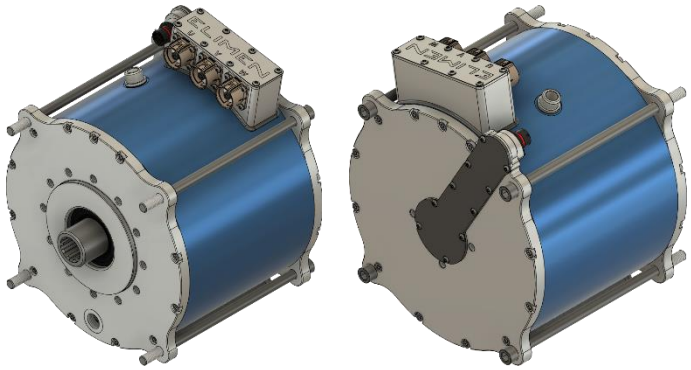
Permanent Magnet Switched Reluctance Motor

PMSRM170 - L112S48P8T5PP2



- Rated for extreme motorsport conditions
- Up to 8.9 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	4 260	4 000	3 750	8 000	7 570	7 070	RPM
S1 Mech. Power @VDC lowbat limit	135	169	199	252	315	375	kW
S1 Mech. Power @VDC nominal	167	209	247	305	383	454	kW
S1 RMS phase current	390	530	700	390	530	700	A
S1 torque @ 120*C out. oil	302	401	507	301	401	507	Nm
S1 torque coolant flow @ 60*C inp. oil	7.5	15	25.7	10	16.5	27.5	liters/min
Efficiency @S1 Power, VDC lowbat	97.35	95.87	94.17	98.11	97.54	96.62	%
Cos(φ) @S1 Power, VDC lowbat	0.938	0.868	0.793	0.929	0.865	0.786	--
S21torque @ 60*C inp. oil (peak time = flow/ system oil capac.)	600			600			Nm
Torque constant	0.772	0.757	0.724	0.772	0.757	0.724	Nm/A
Kv - Velocity constant	13.54	13.87	14.49	13.54	13.87	14.49	RPM/V
Ke - Back-EMF constant	0.631	0.689	0.659	0.631	0.689	0.659	V*s/rad
Inductance Id / Iq @S1 phase current	171 / 312	157 / 252	144 / 204	171 / 312	157 / 252	144 / 204	uH
End winding inductance @0.1Arms	4.3						uH
Phase resistance @ 140°C	8						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	866 - NSx version 1000 - HSx version						Hz

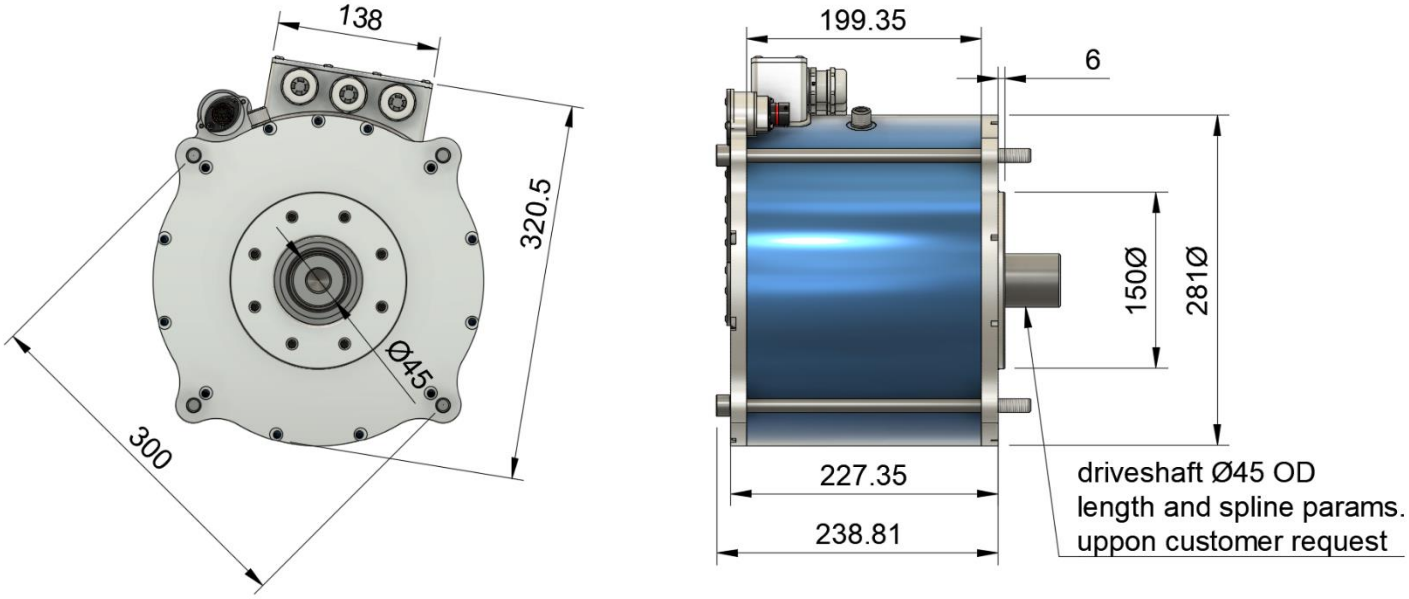
Cooling:

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* :

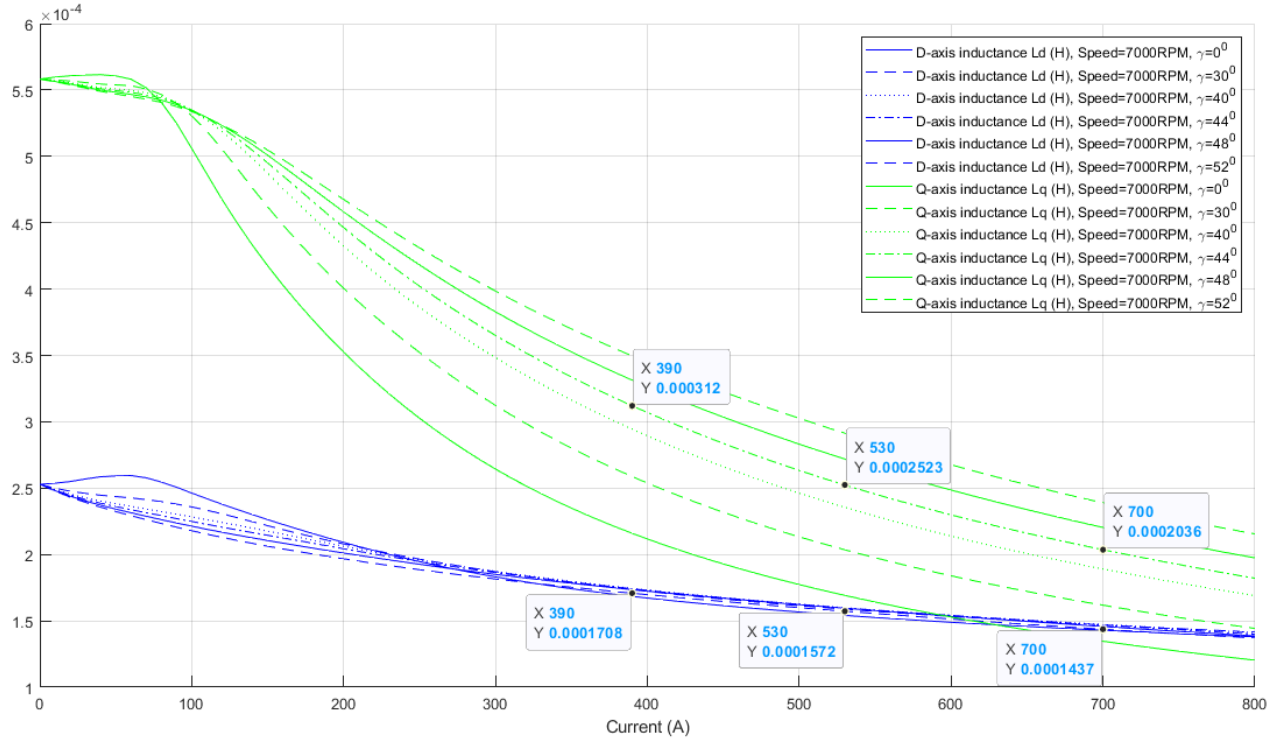


* Refer to PMSRM170-300X_drawing & PMSRM170-300X_3D.step for detailed mechanical documentation

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)

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

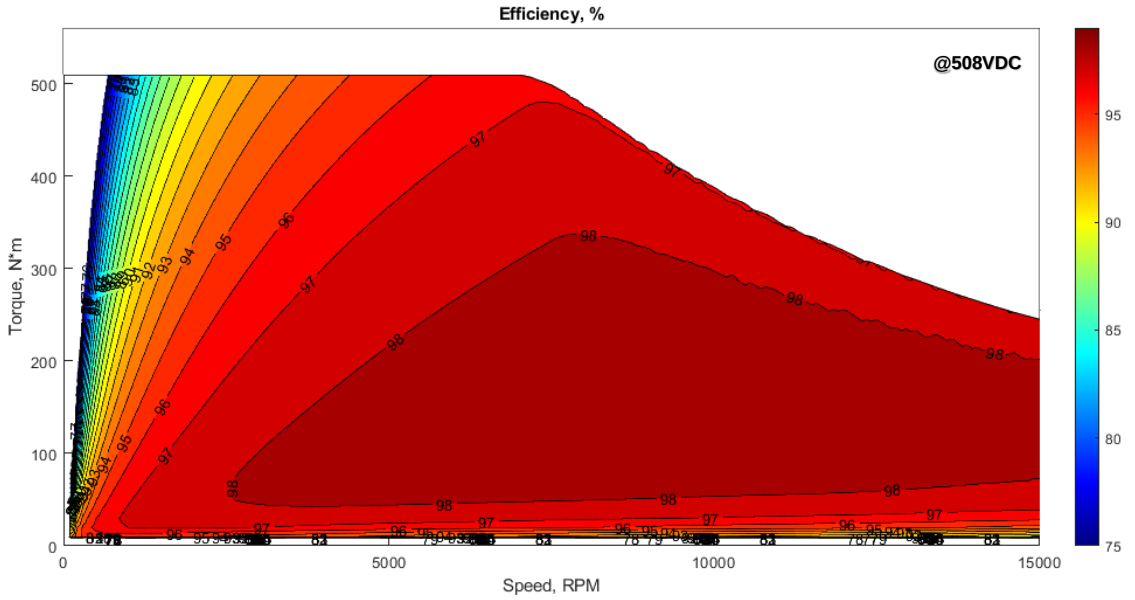
Max Inverter PWM = 0.98 for INV inverters IGBT family at 10kHz switching and SIC family at 20kHz

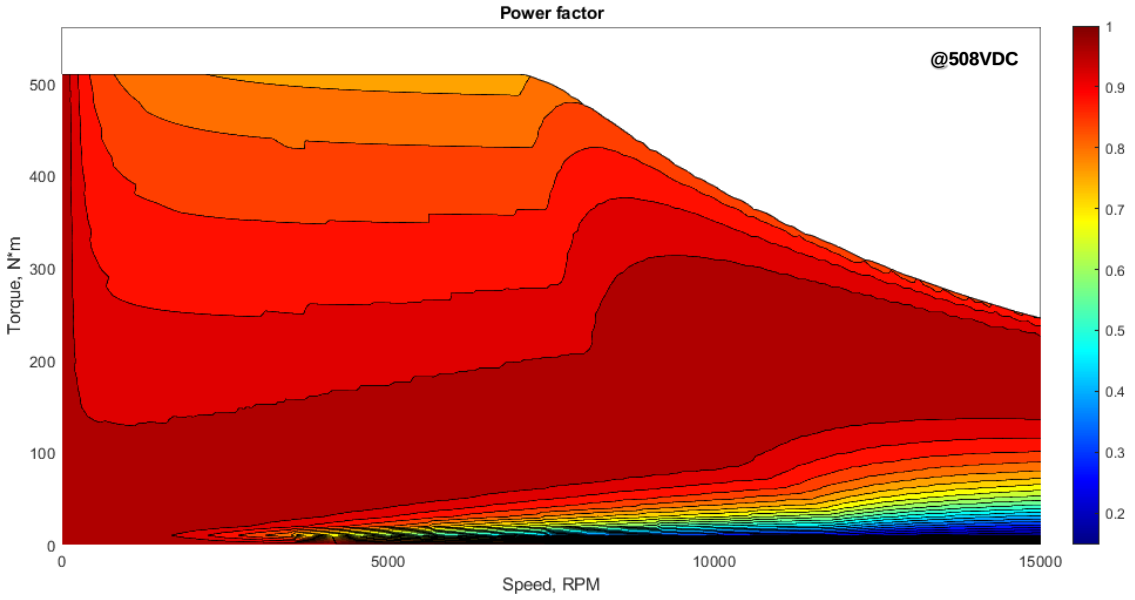
• To calculate needed coolant flow:

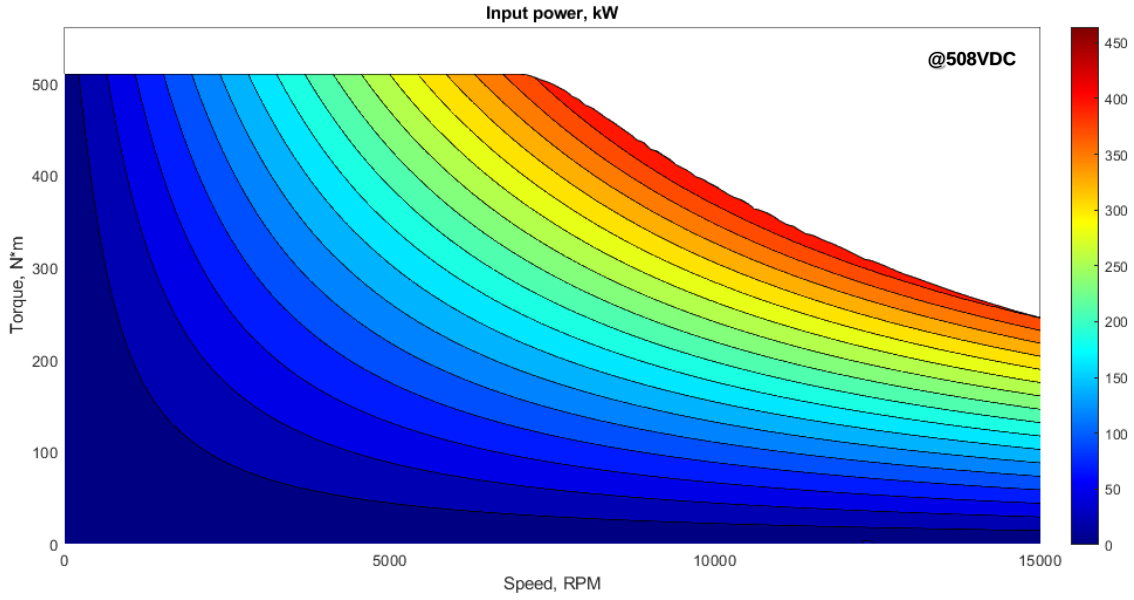
Calculate Energy losses at working point:

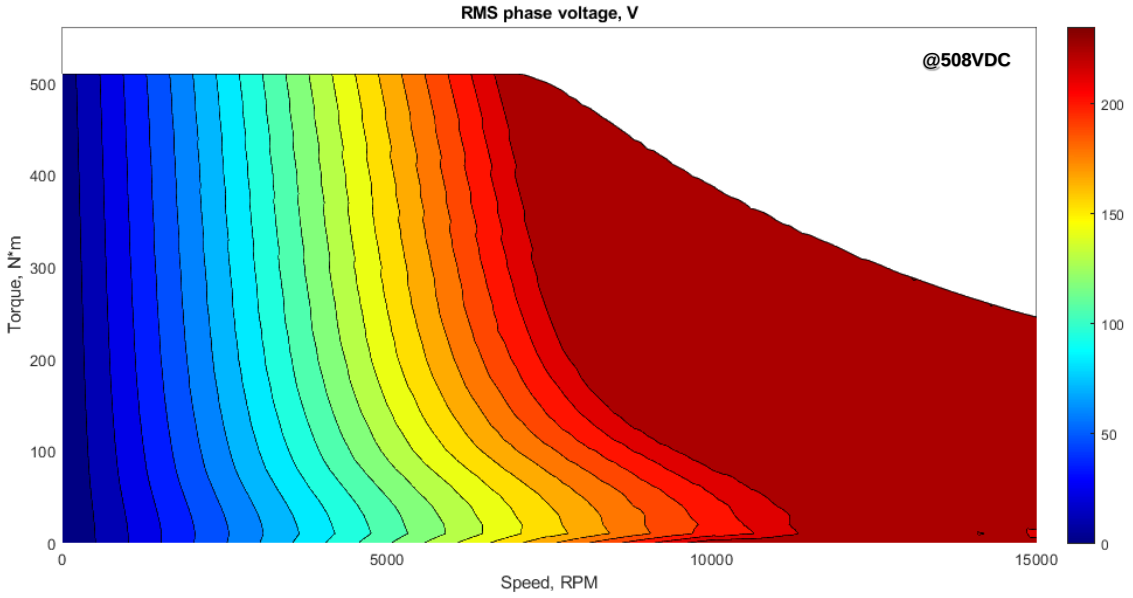
$$\left(\frac{100}{Efficiency[\%]} - 1\right) * Output\ Mechanical\ Power\ [W] = Energy\ Losses\ [W]$$

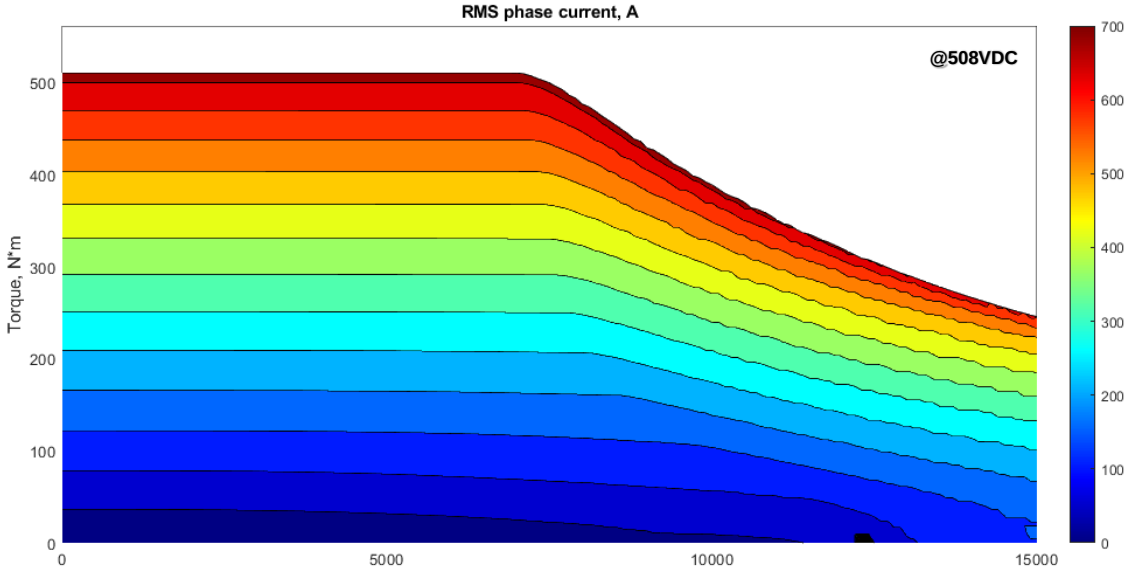
$$Coolant\ Outlet\ Temp\ [K] - \frac{Energy\ Losses\ [W]}{Temp\ Rise\ Coeff\ \left[\frac{W * s}{K * liter}\right] * Coolant\ Flow\ \left[\frac{liter}{s}\right]} = Coolant\ Inlet\ Temperature\ [K]$$

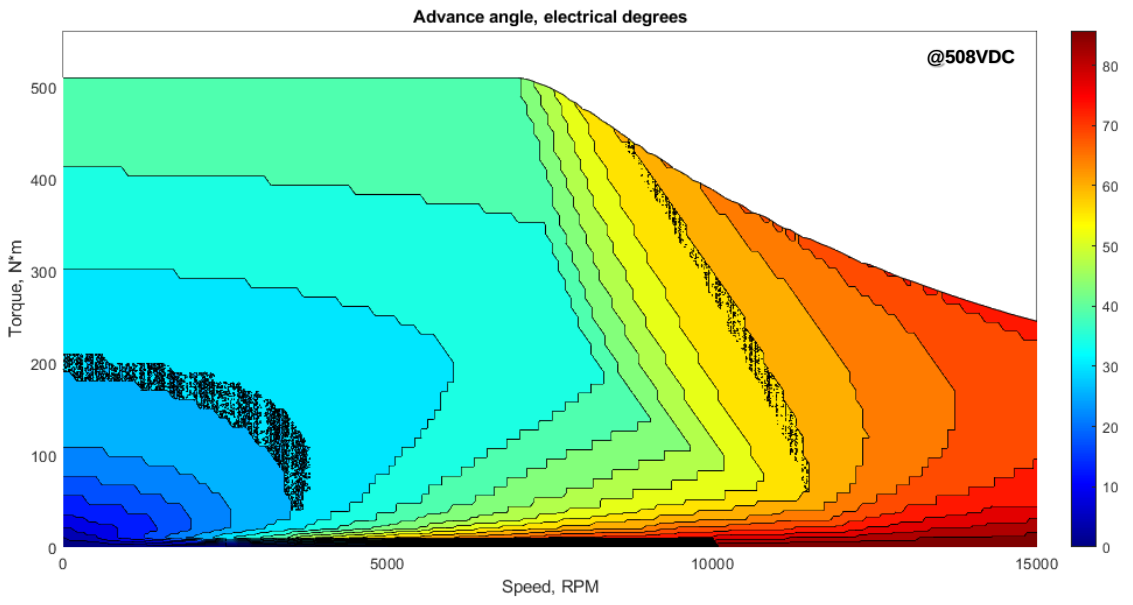

Efficiency, %
@508VDC
Torque, N*m
Speed, RPM
0
100
200
300
400
500
5000
10000
15000
75
80
85
90
95

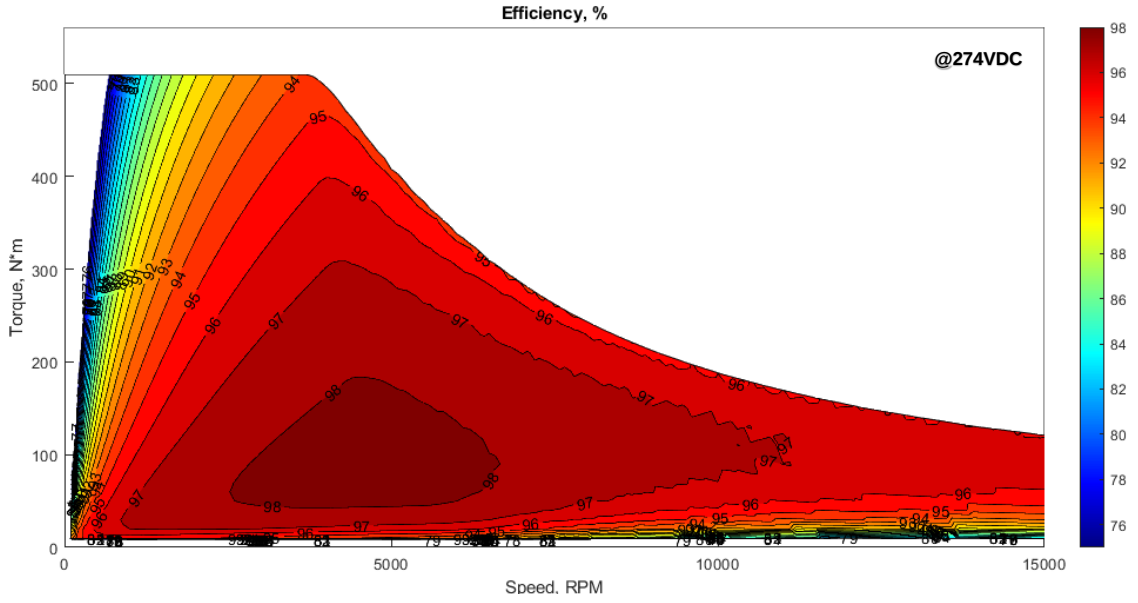

Power factor
@508VDC
Torque, N*m
Speed, RPM
0
100
200
300
400
500
5000
10000
15000
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

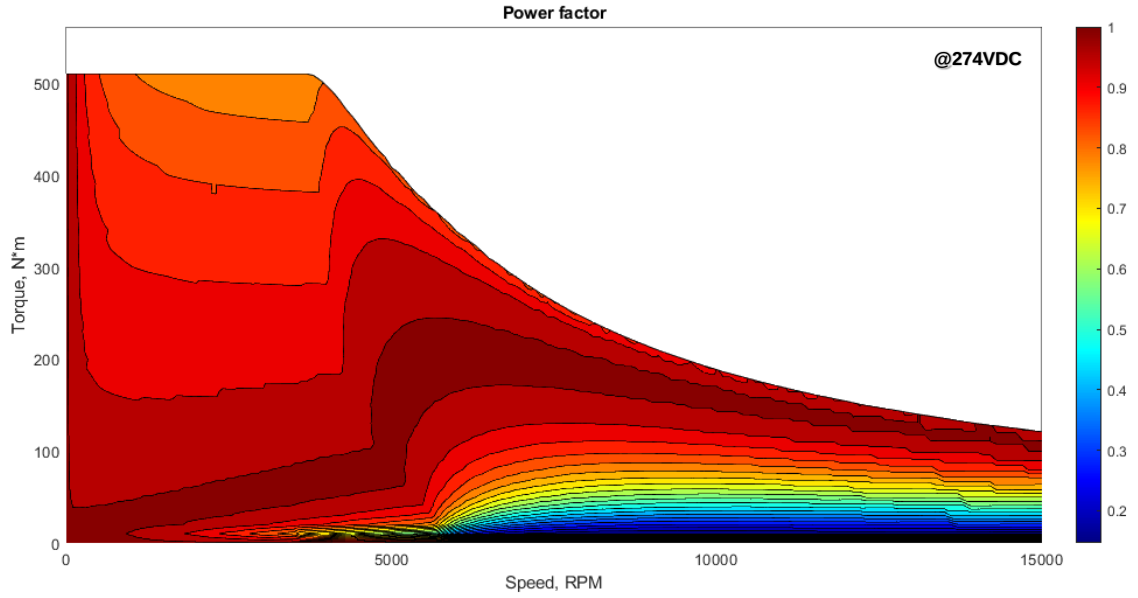

Input power, kW
@508VDC
Torque, N*m
Speed, RPM
0
100
200
300
400
500
5000
10000
15000
0
50
100
150
200
250
300
350
400
450

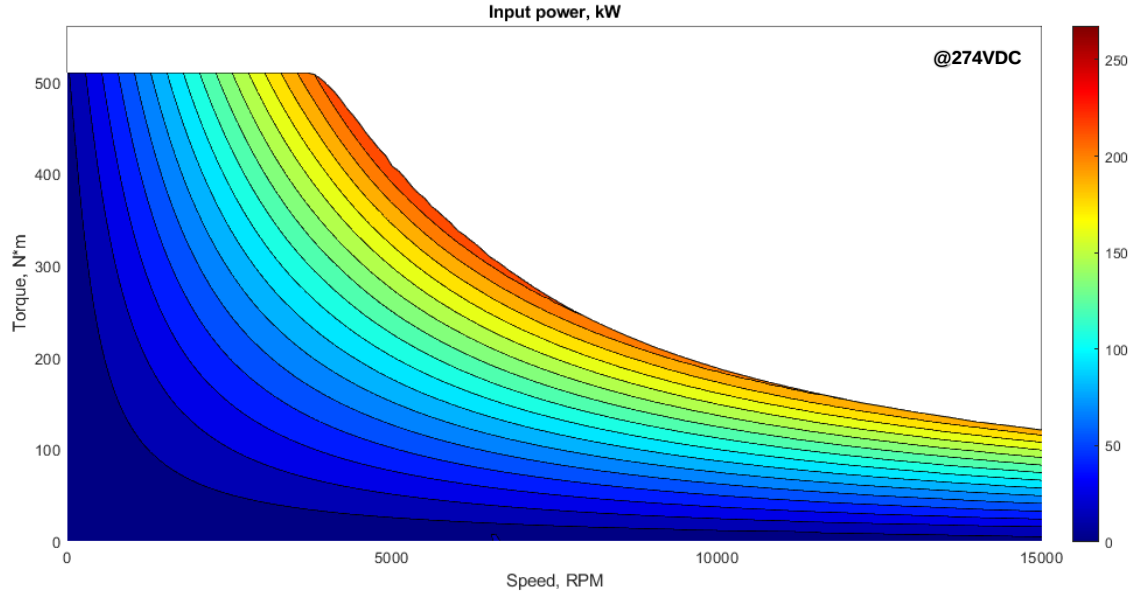

RMS phase voltage, V
@508VDC
Torque, N*m
Speed, RPM
0
100
200
300
400
500
5000
10000
15000
50
150

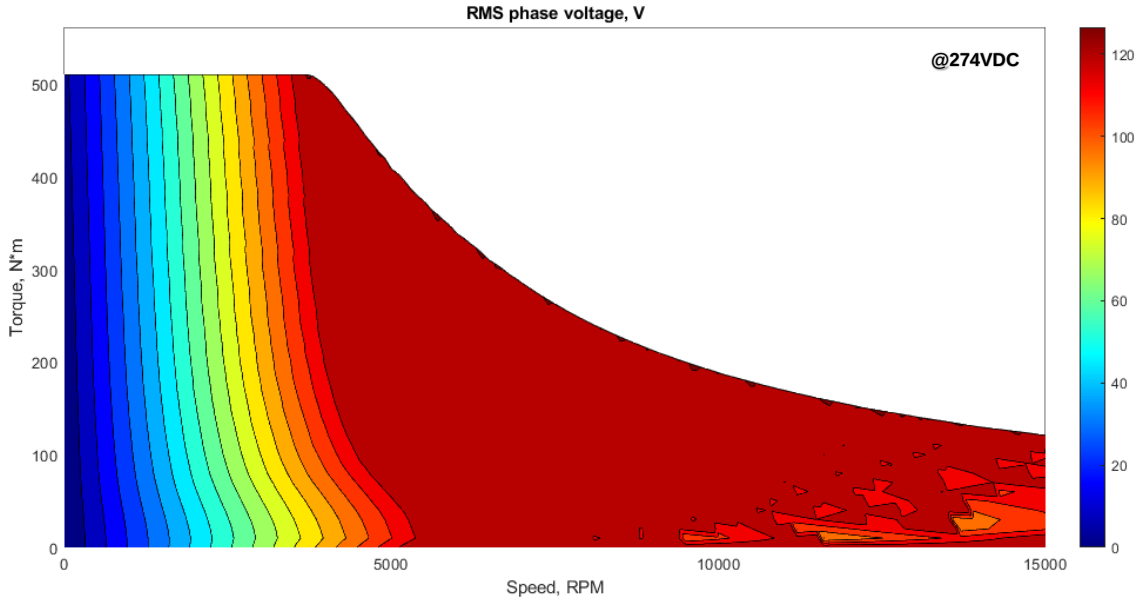

RMS phase current, A
@508VDC
Torque, N*m
0
100
200
300
400
500
5000
10000
15000
600
700

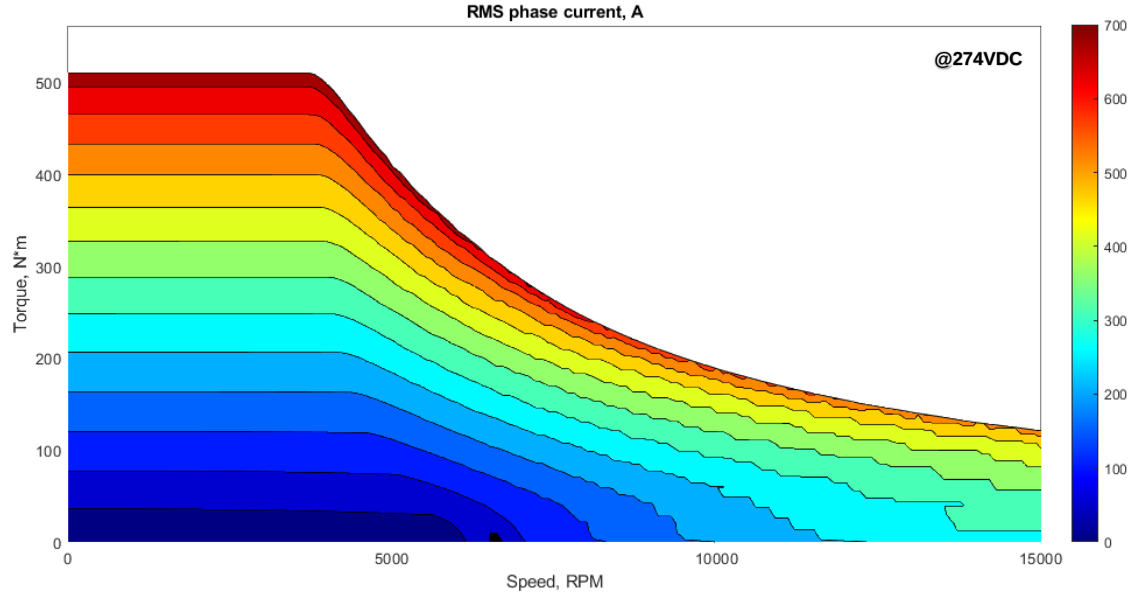

Advance angle, electrical degrees
@508VDC
Torque, N*m
Speed, RPM
0
100
200
300
400
500
5000
10000
15000
10
20
30
40
50
60
70
80

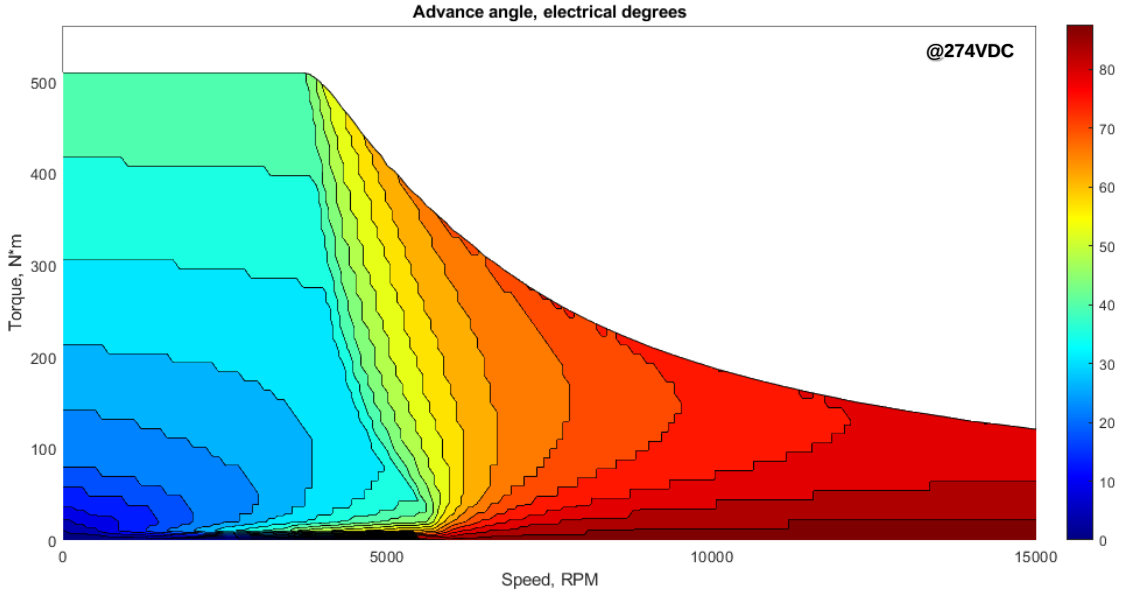

Efficiency, %
@274VDC
Torque, N*m
Speed, RPM
0
5000
10000
15000
100
200
300
400
500
76
78
80
82
84
86
88
90
92
94
96
98


Power factor
@274VDC
Torque, N*m
Speed, RPM
0
5000
10000
15000
100
200
300
400
500
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Input power, kW
@274VDC
Torque, N*m
Speed, RPM
0
5000
10000
15000
100
200
300
400
500
0
50
100
150
200
250


RMS phase voltage, V
@274VDC
Torque, N*m
Speed, RPM
0
100
200
300
400
500
0
5000
10000
15000
0
20
40
60
80
100
120


RMS phase current, A
@274VDC
Torque, N*m
Speed, RPM
0
100
200
300
400
500
0
5000
10000
15000
0
100
200
300
400
500
600
700


Advance angle, electrical degrees
@274VDC
Torque, N*m
Speed, RPM
0
100
200
300
400
500
0
5000
10000
15000
0
10
20
30
40
50
60
70
80