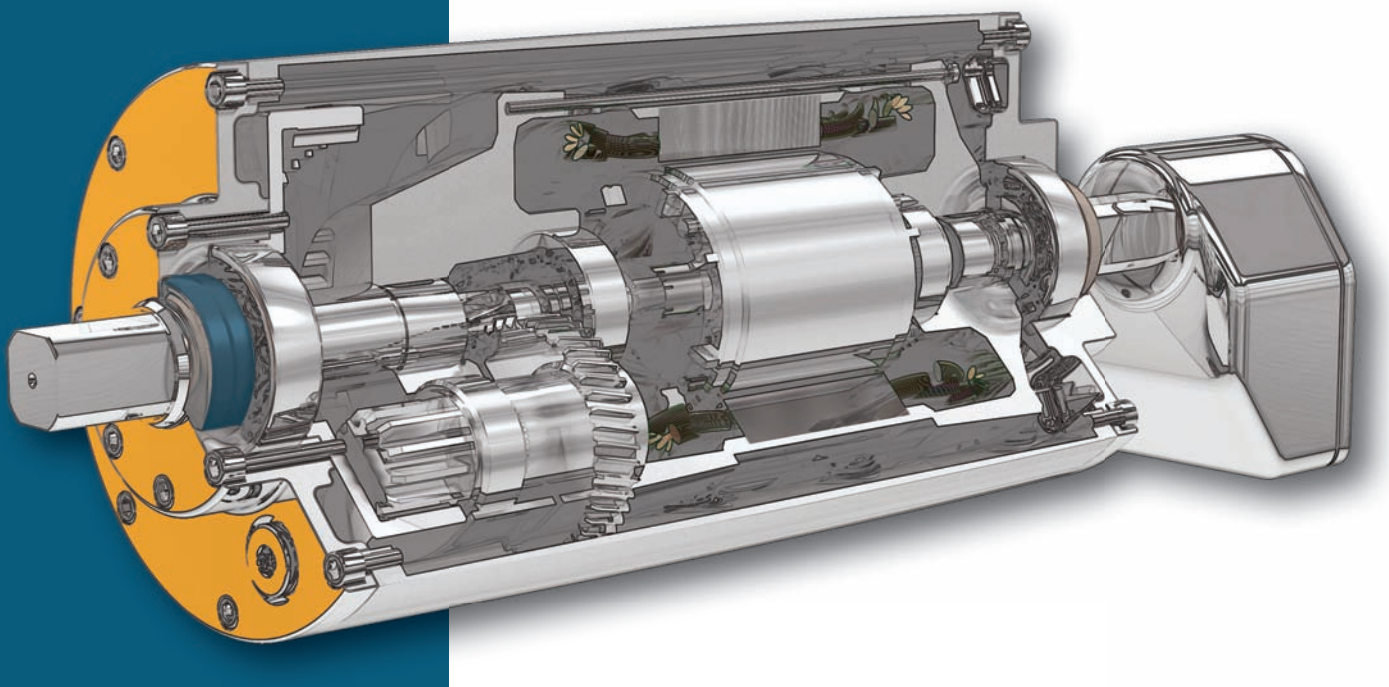
Drum Motor Product Guide



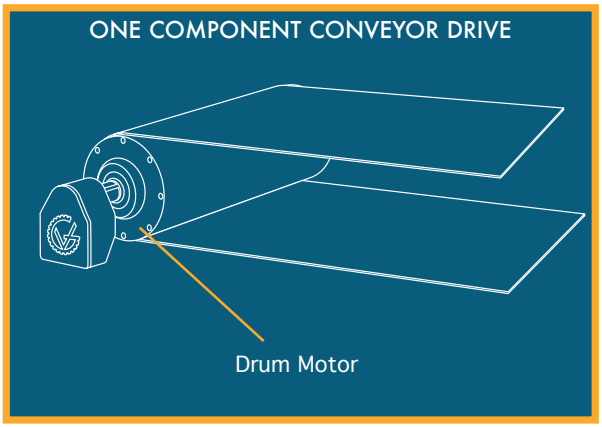
Van der Graaf Inc.
DRUM MOTORS

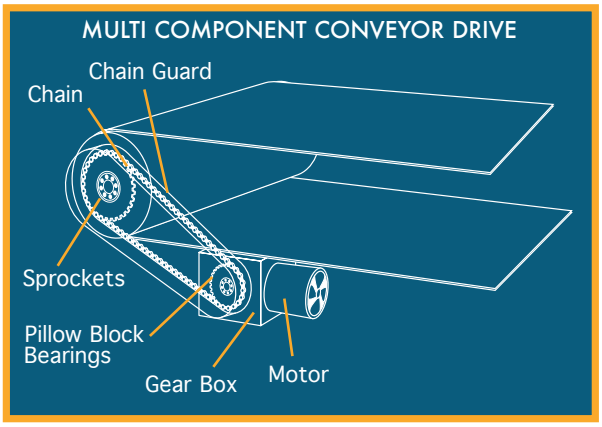
Engineered to Keep Your Business Running

Contents

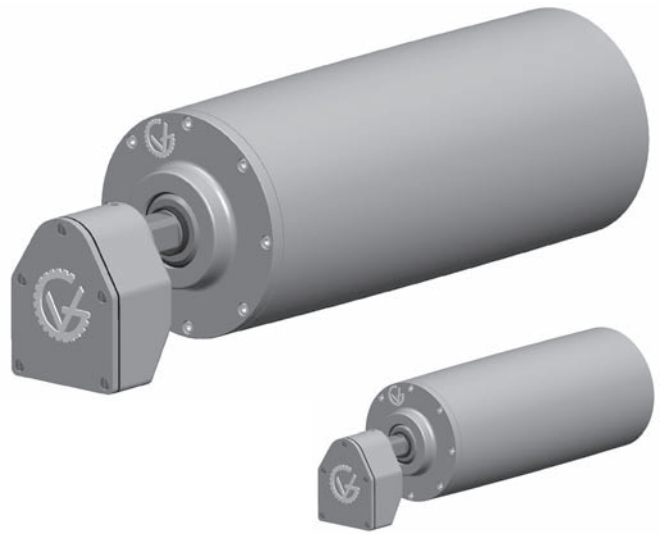
THE DRUM MOTOR

The Van der Graaf Drum motor is a one component conveyor drive where the motor, gear drive and all moving parts are enclosed inside the drum. The motor and gears operate in a sealed oil bath ensuring proper lubrication and cooling. With no external motor, gear reducer, sprockets, chain or OSHA required chain guard, no external component maintenance is required. This reduces operating and maintenance cost, improves safety conditions and because it is completely sealed our drum motors can operate in extreme environmental conditions. The compact low profile design of the drum motor provides the end user a safer and quieter working environment, space savings, efficiency and reliability with virtually no maintenance.





The drum motor houses all components internally, eliminating the need for external components like motor, gearbox, chain, chain guard and pillow block bearings. The drum motor rotates a gear module which transmits power to the outer rotating drum. Drum motor installation is quick and easy requiring less time to install than exposed conveyor drives.



Drum Motors are available in mild steel or stainless steel construction, in a wide range of diameter sizes, belt speeds, horsepower and face widths to suit broad range of applications. The electric motor is available in all standard voltages and frequency suitable for most applications.

DESIGN BENEFITS

The drum motor design reduces energy and operating costs, allows higher density and multiple applications, provides a safer and quiet working environment, reduces maintenance and downtime.

Increase Operator Safety

All external moving parts such as gearbox, chains, motor, chain guard and pillow block bearings that present safety hazards are eliminated.

Lower Energy and Operating Costs

Van der Graaf drum motors operate at 96% mechanical efficiency resulting in lower operating cost compared to conventional drives. The higher efficiency of the internal drive can result in energy savings of up to 30% over conventional exposed-drive conveyors.

Reduce Noise Levels

Our gears are manufactured using high quality alloy steel, machined and honed to AGMA/DIN 6 standards, reducing noise to minimal decibel levels which exceeds OSHA requirements for noise.

Reduce Maintenance and Downtime

Having no external moving components eliminates the need for continual chain adjustment and yearly maintenance. Our motors are virtually maintenance free, requiring only an oil change after 50,000 hours of operation, which can be performed without removing the drum motor from the conveyor.

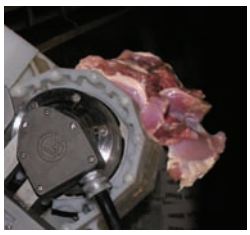
Enhance Space Utilization

Low profile of the drum motor results in a streamline appearance and allows to fit more belt conveyor into less floor or overhead space. Allows higher density and multiple applications.

High Pressure Wash down

Extreme pressure wash down with sanitizer is easily performed without the need to shield sensitive components since the completely sealed drum motor has no external components to protect.

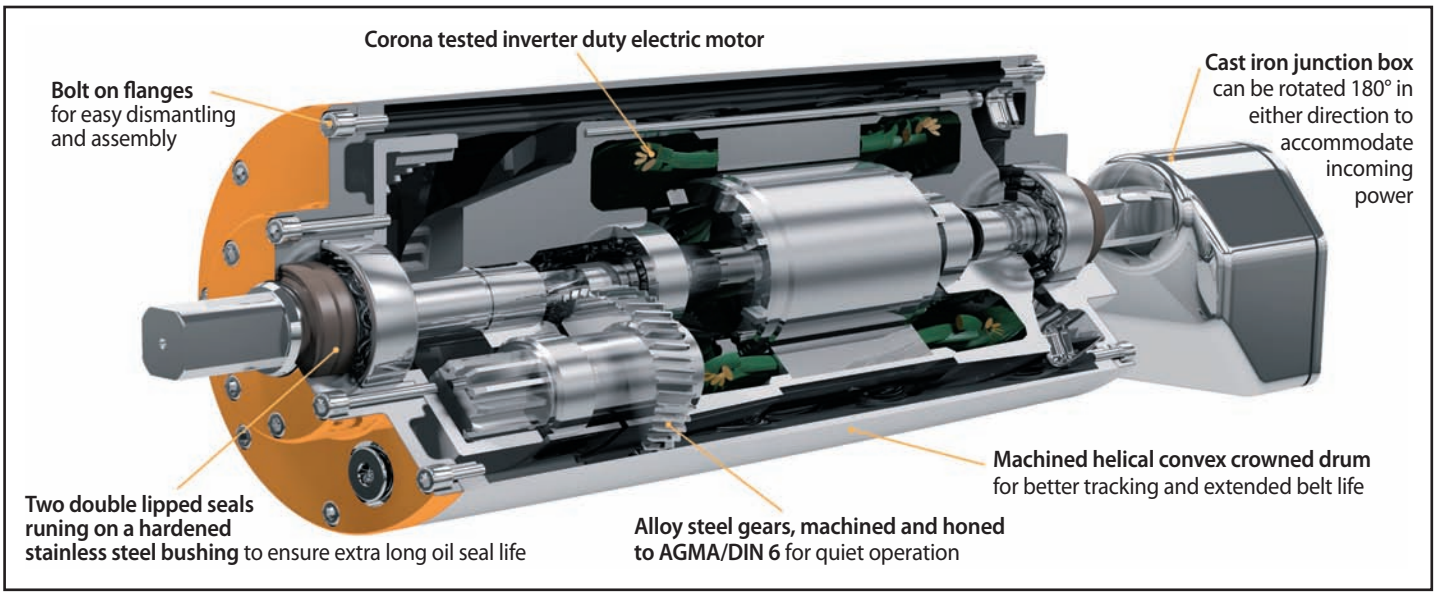


DESIGN TYPES

Standard Drum Motor (TM)

Available in the following diameters: 4.0", 4.5", 5.0", 5.4", 6.5", 8.5", 12.5", 16.0" & 20.0"



T2 Drum Motor (TMD) - Utilizing two electric motors and gear modules with the same diameter

Available in the following diameters: 5.0", 5.4", 6.5", 8.5", 12.5" & 16.0"

Applications where the drum motor needs to be low profile with higher than standard horsepower while maintaining typical operating speeds. Van der Graaf offers the T2 Drum Motor where two motors and gear modules are housed within one drum. This provides double the typical horsepower while maintaining a low profile and the designed belt speed.

Sanitary Handling Antimicrobial Drum Motor (SSVTM) - USDA Approved

Available in the following diameters: 5.0", 5.4", 6.5" & 8.5"

The all stainless steel construction food approved SSV design drum motor incorporates a unique labyrinth sealing system. This allows the drum motor to be washed using up to *2,000psi** wash down pressure, therefore preventing the possible build-up of bacteria like *listeria* and other contaminates. The high pressure wash down can be performed easily without the need to shield sensitive components as there are no external parts to protect. The patented labyrinth SSV sealing system also prevents water, chemicals or contaminates from penetrating the drum motor resulting in long and trouble free performance. The SSV drum motor is available with either stainless junction box or cable entry power hook-up.

**Measured at any point 2 inches from the unit.*

Drum Motor with Sprockets (STM) - for Modular Type Belting

Available in the following diameters: 4.0", 4.5", 5.0", 6.5", 8.5" & 12.5"

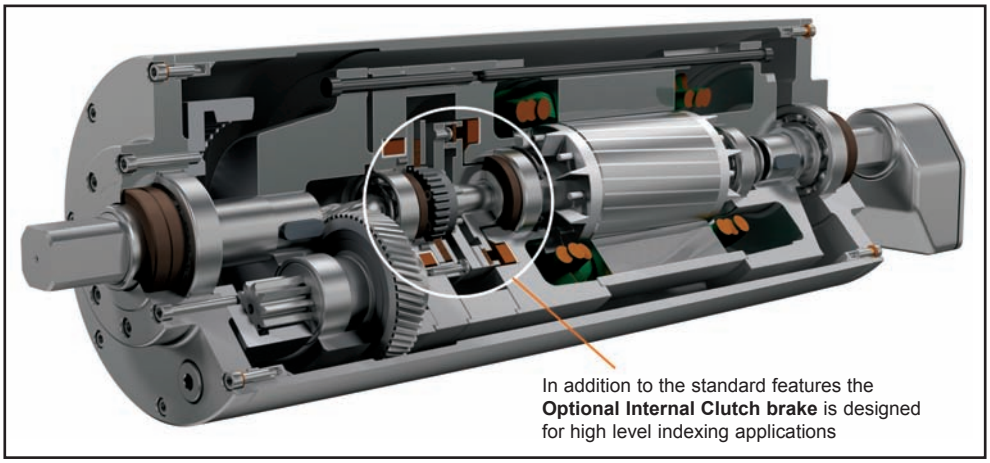
The Van der Graaf drum motor design can accommodate sprockets specifically designed to drive modular type belting, including thermoplastic types. Sprockets are attached to the drum using a patented positive drive pin. Sprockets can be fixed or allowed to float along the drum. The design minimizes product contamination areas and promotes a system that is easily cleaned under wash down.

Drum Motor with Clutch Brake (CBTM)

Available in the following diameters: 6.5" & 8.5"

The patented clutch brake drum motor provides maintenance-free operation in high indexing conveyor applications, up to 80 starts and stops per minute. The clutch brake allows the internal drum motor to run continuously and engages the drum only when conveyor movement is desired. High levels of conveyor drive indexing are often found in a wide variety of applications, such as: baggage handling, manufacturing and assembly lines, document/package handling and palletizing and packaging operations, among others.

A drum motor equipped with the clutch brake eliminates the in-rush current that is a common cause of overheating the electric motor. Disengaging the clutch module allows the motor to continue running while the drum is stopped. The drive motor and clutch brake components are all housed within the drum and are bathed in oil.



In addition to the standard features the **Optional Internal Clutch brake** is designed for high level indexing applications

Drum Motor with Electromagnetic Brake (RTM)

Available in the following diameters: 4.5", 5.0", 5.4", 6.5", 8.5" & 12.5"

The all-internal electromagnetic brake provides accurate and positive stopping engagement. The motor and all rotating components come to a complete stop when power is disengaged. When power is applied, the brake releases, allowing the motor to operate as designed. The RTM drum motor is bidirectional and ideal for cycles up to 40 starts and stops per minute. Typical applications include baggage handling, manufacturing and assembly lines, palletizing and packaging operations, among others.

Drum Motor with Manual Release Backstop (MRB) Device

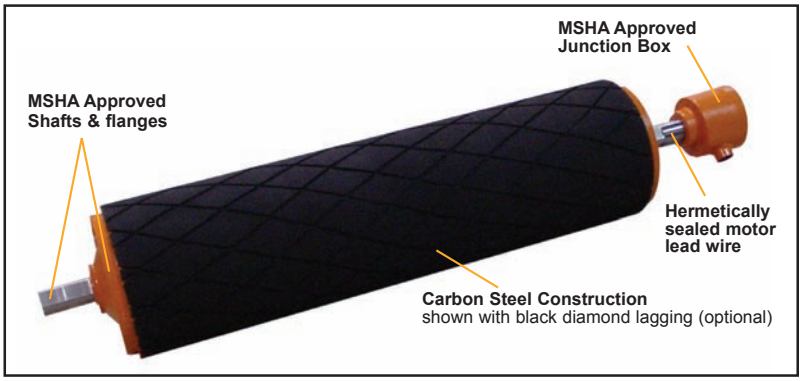
Available in the following diameters: 8.5", 12.5" & 16.0"

Incline conveyors are designed to operate in the upward direction. However, at times it may be necessary to unload the conveyor belt, i.e. power outages, downstream backups, jams, etc. The patented Manual Release Backstop (MRB) can be easily disengaged allowing the belt to roll back for easy unloading; reduces the time and physical effort needed to reverse inclined conveyor direction. The MRB device has the ability to disengage an internal backstop allowing the drum motor drive to move freely in the reverse direction so that the belt can be unloaded. Drum motors with the MRB device can be implemented on both new and existing inclined conveyors.

Explosion Proof (MSHA Approved) Drum Motor

Available up to a 50 hp motor and wide range of drum speeds to accommodate most mining & aggregate applications.

Explosion proof internally powered drum motors provides safe operation for driving belt conveyors in the mining industry. The low-profile motor features heavy-duty bolts, a cast iron end cap and a secondary 'O' ring seal for complete hermetic sealing. The motors allow high wall mining operators to reach coal seams as small as 3 feet in height. These motors may also be used in other applications that have potential for fire or explosion, such as: feed and grain, sugar mills and fertilizer plants, among others.

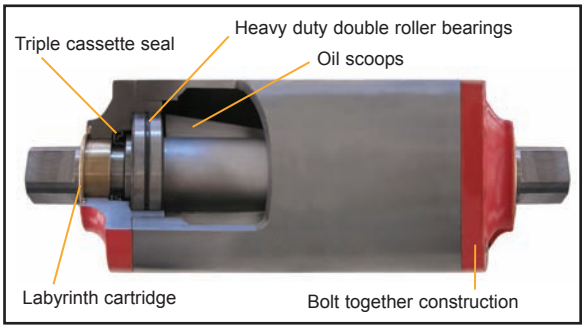


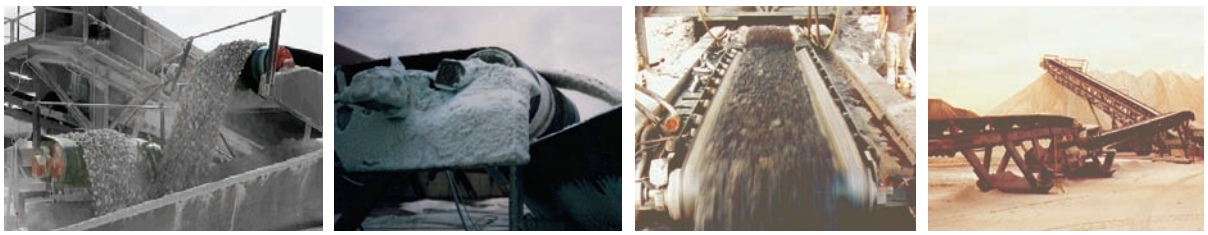
Idler Roller (MAKT)

Specially designed for mining and aggregate and other applications encountering harsh and abrasive environmental conditions.

Idler Roller features:

- Triple cassette seal design for dust resistance.
- Heavy duty double roller bearings.
- Labyrinth cartridge protects the seal cavity from abrasive dust such as coal, gravel, etc..
- Oil scoops for circulating the oil and keep the bearings in a constant oil bath.
- Bolt on construction for easy bearing replacement.





RANGE OF AVAILABLE STANDARD DRUM MOTORS

DRUM MOTOR SERIES	HORSEPOWER (HP)	SPEED♦ (ft./min.)	STANDARD FACE WIDTH *Some face widths are not available in all horsepowers. For min. available face width refer to Drum Motor catalog.*
TM100B (4.0 in diameter)	0.11 to 0.25	7 to 409	10.24, 10.83, 12.20, 14.17, 16.14, 18.11, 20.08, 22.05, 24.02, 25.98, 27.95, 29.92, 31.89, 33.86, 35.83, 37.80, 39.76, 41.73, 43.70, 45.67
TM113B (4.5 in diameter)	0.11 to 0.5	8 to 1031	10.24, 10.83, 12.20, 14.17, 16.14, 18.11, 20.08, 22.05, 24.02, 25.98, 27.95, 29.92, 31.89, 33.86, 35.83, 37.80, 39.76, 41.73, 43.70, 45.67
TM127A/B (5.0 in diameter)	0.18 to 1.5	27 to 307	9.84, 10.83, 11.81, 13.78, 15.75, 16.73, 17.72, 19.69, 21.65, 23.62, 25.59, 27.56, 29.53, 31.50, 33.46, 35.43, 37.40, 39.37, 41.34, 43.31, 45.28, 47.24
TM138A/B (5.4 in diameter)	0.18 to 1.5	29 to 332	9.84, 10.83, 11.81, 13.78, 15.75, 16.73, 17.72, 19.69, 221.65, 23.62, 25.59, 27.56, 29.53, 31.50, 33.46, 35.43, 37.40, 39.37, 41.34, 43.31, 45.28, 47.24
TM160A/B (6.5 in diameter)	3.0 to 0.18	14 to 951	13.78, 15.75, 16.73, 17.72, 19.69, 21.65, 23.62, 25.59, 27.56, 29.53, 31.50, 33.46, 35.43, 37.40, 39.37, 41.34, 43.31, 45.28, 47.24
TM215A/B (8.5 in diameter)	0.5 to 7.5	30 to 1111	16.73, 17.72*, 19.69, 21.65, 23.62, 25.59, 27.56, 29.53, 31.50, 33.46, 35.43, 37.40, 39.37, 41.34, 43.31, 45.28, 47.24
TM315A/B (12.5 in diameter)	1.5 to 15.0	60 to 1039	19.69, 21.65, 23.62, 25.59, 27.56, 29.53, 31.50, 33.46, 35.43, 37.40, 39.37, 41.34, 43.31, 45.28, 47.24, 49.21, 51.18, 53.15, 55.12
TM400A/B (16.0 in diameter)	2.0 to 20.0	51 to 885	23.62, 25.59, 27.56, 29.53, 31.50, 33.46, 35.43, 37.40, 39.37, 41.34, 43.31, 45.28, 47.24, 49.21, 51.18, 53.15, 55.12, 57.09, 59.06
TM500A60 (20.0 in diameter)	2.0 to 20.0	64 to 1111	23.62, 25.59, 27.56, 29.53, 31.50, 33.46, 35.43, 37.40, 39.37, 41.34, 43.31, 45.28, 47.24, 49.21, 51.18, 53.15, 55.12, 57.09, 59.06
TM500A75 (20.0 in diameter)	15.0 to 50.0	184 to 750	33.46, 35.43, 37.40, 39.37, 41.34, 43.31, 45.28, 47.24, 49.21, 51.18, 53.15, 55.12, 57.09, 59.06, 61.02, 62.99, 64.96, 66.93

♦Speed of the drum motor is fixed. The values indicated are the maximum and minimum speeds. For a complete speed range consult your catalog.
NOTE: Other face widths available, please consult a Van der Graaf representative: +1 905 793-8100.

STANDARD FEATURES

Cast Iron Components

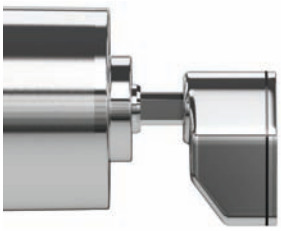
Every Van der Graaf drum motor utilizes cast-iron gear housing and motor flanges. By choosing cast-iron over lighter cast-aluminum components, the Van der Graaf drum motor is able to withstand greater levels of belt tension over typical motorized pulley designs.

Construction Material

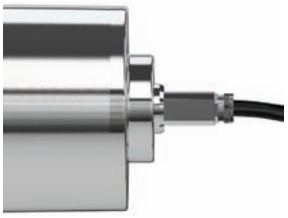
Drum motors are available in all mild steel and optional all stainless steel construction including end caps, shell, shafts and junction box.

Power Hook-Up

Junction box or cable entry type power hook-up connection is available as standard.



Junction box



Cable entry

Hub Design

Two hub designs are available as standard:

***Design A:** Bearing hubs extend beyond the shell.*

***Design B:** Recessed bearing hubs to accommodate narrower conveyor frames while maintaining the same face width.*

Cooling

The drum motor is designed with all vital components, such as motor and gear reducer rotating in an oil bath, sealed and isolated from the environment. Temperature generated from the motor and gear reducer is transferred through the oil to the drum and dissipates on the belt.

Hermetic Sealing

The drum motor incorporates high quality seals to ensure an oil leak free unit. Seals rotate on a hardened bushing to preserve seal life and extend durability. All Van der Graaf drum motors use a bolt-on design utilizing gaskets or 'O' rings.

High Quality Gears

Our gears are manufactured using high alloy steel, teeth machined and honed to AGMA/DIN6 standards, reducing noise to minimal decibel levels. Lower noise levels contribute to good working conditions and Van der Graaf units exceed OSHA low-noise requirements.

Electric Motors:

All Van der Graaf motors are manufactured with inverter duty magnet wire as standard. This wire allows for the motors to be used in conjunction with variable frequency inverters. The magnet wire itself has the ability of withstanding voltage spikes of 7,700 volts.

Insulation Class

All insulation material used for the electric motor winding meet Class F standards (155° C) and optional Class H standards (180° C).

Vacuum Pressure Impregnation (VPI)

One of the high longevity contributors to the electric motor is the method of impregnation. The highest industry standard for electric motor impregnation is through a process called ***Vacuum Pressure Impregnation (VPI).*** This state-of-the-art method is only used in less than 10% of world's standard electric motor production and is primarily applied on extreme heavy duty applications. The VPI method is adopted as standard in all Van der Graaf electric motor designs. This process has helped the end-user to reduce electric motor failures substantially.

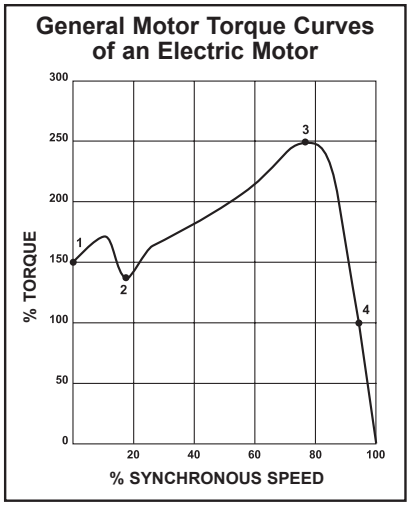
Supply Voltage

The drum motor can be supplied in all standard voltage and all other nonstandard voltage and frequency for three phase or single phase applications.

60 Hz 3 phase	600v 460v 230v
60 Hz 1 phase	120v 240v
50 Hz 3 phase	400v 230v
50 Hz 1 phase	230v

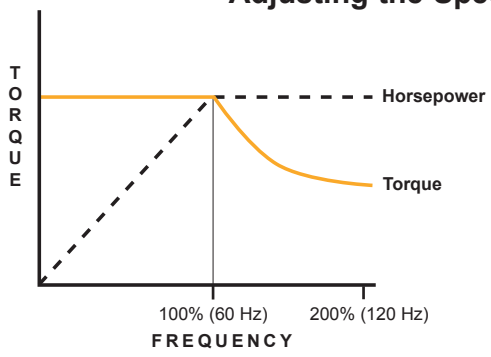
Motor torque is defined as follows:

1. *Brake-away or starting torque*
2. *Minimum or "pull-up"*
3. *Breakdown or "pull-out"*
4. *Full load*



This graph illustrates the typical start-up configuration and the general motor torque curves for Van der Graaf drum motors.

Adjusting the Speed of a Drum Motor Using a Frequency Inverter



- The rated speed of a drum motor is achieved when the frequency is at 60 Hz.
- A frequency inverter can be used to increase or decrease the speed of a drum motor.
- By reducing the frequency below 60 Hz the motor speed decreases while the torque remains constant (most inverters will hold the torque constant as low as 6 Hz).
- By increasing the frequency above 60 Hz the motor speed increases and the torque decreases proportionally.
- Because of the oil cooling design the drum motor can dissipate heat as low as 10% of its rated speed.

NOTE: All Van der Graaf motors are inverter duty.

OPTIONAL FEATURES

All Stainless Steel
All units are available in all stainless steel construction, including end caps, shell, shafts and junction box.

Non-Standard Length / Extra Long Face Width
Many combinations are available, please contact your Van der Graaf technical representative for details.

GV Thermal Overload Protection (GVTHERM)
Thermal overload protectors are bimetal type devices, imbedded into the motor windings (one per phase) to maintaining continuity under normal temperature conditions and are available for both Class F and H insulation. When temperature within the motor rises above 135°C for Class F and 165°C for Class H, the GVTHERM will trip, causing an open circuit between the respective GVTHERM leads.

For their proper operation, it is necessary to wire the GVTHERM leads to the motor starter. Connecting the two GVTHERM leads in series with the coil of a electromagnetic conductor will result in power interruption to the motor, when motor temperature exceeds 135°C for Class F and 165°C for Class H, thus protecting the motor from thermal overload.

"No Belt" (NB) Operation
No Belt design series drum motor is recommended for applications when the drum motor is required to run without a belt or using modular belting.

The NB series drum motor should be specified when:

a) the conveyor belt covers less than two thirds of the overall face width
b) modular sprockets are attached to power modular belting
c) no conveyor belt is used

Please contact your Van der Graaf representative for application assistance.

Class H Insulation
The optional Class H standards (180°C) is required for applications with ambient temperature of 125°F and higher. By providing a higher insulation Class, the electric motor is able to withstand a higher ambient operating temperature.

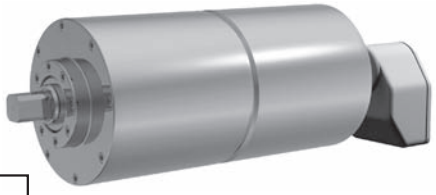
Drum
The drum of the Van der Graaf drum motor is machined to convex crown approximately 1% of the diameter as standard in order to help track the belt more accurately. Available optional crown profiles listed below.

CROWN PROFILES	LAGGING*	FLAT FACE	MICRO FINISH	CONVEX CROWN (standard)	TRAPEZOIDAL CROWN	V-GROOVE	TUNGSTEN CARBIDE
LAGGING*		✓	-	✓	✓	✓	-
FLAT FACE	✓		✓	-	-	✓	✓
MICRO FINISH	-	✓		✓	✓	✓	-
CONVEX CROWN (standard)	✓	-	-		-	-	✓
TRAPEZOIDAL CROWN	✓	✓	✓	✓		-	✓
V GROOVE	✓	✓	✓	✓	✓		✓
TUNGSTEN CARBIDE	-	✓	-	✓	✓	✓	

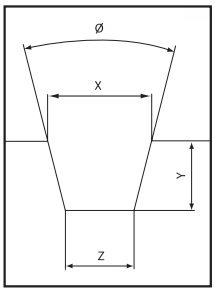
*Variety of lagging materials and profiles available, refer to page 14.

V-Grooves

V-grooves are available on all Van der Graaf drum motors. The v-groove is machined into the shell for optimal tracking; single or multiple v-groove locations are available. If lagging is required, then a 1/4" maximum thickness is available to minimize chance of v-guide climb out.



V-GROOVE	X		Y		Z		Ø
	INCH	MM	INCH	MM	INCH	MM	
A	0.625	15.9	0.375	9.5	0.375	9.5	-
B	0.75	19.1	0.375	9.5	0.5	12.7	-
C	1.125	28.6	0.75	19.1	0.75	19.1	-
K13	0.593	15.06	0.395	10.03	0.384	9.75	-
O	0.409	10.4	-	-	0.27	6.9	44°
3L	0.375	9.5	0.219	5.6	0.219	5.6	-



Tungsten Carbide

Molten tungsten particles are embedded into the surface of the drum by using a thermo spray system resulting in a straight hard-faced coating from 65-68 Rc hardness. The finish has excellent wear resistance with a surface textures from 600 to 800 MS and typical thickness of 0.006-0.10 inches. Drum motor with the tungsten carbide option is highly recommended in slider bed conveyor applications in order to substantially improve belt traction without increasing the coefficient of friction.

On a slider bed conveyor where the head pulley does not have the tungsten carbide finish on the drum, is lagged with rubber for traction. Due to the constant wear of the rubber lagging, the rubber dust accumulates between the belt and the slider bed. This causes the coefficient of friction to increase on the belt, resulting in higher energy consumption. Since the rubber lagging on the head pulley does not wear evenly on the face of the drum, it causes the loss of the crown resulting to belt mistracking. The drum motor with the tungsten carbide option maintains the crown profile due to the hard surface, improves belt traction up to 40% and will not increase the coefficient of friction since there is no rubber lagging to wear off.

Lagging

Van der Graaf offers a complete line of 'hot bond' and urethane laggings.

Hot Bond lagging: is a vulcanization process that cures rubber, wrapped to the desired thickness around the shell of the drum motor, under high-pressure and high-temperature. The result is a seamless, durable and tear resistant lagging.

Urethane lagging: is a two part ribbon flow cast method which pours liquid urethane directly on the drum. The drum finish prior to urethane lagging is prepared by a patented spiral groove to lock the urethane to the drum.

As standard, all white finishes are ground smooth to avoid any type of product contamination.

A variety of finishes are available in 1/8", 3/16" 1/4", 3/8", 1/2", 3/4" and 1" thickness. Non-standard thickness requirements are available upon request.

Material	Available Profiles	Description
Black Rubber	Smooth, C, D	Blend of Polystyrene Butadiene and Nitrile, 65 ± 5 Durometer Shore A, Hot vulcanized
Black Urethane	Smooth	Ribbon Flow (in-house process), Urethane for high wear-ability, 75 ± 5 Durometer Shore A
White USDA/FDA Nitrile	Smooth, C, D	USDA & FDA approved, 65 ± 5 Durometer Shore A, Hot vulcanized
Blue USDA/FDA Nitrile	Smooth, C, D	USDA & FDA approved, 60 ±- 5 Durometer Shore A, Hot vulcanized
White Neoprene	Smooth, C, D	Non standard offering. Available upon request.
Black Neoprene	Smooth, C, D	Non standard offering. Available upon request.
Black USDA Nitrile	Smooth, C, D	Non standard offering. Available upon request.
EPDM Rubber	Smooth, C, D	Non standard offering. Available upon request.
Slide Lagging	Moulded, C	1/2" Holtz Slide Lagging (Tack welded channels)
Ceramic	-	Customized 1/2" square Ceramic Lagging
Metal Tread Lagging	C	Welded on metal strips

C = chevron (herringbone), D = diamond,

ENERGY AND COST SAVINGS ANALYSIS OF USING A VAN DER GRAAF DRUM MOTOR vs. A CONVENTIONAL BELT DRIVE

SCOPE: This is a comparative analysis concerning the energy consumption of a conventional conveyor with an electric motor, a gear reducer and a chain drive, and a conveyor driven by a Van der Graaf drum motor.

HYPOTHESIS: There will be considered that both conveyors, the conventional conveyor and the conveyor driven by Van der Graaf Drum Motor:

a) have the same rated output power,
b) operate in the same environmental conditions (temperature, pressure, humidity, altitude),
c) supplied power have the same parameters (phase number, line voltage, frequency),
d) loaded at the same constant output power, equal by the rated output power, for the whole period of the considered operation time.

CALCULATIONS:

a) The conventional conveyor (index C from conventional) operates with a Baldor motor VM3615T, with rated output power 5 hp, (or 3730 W, rated speed 1750 rpm, rated voltage 3 x 460 V, rated frequency 60 Hz), a coupling, a right angle gear reducer with a gear ratio 20, and a chain drive with gear ratio 1.5. The electric motor has the rated efficiency 85.5%, the coupling has the efficiency 99%, the gear reducer is a right angle helical worm gear reducer with efficiency of 87% [6.5] and the chain drive has the efficiency 75%. *(Refer to page 16, Fig. B: Conveyor Driven by a Conventional Conveyor Drive)*

The total efficiency of the Conventional Conveyor is:

η_C **= 0.855 x 0.99 x 0.87 x 0.75 = 0.552, or 55.2%.**

The input power (index 1 for input and 2 for output) of the conventional conveyor is:

$P_{1c} = P_{2c} / \eta_C = 3730/0.552 = 6757.25$ W ≈ 6.757 kW.

b) The conveyor (index M from drum motor) driven by a Van der Graaf Drum Motor is considered. It has the same rated output power as the conventional conveyor, 5 hp or 3730 W and contains an electric motor with rated efficiency 87% and a parallel-shaft gear reducer with efficiency 96%. *(Refer to page 16, Fig. A: Conveyor Driven by a Van der Graaf Drum Motor)*

The total efficiency of the conveyor driven by Van der Graaf Drum Motor is:

η_M **= 0.87 x 0.96 = 0.835, or 83.5%**.

The input power (1 for input and 2 for output) of the conveyor driven by Van der Graaf drum motor is:

$P_{1M} = P_{2M} / \eta_M = 3730/0.835 = 4467$ W ≈ 4.467 kW.

c) An operation time of both conveyors is determined taking into consideration that both conveyors work 8 hours shift, 2 shifts per day, 5 days per week, and 52 weeks per year,

t = 8 hours/shift x 2 shift/day x 5 days/week x 52 weeks/year = 4160 hours/year.

d) **The electric energy consumed by the conventional conveyor,** in the considered operation time, is determined by the product of the input active power and the operation time:

$E_C = P_{1C}$ x t = 6.757 kW x 4160 hours/year = 28109.12 kWh/yr $\approx$ **28109 kWh/yr.**

e) **The electric energy consumed by the conveyor driven by Van der Graaf Drum Motor,** in the considered operation time, is similarly determined:

$E_M = P_{1M}$ x t = 4.467 kW x 4160 hours/year = **18583 kWh/yr.**

f) An average price of the electric energy in USA is considered:

p = 0.08 USD/kWh.

g) **The cost of the electric energy per year of the conventional conveyor** will be calculated as the product between the consumed electric energy in the considered operation time and the specific price of the electric energy:

$C_C = E_C$ x p = 28109 kWh/yr x 0.08 USD/kWh = 2248.72 USD/yr $\approx$ **2249 USD/yr.**

h) **The cost of the electric energy per year of the conveyor driven by Van der Graaf drum motor** will be similarly calculated:

$C_M = E_M$ x p = 18583 kWh/yr x 0.08 USD/kWh = 1486.64 USD/yr $\approx$ **1487 USD/yr.**

i) The energy saving per year of the higher efficient conveyor, respectively of the conveyor driven by Van der Graaf drum motor, is determined as a difference between the consumed energy of the conventional conveyor and the consumed energy of the conveyor driven by Van der Graaf drum motor, in the considered operation time of one year period: *(Refer to page 16, Graph 1: Energy Consumption Comparison)*

$ES = E_C - E_M$ = 28109 kWh/yr - 18583 kWh/yr = 9562 kWh/yr.

j) The cost saving per year of the higher efficient conveyor, respectively of the conveyor with Van der Graaf drum motor, is determined as a difference between the cost of the consumed energy of the conventional conveyor and the cost of the consumed energy of the conveyor driven by Van der Graaf drum motor, in the considered operation time of one year period:
(Graph 2: Energy Cost Comparison)

$CS = C_C - C_M$ = 2249 USD/yr - 1487 USD/yr = 762 USD/yr.

ENERGY COST SAVING WITH CONVEYOR DRIVEN BY VAN DER GRAAF DRUM MOTOR IS 762 USD/YEAR

NOTE: If the cost of energy of the conventional conveyor is considered 100%, than the cost of energy of the conveyor driven by Van der Graaf Drum Motor is 66% and the cost savings with the Van der Graaf Drum Motor is 34%.

Fig. A: Conveyor driven by a Van der Graaf Drum Motor

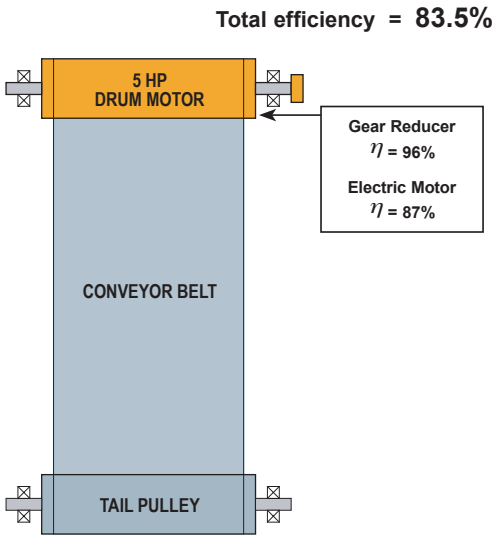
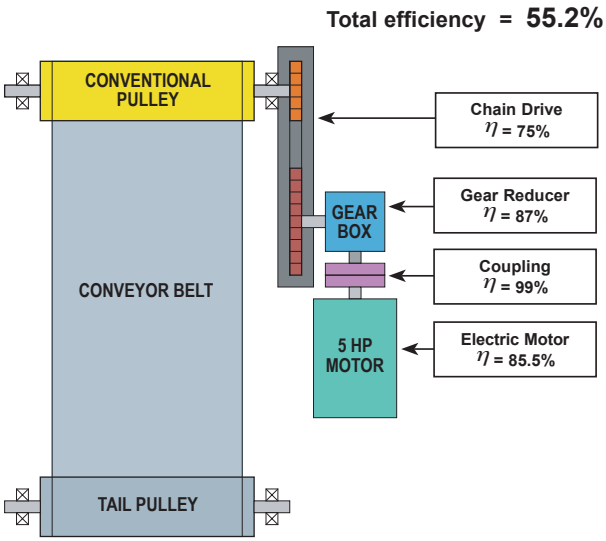
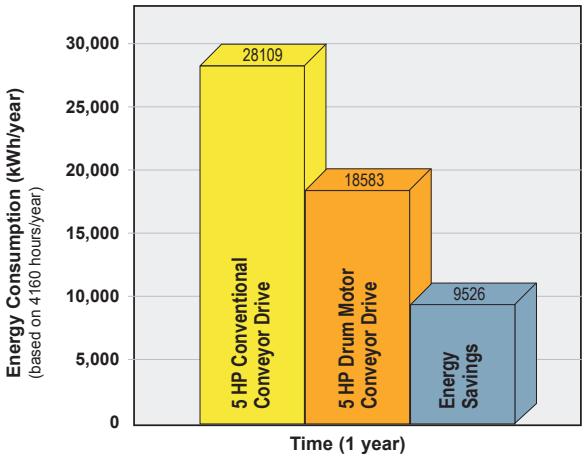


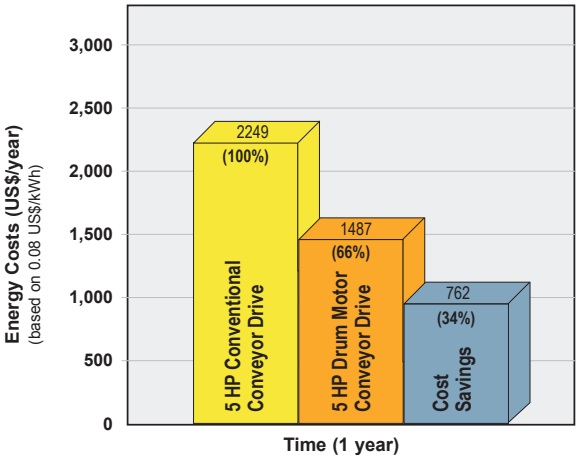
Fig. B: Conveyor driven by a Conventional Conveyor Drive



Graph 1: Energy Consumption Comparison



Graph 2: Energy Cost Comparison



Conventional 5 Hp Conveyor drive | Van der Graaf 5 Hp Conveyor drive | **Energy and Cost savings with Van der Graaf drum motor**

CERTIFICATIONS

CSA & UL

Van der Graaf drum motors are approved by the Canadian Standards Association (CSA) and listed by Underwriters Laboratories (UL) to operate in hazardous locations Class II Group E, F & G.

Class II, Groups E, F & G allow for operation under hazardous locations, as defined in the National Electrical Code and meets the following application requirements:

CSA STC22.2 No 25-1966: Enclosures for use in Class II, Group E, F & G hazardous locations
CAN/CSA-C22.2 No 94-M91: Special purpose enclosures
CAN/CSA-C22.2 No 100-95: Motors and generators
UL Std No 50 (Edition 10): Enclosures for electric equipment
UL Std No 674: Electrical motors and generators for use in hazardous locations: Class II - Groups G & G
UL 1604: Electrical equipment for use in hazardous (Classified) locations: Class I, II & III
UL 1836: Electric motor and generator for use in hazardous (Classified) locations: Class I & II, Division 2

NEMA

The Van der Graaf drum motor meets NEMA Type 9 enclosure properties:
Type 9 enclosures are intended for indoor use in locations classified as Class II, Groups E, F, & G.
Type 9 enclosures are designed to be capable of preventing the entrance of dust. Enclosed heat generating devices are designed not to cause external surfaces to reach temperatures capable of igniting or discoloring dust on the enclosure or igniting dust - air mixtures in the surrounding atmosphere. Enclosures are designed to meet dust penetration and temperature design tests and aging of gaskets.

IP (Ingress Protection) RATING

All Van der Graaf drum motors comply with IP 66 & 68. Degree of protection provided by Integral design of rotating electrical machines (IP) code, as classified by International Electrotechnical Commission (CEI, IEC) Standard IEC 60034-5, Fourth edition 2066-12.

MSHA

The Van der Graaf TM315A60 drum motor is approved by U.S. Department of Labor, Mine Safety and Health Administration (MSHA) CFR 30 Sub-part J for Electric Motor assemblies intended for use in approved equipment in underground mines.

CANMET

Van der Graaf TM315A60 complies with the relevant provisions of Canadian Standards Association Standard C22.2 No.30 - M1984 "Explosion Proof Enclosures for use in Class I Hazardous Locations", gaseous mines category and C22.2 No. 145 - M1986 "Motors and Generators for use in Hazardous Locations" gaseous mines category.

USDA -AMS

Compliance with NSF/ANSI/3-A 14159-1-2002 Hygiene requirements for the design of meat and poultry processing equipment.

CE

All Van der Graaf drum motors comply with the regulations of the European Norm EN 60204-1 (Electrical equipment of industrial machines. General requirements).

THE CROSS DRIVE™

Available in the following diameters: 6.5" & 8.5" (other diameters available upon request)

A unique conveyor drive that bridges the gap between an all enclosed hermetically sealed drum motor and an all exposed conventional drive. The Cross Drive™ design houses all vital components such as gears, bearings and seals, permanently lubricated within the drum and a standard external flange mount electric motor (not supplied by Van der Graaf). The electric motor which is the most sensitive component on any conveyor system and the most likely component to require replacement or exchange, can now be simply removed by loosening four bolts.

DESIGN BENEFITS

The Cross Drive™ design has all the benefits of the drum motor combined with the flexibility of an outboard standard flange mount electric motor (not supplied by Van der Graaf) for quick and easy removal and installation.

Lower Energy & Operating Costs

The Cross Drive operates at 96% mechanical efficiency resulting in lower operating cost. The higher efficiency of the internal drive can result in energy savings of up to 30%.

Reduce Maintenance & Downtime

Having no external moving components eliminates the need for continual chain adjustment and yearly maintenance. Our motors are virtually maintenance free, requiring only an oil change after 50,000 hours of operation, which can be performed without removing the drive from the conveyor.

Increase Operator Safety

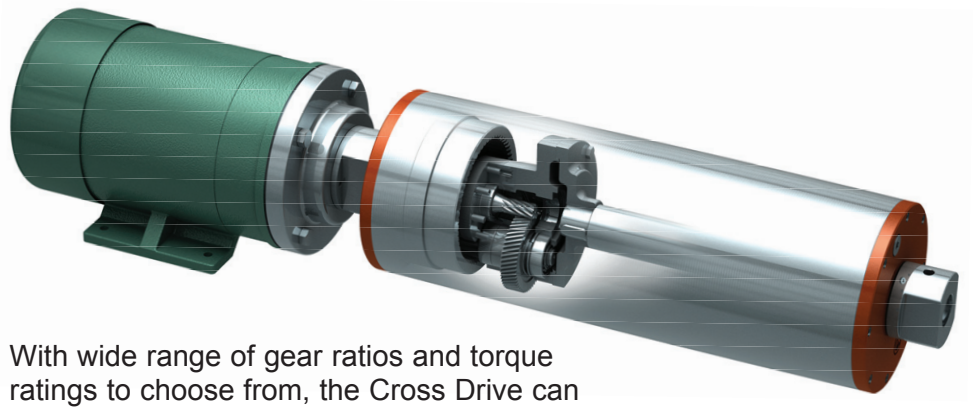
Components that presents safety hazards such as gearbox, chains, chain guard and pillow block bearings are eliminated.

Enhance Space Utilization

Smaller profile allows for higher density and multiple applications.

Reduce Noise Levels

Our gears are manufactured using quality alloy steel, machined and honed to AGMA/DIN 6 standards, reducing noise to minimal decibel levels which exceeds OSHA requirements for noise.



With wide range of gear ratios and torque ratings to choose from, the Cross Drive can be used in a wide variety of conveyor systems.

Drum Motor Specifications

Drum MotorType #: _____

Facewidth (L): _____ ☐ inches or ☐ mm

Diameter (D): _____ ☐ inches or ☐ mm

Horsepower: _____ HP

Belt Speed/Velocity (V): _____ ft/min

Voltage: _____ V, _____ PH, 60 Hertz

Material Construction: _____

Lagging: _____

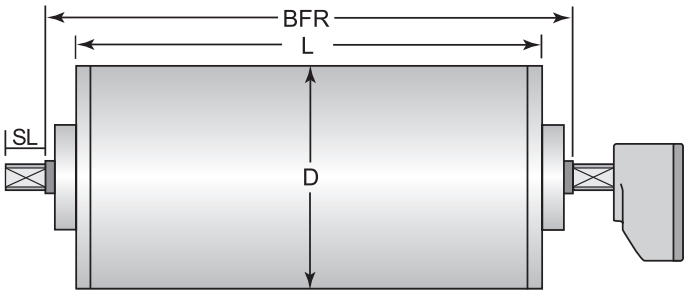
Other Options: _____

*Between Frame Rail (BFR): _____ *Leave blank if standard*

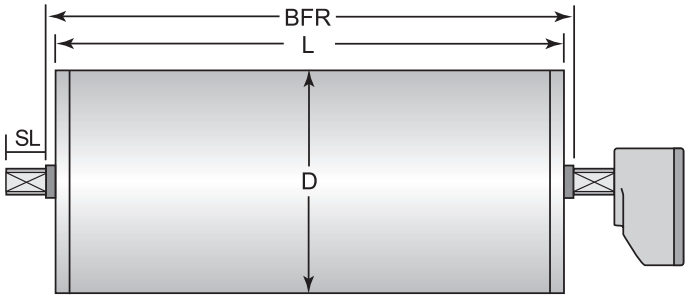
*End Shafts (SL): _____ *Leave blank if standard*

Custom: _____

Hub Design A



Hub Design B



*Shaft length (SL) and between frame rail (BFR) dimensions will be assumed standard *(refer to Drum Motor catalog for standard values)* unless otherwise specified.

All units will be quoted as standard with crowned face width and juction box unless otherwise specified. Keeping standard dimensions will keep prices and lead times down.

Notes

Van der Graaf has provided solutions to the material handling industry for over half a century. By making consistent investments in factory automation over the years, Van der Graaf continues as the leading global supplier of conveyor belt drives for a broad range of industries. Whether it's an explosion-proof motor for driving coal mine conveyor belts or sanitary drives in a food processing plant, Van der Graaf has innovative designs to solve application challenges.

Van der Graaf has adhered to a simple principle: design a superior product to meet customer needs in a changing marketplace.

Van der Graaf offers outstanding application engineering and customer service for high quality products and years of low maintenance performance. Our products and people are trusted around the world for reliable performance and personal service.

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