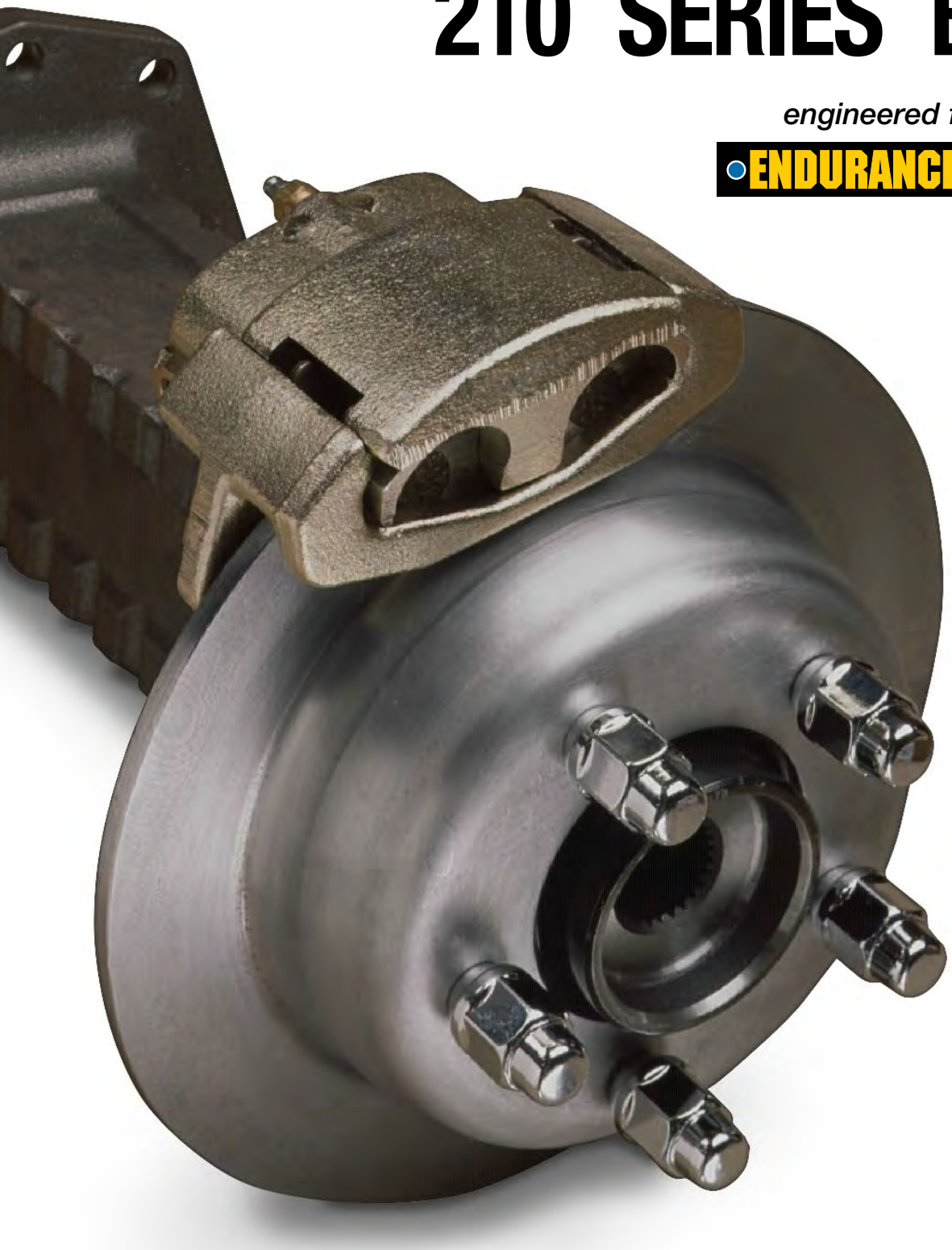
Tolomatic
EXCELLENCE *IN MOTION*®

CALIPER DISC BRAKES

210 SERIES BRAKES

engineered for long life with

ENDURANCE TECHNOLOGY℠



OVER 60 YEARS OF PROVEN PERFORMANCE

OVER 60 YEARS OF PROVEN PERFORMANCE

- Since 1954, Tolomatic has been manufacturing caliper disc brakes for industrial and off-highway applications in Spring Applied, Pneumatic, Hydraulic, Mechanical, and Hydraulic/Mechanical combinations. With hundreds of models to choose from, Tolomatic brakes meet the challenge of the most demanding applications.

ENDURANCE TECHNOLOGY℠

Every Tolomatic brake is designed and built with Endurance Technology℠. Material selection, from seals to castings, and every other design element is optimized for long life and excellent performance. The result is the best performing caliper disc brakes on the market today.

- **TRUST YOUR APPLICATION TO TOLOMATIC**

When you want the job done right, go with the brake experts. Long life. Durability. Ruggedness. Built to your specifications in 5 days or less. Tolomatic. Endurance Technology℠. Proven performance.

Be sure to visit www.tolomatic.com for up-to-date product specifications, and 3D CAD solid files.

210 SERIES BRAKES: APPLICATIONS

A leading manufacture of ground support vehicles utilizes the mechanical version of the 210 in its tow-barless towing tractor. It delivers reliable long lasting stopping power in a small wheel base with parking maneuverability.

"We have been using the Tolomatic ME210 mechanical brake for almost 6 years now. We are very pleased with the robust design and torque capability of the unit. This was the only brake that fit our profile constraints and the performance results have exceeded our expectations."

Chuck Pugh, Service Manager
Lektro Inc.

In the underground mining industry, safe and reliable transportation is a must. This transporter uses a 210 mechanical brake that provides the stopping power required for steep inclines.

"We have been using Tolomatic brakes for years with reliable results. The 210 brake design keeps our wheel rim size down to a minimum which is an important feature in the underground mining industry. We have used this brake on many of our designs including an underground ambulance and couldn't be happier with the performance."

Walter Stewart, President
Damascus Corporation

Tiger, a world-wide supplier of tow tractors, cargo tractors, aircraft tractors and specialty vehicles for the aviation, industrial, commercial, and military markets selected the 210 hydraulic brake for its tow tractor line.

"We needed a front brake on our tractor that could deliver the necessary power required to bring our large moving vehicles to a stop. The 210 brake provided the most braking power for our small envelope size. It has provided us with years of dependable performance."

Jon Gribble, Vice President of Engineering
Taylor-Dunn Corporation

210 SERIES CALIPER DISC BRAKES

ENDURANCE TECHNOLOGY℠

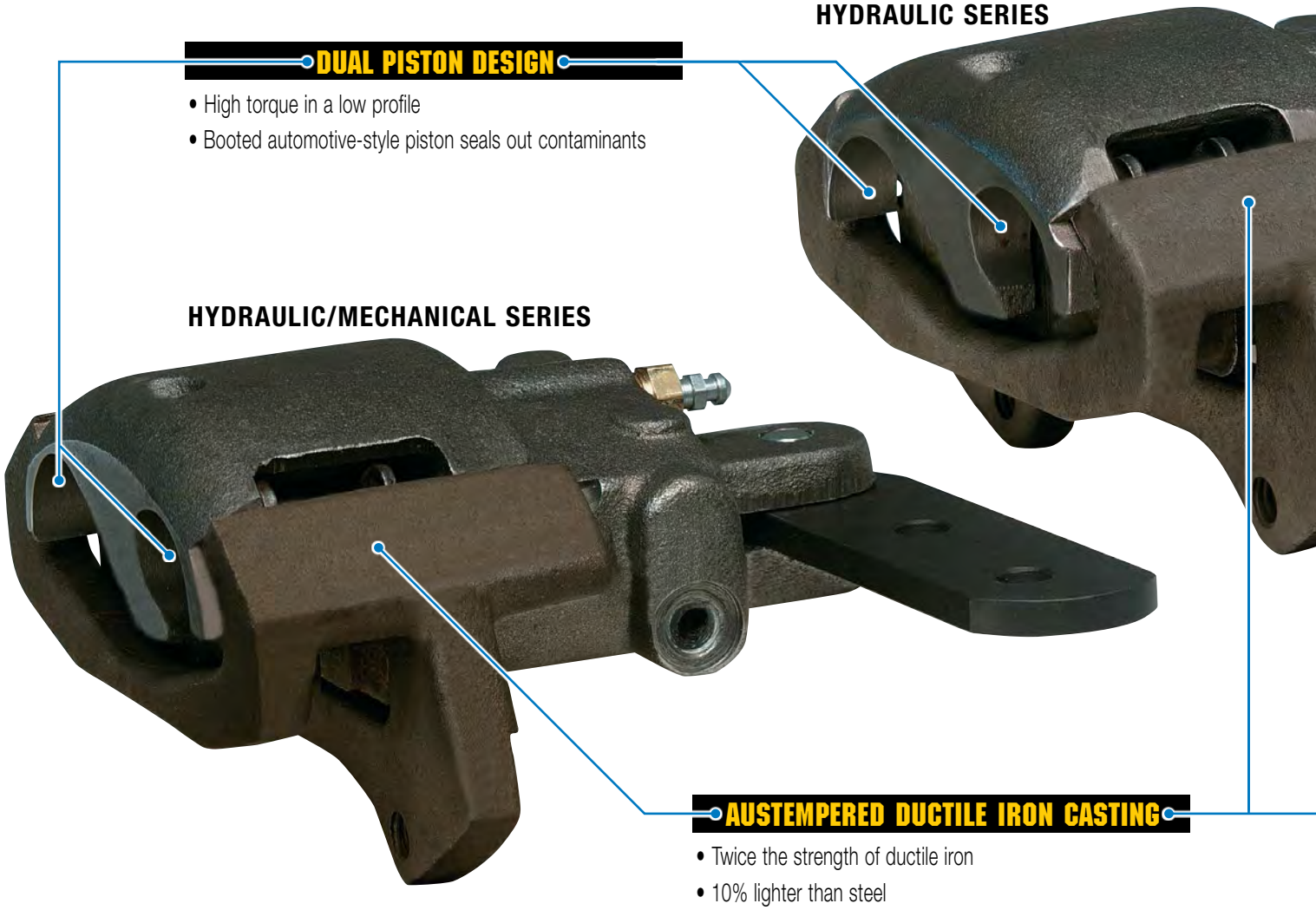
Look for this endurance technology symbol indicating our durability design features

HYDRAULIC SERIES

DUAL PISTON DESIGN

- High torque in a low profile
- Booted automotive-style piston seals out contaminants

HYDRAULIC/MECHANICAL SERIES



AUSTEMPERED DUCTILE IRON CASTING

- Twice the strength of ductile iron
- 10% lighter than steel
- Able to accommodate high pressure and high torque
- Long life performance

TOLOMATIC…OVER 60 YEARS OF PROVEN PERFORMANCE

STANDARD FEATURES INCLUDE:

- Fits inside an 8-inch wheel
- Accommodates 6- to 10-inch discs
- EPR seals
- Replaceable, high-grade friction material
- Quick change friction material
- Universal mounting bracket for easy installation

MECHANICAL SERIES

What is Endurance Technology℠?

Every Tolomatic brake is designed and built with Endurance Technology. Material selection, from castings to seals and every design element is optimized for long life and excellent performance. The result is the best performing brakes on the market today.

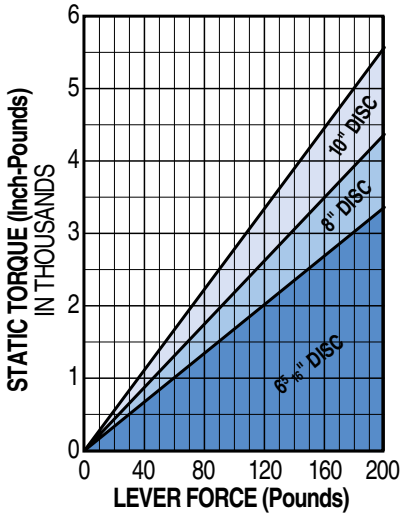
ME210 BRAKE: MECHANICAL

(For use with a 1/4" Fixed Disc)

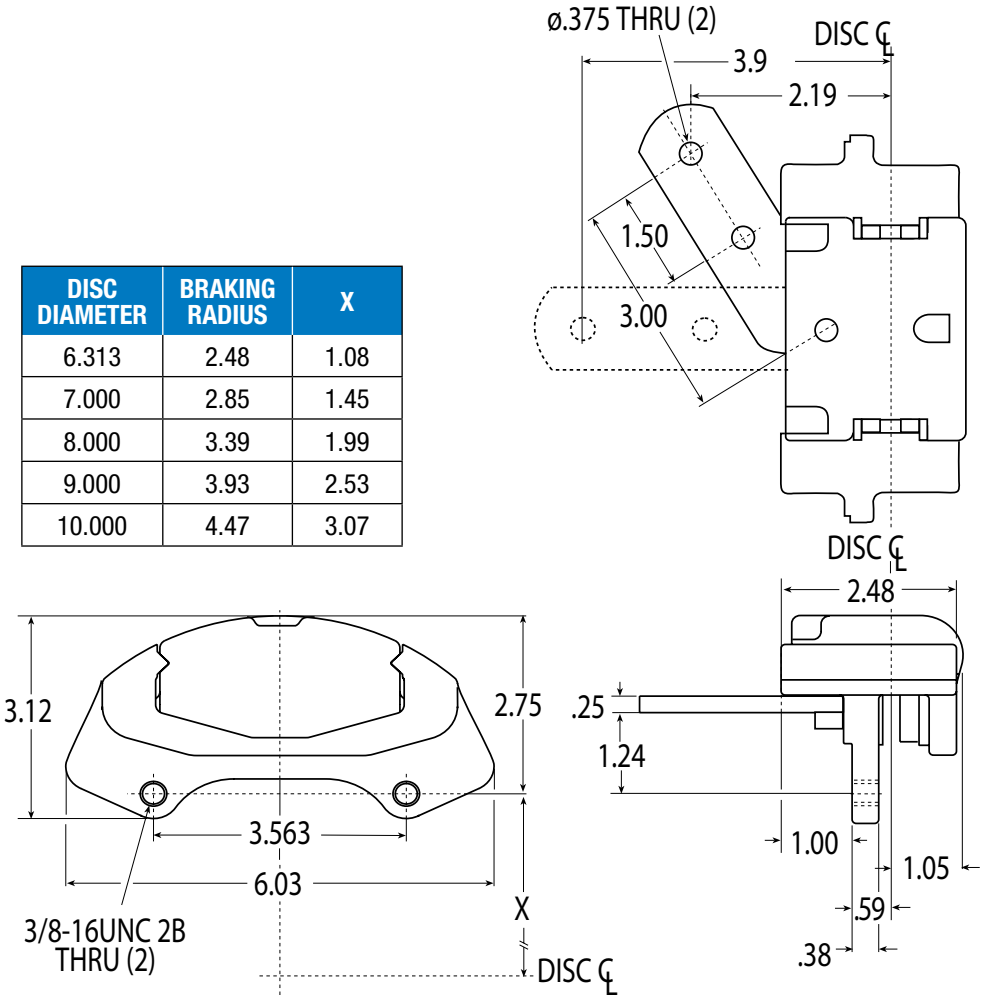
WEIGHT: 3.7 lbs (1.68 kg)
MAXIMUM LEVER FORCE: 200 lbs (90.7 kg)
RIGHT-HAND MODEL: 0786-0100
LEFT-HAND MODEL: 0786-0101

PERFORMANCE DATA

STATIC TORQUE



DISC DIAMETER	BRAKING RADIUS	X
6.313	2.48	1.08
7.000	2.85	1.45
8.000	3.39	1.99
9.000	3.93	2.53
10.000	4.47	3.07



DISC SIZING EQUATIONS:

STATIC (PARKING) TORQUE (in-lbs) = 6.0 x BRAKING RADIUS (in) x LEVER FORCE (lbs)
BRAKING RADIUS = [DISC DIAMETER x 0.54] - 0.93"
X = [DISC DIAMETER x 0.54] - 2.33"

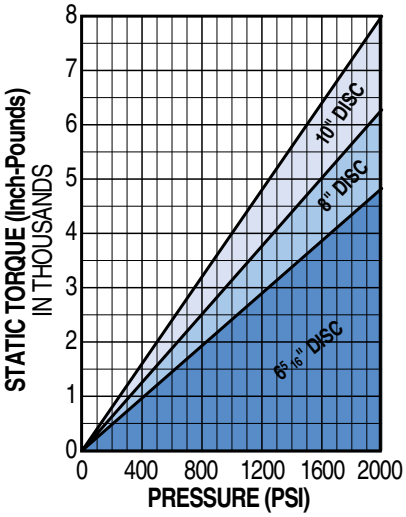
H210 BRAKE: HYDRAULIC

SINGLE ACTING WITH FLOATING BRACKET
(For use with a 1/4" Fixed Disc)

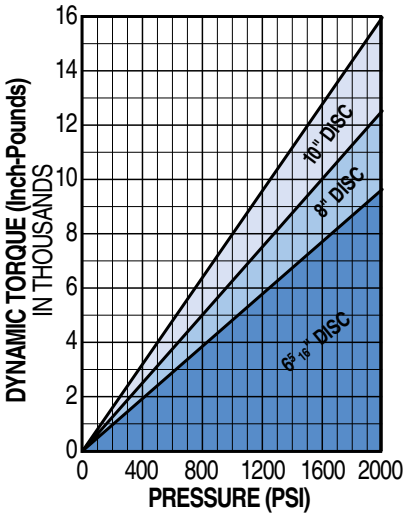
WEIGHT: 4.5 lbs (2.04 kg)
MAXIMUM PRESSURE RATING: 2000 PSI
RIGHT-HAND MODEL: 0786-0300
LEFT-HAND MODEL: 0786-0301

PERFORMANCE DATA

STATIC TORQUE



DYNAMIC TORQUE



DISC DIAMETER	BRAKING RADIUS	X
6.313	2.48	1.08
7.000	2.85	1.45
8.000	3.39	1.99
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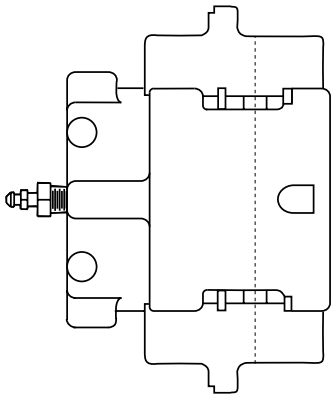
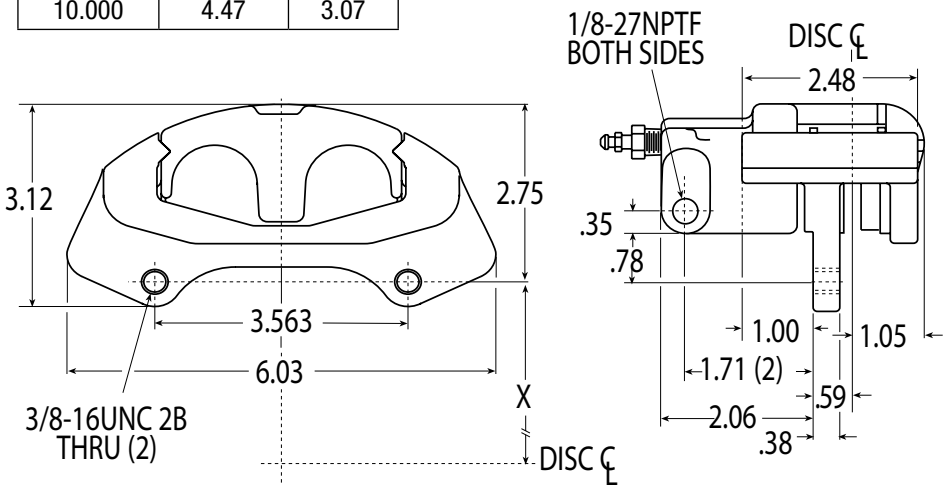




DISC SIZING EQUATIONS:

DYNAMIC TORQUE (in-lbs) = 1.72 x BRAKING RADIUS (in) x PRESSURE (PSI)
STATIC (PARKING) TORQUE (in-lbs) = 0.862 x BRAKING RADIUS (in) x PRESSURE (PSI)
BRAKING RADIUS = [DISC DIAMETER x 0.54] - 0.93"
X = [DISC DIAMETER x 0.54] - 2.33"

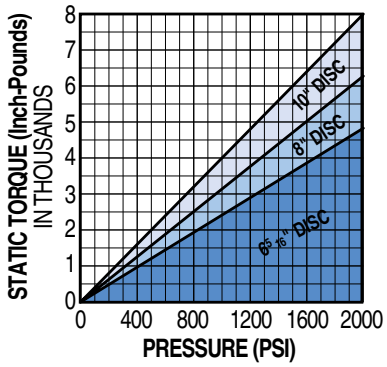
HME210 BRAKE: HYDRAULIC/MECHANICAL

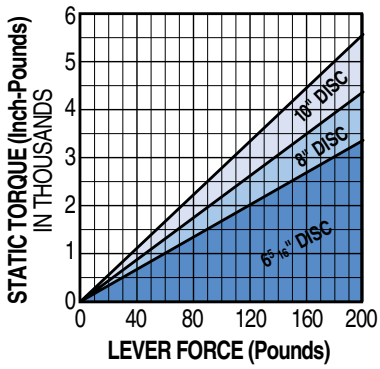
SINGLE ACTING WITH FLOATING BRACKET
(For use with a 1/4" Fixed Disc)

WEIGHT: 5.2 lbs (2.36 kg)
MAXIMUM PRESSURE RATING: 2000 PSI
MAXIMUM LEVER FORCE: 200 lbs (90.7 kg)
RIGHT-HAND MODEL: 0786-0200
LEFT-HAND MODEL: 0786-0201

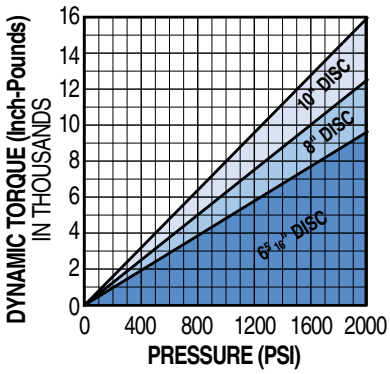
PERFORMANCE DATA

STATIC TORQUE





DYNAMIC TORQUE



DISC DIAMETER	BRAKING RADIUS	X
6.313	2.48	1.08
7.000	2.85	1.45
8.000	3.39	1.99
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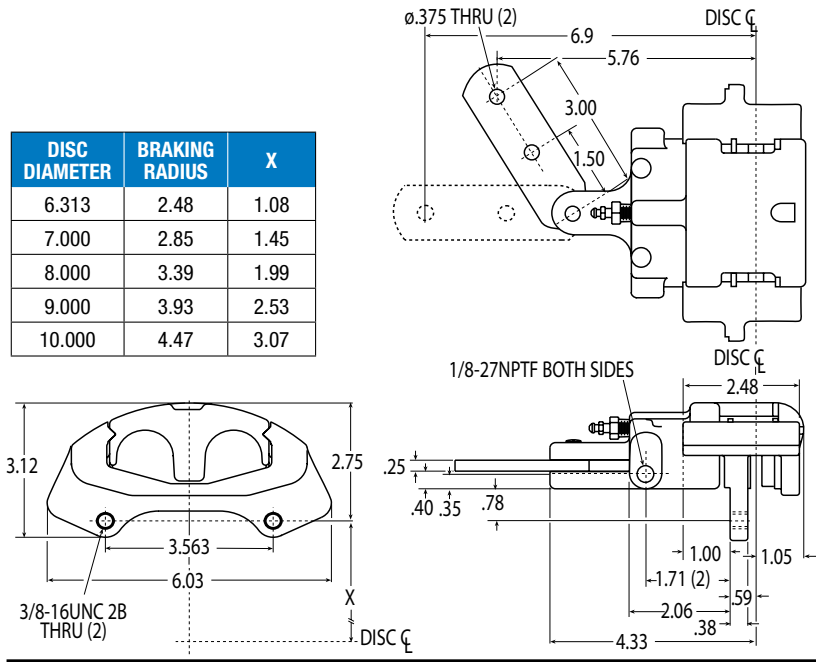
10.000	4.47	3.07



DISC SIZING EQUATIONS (HYDRAULIC):

DYNAMIC TORQUE (in-lbs) = 1.72 x BRAKING RADIUS (in) x PRESSURE (PSI)
STATIC (PARKING) TORQUE (in-lbs) = 0.862 x BRAKING RADIUS (in) x PRESSURE (PSI)
BRAKING RADIUS = [DISC DIAMETER x 0.54] - 0.93"
X = [DISC DIAMETER x 0.54] - 2.33"

DISC SIZING EQUATIONS (MECHANICAL):

STATIC (PARKING) TORQUE (in-lbs) = 6.0 x BRAKING RADIUS (in) x LEVER FORCE (lbs)
BRAKING RADIUS = [DISC DIAMETER x 0.54] - 0.93"
X = [DISC DIAMETER x 0.54] - 2.33"

APPLICATION DATA

Use this form to request engineering assistance. The data you furnish will enable us to understand your application and recommend* the proper braking equipment. When available, please attach prints or dimensional drawings.

Fax to: (763) 478-8080, Email to: help@tolomatic.com, or Mail to: TOLOMATIC, INC., 3800 County Road 116, Hamel, MN 55340

CONTACT NAME: _____

TITLE: _____

COMPANY: _____

ADDRESS: _____

CITY: _____

STATE: _____ ZIP: _____

PHONE: (_____) _____

FAX: (_____) _____

MODEL OR PROJECT REFERENCE

MODEL: _____

PROJECT #: _____

DESCRIPTION OF VEHICLE BRAKES WILL BE USED ON:

_____

_____

_____

_____

A. VEHICLE SPECIFICATIONS

PLEASE CONTACT FACTORY

GROSS WEIGHT: _____ lbs.

ROLLING RADIUS OF TIRE: _____ in.

WEIGHT DISTRIBUTION: Front _____ Rear _____

MAX. LOADED SPEED: Level _____ mph

Downgrade _____ mph

AVERAGE GRADE ENCOUNTERED: _____ %

MAXIMUM GRADE ENCOUNTERED: _____ %

MAXIMUM LONGEST GRADE DISTANCE: _____ ft.

WHEEL BASE: _____ in.

HEIGHT CENTER OF GRAVITY FROM GROUND: _____ in.

DECELERATION NEEDED:

☐ _____ fps^2

☐ Stop in_____ feet from_____mph.

EXPECTED COEFFICIENT OF FRICTION BETWEEN TIRES AND GROUND: _____

NUMBER OF BRAKES PER VEHICLE: _____

LOCATION OF BRAKES: _____

FREQUENCY OF SERVICE (STOPS): _____ per hr.

MAXIMUM DISC DIAMETER: _____ in.

MAXIMUM DISC THICKNESS: _____ in.

MAXIMUM PARKING GRADE: _____ %

BRAKE TO BE ☐ WHEEL MOUNTED OR ☐ DRIVELINE MOUNTED

RELEASE PRESSURE AVAILABLE (FOR SPRING APPLIED BRAKES ONLY): _____ psi

B. GENERAL APPLICATION DATA

DESIRED ACTUATION: ☐ Mechanical ☐ Spring Applied ☐ Dual Function ☐ Hydraulic

MAXIMUM HYDRAULIC PRESSURE: _____ psi

HYDRAULIC SYSTEM BACK PRESSURE: _____ psi

DRIVE SHAFT APPLICATIONS ONLY:

GEAR RATIO IS_____in favor of_____, or against_____the brake

AVAILABLE DISPLACEMENT: _____ $in.^3$

TYPE OF FLUID: _____MAXIMUM TORQUE: _____in. lbs.

AMBIENT TEMPERATURES TO BE ENCOUNTERED: _____ °F

LINING LIFE DESIRED: _____

LEVER FORCE AVAILABLE: _____ lbs.

Please attach (fax) any applicable standards for this vehicle.

C. ADDITIONAL COMMENTS

_____

_____

_____

_____

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_____

* Recommendation is based on information supplied by the customer. Final acceptance and approval is the responsibility of the customer after field testing or simulation of field testing on the designed vehicle or machine.

SELECTION DATA

SELECTING A 210 BRAKE

1. Determine available pressure and/or lever force
2. Calculate required torque
3. Calculate heat dissipation
4. Determine maximum disc diameter
5. Determine type of brake power
6. Determine life expectancy of linings

LINING LIFE FORMULAE

CALCULATING SERVICE LIFE OF LINING(S)

The lining life per cubic inch shown by the curve in **Figure 1** (page 11) is based on horsepower hours.

To find the life in hours of lining(s): (Primarily for tensioning-constant slip applications)

Ft.-lbs./hr. = (BTU/hr. generated)(778) **[1]**
Refer to Formula **[12]** _

$$\text{HP hrs./hr.} = \frac{\text{ft. lbs./hr.}}{1{,}980{,}000} \quad [2]$$

Refer to **Table 2** (page 11) to determine cubic inches of wearable material of 210 brakes.

$$\text{Life in Hours} = \frac{(\text{number of calipers})(\text{cubic in. } \textit{Table 2})(\text{HP hrs./in}^3\ \textit{Figure 1})}{\text{HP hrs. / hr.}} \quad [3]$$

To find the life in stops of lining(s): When a rotating mass is brought to rest, the kinetic energy removed can be calculated by the following formulae:

$$E = \frac{\pi T N t}{60} \quad [4]$$

or

$$E = \frac{WK^2N^2}{5872} \quad [5]$$

where:
E = Kinetic Energy; ft-lbs.

$$\text{HP hrs./Stop} = \frac{E}{1{,}980{,}000} \quad [6]$$

$$\text{Life in Hours} = \frac{(\text{number of calipers})(\text{cubic in. } \textit{Table 2})(\text{HP hrs./in}^3\ \textit{Figure 1})}{\text{HP hrs. / Stop}} \quad [7]$$

Puck life calculations are estimates and do not account for foreign contaminants that may abrade the puck or disc and reduce wear life. When the life must be known accurately, field tests should be conducted under actual or simulated service conditions.

VEHICULAR APPLICATION FORMULAE

CALCULATION OF TORQUE REQUIRED

$$\textit{Dynamic}\ T = \frac{WR\left[\frac{a}{g} + \frac{b}{100}\right]}{D} \quad [8]$$

Where:
- **T** = Torque /Axle, vehicle, or wheel; in-lbs
- **W** = Weight on axle including weight transfer, if any, vehicle or wheel; lbs.
- **R** = Loaded tire radius; ft.
- **g** = 32.2 ft./sec^2
- **b** = % of grade
- **D** = Gear Reduction, if drive line mounted
- **a** = Deceleration rate; ft/sec^2

And

$$a = \frac{V}{t} = \frac{V^2}{2S} \quad [9]$$

Where:
- **V** = Velocity of vehicle at moment of brake application; ft/sec.
- ***t*** = Stopping time required; seconds
- ***S*** = Stopping distance of vehicle; in.

$$\textit{Parking}\ T = \frac{WR\left[\frac{b}{100}\right]}{D} \quad [10]$$

CALCULATION OF HEAT GENERATION AND DISSIPATION REQUIRED

$$E = \frac{WV^2}{2g} \quad [11]$$

Where:
- **E** = Kinetic Energy; ft-lbs.
- **W** = Weight of axle, vehicle, or wheel; lbs.
- **V** = Design speed of vehicle; ft./sec.

$$\text{BTU/hr. generated} = \frac{(E)(\text{stopping frequency/hr.})}{778} \quad [12]$$

Then solving for the number of square feet of exposed disc area to dissipate the heat generated:

$$\text{Sq. Ft. Disc Area} = \frac{\text{BTU/hr}}{660} \quad [13]$$

The constant of 660 is based on a maximum disc temperature of 300°F.

If there is a restriction in the disc diameter(s) and there is sufficient time between stops or multiple of stops for heat dissipation then we can size the disc to act as a heat sink.

$$Wd = \frac{\text{BTU/hr.}}{(220)(Sp)} \quad [14]$$

Where:
- **Wd** = Weight of disc; lbs.
- **Sp** = Specific heat of disc may be taken as .12 for steel

Refer to **Table 1** (page 11) for selection. If your requirement falls outside of the standard(s) you may calculate the required thickness based on the maximum allowable diameter:

$$\text{Disc Thickness} = \frac{Wd}{(A)(.28)} \quad [15]$$

Where:
Disc Thickness in inches
- **A** = Area of maximum allowable diameter; in^2

If it is found the disc thickness is unrealistic from an economic or space limitation standpoint, multiple discs will have to be provided or force ventilation must be considered.

FIGURE 1

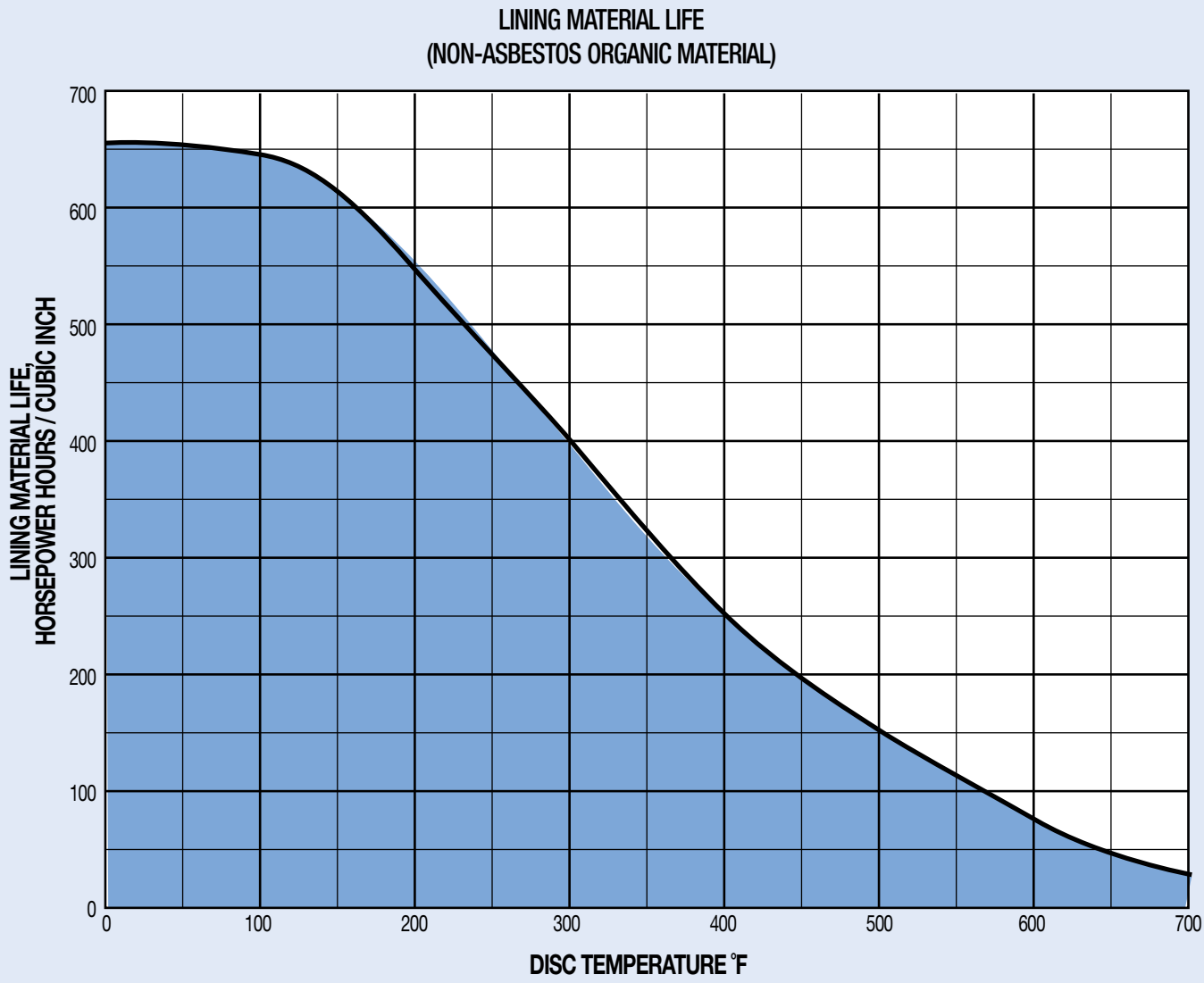


TABLE 1

EXPOSED AREAS, WEIGHTS AND MAX. BTU/HR. OF COMMONLY USED DISCS

DISC THICKNESS	DISC DIA.	EXPOSED AREA		WEIGHT LBS.	MAXIMUM BTU / HR.
		SQ. IN.	SQ. FT.		
5/32	6.313	62.58	0.43	1.37	283.8
1/4	8.000	100.53	0.70	3.52	462.0
1/4	10.000	157.08	1.09	5.46	719.4

TABLE 2

CUBIC INCHES OF WEARABLE FRICTION MATERIAL OF CALIPER

CALIPER	CUBIC INCHES
Series 210	1.27

TABLE 3

CAM TRAVEL DATA

ME210 Calipers

1. Initial cam position, 40° from line parallel to rotor.
2. 20° cam travel with .041 nominal total gap.
3. 112° maximum travel from initial position.
4. .27" maximum displacement from initial position.

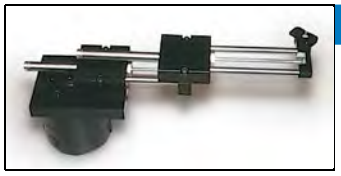
THE TOLOMATIC DIFFERENCE What you expect from the industry leader:

EXCELLENT CUSTOMER SERVICE & TECHNICAL SUPPORT

Our people make the difference! Expect prompt, courteous replies to all of your application and product questions.

INDUSTRY LEADING DELIVERIES

Tolomatic continues to offer the fastest delivery of standard catalog products. Modified and custom products ship weeks ahead of the competition.



INNOVATIVE PRODUCTS

From standard catalog products... to modified products... to completely unique custom products, Tolomatic designs and builds the best solutions for your challenging applications.

ONLINE SIZING & SELECTION SOFTWARE

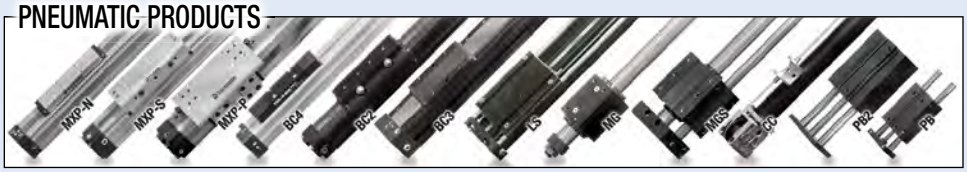
Online sizing that is easy to use, accurate and always up-to-date. Input your application data and the software will determine a Tolomatic electric actuator to meet your requirements.

3D MODELS & 2D DRAWINGS AVAILABLE ON THE WEB

Easy to access CAD files are available in many popular formats.

ALSO CONSIDER THESE OTHER TOLOMATIC PRODUCTS:

PNEUMATIC PRODUCTS



RODLESS CYLINDERS: Band Cylinders, Cable Cylinders, MAGNETICALLY COUPLED CYLINDERS/SLIDES; GUIDED ROD CYLINDER SLIDES

"FOLDOUT" BROCHURE #9900-9075
PRODUCTS BROCHURE #9900-4028

ELECTRIC PRODUCTS

ROD & GUIDED ROD STYLE ACTUATORS, HIGH THRUST ACTUATORS, SCREW & BELT DRIVE RODLESS ACTUATORS, MOTORS, DRIVES AND CONTROLLERS

"FOLDOUT" BROCHURE #9900-9074
PRODUCTS BROCHURE #9900-4016

POWER TRANSMISSION PRODUCTS

GEARBOXES: Float-A-Shaft®, Slide-Rite®; DISC CONE CLUTCH; CALIPER DISC BRAKES

"FOLDOUT" BROCHURE #9900-9076
PRODUCTS BROCHURE #9900-4029

Tolomatic
EXCELLENCE IN MOTION®
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