

## PRODUCT OVERVIEW

### INTRODUCTION

**FlexMove®** integrated flexible and modular conveyor system is designed for wide range of applications in broad manufacturing industries. This unique system employs a side-flexing plastic chain travel on low friction slide rails mounted on aluminium extrusion tracks that allows horizontal turns and elevation changes within a single continuous run driven by a single motor. Products can be directly run on conveyor, in pallets, in pucks or carton box guided by guide rail along the conveyor. This unique and economical system provides versatile and expandable platform of conveying solutions with unlimited advantages and features:

- Easily assemble, dismantle, reconfigure and re-layout
- Infinite layout capability and unlimited conveying options
- Extremely adaptable with freely extendable
- Simplicity in design, flexibility in movement
- Modular and flexible design
- Cost effective system that adaptable to changes
- Minimum components variation and maximize space utilization
- Horizontal and vertical movement capability
- Enhanced and improved productivity
- Wide range of products selection
- Aesthetic design, clean, self-lubricating, low noise, low friction, less maintenance, corrosion-free and light weight

### Industries and Products Served by FlexMove System

- **Food, Beverage & Dairy Industry**  
Biscuit, Ice cream, Bread, Butter, Instant Noodle, Metal and Paper Cans, Candy, Milk Powder, Cereal, Pet Food, Cheese, Snacks, Chewing Gum, Chocolate, Soft Drink, Coffee, Sugar, Confectionery, Tea, Frozen Food, Yogurt, Juice, Glass & PET Bottles
- **Automotive and Machined parts Industry**  
Air and Oil Filters, Gear Wheel, Bearings, Piston, Casting Part, Power Window, Motor, Compressor, Spark Plug, Front and Back Lights, Speedometer and Electronic Instrument, Fuel Pump, Air Bag Control Units
- **Electronics and Electrical Industry**  
Audio and Video Appliances, LCD and Electronics Display, Battery, Mobile Phone, Compact Disc, Substrate, Computer Parts, Bulbs, Electrical Equipment, CRT, Hard Disc Drives
- **Personal Care, Household Consumable, Medical and Pharmaceutical Industry**  
Aerosol Can, Soap, Perfume, Deodorant, Baby Oil, Syringe, Pills, Eye Care Products, Body Lotion, Surgical Instruments, Detergent, Health Supplements, Cosmetics, Shampoo, Dental Equipment, Shower Cream, Dental Floss
- **Paper Converting and Packaging**  
Tissue Paper, Toilet Paper Roll, Diapers, Bags, Bundles, Kitchen Towels, Sanitary Napkins, Carton Boxes

### Basic System Selection

**FlexMove®** provide wide selection of chain sizes to cover wide variety of product sizes and shapes. In order to select the right chain size to use in your application, consider the following selection criteria.

- **Product Dimensions**  
A product can be wider than conveyor chain in two or three times the width of the chain as long as the centre of gravity of product falls on chain width. Extra supporting guide rails are required and testing is recommended.
- **Product Weight**  
Product weight is important in chain selection as each chain has maximum traction force. Traction force calculation is required when there are several heavy products are to be conveyed, and the traction force will be increased further if the products are accumulated on the conveyor.
- **Conveyor Functions Available**  
Most of the conveyor functions are available in all the FlexMove conveyor series. However there are differences with regard to the chain types, drive unit and idler unit variants. Selection of drive type is important as different drive has different traction force.
- **Technical Calculation**  
It is important to calculate total load on conveyor based on product weight, distance between products, accumulation distance and conveyor length of the system. Frequency of start /stop, chain tension, service factor are important consideration factors too. If the calculated capacity is higher than the selected drive and chain series, shorten the conveyor or select system with higher capacity.
- **Floor Space Available**  
Consideration of floor space available and utilization of smallest foot print for conveyor layout.
- **Compatibility With Other Machines**  
In certain applications, interfacing and integrating with other automation equipments can be made much easier by using one of the FlexMove Conveyor system sizes rather than other sizes.

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### FlexMove Comprehensive Products

FlexMove® system consists of pre-engineered modular components that can be classified as follow:

#### 1) Chains

FlexMove® offers a wide selection of chain width from 35mm to 150mm with variety of types to suit every product, packaging size, layout and application. Type of chains available are plain chain, friction top chain, wedge chain, conductive chain, cleat top chain, roller top chain, roller cleat chain, magnet top chain, steel top chain, stainless steel top chain, flocked chain and special purpose chain. We offer FH35, FT35, FK44, FS65, FM85, FC103 and FL150 series of chains to cater for various application needs.

- **Plain Chain**  
The basic of FlexMove chain is plain chain with flat top plate uses for normal horizontal applications. It has low friction surface allowing for accumulation of products.
- **Friction Top Chain**  
Friction top chain is suitable for product transport in incline movement up to 30°. It consists of a moulded friction insert into top plate to increase friction between product and chain. This type of chain is not recommended for accumulation of products during conveying.
- **Cleat Top Chain**  
Cleat chain is suitable for steeply inclines more than 30° where products may have tendency to slip down from friction top chain. Cleats are available in different heights to suite the products.
- **Wedge Top Chain**  
Wedge Top Chain is chain with flexible rubber top which is used in vertical transport application such as elevator and lowerator. Two conveyors with grip / wedge chain mounted facing to each other is used to conveyor products between them for vertical movement. Suitable products to be conveyed by grip / wedge conveyor includes glass and plastic bottles, can and cardboard boxes.
- **Roller Top Chain**  
Roller Top Chain is suitable to use in sensitive products or long accumulation of products where the accumulating pressure could become high with standard plain chain. The rollers on the chain top reduce the friction between products and chains; hence reduce the damage to sensitive products.
- **Roller Cleat Chain**  
Roller Cleat Chain is suitable to use in transferring cardboard box in slop from another conveyor.
- **Steel Top Chain**  
Steel Top Chain is used for application where excessive wear exists in conveying products. Products suitable to be conveyed are metal based products, machined parts or casting parts with sharp edges. A pre-stamped steel plate insert is moulded into the top plate of chain.
- **Stainless Steel Top Chain**  
Stainless steel Top Chain is same as steel top chain except the top plate is pre-stamped stainless steel plate. It is used for application where excessive wear exists in conveying products. Products suitable to be conveyed are metal based products, machined parts or casting parts with sharp edges. A pre-stamped stainless steel plate insert is moulded into the top plate of chain.
- **Conductive Chain**  
Conductive chain is used in static sensitive application where products may be damaged by static charges generated from conveyor while conveying. This chain is used together with conductive slide rail as a medium to discharge static charges to conveyor beam and structure made of aluminium extrusion.
- **Flocked Chain**  
Flocked chain is special chain which chain top plate is covered by soft Velvet material for transportation of fragile and scratch sensitive product. This chain is only available upon request.
- **Magnet Top Chain**  
Magnet top chain is used to carry ferromagnetic product in incline movement.
- **Special Purpose Chain**  
FlexMove also offer special chain used in tobacco industry and other special chain for special purpose of application.

#### 2) Drive Units

Each conveyor required a drive unit or combination of drive and idler end units to move the chain. There are various types of drive unit available for selection for different application as follow:

- **Direct End Drive Unit**  
The direct end drive is placed in front of conveyor to pull the chain through the conveyor beam from top side and return it back to the bottom side of the beam. It is used in conjunction with an idler end unit located at the opposite end of direct end drive. The direct drive is available in both left hand and right-hand versions. The gear motor is directly coupled to the drive unit either at the right or left location of direct drive. Gear motor with adjustable torque limiter can be used to protect conveyor system. This drive is used when the space underneath the drive is limited or not allowed. The direct end drive can be connected in parallel with additional drive units so that common motor can drive several conveyors synchronously. The parallel drive needs longer shaft and modification on bearing mounting and thus it is available only on special request and order tailor to specified requirement from end user. For vertical wedge conveyor application, direct end drive without chain slack (GP models) must be used.
- **Suspended End Drive Unit**  
The suspended end drive is placed in front of conveyor to pull the chain through the conveyor beam from top side and return it back to the bottom side of the beam. It is used in conjunction with an idler end unit located at the opposite end of suspended drive. The gear motor is coupled to the drive shaft of the end suspended drive via power transmission chain where its tension can be adjusted by chain stretching device with adjustment screw. To ensure access to the adjustment screw, an accessible gap must be allowed from drive unit to support closes to drive. The transmission chain is protected by a cover for safety purpose. The suspended drive is available in both left-hand and right-hand versions where suspended motor with transmission mounted on left hand or right hand. An adjustable torque limiter can mounted to drive shaft to protect conveyor system. The advantage of this drive over front direct drive is the motor is mounted underneath drive unit and thus saving space beside drive. The suspended drive can be connected in parallel with additional drive units so that common motor can drive several conveyors synchronously. The parallel drives need longer shaft and modification on bearing mounting and thus it is available only on special request and order tailor to specified requirement from end user.

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- Intermediate Drive Unit**  
 Intermediate drive is best utilized when space restriction prohibit the placement of front drive unit. This drive can be placed anywhere along the conveyor. As it can be placed anywhere along the conveyor, thus it required two idler end unit at each end of the conveyor. In intermediate drive sprocket, only limited part of the sprocket circumference is engaged to drive the chain as compare to front drive, therefore the traction force for intermediate drive is lower compare to front drive. Both direct intermediate and suspended intermediate drives are available. The direct intermediate drive is available in both left-hand and right-hand versions. The gear motor is directly coupled to the drive unit either at the right or left location of direct intermediate drive. Gear motor with adjustable torque limiter can be used to protect conveyor system. Suspended intermediate drive is same as direct intermediate drive except gear motor is mounted underneath drive. The advantage of this drive is space saving beside drive unit. Suspended intermediate drive is best utilized when space restriction prohibit the placement of front drive unit. The advantage of this drive is it can be used when space is a constraint for front end drive and the limitation is it is not so powerful compare to front end drive. Both direct intermediate and suspended intermediate drives are available.
- Catenary Drive Unit**  
 Catenary drive is used where chain return to the bottom of the conveyor beam is not suitable or required. This drive accommodates top-running chain only. Idler end unit is not necessary with this drive and it is used in application where conveyor running in loop or alpine layout. Only suspended catenary is available. Suspended Catenary drive's gear motor is mounted underneath the drive. Suspended Catenary Drive is used where chain return to the bottom of the conveyor beam is not suitable or required.
- Combined Drive and Idler Unit**  
 Combined drive and idler consist of one front direct drive and one idler end unit mounted in a single assembly with transfer rollers in between for smooth transferring of products. Transfer section sometimes can use dead plate, free or power roller for transferring small and unstable products. Although side transferring from one conveyor to the other which is installed side by side provides safer and more stable options of transferring but combined drive and idler has smaller footprint. It will make no different for big products for both options but for small products side transferring has an advantage over end to end transferring. Both combined direct drive and idler as well as combined suspended drive and idler units are available. Combined direct drive and idler unit is available in both left-hand and right-hand versions. The gear motor is directly coupled to the drive unit either at the right or left location of combined direct drive and idler. Gear motor with adjustable torque limiter can be used to protect conveyor system. Combined suspended drive and idler unit is same as combined direct drive and idler except the motor is mounted underneath drive unit and the gear motor is coupled to the drive shaft of the intermediate suspended drive via power transmission chain where its tension can be adjusted by chain stretching device with adjustment screw. To ensure access to the adjustment screw, an accessible gap must be allowed from drive unit to support closes to drive. The transmission chain is protected by a cover for safety purpose. The combined suspended drive and idler is available in both left-hand and right-hand versions where suspended motor with transmission mounted on left hand or right hand.
- Wheel Drive Unit**  
 Wheel drive is suitable to use for conveyor layout required no return chain such as loop or alpine configuration. It is different from the rest of the drive where gear wheel engages chain on the side instead of bottom of the chain as used by other drives. The drive motor is mounted underneath the wheel drive. Both direct wheel drive and suspended wheel drive units are available. Direct wheel drive is drive motor is mounted directly underneath wheel drive shaft and suspended wheel drive is where motor is mounted indirectly through torque limiter and transmission chain and sprocket. The maximum traction force for wheel drive is lower than end drive units.

### 3) Idler End Unit

The function of idler end is to change the direction of the moving chain. There are two types of idler end namely standard idler end unit (180°) and idler bend unit 90°. All idler ends come with connecting strips that can be connected to conveyor beam. Idler end comes with 2 connecting strips at each end for connection to conveyor beam.

- Idler End Unit (standard 180°)**  
 In idler end unit, the moving chain from bottom side of conveyor beam is transfer to the top side of conveyor beam through proper flange guide with minimal friction. The direction of chain movement is changed at 180° from bottom of the conveyor beam to top of conveyor beam.
- Idler Bend Unit (90°)**  
 The idler bend unit convert and change the chain direction in 90° perpendicular to incoming chain direction.

### 4) Bends

Bends are used to change the direction of movement of conveyors. There are 3 types of bends available as follow:

- Wheel bends**  
 Horizontal wheel bends are used to provide horizontal change of conveyor moving direction with minimum amount of friction. It is designed to have top and bottom wheels freely rotate with the chain as it move through the top and bottom tracks of the bend. The wheel is supported by dual sealed ball bearing for long life and minimum friction. In application where products length prohibit the use single wheel bend, for example one 90°, it can be replaced by two 45° or three 30° to form the 90° wheel bend. Horizontal wheel bend are available in 30°, 45°, 60°, 90° and 180° configurations. Special angle of wheel bend is available upon request. Wheel bend has the lowest friction, minimum bend force and smallest turning radius compare to other type of bends. Select wheel bend in application whenever possible.
- Horizontal Bends**  
 Horizontal bends has same function as wheel bend to change the moving direction of conveyor horizontally. It is used in cases where wheel bend is not suitable such as space restriction, long products requiring large radius turns and twin-track bends applications. It is recommended that wheel bend is used whenever possible as horizontal bend has higher friction compare to wheel bend. It is recommended to use larger radius possible as the larger the radius of horizontal bend, the lower the friction and stress on slide rail.
- Vertical Bends**  
 Vertical bend is used to provide vertically change of conveyor moving direction. Vertical bends can be used either as convex or concave bends. Vertical bends increase the tension in the chain and cause higher stress on the slide rail. Avoid using more than four 90° vertical bends in one conveyor.

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### 5) Slide Rail

Slide rail is used to provide a low friction and wear resistance track for chain to slide on. It is snapped into the upper and lower interior flanges of conveyor beam and must be secured mounted and anchored to conveyor beam using screw or rivet to avoid shifting during operation. Two type of slide rail materials HDPE and UHMW-PE are available. HDPE slide rail is used for normal operation whereas UHMW-PE slide rail has the highest wear resistance and is used for accumulation, heavy load, high speed, abrasive condition and low dust generation applications. In application to convey static sensitive product, conductive slide rail and conductive chain are used to discharge static charges to conveyor beam and structure made of aluminium extrusion.

### 6) Conveyor Beams

Conveyor beams are made of anodized aluminium extrusion come in standard length of 3meter section. The special designed of dual T-slot throughout the entire length of both side of the conveyor beams allow drives, idlers and bends to be connected to inner slot using 25mm connecting strip and products guiding brackets, leg supports and other accessories to be connected to outer slot at any location throughout the beams. The conveyor beams form the basic building blocks to which all other components and accessories can be connected and attached onto it to form the entire flexible conveyor system. Aluminium extrusion has advantages of high strength and light weight. Two connecting strips are required for each conveyor beam joint.

### 7) Guide Rail Assembly System

Guide rail components are used to guide and contain products throughout the conveyor system and prevent them from falling off the conveyor. FlexMove provides a comprehensive range of guide rails and guide rail brackets either fixed or adjustable to cover many different product sizes and shapes. The distance of guide rail brackets depend on side forces and guide rail type. In general application, distance of 1–1.5 meter per side guide bracket for straight section is recommended. For bend, guide rail brackets are required for the beginning and end of bends and additional guide rail bracket is needed at the centre of the bend for larger radius bend. In buffer conveyor, conveyor with accumulation or heavy load conveyor, shorter distance like 0.3m-0.5m between guide rail brackets is required. A variety of fixed, adjustable and top hold down guide rail brackets, guide rail supports, guide rail and guide rail covers are available to take care the specialized and extensive demands and needs of manufacturing industries.

### 8) Structural System

**FlexMove®** structural support components that can be interconnected to form robust support structure for every conveying need. The conveyor must be supported with support structure at regular intervals depending on the load on conveyor. The normal leg structure interval is 2m. However, in heavy load application, interval of less than 2m is required. Beam support brackets are used to connect support beam to conveyor beam and feet are used to connect support beam to floor. FlexMove structural components consists of support beams, beam support bracket which are made of anodized aluminium extrusion, feet made of steel with powder coating or aluminium casting and moulded end caps.

### 9) Conveyor Accessories

**FlexMove®** offers a wide selection of conveyor accessories from special bolt & nuts, brackets, connecting strips, rivets, rollers, T-slot cover to washers for inter-connection between modules and components.

**TECHNICAL DATA**

**Materials**

<b>Material</b>	<b>FlexMove Parts</b>
Acetal Copolymer, POM (PolyOxyMethylene)	Conveyor Chain
Aluminium, extruded & anodized	Angle bracket, beam support bracket, conveyor beam, support beam, guide rail, distance tube, fixed and adjustable side guide bracket, spacer
Steel, electro-zinc plated	Bolts and nuts, connecting strips, foot connecting strip
Steel, powder coated	Foot, connecting plate
PA, Polyamide	Chain pivot, side guide bracket, side guide support, drive and idler steering guide, end cal for support beam, end cap for Ø18mm & Ø20mm tubes
Polyamide PA + Glass fibre	Drive sprocket, idler wheel
ABS, Acrylonitrile Butadiene Styrene	Wheel , wheel guide
PP, Polypropylene	Wheel End Cap
PVC, Polyvinyl Chloride	T-slot cover
HDPE, High Density Polyethylene	Slide rail, guide rail
UHMW-PE, Ultra High Molecular Weight Polyethylene	Slide Rail, drive and idler steering guides
TPE, Thermoplastic Elastomer	Chain insert for friction top and wedge top

**Chains**

Series	FH	FT	FK	FS
Chain width (mm)	35mm	35mm	44mm	63mm
Chain width (inch)	1.38"	1.38"	1.73"	2.48"
Tensile strength at 20°C (N)	1000N	4000N	4000N	4000N
Tensile strength at 68°F (lbf)	224.80lbf	899.20lbf	899.20lbf	899.20lbf
Max. working tensile at 20°C (N)	180N	500N	500N	500N
Max. working tensile at 68°F (lbf)	40.46lbf	202.32lbf	112.40lbf	112.40lbf
Working temperature °C	- 20°C - 60°C	- 20°C - 60°C	-20°C - 60°C	-20°C - 60°C
Working temperature °F	-68°F - 140°F	-68°F - 140°F	-68°F - 140°F	-68°F - 140°F
Standard conveyor speed (m/min)	3 - 30m/min	3 - 30m/min	3 – 50m/min	3 – 50m/min
Standard conveyor speed (ft/min)	10-100ft/min	10-100ft/min	10-165ft/min	10-165ft/min
Max. conveyor length (m)	3m	25m	30m	30m
Max. conveyor length (ft)	10ft	80ft	100ft	100ft
Min. turning radius (mm)	N/A	140mm	150mm	150mm
Min. turning radius (inch)	N/A	5.51"	5.91"	6.30"
Link spacing (mm)	12.7mm	25.4mm	25.4mm	25.4mm
Link spacing (inch)	0.50"	1.00"	1.00"	1.00"
Chain weight (plain) (kg/m)	0.33kg/m	0.48kg/m	0.63kg/m	0.75kg/m
Chain weight (plain) (lb/ft)	0.19lb/ft	0.32lb/ft	0.43lb/ft	0.50lb/ft
Max. item weight (kg)	30kg (2 tracks)	30kg (2 tracks)	5kg	10kg
Max. item weight (lb)	66lb (2-tracks)	66lb (2-tracks)	22lb	22lb
Max. weight on conveyor (kg)	250kg	250kg	120kg	150kg
Max. weight on conveyor (lb)	550lb	550lb	330lb	330lb
Item width (mm)	35 - 500mm	35 - 500mm	15 - 100mm	15 – 140mm
Item width (inch)	1.4-19.7"	1.4-19.7"	0.6-4.0"	0.6-5.5"

**Chains**

<b>Series</b>	<b>FM</b>	<b>FC</b>	<b>FL</b>
Chain width (mm)	83mm	103mm	150mm
Chain width (inch)	3.27"	4.06"	5.91"
Tensile strength at 20°C (N)	6000N	6000N	6000N
Tensile strength at 68°F (lbf)	1348.80lbf	1348.80lbf	1348.80lbf
Max. working tensile at 20°C (N)	1250N	1250N	1250N
Max. working tensile at 68°F (lbf)	281lbf	281lbf	281lbf
Working temperature °C	- 20°C - 60°C	- 20°C - 60°C	-20°C - 60°C
Working temperature °F	-68°F - 140°F	-68°F - 140°F	-68°F - 140°F
Standard conveyor speed (m/min)	3 – 50m/min	3 – 50m/min	3 – 50m/min
Standard conveyor speed (ft/min)	10-165ft/min	10-165ft/min	10-165ft/min
Max. conveyor length (m)	30m	30m	30m
Max. conveyor length (ft)	100ft	100ft	100ft
Min. turning radius (mm)	160mm	170mm	200mm
Min. turning radius (inch)	6.30"	6.70"	7.87"
Link spacing (mm)	33.5mm	35.5mm	35.5mm
Link spacing (inch)	1.32"	1.40"	1.40"
Chain weight (plain) (kg/m)	1.20kg/m	1.67kg/m	1.87kg/m
Chain weight (plain) (lb/ft)	0.81lb/ft	1.12lb/ft	1.26lb/ft
Max. item weight (kg)	15kg	20kg	20kg
Max. item weight (lb)	33lb	44lb	44lb
Max. weight on conveyor (kg)	200kg	300kg	300kg
Max. weight on conveyor (lb)	440lb	660lb	660lb
Item width (mm)	20 – 200mm	25 – 300mm	50 – 400mm
Item width (inch)	0.8-7.9"	1.0-11.8"	2.0-15.7"

**TECHNICAL DATA**

**Chain strength and expansion vs. temperature**

Temperature °C	Tensile strength factor	Linear expansion %
-20	1.2	-0.4
0	1.1	-0.2
20	1.0	0.1
40	0.9	0.2
60	0.8	0.5
80	0.6	0.8
100	0.5	1.0
120	0.3	1.3

**Resistance to chemical**

FlexMove® components are basically can withstand continuous contact with most chemicals. However, it is recommended to avoid:

- Acids with PH less than 4
- Bases with PH higher than 9

The following table specifies the resistance of several material used in the conveyor on selected chemicals:

**Legend**

- 1 = Very good
- 2 = Good
- 3 = Moderate resistance
- 4 = Not recommended
- 5 = No data available

Material	Acetal POM	Polyamide PA	High-density Polyethylene HDPE	Thermoplastic Elastomer TPE	Aluminium AL
<b>Acids:</b>					
Acetic acid	3	4	3	-	2
Benzoic acid	3	4	1	-	4
Citric acid	3	2	2	-	2
Chromic acid	4	4	1	-	3
Hydrofluoric acid	4	4	1	-	4
Hydrochloric acid	4	4	1	-	3
Hydro cyanic acid	4	4	2	-	1
Nitric acid	4	4	4	-	3
Phosphoric acid	4	4	1	-	3
Sulphuric acid	4	4	2	1	3
Tartaric acid	3	2	1	-	1
<b>Basic compounds:</b>					
Ammonia	1	2	1	-	2
Calcium hydroxide	1	2	1	-	4
Caustic soda	1	2	1	1	3
Potassium hydroxide	1	2	1	-	4
<b>Salts:</b>					
Potassium bicarbonate	2	2	2	-	1
Potassium permanganate	2	4	2	-	1
Sodium cyanic	2	2	2	-	4
Sodium hydrochloride	3	4	1	-	4
Acid salt	2	3	1	-	-
Basic salt	1	2	1	-	-
Neutral salt	1	2	1	-	-



**TECHNICAL DATA**

Material	Acetal POM	Polyamide PA	High-density Polyethylene HDPE	Thermoplastic Elastomer TPE	Aluminium AL
<b><u>Organic compounds and solvents:</u></b>					
Acetone	1	1	4	3	1
Benzene	1	2	4	3	1
Butyl alcohol	2	2	2	-	1
Carbon disulphide	1	2	3	-	1
Chloroform	1	3	4	-	-
Ethyl acetate	1	2	2	-	1
Ethyl alcohol	1	2	1	-	1
Heptane	2	1	2	-	-
Methyl alcohol	1	2	1	-	2
Methyl ethyl ketone	1	1	4	4	2
Nitrobenzene	2	2	3	-	1
Phenol	3	4	2	-	1
<b><u>Gasses:</u></b>					
Carbon dioxide	3	1	1	-	1
Carbon monoxide	2	1	1	-	1
Chlorine	2	4	3	-	1
Hydrogen sulphide	3	1	2	-	1
Sulphur dioxide	2	3	2	-	1
<b><u>Others:</u></b>					
Beer	1	2	2	-	1
Fruit juices	1	2	3	-	2
Gasoline	1	2	2	-	1
Milk	1	1	2	-	1
Oil	1	1	2	-	1
Vinegar	1	2	3	-	1

Note: the table above is valid for temperature range up to 60°C and it is to be considered as guideline only. Furthermore, precautions should be taken when using cleaning agents. If you in doubt on the material to withstand your special environment, you should go for chemical test or contact our local distributor.

**Friction Coefficient**

Friction coefficients between chain and slide rails is 0.10 – 0.15. the friction coefficients between chain and products is as follow:

Product	Plain Chain	Friction Top
Steel (dry)	0.15-0.25	0.60-0.70
Steel (lubricated)	0.10-0.15	-
Glass (dry)	0.15-0.20	0.505-0.06
Glass (lubricated)	0.10-0.15	-
Aluminium	0.15-0.25	0.06-0.07
Plastic	0.15-0.25	0.05-0.07
Wood and paper	0.15-0.30	0.07-0.08

**Temperature Limits**

This conveyor system can operate continuously in an environment of between -20°C to 60°C. occasionally, the conveyor can withstand up to 100°C for a short period (washing, rinsing).

**Static Electricity**

The standard plastic materials used for conveyors have low electrical conductivity. So, static electricity can build up in the conveyor. when a conveyor is running under normal environment (20°C and humidity 60%) without load, the static electricity build up should be around the following figures:

Above the drive unit	1800-2500V
Idler end	400-500V
Above the wheel bend	400-500V
Above the straight section	250-350V

With the introduction of anti-static material for slide rail and chain, it shall meet the requirement for electronic industry.

**TECHNICAL DATA**

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**Sound Level**

Normally, noise level is higher during the run-in period. The noise level should go down after few days of operation. Generally noise level will increase proportionally to the conveyor speed. Typically, the noise level reading in dB should be around the following:

Chain	Conveyor Speed M/min				
	5	10	20	30	40
FT	56	58	65	70	-
FH	56	58	65	70	-
FK	56	58	65	70	74
FS	55	59	68	71	75
FM	59	62	70	77	78
FC	62	66	74	81	85
FL	64	68	76	83	87

**Chain Tension Calculation**

Calculation is necessary to determine the maximum chain tension on a particular conveyor configuration design, the results are use to decide:

- Drive unit capacity
- Tension limit of conveyor chain

For short, light and low speed applications, the tension limit of the chain normally far exceed the actual requirement of application. If you are in doubt, always calculate.

**Drive Unit Output Capacity, P(W) requirement depend on:**

- Traction force F (N)
- Chain speed V (m/min)

To calculate power, the equation is  $P = 1/60 (F \times V)$

There are several drive unit designs, the maximum permissible traction force on each type of drive unit as below:

Drive unit type	Maximum traction force in Newton (N)						
	FH	FT	FK	FS	FM	FC	FL
End	180	400	500	500	1250	1250	1250
Intermediate	-	-	200	200	200	200	200
Catenary	180	-	500	500	1250	1250	1250

**Chain Tension Limit**

Chain tension limit can be derived from diagram next page. It is depends on various operating conditions, the actual calculation result should be reduced by service factor. Conveyor with high frequency of start/stop will have a high service factor but this could be reduced by providing a frequency inverter incorporated with start/stop function.

Operating conditions	Service factor
Low speed (<15m/min) & max. 1 start/stop per hour	1
Low speed & max. 10 start/stop per hour	1.2
Low speed & max. 20 start/stop per hour	1.4
High speed (>15m/min) & max 20 start/stop per hour	1.6

It is not advisable to operate a conveyor with more than 20 start/stop per hour. If your application must operate this way, please consult FlexMove.

## TECHNICAL DATA

### Bend Factors

Be factors must be considered and calculated at every plain chain. It depends on the angle of the bend  $\alpha$  in radians and friction coefficient  $m$  between chain and slide rails. In application when conveyor is dry and clean, the friction coefficient is close to 0.1.

The bend factor is important to calculate since the frictional force of a plain bend depends not only on weight of chain and product but also the actual the tension through the bend. The result is an additional pressure force of the chain towards the conveyor beam directed toward the centre of the bend. Since the chain tension varies throughout the conveyor, calculation of this additional pressure force is complicated. The highest values are present at the pulling side of the drive unit and virtually zero at the chain inlet. Using bend factor is the easiest way of including added friction in the plain bend for both horizontal and vertical into the calculation. Always use wheel bend unless for exceptional cases. If plain bend is a must, the combined plain bends angle should not more than 180°, unless it is a very short and light application.

Bend type, horizontal or vertical plain bend	Bend factor $\alpha$
30°	1.2
45°	1.3
60°	1.4
90°	1.6

8° inclined is the maximum a product could convey for plain chain whereas friction top chain could take up to 30°

### Calculation

**FlexMove®** chain tension calculation could be simplified as follow:

- Divide the conveyor in sections, each containing a straight part and up to the next plain bend (horizontal or vertical). First section should be from the end furthest away from the drive unit.
- Wheel bend are considered equivalent to straight section. A conveyor with wheel bend but without plain bend should be considered as one straight section.
- Calculate the force caused by gravity load of the return chain.
- Calculate the forces caused by transport friction, accumulation and gravity in the first section and multiply with bend factor.
- Repeat the step above on each section of the conveyor until the last section with the drive unit. The result of the calculation indicates the amount of traction force require to move the conveyor.

**Traction force**, the chain tension is caused by several components such as:

- Friction between unloaded chain and slide rail for example on the return chain.
- Friction between loaded chain and slide rails.
- Friction between accumulating products and top surface of chain.
- Gravity force acting on products and top surface of chain.
- Additional friction in horizontal and vertical bend.

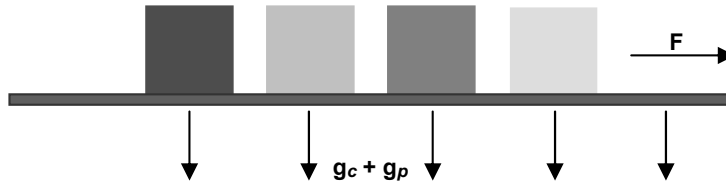
Traction force  $F$  requires to move the chain depends on the following factors:

- Conveyor length (**L**)
- Product gravity load / m, Transport (**gp**)
- Product gravity load / m, Accumulation (**gpa**)
- Chain gravity load / m (**gc**)
- Friction coefficient, chain / slide rail (**mc**)
- Friction coefficient, chain / products (**mp**)
- Incline angle (**A**)
- Bend factor for horizontal plain bend and vertical bend ( **$\alpha$** )

**Diagram A**

Horizontal conveyor without accumulation.

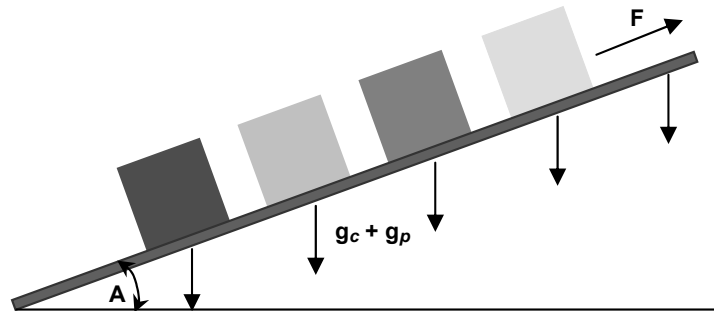
Therefore,  $F = L (g_c + g_p) m$



**Diagram B**

Incline without accumulation.

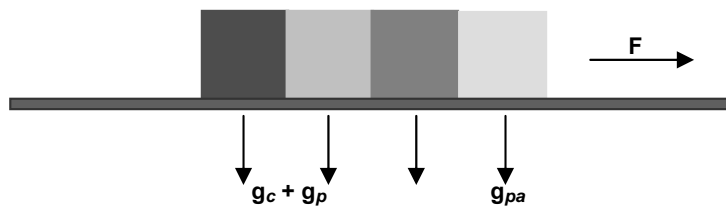
Therefore,  $F = L (g_c + g_p) (m_c \cdot \cos A + \sin A)$



**Diagram C**

Incline with accumulation.

Therefore,  $F = L (g_c + g_p) m + g$



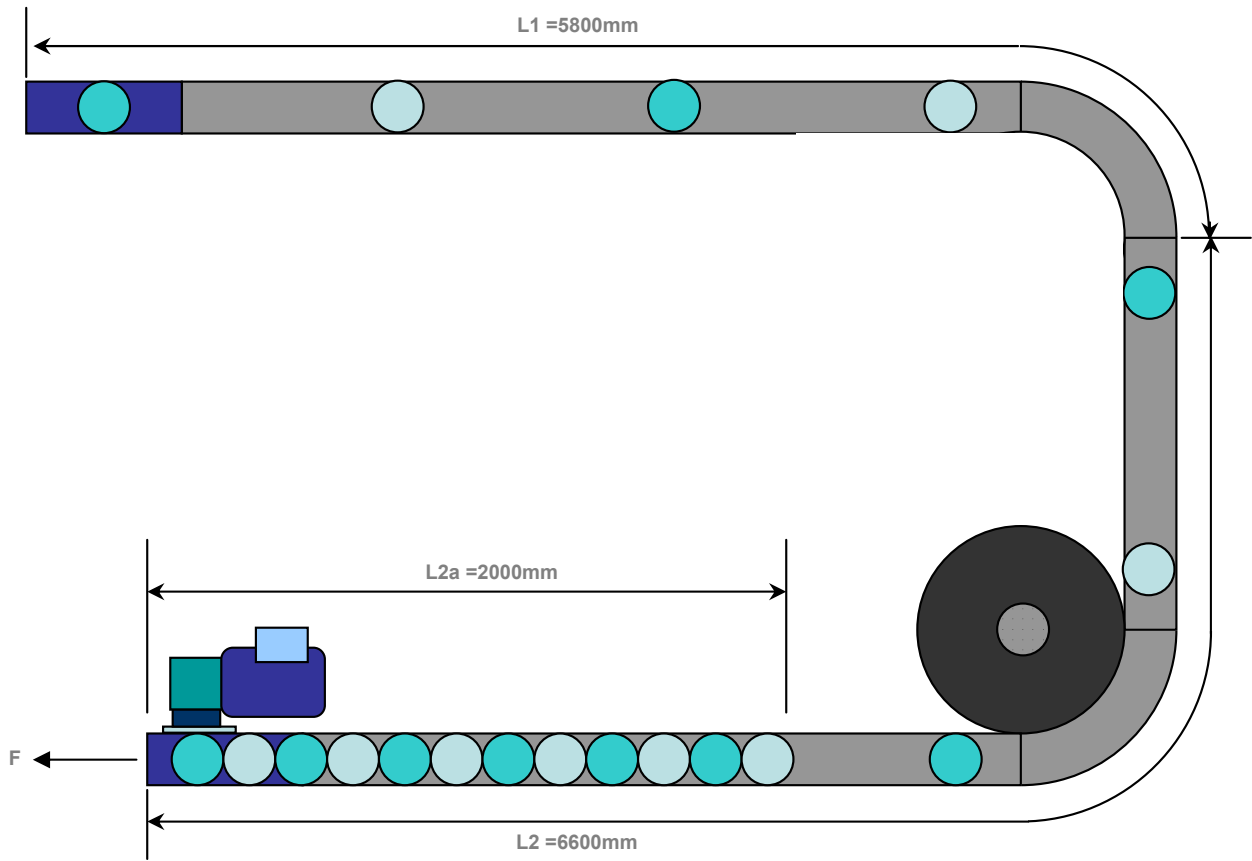
Note: If the traction force exceeds the chain or drive unit capacity, therefore:

- \*Shorten the conveyor or re-layout if possible.
- \*Break the conveyor into two conveyor with individual drive unit.

TECHNICAL DATA

**Calculation Example**

Horizontal conveyor with a 90° horizontal plain bend and a 90° wheel bend.



**Calculation Data:**

- Conveyor series = FM
- Conveyor speed,  $V = 10\text{m/min}$
- Start/stop = 15/hour
- Total length = 12.4m
- Friction coefficient,  $m_c = 0.1$
- Friction coefficient,  $m_p = 0.2$
- Chain weight,  $g_c = 8.83\text{ N/m}$
- Transport product weight,  $g_p (2\text{kg/m}) = 19.62\text{ N/m}$
- Accumulation product weight,  $g_{pa} (14(2\text{kg})/\text{m}) = 274.68\text{ N/m}$

**Section L1**

$$F_1 = [F_0 + L_1 (g_c + g_p) m_c] \alpha_1$$

$$= [0 + 5.8 (8.83 + 19.62) 0.1] 1.6$$

$$= 26.4\text{N}$$

**Section L2**

$$F_2 = F_1 + [L_{2a} (g_c + g_p) + L_{2a} (g_c + g_p)] m_c + L_{2a} \cdot g_{pa} \cdot M_p$$

$$= 26.4 + [2 (8.83 + 264.68) + 4.6 (8.83 + 19.62)] 0.1 + 2 \times 274.68 \times 0.2$$

$$F_{total} = 206.06\text{ N}$$

**Comparison**

The calculation result can now compared with the maximum chain tension for 10m/min is 900N and for 12.4m of conveyor is 1000N. Divide the service factor for 15 start/stop of 1.4. so the actual permission chain tension limit is  $900/1.4 = 643\text{N}$

**Drive Unit Specifications**

**Direct Drive unit**

	<b>FK</b>	<b>FS</b>	<b>FM</b>	<b>FC</b>	<b>FL</b>
Number of Teeth on sprocket	16	16	12	12	12
Chain Pitch (mm)	25.4	25.4	33.5	35.5	35.5
Max. Traction force (N)	500	500	1250	1250	1250

**Suspended Drive unit**

	<b>FK</b>	<b>FS</b>	<b>FM</b>	<b>FC</b>	<b>FL</b>
Number of Teeth on sprocket	16	16	12	12	12
Chain Pitch (mm)	25.4	25.4	33.5	35.5	35.5
Max. Traction force (N)	500	500	1250	1250	1250

**Catenary Drive unit**

	<b>FK</b>	<b>FS</b>	<b>FM</b>	<b>FC</b>	<b>FL</b>
Number of Teeth on sprocket	Nil	16	12	12	Nil
Chain Pitch (mm)	Nil	25.4	33.5	35.5	Nil
Max. Traction force (N)	Nil	500	1250	1250	Nil

**Intermediate Drive unit**

	<b>FK</b>	<b>FS</b>	<b>FM</b>	<b>FC</b>	<b>FL</b>
Number of Teeth on sprocket	Nil	11	9	9	Nil
Chain Pitch (mm)	Nil	25.4	33.5	35.5	Nil
Max. Traction force (N)	Nil	200	200	200	Nil

**Wheel Drive unit**

	<b>FK</b>	<b>FS</b>	<b>FM</b>	<b>FC</b>	<b>FL</b>
Pitch Diameter	300	300	320	340	Nil
Chain Pitch (mm)	25.4	25.4	33.5	35.5	Nil
Max. Traction force (N)	200	200	200	200	Nil