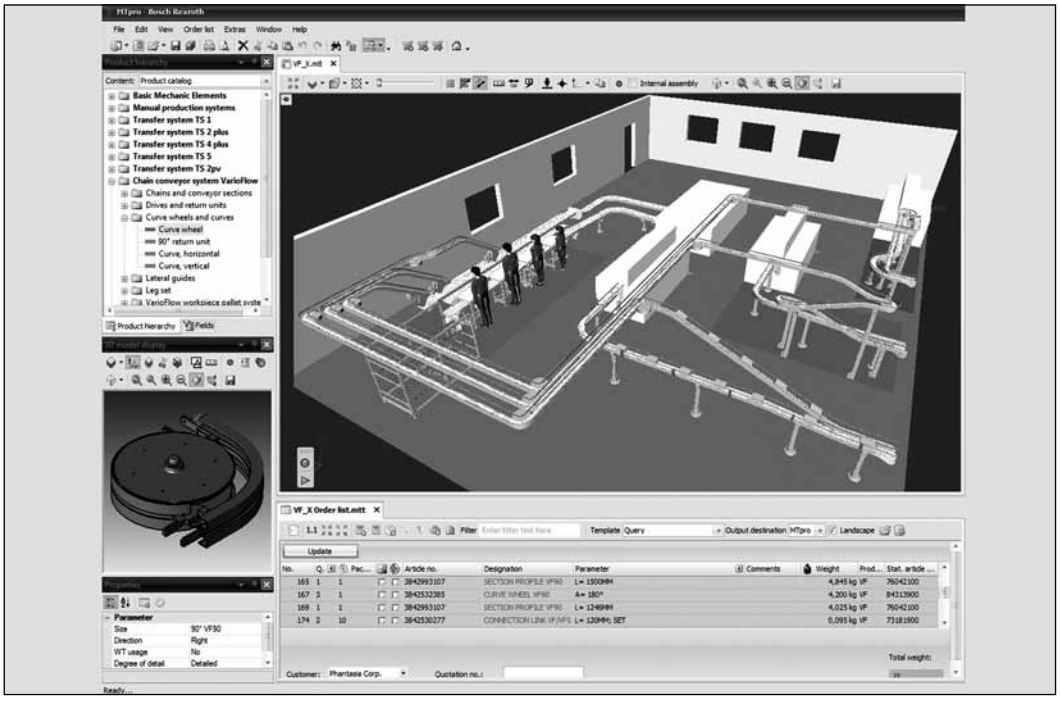
Calculation of chain tensile forces



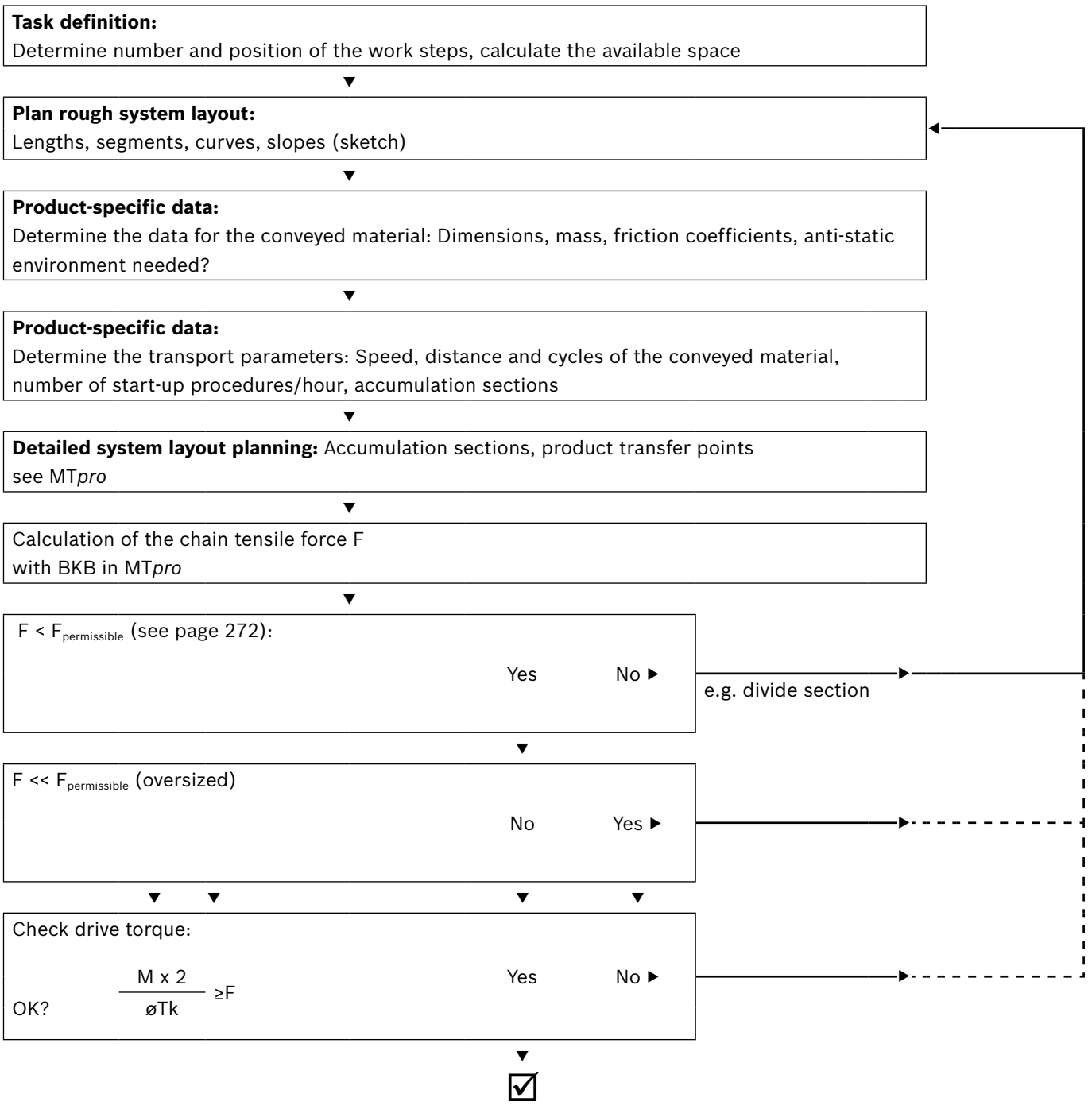
MT*pro* with BKB*soft* – the software for chain calculation
With the software BKB*soft* you can calculate the maximum chain tensile force and the required drive torque quickly and efficiently.

The tensile force of the conveyor chain is made up of multiple individual forces:

- Sliding friction force between unloaded chain and slide rail
- Sliding friction force between loaded chain and slide rail
- Sliding friction force between accumulated goods and chain
- Tangential components of the goods' and chain's force due to weight in inclining sections
- Sliding friction force in curves, between the chain and the inner slide rail in the curve

The BKB*soft* calculation software, included in the MT*pro* planning tool, assists you when designing and making the necessary calculations for your VarioFlow chain conveyor system.

Layout procedure for a chain conveyor system



$$F_{permissible} = F_{(a)} \cdot K_T \cdot c_B$$

$$F_{(v)} < F_{(L)} \Rightarrow F_{(a)} = F_{(v)}$$
$$F_{(v)} > F_{(L)} \Rightarrow F_{(a)} = F_{(L)}$$

$F_{(v)}$, see page 273
$F_{(L)}$, see page 274
K_T, see page 274
c_B, see page 275

Calculating the permissible chain tensile force and the permissible drive torque
The permissible chain tensile force depends on the conveying speed as well as the ambient and operating conditions.
If the calculated chain tensile force exceeds the permissible force, you can:
– divide the section into various chain conveyors.
– alter the system layout, e.g. by replacing curves with curve wheels or, if possible, shorten the section.
– shorten the accumulation sections.
– reduce the speed.

$$M = M_N \cdot \frac{P_V}{P_N}$$

M_N, see page 282
$\frac{P_V}{P_N}$ see page 281

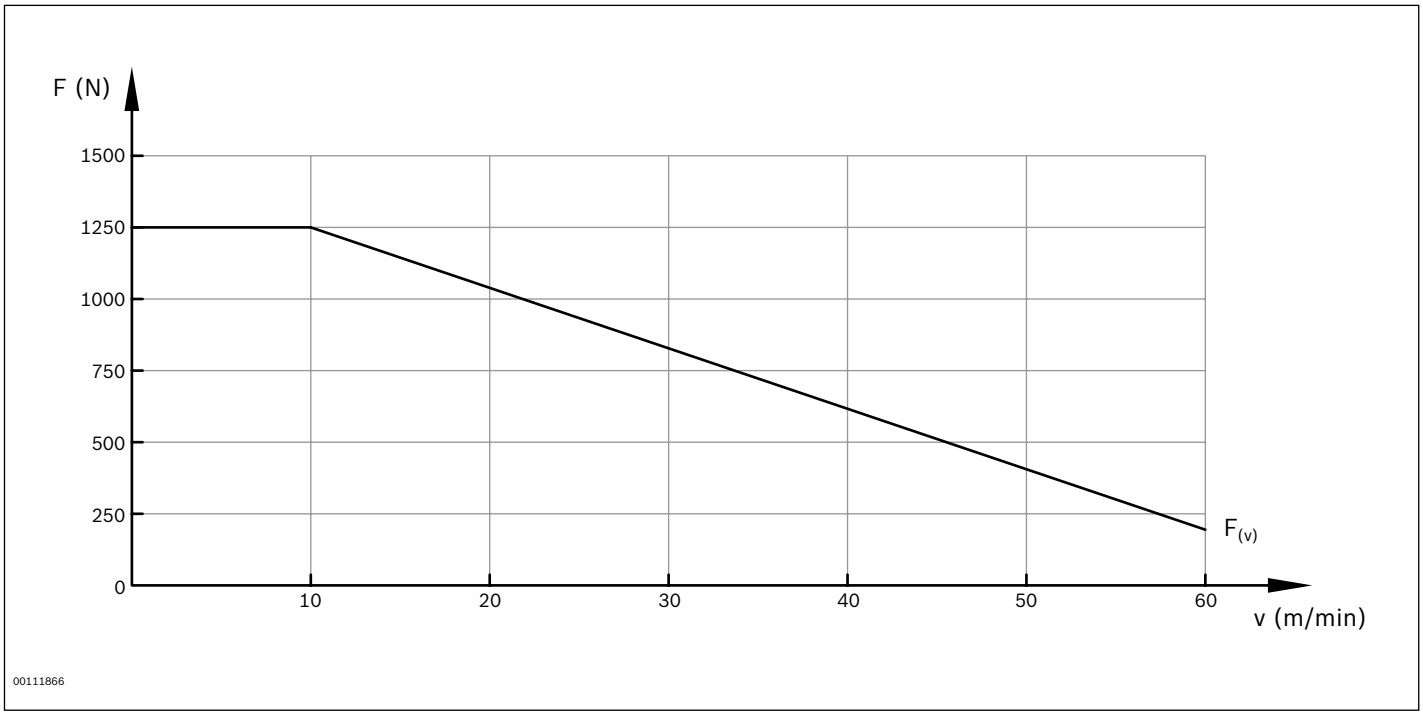
The permissible drive torque of a gear motor is dependent on the transport speed (v), the operating mode (with/without FU), the ambient temperature and the mains frequency.
If the necessary calculated drive torque exceeds that of the selected gear motor, you can:
– reduce the chain tensile force (F).
– reduce the speed (v) and use a gear motor with a higher drive torque, see p. 282.
– change the operating conditions (e. g. the ambient temperature).

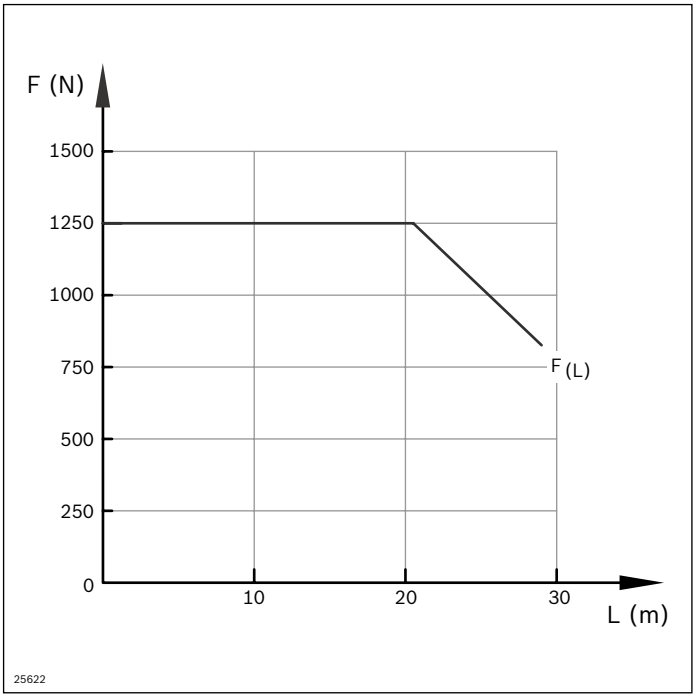
Conveyor chain
The conveyor chain's technical data are included in the chain tensile force calculation as basic data.
Please observe that the breaking force factor depends on the temperature, see p. 274

Permissible section load of the conveyed goods q_{Fi}:
30 N/chain link (34.5 mm)

	Chain section load (own weight N/m)						
	Flat conveyor chain	**Static friction chain**	**Accumulation roller chain**	**Universal chain**	**Cleated chain**	**Wedge chain 3L**	**Wedge chain 5L**
VF*plus* 65	9.5	10	16.0	9.5	10.0		
VF*plus* 90	11.7	12.4	20.5	11.7	12.4	25.3	27.6
VF*plus* 120	13.5	14.5	25.4	13.5			
VF*plus* 160	16.7	18.1					
VF*plus* 240	20.4	22.5					
VF*plus* 320	22.3	25.2					

Permissible chain tensile force depending on the speed $F_{(v)}$ (N); max. 1250 N





Permissible chain tensile force depending on the length of the conveyor section; $F_{(L)}$ (N); max. 1250 N

Breaking force and chain elongation depending on the ambient temperature

The chain material (POM) displays viscoelastic behavior just as every polymer does. This elongates the chain during operation and it is necessary to regularly check the chain elongation and shorten the chain if needed.

A VarioFlow chain conveyor system can be operated without product accumulation and without curves in a temperature range from 0 °C ... + 60 °C. The influence of temperature needs to be taken into account in accumulation operation and for systems with curves.

Other temperatures available on request

Temperature T (°C)	**Breaking force factor K_T**	**Chain elongation** (%)
0	1.12	-0.2
20	1.00	0
40	0.96	0.2
60	0.94	0.5

Stick-slip effect

On conveyor systems with plastic chains, slipping known as the stick-slip effect (chain movement against the direction of transport) may occur in the rear transport area (before the return unit). This is the effect whereby sections of chain take on different running speeds in certain areas, ranging through to a brief standstill.

The effect is more pronounced the larger the distance from the drive. There is no stick-slip effect on the drive unit, as the chain is kept under optimal tension by the chain sprocket.

As a general rule, the stick-slip effect is mostly a visual and not a functional impediment for the continuous material flow. For certain applications, it is important to ensure that sections that may be susceptible to slipping are not used at points in the system with part positioning (e.g. printing).

Curve angles (horizontal/vertical)	**Curve factor k_α**
0° (section without curves)	1.0
Curve wheel 0° ... 180°	1.0
5°	1.05
7.5°	1.05
15°	1.1
30°	1.2
45°	1.3
60°	1.4
90°	1.6

Curve factor k_α

Additional sliding friction forces occur in curves.
They depend on the curve angle and are included in the required chain tensile force calculation via the curve factor.

Start-up procedures/h	**Operating factor c_B**
0 ... 1	1.0
2 ... 10	0.83
11 ... 30	0.71
> 30	0.62

Operating factor c_B

The permissible chain tensile force depends on the number of start-up procedures per time unit. Clocked operation leads to increased chain stress. The application factor is reduced when using a motor control such as a frequency converter. Intermediate values should be interpolated.

Slide rail / Range of application	Basic	Advanced	Premium	ESD	steel
v_{max} (m/min)	60	60	100	30	60
Size: 65-120	✓	✓	✓	✓[1)]	✓[1),2)]
Size: 160-320	✘	✓	✓	✘	✘
Sliding curves horizontal/vertical	✘	✓	✓	✘	✘
Cleanroom use	✘	✓	✓	✘	✘

[1)] Only size 65, 90

[2)] Size 120 on request

Note: We recommend using a homogeneous slide rail variant throughout the entire section, i.e. no mixing of Basic, Advanced, Premium, ESD or steel slide rails within a section.

State of contact surfaces	Basic	Advanced	Premium	ESD	steel
1	0.20	0.15	0.15	0.25	0.26
2	0.25	0.20	0.20	–	0.26
3	> 0.25	> 0.20	> 0.20	–	> 0.26

1 Dry, clean =
* No build-up of particles
* Regular cleaning ≤ 1 x week

2 Remove built-up particles and non-abrasive liquids occasionally, depending on degree of contamination

3 If there is constant exposure to particles and liquids, but no abrasive media please contact www.boschrexroth.com.

Sliding friction factor between slide rail and chain
Average value, related to the total chain running time. The sliding friction factor increases along with increasing running time. Lubricant use can reduce this factor.

Material	Condition of the contact surfaces	POM	Steel coated
plastic	Dry	0.25	–
	Water	0.25	–
	Refrigerant	0.12	–
	Oil	0.12	–
Paper	Dry	0.30	
Glass	Dry	0.18	0.25[3)]
	Water	0.18	
	Refrigerant	0.17	
	Oil	0.17	
Metal	Dry	0.26	0.25[3)]
	Water	0.26	
	Refrigerant	0.11	
	Oil	0.11	

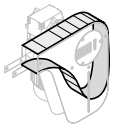
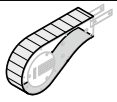
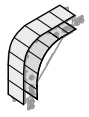
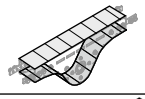
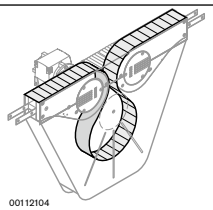
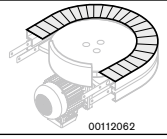
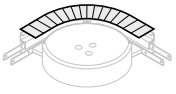
[3)] With sharp-edged parts, the value must be experimentally determined.

Sliding friction factor between goods and chain

Sliding friction factors typical for a product type.
The actual factors must be determined by experimentation for a precise result.

Actual chain and slide rail lengths of components

For an estimated chain and slide rail length calculation

		Actual chain length (m) **Size**					**Effective slide rail length** (m) **Size**			
		65	**90**	**120**	**160-320**		**65**	**90**	**120**	**160-320**
Head drive		1.03					2x 0.2			4x 0.2
Return unit		0.82					2x 0.2			4x 0.2
90° return unit		0.483					4x 117			
Center drive		1.1385					2x 514			
Connection drive		1.51				 00112104	4x 0.2			
Curve wheel drive		0.68	0.72			 00112062	0.82	0.91		
Curve wheel	30°	2x 0.28	2x 0.28	2x 0.29		 00112058	2x 0.34	2x 0.35	2x 0.38	
	45°	2x 0.32	2x 0.33	2x 0.34			2x 0.38	2x 0.41	2x 0.44	
	90°	2x 0.44	2x 0.46	2x 0.48			2x 0.53	2x 0.58	2x 0.63	
	180°	2x 0.68	2x 0.72	2x 0.77			2x 0.82	2x 0.91	2x 1.01	
Roller curve (R500)	30°				2x 0.46					5x 0.46
	45°				2x 0.59					5x 0.59
	90°				2x 0.98					5x 0.98
	180°				2x 1.77					5x 1.77
Sliding curve horizontal (R700)	30°	2x 0.56					4x 0.56			
	45°	2x 0.75					4x 0.75			
	90°	2x 1.3					4x 1.3			
Vertical curve	5°	2x 0.24				 00112059	4x 0.24			8x 0.24 *)
	7.5°	2x 0.26					4x 0.26			8x 0.26 *)
	15°	2x 0.33					4x 0.33			8x 0.33 *)
	30°	2x 0.46					4x 0.46			8x 0.46 *)
	45°	2x 0.59					4x 0.59			8x 0.59 *)
Assembly module		2x 0.24				 00112061	4x 0.24			6x 0.24

*) with support profile

Drive data

Definition of the basic principles of motor specifications
The specified performances, torques and revolutions per minute are rounded values and apply to:

- Operating time/day = 8 h (100% switched-on time)
- Uniform operation (continual), no, or very light, impacts in a direction of rotation at 10 switching cycles/hour
- Installation positions and designs described in the catalog
- Maintenance-free gears with life-long lubrication,
- Ambient operating temperature 0 ... 60 °C. Gear unit with life-long lubrication for ambient operating temperature ≤0 °C available on request
- Protection class IP 55
- f_{mains} = 50 Hz constant
- T_U = 20 °C for gears
  40 °C for motors
- Installation altitude ≤1000 m above sea level
- Overloading the drive will reduce the service life.
  Overloading by 10%: = 75% service life
  Overloading by 20%: = 50% service life
- The gear motor (GM = 1) corresponds to the operating mode S1 (continuous operation)

In the case of other operating conditions, the achievable values may differ from those stated.
In the case of extreme operating conditions, please consult your distribution partner.

Country applicability

	Europe	Switzer-land	USA	Canada	Brazil	Australia	New Zealand	South Korea	China	India
Line voltage (3x....)	400 V	400 V	480 V[1)]	480 V[1)] 575 V	220 V 380 V[3)] 440 V[1)]	400 V 415 V[2)]	400 V 415 V[2)]	220 V 380 V[3)] 440 V[1)]	380 V[2)]	415 V[2)]
Line voltage tolerance	±10%	±10%	±10%	±10%	±10%	±5%	±5%			±5%
Line frequency	50 Hz	50 Hz	60 Hz	60 Hz	60 Hz	50 Hz	50 Hz	60 Hz	50 Hz	50 Hz

[1)] ~ 460 V / 60 Hz
[2)] ~ 400 V / 50 Hz
[3)] ~ 400 V / 60 Hz

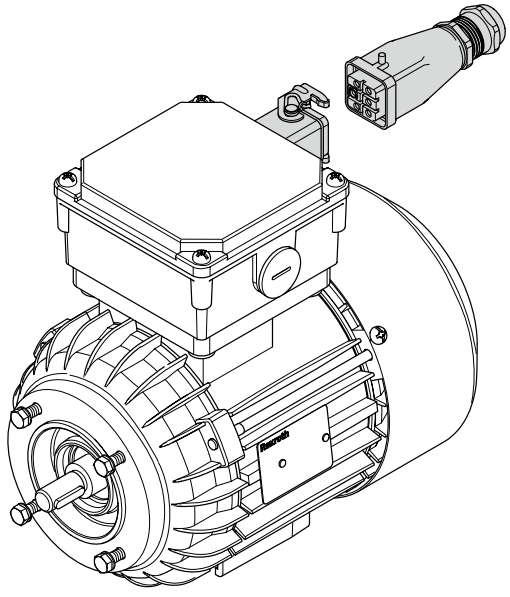
Motor data

Electrical connection requirements:
Connection to a 3-phase, 5-wire system (L1, L2, L3, N, PE), a connection plan is included in the terminal box.
All motors are equipped with a thermal contact*), which has to be connected to an overload switch-off. All

Of the motors comply with protection type IP 55.

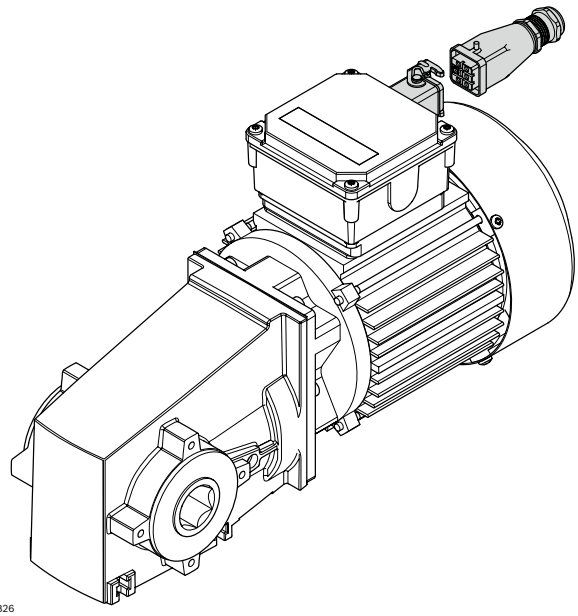
*) Bi-metal thermal contact, opening, tripping at 150 °C ± 5 °C.

Motor types without Index b



Motor connection with plug (AT = S) and 3A metal industrial plug-in connector for motor types without Index b, e.g. 734

Motor types with Index b



Motor connection with plug (AT = S) and 3A metal industrial plug-in connector for motor types with Index b, e.g. 734b

Motor data (GM = 1)

Performance data

Note: The data is typical values. We reserve the right to make changes. See motor type plate for official data. Please note the country assignment.

Voltage class	**A**	**A**	**B**	**D**
Circuit	**Δ**	**Y**	**Y**	**Y**
Voltage U at f = 50 Hz	200 V ±10%		400 V ±10%	
	200 V ±10%		400 V +10...-12%	
Voltage U at f = 60 Hz	220 V ±10%	400 V ±10%	460 V ±10%	575 V ±10%
	220 V ±10%	400 V ±10%	460 V +10...-12%	575 V ±10%

			Current consumption at rated power				Power factor	Power output for	
	Motor type	**IE3**	I_N (A)	I_N (A)	I_N (A)	I_N (A)	**cos φ**	**(50 Hz) P** (kW)	**(60 Hz) P** (kW)
	524	x	0.65	0.35	0.32	0.24	0.6	0.09	0.1
	614b	–	–	–	0.49	–	0.56	0.12	0.14
	624	x	1.15	0.65	0.55	0.45	0.66	0.18	0.22
	634	x	1.65	0.9	0.85	0.65	0.6	0.25	0.29
	644b	–	–	–	–	0.75	0.6	0.25	0.29
	714b	–	1.75	1	0.8	–	0.64	0.25	0.3
	716b	–	1.45	0.85	0.6	0.55	0.66 ... 0.68	0.18	0.22
	716	x	1.3	0.75	0.6	0.62	0.68	0.18	0.22
	734b	–	2.3	1.35	0.95	0.95	0.72 ... 0.77	0.37	0.45
	734	x	1.9	1.05	0.95	0.72	0.74	0.37	0.42
	734a	x	2.5	1.4	1.3	1	0.66	0.45	0.52
	738b	–	1.4	0.8	0.55	0.5	0.60 ... 0.63	0.12	0.14
	744b	–	–	–	1.4	–	0.77	0.55	0.68
	814b	–	3	1.75	–	1.27	0.68 ... 0.69	0.55	0.64
	814	x	3.1	1.7	1.45	1.1	0.69	0.55	0.63
	824	x	4.1	2.25	2	1.6	0.66	0.75	0.86

Suitable for continuous operation, start-stop operation with an operating time of up to 70% and frequency converter operation.

Certification for the motor, cable and plug components:

IE3 motors: CE, cURUS, CCC

Motors with Index b: CE/CCC (50 Hz), CE/cURUS (60 Hz)

3-phase motors	
T_U (°C)	**P_V / P_N**
< 40	1[1)]
45	0.95
50	0.90
55	0.85
60	0.8

[1)] Rated motor power (0.37; 0.25; 0.12 kW)

Rated motor power

The ambient operating temperature T_U influences the rated power P_N of the gear motors.

Motor data (GM = 1)

Conveyor speed v_N is the specification for the rated power and frequency of 50 Hz or 60 Hz.
The actual v values vary depending on:

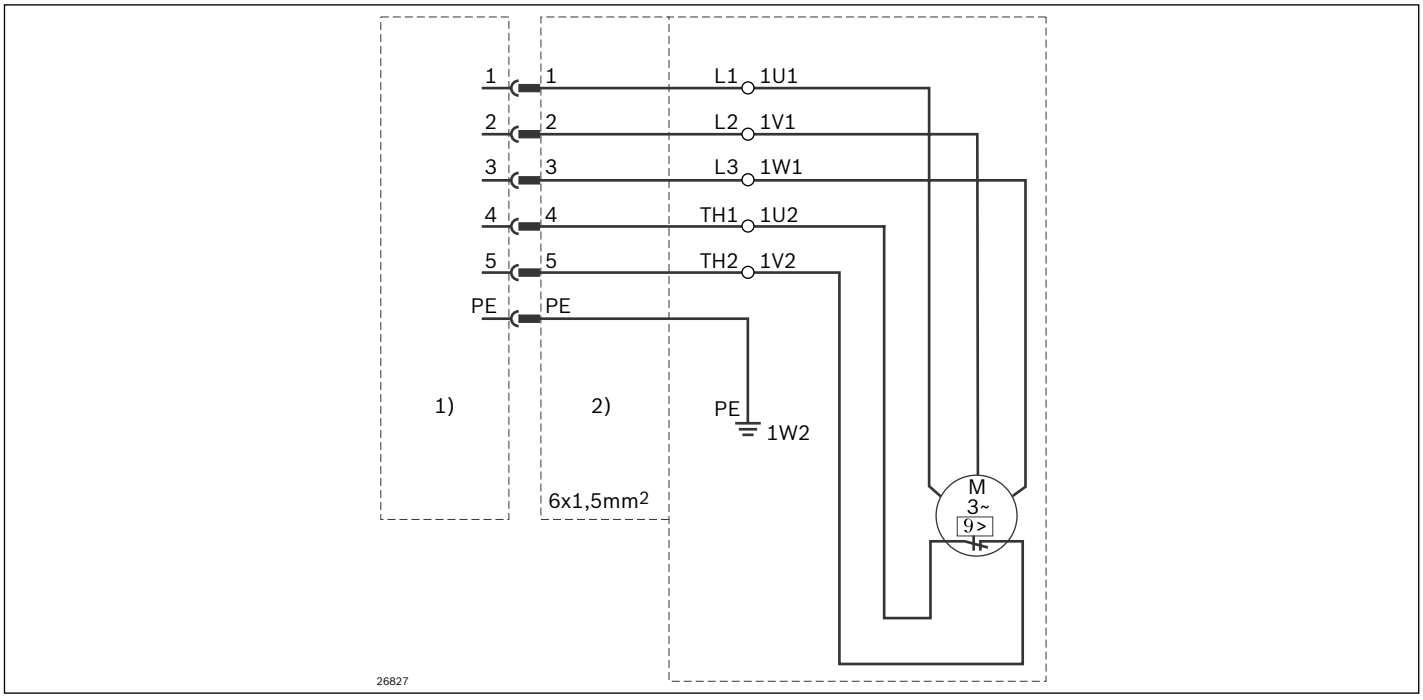
- Tolerance of the standard motors
- Performance range of the motors
- Loads on conveyor chain

Modular unit	**50 Hz** (see page 281)						**Motor type**	**60 Hz** (see page 281)					**Motor type**
	v_N (m/min)	v[1] (m/min)	i	n1[3] (rpm)	n2[4] (rpm)	M_N (Nm)		v[1] (m/min)	i	n1[3] (rpm)	n2[4] (rpm)	M_N (Nm)	
Head drive	5	5.3	60	700	11.7	90	738b	6.1	60	804	13.4	82.1	738b
	10	10.6	60	1400	23.2	90	714b	8.2	60	1080	18.0	90	716b
	13	13.3	47	1400	29.2	90	734b	12.7	60	1680	28.0	82.1	714b
	16	16.9	37	1400	37.1	90	734b	16.0	47	1680	35.1	90	734b
	21	21.7	29	1400	47.7	71.1	734b	20.2	37	1680	44.5	76.1	734b
	27	27.3	23	1400	60.0	56.5	734b	26.1	29	1680	57.3	59.2	734b
	33	33.4	19	1400	73.5	46.2	734b	32.8	23	1680	72.0	47.1	734b
	40	41.0	15	1400	90.0	37.7	734b	40.1	19	1680	88.2	38.4	734b
	50	50.2	12	1400	110.3	30.8	734b	49.2	15	1680	108.0	31.4	734b
Connection drive	5	5.3	60	700	11.7	90	738b	6.1	60	804	13.4	82.1	738b
	10	10.6	60	1400	23.3	90	714b	8.2	60	1080	18.0	90	716b
	13	13.3	47	1400	29.2	90	734b	12.7	60	1680	28.0	82.1	714b
	16	16.9	37	1400	37.1	90	734b	16.0	47	1680	35.1	90	734b
	21	21.7	29	1400	47.7	71.1	734b	20.2	37	1680	44.5	76.1	734b
	27	27.3	23	1400	60.0	56.5	734b	26.1	29	1680	57.3	59.2	734b
Curve wheel drive	5	5.0	269	1425	5.3	60[2]	614b	5.8 5.8	128 269	800 1725	6.2 6.0	60[2] 60[2]	738b[5] 614[6]
	10	11.0	60	700	11.7	60[2]	738b	12.6	60	804	13.4	60[2]	738b
	13	14.4	60	920	15.3	60[2]	716b	17.0	60	1080	18.0	60[2]	716b
	21	21.9	60	1400	23.3	60[2]	714b	26.4	60	1680	28.0	60[2]	714b

[1] Transport speeds at other voltages/frequencies provided on request
[2] Torque limited to 60 Nm by coupling
[3] Motor speed
[4] Gear unit output speed
[5] Voltage class A + D
[6] Voltage class B

Motor connection

Motor connection with cable/plug (AT = S), circuit diagram

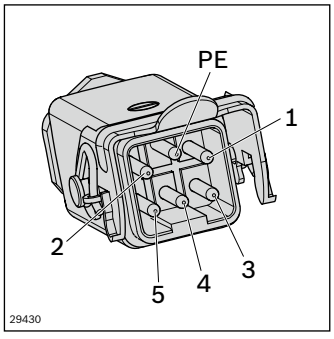


1) Connection cable side
2) Motor side

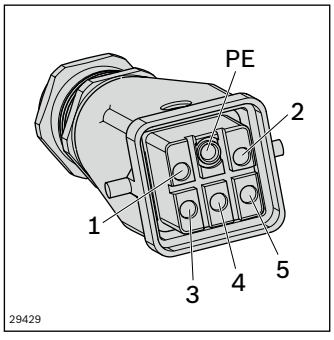
The plug connection consists of UL components.

Connection list

Connection terminals, motor 3~	Pin no.	Code
U1	1	L1
V1	2	L2
W1	3	L3
TW1	4	Th1
TW2	5	Th2
	PE	PE



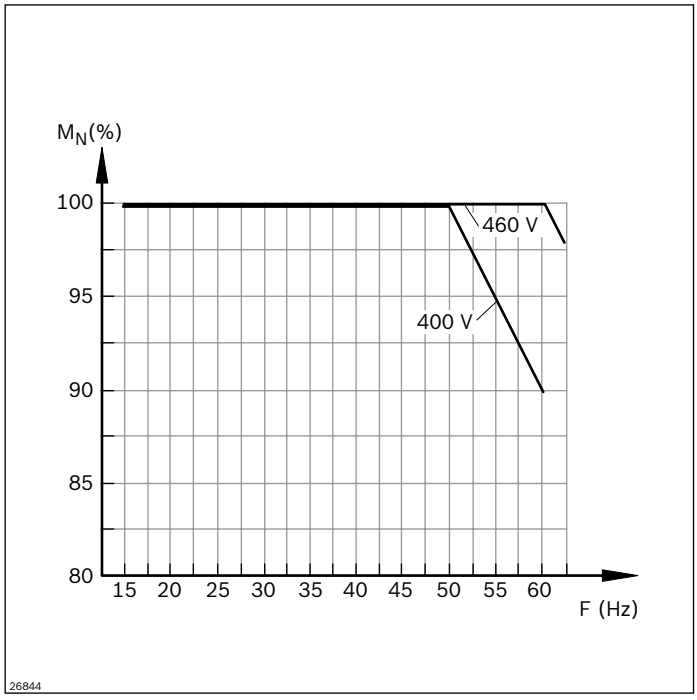
Motor side



Connection cable side

Frequency converter motec 8400 (FU)

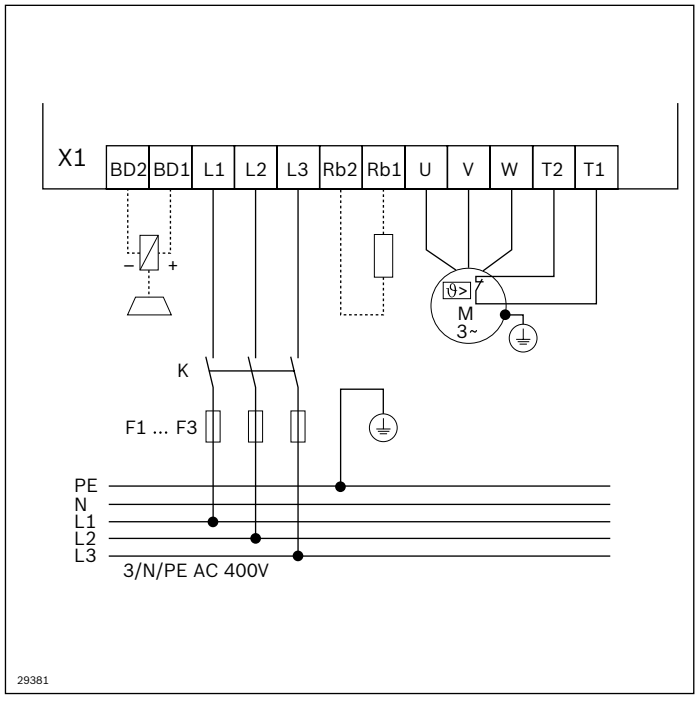
Drive range of the motors with frequency converters (FU)



Technical information:
At rotating field frequencies of ≥ 15 Hz, the motor can be operated under normal operating conditions without an external fan. The motor's thermal conditions should be considered at rotating field frequencies of ≤ 20 Hz. In the range 20 ... 50 Hz, the full torque is available. At rotating field frequencies > 50 Hz, higher speeds can also be achieved with a corresponding drop in performance.

Base speed of motor (m/min) **at 50 Hz**	**Min**[1] (m/min)	**Max**[2] (m/min)	**Max** (m/min) **at max. 80% torque**
5[3]	2	6	8
10[3]	4	12	16
13	5	15	21
16	6	19	26
21	7	25	34
27	9	32	43
33	11	39	52
40	13	48	–
50	16	60	–

[1] Min corresponds to approx. 16 Hz supply frequency
[2] Max corresponds to approx. 60 Hz supply frequency
[3] At 460 V/60 Hz max (m/min) 20% higher



——— Minimum wiring required for operation
----*)---- Additional wiring to change direction of rotation

Frequency converter (FU) accessories

In order to operate a drive with a frequency converter (FU), the user needs to work out the minimum wiring for the internal and external voltage supply (see terminal assignment plan left).

Ordering parameters for SEW motors (GM = 2)

The following ordering information is required if using gear motors from SEW-Eurodrive GmbH & Co, Bruchsal:

- Motor type
- Ratio
- Installation position
- Position of drive output
- Position of terminal box
- Cable entry (Fig. 4)
- Motor voltage/frequency*)
- Thermal class*)
- Motor protection class*)

*) www.seweurodrive.com

Gear motors for power frequency f = 50 Hz

v_N (m/min)	**Is v_N** (m/min)	**Motor type**	**Ratio**	**Drive speed gear motor**	**N** (kW)	**M_{max}** (Nm)
5	4.9	SA47 DR63L4/TH	110.73	12.0	0.25	90
5[1)]	6.2	SA47 DR63L4/TH	201.00	6.5	0.25	90 / 60[3)]
5[2)]	6.7	SA47 DR63L4/TH	201.00	6.5	0.25	90 / 60[3)]
7	6.2	SA47 DR63L4/TH	84.00	15.0	0.25	90
10	9.9	SA47 DRS71S4/TH	54.59	25.0	0.37	90
10[1)]	10.5	SA47 DRS71S4/TH	128.10	11.0	0.37	90 / 60[3)]
10[2)]	10.4	SA47 DRS71M4/TH	137.05	10.0	0.37	90 / 60[3)]
13	12.8	SA47 DRS71M4/TH	44.22	31.0	0.37	90
13[1)]	14.4	SA47 DRS71M4/TH	94.08	15.0	0.37	90 / 60[3)]
13[2)]	12.5	SA47 DRS71S4/TH	110.73	12.0	0.37	90 / 60[3)]
16	14.9	SA47 DRS71S4/TH	38.23	36.0	0.37	78
21	19.9	SA47 DRS71S4/TH	29.00	48.0	0.37	60
21[1)]	21.1	SA47 DRS71S4/TH	63.80	31.0	0.37	60
21[2)]	20.7	SA47 DRS71S4/TH	69.39	20.0	0.37	60
27	24.4	SA47 DRS71S4/TH	23.20	59.0	0.37	49
33	32.3	SA47 DRS71S4/TH	17.62	78.0	0.37	40
40	39.7	SA47 DRS71M4/TH	14.24	97.0	0.55	48
50	46.4	SA47 DRS71M4/TH	12.10	114.0	0.55	41
4 ... 26	2.22 ... 22.0	SA47 DRS71S4 MM05	54.59	5.3 ... 53.0	0.55	69 ... 81
16 ... 60	6.7 ... 68.3	SA47 DRS71M4 MM07	17.62	16 ... 165.0	0.75	36 ... 39

For basic unit curve wheel drive:

[1)] VF*plus* 65 (z = 28 / ø306 mm)

[2)] VF*plus* 90 (z = 30 / ø331 mm)

[3)] at KPG = 1 limited to 60 Nm

Gear motors for power frequency f = 60 Hz

v_N (m/min)	ls v_N (m/min)	Motor type	Ratio	Drive speed gear motor	N (kW)	M_{max} (Nm)
5	4.9	SA47 DR63L4/TH	128.10	12.0	0.25	90
5[1)]	7.4	SA47 DR63L4/TH	201.00	7.8	0.25	90 / 60[3)]
5[2)]	8.1	SA47 DR63L4/TH	201.00	7.8	0.25	90 / 60[3)]
7	7.0	SA47 DR63L4/TH	94.08	16.8	0.25	90
10	9.9	SA47 DRS71S4/TH	63.80	24.0	0.25	90
10[1)]	9.4	SA47 DRS71S4/TH	158.12	9.8	0.25	90 / 60[3)]
10[2)]	10.2	SA47 DRS71M4/TH	158.12	9.8	0.25	90 / 60[3)]
13	12.4	SA47 DRS71M4/TH	54.59	30.0	0.37	90
13[1)]	13.8	SA47 DRS71M4/TH	110.73	14.4	0.37	90 / 60[3)]
13[2)]	13.7	SA47 DRS71S4/TH	128.10	13.2	0.37	90 / 60[3)]
16	15.4	SA47 DRS71S4/TH	44.22	37.2	0.37	90
21	20.9	SA47 DRS71S4/TH	32.48	50.4	0.37	67
21[1)]	21.9	SA47 DRS71S4/TH	71.75	22.8	0.37	67 / 60[3)]
21[2)]	23.7	SA47 DRS71S4/TH	71.75	22.8	0.37	67 / 60[3)]
27	27.8	SA47 DRS71S4/TH	24.77	67.2	0.37	52
33	33.8	SA47 DRS71S4/TH	20.33	81.6	0.37	46
40	41.7	SA47 DRS71M4/TH	16.47	100.8	0.37	37
50	47.7	SA47 DRS71M4/TH	14.24	116.4	0.55	48
4 ... 26	2.22 ... 22.0	SA47 DRS71S4 MM05	54.59	5.3 ... 53.0	0.55	69 ... 81
16 ... 60	6.7 ... 68.3	SA47 DRS71M4 MM07	17.62	16 ... 165.0	0.75	36 ... 39

For basic unit curve wheel drive:

[1)] VF*plus* 65 (z = 28 / ø306 mm)

[2)] VF*plus* 90 (z = 30 / ø331 mm)

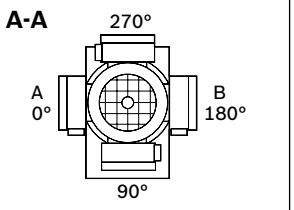
[3)] at KPG = 1 limited to 60 Nm

Direct head drive

Motor mounting	Installation position	Drive output	Terminal box
R	M2 (M1)	B	0°
L	M2 (M1)	A	180°

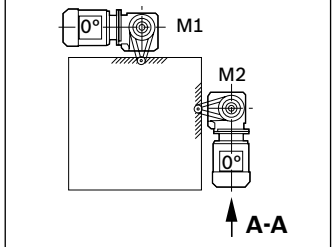
Position of terminal box

Fig. 1



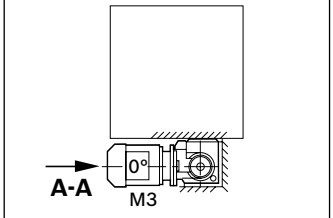
Installation position horizontal top/vertical

Fig. 2



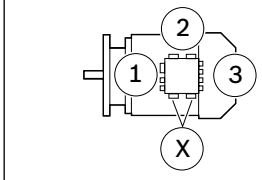
Installation position horizontal (above top edge chain)

Fig. 3



Cable entry point

Fig. 4



Combination matrix

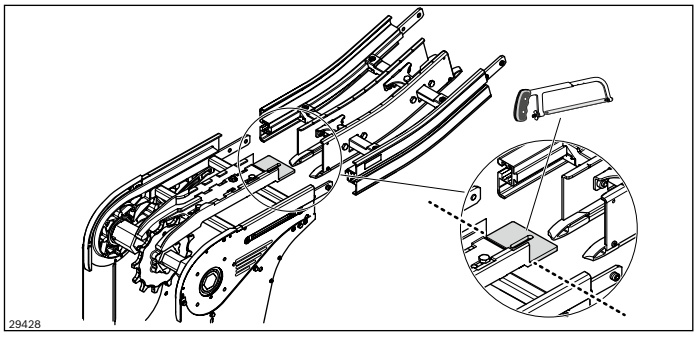
		Straight			Curves				Drives				Return unit		
		Section profile AL open	Section profile AL closed	Assembly module	Curve wheel	Roller curve*	Horizontal sliding curve	Vertical curve	Head drive	Curve wheel drive	Connection drive	Center drive (STS)	Basic unit	90° **(STS)	Transmission kit
Straight	Section profile AL open	J													
	Section profile AL closed	J	J												
	Assembly module	J	J	N											
Curves	Curve wheel	J	J	L[2)]	L[2)]										
	Roller curve*	J	N	J	N	L[1)]									
	Horizontal sliding curve	J	J	J	J	N	L[1)]								
	Vertical curve	J	J	J	J	L[1)]	L[1)]	L[1)]							
Drives	Head drive	J	J	L[2)]	L[2)]	L[1, 4)]	L[1)]	L[1, 4)]	N						
	Curve wheel drive	J	J	L[2)]	L[2)]	N	L[1)]	L[1)]	N	N					
	Connection drive	J	J	L[2)]	L[2)]	N	L[1)]	L[1)]	N	N	N				
	Center drive (STS)**	L[5)]	L[5)]	L[2, 5)]	L[2, 5)]	N	L[1, 5)]	L[1, 5)]	N	N	N	N			
Return unit	Basic unit	J	J	L[2)]	L[2)]	L[1.4)]	L[1)]	L[1, 4)]	L[2)]	N	N	L[2, 3)]	L[2, 3)]		
	90° (STS)**	L[5)]	L[5)]	L[2, 5)]	L[2, 5)]	N	L[1, 5)]	L[1, 5)]	N	N	L[2, 5)]	N	N	L[2)]	
Transmission kit		N	N	N	N	N	N	N	J	N	J	N	J	N	N

J	possible without restrictions
L	possible with restrictions
N	not possible

* Support profile must project 76+2 mm into the roller curve.

** AL-STS adapter included in scope of delivery.

[1)] Profile connector not required
[2)] Use of a profile piece (L_{min} = 120 mm)
[3)] Assembly module required
[4)] For sizes 160-320: shorten the support rail on the dotted line (see figure below)
[5)] Use of the AL-STS adapter



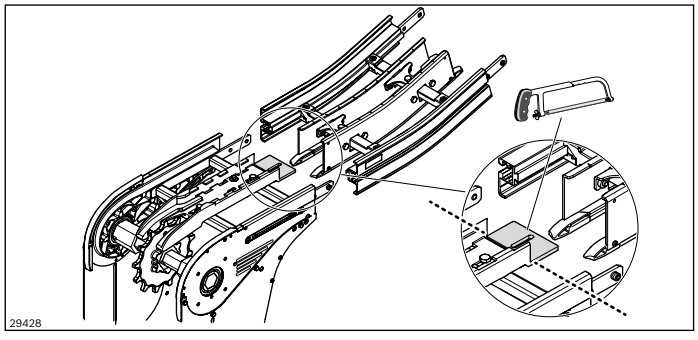
		Straight			Curves			Drives			Return unit	
		Section profile STS open	Section Profile STS Clean	Assembly module	Curve wheel	Roller curve*	Vertical curve	Head drive	Connection drive	Center drive	Basic unit	90° **
Straight	Section profile STS open	J										
	Section Profile STS Clean	L[6)]	L[6)]									
	Assembly module	J	L[6)]	N								
Curves	Curve wheel	J	L[6)]	J	L[2, 7)]							
	Roller curve*	J	N	J	N	L[1)]						
	Vertical curve	J	L[6)]	J	L[1)]	L[1)]	L[1)]					
Drives	Head drive	J	L[6)]	J	L[1)]	L[1, 4)]	L[1, 4)]	N				
	Connection drive	J	L[6)]	J	L[1)]	N	L[1)]	N	N			
	Center drive**	J	L[6)]	J	L[1)]	N	L[1)]	N	N	N		
Return unit	Basic unit	J	L[6)]	J	L[1)]	L[1, 4)]	L[1, 4)]	L[1)]	L[1)]	L[1, 3)]	L[1, 3)]	
	90° **	J	L[6)]	J	L[1)]	N	L[1)]	L[1)]	L[1)]	N	N	L[1)]

J	possible without restrictions
L	possible with restrictions
N	not possible

* Support profile must project 76+2 mm into the roller curve.

** AL-STS adapter included in scope of delivery.

[1)] Profile connector not required
[2)] Use of a profile piece (L_{min} = 224 mm)
[3)] Assembly module required
[4)] For sizes 160-320: shorten the support rail on the dotted line (see figure below)
[5)] Use of the AL-STS adapter
[6)] Replacement of the standard profile connector with profile connector STS Clean Section
[7)] Directly possible with left-right change (one profile connector no longer required)



		Straight			Curves		Drives			Return unit	
		Section profile AL open	Section profile AL closed	Assembly module	Curve wheel ESD	Vertical curve (STS)	Head drive (STS)	Connection drive (STS)	Center drive (STS)	Basic unit (STS)	90° ** (STS)
Straight	Section profile AL open	J									
	Section profile AL closed	J	J								
	Assembly module	J	J	N							
Curves	Curve wheel ESD	J	J	L[2)]	L[2)]						
	Vertical curve	J	J	L[2)]	L[2)]	L[1)]					
Drives	Head drive (STS)	L[5)]	L[5)]	L[2, 5)]	L[2, 5)]	L[1, 5)]	N				
	Connection drive (STS)	L[5)]	L[5)]	L[2, 5)]	L[2, 5)]	L[1, 5)]	N	N			
	Center drive (STS)**	L[5)]	L[5)]	L[2, 5)]	L[2, 5)]	L[1, 5)]	N	N	N		
Return unit	Basic unit (STS)	L[5)]	L[5)]	L[2, 5)]	L[2, 5)]	L[1, 5)]	L[2)]	N	L[2)]	L[2, 3)]	
	90° (STS)**	L[5)]	L[5)]	L[2, 5)]	L[2, 5)]	L[1, 5)]	L[2)]	L[2)]	N	N	L[2)]

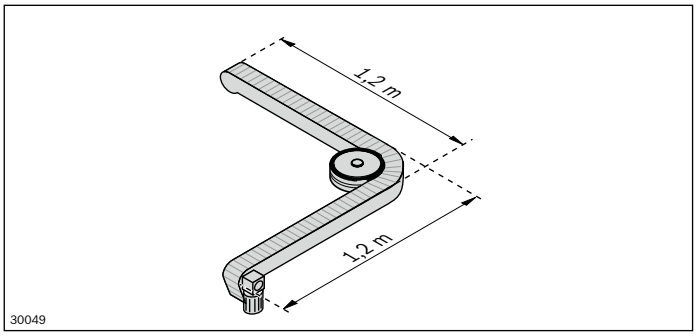
J	possible without restrictions
L	possible with restrictions
N	not possible

* Support profile must project 76+2 mm into the roller curve.

** AL-STS adapter included in scope of delivery.

[1)] Profile connector not required
[2)] Use of a profile piece (L_{min} = 224 mm)
[3)] Assembly module required
[4)] For sizes 160-320: shorten the support rail on the dotted line
[5)] Use of the AL-STS adapter
[6)] Replacement of the standard profile connector with profile connector STS Clean Section
[7)] Directly possible with left-right change (one profile connector no longer required)

Use in clean rooms



Values for Premium and Advanced slide rails

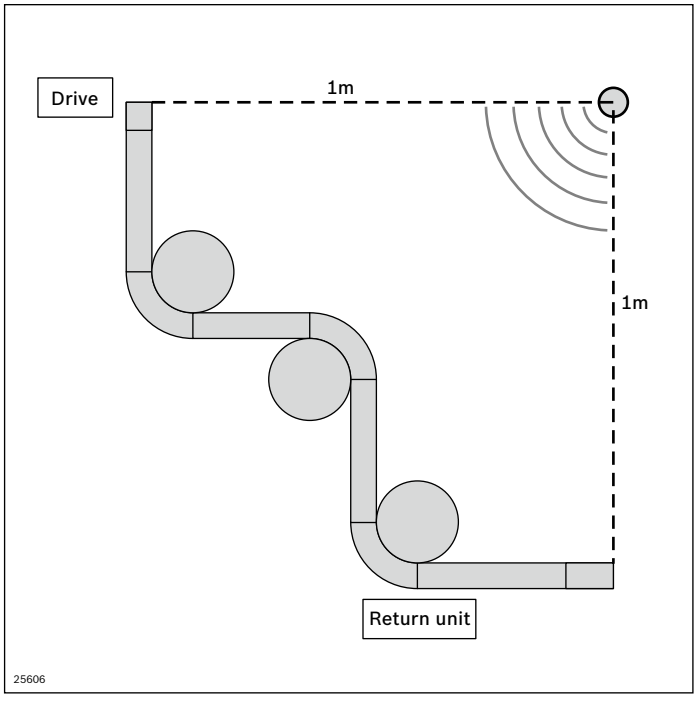
Speed v (m/min)	ISO class
6	6
20	7
50	7

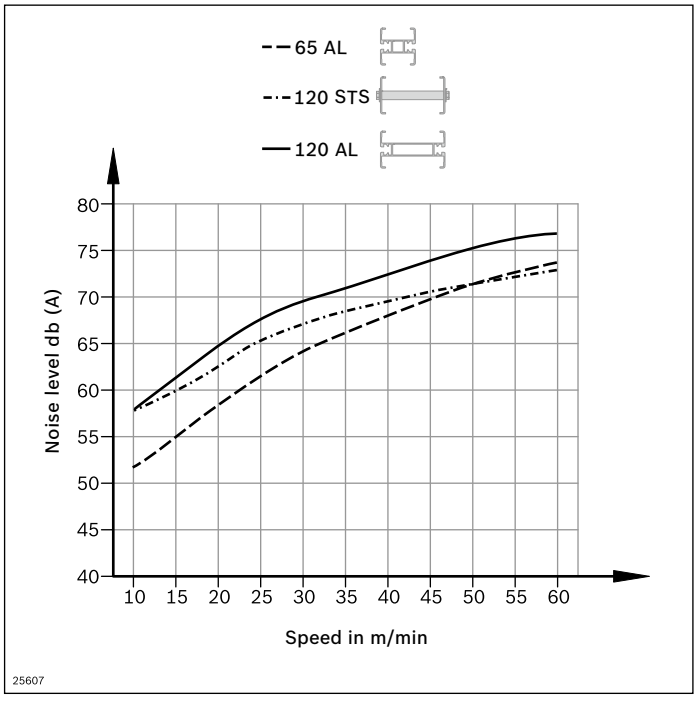
The VarioFlow *plus* 90 conveyor system has been tested for cleanroom suitability according to the procedures described in the EN ISO 14644-1 standard for cleanroom and cleanliness suitability testing. The measurement results for a conveyor system VarioFlow *plus* 90 (AL) were obtained and are presented in the table at left.
The results are based on an application in an L-configuration using a curve wheel 90° and flat conveyor chain, without load!

Before commissioning a chain conveyor system in a cleanroom, the following must be observed:
- Install the slide rails according to the assembly instructions (avoid joints, round off all edges and intersections on the slide rails)
- Check the chain inlets and outlets, if necessary round off edges
- Check the intersections, if necessary round off edges
- Run in for about 100 hours to adapt the slide rail and chain (abrasion and unevenness of plastics)
- Clean the system and the chain
- Transfer of the system via airlock into the cleanroom
- Repeatedly clean the system and the chain with isopropanol

Due to the identical system configurations of sizes 65 and 120, the result can also be transferred to these sizes.
Sliding curves are not suitable for use in cleanrooms due to the increased friction and associated wear.

Conveyor noise level

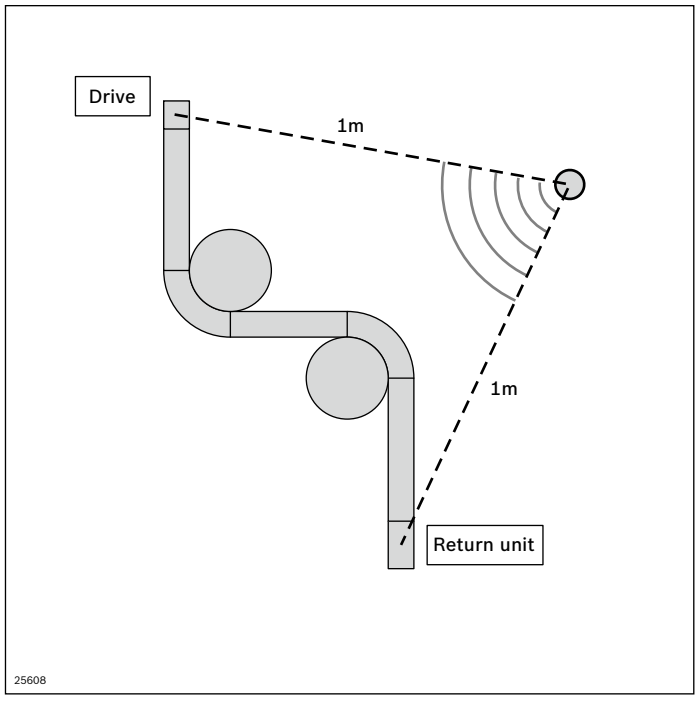


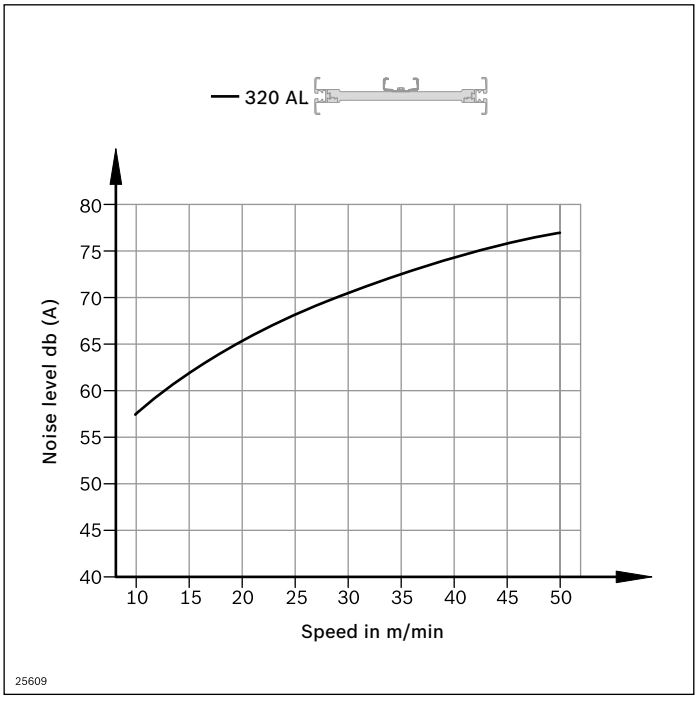


The noise generated by the conveyor chain will decrease after a few days of operation. Generally, a higher speed will result in a higher noise level. The actual noise level depends on several factors:

- Product on the conveyor
- Chain type
- Drive type
- Installation location and fastening of the system (floor, ceiling, wall)
- Ambient conditions (vibrating objects, hard reflective walls, integrated systems of other makes, hall structures)
- Quality of system assembly and layout in accordance with the assembly instructions (slide rail transitions, joints)
- Surrounding equipment
- Conveyor layout and dimensions

Typical noise levels are shown in the graphic. The noise level was measured at the transport height with a distance of 1 m from the conveyor.
The measurement was taken in an industrial hall (ambient noise from approx. 50 dB (A) to 63 dB (A)) for chain speeds up to 60 m/min and with medium-length chain bag.


Drive
1m
1m
Return unit
25608


320 AL
Noise level db (A)
80
75
70
65
60
55
50
45
40
10
15
20
25
30
35
40
45
50
Speed in m/min
25609

Resistance of the chain against chemicals

Chemical	Material
Acids:	**POM**
Benzoic acid	0
Hydrogen cyanide	–
Boric acid	0
Chromic acid	–
Acetic acid	0
Hydrofluoric acid	–
Tannic acid	0
Oleic acid	0
Oxalic acid	–
Perchloric acid	–
Phosphoric acid	–
Phthalic acid	–
Nitric acid	–
Hydrochloric acid	–
Sulfuric acid	–
Tartaric acid	0
Citric acid	0

++ = high resistance
+ = limited resistance
0, – = unsuitable material combination
·/· = no available data

The materials used are resistant to most chemicals used in industrial applications.
With some chemicals, the reaction also depends on the concentration and the physical state.
Contact with the following substances should be avoided:
- Acids with a pH level ≤ 4
- Bases with a pH value ≥ 9
- Chlorinated hydrocarbons (e.g. trichloroethylene/Tri).

For accurate information on resistance, contact the chemical manufacturer; only they can give an official answer to your question. The materials used in the individual components can be found on pages 298 and 217.

Chemical	Material
Alkaline substances:	**POM**
Ammonia (dissolved)	++
Lime hydrate	++
Sodium hydroxide	++
Caustic potash	++
Salts:	
Basic salts	++
Potassium bicarbonate	+
Potassium permanganate	+
Sodium cyanide	+
Sodium hypochloride	0
Neutral salts	++
Acidic salts	+
Solvents/organic media:	
Acetone	+
Solvents/organic media:	
Aniline	+
Gasoline	+
Benzene	++
Butanol	+
Chlorobenzene	++
Chloroform	++
Acetic ether	++
Ethyl alcohol	++
Ethyl ether	++
Formalin	+
Heptane	+
Methyl alcohol	++
Methyl ethyl ketone	++
Nitrobenzene	+

Chemical	Material
Solvents/organic media:	
Phenol	0
Carbon disulfide	++
Turpentine substitute	·/·
Carbon tetrachloride	++
Toluene	++
Gases:	
Chlorine (wet)	–
Chlorine (dry)	+
Carbon dioxide	0
Carbon monoxide	+
Sulfur dioxide (wet)	–
Sulfur dioxide (dry)	+
Hydrogen sulfide	0

Material use

Chains

	Steel, stainless	POM	PA	TPE
Flat conveyor chain	x	x	x	
Static friction chain	x	x	x	x
Accumulation roller chain	x	x	x	
Roller cleat chain ø20	x	x	x	
Roller cleat chain ø35	x	x	x	
Cleated chain	x	x	x	
Universal chain	x	x	x	
Steel-coated chain	x	x	x	
Flocked chain	x	x	x	
Wedge chain	x	x	x	x
ESD conveyor chain	x	x	x	

Drives

	Aluminum	Aluminum, die-cast	Galvanized steel	Steel, stainless	steel	PA	PP
Head/connection drive AL	x	x	x	x		x	x
Head/connection/curve wheel drive AL incl. ball catch coupling	x	x	x	x	x	x	x
Head/connection/center drive STS				x		x	x
Return unit AL	x	x	x	x		x	x
STS return unit				x		x	x
90° return unit				x		x	x
Passive bridge connection kit				x		x	

Sections

	Anodized aluminum	Aluminum, die-cast	Steel, galvanized	Steel, stainless	Brass, nickel-plated	PA	PP	PE-UHMW	PE	HDPE
Straight section AL	x	x	x							
Straight section STS				x						
Vertical + horizontal sliding curve AL	x		x							
Vertical sliding curve STS				x						
Curve wheel AL	x	x	x	x		x				
Curve wheel STS				x		x				
Roller curve AL	x	x	x	x		x		x		
Roller curve STS				x		x		x		
Chain assembly module AL	x		x							
Chain assembly module STS				x						
Leg sets AL	x	x	x				x			
Leg sets STS			x	x	x	x				
Lateral guide	x		x	x		x			x	x
Plastic slide rail								x		
STS slide rail				x						