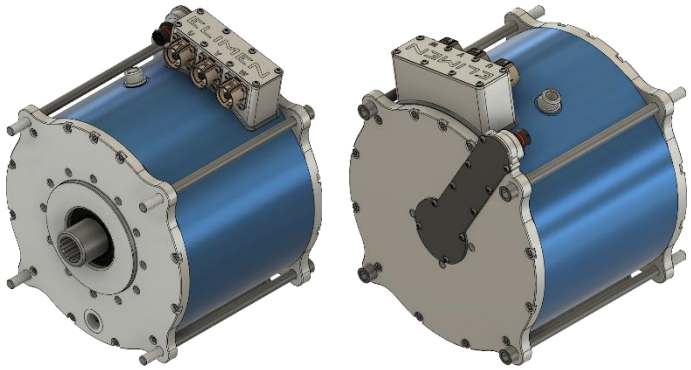
Permanent Magnet Switched Reluctance Motor

PMSRM170 - L112S48P8T2PP1



- Rated for extreme motorsport conditions
- Up to 11 kW/kg constant S1 power density
- Intrinsically safe - induced voltage at max. speed
- VR Resolver position sensor for highest reliability
- Built in temperature sensor
- Low short circuit torque
- Up to 15 000 RPM

Motor data for systems:	**400VDC full battery 340VDC nominal 274VDC low bat loaded**			**740VDC full battery 616VDC nominal 508VDC low bat loaded**			VDC
Nominal Speed @VDC lowbat limit	5 350	5 030	4 735	10 000	9 440	8 888	RPM
S1 Mech. Power @VDC lowbat limit	170	211	250	318	395	469	kW
S1 Mech. Power @VDC nominal	211	261	310	385	479	570	kW
S1 RMS phase current	490	660	870	490	660	870	A
S1 torque @ 120*C out. oil	303	400	505	303	400	507	Nm
S1 torque coolant flow @ 60*C inp. oil	9	15.4	26	11.2	17.8	28.5	liters/min
Efficiency @S1 Power, VDC lowbat	97.48	96.59	95.25	98.32	97.88	97.17	%
Cos(φ) @S1 Power, VDC lowbat	0.929	0.867	0.791	0.928	0.864	0.785	--
S21torque @ 60*C inp. oil (peak time = flow/ system oil capac.)	600			600			Nm
Torque constant	0.618	0.606	0.580	0.618	0.606	0.580	Nm/A
Kv - Velocity constant	16.93	17.36	18.07	16.93	17.36	18.07	RPM/V
Ke - Back-EMF constant	0.564	0.550	0.528	0.564	0.550	0.528	V*s/rad
Inductance Id / Iq @S1 phase current	109 / 199	101 / 162	93.4 / 131	109 / 199	101 / 162	93.4 / 131	uH
End winding inductance @0.1Arms	2.75						uH
Phase resistance @ 140°C	5.18						mOhm
Max. Speed	1100 - NSx version 1500 - HSx version						RPM
Torque ripple	6			8			%

Other electrical data:

Number of pole pairs	4						--
Nominal frequency	284	266.6	250	533.3	504.6	471.3	Hz
Maximum frequency	733 - NSx version 1000 - HSx version						Hz

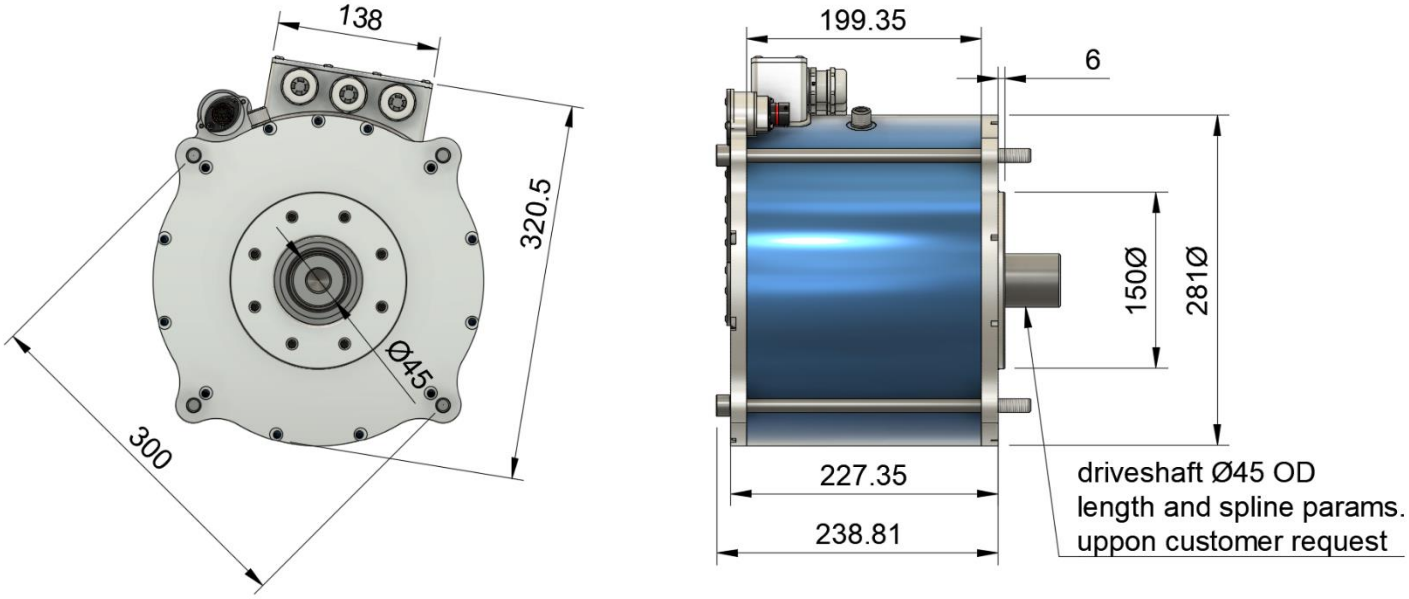
Cooling:

Coolant quantity in device	1	l
Coolant flow rate	2 - 30	l/min
Coolant outlet continuous max. temp	+120	°C
Temperature Rise Coefficient	490.32	$\frac{W * s}{K * liter}$
Input coolant temp. range.	-40 to +90	°C
Coolant type	ATF6 (Dextron 6)	--

Mechanical data:

Weight without coolant	54.2 - NSx 51.5 - HSx	kg
IP protection	IP67	--
Rotor inertia torque	0.06 – NSx 0.045 -HSx	kg*m^2
VR Resolver & T sensor connector	DEUTSCH AS012-98SN / SOURIAU 8STA01298SN	--

Basic dimensions* :

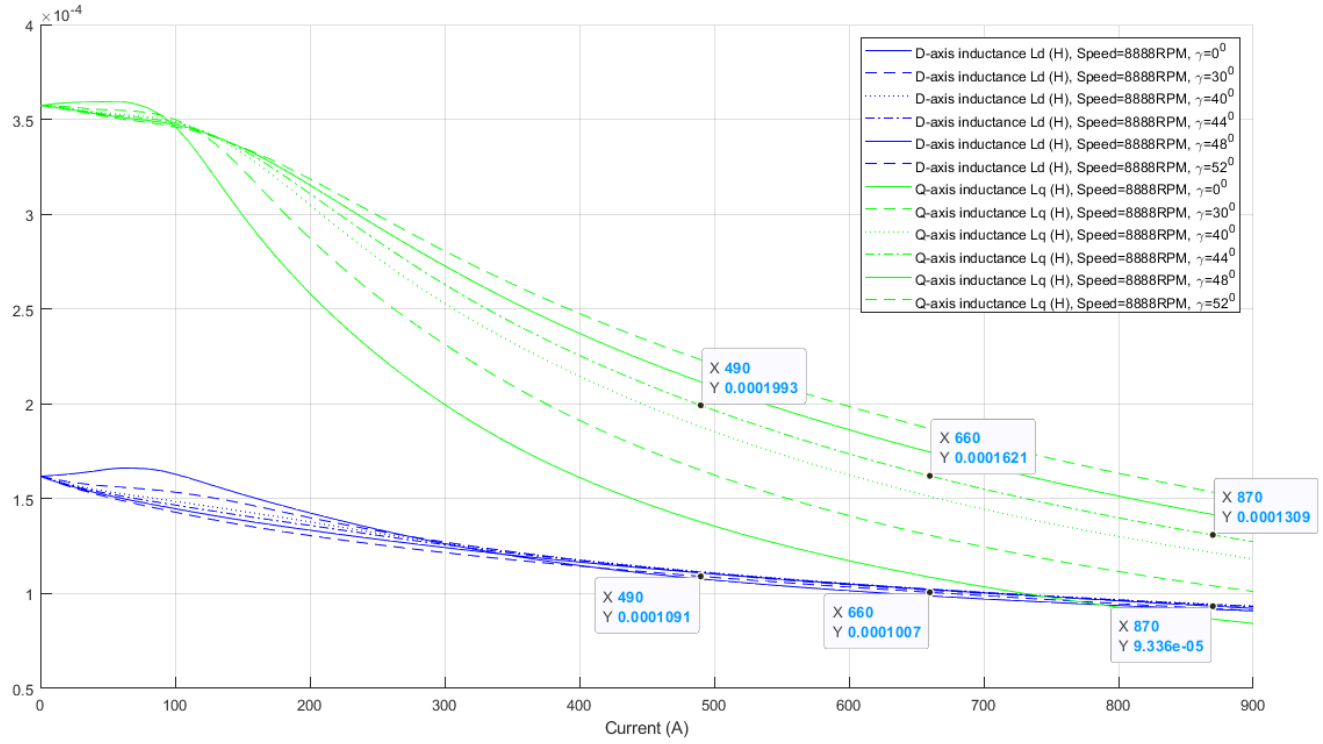


* Refer to PMSRM170-300X_drawing & PMSRM170-300X_3D.step for detailed mechanical documentation

Signal connector pinout :

DEUTSCH AS012-98SN / SOURIAU 8STA01298SN Connector									
1	2	3	4	5	6	7	8	9	10
EXC+	EXC-	SIN+	SIN-	COS+	COS-	HVIL_IN	HVIL_O	TEMP+	TEMP-
Variable Reluctance Resolver Interface						Interlock loop		Temperature sensor	

Inductance Ld/Lq :



Tips:

• To calculate inverter needed DC line voltage from characteristics use equation:

$$\frac{RMS\ Phase\ Voltage * \sqrt{2}\ *\ \sqrt{3}}{Max\ Inverter\ PWM} = needed\ DC\ Inverter\ voltage$$

• When third harmonic modulation in inverter enabled (default: enabled)

$$\frac{RMS\ Phase\ Voltage * \sqrt{2}\ *\ 3}{2 *\ Max\ Inverter\ PWM} = needed\ DC\ Inverter\ voltage$$

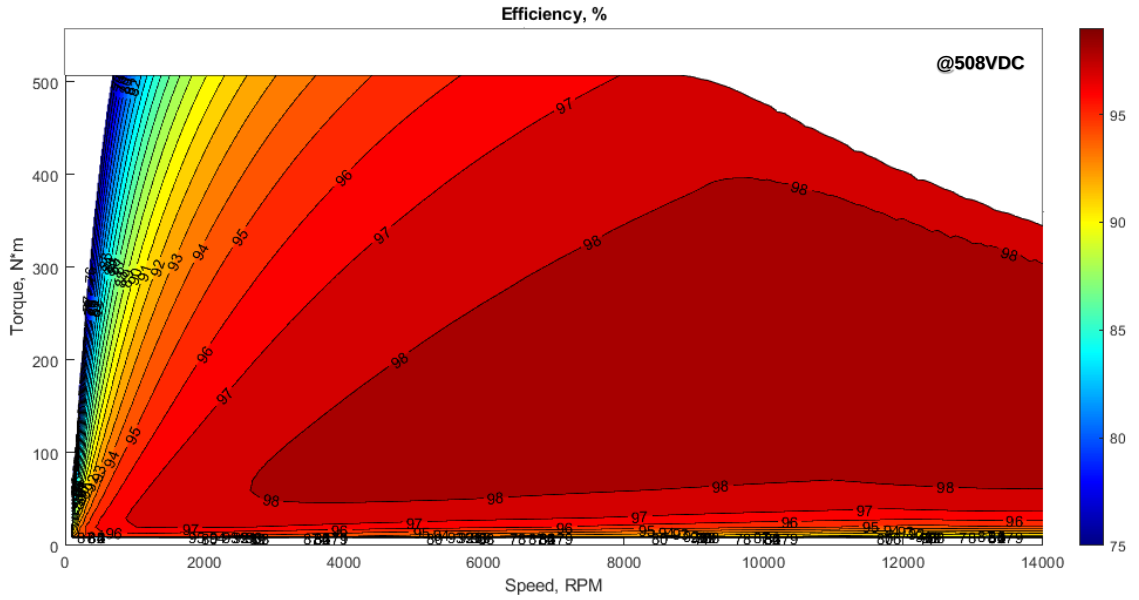
Max Inverter PWM = 0.98 for INV inverters IGBT family at 10kHz switching and SIC family at 20kHz

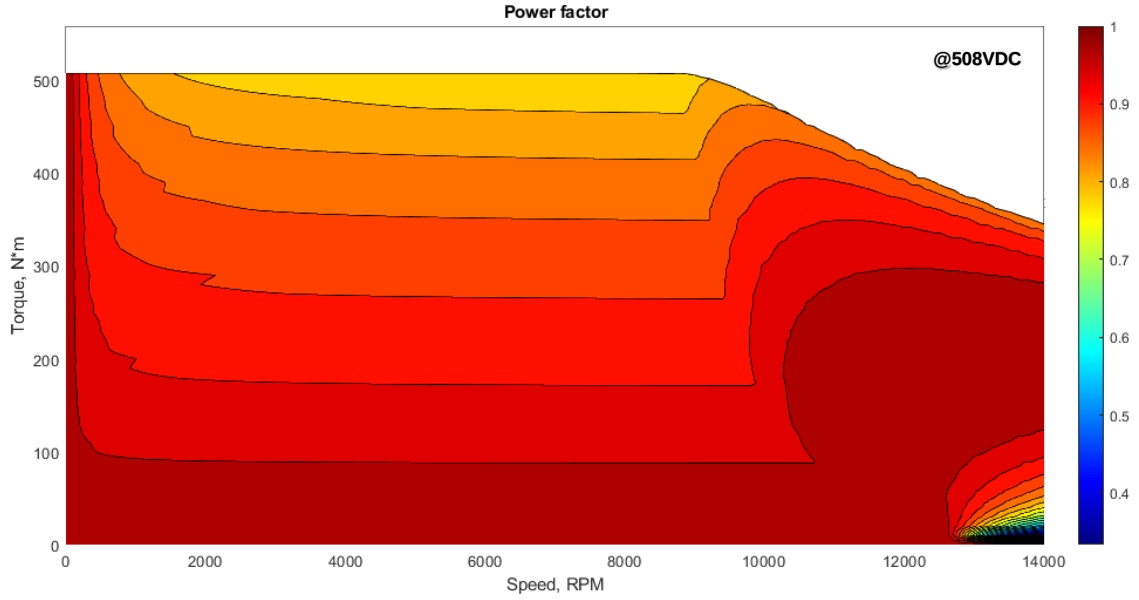
• To calculate needed coolant flow:

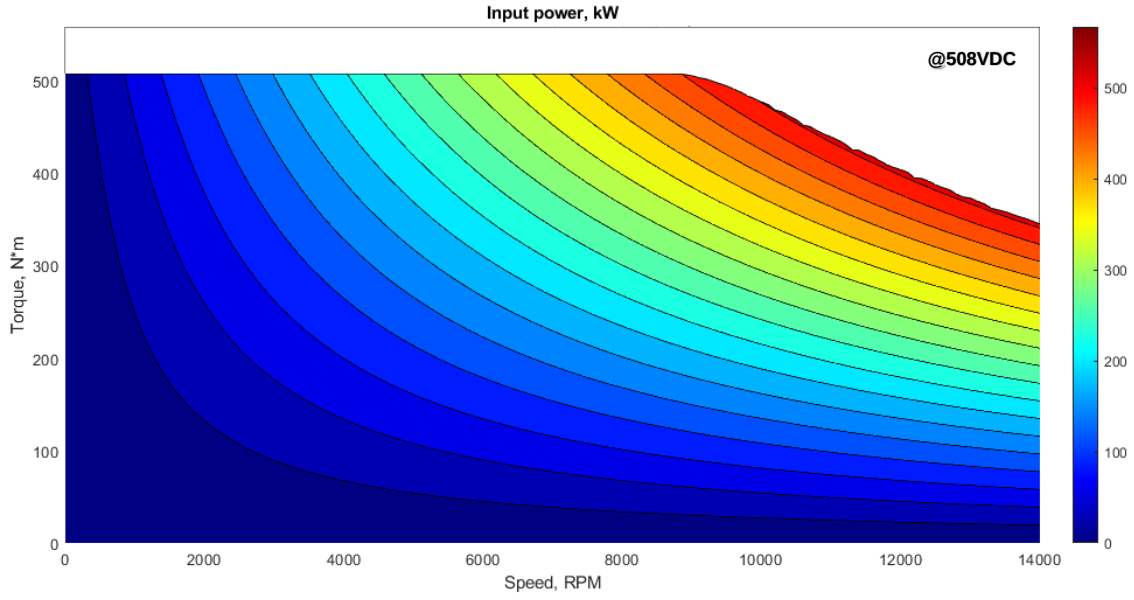
Calculate Energy losses at working point:

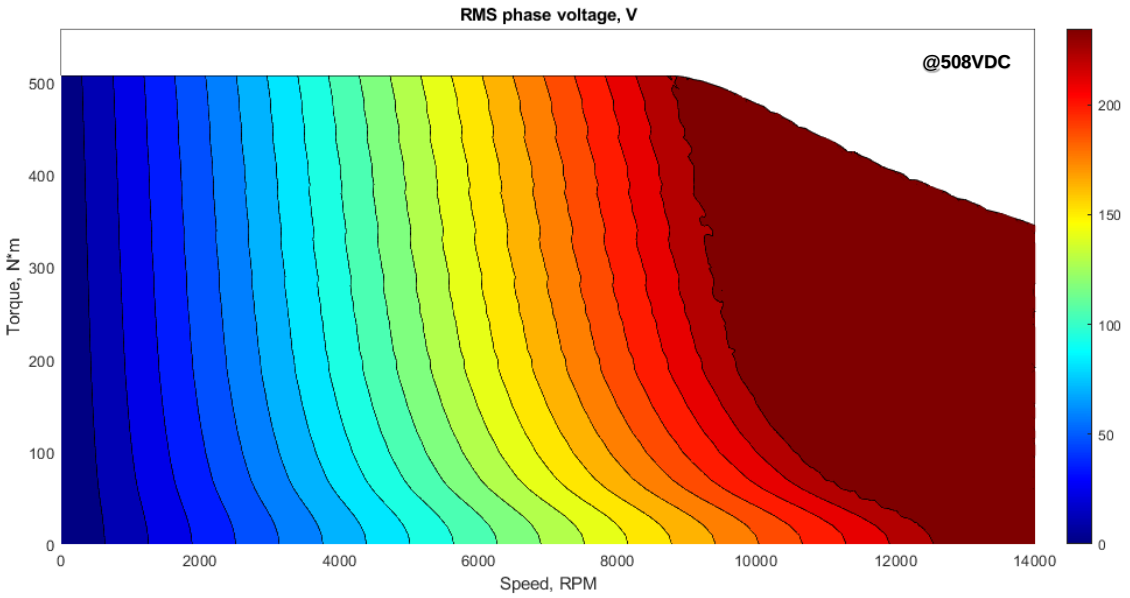
$$\left(\frac{100}{Efficiency[\%]} - 1\right) * Output\ Mechanical\ Power\ [W] = Energy\ Losses\ [W]$$

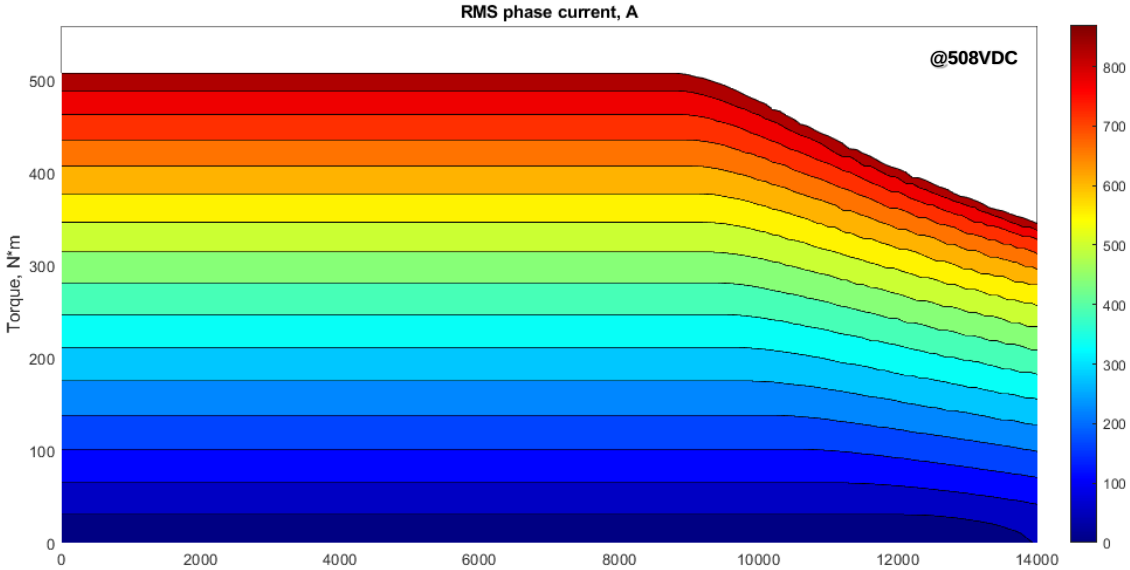
$$Coolant\ Outlet\ Temp\ [K] - \frac{Energy\ Losses\ [W]}{Temp\ Rise\ Coeff\ \left[\frac{W * s}{K * liter}\right] * Coolant\ Flow\ \left[\frac{liter}{s}\right]} = Coolant\ Inlet\ Temperature\ [K]$$

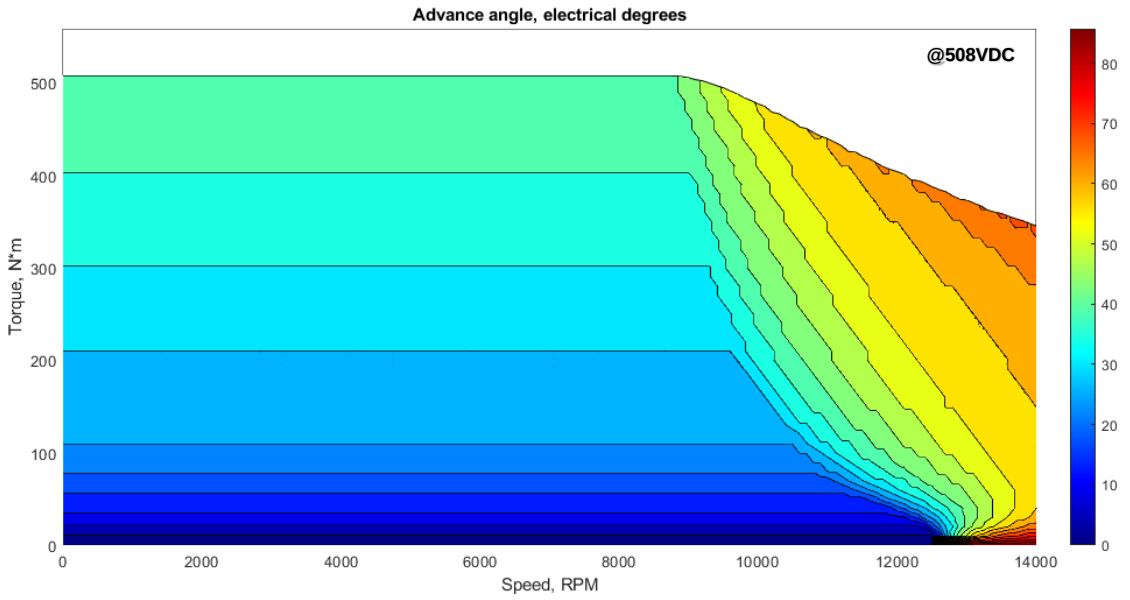

Efficiency, %
@508VDC
Torque, N*m
Speed, RPM

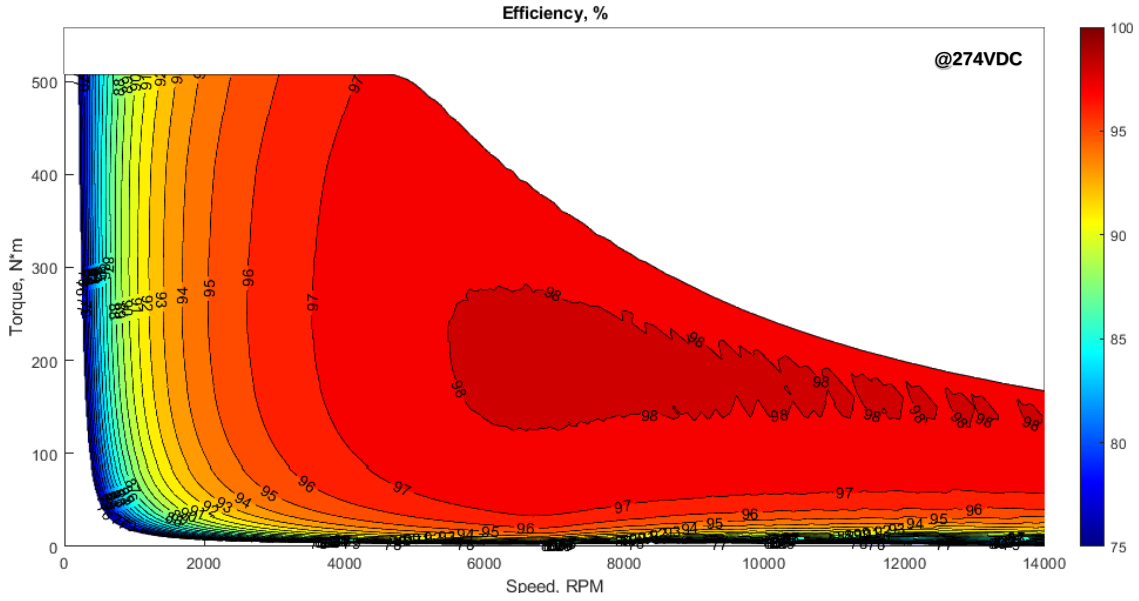

Power factor
@508VDC
Torque, N*m
Speed, RPM

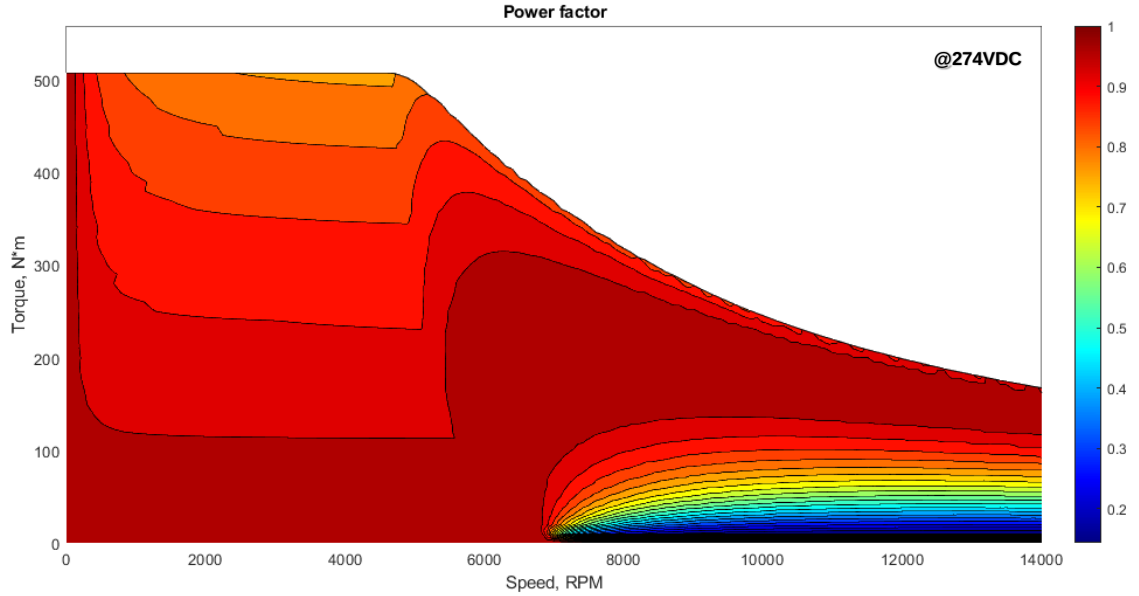

Input power, kW
@508VDC
Torque, N*m
Speed, RPM

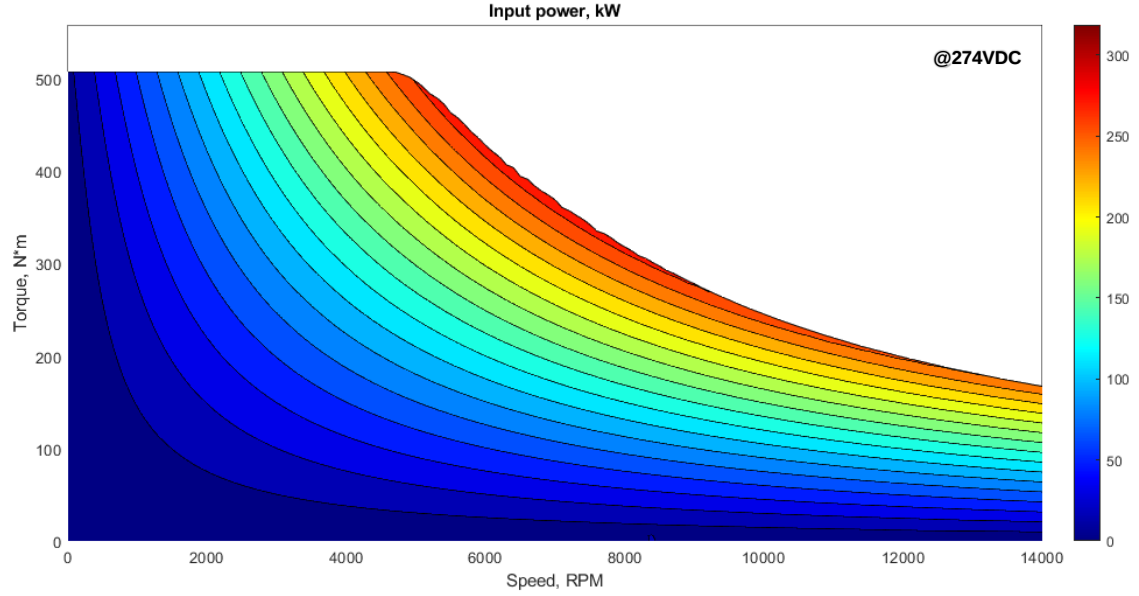

RMS phase voltage, V
@508VDC
Torque, N*m
Speed, RPM
0
100
200
300
400
500
0
2000
4000
6000
8000
10000
12000
14000
0
50
100
150
200

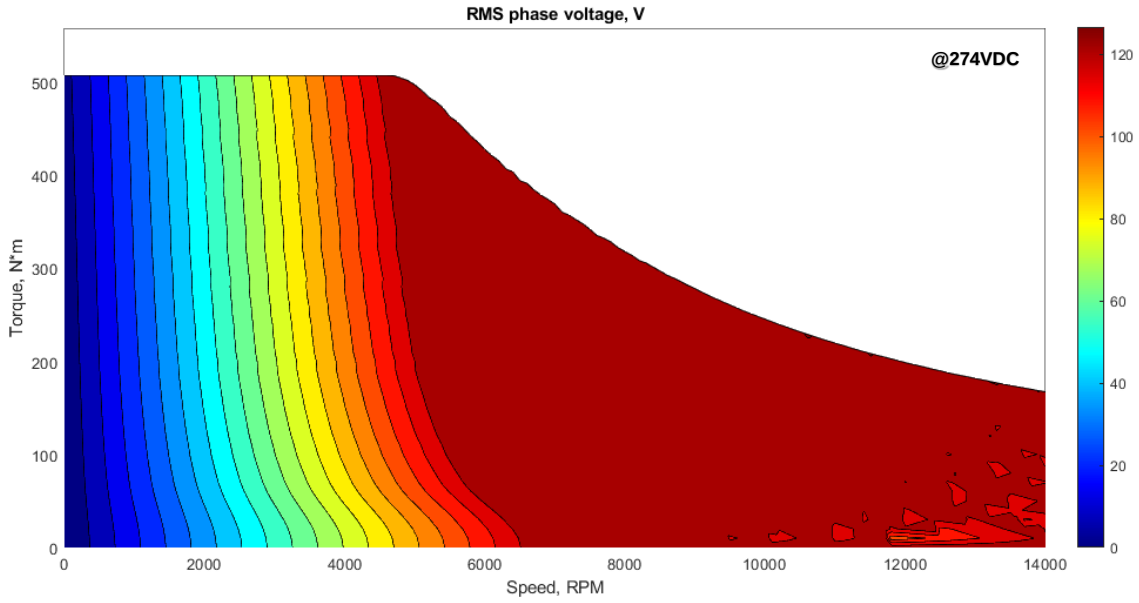

RMS phase current, A
@508VDC
Torque, N*m
0
100
200
300
400
500
0
2000
4000
6000
8000
10000
12000
14000
0
100
200
300
400
500
600
700
800

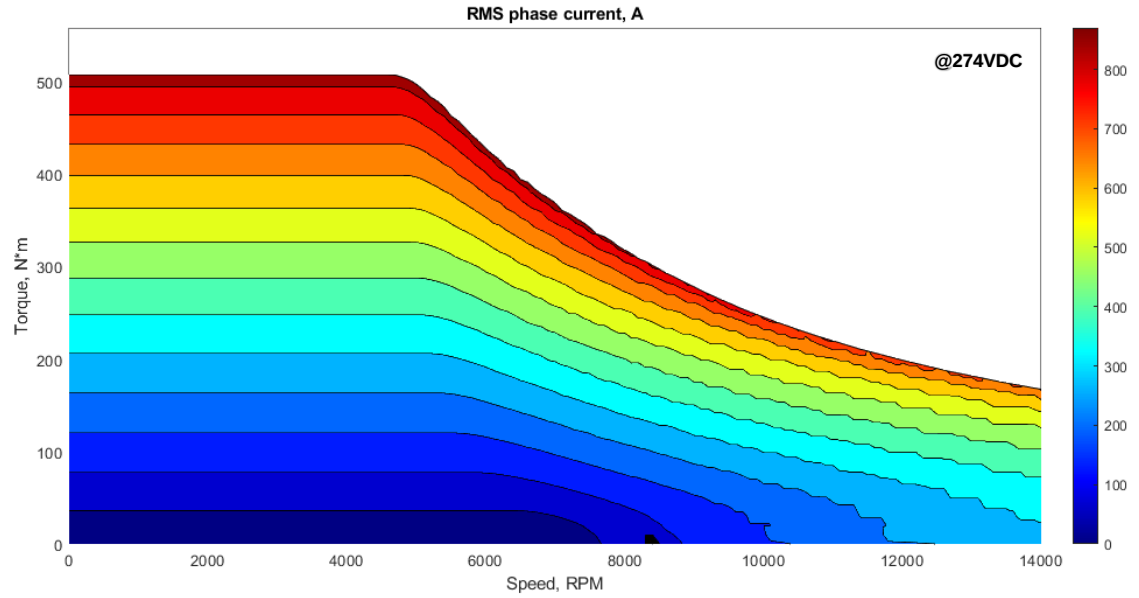

Advance angle, electrical degrees
@508VDC
Torque, N*m
Speed, RPM
0
100
200
300
400
500
0
2000
4000
6000
8000
10000
12000
14000
0
10
20
30
40
50
60
70
80

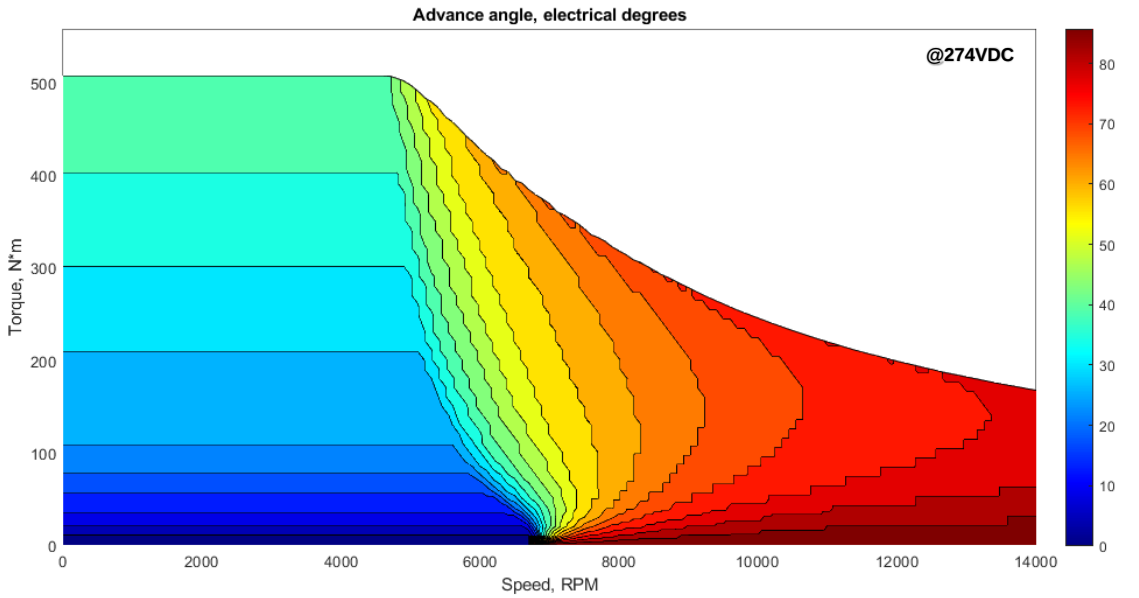

Efficiency, %
@274VDC
Torque, N*m
Speed, RPM


Power factor
@274VDC
Torque, N*m
Speed, RPM


Input power, kW
@274VDC
Torque, N*m
Speed, RPM


RMS phase voltage, V
@274VDC
Torque, N*m
Speed, RPM
0
100
200
300
400
500
0
2000
4000
6000
8000
10000
12000
14000
0
20
40
60
80
100
120


RMS phase current, A
@274VDC
Torque, N*m
Speed, RPM
0
100
200
300
400
500
0
2000
4000
6000
8000
10000
12000
14000
0
100
200
300
400
500
600
700
800


Advance angle, electrical degrees
@274VDC
Torque, N*m
Speed, RPM
0
100
200
300
400
500
0
2000
4000
6000
8000
10000
12000
14000
0
10
20
30
40
50
60
70
80