

Standard 3-Axis Gantry Robot

Baumuller Drives and Motors
Alpha (Wittenstein) Gearboxes

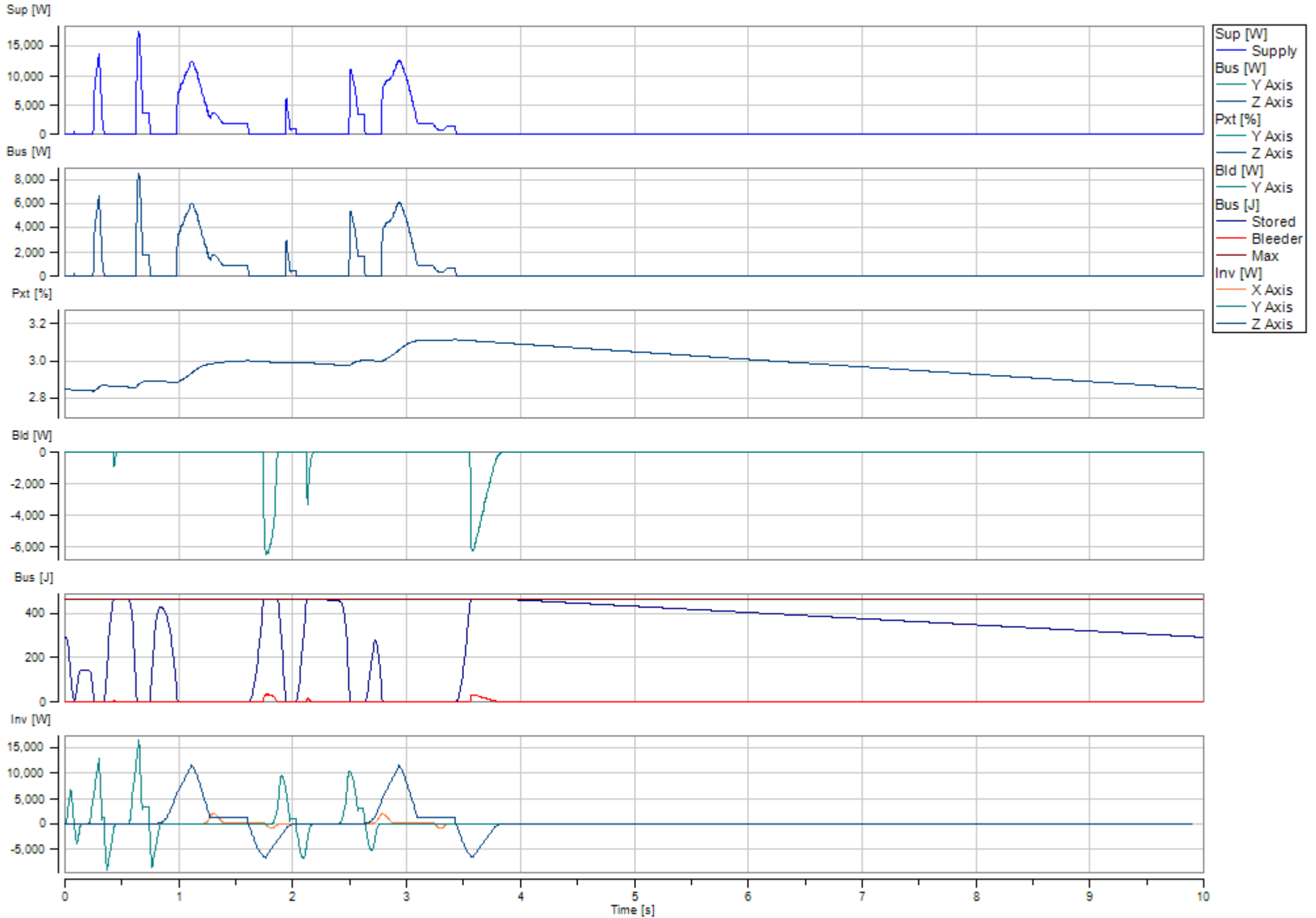
Points of Interest:

1. The Y Axis (Axis 2) has an external bleeder connected to its internal chopper.
2. All bleeder power is channeled through the external bleeder.
3. Click on any module in the 'Power' frame, and its rated and calculated performance values will be displayed.
4. In E-Stop mode, the bleeder has enough peak power capacity to stop the X & Z axes simultaneously, or the Y axis on its own. Hence, the Max-Stop scenario considers the X & Z axes at full speed when a Max-Stop occurs, and the Y axis has no Max-Stop sequence.

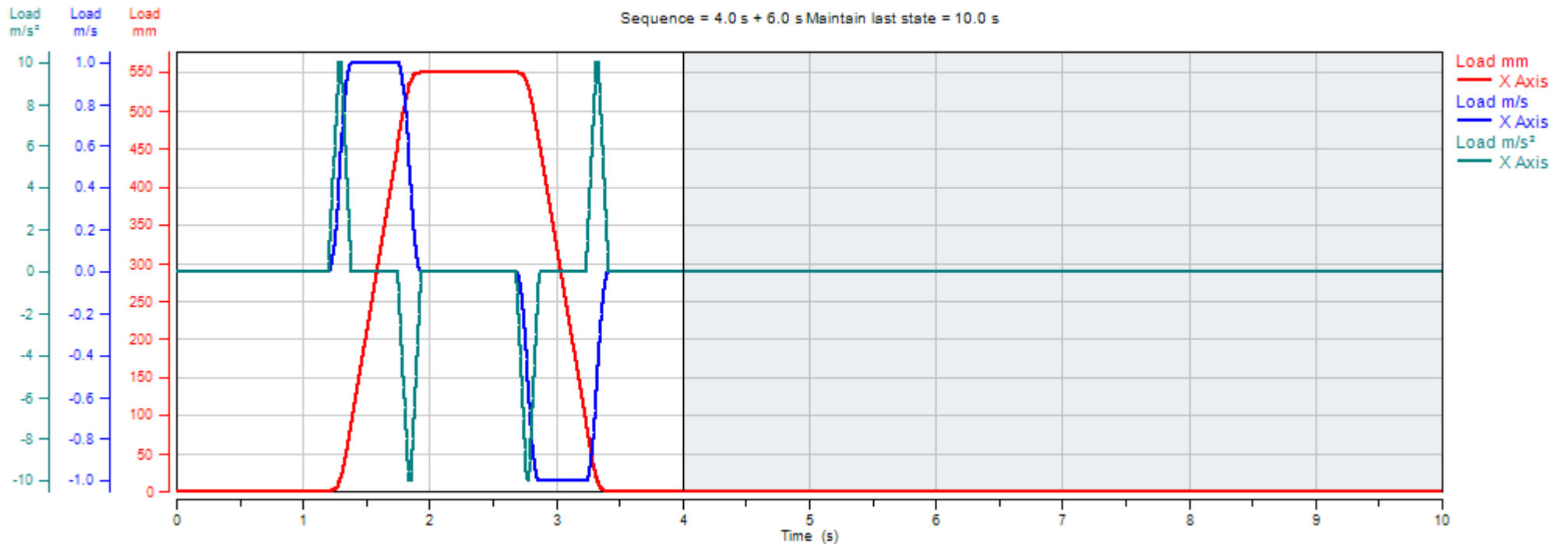
C = Critical W = Warning I = Information

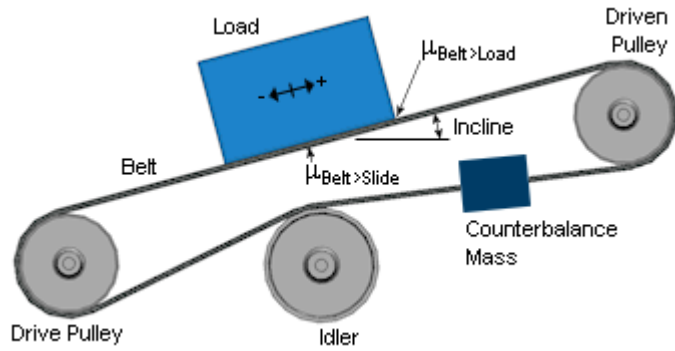
Type	Axis	Description	Stage	Alarm	Value		Limit	Units
I	-	System	System	Shorter sequences: Maintain last state				
W	1	X Axis	T1: Gearbox	Gearbox max output torque could be exceeded if available motor max torque is applied	210	>	90	Nm
W	1	X Axis	T1: Gearbox	Gearbox output shaft load values are different than the calculated values.				
W	2	Y Axis	T1: Gearbox	Gearbox max output torque could be exceeded if available motor max torque is applied	210.6	>	180	Nm
W	2	Y Axis	T1: Gearbox	Gearbox output shaft load values are different than the calculated values.				
W	3	Z Axis	T1: Gearbox	Gearbox max output torque could be exceeded if available motor max torque is applied	351	>	250	Nm
W	3	Z Axis	T1: Gearbox	Gearbox output shaft load values are different than the calculated values.				

Energy: \$ 4,427 /10 years	Units	X Axis	Y Axis	Z Axis
Axis energy cost			\$ 2,218 /10 years	\$ 2,218 /10 years
Supply			400V 3Ø	400V 3Ø
RMS power	W		1,411	1,411
Total cont power	W		462	462
Net cont power	W		462	462
Peak power	W		8,797	8,797
Bus [Shared Bus]			LF [25°C, 1000m] = 1	LF [25°C, 1000m] = 1
Output cont power	W		14,960 / 448 / 97.0%	14,960 / 448 / 97.0%
Output peak power	W		27,280 / 8,533 / 68.7%	27,280 / 8,533 / 68.7%
Regen cont power	W			
Regen peak power	W			
Pxt	%		3.112	3.112
Inverter				
Output cont power	W	59.4	436	612
Output peak power	W	2,057	16,554	11,696
Regen cont power	W	13.11	187.1	262.0
Regen peak power	W	879	9,239	6,721
Ixt	%	1.909	27.14	12.31
Bleeder			LF [25°C, 1000m] = 1	LF [25°C, 1000m] = 1
Cont power	W		1,400 / 149.9 / 89.3%	0 / 0 / 0%
Peak power	W		14,000 / 6,487 / 53.7%	0 / 0 / 0%
Energy dissipation	Ws		140,000 / 820 / 99.4%	0 / 0 / 0%



No.	Description	Type	Start Time (s)	Duration (s)	Distance (mm)	Start Vel (m/s)	End Vel (m/s)	Acceleration (m/s ²)	Jerk (m/s ³)	Payload (kg)	Thrust (N)
1	Dwell	Dwell	0	1.2	0	0	0	0	0	0	0
2	Move to drop	Linear	1.2	0.18333	91.67	0	1	10	120	5	50
			1.3833	0.3667	366.7	1	1	0	0	5	100
			1.75	0.18333	91.67	1	0	-10	120	5	50
			1.9333	0.75	0	0	0	0	0	5	0
3	Move to pick	Linear	2.6833	0.18333	-91.67	0	-1	-10	-120	0	50
			2.8667	0.3667	-366.7	-1	-1	0	0	0	100
			3.233	0.18333	-91.67	-1	0	10	120	0	50
			3.417	0.583	0	0	0	0	0	0	0



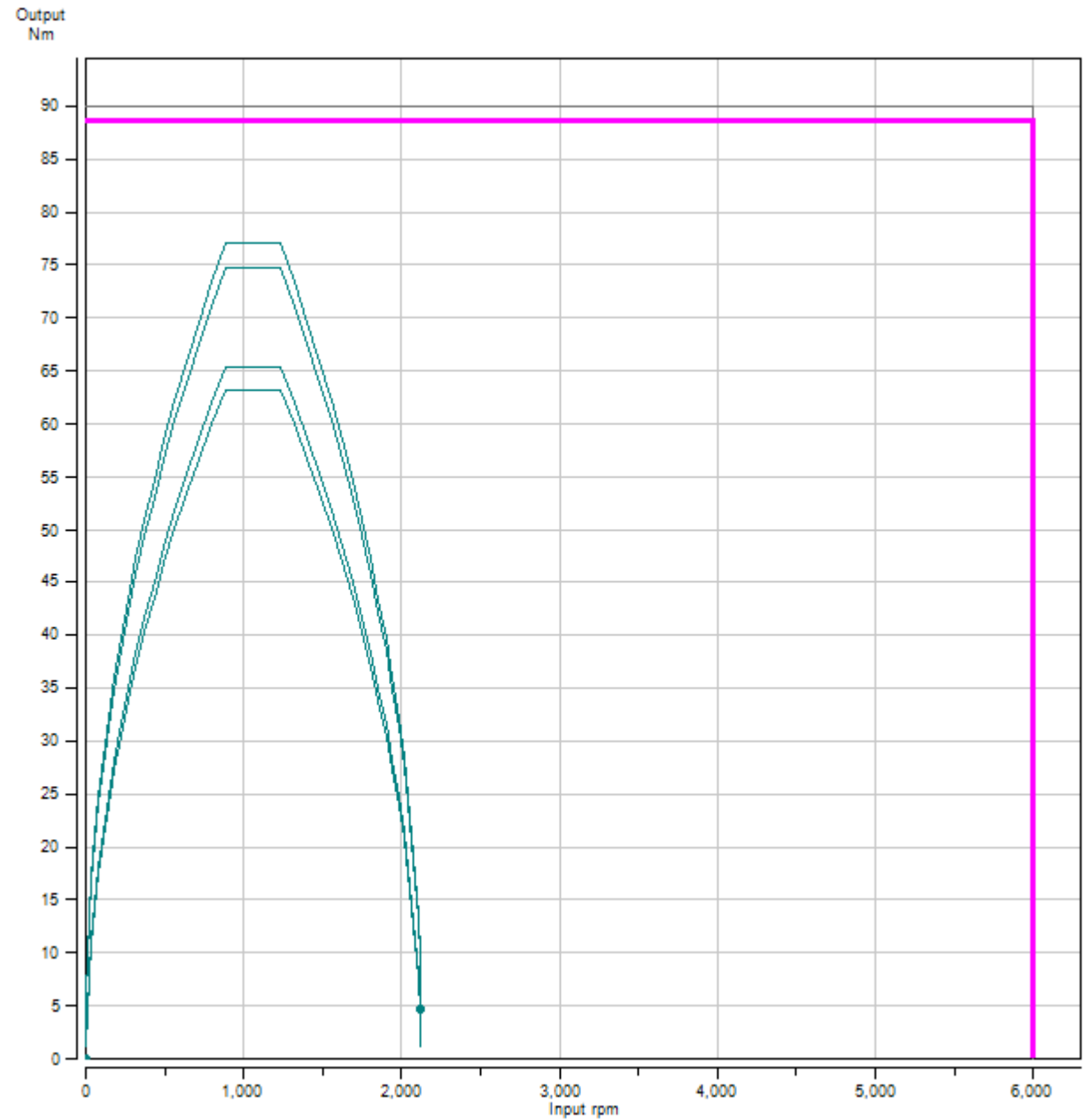


	Rated	Req'd	Margin
Cycle time		10.0 s	
Total travel distance		550 mm	
Velocity		1 m/s	
Acceleration		10 m/s ²	
Deceleration		10 m/s ²	
Drive pulley output torque	0	72.6 Nm	0%
Belt tensile force	0	3,226 N	0%
Rigidity at input		0 Nm/arcmin	

Max load (Load + Payload)	155 kg
Max thrust	100 N
Counterbalance mass	0 kg
Counterbalance force	0 N
Efficiency	95 %
Incline	0 °
Drive pulley radius	45 mm
Drive pulley inertia	0.003043 kg-m ²
Driven pulley radius	45 mm
Driven pulley inertia	0.001047 kg-m ²
Idler radius	30 mm
Idler inertia	0.0002415 kg-m ²
Belt mass	0.5 kg
Belt rigidity	0 N/m
Belt preload	100 %

T1: GEARBOX: Alpha SP075S-MF1-10-0G1

	Rated	Req'd	Margin
Type	Planetary Coaxial		
Input/Output	Hollow / Shaft		
Ratio	10	:1	
Stages	1		
Torque LF		1	
Speed LF [0°C, 0m]		1	
Max output torque	88.6	77.1 Nm	12.99%
Max-Stop output torque	200	Nm	
Max input speed	6,000	2,122 rpm	64.6%
Nominal output torque	52	33.4 Nm	
Mean input speed		233.4 rpm	
Duty Cycle	60	14.58 %	
Efficiency	97	%	
Inertia	0.000191	kg-m ²	
Inertia mismatch		2.638 :1	
Backlash - Standard	4	arcmin	
Backlash - Reduced	2	arcmin	
No load running torque	0.6	Nm	
Gearbox life L10h	0	0 h	
Max input shaft dia	24	19 mm	

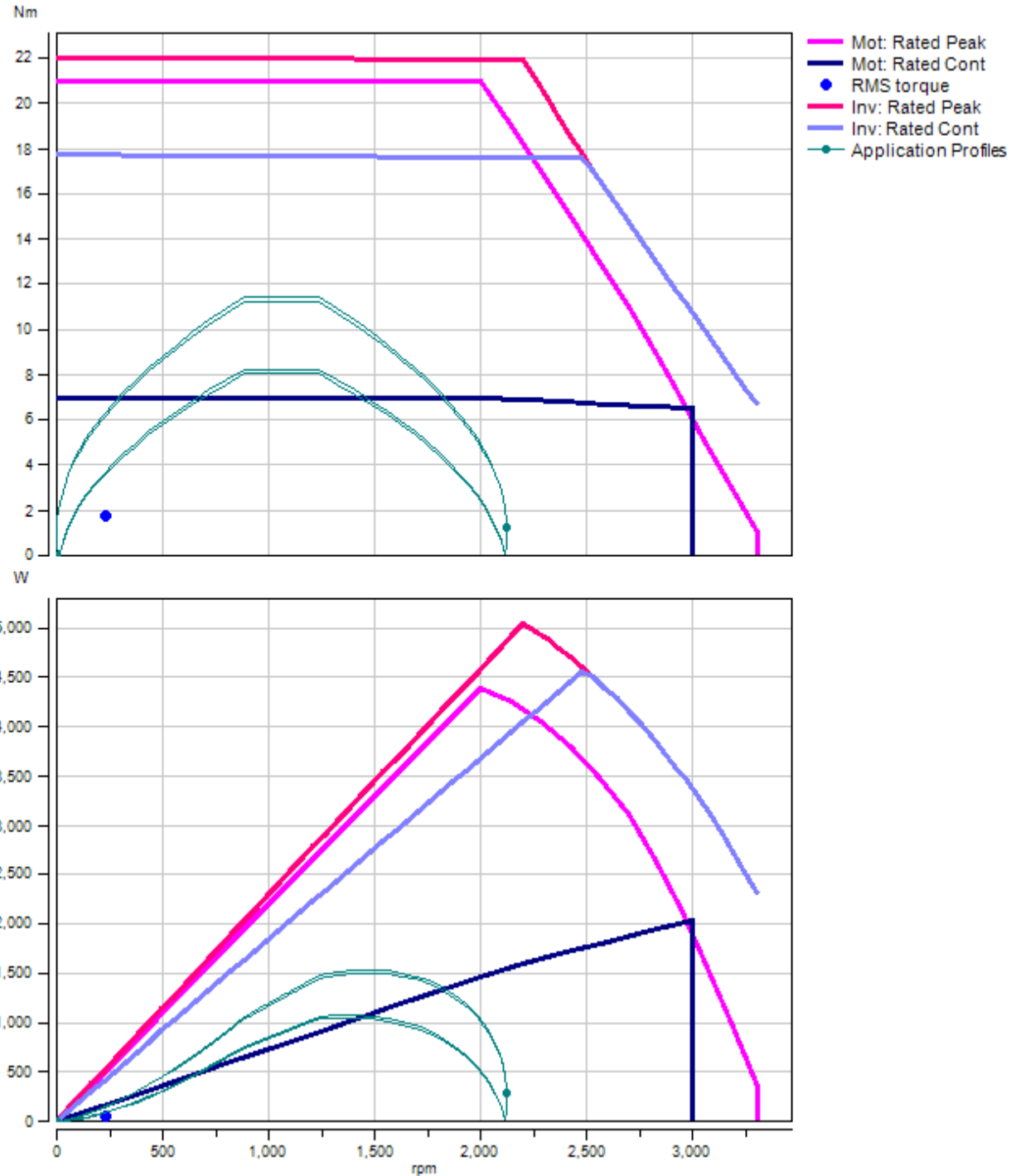


DRIVE: Baumüller BM4423-STx-2

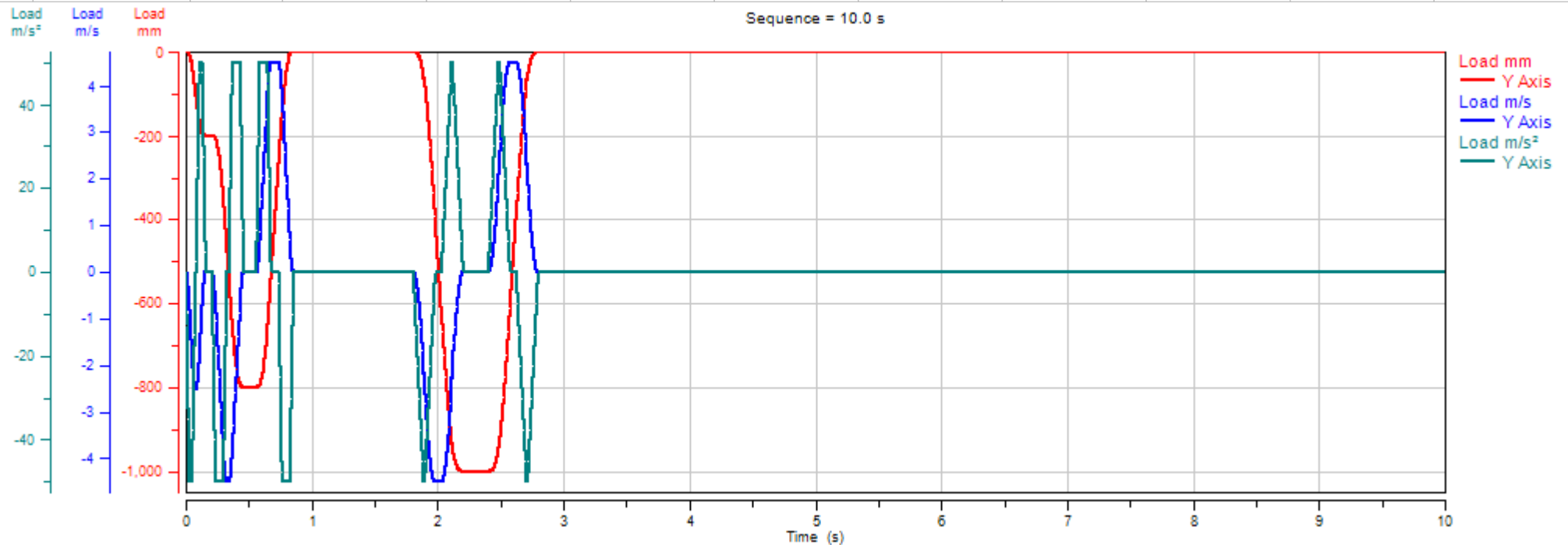
	Rated	Req'd	Margin
Type	Inverter		
LF [25°C, 1000m, 540V]	1		
Bus voltage	540	328 V	39.3%
PWM Frequency	4	kHz	
Max current	22	6.87 A	68.8%
Cont current	11	1.034 A	90.6%
Ixt		1.909 %	

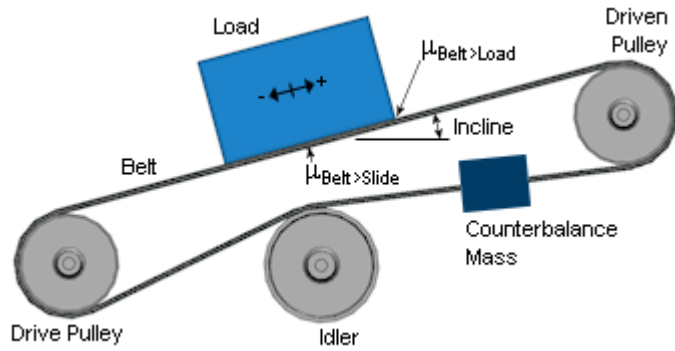
MOTOR: Baumüller DS56M35

	Rated	Req'd	Margin
Type	Synchronous servo motor		
Cooling	Natural convection [105K]		
LF [25°C, 1000m]		1	
Bus voltage	540	328 V	
Cont standstill torque	7	Nm	
Max torque	22	11.43 Nm	45.6%
Max current	14.3	6.87 A	
Torque constant	1.71	Nm/A	
Max speed	3,300	2,122 rpm	
RMS torque	7	1.728 Nm	75.3%
Mean speed		233.4 rpm	
Inertia	0.00102	kg-m ²	
Dwell torque		0 Nm	
Shaft diameter	19	mm	
I _{pt}		24.68 %	
Inertia mismatch		3.32 : 1	



No.	Description	Type	Start Time (s)	Duration (s)	Distance (mm)	Start Vel (m/s)	End Vel (m/s)	Acceleration (m/s ²)	Jerk (m/s ³)	Payload (kg)	Thrust (N)
1	Move to wait	Linear	0	0.07778	-97.22	0	-2.5	-50	-1,800	0	100
			0.07778	0.0022222	-5.556	-2.5	-2.5	0	0	0	200
			0.08	0.07778	-97.22	-2.5	0	50	1,800	0	100
			0.15778	0.05	0	0	0	0	0	0	100
2	Move down to pick	Linear	0.20778	0.11778	-265	0	-4.5	-50	-1,800	0	100
			0.3256	0.015556	-70	-4.5	-4.5	0	0	0	200
			0.3411	0.11778	-265	-4.5	0	50	1,800	0	100
			0.4589	0.1	0	0	0	0	0	0	100
3	Move up from pick	Linear	0.5589	0.11778	265	0	4.5	50	1,800	5	100
			0.6767	0.06	270	4.5	4.5	0	0	5	200
			0.7367	0.11778	265	4.5	0	-50	-1,800	5	100
			0.8544	0.95	0	0	0	0	0	5	100
4	Move down to drop	Linear	1.8044	0.17333	-390	0	-4.5	-50	-600	5	100
			1.9778	0.04889	-220	-4.5	-4.5	0	0	5	200
			2.0267	0.17333	-390	-4.5	0	50	600	5	100
			2.2	0.2	0	0	0	0	0	5	100
5	Move up from drop	Linear	2.4	0.17333	390	0	4.5	50	600	0	100
			2.5733	0.04889	220	4.5	4.5	0	0	0	200
			2.6222	0.17333	390	4.5	0	-50	-600	0	100
			2.7956	7.204	0	0	0	0	0	0	100



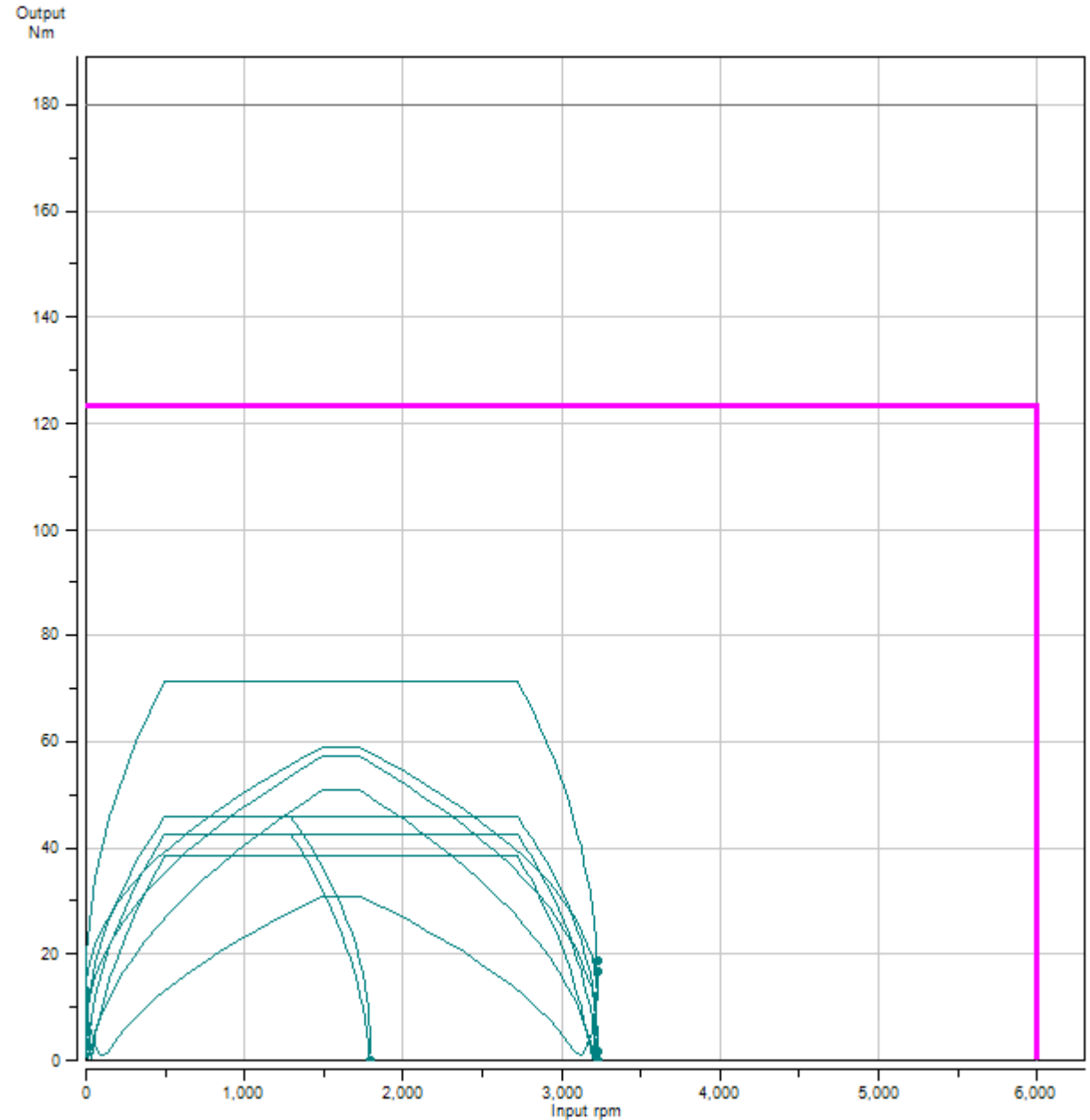


	Rated	Req'd	Margin
Cycle time		10.0 s	
Total travel distance		1,000 mm	
Velocity		4.5 m/s	
Acceleration		50 m/s ²	
Deceleration		50 m/s ²	
Drive pulley output torque	0	66.0 Nm	0%
Belt tensile force	0	3,302 N	0%
Rigidity at input		0 Nm/arcmin	

Max load (Load + Payload)	25 kg
Max thrust	-200 N
Counterbalance mass	0 kg
Counterbalance force	0 N
Efficiency	95 %
Incline	90 °
Drive pulley radius	40 mm
Drive pulley inertia	0.001618 kg-m ²
Driven pulley radius	40 mm
Driven pulley inertia	0.000557 kg-m ²
Idler radius	30 mm
Idler inertia	0.0002415 kg-m ²
Belt mass	0.5 kg
Belt rigidity	0 N/m
Belt preload	100 %

T1: GEARBOX: Alpha SP100S-MC1-3-0G1

	Rated	Req'd	Margin
Type	Planetary Coaxial		
Input/Output	Hollow / Shaft		
Ratio	3	:1	
Stages	1		
Torque LF		1	
Speed LF [0°C, 0m]		1	
Max output torque	123.3	71.5 Nm	42.0%
Max-Stop output torque	500	Nm	
Max input speed	6,000	3,223 rpm	46.3%
Nominal output torque	70	36.8 Nm	
Mean input speed		257.8 rpm	
Duty Cycle	60	14.83 %	
Efficiency	98.5	%	
Inertia	0.000399	kg-m ²	
Inertia mismatch		0.781 :1	
Backlash - Standard	4	arcmin	
Backlash - Reduced	2	arcmin	
No load running torque	2.4	Nm	
Gearbox life L10h	0	0 h	
Max input shaft dia	24	24 mm	

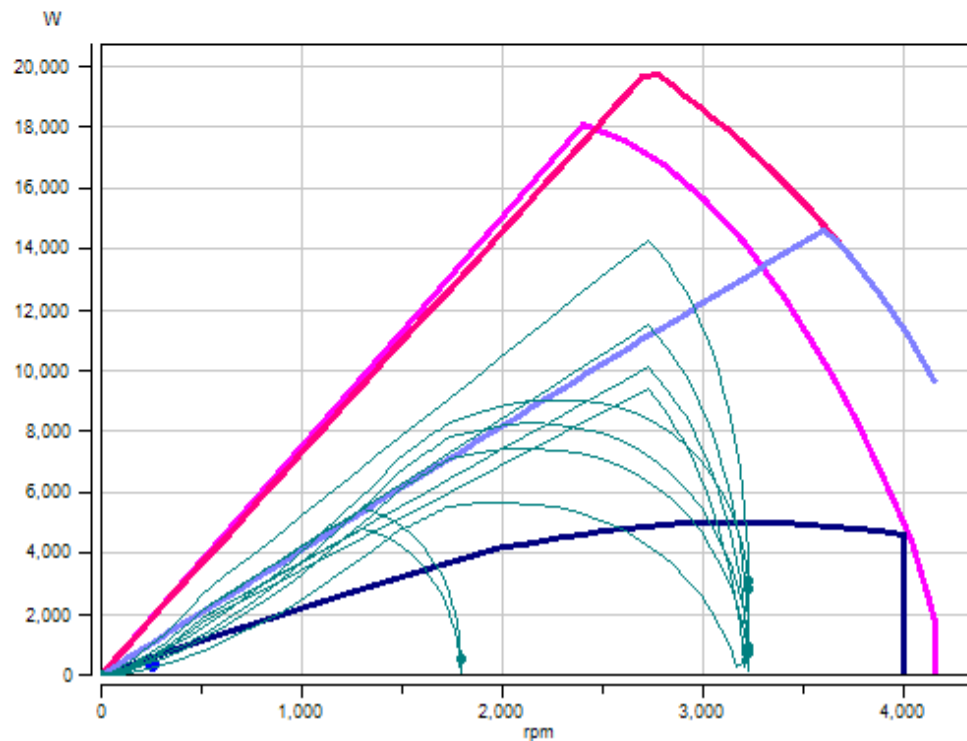
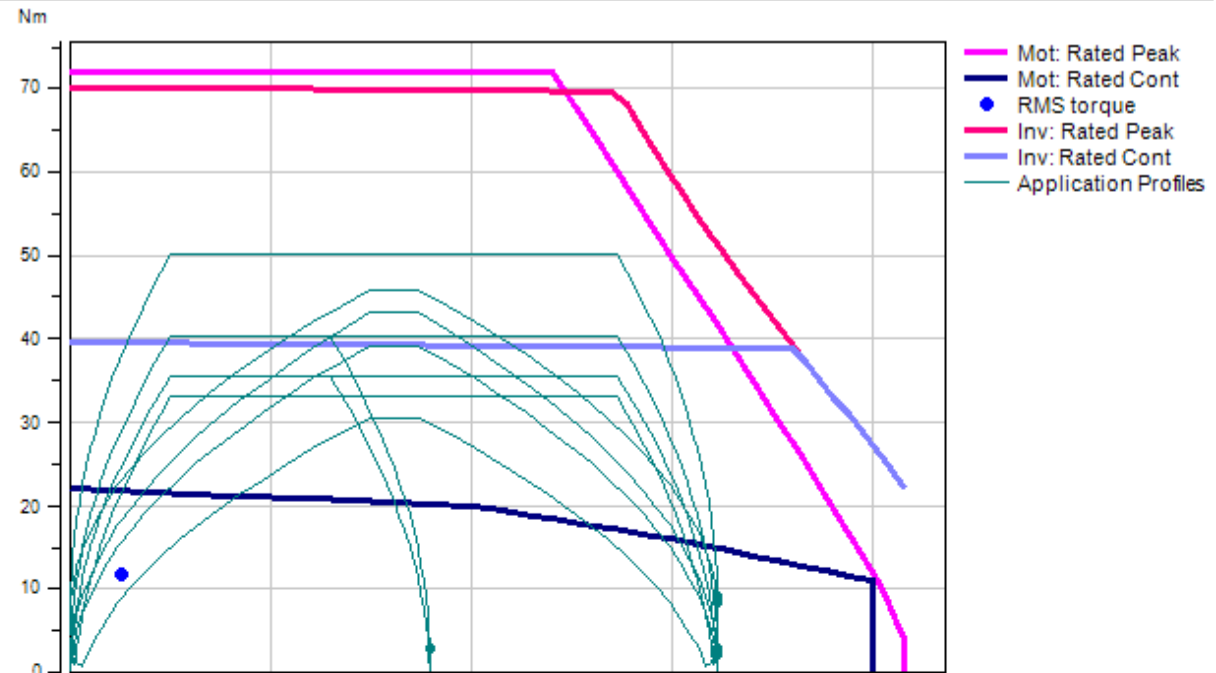


DRIVE: Baumüller BM4433-Six

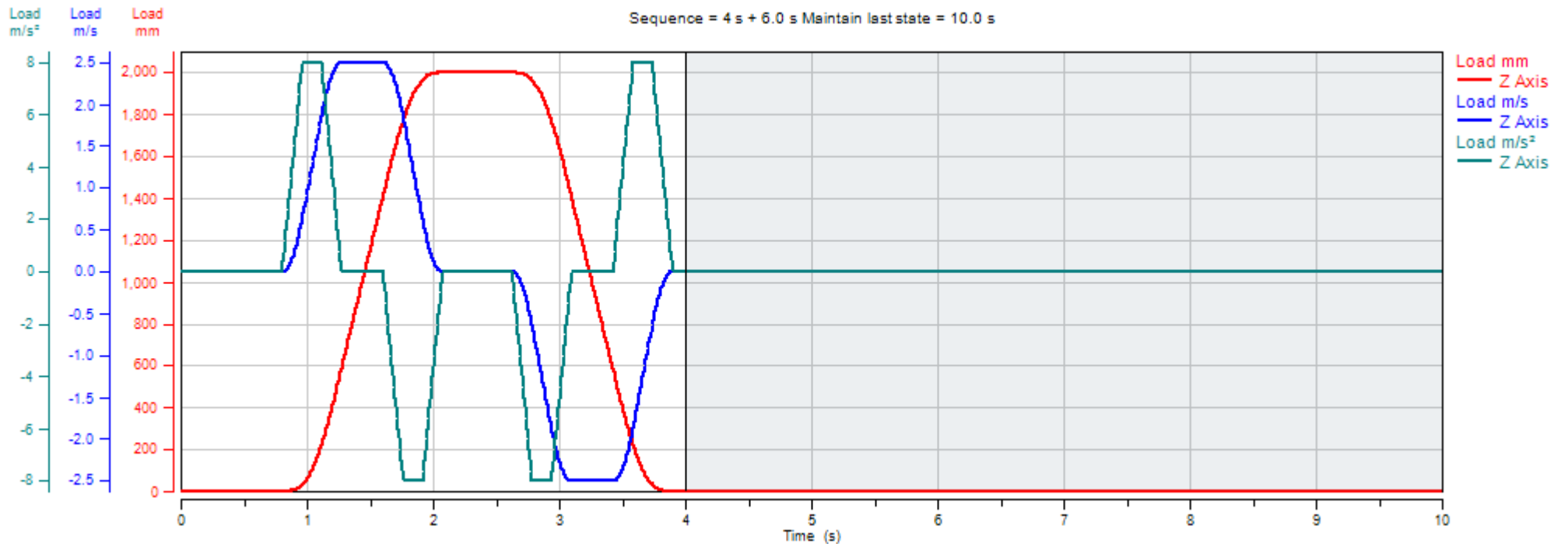
	Rated	Req'd	Margin
Type	Infeed / Inverter / Chopper		
LF [25°C, 1000m, 540V]	1		
Bus voltage	540	457 V	15.4%
PWM Frequency	4	kHz	
Max current	60	39.5 A	34.2%
Cont current	30	8.91 A	70.3%
Ixt		27.14 %	

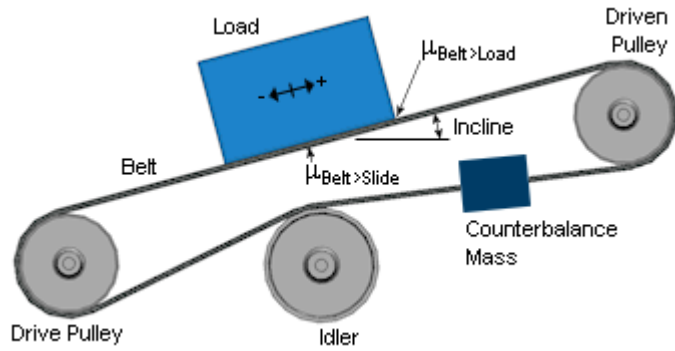
MOTOR: Baumüller DS71M45

	Rated	Req'd	Margin
Type	Synchronous servo motor		
Cooling	Natural convection [105K]		
LF [25°C, 1000m]		1	
Bus voltage	540	457 V	
Cont standstill torque	22	Nm	
Max torque	72.5	50.1 Nm	16.37%
Max current	63.1	39.5 A	
Torque constant	1.37	Nm/A	
Max speed	4,150	3,223 rpm	
RMS torque	21.74	11.8 Nm	45.7%
Mean speed		257.8 rpm	
Inertia	0.00502	kg-m ²	
Brake inertia	0.00076	kg-m ²	
Brake holding torque	20	6.71 Nm	66.5%
Shaft diameter	24	mm	
I _{pt}		54.3 %	
Inertia mismatch		1.192 : 1	



No.	Description	Type	Start Time (s)	Duration (s)	Distance (mm)	Start Vel (m/s)	End Vel (m/s)	Acceleration (m/s ²)	Jerk (m/s ³)	Payload (kg)	Thrust (N)
1	Dwell	Dwell	0	0.8	0	0	0	0	0	5	0
2	Move to drop	Linear	0.8	0.4725	590.6	0	2.5	8	50	5	175
			1.2725	0.3275	818.8	2.5	2.5	0	0	5	250
			1.6	0.4725	590.6	2.5	0	-8	-50	5	175
			2.0725	0.55	0	0	0	0	0	5	0
3	Move to pick	Linear	2.6225	0.4725	-590.6	0	-2.5	-8	-50	0	175
			3.095	0.3275	-818.8	-2.5	-2.5	0	0	0	250
			3.423	0.4725	-590.6	-2.5	0	8	50	0	175
			3.895	0	0	0	0	0	0	0	0
4	Dwell	Dwell	3.895	0.105	0	0	0	0	0	0	0



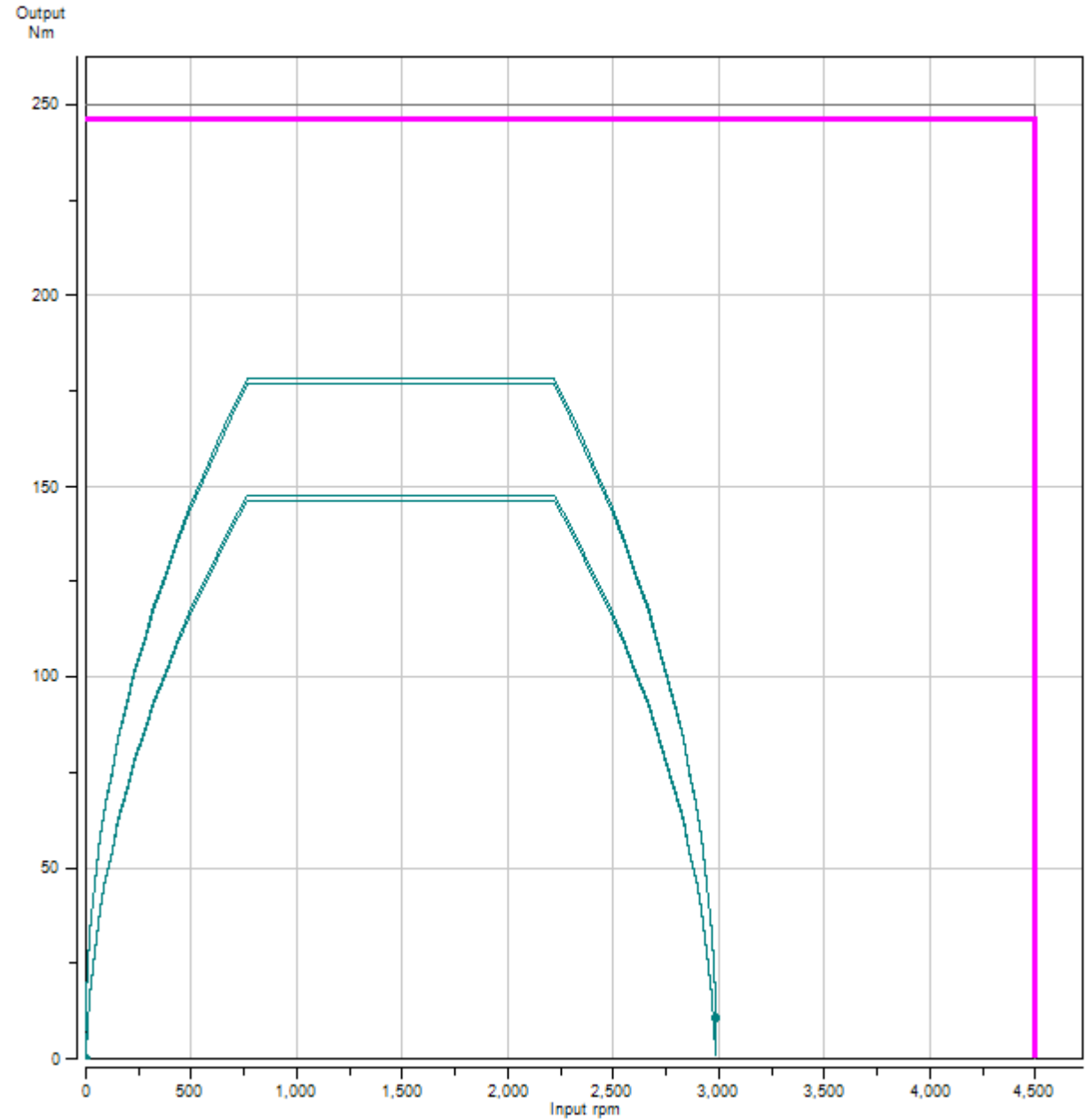


	Rated	Req'd	Margin
Cycle time		10.0 s	
Total travel distance		2,000 mm	
Velocity		2.5 m/s	
Acceleration		8 m/s ²	
Deceleration		8 m/s ²	
Drive pulley output torque	0	169.2 Nm	0%
Belt tensile force	0	8,459 N	0%
Rigidity at input		0 Nm/arcmin	

Max load (Load + Payload)	505 kg
Max thrust	250 N
Counterbalance mass	0 kg
Counterbalance force	0 N
Efficiency	95 %
Incline	0 °
Drive pulley radius	40 mm
Drive pulley inertia	0.00148 kg-m ²
Driven pulley radius	40 mm
Driven pulley inertia	0.000509 kg-m ²
Idler radius	40 mm
Idler inertia	0 kg-m ²
Belt mass	1.5 kg
Belt rigidity	0 N/m
Belt preload	100 %

T1: GEARBOX: Alpha SP100-MF1-5-031

	Rated	Req'd	Margin
Type	Planetary Coaxial		
Input/Output	Hollow / Shaft		
Ratio	5	:1	
Stages	1		
Torque LF		1	
Speed LF [0°C, 0m]		1	
Max output torque	246.1	178.4 Nm	27.5%
Max-Stop output torque	625	Nm	
Max input speed	4,500	2,984 rpm	33.7%
Nominal output torque	170	108.4 Nm	
Mean input speed		477 rpm	
Duty Cycle	60	25.29 %	
Efficiency	97	%	
Inertia	0.00024	kg-m ²	
Inertia mismatch		6.18 :1	
Backlash - Standard	4	arcmin	
Backlash - Reduced	2	arcmin	
No load running torque	1.5	Nm	
Gearbox life L10h	0	0 h	
Max input shaft dia	24	24 mm	

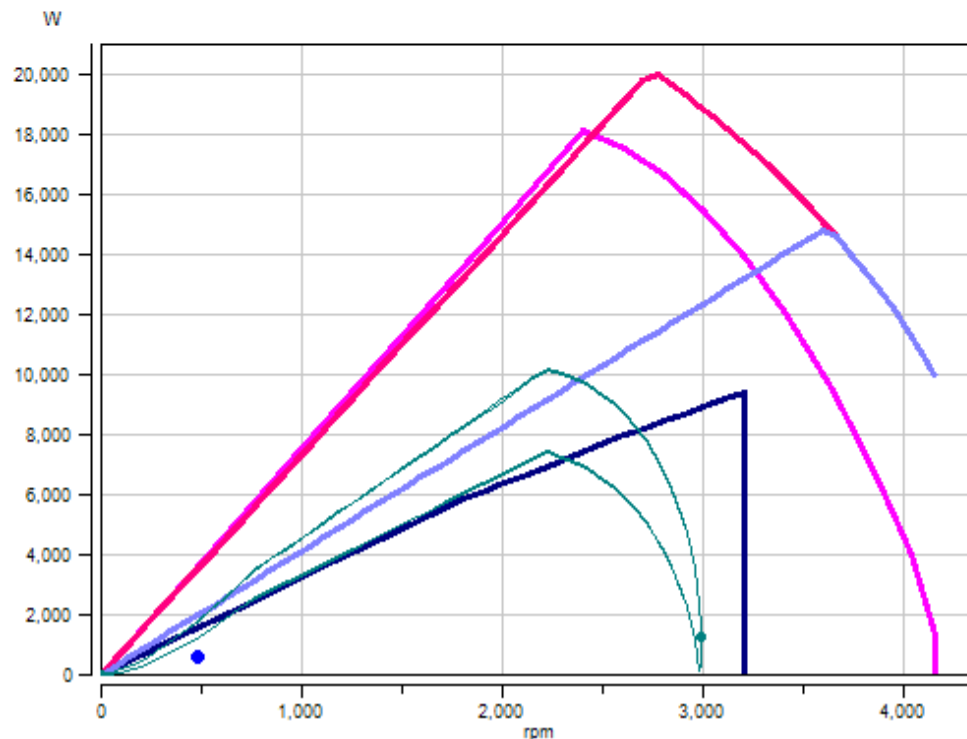
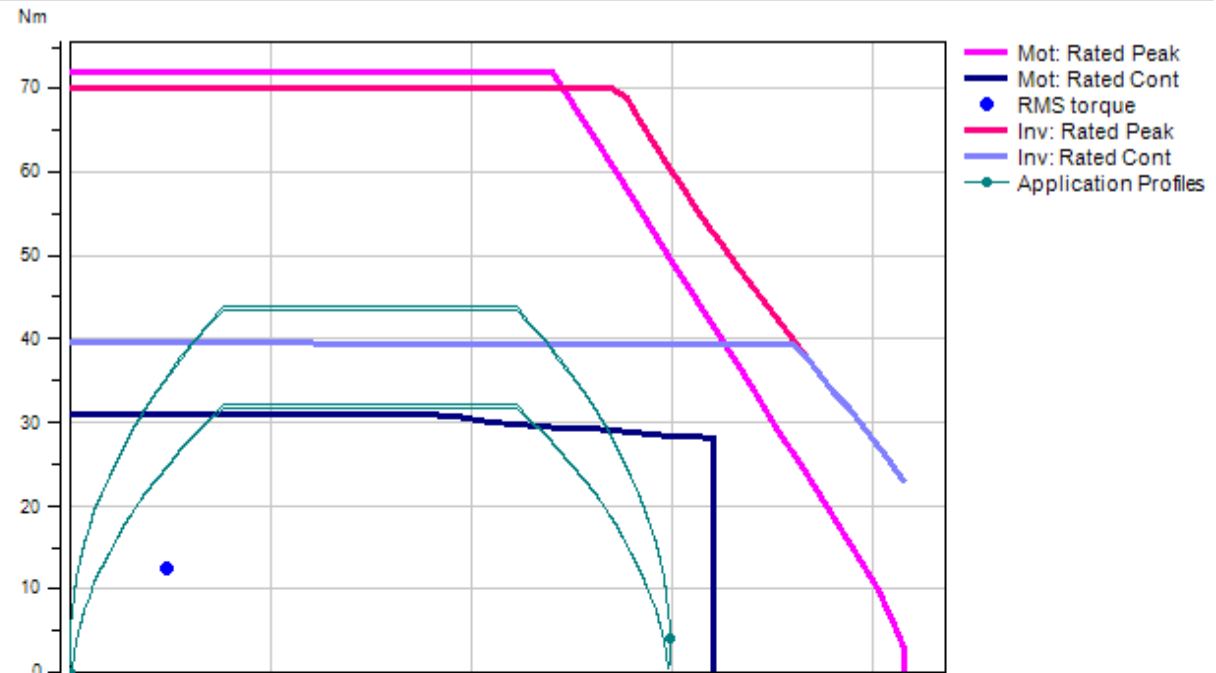


DRIVE: Baumüller BM4433-Six

	Rated	Req'd	Margin
Type	Infeed / Inverter / Chopper		
LF [25°C, 1000m, 540V]	1		
Bus voltage	540	372 V	31.16%
PWM Frequency	4	kHz	
Max current	60	33.7 A	43.8%
Cont current	30	9.41 A	68.6%
Ixt		12.31 %	

MOTOR: Baumüller DSO71M45

	Rated	Req'd	Margin
Type	Synchronous servo motor		
Cooling	Forced air [105K]		
LF [25°C, 1000m]		1	
Bus voltage	540	372 V	
Cont standstill torque	31	Nm	
Max torque	72.5	43.9 Nm	39.1%
Max current	63.1	33.7 A	
Torque constant	1.37	Nm/A	
Max speed	4,150	2,984 rpm	
RMS torque	31	12.43 Nm	59.9%
Mean speed		477 rpm	
Inertia	0.00502	kg-m ²	
Dwell torque		0 Nm	
Shaft diameter	24	mm	
I _{pt}		40.1 %	
Inertia mismatch		6.52 : 1	



Axis	Type	Vendor	Model	Qty	Description
1: X Axis	Inverter	Baumuelller	BM4423-STx-2	1	Inverter: 4 kHz, 11 A cont, 22 A peak
1: X Axis	Motor	Baumuelller	DS56M35	1	Synchronous servo motor, Natural convection, TMax = 22 Nm, IMax = 14.3 A, nMax = 3,300 rpm, kto = 1.71 Nm/A, To = 7 Nm, dT = 105 K, d = 19 mm shaft dia
1: X Axis	T1: Gearbox	Alpha	SP075S-MF1-10-0G1	1	Planetary Coaxial, T2Max = 90 Nm, n1Max = 6,000 rpm, i = 10:1, s = 1, Backlash - Standard 4 arcmin, 97% Efficiency, J = 0.000191 kg-m ² , d1max = 24 mm input shaft dia, Typ1 = Hollow, Typ2 = Shaft
2: Y Axis	Bleeder Module	Baumuelller	R44-1400-20-TS	1	Resistors, 1,400 W avg, 14,000 W peak, 140,000 Ws, 44
2: Y Axis	Infeed / Inverter / Chopper	Baumuelller	BM4433-Slx	1	Supply: 230 - 480Vac +/-10%, 50/60Hz, 3-Ø Bus: 14,960 W cont, 27,280 W peak Inverter: 4 kHz, 30 A cont, 60 A peak Chopper: 10,000 W avg, 27,655 W peak, 36 A max
2: Y Axis	Motor with brake	Baumuelller	DS71M45	1	Synchronous servo motor, Natural convection, TMax = 72.5 Nm, IMax = 63.1 A, nMax = 4,150 rpm, kto = 1.37 Nm/A, To = 22 Nm, dT = 105 K, d = 24 mm shaft dia, 20 Nm holding brake
2: Y Axis	T1: Gearbox	Alpha	SP100S-MC1-3-0G1	1	Planetary Coaxial, T2Max = 180 Nm, n1Max = 6,000 rpm, i = 3:1, s = 1, Backlash - Standard 4 arcmin, 98.5% Efficiency, J = 0.000399 kg-m ² , d1max = 24 mm input shaft dia, Typ1 = Hollow, Typ2 = Shaft
3: Z Axis	Infeed / Inverter / Chopper	Baumuelller	BM4433-Slx	1	Supply: 230 - 480Vac +/-10%, 50/60Hz, 3-Ø Bus: 14,960 W cont, 27,280 W peak Inverter: 4 kHz, 30 A cont, 60 A peak Chopper: 10,000 W avg, 27,655 W peak, 36 A max
3: Z Axis	Motor	Baumuelller	DSO71M45	1	Synchronous servo motor, Forced air, TMax = 72.5 Nm, IMax = 63.1 A, nMax = 4,150 rpm, kto = 1.37 Nm/A, To = 31 Nm, dT = 105 K, d = 24 mm shaft dia

Axis	Type	Vendor	Model	Qty	Description
3: Z Axis	T1: Gearbox	Alpha	SP100-MF1-5-031	1	Planetary Coaxial, T2Max = 250 Nm, n1Max = 4,500 rpm, i = 5:1, s = 1, Backlash - Standard 4 arcmin, 97% Efficiency, J = 0.00024 kg-m ² , d1max = 24 mm input shaft dia, Typ1 = Hollow, Typ2 = Shaft