuating volume:** 0.05 inch<sup>3</sup> nominal
- **Caliper material:** ductile iron
- **Caliper finish:** zinc chromate yellow
- **Lining thickness:** 0.22 inch
- **Usable lining thickness:** 0.22 inch
- **Lining material:** non-asbestos, lead free
- **Piston diameter:** 1.50 inch
- **Approximate weight:** 3.8 lb
- **Porting:** 1/8-27NPTF

## DESCRIPTION

Floating caliper, hydraulic apply type. Designed to provide braking for applications in the agricultural, construction, mining, and logging industries. High strength aluminum piston and module assembly.

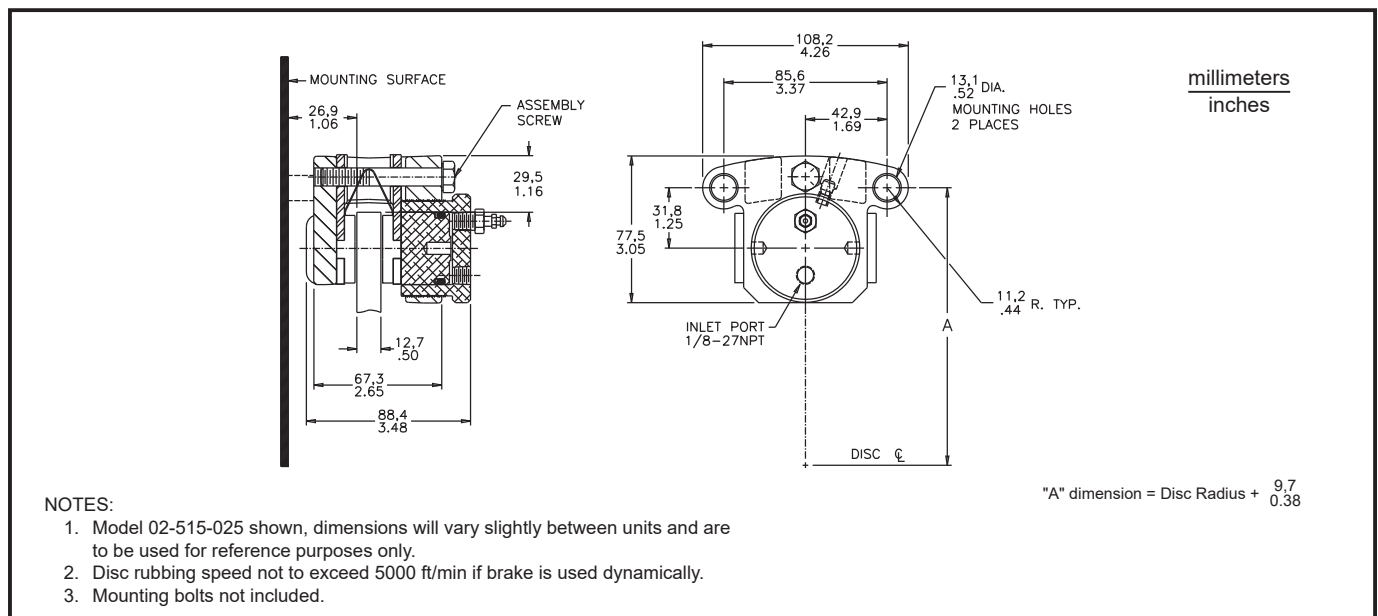
Consult ZF Off-Highway Solutions Minnesota Inc. Applications Department for other models.



## TORQUE FORMULA (Bt = Brake Torque)

$$Bt = \text{PSI} \times 1.23 \times (\text{Disc Radius} - 1.00)$$

**NOTE:** Maximum torque achieved only after brake has been properly adjusted and burnished, see Technical Notice (form no. 81-950-016).





# 520 Series Caliper Disc Brake

## Model Numbers

Brake Fluid  
02-520-151

Hydraulic Oil  
02-520-152

## SPECIFICATIONS

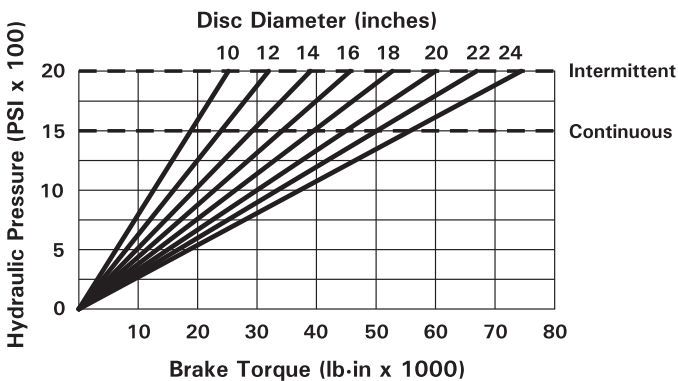
- **Disc diameter:** 9 inch to unlimited
- **Disc thickness:** 0.25 inch minimum
- **Total lining contact area:** 8.88 inch<sup>2</sup>
- **Continuous duty pressure:** 1500 PSI
- **Intermittent duty pressure:** 2000 PSI
- **Actuating volume:** 0.30 inch<sup>3</sup> nominal
- **Caliper material:** ductile iron
- **Caliper finish:** zinc chromate
- **Lining thickness:** 0.56 inch
- **Usable lining thickness:** 0.48 inch
- **Lining material:** non-asbestos, lead free
- **Piston diameter:** 2.50 inch
- **Approximate weight:** 16 lb
- **Porting:** 1/8-27NPTF

## DESCRIPTION

Fixed caliper disc brake, hydraulic apply with opposed hardcoat anodized aluminum pistons. The split caliper disc brakes are mounted using a spacer or torque member between the caliper halves. These brakes can also be purchased as a single caliper half assembly. In either case, the customer supplies fittings, tubing assembly, hardware, and spacer.

Designed for medium torque, drive line mounted, and stationary equipment applications.

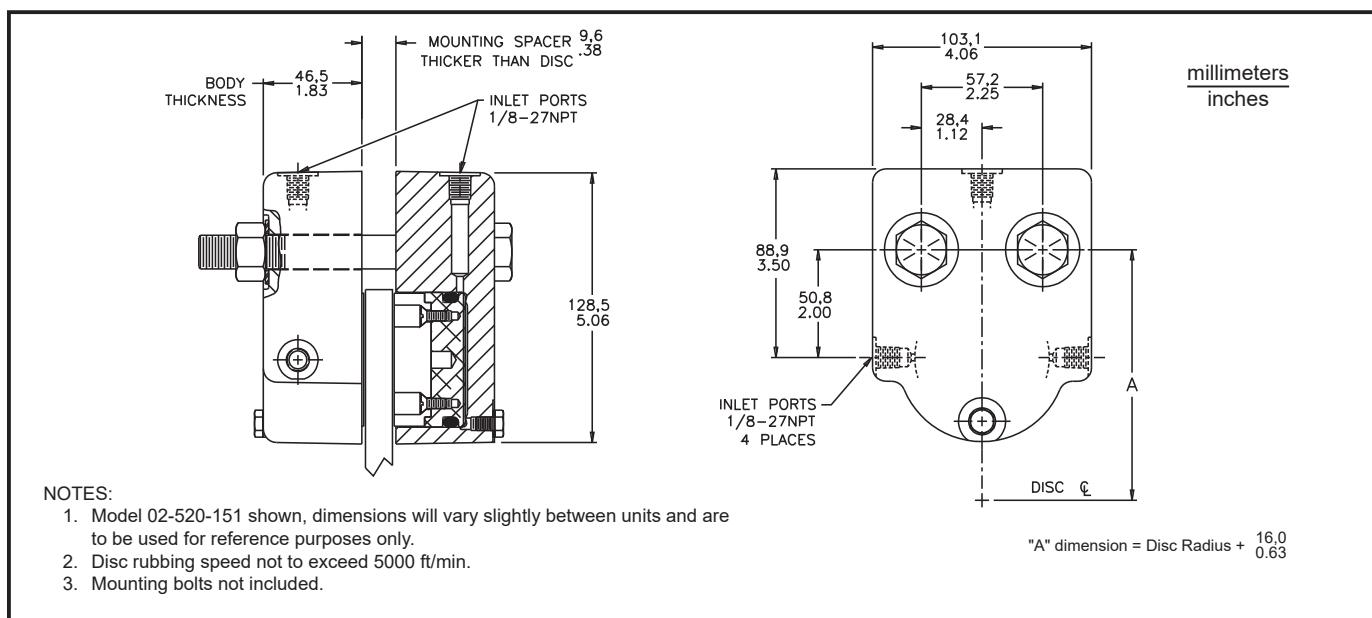
Consult ZF Off-Highway Solutions Minnesota Inc. Applications Department for other models.



## TORQUE FORMULA (Bt = Brake Torque)

$Bt = \text{PSI} \times 3.43 \times (\text{Disc Radius} - 1.25)$  for hole

**NOTE:** Maximum torque achieved only after brake has been properly adjusted and burnished, see Technical Notice (form no. 81-950-016).







# 520 Series Caliper Disc Brake

## Model Numbers

**Brake Fluid**  
02-520-201

**Hydraulic Oil**  
02-520-202

## DESCRIPTION

Fixed caliper disc brake, hydraulic apply with opposed pistons. Split calipers with one piston per caliper half.

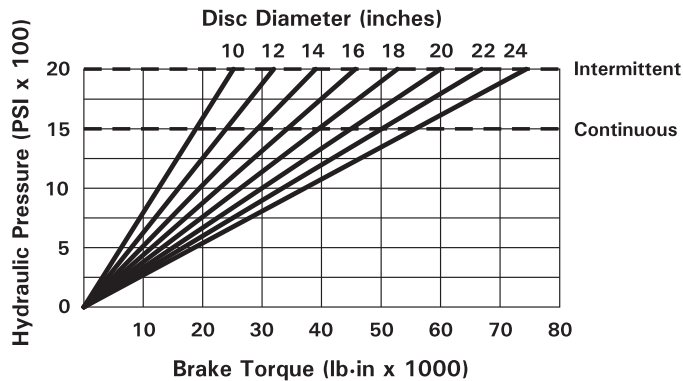
Brake torque is transmitted directly to the housing protecting the piston from side loads. Dust boot and o-ring seal protects hardcoat anodized aluminum piston from contaminants. Features quick-change type linings and internal porting.

Applications include pivotal steering assists, winch clutches, drivelines, various vehicles, and equipment requiring fade-free braking.

Consult ZF Off-Highway Solutions Minnesota Inc. Applications Department for other models.

## SPECIFICATIONS

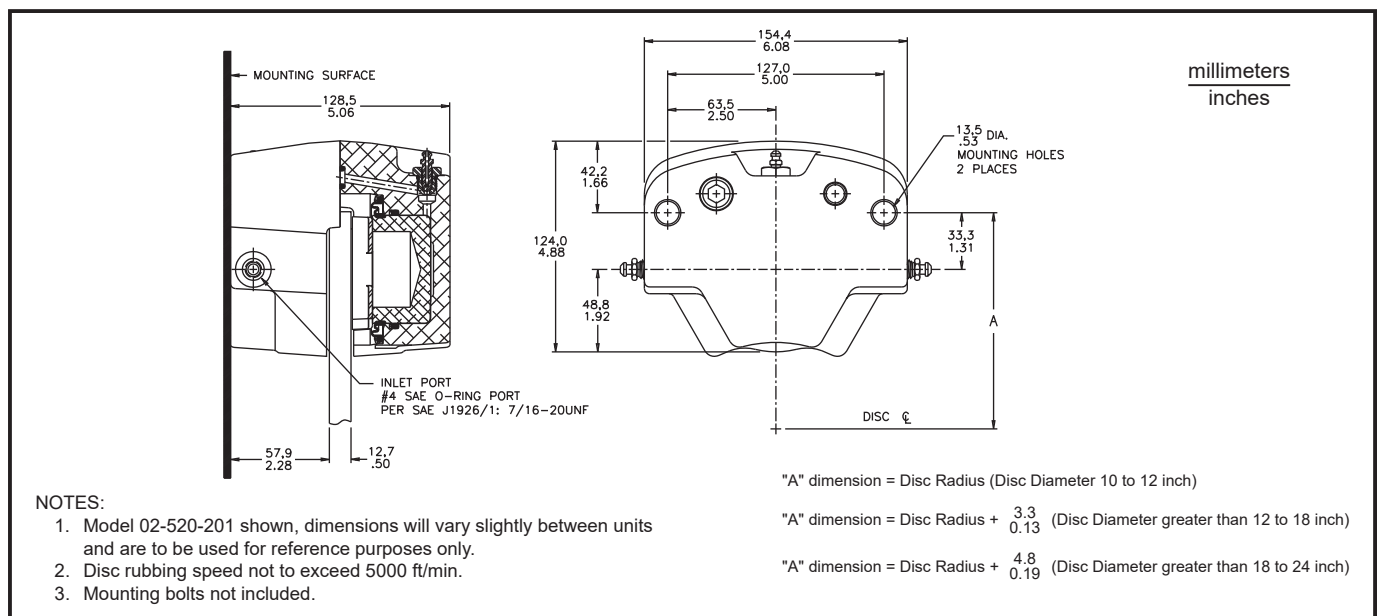
- **Disc diameter:** 10 to 24 inches
- **Disc thickness:** 0.50 inch
- **Total lining contact area:** 15.74 inch<sup>2</sup>
- **Continuous duty pressure:** 1500 PSI
- **Intermittent duty pressure:** 2000 PSI
- **Actuating volume:**
  - 500 PSI / 0.32 inch<sup>3</sup>
  - 1000 PSI / 0.37 inch<sup>3</sup>
  - 1500 PSI / 0.45 inch<sup>3</sup>
  - 2000 PSI / 0.54 inch<sup>3</sup>
- **Caliper material:** aluminum
- **Caliper finish:** clear anodized
- **Lining thickness:** 0.37 inch
- **Usable lining thickness:** 0.37 inch
- **Lining material:** non-asbestos, lead free
- **Piston diameter:** 2.50 inch
- **Approximate weight:** 10 lb
- **Porting:** No. 4 SAE o-ring port per SAE J1926/1: 7/16-20



## TORQUE FORMULA (Bt = Brake Torque)

$$Bt = \text{PSI} \times 3.43 \times (\text{Disc Radius} - 1.25)$$

**NOTE:** Maximum torque achieved only after brake has been properly adjusted and burnished, see Technical Notice (form no. 81-950-016).





# 520 Series Caliper Disc Brake

## Model Numbers

**Brake Fluid**  
02-520-261  
02-520-265

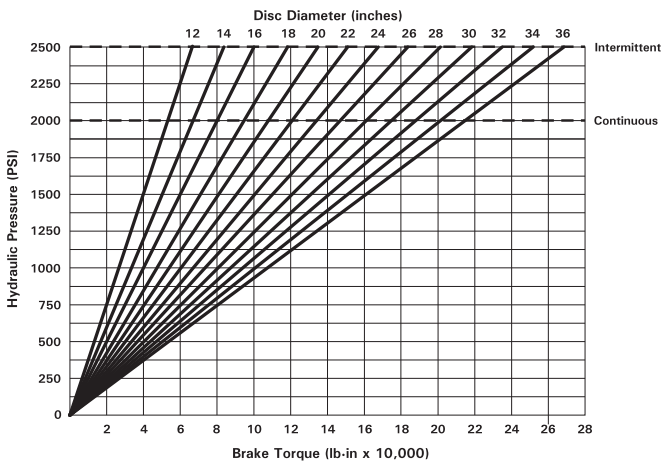
**Hydraulic Oil**  
02-520-260

## DESCRIPTION

Fixed caliper, hydraulic apply with opposed pistons.

Flexibility of the split caliper design makes it possible to use a variety of disc thicknesses. This design also allows the brake to be mounted with the torque member between the caliper halves. In this case the torque member serves as the spacer.

Designed for use with vehicles or stationary equipment requiring fade-free braking. Also available as caliper half assembly. Consult ZF Off-Highway Solutions Minnesota Inc. Applications Department for other models.



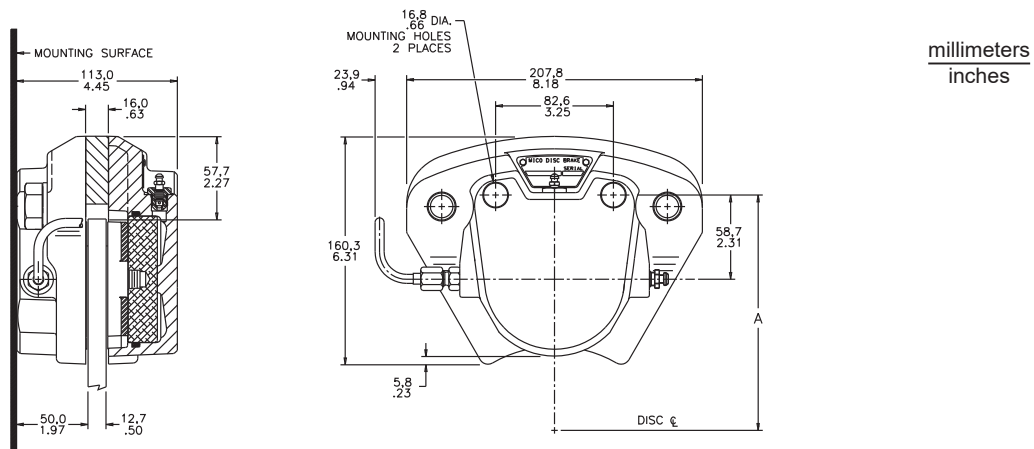
## SPECIFICATIONS

- **Disc diameter:** 12 to 36 inch  
(consult MICO, Inc. for larger sizes)
- **Disc thickness:** 0.50 inch 02-520-260  
0.50 inch 02-520-261  
1.00 inch 02-520-265
- **Total lining contact area:** 33.63 inch<sup>2</sup>
- **Continuous duty pressure:** 2000 PSI
- **Intermittent duty pressure:** 2500 PSI
- **Actuating volume:**  
500 PSI / 0.38 inch<sup>3</sup>  
1000 PSI / 0.49 inch<sup>3</sup>  
1500 PSI / 0.59 inch<sup>3</sup>  
2000 PSI / 0.68 inch<sup>3</sup>  
2500 PSI / 0.79 inch<sup>3</sup>
- **Caliper material:** ductile iron
- **Caliper finish:** electroless nickel
- **Lining thickness:** 0.37 inch
- **Usable lining thickness:** 0.37 inch
- **Lining material:** non-asbestos, lead free
- **Piston diameter:** 3.50 inch
- **Porting:** No. 4 SAE o-ring port per SAE J1926/1: 7/16-20
- **Approximate weight:** 22 lb

## TORQUE FORMULA (Bt = Brake Torque)

$$Bt = \text{PSI} \times 6.72 \times (\text{Disc Radius} - 2.00)$$

**NOTE:** Maximum torque achieved only after brake has been properly adjusted and burnished, see Technical Notice (form no. 81-950-016).



### NOTES:

1. Model 02-520-260 shown, dimensions will vary slightly between units and are to be used for reference purposes only.
2. Disc rubbing speed not to exceed 5000 ft/min.
3. Mounting bolts not included.

"A" dimension = Disc Radius + 15.8  
0.62



# 520 Series Caliper Disc Brake

## Model Numbers

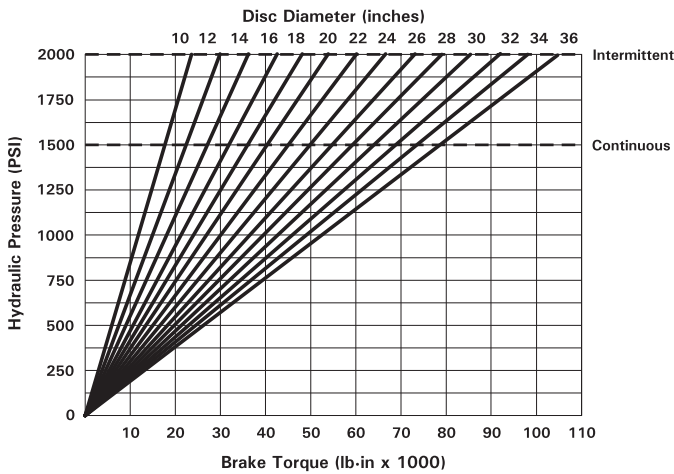
**Brake Fluid**  
03-520-281

**Hydraulic Oil**  
03-520-282

## DESCRIPTION

Fixed caliper, hydraulic apply with opposed pistons. One piece single caliper with internally ported fluid passages to both hardcoat anodized aluminum pistons.

Consult ZF Off-Highway Solutions Minnesota Inc. Applications Department for other models.

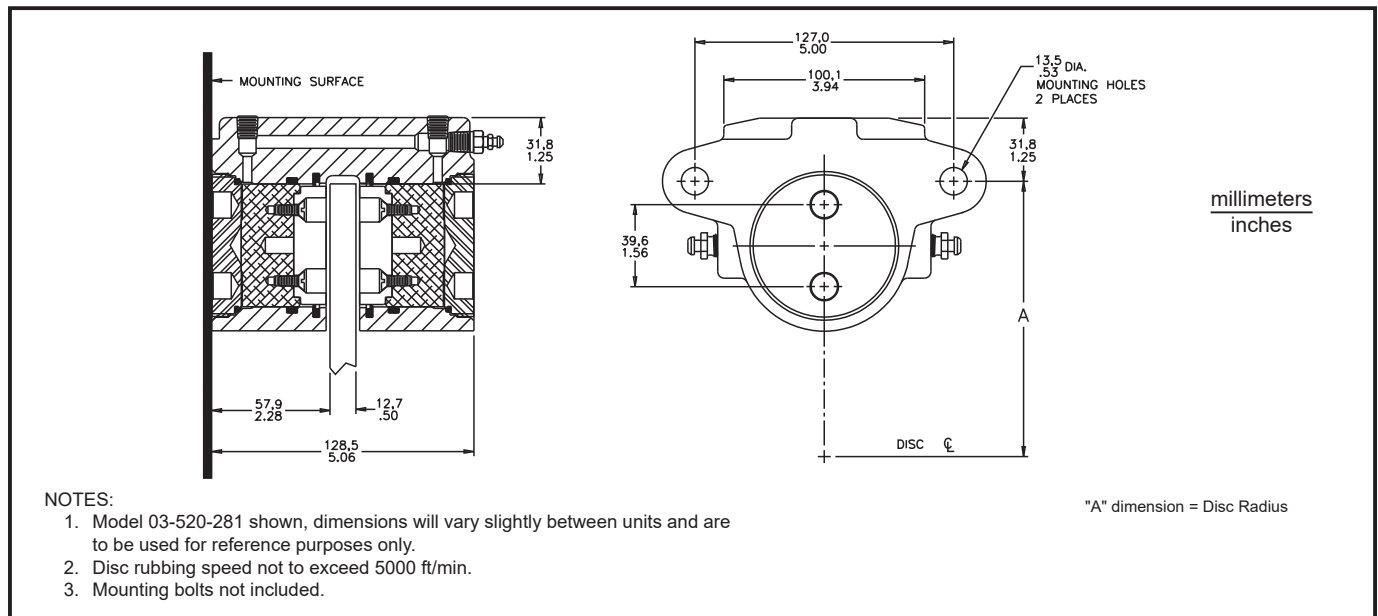


## SPECIFICATIONS

- **Disc diameter:** 9 to 36 inch
- **Disc thickness:** 0.50 inch
- **Total lining contact area:** 7.82 inch<sup>2</sup>
- **Continuous duty pressure:** 1500 PSI
- **Intermittent duty pressure:** 2000 PSI
- **Actuating volume:**
  - 500 PSI / 0.30 inch<sup>3</sup>
  - 1000 PSI / 0.40 inch<sup>3</sup>
  - 1500 PSI / 0.43 inch<sup>3</sup>
  - 2000 PSI / 0.48 inch<sup>3</sup>
- **Caliper material:** ductile iron
- **Caliper finish:** zinc chromate yellow
- **Lining thickness:** 0.50 inch
- **Usable lining thickness:** 0.44 inch
- **Lining material:** non-asbestos, lead free
- **Piston diameter:** 2.37 inch
- **Porting:** No. 4 SAE o-ring port per SAE J1926/1: 7/16-20
- **Approximate weight:** 14 lb

**TORQUE FORMULA** (Bt = Brake Torque)  
 $Bt = \text{PSI} \times 3.09 \times (\text{Disc Radius} - 1.187)$

**NOTE:** Maximum torque achieved only after brake has been properly adjusted and burnished, see Technical Notice (form no. 81-950-016).





# 520 Series Caliper Disc Brake

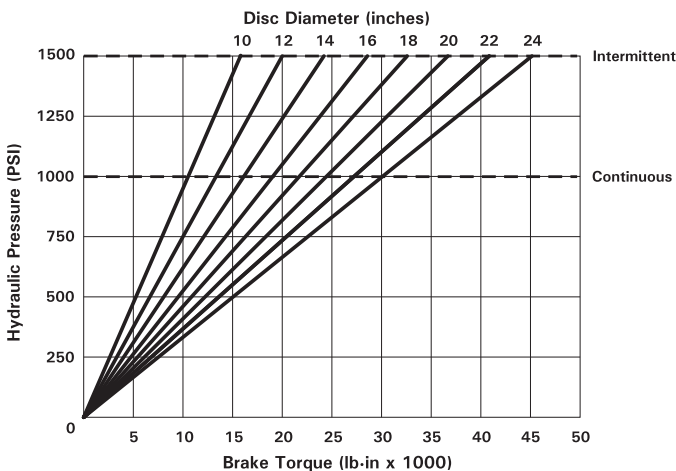
## Model Number

Hydraulic Oil  
02-520-300

## DESCRIPTION

This 520 Series Brake is used in service braking applications. It uses a modulated hydraulic pressure source, such as a master cylinder, to control brake torque. The brake can also be mounted in virtually any position. The cross-over tube allows hydraulic pressure to the two caliper halves to actuate the piston in each half. This brake has a lining retractor mechanism which reduces unnecessary lining wear by maintaining a constant lining to rotor disc clearance distance while the brake is not applied.

Consult ZF Off-Highway Solutions Minnesota Inc. Applications Department for other models.



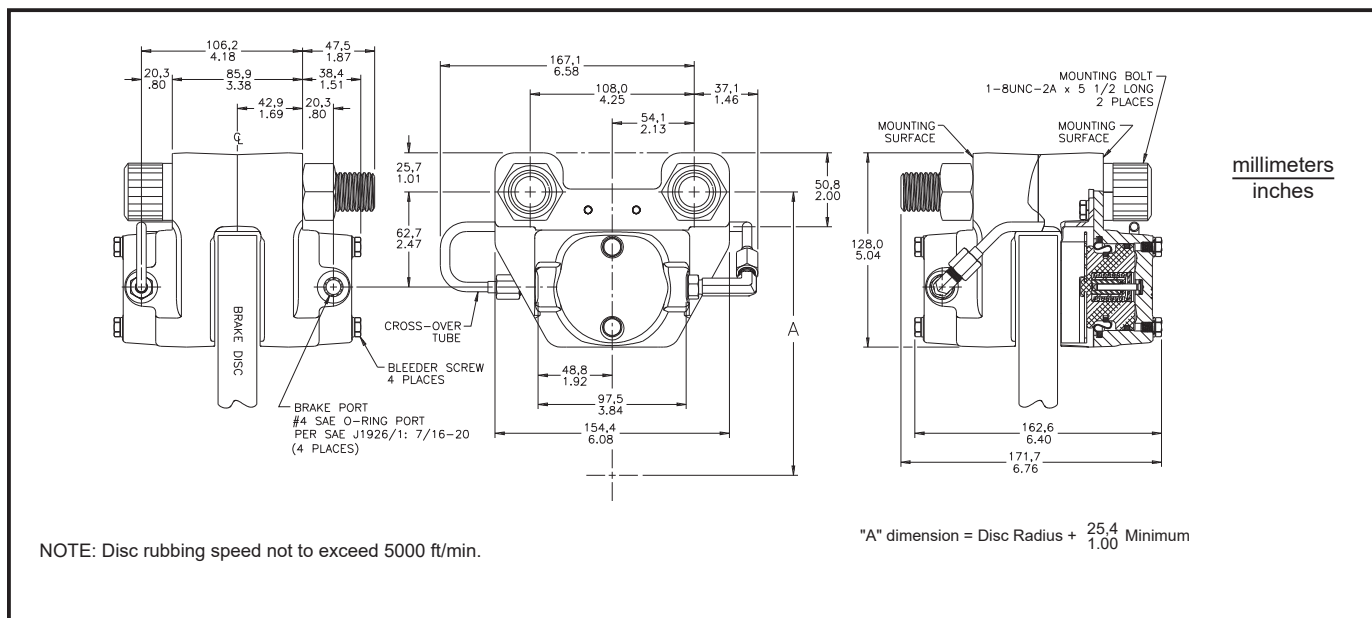
## SPECIFICATIONS

- **Disc diameter:** 10 inch to unlimited
- **Disc thickness:** 1.00 inch
- **Total lining contact area:** 12.4 inch<sup>2</sup>
- **Continuous duty pressure:** 1000 PSI
- **Intermittent duty pressure:** 1500 PSI
- **Actuating volume:** 0.25 in<sup>3</sup>
- **Caliper material:** ductile iron
- **Caliper finish:** vinyl primer
- **Lining thickness:** 0.66 inch
- **Usable lining thickness:** 0.32 inch
- **Lining material:** non-asbestos, lead free
- **Piston diameter:** 2.25 inch
- **Porting:** #4 SAE o-ring port per SAE J1926/1: 7/16-20
- **Approximate weight:** 17 lb

## TORQUE FORMULA (Bt = Brake Torque)

$$Bt = \text{PSI} \times 2.78 \times (\text{Disc Radius} - 1.20)$$

**NOTE:** Maximum torque achieved only after brake has been properly adjusted and burnished, see Technical Notice (form no. 81-950-016).





# 530 Series Caliper Disc Brake

(3000 lb)

## Model Numbers

### Brake Fluid

\* 01-530-307  
02-530-307  
03-530-307

### Hydraulic Oil

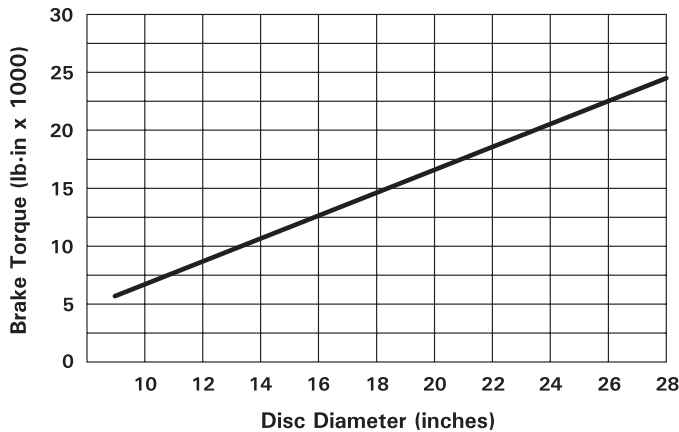
\* 01-530-306  
02-530-306  
03-530-306

\* No mounting bracket, contact ZF Off-Highway for mounting information.

## DESCRIPTION

Floating caliper, spring apply, hydraulic release design. Caliper can be reversed on mounting bracket.

The brakes shown are designed to operate as parking and/or emergency brakes. If your application requires rapid cycling please consult ZF Off-Highway Solutions Minnesota Inc. for recommendations and other model numbers.



## SPECIFICATIONS

- **Disc diameter:** 9 inch to unlimited
- **Disc thickness:** 0.31 to 0.50 inch
- **Total lining contact area:** 7.82 inch<sup>2</sup>
- **Continuous duty pressure:** 2000 PSI
- **Intermittent duty pressure:** 2500 PSI
- **Full retraction volume:** 0.80 inch<sup>3</sup> maximum
- **Caliper material:** ductile iron
- **Caliper finish:** zinc chromate yellow
- **Lining thickness:** 0.37 inch
- **Usable lining thickness:** 0.28 inch
- **Lining material:** non-asbestos, lead free
- **Piston diameter:** 3.50 inch
- **Porting:** No. 4 SAE o-ring port per SAE J1926/1: 7/16-20
- **Approximate weight:** 20 lb

## MOUNTING STYLES

02-530-306  
02-530-307



03-530-306  
03-530-307



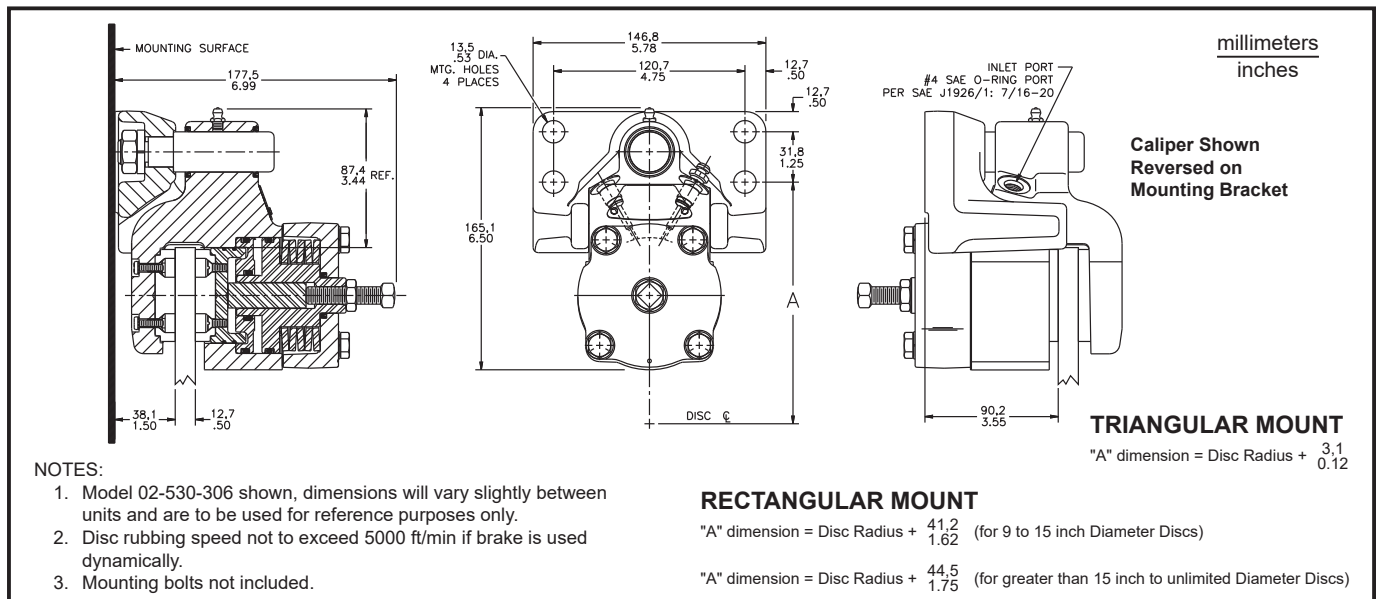
(See page 14 for dimensions)

## TORQUE FORMULA (Bt = Brake Torque)

$$Bt = 1920 \times (\text{Disc Radius} - 1.18)$$

Complete Retraction Pressure: 1000 PSI

**NOTE:** Maximum torque achieved only after brake has been properly adjusted and burnished, see Technical Notice (form no. 81-950-016).





# 530 Series Caliper Disc Brake

(6000 lb)

## Model Numbers

### Brake Fluid

\* 01-530-629  
02-530-629  
03-530-629

### Hydraulic Oil

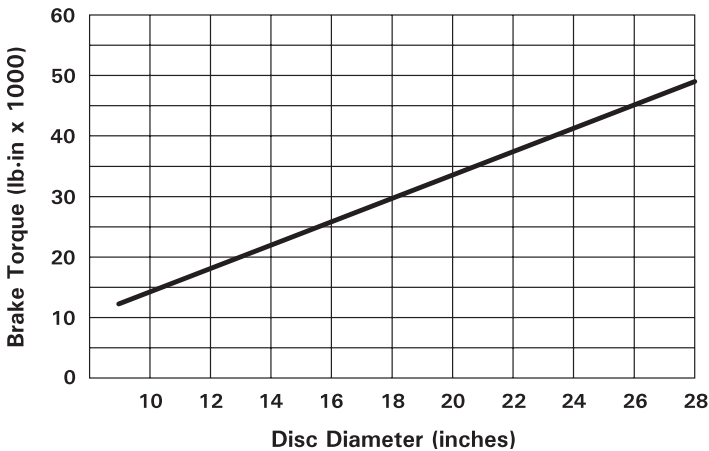
\* 01-530-628  
02-530-628  
03-530-628

\* No mounting bracket, contact ZF Off-Highway for mounting information.

## DESCRIPTION

Floating caliper, spring apply, hydraulic release design. Caliper can be reversed on mounting bracket.

The brakes shown are designed to operate as parking and/or emergency brakes. If your application requires rapid cycling please consult ZF Off-Highway Solutions Minnesota Inc. for recommendations and other model numbers.



## TORQUE FORMULA (Bt = Brake Torque)

$$Bt = 3840 \times (\text{Disc Radius} - 1.18)$$

Complete Retraction Pressure: 1500 PSI

## SPECIFICATIONS

- **Disc diameter:** 9 inch to unlimited
- **Disc thickness:** 0.31 to 0.50 inch
- **Total lining contact area:** 7.82 inch<sup>2</sup>
- **Continuous duty pressure:** 2000 PSI
- **Intermittent duty pressure:** 2500 PSI
- **Full retraction volume:** 0.80 inch<sup>3</sup> maximum
- **Caliper material:** ductile iron
- **Caliper finish:** zinc chromate yellow
- **Lining thickness:** 0.37 inch
- **Usable lining thickness:** 0.28 inch
- **Lining material:** non-asbestos, lead free
- **Porting:** No. 4 SAE o-ring port per SAE J1926/1: 7/16-20
- **Approximate weight:** 20 lb

## MOUNTING STYLES

02-530-628  
02-530-629



03-530-628  
03-530-629



(See page 13 for dimensions)

**NOTE:** Maximum torque achieved only after brake has been properly adjusted and burnished, see Technical Notice (form no. 81-950-016).

177.5  
6.99

87.4 REF.  
3.44

38.1  
1.50

12.7  
.50

203.5  
8.01

171.5  
6.75

165.1  
6.50

57.2  
2.25

13.5 DIA.  
.53  
MTG. HOLES  
2 PLACES

DISC C

INLET PORT  
#4 SAE O-RING PORT  
PER SAE J1926/1: 7/16-20

90.2  
3.55

millimeters  
inches

Caliper Shown  
Reversed on  
Mounting Bracket

**TRIANGULAR MOUNT**

"A" dimension = Disc Radius +  $\frac{3.1}{0.12}$

**NOTES:**

1. Model 03-530-628 shown, dimensions will vary slightly between units and are to be used for reference purposes only.
2. Disc rubbing speed not to exceed 5000 ft/min if brake is used dynamically.
3. Mounting bolts not included.

**RECTANGULAR MOUNT**

"A" dimension = Disc Radius +  $\frac{41.2}{1.62}$  (for 9 to 15 inch Diameter Discs)

"A" dimension = Disc Radius +  $\frac{44.5}{1.75}$  (for greater than 15 inch to unlimited Diameter Discs)



# 530 Series Caliper Disc Brake

(9000 lb)

## Model Numbers

Hydraulic Oil

\* 01-530-904

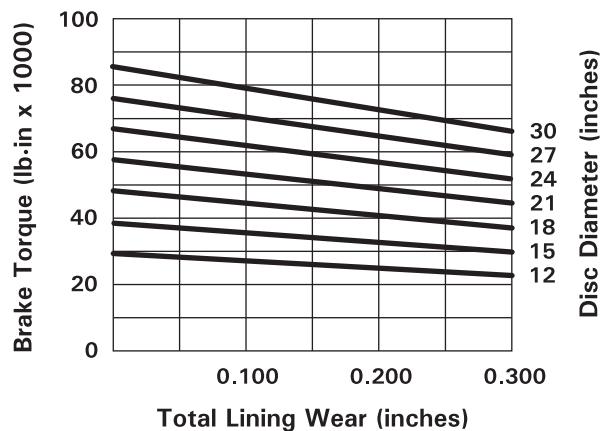
03-530-904

\* No mounting bracket, contact ZF Off-Highway for mounting information.

## DESCRIPTION

Floating caliper, spring apply, hydraulic release design.

The brake shown is designed to operate as parking and/or emergency brake. If your application requires rapid cycling please consult ZF Off-Highway Solutions Minnesota Inc. for recommendations and other model numbers.



## SPECIFICATIONS

- **Disc diameter:** 9 inch to unlimited
- **Disc thickness:** 0.50 inch
- **Total lining contact area:** 9.40 inch<sup>2</sup>
- **Continuous duty pressure:** 2000 PSI
- **Intermittent duty pressure:** 2500 PSI
- **Full retraction volume:** 4.53 inch<sup>3</sup> maximum
- **Caliper material:** ductile iron
- **Caliper finish:** zinc chromate yellow
- **Usable lining thickness:** 0.15 inch
- **Lining material:** non-asbestos, lead free
- **Porting:** No. 4 SAE o-ring port per SAE J1926/1: 7/16-20
- **Approximate weight:** 37 lb

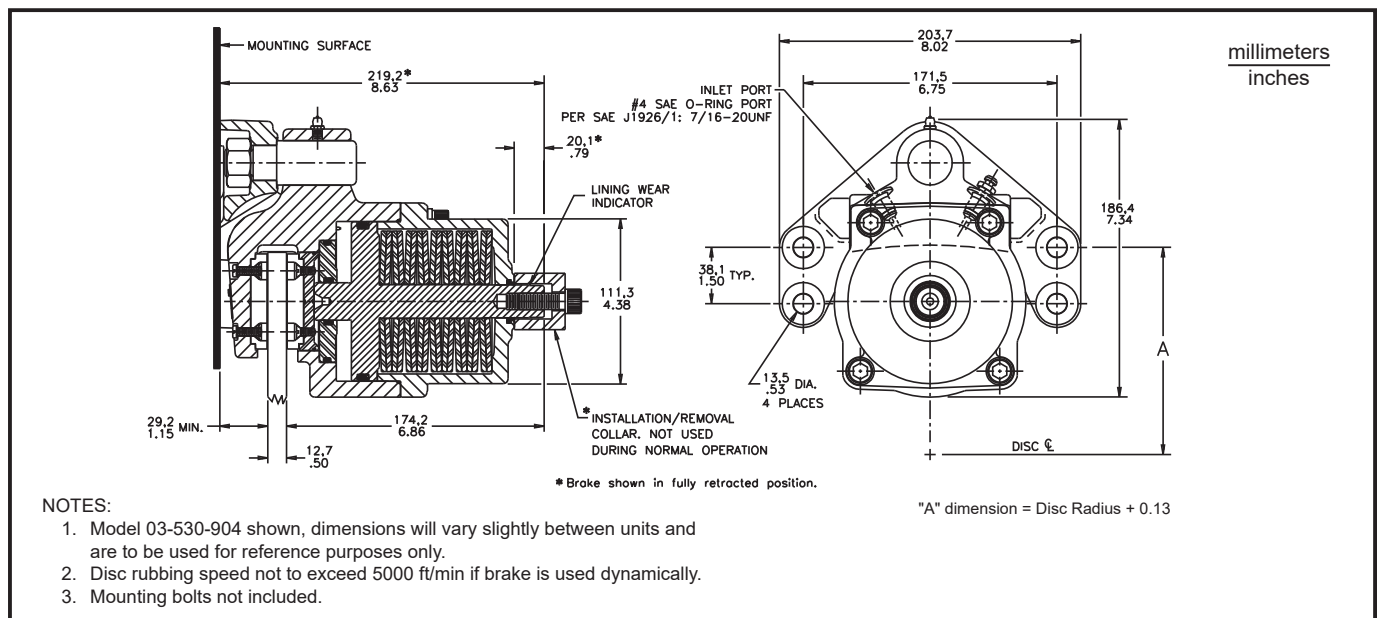
## TORQUE FORMULA (Bt = Brake Torque)

$$Bt \text{ (new)} = 6225 \times (\text{Disc Radius} - 1.31)$$

$$Bt \text{ (worn)} = 4895 (\text{Disc Radius} - 1.31)$$

Complete Retraction Pressure: 1000 PSI

**NOTE:** Maximum torque achieved only after brake has been properly adjusted and burnished, see Technical Notice (form no. 81-950-016).





# 530 Series Caliper Disc Brake

## Model Numbers

### Brake Fluid

- \* 01-530-045
- 02-530-045
- 03-530-045

### Hydraulic Oil

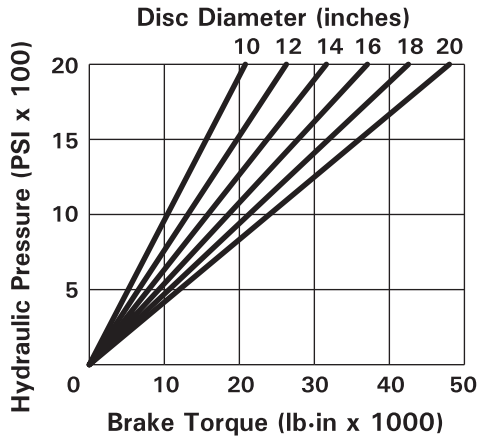
- \* 01-530-040
- 02-530-040
- 03-530-040

\* No mounting bracket, contact ZF Off-Highway for mounting information.

## DESCRIPTION

Floating caliper, hydraulic apply design. Caliper may be reversed on mounting bracket.

Consult ZF Off-Highway Solutions Minnesota Inc. Applications Department for other models.



## SPECIFICATIONS

- **Disc diameter:** 9 inch to unlimited
- **Disc thickness:** 0.50 inch
- **Total lining contact area:** 7.82 inch<sup>2</sup>
- **Continuous duty pressure:** 1500 PSI
- **Intermittent duty pressure:** 2000 PSI
- **Caliper material:** ductile iron
- **Caliper finish:** zinc chromate yellow
- **Lining thickness:** 0.37 inch
- **Usable lining thickness:** 0.30 inch
- **Lining material:** non-asbestos, lead free
- **Piston diameter:** 2.37 inch
- **Porting:** No. 4 SAE o-ring port per SAE J1926/1: 7/16-20
- **Approximate weight:** 16 lb

## MOUNTING STYLES

02-530-040  
02-530-045



03-530-040  
03-530-045

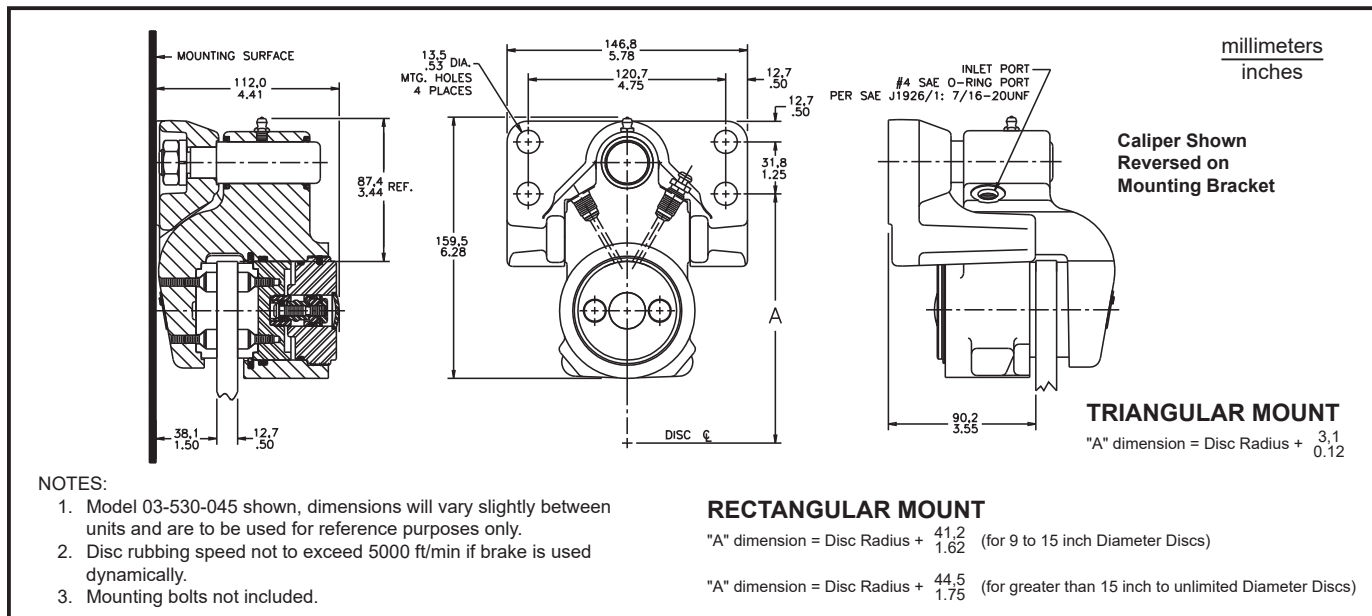


(See page 14 for dimensions)

**NOTE:** Maximum torque achieved only after brake has been properly adjusted and burnished, see Technical Notice (form no. 81-950-016).

## TORQUE FORMULA (Bt = Brake Torque)

$$Bt = \text{PSI} \times 2.72 \times (\text{Disc Radius} - 1.18)$$





# USEFUL FORMULAS

See page 18 for conversion factors.

## NOTES:

1. To convert a known percent of grade into the sine of the angle of the grade, see table on page 19.
2. The formulas shown on this page estimate torque and energy requirements and may be helpful with brake selection, however, many factors affect brake performance and are not considered in the equations. Some of these factors are:
  - road conditions
  - tire performance
  - engine drag
  - vehicle inertia
  - duty cycle
  - disc speed
  - lining wear
  - environment

Contact ZF Off-Highway Solutions Minnesota Inc. for a basic recommendation.

## Vehicle Application

### Torque Required to Hold a Vehicle on an Incline

$$T = WR\sin \theta$$

#### Where:

T = Total torque required (lb·in)  
W = Gross vehicle weight (lb)  
R = Rolling radius (in)  
 $\sin \theta$  = Sine of the angle of the grade (See Note 1)

### Torque Required to Stop a Moving Vehicle

$$T = WR \left( \frac{d}{g} + \sin \theta \right)$$

#### Where:

T = Total torque required (lb·in)  
W = Gross vehicle weight (lb)  
R = Rolling radius (in)  
 $\sin \theta$  = Sine of the angle of the grade (See Note 1)  
g = Acceleration due to gravity (32.2 ft/sec<sup>2</sup>)  
d = Deceleration rate (ft/sec<sup>2</sup>)

And:

$$d = \frac{V^2}{2s} = \frac{V}{t}$$

#### Where:

V = Vehicle velocity at instant of brake application (ft/sec)  
s = Stopping distance (ft)  
t = Stopping time (sec)

### Torque Required per Brake

$$B_t = \frac{T}{NB}$$

#### Where:

B<sub>t</sub> = Torque required per brake (lb·in)  
T = Total torque required (lb·in)  
NB = Number of brakes

### Torque Required if Gear Reduction is Used

$$B_t = \frac{T}{GR}$$

#### Where:

B<sub>t</sub> = Brake torque required (lb·in)  
T = Total torque required (lb·in)  
GR = Gear reduction ratio

### Kinetic Energy Required to Stop a Moving Vehicle

$$KE = \frac{WV^2}{2g}$$

#### Where:

KE = Kinetic energy (ft·lb)  
W = Gross vehicle weight (lb)  
V = Vehicle speed (ft/sec)  
g = Acceleration due to gravity (32.2 ft/sec<sup>2</sup>)

## Stationary Equipment Application

### Torque Required to Stop a Rotating Mass

$$T = \frac{0.039WK^2N}{t}$$

#### Where:

T = Torque (lb·in)  
W = Weight of rotating members (lb)  
K = Radius of gyration of rotating members (ft)  
N = RPM  
t = Stopping time required (sec)

### Kinetic Energy Required to Stop a Rotating Mass

$$KE = \frac{WK^2N^2}{5872}$$

#### Where:

KE = Kinetic energy (ft·lb)  
W = Weight of rotating member (lb)  
K = Radius of gyration of rotating member (ft)  
N = RPM

### Constant Drag Application

$$T = \frac{63,025 \text{ hp}}{N}$$

#### Where:

T = Total torque required (lb·in)  
hp = Horsepower  
N = RPM

# CONVERSION FACTORS

## TORQUE

| lb·ft   | lb·in | daN·m   | N·m    | kg·m    |
|---------|-------|---------|--------|---------|
| 1       | 12    | 0.13556 | 1.356  | 0.1382  |
| 0.08333 | 1     | 0.01130 | 0.1130 | 0.01152 |
| 7.376   | 88.51 | 1       | 10     | 1.019   |
| 0.7376  | 8.851 | 0.1     | 1      | 0.102   |
| 7.2359  | 86.80 | 0.9806  | 9.806  | 1       |

## PRESSURE

| PSI   | MPa      | bar     | kPa   | kg/mm <sup>2</sup> | kg/cm <sup>2</sup> |
|-------|----------|---------|-------|--------------------|--------------------|
| 1     | 0.006895 | 0.06895 | 6.895 | 0.0007031          | 0.07031            |
| 145   | 1        | 10      | 1000  | 0.102              | 10.20              |
| 14.50 | 0.1      | 1       | 100   | 0.0102             | 1.02               |
| 0.145 | 0.001    | 0.01    | 1     | 0.000102           | 0.0102             |
| 1422  | 9.807    | 98.07   | 9807  | 1                  | 100                |
| 14.22 | 0.09807  | 0.9807  | 98.07 | 0.01               | 1                  |

1 Atmosphere = 14.7 lb/in<sup>2</sup>

1 Atmosphere = 29.92 inches of Mercury

1 Atmosphere = 33.96 ft of water

1 inch of Mercury = 0.491 lb/in<sup>2</sup> = 13.6 inches of water

1 PSI = 2.0416 inches of Mercury at 62 °F

## ENERGY

| ft·lb   | kgf·m  | kW·hr    | hp·hr    | J       |
|---------|--------|----------|----------|---------|
| 1       | 0.1383 | 3.766e-7 | 5.051e-7 | 1.356   |
| 7.233   | 1      | 2.724e-6 | 3.653e-6 | 9.806   |
| 2655224 | 367098 | 1        | 1.341    | 3600000 |
| 1980000 | 273745 | 0.7457   | 1        | 2684520 |
| 0.7376  | 0.1020 | 2.778e-7 | 3.725e-7 | 1       |

1 BTU = British thermal unit = heat required to raise temperature of 1 lb of water 1 °F

1 BTU = 778.17 ft·lb

## VELOCITY

| m/sec   | ft/s    | km/hr   | MPH     | ft/min |
|---------|---------|---------|---------|--------|
| 1       | 3.281   | 3.6     | 2.237   | 196.85 |
| 0.3048  | 1       | 1.097   | 0.6818  | 60     |
| 0.2778  | 0.9113  | 1       | 0.6214  | 54.68  |
| 0.4470  | 1.467   | 1.609   | 1       | 88     |
| 0.00508 | 0.01667 | 0.01829 | 0.01136 | 1      |

## LENGTH

| cm      | in     | ft      | m      | km       | mile     |
|---------|--------|---------|--------|----------|----------|
| 1       | 0.3937 | 0.03281 | 0.01   | 0.00001  | 0.000006 |
| 2.54    | 1      | 0.08333 | 0.0254 | 0.000024 | 0.000017 |
| 30.48   | 12     | 1       | 0.3048 | 0.0003   | 0.000186 |
| 100     | 39.37  | 3.281   | 1      | 0.001    | 0.000621 |
| 100,000 | 39,370 | 3281    | 1000   | 1        | 0.6214   |
| 160,934 | 63,360 | 5280    | 1609   | 1.609    | 1        |

## VOLUME

| in <sup>3</sup> | cm <sup>3</sup> | L       | qt       |
|-----------------|-----------------|---------|----------|
| 1               | 16.39           | 0.01639 | 0.01732  |
| 0.06102         | 1               | 0.001   | 0.001057 |
| 61.02           | 1000            | 1       | 1.057    |
| 57.75           | 946.4           | 0.9464  | 1        |

1 U.S. gallon = 231 in<sup>3</sup>

1 U.S. gallon = 0.13368 ft<sup>3</sup>

## FLOW

| GPM   | in <sup>3</sup> /s | L/min |
|-------|--------------------|-------|
| 1     | 3.850              | 3.785 |
| 0.260 | 1                  | 0.983 |
| 0.264 | 1.017              | 1     |

## FORCE

| N      | lb     |
|--------|--------|
| 1      | 0.2248 |
| 4.4482 | 1      |

## ACCELERATION

| ft/s <sup>2</sup> | in/s <sup>2</sup> | m/s <sup>2</sup> | cm/s <sup>2</sup> |
|-------------------|-------------------|------------------|-------------------|
| 1                 | 12                | 0.3048           | 30.48             |
| 0.08333           | 1                 | 0.0254           | 2.54              |
| 3.281             | 39.37             | 1                | 100               |
| 0.03281           | 3937              | 0.01             | 1                 |

## AREA

| in <sup>2</sup> | cm <sup>2</sup> | mm <sup>2</sup> |
|-----------------|-----------------|-----------------|
| 1               | 6.452           | 645.2           |
| 0.1550          | 1               | 100             |
| 0.001550        | 0.01            | 1               |

## POWER

| hp     | kW     | met·hp |
|--------|--------|--------|
| 1      | 0.7457 | 1.014  |
| 1.341  | 1      | 1.360  |
| 0.9863 | 0.7355 | 1      |

1 hp = 550 ft·lb/s

1 hp = 33,000 ft·lb/min

1 hp = 42.44 BTU/min

## TEMPERATURE

°F = (°C x 1.8) + 32

°C = (°F - 32) ÷ 1.8

continued . . .

**GRADE**

| Percent of Grade | $\theta$ (Degrees) | $\sin \theta$ |
|------------------|--------------------|---------------|
| 1                | 0° 34'             | 0.0100        |
| 2                | 1° 09'             | 0.0200        |
| 3                | 1° 43'             | 0.0300        |
| 4                | 2° 17'             | 0.0400        |
| 5                | 2° 52'             | 0.0499        |
| 6                | 3° 26'             | 0.0599        |
| 7                | 4° 00'             | 0.0698        |
| 8                | 4° 34'             | 0.0797        |
| 9                | 5° 09'             | 0.0896        |
| 10               | 5° 43'             | 0.0995        |
| 11               | 6° 17'             | 0.1093        |
| 12               | 6° 51'             | 0.1191        |
| 13               | 7° 24'             | 0.1289        |
| 14               | 7° 58'             | 0.1386        |
| 15               | 8° 32'             | 0.1483        |
| 16               | 9° 05'             | 0.1580        |
| 17               | 9° 39'             | 0.1676        |
| 18               | 10° 12'            | 0.1772        |

| Percent of Grade | $\theta$ (Degrees) | $\sin \theta$ |
|------------------|--------------------|---------------|
| 19               | 10° 45'            | 0.1867        |
| 20               | 11° 19'            | 0.1961        |
| 21               | 11° 52'            | 0.2055        |
| 22               | 12° 24'            | 0.2149        |
| 23               | 12° 57'            | 0.2241        |
| 24               | 13° 30'            | 0.2334        |
| 25               | 14° 02'            | 0.2425        |
| 26               | 14° 34'            | 0.2516        |
| 27               | 15° 07'            | 0.2607        |
| 28               | 15° 39'            | 0.2696        |
| 29               | 16° 10'            | 0.2785        |
| 30               | 16° 42'            | 0.2873        |
| 35               | 19° 17'            | 0.3304        |
| 40               | 21° 48'            | 0.3714        |
| 45               | 24° 14'            | 0.4104        |
| 50               | 26° 34'            | 0.4472        |
| 55               | 28° 49'            | 0.4819        |
| 60               | 30° 58'            | 0.5145        |



**BRAKES**



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# NOTES

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