Condition 34

SCR evidence

Colt Hayes, London

Glasgow
April 3, 2025

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Document Control

Issue	Date	Status	HDR Author	HDR Approval	Notes
0.1	06/02/2025	Draft	13/01/2025_AC	16/01/2025_NS	Draft for comment
0.2	14/02/2025	Draft	06/02/2025_HL	14/02/2025_NS	Revisions following comments
1.0	03/04/2025	Issue	03/04/2025_HL	03/04/2025_NS	First issue

Contents

Appendices

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1 Introduction

The purpose of this Technical Note is to partially discharge Planning Condition 34 of the Original Permission (ref. 38421/APP/2021/4045) as quoted below.

This technical note pertains to the partial discharge of Buildings 1 & 2 generators only. Separate submissions will be submitted for each development phase (as applicable).

Planning Condition 34 wording:

> *Prior to operation of the development, or each development phase, evidence that the backup generators are to be fitted with selective catalytic reduction (SCR) technology to achieve a NOx emission concentration of 95mg/m^3 as minimum (at normalized conditions: 273.15 K, 101.3 kPa, and corrected for water vapor content (dry gas) and oxygen concentration of 15%) for the development, or each development phase, is to be submitted to and approved in writing by the Local Planning Authority. Evidence is to include, but is not restricted to, a written warranty and supporting documentation by the equipment manufacturers that this NOx emission concentration is to be achieved, within 20 minutes of generator start-up. Thereafter the development shall be implemented and operated in accordance with these details.*

2 SCR performance specification

The Colt L4 Hayes (L4) data centre will use Emergency Standby Generators or 'ESGs' to provide emergency power in the event of grid electrical failure.

Colt has made significant investment in NO_x abatement technology in the form of Selective Catalytic Reduction (SCR). All generators will be fitted with SCR to achieve a NO_x concentration of <250 mg/Nm^3 (5% O_2), which is equivalent to 95mg/m^3 at 15% O_2, within 20 minutes of generator start-up.

Once the SCR is fully operational the NO_x emissions will be reduced to a level that surpasses what can generally be achieved by a gas generator of equivalent size and output. This SCR system is to be located on top of the generator container and connected to the generator flue system. The system works by dosing the exhaust gases with ammonia to convert NO_x to Nitrogen (N_2) and water (H_2O).

Current plans are for the generators and SCR units to be commissioned in Q2 of 2025. Once completed, commissioning documents including evidence of SCR performance etc. can be provided upon request.

The datasheets, performance lag graphs and a manufacturer warranty letter can be found in the appendices overleaf.

3 Conclusion

In conclusion, the ESGs are fitted with SCR technology and will achieve the required NOx emission concentration, as evidenced in Appendix B. Furthermore, the ESGs will achieve the required NOx emission concentration within 20 minutes of generator start-up, as detailed in Appendix C. Additional details on the SCR technology and emissions data can be found in Appendix A.

Appendix A.

SCR Datasheets

Engine data

	Genset	Marine	O & G	Rail	C & I
Application	X				
Engine model	20V4000G74F				
Application Group	3D				
Legislative body	NEA Singapore for ORDE				
Test cycle	D2				
Fuel sulphur content [ppm]	5				
mg/mN^3 values base on residual oxygen value of [%]	5				

Engine raw emissions*

Cycle point	[-]	n1	n2	n3	n4	n5
Power	kW	2670	2002	1335	667	267
Power relative	[-]	1	0.75	0.5	0.25	0.1
Engine speed	1/min	1500	1500	1500	1500	1500
Engine speed relative	[-]	1	1	1	1	1
Exhaust back pressure after ETC (static)	mbar	84.2	58	30.1	12	5.7
Exhaust temperature after ETC	grdC	528	498	463	366	224
Oxygen (O2)	%	8	9.3	10.5	12.9	16.1
Exhaust mass flow wet	kg/h	12872	11019	8525	5859	4658
NOX-Emissions specific	g/kWh	7.65	5.49	4.33	4.89	9.52
CO-Emissions specific	g/kWh	0.46	0.58	0.77	1.53	4.29
CO2-Emissions specific	g/kWh	618.7	638.3	669.8	717.2	871.2
HC1-Emissions specific	g/kWh	0.15	0.18	0.27	0.58	2
NMHC-Emissions specific	g/kWh	0.15	0.18	0.27	0.57	1.96
NOX+HC1-Emissions specific	g/kWh	7.8	5.68	4.61	5.47	11.51
NOX+NMHC-Emissions specific	g/kWh	7.8	5.67	4.6	5.46	11.47

PDF	Name	Project no.	Size
		LMQ117	**A4**
Configurator	Lenhof, Torsten (TARC)	Order no.	
		Colt Lon 4 OFCI (DS3100)	
Approver1	Schmid, Tobias (TSLE)	EDS-ID	
Approver2	Breuer, Joerg (TVA)	**3578-24.05.2024**	
Approver3			
Approver4			
User	FN2\I170260		

Engine model
20V4000G74F

Title
Emission data sheet

Description of Revision	Frequency

Data generated by EDS Creator version 1.0 and uniplot.
Ref.-dataset: 420893_003_tes_D2.nc for 269 in EDS platfrom.

Emissionstage
NEA Singapore for ORDE

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Configuration-ID	Documentation
269	

Emissionstage basis
NEA Singapore for ORDE

PM-Emissions specific (Meas.)	g/kWh	0.042	0.047	0.097	0.241	0.77
NOX-Emissions (based on 5% O2)	mg/m3N	2751	1907	1435	1507	2390
CO-Emissions (based on 5% O2)	mg/m3N	168	203	256	475	1077
CO2-Emissions (based on 5% O2)	mg/m3N	224171	223768	223275	222139	218788
HC1-Emissions (based on 5% O2)	mg/m3N	54	65	91	180	500
NOX+HC1-Emissions (based on 5% O2)	mg/m3N	2805	1972	1526	1686	2891
NOX+NMHC-Emissions (based on 5% O2)	mg/m3N	2804	1971	1524	1683	2881

PDF	Name	Project no.	Size
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Configurator	Lenhof, Torsten (TARC)	Order no.	
		Colt Lon 4 OFCI (DS3100)	
Approver1	Schmid, Tobias (TSLE)	EDS-ID	
Approver2	Breuer, Joerg (TVA)	**3578-24.05.2024**	
Approver3			
Approver4			
User	FN2\I170260		

Engine model
20V4000G74F

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Emission data sheet

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Data generated by EDS Creator version 1.0 and uniplot.
Ref.-dataset: 420893_003_tes_D2.nc for 269 in EDS platfrom.

Emissionstage
NEA Singapore for ORDE

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Configuration-ID	Documentation
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Emissionstage basis
NEA Singapore for ORDE

Engine data

	Genset	Marine	O & G	Rail	C & I
Application	X				
Engine model	20V4000G74F				
Application Group	3D				
Legislative body	NEA Singapore for ORDE				
Test cycle	D2				
Fuel sulphur content [ppm]	5				
mg/mN^3 values base on residual oxygen value of [%]	5				

Not to exceed emission values*

Cycle point	[-]	n1	n2	n3	n4	n5
Power	kW	2670	2002	1335	667	267
Power relative	[-]	1	0.75	0.5	0.25	0.1
Engine speed	1/min	1500	1500	1500	1500	1500
Engine speed relative	[-]	1	1	1	1	1
NOX-Emissions specific	g/kWh	9.95	7.14	5.63	7.33	18.08
CO-Emissions specific	g/kWh	0.79	0.99	1.46	3.07	8.58
HC1-Emissions specific	g/kWh	0.26	0.31	0.52	1.16	5.79
NMHC-Emissions specific	g/kWh	0.25	0.31	0.51	1.14	
NOX+HC1-Emissions specific	g/kWh	10.21	7.46	6.15	8.5	23.87
NOX+NMHC-Emissions specific	g/kWh	10.2	7.45	6.14	8.47	
PM-Emissions specific (Meas.)	g/kWh	0.063	0.074	0.145	0.362	2.848
NOX-Emissions (based on 5% O2)	mg/m3N	3576	2479	1865	2260	4541
CO-Emissions (based on 5% O2)	mg/m3N	286	345	487	949	2155
HC1-Emissions (based on 5% O2)	mg/m3N	93	110	173	360	1451

PDF	Name	Project no.	Size
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Configurator	Lenhof, Torsten (TARC)	Order no.	
		Colt Lon 4 OFCI (DS3100)	
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Approver2	Breuer, Joerg (TVA)	**3578-24.05.2024**	
Approver3			
Approver4			
User	FN2\I170260		

Engine model
20V4000G74F

Title
Emission data sheet

Description of Revision	Frequency

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Ref.-dataset: 420893_003_tes_D2.nc for 269 in EDS platfrom.

Emissionstage
NEA Singapore for ORDE

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of
6

Configuration-ID	Documentation
269	

Emissionstage basis
NEA Singapore for ORDE

NOX+HC1-Emissions (based on 5% O2)	mg/m3N	3669	2589	2038	2620	5992
NOX+NMHC-Emissions (based on 5% O2)	mg/m3N	3667	2587	2034	2612	

PDF	Name	Project no. **LMQ117**	Size **A4**
Configurator	Lenhof, Torsten (TARC)	Order no. **Colt Lon 4 OFCI (DS3100)**	
Approver1	Schmid, Tobias (TSLE)	EDS-ID **3578-24.05.2024**	
Approver2	Breuer, Joerg (TVA)		
Approver3			
Approver4			
User	FN2\I170260		

Engine model **20V4000G74F**

Title **Emission data sheet**

Description of Revision	Frequency

Data generated by EDS Creator version 1.0 and uniplot.
Ref.-dataset: 420893_003_tes_D2.nc for 269 in EDS platfrom.

Emissionstage **NEA Singapore for ORDE**

Sheet **6** of **6**

Configuration-ID	Documentation
269	

Emissionstage basis **NEA Singapore for ORDE**

Engine data

	Genset	Marine	O & G	Rail	C & I
Application	X				
Engine model	20V4000G94F				
Fuel type	EN590				
Application Group	3D				
Legislative body	Customer specific				
Test cycle	D2				
Fuel sulphur content [ppm]	5				
mg/mN^3 values base on residual oxygen value of [%]	5				

Engine raw emissions*

Cycle point	[-]	n1	n2	n3	n4	n5
Power	kW	3088	2316	1544	772	309
Power relative	[-]	1	0.75	0.5	0.25	0.1
Engine speed	1/min	1500	1500	1500	1500	1500
Engine speed relative	[-]	1	1	1	1	1
Exhaust back pressure after ETC (static)	mbar	30.3	19.8	7.6	2.6	0
Exhaust temperature after ETC	grdC	494	414	406	366	253
Exhaust mass flow wet	kg/h	19340	16799	12073	7420	5554
NOX-Emissions specific	g/kWh	5.13	4.48	3.9	4.81	9.06
CO-Emissions specific	g/kWh	0.97	0.27	0.68	1.37	10.15
CO2-Emissions specific	g/kWh	693.1	685.4	685.3	731.2	901.4
HC1-Emissions specific	g/kWh	0.07	0.1	0.12	0.24	2.52
PM-Emissions specific (Meas.)	g/kWh	0.093	0.034	0.08	0.145	0.168
NOX-Emissions (based on 5% O2)	mg/m3N	1719	1524	1325	1528	2302
CO-Emissions (based on 5% O2)	mg/m3N	314	89	221	417	2441

PDF	Name	Project no.	Size
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Configurator	Theiss, Sandro (TVMG)	Order no.	
		Colt Lon 4 OFCI (DS3600)	
Approver1	Kneifel, Alexander (TSLE)	EDS-ID	
Approver2	Fraser, Neil (TSL)	**3582-24.05.2024**	
Approver3			
Approver4			
User	FN2\I170260		

Engine model
20V4000G94F

Title
Emission data sheet

Description of Revision	Frequency

Data generated by EDS Creator version 1.0 and uniplot.
Ref.-dataset: BR4000_549101860_007D2 Zyklus Optimiert SPC;1_D;1_2_P131_TTME for 1767 in EDS platfrom.

Emissionstage
Customer specific

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5

Configuration-ID	Documentation
1767	

Emissionstage basis
Customer specific

CO2-Emissions (based on 5% O2)	mg/m3N	225048	224448	223985	222911	216999
HC1-Emissions (based on 5% O2)	mg/m3N	22	34	38	72	605

PDF	Name	Project no. **LMQ114**	Size **A4**
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Approver2	Fraser, Neil (TSL)		
Approver3			
Approver4			
User	FN2\I170260		

Engine model **20V4000G94F**

Title **Emission data sheet**

Description of Revision	Frequency

Data generated by EDS Creator version 1.0 and uniplot.
Ref.-dataset: BR4000_549101860_007D2 Zyklus Optimiert SPC;1_D;1_2_P131_TTME for 1767 in EDS platfrom.

Emissionstage **Customer specific**

Sheet **4** of **5**

Configuration-ID	Documentation
1767	

Emissionstage basis **Customer specific**

Engine data

	Genset	Marine	O & G	Rail	C & I
Application	X				
Engine model	20V4000G94F				
Fuel type	EN590				
Application Group	3D				
Legislative body	Customer specific				
Test cycle	D2				
Fuel sulphur content [ppm]	5				
mg/mN^3 values base on residual oxygen value of [%]	5				

Not to exceed emission values*

Cycle point	[-]	n1	n2	n3	n4	n5
Power	kW	3088	2316	1544	772	309
Power relative	[-]	1	0.75	0.5	0.25	0.1
Engine speed	1/min	1500	1500	1500	1500	1500
Engine speed relative	[-]	1	1	1	1	1
NOX+HC1 mass flow	kg/h	18.75	13.89	8.16	5.93	7.57
NOX-Emissions specific	g/kWh	5.96	5.82	5.07	7.21	17.22
CO-Emissions specific	g/kWh	1.65	0.46	1.29	2.74	20.29
HC1-Emissions specific	g/kWh	0.12	0.18	0.22	0.47	7.29
NOX+HC1-Emissions specific	g/kWh	6.07	6	5.29	7.68	24.51
PM-Emissions specific (Meas.)	g/kWh	0.139	0.054	0.12	0.218	0.623
NOX-Emissions (based on 5% O2)	mg/m3N	1998	1982	1722	2292	4373
CO-Emissions (based on 5% O2)	mg/m3N	534	152	421	835	4882
HC1-Emissions (based on 5% O2)	mg/m3N	38	57	73	144	1753
NOX+HC1-Emissions (based on 5% O2)	mg/m3N	2036	2039	1795	2436	6127

PDF	Name	Project no.	Size
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Configurator	Theiss, Sandro (TVMG)	Order no.	
		Colt Lon 4 OFCI (DS3600)	
Approver1	Kneifel, Alexander (TSLE)	EDS-ID	
Approver2	Fraser, Neil (TSL)	**3582-24.05.2024**	
Approver3			
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Engine model
20V4000G94F

Title
Emission data sheet

Description of Revision	Frequency

Data generated by EDS Creator version 1.0 and uniplot.
Ref.-dataset: BR4000_549101860_007D2 Zyklus Optimiert SPC;1_D;1_2_P131_TTME for 1767 in EDS platfrom.

Emissionstage
Customer specific

Sheet
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Configuration-ID	Documentation
1767	

Emissionstage basis
Customer specific

Appendix B.

SCR Manufacturer Warranty

Warranty values

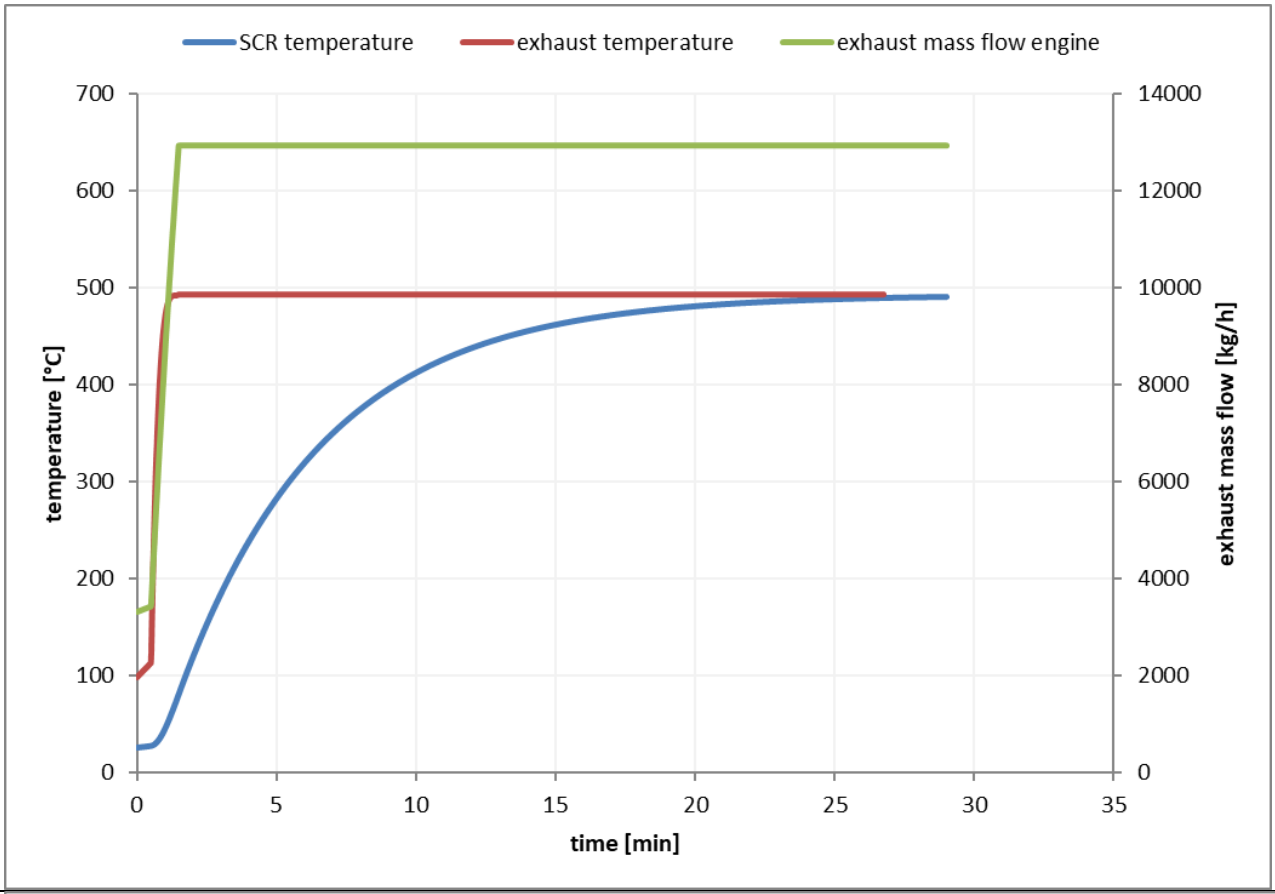
Nitrogen oxide NOx ≤ 250 mg/Nm3 @ 5 % O2
Noise Level dB(A) ≤ 80 dB(A) @ 1 m

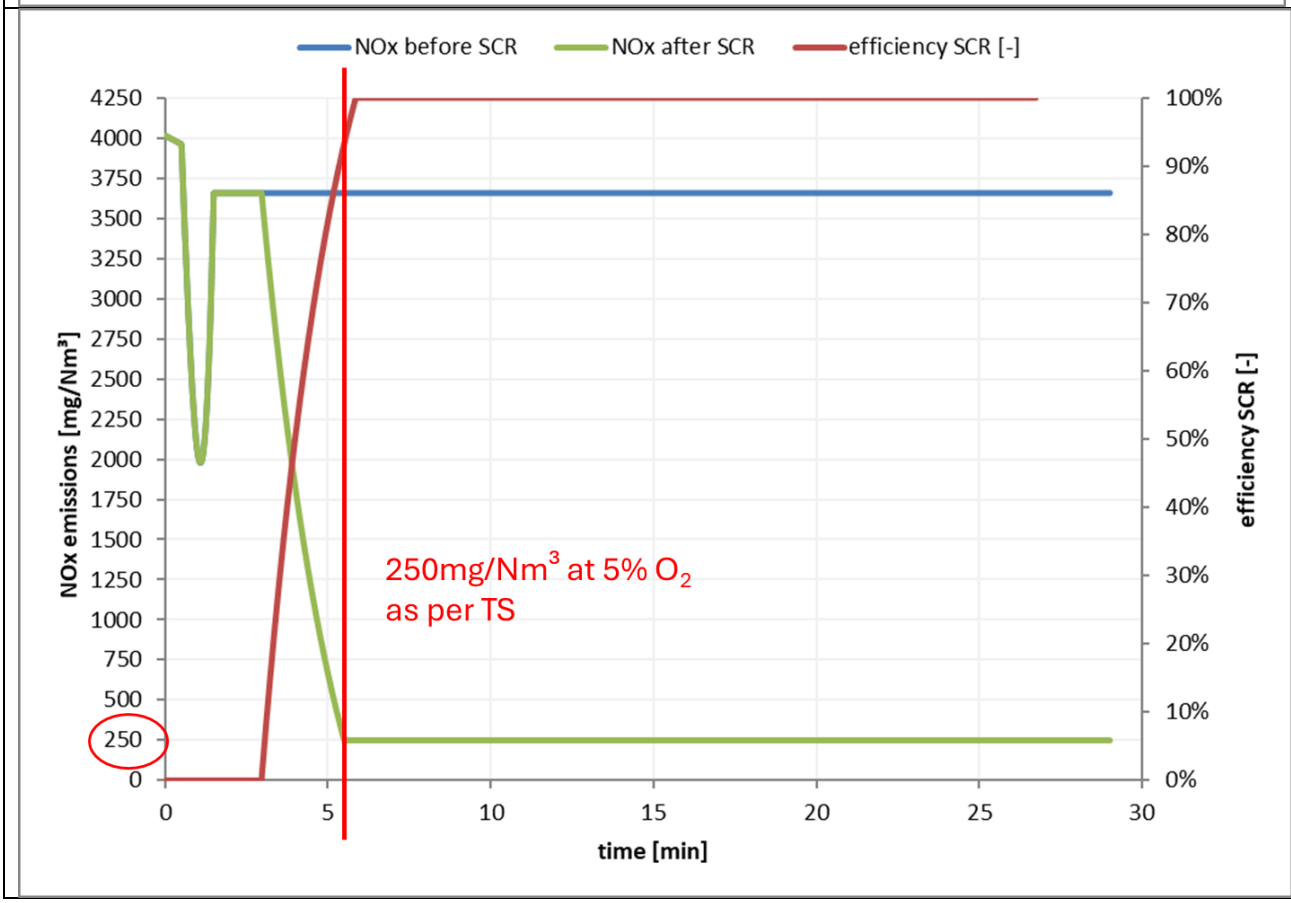
Note – the warranty values are equivalent to 95mg/m^3 at 15% O_2 as stated in the planning condition.

Appendix C.

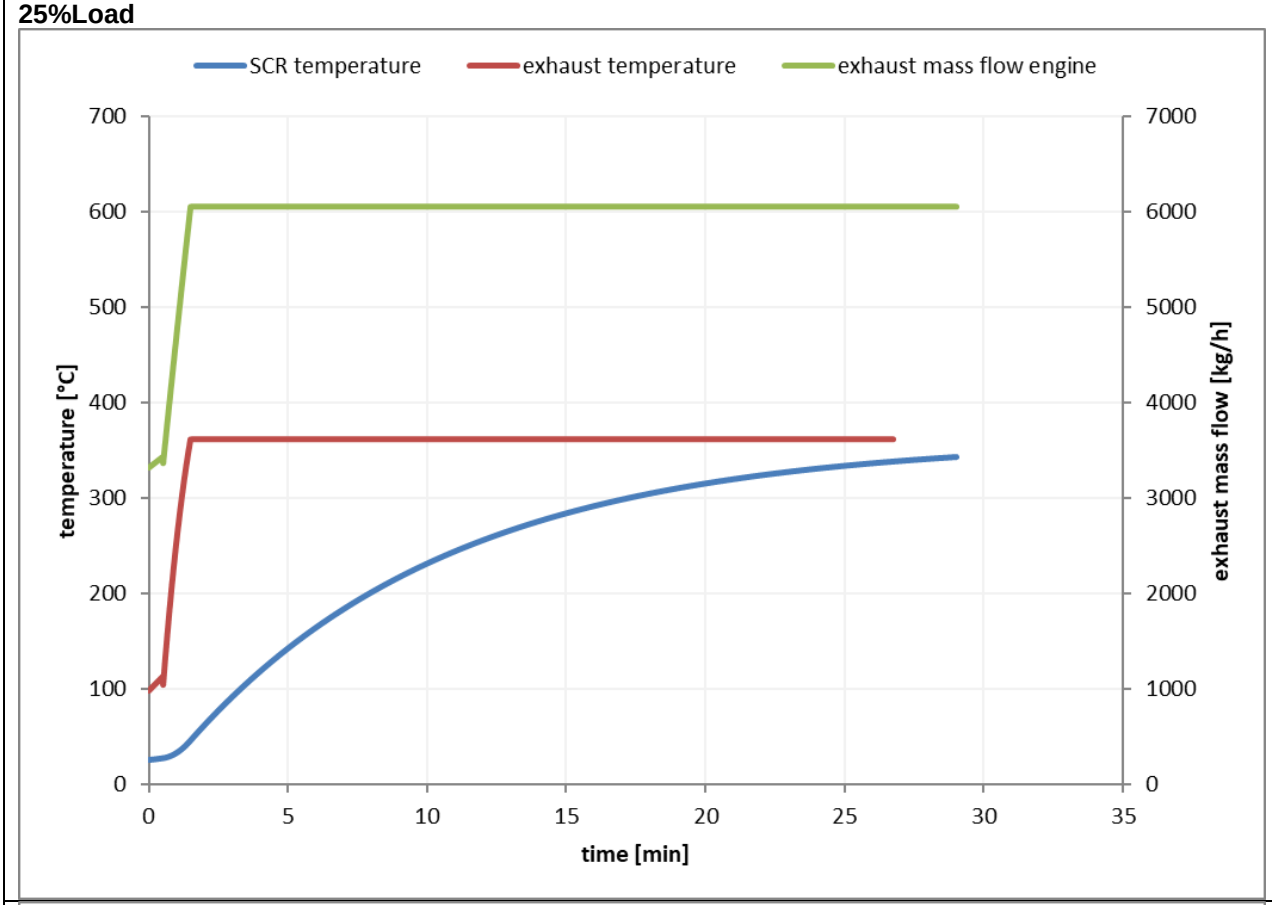
SCR Performance Lag

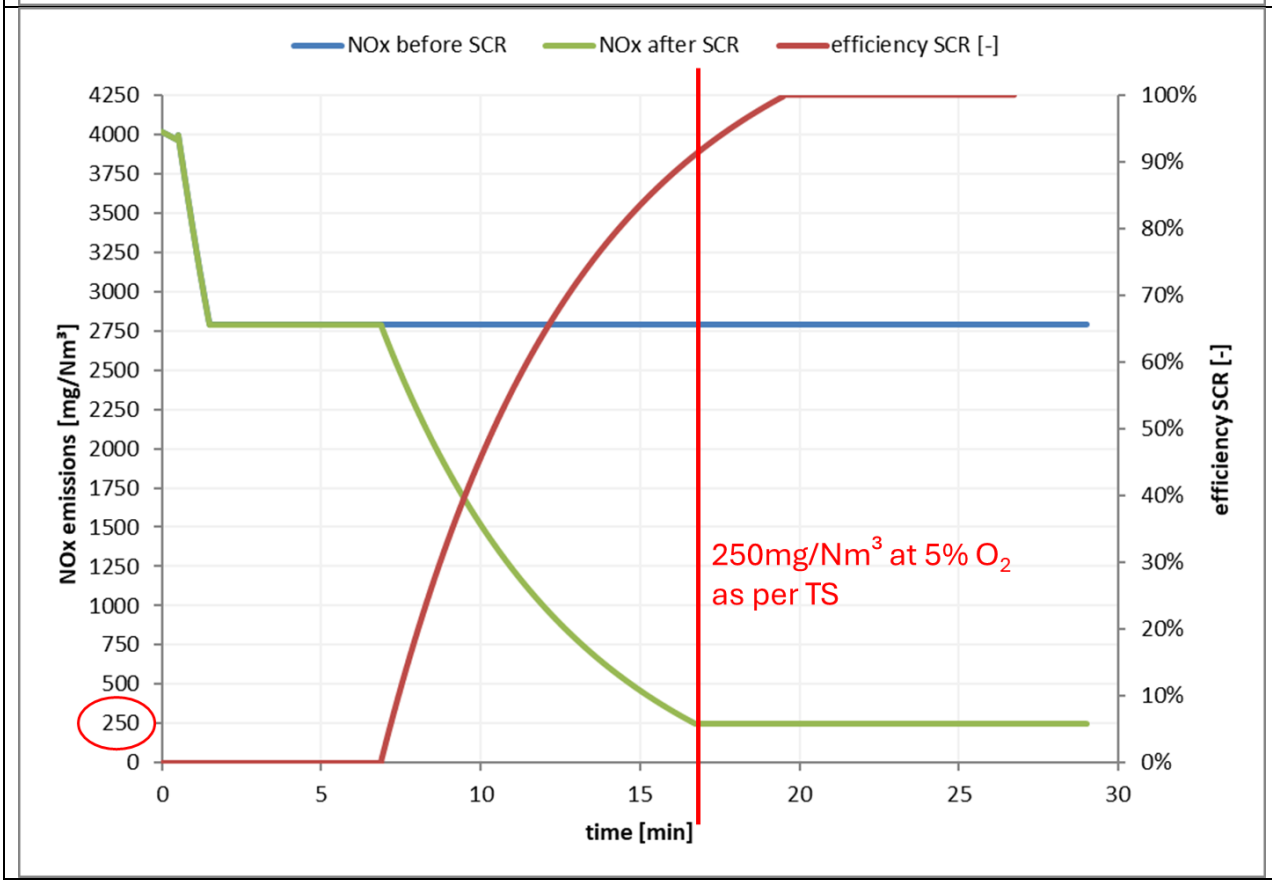
100% Load


SCR temperature
exhaust temperature
exhaust mass flow engine
temperature [°C]
exhaust mass flow [kg/h]
time [min]
0
100
200
300
400
500
600
700
0
2000
4000
6000
8000
10000
12000
14000
0
5
10
15
20
25
30
35

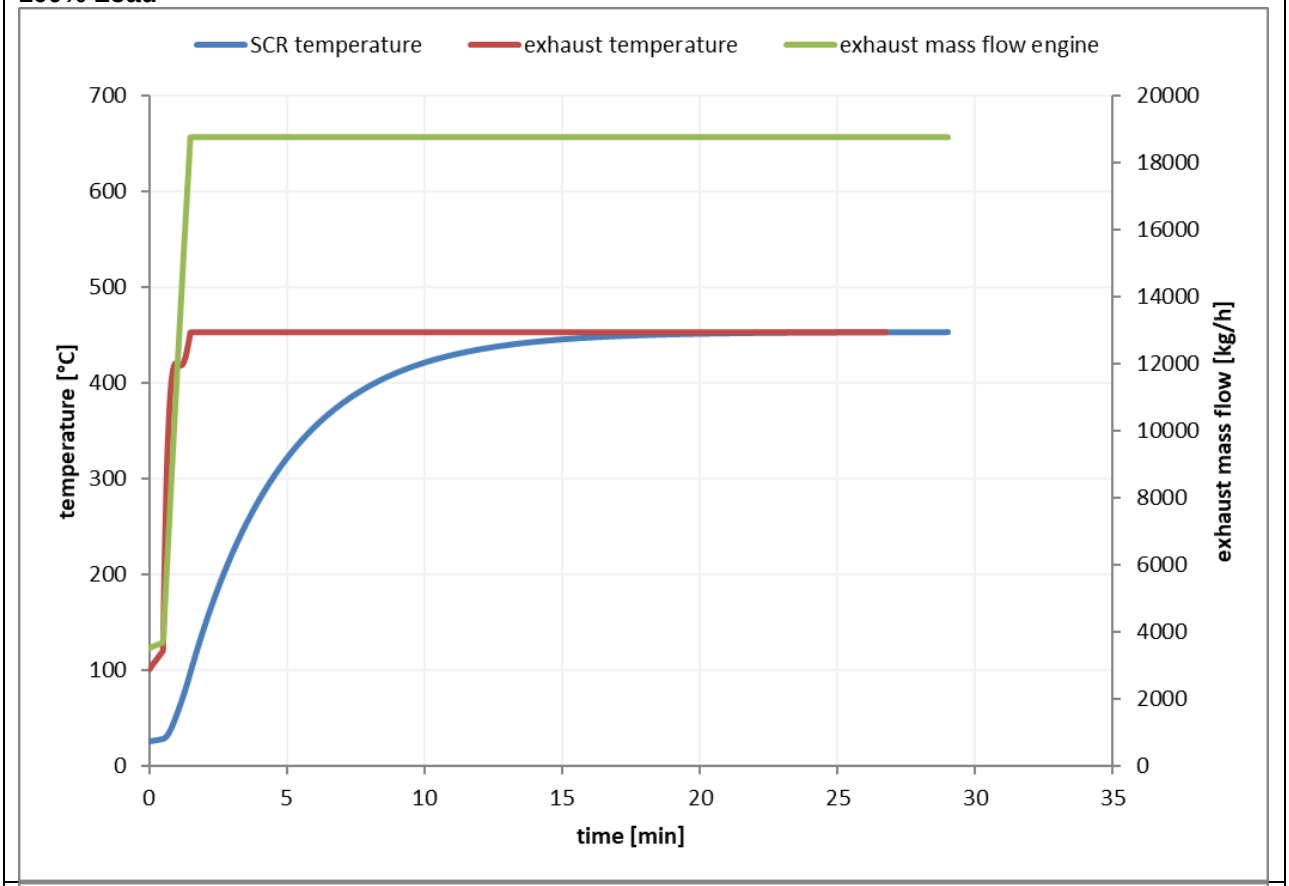

NOx before SCR
NOx after SCR
efficiency SCR [-]
NOx emissions [mg/Nm³]
efficiency SCR [-]
time [min]
250mg/Nm³ at 5% O₂
as per TS
0
250
500
750
1000
1250
1500
1750
2000
2250
2500
2750
3000
3250
3500
3750
4000
4250
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
0
5
10
15
20
25
30

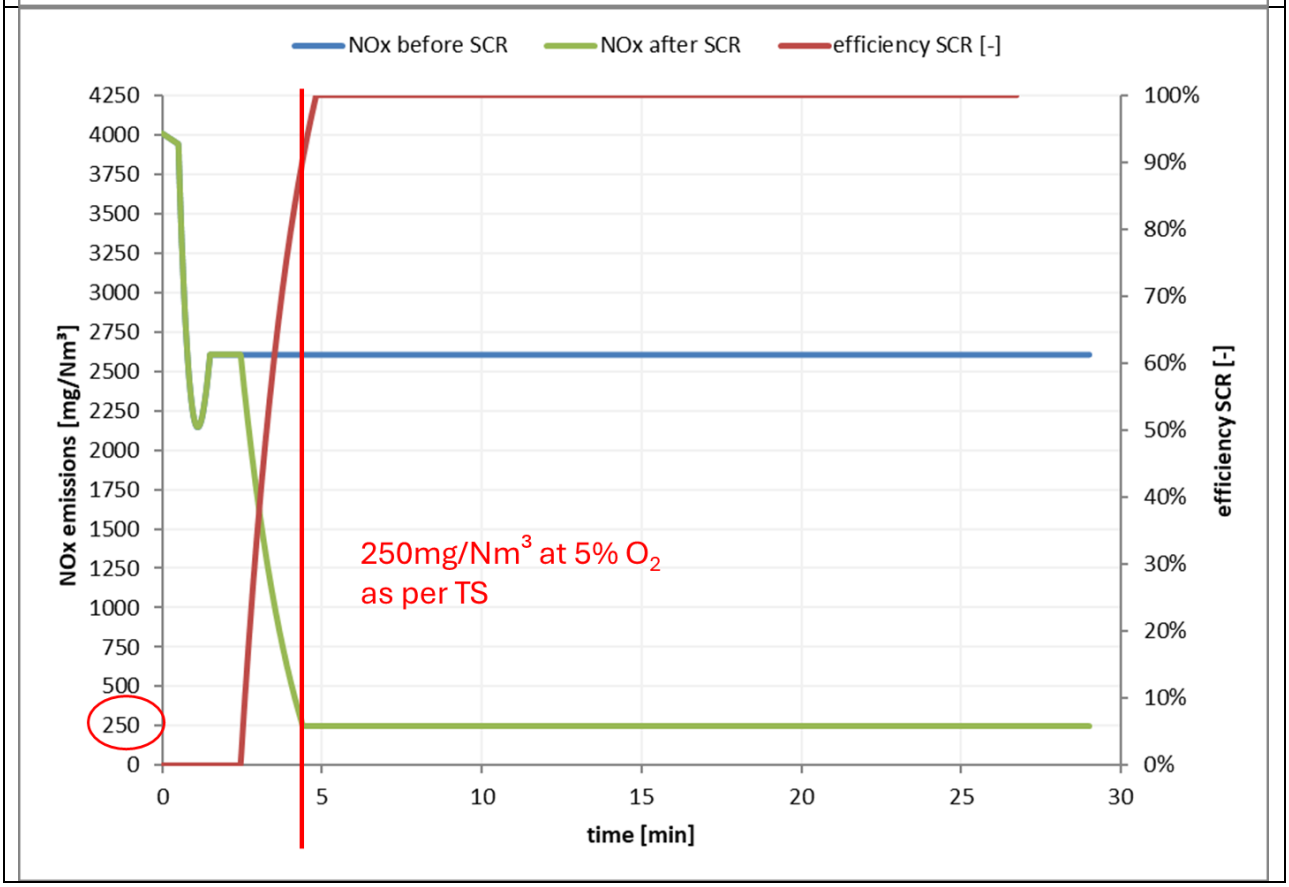
25%Load


SCR temperature
exhaust temperature
exhaust mass flow engine
temperature [°C]
exhaust mass flow [kg/h]
time [min]
0
100
200
300
400
500
600
700
0
1000
2000
3000
4000
5000
6000
7000
0
5
10
15
20
25
30
35

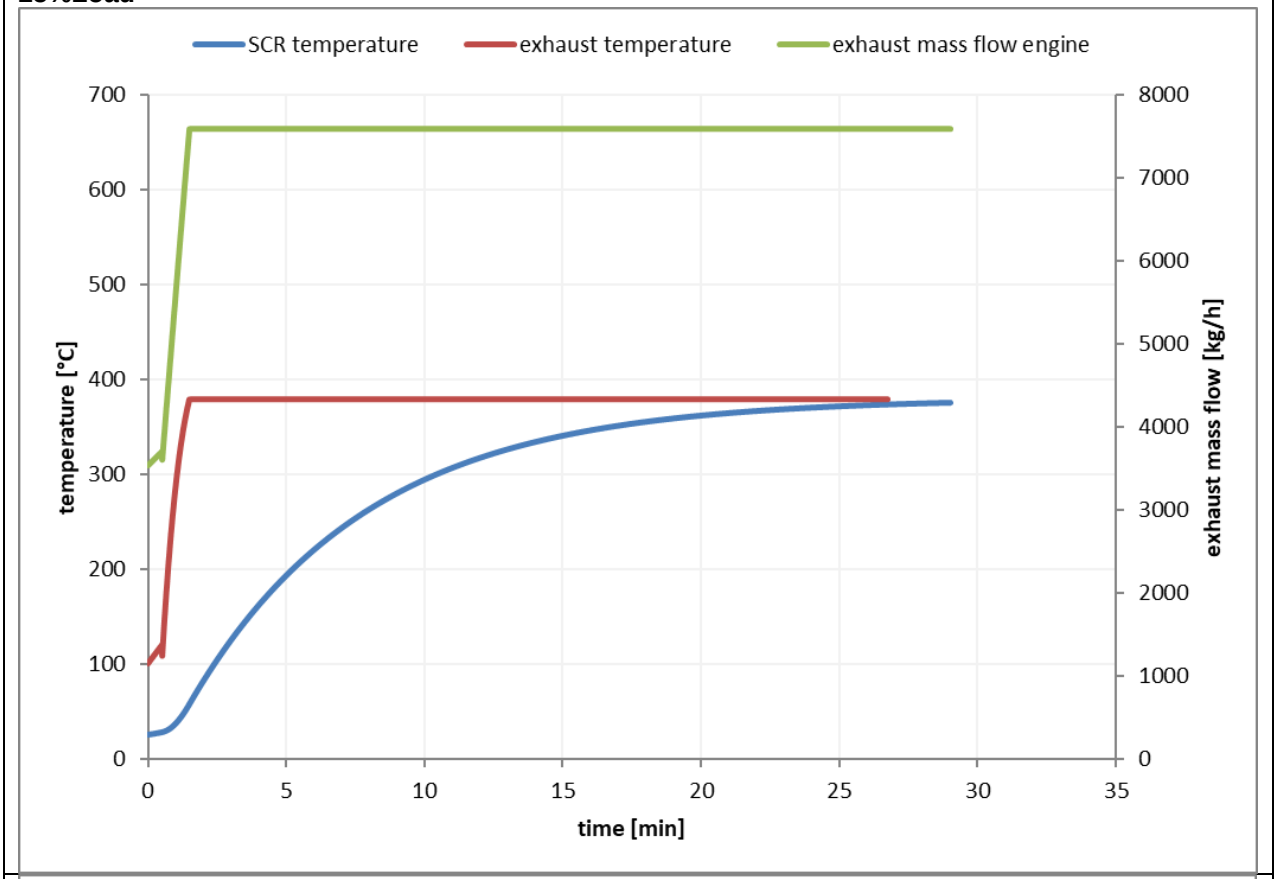

NOx before SCR
NOx after SCR
efficiency SCR [-]
NOx emissions [mg/Nm³]
efficiency SCR [-]
time [min]
250mg/Nm³ at 5% O₂
as per TS
0
250
500
750
1000
1250
1500
1750
2000
2250
2500
2750
3000
3250
3500
3750
4000
4250
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
0
5
10
15
20
25
30

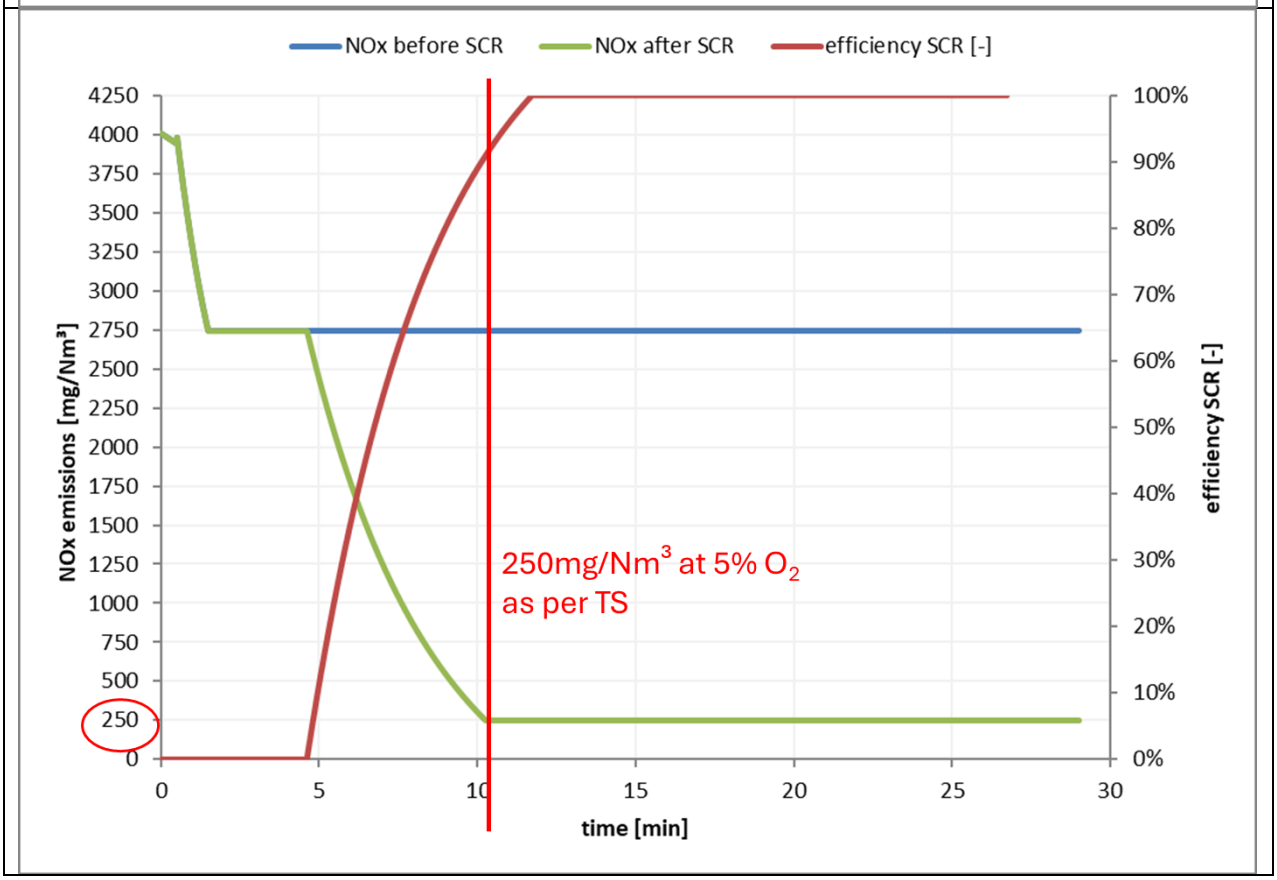
100% Load


SCR temperature
exhaust temperature
exhaust mass flow engine
temperature [°C]
exhaust mass flow [kg/h]
time [min]


NOx before SCR
NOx after SCR
efficiency SCR [-]
NOx emissions [mg/Nm³]
efficiency SCR [-]
time [min]
250mg/Nm³ at 5% O2
as per TS

25%Load


SCR temperature
exhaust temperature
exhaust mass flow engine
temperature [°C]
exhaust mass flow [kg/h]
time [min]


NOx before SCR
NOx after SCR
efficiency SCR [-]
NOx emissions [mg/Nm³]
efficiency SCR [-]
time [min]
250mg/Nm³ at 5% O2
as per TS