SERVICE REPORT

PREVENTIVE MAINTENANCE

CHASSIS DYNAMOMETER

R40 Lab

BPLJSKB-Perhubungan Darat
Bekasi, Jawa Barat, Indonesia

Duration: 2 Oct - 6 Oct 2023

By

David Paruntu & Santad Protjaroen

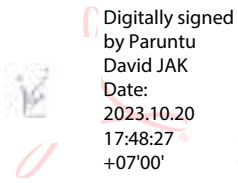
☐ **Semi Annual Maintenance**

■ **Annual Maintenance**

AVL SEA & Australia Co., Ltd. have performed the preventive maintenance work at Chassis Dynamometer Test Cell **R40 Lab, BPLJSKB-Perhubungan Darat, Bekasi, Jawa Barat, Indonesia.** The works were conducted during **2 Oct - 6 Oct 2023** and followed the AVL List GmbH maintenance instruction. The replaced parts were original and recommended in the equipment's maintenance instruction.

The preventive maintenance works were completely done. The detail report had been attached.

Performed by



( )

AVL SEA & Australia Co., Ltd.

Date: Oct 2023

Acceptance by

( )

BPLJSKB-Perhubungan Darat

Date:

Checked by



( )

AVL SEA & Australia Co., Ltd.

Date: Oct 2023

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1. Executive Summary

Executive Summary

No.	Description	Product Name	Priority	Possible Effect	Remark
1	Suggest to upgrade to VECON 2	VECON2016	HIGH	- SW issue/problem become more difficult, SW standard support will not be available anymore start from Dec 2023 - HW spare parts availability will be limited, standard spareparts availability Dec 2023	- AVL Hotline will support in case quotation is required - Details information related to new successor VECON 2 will be support by AVL Hotline - By upgrade VECON2016 to VECON 2(with Puma Open 2), at least SW and HW still be supported in case any issue/problem. A lots of benefit will come together with new windows10 and other new technology will be applied
2	Suggest to order ABB maintenance, part replacements, and reconditioning services for next year(2024)	ABB Drive	MID	Reduce ACS800 drive operating costs with preventive maintenance and reconditioning services	Can be performed during AVL maintenance 2024

2. List of Exchanged Parts

LIST OF EXCHANGED PARTS

No.	Description	Product Number	Remark
1	GREASE AERO SHELL 22	IC0654SP	
2	Mat Filter	GY3318SP	



3. Product Lifecycle

PRODUCT LIFECYCLE

No.	Description	Product Number	Priority	End-of-standard-support	Availability end (spare-parts)
1	PUMA 1.5.3 TWS	9-03271551		31/12/2023	31/12/2023
2	F-FEM-CON ADVANCED 6260.37	9138		31/12/2028	-
3	ABB ISU	ACS800-104-0145-3 S/N : 1162100703		2017	2029
4	ABB INU	Type : ACS800-104-0105-3+F272+Q967 S/N : 1162100702		2017	2029
5	ABB VCS	Type : ACS800-104-0040-3+N678+Q967 S/N :1162000529		2017	2029

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PREVENTIVE MAINTENANCE-CHECK LIST
CHASSIS DYNAMOMETER

Denomination	**Description**	**Status**		
Physical check		**O.K**	**N.O .K**	**Remark**
Signal Lamps	Check the signal lamps of the cabinet by press **Test Lamp** button at panel	X		- OK
Cable Remote Control	Visual check for remote control	X		- OK, working properly. Test with eStop from remote@100Km/h
Filter of cabinets	Visual check the filter	X		- Dirty / Replace
Cable Connections	Fasten loose connections change damaged connections Control the cable connections of • Cabinets • Connection boxes • Roller test stand • Voltage input • Cable remote control	X		-Re-fasten all connectors/Done
Cable Isolation	Visual check for cable isolation	X		-Re-fasten all connectors/Done
Pneumatic	-Check tightness of pneumatic connections -Air quality -Check pressure (min 4 bar)	X		- Leakage found - O.K. - Measure 5.5 bar
Brake pad	-Check brake thickness not less than 5mm -Check beak pad function On/Off	X		- It is working well - Brake thickness 8mm and 9mm
Function test		**O.K**	**N. O.K**	**Remark**
VECON 2016 PC	Test by turn on the VECON PC -Back up PUMA data and image file -Check cooling fan/clean cooling filter	X		- OK
Roller Brake	Automatic stop function	X		- OK
	Quick stop function	X		- OK
	Emergency stop -At VECON control desk -At Remote control -At Power cabinet	X		- OK
Locking device	-Test On/Off	X		- OK

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Check the vehicle cooling fan	Measured cooling fan is running for each vary speed, fan coefficient adjusted	X		- Done
QA Test	- Road Load Curve Evaluation 97- 08 - Dynamic Base Inertia Verification 97-05 - Chassis Dynamometer Looses static - Response Time Evaluation 97-04 - Parasitic Friction Compensation Evaluation 97-07	X		- Done, all test passed (result attached) - Additional note at summary
Load Cell Adjustment	1. Mount calibration device and adjust to zero point 2. Put on weights and adjust final point 3. Demount calibration device and adjust zero point 97-13	X		- Adjusted
Bearing lubrication	Lubricate bearings with grease type Aero Shell Grease 22	X		- Done
+S4 cabinet cooling fan C1N0-4B2	Set On/Off at 30 degree Celsius	X		- OK
Check power supply	- L1-L2, L1-L3, L2-L3, - L1-N - DC power supply	X		Measured - 3 Phase 408.5VAC, 409.9VAC, 406.5VAC - Single phase 232,2VAC, current 0.1Amp - Current 0.9Amp, 0.9Amp, 0.9Amp - DC power supply T3 = 23,79 VDC and T6 = 24VDC, 0.1Amp ==> Being adjusted to 24.14 and 24.26

Appendix A
97-04 ResponseTime

97-04 Response time evaluation
Cover sheet

General test data

Item	Chassis dynamometer
Type	25 inch MIL 1x1 ATV Emis AMB
Testbed configuration	1A1M Front
Driveline type	FWD
IZO-Number	IZO.150361
Customer	HUBDAT
Customer identification	IZO.150361
Test location	Jakarta
Tester	AVL
Department	Service Department
Current SW Version	VECON 1.5.3 HotFix: 16 Build: 5208 VV: 36
Measured data	Force
Signal/Channel	F_LC_act_WORK__XRX_C_GSV
Test date/Time start	10/4/2023 2:06:02 PM
Test date/Time end	10/4/2023 2:06:43 PM
Next test date	To be defined by Interval
Recommended inspection interval [Months]	To be defined by customer
Adjustments made since last test	Yes
Overall result	**Tolerances OK**

Environmental conditions	**Air temperature** [°C]	**Air humidity** [%rel]	**Air pressure** [hPa]
Tolerances	+/- 2.0	+/- 5.00	+/- 10.0
Test cell	31.5	33.20	992.1
Control room	31.5	33.20	992.1
Electrical cabinet room	31.5	33.20	992.1

Applied normal / measuring equipment	**Manufacturer and type**	**Serial no. / PM no.**	**valid until**
Testbed workstation	-	-	Not available

Description / method
97-04 evaluation of response-, settling time and overshoot analogue to method 1
Set an equivalent tractive force jump via parameter F0 and compare measured tractive force in VECON
By this, the complete tractive force measuring chain inclusive software is addressed

☐ Quality assurance settings used

Evaluation
Response time, overshoot, settling time (analogue to 97-04 method 1)

Response time

Simulated inertia [kg]	Evaluation [OK] / [NOK]
426.0	OK

Overshoot

Simulated inertia [kg]	Evaluation [OK] / [NOK]
426.0	OK

Settling time

Simulated inertia [kg]	Evaluation [OK] / [NOK]
426.0	OK

Comment

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Location, date, signature (inspector)

Location, date, signature (approver, different than inspector)

97-04 Response time evaluation
Test report

General test data

Description of measuring chain	Manufacturer and type	Serial no.	Module
Testbed workstation	-	-	-

Description of measuring chain Load Unit 1	Manufacturer and type	Serial no.	Module
Force Sensor	Interface	519080A	
Force Amplifier	SAFO	4299	
Force I/O Device	F-FEM CNT	2881	

Tolerances	Response time T90 [ms]	Overshoot [%]	Settling time [ms]	Settling time tolerance band of FS [%]
Customized settings	100	125.00	150	+/- 2.00

Response time

Simulated inertia [kg]	Response time [ms]	Evaluation [OK] / [NOK]
426.0	94	OK

Overshoot

Simulated inertia [kg]	Overshoot [%]	Evaluation [OK] / [NOK]
426.0	1.34	OK

Settling time

Simulated inertia [kg]	Settling time [ms]	Evaluation [OK] / [NOK]
426.0	112	OK

97-04 Response time evaluation

☐ Quality assurance settings

Settings

Number of runs		1
Simulated inertia	[kg]	426.0
Pulse width	[s]	2.000
Force amplitude	[N]	249.0
Start velocity	[km/h]	64.37

Nominal tolerance

Maximum response time	[ms]	100
Maximum overshoot	[%]	125.00
Maximum settling time	[ms]	150

Measured tolerance

Response time	[ms]	94
Overshoot	[%]	1.34
Settling time	[ms]	112

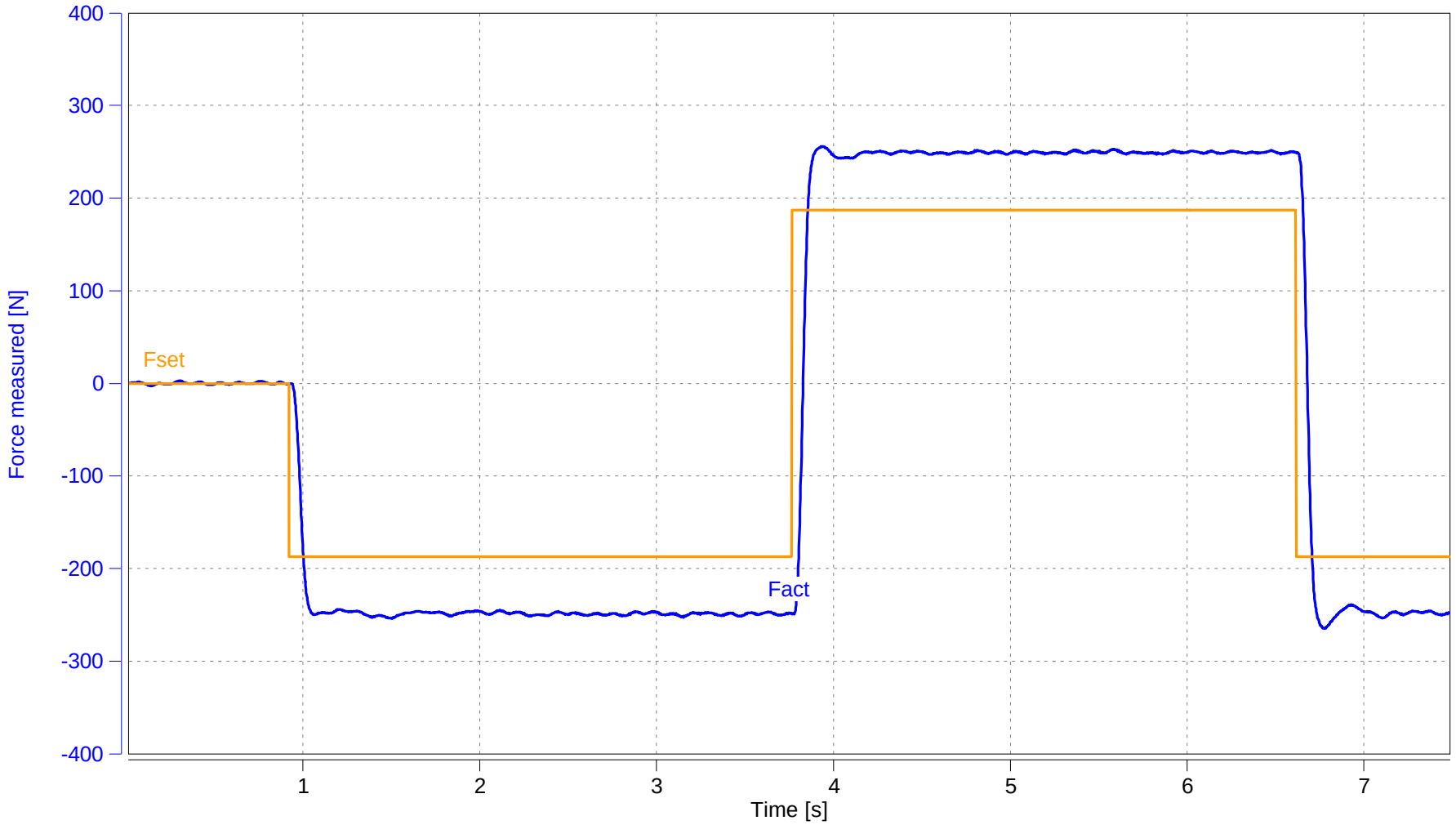
Procedure type: Positive and negative pulses without pause

Measured data

Run	Driveline type	F0 [N]	Simulated inertia [kg]	Response time [ms]	Overshoot [%]	Settling time [ms]
1	FWD	187.2	426.0	94	1.34	112

97-04 Response time evaluation

Graph

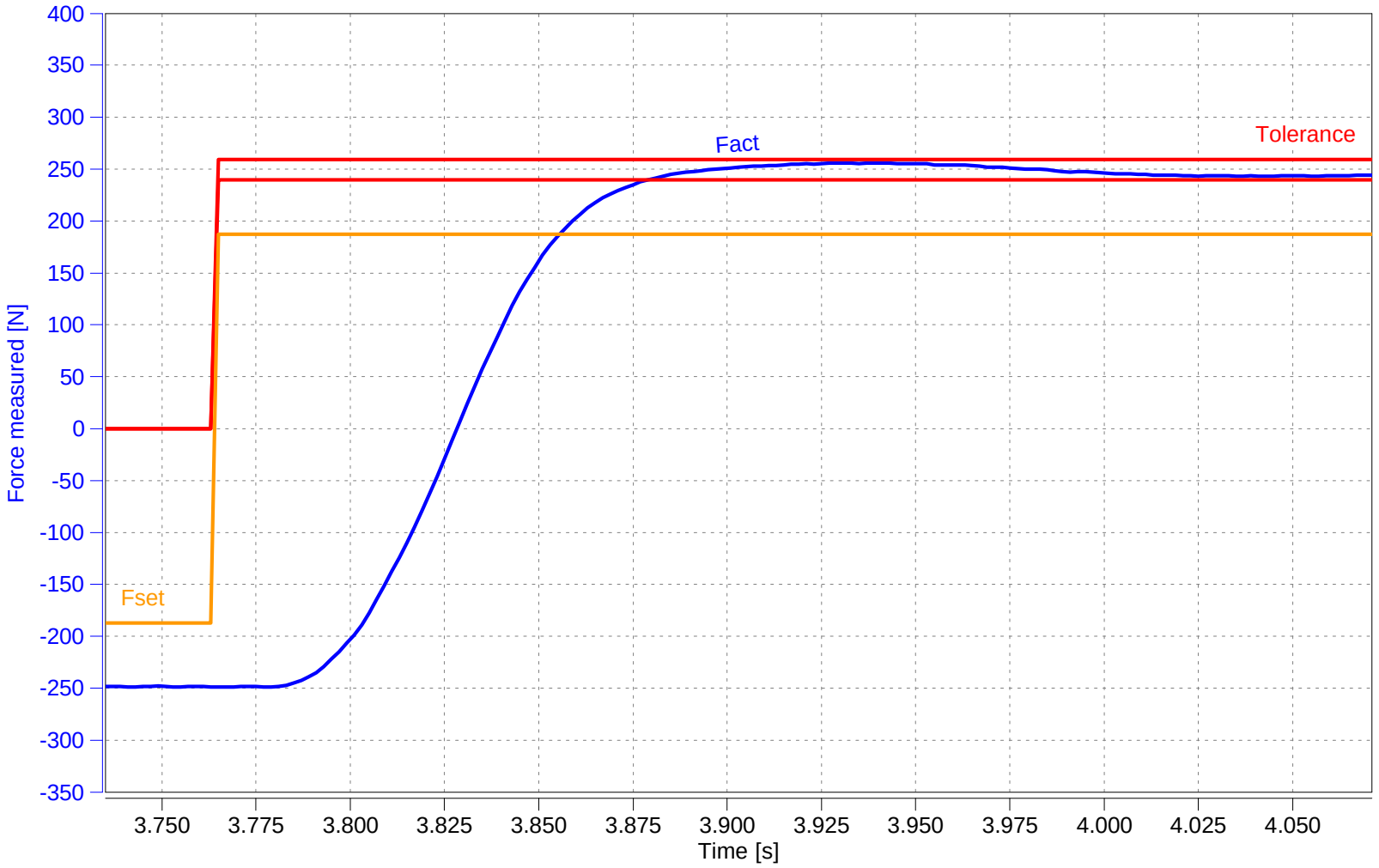


97-04 Response time evaluation

Graph settling time and overshoot

Jump number

1

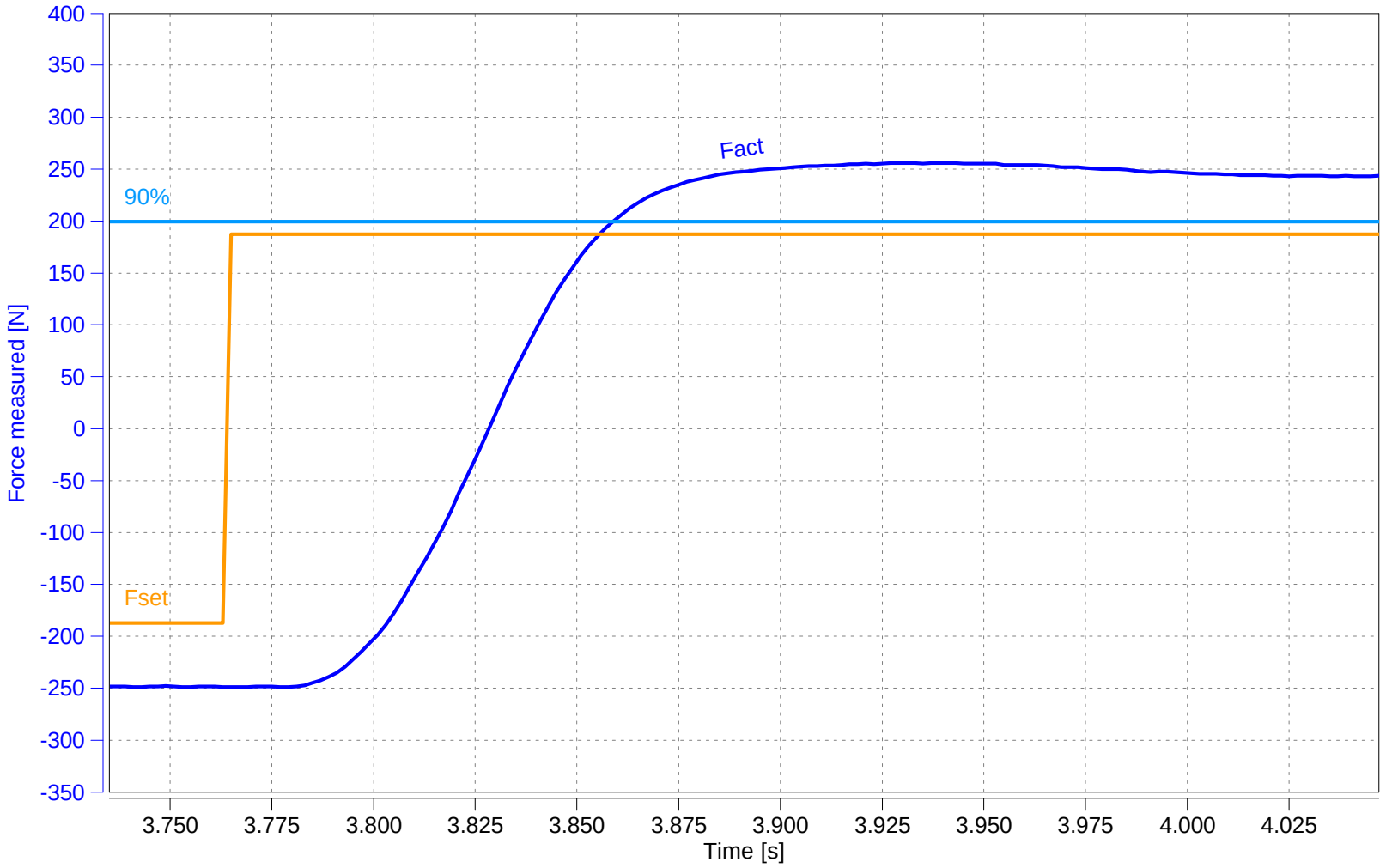


97-04 Response time evaluation

Graph response time

Jump number

1



97-04 Response time evaluation
Cover sheet

General test data

Item	Chassis dynamometer
Type	25 inch MIL 1x1 ATV Emis AMB
Testbed configuration	1A1M Front
Driveline type	FWD
IZO-Number	IZO.150361
Customer	HUBDAT
Customer identification	IZO.150361
Test location	Jakarta
Tester	AVL
Department	Service Department
Current SW Version	VECON 1.5.3 HotFix: 16 Build: 5208 VV: 36
Measured data	Force
Signal/Channel	F_LC_act_WORK__XRX_C_GSV
Test date/Time start	10/4/2023 1:56:32 PM
Test date/Time end	10/4/2023 1:57:13 PM
Next test date	To be defined by Interval
Recommended inspection interval [Months]	To be defined by customer
Adjustments made since last test	Yes
Overall result	**Tolerances OK**

Environmental conditions	**Air temperature** [°C]	**Air humidity** [%rel]	**Air pressure** [hPa]
Tolerances	+/- 2.0	+/- 5.00	+/- 10.0
Test cell	31.5	33.20	992.1
Control room	31.5	33.20	992.1
Electrical cabinet room	31.5	33.20	992.1

Applied normal / measuring equipment	**Manufacturer and type**	**Serial no. / PM no.**	**valid until**
Testbed workstation	-	-	Not available

Description / method
97-04 evaluation of response-, settling time and overshoot analogue to method 1
Set an equivalent tractive force jump via parameter F0 and compare measured tractive force in VECON
By this, the complete tractive force measuring chain inclusive software is addressed

☐ Quality assurance settings used

Evaluation
Response time, overshoot, settling time (analogue to 97-04 method 1)

Response time

Simulated inertia [kg]	Evaluation [OK] / [NOK]
566.7	OK

Overshoot

Simulated inertia [kg]	Evaluation [OK] / [NOK]
566.7	OK

Settling time

Simulated inertia [kg]	Evaluation [OK] / [NOK]
566.7	OK

Comment

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Location, date, signature (inspector)

Location, date, signature (approver, different than inspector)

97-04 Response time evaluation
Test report

General test data

Description of measuring chain	Manufacturer and type	Serial no.	Module
Testbed workstation	-	-	-

Description of measuring chain Load Unit 1	Manufacturer and type	Serial no.	Module
Force Sensor	Interface	519080A	
Force Amplifier	SAFO	4299	
Force I/O Device	F-FEM CNT	2881	

Tolerances	Response time T90 [ms]	Overshoot [%]	Settling time [ms]	Settling time tolerance band of FS [%]
Customized settings	100	125.00	150	+/- 2.00

Response time

Simulated inertia [kg]	Response time [ms]	Evaluation [OK] / [NOK]
566.7	96	OK

Overshoot

Simulated inertia [kg]	Overshoot [%]	Evaluation [OK] / [NOK]
566.7	1.05	OK

Settling time

Simulated inertia [kg]	Settling time [ms]	Evaluation [OK] / [NOK]
566.7	112	OK

97-04 Response time evaluation

☐ Quality assurance settings

Settings

Number of runs		1
Simulated inertia	[kg]	566.7
Pulse width	[s]	2.000
Force amplitude	[N]	340.4
Start velocity	[km/h]	64.37

Nominal tolerance

Maximum response time	[ms]	100
Maximum overshoot	[%]	125.00
Maximum settling time	[ms]	150

Measured tolerance

Response time	[ms]	96
Overshoot	[%]	1.05
Settling time	[ms]	112

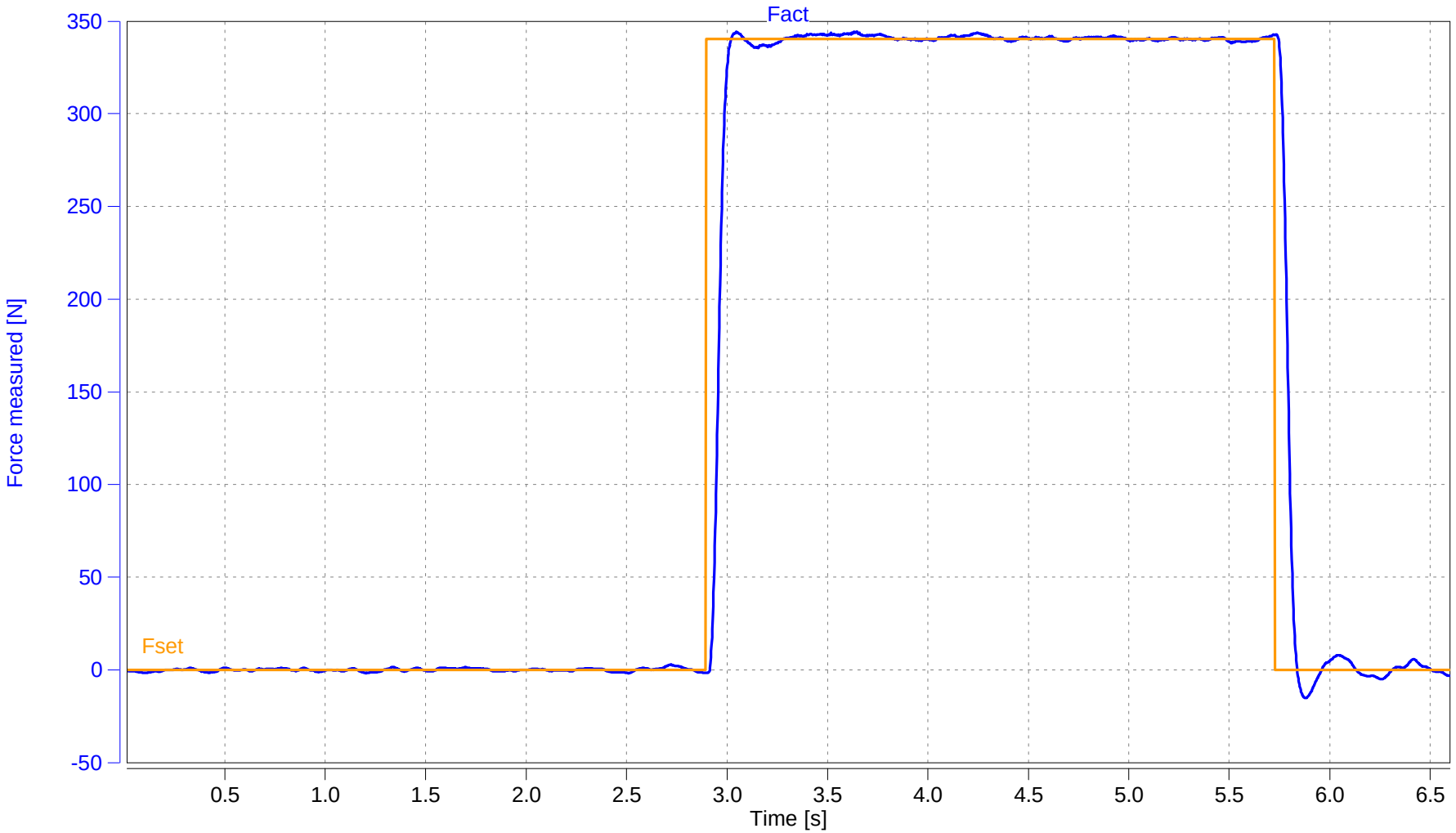
Procedure type: Positive and negative pulses with pause

Measured data

Run	Driveline type	F0 [N]	Simulated inertia [kg]	Response time [ms]	Overshoot [%]	Settling time [ms]
1	FWD	340.4	566.7	96	1.05	112

97-04 Response time evaluation

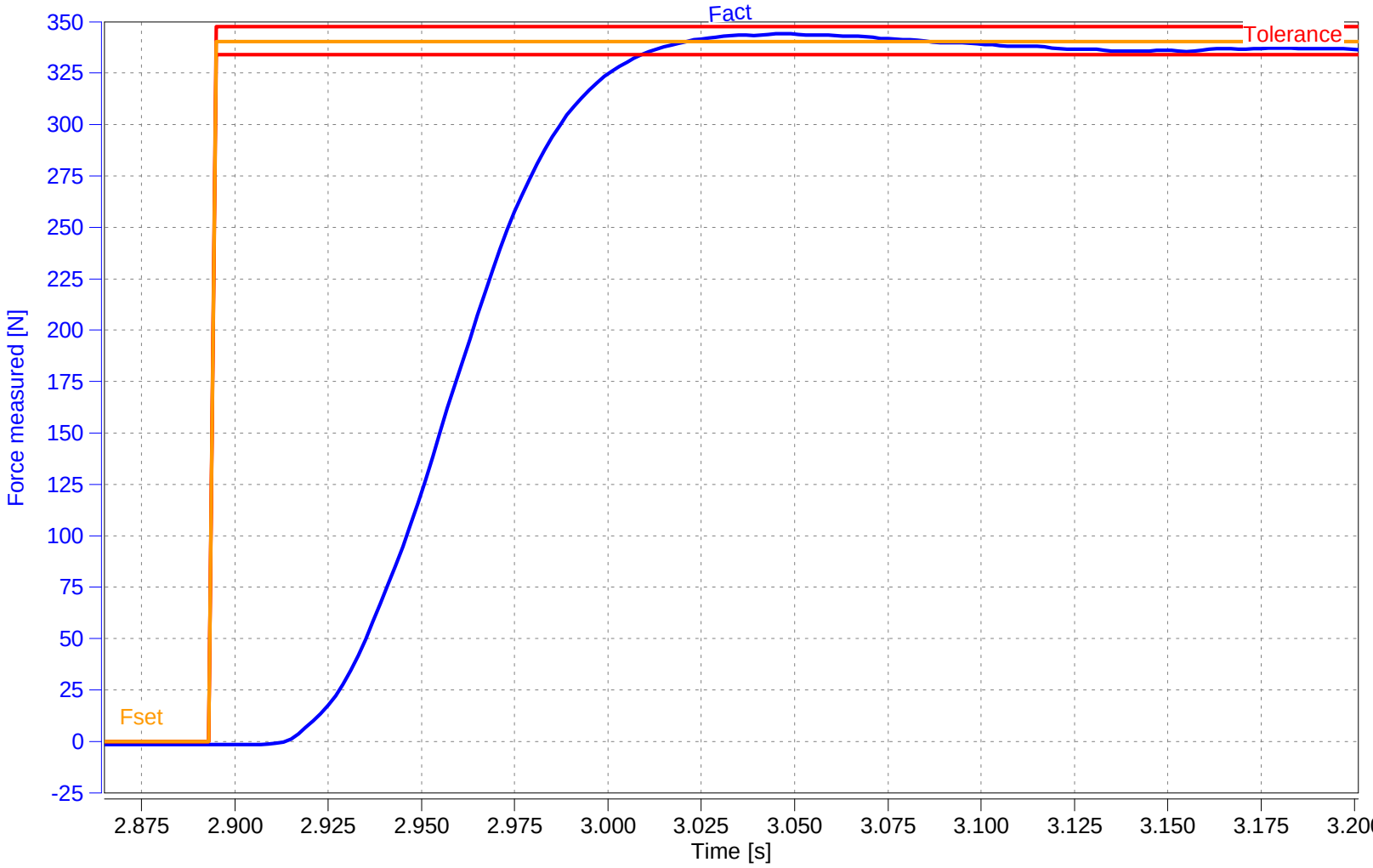
Graph



97-04 Response time evaluation

Graph settling time and overshoot

Jump number 1

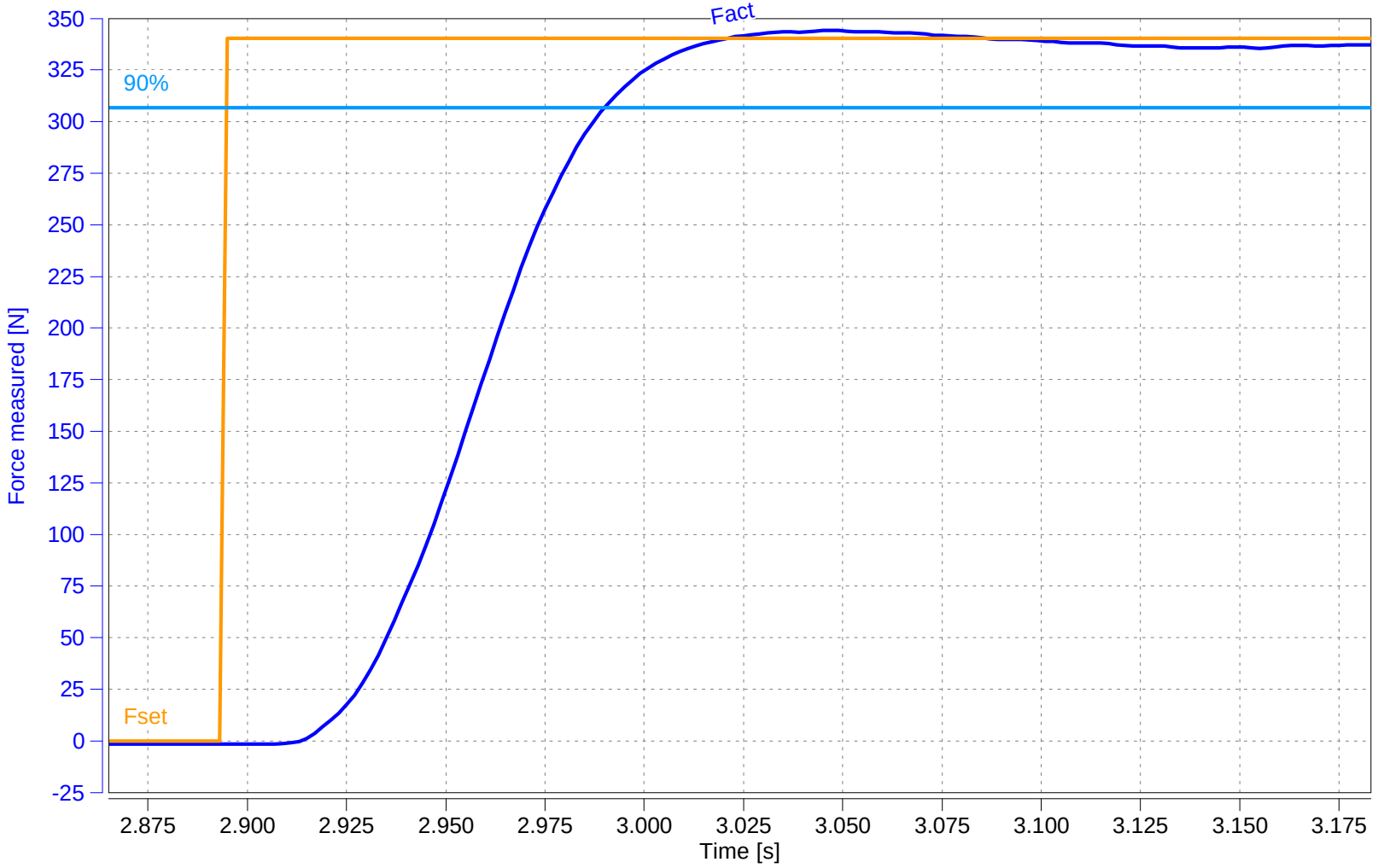


97-04 Response time evaluation

Graph response time

Jump number

1



97-04 Response time evaluation
Cover sheet

General test data

Item	Chassis dynamometer
Type	25 inch MIL 1x1 ATV Emis AMB
Testbed configuration	1A1M Front
Driveline type	FWD
IZO-Number	IZO.150361
Customer	HUBDAT
Customer identification	IZO.150361
Test location	Jakarta
Tester	AVL
Department	Service Department
Current SW Version	VECON 1.5.3 HotFix: 16 Build: 5208 VV: 36
Measured data	Force
Signal/Channel	F_LC_act_WORK__XRX_C_GSV
Test date/Time start	10/4/2023 3:18:47 PM
Test date/Time end	10/4/2023 3:19:27 PM
Next test date	To be defined by Interval
Recommended inspection interval [Months]	To be defined by customer
Adjustments made since last test	Yes
Overall result	**Tolerances OK**

Environmental conditions	**Air temperature** [°C]	**Air humidity** [%rel]	**Air pressure** [hPa]
Tolerances	+/- 2.0	+/- 5.00	+/- 10.0
Test cell	31.5	33.20	992.1
Control room	31.5	33.20	992.1
Electrical cabinet room	31.5	33.20	992.1

Applied normal / measuring equipment	**Manufacturer and type**	**Serial no. / PM no.**	**valid until**
Testbed workstation	-	-	Not available

Description / method
97-04 evaluation of response-, settling time and overshoot analogue to method 1
Set an equivalent tractive force jump via parameter F0 and compare measured tractive force in VECON
By this, the complete tractive force measuring chain inclusive software is addressed

☐ Quality assurance settings used

Evaluation
Response time, overshoot, settling time (analogue to 97-04 method 1)

Response time

Simulated inertia [kg]	Evaluation [OK] / [NOK]
1172.0	OK

Overshoot

Simulated inertia [kg]	Evaluation [OK] / [NOK]
1172.0	OK

Settling time

Simulated inertia [kg]	Evaluation [OK] / [NOK]
1172.0	OK

Comment

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Location, date, signature (inspector)

Location, date, signature (approver, different than inspector)

97-04 Response time evaluation
Test report

General test data

Description of measuring chain	Manufacturer and type	Serial no.	Module
Testbed workstation	-	-	-

Description of measuring chain Load Unit 1	Manufacturer and type	Serial no.	Module
Force Sensor	Interface	519080A	
Force Amplifier	SAFO	4299	
Force I/O Device	F-FEM CNT	2881	

Tolerances	Response time T90 [ms]	Overshoot [%]	Settling time [ms]	Settling time tolerance band of FS [%]
Customized settings	100	125.00	150	+/- 2.00

Response time

Simulated inertia [kg]	Response time [ms]	Evaluation [OK] / [NOK]
1172.0	96	OK

Overshoot

Simulated inertia [kg]	Overshoot [%]	Evaluation [OK] / [NOK]
1172.0	1.96	OK

Settling time

Simulated inertia [kg]	Settling time [ms]	Evaluation [OK] / [NOK]
1172.0	108	OK

97-04 Response time evaluation

☐ Quality assurance settings

Settings

Number of runs		1
Simulated inertia	[kg]	1172.0
Pulse width	[s]	2.000
Force amplitude	[N]	682.0
Start velocity	[km/h]	64.37

Nominal tolerance

Maximum response time	[ms]	100
Maximum overshoot	[%]	125.00
Maximum settling time	[ms]	150

Measured tolerance

Response time	[ms]	96
Overshoot	[%]	1.96
Settling time	[ms]	108

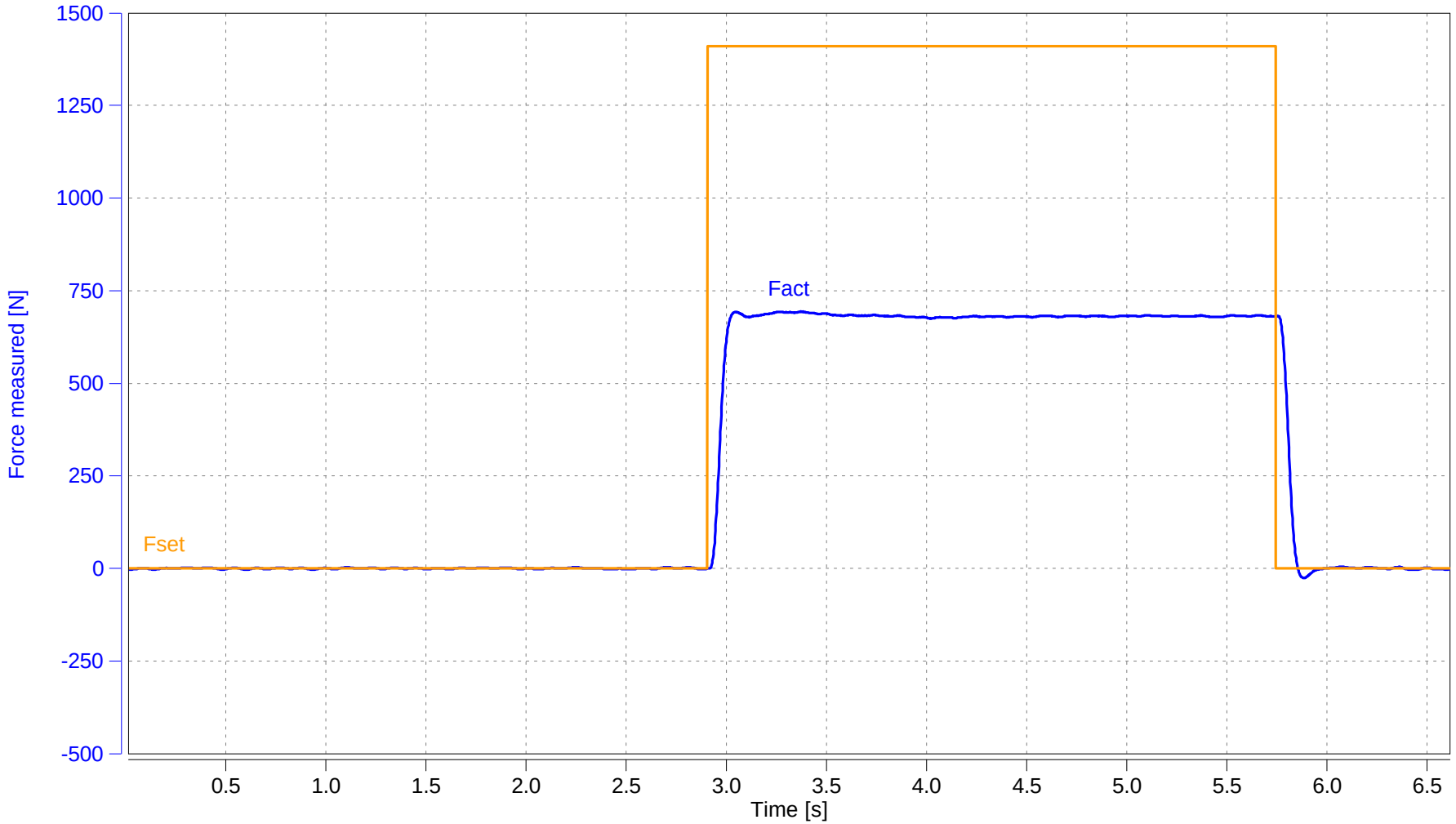
Procedure type: Positive and negative pulses with pause

Measured data

Run	Driveline type	F0 [N]	Simulated inertia [kg]	Response time [ms]	Overshoot [%]	Settling time [ms]
1	FWD	1410.5	1172.0	96	1.96	108

97-04 Response time evaluation

Graph

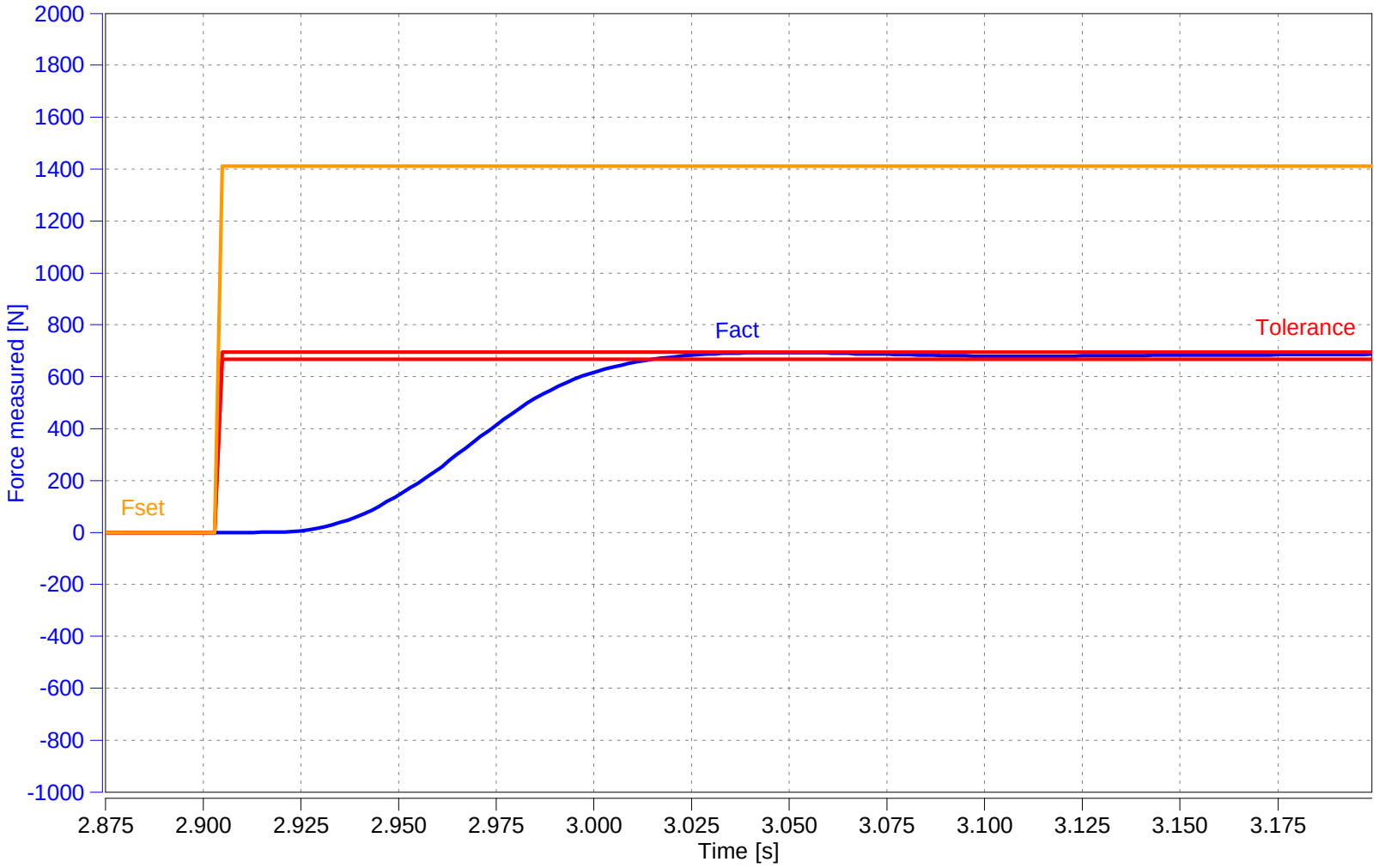


97-04 Response time evaluation

Graph settling time and overshoot

Jump number

1

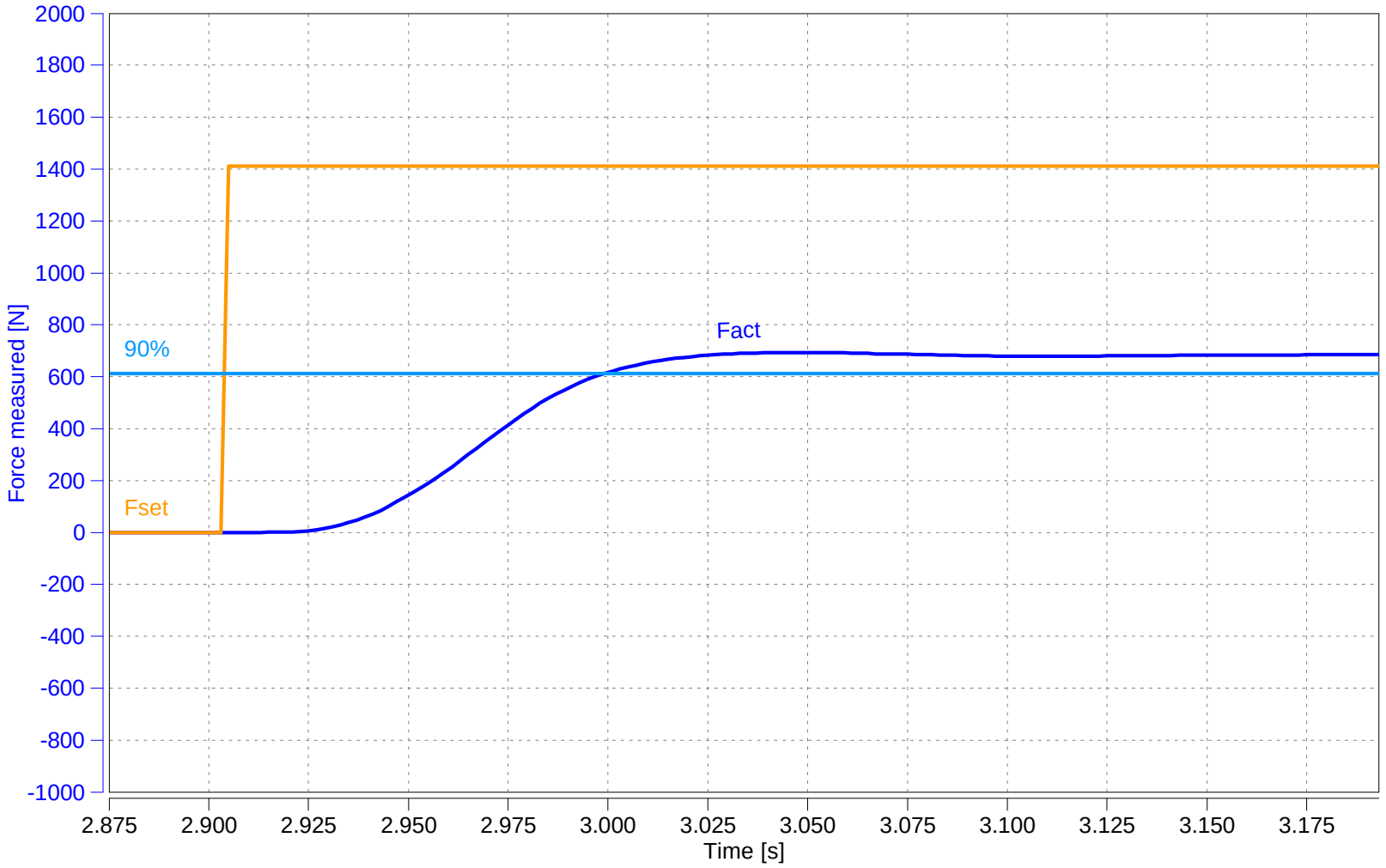


97-04 Response time evaluation

Graph response time

Jump number

1



Appendix B
97-05 Dynamic base inertia verification

97-05 Dynamic base inertia verification
Cover sheet

General test data

Item	Chassis dynamometer
Type	25 inch MIL 1x1 ATV Emis AMB
Testbed configuration	1A1M Front
Driveline type	FWD
IZO-Number	IZO.150361
Customer	HUBDAT
Customer identification	IZO.150361
Test location	Jakarta
Tester	AVL
Department	Service Department
Current SW Version	VECON 1.5.3 HotFix: 16 Build: 5208 VV: 36
Measured data	Force, Time
Signal/Channel	F_LC_act_WORK__XRX_C_GSV, Time (Eav_v)
Test date/Time start	10/4/2023 1:44:54 PM
Test date/Time end	10/4/2023 1:53:37 PM
Next test date	To be defined by Interval
Recommended inspection interval [Months]	To be defined by customer
Adjustments made since last test	Yes
Overall result	**Tolerances OK**

Environmental conditions	**Air temperature** [°C]	**Air humidity** [%rel]	**Air pressure** [hPa]
Tolerances	+/- 2.0	+/- 5.00	+/- 10.0
Test cell	31.5	33.20	992.1
Control room	31.5	33.20	992.1
Electrical cabinet room	31.5	33.20	992.1

Applied normal / measuring equipment	**Manufacturer and type**	**Serial no. / PM no.**	**valid until**
Testbed workstation	-	-	Not available

Description / method
97-05 evaluation of base inertia

☐ Quality assurance settings used

Evaluation
All individual base inertias are within the given tolerance

Results

Run	Evaluation [OK] / [NOK]
1	OK
2	OK
3	OK
4	OK
5	OK

Comment

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Location, date, signature (inspector)

Location, date, signature (approver, different than inspector)

General test data

Description of measuring chain	Manufacturer and type	Serial no.	Module
Testbed workstation	-	-	-
Velocity I/O Device	F-FEM CON	9607	

Description of measuring chain Load Unit 1	Manufacturer and type	Serial no.	Module
Force Sensor	Interface	519080A	
Force Amplifier	SAFO	4299	
Force I/O Device	F-FEM CNT	2881	

Tolerances	Measured inertia to BIW Absolute tolerance of full scale [kg]	BIW to demand inertia Relative tolerance of full scale [%]
Customized settings	+/- 13.6	+/- 0.20

Results

Run	Acceleration / Deceleration [m/s2]	Average inertia Dev. abs. [kg]	Average inertia Dev. rel. [%]	Evaluation [OK] / [NOK]
1	0.447	-1.1	-0.04	OK
1	-0.447	1.3	-0.04	OK
2	0.447	-1.2	-0.04	OK
2	-0.447	0.9	-0.04	OK
3	0.447	-0.6	-0.04	OK
3	-0.447	0.6	-0.04	OK
4	0.447	-0.7	-0.04	OK
4	-0.447	0.7	-0.04	OK
5	0.447	-0.7	-0.04	OK
5	-0.447	0.6	-0.04	OK

97-05 Dynamic base inertia verification

Inertia verification

☐ Quality assurance settings ☑ Use mechanical base inertia

Settings

Number of runs	5
Simulated inertia [kg]	566.7

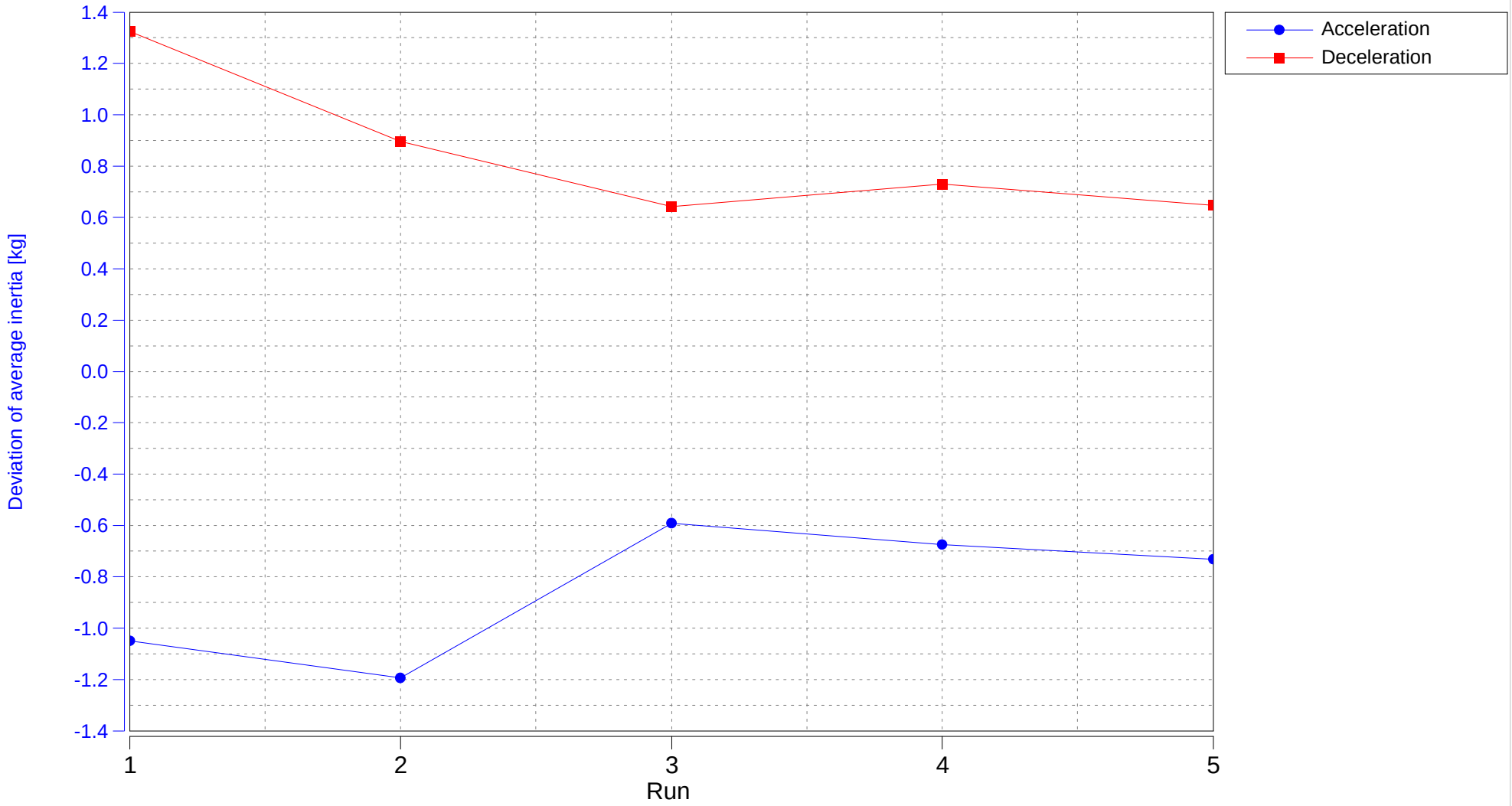
Acceleration	[m/s2]	0.447
Start velocity	[km/h]	16.09
Final velocity	[km/h]	64.37

	Tolerance		Measured
BIW			[kg] 566.9
Measured inertia to BIW	[kg]	13.6	[kg] 1.3
BIW to demand inertia	[%]	0.20	[%] -0.04

Measured data

Run	Driveline type	Acceleration / Deceleration [m/s2]	Start velocity [km/h]	Final velocity [km/h]	Force meas. [N]	Time meas. [s]	Inertia meas. [kg]	Average inertia [kg]	Average inertia Dev. abs. [kg]	Average inertia Dev. rel. [%]
1	FWD	0.447	16.09	64.37	-253.3	30.071	568.0	566.9	-1.1	-0.04
1	FWD	-0.447	64.37	16.09	253.3	29.941	565.6	566.9	1.3	-0.04
2	FWD	0.447	16.09	64.37	-253.3	30.081	568.1	566.9	-1.2	-0.04
2	FWD	-0.447	64.37	16.09	253.3	29.965	566.0	566.9	0.9	-0.04
3	FWD	0.447	16.09	64.37	-253.3	30.049	567.5	566.9	-0.6	-0.04
3	FWD	-0.447	64.37	16.09	253.3	29.977	566.3	566.9	0.6	-0.04
4	FWD	0.447	16.09	64.37	-253.3	30.053	567.6	566.9	-0.7	-0.04
4	FWD	-0.447	64.37	16.09	253.4	29.969	566.2	566.9	0.7	-0.04
5	FWD	0.447	16.09	64.37	-253.3	30.053	567.7	566.9	-0.7	-0.04
5	FWD	-0.447	64.37	16.09	253.3	29.979	566.3	566.9	0.6	-0.04

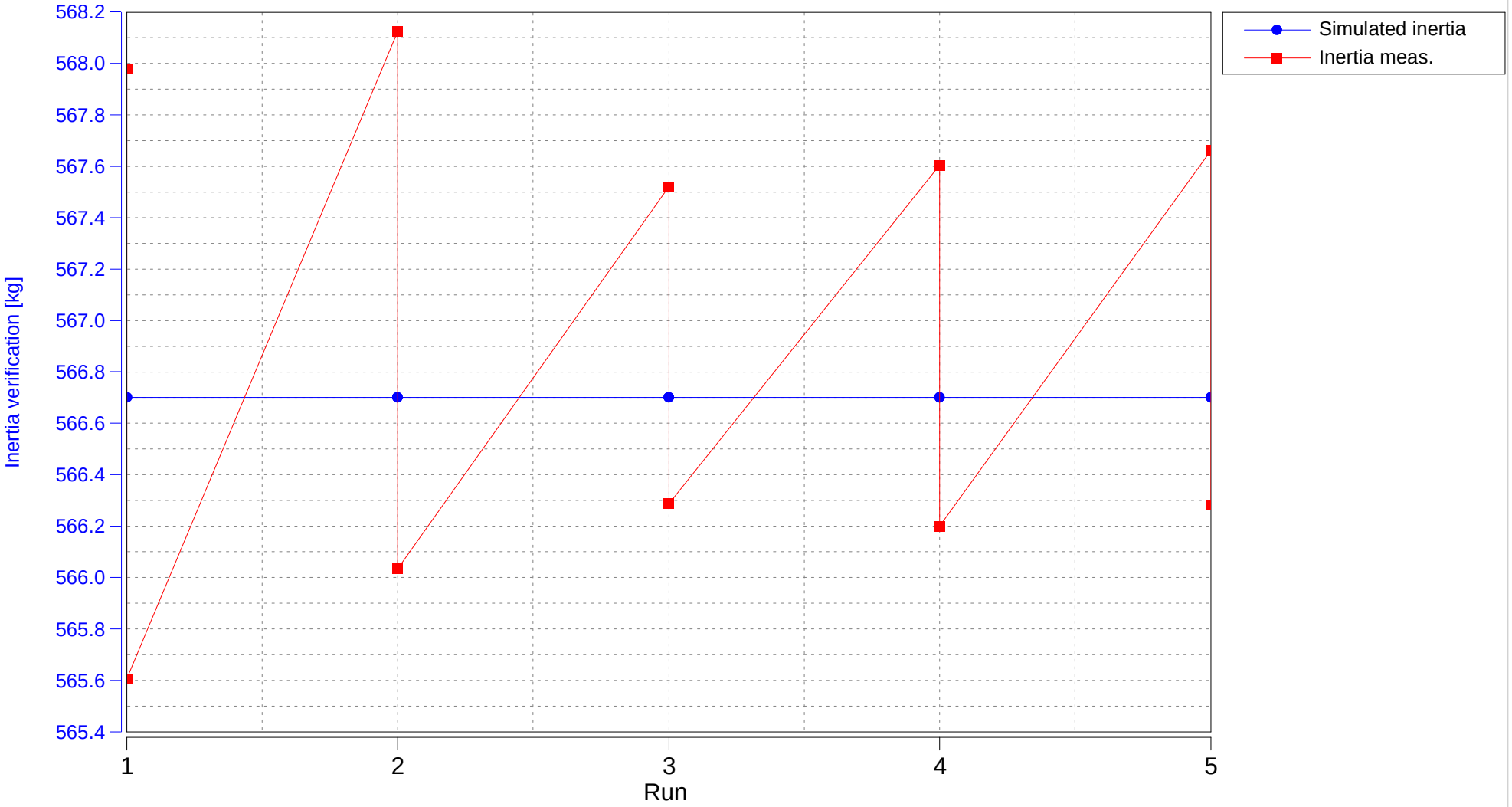
Graph


Deviation of average inertia [kg]
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
1
2
3
4
5
Run
Acceleration
Deceleration

97-05 Dynamic base inertia verification

Inertia verification

Graph



97-05 Dynamic base inertia verification
Cover sheet

General test data

Item	Chassis dynamometer
Type	25 inch MIL 1x1 ATV Emis AMB
Testbed configuration	1A1M Front
Driveline type	FWD
IZO-Number	IZO.150361
Customer	HUBDAT
Customer identification	IZO.150361
Test location	Jakarta
Tester	AVL
Department	Service Department
Current SW Version	VECON 1.5.3 HotFix: 16 Build: 5208 VV: 36
Measured data	Force, Time
Signal/Channel	F_LC_act_WORK__XRX_C_GSV, Time (Eav_v)
Test date/Time start	10/4/2023 1:28:15 PM
Test date/Time end	10/4/2023 1:32:31 PM
Next test date	To be defined by Interval
Recommended inspection interval [Months]	To be defined by customer
Adjustments made since last test	Yes
Overall result	**Tolerances OK**

Environmental conditions	**Air temperature** [°C]	**Air humidity** [%rel]	**Air pressure** [hPa]
Tolerances	+/- 2.0	+/- 5.00	+/- 10.0
Test cell	31.5	33.20	992.1
Control room	31.5	33.20	992.1
Electrical cabinet room	31.5	33.20	992.1

Applied normal / measuring equipment	**Manufacturer and type**	**Serial no. / PM no.**	**valid until**
Testbed workstation	-	-	Not available

Description / method
97-05 evaluation of base inertia

☐ Quality assurance settings used

Evaluation
All individual base inertias are within the given tolerance

Results

Run	Evaluation [OK] / [NOK]
1	OK
2	OK
3	OK
4	OK
5	OK

Comment

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Location, date, signature (inspector)

Location, date, signature (approver, different than inspector)

General test data

Description of measuring chain	Manufacturer and type	Serial no.	Module
Testbed workstation	-	-	-
Velocity I/O Device	F-FEM CON	9607	

Description of measuring chain Load Unit 1	Manufacturer and type	Serial no.	Module
Force Sensor	Interface	519080A	
Force Amplifier	SAFO	4299	
Force I/O Device	F-FEM CNT	2881	

Tolerances	Measured inertia to BIW Absolute tolerance of full scale [kg]	BIW to demand inertia Relative tolerance of full scale [%]
Customized settings	+/- 13.6	+/- 0.20

Results

Run	Acceleration / Deceleration [m/s2]	Average inertia Dev. abs. [kg]	Average inertia Dev. rel. [%]	Evaluation [OK] / [NOK]
1	1.341	-1.2	-0.01	OK
1	-1.341	1.0	-0.01	OK
2	1.341	-0.8	-0.01	OK
2	-1.341	1.1	-0.01	OK
3	1.341	-0.9	-0.01	OK
3	-1.341	1.0	-0.01	OK
4	1.341	-0.9	-0.01	OK
4	-1.341	1.0	-0.01	OK
5	1.341	-1.2	-0.01	OK
5	-1.341	1.0	-0.01	OK

97-05 Dynamic base inertia verification

Inertia verification

☐ Quality assurance settings ☑ Use mechanical base inertia

Settings

Number of runs	5
Simulated inertia [kg]	566.7

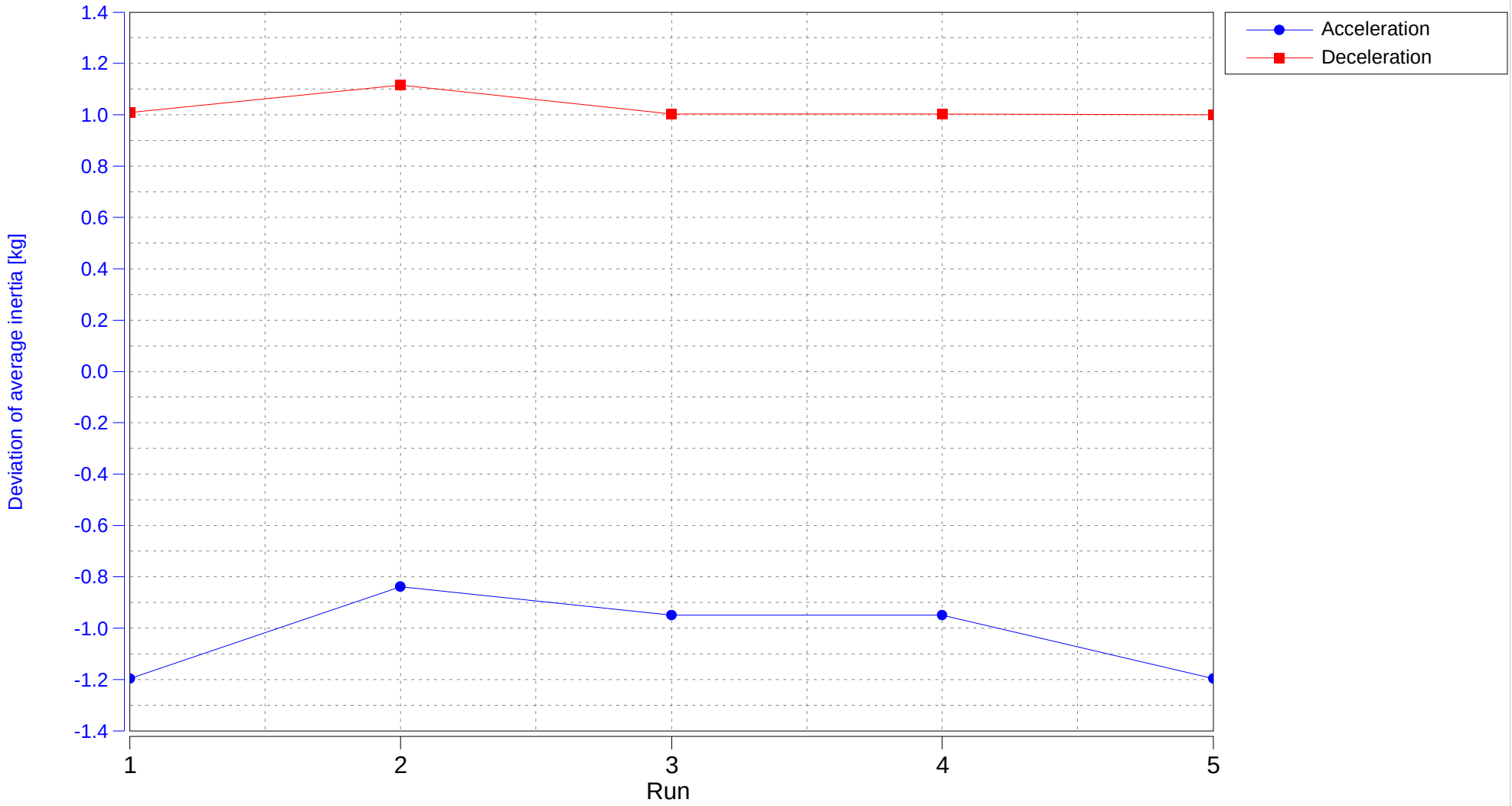
Acceleration	[m/s2]	1.341
Start velocity	[km/h]	16.09
Final velocity	[km/h]	64.37

	Tolerance		Measured
BIW			[kg] 566.7
Measured inertia to BIW	[kg]	13.6	[kg] -1.2
BIW to demand inertia	[%]	0.20	[%] -0.01

Measured data

Run	Driveline type	Acceleration / Deceleration [m/s2]	Start velocity [km/h]	Final velocity [km/h]	Force meas. [N]	Time meas. [s]	Inertia meas. [kg]	Average inertia [kg]	Average inertia Dev. abs. [kg]	Average inertia Dev. rel. [%]
1	FWD	1.341	16.09	64.37	-760.0	10.022	567.9	566.7	-1.2	-0.01
1	FWD	-1.341	64.37	16.09	760.2	9.980	565.7	566.7	1.0	-0.01
2	FWD	1.341	16.09	64.37	-759.9	10.016	567.6	566.7	-0.8	-0.01
2	FWD	-1.341	64.37	16.09	760.2	9.978	565.6	566.7	1.1	-0.01
3	FWD	1.341	16.09	64.37	-759.9	10.018	567.7	566.7	-0.9	-0.01
3	FWD	-1.341	64.37	16.09	760.2	9.980	565.7	566.7	1.0	-0.01
4	FWD	1.341	16.09	64.37	-759.9	10.018	567.7	566.7	-0.9	-0.01
4	FWD	-1.341	64.37	16.09	760.2	9.980	565.7	566.7	1.0	-0.01
5	FWD	1.341	16.09	64.37	-760.0	10.022	567.9	566.7	-1.2	-0.01
5	FWD	-1.341	64.37	16.09	760.2	9.980	565.7	566.7	1.0	-0.01

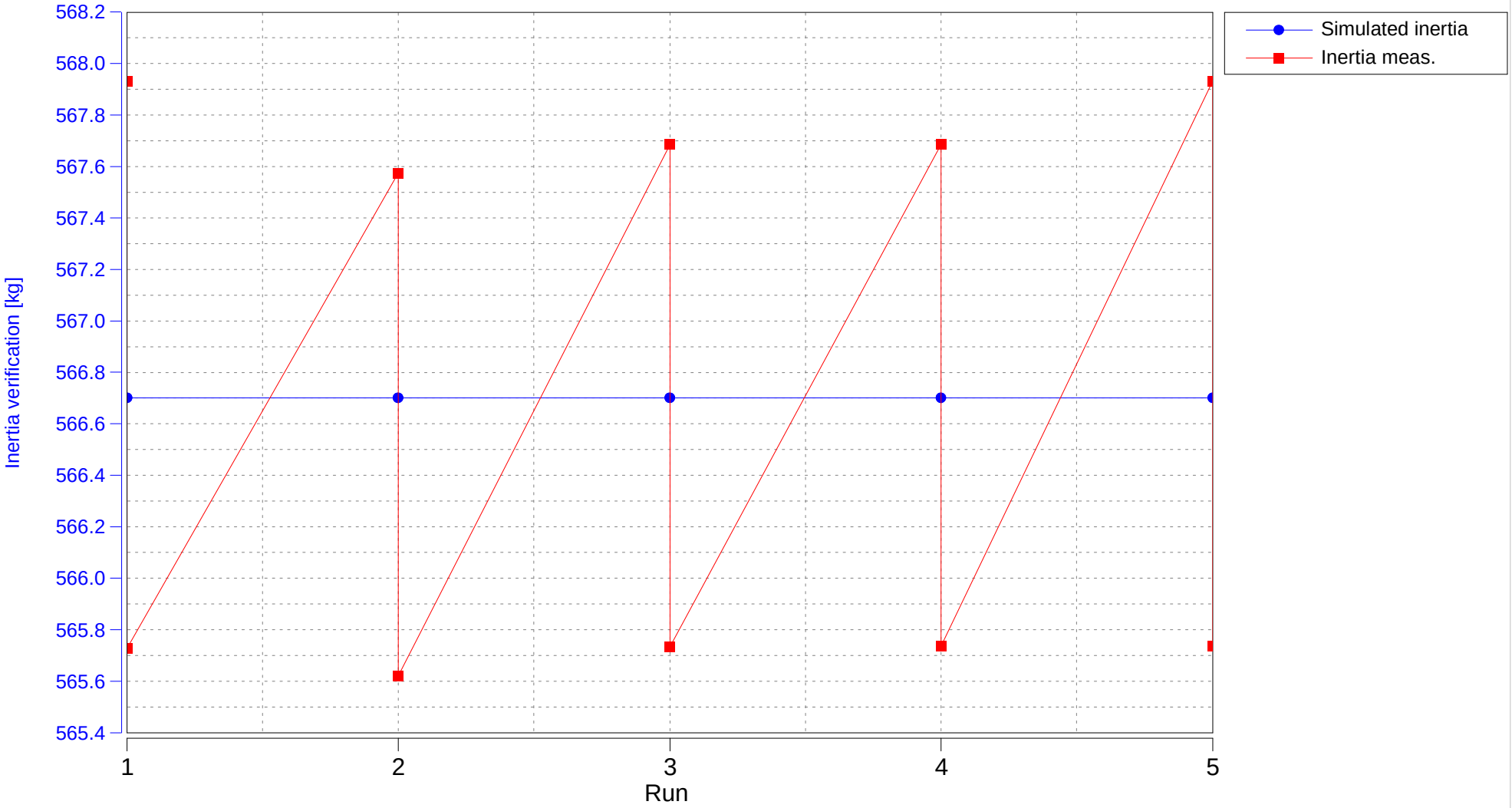
Graph


Deviation of average inertia [kg]
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
1
2
3
4
5
Run
Acceleration
Deceleration

97-05 Dynamic base inertia verification

Inertia verification

Graph



97-05 Dynamic base inertia verification
Cover sheet

General test data

Item	Chassis dynamometer
Type	25 inch MIL 1x1 ATV Emis AMB
Testbed configuration	1A1M Front
Driveline type	FWD
IZO-Number	IZO.150361
Customer	HUBDAT
Customer identification	IZO.150361
Test location	Jakarta
Tester	AVL
Department	Service Department
Current SW Version	VECON 1.5.3 HotFix: 16 Build: 5208 VV: 36
Measured data	Force, Time
Signal/Channel	F_LC_act_WORK__XRX_C_GSV, Time (Eav_v)
Test date/Time start	10/4/2023 1:37:15 PM
Test date/Time end	10/4/2023 1:40:39 PM
Next test date	To be defined by Interval
Recommended inspection interval [Months]	To be defined by customer
Adjustments made since last test	Yes
Overall result	**Tolerances OK**

Environmental conditions	**Air temperature** [°C]	**Air humidity** [%rel]	**Air pressure** [hPa]
Tolerances	+/- 2.0	+/- 5.00	+/- 10.0
Test cell	31.5	33.20	992.1
Control room	31.5	33.20	992.1
Electrical cabinet room	31.5	33.20	992.1

Applied normal / measuring equipment	**Manufacturer and type**	**Serial no. / PM no.**	**valid until**
Testbed workstation	-	-	Not available

Description / method
97-05 evaluation of base inertia

☐ Quality assurance settings used

Evaluation
All individual base inertias are within the given tolerance

Results

Run	Evaluation [OK] / [NOK]
1	OK
2	OK
3	OK
4	OK
5	OK

Comment

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Location, date, signature (inspector)

Location, date, signature (approver, different than inspector)

General test data

Description of measuring chain	Manufacturer and type	Serial no.	Module
Testbed workstation	-	-	-
Velocity I/O Device	F-FEM CON	9607	

Description of measuring chain Load Unit 1	Manufacturer and type	Serial no.	Module
Force Sensor	Interface	519080A	
Force Amplifier	SAFO	4299	
Force I/O Device	F-FEM CNT	2881	

Tolerances	Measured inertia to BIW Absolute tolerance of full scale [kg]	BIW to demand inertia Relative tolerance of full scale [%]
Customized settings	+/- 13.6	+/- 0.20

Results

Run	Acceleration / Deceleration [m/s2]	Average inertia Dev. abs. [kg]	Average inertia Dev. rel. [%]	Evaluation [OK] / [NOK]
1	2.235	-0.9	0.02	OK
1	-2.235	0.7	0.02	OK
2	2.235	-0.7	0.02	OK
2	-2.235	0.7	0.02	OK
3	2.235	-0.6	0.02	OK
3	-2.235	0.7	0.02	OK
4	2.235	-0.6	0.02	OK
4	-2.235	0.5	0.02	OK
5	2.235	-0.6	0.02	OK
5	-2.235	0.7	0.02	OK

97-05 Dynamic base inertia verification

Inertia verification

☐ Quality assurance settings ☑ Use mechanical base inertia

Settings

Number of runs	5
Simulated inertia [kg]	566.7

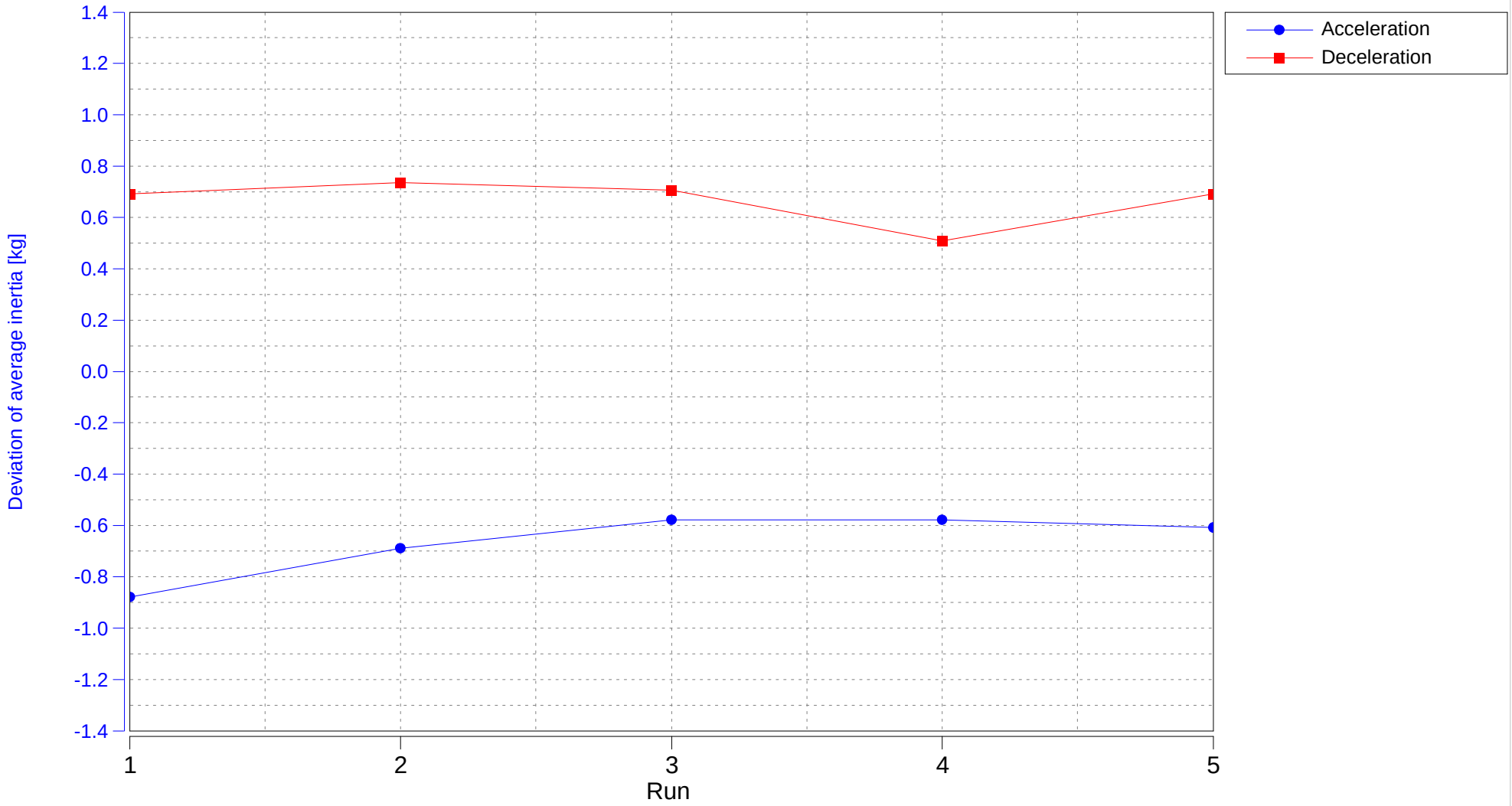
Acceleration	[m/s2]	2.235
Start velocity	[km/h]	16.09
Final velocity	[km/h]	64.37

	Tolerance		Measured	
BIW			[kg]	566.6
Measured inertia to BIW	[kg]	13.6	[kg]	-0.9
BIW to demand inertia	[%]	0.20	[%]	0.02

Measured data

Run	Driveline type	Acceleration / Deceleration [m/s2]	Start velocity [km/h]	Final velocity [km/h]	Force meas. [N]	Time meas. [s]	Inertia meas. [kg]	Average inertia [kg]	Average inertia Dev. abs. [kg]	Average inertia Dev. rel. [%]
1	FWD	2.235	16.09	64.37	-1265.9	6.012	567.5	566.6	-0.9	0.02
1	FWD	-2.235	64.37	16.09	1267.5	5.988	565.9	566.6	0.7	0.02
2	FWD	2.235	16.09	64.37	-1265.9	6.010	567.3	566.6	-0.7	0.02
2	FWD	-2.235	64.37	16.09	1267.4	5.988	565.9	566.6	0.7	0.02
3	FWD	2.235	16.09	64.37	-1266.1	6.008	567.2	566.6	-0.6	0.02
3	FWD	-2.235	64.37	16.09	1267.5	5.988	565.9	566.6	0.7	0.02
4	FWD	2.235	16.09	64.37	-1266.1	6.008	567.2	566.6	-0.6	0.02
4	FWD	-2.235	64.37	16.09	1267.5	5.990	566.1	566.6	0.5	0.02
5	FWD	2.235	16.09	64.37	-1266.2	6.008	567.2	566.6	-0.6	0.02
5	FWD	-2.235	64.37	16.09	1267.5	5.988	565.9	566.6	0.7	0.02

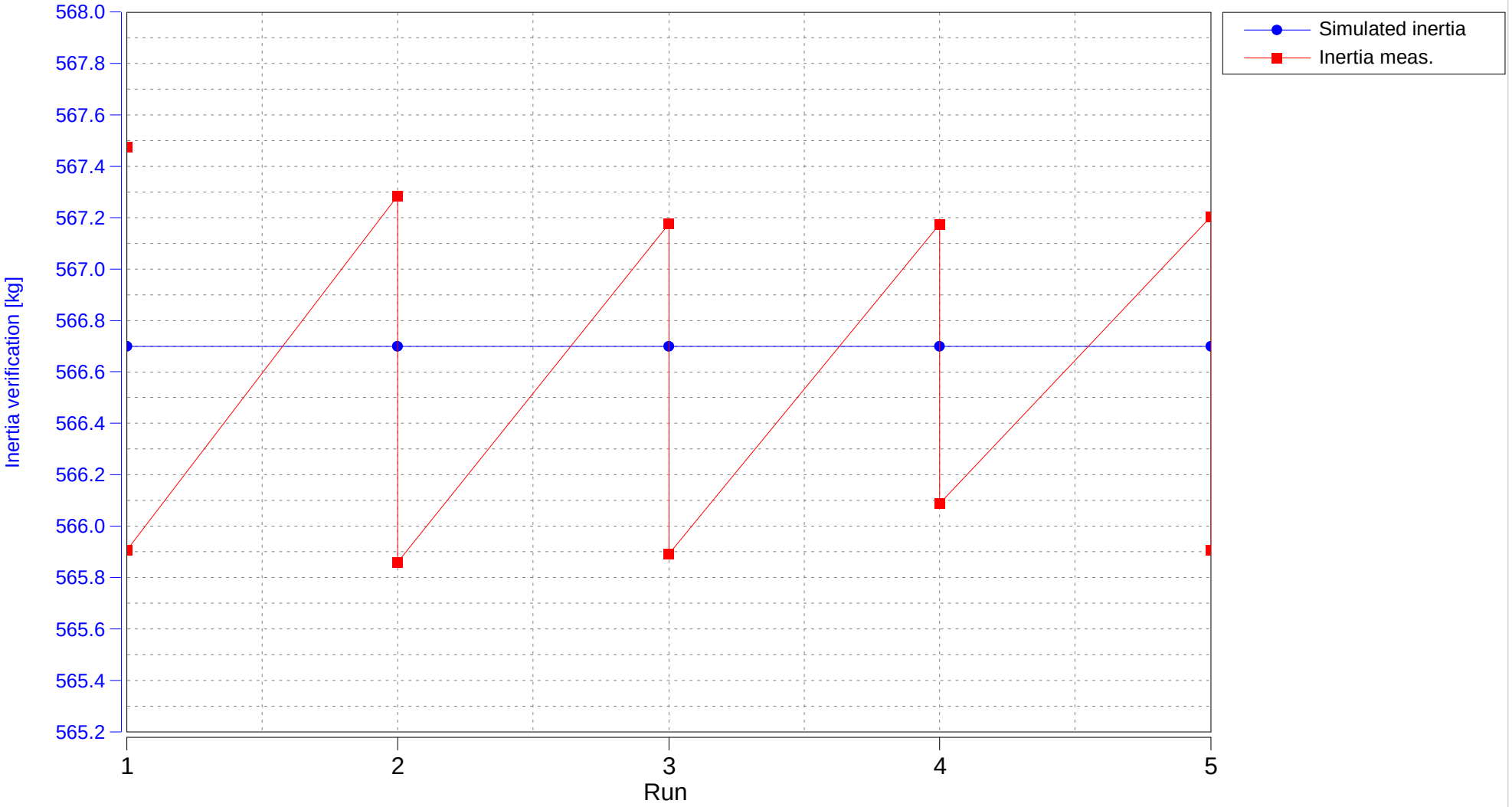
Graph


Deviation of average inertia [kg]
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
1
2
3
4
5
Run
Acceleration
Deceleration

97-05 Dynamic base inertia verification

Inertia verification

Graph



Appendix C
97-07 Loss compensation evaluation

97-07 Parasitic friction compensation evaluation
Cover sheet

General test data

Item	Chassis dynamometer
Type	25 inch MIL 1x1 ATV Emis AMB
Testbed configuration	1A1M Front
Driveline type	FWD
IZO-Number	IZO.150361
Customer	HUBDAT
Customer identification	IZO.150361
Test location	Jakarta
Tester	AVL
Department	Service Department
Current SW Version	VECON 1.5.3 HotFix: 16 Build: 5208 VV: 36
Measured data	Velocity
Signal/Channel	V_act_WORK_____XRX_C_GSV
Test date/Time start	10/3/2023 5:00:04 PM
Test date/Time end	10/3/2023 5:14:18 PM
Next test date	To be defined by Interval
Recommended inspection interval [Months]	To be defined by customer
Adjustments made since last test	Yes
Overall result	**Tolerances OK**

Environmental conditions	**Air temperature** [°C]	**Air humidity** [%rel]	**Air pressure** [hPa]
Tolerances	+/- 2.0	+/- 5.00	+/- 10.0
Test cell	31.5	33.20	992.1
Control room	31.5	33.20	992.1
Electrical cabinet room	31.5	33.20	992.1

Applied normal / measuring equipment	**Manufacturer and type**	**Serial no. / PM no.**	**valid until**
Testbed workstation	-	-	Not available

Description / method
97-07 evaluation of parasitic loss compensation

☐ Quality assurance settings used

Evaluation
Evaluation of loss compensation of vehicle testbed

Results

No.	Simulated inertia [kg]	Evaluation [OK] / [NOK]
1	80.0	OK
2	80.0	OK
3	80.0	OK
4	80.0	OK
5	80.0	OK
6	80.0	OK
7	80.0	OK
8	80.0	OK
9	80.0	OK
10	80.0	OK

Comment

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Location, date, signature (inspector)

Location, date, signature (approver, different than inspector)

General test data

Description of measuring chain	Manufacturer and type	Serial no.	Module
Testbed workstation	-	-	-

Description of measuring chain Load Unit 1	Manufacturer and type	Serial no.	Module
Encoder disc	-	-	-
Velocity Sensor 1	Heidenhain		
Velocity Sensor 2	-	-	-
Velocity Sensor 3	-	-	-
Velocity Sensor 4	-	-	-
Velocity Signal Processing 1	Heag		
Velocity Signal Processing 2	-	-	-
Velocity Signal Processing 3	-	-	-
Velocity I/O Device	F-FEM CON	9607	

Tolerances	Force [N]	Power [W]
Customized settings	+/- 100.0	+/- 75.00

Results

No.	Simulated inertia [kg]	Power Dev. abs. [W]	Evaluation [OK] / [NOK]
1	80.0	0.22	OK
2	80.0	1.40	OK
3	80.0	3.93	OK
4	80.0	4.04	OK
5	80.0	0.58	OK
6	80.0	7.85	OK
7	80.0	12.82	OK
8	80.0	14.29	OK
9	80.0	13.43	OK
10	80.0	15.05	OK

97-07 Parasitic friction compensation evaluation
Loss compensation evaluation

☐ Quality assurance settings

Settings

Simulated inertia	[kg]	80.0
Measurement time	[s]	60.000

Evaluation by

◉ Power
○ Force

Tolerance

Power tolerance	[W]	75.00
Force tolerance	[N]	100.0

Maximum measured values

Power measured	[W]	15.05
Force measured	[N]	0.7

Road load coefficients

F0	[N]	0.0
F1	[N/km/h]	0.0000
F2	[N/km2/h2]	0.00000

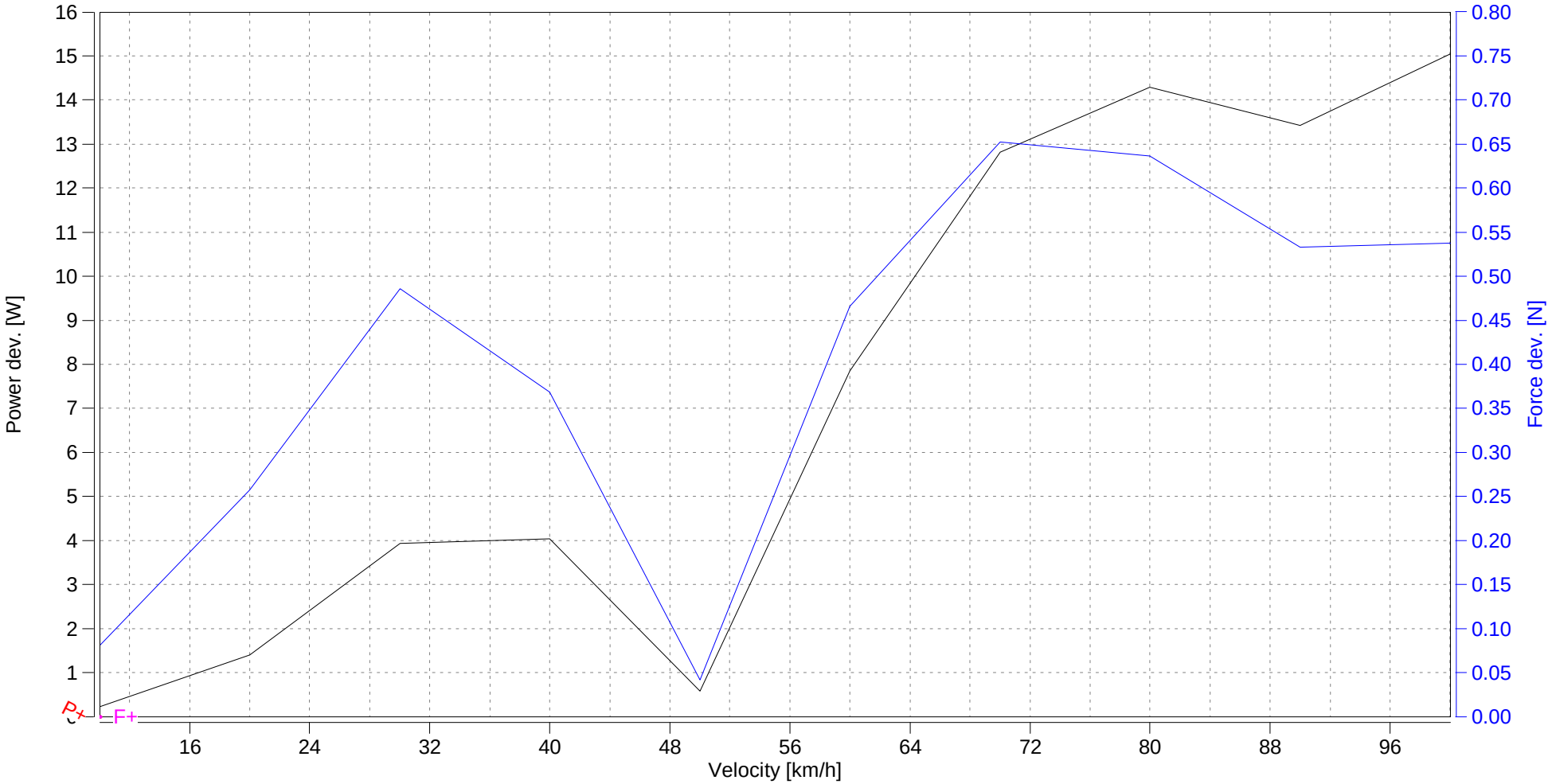
Measured data

No.	Driveline type	Simulated inertia [kg]	Nominal velocity [km/h]	Velocity Dev. abs. [km/h]	Power Dev. abs. [W]	Force Dev. abs. [N]
1	FWD	80.0	10.00	0.22	0.22	0.1
2	FWD	80.0	20.00	0.69	1.40	0.3
3	FWD	80.0	30.00	1.31	3.93	0.5
4	FWD	80.0	40.00	0.99	4.04	0.4
5	FWD	80.0	50.00	0.11	0.58	0.0
6	FWD	80.0	60.00	1.26	7.85	0.5
7	FWD	80.0	70.00	1.76	12.82	0.7
8	FWD	80.0	80.00	1.72	14.29	0.6
9	FWD	80.0	90.00	1.44	13.43	0.5
10	FWD	80.0	100.00	1.45	15.05	0.5

97-07 Parasitic friction compensation evaluation

Loss compensation evaluation

Graph



97-07 Parasitic friction compensation evaluation
Cover sheet

General test data

Item	Chassis dynamometer
Type	25 inch MIL 1x1 ATV Emis AMB
Testbed configuration	1A1M Front
Driveline type	FWD
IZO-Number	IZO.150361
Customer	HUBDAT
Customer identification	IZO.150361
Test location	Jakarta
Tester	AVL
Department	Service Department
Current SW Version	VECON 1.5.3 HotFix: 16 Build: 5208 VV: 36
Measured data	Velocity
Signal/Channel	V_act_WORK_____XRX_C_GSV
Test date/Time start	10/3/2023 4:42:26 PM
Test date/Time end	10/3/2023 4:56:39 PM
Next test date	To be defined by Interval
Recommended inspection interval [Months]	To be defined by customer
Adjustments made since last test	Yes
Overall result	**Tolerances OK**

Environmental conditions	**Air temperature** [°C]	**Air humidity** [%rel]	**Air pressure** [hPa]
Tolerances	+/- 2.0	+/- 5.00	+/- 10.0
Test cell	31.5	33.20	992.1
Control room	31.5	33.20	992.1
Electrical cabinet room	31.5	33.20	992.1

Applied normal / measuring equipment	**Manufacturer and type**	**Serial no. / PM no.**	**valid until**
Testbed workstation	-	-	Not available

Description / method
97-07 evaluation of parasitic loss compensation

☐ Quality assurance settings used

Evaluation
Evaluation of loss compensation of vehicle testbed

Results

No.	Simulated inertia [kg]	Evaluation [OK] / [NOK]
1	565.0	OK
2	565.0	OK
3	565.0	OK
4	565.0	OK
5	565.0	OK
6	565.0	OK
7	565.0	OK
8	565.0	OK
9	565.0	OK
10	565.0	OK

Comment

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Date: 2023.10.20 17:51:12 +07'00'

Location, date, signature (inspector)

Location, date, signature (approver, different than inspector)

General test data

Description of measuring chain	Manufacturer and type	Serial no.	Module
Testbed workstation	-	-	-

Description of measuring chain Load Unit 1	Manufacturer and type	Serial no.	Module
Encoder disc	-	-	-
Velocity Sensor 1	Heidenhain		
Velocity Sensor 2	-	-	-
Velocity Sensor 3	-	-	-
Velocity Sensor 4	-	-	-
Velocity Signal Processing 1	Heag		
Velocity Signal Processing 2	-	-	-
Velocity Signal Processing 3	-	-	-
Velocity I/O Device	F-FEM CON	9607	

Tolerances	Force [N]	Power [W]
Customized settings	+/- 100.0	+/- 75.00

Results

No.	Simulated inertia [kg]	Power Dev. abs. [W]	Evaluation [OK] / [NOK]
1	565.0	0.44	OK
2	565.0	2.39	OK
3	565.0	6.35	OK
4	565.0	6.19	OK
5	565.0	3.64	OK
6	565.0	5.44	OK
7	565.0	11.84	OK
8	565.0	15.31	OK
9	565.0	22.70	OK
10	565.0	23.26	OK

97-07 Parasitic friction compensation evaluation
Loss compensation evaluation

☐ Quality assurance settings

Settings

Simulated inertia	[kg]	565.0
Measurement time	[s]	60.000

Evaluation by

◉ Power
○ Force

Tolerance

Power tolerance	[W]	75.00
Force tolerance	[N]	100.0

Maximum measured values

Power measured	[W]	23.26
Force measured	[N]	0.9

Road load coefficients

F0	[N]	0.0
F1	[N/km/h]	0.0000
F2	[N/km2/h2]	0.00000

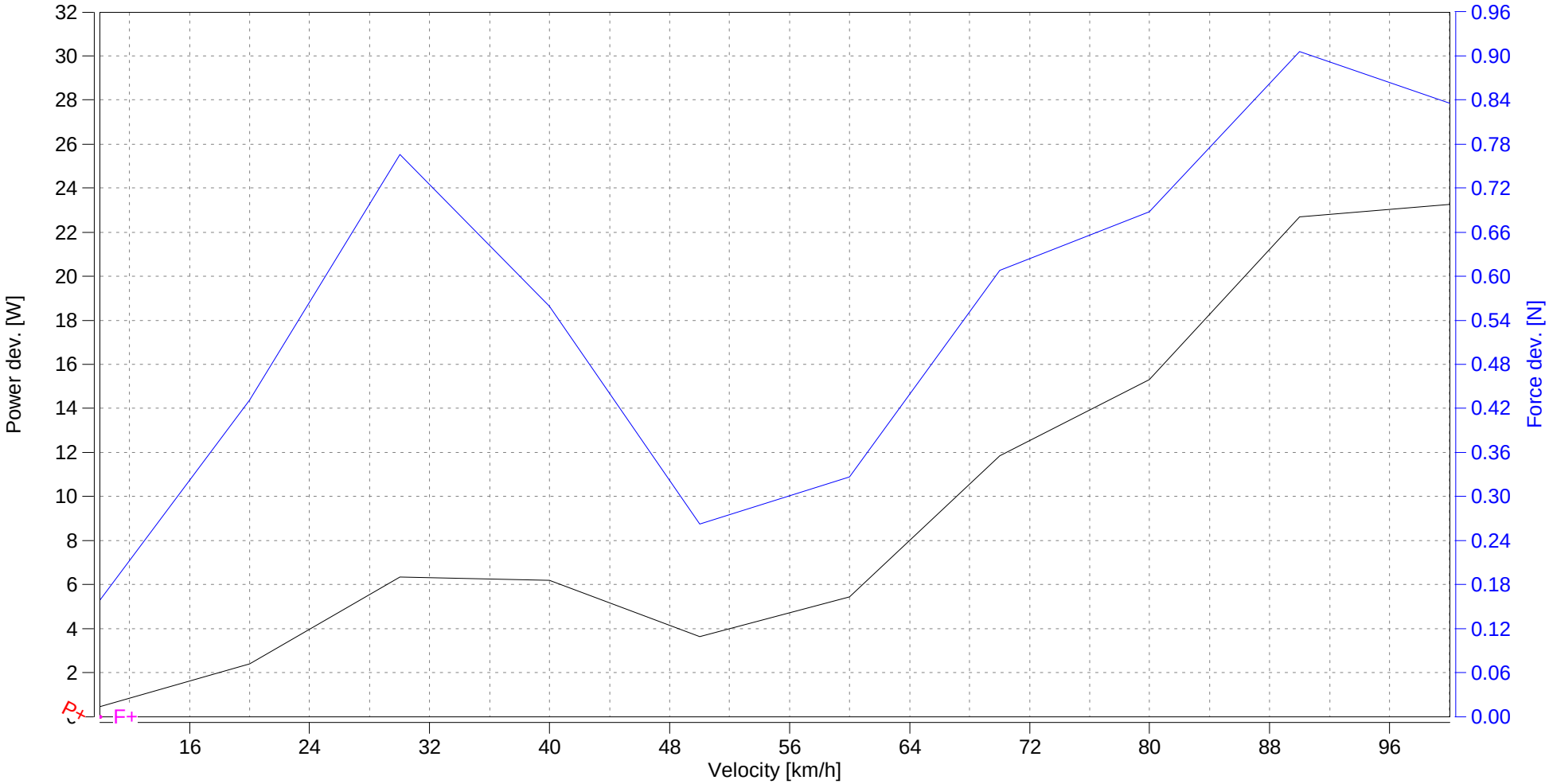
Measured data

No.	Driveline type	Simulated inertia [kg]	Nominal velocity [km/h]	Velocity Dev. abs. [km/h]	Power Dev. abs. [W]	Force Dev. abs. [N]
1	FWD	565.0	10.00	0.06	0.44	0.2
2	FWD	565.0	20.00	0.16	2.39	0.4
3	FWD	565.0	30.00	0.29	6.35	0.8
4	FWD	565.0	40.00	0.21	6.19	0.6
5	FWD	565.0	50.00	0.10	3.64	0.3
6	FWD	565.0	60.00	0.12	5.44	0.3
7	FWD	565.0	70.00	0.23	11.84	0.6
8	FWD	565.0	80.00	0.26	15.31	0.7
9	FWD	565.0	90.00	0.35	22.70	0.9
10	FWD	565.0	100.00	0.32	23.26	0.8

97-07 Parasitic friction compensation evaluation

Loss compensation evaluation

Graph



97-07 Parasitic friction compensation evaluation
Cover sheet

General test data

Item	Chassis dynamometer
Type	25 inch MIL 1x1 ATV Emis AMB
Testbed configuration	1A1M Front
Driveline type	FWD
IZO-Number	IZO.150361
Customer	HUBDAT
Customer identification	IZO.150361
Test location	Jakarta
Tester	AVL
Department	Service Department
Current SW Version	VECON 1.5.3 HotFix: 16 Build: 5208 VV: 36
Measured data	Velocity
Signal/Channel	V_act_WORK_____XRX_C_GSV
Test date/Time start	10/3/2023 5:17:09 PM
Test date/Time end	10/3/2023 5:31:24 PM
Next test date	To be defined by Interval
Recommended inspection interval [Months]	To be defined by customer
Adjustments made since last test	Yes
Overall result	**Tolerances OK**

Environmental conditions	**Air temperature** [°C]	**Air humidity** [%rel]	**Air pressure** [hPa]
Tolerances	+/- 2.0	+/- 5.00	+/- 10.0
Test cell	31.5	33.20	992.1
Control room	31.5	33.20	992.1
Electrical cabinet room	31.5	33.20	992.1

Applied normal / measuring equipment	**Manufacturer and type**	**Serial no. / PM no.**	**valid until**
Testbed workstation	-	-	Not available

Description / method
97-07 evaluation of parasitic loss compensation

☐ Quality assurance settings used

Evaluation
Evaluation of loss compensation of vehicle testbed

Results

No.	Simulated inertia [kg]	Evaluation [OK] / [NOK]
1	1600.0	OK
2	1600.0	OK
3	1600.0	OK
4	1600.0	OK
5	1600.0	OK
6	1600.0	OK
7	1600.0	OK
8	1600.0	OK
9	1600.0	OK
10	1600.0	OK

Comment

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Location, date, signature (inspector)

Location, date, signature (approver, different than inspector)

General test data

Description of measuring chain	Manufacturer and type	Serial no.	Module
Testbed workstation	-	-	-

Description of measuring chain Load Unit 1	Manufacturer and type	Serial no.	Module
Encoder disc	-	-	-
Velocity Sensor 1	Heidenhain		
Velocity Sensor 2	-	-	-
Velocity Sensor 3	-	-	-
Velocity Sensor 4	-	-	-
Velocity Signal Processing 1	Heag		
Velocity Signal Processing 2	-	-	-
Velocity Signal Processing 3	-	-	-
Velocity I/O Device	F-FEM CON	9607	

Tolerances	Force [N]	Power [W]
Customized settings	+/- 100.0	+/- 75.00

Results

No.	Simulated inertia [kg]	Power Dev. abs. [W]	Evaluation [OK] / [NOK]
1	1600.0	0.21	OK
2	1600.0	0.76	OK
3	1600.0	2.51	OK
4	1600.0	0.60	OK
5	1600.0	6.10	OK
6	1600.0	5.02	OK
7	1600.0	21.49	OK
8	1600.0	27.30	OK
9	1600.0	34.84	OK
10	1600.0	27.03	OK

97-07 Parasitic friction compensation evaluation
Loss compensation evaluation

☐ Quality assurance settings

Settings

Simulated inertia	[kg]	1600.0
Measurement time	[s]	60.000

Evaluation by

◉ Power
○ Force

Tolerance

Power tolerance	[W]	75.00
Force tolerance	[N]	100.0

Maximum measured values

Power measured	[W]	34.84
Force measured	[N]	1.4

Road load coefficients

F0	[N]	0.0
F1	[N/km/h]	0.0000
F2	[N/km2/h2]	0.00000

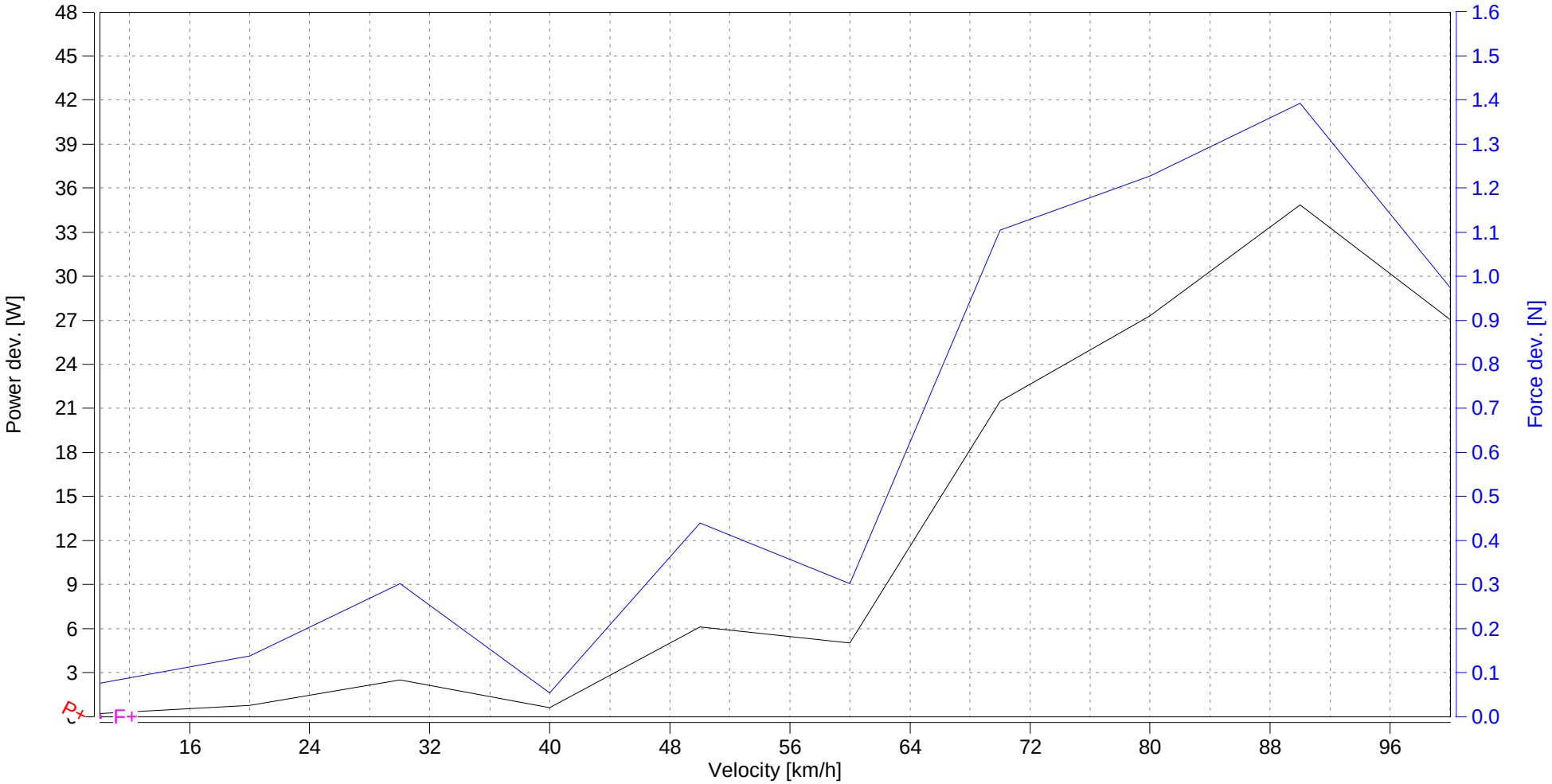
Measured data

No.	Driveline type	Simulated inertia [kg]	Nominal velocity [km/h]	Velocity Dev. abs. [km/h]	Power Dev. abs. [W]	Force Dev. abs. [N]
1	FWD	1600.0	10.00	0.01	0.21	0.1
2	FWD	1600.0	20.00	0.02	0.76	0.1
3	FWD	1600.0	30.00	0.04	2.51	0.3
4	FWD	1600.0	40.00	0.01	0.60	0.1
5	FWD	1600.0	50.00	0.06	6.10	0.4
6	FWD	1600.0	60.00	0.04	5.02	0.3
7	FWD	1600.0	70.00	0.15	21.49	1.1
8	FWD	1600.0	80.00	0.17	27.30	1.2
9	FWD	1600.0	90.00	0.19	34.84	1.4
10	FWD	1600.0	100.00	0.13	27.03	1.0

97-07 Parasitic friction compensation evaluation

Loss compensation evaluation

Graph



Appendix D
97-08 Road load curve evaluation

Coastdown (without vehicle) / 97-08 Road load curve evaluation
Cover sheet

General test data

Item	Chassis dynamometer
Type	25 inch MIL 1x1 ATV Emis AMB
Testbed configuration	1A1M Front
Driveline type	FWD
IZO-Number	IZO.150361
Customer	HUBDAT
Customer identification	IZO.150361
Test location	Jakarta
Tester	AVL
Department	Service Department
Current SW Version	VECON 1.5.3 HotFix: 16 Build: 5208 VV: 36
Measured data	Time
Signal/Channel	Time (Eav_v)
Test date/Time start	10/4/2023 10:30:38 AM
Test date/Time end	10/4/2023 10:58:14 AM
Next test date	To be defined by Interval
Recommended inspection interval [Months]	To be defined by customer
Adjustments made since last test	Yes
Overall result	**Tolerances OK**

Environmental conditions	**Air temperature** [°C]	**Air humidity** [%rel]	**Air pressure** [hPa]
Tolerances	+/- 2.0	+/- 5.00	+/- 10.0
Test cell	31.5	33.20	992.1
Control room	31.5	33.20	992.1
Electrical cabinet room	31.5	33.20	992.1

Applied normal / measuring equipment	**Manufacturer and type**	**Serial no. / PM no.**	**valid until**
Testbed workstation	-	-	Not available

Description / method
97-08 evaluation of road load simulation

☐ Quality assurance settings used

Evaluation
Force in each velocity interval are within the given tolerance

Results

Run	Evaluation [OK] / [NOK]
1	OK
2	OK
3	OK
4	OK
5	OK

Comment

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Location, date, signature (inspector)

Location, date, signature (approver, different than inspector)

General test data

Description of measuring chain	Manufacturer and type	Serial no.	Module
Testbed workstation	-	-	-
Velocity I/O Device	F-FEM CON	9607	

Description of measuring chain Load Unit 1	Manufacturer and type	Serial no.	Module
Force Sensor	Interface	519080A	
Force Amplifier	SAFO	4299	
Force I/O Device	F-FEM CNT	2881	

Tolerances	Absolute tolerance [N]	Relative tolerance [%]
Customized settings	+/- 9.8	+/- 2.00

Results

Run	Force Dev. abs. [N]	Force Dev. rel. [%]	Evaluation [OK] / [NOK]
1	1.3	4.25	OK
2	-1.0	-3.49	OK
3	-1.2	-4.16	OK
4	-1.4	-4.67	OK
5	-1.6	-5.25	OK

Coastdown (without vehicle) / 97-08 Road load curve evaluation

☐ Quality assurance settings

Settings

Evaluation by	Force (absolute & relative)
Regulation	ECE
Simulation type	Coefficients
Number of runs	5
Simulated inertia [kg]	200.0

Tolerance

Absolute tolerance [N]	9.8
Relative tolerance [%]	2.00

Max. measured

[N]	-1.6
[%]	-5.25

A [N]	30.0
B [N/m/s]	0.0000
C [N/m2/s2]	0.00000

Measured data

Run	Upper Velocity [km/h]	Lower Velocity [km/h]	Tolerance Force dev. abs. [N]	Tolerance Force dev. rel. [%]	Time Set [s]	Time Meas. [s]	Time Dev. abs. [s]	Time Dev. rel. [%]	Power Set [W]	Power Meas. [W]	Power Dev. abs. [W]	Power Dev. rel. [%]	Force Set [N]	Force Meas. [N]	Force Dev. abs. [N]	Force Dev. rel. [%]
1	152.90	136.80	9.8	2.00	29.815	28.600	-1.215	-4.07	1207.08	1258.36	51.28	4.25	30.0	31.3	1.3	4.25
1	136.80	120.70	9.8	2.00	29.815	29.349	-0.465	-1.56	1072.92	1089.93	17.01	1.59	30.0	30.5	0.5	1.59
1	120.70	104.60	9.8	2.00	29.815	29.953	0.138	0.46	938.75	934.41	-4.34	-0.46	30.0	29.9	-0.1	-0.46
1	104.60	88.50	9.8	2.00	29.815	30.529	0.714	2.39	804.58	785.77	-18.82	-2.34	30.0	29.3	-0.7	-2.34
1	88.50	72.40	9.8	2.00	29.815	30.527	0.712	2.39	670.42	654.78	-15.64	-2.33	30.0	29.3	-0.7	-2.33
1	72.40	56.30	9.8	2.00	29.815	30.255	0.440	1.48	536.25	528.45	-7.80	-1.45	30.0	29.6	-0.4	-1.45
1	56.30	40.30	9.8	2.00	29.630	29.445	-0.184	-0.62	402.50	405.02	2.52	0.63	30.0	30.2	0.2	0.63
1	40.30	24.00	9.8	2.00	30.185	29.991	-0.194	-0.64	267.92	269.65	1.73	0.65	30.0	30.2	0.2	0.65
1	24.00	8.10	9.8	2.00	29.444	29.417	-0.027	-0.09	133.75	133.87	0.12	0.09	30.0	30.0	0.0	0.09
2	152.90	136.80	9.8	2.00	29.815	29.008	-0.807	-2.71	1207.08	1240.67	33.59	2.78	30.0	30.8	0.8	2.78
2	136.80	120.70	9.8	2.00	29.815	29.591	-0.223	-0.75	1072.92	1081.02	8.10	0.76	30.0	30.2	0.2	0.76
2	120.70	104.60	9.8	2.00	29.815	30.377	0.562	1.89	938.75	921.38	-17.37	-1.85	30.0	29.4	-0.6	-1.85
2	104.60	88.50	9.8	2.00	29.815	30.893	1.078	3.61	804.58	776.51	-28.07	-3.49	30.0	29.0	-1.0	-3.49
2	88.50	72.40	9.8	2.00	29.815	30.809	0.994	3.33	670.42	648.79	-21.63	-3.23	30.0	29.0	-1.0	-3.23
2	72.40	56.30	9.8	2.00	29.815	30.515	0.700	2.35	536.25	523.95	-12.30	-2.29	30.0	29.3	-0.7	-2.29
2	56.30	40.30	9.8	2.00	29.630	29.677	0.048	0.16	402.50	401.85	-0.65	-0.16	30.0	30.0	-0.0	-0.16
2	40.30	24.00	9.8	2.00	30.185	30.233	0.048	0.16	267.92	267.49	-0.42	-0.16	30.0	30.0	-0.0	-0.16
2	24.00	8.10	9.8	2.00	29.444	29.547	0.103	0.35	133.75	133.28	-0.47	-0.35	30.0	29.9	-0.1	-0.35

Coastdown (without vehicle) / 97-08 Road load curve evaluation

☐ Quality assurance settings

Settings

Evaluation by	Force (absolute & relative)
Regulation	ECE
Simulation type	Coefficients
Number of runs	5
Simulated inertia [kg]	200.0

Tolerance

Absolute tolerance [N]	9.8
Relative tolerance [%]	2.00

Max. measured

[N]	-1.6
[%]	-5.25

A [N]	30.0
B [N/m/s]	0.0000
C [N/m2/s2]	0.00000

Measured data

Run	Upper Velocity [km/h]	Lower Velocity [km/h]	Tolerance Force dev. abs. [N]	Tolerance Force dev. rel. [%]	Time Set [s]	Time Meas. [s]	Time Dev. abs. [s]	Time Dev. rel. [%]	Power Set [W]	Power Meas. [W]	Power Dev. abs. [W]	Power Dev. rel. [%]	Force Set [N]	Force Meas. [N]	Force Dev. abs. [N]	Force Dev. rel. [%]
3	152.90	136.80	9.8	2.00	29.815	29.701	-0.114	-0.38	1207.08	1211.70	4.61	0.38	30.0	30.1	0.1	0.38
3	136.80	120.70	9.8	2.00	29.815	30.485	0.670	2.25	1072.92	1049.33	-23.58	-2.20	30.0	29.3	-0.7	-2.20
3	120.70	104.60	9.8	2.00	29.815	30.801	0.986	3.31	938.75	908.70	-30.05	-3.20	30.0	29.0	-1.0	-3.20
3	104.60	88.50	9.8	2.00	29.815	31.109	1.294	4.34	804.58	771.12	-33.46	-4.16	30.0	28.8	-1.2	-4.16
3	88.50	72.40	9.8	2.00	29.815	31.009	1.194	4.00	670.42	644.61	-25.81	-3.85	30.0	28.8	-1.2	-3.85
3	72.40	56.30	9.8	2.00	29.815	30.591	0.776	2.60	536.25	522.65	-13.60	-2.54	30.0	29.2	-0.8	-2.54
3	56.30	40.30	9.8	2.00	29.630	29.811	0.182	0.61	402.50	400.05	-2.45	-0.61	30.0	29.8	-0.2	-0.61
3	40.30	24.00	9.8	2.00	30.185	30.377	0.192	0.64	267.92	266.23	-1.69	-0.63	30.0	29.8	-0.2	-0.63
3	24.00	8.10	9.8	2.00	29.444	29.475	0.031	0.11	133.75	133.61	-0.14	-0.11	30.0	30.0	-0.0	-0.11
4	152.90	136.80	9.8	2.00	29.815	29.967	0.152	0.51	1207.08	1200.95	-6.14	-0.51	30.0	29.8	-0.2	-0.51
4	136.80	120.70	9.8	2.00	29.815	30.611	0.796	2.67	1072.92	1045.02	-27.90	-2.60	30.0	29.2	-0.8	-2.60
4	120.70	104.60	9.8	2.00	29.815	30.943	1.128	3.78	938.75	904.53	-34.22	-3.64	30.0	28.9	-1.1	-3.64
4	104.60	88.50	9.8	2.00	29.815	31.274	1.460	4.90	804.58	767.03	-37.55	-4.67	30.0	28.6	-1.4	-4.67
4	88.50	72.40	9.8	2.00	29.815	31.097	1.282	4.30	670.42	642.78	-27.63	-4.12	30.0	28.8	-1.2	-4.12
4	72.40	56.30	9.8	2.00	29.815	30.565	0.750	2.52	536.25	523.09	-13.16	-2.45	30.0	29.3	-0.7	-2.45
4	56.30	40.30	9.8	2.00	29.630	29.871	0.242	0.82	402.50	399.25	-3.25	-0.81	30.0	29.8	-0.2	-0.81
4	40.30	24.00	9.8	2.00	30.185	30.287	0.102	0.34	267.92	267.02	-0.90	-0.34	30.0	29.9	-0.1	-0.34
4	24.00	8.10	9.8	2.00	29.444	29.417	-0.027	-0.09	133.75	133.87	0.12	0.09	30.0	30.0	0.0	0.09

Coastdown (without vehicle) / 97-08 Road load curve evaluation

☐ Quality assurance settings

Settings

Evaluation by	Force (absolute & relative)
Regulation	ECE
Simulation type	Coefficients
Number of runs	5
Simulated inertia [kg]	200.0

Tolerance

Absolute tolerance [N]	9.8
Relative tolerance [%]	2.00

Max. measured

[N]	-1.6
[%]	-5.25

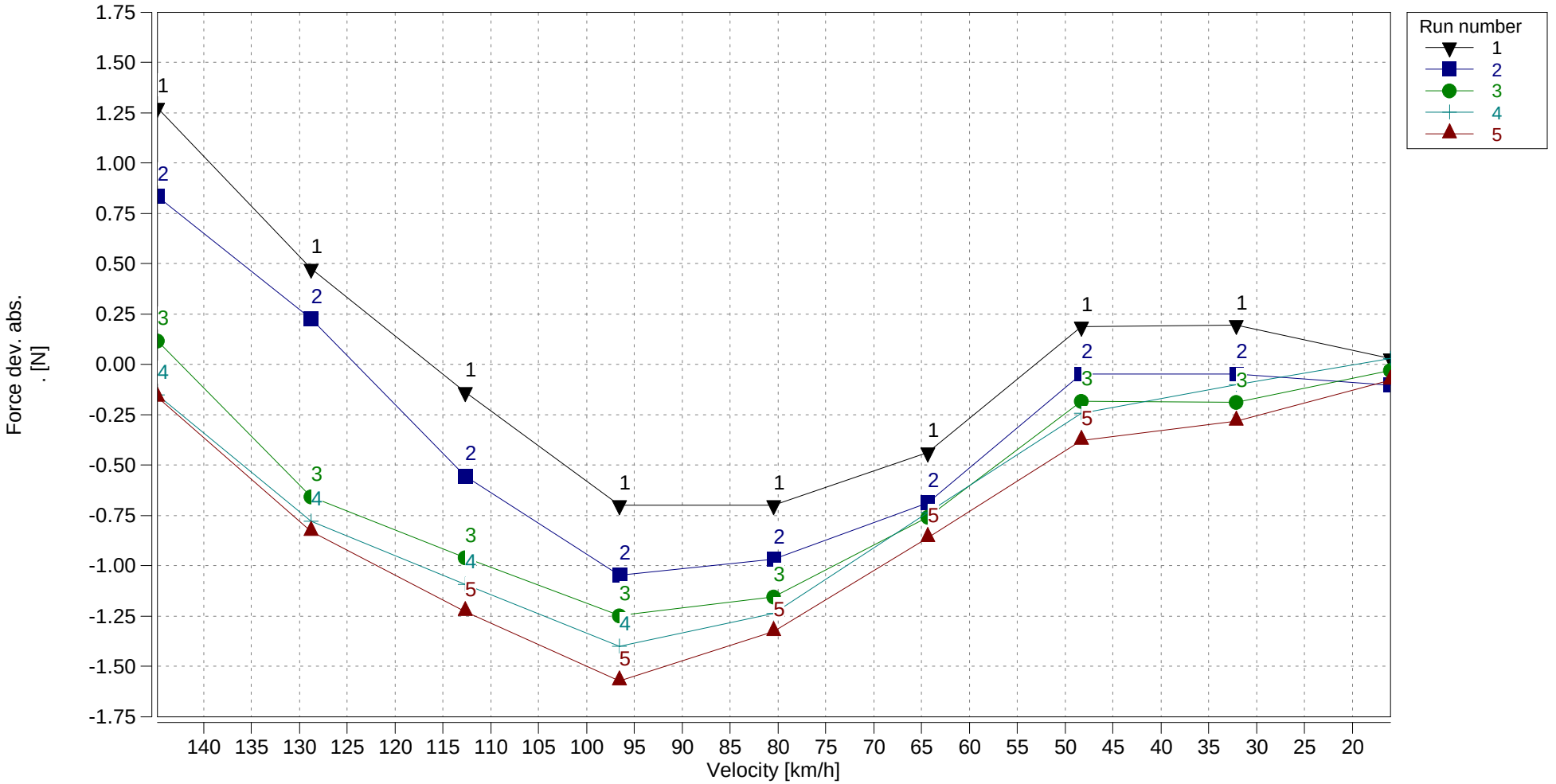
A [N]	30.0
B [N/m/s]	0.0000
C [N/m2/s2]	0.00000

Measured data

Run	Upper Velocity [km/h]	Lower Velocity [km/h]	Tolerance Force dev. abs. [N]	Tolerance Force dev. rel. [%]	Time Set [s]	Time Meas. [s]	Time Dev. abs. [s]	Time Dev. rel. [%]	Power Set [W]	Power Meas. [W]	Power Dev. abs. [W]	Power Dev. rel. [%]	Force Set [N]	Force Meas. [N]	Force Dev. abs. [N]	Force Dev. rel. [%]
5	152.90	136.80	9.8	2.00	29.815	29.979	0.164	0.55	1207.08	1200.47	-6.62	-0.55	30.0	29.8	-0.2	-0.55
5	136.80	120.70	9.8	2.00	29.815	30.663	0.848	2.84	1072.92	1043.25	-29.67	-2.77	30.0	29.2	-0.8	-2.77
5	120.70	104.60	9.8	2.00	29.815	31.089	1.274	4.27	938.75	900.29	-38.46	-4.10	30.0	28.8	-1.2	-4.10
5	104.60	88.50	9.8	2.00	29.815	31.466	1.651	5.54	804.58	762.36	-42.23	-5.25	30.0	28.4	-1.6	-5.25
5	88.50	72.40	9.8	2.00	29.815	31.196	1.382	4.63	670.42	640.72	-29.69	-4.43	30.0	28.7	-1.3	-4.43
5	72.40	56.30	9.8	2.00	29.815	30.697	0.882	2.96	536.25	520.84	-15.41	-2.87	30.0	29.1	-0.9	-2.87
5	56.30	40.30	9.8	2.00	29.630	30.009	0.379	1.28	402.50	397.41	-5.09	-1.26	30.0	29.6	-0.4	-1.26
5	40.30	24.00	9.8	2.00	30.185	30.471	0.286	0.95	267.92	265.40	-2.51	-0.94	30.0	29.7	-0.3	-0.94
5	24.00	8.10	9.8	2.00	29.444	29.523	0.079	0.27	133.75	133.39	-0.36	-0.27	30.0	29.9	-0.1	-0.27

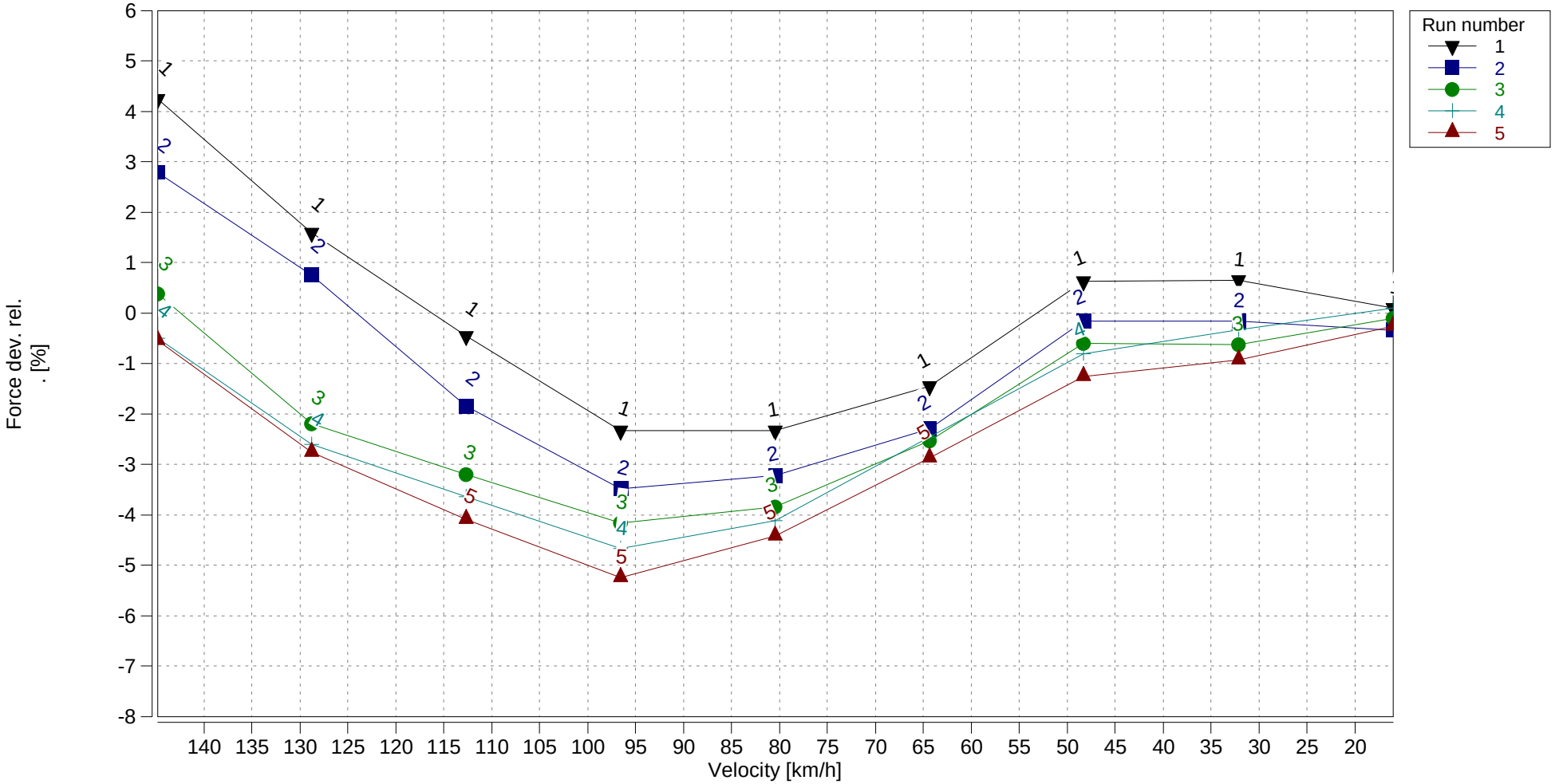
Coastdown (without vehicle) / 97-08 Road load curve evaluation

Graph



Coastdown (without vehicle) / 97-08 Road load curve evaluation

Graph



Coastdown (without vehicle) / 97-08 Road load curve evaluation
Cover sheet

General test data

Item	Chassis dynamometer
Type	25 inch MIL 1x1 ATV Emis AMB
Testbed configuration	1A1M Front
Driveline type	FWD
IZO-Number	IZO.150361
Customer	HUBDAT
Customer identification	IZO.150361
Test location	Jakarta
Tester	AVL
Department	Service Department
Current SW Version	VECON 1.5.3 HotFix: 16 Build: 5208 VV: 36
Measured data	Time
Signal/Channel	Time (Eav_v)
Test date/Time start	10/4/2023 10:06:26 AM
Test date/Time end	10/4/2023 10:26:09 AM
Next test date	To be defined by Interval
Recommended inspection interval [Months]	To be defined by customer
Adjustments made since last test	Yes
Overall result	**Tolerances OK**

Environmental conditions	**Air temperature** [°C]	**Air humidity** [%rel]	**Air pressure** [hPa]
Tolerances	+/- 2.0	+/- 5.00	+/- 10.0
Test cell	31.5	33.20	992.1
Control room	31.5	33.20	992.1
Electrical cabinet room	31.5	33.20	992.1

Applied normal / measuring equipment	**Manufacturer and type**	**Serial no. / PM no.**	**valid until**
Testbed workstation	-	-	Not available

Description / method
97-08 evaluation of road load simulation

☐ Quality assurance settings used

Evaluation
Force in each velocity interval are within the given tolerance

Results

Run	Evaluation [OK] / [NOK]
1	OK
2	OK
3	OK
4	OK
5	OK

Comment

Digitally signed by Paruntu David JAK
Date: 2023.10.20 17:52:20 +07'00'

Location, date, signature (inspector)

Location, date, signature (approver, different than inspector)

Coastdown (without vehicle) / 97-08 Road load curve evaluation
Test report

General test data

Description of measuring chain	Manufacturer and type	Serial no.	Module
Testbed workstation	-	-	-
Velocity I/O Device	F-FEM CON	9607	

Description of measuring chain Load Unit 1	Manufacturer and type	Serial no.	Module
Force Sensor	Interface	519080A	
Force Amplifier	SAFO	4299	
Force I/O Device	F-FEM CNT	2881	

Tolerances	Absolute tolerance [N]	Relative tolerance [%]
Customized settings	+/- 9.8	+/- 2.00

Results

Run	Force Dev. abs. [N]	Force Dev. rel. [%]	Evaluation [OK] / [NOK]
1	1.4	1.66	OK
2	1.2	2.49	OK
3	1.0	2.74	OK
4	0.9	3.08	OK
5	0.7	1.55	OK

Coastdown (without vehicle) / 97-08 Road load curve evaluation

☐ Quality assurance settings

Settings

Evaluation by	Force (absolute & relative)
Regulation	ECE
Simulation type	Coefficients
Number of runs	5
Simulated inertia [kg]	200.0

Tolerance

Absolute tolerance [N]	9.8
Relative tolerance [%]	2.00

Max. measured

[N]	1.4
[%]	3.08

A [N]	20.0
B [N/m/s]	-0.3000
C [N/m2/s2]	0.08000

Measured data

Run	Upper Velocity [km/h]	Lower Velocity [km/h]	Tolerance Force dev. abs. [N]	Tolerance Force dev. rel. [%]	Time Set [s]	Time Meas. [s]	Time Dev. abs. [s]	Time Dev. rel. [%]	Power Set [W]	Power Meas. [W]	Power Dev. abs. [W]	Power Dev. rel. [%]	Force Set [N]	Force Meas. [N]	Force Dev. abs. [N]	Force Dev. rel. [%]
1	152.90	136.80	9.8	2.00	6.523	6.442	-0.081	-1.25	5530.24	5586.86	56.62	1.02	137.4	138.9	1.4	1.02
1	136.80	120.70	9.8	2.00	8.037	7.956	-0.081	-1.01	3991.08	4020.91	29.83	0.75	111.6	112.4	0.8	0.75
1	120.70	104.60	9.8	2.00	10.08	10.01	-0.078	-0.77	2783.27	2795.95	12.68	0.46	88.9	89.4	0.4	0.46
1	104.60	88.50	9.8	2.00	12.91	12.88	-0.031	-0.24	1863.87	1861.66	-2.21	-0.12	69.5	69.4	-0.1	-0.12
1	88.50	72.40	9.8	2.00	16.86	16.85	-0.011	-0.07	1189.94	1186.22	-3.71	-0.31	53.2	53.1	-0.2	-0.31
1	72.40	56.30	9.8	2.00	22.32	22.20	-0.121	-0.54	718.55	720.01	1.46	0.20	40.2	40.3	0.1	0.20
1	56.30	40.30	9.8	2.00	29.31	28.84	-0.470	-1.60	407.54	413.47	5.93	1.45	30.4	30.8	0.4	1.45
1	40.30	24.00	9.8	2.00	38.13	37.66	-0.467	-1.22	211.66	214.70	3.04	1.43	23.7	24.0	0.3	1.43
1	24.00	8.10	9.8	2.00	43.36	42.90	-0.463	-1.07	90.29	91.79	1.50	1.66	20.3	20.6	0.3	1.66
2	152.90	136.80	9.8	2.00	6.523	6.452	-0.071	-1.09	5530.24	5578.20	47.96	0.87	137.4	138.6	1.2	0.87
2	136.80	120.70	9.8	2.00	8.037	7.972	-0.065	-0.81	3991.08	4012.84	21.76	0.55	111.6	112.2	0.6	0.55
2	120.70	104.60	9.8	2.00	10.08	10.03	-0.050	-0.49	2783.27	2788.15	4.88	0.18	88.9	89.1	0.2	0.18
2	104.60	88.50	9.8	2.00	12.91	12.91	-0.007	-0.05	1863.87	1858.20	-5.67	-0.30	69.5	69.3	-0.2	-0.30
2	88.50	72.40	9.8	2.00	16.86	16.87	0.017	0.10	1189.94	1184.26	-5.68	-0.48	53.2	53.0	-0.3	-0.48
2	72.40	56.30	9.8	2.00	22.32	22.26	-0.065	-0.29	718.55	718.20	-0.35	-0.05	40.2	40.2	-0.0	-0.05
2	56.30	40.30	9.8	2.00	29.31	28.55	-0.761	-2.60	407.54	417.69	10.15	2.49	30.4	31.1	0.8	2.49
2	40.30	24.00	9.8	2.00	38.13	37.60	-0.529	-1.39	211.66	215.05	3.39	1.60	23.7	24.1	0.4	1.60
2	24.00	8.10	9.8	2.00	43.36	42.91	-0.453	-1.05	90.29	91.77	1.48	1.64	20.3	20.6	0.3	1.64

Coastdown (without vehicle) / 97-08 Road load curve evaluation

☐ Quality assurance settings

Settings

Evaluation by	Force (absolute & relative)
Regulation	ECE
Simulation type	Coefficients
Number of runs	5
Simulated inertia [kg]	200.0

Tolerance

Absolute tolerance [N]	9.8
Relative tolerance [%]	2.00

Max. measured

[N]	1.4
[%]	3.08

A [N]	20.0
B [N/m/s]	-0.3000
C [N/m2/s2]	0.08000

Measured data

Run	Upper Velocity [km/h]	Lower Velocity [km/h]	Tolerance Force dev. abs. [N]	Tolerance Force dev. rel. [%]	Time Set [s]	Time Meas. [s]	Time Dev. abs. [s]	Time Dev. rel. [%]	Power Set [W]	Power Meas. [W]	Power Dev. abs. [W]	Power Dev. rel. [%]	Force Set [N]	Force Meas. [N]	Force Dev. abs. [N]	Force Dev. rel. [%]
3	152.90	136.80	9.8	2.00	6.523	6.460	-0.063	-0.97	5530.24	5571.29	41.05	0.74	137.4	138.5	1.0	0.74
3	136.80	120.70	9.8	2.00	8.037	7.992	-0.045	-0.57	3991.08	4002.80	11.72	0.29	111.6	111.9	0.3	0.29
3	120.70	104.60	9.8	2.00	10.08	10.05	-0.038	-0.37	2783.27	2784.82	1.55	0.06	88.9	89.0	0.0	0.06
3	104.60	88.50	9.8	2.00	12.91	12.93	0.017	0.13	1863.87	1854.75	-9.12	-0.49	69.5	69.2	-0.3	-0.49
3	88.50	72.40	9.8	2.00	16.86	16.92	0.067	0.40	1189.94	1180.76	-9.18	-0.77	53.2	52.8	-0.4	-0.77
3	72.40	56.30	9.8	2.00	22.32	22.36	0.035	0.16	718.55	714.99	-3.56	-0.50	40.2	40.0	-0.2	-0.50
3	56.30	40.30	9.8	2.00	29.31	28.71	-0.601	-2.05	407.54	415.37	7.83	1.92	30.4	31.0	0.6	1.92
3	40.30	24.00	9.8	2.00	38.13	37.25	-0.878	-2.30	211.66	217.07	5.41	2.56	23.7	24.3	0.6	2.56
3	24.00	8.10	9.8	2.00	43.36	42.45	-0.913	-2.11	90.29	92.76	2.47	2.74	20.3	20.8	0.6	2.74
4	152.90	136.80	9.8	2.00	6.523	6.464	-0.059	-0.91	5530.24	5567.85	37.60	0.68	137.4	138.4	0.9	0.68
4	136.80	120.70	9.8	2.00	8.037	7.988	-0.049	-0.62	3991.08	4004.81	13.72	0.34	111.6	112.0	0.4	0.34
4	120.70	104.60	9.8	2.00	10.08	10.06	-0.024	-0.23	2783.27	2780.94	-2.32	-0.08	88.9	88.9	-0.1	-0.08
4	104.60	88.50	9.8	2.00	12.91	12.96	0.043	0.33	1863.87	1851.03	-12.84	-0.69	69.5	69.0	-0.5	-0.69
4	88.50	72.40	9.8	2.00	16.86	16.95	0.093	0.55	1189.94	1178.95	-10.99	-0.92	53.2	52.8	-0.5	-0.92
4	72.40	56.30	9.8	2.00	22.32	22.32	-0.005	-0.02	718.55	716.27	-2.28	-0.32	40.2	40.1	-0.1	-0.32
4	56.30	40.30	9.8	2.00	29.31	28.66	-0.647	-2.21	407.54	416.03	8.49	2.08	30.4	31.0	0.6	2.08
4	40.30	24.00	9.8	2.00	38.13	37.13	-0.996	-2.61	211.66	217.76	6.10	2.88	23.7	24.4	0.7	2.88
4	24.00	8.10	9.8	2.00	43.36	42.31	-1.053	-2.43	90.29	93.07	2.78	3.08	20.3	20.9	0.6	3.08

Coastdown (without vehicle) / 97-08 Road load curve evaluation

☐ Quality assurance settings

Settings

Evaluation by	Force (absolute & relative)
Regulation	ECE
Simulation type	Coefficients
Number of runs	5
Simulated inertia [kg]	200.0

Tolerance

Absolute tolerance	[N]	9.8
Relative tolerance	[%]	2.00

Max. measured

[N]	1.4
[%]	3.08

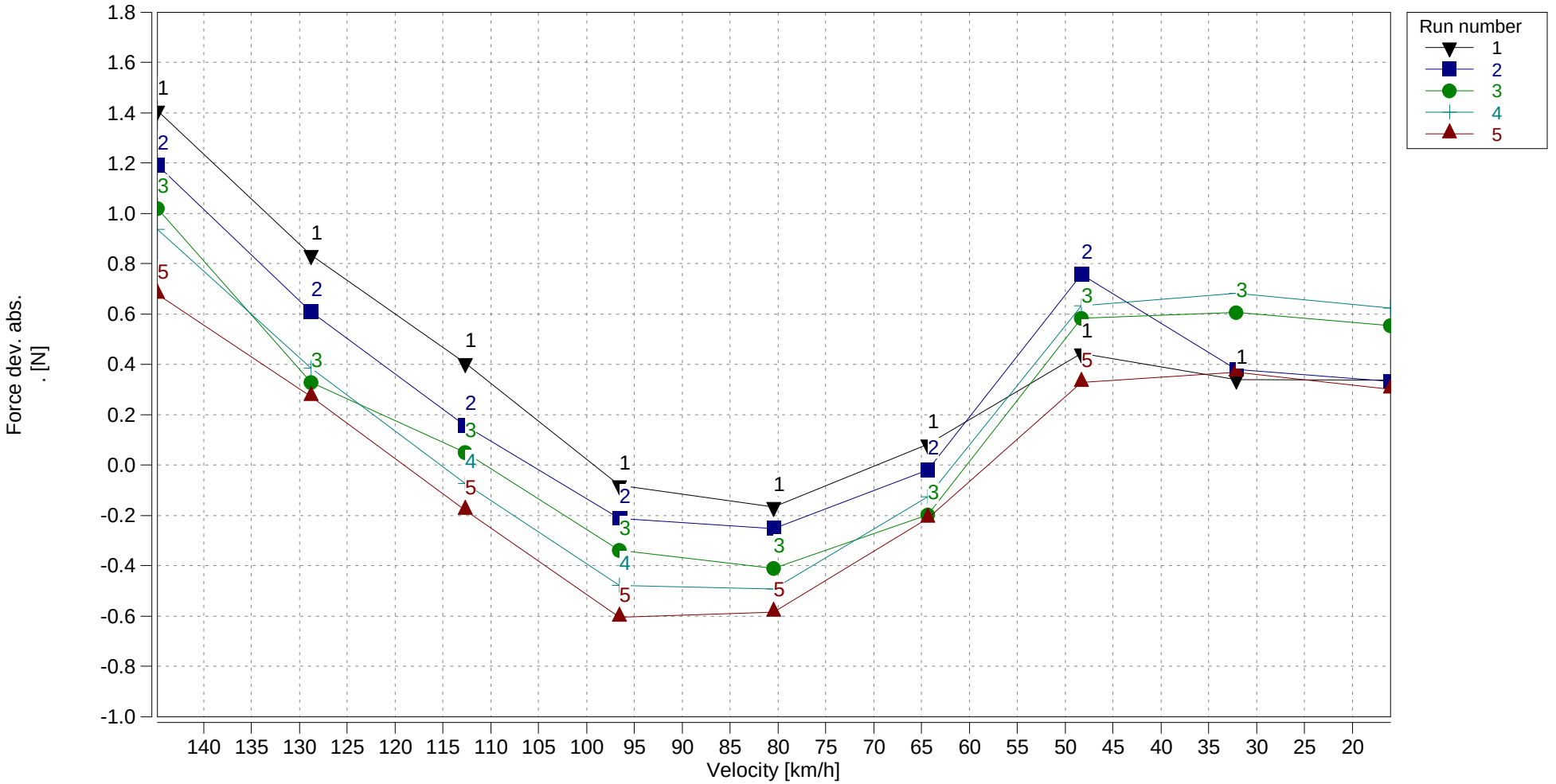
A [N]	20.0
B [N/m/s]	-0.3000
C [N/m2/s2]	0.08000

Measured data

Run	Upper Velocity [km/h]	Lower Velocity [km/h]	Tolerance Force dev. abs. [N]	Tolerance Force dev. rel. [%]	Time Set [s]	Time Meas. [s]	Time Dev. abs. [s]	Time Dev. rel. [%]	Power Set [W]	Power Meas. [W]	Power Dev. abs. [W]	Power Dev. rel. [%]	Force Set [N]	Force Meas. [N]	Force Dev. abs. [N]	Force Dev. rel. [%]
5	152.90	136.80	9.8	2.00	6.523	6.476	-0.047	-0.73	5530.24	5557.53	27.29	0.49	137.4	138.1	0.7	0.49
5	136.80	120.70	9.8	2.00	8.037	7.996	-0.041	-0.52	3991.08	4000.80	9.72	0.24	111.6	111.9	0.3	0.24
5	120.70	104.60	9.8	2.00	10.08	10.07	-0.012	-0.11	2783.27	2777.63	-5.64	-0.20	88.9	88.8	-0.2	-0.20
5	104.60	88.50	9.8	2.00	12.91	12.98	0.067	0.52	1863.87	1847.60	-16.26	-0.87	69.5	68.9	-0.6	-0.87
5	88.50	72.40	9.8	2.00	16.86	16.98	0.123	0.73	1189.94	1176.87	-13.07	-1.10	53.2	52.7	-0.6	-1.10
5	72.40	56.30	9.8	2.00	22.32	22.36	0.043	0.19	718.55	714.74	-3.82	-0.53	40.2	40.0	-0.2	-0.53
5	56.30	40.30	9.8	2.00	29.31	28.95	-0.362	-1.23	407.54	411.93	4.39	1.08	30.4	30.7	0.3	1.08
5	40.30	24.00	9.8	2.00	38.13	37.62	-0.511	-1.34	211.66	214.95	3.29	1.55	23.7	24.1	0.4	1.55
5	24.00	8.10	9.8	2.00	43.36	42.97	-0.391	-0.90	90.29	91.64	1.34	1.49	20.3	20.6	0.3	1.49

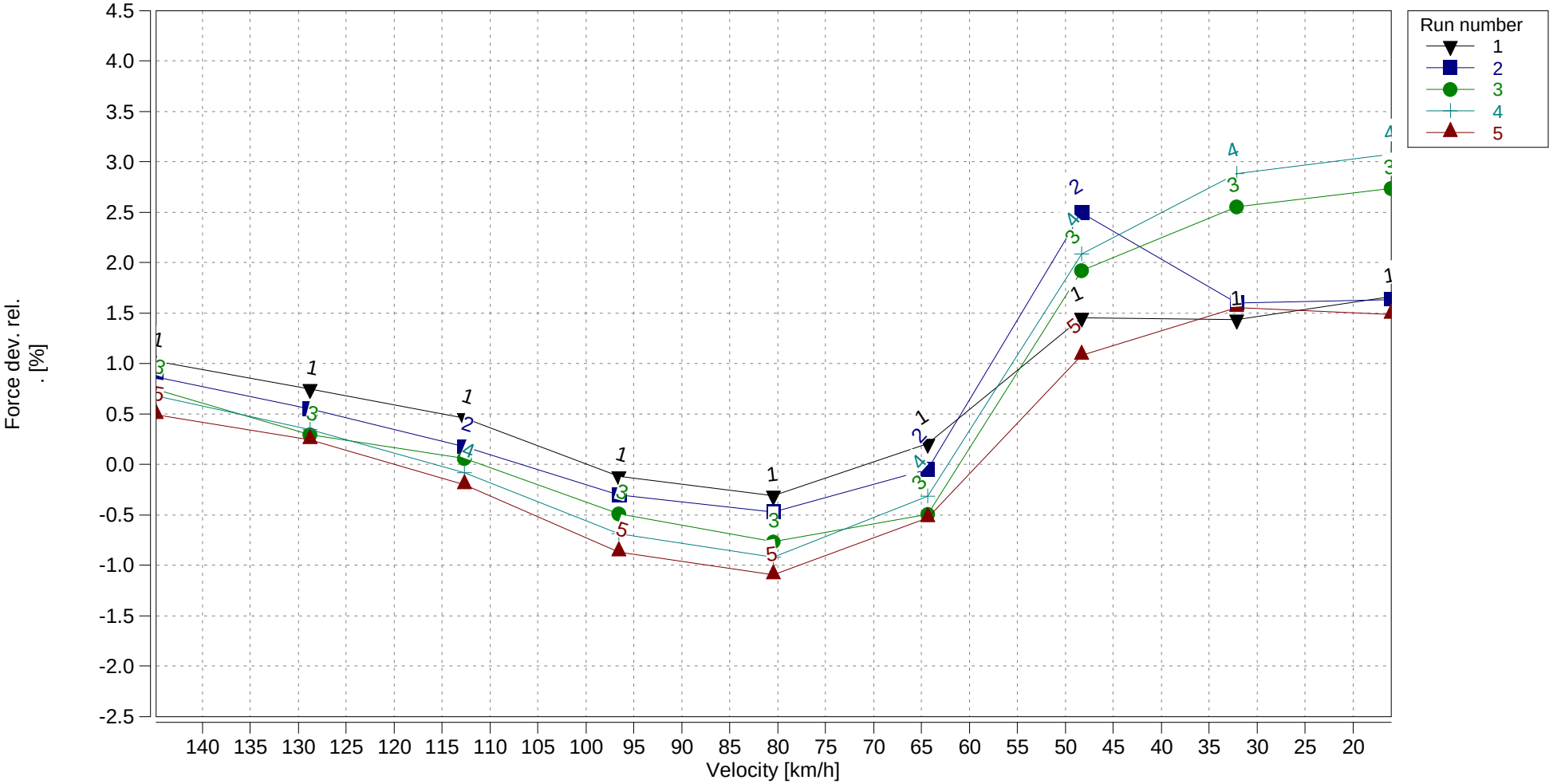
Coastdown (without vehicle) / 97-08 Road load curve evaluation

Graph



Coastdown (without vehicle) / 97-08 Road load curve evaluation

Graph



Coastdown (without vehicle) / 97-08 Road load curve evaluation
Cover sheet

General test data

Item	Chassis dynamometer
Type	25 inch MIL 1x1 ATV Emis AMB
Testbed configuration	1A1M Front
Driveline type	FWD
IZO-Number	IZO.150361
Customer	HUBDAT
Customer identification	IZO.150361
Test location	Jakarta
Tester	AVL
Department	Service Department
Current SW Version	VECON 1.5.3 HotFix: 16 Build: 5208 VV: 36
Measured data	Time
Signal/Channel	Time (Eav_v)
Test date/Time start	10/4/2023 11:02:16 AM
Test date/Time end	10/4/2023 11:22:03 AM
Next test date	To be defined by Interval
Recommended inspection interval [Months]	To be defined by customer
Adjustments made since last test	Yes
Overall result	**Tolerances OK**

Environmental conditions	**Air temperature** [°C]	**Air humidity** [%rel]	**Air pressure** [hPa]
Tolerances	+/- 2.0	+/- 5.00	+/- 10.0
Test cell	31.5	33.20	992.1
Control room	31.5	33.20	992.1
Electrical cabinet room	31.5	33.20	992.1

Applied normal / measuring equipment	**Manufacturer and type**	**Serial no. / PM no.**	**valid until**
Testbed workstation	-	-	Not available

Description / method
97-08 evaluation of road load simulation

☐ Quality assurance settings used

Evaluation
Force in each velocity interval are within the given tolerance

Results

Run	Evaluation [OK] / [NOK]
1	OK
2	OK
3	OK
4	OK
5	OK

Comment

Digitally signed by Paruntu David JAK
Date: 2023.10.20 17:52:43 +07'00'

Location, date, signature (inspector)

Location, date, signature (approver, different than inspector)

General test data

Description of measuring chain	Manufacturer and type	Serial no.	Module
Testbed workstation	-	-	-
Velocity I/O Device	F-FEM CON	9607	

Description of measuring chain Load Unit 1	Manufacturer and type	Serial no.	Module
Force Sensor	Interface	519080A	
Force Amplifier	SAFO	4299	
Force I/O Device	F-FEM CNT	2881	

Tolerances	Absolute tolerance [N]	Relative tolerance [%]
Customized settings	+/- 9.8	+/- 2.00

Results

Run	Force Dev. abs. [N]	Force Dev. rel. [%]	Evaluation [OK] / [NOK]
1	-1.2	-0.35	OK
2	-1.3	-0.38	OK
3	-1.6	-0.47	OK
4	-1.7	-0.50	OK
5	-1.8	-0.52	OK

Coastdown (without vehicle) / 97-08 Road load curve evaluation

☐ Quality assurance settings

Settings

Evaluation by	Force (absolute & relative)
Regulation	ECE
Simulation type	Coefficients
Number of runs	5
Simulated inertia [kg]	1600.0

Tolerance

Absolute tolerance	[N]	9.8
Relative tolerance	[%]	2.00

Max. measured

[N]	-1.8
[%]	-0.52

A	[N]	350.0
B	[N/m/s]	0.0000
C	[N/m2/s2]	0.00000

Measured data

Run	Upper Velocity [km/h]	Lower Velocity [km/h]	Tolerance Force dev. abs. [N]	Tolerance Force dev. rel. [%]	Time Set [s]	Time Meas. [s]	Time Dev. abs. [s]	Time Dev. rel. [%]	Power Set [W]	Power Meas. [W]	Power Dev. abs. [W]	Power Dev. rel. [%]	Force Set [N]	Force Meas. [N]	Force Dev. abs. [N]	Force Dev. rel. [%]
1	152.90	136.80	9.8	2.00	20.444	20.464	0.020	0.10	14082.64	14068.92	-13.72	-0.10	350.0	349.7	-0.3	-0.10
1	136.80	120.70	9.8	2.00	20.444	20.500	0.056	0.27	12517.36	12483.22	-34.15	-0.27	350.0	349.0	-1.0	-0.27
1	120.70	104.60	9.8	2.00	20.444	20.506	0.062	0.30	10952.08	10919.01	-33.08	-0.30	350.0	348.9	-1.1	-0.30
1	104.60	88.50	9.8	2.00	20.444	20.516	0.072	0.35	9386.81	9353.92	-32.88	-0.35	350.0	348.8	-1.2	-0.35
1	88.50	72.40	9.8	2.00	20.444	20.510	0.066	0.32	7821.53	7796.38	-25.14	-0.32	350.0	348.9	-1.1	-0.32
1	72.40	56.30	9.8	2.00	20.444	20.486	0.042	0.21	6256.25	6243.45	-12.80	-0.20	350.0	349.3	-0.7	-0.20
1	56.30	40.30	9.8	2.00	20.317	20.330	0.013	0.06	4695.83	4692.84	-3.00	-0.06	350.0	349.8	-0.2	-0.06
1	40.30	24.00	9.8	2.00	20.698	20.706	0.008	0.04	3125.69	3124.51	-1.19	-0.04	350.0	349.9	-0.1	-0.04
1	24.00	8.10	9.8	2.00	20.190	20.197	0.006	0.03	1560.42	1559.95	-0.47	-0.03	350.0	349.9	-0.1	-0.03
2	152.90	136.80	9.8	2.00	20.444	20.452	0.008	0.04	14082.64	14077.17	-5.47	-0.04	350.0	349.9	-0.1	-0.04
2	136.80	120.70	9.8	2.00	20.444	20.490	0.046	0.22	12517.36	12489.30	-28.06	-0.22	350.0	349.2	-0.8	-0.22
2	120.70	104.60	9.8	2.00	20.444	20.498	0.054	0.26	10952.08	10923.26	-28.82	-0.26	350.0	349.1	-0.9	-0.26
2	104.60	88.50	9.8	2.00	20.444	20.522	0.078	0.38	9386.81	9351.19	-35.62	-0.38	350.0	348.7	-1.3	-0.38
2	88.50	72.40	9.8	2.00	20.444	20.510	0.066	0.32	7821.53	7796.38	-25.14	-0.32	350.0	348.9	-1.1	-0.32
2	72.40	56.30	9.8	2.00	20.444	20.486	0.042	0.21	6256.25	6243.45	-12.80	-0.20	350.0	349.3	-0.7	-0.20
2	56.30	40.30	9.8	2.00	20.317	20.318	0.001	0.00	4695.83	4695.61	-0.23	-0.00	350.0	350.0	-0.0	-0.00
2	40.30	24.00	9.8	2.00	20.698	20.698	-0.000	-0.00	3125.69	3125.71	0.02	0.00	350.0	350.0	0.0	0.00
2	24.00	8.10	9.8	2.00	20.190	20.191	0.000	0.00	1560.42	1560.41	-0.00	-0.00	350.0	350.0	-0.0	-0.00

Coastdown (without vehicle) / 97-08 Road load curve evaluation

☐ Quality assurance settings

Settings

Evaluation by	Force (absolute & relative)
Regulation	ECE
Simulation type	Coefficients
Number of runs	5
Simulated inertia [kg]	1600.0

Tolerance

Absolute tolerance [N]	9.8
Relative tolerance [%]	2.00

Max. measured

[N]	-1.8
[%]	-0.52

A [N]	350.0
B [N/m/s]	0.0000
C [N/m2/s2]	0.00000

Measured data

Run	Upper Velocity [km/h]	Lower Velocity [km/h]	Tolerance Force dev. abs. [N]	Tolerance Force dev. rel. [%]	Time Set [s]	Time Meas. [s]	Time Dev. abs. [s]	Time Dev. rel. [%]	Power Set [W]	Power Meas. [W]	Power Dev. abs. [W]	Power Dev. rel. [%]	Force Set [N]	Force Meas. [N]	Force Dev. abs. [N]	Force Dev. rel. [%]
3	152.90	136.80	9.8	2.00	20.444	20.478	0.034	0.17	14082.64	14059.30	-23.34	-0.17	350.0	349.4	-0.6	-0.17
3	136.80	120.70	9.8	2.00	20.444	20.498	0.054	0.26	12517.36	12484.43	-32.93	-0.26	350.0	349.1	-0.9	-0.26
3	120.70	104.60	9.8	2.00	20.444	20.512	0.068	0.33	10952.08	10915.81	-36.27	-0.33	350.0	348.8	-1.2	-0.33
3	104.60	88.50	9.8	2.00	20.444	20.540	0.096	0.47	9386.81	9343.00	-43.81	-0.47	350.0	348.4	-1.6	-0.47
3	88.50	72.40	9.8	2.00	20.444	20.516	0.072	0.35	7821.53	7794.10	-27.42	-0.35	350.0	348.8	-1.2	-0.35
3	72.40	56.30	9.8	2.00	20.444	20.498	0.054	0.26	6256.25	6239.79	-16.46	-0.26	350.0	349.1	-0.9	-0.26
3	56.30	40.30	9.8	2.00	20.317	20.346	0.029	0.14	4695.83	4689.15	-6.68	-0.14	350.0	349.5	-0.5	-0.14
3	40.30	24.00	9.8	2.00	20.698	20.734	0.036	0.17	3125.69	3120.29	-5.40	-0.17	350.0	349.4	-0.6	-0.17
3	24.00	8.10	9.8	2.00	20.190	20.203	0.012	0.06	1560.42	1559.49	-0.93	-0.06	350.0	349.8	-0.2	-0.06
4	152.90	136.80	9.8	2.00	20.444	20.484	0.040	0.20	14082.64	14055.19	-27.45	-0.19	350.0	349.3	-0.7	-0.19
4	136.80	120.70	9.8	2.00	20.444	20.524	0.080	0.39	12517.36	12468.63	-48.73	-0.39	350.0	348.6	-1.4	-0.39
4	120.70	104.60	9.8	2.00	20.444	20.524	0.080	0.39	10952.08	10909.43	-42.65	-0.39	350.0	348.6	-1.4	-0.39
4	104.60	88.50	9.8	2.00	20.444	20.546	0.102	0.50	9386.81	9340.27	-46.53	-0.50	350.0	348.3	-1.7	-0.50
4	88.50	72.40	9.8	2.00	20.444	20.536	0.092	0.45	7821.53	7786.52	-35.01	-0.45	350.0	348.4	-1.6	-0.45
4	72.40	56.30	9.8	2.00	20.444	20.506	0.062	0.30	6256.25	6237.36	-18.89	-0.30	350.0	348.9	-1.1	-0.30
4	56.30	40.30	9.8	2.00	20.317	20.340	0.023	0.11	4695.83	4690.53	-5.30	-0.11	350.0	349.6	-0.4	-0.11
4	40.30	24.00	9.8	2.00	20.698	20.718	0.020	0.10	3125.69	3122.70	-3.00	-0.10	350.0	349.7	-0.3	-0.10
4	24.00	8.10	9.8	2.00	20.190	20.199	0.008	0.04	1560.42	1559.80	-0.62	-0.04	350.0	349.9	-0.1	-0.04

Coastdown (without vehicle) / 97-08 Road load curve evaluation

☐ Quality assurance settings

Settings

Evaluation by	Force (absolute & relative)
Regulation	ECE
Simulation type	Coefficients
Number of runs	5
Simulated inertia [kg]	1600.0

Tolerance

Absolute tolerance [N]	9.8
Relative tolerance [%]	2.00

Max. measured

[N]	-1.8
[%]	-0.52

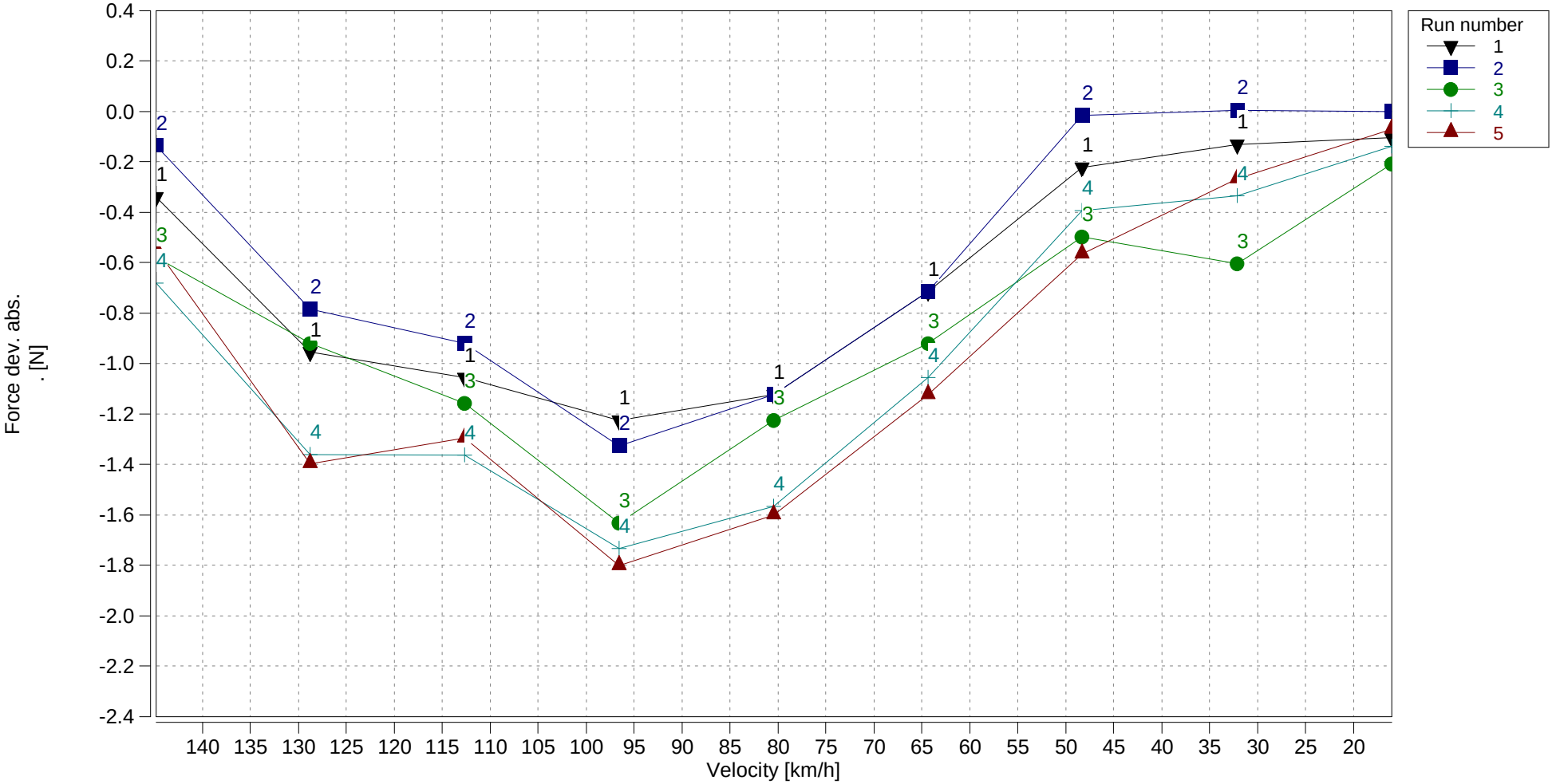
A [N]	350.0
B [N/m/s]	0.0000
C [N/m2/s2]	0.00000

Measured data

Run	Upper Velocity [km/h]	Lower Velocity [km/h]	Tolerance Force dev. abs. [N]	Tolerance Force dev. rel. [%]	Time Set [s]	Time Meas. [s]	Time Dev. abs. [s]	Time Dev. rel. [%]	Power Set [W]	Power Meas. [W]	Power Dev. abs. [W]	Power Dev. rel. [%]	Force Set [N]	Force Meas. [N]	Force Dev. abs. [N]	Force Dev. rel. [%]
5	152.90	136.80	9.8	2.00	20.444	20.476	0.032	0.16	14082.64	14060.68	-21.96	-0.16	350.0	349.5	-0.5	-0.16
5	136.80	120.70	9.8	2.00	20.444	20.526	0.082	0.40	12517.36	12467.41	-49.95	-0.40	350.0	348.6	-1.4	-0.40
5	120.70	104.60	9.8	2.00	20.444	20.520	0.076	0.37	10952.08	10911.56	-40.52	-0.37	350.0	348.7	-1.3	-0.37
5	104.60	88.50	9.8	2.00	20.444	20.550	0.106	0.52	9386.81	9338.46	-48.35	-0.52	350.0	348.2	-1.8	-0.52
5	88.50	72.40	9.8	2.00	20.444	20.538	0.094	0.46	7821.53	7785.76	-35.77	-0.46	350.0	348.4	-1.6	-0.46
5	72.40	56.30	9.8	2.00	20.444	20.510	0.066	0.32	6256.25	6236.15	-20.10	-0.32	350.0	348.9	-1.1	-0.32
5	56.30	40.30	9.8	2.00	20.317	20.350	0.033	0.16	4695.83	4688.23	-7.60	-0.16	350.0	349.4	-0.6	-0.16
5	40.30	24.00	9.8	2.00	20.698	20.714	0.016	0.08	3125.69	3123.30	-2.39	-0.08	350.0	349.7	-0.3	-0.08
5	24.00	8.10	9.8	2.00	20.190	20.195	0.004	0.02	1560.42	1560.10	-0.31	-0.02	350.0	349.9	-0.1	-0.02

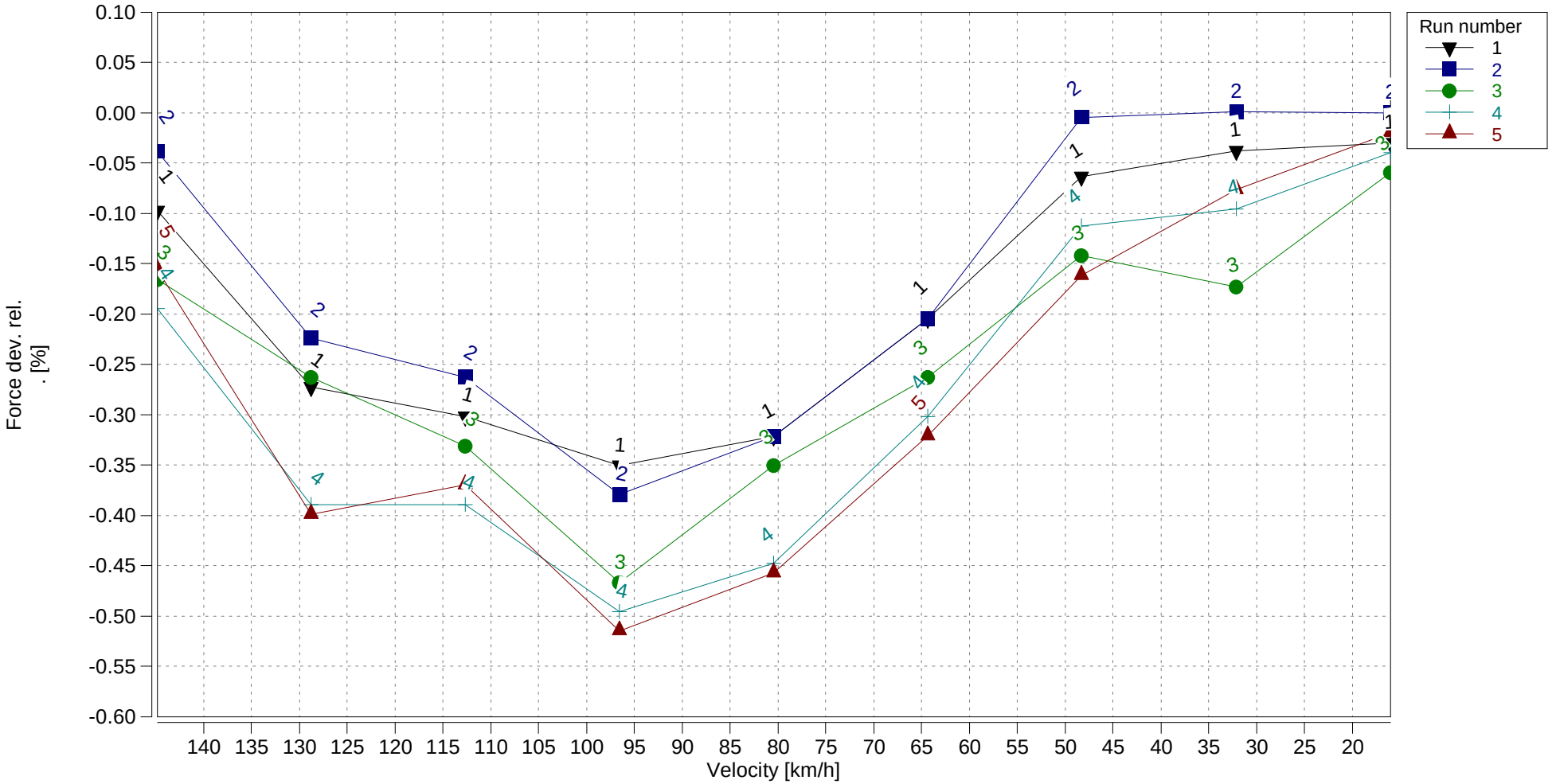
Coastdown (without vehicle) / 97-08 Road load curve evaluation

Graph



Coastdown (without vehicle) / 97-08 Road load curve evaluation

Graph



Coastdown (without vehicle) / 97-08 Road load curve evaluation
Cover sheet

General test data

Item	Chassis dynamometer
Type	25 inch MIL 1x1 ATV Emis AMB
Testbed configuration	1A1M Front
Driveline type	FWD
IZO-Number	IZO.150361
Customer	HUBDAT
Customer identification	IZO.150361
Test location	Jakarta
Tester	AVL
Department	Service Department
Current SW Version	VECON 1.5.3 HotFix: 16 Build: 5208 VV: 36
Measured data	Time
Signal/Channel	Time (Eav_v)
Test date/Time start	10/4/2023 11:36:53 AM
Test date/Time end	10/4/2023 11:56:09 AM
Next test date	To be defined by Interval
Recommended inspection interval [Months]	To be defined by customer
Adjustments made since last test	Yes
Overall result	**Tolerances OK**

Environmental conditions	**Air temperature** [°C]	**Air humidity** [%rel]	**Air pressure** [hPa]
Tolerances	+/- 2.0	+/- 5.00	+/- 10.0
Test cell	31.5	33.20	992.1
Control room	31.5	33.20	992.1
Electrical cabinet room	31.5	33.20	992.1

Applied normal / measuring equipment	**Manufacturer and type**	**Serial no. / PM no.**	**valid until**
Testbed workstation	-	-	Not available

Description / method
97-08 evaluation of road load simulation

☐ Quality assurance settings used

Evaluation
Force in each velocity interval are within the given tolerance

Results

Run	Evaluation [OK] / [NOK]
1	OK
2	OK
3	OK
4	OK
5	OK

Comment

Digitally signed by Paruntu David JAK
Date: 2023.10.20 17:53:08 +07'00'

Location, date, signature (inspector)

Location, date, signature (approver, different than inspector)

General test data

Description of measuring chain	Manufacturer and type	Serial no.	Module
Testbed workstation	-	-	-
Velocity I/O Device	F-FEM CON	9607	

Description of measuring chain Load Unit 1	Manufacturer and type	Serial no.	Module
Force Sensor	Interface	519080A	
Force Amplifier	SAFO	4299	
Force I/O Device	F-FEM CNT	2881	

Tolerances	Absolute tolerance [N]	Relative tolerance [%]
Customized settings	+/- 9.8	+/- 2.00

Results

Run	Force Dev. abs. [N]	Force Dev. rel. [%]	Evaluation [OK] / [NOK]
1	-2.9	1.04	OK
2	-3.1	0.90	OK
3	-3.3	0.97	OK
4	-3.4	0.82	OK
5	-3.3	0.85	OK

Coastdown (without vehicle) / 97-08 Road load curve evaluation

☐ Quality assurance settings

Settings

Evaluation by	Force (absolute & relative)
Regulation	ECE
Simulation type	Coefficients
Number of runs	5
Simulated inertia [kg]	1600.0

Tolerance

Absolute tolerance	[N]	9.8
Relative tolerance	[%]	2.00

Max. measured

[N]	-3.4
[%]	1.04

A	[N]	150.0
B	[N/m/s]	-3.0000
C	[N/m2/s2]	0.80000

Measured data

Run	Upper Velocity [km/h]	Lower Velocity [km/h]	Tolerance Force dev. abs. [N]	Tolerance Force dev. rel. [%]	Time Set [s]	Time Meas. [s]	Time Dev. abs. [s]	Time Dev. rel. [%]	Power Set [W]	Power Meas. [W]	Power Dev. abs. [W]	Power Dev. rel. [%]	Force Set [N]	Force Meas. [N]	Force Dev. abs. [N]	Force Dev. rel. [%]
1	152.90	136.80	9.8	2.00	5.417	5.414	-0.003	-0.05	53290.61	53181.16	-109.45	-0.21	1324.4	1321.7	-2.7	-0.21
1	136.80	120.70	9.8	2.00	6.733	6.726	-0.008	-0.11	38122.63	38049.66	-72.96	-0.19	1066.0	1063.9	-2.0	-0.19
1	120.70	104.60	9.8	2.00	8.555	8.552	-0.003	-0.04	26268.10	26182.60	-85.50	-0.33	839.5	836.7	-2.7	-0.33
1	104.60	88.50	9.8	2.00	11.14	11.14	0.002	0.02	17297.68	17219.43	-78.24	-0.45	645.0	642.1	-2.9	-0.45
1	88.50	72.40	9.8	2.00	14.90	14.90	0.005	0.03	10782.02	10725.94	-56.08	-0.52	482.5	480.0	-2.5	-0.52
1	72.40	56.30	9.8	2.00	20.43	20.42	-0.009	-0.04	6291.78	6263.00	-28.78	-0.46	352.0	350.4	-1.6	-0.46
1	56.30	40.30	9.8	2.00	28.12	28.05	-0.069	-0.24	3404.55	3401.07	-3.48	-0.10	253.8	253.5	-0.3	-0.10
1	40.30	24.00	9.8	2.00	38.69	38.58	-0.110	-0.29	1670.12	1676.85	6.72	0.40	187.0	187.8	0.8	0.40
1	24.00	8.10	9.8	2.00	45.99	45.85	-0.142	-0.31	680.01	687.11	7.09	1.04	152.5	154.1	1.6	1.04
2	152.90	136.80	9.8	2.00	5.417	5.412	-0.005	-0.09	53290.61	53200.82	-89.79	-0.17	1324.4	1322.2	-2.2	-0.17
2	136.80	120.70	9.8	2.00	6.733	6.730	-0.004	-0.06	38122.63	38027.05	-95.57	-0.25	1066.0	1063.3	-2.7	-0.25
2	120.70	104.60	9.8	2.00	8.555	8.550	-0.005	-0.06	26268.10	26188.73	-79.37	-0.30	839.5	836.9	-2.5	-0.30
2	104.60	88.50	9.8	2.00	11.14	11.14	0.006	0.06	17297.68	17213.25	-84.43	-0.49	645.0	641.8	-3.1	-0.49
2	88.50	72.40	9.8	2.00	14.90	14.91	0.015	0.10	10782.02	10718.75	-63.27	-0.59	482.5	479.6	-2.8	-0.59
2	72.40	56.30	9.8	2.00	20.43	20.43	-0.001	-0.00	6291.78	6260.55	-31.23	-0.50	352.0	350.2	-1.7	-0.50
2	56.30	40.30	9.8	2.00	28.12	28.08	-0.033	-0.12	3404.55	3396.71	-7.84	-0.23	253.8	253.2	-0.6	-0.23
2	40.30	24.00	9.8	2.00	38.69	38.59	-0.098	-0.25	1670.12	1676.33	6.20	0.37	187.0	187.7	0.7	0.37
2	24.00	8.10	9.8	2.00	45.99	45.91	-0.076	-0.17	680.01	686.12	6.11	0.90	152.5	153.9	1.4	0.90

Coastdown (without vehicle) / 97-08 Road load curve evaluation

☐ Quality assurance settings

Settings

Evaluation by	Force (absolute & relative)
Regulation	ECE
Simulation type	Coefficients
Number of runs	5
Simulated inertia [kg]	1600.0

Tolerance

Absolute tolerance [N]	9.8
Relative tolerance [%]	2.00

Max. measured

[N]	-3.4
[%]	1.04

A [N]	150.0
B [N/m/s]	-3.0000
C [N/m2/s2]	0.80000

Measured data

Run	Upper Velocity [km/h]	Lower Velocity [km/h]	Tolerance Force dev. abs. [N]	Tolerance Force dev. rel. [%]	Time Set [s]	Time Meas. [s]	Time Dev. abs. [s]	Time Dev. rel. [%]	Power Set [W]	Power Meas. [W]	Power Dev. abs. [W]	Power Dev. rel. [%]	Force Set [N]	Force Meas. [N]	Force Dev. abs. [N]	Force Dev. rel. [%]
3	152.90	136.80	9.8	2.00	5.417	5.412	-0.005	-0.09	53290.61	53200.82	-89.79	-0.17	1324.4	1322.2	-2.2	-0.17
3	136.80	120.70	9.8	2.00	6.733	6.732	-0.002	-0.03	38122.63	38015.75	-106.87	-0.28	1066.0	1063.0	-3.0	-0.28
3	120.70	104.60	9.8	2.00	8.555	8.552	-0.003	-0.04	26268.10	26182.60	-85.50	-0.33	839.5	836.7	-2.7	-0.33
3	104.60	88.50	9.8	2.00	11.14	11.15	0.008	0.08	17297.68	17210.16	-87.51	-0.51	645.0	641.7	-3.3	-0.51
3	88.50	72.40	9.8	2.00	14.90	14.91	0.015	0.10	10782.02	10718.75	-63.27	-0.59	482.5	479.6	-2.8	-0.59
3	72.40	56.30	9.8	2.00	20.43	20.44	0.013	0.07	6291.78	6256.27	-35.51	-0.56	352.0	350.0	-2.0	-0.56
3	56.30	40.30	9.8	2.00	28.12	28.06	-0.055	-0.19	3404.55	3399.37	-5.18	-0.15	253.8	253.4	-0.4	-0.15
3	40.30	24.00	9.8	2.00	38.69	38.58	-0.112	-0.29	1670.12	1676.93	6.81	0.41	187.0	187.8	0.8	0.41
3	24.00	8.10	9.8	2.00	45.99	45.88	-0.108	-0.24	680.01	686.60	6.59	0.97	152.5	154.0	1.5	0.97
4	152.90	136.80	9.8	2.00	5.417	5.414	-0.003	-0.05	53290.61	53181.16	-109.45	-0.21	1324.4	1321.7	-2.7	-0.21
4	136.80	120.70	9.8	2.00	6.733	6.732	-0.002	-0.03	38122.63	38015.75	-106.87	-0.28	1066.0	1063.0	-3.0	-0.28
4	120.70	104.60	9.8	2.00	8.555	8.552	-0.003	-0.04	26268.10	26182.60	-85.50	-0.33	839.5	836.7	-2.7	-0.33
4	104.60	88.50	9.8	2.00	11.14	11.15	0.010	0.09	17297.68	17207.08	-90.60	-0.52	645.0	641.6	-3.4	-0.52
4	88.50	72.40	9.8	2.00	14.90	14.91	0.011	0.07	10782.02	10721.63	-60.39	-0.56	482.5	479.8	-2.7	-0.56
4	72.40	56.30	9.8	2.00	20.43	20.43	0.005	0.03	6291.78	6258.71	-33.06	-0.53	352.0	350.1	-1.8	-0.53
4	56.30	40.30	9.8	2.00	28.12	28.07	-0.047	-0.17	3404.55	3398.41	-6.15	-0.18	253.8	253.3	-0.5	-0.18
4	40.30	24.00	9.8	2.00	38.69	38.61	-0.078	-0.20	1670.12	1675.46	5.34	0.32	187.0	187.6	0.6	0.32
4	24.00	8.10	9.8	2.00	45.99	45.95	-0.042	-0.09	680.01	685.61	5.60	0.82	152.5	153.8	1.3	0.82

Coastdown (without vehicle) / 97-08 Road load curve evaluation

☐ Quality assurance settings

Settings

Evaluation by	Force (absolute & relative)
Regulation	ECE
Simulation type	Coefficients
Number of runs	5
Simulated inertia [kg]	1600.0

Tolerance

Absolute tolerance [N]	9.8
Relative tolerance [%]	2.00

Max. measured

[N]	-3.4
[%]	1.04

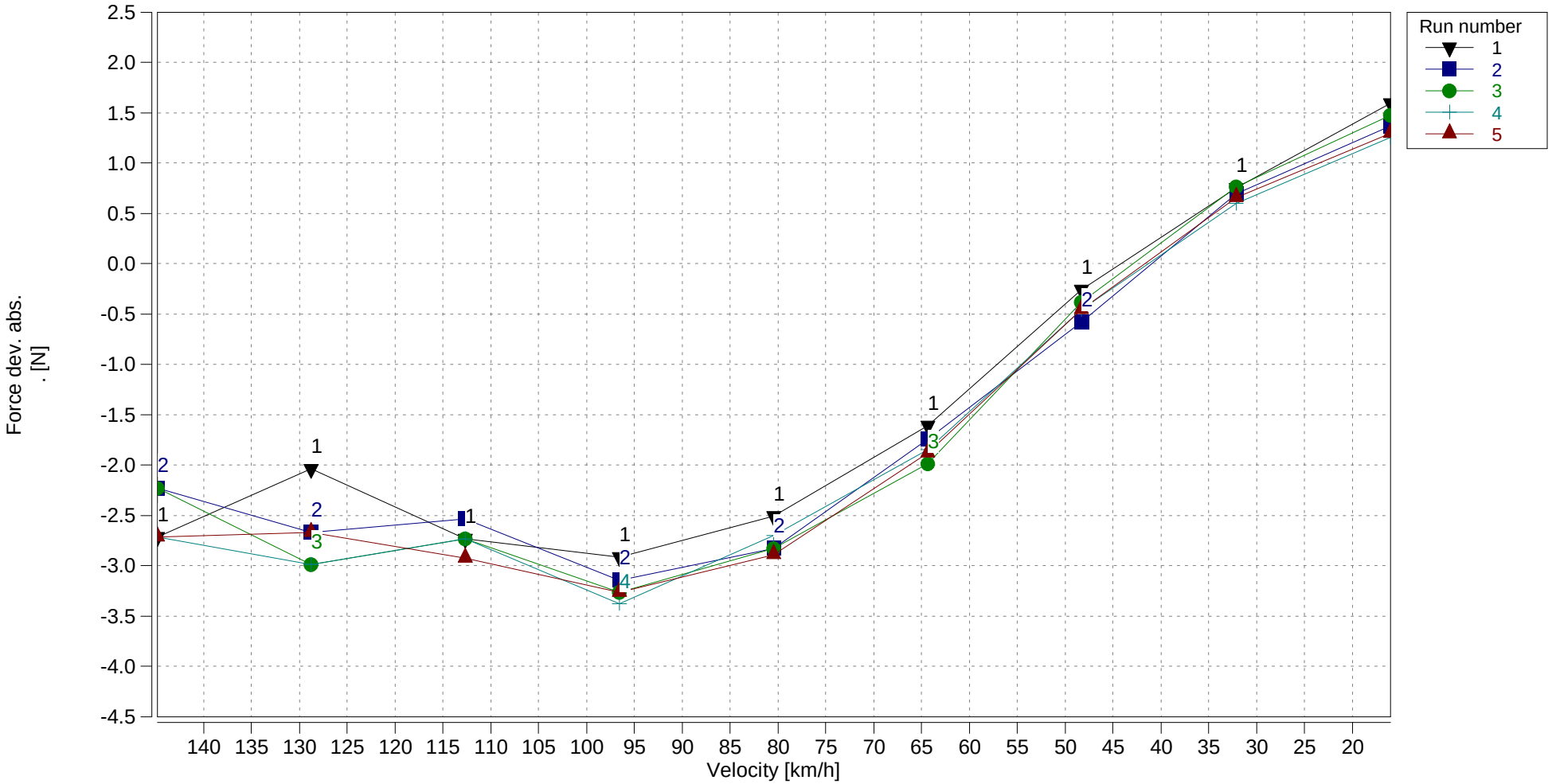
A [N]	150.0
B [N/m/s]	-3.0000
C [N/m2/s2]	0.80000

Measured data

Run	Upper Velocity [km/h]	Lower Velocity [km/h]	Tolerance Force dev. abs. [N]	Tolerance Force dev. rel. [%]	Time Set [s]	Time Meas. [s]	Time Dev. abs. [s]	Time Dev. rel. [%]	Power Set [W]	Power Meas. [W]	Power Dev. abs. [W]	Power Dev. rel. [%]	Force Set [N]	Force Meas. [N]	Force Dev. abs. [N]	Force Dev. rel. [%]
5	152.90	136.80	9.8	2.00	5.417	5.414	-0.003	-0.05	53290.61	53181.16	-109.45	-0.21	1324.4	1321.7	-2.7	-0.21
5	136.80	120.70	9.8	2.00	6.733	6.730	-0.004	-0.06	38122.63	38027.05	-95.57	-0.25	1066.0	1063.3	-2.7	-0.25
5	120.70	104.60	9.8	2.00	8.555	8.554	-0.001	-0.02	26268.10	26176.48	-91.62	-0.35	839.5	836.5	-2.9	-0.35
5	104.60	88.50	9.8	2.00	11.14	11.15	0.008	0.08	17297.68	17210.16	-87.51	-0.51	645.0	641.7	-3.3	-0.51
5	88.50	72.40	9.8	2.00	14.90	14.92	0.017	0.11	10782.02	10717.31	-64.71	-0.60	482.5	479.6	-2.9	-0.60
5	72.40	56.30	9.8	2.00	20.43	20.43	0.007	0.04	6291.78	6258.10	-33.68	-0.54	352.0	350.1	-1.9	-0.54
5	56.30	40.30	9.8	2.00	28.12	28.07	-0.047	-0.17	3404.55	3398.41	-6.15	-0.18	253.8	253.3	-0.5	-0.18
5	40.30	24.00	9.8	2.00	38.69	38.60	-0.090	-0.23	1670.12	1675.98	5.86	0.35	187.0	187.7	0.7	0.35
5	24.00	8.10	9.8	2.00	45.99	45.94	-0.054	-0.12	680.01	685.79	5.78	0.85	152.5	153.8	1.3	0.85

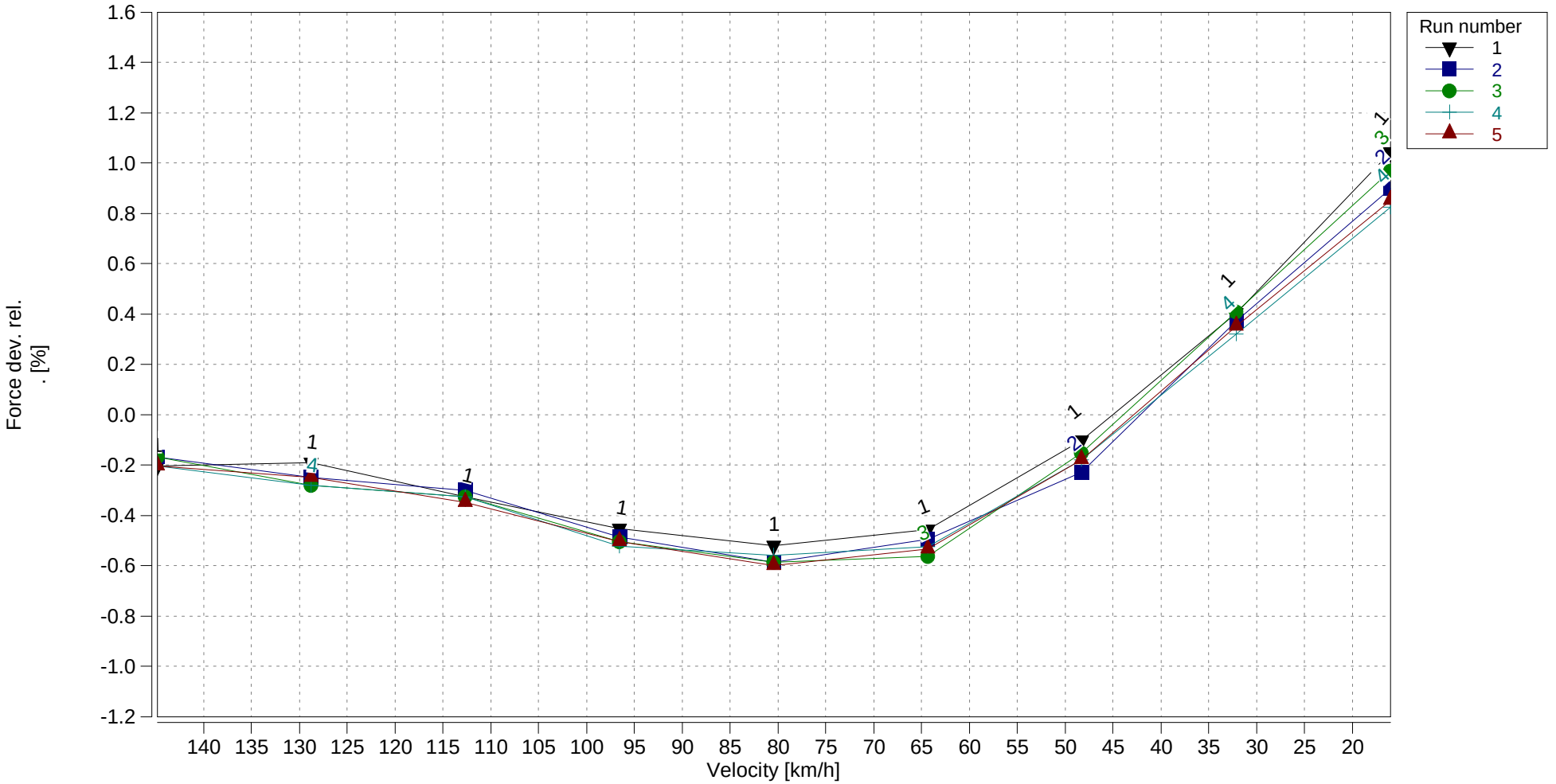
Coastdown (without vehicle) / 97-08 Road load curve evaluation

Graph



Coastdown (without vehicle) / 97-08 Road load curve evaluation

Graph



Appendix E
97-17 Dynamic parasitic losses

Chassis dynamometer losses static

General test data

Customer	HUBDAT
Customer identification	IZO.150361
IZO-Number	IZO.150361
Driveline type	FWD
Test location	Jakarta
Tester	David Paruntu
Department	Service Department
Date / Time	2023/10/04 09:52:27
Data-applied	Yes
Overall result	Tolerances OK

Digitally signed by Paruntu David JAK
Date: 2023.10.20 17:53:33 +07'00'

Location, date, signature (inspecto

Chassis dynamometer losses static

General test data

Name	Data
Chassis dynamometer number	IZO.150361
Chassis dynamometer type	25 inch MIL 1x1 ATV Emis AMB

Load Unit 1

Name
Load unit 1 force sensor
Load unit 1 force amplifier
Load unit 1 force I/O
Load unit 1 velocity sensor
Load unit 1 velocity inverter
Load unit 1 velocity I/O

Chassis dynamometer losses static

Load Unit 1

Measured data

No.	Velocity [km/h]	Force Meas. [N]	Force Dev. abs. [N]	Force Previous [N]
1	5.00	-4.3	0.2	-4.5
2	15.00	-5.6	0.3	-5.9
3	25.00	-7.3	0.1	-7.4
4	35.00	-9.3	-0.1	-9.2
5	45.00	-10.9	0.0	-10.9
6	55.00	-12.9	0.4	-13.4
7	65.00	-15.4	0.1	-15.5
8	75.00	-18.0	0.1	-18.1
9	85.00	-20.7	-0.1	-20.6
10	95.00	-23.7	-0.2	-23.4
11	105.00	-26.3	-0.3	-26.1
12	115.00	-29.4	-0.5	-28.9
13	125.00	-32.6	-0.5	-32.1
14	135.00	-36.2	-0.6	-35.6

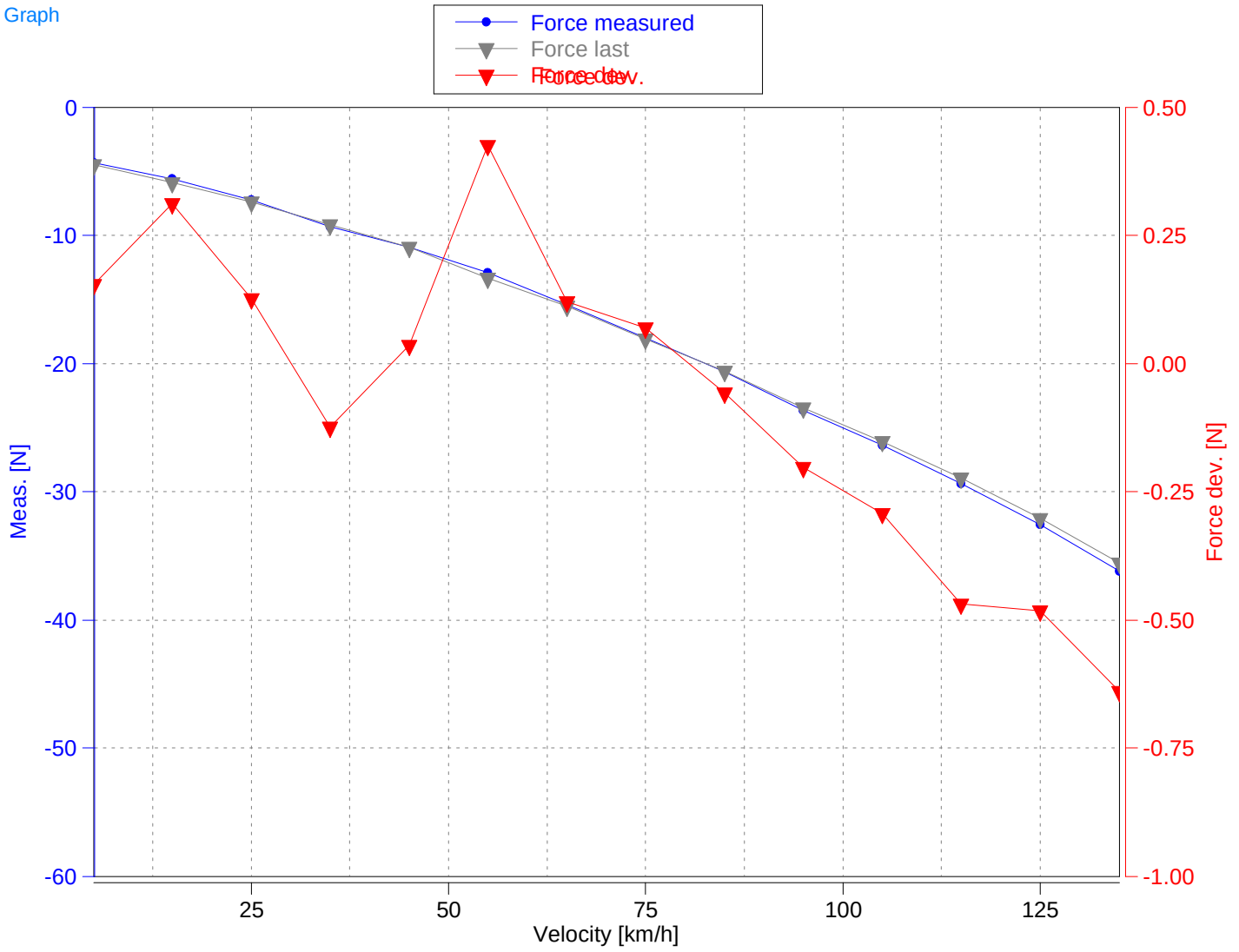
Current : 2023-10-04 09:52:24

A	[N]	-3.5
B	[N/km/h]	-0.1297
C	[N/km2/h2]	-0.00083
Maximum force dev	[N]	0.6
...at step no.		14

Previous : 2023-10-04 09:47:44

A	[N]	-3.7
B	[N/km/h]	-0.1337
C	[N/km2/h2]	-0.00076

Graph



Appendix F
97-13 Torque Transducer Evaluation

Adjustment / Calibration / 97-13 Evaluation of tractive force measureme Cover sheet 1/2

General test data

Item	Chassis dynamometer
Type	25 inch MIL 1x1 ATV Emis AMB
Testbed configuration	1A1M Front
Driveline type	FWD
IZO-Number	IZO.150361
Customer	HUBDAT
Customer identification	-
Test location	Jakarta
Tester	AVL SERVICE
Department	Service Department
Current SW Version	VECON 1.5.3 HotFix: 16 Build: 5208 VV: 36
Signal/Channel	F_ACT_D1
Test date/Time start	10/3/2023 13:15
Test date/Time end	10/3/2023 15:42
Next test date	To be defined by Interval
Recommended inspection interval [Months]	0
Adjustments made since last test	Yes
Overall result	**Tolerances OK**

Environmental conditions	Air temperature [°C]	Air humidity [%rel]	Air pressure [hPa]
Tolerances	+/- 2.0	+/- 5.00	+/- 10.0
Test cell	31.5	55.6	992.1
Control room	31.5	56.3	992.1
Electrical cabinet room	32.1	55.6	992.1

No.	Manufacturer and type	Serial no./ PM no.	Certificate	Valid until	CDR text	Weight	Weight sum
m01	Ing. Jiri Shacal	H560	KLZ-16K-1217			10.00024	10.00024
m02	Ing. Jiri Shacal	H569	KLZ-16K-1226			10.00026	20.00050
m03	Ing. Jiri Shacal	H572	KLZ-16K-1229			10.00024	30.00074
m04	Ing. Jiri Shacal	H575	KLZ-16K-1232			10.00029	40.00103
m05	Ing. Jiri Shacal	H576	KLZ-16K-1233			10.00025	50.00128
m06	Ing. Jiri Shacal	H592	KLZ-16K-1249			10.00026	60.00154

Applied normal	Manufacturer and type	Serial no. / PM no.	valid until	Actual value [mm]
Mean value roller diameter	Rollers on same axle	A:/B:	-	648.000

Applied normal	Manufacturer and type	Source of info	valid until
Local gravitational acceleration	PTB	http://www.ptb.de/cartoweb3/SISproject.php	-

Adjustment / Calibration / 97-13 Evaluation of tractive force measureme Cover sheet 1/2

General test data

Description / method
97-13 evaluation of tractive force, method 1
Verification of torque measuring accuracy. Calibration/adjustment with known force, lever arm and roller
The displayed values are compared to the calculated values of the reference values.

Evaluation
Tractive force in positive and negative direction, repeatability

Calculated values	Nominal value [m/s2]	Absolute tolerance of full scale [m/s2]
Local gravitational acceleration	9.80665	+/- 0.000047

Calculated values	Nominal value [kg]	Absolute tolerance of full scale [kg]
Weight sum	60.00154	+/- 0.016

Calculated values	Nominal value [mm]
Scaling factor positive	826.000
Scaling factor negative	826.000

	[N]
Nominal range positive	185.2
Nominal range negative	185.2

	[mm]
Effective lever arm positive	826.000
Effective lever arm negative	826.000

	[mm]
Roller radius	0.3240

Result

Tolerances	Evaluation [OK] / [NOK]
Linearity FS	OK
Accuracy FS	OK
Repeatability FS	OK
Hysteresis FS	OK

Digitally signed by Paruntu David JAK
Date: 2023.10.20 17:54:00 +07'00'

Location, date, signature (inspector)

Location, date, signature (approver, different than inspector)

Adjustment / Calibration / 97-13 Evaluation of tractive force measureme Test report LU 1 (front)

General test data

Description of measuring chain	Manufacturer and type	Serial no.	Module
Force Sensor	Interface	519080A	
Force Amplifier	SAFO	4299	
I/O manuf./type	F-FEM CNT	2881	
Testbed workstation			

Applied normal / measuring equipment				Actual value [mm]
Lever arm L2 positive				826.000
Lever arm L2 negative				826.000

Tolerances	Relative tolerance of full scale [%]
Linearity FS	+/- 0.10
Accuracy FS	+/- 0.10
Repeatability FS	+/- 0.03
Hysteresis FS	+/- 0.10

Result

Tolerances	Relative tolerance of full scale [%]	Evaluation [OK] / [NOK]
Linearity FS	0.03%	OK
Accuracy FS	-0.03%	OK
Repeatability FS	0.02%	OK
Hysteresis FS	-0.05%	OK

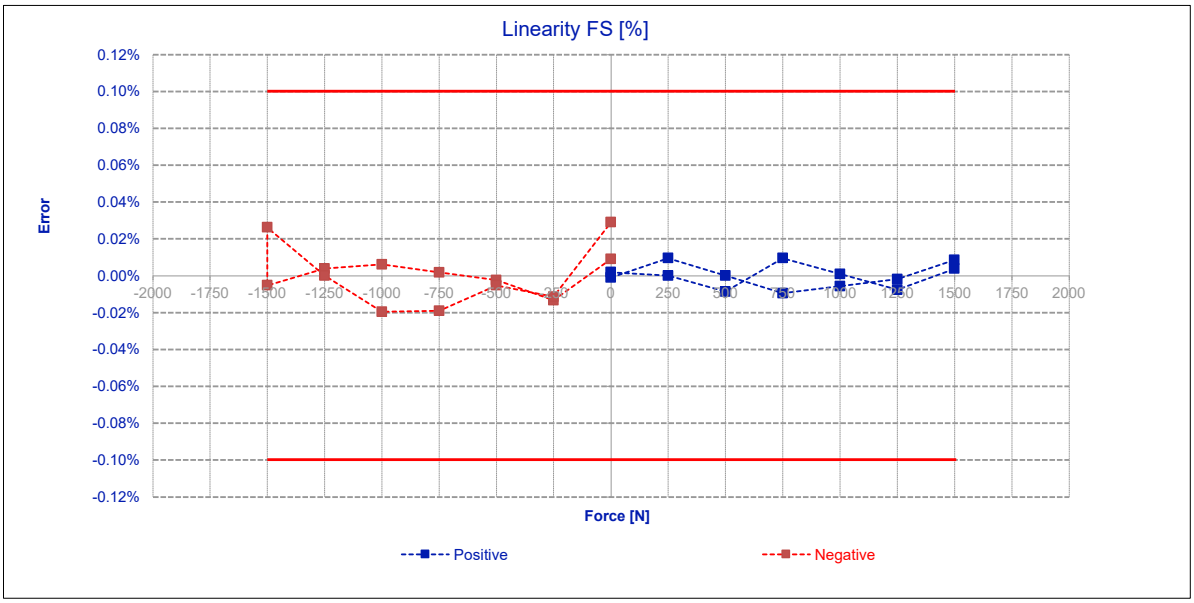
Adjustment / Calibration / 97-13 Evaluation of tractive force measureme Adjustment/Calibration

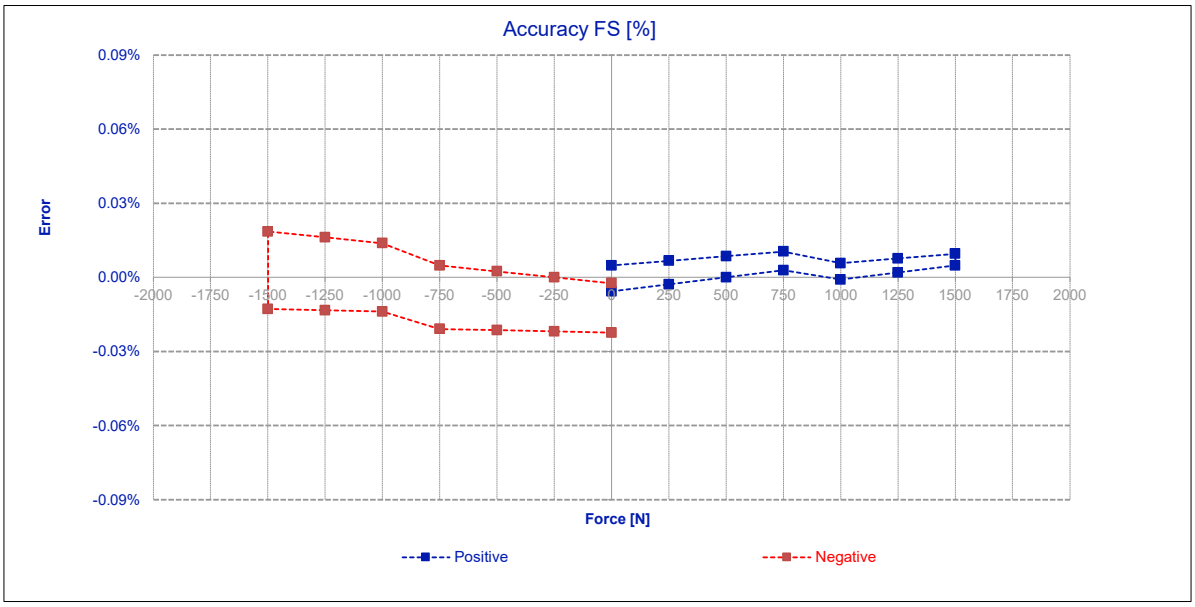
Select unit: Load unit 1 (Front)

No.	Weight [kg]	Fref [N]	F load [N]	Err abs [N]	Lin FS [%]	Acc FS [%]	Rep FS [%]	F unload [N]	Err abs [N]	Lin FS [%]	Acc FS [%]	Rep FS [%]	Hyst FS [%]	Rep ? [Yes] / [No]
0	0.00000	0.0	-0.1	-0.1	0.00%	-0.01%	0.01%	0.1	0.1	0.00%	0.00%	0.00%	0.01%	**Yes**
1	10.00024	250.0	250.1	0.1	0.01%	0.00%		250.1	0.1	0.00%	0.01%		0.00%	**No**
2	20.00050	500.0	500.0	0.0	0.00%	0.00%	0.01%	500.0	0.0	-0.01%	0.01%	0.02%	0.00%	**Yes**
3	30.00074	750.0	749.9	-0.1	-0.01%	0.00%		750.3	0.3	0.01%	0.01%		0.03%	**No**
4	40.00103	1000.1	1000.0	-0.1	-0.01%	0.00%	0.02%	1000.2	0.1	0.00%	0.01%	0.02%	0.01%	**Yes**
5	50.00128	1250.1	1250.1	0.0	0.00%	0.00%		1250.1	0.0	-0.01%	0.01%		0.00%	**No**
6	60.00154	1500.1	1500.3	0.2	0.01%	0.00%	0.01%	1500.3	0.2	0.00%	0.01%	0.01%	0.00%	**Yes**
7	0.00000	0.0	0.1	0.1	0.01%	0.00%	0.00%	0.1	0.1	0.03%	-0.02%	0.01%	0.00%	**Yes**
8	10.00024	-250.0	-250.2	-0.2	-0.01%	0.00%		-250.5	-0.5	-0.01%	-0.02%		-0.02%	**No**
9	20.00050	-500.0	-500.0	0.0	0.00%	0.00%	0.02%	-500.4	-0.4	-0.01%	-0.02%	0.02%	-0.03%	**Yes**
10	30.00074	-750.0	-749.9	0.1	0.00%	0.00%		-750.6	-0.6	-0.02%	-0.02%		-0.05%	**No**
11	40.00103	-1000.1	-999.8	0.3	0.01%	0.01%	0.02%	-1000.6	-0.5	-0.02%	-0.01%	0.01%	-0.05%	**Yes**
12	50.00128	-1250.1	-1249.8	0.3	0.00%	0.02%		-1250.3	-0.2	0.00%	-0.01%		-0.03%	**No**
13	60.00154	-1500.1	-1499.9	0.2	-0.01%	0.02%	0.01%	-1499.9	0.2	0.03%	-0.01%	0.01%	0.00%	**Yes**
14	0.00000	-0.1	0.1	0.2		0.00%		0.1	0.2		0.01%		0.00%	**No**
15	20.00050	500	499.9	-0.1		0.00%		499.6	-0.4		0.01%		-0.02%	**No**
16	40.00103	1000	999.6	-0.4		0.01%		1000.4	0.4		0.01%		0.05%	**No**
17	60.00154	1500.3	1499.9	-0.4		-0.01%		1499.9	-0.4		0.00%		0.00%	**No**
18	0.00000	0.1	0.1	0.0		-0.01%		-0.2	-0.3		-0.02%		-0.02%	**No**
19	20.00050	-500	-500.5	-0.5		0.00%		-500.8	-0.8		-0.02%		-0.02%	**No**
20	40.00103	-999.8	-1000.2	-0.4		-0.01%		-1000.6	-0.8		-0.01%		-0.03%	**No**
21	60.00154	-1499.9	-1500.1	-0.2		0.01%		-1500.1	-0.2		-0.01%		0.00%	**No**
22	0.00000	-0.1	-0.3	-0.2		0.00%		0.0	0.1		0.01%		0.02%	**No**
23	20.00050	500	499.7	-0.3		0.00%		500.3	0.3		0.01%		0.04%	**No**
24	40.00103	1000	1000.2	0.2		0.01%		1000.8	0.8		0.01%		0.04%	**No**
25	60.00154	1500.3	1500.2	-0.1		-0.01%		1500.2	-0.1		0.00%		0.00%	**No**
26	0.00000	0.1	0.0	-0.1		-0.01%		-0.2	-0.3		-0.03%		-0.01%	**No**
27	20.00050	-500	-500.4	-0.4		0.00%		-501.0	-1.0		-0.02%		-0.04%	**No**
28	40.00103	-999.8	-1000.2	-0.4		-0.01%		-1000.8	-1.0		-0.03%		-0.04%	**No**
29	60.00154	-1499.9	-1500.1	-0.2		0.01%		-1500.1	-0.2		-0.03%		0.00%	**No**

Adjustment / Calibration / 97-13 Evaluation of tractive force measureme Adjustment/Calibration

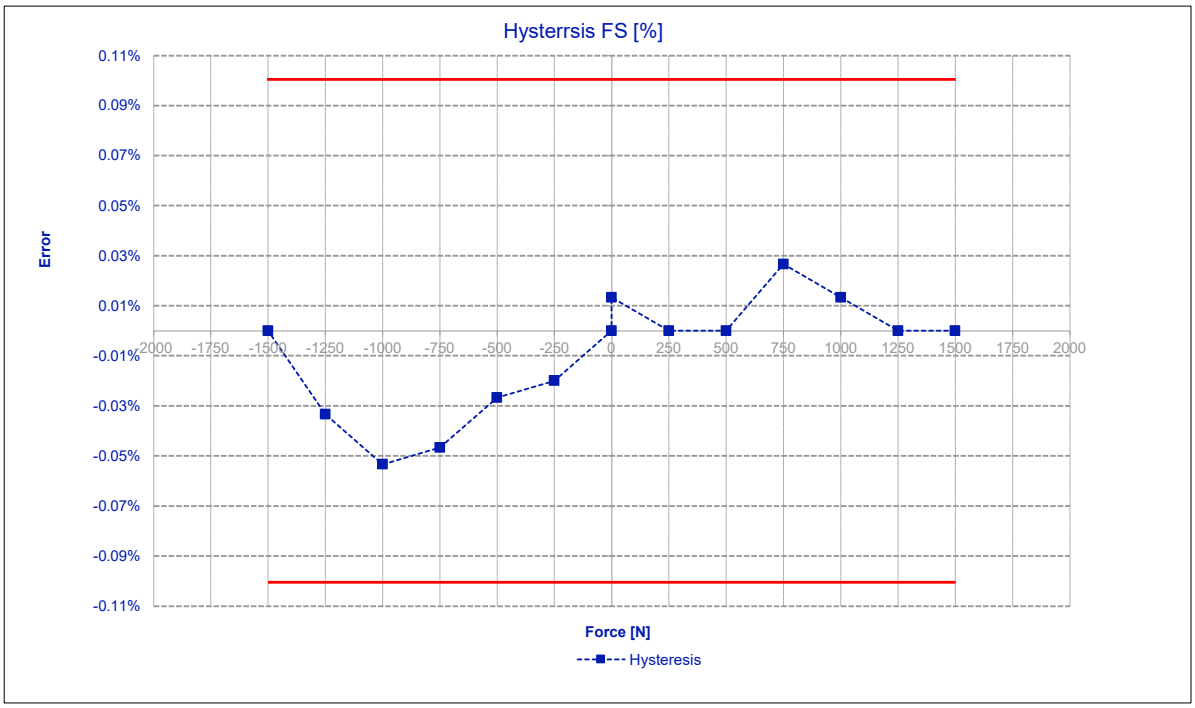
Graph

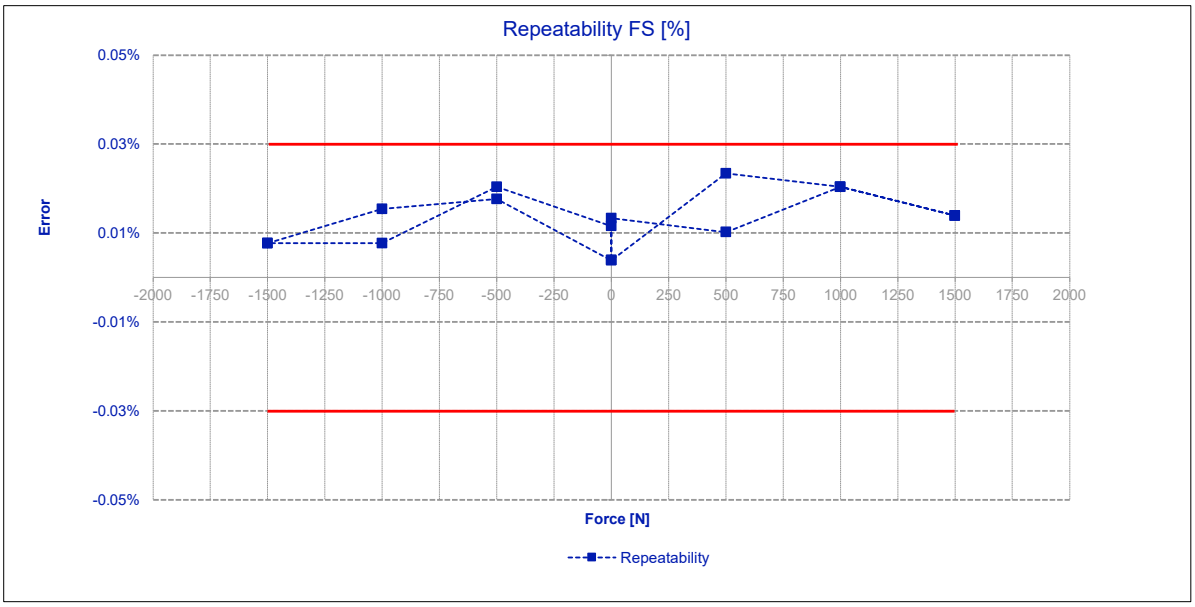




Adjustment / Calibration / 97-13 Evaluation of tractive force measureme Adjustment/Calibration

Graph





Appendix G
Vehicle cooling fan check

ZÖLLNER GMBH

Maintenance Protocol Vehicle Cooling Fan

Customer	HUBDAT R40
Location	Bekasi, Indonesia
Type	Vehicle Cooling Fan
AVL Order Number	IZO150361
Service Engineer	David Paruntu
Date	2-Oct-23 to 6-Oct-23

Test Cell	HUBDAT R40
Service Order	PM 2023

Digitally signed by Paruntu David JAK
Date: 2023.10.20 17:40:13 +07'00'

Location:	Bekasi, Indonesia
Date:	6-Oct-23

Service Engineer:

Maintenance Protocol Vehicle Cooling Fan

ZÖLLNER GMBH

Test Cell	HUBDAT R40
Service Order	PM 2023

General Data

AVL Order Number	IZO150361
Type	Vehicle Cooling Fan

Fan Coefficients

	Old	New
n0 [%]	7.0000	5.0000
n1 [%/(km/h)]	0.5000	0.5000
n2 [%/(km/h)^2]	0.0001	0.0001

** Check with old coefficients the fan speed error too high but still are in limit then calibration adjustment n1 is variable by roller speed parameter now the result of fan speed are good condition.

Device Status

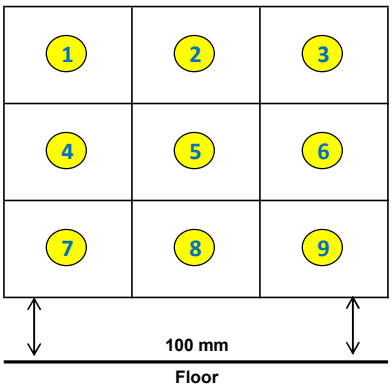
Not used since the last maintenance	
Device rarely used	
Device frequently used	✓
Last check	20-Sep-21

Tolerances

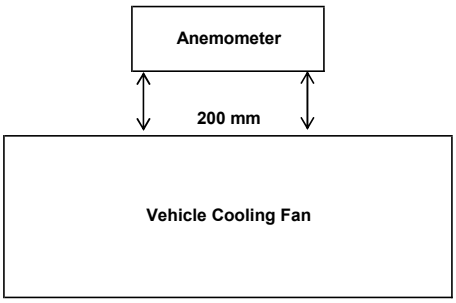
Tolerance at speed between 10-50 km/h	± 5.0 km/h
Tolerance at speed more than 50 km/h	± 10.0 %

Test Conditions

Front view



Top view



List of used measuring tools

Devices	Serial Number
Anemometer	Tenmars TM-4001170600054

The used tools are subject to monitoring in accordance with ISO 9001.

The sequence of tests correspond to the demands according to ISO 9001.

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Date: 2023.10.20 17:40:36 +07'00'

Service Engineer:

Maintenance Protocol Vehicle Cooling Fan

ZÖLLNER GMBH

Test Cell	HUBDAT R40
Service Order	PM 2023

Fan Coefficients

n0 [%]	5.0000
n1 [%/(km/h)]	0.5000
n2 [%/(km/h)^2]	0.0001

Data required
Result is in tolerance
Result is out of tolerance

Parameter

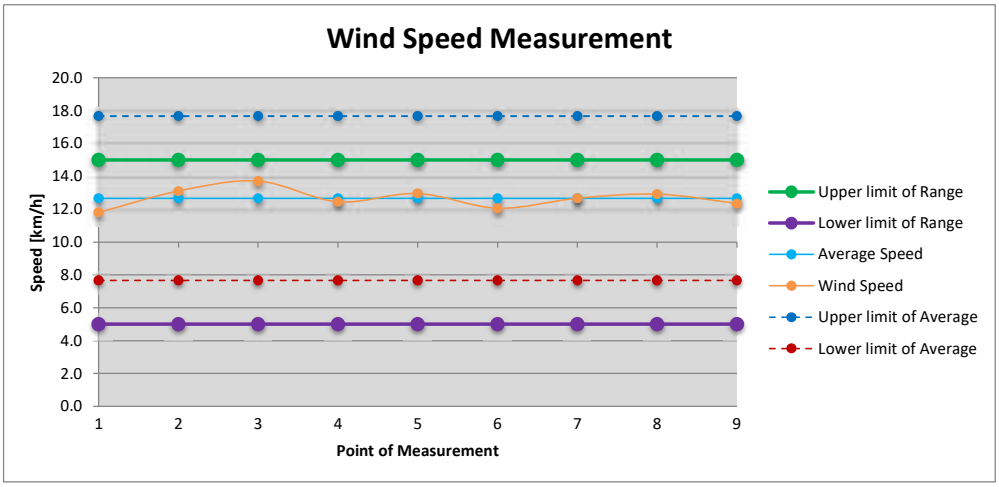
Demand speed	10.0 km/h

Results

Point of Measurement	1	2	3	4	5	6	7	8	9
Measurement Value [m/s]	3.28	3.64	3.81	3.46	3.60	3.35	3.52	3.59	3.43
Measurement Value [km/h]	11.8	13.1	13.7	12.5	13.0	12.1	12.7	12.9	12.3
Deviation of range [km/h]	-1.81	-3.10	-3.72	-2.46	-2.96	-2.06	-2.67	-2.92	-2.35

Test Status

Average speed [km/h]	Demand speed [km/h]	Diff. of speed [km/h]	Diff. of speed [%]	Max speed [km/h]	Dev. of average [%]	Min speed [km/h]	Dev. of average [%]	Limit [km/h]	Status
12.67	10.00	-2.67	x	13.72	8.24	11.81	6.82	± 5	Passed



Service Engineer:

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Date: 2023.10.20 17:40:49 +07'00'

Maintenance Protocol Vehicle Cooling Fan

ZÖLLNER GMBH

Test Cell	HUBDAT R40
Service Order	PM 2023

Fan Coefficients

n0 [%]	5.0000
n1 [%/(km/h)]	0.5000
n2 [%/(km/h)^2]	0.0001

Data required
Result is in tolerance
Result is out of tolerance

Parameter

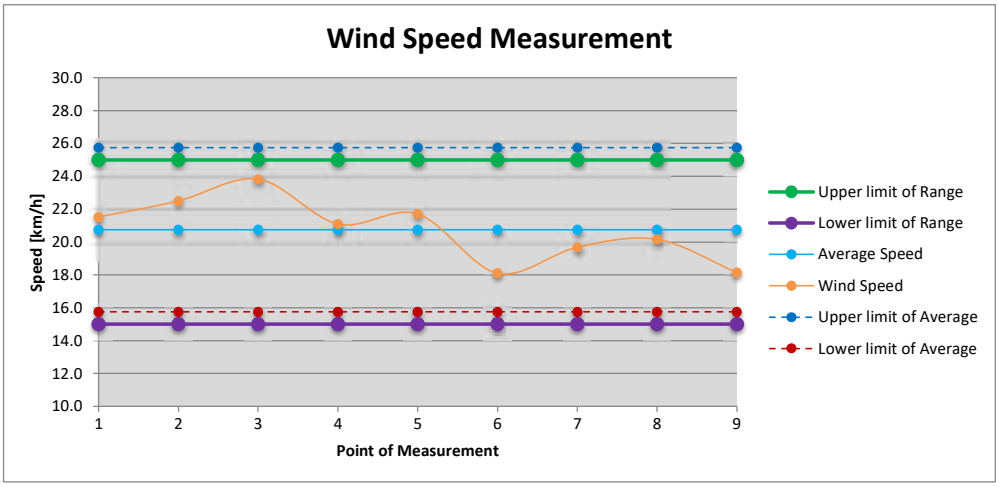
Demand speed	20.0 km/h

Results

Point of Measurement	1	2	3	4	5	6	7	8	9
Measurement Value [m/s]	5.98	6.25	6.62	5.86	6.03	5.03	5.47	5.60	5.04
Measurement Value [km/h]	21.5	22.5	23.8	21.1	21.7	18.1	19.7	20.2	18.1
Deviation of range [km/h]	-1.53	-2.50	-3.83	-1.10	-1.71	1.89	0.31	-0.16	1.86

Test Status

Average speed [km/h]	Demand speed [km/h]	Diff. of speed [km/h]	Diff. of speed [%]	Max speed [km/h]	Dev. of average [%]	Min speed [km/h]	Dev. of average [%]	Limit [km/h]	Status
20.75	20.00	-0.75	x	23.83	14.84	18.11	12.74	± 5	Passed



Service Engineer:

Digitally signed by Paruntu David JAK
Date: 2023.10.20 17:41:05 +07'00'

Maintenance Protocol Vehicle Cooling Fan

Test Cell	HUBDAT R40
Service Order	PM 2023

ZÖLLNER GMBH

Fan Coefficients

n0 [%]	5.0000
n1 [%/(km/h)]	0.5000
n2 [%/(km/h)^2]	0.0001

Data required
Result is in tolerance
Result is out of tolerance

Parameter

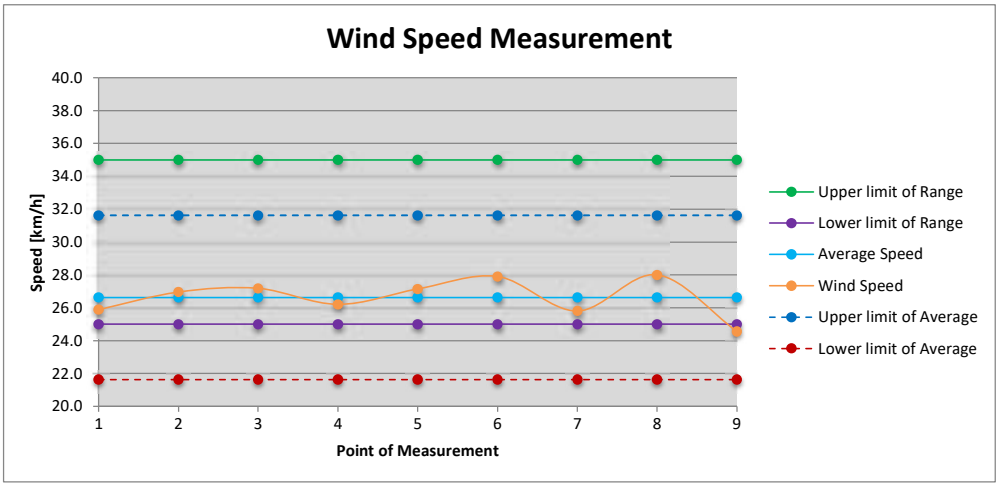
Demand speed	30.0 km/h

Results

Point of Measurement	1	2	3	4	5	6	7	8	9
Measurement Value [m/s]	7.19	7.49	7.55	7.28	7.54	7.75	7.17	7.78	6.82
Measurement Value [km/h]	25.9	27.0	27.2	26.2	27.1	27.9	25.8	28.0	24.6
Deviation of range [km/h]	4.12	3.04	2.82	3.79	2.86	2.10	4.19	1.99	5.45

Test Status

Average speed [km/h]	Demand speed [km/h]	Diff. of speed [km/h]	Diff. of speed [%]	Max speed [km/h]	Dev. of average [%]	Min speed [km/h]	Dev. of average [%]	Limit [km/h]	Status
26.63	30.00	3.37	x	28.01	5.18	24.55	7.80	± 5	Passed



Service Engineer:

Digitally signed by Paruntu David JAK
Date: 2023.10.20 17:41:20 +07'00'

Maintenance Protocol Vehicle Cooling Fan

ZÖLLNER GMBH

Test Cell	HUBDAT R40
Service Order	PM 2023

Fan Coefficients

n0 [%]	5.0000
n1 [%/(km/h)]	0.5000
n2 [%/(km/h)^2]	0.0001

Data required
Result is in tolerance
Result is out of tolerance

Parameter

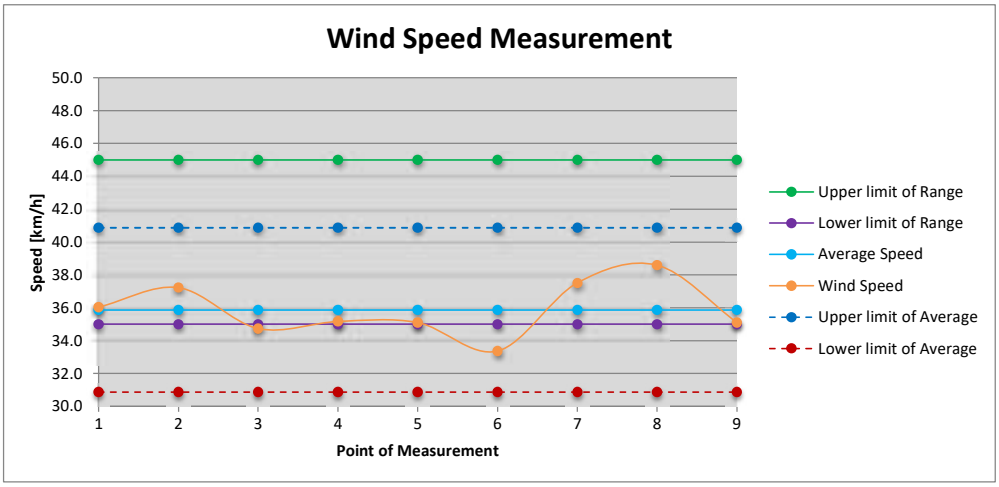
Demand speed	40.0 km/h

Results

Point of Measurement	1	2	3	4	5	6	7	8	9
Measurement Value [m/s]	10.01	10.34	9.65	9.77	9.75	9.27	10.42	10.72	9.75
Measurement Value [km/h]	36.0	37.2	34.7	35.2	35.1	33.4	37.5	38.6	35.1
Deviation of range [km/h]	3.96	2.78	5.26	4.83	4.90	6.63	2.49	1.41	4.90

Test Status

Average speed [km/h]	Demand speed [km/h]	Diff. of speed [km/h]	Diff. of speed [%]	Max speed [km/h]	Dev. of average [%]	Min speed [km/h]	Dev. of average [%]	Limit [km/h]	Status
35.87	40.00	4.13	x	38.59	7.58	33.37	6.97	± 5	Passed



Service Engineer:

Digitally signed by Paruntu David JAK
Date: 2023.10.20 17:41:33 +07'00'

Maintenance Protocol Vehicle Cooling Fan

Test Cell	HUBDAT R40
Service Order	PM 2023

ZÖLLNER GMBH

Fan Coefficients

n0 [%]	5.0000
n1 [%/(km/h)]	0.5000
n2 [%/(km/h)^2]	0.0001

Data required
Result is in tolerance
Result is out of tolerance

Parameter

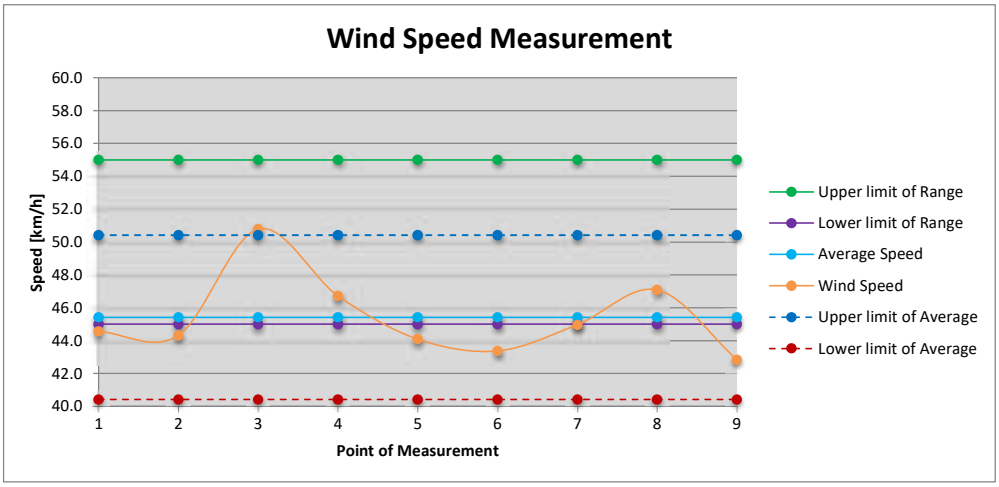
Demand speed	50.0 km/h

Results

Point of Measurement	1	2	3	4	5	6	7	8	9
Measurement Value [m/s]	12.38	12.31	14.11	12.98	12.25	12.05	12.49	13.08	11.90
Measurement Value [km/h]	44.6	44.3	50.8	46.7	44.1	43.4	45.0	47.1	42.8
Deviation of range [km/h]	5.43	5.68	-0.80	3.27	5.90	6.62	5.04	2.91	7.16

Test Status

Average speed [km/h]	Demand speed [km/h]	Diff. of speed [km/h]	Diff. of speed [%]	Max speed [km/h]	Dev. of average [%]	Min speed [km/h]	Dev. of average [%]	Limit [km/h]	Status
45.42	50.00	4.58	x	50.80	11.84	42.84	5.68	± 5	Passed



Service Engineer:

Digitally signed by Paruntu David JAK
Date: 2023.10.20 17:41:48 +07'00'

Maintenance Protocol Vehicle Cooling Fan

Test Cell	HUBDAT R40
Service Order	PM 2023

ZÖLLNER GMBH

Fan Coefficients

n0 [%]	5.0000
n1 [%/(km/h)]	0.5000
n2 [%/(km/h)^2]	0.0001

Data required
Result is in tolerance
Result is out of tolerance

Parameter

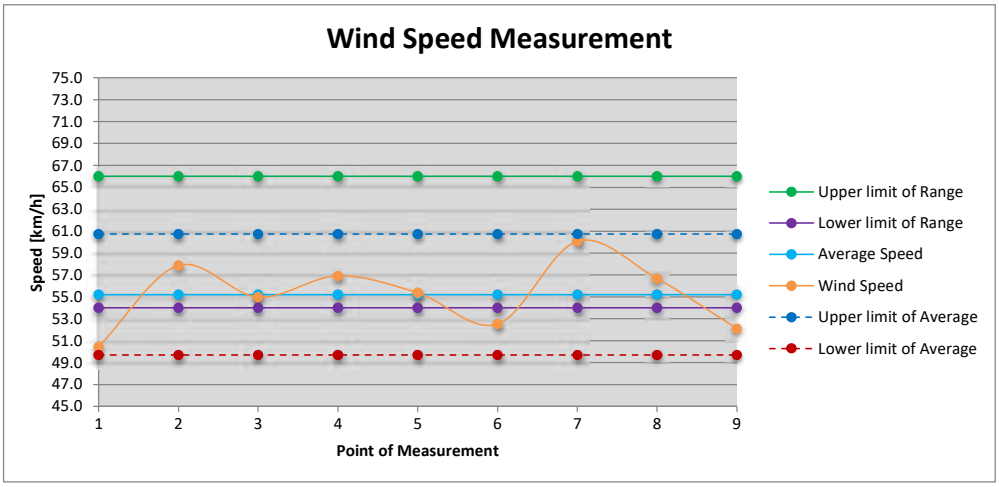
Demand speed	60.0 km/h

Results

	1	2	3	4	5	6	7	8	9
Measurement Value [m/s]	14.01	16.07	15.27	15.81	15.38	14.59	16.69	15.74	14.47
Measurement Value [km/h]	50.4	57.9	55.0	56.9	55.4	52.5	60.1	56.7	52.1
Deviation of range [%]	15.94	3.58	8.38	5.14	7.72	12.46	-0.14	5.56	13.18

Test Status

Average speed [km/h]	Demand speed [km/h]	Diff. of speed [km/h]	Diff. of speed [%]	Max speed [km/h]	Dev. of average [%]	Min speed [km/h]	Dev. of average [%]	Limit [%]	Status
55.21	60.00	x	7.98	60.08	8.82	50.44	8.65	± 10	Passed



Service Engineer:

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Date: 2023.10.20 17:42:02 +07'00'

Maintenance Protocol Vehicle Cooling Fan

Test Cell	HUBDAT R40
Service Order	PM 2023

ZÖLLNER GMBH

Fan Coefficients

n0 [%]	5.0000
n1 [%/(km/h)]	0.5000
n2 [%/(km/h)^2]	0.0001

Data required
Result is in tolerance
Result is out of tolerance

Parameter

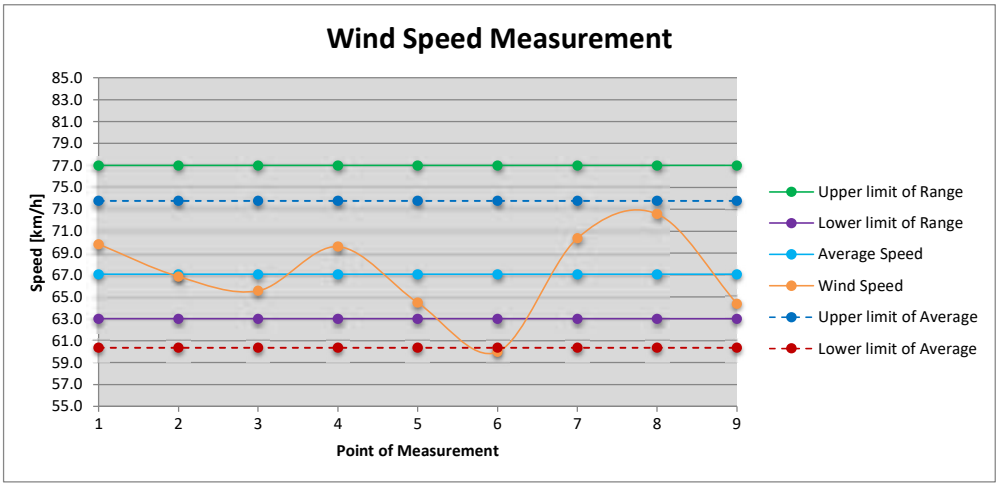
Demand speed	70.0 km/h

Results

	1	2	3	4	5	6	7	8	9
Measurement Value [m/s]	19.39	18.57	18.21	19.33	17.91	16.66	19.54	20.16	17.88
Measurement Value [km/h]	69.8	66.9	65.6	69.6	64.5	60.0	70.3	72.6	64.4
Deviation of range [%]	0.28	4.50	6.35	0.59	7.89	14.32	-0.49	-3.68	8.05

Test Status

Average speed [km/h]	Demand speed [km/h]	Diff. of speed [km/h]	Diff. of speed [%]	Max speed [km/h]	Dev. of average [%]	Min speed [km/h]	Dev. of average [%]	Limit [%]	Status
67.06	70.00	x	4.20	72.58	8.23	59.98	10.56	± 10	Passed



Service Engineer:

Digitally signed by Paruntu David JAK
Date: 2023.10.20 17:42:17 +07'00'

Maintenance Protocol Vehicle Cooling Fan

Test Cell	HUBDAT R40
Service Order	PM 2023

ZÖLLNER GMBH

Fan Coefficients

n0 [%]	5.0000
n1 [%/(km/h)]	0.5000
n2 [%/(km/h)^2]	0.0001

Data required
Result is in tolerance
Result is out of tolerance

Parameter

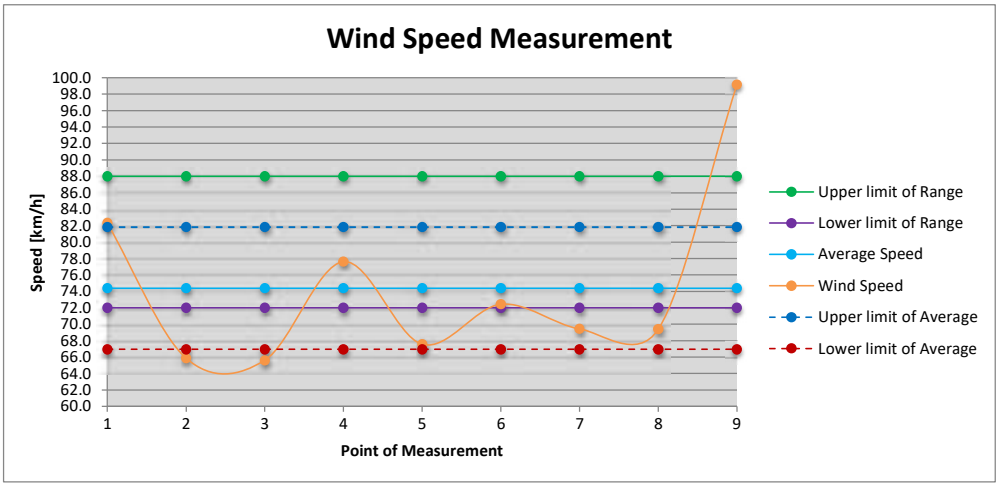
Demand speed	80.0 km/h

Results

	1	2	3	4	5	6	7	8	9
Measurement Value [m/s]	22.87	18.30	18.22	21.56	18.77	20.12	19.29	19.28	27.55
Measurement Value [km/h]	82.3	65.9	65.6	77.6	67.6	72.4	69.4	69.4	99.2
Deviation of range [%]	-2.92	17.65	18.01	2.98	15.54	9.46	13.20	13.24	-23.98

Test Status

Average speed [km/h]	Demand speed [km/h]	Diff. of speed [km/h]	Diff. of speed [%]	Max speed [km/h]	Dev. of average [%]	Min speed [km/h]	Dev. of average [%]	Limit [%]	Status
74.38	80.00	x	7.02	99.18	33.34	65.59	11.82	± 10	Passed



Service Engineer:

Digitally signed by Paruntu David JAK
Date: 2023.10.20 17:42:31 +07'00'

Maintenance Protocol Vehicle Cooling Fan

Test Cell	HUBDAT R40
Service Order	PM 2023

ZÖLLNER GMBH

Fan Coefficients

n0 [%]	5.0000
n1 [%/(km/h)]	0.5000
n2 [%/(km/h)^2]	0.0001

Data required
Result is in tolerance
Result is out of tolerance

Parameter

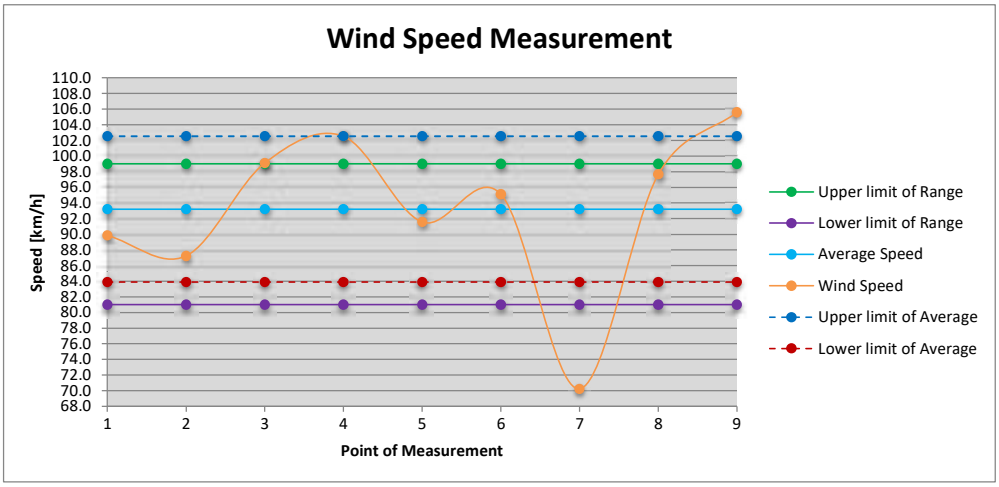
Demand speed	90.0 km/h

Results

	1	2	3	4	5	6	7	8	9
Measurement Value [m/s]	24.96	24.23	27.53	28.48	25.44	26.42	19.51	27.13	29.33
Measurement Value [km/h]	89.9	87.2	99.1	102.5	91.6	95.1	70.2	97.7	105.6
Deviation of range [%]	0.16	3.08	-10.12	-13.92	-1.76	-5.68	21.96	-8.52	-17.32

Test Status

Average speed [km/h]	Demand speed [km/h]	Diff. of speed [km/h]	Diff. of speed [%]	Max speed [km/h]	Dev. of average [%]	Min speed [km/h]	Dev. of average [%]	Limit [%]	Status
93.21	90.00	x	-3.57	105.59	13.28	70.24	24.65	± 10	Passed



Service Engineer:

Digitally signed by Paruntu David JAK
Date: 2023.10.20 17:42:45 +07'00'

Maintenance Protocol Vehicle Cooling Fan

Test Cell	HUBDAT R40
Service Order	PM 2023

ZÖLLNER GMBH

Fan Coefficients

n0 [%]	5.0000
n1 [%/(km/h)]	0.5000
n2 [%/(km/h)^2]	0.0001

Data required
Result is in tolerance
Result is out of tolerance

Parameter

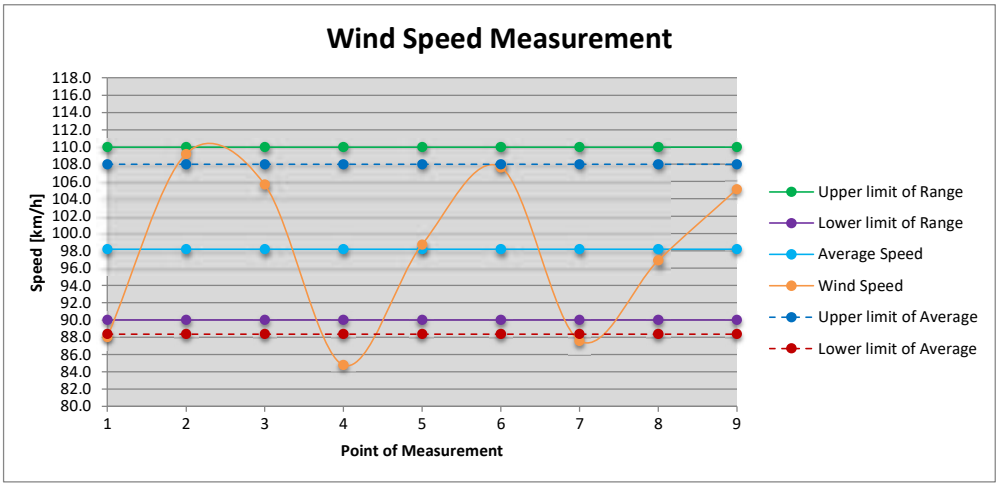
Demand speed	100.0 km/h

Results

	1	2	3	4	5	6	7	8	9
Measurement Value [m/s]	24.45	30.33	29.35	23.55	27.42	29.90	24.33	26.91	29.20
Measurement Value [km/h]	88.0	109.2	105.7	84.8	98.7	107.6	87.6	96.9	105.1
Deviation of range [%]	11.98	-9.19	-5.66	15.22	1.29	-7.64	12.41	3.12	-5.12

Test Status

Average speed [km/h]	Demand speed [km/h]	Diff. of speed [km/h]	Diff. of speed [%]	Max speed [km/h]	Dev. of average [%]	Min speed [km/h]	Dev. of average [%]	Limit [%]	Status
98.18	100.00	x	1.82	109.19	11.22	84.78	13.64	± 10	Passed



Service Engineer:

Digitally signed by Paruntu David JAK
Date: 2023.10.20 17:42:58 +07'00'

Appendix H
Chassis Dynamometer Distance Check

ZÖLLNER GMBH

Chassis Dynamometer Distance Check

Customer	HUBDAT
Location	Bekasi, Indonesia
Type	Roller Distance Check
Dyno serial number	IZO150361
Service Engineer	Mr. David Paruntu
Date	4-Oct-23 to 4-Oct-23

Test Cell	R40_New
Service Order	PM2023

Location:	Bekasi, Indonesia
Date:	4-Oct-23

Service Engineer:

Mr. David Paruntu

Chassis Dynamometer Distance Check

ZÖLLNER GMBH

Test Cell	R40_New
Service Order	PM2023

General Data

AVL Order Number	-
Type	Roller Distance Check
Dyno Serial No	IZO150361

Maximum speed this dyno 200 km/h

Measurement standard point

Speed target	Distance target	Time target
10.0 km/h	5000 m.	1800 sec.
50.0 km/h	10000 m.	720 sec.
100.0 km/h	10000 m.	360 sec.
150.0 km/h	10000 m.	240 sec.
200.0 km/h	10000 m.	180 sec.

Device Status

Not used since the last maintenance	
Device rarely used	
Device frequently used	✓
Last check	-

Tolerances

Tolerance of Distance Measurement	± 1.0 m. of Standard

Service Engineer:

Mr. David Paruntu

Chassis Dynamometer Distance Check

ZÖLLNER GMBH

Test Cell	R40_New
Service Order	PM2023

Expected value

Calculate : Distance = Speed x Time

Speed	Distance m.	Time
50 km/h	10000 m.	720 sec.
100 km/h	10000 m.	360 sec.
150 km/h	10000 m.	240 sec.
200 km/h	10000 m.	180 sec.

Data required

Result is out of tolerance

Results

Measurement point	Time meausrement		Actual distance	Diviation of standard	Diviation	Status
	Target (Sec.)	Actual (Sec.)	(m.)	(m.)	% of Standard	
50 km/h	720.00	720.00	10000.00	0.00	0.000	Passed
100 km/h	360.00	360.00	10000.00	0.00	0.000	Passed
150 km/h	240.00	240.00	10000.00	0.00	0.000	Passed
200 km/h	180.00	180.00	10000.00	0.00	0.000	Passed

Tolerances

Tolerance of Distance Measurement	± 1.0 m. of Standard

Test result from VECON

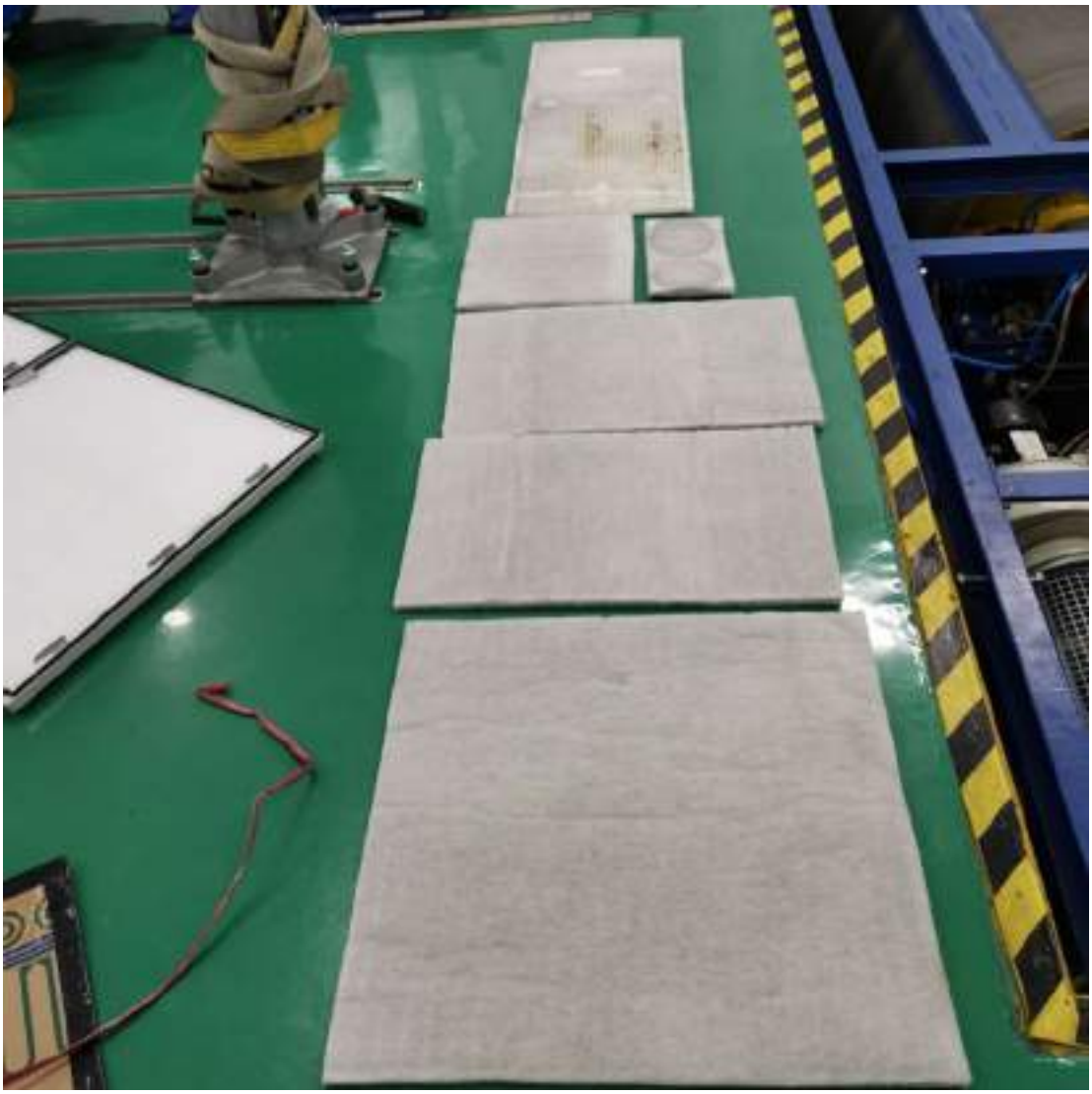


Digitally signed by Paruntu David JAK
Date: 2023.10.24 10:30:04 +07'00'

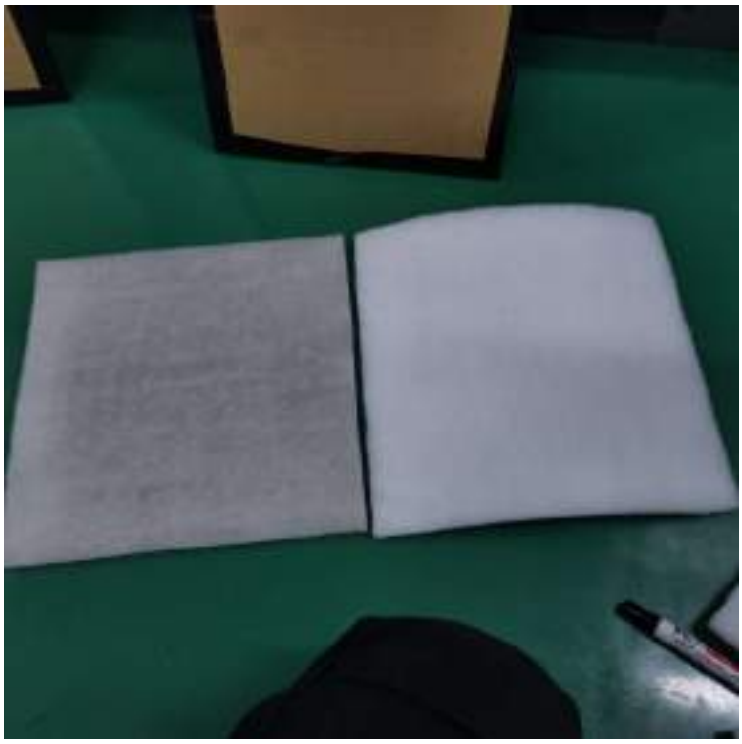
Service Engineer:

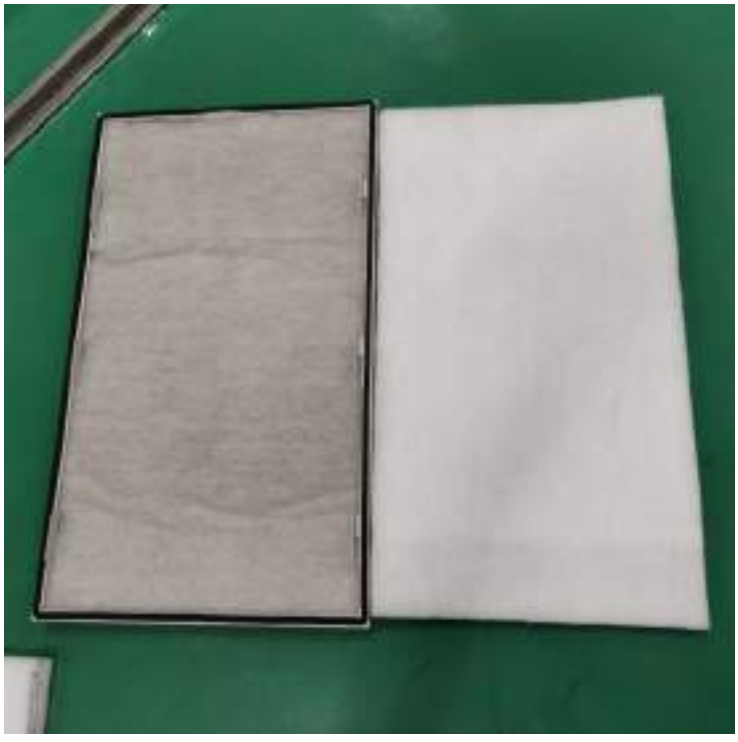
Mr. David Paruntu

Appendix I
Photos



Filter parts replacement





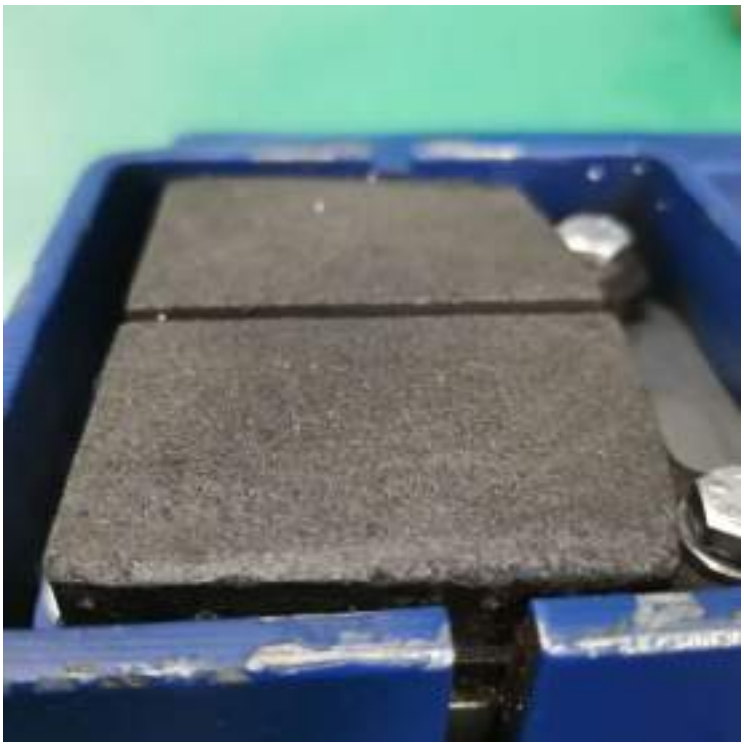
Chassis Dynamometer cabinet





Leak check at pneumatic line



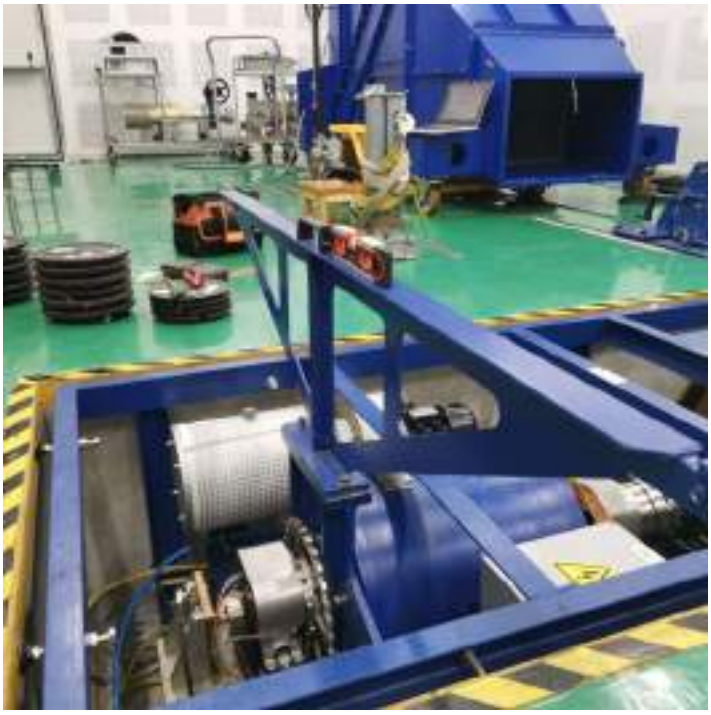


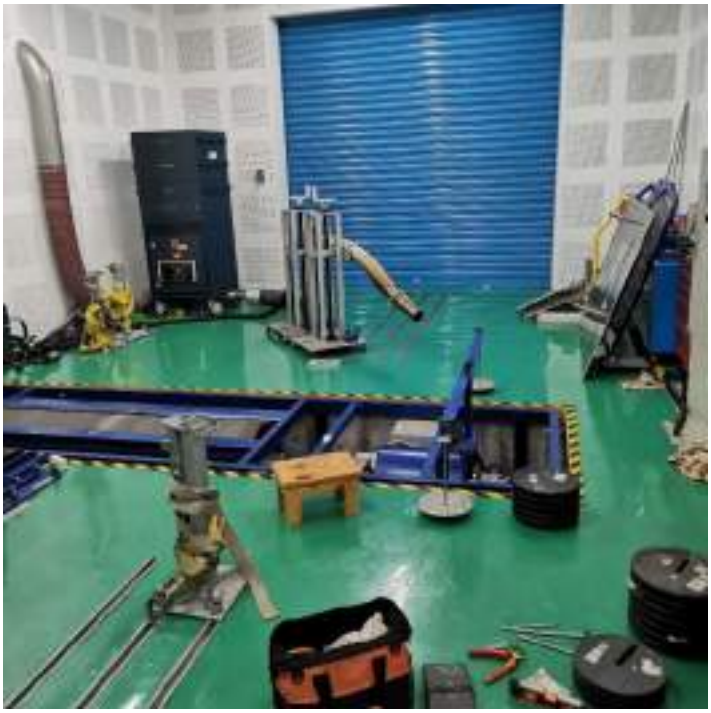
Brake pad cleaned from dirt





Measured brake pads, 8mm and 9mm(minimum 5mm)





Load cell calibration

Appendix J
Certificate for Calibration Devices

PT. DELTA INSTRUMENTASI
PORTO SQUARE Blok E No.6 Kota Deltamas Cikarang Pusat - Bekasi, 17550
Tlp. 021-89979024 | Fax. 021-89910708 http://www.deltainstrumentasi.com - info@deltainstrumentasi.com

KAN
KOMITE AKREDITASI NASIONAL
LK - 172 - IDN

Nama Alat *Instrument*	AIR VELOCITY METER	No. Sertifikat *Certificate No.*	S 23 00 240
Merk, Tipe *Manufacturer, Type*	TENMARS, TM-4001		
Nomor Seri *Serial Number*	170600054	Tanggal Order *Date of Order*	08/Jun/2023
Tempat Kalibrasi *Venue of calibration*	PT Delta Instrumentasi	Tanggal Kalibrasi *Date of Calibration*	09/Jun/2023
		Suhu | *Temp.*:	(23.6 ± 1,2)°C
		RH:	(57 ± 4)%RH
Pemilik *Owner*	AVL & AUSTRALIA CO.LTD		
Alamat *Address*	Palma Tower 18th Floor - Unit 18C, Jl RA Kartini Kavling, 12310 Jakarta Selatan - Indonesia.		

Alat tersebut di atas dikalibrasi terhadap standar & kalibrator PT Delta Instrumentasi yang tertelusur ke SI. Pengukuran dilakukan berdasarkan metode dan prosedur internal dengan nomor referensi seperti tertera di bawah. Hasil kalibrasi dapat dilihat pada tabel di bawah, dan/atau pada lembar-lembar lampiran berikutnya.
Hasil kalibrasi berupa koreksi alat pada penunjukan, M. Koreksi dinyatakan dalam nilai ekspektasi, y, dengan ketidakpastian U_{95}, yang merupakan ketidakpastian bentangan pada tingkat kepercayaan sekitar 95 %, dengan faktor cakupan k = 2.

Instrument stated above has been calibrated against standard & calibrator of PT Delta Instrumentasi traceable to SI. Measurement was carried out based on internal method and procedure as stated below . Calibration results can be found in the table below and/or in the following attachement(s).
Calibration yield corrections of instrument at its reading, M.The correction is expressed as expected value, y, with its uncertainty, U_{95}, that represents expanded uncertainty at the confidence level of around 95 % at coverage factor of k = 2.

No Referensi Metode | *Method Ref No.*: TO-MD 8.01

Hasil Kalibrasi | *Calibration Result*
lihat lampiran | ***see attachment(s)***

Nilai Terukur sebenarnya | *The True measured value of UUT, will be* $T = (M + y) \pm U_{95}$

Hasil kalibrasi tertelusur ke SI melalui
Calibration result are traceable to SI through
LK 032 IDN
Menggunakan Anemometer
Merk : Fluke , Tipe : 922
No. Sertifikat : S. 22 006 449

Sertifikat ini mempunyai 1 lampiran
This certificate has *attachment(s)*
Cikarang, 09 Juni 2023
Disetujui oleh | *Approved by*

(Amin Gunawan, BSc MBA)
Approve Signatory

file: S 23 00 240.ext

* Tidak diperbanyak sebagian dari isi keseluruhan Sertifikat Kalibrasi ini.
* Hasil memperbanyak Sertifikat Kalibrasi ini bukan dokumen resmi, kecuali diketahui oleh Lab. Kalibrasi PT. Delta Instrumentasi.

PT Delta Instrumentasi

Lampiran Data Kalibrasi
Calibration Data Attachment

untuk
for

Nomor Sertifikat
Certificate No. **S 23 00 240**

lembar lampiran ke 1 dari 1
attachment sheet *of*

Range	Penunjukan Alat *Instr. Reading* M	Koreksi | *Correction* Nilai Ekspektasi *Expected Value* y	Ketidakpastian *Uncertainty* U_{95}
10 m/s	2,000 m/s	-0,48 m/s	0,93 m/s
	4,000	-0,67	0,93
	6,000	-0,84	0,93
	8,000	-1,09	0,93
	10,000	-1,32	0,93

-- akhir data | *end of data* --

approved by
DI-13061
PT. Delta Instrumentasi

PT. DELTA INSTRUMENTASI

> *Lampiran ini tidak berlaku jika terpisah dengan lembar pokoknya.*
> *Tidak dibenarkan memperbanyak sebagian dari isi keseluruhan Sertifikat Kalibrasi.*
> *Hasil memperbanyak Sertifikat Kalibrasi ini bukan dokumen resmi, kecuali diketahui oleh Lab. Kalibrasi PT. Delta Instrumentasi.*

LABORATORIUM KALIBRASI
PT. HEKSA INSTRUMEN SINERGI
Office : Jln. Lingkar Selatan No. 10 Kp. Sengkol RT. 06 RW. 02 Tangerang Selatan - Banten
Laboratorium : Serpong Grand Park Blok A3 No. 15, Muncul, Setu, Tangerang Selatan - Banten
Telp : 021-22757873 Mobile : 082119541990 Email : info@heksa.co.id

Komite Akreditasi Nasional
LK-264-IDN
ISO/IEC-17025-2017

SERTIFIKAT KALIBRASI
Calibration Certificate

Nama Alat *Instrumen Name*	: AC/DC CLAMP METER	No Order *Order no*	: 23 HIS 05 0104
Merk *Manufacturer*	: KYORITSU	No Sertifikat *Certificate no*	: **S. 2305 - 0688**
Tipe *Type*	: 2055	Tanggal Terima *Received of Date*	: 26 Mei 2023
Nomor Seri *Serial Number*	: 1205313	Tanggal Kalibrasi *Date of Calibration*	: 29 Mei 2023
Rentang ukur *Measuring Range*	: 600V/ 1000A	Suhu *Temperature*	: (23,0 ± 0,5) ° C
Tempat Kalibrasi *Venue of calibration*	: PT. Heksa Instrumen Sinergi	Kelembaban *Relative Humidity*	: (58 ± 2) % RH
Pemilik *Owner*	: AVL Sea & Australia Co., Ltd.		
Alamat *Adress*	: Palma Tower 18th Floor - Unit 18C Jl.RA Kartini II-S Kavling, 12310 Jakarta Selatan Indonesia		

Alat tersebut di atas dikalibrasi terhadap standard PT. Heksa Instrumen Sinergi yang tertelusur ke SI. Pengukuran dilakukan berdasarkan metode yang mengacu ke EURAMET cg-15 dan prosedur internal dengan nomor referensi IK-HIS-LE 13. Hasil kalibrasi diperoleh dari rata - rata setiap pengukuran dan nilai ketidakpastian kalibrasi tertuang dihalaman-halaman lampiran berikutnya pada sertifikat kalibrasi ini. Ketidakpastian kalibrasi ini merupakan ketidakpastian bentangan yang diperoleh dari sumber - sumber kesalahan tipe A dan tipe B sesuai dengan JCGM 100 : 2008 "Guide to the Expression of Uncertainty in Measurement" yang dinyatakan pada tingkat kepercayaan 95 %

Instrumen stated above has been calibrated against standard of PT. Heksa Instrumen Sinergi traceable to SI. Measurement was carried out based on EURAMET cg-15 and Internal procedure IK-HIS-LE 13. The calibration result is obtained from average for each measurement and the calibration uncertainty value are seen on the follwing page(s) in this calibration certificate. The calibration uncertainty is expanded uncertainty which referred to type A and B sources of error according to JCGM 100 : 2008 "Guide to the Expression of Uncertainty in Measurement" which is expressed at a 95 % confidence level by the coverage factor k = 2.

Diterbitkan Tanggal , 31 Mei 2023
Date of Issue

Disetujui oleh / *Approved by*

(Toplik Hidayat)
Approve Signatory

Dilarang memproduksi sertifikat ini dengan cara apapun kecuali dengan proses fotocopy sertifikat secara keseluruhan.
This certificate may not be reproduced other than full photographic process

Nomor Sertifikat / *Certificate No.* : **S. 2305 - 0688**

Bidang Kalibrasi Listrik/*Electric Calibration Field*

Nama Alat / *Instrument Name* : AC/DC CLAMP METER

Nomor Seri / *Serial Number* : 1205313

HASIL KALIBRASI / *CALIBRATION RESULT*

DC Voltage

Pembacaan Standar *Standard*		Pembacaan Alat *Reading*		Koreksi *Correction*		Ketidakpastian *Uncertainty*
60,0	mV	60,00	mV	-0,04	mV	0,06%
539,9		539,80		0,11		0,06%
0,601	V	0,596	V	0,005	V	0,01%
5,402		5,401		0,001		0,01%
6,00	V	6,01	V	-0,01	V	0,01%
18,00		18,03		-0,03		0,01%
30,00		30,05		-0,05		0,01%
42,00		42,08		-0,08		0,01%
54,00		54,10		-0,10		0,01%
60,0	V	60,1	V	-0,1	V	0,07%
540,1		541,2		-1,1		0,07%

Heksa Instrumen Sinergi

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Nomor Sertifikat / *Certificate No.* : **S. 2305 - 0688**

Bidang Kalibrasi Listrik/*Electric Calibration Field*

Nama Alat / *Instrument Name* : AC/DC CLAMP METER

Nomor Seri / *Serial Number* : 1205313

HASIL KALIBRASI / *CALIBRATION RESULT*

AC Voltage **50 Hz**

Pembacaan Standar *Standard*		Pembacaan Alat *Reading*		Koreksi *Correction*		Ketidakpastian *Uncertainty*
0,6	V	0,607	V	-0,004	V	0,02%
5,4		5,394		0,001		0,02%
5,99	V	5,99	V	0,00	V	0,04%
17,97		18,02		-0,05		0,04%
29,96		30,03		-0,07		0,04%
41,94		42,05		-0,11		0,04%
53,92		54,08		-0,16		0,04%
59,9	V	60,1	V	-0,2	V	0,02%
539,1		541,4		-2,3		0,02%

Heksa Instrumen SINERGI

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Nomor Sertifikat / *Certificate No.* : **S. 2305 - 0688**

Bidang Kalibrasi Listrik/*Electric Calibration Field*

Nama Alat / *Instrument Name* : AC/DC CLAMP METER

Nomor Seri / *Serial Number* : 1205313

HASIL KALIBRASI / *CALIBRATION RESULT*

DC Current COIL

Pembacaan Standar *Standard*		Pembacaan Alat *Reading*		Koreksi *Correction*		Ketidakpastian *Uncertainty*
61,0	A	60,0	A	1,0	A	0,65%
182,7		180,4		2,3		0,65%
304,3		300,8		3,5		0,65%
426,0		421,2		4,8		0,65%
547,7		541,7		6,0		0,65%
0	A	0	A	0	A	0,59%
102		100		2		0,59%
505		500		5		0,59%
706		700		6		0,59%
908		902		6		0,59%

Dilarang memperbanyak sertifikat ini dengan cara apapun kecuali dengan proses fotocopy sertifikat secara keseluruhan.
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Bidang Kalibrasi Listrik/*Electric Calibration Field*

Nama Alat / *Instrument Name* : AC/DC CLAMP METER

Nomor Seri / *Serial Number* : 1205313

HASIL KALIBRASI / *CALIBRATION RESULT*

AC Current COIL **50 Hz**

Pembacaan Standar *Standard*		Pembacaan Alat *Reading*		Koreksi *Correction*		Ketidakpastian *Uncertainty*
61,0	A	59,8	A	1,2	A	0,84%
184,0		179,8		4,2		0,84%
307,1		300,2		6,9		0,84%
430,2		420,6		9,6		0,84%
553,2		540,9		12,3		0,84%
102	A	99	A	3	A	0,76%
914		901		13		0,76%

Heksa Instrumen

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Nomor Sertifikat / *Certificate No.* : **S. 2305 - 0688**

Bidang Kalibrasi Listrik/*Electric Calibration Field*

Nama Alat / *Instrument Name* : AC/DC CLAMP METER

Nomor Seri / *Serial Number* : 1205313

HASIL KALIBRASI / *CALIBRATION RESULT*

Resistance

Pembacaan Alat *Reading*		Pembacaan Standar *Standrad*		Koreksi *Correction*		Ketidakpastian *Uncertainty*
546,1	Ω	540,0	Ω	6,1	Ω	0,03%
5,642	KΩ	5,400	KΩ	0,242	KΩ	0,02%
54,77	KΩ	54,10	KΩ	0,67	KΩ	0,02%
546,1	KΩ	539,6	KΩ	6,5	KΩ	0,06%
0,911	MΩ	0,923	MΩ	-0,012	MΩ	0,08%
1,822	MΩ	1,804	MΩ	0,018	MΩ	0,06%

Catatan /*Notes*

Standar yang digunakan Clamp Type Multimeter Calibrator Tipe / No Seri : GF6018A / 20190510 dengan nomor sertifikat CE00393 tertelusur ke Sistem Satuan Internasional (SI) melalui Certus Metrology

This was calibrated by standard Clamp Type Multimeter Calibrator Type / No Seri : GF6018A / 20190510 dengan nomor sertifikat CE00393 traceable to International System of Unit (SI) through Certus Metrology

Akhir dari sertifikat / *End of certificate*

Dilarang memproduksi sertifikat ini dengan cara apapun kecuali dengan proses fotocopy sertifikat secara keseluruhan.
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PT. HEKSA INSTRUMEN SINERGI
Office : Jln. Lingkar Selatan No. 10 Kp. Sengkol RT. 06 RW. 02 Tangerang Selatan - Banten
Laboratorium : Serpong Grand Park Blok A3 No. 15, Muncul, Setu, Tangerang Selatan - Banten
Telp : 021-22757873 Mobile : 082119641990 Email : info@heksa.co.id

Komite Akreditasi Nasional
LK-264-IDN
ISO/IEC-17025-2017

SERTIFIKAT KALIBRASI
Calibration Certificate

Nama Alat *Instrumen Name*	: TRUE RMS DIGITAL MULTIMETER	No Order *Order no*	: 23 HIS 05 0104
Merk *Manufacturer*	: FLUKE	No Sertifikat *Certificate no*	: **S. 2305 - 0686**
Tipe *Type*	: 87 V	Tanggal Terima *Received of Date*	: 26 Mei 2023
Nomor Seri *Serial Number*	: 43120324	Tanggal Kalibrasi *Date of Calibration*	: 29 Mei 2023
Rentang ukur *Measuring Range*	: 600mV / 1000 V / 10 A / 50 MΩ	Suhu *Temperature*	: (23,4 ± 0,4) ° C
Tempat Kalibrasi *Venue of calibration*	: PT. Heksa Instrumen Sinergi	Kelembaban *Relative Humidity*	: (63 ± 2) % RH
Pemilik *Owner*	: AVL Sea & Australia Co., Ltd.		
Alamat *Adress*	: Palma Tower 18th Floor - Unit 18C Jl.RA Kartini II-S Kavling, 12310		

Alat tersebut di atas dikalibrasi terhadap standard PT. Heksa Instrumen Sinergi yang tertelusur ke SI. Pengukuran dilakukan berdasarkan metode yang mengacu ke EURAMET cg-15 dan prosedur internal dengan nomor referensi IK-HIS-LE 12. Hasil kalibrasi diperoleh dari rata - rata setiap pengukuran dan nilai ketidakpastian kalibrasi tertuang dihalaman-halaman lampiran berikutnya pada sertifikat kalibrasi ini. Ketidakpastian kalibrasi ini merupakan ketidakpastian bentangan yang diperoleh dari sumber - sumber kesalahan tipe A dan tipe B sesuai dengan JCGM 100 : 2008 "Guide to the Expression of Uncertainty in Measurement" yang dinyatakan pada tingkat kepercayaan 95 % dengan faktor cakupan k = 2.

Instrumen stated above has been calibrated against standard of PT. Heksa Instrumen Sinergi traceable to SI. Measurement was carried out based on EURAMET cg-15 and Internal procedure IK-HIS-LE 12. The calibration result is obtained from average for each measurement and the calibration uncertainty value are seen on the follwing page(s) in this calibration certificate. The calibration uncertainty is expanded uncertainty which referred to type A and B sources of error according to JCGM 100 : 2008 "Guide to the Expression of Uncertainty in Measurement" which is expressed at a 95 % confidence level by the coverage factor k = 2.

Diterbitkan Tanggal , 31 Mei 2023
Date of Issue

Disetujui oleh / *Approved by*

(Topik Hidayat)
Approve Signatory

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Nomor Sertifikat / *Certificate No.* : **S. 2305 - 0686**

Bidang Kalibrasi Listrik/*Electric Calibration Field*

Nama Alat / *Instrument Name* : TRUE RMS DIGITAL MULTIMETER

Nomor Seri / *Serial Number* : 43120324

HASIL KALIBRASI / *CALIBRATION RESULT*

DC Voltage

Pembacaan Standar *Standard*		Pembacaan Alat *Reading*		Koreksi *Correction*		Ketidakpastian *Uncertainty*
60,0	mV	60,0	mV	0,0	mV	0,012%
539,9		539,9		0,0		0,012%
0,603	V	0,600	V	0,003	V	0,014%
5,403		5,399		0,004		0,014%
6,00	V	6,00	V	0,00	V	0,022%
18,00		18,00		0,00		0,022%
30,00		29,99		0,01		0,022%
42,00		41,99		0,01		0,022%
54,01		53,99		0,02		0,022%
300,0	V	300,0	V	0,0	V	0,01%
540,0		539,9		0,1		0,01%
500	V	500	V	0	V	0,06%
900		900		0		0,06%

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Nomor Sertifikat / *Certificate No.* : **S. 2305 - 0686**

Bidang Kalibrasi Listrik/*Electric Calibration Field*

Nama Alat / *Instrument Name* : TRUE RMS DIGITAL MULTIMETER

Nomor Seri / *Serial Number* : 43120324

HASIL KALIBRASI / *CALIBRATION RESULT*

DC Current

Pembacaan Standar *Standard*		Pembacaan Alat *Reading*		Koreksi *Correction*		Ketidakpastian *Uncertainty*
5,99	mA	6,01	mA	-0,02	mA	0,027%
53,94		53,98		-0,04		0,027%
60,0	mA	60,0	mA	0,0	mA	0,09%
540,6		539,8		0,8		0,09%
0,601	A	0,601	A	0,000	A	0,086%
5,409		5,399		0,010		0,086%
5,01	A	5,00	A	0,01	A	0,08%
9,02		9,00		0,02		0,08%

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Nomor Sertifikat / *Certificate No.* : **S. 2305 - 0686**
Bidang Kalibrasi Listrik/*Electric Calibration Field*

Nama Alat / *Instrumen Name* : TRUE RMS DIGITAL MULTIMETER
Nomor Seri / *Serial Number* : 43120324

HASIL KALIBRASI / *CALIBRATION RESULT*

AC Voltage **50 Hz**

Pembacaan Standar *Standard*		Pembacaan Alat *Reading*		Koreksi *Correction*		Ketidakpastian *Uncertainty*
60,1	mV	60,1	mV	0,0	mV	0,08%
540,2		540,1		0,1		0,08%
0,603	V	0,601	V	0,002	V	0,105%
5,395		5,400		-0,005		0,105%
5,99	V	6,00	V	-0,006	V	0,10%
17,97		17,99		-0,015		0,10%
29,96		29,98		-0,025		0,10%
41,94		41,99		-0,054		0,10%
53,92		53,98		-0,063		0,10%
59,9	V	299,9	V	-239,99	V	0,10%
539,0		539,9		-0,89		0,10%
499	V	500	V	-1	V	0,1%
898		899		-1		0,1%

Hexsa Instrumen

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Nomor Sertifikat / *Certificate No.* : **S. 2305 - 0686**

Bidang Kalibrasi Listrik/*Electric Calibration Field*

Nama Alat / *Instrumen Name* : TRUE RMS DIGITAL MULTIMETER

Nomor Seri / *Serial Number* : 43120324

HASIL KALIBRASI / *CALIBRATION RESULT*

AC Current **50 Hz**

Pembacaan Standar *Standard*		Pembacaan Alat *Reading*		Koreksi *Correction*		Ketidakpastian *Uncertainty*
5,92	mA	5,99	mA	-0,07	mA	0,96%
53,87		53,99		-0,12		0,96%
59,9	mA	59,9	mA	0,0	mA	0,4%
539,9		540,2		-0,3		0,4%
0,599	A	0,600	A	-0,001	A	0,206%
5,396		5,401		-0,005		0,206%
5,00	A	4,98	A	0,02	A	0,14%
8,99		9,00		-0,01		0,14%

Heksa Instrumen

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Nomor Sertifikat / *Certificate No.* : **S. 2305 - 0686**

Bidang Kalibrasi Listrik/*Electric Calibration Field*

Nama Alat / *Instrumen Name* : TRUE RMS DIGITAL MULTIMETER

Nomor Seri / *Serial Number* : 43120324

HASIL KALIBRASI / *CALIBRATION RESULT*

Resistance

Pembacaan Standar *Reading*		Pembacaan Alat *Standrad*		Koreksi *Correction*		Ketidakpastian *Uncertainty*
60,0	Ω	60,1	Ω	-0,1	Ω	0,155%
541,0		539,9		1,1		0,155%
0,724	KΩ	0,600	KΩ	0,124	KΩ	0,176%
5,585		5,399		0,186		0,176%
6,19	KΩ	6,00	KΩ	0,19	KΩ	0,040%
54,81		54,00		0,81		0,040%
60,8	KΩ	60,0	KΩ	0,8	KΩ	0,062%
546,1		539,9		6,2		0,062%
0,606	MΩ	0,600	MΩ	0,006	MΩ	0,011%
2,025		2,097		-0,072		0,011%

Catatan */Notes:*

Standar yang digunakan Clamp Type Multimeter Calibrator Tipe / No Seri : GF6018A / 20190510 dengan nomor sertifikat CE00393 tertelusur ke Sistem Satuan Internasional (SI) melalui Certus Metrology

This was calibrated by standard Clamp Type Multimeter Calibrator Type / No Seri : GF6018A / 20190510 dengan nomor sertifikat CE00393 traceable to International System of Unit (SI) through Certus Metrology

Hekса Instrumen

Akhir dari sertifikat / *End of certificate*

Dilarang memproduksi sertifikat ini dengan cara apapun kecuali dengan proses fotocopy sertifikat secara keseluruhan.
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Preventive Maintenance Protocol
Emission Test System

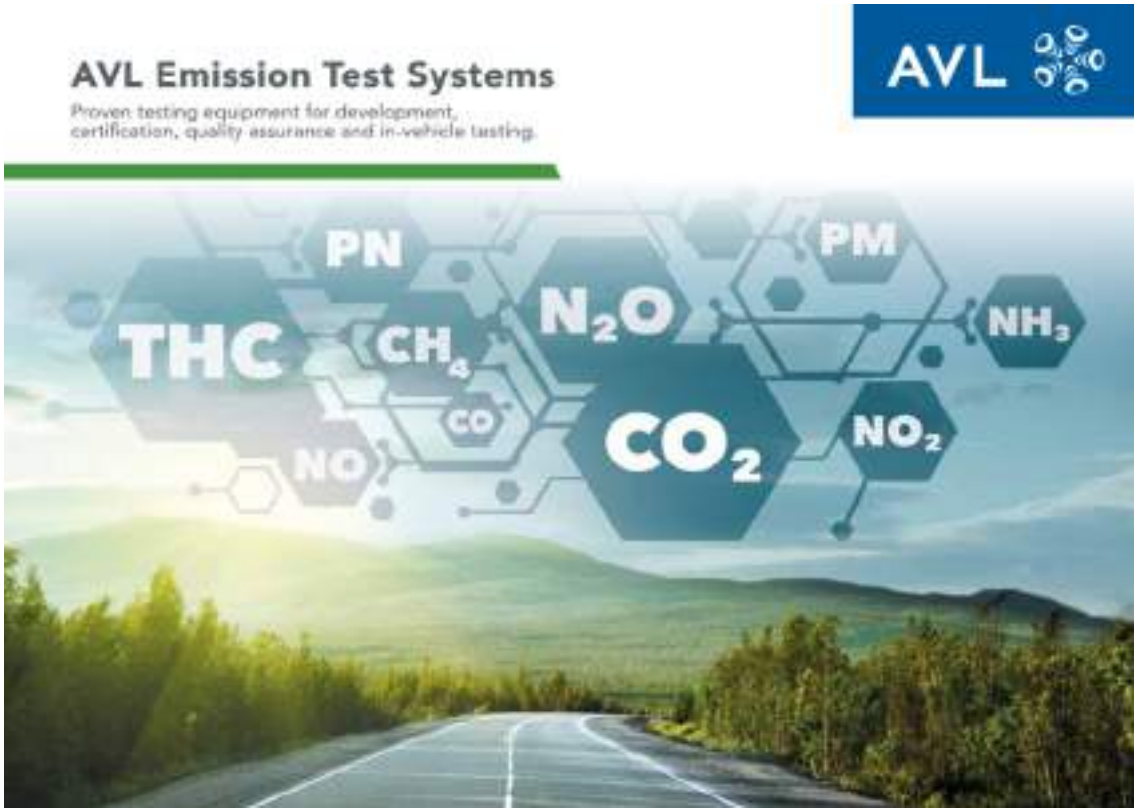


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Product Life Cycle

Testbed	R40
AVL Order No.	IDID4175S23-00
Customer Order No.	IL230530ALN/P

Item	Product	Serial Number	Priority
1	AVL AMA i60 SII R1-D1	7422	
2	AVL CVS i60 SII LD G	11184	
3	HSS i60 Small G02	2827	

Item 1

☑	Planned End of Sales	31.12.2023
☑	Planned End of Standard Support	31.12.2033
☐	End of Sales	
☐	End of Spare Part Availibility	
☐	End of Standard Support	
☐	End of Standard SW Support	

Item 2

☑	Planned End of Sales	31.12.2023
☑	Planned End of Standard Support	31.12.2033
☐	End of Sales	
☐	End of Spare Part Availibility	
☐	End of Standard Support	
☐	End of Standard SW Support	

Item 3

☑	Planned End of Sales	30.06.2023
☑	Planned End of Standard Support	30.06.2030
☐	End of Sales	
☐	End of Spare Part Availibility	
☐	End of Standard Support	
☐	End of Standard SW Support	

☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐

Definition of Priority

	support and spare part are no longer available.
	support are very rare, spare part need a successor.
	support and spare part are still available.

Service Engineer: Cahya Santika

Problem Summary

Testbed	R40
AVL Order No.	IDID4175S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	HSS i60 Small G02
Device Serial No.	2827

Problem Description

since 1st day PM HSS Prefilter not able to power up
The defective possibility from TCU Boards and Power Signal Boards
MAIN BOARD TCU BB1650SP



Effect of the problem

The defective TCU i60 one component burnt, and need to replaced to make it Pre filter able to operate and controll the HSS system, and another next step check are BX4382SP HSS S G02 POWER BOARD II 4769 for heated up HLI & HL2





Solution / Workaround

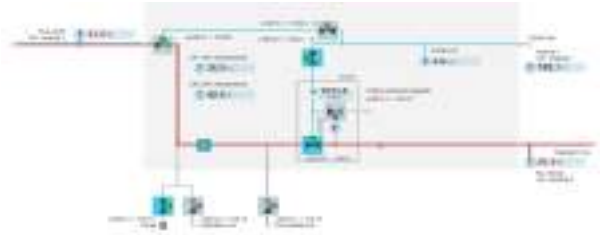
1. Replace the new MAIN BOARD TCU BB1650SP
2. After replaced update the FW and assigne can-node communication 81
3. Run the prifilter, we found another issue on the HL1 not fully heated up (Max 30c)
4. Commnicate with CSC and next further step action is replaced the power boards signal

Attached Picture

1	71	+A20-A1.1.1UF2	GPU	0	V1.703	Enabled
1	91	CAN board TCUi60 1	GPU	879	V1.703	Enabled
1	96\81	+A20-A1.1.1UF1	GPU	0	V1.703	Enabled_2

Update firmware Node 81 TCUi60





After replaced TCU boards are able to operate HSS (except HL1)

Service Engineer: Cahya Santika

Problem Summary

Testbed	R40
AVL Order No.	IDID4175S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	CVS
Device Serial No.	11184

Problem Description
* Pump CVS GQ02 not able controlled by software on and off by following the blower CVS

Effect of the problem
* Will make the pump +A8-GQ2.1-4 run all the time same condition with CVS status ON/OFF

Solution / Workaround
1. Replace the power box BY1029SP suggestion CSC 2. solution BB1986 (PCB WIRING HEATED SYSTEMS 230V AC) BB1985 (PCB SSR-DRIVER STAGE 4-FOLD 4X10A) 3. in current condition system still able to work normally.

Attached Picture



BY1029SP





Mr. Cahya Santika

Service Engineer: Cahya Santika

Quality Check Summary

Testbed	R40
AVL Order No.	IDID4175S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	AVL AMA i60 SII R1-D1
Device Serial No.	7422

Analyzer Linearization Check

Analyzer Channel	Stream	Range 1	Range 2	Range 3	Range 4
THC	1	Passed			
CH4					
NO	1	Passed			
NOx	1	Passed			
CO2	1	Passed			
COH	1	Passed			
COL	1	Passed			
O2	1	Passed			
THC	2	Passed			
CH4					
NOx	2	Passed			
CO2	2	Passed			
COL	2	Passed			
THC					
CH4					

Limit: ± 2.0%

Analyzer Response Time Check

Analyzer Channel	Stream	Range	T10-T90 (s)	T90-T10 (s)
THC	1	2.00	0.38	0.51
CH4				
NO	1	1.00	0.94	0.90
NOx	1	2.00	0.46	0.41
CO2	1	2.00	1.21	1.09
COH	1	2.00	1.14	1.09
COL	1	1.00	1.46	1.64
O2	1	1.00	1.68	1.92
THC	2	2.00	0.54	0.89
CH4				
NOx				
CO2				
COL				
THC				
CH4				

Mr. Cahya Santika

Service Engineer: Cahya Santika

Quality Check Summary

Testbed	R40
AVL Order No.	IDID4175S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	AVL AMA i60 SII R1-D1
Device Serial No.	7422

NOx Converter Check

Analyzer Channel	Stream	Status
NOx	1	Passed
NOx	2	Passed

Limit: ≥ 95.0%

H2O Rejection Ratio Check

Analyzer Channel	Stream	Status
CO2	1	Passed

CH4 Cutter Efficiency Check

Analyzer Channel	Stream	Status

Limit: ± 2.0%

COH Cross Sentivity Check

Analyzer Channel	Stream	Status
COH	1	Passed

O2 Interference Check

Analyzer Channel	Stream	Status

Limit: ± 3.0%

COL Cross Sentivity Check

Analyzer Channel	Stream	Status
COL	1	Passed

Mr. Cahya Santika

Service Engineer: Cahya Santika

Quality Check Summary

Testbed	R40
AVL Order No.	IDID4175S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	AVL AMA i60 SII R1-D1
Device Serial No.	7422

Vacuum Leak Check

Stream	Status
Vacuum Leak Check Stream 1	Passed
Vacuum Leak Check Stream 2	Passed

CO2 Leak Check

Stream	Status
CO2 Leak Check Stream 1	Passed

Pressure Sensor Check

Stream	Status
Pressure Sensor Stream 1	Passed
Pressure Sensor Stream 2	Passed

Drift Check

Analyzer Channel	Stream	Range	Status
THC	1	1.00	Passed
CH4			
NO	1	1.00	Passed
NOx	1	1.00	Passed
CO2	1	1.00	Passed
COH	1	2.00	Passed
COL	1	1.00	Passed
O2	1	1.00	Passed
THC	2	1.00	Passed
CH4			
NO	2	2.00	Passed
NOx	2	1.00	Passed
CO2	2	1.00	Passed
COL	2	1.00	Passed
THC			
CH4			

Limit: ± 2.0%

Mr. Cahya Santika

Service Engineer: Cahya Santika

Pre-Test before Preventive Maintenance

Testbed	R40
AVL Order No.	IDID4239S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device	AMA i60 SII	Device	HSS Pre Filter	Device	CVS i60 SII
Serial No.	7422	Serial No.	5269	Serial No.	11184
Test Date	11-Sep-23				

Device inspection before Preventive Maintenance
* HSS i60 Small G02 5269 not function

Device operating function before Preventive Maintenance	
Quality check regarding to EPA (non-1065)/ECE	
AMAi60	- ANR check
	- Lincheck Multipolynomial
	- Leak check for sampling 1 line1, sampling 1 line2, sampling 1 line3 and sampling 1 line4
	- Nox Converter check
	- H2O rejection ratio check passed
	- Analyzer response time check
	- Drift check_EPA (non-1065) _ECE
	- Pressure sensor check
HSS	- Not able to power up, SC_1345447 Pre-Filter is not heated up
CVSi60	- HCVS [11184] Warning set on MFC/MFC 1 1531
	- SC_1347533 Pump from CVS is always on following CVS cabinet
	- SC_1347531 Proportional valve is not working properly
	- SC_1347531/3 Error warning is set on MFC/MFM CVSi50 Sn. 11184
	- Error 21003 Value too high Humidty channel >3<
	- Error 25054 ADC overflow press. Group 1 channel >54<
	- Error 25055 ADC overflow press. Group 2 channel >55<

Service Engineer: Cahya Santika

Preventive Maintenance Protocol
AMA i60



Customer:	HUBDAT		
Testbed:	R40		
Device Type:	AMA i60 SII		
Device SN:	7422		
Location:	Cibitung, Indonesia		
Date:	11-Sep-23	to	22-Sep-23

AVL Certification No. *ID0012716-202309-LD_EMISS-010-21-01_AMA i60*

Issue Date: 22-Sep-2023

Customer Name: HUBDAT

Location: Cibitung, Indonesia

Certificate of Preventive Maintenance

This is to certify that AVL SEA & AUSTRALIA CO., LTD have completed the preventive maintenance of following devices.

Device Name	Device Serial Number
AMA i60 SII	**7422**

During this preventive maintenance, The system verification/quality check have been performed, The necessary sensors have been checked/calibrated according to maintenance instruction from manufacturer. For further detail, please refers to maintenance protocol and system verification/quality check results.

Service Engineer: Cahya Santika

QC Engineer: Chaiyasit Jitsongserm

Preventive Maintenance Protocol AMA i60

Testbed	R40
AVL Order No.	IDID4239S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	AMA i60 SII
Device Serial No.	7422

Component	Description	Execution				Status
		check	clean	adjust	replace	
Main Cabinet						
bench fans	cleaning	x	x			done
heating control	function check	-	-	-	-	n.a.
Gas Preparation Unit (GPU)						
sample gas filter 1	filter case		x			done
	o-ring				x	done
	filter insert				x	done
sample gas filter 2	filter case					n.a.
	o-ring					n.a.
	filter insert					n.a.
peristaltic pump 1	hose				x	done
	function check	x				done
peristaltic pump 2	hose					n.a.
	function check					n.a.
peristaltic pump 3	hose					n.a.
	function check					n.a.
sample pump 1	maintenance kit				x	done
	function check	x				done
sample pump 2	maintenance kit	-	-	-	-	n.a.
	function check	-	-	-	-	n.a.
bypass pump	maintenance kit				x	done
	function check	x				done
vacuum pump 1	maintenance kit				x	done
	function check	x				done
vacuum pump 2	maintenance kit	-	-	-	-	n.a.
	function check	-	-	-	-	n.a.
gas cooler	function check					n.a.
exhaust extraction	function check	x				done
condensate bottle	function check	x	x			done
Power Distribution Unit (PDU)						
DC voltage output	inspection	x				done
Analyzer Valve Unit (AVU)						
functional of valve	function check	x				done
Tunnel Heated Filter						
tunnel heated filter	maintenance kit	-	-	-	-	n.a.
	filter insert	-	-	-	x	done
	function check	x	-	-	-	done
MSR Unit						
fan filter	spare part				x	done
battery	spare part	x	-	-	-	done

Service Engineer: Cahya Santika

Preventive Maintenance Protocol AMA i60

Testbed	R40
AVL Order No.	IDID4239S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	FID i60 HH	Driver Name	FID AVL	Analyzer Hour (h)	660
Device Serial No.	3241	Driver Version	2.649	Pump Hour (h)	0
Firmware Version	V4.201	Zero/Span Gas Path	Direct	Measuring Mode	Hot

Spare Part

Component	Description	Execution			Status
		check	clean	replace	
analyzer	maintenance kit			x	done
heated pump	maintenance kit			x	done
cutter material	maintenance kit	-	-	-	n.a.
sample gas capillary	spare part	x	x		done
burner air capillary	spare part	x	x		done
burner gas capillary	spare part	x	x		done
fuel gas capillary	spare part	-	-	-	n.a.
heated switch valve	spare part	x	x		done

Electrical Check

Content	Measured Value	Description	Status
PT100 sensor pump	107.1 Ω	approximate 108 - 110 Ω at 20 °C	ok
PT100 sensor detector	106.7 Ω	approximate 108 - 110 Ω at 20 °C	ok
PT100 sensor cutter	-	approximate 108 - 110 Ω at 20 °C	n.a.
voltage detector	-110.2 V	between -115 V and -90 V	ok
voltage supply +5 vdc	5.0 V	between 4.75 - 5.25 V	ok
voltage supply +24 vdc	24.0 V	between 21.0 - 27.5 V	ok
ignition current (glow plug)	2.3 A	approx. 2.5 A	ok

Temperature Check

Content	Measured Value	Description	Status
temperature pump	120.0 °C	pause mode	ok
temperature detector	120.0 °C	pause mode	ok
temperature cutter	-	pause mode	n.a.
temperature pump	191.0 °C	setpoint: 191°C ± 6°C	ok
temperature detector	191.0 °C	setpoint: 191°C ± 6°C	ok
temperature cutter	-	setpoint: 260°C ± 6°C	n.a.
temperature inside device	37.7 °C	between 10 - 65°C	ok
temperature ADC THC	34.3 °C	between 10 - 65°C	ok
temperature ADC CH4	-	between 10 - 65°C	n.a.
temperature flame	625.5 °C	between 250 - 900°C	ok



Service Engineer: Cahya Santika

Preventive Maintenance Protocol AMA i60

Testbed	R40
AVL Order No.	IDID4239S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	FID i60 HH	Driver Name	FID AVL	Analyzer Hour (h)	660
Device Serial No.	3241	Driver Version	2.649	Pump Hour (h)	0
Firmware Version	V4.201	Zero/Span Gas Path	Direct	Measuring Mode	Hot

Flow and Pressure Check

Content	Measured Value	Description	Status
sample flowrate	2.7 l/min	between 0.2 - 5.0 l/min	ok
pressure burner gas	410.7 hPa	between 300 - 500 hPa	ok
pressure burner air	380.5 hPa	between 600 - 1000 hPa	ok
pressure cutter	-	between 250 - 450 hPa	n.a.
pressure sample	300.3 hPa	between 250 - 350 hPa	ok
pressure inlet	-192.4 hPa	between -350 and 350 hPa	ok

Quality Check

THC Channel	Status
Lincheck Multipolinomial Range 1	passed
Lincheck Multipolinomial Range 2	n.a.
Lincheck Multipolinomial Range 3	n.a.
Lincheck Multipolinomial Range 4	n.a.
HC Hang-Up Check	passed
HC Response Check	n.a.
O2 Interference Check	n.a.
Analyzer Response Time Check	passed
Midspan Check	n.a.
ANR Check	passed
CH4 Channel	**Status**
Lincheck Multipolinomial Range 1	n.a.
Lincheck Multipolinomial Range 2	n.a.
Lincheck Multipolinomial Range 3	n.a.
Lincheck Multipolinomial Range 4	n.a.
Cutter Efficiency Check	n.a.
Analyzer Response Time Check	n.a.
Midspan Check	n.a.
ANR Check	n.a.



Service Engineer: Cahya Santika

Preventive Maintenance Protocol AMA i60

Testbed	R40
AVL Order No.	IDID4239S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	FID i60 LC	Driver Name	FID AVL	Analyzer Hour (h)	660
Device Serial No.	3248	Driver Version	2.649	Pump Hour (h)	0
Firmware Version	V4.218	Zero/Span Gas Path	Direct	Measuring Mode	Hot

Spare Part

Component	Description	Execution			Status
		check	clean	replace	
analyzer	maintenance kit			x	done
heated pump	maintenance kit			x	done
cutter material	maintenance kit				n.a.
sample gas capillary	spare part			x	done
burner air capillary	spare part			x	done
burner gas capillary	spare part			x	done
fuel gas capillary	spare part			x	done
heated switch valve	spare part			x	done

Electrical Check

Content	Measured Value	Description	Status
PT100 sensor pump	107.1 Ω	approximate 108 - 110 Ω at 20 °C	ok
PT100 sensor detector	106.7 Ω	approximate 108 - 110 Ω at 20 °C	ok
PT100 sensor cutter	-	approximate 108 - 110 Ω at 20 °C	n.a.
voltage detector	-111.2 V	between -115 V and -90 V	ok
voltage supply +5 vdc	5.0 V	between 4.75 - 5.25 V	ok
voltage supply +24 vdc	24.0 V	between 21.0 - 27.5 V	ok
ignition current (glow plug)	2.3 A	approx. 2.5 A	ok

Temperature Check

Content	Measured Value	Description	Status
temperature pump	120.0 °C	pause mode	ok
temperature detector	120.0 °C	pause mode	ok
temperature cutter	-	pause mode	n.a.
temperature pump	191.0 °C	setpoint: 191°C ± 6°C	ok
temperature detector	191.0 °C	setpoint: 191°C ± 6°C	ok
temperature cutter	-	setpoint: 260°C ± 6°C	n.a.
temperature inside device	39.8 °C	between 10 - 65°C	ok
temperature ADC THC	42.2 °C	between 10 - 65°C	ok
temperature ADC CH4	-	between 10 - 65°C	n.a.
temperature flame	572.7 °C	between 250 - 900°C	ok



Service Engineer: Cahya Santika

Preventive Maintenance Protocol AMA i60

Testbed	R40
AVL Order No.	IDID4239S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	FID i60 LC	Driver Name	FID AVL	Analyzer Hour (h)	7579
Device Serial No.	3248	Driver Version	2.649	Pump Hour (h)	0
Firmware Version	V4.218	Zero/Span Gas Path	Direct	Measuring Mode	Hot

Flow and Pressure Check

Content	Measured Value	Description	Status
sample flowrate	1.5 l/min	between 0.2 - 5.0 l/min	ok
pressure burner gas	470.2 hPa	between 300 - 500 hPa	ok
pressure burner air	379.9 hPa	between 600 - 1000 hPa	ok
pressure cutter	-	between 250 - 450 hPa	n.a.
pressure sample	300.3 hPa	between 250 - 350 hPa	ok
pressure inlet	2.8 hPa	between -350 and 350 hPa	ok

Quality Check

THC Channel	Status
Lincheck Multipolinomial Range 1	passed
Lincheck Multipolinomial Range 2	n.a.
Lincheck Multipolinomial Range 3	n.a.
Lincheck Multipolinomial Range 4	n.a.
HC Hang-Up Check	n.a.
HC Response Check	n.a.
O2 Interference Check	n.a.
Analyzer Response Time Check	passed
Midspan Check	n.a.
ANR Check	passed
CH4 Channel	**Status**
Lincheck Multipolinomial Range 1	n.a.
Lincheck Multipolinomial Range 2	n.a.
Lincheck Multipolinomial Range 3	n.a.
Lincheck Multipolinomial Range 4	n.a.
Cutter Efficiency Check	n.a.
Analyzer Response Time Check	n.a.
Midspan Check	n.a.
ANR Check	n.a.

Service Engineer: Cahya Santika

Preventive Maintenance Protocol AMA i60

Testbed	R40
AVL Order No.	IDID4239S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	CLD i60 HH HOT	Driver Name	CLD AVL	Analyzer Hour (h)	644
Device Serial No.	2748	Driver Version	2.615	Ozonator Hour (h)	0
Firmware Version	V4.218	Zero/Span Gas Path	Direct	Measuring Mode	Cold

Spare Part

Component	Description	Execution			Status
		check	clean	replace	
analyzer	maintenance kit			x	done
vacuum pump	maintenance kit			x	done
converter material	maintenance kit			x	done
ozone capillary	spare part			x	done
sample gas capillary	spare part			x	done
sample gas filter	spare part			x	done
heated switch valve	spare part	x			done

Electrical Check

Content	Measured Value	Description	Status
PT100 sensor cooling chamber NOX	107.0 Ω	approximate 108 - 110 Ω at 20 °C	ok
PT100 sensor reaction chamber NOX	106.9 Ω	approximate 108 - 110 Ω at 20 °C	ok
PT100 sensor cooling chamber NO	107.0 Ω	approximate 108 - 110 Ω at 20 °C	ok
PT100 sensor reaction chamber NO	106.9 Ω	approximate 108 - 110 Ω at 20 °C	ok
PT100 sensor converter	107.0 Ω	approximate 108 - 110 Ω at 20 °C	ok
current ozonator	0.9 A	setpoint = 1, min = 0.6 max = 1.2 A	ok
current chiller	3.9 A	setpoint = 3, min = 1 max = 7 A	ok
voltage supply +5 vdc	5.0 V	between 4.75 - 5.25 V	ok
voltage supply +24 vdc	23.9 V	between 21.0 - 27.5 V	ok

Temperature Check

Content	Measured Value	Description	Status
temperature converter	150.0 °C	pause mode	ok
temperature chiller NOX	23.0 °C	setpoint = 23°C ± 2°C	ok
temperature reaction chamber NOX	80.0 °C	setpoint = 80°C ± 2°C	ok
temperature chiller NO	15.0 °C	setpoint = 15°C, min = 10°C max = 22°C	ok
temperature reaction chamber NO	80.0 °C	setpoint = 80°C, min = 70°C max = 85°C	ok
temperature converter	220.0 °C	setpoint = 220°C ± 5°C	ok
temperature inside device	42.2 °C	between 0 - 65°C	ok
temperature ADC NOX	40.8 °C	between 0 - 65°C	ok
temperature ADC NO	40.4 °C	between 0 - 65°C	ok



Service Engineer: Cahya Santika

Preventive Maintenance Protocol AMA i60

Testbed	R40
AVL Order No.	IDID4239S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	CLD i60 HH HOT	Driver Name	CLD AVL	Analyzer Hour (h)	644
Device Serial No.	2748	Driver Version	2.615	Ozonator Hour (h)	0
Firmware Version	V4.218	Zero/Span Gas Path	Direct	Measuring Mode	#FIELD!

Flow and Pressure Check

Content	Measured Value	Description	Status
sample flowrate	1.5 l/min	between 0.2 - 3.0 l/min	ok
pressure O2	1102.0 hPa	between 1080 - 1200 hPa	ok
pressure bypass	1010.7 hPa	between 800 - 1100 hPa	ok
pressure vacuum	21.6 hPa	between 0 - 60 hPa	ok
pressure sample	1010.8 hPa	between 700 - 1300 hPa	ok

Quality Check

NOx Channel	Status
Lincheck Multipolinomial Range 1	passed
Lincheck Multipolinomial Range 2	passed
Lincheck Multipolinomial Range 3	n.a.
Lincheck Multipolinomial Range 4	n.a.
NOx Converter Efficiency Check	passed
Quench Check	n.a.
Analyzer Response Time Check	passed
Midspan Check	n.a.
ANR Check	passed
NO Channel	**Status**
Lincheck Multipolinomial Range 1	passed
Lincheck Multipolinomial Range 2	n.a.
Lincheck Multipolinomial Range 3	n.a.
Lincheck Multipolinomial Range 4	n.a.
Quench Check	n.a.
Analyzer Response Time Check	passed
Midspan Check	n.a.
ANR Check	passed



Service Engineer: Cahya Santika

Preventive Maintenance Protocol AMA i60

Testbed	R40
AVL Order No.	IDID4239S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	CLD i60 LC	Driver Name	CLD AVL	Analyzer Hour (h)	157
Device Serial No.	2781	Driver Version	2.615	Ozonator Hour (h)	0
Firmware Version	V4.218	Zero/Span Gas Path	Direct	Measuring Mode	Cold

Spare Part

Component	Description	Execution			Status
		check	clean	replace	
analyzer	maintenance kit			x	done
vacuum pump	maintenance kit			x	done
converter material	maintenance kit			x	done
ozone capillary	spare part			x	done
sample gas capillary	spare part			x	done
sample gas filter	spare part			x	done
heated switch valve	spare part	x			done

Electrical Check

Content	Measured Value	Description	Status
PT100 sensor cooling chamber NOX	107.0 Ω	approximate 108 - 110 Ω at 20 °C	ok
PT100 sensor reaction chamber NOX	106.9 Ω	approximate 108 - 110 Ω at 20 °C	ok
PT100 sensor cooling chamber NO	107.0 Ω	approximate 108 - 110 Ω at 20 °C	ok
PT100 sensor reaction chamber NO	106.9 Ω	approximate 108 - 110 Ω at 20 °C	ok
PT100 sensor converter	107.0 Ω	approximate 108 - 110 Ω at 20 °C	ok
current ozonator	0.9 A	setpoint = 1, min = 0.6 max = 1.2 A	ok
current chiller	3.9 A	setpoint = 3, min = 1 max = 7 A	ok
voltage supply +5 vdc	5.0 V	between 4.75 - 5.25 V	ok
voltage supply +24 vdc	23.9 V	between 21.0 - 27.5 V	ok

Temperature Check

Content	Measured Value	Description	Status
temperature converter	150.0 °C	pause mode	ok
temperature chiller NOX	23.0 °C	setpoint = 23°C ± 2°C	ok
temperature reaction chamber NOX	80.0 °C	setpoint = 80°C ± 2°C	ok
temperature chiller NO	15.0 °C	setpoint = 15°C, min = 10°C max = 22°C	ok
temperature reaction chamber NO	80.0 °C	setpoint = 80°C, min = 70°C max = 85°C	ok
temperature converter	210.0 °C	setpoint = 220°C ± 5°C	ok
temperature inside device	46.1 °C	between 0 - 65°C	ok
temperature ADC NOX	42.1 °C	between 0 - 65°C	ok
temperature ADC NO	42.1 °C	between 0 - 65°C	ok



Service Engineer: Cahya Santika

Preventive Maintenance Protocol AMA i60

Testbed	R40
AVL Order No.	IDID4239S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	CLD i60 LC	Driver Name	CLD AVL	Analyzer Hour (h)	157
Device Serial No.	2781	Driver Version	2.615	Ozonator Hour (h)	0
Firmware Version	V4.218	Zero/Span Gas Path	Direct	Measuring Mode	Cold

Flow and Pressure Check

Content	Measured Value	Description	Status
sample flowrate	1.5 l/min	between 0.2 - 3.0 l/min	ok
pressure O2	1100.4 hPa	between 1080 - 1200 hPa	ok
pressure bypass	599.3 hPa	between 580 - 620 hPa	ok
pressure vacuum	24.9 hPa	between 0 - 60 hPa	ok
pressure sample	1014.4 hPa	between 700 - 1300 hPa	ok

Quality Check

NOx Channel	Status
Lincheck Multipolinomial Range 1	n.a.
Lincheck Multipolinomial Range 2	passed
Lincheck Multipolinomial Range 3	n.a.
Lincheck Multipolinomial Range 4	n.a.
NOx Converter Efficiency Check	passed
Quench Check	n.a.
Analyzer Response Time Check	passed
Midspan Check	n.a.
ANR Check	passed
NO Channel	**Status**
Lincheck Multipolinomial Range 1	n.a.
Lincheck Multipolinomial Range 2	passed
Lincheck Multipolinomial Range 3	n.a.
Lincheck Multipolinomial Range 4	n.a.
Quench Check	n.a.
Analyzer Response Time Check	passed
Midspan Check	n.a.
ANR Check	n.a.

Service Engineer: Cahya Santika

Preventive Maintenance Protocol AMA i60

Testbed	R40
AVL Order No.	IDID4239S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	IRD i60 CO2 H / CO H	Driver Name	ANA AVL
Device Serial No.	32645795	Driver Version	2.61
Firmware Version	3.2.16.0	Analyzer Hour	7691

CO2 Channel

Hardware Check

Component	Description	Execution			Measured Value	Status
		check	clean	replace		
sample nozzle	cleaning	x	x		-	done
temperature sensor	function check	x			58.0 °C	done
pressure sensor	function check	x			1001.0 hPa	done
flow sensor	function check	x			1.2 l/min	done

Quality Check

	Status
Lincheck Multipolinomial Range 1	n.a.
Lincheck Multipolinomial Range 2	passed
Lincheck Multipolinomial Range 3	n.a.
Lincheck Multipolinomial Range 4	n.a.
Analyzer Response Time Check	passed
Analyzer Cross Sensitivity Check	passed
Midspan Check	n.a.
ANR Check	passed

CO H Channel

Hardware Check

Component	Description	Execution			Measured Value	Status
		check	clean	replace		
sample nozzle	cleaning	x	x		-	done
temperature sensor	function check	x			58.0 °C	done
pressure sensor	function check	x			1001.0 hPa	done
flow sensor	function check	x			1.3 l/min	done

Quality Check

	Status
Lincheck Multipolinomial Range 1	n.a.
Lincheck Multipolinomial Range 2	passed
Lincheck Multipolinomial Range 3	n.a.
Lincheck Multipolinomial Range 4	n.a.
Analyzer Response Time Check	passed
Analyzer Cross Sensitivity Check	passed
Midspan Check	n.a.
ANR Check	passed

Mr. Cahya Santika

Service Engineer: Cahya Santika

Preventive Maintenance Protocol AMA i60

Testbed	R40
AVL Order No.	IDID4239S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	IRD i60 CO2 L / CO L	Driver Name	ANA AVL
Device Serial No.	32632555	Driver Version	2.61
Firmware Version	3.9.0.0	Analyzer Hour	5788

CO2 Channel

Hardware Check

Component	Description	Execution			Measured Value	Status
		check	clean	replace		
sample nozzle	cleaning		x		-	done
temperature sensor	function check	x			58.0 °C	done
pressure sensor	function check	x			1005.7 hPa	done
flow sensor	function check	x			1.1 l/min	done

Quality Check

	Status
Lincheck Multipolinomial Range 1	passed
Lincheck Multipolinomial Range 2	passed
Lincheck Multipolinomial Range 3	n.a.
Lincheck Multipolinomial Range 4	n.a.
Analyzer Response Time Check	passed
Analyzer Cross Sensitivity Check	n.a.
Midspan Check	n.a.
ANR Check	passed

CO L Channel

Hardware Check

Component	Description	Execution			Measured Value	Status
		check	clean	replace		
sample nozzle	cleaning	x	x		-	done
temperature sensor	function check	x			58.0 °C	done
pressure sensor	function check	x			1005.7 hPa	done
flow sensor	function check	x			1.2 l/min	done

Quality Check

	Status
Lincheck Multipolinomial Range 1	passed
Lincheck Multipolinomial Range 2	n.a.
Lincheck Multipolinomial Range 3	n.a.
Lincheck Multipolinomial Range 4	n.a.
Analyzer Response Time Check	passed
Analyzer Cross Sensitivity Check	passed
Midspan Check	n.a.
ANR Check	passed

Digitally signed by Mr. Cahya Santika

Service Engineer: Cahya Santika

Preventive Maintenance Protocol AMA i60

Testbed	R40
AVL Order No.	IDID4239S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	Pre-Filter C	Device Generation	G02
Device Serial No.	2827	Main Filter Type	Ceramic

Maintenance Task

Component	Description	Execution			Status
		check	clean	replace	
fan filter	maintenance kit			x	done
main filter	maintenance kit			x	done
heated line inlet	cleaning	x	x		done
heated line outlet	cleaning	x	x		done
heated block	maintenance kit			x	done
bellows valve	spare part	x			done
thermoswitch	spare part	x			done

Temperature Check

Content	Measured Value	Description	Status
temperature internal heating	191.0 °C	setpoint: 191°C ± 6°C	ok
temperature heated line inlet 1	30.6 °C	setpoint: 191°C ± 6°C	not ok
temperature heated line inlet 2	191.0 °C	setpoint: 191°C ± 6°C	ok
temperature heated line inlet 3	191.0 °C	setpoint: 191°C ± 6°C	n.a.
temperature heated line inlet 4	-	setpoint: 191°C ± 6°C	n.a.
temperature heated line outlet	191.0 °C	setpoint: 191°C ± 6°C	ok

Pressure Check

Content	Measured Value	Description	Status
control air	3.0 bar	between 2.3 - 3.5 bar	ok
pressure drop filter	-	between 0 - 100 hPa	n.a.
pressure drop flow	-	between 0 - 100 hPa	n.a.

Quality Check

	Status
Backflush Probe (if installed)	ok
Backflush Ambient (if installed)	n.a.
Purge Sequence (if installed)	n.a.
Leak Check	ok



Service Engineer: Cahya Santika

Preventive Maintenance Protocol AMA i60

Testbed	R40
AVL Order No.	IDID4239S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	AMA i60 SII
Device Serial No.	7422

Component	Total (h)	Service Interval (h)	Last Maintenance (h)	Next Maintenance (h)
FID i60 HH	672	0	672	672
FID Pump	0	0	0	0
Cutter [ppmh]	0	0	0	0
FID i60 lc	7591	8760	7591	16351
FID Pump	0	8760	0	8760
Cutter [ppmh]	0	0	0	0
CLD i60 hh	644	8760	644	9404
Ozonator	338	8760	338	9098
Converter [ppmh]	200	0	200	200
CLD i60 lc	157	8760	157	8917
Ozonator	337	8760	337	9097
Converter [ppmh]	300	0	300	300
CO2 H / CO H	7691	8760	7691	16451
CO2 L / CO L	5788	8760	5788	14548
GPU	0	0	0	0
Bypass pump CLD	265	6000	265	6265
+A6-A0. 1GQ2	3349	6000	3349	9349
+A6-A0. 2GQ2	3345	6000	3345	9345
Peristaltic pump stream 1	212	2000	212	2212
Sample pump stream 1	175	6000	175	6175
Sample pump stream 2	62	6000	62	6062

Service Engineer: Cahya Santika

Lincheck

2.8.34.7

Test data

Test name:	**Lincheck multipolynomial_EPA (non-1065) /ECE_32632555_CO2_S2_R1_20231018_1124**		
Bench:	Hubdat	Date:	10/18/2023
Serial number:	7422	Time / duration:	11:24:30 AM / 20m 28s
Operator:	Cahya Santika	Meas. duration [s]:	10
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

Analyzer

Tag:	CO2 L / CO L	Cal gas [ppm]:	4502
Serial number:	32632555	Range limit [ppm]:	5000
Manufacturer:	AVL Emission	Range:	1

Gas divider

GDU type:	GDU	Zero gas:	N2
Serial number:	5765	Gas type:	CO2
Calib. date:	3/4/2021		

Zero/span adjust

Zero pt. [ppm]:	0.467	Span pt. [ppm]:	4499
Zero dev. [%FS]:	0.009	Span dev. [%FS]:	-0.065
		Span factor:	1.284

Midspan check

Span gas [ppm]:	--	Deviation [%]:	--
Measured [ppm]:	--	Limit [%]:	--

Span gas

Name	CO2_L_1	Concentration	0.450	Connected	11/4/2021
Bottle No.	13	Unit	Vol%	Expiration	11/3/2024

Test results	Actual polynomial	4. Order		Calculated polynomial	1. Order	
	Limit [%]	Dev. [ppm]	Dev. [%]		Dev. [ppm]	Dev. [%]
Deviation zero point	0.3	1.834	0.037		-0.002	0.000
*Deviation < 10 % FS	0.2	9.183	0.184		0.971	0.019
Deviation point	2.0	12.392	1.246		-5.704	-0.185
Deviation FS	1.0	14.256	0.285		-5.704	-0.114
Deviation end point	1.0	0.170	0.004		2.949	0.066
Test state			Passed			Passed
Coefficient A0			0.00000E+0			-2.99198E-5
Coefficient A1			1.01683E+0			1.00129E+0
Coefficient A2			-2.63818E-1			0.00000E+0
Coefficient A3			5.71586E-1			0.00000E+0
Coefficient A4			-3.30251E-1			0.00000E+0

Test data

Test name:	**Lincheck multipolynomial_EPA (non-1065) /ECE_32632555_CO2_S2_R1_20231018_1124**		
Bench:	Hubdat	Date:	10/18/2023
Serial number:	7422	Time / duration:	11:24:30 AM / 20m 28s
Operator:	Cahya Santika	Meas. duration [s]:	10
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

Index	GD step	GD conc. [ppm]	Analyzer [ppm]	Dev. [ppm]	Dev. [%]	Calc. [ppm]	Dev. [ppm]	Dev. [%]
1	0	0.000	1.834	1.834	0.037	-0.002	-0.002	-0.000
2	7	494.3	503.5	9.183	1.858	495.2	0.971	0.196
3	14	994.4	1007	12.39	1.246	994.1	-0.349	-0.035
4	21	1494	1508	14.26	0.954	1493	-0.747	-0.050
5	28	1995	2007	12.64	0.634	1991	-3.198	-0.160
6	36	2576	2587	10.17	0.395	2572	-4.438	-0.172
7	43	3076	3082	6.352	0.207	3070	-5.704	-0.185
8	50	3577	3583	5.891	0.165	3575	-2.456	-0.069
9	57	4077	4078	1.117	0.027	4076	-0.475	-0.012
10	63	4502	4502	0.170	0.004	4505	2.949	0.066

Test data

Test name:	**Lincheck multipolynomial_EPA (non-1065) /ECE_32632555_CO2_S2_R1_20231018_1124**		
Bench:	Hubdat	Date:	10/18/2023
Serial number:	7422	Time / duration:	11:24:30 AM / 20m 28s
Operator:	Cahya Santika	Meas. duration [s]:	10
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

This document is done automatically and is valid without signature.

Comments: * Max. allowed deviation at concentrations below 10% of the range

ANR check

2.8.105.1

Test data

Test name:	**ANR check_EPA (non-1065) /ECE_32632555_CO2_S2_R2_20231018_1417**		
Bench:	Hubdat	Date:	10/18/2023
Serial number:	7422	Time / duration:	2:17:14 PM / 1h 00m 49s
Legislation:	EPA (non-1065) /ECE	Operator:	Cahya Santika
Engine:	AK parameters		

Analyzer

Tag:	CO2 L / CO L	Manufacturer:	AVL Emission
SN:	32632555		
Channel:	CO2	Span gas [ppm]:	18030
Stream:	2	Range limit [ppm]:	30000

Iteration	Zero pt. [ppm]	Z. std dev [ppm]	Zero error [ppm]	Span pt. [ppm]	Sp. std dev [ppm]	Span error [ppm]	Span factor
1	1.423	0.593	1.423	18036	0.467	5.620	1.000
2	-1.038	0.294	-1.038	18030	0.445	-0.108	1.000
3	-1.218	0.333	-1.218	18030	0.704	-0.434	1.000
4	-0.971	0.218	-0.971	18030	0.737	0.441	1.000
5	-0.891	0.302	-0.891	18030	0.960	-0.083	1.000
6	0.008	0.346	0.008	18029	0.531	-0.585	1.000
7	-0.950	0.328	-0.950	18031	0.683	0.795	1.001
8	0.218	0.330	0.218	18033	5.665	2.806	1.001
9	-0.786	0.175	-0.786	18029	0.619	-0.974	1.001
10	-1.067	0.182	-1.067	18030	1.849	0.154	1.001

ANR check

2.8.105.1

Test data

Test name:	**ANR check_EPA (non-1065) /ECE_32632555_CO2_S2_R2_20231018_1417**		
Bench:	Hubdat	Date:	10/18/2023
Serial number:	7422	Time / duration:	2:17:14 PM / 1h 00m 49s
Legislation:	EPA (non-1065) /ECE	Operator:	Cahya Santika
Engine:	AK parameters		

Standard conditions

Flow-weighted mean conc. [ppm]:	27100
Low. mean conc. [ppm]:	399.9
High. exp. conc. [ppm]:	27100
Low. conc. [ppm]:	66.00

	Result	Limit	Comments
Accuracy [ppm]:	0.763	542.0	2% of flow-weighted mean conc. at standard cond.
Noise [ppm]:	0.660	271.0	1% of maximum concentration
Noise span [ppm]:	3.951		
Repeatability [ppm]:	3.999	271.0	1% of flow-weighted mean conc. at standard cond.
Test status:	**Passed**		

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Vacuum leak check

2.8.5.1

Test data

Test name:	**Vacuum leak check_EPA (non-1065) /ECE_7422_S2_SL3_20231020_1930**		
Bench:	Hubdat	Date:	10/20/2023
Serial number:	7422	Time / duration:	7:30:21 PM / 01m 53s
Operator:	Cahya Santika	Stream:	2
Legislation:	EPA (non-1065) /ECE	Sample line:	Ambient modal
		Sample point:	1
		Sample line ID:	3

Vacuum leak check

Check type:	Automatic	Vacuum pressure [hPa]:	-400.00
Initial pressure [hPa]:	-737.89	Duration [s]:	60
Final pressure [hPa]:	-737.11	Typical flow [l/min]:	10.00
Leak flow [%]:	0.003	Vacuum volume [l]:	0.40
Test status:	**Passed**	Max. leak flow [%]:	0.50

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Vacuum leak check

2.8.5.1

Test data

Test name:	**Vacuum leak check_EPA (non-1065) /ECE_7422_S2_SL6_20231020_1947**		
Bench:	Hubdat	Date:	10/20/2023
Serial number:	7422	Time / duration:	7:47:05 PM / 02m 03s
Operator:	Cahya Santika	Stream:	2
Legislation:	EPA (non-1065) /ECE	Sample line:	External
		Sample point:	1
		Sample line ID:	6

Vacuum leak check

Check type:	Automatic	Vacuum pressure [hPa]:	-400.00
Initial pressure [hPa]:	-748.63	Duration [s]:	60
Final pressure [hPa]:	-748.23	Typical flow [l/min]:	10.00
Leak flow [%]:	0.002	Vacuum volume [l]:	0.40
Test status:	**Passed**	Max. leak flow [%]:	0.50

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Vacuum leak check

2.8.5.1

Test data

Test name:	**Vacuum leak check_EPA (non-1065) /ECE_7422_S2_SL4_20231020_1951**		
Bench:	Hubdat	Date:	10/20/2023
Serial number:	7422	Time / duration:	7:51:04 PM / 02m 02s
Operator:	Cahya Santika	Stream:	2
Legislation:	EPA (non-1065) /ECE	Sample line:	Modal clean
		Sample point:	1
		Sample line ID:	4

Vacuum leak check

Check type:	Automatic	Vacuum pressure [hPa]:	-400.00
Initial pressure [hPa]:	-741.10	Duration [s]:	60
Final pressure [hPa]:	-740.35	Typical flow [l/min]:	10.00
Leak flow [%]:	0.003	Vacuum volume [l]:	0.40
Test status:	**Passed**	Max. leak flow [%]:	0.50

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Vacuum leak check

2.8.5.1

Test data

Test name:	**Vacuum leak check_EPA (non-1065) /ECE_7422_S2_SL5_20231020_1953**		
Bench:	Hubdat	Date:	10/20/2023
Serial number:	7422	Time / duration:	7:53:58 PM / 02m 02s
Operator:	Cahya Santika	Stream:	2
Legislation:	EPA (non-1065) /ECE	Sample line:	Modal dirty
		Sample point:	1
		Sample line ID:	5

Vacuum leak check

Check type:	Automatic	Vacuum pressure [hPa]:	-400.00
Initial pressure [hPa]:	-736.75	Duration [s]:	60
Final pressure [hPa]:	-736.03	Typical flow [l/min]:	10.00
Leak flow [%]:	0.003	Vacuum volume [l]:	0.40
Test status:	**Passed**	Max. leak flow [%]:	0.50

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Vacuum leak check

2.8.5.1

Test data

Test name:	**Vacuum leak check_EPA (non-1065) /ECE_7422_S1_SL2_20231024_1730**		
Bench:	Hubdat	Date:	10/24/2023
Serial number:	7422	Time / duration:	5:30:28 PM / 01m 53s
Operator:	Cahya Santika	Stream:	1
Legislation:	EPA (non-1065) /ECE	Sample line:	External
		Sample point:	1
		Sample line ID:	2

Vacuum leak check

Check type:	Automatic	Vacuum pressure [hPa]:	-400.00
Initial pressure [hPa]:	-459.62	Duration [s]:	60
Final pressure [hPa]:	-459.30	Typical flow [l/min]:	10.00
Leak flow [%]:	0.001	Vacuum volume [l]:	0.40
Test status:	**Passed**	Max. leak flow [%]:	0.50

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Vacuum leak check

2.8.5.1

Test data

Test name:	**Vacuum leak check_EPA (non-1065) /ECE_7422_S1_SL1_20231024_1733**		
Bench:	Hubdat	Date:	10/24/2023
Serial number:	7422	Time / duration:	5:33:31 PM / 01m 53s
Operator:	Cahya Santika	Stream:	1
Legislation:	EPA (non-1065) /ECE	Sample line:	S1 Line1
		Sample point:	1
		Sample line ID:	1

Vacuum leak check

Check type:	Automatic	Vacuum pressure [hPa]:	-400.00
Initial pressure [hPa]:	-394.88	Duration [s]:	60
Final pressure [hPa]:	-339.27	Typical flow [l/min]:	10.00
Leak flow [%]:	0.220	Vacuum volume [l]:	0.40
Test status:	**Passed**	Max. leak flow [%]:	0.50

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Pressure sensor check

2.7.1.2

Test data

Test name:	**Pressure sensor check_7422_S1_20231024_1741**		
Bench:	Hubdat	Date:	10/24/2023
Serial number:	7422	Time / duration:	5:41:28 PM / 10m 52s
Operator:	Cahya Santika	Stream:	1

Test results

Regulator:	+A8-A0.1KK1P	Factor:	1.056
Zero [hPa]:	0.92	Offset:	16.87
End [hPa]:	347.58	Factor (output):	0.0027

Regulator	Zero raw	End raw	Zero corr.	End corr.	Factor	Offset	Old factor	Old offset	Status
+A8-A9.1KK1P	17	345	0	348	1.059	16.34	1.033	10.04	Passed
+A8-A8.1KK1P	30	362	0	348	1.045	28.86	1.005	17.53	Passed
+A8-A7.1KK1P	26	354	0	348	1.060	24.95	1.029	17.24	Passed
+A8-A5.1KK1P	29	355	0	348	1.066	27.68	1.022	15.51	Passed

Regulator	End	End corr.	Factor	Old factor	Offset	Status
+A8-A9.1KK1P	350	350	2.701E-3	2.700E-3	0.85	Passed
+A8-A8.1KK1P	349	350	2.704E-3	2.703E-3	0.85	Passed
+A8-A7.1KK1P	348	350	2.719E-3	2.719E-3	0.85	Passed
+A8-A5.1KK1P	345	350	2.737E-3	2.737E-3	0.85	Passed

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Analyzer response time check

2.8.1.2

Test data

Test name:	**Analyzer response time check_3248_THC_S2_R2_20231024_1754**		
Bench:	Hubdat	Date:	10/24/2023
Serial number:	7422	Time / duration:	5:54:02 PM / 03m 13s
		Operator:	Cahya Santika

Analyzer

Tag:	FID i60 lc	Span gas [ppm]:	949.24
SN:	3248	Range limit [ppm]:	1000
Manufacturer:	AVL Emission	Range:	2
		Sample rate [Hz]:	10

Pre-test zero/span adjust

Zero pt. [ppm]:	--	Span pt. [ppm]:	--
Zero dev. [%FS]:	--	Span dev. [%FS]:	--

Span gas

Name	THC_2/SA	Concentration	949.24	Connected	8/29/2019
Bottle No.	12	Unit	ppmC3	Expiration	1/25/2026

Test results

Rising time T10-T90 [s]:	0.55
Falling time T90-T10 [s]:	0.85

Comment:

Switching between zero and span gas takes place in the AVU and the length of the line between the AVU and the analyzer input is also measured.

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Pressure sensor check

2.7.1.2

Test data

Test name:	**Pressure sensor check_7422_S2_20231024_1811**		
Bench:	Hubdat	Date:	10/24/2023
Serial number:	7422	Time / duration:	6:11:46 PM / 10m 50s
Operator:	Cahya Santika	Stream:	2

Test results

Regulator:	+A8-A0.2KK1P	Factor:	1.057
Zero [hPa]:	0.41	Offset:	27.04
End [hPa]:	351.20	Factor (output):	0.0027

Regulator	Zero raw	End raw	Zero corr.	End corr.	Factor	Offset	Old factor	Old offset	Status
+A8-A10.1KK1P	20	362	0	351	1.027	19.97	1.020	18.04	Passed
+A8-A8.2KK1P	5	336	0	351	1.064	4.97	1.060	6.70	Passed
+A8-A7.2KK1P	12	344	0	351	1.058	11.37	1.052	9.04	Passed
+A8-A5.2KK1P	23	361	0	351	1.040	22.68	1.023	15.19	Passed

Regulator	End	End corr.	Factor	Old factor	Offset	Status
+A8-A10.1KK1P	353	350	2.677E-3	2.700E-3	0.85	Passed
+A8-A8.2KK1P	347	350	2.725E-3	2.700E-3	0.85	Passed
+A8-A7.2KK1P	344	350	2.746E-3	2.700E-3	0.85	Passed
+A8-A5.2KK1P	345	350	2.738E-3	2.736E-3	0.85	Passed

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Drift check

2.8.102.4

Test data

Test name:	**Drift check_7422_20231108_2132**		
Bench:	Hubdat	Date:	11/8/2023
Serial number:	7422	Time / duration:	9:32:14 PM / 8h 17m 58s
Drift limit [%FS]:	2.00	Operator:	Cahya Santika

Analyzer

Tag:	CLD i60 hh	Manufacturer:	AVL Emission
SN:	2748		

Pre-test zero/span adjust

Zero pt. [ppm]:	-0.010	Span pt. [ppm]:	94.31
Zero dev. [%FS]:	-0.010	Span dev. [%FS]:	-0.050

Test results

Channel:	**NOx**	Stream:	1
Pre zero [ppm]:	0.054	Span gas [ppm]:	94.36
Pre span [ppm]:	94.29	Range limit [ppm]:	100

Iterations	Post zero	Post span	Dev. zero [ppm]	Dev. zero [%FS]	Dev. span [ppm]	Dev. span [%FS]	Result
1	0.011	94.59	-0.043	-0.043	0.300	0.300	**Passed**
2	0.054	94.39	0.000	0.000	0.094	0.094	**Passed**
3	0.063	94.55	0.009	0.009	0.252	0.252	**Passed**
4	0.042	94.53	-0.012	-0.012	0.237	0.237	**Passed**
5	0.037	94.60	-0.017	-0.017	0.307	0.307	**Passed**
6	0.007	94.58	-0.047	-0.047	0.290	0.290	**Passed**
7	0.019	94.44	-0.035	-0.035	0.147	0.147	**Passed**
8	0.019	94.35	-0.035	-0.035	0.054	0.054	**Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Drift check

2.8.102.4

Test data

Test name:	**Drift check_7422_20231107_1633**		
Bench:	Hubdat	Date:	11/7/2023
Serial number:	7422	Time / duration:	4:33:59 PM / 8h 10m 16s
Drift limit [%FS]:	2.00	Operator:	Cahya Santika

Analyzer

Tag:	CO2 H / CO H	Manufacturer:	AVL Emission
SN:	32645795		

Pre-test zero/span adjust

Zero pt. [ppm]:	-1.380	Span pt. [ppm]:	55453
Zero dev. [%FS]:	0.000	Span dev. [%FS]:	0.000

Test results

Channel:	**CO2**	Stream:	1
Pre zero [ppm]:	0.000	Span gas [ppm]:	55450
Pre span [ppm]:	55486	Range limit [ppm]:	60000

Iterations	Post zero	Post span	Dev. zero [ppm]	Dev. zero [%FS]	Dev. span [ppm]	Dev. span [%FS]	Result
1	0.000	55487	0.000	0.000	1.009	0.002	**Passed**
2	0.000	55528	0.000	0.000	41.48	0.069	**Passed**
3	0.000	55584	0.000	0.000	98.09	0.163	**Passed**
4	0.000	55642	0.000	0.000	156.1	0.260	**Passed**
5	0.000	55697	0.000	0.000	210.4	0.351	**Passed**
6	0.000	55738	0.000	0.000	252.3	0.421	**Passed**
7	0.000	55773	0.000	0.000	286.6	0.478	**Passed**
8	0.000	55798	0.000	0.000	312.2	0.520	**Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Test data

Test name:	**Lincheck multipolynomial_EPA (non-1065) /ECE_32645795_CO2_S1_R2_20231025_0210**		
Bench:	Hubdat	Date:	10/25/2023
Serial number:	7422	Time / duration:	2:10:11 AM / 25m 34s
Operator:	Cahya Santika	Meas. duration [s]:	10
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

Analyzer

Tag:	CO2 H / CO H	Cal gas [ppm]:	180100
Serial number:	32645795	Range limit [ppm]:	200000
Manufacturer:	AVL Emission	Range:	2

Gas divider

GDU type:	GDU	Zero gas:	N2
Serial number:		Gas type:	CO2
Calib. date:	3/4/2021		

Zero/span adjust

Zero pt. [ppm]:	-4.234	Span pt. [ppm]:	180146
Zero dev. [%FS]:	-0.002	Span dev. [%FS]:	0.023
		Span factor:	0.998

Midspan check

Span gas [ppm]:	55450	Deviation [%]:	-2.384
Measured [ppm]:	54128	Limit [%]:	2.0

Span gas

Name	CO2_H_2	Concentration	18.01	Connected	5/23/2019
Bottle No.	3	Unit	Vol%	Expiration	1/8/2021

Midspan calibration gas

Name	CO2_H_1	Concentration	5.545	Connected	10/16/2023
Bottle No.	8	Unit	Vol%	Expiration	4/18/2024

Test results

Test results	Actual polynomial	4. Order		Calculated polynomial	1. Order	
	Limit [%]	Dev. [ppm]	Dev. [%]		Dev. [ppm]	Dev. [%]
Deviation zero point	0.3	22.523	0.011		-1.558	-0.001
*Deviation < 10 % FS	0.2	-284.975	-0.142		-49.252	-0.025
Deviation point	2.0	-1388.164	-1.362		928.905	1.588
Deviation FS	1.0	-1571.500	-0.786		928.905	0.464
Deviation end point	1.0	-1571.500	-0.865		-486.373	-0.268
Test state			Passed			Passed
Coefficient A0			0.00000E+0			-1.17936E-4
Coefficient A1			1.01887E+0			1.01381E+0
Coefficient A2			-2.42356E-1			0.00000E+0
Coefficient A3			5.86760E-1			0.00000E+0
Coefficient A4			-3.69967E-1			0.00000E+0

Lincheck

2.8.34.7

Test data

Test name:	**Lincheck multipolynomial_EPA (non-1065) /ECE_32645795_CO2_S1_R2_20231025_0210**		
Bench:	Hubdat	Date:	10/25/2023
Serial number:	7422	Time / duration:	2:10:11 AM / 25m 34s
Operator:	Cahya Santika	Meas. duration [s]:	10
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

Index	GD step	GD conc. [ppm]	Analyzer [ppm]	Dev. [ppm]	Dev. [%]	Calc. [ppm]	Dev. [ppm]	Dev. [%]
1	0	0.000	22.52	22.52	0.011	-1.558	-1.558	-0.001
2	7	19157	18872	-285.0	-1.488	19108	-49.25	-0.257
3	14	38733	38418	-315.3	-0.814	39286	553.2	1.428
4	21	58483	57965	-518.4	-0.886	59412	928.9	1.588
5	28	78462	77511	-951.7	-1.213	79224	761.9	0.971
6	36	101947	100559	-1388	-1.362	102121	174.2	0.171
7	43	122322	120804	-1518	-1.241	121903	-418.7	-0.342
8	50	142979	141668	-1312	-0.917	142233	-746.5	-0.522
9	57	163796	162526	-1270	-0.775	162923	-872.6	-0.533
10	63	181660	180089	-1572	-0.865	181174	-486.4	-0.268

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Comments: * Max. allowed deviation at concentrations below 10% of the range

ANR check

2.8.105.1

Test data

Test name:	**ANR check_EPA (non-1065) /ECE_32645795_CO2_S1_R1_20231024_1928**		
Bench:	Hubdat	Date:	10/24/2023
Serial number:	7422	Time / duration:	7:28:30 PM / 1h 00m 41s
Legislation:	EPA (non-1065) /ECE	Operator:	Cahya Santika
Engine:	AK parameters		

Analyzer

Tag:	CO2 H / CO H	Manufacturer:	AVL Emission
SN:	32645795		
Channel:	CO2	Span gas [ppm]:	55450
Stream:	1	Range limit [ppm]:	60000

Iteration	Zero pt. [ppm]	Z. std dev [ppm]	Zero error [ppm]	Span pt. [ppm]	Sp. std dev [ppm]	Span error [ppm]	Span factor
1	0.998	0.876	0.998	55552	15.98	101.9	1.018
2	-2.339	1.322	-2.339	55448	2.495	-1.703	1.016
3	-2.863	1.134	-2.863	55449	2.787	-0.607	1.016
4	-3.942	1.167	-3.942	55448	1.834	-1.646	1.016
5	-2.953	0.941	-2.953	55447	1.977	-3.446	1.016
6	-4.329	1.095	-4.329	55445	2.428	-5.016	1.016
7	-3.848	1.159	-3.848	55454	1.629	4.469	1.016
8	-3.158	0.734	-3.158	55446	2.162	-3.521	1.016
9	0.587	0.722	0.587	55450	6.847	0.299	1.016
10	-3.515	1.012	-3.515	55445	6.663	-4.519	1.016

ANR check

2.8.105.1

Test data

Test name:	**ANR check_EPA (non-1065) /ECE_32645795_CO2_S1_R1_20231024_1928**		
Bench:	Hubdat	Date:	10/24/2023
Serial number:	7422	Time / duration:	7:28:30 PM / 1h 00m 41s
Legislation:	EPA (non-1065) /ECE	Operator:	Cahya Santika
Engine:	AK parameters		

Standard conditions

Flow-weighted mean conc. [ppm]:	55450
Low. mean conc. [ppm]:	6577
High. exp. conc. [ppm]:	55450
Low. conc. [ppm]:	206.6

	Result	Limit	Comments
Accuracy [ppm]:	8.620	1109	2% of flow-weighted mean conc. at standard cond.
Noise [ppm]:	2.066	554.5	1% of maximum concentration
Noise span [ppm]:	12.35		
Repeatability [ppm]:	65.77	554.5	1% of flow-weighted mean conc. at standard cond.
Test status:	**Passed**		

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Analyzer response time check

2.8.1.2

Test data

Test name:	**Analyzer response time check_32645795_CO2_S1_R2_20231024_1854**		
Bench:	Hubdat	Date:	10/24/2023
Serial number:	7422	Time / duration:	6:54:06 PM / 03m 12s
		Operator:	Cahya Santika

Analyzer

Tag:	CO2 H / CO H	Span gas [ppm]:	180100
SN:	32645795	Range limit [ppm]:	200000
Manufacturer:	AVL Emission	Range:	2
		Sample rate [Hz]:	10

Pre-test zero/span adjust

Zero pt. [ppm]:	--	Span pt. [ppm]:	--
Zero dev. [%FS]:	--	Span dev. [%FS]:	--

Span gas

Name	CO2_H_2	Concentration	18.01	Connected	5/23/2019
Bottle No.	3	Unit	Vol%	Expiration	1/8/2021

Test results

Rising time T10-T90 [s]:	1.21
Falling time T90-T10 [s]:	1.09

Comment:

Switching between zero and span gas takes place in the AVU and the length of the line between the AVU and the analyzer input is also measured.

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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H2O rejection ratio check report

2.9.102.1

Test data

Test name:	**H2O rejection ratio check_EPA (non-1065) /ECE_32645795_CO2_S1_R1_20231024_1846**		
Bench:	Hubdat	Date:	10/24/2023
Serial number:	7422	Time / duration:	6:46:07 PM / 04m 40s
Legislation:	EPA (non-1065) /ECE	Operator:	Cahya Santika
Engine:	AK parameters		

Analyzer

Tag:	CO2 H / CO H	Gas type:	CO2
SN:	32645795	Range:	1
Manufacturer:	AVL Emission	Span gas [ppm]:	55450
		Range limit [ppm]:	60000

Zero/span adjust

Zero [ppm]:	-0.30	Span [ppm]:	55497.24
Zero dev. [%FS]:	-0.00	Span dev. [%FS]:	0.08

CO2 calibration gas

Name	CO2_H_1	Concentration	5.545	Connected	10/16/2023
Bottle No.	8	Unit	Vol%	Expiration	4/18/2024

Test results

TWB [éC]	H2O [Vol%]	AR [ppm]	Z [ppm]	WRR	Min. Limit	Status
27.4	2.65	7.88	26926.94	3418	100	Passed

Pressure GP [hPa]: 1359.5

Test status **Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Comment:

Drift check

2.8.102.4

Test data

Test name:	**Drift check_7422_20231107_1633**		
Bench:	Hubdat	Date:	11/7/2023
Serial number:	7422	Time / duration:	4:33:59 PM / 8h 10m 16s
Drift limit [%FS]:	2.00	Operator:	Cahya Santika

Analyzer

Tag:	CO2 H / CO H	Manufacturer:	AVL Emission
SN:	32645795		

Pre-test zero/span adjust

Zero pt. [ppm]:	3.550	Span pt. [ppm]:	18089
Zero dev. [%FS]:	0.020	Span dev. [%FS]:	0.040

Test results

Channel:	**CO H**	Stream:	1
Pre zero [ppm]:	0.590	Span gas [ppm]:	18080
Pre span [ppm]:	18091	Range limit [ppm]:	20000

Iterations	Post zero	Post span	Dev. zero [ppm]	Dev. zero [%FS]	Dev. span [ppm]	Dev. span [%FS]	Result
1	13.51	18087	12.92	0.065	-4.161	-0.021	**Passed**
2	16.48	18086	15.89	0.079	-5.478	-0.027	**Passed**
3	18.55	18085	17.96	0.090	-6.399	-0.032	**Passed**
4	20.04	18083	19.45	0.097	-8.207	-0.041	**Passed**
5	21.87	18083	21.28	0.106	-8.539	-0.043	**Passed**
6	22.23	18079	21.64	0.108	-12.32	-0.062	**Passed**
7	22.28	18078	21.68	0.108	-13.02	-0.065	**Passed**
8	22.70	18076	22.10	0.111	-15.50	-0.078	**Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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CO cross check report

2.8.101.2

Test data

Test name:	CO cross check_EPA (non-1065) /ECE_32645795_CO H_S1_R1_20231025_0051		
Bench:	Hubdat	Date:	10/25/2023
Serial number:	7422	Time / duration:	12:51:29 AM / 05m 54s
Operator:	Cahya Santika		
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

Analyzer

Tag:	CO2 H / CO H	Range:	1
SN:	32645795	Cal gas [ppm]:	18080
Manufacturer:	AVL Emission	Range limit [ppm]:	20000
Gas type:	CO		

Zero/span adjust

Zero [ppm]:	--	Span [ppm]:	--
Zero dev. [%FS]:	--	Span dev. [%FS]:	--

CO calibration gas

Name		Concentration		Connected	
Bottle No.		Unit		Expiration	

CO2 calibration gas (for wet CO2 rejection ratio)

Name	CO2_H_2	Concentration	18.01	Connected	5/23/2019
Bottle No.	3	Unit	Vol%	Expiration	1/8/2021

CO2 calibration gas (for dry CO2 rejection ratio)

Name	CO2_H_2	Concentration	18.01	Connected	5/23/2019
Bottle No.	3	Unit	Vol%	Expiration	1/8/2021

Test results

Wet rejection ratio

ppmCO2 [ppm]	AR [ppm]	max. Limit [ppm]	Status
180100	10.81	200.0	Passed

H2O rejection ratio

TWB [éC]	GP [hPa]	H2O [Vol%]	AR [ppm]	Z [ppm]	WRR	Min. Limit	Status
26.3	1359	2.48	6.38	25221	3955	1000	Passed

Dry CO2 rejection ratio

ppmCO2 [ppm]	AR [ppm]	CO2 rejection ratio	Min. Limit	Status
180100	6.108	29488	5000	Passed

CO cross check report

2.8.101.2

Test data

Test name:	**CO cross check_EPA (non-1065) /ECE_32645795_CO H_S1_R1_20231025_0051**		
Bench:	Hubdat	Date:	10/25/2023
Serial number:	7422	Time / duration:	12:51:29 AM / 05m 54s
Operator:	Cahya Santika		
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

Test status: **Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Comment:

Analyzer response time check

2.8.1.2

Test data

Test name:	**Analyzer response time check_32645795_CO H_S1_R2_20231024_1850**		
Bench:	Hubdat	Date:	10/24/2023
Serial number:	7422	Time / duration:	6:50:50 PM / 03m 12s
		Operator:	Cahya Santika

Analyzer

Tag:	CO2 H / CO H	Span gas [ppm]:	27000
SN:	32645795	Range limit [ppm]:	60000
Manufacturer:	AVL Emission	Range:	2
		Sample rate [Hz]:	10

Pre-test zero/span adjust

Zero pt. [ppm]:	--	Span pt. [ppm]:	--
Zero dev. [%FS]:	--	Span dev. [%FS]:	--

Span gas

Name		Concentration		Connected	
Bottle No.		Unit		Expiration	

Test results

Rising time T10-T90 [s]:	1.14
Falling time T90-T10 [s]:	1.09

Comment:

Switching between zero and span gas takes place in the AVU and the length of the line between the AVU and the analyzer input is also measured.

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Drift check

2.8.102.4

Test data

Test name:	**Drift check_7422_20231025_1730**		
Bench:	Hubdat	Date:	10/25/2023
Serial number:	7422	Time / duration:	5:30:22 PM / 8h 10m 54s
Drift limit [%FS]:	2.00	Operator:	Cahya Santika

Analyzer

Tag:	CLD i60 lc	Manufacturer:	AVL Emission
SN:	2781		

Pre-test zero/span adjust

Zero pt. [ppm]:	-0.010	Span pt. [ppm]:	94.19
Zero dev. [%FS]:	0.000	Span dev. [%FS]:	-0.020

Test results

Channel:	**NOx**	Stream:	2
Pre zero [ppm]:	-0.032	Span gas [ppm]:	94.36
Pre span [ppm]:	94.21	Range limit [ppm]:	1000

Iterations	Post zero	Post span	Dev. zero [ppm]	Dev. zero [%FS]	Dev. span [ppm]	Dev. span [%FS]	Result
1	0.000	94.06	0.032	0.003	-0.147	-0.015	**Passed**
2	0.008	93.52	0.040	0.004	-0.687	-0.069	**Passed**
3	0.010	93.35	0.042	0.004	-0.859	-0.086	**Passed**
4	0.014	93.29	0.046	0.005	-0.916	-0.092	**Passed**
5	0.042	93.42	0.074	0.007	-0.786	-0.079	**Passed**
6	0.023	93.09	0.055	0.006	-1.118	-0.112	**Passed**
7	0.002	93.06	0.034	0.003	-1.143	-0.114	**Passed**
8	0.010	92.92	0.042	0.004	-1.288	-0.129	**Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Test data

Test name:	**Lincheck multipolynomial_EPA (non-1065) /ECE_2781_NOx_S2_R1_20231025_0356**		
Bench:	Hubdat	Date:	10/25/2023
Serial number:	7422	Time / duration:	3:56:28 AM / 21m 17s
Operator:	Cahya Santika	Meas. duration [s]:	10
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

Analyzer

Tag:	CLD i60 lc	Cal gas [ppm]:	94.36
Serial number:	2781	Range limit [ppm]:	1000
Manufacturer:	AVL Emission	Range:	1

Gas divider

GDU type:	GDU	Zero gas:	N2
Serial number:	5765	Gas type:	NOX
Calib. date:	3/4/2021		

Zero/span adjust

Zero pt. [ppm]:	-0.008	Span pt. [ppm]:	94.59
Zero dev. [%FS]:	-0.001	Span dev. [%FS]:	0.023
		Span factor:	1.024

Midspan check

Span gas [ppm]:	--	Deviation [%]:	--
Measured [ppm]:	--	Limit [%]:	--

Span gas

Name	NOx_1	Concentration	94.36	Connected	10/16/2023
Bottle No.	7	Unit	ppm	Expiration	11/4/2024

Test results	Actual polynomial	4. Order		Calculated polynomial	Order 2	
	Limit [%]	Dev. [ppm]	Dev. [%]		Dev. [ppm]	Dev. [%]
Deviation zero point	0.3	0.012	0.001		0.001	0.000
*Deviation < 10 % FS	0.2	-2.058	-0.206		0.538	0.054
Deviation point	2.0	0.012	0.001		0.001	0.000
Deviation FS	1.0	-2.058	-0.206		0.538	0.054
Deviation end point	1.0	0.214	0.227		-0.200	-0.212
Test state			Failed			Passed
Coefficient A0	0.00000E+0		1.00000E+0			-1.27377E-5
Coefficient A1	9.86000E-1		1.60000E+1			1.09835E+0
Coefficient A2	1.60000E+1		9.60000E+1			-1.12779E+0
Coefficient A3	9.70000E+1		7.30000E+1			0.00000E+0
Coefficient A4	7.20000E+1		0.00000E+0			0.00000E+0

Lincheck

2.8.34.7

Test data

Test name:	**Lincheck multipolynomial_EPA (non-1065) /ECE_2781_NOx_S2_R1_20231025_0356**		
Bench:	Hubdat	Date:	10/25/2023
Serial number:	7422	Time / duration:	3:56:28 AM / 21m 17s
Operator:	Cahya Santika	Meas. duration [s]:	10
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

Index	GD step	GD conc. [ppm]	Analyzer [ppm]	Dev. [ppm]	Dev. [%]	Calc. [ppm]	Dev. [ppm]	Dev. [%]
1	0	0.000	0.012	0.012	0.001	0.001	0.001	0.000
2	7	10.37	9.253	-1.118	-10.78	10.17	-0.199	-1.922
3	14	20.86	19.12	-1.740	-8.340	20.81	-0.047	-0.225
4	21	31.34	29.33	-2.013	-6.422	31.51	0.169	0.539
5	28	41.83	39.77	-2.058	-4.919	42.22	0.389	0.929
6	36	54.03	52.15	-1.882	-3.483	54.56	0.532	0.985
7	43	64.49	62.97	-1.524	-2.364	65.03	0.538	0.835
8	50	74.99	74.00	-0.993	-1.324	75.47	0.476	0.635
9	57	85.46	85.12	-0.344	-0.403	85.68	0.222	0.260
10	63	94.36	94.57	0.214	0.227	94.16	-0.200	-0.212

Test data

Test name:	**Lincheck multipolynomial_EPA (non-1065) /ECE_2781_NOx_S2_R1_20231025_0356**		
Bench:	Hubdat	Date:	10/25/2023
Serial number:	7422	Time / duration:	3:56:28 AM / 21m 17s
Operator:	Cahya Santika	Meas. duration [s]:	10
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Comments: * Max. allowed deviation at concentrations below 10% of the range

NOx converter check report

2.8.7.4

Test data

Test name:	**NOx converter check_EPA (non-1065) /ECE_2781_NOx_S2_R1_20231025_0123**		
Bench:	Hubdat	Date:	10/25/2023
Serial number:	7422	Time / duration:	1:23:14 AM / 22m 45s
Operator:	Cahya Santika	Converter type:	NOXConverterType1
Legislation:	EPA (non-1065) /ECE	Converter SN:	GDC703
		Calib. date:	3/4/2021

Analyzer

Tag:	CLD i60 lc	Cal gas [ppm]:	94.36
SN:	2781	Range limit [ppm]:	1000
Manufacturer:	AVL Emission	Range:	1
Ozonator [h]:	38	Converter [ppmh]:	48

NO zero/span adjust

Zero [ppm]:	--	Span [ppm]:	--
Zero dev. [%FS]:	--	Span dev. [%FS]:	--

Span gas

Name	NOx_1	Concentration	94.36	Connected	10/16/2023
Bottle No.	7	Unit	ppm	Expiration	11/4/2024

Test results

Step	Mode	O2	O3	Value [ppm]
F	NO	Off	Off	92.07
C	NO	On	Off	80.00
D	NO	On	On	17.43
A	NOx	On	On	80.01
B	NOx	On	Off	81.87
E	NOx	Off	Off	92.65

NOx converter check report

2.8.7.4

Test data

Test name:	**NOx converter check_EPA (non-1065) /ECE_2781_NOx_S2_R1_20231025_0123**		
Bench:	Hubdat	Date:	10/25/2023
Serial number:	7422	Time / duration:	1:23:14 AM / 22m 45s
Operator:	Cahya Santika	Converter type:	NOXConverterType1
Legislation:	EPA (non-1065) /ECE	Converter SN:	GDC703
		Calib. date:	3/4/2021

Efficiency

Value [%]:	97.02	Lower limit [%]:	95.00	Status:	Passed

NO2 in NO

Value [%]:	0.625	Upper limit [%]:	5.000	Status:	Passed

Test status: **Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Comment:

Check performed with converter temperature210éC

ANR check

2.8.105.1

Test data

Test name:	**ANR check_EPA (non-1065) /ECE_2781_NOx_S2_R1_20231024_2248**		
Bench:	Hubdat	Date:	10/24/2023
Serial number:	7422	Time / duration:	10:48:55 PM / 1h 01m 22s
Legislation:	EPA (non-1065) /ECE	Operator:	Cahya Santika
Engine:	AK parameters		

Analyzer

Tag:	CLD i60 lc	Manufacturer:	AVL Emission
SN:	2781		
Channel:	NOx	Span gas [ppm]:	94.36
Stream:	2	Range limit [ppm]:	1000

Iteration	Zero pt. [ppm]	Z. std dev [ppm]	Zero error [ppm]	Span pt. [ppm]	Sp. std dev [ppm]	Span error [ppm]	Span factor
1	0.035	0.010	0.035	94.18	0.164	-0.178	1.067
2	-0.009	0.010	-0.009	94.45	0.161	0.088	1.072
3	-0.009	0.010	-0.009	94.48	0.167	0.125	1.072
4	-0.009	0.011	-0.009	94.41	0.164	0.050	1.072
5	-0.012	0.010	-0.012	94.31	0.175	-0.053	1.072
6	-0.012	0.010	-0.012	94.42	0.170	0.057	1.074
7	-0.010	0.012	-0.010	94.45	0.156	0.089	1.075
8	-0.013	0.009	-0.013	94.40	0.172	0.041	1.075
9	-0.008	0.010	-0.008	94.39	0.154	0.026	1.076
10	-0.011	0.011	-0.011	94.44	0.149	0.082	1.076

ANR check

2.8.105.1

Test data

Test name:	**ANR check_EPA (non-1065) /ECE_2781_NOx_S2_R1_20231024_2248**		
Bench:	Hubdat	Date:	10/24/2023
Serial number:	7422	Time / duration:	10:48:55 PM / 1h 01m 22s
Legislation:	EPA (non-1065) /ECE	Operator:	Cahya Santika
Engine:	AK parameters		

Standard conditions

Flow-weighted mean conc. [ppm]:	94.36
Low. mean conc. [ppm]:	17.60
High. exp. conc. [ppm]:	94.36
Low. conc. [ppm]:	2.100

	Result	Limit	Comments
Accuracy [ppm]:	0.033	1.887	2% of flow-weighted mean conc. at standard cond.
Noise [ppm]:	0.021	0.944	1% of maximum concentration
Noise span [ppm]:	0.327		
Repeatability [ppm]:	0.176	0.944	1% of flow-weighted mean conc. at standard cond.
Test status:	**Passed**		

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Drift check

2.8.102.4

Test data

Test name:	**Drift check_7422_20231107_1633**		
Bench:	Hubdat	Date:	11/7/2023
Serial number:	7422	Time / duration:	4:33:59 PM / 8h 10m 16s
Drift limit [%FS]:	2.00	Operator:	Cahya Santika

Analyzer

Tag:	CO2 L / CO L	Manufacturer:	AVL Emission
SN:	32632555		

Pre-test zero/span adjust

Zero pt. [ppm]:	-0.480	Span pt. [ppm]:	4506
Zero dev. [%FS]:	-0.010	Span dev. [%FS]:	0.080

Test results

Channel:	**CO2**	Stream:	2
Pre zero [ppm]:	0.040	Span gas [ppm]:	4502
Pre span [ppm]:	4511	Range limit [ppm]:	5000

Iterations	Post zero	Post span	Dev. zero [ppm]	Dev. zero [%FS]	Dev. span [ppm]	Dev. span [%FS]	Result
1	-0.013	4511	-0.053	-0.001	-0.227	-0.005	**Passed**
2	-0.018	4515	-0.058	-0.001	4.303	0.086	**Passed**
3	-0.020	4520	-0.060	-0.001	9.155	0.183	**Passed**
4	-0.022	4526	-0.062	-0.001	15.03	0.301	**Passed**
5	-0.022	4530	-0.062	-0.001	19.21	0.384	**Passed**
6	-0.025	4535	-0.065	-0.001	24.33	0.487	**Passed**
7	-0.023	4538	-0.063	-0.001	26.70	0.534	**Passed**
8	-0.026	4540	-0.066	-0.001	29.38	0.588	**Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Test data

Test name:	**Lincheck multipolynomial_EPA (non-1065) /ECE_32632555_CO2_S2_R1_20231025_0306**		
Bench:	Hubdat	Date:	10/25/2023
Serial number:	7422	Time / duration:	3:06:06 AM / 19m 30s
Operator:	Cahya Santika	Meas. duration [s]:	10
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

Analyzer

Tag:	CO2 L / CO L	Cal gas [ppm]:	4502
Serial number:	32632555	Range limit [ppm]:	5000
Manufacturer:	AVL Emission	Range:	1

Gas divider

GDU type:	GDU	Zero gas:	N2
Serial number:	5765	Gas type:	CO2
Calib. date:	3/4/2021		

Zero/span adjust

Zero pt. [ppm]:	-0.245	Span pt. [ppm]:	4502
Zero dev. [%FS]:	-0.005	Span dev. [%FS]:	0.001
		Span factor:	1.279

Midspan check

Span gas [ppm]:	--	Deviation [%]:	--
Measured [ppm]:	--	Limit [%]:	--

Span gas

Name	CO2_L_1	Concentration	0.450	Connected	11/4/2021
Bottle No.	13	Unit	Vol%	Expiration	11/3/2024

Test results

Test results	Actual polynomial	4. Order		Calculated polynomial	Order 2	
	Limit [%]	Dev. [ppm]	Dev. [%]		Dev. [ppm]	Dev. [%]
Deviation zero point	0.3	4.726	0.095		-0.038	-0.001
*Deviation < 10 % FS	0.2	24.433	0.489		5.505	0.110
Deviation point	2.0	29.145	2.931		-11.894	-0.596
Deviation FS	1.0	31.181	0.624		-15.363	-0.307
Deviation end point	1.0	8.914	0.198		5.187	0.115
Test state			Failed			Passed
Coefficient A0			0.00000E+0			-7.86352E-5
Coefficient A1			1.01683E+0			9.85447E-1
Coefficient A2			-2.63818E-1			2.02050E-1
Coefficient A3			5.71586E-1			0.00000E+0
Coefficient A4			-3.30251E-1			0.00000E+0

Test data

Test name:	**Lincheck multipolynomial_EPA (non-1065) /ECE_32632555_CO2_S2_R1_20231025_0306**		
Bench:	Hubdat	Date:	10/25/2023
Serial number:	7422	Time / duration:	3:06:06 AM / 19m 30s
Operator:	Cahya Santika	Meas. duration [s]:	10
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

Index	GD step	GD conc. [ppm]	Analyzer [ppm]	Dev. [ppm]	Dev. [%]	Calc. [ppm]	Dev. [ppm]	Dev. [%]
1	0	0.000	4.726	4.726	0.095	-0.038	-0.038	-0.001
2	7	494.3	518.7	24.43	4.943	499.8	5.505	1.114
3	14	994.4	1024	29.15	2.931	993.8	-0.628	-0.063
4	21	1494	1525	31.18	2.087	1488	-5.605	-0.375
5	28	1995	2022	27.67	1.387	1983	-11.89	-0.596
6	36	2576	2600	23.47	0.911	2562	-14.39	-0.559
7	43	3076	3093	17.66	0.574	3060	-15.36	-0.499
8	50	3577	3594	16.61	0.464	3568	-8.995	-0.251
9	57	4077	4089	11.88	0.291	4074	-2.770	-0.068
10	63	4502	4511	8.914	0.198	4507	5.187	0.115

Test data

Test name:	**Lincheck multipolynomial_EPA (non-1065) /ECE_32632555_CO2_S2_R1_20231025_0306**		
Bench:	Hubdat	Date:	10/25/2023
Serial number:	7422	Time / duration:	3:06:06 AM / 19m 30s
Operator:	Cahya Santika	Meas. duration [s]:	10
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

This document is done automatically and is valid without signature.

Comments: * Max. allowed deviation at concentrations below 10% of the range

ANR check

2.8.105.1

Test data

Test name:	**ANR check_EPA (non-1065) /ECE_32632555_CO2_S2_R1_20231024_2143**		
Bench:	Hubdat	Date:	10/24/2023
Serial number:	7422	Time / duration:	9:43:07 PM / 1h 00m 44s
Legislation:	EPA (non-1065) /ECE	Operator:	Cahya Santika
Engine:	AK parameters		

Analyzer

Tag:	CO2 L / CO L	Manufacturer:	AVL Emission
SN:	32632555		
Channel:	CO2	Span gas [ppm]:	4502
Stream:	2	Range limit [ppm]:	5000

Iteration	Zero pt. [ppm]	Z. std dev [ppm]	Zero error [ppm]	Span pt. [ppm]	Sp. std dev [ppm]	Span error [ppm]	Span factor
1	-0.892	0.299	-0.892	4512	0.608	10.41	1.284
2	-0.262	0.356	-0.262	4502	0.504	-0.065	1.281
3	-0.851	0.368	-0.851	4503	0.474	0.695	1.281
4	-2.704	0.170	-2.704	4503	0.644	0.783	1.282
5	-0.163	0.258	-0.163	4502	0.336	0.248	1.281
6	-0.561	0.219	-0.561	4502	0.303	0.095	1.281
7	-1.119	0.506	-1.119	4502	0.263	-0.242	1.281
8	0.526	0.432	0.526	4502	0.245	0.282	1.280
9	-0.653	0.261	-0.653	4502	0.346	0.308	1.280
10	-0.095	0.194	-0.095	4502	0.459	0.411	1.280

ANR check

2.8.105.1

Test data

Test name:	**ANR check_EPA (non-1065) /ECE_32632555_CO2_S2_R1_20231024_2143**		
Bench:	Hubdat	Date:	10/24/2023
Serial number:	7422	Time / duration:	9:43:07 PM / 1h 00m 44s
Legislation:	EPA (non-1065) /ECE	Operator:	Cahya Santika
Engine:	AK parameters		

Standard conditions

Flow-weighted mean conc. [ppm]:	4502
Low. mean conc. [ppm]:	643.6
High. exp. conc. [ppm]:	4502
Low. conc. [ppm]:	64.60

	Result	Limit	Comments
Accuracy [ppm]:	1.292	90.04	2% of flow-weighted mean conc. at standard cond.
Noise [ppm]:	0.646	45.02	1% of maximum concentration
Noise span [ppm]:	0.878		
Repeatability [ppm]:	6.436	45.02	1% of flow-weighted mean conc. at standard cond.
Test status:	**Passed**		

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Analyzer response time check

2.8.1.2

Test data

Test name:	**Analyzer response time check_32632555_CO2_S2_R2_20231024_1911**		
Bench:	Hubdat	Date:	10/24/2023
Serial number:	7422	Time / duration:	7:11:40 PM / 03m 13s
		Operator:	Cahya Santika

Analyzer

Tag:	CO2 L / CO L	Span gas [ppm]:	18030
SN:	32632555	Range limit [ppm]:	30000
Manufacturer:	AVL Emission	Range:	2
		Sample rate [Hz]:	10

Pre-test zero/span adjust

Zero pt. [ppm]:	--	Span pt. [ppm]:	--
Zero dev. [%FS]:	--	Span dev. [%FS]:	--

Span gas

Name	CO2_L_2	Concentration	1.803	Connected	4/17/2018
Bottle No.	18	Unit	Vol%	Expiration	8/3/2023

Test results

Rising time T10-T90 [s]:	1.16
Falling time T90-T10 [s]:	1.08

Comment:

Switching between zero and span gas takes place in the AVU and the length of the line between the AVU and the analyzer input is also measured.

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Unit check report

2.8.1.1

Test data

Test name:	**Unit check_32632555_CO2_S2_20231018_1519**		
Bench:	Hubdat	Date:	10/18/2023
Serial number:	7422	Time / duration:	3:19:56 PM / 01m 20s
Operator:	Cahya Santika		

Analyzer

Analyzer	SN	Manufacturer	Channel	Range	End value [ppm]	Conc. [ppm]
IRD i60 CO2 COL	32632555	AVL Emission	CO2	2	30000	16211

Comment:

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Drift check

2.8.102.4

Test data

Test name:	**Drift check_7422_20231108_2132**		
Bench:	Hubdat	Date:	11/8/2023
Serial number:	7422	Time / duration:	9:32:14 PM / 8h 17m 58s
Drift limit [%FS]:	2.00	Operator:	Cahya Santika

Analyzer

Tag:	CO2 L / CO L	Manufacturer:	AVL Emission
SN:	32632555		

Pre-test zero/span adjust

Zero pt. [ppm]:	-0.270	Span pt. [ppm]:	224.1
Zero dev. [%FS]:	-0.090	Span dev. [%FS]:	-0.560

Test results

Channel:	**CO L**	Stream:	2
Pre zero [ppm]:	-0.204	Span gas [ppm]:	225.7
Pre span [ppm]:	226.4	Range limit [ppm]:	300

Iterations	Post zero	Post span	Dev. zero [ppm]	Dev. zero [%FS]	Dev. span [ppm]	Dev. span [%FS]	Result
1	-0.166	226.7	0.038	0.013	0.339	0.113	**Passed**
2	-0.109	224.2	0.095	0.032	-2.251	-0.750	**Passed**
3	-0.244	228.5	-0.040	-0.013	2.061	0.687	**Passed**
4	-0.265	229.5	-0.061	-0.020	3.062	1.021	**Passed**
5	-0.233	219.5	-0.029	-0.010	-6.917	-2.306	**Failed**
6	-0.255	229.0	-0.051	-0.017	2.628	0.876	**Passed**
7	-0.261	231.8	-0.057	-0.019	5.357	1.786	**Passed**
8	-0.064	223.6	0.140	0.047	-2.841	-0.947	**Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Lincheck

2.8.34.7

Test data

Test name:	**Lincheck multipolynomial_EPA (non-1065) /ECE_32632555_CO L_S2_R1_20231108_1715**		
Bench:	Hubdat	Date:	11/8/2023
Serial number:	7422	Time / duration:	5:15:51 PM / 21m 14s
Operator:	Cahya Santika	Meas. duration [s]:	10
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

Analyzer

Tag:	CO2 L / CO L	Cal gas [ppm]:	225.7
Serial number:	32632555	Range limit [ppm]:	300
Manufacturer:	AVL Emission	Range:	1

Gas divider

GDU type:	GDU	Zero gas:	N2
Serial number:	5765	Gas type:	CO
Calib. date:	3/4/2021		

Zero/span adjust

Zero pt. [ppm]:	-0.040	Span pt. [ppm]:	224.5
Zero dev. [%FS]:	-0.013	Span dev. [%FS]:	-0.416
		Span factor:	1.163

Midspan check

Span gas [ppm]:	--	Deviation [%]:	--
Measured [ppm]:	--	Limit [%]:	--

Span gas

Name	CO_L_1	Concentration	225.7	Connected	10/16/2023
Bottle No.	14	Unit	ppm	Expiration	10/25/2025

Test results	Actual polynomial	1. Order		Calculated polynomial	1. Order	
	Limit [%]	Dev. [ppm]	Dev. [%]		Dev. [ppm]	Dev. [%]
Deviation zero point	0.3	0.001	0.000		0.002	0.001
*Deviation < 10 % FS	0.2	-0.695	-0.232		-0.275	-0.092
Deviation point	2.0	-1.455	-1.940		1.773	1.372
Deviation FS	1.0	-4.038	-1.346		1.773	0.591
Deviation end point	1.0	-4.038	-1.789		-0.141	-0.063
Test state			Failed			Passed
Coefficient A0			0.00000E+0			-1.63845E-6
Coefficient A1			9.71001E-1			9.88134E-1
Coefficient A2			0.00000E+0			0.00000E+0
Coefficient A3			0.00000E+0			0.00000E+0
Coefficient A4			0.00000E+0			0.00000E+0

Test data

Test name:	**Lincheck multipolynomial_EPA (non-1065) /ECE_32632555_CO L_S2_R1_20231108_1715**		
Bench:	Hubdat	Date:	11/8/2023
Serial number:	7422	Time / duration:	5:15:51 PM / 21m 14s
Operator:	Cahya Santika	Meas. duration [s]:	10
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

Index	GD step	GD conc. [ppm]	Analyzer [ppm]	Dev. [ppm]	Dev. [%]	Calc. [ppm]	Dev. [ppm]	Dev. [%]
1	0	0.000	0.001	0.001	0.000	0.002	0.002	0.001
2	7	24.81	24.12	-0.695	-2.801	24.53	-0.275	-1.110
3	14	49.91	48.98	-0.929	-1.862	49.91	-0.001	-0.002
4	21	74.98	73.52	-1.455	-1.940	74.81	-0.166	-0.221
5	28	100.1	98.48	-1.598	-1.597	100.2	0.149	0.149
6	36	129.3	128.8	-0.448	-0.346	131.0	1.773	1.372
7	43	154.3	151.7	-2.627	-1.703	154.2	-0.105	-0.068
8	50	179.4	176.9	-2.481	-1.383	180.0	0.620	0.346
9	57	204.5	200.6	-3.849	-1.882	204.6	0.122	0.060
10	63	225.7	221.7	-4.038	-1.789	225.6	-0.141	-0.063

Test data

Test name:	**Lincheck multipolynomial_EPA (non-1065) /ECE_32632555_CO L_S2_R1_20231108_1715**		
Bench:	Hubdat	Date:	11/8/2023
Serial number:	7422	Time / duration:	5:15:51 PM / 21m 14s
Operator:	Cahya Santika	Meas. duration [s]:	10
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Comments: * Max. allowed deviation at concentrations below 10% of the range

CO cross check report

2.8.101.2

Test data

Test name:	CO cross check_EPA (non-1065) /ECE_32632555_CO L_S2_R1_20231025_0057		
Bench:	Hubdat	Date:	10/25/2023
Serial number:	7422	Time / duration:	12:57:25 AM / 05m 54s
Operator:	Cahya Santika		
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

Analyzer

Tag:	CO2 L / CO L	Range:	1
SN:	32632555	Cal gas [ppm]:	0.000
Manufacturer:	AVL Emission	Range limit [ppm]:	300
Gas type:	CO		

Zero/span adjust

Zero [ppm]:	--	Span [ppm]:	--
Zero dev. [%FS]:	--	Span dev. [%FS]:	--

CO calibration gas

Name		Concentration		Connected	
Bottle No.		Unit		Expiration	

CO2 calibration gas (for wet CO2 rejection ratio)

Name	CO2_L_2	Concentration	1.803	Connected	4/17/2018
Bottle No.	18	Unit	Vol%	Expiration	8/3/2023

CO2 calibration gas (for dry CO2 rejection ratio)

Name	CO2_L_2	Concentration	1.803	Connected	4/17/2018
Bottle No.	18	Unit	Vol%	Expiration	8/3/2023

Test results

Wet rejection ratio

ppmCO2 [ppm]	AR [ppm]	max. Limit [ppm]	Status
18030	0.430	3.000	Passed

H2O rejection ratio

TWB [éC]	GP [hPa]	H2O [Vol%]	AR [ppm]	Z [ppm]	WRR	Min. Limit	Status
24.7	1363	2.25	-0.17	22840	-136281	1000	Passed

Dry CO2 rejection ratio

ppmCO2 [ppm]	AR [ppm]	CO2 rejection ratio	Min. Limit	Status
18030	0.774	23289	5000	Passed

CO cross check report

2.8.101.2

Test data

Test name:	**CO cross check_EPA (non-1065) /ECE_32632555_CO L_S2_R1_20231025_0057**		
Bench:	Hubdat	Date:	10/25/2023
Serial number:	7422	Time / duration:	12:57:25 AM / 05m 54s
Operator:	Cahya Santika		
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

Test status: **Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Comment:

Analyzer response time check

2.8.1.2

Test data

Test name:	**Analyzer response time check_32632555_CO L_S2_R2_20231024_1908**		
Bench:	Hubdat	Date:	10/24/2023
Serial number:	7422	Time / duration:	7:08:48 PM / 08s
		Operator:	Cahya Santika

Analyzer

Tag:	CO2 L / CO L	Span gas [ppm]:	0
SN:	32632555	Range limit [ppm]:	5000
Manufacturer:	AVL Emission	Range:	2
		Sample rate [Hz]:	0

Pre-test zero/span adjust

Zero pt. [ppm]:	--	Span pt. [ppm]:	--
Zero dev. [%FS]:	--	Span dev. [%FS]:	--

Span gas

Test results

Rising time T10-T90 [s]:	--
Falling time T90-T10 [s]:	--

Comment:

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Unit check report

2.8.1.1

Test data

Test name:	**Unit check_32632555_CO L_S2_20231018_1404**		
Bench:	Hubdat	Date:	10/18/2023
Serial number:	7422	Time / duration:	2:04:27 PM / 01m 20s
Operator:	Cahya Santika		

Analyzer

Analyzer	SN	Manufacturer	Channel	Range	End value [ppm]	Conc. [ppm]
IRD i60 CO2 COL	32632555	AVL Emission	CO L	1	300	9.684

Comment:

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Lincheck

2.8.34.7

Test data

Test name:	**Lincheck multipolynomial_EPA (non-1065) /ECE_32632555_CO2_S2_R1_20231127_1226**		
Bench:	Hubdat	Date:	11/27/2023
Serial number:	7422	Time / duration:	12:26:12 PM / 20m 08s
Operator:	Cahya Santika	Meas. duration [s]:	10
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

Analyzer

Tag:	CO2 L / CO L	Cal gas [ppm]:	4502
Serial number:	32632555	Range limit [ppm]:	5000
Manufacturer:	AVL Emission	Range:	1

Gas divider

GDU type:	GDU	Zero gas:	N2
Serial number:	5765	Gas type:	CO2
Calib. date:	3/4/2021		

Zero/span adjust

Zero pt. [ppm]:	-0.274	Span pt. [ppm]:	4502
Zero dev. [%FS]:	-0.005	Span dev. [%FS]:	0.001
		Span factor:	1.270

Midspan check

Span gas [ppm]:	--	Deviation [%]:	--
Measured [ppm]:	--	Limit [%]:	--

Span gas

Name	CO2_L_1	Concentration	0.450	Connected	11/4/2021
Bottle No.	13	Unit	Vol%	Expiration	11/3/2024

Test results

Test results	Actual polynomial	4. Order		Calculated polynomial	1. Order	
	Limit [%]	Dev. [ppm]	Dev. [%]		Dev. [ppm]	Dev. [%]
Deviation zero point	0.3	0.338	0.007		0.010	0.000
*Deviation < 10 % FS	0.2	6.216	0.124		-0.622	-0.012
Deviation point	2.0	9.931	0.999		-3.084	-0.155
Deviation FS	1.0	13.249	0.265		-4.745	-0.095
Deviation end point	1.0	-1.189	-0.026		3.538	0.079
Test state			Passed			Passed
Coefficient A0			0.00000E+0			-5.96216E-6
Coefficient A1			1.01683E+0			1.00128E+0
Coefficient A2			-2.63818E-1			0.00000E+0
Coefficient A3			5.71586E-1			0.00000E+0
Coefficient A4			-3.30251E-1			0.00000E+0

Lincheck

2.8.34.7

Test data

Test name:	**Lincheck multipolynomial_EPA (non-1065) /ECE_32632555_CO2_S2_R1_20231127_1226**		
Bench:	Hubdat	Date:	11/27/2023
Serial number:	7422	Time / duration:	12:26:12 PM / 20m 08s
Operator:	Cahya Santika	Meas. duration [s]:	10
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

Index	GD step	GD conc. [ppm]	Analyzer [ppm]	Dev. [ppm]	Dev. [%]	Calc. [ppm]	Dev. [ppm]	Dev. [%]
1	0	0.000	0.338	0.338	0.007	0.010	0.010	0.000
2	7	494.3	500.5	6.216	1.258	493.7	-0.622	-0.126
3	14	994.4	1004	9.931	0.999	994.3	-0.180	-0.018
4	21	1494	1507	13.25	0.887	1493	-0.890	-0.060
5	28	1995	2007	12.27	0.615	1991	-3.084	-0.155
6	36	2576	2587	10.35	0.402	2573	-3.790	-0.147
7	43	3076	3082	5.794	0.188	3071	-4.745	-0.154
8	50	3577	3583	5.722	0.160	3576	-1.313	-0.037
9	57	4077	4078	1.356	0.033	4077	0.069	0.002
10	63	4502	4501	-1.189	-0.026	4506	3.538	0.079

Test data

Test name:	**Lincheck multipolynomial_EPA (non-1065) /ECE_32632555_CO2_S2_R1_20231127_1226**		
Bench:	Hubdat	Date:	11/27/2023
Serial number:	7422	Time / duration:	12:26:12 PM / 20m 08s
Operator:	Cahya Santika	Meas. duration [s]:	10
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Comments: * Max. allowed deviation at concentrations below 10% of the range

Lincheck

2.8.34.7

Test data

Test name:	**Lincheck multipolynomial_EPA (non-1065) /ECE_2781_NOx_S2_R1_20231127_1246**		
Bench:	Hubdat	Date:	11/27/2023
Serial number:	7422	Time / duration:	12:46:23 PM / 21m 19s
Operator:	Cahya Santika	Meas. duration [s]:	10
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

Analyzer

Tag:	CLD i60 lc	Cal gas [ppm]:	91.95
Serial number:	2781	Range limit [ppm]:	100
Manufacturer:	AVL Emission	Range:	1

Gas divider

GDU type:	GDU	Zero gas:	N2
Serial number:	5765	Gas type:	NOX
Calib. date:	3/4/2021		

Zero/span adjust

Zero pt. [ppm]:	0.002	Span pt. [ppm]:	91.96
Zero dev. [%FS]:	0.002	Span dev. [%FS]:	0.011
		Span factor:	1.716

Midspan check

Span gas [ppm]:	--	Deviation [%]:	--
Measured [ppm]:	--	Limit [%]:	--

Span gas

Name	NOx_1	Concentration	91.95	Connected	11/16/2023
Bottle No.	7	Unit	ppm	Expiration	4/20/2025

Test results

Test results	Actual polynomial	4. Order		Calculated polynomial	1. Order	
	Limit [%]	Dev. [ppm]	Dev. [%]		Dev. [ppm]	Dev. [%]
Deviation zero point	0.3	0.013	0.013		0.001	0.001
Deviation point	2.0	-0.191	-1.894		-0.118	-1.171
Deviation FS	1.0	-0.271	-0.271		-0.118	-0.118
Deviation end point	1.0	-0.053	-0.058		0.115	0.125
Test state			Passed			Passed
Coefficient A0	0.00000E+0		1.00000E+0			-6.96256E-6
Coefficient A1	9.86000E-1		1.60000E+1			9.96920E-1
Coefficient A2	1.60000E+1		9.60000E+1			0.00000E+0
Coefficient A3	9.70000E+1		7.30000E+1			0.00000E+0
Coefficient A4	7.20000E+1		0.00000E+0			0.00000E+0

Lincheck

2.8.34.7

Test data

Test name:	**Lincheck multipolynomial_EPA (non-1065) /ECE_2781_NOx_S2_R1_20231127_1246**		
Bench:	Hubdat	Date:	11/27/2023
Serial number:	7422	Time / duration:	12:46:23 PM / 21m 19s
Operator:	Cahya Santika	Meas. duration [s]:	10
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

Index	GD step	GD conc. [ppm]	Analyzer [ppm]	Dev. [ppm]	Dev. [%]	Calc. [ppm]	Dev. [ppm]	Dev. [%]
1	0	0.000	0.013	0.013	0.013	0.001	0.001	0.001
2	7	10.11	9.914	-0.191	-1.894	9.987	-0.118	-1.171
3	14	20.33	20.11	-0.220	-1.082	20.28	-0.049	-0.241
4	21	30.54	30.30	-0.235	-0.771	30.52	-0.018	-0.057
5	28	40.76	40.52	-0.241	-0.592	40.76	-0.003	-0.007
6	36	52.65	52.39	-0.254	-0.482	52.66	0.015	0.028
7	43	62.84	62.57	-0.271	-0.431	62.83	-0.019	-0.031
8	50	73.08	72.96	-0.118	-0.162	73.17	0.092	0.126
9	57	83.28	83.12	-0.159	-0.191	83.35	0.068	0.081
10	63	91.95	91.90	-0.053	-0.058	92.06	0.115	0.125

Test data

Test name:	**Lincheck multipolynomial_EPA (non-1065) /ECE_2781_NOx_S2_R1_20231127_1246**		
Bench:	Hubdat	Date:	11/27/2023
Serial number:	7422	Time / duration:	12:46:23 PM / 21m 19s
Operator:	Cahya Santika	Meas. duration [s]:	10
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Comments:

CO cross check report

2.8.101.2

Test data

Test name:	CO cross check_EPA (non-1065) /ECE_32632555_CO L_S2_R1_20231127_1124		
Bench:	Hubdat	Date:	11/27/2023
Serial number:	7422	Time / duration:	11:24:37 AM / 05m 54s
Operator:	Cahya Santika		
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

Analyzer

Tag:	CO2 L / CO L	Range:	1
SN:	32632555	Cal gas [ppm]:	225.7
Manufacturer:	AVL Emission	Range limit [ppm]:	300
Gas type:	CO		

Zero/span adjust

Zero [ppm]:	--	Span [ppm]:	--
Zero dev. [%FS]:	--	Span dev. [%FS]:	--

CO calibration gas

Name	CO_L_1	Concentration	225.7	Connected	10/16/2023
Bottle No.	14	Unit	ppm	Expiration	10/25/2025

CO2 calibration gas (for wet CO2 rejection ratio)

Name	CO2_L_2	Concentration	1.803	Connected	4/17/2018
Bottle No.	18	Unit	Vol%	Expiration	8/3/2023

CO2 calibration gas (for dry CO2 rejection ratio)

Name	CO2_L_2	Concentration	1.803	Connected	4/17/2018
Bottle No.	18	Unit	Vol%	Expiration	8/3/2023

Test results

Wet rejection ratio

ppmCO2 [ppm]	AR [ppm]	max. Limit [ppm]	Status
18030	-0.184	3.000	Passed

H2O rejection ratio

TWB [éC]	GP [hPa]	H2O [Vol%]	AR [ppm]	Z [ppm]	WRR	Min. Limit	Status
25.6	1360	2.36	-0.72	24086	-33667	1000	Passed

Dry CO2 rejection ratio

ppmCO2 [ppm]	AR [ppm]	CO2 rejection ratio	Min. Limit	Status
18030	0.511	35309	5000	Passed

CO cross check report

2.8.101.2

Test data

Test name:	**CO cross check_EPA (non-1065) /ECE_32632555_CO L_S2_R1_20231127_1124**		
Bench:	Hubdat	Date:	11/27/2023
Serial number:	7422	Time / duration:	11:24:37 AM / 05m 54s
Operator:	Cahya Santika		
Legislation:	EPA (non-1065) /ECE		
Engine:	AK parameters		

Test status: **Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Comment:

Analyzer response time check

2.8.1.2

Test data

Test name:	**Analyzer response time check_32632555_CO L_S2_R2_20231127_1139**		
Bench:	Hubdat	Date:	11/27/2023
Serial number:	7422	Time / duration:	11:39:35 AM / 03m 16s
		Operator:	Cahya Santika

Analyzer

Tag:	CO2 L / CO L	Span gas [ppm]:	4646
SN:	32632555	Range limit [ppm]:	5000
Manufacturer:	AVL Emission	Range:	2
		Sample rate [Hz]:	10

Pre-test zero/span adjust

Zero pt. [ppm]:	--	Span pt. [ppm]:	--
Zero dev. [%FS]:	--	Span dev. [%FS]:	--

Span gas

Name	CO_L_2	Concentration	4646	Connected	1/8/2017
Bottle No.	4	Unit	ppm	Expiration	1/8/2019

Test results

Rising time T10-T90 [s]:	1.41
Falling time T90-T10 [s]:	1.70

Comment:

Switching between zero and span gas takes place in the AVU and the length of the line between the AVU and the analyzer input is also measured.

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Unit check report

2.8.1.1

Test data

Test name:	**Unit check_32632555_CO L_S2_20231127_1122**		
Bench:	Hubdat	Date:	11/27/2023
Serial number:	7422	Time / duration:	11:22:18 AM / 01m 22s
Operator:	Cahya Santika		

Analyzer

Analyzer	SN	Manufacturer	Channel	Range	End value [ppm]	Conc. [ppm]
IRD i60 CO2 COL	32632555	AVL Emission	CO L	1	300	0.936

Comment:

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Unit check report

2.8.1.1

Test data

Test name:	**Unit check_32632555_CO2_S2_20231018_1519**		
Bench:	Hubdat	Date:	10/18/2023
Serial number:	7422	Time / duration:	3:19:56 PM / 01m 20s
Operator:	Cahya Santika		

Analyzer

Analyzer	SN	Manufacturer	Channel	Range	End value [ppm]	Conc. [ppm]
IRD i60 CO2 COL	32632555	AVL Emission	CO2	2	30000	16211

Comment:

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Unit check report

2.8.1.1

Test data

Test name:	**Unit check_2748_NO_S1_20231205_1045**		
Bench:	Hubdat	Date:	12/5/2023
Serial number:	7422	Time / duration:	10:45:00 AM / 01m 19s
Operator:	Cahya Santika		

Analyzer

Analyzer	SN	Manufacturer	Channel	Range	End value [ppm]	Conc. [ppm]
CLD i60 H	2748	AVL Emission	NO	1	100	2.262

Comment:

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Drift check

2.8.102.4

Test data

Test name:	**Drift check_7422_20231025_0433**		
Bench:	Hubdat	Date:	10/25/2023
Serial number:	7422	Time / duration:	4:33:21 AM / 8h 10m 25s
Drift limit [%FS]:	2.00	Operator:	Cahya Santika

Analyzer

Tag:	FID i60 hh	Manufacturer:	AVL Emission
SN:	3241		

Pre-test zero/span adjust

Zero pt. [ppm]:	0.020	Span pt. [ppm]:	93.51
Zero dev. [%FS]:	0.020	Span dev. [%FS]:	0.000

Test results

Channel:	**THC**	Stream:	1
Pre zero [ppm]:	0.077	Span gas [ppm]:	93.51
Pre span [ppm]:	93.61	Range limit [ppm]:	100

Iterations	Post zero	Post span	Dev. zero [ppm]	Dev. zero [%FS]	Dev. span [ppm]	Dev. span [%FS]	Result
1	-0.000	93.57	-0.077	-0.077	-0.039	-0.039	**Passed**
2	-0.004	93.60	-0.081	-0.081	-0.008	-0.008	**Passed**
3	-0.011	93.56	-0.088	-0.088	-0.052	-0.052	**Passed**
4	-0.023	93.01	-0.100	-0.100	-0.600	-0.600	**Passed**
5	-0.034	92.64	-0.111	-0.111	-0.969	-0.969	**Passed**
6	-0.045	92.11	-0.122	-0.122	-1.501	-1.501	**Passed**
7	-0.050	92.48	-0.127	-0.127	-1.128	-1.128	**Passed**
8	-0.062	92.29	-0.139	-0.139	-1.321	-1.321	**Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Drift check

2.8.102.4

Test data

Test name:	**Drift check_7422_20231025_0433**		
Bench:	Hubdat	Date:	10/25/2023
Serial number:	7422	Time / duration:	4:33:21 AM / 8h 10m 25s
Drift limit [%FS]:	2.00	Operator:	Cahya Santika

Analyzer

Tag:	CO2 H / CO H	Manufacturer:	AVL Emission
SN:	32645795		

Pre-test zero/span adjust

Zero pt. [ppm]:	-4.430	Span pt. [ppm]:	55446
Zero dev. [%FS]:	-0.010	Span dev. [%FS]:	-0.010

Test results

Channel:	**CO2**	Stream:	1
Pre zero [ppm]:	-8.605	Span gas [ppm]:	55450
Pre span [ppm]:	55482	Range limit [ppm]:	60000

Iterations	Post zero	Post span	Dev. zero [ppm]	Dev. zero [%FS]	Dev. span [ppm]	Dev. span [%FS]	Result
1	-4.624	55478	3.981	0.007	-3.565	-0.006	**Passed**
2	-4.019	55481	4.586	0.008	-0.562	-0.001	**Passed**
3	-4.488	55482	4.117	0.007	-0.075	-0.000	**Passed**
4	-4.903	55445	3.702	0.006	-36.98	-0.062	**Passed**
5	-5.483	55420	3.122	0.005	-61.79	-0.103	**Passed**
6	-7.148	55305	1.457	0.002	-176.7	-0.295	**Passed**
7	-9.676	55100	-1.071	-0.002	-381.7	-0.636	**Passed**
8	-10.62	55077	-2.017	-0.003	-405.1	-0.675	**Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Drift check

2.8.102.4

Test data

Test name:	**Drift check_7422_20231025_0433**		
Bench:	Hubdat	Date:	10/25/2023
Serial number:	7422	Time / duration:	4:33:21 AM / 8h 10m 25s
Drift limit [%FS]:	2.00	Operator:	Cahya Santika

Analyzer

Tag:	FID i60 lc	Manufacturer:	AVL Emission
SN:	3248		

Pre-test zero/span adjust

Zero pt. [ppm]:	-0.010	Span pt. [ppm]:	93.52
Zero dev. [%FS]:	-0.010	Span dev. [%FS]:	0.010

Test results

Channel:	**THC**	Stream:	2
Pre zero [ppm]:	-0.021	Span gas [ppm]:	93.51
Pre span [ppm]:	93.27	Range limit [ppm]:	100

Iterations	Post zero	Post span	Dev. zero [ppm]	Dev. zero [%FS]	Dev. span [ppm]	Dev. span [%FS]	Result
1	-0.014	93.49	0.007	0.007	0.213	0.213	**Passed**
2	-0.028	93.51	-0.007	-0.007	0.241	0.241	**Passed**
3	-0.039	93.53	-0.018	-0.018	0.255	0.255	**Passed**
4	-0.073	93.21	-0.052	-0.052	-0.066	-0.066	**Passed**
5	-0.090	93.11	-0.069	-0.069	-0.159	-0.159	**Passed**
6	-0.118	92.91	-0.097	-0.097	-0.365	-0.365	**Passed**
7	-0.129	92.73	-0.108	-0.108	-0.542	-0.542	**Passed**
8	-0.140	92.81	-0.119	-0.119	-0.460	-0.460	**Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Drift check

2.8.102.4

Test data

Test name:	**Drift check_7422_20231025_0433**		
Bench:	Hubdat	Date:	10/25/2023
Serial number:	7422	Time / duration:	4:33:21 AM / 8h 10m 25s
Drift limit [%FS]:	2.00	Operator:	Cahya Santika

Analyzer

Tag:	CO2 L / CO L	Manufacturer:	AVL Emission
SN:	32632555		

Pre-test zero/span adjust

Zero pt. [ppm]:	-0.120	Span pt. [ppm]:	4502
Zero dev. [%FS]:	-0.000	Span dev. [%FS]:	0.000

Test results

Channel:	**CO2**	Stream:	2
Pre zero [ppm]:	-0.909	Span gas [ppm]:	4502
Pre span [ppm]:	4504	Range limit [ppm]:	5000

Iterations	Post zero	Post span	Dev. zero [ppm]	Dev. zero [%FS]	Dev. span [ppm]	Dev. span [%FS]	Result
1	-0.867	4502	0.042	0.001	-1.119	-0.022	**Passed**
2	-0.836	4502	0.073	0.001	-1.041	-0.021	**Passed**
3	-0.571	4503	0.338	0.007	-0.976	-0.020	**Passed**
4	-1.116	4499	-0.207	-0.004	-4.443	-0.089	**Passed**
5	-1.162	4497	-0.253	-0.005	-6.396	-0.128	**Passed**
6	-1.371	4489	-0.462	-0.009	-14.98	-0.300	**Passed**
7	-1.598	4470	-0.689	-0.014	-33.13	-0.663	**Passed**
8	-1.601	4465	-0.692	-0.014	-38.23	-0.765	**Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Drift check

2.8.102.4

Test data

Test name:	**Drift check_7422_20231026_1953**		
Bench:	Hubdat	Date:	10/26/2023
Serial number:	7422	Time / duration:	7:53:10 PM / 8h 10m 11s
Drift limit [%FS]:	2.00	Operator:	Cahya Santika

Analyzer

Tag:	FID i60 hh	Manufacturer:	AVL Emission
SN:	3241		

Pre-test zero/span adjust

Zero pt. [ppm]:	0.020	Span pt. [ppm]:	93.53
Zero dev. [%FS]:	0.020	Span dev. [%FS]:	0.020

Test results

Channel:	**THC**	Stream:	1
Pre zero [ppm]:	0.099	Span gas [ppm]:	93.51
Pre span [ppm]:	93.58	Range limit [ppm]:	100

Iterations	Post zero	Post span	Dev. zero [ppm]	Dev. zero [%FS]	Dev. span [ppm]	Dev. span [%FS]	Result
1	0.025	94.09	-0.074	-0.074	0.504	0.504	**Passed**
2	0.035	94.69	-0.064	-0.064	1.108	1.108	**Passed**
3	0.029	94.66	-0.070	-0.070	1.078	1.078	**Passed**
4	0.029	94.83	-0.070	-0.070	1.246	1.246	**Passed**
5	0.026	94.97	-0.073	-0.073	1.387	1.387	**Passed**
6	0.022	95.09	-0.077	-0.077	1.505	1.505	**Passed**
7	0.022	95.20	-0.077	-0.077	1.616	1.616	**Passed**
8	0.023	95.34	-0.076	-0.076	1.753	1.753	**Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Drift check

2.8.102.4

Test data

Test name:	**Drift check_7422_20231026_1953**		
Bench:	Hubdat	Date:	10/26/2023
Serial number:	7422	Time / duration:	7:53:10 PM / 8h 10m 11s
Drift limit [%FS]:	2.00	Operator:	Cahya Santika

Analyzer

Tag:	CLD i60 hh	Manufacturer:	AVL Emission
SN:	2748		

Pre-test zero/span adjust

Zero pt. [ppm]:	-0.000	Span pt. [ppm]:	86.86
Zero dev. [%FS]:	-0.000	Span dev. [%FS]:	-0.140

Test results

Channel:	**NO**	Stream:	1
Pre zero [ppm]:	0.028	Span gas [ppm]:	87.00
Pre span [ppm]:	87.15	Range limit [ppm]:	100

Iterations	Post zero	Post span	Dev. zero [ppm]	Dev. zero [%FS]	Dev. span [ppm]	Dev. span [%FS]	Result
1	0.041	86.71	0.013	0.013	-0.436	-0.436	**Passed**
2	0.012	86.29	-0.016	-0.016	-0.856	-0.856	**Passed**
3	0.031	86.48	0.003	0.003	-0.674	-0.674	**Passed**
4	0.061	86.57	0.033	0.033	-0.577	-0.577	**Passed**
5	0.064	86.55	0.036	0.036	-0.599	-0.599	**Passed**
6	0.075	86.50	0.047	0.047	-0.647	-0.647	**Passed**
7	0.063	86.52	0.035	0.035	-0.625	-0.625	**Passed**
8	0.072	86.39	0.044	0.044	-0.763	-0.763	**Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Drift check

2.8.102.4

Test data

Test name:	**Drift check_7422_20231026_1953**		
Bench:	Hubdat	Date:	10/26/2023
Serial number:	7422	Time / duration:	7:53:10 PM / 8h 10m 11s
Drift limit [%FS]:	2.00	Operator:	Cahya Santika

Analyzer

Tag:	CO2 H / CO H	Manufacturer:	AVL Emission
SN:	32645795		

Pre-test zero/span adjust

Zero pt. [ppm]:	-3.200	Span pt. [ppm]:	55509
Zero dev. [%FS]:	-0.010	Span dev. [%FS]:	0.100

Test results

Channel:	**CO2**	Stream:	1
Pre zero [ppm]:	-0.573	Span gas [ppm]:	55450
Pre span [ppm]:	55627	Range limit [ppm]:	60000

Iterations	Post zero	Post span	Dev. zero [ppm]	Dev. zero [%FS]	Dev. span [ppm]	Dev. span [%FS]	Result
1	13.00	55723	13.57	0.023	96.53	0.161	**Passed**
2	18.27	55826	18.84	0.031	199.6	0.333	**Passed**
3	18.46	55918	19.03	0.032	291.6	0.486	**Passed**
4	20.64	55995	21.21	0.035	368.5	0.614	**Passed**
5	22.40	56047	22.97	0.038	420.7	0.701	**Passed**
6	24.25	56090	24.82	0.041	463.6	0.773	**Passed**
7	24.11	56122	24.68	0.041	495.6	0.826	**Passed**
8	24.06	56147	24.63	0.041	520.5	0.867	**Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Drift check

2.8.102.4

Test data

Test name:	**Drift check_7422_20231026_1953**		
Bench:	Hubdat	Date:	10/26/2023
Serial number:	7422	Time / duration:	7:53:10 PM / 8h 10m 11s
Drift limit [%FS]:	2.00	Operator:	Cahya Santika

Analyzer

Tag:	CO2 H / CO H	Manufacturer:	AVL Emission
SN:	32645795		

Pre-test zero/span adjust

Zero pt. [ppm]:	-2.370	Span pt. [ppm]:	18077
Zero dev. [%FS]:	-0.010	Span dev. [%FS]:	-0.020

Test results

Channel:	**CO H**	Stream:	1
Pre zero [ppm]:	-3.247	Span gas [ppm]:	18080
Pre span [ppm]:	18077	Range limit [ppm]:	20000

Iterations	Post zero	Post span	Dev. zero [ppm]	Dev. zero [%FS]	Dev. span [ppm]	Dev. span [%FS]	Result
1	-2.635	18069	0.612	0.003	-7.907	-0.040	**Passed**
2	-2.170	18068	1.077	0.005	-8.961	-0.045	**Passed**
3	-3.798	18066	-0.551	-0.003	-11.43	-0.057	**Passed**
4	-4.651	18065	-1.404	-0.007	-12.19	-0.061	**Passed**
5	-4.512	18062	-1.265	-0.006	-14.82	-0.074	**Passed**
6	-3.352	18061	-0.105	-0.001	-15.73	-0.079	**Passed**
7	-6.237	18060	-2.990	-0.015	-16.64	-0.083	**Passed**
8	-6.484	18060	-3.237	-0.016	-16.69	-0.083	**Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Drift check

2.8.102.4

Test data

Test name:	**Drift check_7422_20231026_1953**		
Bench:	Hubdat	Date:	10/26/2023
Serial number:	7422	Time / duration:	7:53:10 PM / 8h 10m 11s
Drift limit [%FS]:	2.00	Operator:	Cahya Santika

Analyzer

Tag:	FID i60 lc	Manufacturer:	AVL Emission
SN:	3248		

Pre-test zero/span adjust

Zero pt. [ppm]:	-0.000	Span pt. [ppm]:	93.49
Zero dev. [%FS]:	-0.000	Span dev. [%FS]:	-0.020

Test results

Channel:	**THC**	Stream:	2
Pre zero [ppm]:	-0.022	Span gas [ppm]:	93.51
Pre span [ppm]:	93.20	Range limit [ppm]:	100

Iterations	Post zero	Post span	Dev. zero [ppm]	Dev. zero [%FS]	Dev. span [ppm]	Dev. span [%FS]	Result
1	0.035	93.79	0.057	0.057	0.592	0.592	**Passed**
2	0.045	93.86	0.067	0.067	0.657	0.657	**Passed**
3	0.053	93.99	0.075	0.075	0.791	0.791	**Passed**
4	0.052	93.89	0.074	0.074	0.691	0.691	**Passed**
5	0.047	93.91	0.069	0.069	0.713	0.713	**Passed**
6	0.045	93.97	0.067	0.067	0.771	0.771	**Passed**
7	0.041	93.91	0.063	0.063	0.710	0.710	**Passed**
8	0.045	94.02	0.067	0.067	0.818	0.818	**Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Drift check

2.8.102.4

Test data

Test name:	**Drift check_7422_20231026_1953**		
Bench:	Hubdat	Date:	10/26/2023
Serial number:	7422	Time / duration:	7:53:10 PM / 8h 10m 11s
Drift limit [%FS]:	2.00	Operator:	Cahya Santika

Analyzer

Tag:	CLD i60 lc	Manufacturer:	AVL Emission
SN:	2781		

Pre-test zero/span adjust

Zero pt. [ppm]:	-0.000	Span pt. [ppm]:	87.08
Zero dev. [%FS]:	-0.000	Span dev. [%FS]:	0.010

Test results

Channel:	**NO**	Stream:	2
Pre zero [ppm]:	0.013	Span gas [ppm]:	87.00
Pre span [ppm]:	87.09	Range limit [ppm]:	1000

Iterations	Post zero	Post span	Dev. zero [ppm]	Dev. zero [%FS]	Dev. span [ppm]	Dev. span [%FS]	Result
1	0.007	86.74	-0.006	-0.001	-0.344	-0.034	**Passed**
2	0.006	86.50	-0.007	-0.001	-0.583	-0.058	**Passed**
3	0.006	86.48	-0.007	-0.001	-0.603	-0.060	**Passed**
4	0.007	86.32	-0.006	-0.001	-0.762	-0.076	**Passed**
5	0.005	86.18	-0.008	-0.001	-0.902	-0.090	**Passed**
6	0.008	86.13	-0.005	-0.000	-0.957	-0.096	**Passed**
7	0.008	86.01	-0.005	-0.000	-1.080	-0.108	**Passed**
8	0.006	85.92	-0.007	-0.001	-1.166	-0.117	**Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Drift check

2.8.102.4

Test data

Test name:	**Drift check_7422_20231026_1953**		
Bench:	Hubdat	Date:	10/26/2023
Serial number:	7422	Time / duration:	7:53:10 PM / 8h 10m 11s
Drift limit [%FS]:	2.00	Operator:	Cahya Santika

Analyzer

Tag:	CLD i60 hh	Manufacturer:	AVL Emission
SN:	2748		

Pre-test zero/span adjust

Zero pt. [ppm]:	0.000	Span pt. [ppm]:	86.86
Zero dev. [%FS]:	0.000	Span dev. [%FS]:	-0.140

Test results

Channel:	**NO**	Stream:	1
Pre zero [ppm]:	0.028	Span gas [ppm]:	87.00
Pre span [ppm]:	87.15	Range limit [ppm]:	100

Iterations	Post zero	Post span	Dev. zero [ppm]	Dev. zero [%FS]	Dev. span [ppm]	Dev. span [%FS]	Result
1	0.041	86.71	0.013	0.013	-0.436	-0.436	**Passed**
2	0.012	86.29	-0.016	-0.016	-0.856	-0.856	**Passed**
3	0.031	86.48	0.003	0.003	-0.674	-0.674	**Passed**
4	0.061	86.57	0.033	0.033	-0.577	-0.577	**Passed**
5	0.064	86.55	0.036	0.036	-0.599	-0.599	**Passed**
6	0.075	86.50	0.047	0.047	-0.647	-0.647	**Passed**
7	0.063	86.52	0.035	0.035	-0.625	-0.625	**Passed**
8	0.072	86.39	0.044	0.044	-0.763	-0.763	**Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Drift check

2.8.102.4

Test data

Test name:	**Drift check_7422_20231026_1953**		
Bench:	Hubdat	Date:	10/26/2023
Serial number:	7422	Time / duration:	7:53:10 PM / 8h 10m 11s
Drift limit [%FS]:	2.00	Operator:	Cahya Santika

Analyzer

Tag:	CLD i60 lc	Manufacturer:	AVL Emission
SN:	2781		

Pre-test zero/span adjust

Zero pt. [ppm]:	0.000	Span pt. [ppm]:	87.08
Zero dev. [%FS]:	0.000	Span dev. [%FS]:	0.010

Test results

Channel:	**NO**	Stream:	2
Pre zero [ppm]:	0.013	Span gas [ppm]:	87.00
Pre span [ppm]:	87.09	Range limit [ppm]:	1000

Iterations	Post zero	Post span	Dev. zero [ppm]	Dev. zero [%FS]	Dev. span [ppm]	Dev. span [%FS]	Result
1	0.007	86.74	-0.006	-0.001	-0.344	-0.034	**Passed**
2	0.006	86.50	-0.007	-0.001	-0.583	-0.058	**Passed**
3	0.006	86.48	-0.007	-0.001	-0.603	-0.060	**Passed**
4	0.007	86.32	-0.006	-0.001	-0.762	-0.076	**Passed**
5	0.005	86.18	-0.008	-0.001	-0.902	-0.090	**Passed**
6	0.008	86.13	-0.005	-0.000	-0.957	-0.096	**Passed**
7	0.008	86.01	-0.005	-0.000	-1.080	-0.108	**Passed**
8	0.006	85.92	-0.007	-0.001	-1.166	-0.117	**Passed**

A test result that is marked as "passed" implies that the system has been properly set up and operated and, especially, that all legal requirements for the test and operating gases have been met. These include, in particular, the accuracy, concentrations and validity of the gas certificates. These properties of the span and operating gases are not checked by the automated check functions. The responsibility for the use of proper gases lies with the operator of the equipment.

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Drift check

2.8.102.4

Test data

Test name:	**Drift check_7422_20231107_1633**		
Bench:	Hubdat	Date:	11/7/2023
Serial number:	7422	Time / duration:	4:33:59 PM / 8h 10m 16s
Drift limit [%FS]:	2.00	Operator:	Cahya Santika

Analyzer

Tag:	FID i60 hh	Manufacturer:	AVL Emission
SN:	3241		

Pre-test zero/span adjust

Zero pt. [ppm]:	0.000	Span pt. [ppm]:	93.52
Zero dev. [%FS]:	0.000	Span dev. [%FS]:	0.010

Test results

Channel:	**THC**	Stream:	1
Pre zero [ppm]:	-0.013	Span gas [ppm]:	93.51
Pre span [ppm]:	93.59	Range limit [ppm]:	100

Iterations	Post zero	Post span	Dev. zero [ppm]	Dev. zero [%FS]	Dev. span [ppm]	Dev. span [%FS]	Result
1	-0.091	93.90	-0.078	-0.078	0.308	0.308	**Passed**
2	-0.080	94.35	-0.067	-0.067	0.757	0.757	**Passed**
3	-0.072	94.74	-0.059	-0.059	1.151	1.151	**Passed**
4	-0.067	94.95	-0.054	-0.054	1.352	1.352	**Passed**
5	-0.062	95.16	-0.049	-0.049	1.562	1.562	**Passed**
6	-0.075	94.91	-0.062	-0.062	1.315	1.315	**Passed**
7	-0.082	94.76	-0.069	-0.069	1.170	1.170	**Passed**
8	-0.087	94.72	-0.074	-0.074	1.130	1.130	**Passed**

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Drift check

2.8.102.4

Test data

Test name:	**Drift check_7422_20231107_1633**		
Bench:	Hubdat	Date:	11/7/2023
Serial number:	7422	Time / duration:	4:33:59 PM / 8h 10m 16s
Drift limit [%FS]:	2.00	Operator:	Cahya Santika

Analyzer

Tag:	CO2 H / CO H	Manufacturer:	AVL Emission
SN:	32645795		

Pre-test zero/span adjust

Zero pt. [ppm]:	-1.380	Span pt. [ppm]:	55453
Zero dev. [%FS]:	-0.000	Span dev. [%FS]:	0.000

Test results

Channel:	**CO2**	Stream:	1
Pre zero [ppm]:	0.000	Span gas [ppm]:	55450
Pre span [ppm]:	55486	Range limit [ppm]:	60000

Iterations	Post zero	Post span	Dev. zero [ppm]	Dev. zero [%FS]	Dev. span [ppm]	Dev. span [%FS]	Result
1	0.000	55487	0.000	0.000	1.009	0.002	**Passed**
2	0.000	55528	0.000	0.000	41.48	0.069	**Passed**
3	0.000	55584	0.000	0.000	98.09	0.163	**Passed**
4	0.000	55642	0.000	0.000	156.1	0.260	**Passed**
5	0.000	55697	0.000	0.000	210.4	0.351	**Passed**
6	0.000	55738	0.000	0.000	252.3	0.421	**Passed**
7	0.000	55773	0.000	0.000	286.6	0.478	**Passed**
8	0.000	55798	0.000	0.000	312.2	0.520	**Passed**

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Drift check

2.8.102.4

Test data

Test name:	**Drift check_7422_20231026_1953**		
Bench:	Hubdat	Date:	10/26/2023
Serial number:	7422	Time / duration:	7:53:10 PM / 8h 10m 11s
Drift limit [%FS]:	2.00	Operator:	Cahya Santika

Analyzer

Tag:	CLD i60 lc	Manufacturer:	AVL Emission
SN:	2781		

Pre-test zero/span adjust

Zero pt. [ppm]:	0.000	Span pt. [ppm]:	87.08
Zero dev. [%FS]:	0.000	Span dev. [%FS]:	0.010

Test results

Channel:	**NO**	Stream:	2
Pre zero [ppm]:	0.013	Span gas [ppm]:	87.00
Pre span [ppm]:	87.09	Range limit [ppm]:	1000

Iterations	Post zero	Post span	Dev. zero [ppm]	Dev. zero [%FS]	Dev. span [ppm]	Dev. span [%FS]	Result
1	0.007	86.74	-0.006	-0.001	-0.344	-0.034	**Passed**
2	0.006	86.50	-0.007	-0.001	-0.583	-0.058	**Passed**
3	0.006	86.48	-0.007	-0.001	-0.603	-0.060	**Passed**
4	0.007	86.32	-0.006	-0.001	-0.762	-0.076	**Passed**
5	0.005	86.18	-0.008	-0.001	-0.902	-0.090	**Passed**
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Preventive Maintenance Protocol
CVS i60



Customer:	HUBDAT		
Testbed:	R40		
Device Type:	CVS i60 SII		
Device SN:	11184		
Location:	Cibitung, Indonesia		
Date:	11-Sep-23	to	22-Sep-23

AVL Certification No. *ID0012716-202309-LD_EMISS-010-23-01_CVS i60*

Issue Date: September 22, 2023

Customer Name: HUBDAT

Location: Cibitung, Indonesia

Certificate of Preventive Maintenance

This is to certify that AVL SEA & AUSTRALIA CO., LTD have completed the preventive maintenance of following devices.

Device Name	Device Serial Number
CVS i60 SII	**11184**

During this preventive maintenance, The system verification/quality check have been performed, The necessary sensors have been checked/calibrated according to maintenance instruction from manufacturer. For further detail, please refers to maintenance protocol and system verification/quality check results.

Service Engineer: Cahya Santika

QC Engineer: Chaiyasit Jitsongserm

Preventive Maintenance Protocol CVS i60

Testbed	R40
AVL Order No.	IDID4175S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	CVS i60 SII
Device Serial No.	11184

Maintenance Task

Component	Description	Execution				Status
		check	clean	adjust	replace	
Main Cabinet						
bench fans	cleaning		x			done
tube and connector	visual inspection	x				done
heating control	function check	x				done
compressed air unit	spare part	x				done
Power Box						
fuse	visual inspection	x				done
electronic board	visual inspection	x				done
CAN input/output unit (CIO)						
electronic board	visual inspection	x				done
Bag Valve Unit (BVU)						
electronic board	visual inspection	x				done
valve	function check	x				done
Power Distribution Unit (PDU)						
DC voltage output	function check	x				done
Venturi Flap Control (VFC)						
control valve	visual inspection	x				done
interface/control	function check	x				done
Pump Unit (PU)						
sample gas filter	filter case		x			done
	o-ring				x	done
	filter insert				**x**	done
sample gas pump	maintenance kit				x	done
	function check	x				done
evacuation gas pump	maintenance kit				x	done
	function check	x				done
Gas Connection Unit (GCU)						
electronic board	visual inspection	x				done
valve	function check	x				done

Mr. Cahya Santika

Service Engineer: Cahya Santika

Preventive Maintenance Protocol CVS i60

Testbed	R40
AVL Order No.	IDID4175S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	CVS i60 SII
Device Serial No.	11184

Maintenance Task

Component	Description	Execution				Status
		check	clean	adjust	replace	
BAG Cabinet						
bench fans	cleaning					n.a.
tube and connector	visual inspection	x				done
sample bag	visual inspection	x				done
heating control	function check					n.a.
Blower						
blower housing	cleaning	x				done
blower housing filter	spare part				x	done
control cabinet filter	spare part				x	done
manual lubrication	lubrication grease					n.a.
automate lubrication	regreasing device		**x**			done
	cartridge regreasing				x	done
	battery pack				x	done
Booster						
booster housing	cleaning					n.a.
control cabinet filter	spare part					n.a.
Dilution Air Filter						
coarse filter	inspection	x				done
charcoal cartridge	inspection	x				done
combined coarse and active charcoal filter	inspection	x				done
H14-HEPA filter	inspection	x				done
tailpipe press. sensor	inspection	x				done
Heat Exchanger (GWK)						
fan filter	cleaning / replace					n.a.
inlet water filter	cleaning / replace					n.a.
outlet water filter	cleaning / replace					n.a.
Sensor Calibration Check						
temperature sensor	calibration check			x		done
pressure sensor	calibration check			x		done
MSR Unit						
fan filter	spare part				x	done
battery	spare part	x				done

Service Engineer: Cahya Santika

Preventive Maintenance Protocol CVS i60

Testbed	R40
AVL Order No.	IDID4175S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	CVS i60 SII
Device Serial No.	11184

Temperature Check

Content	Measured Value	Description	Status
temp. nozzle	29.9 °C	CVS standby, testbed conditions	ok
temp. after air filter (A17-BT2)	40.9 °C	CVS standby, set point : 40°C	ok
temp. tunnel inlet (A17-BT1)	47.1 °C	CVS standby, set point : 47°C	ok
temp. heater cabinet top		set point : 35°C ± 5°C	
temp. heater cabinet bottom		set point : 35°C ± 5°C	
temp. heater bag cabinet 1		set point : 35°C ± 5°C	
temp. heater bag cabinet 2		set point : 35°C ± 5°C	
temp. tunnel heater 1/1		set point : 55°C ± 5°C	
temp. tunnel heater 1/2		set point : 55°C ± 5°C	
temp. tunnel heater 1/3		set point : 55°C ± 5°C	
temp. tunnel heater 1/4		set point : 55°C ± 5°C	
temp. tunnel heater 2/1		set point : 55°C ± 5°C	
temp. tunnel heater 2/2		set point : 55°C ± 5°C	
temp. tunnel heater 2/3		set point : 55°C ± 5°C	
temp. tunnel heater 2/4		set point : 55°C ± 5°C	

Pressure and Humidity Check

Content	Measured Value	Description	Status
pressure absolute	1006.2 hPa	between 900 - 1100 hPa	ok
pressure difference	.1 hPa	between -10 hPa and 200 hPa	ok
pressure dilution air filter	.2 hPa	between -12.5 hPa and 12.5 hPa	ok
pressure diff. exhaust	-.2 hPa	between -12.5 hPa and 12.5 hPa	ok
humidity	58.9 %	between 0 - 90 %	ok

Service Engineer: Cahya Santika

Preventive Maintenance Protocol CVS i60

Testbed	R40
AVL Order No.	IDID4175S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	CVS i60 SII
Device Serial No.	11184

Flow Check MFC1

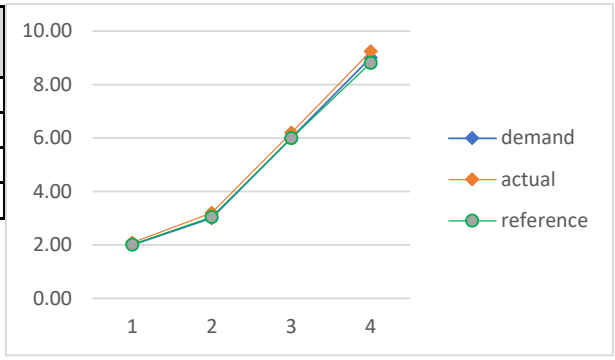
Demand (l/min)	Actual (l/min)	Reference (l/min)	Deviation (% RS)	Status
2.00	2.08	2.01	-3.37	passed
3.00	3.19	3.04	-4.70	passed
6.00	6.19	5.99	-3.23	passed
9.00	9.24	8.81	-4.65	passed

Limit : ± 5.0 % Reading Scale

Polynomial

A0 = A2 =

A1 = A3 =



Flow Check MFM2

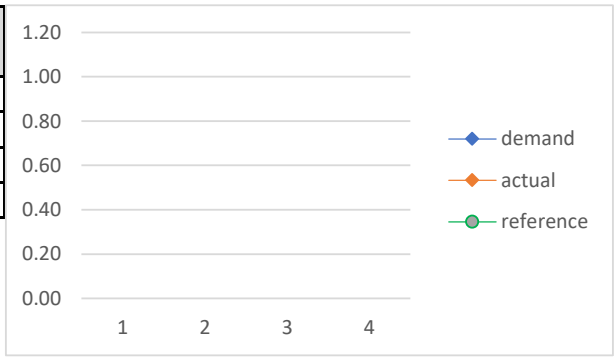
Demand (l/min)	Actual (l/min)	Reference (l/min)	Deviation (% RS)	Status
			#DIV/0!	#DIV/0!
			#DIV/0!	#DIV/0!
			#DIV/0!	#DIV/0!
			#DIV/0!	#DIV/0!

Limit : ± 5.0 % Reading Scale

Polynomial

A0 = A2 =

A1 = A3 =



Flow Check MFM3

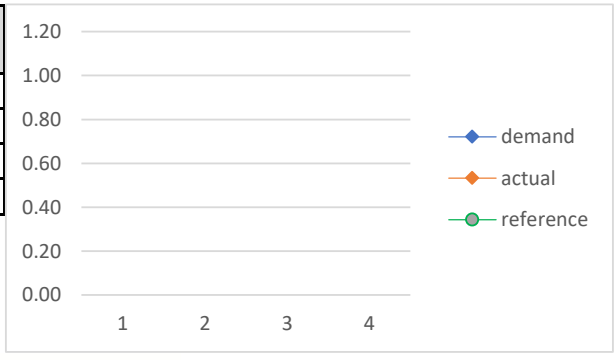
Demand (l/min)	Actual (l/min)	Reference (l/min)	Deviation (% RS)	Status
			#DIV/0!	#DIV/0!
			#DIV/0!	#DIV/0!
			#DIV/0!	#DIV/0!
			#DIV/0!	#DIV/0!

Limit : ± 5.0 % Reading Scale

Polynomial

A0 = A2 =

A1 = A3 =



Calibration polynomials



Service Engineer: Cahya Santika

Preventive Maintenance Protocol CVS i60

Testbed	R40
AVL Order No.	IDID4175S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	CVS i60 SII
Device Serial No.	11184

Blower speed and Differential pressure

No.	CVS flow m^3/min	Blower Speed RPM	Differential Pressure hPa
1	1	6450	120.1
2	2	6475	120.1
3	3	6385	120.0
4	4	6365	120.0
5	5	6335	120.0
6	6	6315	120.2
7	7	6300	120.1
8	8	6295	119.9
9	9	6295	120.0
10	10	6295	120.1
11	11	6315	120.0
12	12	6375	119.9
13	13	6395	120.1
14			
15			

Criteria : maintain differential pressure at approximate 120 hpa

Mr. Cahya Santika

Service Engineer: Cahya Santika

Preventive Maintenance Protocol CVS i60

Testbed	R40
AVL Order No.	IDID4175S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	CVS i60 SII
Device Serial No.	11184

Standard Conditions

Temperature	20.0 °C
Pressure	1006.1 hPa

Standby Setting Device

pump	☐ unchange ☐ off ☐ on ☑ like blower
blower	☑ unchange ☐ off ☐ on

Standby Setting Procedure

affected bags	☑ all ☐ used bags
bag leak check after standby	☑ never ☐ always ☐ pause->standby ☐ not applicable
line leak check after standby	☑ never ☐ always ☐ pause->standby ☐ not applicable
bag purge after standby	☑ never ☐ always ☐ pause->standby ☐ not applicable
bag sensor adjust after standby	☑ never ☐ always ☐ pause->standby ☐ not applicable

Pause Procedure Setting

relax bags	☐ no ☐ yes ☑ not applicable

Operating Function

blower ON/OFF	☑ ok	☐ not ok	☐ not applicable
standby	☑ ok	☐ not ok	☐ not applicable
pause	☑ ok	☐ not ok	☐ not applicable
purge bag	☑ ok	☐ not ok	☐ not applicable
evacuate bag	☑ ok	☐ not ok	☐ not applicable
fill bag	☑ ok	☐ not ok	☐ not applicable

Mr. Cahya Santika

Service Engineer: Cahya Santika

Preventive Maintenance Protocol CVS i60

Testbed	R40
AVL Order No.	IDID4175S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device Type	CVS i60 SII
Device Serial No.	11184

Component	Total (h)	Service Interval (h)	Last Maintenance (h)	Next Maintenance (h)
CVS	4420	10000	4420	14420
Blower	753	5000	753	5753
Heat Exchanger	0	10000	0	10000
Fill Pump	1349	8000	1349	9349
Evacuation Pump	32	8000	32	8032
Purge Pump	19	8000	19	8019
Air Heater Diesel	546	100000	546	100546

Mr. Cahya Santika

Service Engineer: Cahya Santika

Extended Line Leak Check

2.8.5.12

Test data

Test name:	**Leak check line_EPA (non-1065) /ECE_11184_20231127_1039**		
CVS:	Hubdat	Date:	11/27/2023
Serial number:	11184	Time / duration:	10:39:57 AM / 02m 07s
Operator:	Cahya Santika		
Legislation:	EPA (non-1065) /ECE		

Test results

Sensor	+A10-A0-BP1	+A10-A0-BP2	+A7-BP2
Initial pressure [hPa]	-846.5	-846.9	-981.5
Final pressure [hPa]	-845.8	-845.8	-980.7
Leak flow [hPa/min]	1.40	2.20	1.40
Result	OK	OK	OK

Stabilization time [s]:	30.0
Measuring time [s]:	30.0
Max. leak rate [hPa/min]:	20.0
Total result:	**Passed**

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CVS calibration with LFE

2.8.0.7

Test data

Test name:	**LFE calibration_EPA (non-1065) /ECE_11184_Venturi4_S10_20231011_1741**		
CVS	Hubdat	Date:	10/11/2023
Serial number:	11184	Time / duration:	5:41:00 PM / 24m 39s
Operator:	Cahya Santika		
Legislation:	EPA (non-1065) /ECE		

Calibration device

Tag:	LMF	Manufacturer:	Tetratec
Ser.No. LMF:	PH019	Calibration date:	
Ser.No. LFE:	LFE0-50MC02-04FS SN: 533L265 CAL039157	Calib. date LFE:	
Standard temp. [éC]:	0	Standard press. [hPa]:	1013.25

Venturi data

Serial number nozzle:	4
Flow rate [m3/min]:	6

Evaluation

Average Kv factor:	0.968917		
Standard deviation [%]:	0.04		
Standardized flow [m3/min]:	5.94	Max. standard deviation [%]:	0.30
Test status:	**Passed**		

CVS					LFE		Results			
Activate	Index	P [hPa]	dP [hPa]	T [éC]	Q [m3/min]	Q [mol/s]	P ratio	Humidity [%]	Dew point [éC]	Kv
1	1	993.35	131.1	23.96	5.584	4.152	0.868	59.7	15.9	0.969017
1	2	990.29	128.1	23.88	5.569	4.141	0.871	59.8	16.0	0.969195
1	3	987.32	125.3	23.86	5.547	4.125	0.873	59.8	15.9	0.968314
1	4	984.29	122.0	23.84	5.532	4.114	0.876	59.8	16.0	0.968640
1	5	981.35	119.0	23.88	5.514	4.100	0.879	59.7	15.9	0.968350
1	6	978.37	116.2	23.83	5.504	4.093	0.881	59.8	15.9	0.969567
1	7	975.41	113.2	23.83	5.484	4.078	0.884	59.7	15.9	0.968825
1	8	972.46	110.3	23.76	5.468	4.066	0.887	59.7	15.9	0.968922
1	9	969.35	107.0	23.78	5.452	4.054	0.890	59.8	15.9	0.969147
1	10	966.46	104.2	23.76	5.436	4.042	0.892	59.8	15.9	0.969190

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CVS calibration with LFE

2.8.0.7

Test data

Test name:	**LFE calibration_EPA (non-1065) /ECE_11184_Venturi3_S10_20231011_1714**		
CVS	Hubdat	Date:	10/11/2023
Serial number:	11184	Time / duration:	5:14:03 PM / 23m 18s
Operator:	Cahya Santika		
Legislation:	EPA (non-1065) /ECE		

Calibration device

Tag:	LMF	Manufacturer:	Tetratec
Ser.No. LMF:	PH019	Calibration date:	"
Ser.No. LFE:	LFE0-50MC02-04FS SN: 533L265 CAL039157	Calib. date LFE:	
Standard temp. [éC]:	0	Standard press. [hPa]:	1013.25

Venturi data

Serial number nozzle:	3
Flow rate [m3/min]:	4

Evaluation

Average Kv factor:	0.644052		
Standard deviation [%]:	0.02		
Standardized flow [m3/min]:	3.95	Max. standard deviation [%]:	0.30

Test status: **Passed**

CVS					LFE		Results			
Activate	Index	P [hPa]	dP [hPa]	T [éC]	Q [m3/min]	Q [mol/s]	P ratio	Humidity [%]	Dew point [éC]	Kv
1	1	996.93	129.2	23.79	3.725	2.770	0.870	60.2	16.0	0.643902
1	2	993.79	125.7	23.77	3.714	2.762	0.874	60.2	16.0	0.644043
1	3	990.92	122.6	23.75	3.704	2.754	0.876	60.2	16.1	0.644142
1	4	987.97	119.5	23.82	3.692	2.745	0.879	60.1	16.1	0.643940
1	5	984.99	116.5	23.81	3.681	2.737	0.882	60.1	16.1	0.644037
1	6	981.94	113.5	23.82	3.670	2.729	0.884	60.1	16.1	0.644113
1	7	978.86	110.2	23.80	3.658	2.720	0.887	60.1	16.0	0.643939
1	8	975.90	107.6	23.81	3.647	2.712	0.890	60.0	16.1	0.644036
1	9	972.84	104.0	23.80	3.637	2.704	0.893	60.0	16.1	0.644153
1	10	969.72	101.1	23.83	3.625	2.696	0.896	59.8	16.0	0.644213

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CVS calibration with LFE

2.8.0.7

Test data

Test name:	**LFE calibration_EPA (non-1065) /ECE_11184_Venturi2_S10_20231011_1602**		
CVS	Hubdat	Date:	10/11/2023
Serial number:	11184	Time / duration:	4:02:58 PM / 42m 18s
Operator:	Cahya Santika		
Legislation:	EPA (non-1065) /ECE		

Calibration device

Tag:	LMF	Manufacturer:	Tetratec
Ser.No. LMF:	PH019	Calibration date:	"
Ser.No. LFE:	LFE0-50MC02-04FS SN: 533L265 CAL039157	Calib. date LFE:	
Standard temp. [éC]:	0	Standard press. [hPa]:	1013.25

Venturi data

Serial number nozzle:	2
Flow rate [m3/min]:	2

Evaluation

Average Kv factor:	0.321798		
Standard deviation [%]:	0.08		
Standardized flow [m3/min]:	1.97	Max. standard deviation [%]:	0.30
Test status:	**Passed**		

CVS					LFE		Results			
Activate	Index	P [hPa]	dP [hPa]	T [éC]	Q [m3/min]	Q [mol/s]	P ratio	Humidity [%]	Dew point [éC]	Kv
1	1	999.68	123.3	24.86	1.863	1.385	0.877	60.2	16.7	0.321705
1	2	996.63	119.1	24.52	1.861	1.384	0.880	54.1	13.9	0.322141
1	3	993.57	115.7	24.40	1.855	1.379	0.884	55.9	14.7	0.322070
1	4	990.47	112.4	24.35	1.848	1.374	0.887	57.8	15.5	0.321817
1	5	987.43	108.8	24.37	1.841	1.369	0.890	59.8	16.2	0.321632
1	6	984.37	105.6	24.34	1.835	1.365	0.893	60.2	16.4	0.321577
1	7	981.60	102.1	24.32	1.830	1.361	0.896	58.2	15.6	0.321601
1	8	978.67	99.3	24.03	1.829	1.360	0.899	54.0	13.6	0.322122
1	9	975.74	96.1	24.07	1.822	1.355	0.902	56.0	14.5	0.321856
1	10	972.81	92.8	24.09	1.814	1.349	0.905	58.5	15.5	0.321454

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CVS calibration with LFE

2.8.0.7

Test data

Test name:	**LFE calibration_EPA (non-1065) /ECE_11184_Venturi1_S10_20231011_1523**		
CVS	Hubdat	Date:	10/11/2023
Serial number:	11184	Time / duration:	3:23:24 PM / 36m 29s
Operator:	Cahya Santika		
Legislation:	EPA (non-1065) /ECE		

Calibration device

Tag:	LMF	Manufacturer:	Tetratec
Ser.No. LMF:	PH019	Calibration date:	"
Ser.No. LFE:	LFE0-50MC02-04FS SN: 533L265 CAL039157	Calib. date LFE:	
Standard temp. [éC]:	0	Standard press. [hPa]:	1013.25

Venturi data

Serial number nozzle:	1
Flow rate [m3/min]:	1

Evaluation

Average Kv factor:	0.158866		
Standard deviation [%]:	0.27		
Standardized flow [m3/min]:	0.97	Max. standard deviation [%]:	0.30
Test status:	**Passed**		

CVS					LFE		Results			
Activate	Index	P [hPa]	dP [hPa]	T [éC]	Q [m3/min]	Q [mol/s]	P ratio	Humidity [%]	Dew point [éC]	Kv
1	1	1001.12	120.3	26.10	0.922	0.686	0.880	58.4	16.3	0.159312
1	2	998.29	112.6	25.61	0.920	0.684	0.887	54.2	14.6	0.159290
1	3	995.28	108.6	25.43	0.917	0.682	0.891	53.2	14.0	0.159287
1	4	992.20	104.5	25.30	0.914	0.680	0.895	54.8	14.5	0.159175
1	5	989.17	100.7	25.24	0.911	0.677	0.898	56.7	15.3	0.159015
1	6	986.26	96.4	25.15	0.907	0.674	0.902	59.1	16.4	0.158795
1	7	983.26	92.6	25.12	0.903	0.672	0.906	59.6	16.6	0.158666
1	8	980.41	88.8	25.09	0.900	0.669	0.909	59.1	16.5	0.158561
1	9	977.61	85.1	24.92	0.898	0.667	0.913	52.5	13.4	0.158528
1	10	974.71	81.7	24.76	0.892	0.664	0.916	55.4	14.1	0.158032

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Bag leak check

2.8.2.6

Test data

Test name:	**Leak check bag_EPA (non-1065) /ECE_11184_20231011_0924**		
CVS:	Hubdat	Date:	10/11/2023
Serial number:	11184	Time / duration:	9:24:12 AM / 01m 23s
Operator:	Cahya Santika		
Legislation:	EPA (non-1065) /ECE		

Test results

Bag	1	2	3	4	5	6
Initial pressure [hPa]	-852.7	-810.2	-828.9	-852.7	-863.8	-808.4
Final pressure [hPa]	-849.8	-775.3	-825.3	-849.1	-861.7	-768.8
Leak flow [hPa/min]	5.80	69.80	7.20	7.20	4.30	79.20
Result	OK	OK	OK	OK	OK	OK

Stabilization time [s]:	30.0
Measuring time [s]:	30.0
Max. leak rate [hPa/min]:	250.0
Total result:	**Passed**

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Sensor calibration

2.8.1.4

Test data

Test name:	**Sensor check_EPA (non-1065) /ECE_11184_Press. absolute_S11184_20231010_1035**		
HCVS	Hubdat	Date:	10/10/2023
Serial number:	11184	Time / duration:	10:35:28 AM / 06m 16s
Operator:	Cahya Santika		
Legislation:	EPA (non-1065) /ECE		

Calibration device

Tag:	Memocal 2000	Last calibration:	5/29/2023
Serial number:	IT1141000158	Calibration valid until:	5/29/2024
Unit:	hPa		

Test results — Actual polynomial

	Limit	Deviation
Rel. deviation point [%]	2.500	-0.013
Abs. deviation point [hPa]	1.000	0.089
Test state		Passed
Coefficient A0		-4.91267E+0
Coefficient A1		1.00710E+0
Coefficient A2		0.00000E+0
Coefficient A3		0.00000E+0
Coefficient A4		0.00000E+0

Index	Reference [hPa]	Reference [hPa]	Sensor [hPa]	Dev. [hPa]	Dev. [%]
1	700.000	700.000	699.912	-0.088	-0.013
2	750.000	750.000	750.022	0.022	0.003
3	800.000	800.000	800.047	0.047	0.006
4	850.000	850.000	850.071	0.071	0.008
5	900.000	900.000	900.089	0.089	0.010
6	950.000	950.000	950.046	0.046	0.005
7	1000.000	1000.000	1000.085	0.085	0.008
8	1025.000	1025.000	1024.981	-0.019	-0.002
9	1050.000	1050.000	1050.000	-0.000	-0.000
10	1100.000	1100.000	1099.959	-0.041	-0.004

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Sensor calibration

2.8.1.4

Test data

Test name:	**Sensor check_EPA (non-1065) /ECE_11184_Temp. nozzle_S11184_20231010_1017**		
HCVS	Hubdat	Date:	10/10/2023
Serial number:	11184	Time / duration:	10:17:26 AM / 05m 40s
Operator:	Cahya Santika		
Legislation:	EPA (non-1065) /ECE		

Calibration device

Tag:	Memocal 2000	Last calibration:	5/29/2023
Serial number:	IT1141000158	Calibration valid until:	5/29/2024
Unit:	éC		

Test results — Actual polynomial

	Limit	Deviation
Rel. deviation [% of pt. K]	2.500	-0.042
Abs. deviation point [K]	1.000	-0.158
Test state		Passed
Coefficient A0		-4.78085E-1
Coefficient A1		1.00587E+0
Coefficient A2		0.00000E+0
Coefficient A3		0.00000E+0
Coefficient A4		0.00000E+0

Index	Reference [éC]	Reference [K]	Sensor [éC]	Sensor [K]	Dev. [K]	Dev. [%]
1	-10.000	263.150	-10.029	263.121	-0.029	-0.011
2	0.000	273.150	-0.053	273.097	-0.053	-0.019
3	10.000	283.150	9.975	283.125	-0.025	-0.009
4	20.000	293.150	20.005	293.155	0.005	0.002
5	40.000	313.150	39.975	313.125	-0.025	-0.008
6	60.000	333.150	59.975	333.125	-0.025	-0.008
7	80.000	353.150	79.993	353.143	-0.007	-0.002
8	100.000	373.150	99.842	372.992	-0.158	-0.042
9	110.000	383.150	109.933	383.083	-0.067	-0.018
10	130.000	403.150	129.943	403.093	-0.057	-0.014

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Testcell name	MC2
Project	EMA
Test series	EMA_Internal
Test result	20231123_1737_CFO Check EU
Test version/iVersion	175/1
Test date/time	2023/11/23 17:37:25

CFO device settings

Gas name	[-]	C3H8
Gas bottle number	[-]	1
Diluted gas density	[kg/m3]	1.968
CFO gas density	[kg/m3]	2.003
Gas purity	[%]	99.990
CFO device name	[-]	AVLiCalCFO
CFO kit serial number	[-]	6207
CFO firmware version	[-]	Ver1.029
CFO software version	[-]	NA
Calibration date	[yyyymmdd]	20210219

Prefill executed	No
Duration	NA

Ambient concentrations

Phase	[-]	1	2	3
THC uncorrected	[µmol/mol]	1.383	1.352	1.447

Test results - Bag

Phase	[-]	1	2	3
Actual flow (propane)	[l/min]	1.117	1.117	1.117
Concentration (expected)	[ppm]	614.721	524.119	366.143
Concentration (measured)	[ppm]	626.145	534.278	372.225
Mass of injected gas (expected)	[g]	11.401	11.350	11.354
Mass of injected gas (measured)	[g]	11.615	11.571	11.544
Gas mass deviation	[%]	1.883	1.951	1.672
Limit gas mass deviation (+/-)	[%]	3.000	3.000	3.000
Status	[-]	Passed	Passed	Passed

Post-Test after Preventive Maintenance

Testbed	R40
AVL Order No.	IDID4239S23-00
Customer Order No.	IL230530ALN/P

Device Technical Data

Device	AMA i60 SII	Device	HSS i60 Small G02	Device	CVS i60 SII
Serial No.	7422	Serial No.	2827	Serial No.	11184
Test Date	16-Aug-23				

Device condition after Preventive Maintenance
1. AMA i60 7422 install new IPC
2. AMA i60 and CVS i60 update gem software
Status: Problem resolved
1. AMAi60 & CVSi60 now are able to communincate with whole system
Status: Problem resolved
1. Problem done case by case during upgrade periode
Status: Problem resolved
* SC_1345447 Pre-Filter is not power up, after replaced the TCU now able to operate and only HL1 issue
* SC_1347533 Pump from CVS is always on following CVS cabinet, suggestion from CSC for signal boards
* SC_1347531/3 Error warning is set on MFC/MFM CVSi50 Sn. 11184 solved
* SC_1347818 - EMISSION CLD Control Boards BB1693SP solved
* SC_1343342 AMAi60 SII CAN Communication Error at 1st run GEM v2.0 R8.1 FID LC & HH solved
* SC_1345491 Error related to MFC/MFM solved

Device operating function after Preventive Maintenance
Quality check regarding to EPA (non-1065)/ECE are completed as below
- ANR check : THC, NOX, NO, CO2, CO H, CO L and O2 is passed.
- Lincheck Multipolynomial : THC, NOX, NO, CO2, CO H, CO L
- NOx Conveter Check is passed.
- CO2, CO L, CO H cross sensitivity check.
- Analyzer response time check : THC, NOX, NO, CO2, CO H, CO L and O2 is done.
- Analyzer unit check : THC, NOX, NO, CO2, CO H, CO L and O2 is done.
- Leak check for S1 and S2
- Vacuum leak check
- Drift check all analyzer (THC, NOx, CO2, COH, COL)

Mr. Cahya Santika

Service Engineer: Cahya Santika

Exchanged Sparepart during This Maintenance

Testbed	R40
AVL Order No.	IDID4175S23-00
Customer Order No.	IL230530ALN/P

Item	Item Description	AVL Item No.	Quantity
1	MAINT. KIT CLD i60 VACUUM PUMP	BH0780SP	2
2	MAINTENANCE KIT ANNUAL RAW STREAM	BH0830SP	1
3	MAINTENANCE KIT DILLUTION STREAM ANNUAL	BH0831SP	1
4	MAINTENANCE KIT AMA I60 PUMP SAMPLE/BYP	BH0778SP	3
5	MAINTENANCE KIT ANNUAL HEATED FID I60	BH0824SP	1
6	MAINTENANCE KIT AMA I60/PSSI60 HFID PUMP	BH0648SP	1
7	SEALSET DETECTOR FID ANALYZER	QA1777SP	1
8	MAINTENANCE KIT COLD FID I60 ANNUAL	BH0826SP	1
9	MAINTENANCE KIT HEATED CLD I60 ANNUAL	BH0825SP	1
10	CONVERTER CLD FILLING SET HIGH	BW1119SP	1
11	MAINTENANCE KIT COLD CLD I60 ANNUAL	BH0827SP	1
12	CONVERTER CLD FILLING SET LOW	BW1120SP	1
13	MAINT. KIT CVS I60 ANNUAL	BH0636SP	1
14	MAINT. KIT CVS I60 PUMP	HP0220SP	2
15	O-RING 10.00X2.00	BH1131SP	1
16	FAN GUARD ASSEMBLY 60X60MM PLASTIC BLACK	MR1428SP	2
17	MAINTANCE KIT 12 MONTHS PREFILTER G02	BH0793SP	1
18	SEALSET DETECTOR FID ANALYZER	QA1777SP	1
19	THERM.TRANSF.COMP FEROTHERM 4 300 DEG.	EM0159SP	1
20	CHINO HN-GRBF1N CAL	SA162A099	1
21	DIAPHRAGM HEAD 4- HEAD (100-230 V)	MV0568SP	1

Service Engineer: Mr. Cahya Santika Cahya Santika

Recommended Sparepart for Next Maintenance

Testbed	R40
AVL Order No.	IDID4239S23-00
Customer Order No.	IL230530ALN/P

Item	Item Description	AVL Item No.	Quantity
1	MAINT. KIT CLD i60 VACUUM PUMP	BH0780SP	2
2	MAINTENANCE KIT ANNUAL RAW STREAM	BH0830SP	1
3	MAINTENANCE KIT DILLUTION STREAM ANNUAL	BH0831SP	1
4	MAINTENANCE KIT AMA I60 PUMP SAMPLE/BYP	BH0778SP	3
5	MAINTENANCE KIT ANNUAL HEATED FID I60	BH0824SP	1
6	MAINTENANCE KIT AMA I60/PSSI60 HFID PUMP	BH0648SP	1
7	MAINTENANCE KIT COLD FID I60 ANNUAL	BH0826SP	1
8	MAINTENANCE KIT HEATED CLD I60 ANNUAL	BH0825SP	1
9	CONVERTER CLD FILLING SET HIGH	BW1119SP	1
10	MAINTENANCE KIT COLD CLD I60 ANNUAL	BH0827SP	1
11	CONVERTER CLD FILLING SET LOW	BW1120SP	1
12	MAINT. KIT CVS I60 ANNUAL	BH0636SP	1
13	MAINT. KIT CVS I60 PUMP	HP0220SP	2
14	O-RING 10.00X2.00	BH1131SP	1
15	FAN GUARD ASSEMBLY 60X60MM PLASTIC BLACK	MR1428SP	2
16	MAINTANCE KIT 12 MONTHS PREFILTER G02	BH0793SP	1
17	THERM.TRANSF.COMP FEROTHERM 4 300 DEG.	EM0159SP	1
18	CHINO HN-GRBF1N Verify onsite reading	SA162A099	1
19	GNU 63 Sn. 5765 (04 Mar 21)		1
20	iCAL-CFO Sn.6207 (19 Feb 21)		1
21	LFE0 CVS PH019 Sn.533L265 (30 March 21)		1
22	HUMTMP-MF-G12 Sn.409H790 (28 Mar 21)		1
23	Pabs PPTOO01GKKSVB-S017 Sn. 85180 (29 Mar 21)		1
24	Pdiff M1500-DNo028-02-1 Sn. 2049000105 (29 Mar 21)		1
25	Temp WIT-S-PTM8-SO-20100-GB03 Sn.512T020 (29 Mar 21)		1

Service Engineer: Cahya Santika

Certificate of Calibration Tools

Kalibrierschein / Calibration Certificate

erstellt durch das Kalibrierlaboratorium

issued by the calibration laboratory

Deutscher Kalibrierdienst DKD

AVL Emission Test Systems GmbH
Max-Roth-Strasse 1
D-76571 Gaggenau
Deutschland

DAkkS Deutsche Akkreditierungsstelle D-K-21152-01-00

Kalibrierzeichen / *Calibration mark*	004542 / D-K-21152-01-00 / 2021-03

Gegenstand / *Object*	Gasteiler / Gas divider
Hersteller / *Manufacturer*	AVL Emission Test Systems GmbH
Typ / *Type*	GNU 63
Fabrikat/Serien-Nr. / *Serial number*	5765
Auftraggeber / *Customer*	Balai Pengujian Laik Jalan
Auftragsnummer / *Order No.*	853003590
Anzahl der Seiten des Kalibrierscheines / *Number of pages of the certificate*	5
Anzahl Seiten Anhang / *Number of pages of the appendix*	1
Datum der Kalibrierung / *Date of calibration*	04. Mar 2021

Dieser Kalibrierschein dokumentiert die metrologische Rückführbarkeit auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI).
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The DAkkS is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates.
Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.
The user is obliged to have the object recalibrated at appropriate intervals.

Dieser Kalibrierschein darf nur vollständig und unverändert weiterverbreitet werden. Auszüge oder Änderungen bedürfen der Genehmigung des ausstellenden Kalibrierlaboratoriums. Kalibrierscheine sind bei Nennung des für die Freigabe Verantwortlichen in Klarschrift auch ohne Unterschrift gültig.
This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates with the full name of the approval responsible person are valid without signature.

Datum der Ausstellung / *Date of issue*	Freigabe des Kalibrierscheins durch / *Approval of the certificate of calibration by*	Bearbeiter / *Person in charge*
05. Mar 2021	Christian Wunsch	Andreas Hörg

AVL Emission Test Systems GmbH
Max-Roth-Strasse 1
D-76571 Gaggenau
Deutschland

TEL.: +49 (0) 7225 9636-0
FAX: +49 (0) 7225 9636-88
Internet: www.avl.com/ets
e-mail: repaircenter.emission@avl.com

004542
D-K-21152-01-00
2021-03

1. Kalibriergegenstand / *Unit Under Test*

Gerätename / *Device Name*	Gasteiler / Gas divider
Typ / *Type*	GNU 63
Kalibriergas / *Calibration Gas*	N2 5.0
Verdünnungsstufen / *Dilution steps*	63
Software Version	4.045

2. Normbedingungen / *Standardized Conditions*

Druck / *Pressure*	1013.25 hPa abs.
Temperatur / *Temperature*	293.15K (20°C)

3. Bezugsnormale / *Standards Used*

Modell / *Model*	molbox1
Hersteller / *Manufacturer*	DH Instruments
Serien Nr. / *Serial number*	456
Kalibrierzeichen / *Calibration mark*	S12828
Datum der Kalibrierung / *Date of calibration*	Apr 2020
Druckbereich / *Pressure range*	0 mbar abs. - 5500 mbar abs.
Genauigket / *Accuracy*	+/-0.02% of reading (manufacturer specification)
Kalibrierlaboratorium / *Calibration laboratory*	Europascal GmbH
Registrierungsnummer der Urkunde / *Certificate number*	DAkkS D-K-15055-01-00

Modell / *Model*	molbloc-L Laminar Element (2E2-VCR-V-Q)
Hersteller / *Manufacturer*	DH Instruments
Serien Nr. / *Serial number*	1340
Kalibrierzeichen / *Calibration mark*	1500284176
Datum der Kalibrierung / *Date of calibration*	May 2020
Druckbereich downstream / *Operating pressure downstream*	80 kPa abs. to 110 kPa abs.
Messunsicherkeit / *Uncertainty*	+/-0.2% of reading (manufacturer specification)
Kalibrierlaboratorium / *Calibration laboratory*	FLUKE CALIBRATION, PHOENIX
Registrierungsnummer der Urkunde / *Certificate number*	A2LA 1599.01

Modell / *Model*	molbloc-L Laminar Element (1E3-VCR-V-Q)
Hersteller / *Manufacturer*	DH Instruments
Serien Nr. / *Serial number*	1341
Kalibrierzeichen / *Calibration mark*	1500284181
Datum der Kalibrierung / *Date of calibration*	May 2020
Druckbereich downstream / *Operating pressure downstream*	80 kPa abs. to 110 kPa abs.
Messunsicherkeit / *Uncertainty*	+/-0.2% of reading (manufacturer specification)
Kalibrierlaboratorium / *Calibration laboratory*	FLUKE CALIBRATION, PHOENIX
Registrierungsnummer der Urkunde / *Certificate number*	A2LA 1599.01

Modell / *Model*	molbloc-L Laminar Element (1E4-VCR-V-Q)
Hersteller / *Manufacturer*	DH Instruments
Serien Nr. / *Serial number*	1075
Kalibrierzeichen / *Calibration mark*	1500284141
Datum der Kalibrierung / *Date of calibration*	Jun 2020
Druckbereich downstream / *Operating pressure downstream*	80 kPa abs. to 110 kPa abs.
Messunsicherkeit / *Uncertainty*	+/-0.2% of reading (manufacturer specification)
Kalibrierlaboratorium / *Calibration laboratory*	FLUKE CALIBRATION, PHOENIX
Registrierungsnummer der Urkunde / *Certificate number*	A2LA 1599.01

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4. Kalibrierverfahren / *Calibration procedure*

Vor der Kalibrierung wurde der Gasteiler 12 Stunden unter Laborbedingungen gelagert, einschließlich eine Stunde im eingeschalteten Zustand im Labor (Akklimatisierung). Der Messaufbau und der Gasteiler wurden auf Dichtheit geprüft. Vor dem Start der Messwerterfassung wurde der komplette Gasweg mit dem entsprechenden Messgas mindestens 10 Minuten gespült. Die Messwerte wurden, nach einer Stabilisierungszeit von jeweils mindestens 70 Sekunden ermittelt. Die Messzeit betrug 35 - 40 Sekunden je Durchflusswert. Die Durchflussmessungen (as found, as left) erfolgen mit einer Software die den Gasteiler und das Kalibriernormal ansteuert. Das Auslesen der Durchflusswerte erfolgt mittels speziell dafür vom Kalibriernormal vorgesehenen Befehlen. Es werden nacheinander die einzelnen Düsendurchflüsse gemessen.

Prior to calibration, the gas divider was stored for 12 hours at laboratory conditions, including one hour switched on in the laboratory (acclimatization). The test setup and the gas divider were tested for tightness. Before starting the measurement, the complete gas path was purged with the corresponding sample gas for at least 10 minutes. The measured values were determined after a stabilization time of at least 70 seconds. The measuring time was 35 - 40 seconds per flow value. The flow measurements (as found, as left) are made using a software that controls the gas divider and the calibration standard. The read-out of the flow values is done using special commands provided by the calibration standard. The individual nozzle flows are measured one after the other.

Beschreibung der Messstrecke:
Gasversorgung - Druckregler - Gasteiler Eingang/Ausgang - Kalibriernormal - Absaugung
Description of the measuring setup:
Gas supply - Pressure regulator - gas divider input/output - Calibration standard - suction

5. Messraumbedingungen / *Measurement room conditions*

Ort / *Place*	D-76571 Gaggenau Deutschland
Raumtemperatur / *Room temperature*	22.5 °C
Barometerdruck / *Barometric pressure*	1000.1 hPa abs.
Luftfeuchtigkeit / *Air humidity*	32.0 %

6. Messunsicherheit / *Uncertainties of measurement*

Volumenstrom/ *Flow*	+/-0.38% v.M.
Umgebungstemperatur / *Air temperature*	+/-0.3K
Luftdruck / *Atmospheric pressure*	+/-0.5hPa
Luftfeuchtigkeit / *Air humidity*	+/-2.0% r.F.

Angegeben ist die erweiterte Messunsicherheit, die sich aus der Standardmessunsicherheit durch Multiplikation mit dem Erweiterungsfaktor $k = 2$ ergibt. Der Wert der Messgröße liegt mit einer Wahrscheinlichkeit von 95% im zugeordneten Werteintervall.
Given is the extended uncertainty, which is calculated from the standard uncertainty by multiplication with the extension factor k = 2. The value of the measured variable is in the corresponding interval of values with a probability of 95%.

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2021-03

7. Messergebnisse as found / *Measurement results as found*

Gasteiler Kalibriermesspunkte / *Gas divider calibrated setpoints*
Setpoint 3: Inlet pressure 3200 mbar abs.

Verwendete Abkürzungen / *List of abbreviation*

$Q_{v,Standard}$	Volumendurchfluss Standard (Der Durchflusswert kann bei veränderten Bedingungen vom Messwert abweichen) *Volume flow standard (the flow value may deviate from the measured value under changed conditions).*
$P_{GD,IN}$	Eingangsdruck des Gasteilers (Ablesewert) / *Gas divider input pressure (Reading)*
$P_{GD,OUT}$	Ausgangsdruck des Gasteilers (Ablesewert) / *Gas divider output pressure (Reading)*
Ratio	Durchflussverhältniss bezogen auf Düse 1 = Dx/D1 / *Flow-Ratio related to Nozzle 1 = Dx/D1*

Eingangsmesswerte / *as found*

Calibration Setpoint 3

GD nozzle number	$P_{GD,IN}$	$P_{GD,OUT}$	$Q_{v,Standard}$	Ratio
	mbar abs.	mbar abs.	ml/min	
1	3199.10	1500.00	52.50	1.00
2	3199.00	1500.20	105.75	2.01
3	3199.90	1500.10	211.70	4.03
4	3199.20	1500.20	426.80	8.13
5	3199.60	1500.20	853.89	16.27
6	3199.10	1500.00	1716.04	32.69

Die ermittelten Messwerte sind nur während des Zeitpunktes der Überprüfung und für das kalibrierte Gerät gültig.
The measured values determined are valid for the moment of the validation and the calibrated device only.

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8. Messergebnisse as left / Measurement results as left

Gasteiler Kalibriermesspunkte / *Gas divider calibrated setpoints*
Setpoint 3: inlet pressure 3200 mbar abs.

Verwendete Abkürzungen / *List of abbreviation*

$Q_{V\text{Standard}}$	Volumendurchfluss Standard (Der Durchflusswert kann bei veränderten Bedingungen vom Messwert abweichen) *Volume flow standard (the flow value may deviate from the measured value under changed conditions).*
$P_{GD,IN}$	Eingangsdruck des Gasteilers (Ablesewert) / *Gas divider input pressure (Reading)*
$P_{GD,OUT}$	Ausgangsdruck des Gasteilers (Ablesewert) / *Gas divider output pressure (Reading)*
Ratio	Durchflussverhältniss bezogen auf Düse 1 = Dx/D1 / *Flow-Ratio related to Nozzle 1 = Dx/D1*

Ausgangsmesswerte / *as left*

Calibration Setpoint 3

GD nozzle number	$P_{GD,IN}$	$P_{GD,OUT}$	$Q_{V\_Standard}$	*Ratio*
	mbar abs.	mbar abs.	ml/min	
1	3199.20	1500.10	52.47	1.00
2	3199.40	1500.20	105.71	2.01
3	3199.50	1499.90	211.63	4.03
4	3199.60	1500.10	426.59	8.13
5	3199.40	1500.10	853.45	16.26
6	3198.60	1500.10	1714.95	32.68

Die ermittelten Messwerte sind nur während des Zeitpunktes der Überprüfung und für das kalibrierte Gerät gültig.
The measured values determined are valid for the moment of the validation and the calibrated device only.

*** Ende des Kalibrierzertifikates / *End of calibration certificate* ***

Anhang zum Kalibrierschein Nummer 4542 / 2021-03
Appendix of calibration certificate 4542 / 2021-03

Resultierender Verdünnungsfaktor je Stufe als Ergebnis der Kombination der Einzeldüsen
Resulting dilution factor per step as result of the combination of the single nozzles

Anmerkung: Die hier angegebenen Verdünnungsfaktoren beziehen sich auf Ideales Gas(N2). Da der Gasdurchfluss vom Gastyp abhängig ist ergeben sich für andere Gase leicht abweichende Verdünnungsfaktoren. Diese werden vom Gerät automatisch berechnet. Weitere Informationen hierzu befinden sich im Handbuch.
Note: The dilution factors given here refer to ideal gas (N2). Since the gas flow depends on the gas type, the dilution factors for other gases are slightly different. These are calculated automatically by the device. Further information can be found in the manual.

Calibration Setpoint 3: inlet pressure 3200 mbar abs.

Stufe *Step*	Verdünnungsfaktor as left *Dilutionfactor as left* [%]	Verdünnungsfaktor aus Eingangsmessung *Dilutionfactor measured as found* [%]	Verdünnungsfaktor im Gerät bei Anlieferung *Dilutionfactor device as found* [%]	Abweichung Eingangsmessung und Anlieferung *Deviation as found and device* [%]
0	0.0000	0.0000	0.0000	0.0000
1	1.5595	1.5593	1.5680	-0.5740
2	3.1415	3.1409	3.1431	-0.0687
3	4.7010	4.7002	4.7113	-0.2363
4	6.2895	6.2880	6.2746	0.2128
5	7.8490	7.8473	7.8428	0.0565
6	9.4310	9.4289	9.4177	0.1190
7	10.9905	10.9882	10.9859	0.0207
8	12.6780	12.6773	12.7058	-0.2247
9	14.2375	14.2366	14.2740	-0.2630
10	15.8195	15.8183	15.8489	-0.1937
11	17.3790	17.3775	17.4171	-0.2279
12	18.9675	18.9653	18.9804	-0.0797
13	20.5270	20.5246	20.5487	-0.1172
14	22.1090	22.1063	22.1235	-0.0781
15	23.6685	23.6655	23.6918	-0.1108
16	25.3643	25.3630	25.4001	-0.1461
17	26.9238	26.9223	26.9683	-0.1709
18	28.5058	28.5040	28.5432	-0.1376
19	30.0653	30.0633	30.1114	-0.1603
20	31.6538	31.6510	31.6747	-0.0748
21	33.2133	33.2103	33.2429	-0.0983
22	34.7953	34.7920	34.8178	-0.0743
23	36.3548	36.3512	36.3860	-0.0957
24	38.0423	38.0404	38.1059	-0.1723
25	39.6018	39.5998	39.6741	-0.1881
26	41.1838	41.1813	41.2490	-0.1644
27	42.7433	42.7406	42.8172	-0.1794
28	44.3318	44.3284	44.3805	-0.1177
29	45.8913	45.8876	45.9488	-0.1332
30	47.4733	47.4693	47.5236	-0.1145
31	49.0328	49.0286	49.0939	-0.1331
32	50.9673	50.9714	50.9081	0.1241
33	52.5267	52.5307	52.4764	0.1034
34	54.1087	54.1124	54.0512	0.1130
35	55.6682	55.6716	55.6195	0.0937
36	57.2567	57.2594	57.1827	0.1339
37	58.8162	58.8187	58.7510	0.1151
38	60.3982	60.4004	60.3258	0.1234
39	61.9577	61.9596	61.8941	0.1058
40	63.6452	63.6488	63.6140	0.0547
41	65.2047	65.2080	65.1822	0.0396
42	66.7867	66.7897	66.7571	0.0489
43	68.3462	68.3490	68.3253	0.0347
44	69.9347	69.9367	69.8886	0.0689
45	71.4942	71.4960	71.4568	0.0549
46	73.0762	73.0777	73.0317	0.0630
47	74.6357	74.6370	74.5999	0.0497
48	76.3315	76.3345	76.3082	0.0343
49	77.8910	77.8937	77.8765	0.0221
50	79.4730	79.4754	79.4513	0.0303
51	81.0325	81.0347	81.0196	0.0186
52	82.6210	82.6235	82.5829	0.0491
53	84.1805	84.1817	84.1511	0.0364
54	85.7625	85.7634	85.7260	0.0437
55	87.3220	87.3217	87.2942	0.0316
56	89.0095	89.0118	89.0141	-0.0026
57	90.5690	90.5711	90.5823	-0.0124
58	92.1510	92.1527	92.1572	-0.0048
59	93.7105	93.7120	93.7254	-0.0143
60	95.2990	95.2998	95.2887	0.0117
61	96.8585	96.8591	96.8569	0.0022
62	98.4405	98.4407	98.4318	0.0091
63	100.0000	100.0000	100.0000	0.0000

Kalibrierschein / Calibration Certificate

erstellt durch das Kalibrierlaboratorium

issued by the calibration laboratory

Deutscher Kalibrierdienst DKD

AVL Emission Test Systems GmbH

Max-Roth-Strasse 1
D-76571 Gaggenau
Deutschland

DAkkS Deutsche Akkreditierungsstelle D-K-21152-01-00

Kalibrierzeichen *Calibration mark*	004519 D-K-21152-01-00 2021-02

Gegenstand *Object*	CFO Checker
Hersteller *Manufacturer*	AVL Emission Test Systems GmbH
Typ *Type*	iCAL-CFO
Fabrikat/Serien-Nr. *Serial number*	6207
Auftraggeber *Customer*	Balai Pengujian Laik Jalan
Auftragsnummer *Order No.*	853003591
Anzahl der Seiten des Kalibrierscheines *Number of pages of the certificate*	5
Datum der Kalibrierung *Date of calibration*	19. Feb 2021

Dieser Kalibrierschein dokumentiert die metrologische Rückführbarkeit auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem internationalen Einheitensystem (SI).
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Datum der Ausstellung *Date of issue*	Freigabe des Kalibrierscheins durch *Approval of the certificate of calibration by*	Bearbeiter *Person in charge*
19. Feb 2021	Christian Wurach	Björn Brendel

AVL Emission Test Systems GmbH
Max-Roth-Strasse 1
D-76571 Gaggenau
Deutschland

TEL: +49 (0) 7225 9636-0
FAX: +49 (0) 7225 9636-88
Internet: www.avl.com/ets
e-mail: repaircenter.emission@avl.com

004519
D-K-21152-01-00
2021-02

1. Kalibriergegenstand / *Unit Under Test*

Gerätename / *Device Name*	CFO Checker
Typ / *Type*	iCAL-CFO
Kalibriergas / *Calibration Gas*	C3H8 3.5
Durchflussbereich / *Flow Range*	0.183-1.58 l/min
Software Version	1.029

2. Normbedingungen / *Standardized Conditions*

Druck / *Pressure*	1013.25 hPa abs.
Temperatur / *Temperature*	293.15K (20°C)

3. Bezugsnormale / *Standards Used*

Modell / *Model*	molbox1 A700K
Hersteller / *Manufacturer*	DH Instruments
Serien Nr. / *Serial number*	1004
Kalibrierzeichen / *Calibration mark*	513487
Datum der Kalibrierung / *Date of calibration*	Aug 2020
Druckbereich / *Pressure range*	0 mbar abs. - 5500 mbar abs.
Genauigkeit / *Accuracy*	+/-0.02% of reading (manufacturer specification)
Kalibrierlaboratorium / *Calibration laboratory*	Europascal GmbH
Registrierungsnummer der Urkunde / *Certificate number*	DAkkS D-K-15055-01-00

Modell / *Model*	molbloc-L Laminar Element (2E2-VCR-V-Q)
Hersteller / *Manufacturer*	DH Instruments
Serien Nr. / *Serial number*	3270
Kalibrierzeichen / *Calibration mark*	1500291125
Datum der Kalibrierung / *Date of calibration*	Sep 2020
Druckbereich downstream / *Operating pressure downstream*	80 kPa abs. to 110 kPa abs.
Messunsicherkeit / *Uncertainty*	+/-0.2% of reading (manufacturer specification)
Kalibrierlaboratorium / *Calibration laboratory*	FLUKE CALIBRATION, PHOENIX
Registrierungsnummer der Urkunde / *Certificate number*	A2LA 1599.01

Modell / *Model*	molbloc-L Laminar Element (1E3-VCR-V-Q)
Hersteller / *Manufacturer*	DH Instruments
Serien Nr. / *Serial number*	3402
Kalibrierzeichen / *Calibration mark*	1500291257
Datum der Kalibrierung / *Date of calibration*	Sep 2020
Druckbereich downstream / *Operating pressure downstream*	80 kPa abs. to 110 kPa abs.
Messunsicherkeit / *Uncertainty*	+/-0.2% of reading (manufacturer specification)
Kalibrierlaboratorium / *Calibration laboratory*	FLUKE CALIBRATION, PHOENIX
Registrierungsnummer der Urkunde / *Certificate number*	A2LA 1599.01

Modell / *Model*	molbloc-L Laminar Element (1E4-VCR-V-Q)
Hersteller / *Manufacturer*	DH Instruments
Serien Nr. / *Serial number*	3457
Kalibrierzeichen / *Calibration mark*	1500291254
Datum der Kalibrierung / *Date of calibration*	Sep 2020
Druckbereich downstream / *Operating pressure downstream*	80 kPa abs. to 110 kPa abs.
Messunsicherkeit / *Uncertainty*	+/-0.2% of reading (manufacturer specification)
Kalibrierlaboratorium / *Calibration laboratory*	FLUKE CALIBRATION, PHOENIX
Registrierungsnummer der Urkunde / *Certificate number*	A2LA 1599.01

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4. Kalibrierverfahren / *Calibration procedure*

Vor der Kalibrierung wurde der CFO 12 Stunden unter Laborbedingungen gelagert, einschließlich einer Stunde im eingeschalteten Zustand im Labor (Akklimatisierung). Der Messaufbau und der CFO wurden auf Dichtheit geprüft. Vor dem Start der Messwerterfassung wurde der komplette Gasweg mit dem entsprechenden Messgas mindestens 10 Minuten gespült. Die Messwerte wurden nach einer Stabilisierungszeit von jeweils mindestens 70 Sekunden ermittelt. Die Messzeit betrug 35 - 40 Sekunden je Durchflusswert. Die Durchflussmessungen (as found, as left) erfolgten mit einer Software die den CFO und das Kalibriernormal ansteuerte. Das Auslesen der Durchflusswerte erfolgte mittels speziell dafür vom Kalibriernormal vorgesehenen Befehlen. Es wurden nacheinander die einzelnen Düsendurchflüsse gemessen.

Prior to calibration, the CFO was stored for 12 hours at laboratory conditions, including one hour switched on in the laboratory (acclimatization). The test setup and the CFO were tested for tightness. Before starting the measurement, the complete gas path was purged with the corresponding sample gas for at least 10 minutes. The measured values were determined after a stabilization time of at least 70 seconds. The measuring time was 35 - 40 seconds per flow value. The flow measurements (as found, as left) are made using a software that controls the CFO and the calibration standard. The read-out of the flow values is done using special commands provided by the calibration standard. The individual nozzle flows are measured one after the other.

Beschreibung der Messstrecke:
Gasversorgung - Druckregler - CFO Eingang/Ausgang - Kalibriernormal - Absaugung
Description of the measuring setup:
Gas supply - Pressure regulator - CFO input/output - Calibration standard - suction

5. Messraumbedingungen / *Measurement room conditions*

Ort / *Place*	D-76571 Gaggenau Deutschland
Raumtemperatur / *Room temperature*	23.6 °C
Barometerdruck / *Barometric pressure*	1000.1 hPa abs.
Luftfeuchtigkeit / *Air humidity*	30.1 %

6. Messunsicherheit / *Uncertainties of measurement*

Volumenstrom/ *Flow*	+/-0.58% v.M.
Umgebungstemperatur / *Air temperature*	+/-0.3K
Luftdruck / *Atmospheric pressure*	+/-0.5hPa
Luftfeuchtigkeit / *Air humidity*	+/-2.0% r.F.

Angegeben ist die erweiterte Messunsicherheit, die sich aus der Standardmessunsicherheit durch Multiplikation mit dem Erweiterungsfaktor $k = 2$ ergibt. Der Wert der Messgröße liegt mit einer Wahrscheinlichkeit von 95% im zugeordneten Werteintervall.
Given is the extended uncertainty, which is calculated from the standard uncertainty by multiplication with the extension factor $k = 2$. The value of the measured variable is in the corresponding interval of values with a probability of 95%.

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7. Messergebnisse as found / *Measurement results as found*

Verwendete Abkürzungen / *List of abbreviation*

Set	Eingestellter CFO Durchfluss / *Adjusted CFO flow*
Q_{CFO}	Durchfluss (Anzeige CFO) / *flow (CFO display)*
T_{CFO}	CFO Block Temperatur (Anzeige CFO) / *CFO block temperature (CFO display)*
y	ist der k-faktor / *is the k-factor*
$p_{CFO,in}$	ist der CFO Eingangsdruck (Anzeige CFO) / *is the CFO input pressure (CFO display)*
$p_{CFO,out}$	ist der CFO Ausgangsdruck (Anzeige CFO) / *is the CFO output pressure (CFO display)*
Stell	Stellgröße Regelventil (Anzeige CFO) / *regualtion size of control valve (CFO display)*
Deviation "as found" $_{\Sigma}$	Abweichung as found $_{\Sigma}$ / *Deviation as found* = $(Q_{CFO}/Q_{N}-1)*100$

Auslesen der Koeffizienten aus CFO / *Read the Coefficients from CFO*:

Nozzle 1 Polynomial:

Y=(1.29450E+00)+(1.69066E-01)*x+(-6.75756E-02)*x^2+(1.48361E-02)*x^3+(-1.65348E-03)*x^4+(7.39900E-05)*x^5

Nozzle 2 Polynomial:

Y=(3.07635E+00)+(2.99053E-01)*x+(-1.18978E-01)*x^2+(2.65272E-02)*x^3+(-3.03038E-03)*x^4+(1.39830E-04)*x^5

Nozzle 1+2 Polynomial:

Y=(4.99193E+00)+(-2.70394E-01)*x+(1.55285E-01)*x^2+(-3.58344E-02)*x^3+(3.84781E-03)*x^4+(-1.56790E-04)*x^5

where y is the k-factor and x is the pressure in bar abs

Range	N1 [slm]:	0.1818	to	0.4794
Range	N2 [slm]:	0.4794	to	1.1019
Range	N1+2 [slm]:	1.1019	to	1.5813

Pressure Sensor internal Polynomial: offset: -0.29 coefficient: 1

Regression analysis

	CFO Criteria	Limits
a1	1.00272	0.98 <= a1 <= 1.02
|xmin(a1-1) + a0|	1.06481	< 15.7
SEE	0.35448	< 31.4
R^2	1.00000	>=0.99

Step	*Set*	Q_{CFO}	Q_{N}	T_{CFO}	$p_{CFO,in}$	$p_{CFO,out}$	*Deviation as found* $_{\Sigma}$
	slm	*slm/m*	*slm/m*	*K*	*bar*	*kPa*	*% of*
1	0.1818	181.76	182.24	328.34	2.2502	108.79	0.26
2	0.2549	254.80	255.35	328.28	3.1194	112.33	0.22
3	0.3279	327.82	328.35	328.21	3.9823	115.76	0.16
4	0.4010	400.84	401.14	328.12	4.8373	119.11	0.07
5	0.4741	474.19	474.77	328.06	2.5325	122.41	0.12
6	0.5471	547.19	547.60	328.00	2.9107	125.61	0.07
7	0.6202	620.05	620.45	327.99	3.2875	128.74	0.06
8	0.6932	693.14	693.20	327.99	3.6642	131.79	0.01
9	0.7663	766.31	765.98	328.04	4.0405	134.79	-0.04
10	0.8394	839.48	838.87	328.08	4.4155	137.73	-0.07
11	0.9124	912.33	911.68	328.11	4.7878	140.61	-0.07
12	0.9855	985.46	984.54	328.15	5.1604	143.45	-0.09
13	1.0586	1058.63	1057.53	328.15	5.5314	146.26	-0.10
14	1.1316	1131.73	1129.81	328.20	4.1575	148.98	-0.17
15	1.2047	1204.71	1202.57	328.19	4.4178	151.69	-0.18
16	1.2777	1277.78	1275.37	328.15	4.6778	154.35	-0.19
17	1.3508	1350.81	1348.45	328.09	4.9371	156.98	-0.17
18	1.4239	1423.88	1421.50	328.04	5.1959	159.58	-0.17
19	1.4969	1496.91	1494.26	328.01	5.4541	162.14	-0.18
20	1.5700	1570.58	1568.36	328.03	4.5730	162.29	-0.14

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8. Messergebnisse as left / *Measurement results as left*

Verwendete Abkürzungen / *List of abbreviation*

Set	Eingestellter CFO Durchfluss / *Adjusted CFO flow*
Q_{CFO}	Durchfluss (Anzeige CFO) / *flow (CFO display)*
T_{CFO}	CFO Block Temperatur (Anzeige CFO) / *CFO block temperature (CFO display)*
y	ist der k-faktor / *is the k-factor*
$p_{CFO,in}$	ist der CFO Eingangsdruck (Anzeige CFO) / *is the CFO input pressure (CFO display)*
$p_{CFO,out}$	ist der CFO Ausgangsdruck (Anzeige CFO) / *is the CFO output pressure (CFO display)*
Stell	Stellgröße Regelventil (Anzeige CFO) / *regvaltion size of control valve (CFO display)*
Deviation "as left" $_1$	Abweichung as left $_1$ / *Deviation as left* = $(Q_{CFO}/Q_N\text{-}1)*100$

Auslesen der Koeffizienten aus CFO / *Read the Coefficients from CFO* :

Nozzle 1 Polynomial:

Y=(1.30666E+00)+(1.64346E-01)*x+(-6.65573E-02)*x^2+(1.45591E-02)*x^3+(-1.59884E-03)*x^4+(6.98938E-05)*x^5

Nozzle 2 Polynomial:

Y=(3.16292E+00)+(2.04299E-01)*x+(-7.35719E-02)*x^2+(1.51383E-02)*x^3+(-1.59530E-03)*x^4+(6.81963E-05)*x^5

Nozzle 1+2 Polynomial:

Y=(3.87054E+00)+(1.02642E+00)*x+(-4.30743E-01)*x^2+(9.35170E-02)*x^3+(-1.01588E-02)*x^4+(4.40050E-04)*x^5

where y is the k-factor and x is the pressure in bar abs

Range	N1 [slm]:	0.1823	to	0.4794
Range	N2 [slm]:	0.4794	to	1.1007
Range	N1+2 [slm]:	1.1007	to	1.5801

Pressure Sensor Internal Polynomial: offset: -0.33 coefficient: 1

Regression analysis

	CFO Criteria	Limits
a1	0.99969	0.98 <= a1 <= 1.02
|xmin(a1-1) + a0|	0.11267	< 15.1
SEE	0.10586	< 30.1
R^2	1.00000	>=0.99

Step	*Set*	Q_{CFO}	Q_N	T_{CFO}	$p_{CFO,in}$	$p_{CFO,out}$	*Deviation as left* $_1$
	slm	*sm/m*	*sm/m*	*K*	*bar*	*kPa*	*% of*
1	0.1823	182.30	182.19	328.53	2.2502	109.04	-0.06
2	0.2559	255.83	255.84	328.46	3.1265	112.57	0.01
3	0.3294	329.28	329.50	328.29	3.9957	116.01	0.07
4	0.4030	402.82	403.11	328.10	4.8576	119.35	0.07
5	0.4766	476.66	477.00	327.97	2.5418	122.63	0.07
6	0.5501	550.11	550.45	327.88	2.9232	125.82	0.06
7	0.6237	623.66	624.02	327.87	3.3043	128.94	0.06
8	0.6973	697.21	697.51	327.92	3.6848	132.01	0.04
9	0.7708	770.82	771.10	327.98	4.0644	135.00	0.04
10	0.8444	844.30	844.61	328.06	4.4423	137.95	0.04
11	0.9180	917.94	918.25	328.15	4.8198	140.84	0.03
12	0.9916	991.49	991.80	328.18	5.1955	143.69	0.03
13	1.0651	1065.00	1065.33	328.20	5.5691	146.48	0.03
14	1.1387	1138.83	1139.19	328.22	4.1890	149.24	0.03
15	1.2123	1212.41	1212.85	328.20	4.4522	151.96	0.04
16	1.2858	1285.79	1286.30	328.15	4.7137	154.62	0.04
17	1.3594	1359.56	1359.86	328.08	4.9760	157.27	0.02
18	1.4330	1432.97	1433.60	328.03	5.2365	159.88	0.04
19	1.5065	1505.40	1507.05	328.00	5.4966	162.45	0.04
20	1.5801	1506.57	1506.99	328.02	5.4974	162.44	0.03

*** Ende des Kalibrierzertifikates / *End of calibration certificate* ***

Kalibrierlaboratorium der TetraTec Instruments GmbH
Calibration Laboratory of TetraTec Instruments GmbH

TetraTec® Instruments

Kalibrierschein / Calibration Certificate

Mitglied im
Member of the

Deutschen Kalibrierdienst DKD

DAkkS Deutsche Akkreditierungsstelle D-K-17589-01-00

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D-K-17589-01-00
2021-04

Kalibrierschein
Calibration certificate

Kalibrierzeichen
Calibration mark

Gegenstand *Object*	**Laminar Flow Element with CVS PH019**
Hersteller *Manufacturer*	**TetraTec Instruments GmbH**
Typ *Type*	**50MC02-04-FS**
Fabrikat/Serien-Nr. *Serial number*	**533L265** **LFE0**
Auftraggeber *Customer*	**AVL Emission Test Systems GmbH** **41460 Neuss**
Auftragsnummer *Order No.*	**PS910**
Anzahl der Seiten des Kalibrierscheines *Number of pages of the certificate*	**4**
Datum der Kalibrierung *Date of calibration*	**30.04.2021**

Dieser Kalibrierschein dokumentiert die metrologische Rückführung auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI).
Der DAkkS ist Unterzeichner der multilateralen Übereinkommen der European co-operation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine.
Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

This calibration certificate documents the metrological traceability to national standards, which realize the units of measurement according to the International System of Units (SI).
The DAkkS is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates.
The user is obliged to have the object recalibrated at appropriate intervals.

Dieser Kalibrierschein darf nur vollständig und unverändert weiterverbreitet werden. Auszüge oder Änderungen bedürfen der Genehmigung des ausstellenden Kalibrierlaboratoriums. Kalibrierscheine ohne Unterschrift haben keine Gültigkeit.

This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature are not valid.

Ausstellungsdatum *Issue Date*	Stellv. Leiter des Kalibrierlaboratoriums *Deputy Head of the calibration laboratory*	Bearbeiter *Person in charge*
30.04.2021	Dr. Marc Plüschau	Dipl.-Ing. (FH) Peter Kienzle

TetraTec Instruments GmbH · Gewerbestrasse 8 · 71144 Steinenbronn · Germany
Tel +497157/53870 · Fax +497157/538710 · www.tetratec.de · info@tetratec.de

Calibration item

Laminar Flow Element with CVS PH019

Type	50MC02-04-FS
Manufacturer	TetraTec Instruments GmbH
Serial number	533L265
Range	0 ... 13 m³/min
Accuracy	1 %OR in the range 1,4 to 13 m³/min

Method of calibration

The calibration was carried out according to the internal calibration procedure VQ100: laminar flow element in suction mode.
Depending on the pressure drop across the laminar flow element, a characteristic curve for calculating the flow values is determined or this characteristic curve is verified.

Medium	Air atmospheric
Calculation method	Density: real gas calculation for air (CIPM)

Setup: atmosphere - unit under test - calibration standard - throttle valve - vacuum pump

Measurement conditions

The calibration set-up was leak-proofed before calibration.

The calibration object was energized about 30 min before the calibration. Before taking measurements the calibration object did run about 10 min at max. flow. Measurements were taken at least 3 min after changing the flow. The calibration was performed after an adequate of thermal accomodation of the unit under test (uut) in the laboratory. The testing time at each measurement point was 60 s.

Environmental data

Air Pressure: (958,2 ± 1,0) mbar, Temperature: (23,0 ± 0,5) °C, Air Humidity: (24,8 ± 3,0) % rH

Measurement uncertainty

The measurement uncertainty is specified as extended measurement uncertainty, resulting from the standard measurement uncertainty by multiplication with factor k = 2 and includes the uncertainty of the reference and the method of calibration. It was determined according to EA-4/02 M:2013. The value of the result will be within the associated interval with a probability of 95 %. A part for the long-term stability of the device is not included.

Results

Absolute pressure PAp, temperature Tp and humidity Hp were taken at the inlet of the unit under test.

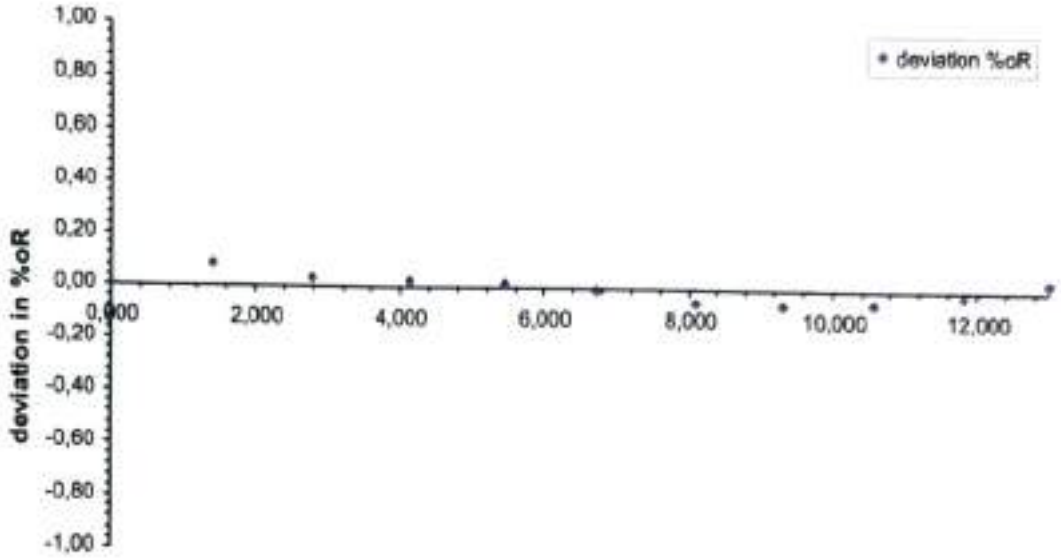
Qs	*Qp*	*PAp*	*Tp*	*Hp*	*PDp*	*ABW*		*MU*
m³/min	m³/min	hPa	°C	%	hPa	m³/min	%oR	m³/min
0,000	0,000	958,5	22,99	27,4	0,00			
1,397	1,398	958,3	23,00	27,4	2,51	0,001	0,08	0,0037
2,773	2,774	958,1	22,99	27,3	5,02	0,001	0,03	0,0073
4,130	4,131	957,7	22,92	27,3	7,53	0,001	0,02	0,011
5,458	5,459	957,5	22,97	27,4	10,03	0,001	0,02	0,015
6,720	6,719	957,1	22,94	27,4	12,44	-0,001	-0,01	0,018
8,086	8,081	956,8	22,89	27,5	15,08	-0,005	-0,06	0,022
9,312	9,306	956,5	22,88	27,6	17,49	-0,006	-0,06	0,025
10,583	10,578	956,0	22,81	27,7	20,03	-0,005	-0,05	0,028
11,815	11,813	955,6	22,86	27,7	22,55	-0,002	-0,02	0,031
12,996	13,000	955,2	22,87	27,8	25,00	0,004	0,03	0,034

Identifier and Reference Standards

Qs	Standard volume flow of the reference for the following standard conditions: absolute static pressure: 1013,25 mbar, temperature: 0,00 °C, humidity: 0,0 % rH Q Air, TGZ Turbinenrad-Gaszähler G1000, SerNo: 3400774467
Qp	Standard volume flow of the unit under test
PAp	Absolute Pressure
Tp	Temperature
Hp	Relative Humidity
PDp	Differential pressure
ABW	Difference Qp - Qs absolute and in percent of reading
MU	Extended measurement uncertainty

Graphical representation

deviation of measured value in % of reading over range



volume flow in m³/min

Adjustments

The stored polynomial coefficients of the sensor were not changed in the calibration-unit.

The following coefficients are stored:

S4000=0
S4005=3
S4011=+1.0829968E+00
S4012=-8.7238972E-02
S4013=+8.4745162E-03
S4020=+4.0000000E-04
S4021=+4.0000000E+00
S4022=SN: 533L265 CAL039157

*** end of calibration certificate ***

Kalibrierlaboratorium der TetraTec Instruments GmbH
Calibration Laboratory of TetraTec Instruments GmbH

TetraTec® Instruments

Kalibrierschein / Calibration Certificate

DAkkS Deutsche Akkreditierungsstelle D-K-17589-01-00

Mitglied im
Member of the

Deutschen Kalibrierdienst DKD

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D-K-17589-01-00
2021-04

Kalibrierschein
Calibration certificate

Kalibrierzeichen
Calibration mark

Gegenstand *Object*	**Humidity sensor in CVS-calibration-unit PH019**
Hersteller *Manufacturer*	**TetraTec Instruments GmbH**
Typ *Type*	**HUMTMP-MF-G12**
Fabrikat/Serien-Nr. *Serial number*	**409H790** **Hum**
Auftraggeber *Customer*	**AVL Emission Test Systems GmbH** **41460 Neuss**
Auftragsnummer *Order No.*	**PS910**
Anzahl der Seiten des Kalibrierscheines *Number of pages of the certificate*	3
Datum der Kalibrierung *Date of calibration*	**28.04.2021**

Dieser Kalibrierschein dokumentiert die metrologische Rückführung auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI).
Der DAkkS ist Unterzeichner der multilateralen Übereinkommen der European co-operation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine.
Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

This calibration certificate documents the metrological traceability to national standards, which realize the units of measurement according to the International System of Units (SI).
The DAkkS is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates.
The user is obliged to have the object recalibrated at appropriate intervals.

Dieser Kalibrierschein darf nur vollständig und unverändert weiterverbreitet werden. Auszüge oder Änderungen bedürfen der Genehmigung des ausstellenden Kalibrierlaboratoriums. Kalibrierscheine ohne Unterschrift haben keine Gültigkeit.

This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature are not valid.

Ausstellungsdatum *Issue Date*	Stellv. Leiter des Kalibrierlaboratoriums *Deputy Head of the calibration laboratory*	Bearbeiter *Person in charge*
29.04.2021	Dr. Marc Plüschau	Volker Weinfurter

Calibration item

Humidity sensor in CVS-calibration-unit PH019

Type	HUMTMP-MF-G12
Manufacturer	TetraTec Instruments GmbH
Serial number	409H790
Range	10 ... 75 %

Method of calibration

The calibration was carried out according to the internal calibration procedure VH200: Direct Comparison with the Humidity standard.

Medium	Air atmospheric
Calculation method	Density: real, virial coefficient calculation

Resolution of the unit under test: 0.03 %r.h.

Measurement conditions

Measurement time: 600 seconds per measurement point

Environmental data

Air Pressure: (950,3 ± 1,0) mbar, Temperature: (23,0 ± 0,5) °C, Air Humidity: (39,9 ± 3,0) % rH

Measurement uncertainty

The measurement uncertainty is specified as extended measurement uncertainty, resulting from the standard measurement uncertainty by multiplication with factor k = 2 and includes the uncertainty of the reference and the method of calibration. It was determined according to EA-4/02 M:2013. The value of the result will be within the associated interval with a probability of 95 %. A part for the long-term stability of the device is not included.

Results

as found

Hs	*Hp*	*ABW*	*MU*
%	%	%	%
10,98	14,63	3,65	0,19
32,91	36,78	3,87	0,35
73,04	75,70	2,66	0,65

as left

Hs	*Hp*	*ABW*	*MU*
%	%	%	%
11,01	11,08	0,07	0,19
32,99	33,15	0,15	0,35
73,07	73,23	0,17	0,65

Identifier and Reference Standards

Hs	relative humidity Reference Feuchte, AE57 Auswerteeinheit Taupunktspiegel 973S, SerNo: 612M133
Hp	Output unit under test
ABW	Difference Hp - Hs
MU	Extended measurement uncertainty

Adjustments

Sensor-coefficients as found:

S2305=2
S2310=+0.0000000E+00
S2311=+1.0000000E+00
S2312=+0.0000000E+00
S2320=+1.0000000E+00
S2321=+1.0000000E+00
S2322=Hum SN: 409H790

New polynomial coefficients were calculated and stored. After changing the coefficients a second calibration run was performed.

The following coefficients are stored:

S2305=2
S2310=-3.3463234E-02
S2311=+9.6878165E-01
S2312=+5.4127999E-02
S2320=+1.0000000E+00
S2321=+1.0000000E+00
S2322=Hum SN: 409H790 CAL092363

*** end of calibration certificate ***

Kalibrierlaboratorium der TetraTec Instruments GmbH
Calibration Laboratory of TetraTec Instruments GmbH

TetraTec® Instruments

Kalibrierschein / Calibration Certificate

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DAkkS Deutsche Akkreditierungsstelle D-K-17589-01-00

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D-K-17589-01-00
2021-04

Kalibrierschein
Calibration certificate

Kalibrierzeichen
Calibration mark

Gegenstand *Object*	**Absolute pressure sensor in CVS-calibration-unit PH019**
Hersteller *Manufacturer*	**Honeywell International Inc.**
Typ *Type*	**PPT0001GKK5VB-S017**
Fabrikat/Serien-Nr. *Serial number*	**85180** **Pabs**
Auftraggeber *Customer*	**AVL Emission Test Systems GmbH** **41460 Neuss**
Auftragsnummer *Order No.*	**PS910**
Anzahl der Seiten des Kalibrierscheines *Number of pages of the certificate*	**5**
Datum der Kalibrierung *Date of calibration*	**26.04.2021**

Dieser Kalibrierschein dokumentiert die metrologische Rückführung auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI).
Der DAkkS ist Unterzeichner der multilateralen Übereinkommen der European co-operation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine.
Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

This calibration certificate documents the metrological traceability to national standards, which realize the units of measurement according to the International System of Units (SI).
The DAkkS is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates.
The user is obliged to have the object recalibrated at appropriate intervals.

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This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature are not valid.

Ausstellungsdatum *Issue Date*	Stellv. Leiter des Kalibrierlaboratoriums *Deputy Head of the calibration laboratory*	Bearbeiter *Person in charge*
29.04.2021	Dr. Marc Plüschau	Volker Weinfurter

Calibration item

Absolute pressure sensor in CVS-calibration-unit PH019

Type	PPT0001GKK5VB-S017
Manufacturer	Honeywell International Inc.
Serial number	85180
Range	800 ... 1200 hPa

Method of calibration

The calibration was carried out according to the internal, normative calibration procedure VP200: Direct comparison with the pressure reference (DKD-R 6-1 03/2014).

absolute pressure pabs, calibration sequence A

Medium	Air compressed
Calculation method	Density: real gas calculation for air (CIPM)

Resolution of the unit under test: 0.01 hPa

Measurement conditions

Pressure reference level: Lower edge of the unit under test
orientation: vertical
corrected height difference to reference: -4.8 cm
Measurement time: 10 seconds per measurement point

Environmental data

Air Pressure: (963,3 ± 1,0) mbar, Temperature: (23,0 ± 0,5) °C, Air Humidity: (29,2 ± 3,0) % rH

Measurement uncertainty

The measurement uncertainty is specified as extended measurement uncertainty, resulting from the standard measurement uncertainty by multiplication with factor k = 2 and includes the uncertainty of the reference and the method of calibration. It was determined according to EA-4/02 M:2013. The value of the result will be within the associated interval with a probability of 95 %. A part for the long-term stability of the device is not included.

Results

as-found

N	*Ps* hPa	*M1* hPa	*M2* hPa	*M3* hPa	*M4* hPa	*Pm* hPa
1	799,99	800,91	800,90	800,94	800,94	800,92
1	849,99	851,00	850,97	850,98	850,98	850,98
1	899,99	901,00	900,98	900,99	900,98	900,98
1	949,99	951,10	951,08	951,10	951,09	951,09
1	999,99	1000,98	1000,99	1000,98	1001,02	1000,99
1	1049,99	1051,25	1051,24	1051,24	1051,23	1051,24
1	1099,99	1101,09	1101,07	1101,08	1101,08	1101,08
1	1149,99	1151,15	1151,19	1151,19	1151,18	1151,18
1	1199,98	1201,06	1201,06	1201,06	1201,06	1201,06

as-left

N	*Ps* hPa	*M1* hPa	*M2* hPa	*M3* hPa	*M4* hPa	*Pm* hPa
1	799,99	799,96	799,92	799,92	799,98	799,95
1	849,99	850,03	850,00	850,01	850,05	850,02
1	900,00	899,95	899,98	899,98	899,97	899,97
1	949,99	950,05	950,02	950,04	950,02	950,03
1	999,99	999,88	999,86	999,87	999,87	999,87
1	1049,99	1050,09	1050,08	1050,10	1050,05	1050,08
1	1099,99	1099,94	1099,93	1099,94	1099,93	1099,93
1	1149,99	1150,04	1149,96	1149,97	1150,02	1150,00
1	1199,98	1199,99	1199,99	1199,99	1199,99	1199,99

Identifier and Reference Standards

Ps	Pressure Reference N=1: AE26 (Pabs), AE26 Pabs PPT20020AKN5VS-N003, SerNo: 81624
M1 - M4	Signal unit under test: M1, M3 up; M2, M4 down
Pm	mean value, calculated by Pm = ((M1 + M3) / 2 + (M2 + M4) / 2) / 2

More calculated values

as-found

Pm hPa	*Δp* hPa	*b'* hPa	*h* hPa	*U* hPa	*U'* hPa
800,92	0,93	0,04	0,01	0,18	1,11
850,98	0,99	0,02	0,01	0,18	1,17
900,98	0,99	0,01	0,02	0,18	1,17
951,09	1,10	0,01	0,02	0,18	1,28
1000,99	1,00	0,03	0,03	0,18	1,18
1051,24	1,25	0,01	0,01	0,18	1,43
1101,08	1,09	0,00	0,01	0,18	1,27
1151,18	1,18	0,04	0,02	0,19	1,37
1201,06	1,08	0,01	0,00	0,18	1,26

as-left

Pm hPa	*Δp* hPa	*b'* hPa	*h* hPa	*U* hPa	*U'* hPa
799,95	-0,05	0,06	0,05	0,19	0,24
850,02	0,03	0,04	0,03	0,18	0,21
899,97	-0,03	0,04	0,02	0,18	0,21
950,03	0,04	0,01	0,02	0,18	0,22
999,87	-0,12	0,01	0,01	0,18	0,30
1050,08	0,09	0,03	0,02	0,18	0,27
1099,93	-0,06	0,00	0,01	0,18	0,24
1150,00	0,00	0,07	0,06	0,19	0,19
1199,99	0,01	0,01	0,00	0,18	0,19

Identifier and Reference Standards

Pm	see above
Δp	Deviation
b'	Repeatability
h	Hysteresis error
U	Extended uncertainty
U'	Deviation span

The calculation of the mean values is internally done with a higher precision than shown here.

Adjustments

Sensor-coefficients as found:

S2105=3
S2110=+4.1329782E-03
S2111=+9.8370618E-01
S2112=+2.6119379E-02
S2113=-1.2324535E-02
S2120=+8.3333333E-06
S2121=+8.3333333E-06
S2122=Pabs SN: 85180 CAL039112

New polynomial coefficients were calculated and stored. After changing the coefficients a second calibration run was performed.
The following coefficients are stored:

S2105=3
S2110=-4.8819545E-03
S2111=+1.0168375E+00
S2112=-1.7406574E-02
S2113=+6.1912484E-03
S2120=+8.3333333E-06
S2121=+8.3333333E-06
S2122=Pabs SN: 85180 CAL092289

*** end of calibration certificate ***

Kalibrierlaboratorium der TetraTec Instruments GmbH
Calibration Laboratory of TetraTec Instruments GmbH

TetraTec® Instruments

Kalibrierschein / Calibration Certificate

DAkkS Deutsche Akkreditierungsstelle D-K-17589-01-00

Mitglied im
Member of the

Deutschen Kalibrierdienst DKD

21541
D-K-17589-01-00
2021-04

Kalibrierschein
Calibration certificate

Kalibrierzeichen
Calibration mark

Gegenstand *Object*	**Differential pressure sensor in CVS-calibration-unit PH019**
Hersteller *Manufacturer*	**Meriam Process Technologies**
Typ *Type*	**M1500-DN0028-02-1**
Fabrikat/Serien-Nr. *Serial number*	**2049000105** **Pdiff**
Auftraggeber *Customer*	**AVL Emission Test Systems GmbH** **41460 Neuss**
Auftragsnummer *Order No.*	**PS910**
Anzahl der Seiten des Kalibrierscheines *Number of pages of the certificate*	**4**
Datum der Kalibrierung *Date of calibration*	**26.04.2021**

Dieser Kalibrierschein dokumentiert die metrologische Rückführung auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI).
Der DAkkS ist Unterzeichner der multilateralen Übereinkommen der European co-operation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine.
Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

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The DAkkS is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates.
The user is obliged to have the object recalibrated at appropriate intervals.

Dieser Kalibrierschein darf nur vollständig und unverändert weiterverbreitet werden. Auszüge oder Änderungen bedürfen der Genehmigung des ausstellenden Kalibrierlaboratoriums. Kalibrierscheine ohne Unterschrift haben keine Gültigkeit.

This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature are not valid.

Ausstellungsdatum *Issue Date*	Stellv. Leiter des Kalibrierlaboratoriums *Deputy Head of the calibration laboratory*	Bearbeiter *Person in charge*
29.04.2021	Dr. Marc Plüschau	Volker Weinfurter

Calibration item

Differential pressure sensor in CVS-calibration-unit PH019

Type	M1500-DN0028-02-1
Manufacturer	Meriam Process Technologies
Serial number	2049000105
Range	0 ... 50 hPa

Method of calibration

The calibration was carried out according to the internal, normative calibration procedure VP200: Direct comparison with the pressure reference (DKD-R 6-1 03/2014).

differential pressure pdiff, calibration sequence A

Medium	Air compressed
Calculation method	Density: real gas calculation for air (CIPM)

Resolution of the unit under test: 0.001 hPa

Measurement conditions

Pressure reference level: Lower edge of the unit under test
orientation: vertical
corrected height difference to reference: -4.8 cm
Measurement time: 10 seconds per measurement point

Environmental data

Air Pressure: (963,0 ± 1,0) mbar, Temperature: (23,2 ± 0,5) °C, Air Humidity: (29,6 ± 3,0) % rH

Measurement uncertainty

The measurement uncertainty is specified as extended measurement uncertainty, resulting from the standard measurement uncertainty by multiplication with factor k = 2 and includes the uncertainty of the reference and the method of calibration. It was determined according to EA-4/02 M:2013. The value of the result will be within the associated interval with a probability of 95 %. A part for the long-term stability of the device is not included.

Results

N	*Ps* hPa	*M1* hPa	*M2* hPa	*M3* hPa	*M4* hPa	*Pm* hPa
1	-0,0006	-0,0006	-0,0005	-0,0010	-0,0007	-0,0007
1	0,7967	0,7973	0,7967	0,7961	0,7963	0,7966
1	2,4973	2,4988	2,4977	2,4969	2,4978	2,4978
1	4,9968	4,9991	4,9976	4,9964	4,9971	4,9976
1	7,4965	7,4985	7,4975	7,4966	7,4972	7,4974
1	9,9970	9,9998	9,9983	9,9966	9,9978	9,9982
1	14,9972	15,0011	14,9992	14,9979	14,9983	14,9991
1	19,9967	20,0014	19,9997	19,9976	19,9978	19,9991
1	24,9975	25,0024	25,0006	24,9989	24,9993	25,0003
1	29,997	30,002	30,001	29,998	29,999	30,000
1	39,997	40,003	40,002	39,999	39,999	40,001
1	49,997	50,004	50,003	49,999	50,000	50,002

Identifier and Reference Standards

Ps	Pressure Reference N=1: AE30 PDiff, AE30 Pdiff Mensor CPT6100, SerNo: 41000K86
M1 - M4	Signal unit under test: M1, M3 up; M2, M4 down
Pm	mean value, calculated by Pm = ((M1 + M3) / 2 + (M2 + M4) / 2) / 2

More calculated values

Pm hPa	*Δp* hPa	*b'* hPa	*f* hPa	*h* hPa	*U* hPa	*U'* hPa
-0,0007	-0,0001	0,0001	0,0003	0,0002	0,0080	0,0081
0,7966	0,0000	0,0008		0,0004	0,0080	0,0080
2,4978	0,0004	0,0015		0,0010	0,0081	0,0085
4,9976	0,0008	0,0023		0,0011	0,0082	0,0090
7,4974	0,0009	0,0015		0,0008	0,0081	0,0090
9,9982	0,0012	0,0028		0,0014	0,0082	0,0094
14,9991	0,0019	0,0029		0,0011	0,0082	0,0101
19,9991	0,0024	0,0034		0,0010	0,0083	0,0107
25,0003	0,0028	0,0031		0,0011	0,0090	0,0118
30,000	0,003	0,004		0,001	0,010	0,013
40,001	0,004	0,004		0,001	0,013	0,017
50,002	0,005	0,005		0,001	0,015	0,020

Identifier and Reference Standards

Pm	see above
Δp	Deviation
b'	Repeatability
f	Zero drift
h	Hysteresis error
U	Extended uncertainty
U'	Deviation span

The calculation of the mean values is internally done with a higher precision than shown here.

Adjustments

The following coefficients are stored:

S2005=3
S2010=-1.3970439E-03
S2011=+9.9995830E-01
S2012=-7.3917095E-04
S2013=+4.7938334E-04
S2020=+2.0000000E-04
S2021=+2.0000000E-04
S2022=Pdiff SN: 2049000105 CAL092287

Comments

The sensor with serial number 2049000105 replaces the sensor with serial number 85160

*** end of calibration certificate ***

Kalibrierlaboratorium der TetraTec Instruments GmbH
Calibration Laboratory of TetraTec Instruments GmbH

Kalibrierschein / Calibration Certificate

Mitglied im
Member of the

Deutschen Kalibrierdienst DKD

DAkkS Deutsche Akkreditierungsstelle D-K-17589-01-00

21555
D-K-17589-01-00
2021-04

Kalibrierschein
Calibration certificate

Kalibrierzeichen
Calibration mark

Gegenstand *Object*	**Temperature sensor in CVS-calibration-unit PH019**
Hersteller *Manufacturer*	**TetraTec Instruments GmbH**
Typ *Type*	**WIT-S-PTM8-SO-20100-GB03**
Fabrikat/Serien-Nr. *Serial number*	**512T020** **Temp**
Auftraggeber *Customer*	**AVL Emission Test Systems GmbH** **41460 Neuss**
Auftragsnummer *Order No.*	**PS910**
Anzahl der Seiten des Kalibrierscheines *Number of pages of the certificate*	**3**
Datum der Kalibrierung *Date of calibration*	**29.04.2021**

Dieser Kalibrierschein dokumentiert die metrologische Rückführung auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI).
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Ausstellungsdatum *Issue Date*	Stellv. Leiter des Kalibrierlaboratoriums *Deputy Head of the calibration laboratory*	Bearbeiter *Person in charge*
30.04.2021	Dr. Marc Plüschau	Volker Weinfurter

Calibration item

Temperature sensor in CVS-calibration-unit PH019

Type	WIT-S-PTM8-SO-20100-GB03
Manufacturer	TetraTec Instruments GmbH
Serial number	512T020
Range	0 ... 50 °C

Method of calibration

The calibration was carried out according to the internal, normative calibration procedure VT200: Direct comparison with the temperature reference in the calibrator (DKD-R 5-1).

Resolution of the unit under test: 0.001 °C. Calibration in water quench, depth of immersion approx. 100 mm.

Measurement conditions

Measurement time: 10 seconds per measurement point

Environmental data

Air Pressure: (953,0 ± 1,0) mbar, Temperature: (23,0 ± 0,5) °C, Air Humidity: (34,6 ± 3,0) % rH

Measurement uncertainty

The measurement uncertainty is specified as extended measurement uncertainty, resulting from the standard measurement uncertainty by multiplication with factor k = 2 and includes the uncertainty of the reference and the method of calibration. It was determined according to EA-4/02 M:2013. The value of the result will be within the associated interval with a probability of 95 %. A part for the long-term stability of the device is not included.

Results

Ts	*Sp*	*ABW*	*MU*
°C	°C	°C	°C
0,731	0,698	-0,033	0,026
19,700	19,658	-0,042	0,026
49,639	49,585	-0,054	0,026

Identifier and Reference Standards

Ts	Temperature Reference TRef0 (Wasser), AE60 TRef0 WIT-S-PTM8-SO-20100-GB10, SerNo: 832T915
Sp	Output unit under test
ABW	Difference Sp - Ts
MU	Extended measurement uncertainty

Adjustments

The following coefficients are stored:

S2205=1
S2210=+4.4664159E-04
S2211=+9.9879234E-01
S2220=+3.0945381E-03
S2221=+3.0945381E-03
S2222=Temp SN: 512T020 CAL039083

*** end of calibration certificate ***

LABORATORIUM KALIBRASI
PT. HEKSA INSTRUMEN SINERGI
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Laboratorium : Serpong Grand Park Blok A3 No. 15, Muncul, Setu, Tangerang Selatan - Banten
Telp : 021-22757873 Mobile : 082119541990 Email : info@heksa.co.id

ilac-MRA
KAN Komite Akreditasi Nasional
LK-264-IDN
ISO/IEC-17025-2017

SERTIFIKAT KALIBRASI
Calibration Certificate

Nama Alat *Instrumen Name*	: TEMPERATURE HUMIDITY CONVERTER	No Order *Order no*	: 23 HIS 11 0122
Merk *Manufacturer*	: CHINO	No Sertifikat *Certificate no*	: **S. 2311 - 0376**
Tipe *Type*	: HN-GRBF1N	Tanggal Terima *Received of Date*	: 24 November 2023
Nomor Seri *Serial Number*	: SA162A099	Tanggal Kalibrasi *Date of Calibration*	: 24 November 2023
Tempat Kalibrasi *Venue of calibration*	: AVL Sea & Australia Co., Ltd	Suhu *Temperature*	: (24,7 ± 0,8) ° C
Pemilik *Owner*	: AVL Sea & Australia Co., Ltd	Kelembaban *Relative Humidity*	: (52 ± 6) % RH
Alamat *Address*	: Palma Tower 18th Floor - Unit 18 C, Jl. RA Kartini II-S Kavling, 12310 Jakarta Selatan - Indonesia		

Alat tersebut di atas dikalibrasi terhadap standard PT. Heksa Instrumen Sinergi yang tertelusur ke SI. Pengukuran dilakukan berdasarkan metode yang mengacu ke JIS Z 8806 – 1981 dan prosedur internal dengan nomor referensi IK-HIS-SH 08. Hasil kalibrasi diperoleh dari rata - rata setiap pengukuran dan nilai ketidakpastian kalibrasi tertuang dihalaman-halaman lampiran berikutnya pada sertifikat kalibrasi ini. Ketidakpastian kalibrasi ini merupakan ketidakpastian bentangan yang diperoleh dari sumber - sumber kesalahan tipe A dan tipe B sesuai dengan JCGM 100 : 2008 "Guide to the Expression of Uncertainty in Measurement" yang dinyatakan pada tingkat kepercayaan 95 %

Instrumen stated above has been calibrated against standard of PT. Heksa Instrumen Sinergi traceable to SI. Measurement was carried out based on JIS Z 8806 – 1981 and Internal procedure IK-HIS-SH 08. The calibration result is obtained from average for each measurement and the calibration uncertainty value are seen on the follwing page(s) in this calibration certificate. The calibration uncertainty is expanded uncertainty which referred to type A and B sources of error according to JCGM 100 : 2008 "Guide to the Expression of Uncertainty in Measurement" which is expressed at a 95 % confidence level by the coverage factor k = 2.

Diterbitkan Tanggal , 27 November 2023
Date of Issue

Disetujui oleh / *Approved by*

(Topik Hidayat)
Approve Signatory

Laboratorium Kalibrasi
PT. Heksa Instrumen Sinergi
LK-264-IDN

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Heksa Instrumen SINERGI
HIS - FR - MM17

Nomor Sertifikat / *Certificate No.* : **S. 2311 - 0376**

Bidang Kalibrasi Suhu/*Temperature Calibration Field*

Nama Alat / *Instrument Name* : TEMPERATURE HUMIDITY CONVERTER

Nomor Seri / *Serial Number* : SA162A099

HASIL KALIBRASI / *CALIBRATION RESULT*

Pembacaan Alat / *Reading*		**Penunjukan Standar** / *Standard*		**Koreksi** / *Correction*	
°C	**mA**	**°C**	**mA**	**°C**	**mA**
0,5	4	0,46	4,0016	0,0	0,002
25,3	8	25,42	8,0021	0,1	0,002
49,8	12	49,77	12,0023	0,0	0,002
75,3	16	75,35	16,0025	0,0	0,003
100,2	20	100,37	20,0027	0,2	0,003
Ketidakpastian kalibrasi / *Calibration Uncertainty* : 0,15 °C					

Pembacaan Alat / *Reading*		**Penunjukan Standar** / *Standard*		**Koreksi** / *Correction*	
%	**mA**	**%**	**mA**	**%**	**mA**
40,0	10,40	38,92	10,2407	-1,1	-0,159
50,0	12,00	49,78	11,9618	-0,2	-0,038
65,0	14,40	64,84	14,3754	-0,2	-0,025
75,0	16,00	74,87	15,9866	-0,1	-0,013
80,0	16,80	79,85	16,7829	-0,2	-0,017
Ketidakpastian kalibrasi / *Calibration Uncertainty* : 1,3 %					

Catatan /*Notes*:

Standar yang digunakan Thermohygrometer tipe/no seri 5020;2626-S/A67102;A89214 dan Loop Kalibrator tipe/no ser ADT 209 / 31016010074 dengan nomor sertifikat CE00924 dan S.20-0642 tertelusur ke Sistem Satuan Internasional (SI) melalui Certus Metrology dan BSN - Laboratorium SNSU

This was calibrated by standard Humidity Temperature type/no seri 5020;2626-S/A67102;A89214 and Loop Kalibrator type/no.ser ADT 209 / 31016010074 which officially have certified number CE00924 and S.20-0642 traceable to International System of Unit (SI) through Certus Metrology and BSN - Laboratorium SNSU

Heksa

Akhir dari sertifikat / *End of certificate*

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Laboratorium : Serpong Grand Park Blok A3 No. 15, Muncul, Setu, Tangerang Selatan - Banten
Telp : 021-22757873 Mobile : 082119641990 Email : info@heksa.co.id

Komite Akreditasi Nasional
LK-264-IDN
ISO/IEC-17025-2017

SERTIFIKAT KALIBRASI
Calibration Certificate

Nama Alat *Instrumen Name*	: TRUE RMS DIGITAL MULTIMETER	No Order *Order no*	: 23 HIS 05 0104
Merk *Manufacturer*	: FLUKE	No Sertifikat *Certificate no*	: **S. 2305 - 0686**
Tipe *Type*	: 87 V	Tanggal Terima *Received of Date*	: 26 Mei 2023
Nomor Seri *Serial Number*	: 43120324	Tanggal Kalibrasi *Date of Calibration*	: 29 Mei 2023
Rentang ukur *Measuring Range*	: 600mV / 1000 V / 10 A / 50 MΩ	Suhu *Temperature*	: (23,4 ± 0,4) ° C
Tempat Kalibrasi *Venue of calibration*	: PT. Heksa Instrumen Sinergi	Kelembaban *Relative Humidity*	: (63 ± 2) % RH
Pemilik *Owner*	: AVL Sea & Australia Co., Ltd.		
Alamat *Adress*	: Palma Tower 18th Floor - Unit 18C Jl.RA Kartini II-S Kavling, 12310		

Alat tersebut di atas dikalibrasi terhadap standard PT. Heksa Instrumen Sinergi yang tertelusur ke SI. Pengukuran dilakukan berdasarkan metode yang mengacu ke EURAMET cg-15 dan prosedur internal dengan nomor referensi IK-HIS-LE 12. Hasil kalibrasi diperoleh dari rata - rata setiap pengukuran dan nilai ketidakpastian kalibrasi tertuang dihalaman-halaman lampiran berikutnya pada sertifikat kalibrasi ini. Ketidakpastian kalibrasi ini merupakan ketidakpastian bentangan yang diperoleh dari sumber - sumber kesalahan tipe A dan tipe B sesuai dengan JCGM 100 : 2008 "Guide to the Expression of Uncertainty in Measurement" yang dinyatakan pada tingkat kepercayaan 95 % dengan faktor cakupan k = 2.

Instrumen stated above has been calibrated against standard of PT. Heksa Instrumen Sinergi traceable to SI. Measurement was carried out based on EURAMET cg-15 and Internal procedure IK-HIS-LE 12. The calibration result is obtained from average for each measurement and the calibration uncertainty value are seen on the follwing page(s) in this calibration certificate. The calibration uncertainty is expanded uncertainty which referred to type A and B sources of error according to JCGM 100 : 2008 "Guide to the Expression of Uncertainty in Measurement" which is expressed at a 95 % confidence level by the coverage factor k = 2.

Diterbitkan Tanggal , 31 Mei 2023
Date of Issue

Disetujui oleh / *Approved by*

(Topik Hidayat)
Approve Signatory

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Nomor Sertifikat / *Certificate No.* : **S. 2305 - 0686**

Bidang Kalibrasi Listrik/*Electric Calibration Field*

Nama Alat / *Instrument Name* : TRUE RMS DIGITAL MULTIMETER

Nomor Seri / *Serial Number* : 43120324

HASIL KALIBRASI / *CALIBRATION RESULT*

DC Voltage

Pembacaan Standar *Standard*		Pembacaan Alat *Reading*		Koreksi *Correction*		Ketidakpastian *Uncertainty*
60,0	mV	60,0	mV	0,0	mV	0,012%
539,9		539,9		0,0		0,012%
0,603	V	0,600	V	0,003	V	0,014%
5,403		5,399		0,004		0,014%
6,00	V	6,00	V	0,00	V	0,022%
18,00		18,00		0,00		0,022%
30,00		29,99		0,01		0,022%
42,00		41,99		0,01		0,022%
54,01		53,99		0,02		0,022%
300,0	V	300,0	V	0,0	V	0,01%
540,0		539,9		0,1		0,01%
500	V	500	V	0	V	0,06%
900		900		0		0,06%

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Nomor Sertifikat / *Certificate No.* : **S. 2305 - 0686**

Bidang Kalibrasi Listrik/*Electric Calibration Field*

Nama Alat / *Instrument Name* : TRUE RMS DIGITAL MULTIMETER

Nomor Seri / *Serial Number* : 43120324

HASIL KALIBRASI / *CALIBRATION RESULT*

DC Current

Pembacaan Standar *Standard*		Pembacaan Alat *Reading*		Koreksi *Correction*		Ketidakpastian *Uncertainty*
5,99	mA	6,01	mA	-0,02	mA	0,027%
53,94		53,98		-0,04		0,027%
60,0	mA	60,0	mA	0,0	mA	0,09%
540,6		539,8		0,8		0,09%
0,601	A	0,601	A	0,000	A	0,086%
5,409		5,399		0,010		0,086%
5,01	A	5,00	A	0,01	A	0,08%
9,02		9,00		0,02		0,08%

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Nomor Sertifikat / *Certificate No.* : **S. 2305 - 0686**
Bidang Kalibrasi Listrik/*Electric Calibration Field*

Nama Alat / *Instrumen Name* : TRUE RMS DIGITAL MULTIMETER
Nomor Seri / *Serial Number* : 43120324

HASIL KALIBRASI / *CALIBRATION RESULT*

AC Voltage **50 Hz**

Pembacaan Standar *Standard*		Pembacaan Alat *Reading*		Koreksi *Correction*		Ketidakpastian *Uncertainty*
60,1	mV	60,1	mV	0,0	mV	0,08%
540,2		540,1		0,1		0,08%
0,603	V	0,601	V	0,002	V	0,105%
5,395		5,400		-0,005		0,105%
5,99	V	6,00	V	-0,006	V	0,10%
17,97		17,99		-0,015		0,10%
29,96		29,98		-0,025		0,10%
41,94		41,99		-0,054		0,10%
53,92		53,98		-0,063		0,10%
59,9	V	299,9	V	-239,99	V	0,10%
539,0		539,9		-0,89		0,10%
499	V	500	V	-1	V	0,1%
898		899		-1		0,1%

Hexsa Instrumen

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Nomor Sertifikat / *Certificate No.* : **S. 2305 - 0686**

Bidang Kalibrasi Listrik/*Electric Calibration Field*

Nama Alat / *Instrumen Name* : TRUE RMS DIGITAL MULTIMETER

Nomor Seri / *Serial Number* : 43120324

HASIL KALIBRASI / *CALIBRATION RESULT*

AC Current **50 Hz**

Pembacaan Standar *Standard*		Pembacaan Alat *Reading*		Koreksi *Correction*		Ketidakpastian *Uncertainty*
5,92	mA	5,99	mA	-0,07	mA	0,96%
53,87		53,99		-0,12		0,96%
59,9	mA	59,9	mA	0,0	mA	0,4%
539,9		540,2		-0,3		0,4%
0,599	A	0,600	A	-0,001	A	0,206%
5,396		5,401		-0,005		0,206%
5,00	A	4,98	A	0,02	A	0,14%
8,99		9,00		-0,01		0,14%

Heksa Instrumen

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Nomor Sertifikat / *Certificate No.* : **S. 2305 - 0686**

Bidang Kalibrasi Listrik/*Electric Calibration Field*

Nama Alat / *Instrumen Name* : TRUE RMS DIGITAL MULTIMETER

Nomor Seri / *Serial Number* : 43120324

HASIL KALIBRASI / *CALIBRATION RESULT*

Resistance

Pembacaan Standar *Reading*		Pembacaan Alat *Standrad*		Koreksi *Correction*		Ketidakpastian *Uncertainty*
60,0	Ω	60,1	Ω	-0,1	Ω	0,155%
541,0		539,9		1,1		0,155%
0,724	KΩ	0,600	KΩ	0,124	KΩ	0,176%
5,585		5,399		0,186		0,176%
6,19	KΩ	6,00	KΩ	0,19	KΩ	0,040%
54,81		54,00		0,81		0,040%
60,8	KΩ	60,0	KΩ	0,8	KΩ	0,062%
546,1		539,9		6,2		0,062%
0,606	MΩ	0,600	MΩ	0,006	MΩ	0,011%
2,025		2,097		-0,072		0,011%

Catatan */Notes:*

Standar yang digunakan Clamp Type Multimeter Calibrator Tipe / No Seri : GF6018A / 20190510 dengan nomor sertifikat CE00393 tertelusur ke Sistem Satuan Internasional (SI) melalui Certus Metrology

This was calibrated by standard Clamp Type Multimeter Calibrator Type / No Seri : GF6018A / 20190510 dengan nomor sertifikat CE00393 traceable to International System of Unit (SI) through Certus Metrology

Hekса Instrumen

Akhir dari sertifikat / *End of certificate*

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Laboratorium : Serpong Grand Park Blok A3 No. 15, Muncul, Setu, Tangerang Selatan - Banten
Telp : 021-22757873 Mobile : 082119541990 Email : info@heksa.co.id

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KAN Komite Akreditasi Nasional
LK-264-IDN
ISO/IEC-17025-2017

SERTIFIKAT KALIBRASI
Calibration Certificate

Nama Alat *Instrumen Name*	: DIGITAL MEMOCAL	No Order *Order no*	: 23 HIS 05 0104
Merk *Manufacturer*	: ERO ELECTRONIC	No Sertifikat *Certificate no*	: **S. 2305 - 0687**
Tipe *Type*	: MEM 2090RS100	Tanggal Terima *Received of Date*	: 25 Mei 2023
Nomor Seri *Serial Number*	: IT. 1141000158	Tanggal Kalibrasi *Date of Calibration*	: 29 Mei 2023
Rentang ukur *Measuring Range*	: VARIABLE	Suhu *Temperature*	: (19,6 ± 0,4) ° C
Tempat Kalibrasi *Venue of calibration*	: PT. Heksa Instrumen Sinergi	Kelembaban *Relative Humidity*	: (54 ± 2) % RH
Pemilik *Owner*	: AVL Sea & Australia Co., Ltd.		
Alamat *Adress*	: Palma Tower 18th Floor - Unit 18C JLRA Kartini II-S Kavling, 12310 Jakarta Selatan Indonesia		

Alat tersebut di atas dikalibrasi terhadap standard PT. Heksa Instrumen Sinergi yang tertelusur ke SI. Pengukuran dilakukan berdasarkan metode yang mengacu ke EURAMET cg-11 / V. 01 dan prosedur internal dengan nomor referensi IK-HIS-SH 02. Hasil kalibrasi diperoleh dari rata - rata setiap pengukuran dan nilai ketidakpastian kalibrasi tertuang dihalaman-halaman lampiran berikutnya pada sertifikat kalibrasi ini. Ketidakpastian kalibrasi ini merupakan ketidakpastian bentangan yang diperoleh dari sumber - sumber kesalahan tipe A dan tipe B sesuai dengan JCGM 100 : 2008 "Guide to the Expression of Uncertainty in Measurement" yang dinyatakan pada tingkat kepercayaan 95 % dengan faktor cakupan k = 2.

Instrumen stated above has been calibrated against standard of PT. Heksa Instrumen Sinergi traceable to SI. Measurement was carried out based on EURAMET cg-11 / V. 01 and Internal procedure IK-HIS-SH02. The calibration result is obtained from average for each measurement and the calibration uncertainty value are seen on the follwing page(s) in this calibration certificate. The calibration uncertainty is expanded uncertainty which referred to type A and B sources of error according to JCGM 100 : 2008 "Guide to the Expression of Uncertainty in Measurement" which is expressed at a 95 % confidence level by the coverage factor k = 2.

Diterbitkan Tanggal, 31 Mei 2023
Date of Issue

Disetujui oleh / *Approved by*

(Topik Hidayat)
Approve Signatory

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Heksa Instrumen SINERGI
HIS - FR - MM17

Nomor Sertifikat / *Certificate No* : **S. 2305 - 0687**

Bidang Kalibrasi Suhu/*Temperature Calibration Field*

Nama Alat / *Instrument Name* : DIGITAL MEMOCAL

Nomor Seri / *Serial Number* : IT. 1141000158

HASIL KALIBRASI / *CALIBRATION RESULT*

SOURCE

TYPE J

Pembacaan Alat / *Reading* °C	mV	Penunjukan Standar / *Standard* mV	Koreksi / *Correction* mV
0	0	0	0
100	5,268	5,2540	-0,0140
300	16,327	16,3150	-0,0120
500	27,392	27,3840	-0,0076
700	39,131	39,1280	-0,0030
900	51,877	51,8710	-0,0060
Ketidakpastian kalibrasi / *Calibration Uncertainty* :			0,58 mV

TYPE K

Pembacaan Alat / *Reading* °C	mV	Penunjukan Standar / *Standard* mV	Koreksi / *Correction* mV
0		0	0
100	4,096	4,0760	-0,0202
300	12,209	12,1920	-0,0166
500	20,644	20,6330	-0,0113
700	29,129	29,1140	-0,0150
900	37,326	37,3170	-0,0089
Ketidakpastian kalibrasi / *Calibration Uncertainty* :			0,59 mV

TYPE T

Pembacaan Alat / *Reading* °C	mV	Penunjukan Standar / *Standard* mV	Koreksi / *Correction* mV
0	0	0	0
100	4,278	4,2640	-0,0140
200	9,288	9,2770	-0,0110
300	14,861	14,8520	-0,0090
400	20,872	20,8620	-0,0100
Ketidakpastian kalibrasi / *Calibration Uncertainty* :			0,58 mV

TYPE R

Pembacaan Alat / *Reading* °C	mV	Penunjukan Standar / *Standard* mV	Koreksi / *Correction* mV
0		0	0
100	0,647	0,6340	-0,0130
300	2,400	2,3900	-0,0100
500	4,471	4,4590	-0,0120
700	6,742	6,7320	-0,0100
900	9,204	9,1950	-0,0090
Ketidakpastian kalibrasi / *Calibration Uncertainty* :			0,58 mV

Heksa Instrumen Sinergi

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Nomor Sertifikat / *Certificate No.* : **S. 2305 - 0687**

Bidang Kalibrasi Suhu/*Temperature Calibration Field*

Nama Alat / *Instrument Name* : DIGITAL MEMOCAL

Nomor Seri / *Serial Number* : IT. 1141000158

HASIL KALIBRASI / *CALIBRATION RESULT*

TYPE S

Pembacaan Alat / *Reading* °C	Pembacaan Alat / *Reading* mV	Penunjukan Standar / *Standard* mV	Koreksi / *Correction* mV
0	0	0	0
100	0,645	0,6340	-0,0110
300	2,323	2,3120	-0,0110
500	4,233	4,2230	-0,0100
700	6,275	6,2660	-0,0090
900	8,449	8,4410	-0,0080
Ketidakpastian kalibrasi / *Calibration Uncertainty* :			0,58 mV

SOURCE

Pembacaan Alat / *Reading* mV	Penunjukan Standar / *Standard* mV	Koreksi / *Correction* mV
2	2,004	0,004
4	4,006	0,006
6	6,009	0,009
8	8,011	0,011
10	10,011	0,011
12	12,012	0,012
14	14,014	0,014
16	16,015	0,015
18	18,018	0,018
20	20,056	0,056
Ketidakpastian kalibrasi / *Calibration Uncertainty* :		0,54 mV

Pembacaan Alat / *Reading* mV	Penunjukan Standar / *Standard* mV	Koreksi / *Correction* mV
20	20,000	0,000
40	40,000	0,000
60	60,000	0,000
80	80,000	0,000
100	100,000	0,000
120	120,001	0,001
140	140,001	0,001
160	160,002	0,002
180	180,001	0,001
200	200,003	0,003
Ketidakpastian kalibrasi / *Calibration Uncertainty* :		0,54 mV

Pembacaan Alat / *Reading* V	Penunjukan Standar / *Standard* V	Koreksi / *Correction* V
0,2	0,2001	0,0001
0,4	0,4002	0,0002
0,6	0,6002	0,0002
0,8	0,8001	0,0001
1,0	1,0003	0,0003
1,2	1,2001	0,0001
1,4	1,4002	0,0002
1,6	1,6003	0,0003
1,8	1,8005	0,0005
2,0	2,0004	0,0004
Ketidakpastian kalibrasi / *Calibration Uncertainty* :		0,43 V

Heksa Instrumen Sinergi

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Nomor Sertifikat / *Certificate No.* : **S. 2305 - 0687**

Bidang Kalibrasi Listrik / *Electric Calibration Field*

Nama Alat / *Instrumen Name* : DIGITAL MEMOCAL

Nomor Seri / *Serial Number* : IT. 1141000158

HASIL KALIBRASI / *CALIBRATION RESULT*

Pembacaan Alat / *Reading* V	Penunjukan Standar / *Standard* V	Koreksi / *Correction* V
2	2,000	0,000
4	4,000	0,000
6	6,000	0,000
8	8,000	0,000
10	10,003	0,003
12	12,001	0,001
14	14,001	0,001
16	16,004	0,004
18	18,005	0,005
20	20,004	0,004
Ketidakpastian kalibrasi / *Calibration Uncertainty* :		0,43 V

SOURCE

Pembacaan Alat / *Reading* mA	Penunjukan Standar / *Standard* mA	Koreksi / *Correction* mA
2	2,3996	0,3996
4	4,8000	0,8000
6	7,2004	1,2004
8	9,5998	1,5998
10	12,0002	2,0002
12	14,4003	2,4003
14	16,8002	2,8002
16	19,2001	3,2001
18	21,6005	3,6005
20	24,0004	4,0004
Ketidakpastian kalibrasi / *Calibration Uncertainty* :		0,43 mA

Penunjukan Standar / *Standard* Ω	Pembacaan Alat / *Reading* Ω	Koreksi / *Correction* Ω
40	40,1000	-0,1355
200	200,4000	-0,4085
360	360,4000	-0,3815
Ketidakpastian kalibrasi / *Calibration Uncertainty* :		0,61 Ω

MEASURE

Penunjukan Standar / *Standard* mV	Pembacaan Alat / *Reading* mV	Koreksi / *Correction* mV
2	2,074	-0,074
4	3,995	0,005
6	5,788	0,212
8	7,898	0,102
10	9,843	0,157
12	11,856	0,144
14	13,849	0,151
16	15,548	0,452
18	17,954	0,046
20	19,896	0,104
Ketidakpastian kalibrasi / *Calibration Uncertainty* :		0,43 mV

Heksa Instrumen Sinergi

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Bidang Kalibrasi Listrik / *Electric Calibration Field*

Nama Alat / *Instrument Name* : DIGITAL MEMOCAL

Nomor Seri / *Serial Number* : IT. 1141000158

HASIL KALIBRASI / *CALIBRATION RESULT*

Penunjukan Standar / *Standard* mV	Pembacaan Alat / *Reading* mV	Koreksi / *Correction* mV
20	19,97	0,03
40	39,96	0,04
60	59,81	0,19
80	79,85	0,15
100	99,91	0,09
120	119,89	0,11
140	139,77	0,23
160	159,65	0,35
180	179,91	0,09
200	199,95	0,05
Ketidakpastian kalibrasi / *Calibration Uncertainty* :		0,43 mV

Penunjukan Standar / *Standard* V	Pembacaan Alat / *Reading* V	Koreksi / *Correction* V
0,2	0,198	0,002
0,4	0,398	0,002
0,6	0,599	0,001
0,8	0,799	0,001
1,0	0,996	0,004
1,2	1,196	0,004
1,4	1,399	0,001
1,6	1,599	0,001
1,8	1,798	0,002
2,0	1,998	0,002
Ketidakpastian kalibrasi / *Calibration Uncertainty* :		0,58 V

Penunjukan Standar / *Standard* V	Pembacaan Alat / *Reading* V	Koreksi / *Correction* V
2	2,00	0,00
4	3,99	0,01
6	5,99	0,01
8	7,99	0,01
10	9,96	0,04
12	11,95	0,05
14	13,95	0,05
16	15,96	0,04
18	17,95	0,05
20	19,96	0,04
Ketidakpastian kalibrasi / *Calibration Uncertainty* :		0,58 V

Heksa Instrumen Sinergi

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Nomor Sertifikat / *Certificate No.* : **S. 2305 - 0687**

Bidang Kalibrasi Listrik / *Electric Calibration Field*

Nama Alat / *Instrument Name* : DIGITAL MEMOCAL

Nomor Seri / *Serial Number* : IT. 1141000158

HASIL KALIBRASI / *CALIBRATION RESULT*

Penunjukan Standar / *Standard* mA	Pembacaan Alat / *Reading* mA	Koreksi / *Correction* mA
2	1,999	0,001
4	3,999	0,001
6	5,998	0,002
8	7,999	0,001
10	9,995	0,005
12	11,994	0,006
14	13,993	0,007
16	15,995	0,005
18	17,991	0,009
20	19,993	0,007
Ketidakpastian kalibrasi / *Calibration Uncertainty* :		0,43 mA

Penunjukan Standar / *Standard* mA	Pembacaan Alat / *Reading* mA	Koreksi / *Correction* mA
20	19,98	0,02
40	39,96	0,04
60	59,96	0,04
80	79,96	0,04
100	99,95	0,05
120	119,94	0,06
140	139,94	0,06
160	159,93	0,07
180	179,93	0,07
200	199,95	0,05
Ketidakpastian kalibrasi / *Calibration Uncertainty* :		0,43 mA

Catatan /*Notes*

Standar yang digunakan untuk kalibrasi Temp Calibrator, Merek Fluke No.seri/model 724/2496124, dengan nomor sertifikat 21426/GQI-Sert/10/20, tertelusur ke Sistem Satuan Internasional (SI) melalui PT. Global Quality Indonesia LK-057-IDN

The standard used for calibration is Temp Calibrator, merk Fluke serial number type 724/2496124, which officially have certified number 21426/GQI-Sert/10/20, traceable to International System of Unit (SI) through PT. Global Quality Indonesia LK-057-IDN

Standar yang digunakan Clamp Type Multimeter Calibrator Tipe / No Seri : GF6018A / 20190510 dengan nomor sertifikat CCL/20/0021-A/HS tertelusur ke Sistem Satuan Internasional (SI) melalui Telkom Indonesia

This was calibrated by standard Clamp Type Multimeter Calibrator Type / No Seri : GF6018A / 20190510 which officially have certified number CCL/20/0021-A/HS traceable to International System of Unit (SI) through Telkom Indonesia

Standar yang digunakan Digital Multi Meter Tipe / No Seri : 8846A / 9528010 dengan nomor sertifikat CCL/20/0020/AK tertelusur ke Sistem Satuan Internasional (SI) melalui Telkom Indonesia

This was calibrated by standard Digital Multi Meter Type / No Seri : 8846A / 9528010 - which officially have certified number CCL/20/0020/AK traceable to International System of Unit (SI) through Telkom Indonesia

Akhir dari sertifikat / *End of certificate*

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PT. HEKSA INSTRUMEN SINERGI
Office : Jln. Lingkar Selatan No. 10 Kp. Sengkol RT. 06 RW. 02 Tangerang Selatan - Banten
Laboratorium : Serpong Grand Park Blok A3 No. 15, Muncul, Setu, Tangerang Selatan - Banten
Telp : 021-22757873 Mobile : 082119541990 Email : info@heksa.co.id

Komite Akreditasi Nasional
LK-264-IDN
ISO/IEC-17025-2017

SERTIFIKAT KALIBRASI
Calibration Certificate

Nama Alat *Instrumen Name*	: PRESSURE CALIBRATOR	No Order *Order no*	: 23 HIS 05 0104
Merk *Manufacturer*	: FLUKE	No Sertifikat *Certificate no*	: **S. 2305 - 0692**
Tipe *Type*	: 718300G	Tanggal Terima *Received of Date*	: 26 Mei 2023
Nomor Seri *Serial Number*	: 4033062	Tanggal Kalibrasi *Date of Calibration*	: 07 Juni 2023
Rentang ukur *Measuring Range*	: (-0,8 sampai 20) bar	Suhu *Temperature*	: (23,5 ± 0,4) °C
Resolusi *Resolution*	: 0,001 bar	Kelembaban *Relative Humidity*	: (54,9 ± 2,2) % Rh
Tempat Kalibrasi *Venue of calibration*	: PT. Heksa Instrumen Sinergi		
Pemilik *Owner*	: AVL Sea & Australia Co., Ltd.		
Alamat *Adress*	: Palma Tower 18th Floor - Unit 18C Jl.RA Kartini II-S Kavling, 12310 Jakarta Selatan Indonesia		

Alat tersebut di atas dikalibrasi terhadap standard PT. Heksa Instrumen Sinergi yang tertelusur ke SI. Pengukuran dilakukan berdasarkan metode yang mengacu ke DKD – R : 6-1 : 2014 dan prosedur internal dengan nomor referensi IK-HIS-PR 01. Hasil kalibrasi diperoleh dari rata - rata setiap pengukuran dan nilai ketidakpastian kalibrasi tertuang dihalaman-halaman lampiran berikutnya pada sertifikat kalibrasi ini. Ketidakpastian kalibrasi ini merupakan ketidakpastian bentangan yang diperoleh dari sumber - sumber kesalahan tipe A dan tipe B sesuai dengan JCGM 100 : 2008 "Guide to the Expression of Uncertainty in Measurement" yang dinyatakan pada tingkat kepercayaan 95 % dengan faktor cakupan k = 2.

Instrumen stated above has been calibrated against standard of PT. Heksa Instrumen Sinergi traceable to SI. Measurement was carried out based on DKD – R : 6-1 : 2014 and Internal procedure IK-HIS-PR01. The calibration result is obtained from average for each measurement and the calibration uncertainty value are seen on the follwing page(s) in this calibration certificate. The calibration uncertainty is expanded uncertainty which referred to type A and B sources of error according to JCGM 100 : 2008 "Guide to the Expression of Uncertainty in Measurement" which is expressed at a 95 % confidence level by the coverage factor k = 2.

Diterbitkan Tanggal , 09 Juni 2023
Date of Issue

Disetujui oleh / *Approved by*

(Ir. H. Karta Haryanto)
Approve Signatory

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Nomor Sertifikat / *Certificate No* : **S. 2305 - 0692**

Bidang Kalibrasi Tekanan / *Pressure Calibration Field*

Nama Alat / *Instrument Name* : PRESSURE CALIBRATOR

Nomor Seri / *Serial Number* : 4033062

HASIL KALIBRASI / *CALIBRATION RESULT*

Pembacaan Alat / *Reading* bar	Penunjukan Standar / *Standard* bar		Koreksi / *Correction* bar	
	Naik / *up*	Turun / *Down*	Naik / *up*	Turun / Down
0	0,000	0,000	0,000	0,000
2	2,001	2,000	0,001	0,000
4	4,001	4,000	0,001	0,000
6	6,001	6,000	0,001	0,000
8	8,001	8,000	0,001	0,000
10	10,001	10,000	0,001	0,000
12	12,003	12,002	0,003	0,002
14	14,001	14,000	0,001	0,000
16	16,002	16,001	0,002	0,001
18	18,001	18,000	0,001	0,000
20	20,000	20,000	0,000	0,000
Ketidakpastian kalibrasi / *Calibration Uncertainty* : 0,007 bar				

Heksa Instrumen

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Nomor Sertifikat / *Certificate No* : **S. 2305 - 0692**
Bidang Kalibrasi Tekanan / *Pressure Calibration Field*
Halaman ke 3 dari 3 halaman
Page of pages

Nama Alat / *Instrument Name* : PRESSURE CALIBRATOR
Nomor Seri / *Serial Number* : 4033062

HASIL KALIBRASI / *CALIBRATION RESULT*

Pembacaan Alat / *Reading* bar	**Penunjukan Standar** / *Standard* bar		Koreksi / *Correction* bar	
	Naik / *up*	Turun / *Down*	Naik / *up*	Turun / *Down*
0,00	0,000	0,000	0	0
-0,10	-0,100	-0,100	0,000	0,000
-0,20	-0,201	-0,201	-0,001	-0,001
-0,30	-0,300	-0,300	0,000	0,000
-0,40	-0,401	-0,401	-0,001	-0,001
-0,50	-0,500	-0,500	0,000	0,000
-0,60	-0,601	-0,601	-0,001	-0,001
-0,70	-0,700	-0,700	0,000	0,000
-0,80	-0,801	-0,801	-0,001	-0,001
Ketidakpastian kalibrasi / *Calibration Uncertainty* : 0,003 bar				

Catatan / *Notes*:
Standar yang digunakan untuk kalibrasi Digital Pressure Indicator, No seri/model MC2-PE / 11201, dengan nomor sertifikat 2315323, tertelusur ke Sistem Satuan Internasional (SI) melalui FUKUDA TECHNOLOGY LK - 176 - IDN
The standard used for calibration is Digital Pressure, serial number/model MC2-PE / 11201, which officially have certified number 2315323, traceable to International System of Unit (SI) through FUKUDA TECHNOLOGY LK - 176 - IDN

Akhir dari sertifikat / *End of certificate*

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Laboratorium : Serpong Grand Park Blok A3 No. 15, Muncul, Setu, Tangerang Selatan - Banten
Telp : 021-22757873 Mobile : 082119541990 Email : info@heksa.co.id

KAN Komite Akreditasi Nasional
LK-264-IDN
ISO/IEC-17025-2017

SERTIFIKAT KALIBRASI
Calibration Certificate

Nama Alat *Instrumen Name*	: Pressure Meter	No Order *Order no*	: 23 HIS 05 0104
Merk *Manufacturer*	: Digima Junior	No Sertifikat *Certificate no*	: **S. 2305 - 0693**
Tipe *Type*	: D-86720	Tanggal Terima *Received of Date*	: 26 Mei 2023
Nomor Seri *Serial Number*	: Q - 804	Tanggal Kalibrasi *Date of Calibration*	: 07 Juni 2023
Rentang ukur *Measuring Range*	: (0 sampai 2000) mBar	Suhu *Temperature*	: (24,2 ± 0,4) °C
Resolusi *Resolution*	: 1 mBar	Kelembaban *Relative Humidity*	: (62,3 ± 2,0) % Rh
Tempat Kalibrasi *Venue of calibration*	: PT. Heksa Instrumen Sinergi		
Pemilik *Owner*	: AVL Sea & Australia Co., Ltd.		
Alamat *Adress*	: Palma Tower 18th Floor - Unit 18C Jl.RA Kartini II-S Kavling, 12310 Jakarta Selatan Indonesia		

Alat tersebut di atas dikalibrasi terhadap standard PT. Heksa Instrumen Sinergi yang tertelusur ke SI. Pengukuran dilakukan berdasarkan metode yang mengacu ke DKD – R : 6-1 : 2014 dan prosedur internal dengan nomor referensi IK-HIS-PR 01. Hasil kalibrasi diperoleh dari rata - rata setiap pengukuran dan nilai ketidakpastian kalibrasi tertuang dihalaman-halaman lampiran berikutnya pada sertifikat kalibrasi ini. Ketidakpastian kalibrasi ini merupakan ketidakpastian bentangan yang diperoleh dari sumber - sumber kesalahan tipe A dan tipe B sesuai dengan JCGM 100 : 2008 "Guide to the Expression of Uncertainty in Measurement" yang dinyatakan pada tingkat kepercayaan 95 % dengan faktor cakupan k = 2.

Instrumen stated above has been calibrated against standard of PT. Heksa Instrumen Sinergi traceable to SI. Measurement was carried out based on DKD – R : 6-1 : 2014 and Internal procedure IK-HIS-PR01. The calibration result is obtained from average for each measurement and the calibration uncertainty value are seen on the follwing page(s) in this calibration certificate. The calibration uncertainty is expanded uncertainty which referred to type A and B sources of error according to JCGM 100 : 2008 "Guide to the Expression of Uncertainty in Measurement" which is expressed at a 95 % confidence level by the coverage factor k = 2.

Diterbitkan Tanggal, 09 Juni 2023
Date of Issue

Disetujui oleh / *Approved by*

(Ir. H. Karta Haryanto)
Approve Signatory

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Heksa Instrumen SINERGI
HIS - FR - IM17

LABORATORIUM KALIBRASI
PT. HEKSA INSTRUMEN SINERGI

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Komite Akreditasi Nasional
LK-264-IDN
ISO/IEC 17025:2017

Nomor Sertifikat / *Certificate No* : **S. 2305 - 0693**

Bidang Kalibrasi Tekanan / *Pressure Calibration Field*

Nama Alat / *Instrument Name* : Pressure Meter

Nomor Seri / *Serial Number* : Q - 804

HASIL KALIBRASI / *CALIBRATION RESULT*

Pembacaan Alat/*Reading* mBar		**Penunjukan Standar** / *Standard* mBar		**Koreksi** / *Correction* mBar	
Absolute	Aktual Pressure	Naik / *up*	Turun / *Down*	Naik / *up*	Turun / *Down*
70	-930	-920	-919	10	11
200	-800	-794	-793	6	7
400	-600	-596	-595	4	5
600	-400	-399	-398	1	2
800	-200	-203	-202	-3	-2
1000	0	-6	-6	-6	-6
1200	200	191	190	-9	-10
1400	400	384	383	-16	-17
1600	600	580	579	-20	-21
1800	800	776	775	-24	-25
2000	1000	972	971	-28	-29
Ketidakpastian kalibrasi / *Calibration Uncertainty* : 1,40 mBar					

Catatan /*Notes*

Standar yang digunakan untuk kalibrasi Digital Pressure Indicator, No.seri/model MC2 - PE / 11201, dengan nomor sertifikat S.19-0243, tertelusur ke Sistem Satuan Internasional (SI) melalui Laboratorium Standard Nasional Satuan Ukur.

The standard used for calibration is Digital Pressure Indicator, serial number model MC2 - PE / 11201, which officially have certified number S.19-0243, traceable to International System of Unit (SI) through Laboratory of National Measure Standards

Alat tidak bisa di posisi 0

Akhir dari sertifikat / *End of certificate*

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Laboratorium : Serpong Grand Park Blok A3 No. 15, Muncul, Setu, Tangerang Selatan - Banten
Telp : 021-22757873 Mobile : 082119541990 Email : info@heksa.co.id

Komite Akreditasi Nasional
LK-264-IDN
ISO/IEC-17025-2017

SERTIFIKAT KALIBRASI
Calibration Certificate

Nama Alat *Instrumen Name*	: PRESSURE METER	No Order *Order no*	: 23 HIS 05 0104
Merk *Manufacturer*	: SIGMA JUNIOR	No Sertifikat *Certificate no*	: **S. 2305 - 0694**
Tipe *Type*	: D-86720	Tanggal Terima *Received of Date*	: 26 Mei 2023
Nomor Seri *Serial Number*	: H-625	Tanggal Kalibrasi *Date of Calibration*	: 07 Juni 2023
Rentang ukur *Measuring Range*	: (-2000 sampai 2000) mBar	Suhu *Temperature*	: (22,6 ± 0,4) °C
Resolusi *Resolution*	: 1 mBar	Kelembaban *Relative Humidity*	: (56,8 ± 2,2) % Rh
Tempat Kalibrasi *Venue of calibration*	: PT. Heksa Instrumen Sinergi		
Pemilik *Owner*	: AVL Sea & Australia Co., Ltd.		
Alamat *Adress*	: Palma Tower 18th Floor - Unit 18C Jl.RA Kartini II-S Kavling, 12310 Jakarta Selatan Indonesia		

Alat tersebut di atas dikalibrasi terhadap standard PT. Heksa Instrumen Sinergi yang tertelusur ke SI. Pengukuran dilakukan berdasarkan metode yang mengacu ke DKD – R : 6-1 : 2014 dan prosedur internal dengan nomor referensi IK-HIS-PR 01. Hasil kalibrasi diperoleh dari rata - rata setiap pengukuran dan nilai ketidakpastian kalibrasi tertuang dihalaman-halaman lampiran berikutnya pada sertifikat kalibrasi ini. Ketidakpastian kalibrasi ini merupakan ketidakpastian bentangan yang diperoleh dari sumber - sumber kesalahan tipe A dan tipe B sesuai dengan JCGM 100 : 2008 "Guide to the Expression of Uncertainty in Measurement" yang dinyatakan pada tingkat kepercayaan 95 % dengan faktor cakupan k = 2.

Instrumen stated above has been calibrated against standard of PT. Heksa Instrumen Sinergi traceable to SI. Measurement was carried out based on DKD – R : 6-1 : 2014 and Internal procedure IK-HIS-PR01. The calibration result is obtained from average for each measurement and the calibration uncertainty value are seen on the following page(s) in this calibration certificate. The calibration uncertainty is expanded uncertainty which referred to type A and B sources of error according to JCGM 100 : 2008 "Guide to the Expression of Uncertainty in Measurement" which is expressed at a 95 % confidence level by the coverage factor k = 2.

Diterbitkan Tanggal , 09 Juni 2023
Date of Issue

Disetujui oleh / *Approved by*

(Ir. H. Karta Haryanto)
Approve Signatory

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Heksa Instrumen SINERGI
HIS - FR - MM17

Nomor Sertifikat / *Certificate No* : **S. 2305 - 0694**

Bidang Kalibrasi Tekanan / *Pressure Calibration Field*

Nama Alat / *Instrumen Name* : PRESSURE METER

Nomor Seri / *Serial Number* : H-625

HASIL KALIBRASI / *CALIBRATION RESULT*

Pembacaan Alat / *Reading* mBar	**Penunjukan Standar** / *Standard* mBar		**Koreksi** / *Correction* mBar	
	Naik / *up*	Turun / *Down*	Naik / *up*	Turun / *Down*
0	0	0	0	0
200	201	201	1	1
400	402	402	2	2
600	602	602	2	2
800	803	803	3	3
1000	1004	1004	4	4
1200	1204	1204	4	4
1400	1405	1405	5	5
1600	1605	1605	5	5
1800	1806	1806	6	6
2000	2005	2005	5	5
Ketidakpastian kalibrasi / *Calibration Uncertainty* : 0,63 mBar				

Heksa Instrumen Sinergi

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Nomor Sertifikat / *Certificate No* : **S. 2305 - 0694**

Bidang Kalibrasi Tekanan / *Pressure Calibration Field*

Nama Alat / *Instrument Name* : Pressure Meter

Nomor Seri / *Serial Number* : H-625

HASIL KALIBRASI / *CALIBRATION RESULT*

Vacuum Gauge

Pembacaan Alat / *Reading* mBar	**Penunjukan Standar** / *Standard* mBar		**Koreksi** / *Correction* mBar	
	Naik / *up*	Turun / *Down*	Naik / *up*	Turun / *Down*
0	0	0	0	0
-200	-201	-201	-1	-1
-400	-401	-401	-1	-1
-600	-601	-601	-1	-1
-800	-801	-801	-1	-1
-1000	-1002	-1002	-2	-2
-1200	-1203	-1203	-3	-3
-1400	-1404	-1404	-4	-4
-1600	-1605	-1605	-5	-5
-1800	-1806	-1806	-6	-6
-2000	-2007	-2007	-7	-7
Ketidakpastian kalibrasi / *Calibration Uncertainty* : 0,57 mBar				

Catatan / *Notes*:

Standar yang digunakan untuk kalibrasi Digital Pressure Indicator, No.seri/model MC2 - PE / 11201, dengan nomor sertifikat 2315323, tertelusur ke Sistem Satuan Internasional (SI) melalui FUKUDA TECHNOLOGY LK 176 - IDN

The standard used for calibration is Digital Pressure Indicator, serial number/model MC2 - PE / 11201, which officially have certified number 2315323, traceable to International System of Unit (SI) through FUKUDA TECHNOLOGY LK 176 - IDN

Heksa Instrumen

Akhir dari sertifikat / *End of certificate*

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PT. HEKSA INSTRUMEN SINERGI
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Laboratorium : Serpong Grand Park Blok A3 No. 15, Muncul, Setu, Tangerang Selatan - Banten
Telp : 021-22757373 Mobile : 082119541990 Email : info@heksa.co.id

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KAN Komite Akreditasi Nasional
LK-264-IDN
ISO/IEC-17025-2017

SERTIFIKAT KALIBRASI
Calibration Certificate

Nama Alat *Instrumen Name*	: FLOW METER	No Order *Order no*	: 23 HIS 05 0104
Merk *Manufacturer*	: RED-Y	No Sertifikat *Certificate no*	**: S. 2305 - 0744**
Tipe *Type*	: GCM-C5SA-BN00	Tanggal Terima *Receive of Date*	: 26 Mei 2023
Nomor Seri *Serial Number*	: 301015	Tanggal Kalibrasi *Date of Calibration*	: 05 Juni 2023
Rentang ukur *Measuring Range*	: (0 sampai 50) L/min	Suhu *Temperature*	: (22,0 ± 0,4) ° C
Tempat Kalibrasi *Venue of calibration*	: PT. Heksa Instrumen Sinergi	Kelembaban *Relative Humidity*	: (60 ± 3) % RH
Pemilik *Owner*	: AVL Sea & Australia Co., Ltd		
Alamat *Adress*	: Palma Tower 18th Floor - Unit 18C Jl.RA Kartini II-S Kavling, 12310 Jakarta Selatan Ind		

Alat tersebut di atas dikalibrasi terhadap standard PT. Heksa Instrumen Sinergi yang tertelusur ke SI. Pengukuran dilakukan berdasarkan metode yang mengacu ke prosedur internal dengan nomor referensi IK-HIS-FL 01. Hasil kalibrasi diperoleh dari rata - rata setiap pengukuran dan nilai ketidakpastian kalibrasi tertuang dihalaman-halaman lampiran berikutnya pada sertifikat kalibrasi ini. Ketidakpastian kalibrasi ini merupakan ketidakpastian bentangan yang diperoleh dari sumber - sumber kesalahan tipe A dan tipe B sesuai dengan JCGM 100 : 2008 "Guide to the Expression of Uncertainty in Measurement" yang dinyatakan pada tingkat kepercayaan 95 % dengan faktor cakupan k = 2.

Instrumen stated above has been calibrated against standard of PT. Heksa Instrumen Sinergi traceable to SI. Measurement was carried out based on Internal procedure IK-HIS-FL 01 The calibration result is obtained from average for each measurement and the calibration uncertainty value are seen on the following page(s) in this calibration certificate. The calibration uncertainty is expanded uncertainty which referred to type A and B sources of error according to JCGM 100 : 2008 "Guide to the Expression of Uncertainty in Measurement" which is expressed at a 95 % confidence level by the coverage factor k = 2.

Diterbitkan Tanggal , 09 Juni 2023

Disetujui oleh / *Approved by*

(Topik Hidayat)
Approve Signatory

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Nomor Sertifikat / *Certificate No.* : **S. 2305 - 0744**

Bidang Kalibrasi Aliran / *Flow Meter Calibration Field*

Nama Alat / *Instrument Name* : FLOW METER

Nomor Seri / *Serial Number* : 301015

HASIL KALIBRASI / *CALIBRATION RESULT*

Pembacaan Alat *Reading* (L/min)	**Penunjukan Standar** *Standard* (L/min)	**Koreksi** *Correction* (L/min)
1,04	1,13	0,09
2,03	2,19	0,16
3,06	3,24	0,18
4,08	4,29	0,21
5,11	5,34	0,23
6,12	6,37	0,26
Ketidakpastian Kalibrasi / *Calibration Uncertainty* : 0,09%		

Catatan *Notes:*

Standar yang digunakan untuk kalibrasi FLOW METER, Merek Siargo No seri/model MF 5700 / INV-HIS-21-FL-02, dengan nomor sertifikat E-21170031, tertelusur ke Sistem Satuan Internasional (SI) melalui BT2MP

The standard used for calibration is FLOW METER, merk Siargo serial number/model MF 5700 / INV-HIS-21-FL-02, which officially have certified number E-21170031, traceable to International System of Unit (SI) through BT2MP

Titik kalibrasi atas permintaan pelanggan

Akhir dari sertifikat / *End of certificate*

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T : (021) 3857751 (Hunting)
W : www@nemoint.com
E : nmi@nemoint.com

SURAT JALAN

Kepada Yth,
Balai Pengujian Laik Jalan dan Sertifikasi
Kendaraan Bermotor
Jl. Raya Setu, Cibuntu, Cibitung
Bekasi

FILE NO. : TES230526A
SURAT JALAN / D.O. NO. : SJA 023 SEP 23
JAKARTA : 11 SEPTEMBER 2023

No.	Nama Barang / Description		Banyaknya / Quantity
1	BH0780SP	MAINT. KIT CLD I60 VACUUM PUMP	2
	BH0830SP	MAINTENANCE KIT ANNUAL RAW STREAM	1
	BH0831SP	MAINTENANCE KIT DILUTION STREAM ANNUAL	1
	BH0778SP	MAINTENANCE KIT AMA I60 PUMP SAMPLE/BYP.	3
	BH0824SP	MAINTENANCE KIT ANNUAL HEATED FID I60	1
	BH0648SP	MAINTENANCE KIT AMA I60/PSSI60 HFID PUMP	1
	BH0825SP	MAINTENANCE KIT-HEATED CLD I60 ANNUAL	1
	BH0827SP	MAINTENANCE KIT COLD CLD I60 ANNUAL	1
	BH0636SP	MAINT. KIT CVS I60 ANNUAL	1
	BH1397SP	MAINT. KIT CVS I60 PUMP MZ-2	2
	DA0559SP	O-RING 10.00X2.00	1
	MR1428SP	FAN GUARD ASSEMBLY 60X60MM PLASTIC BLACK	2
	BH0793SP	MAINTENANCE KIT 12 MONTHS PREFILTER G02	1
	EM0159SP	THERM.TRANSF.COMP FEROTHERM 4 300 DEG.	1
	DA1777SP	SEALSET DETECTOR FID ANALYZER	1
	MV0568SP	DIAPHRAGM HEAD 4- HEAD (100-230 V)	1
2	CONVERTER CLD FILLING SET HIGH		1
	CONVERTER CLD FILLING SET LOW		1

SPK NO. 97.A/PPK/RUTIN/BPLJSKB/V/2023,
Tanggal: 31 Mei 2023

Menerangkan bahwa barang2 tsb. telah diterima dalam keadaan baik
Certification of above goods received and accepted in a good condition

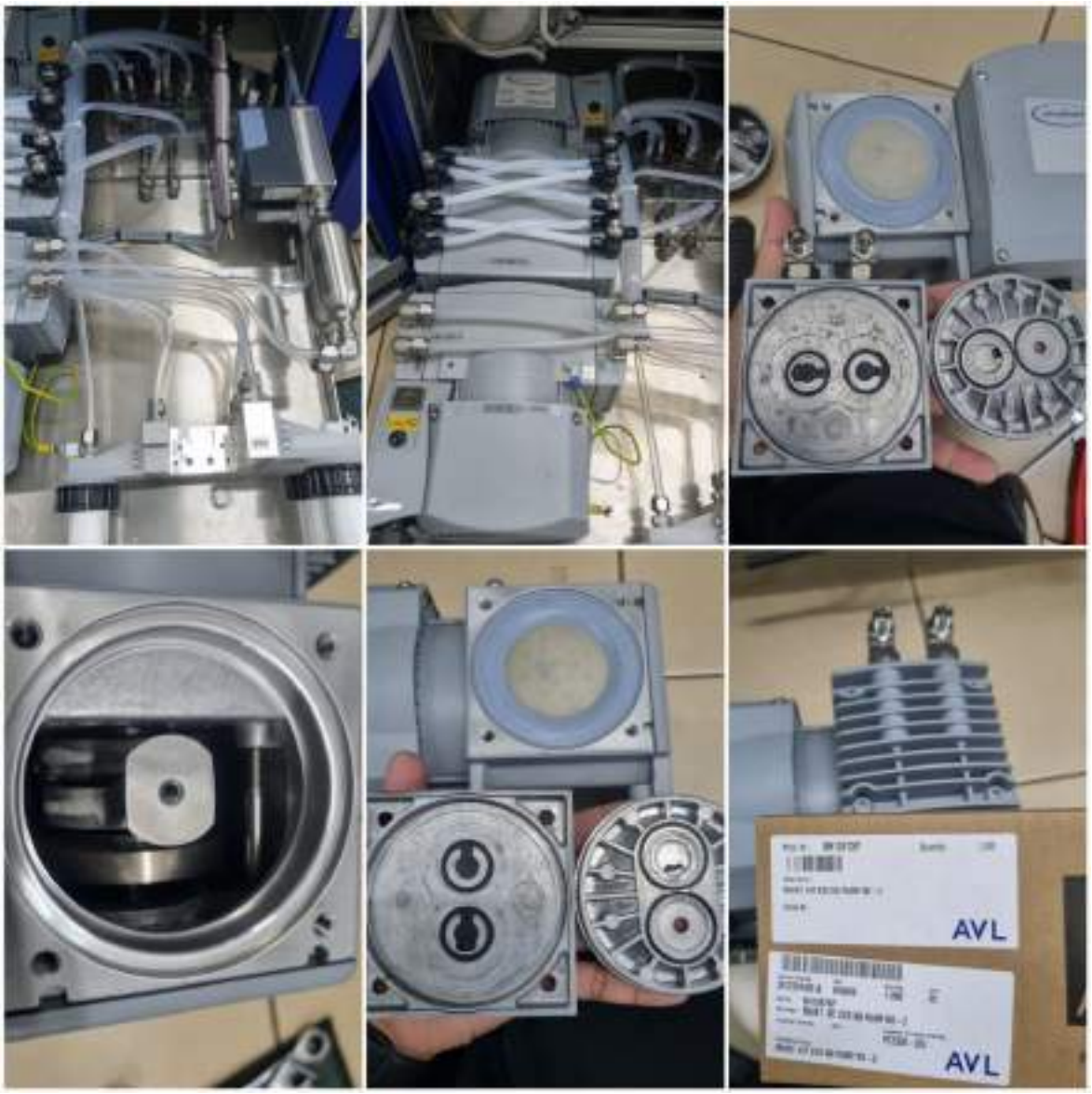
Hormat kami,
PT. NEW MODULE INTERNATIONAL

PM HUBDAT R40 Daily activity:

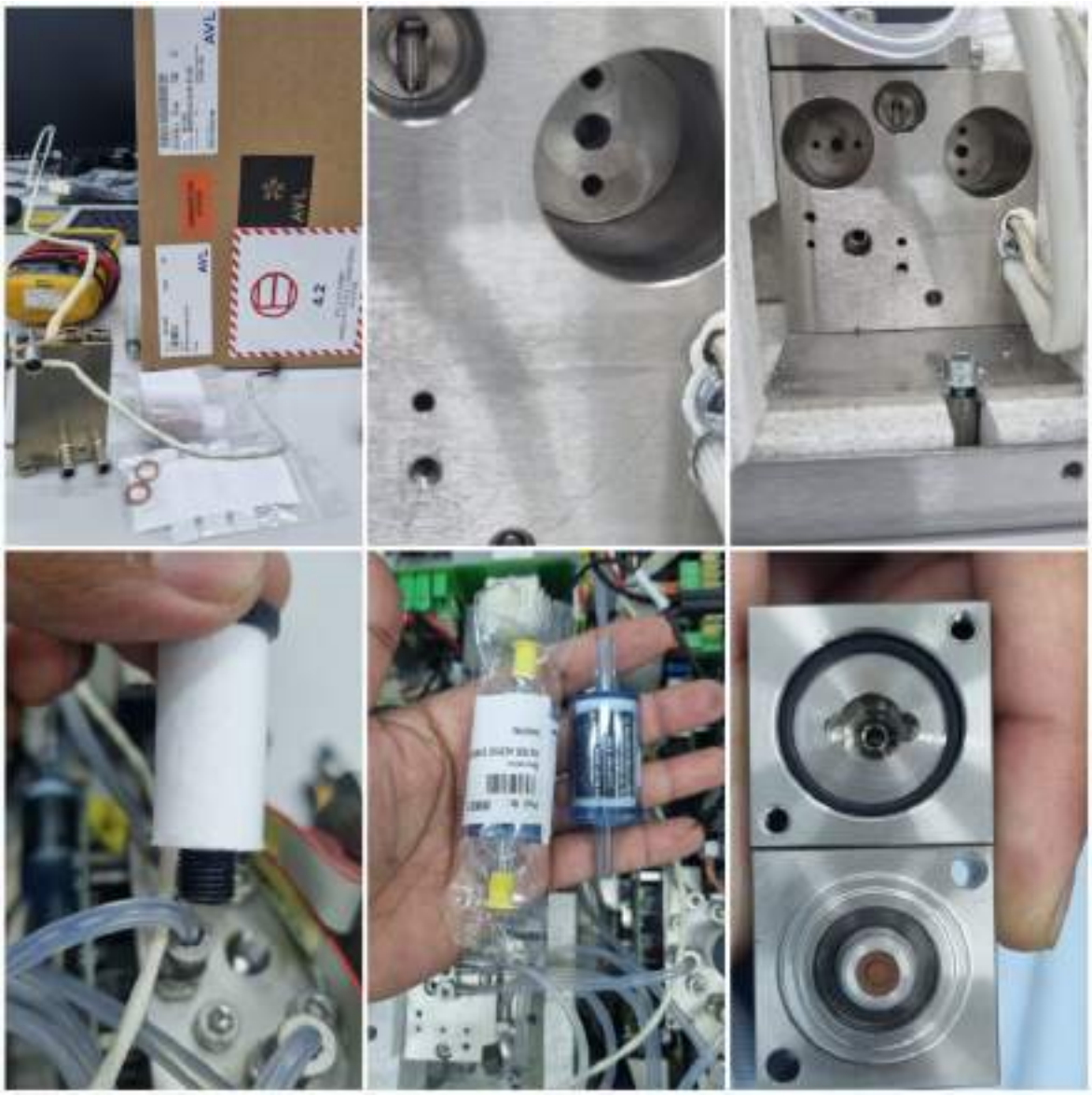



AVL
AVL
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AVL


Prod. Nr.: MY1157
SOUND ABSORBER AMTE - M - LH - MS
SAMPLE


AVL
AVL

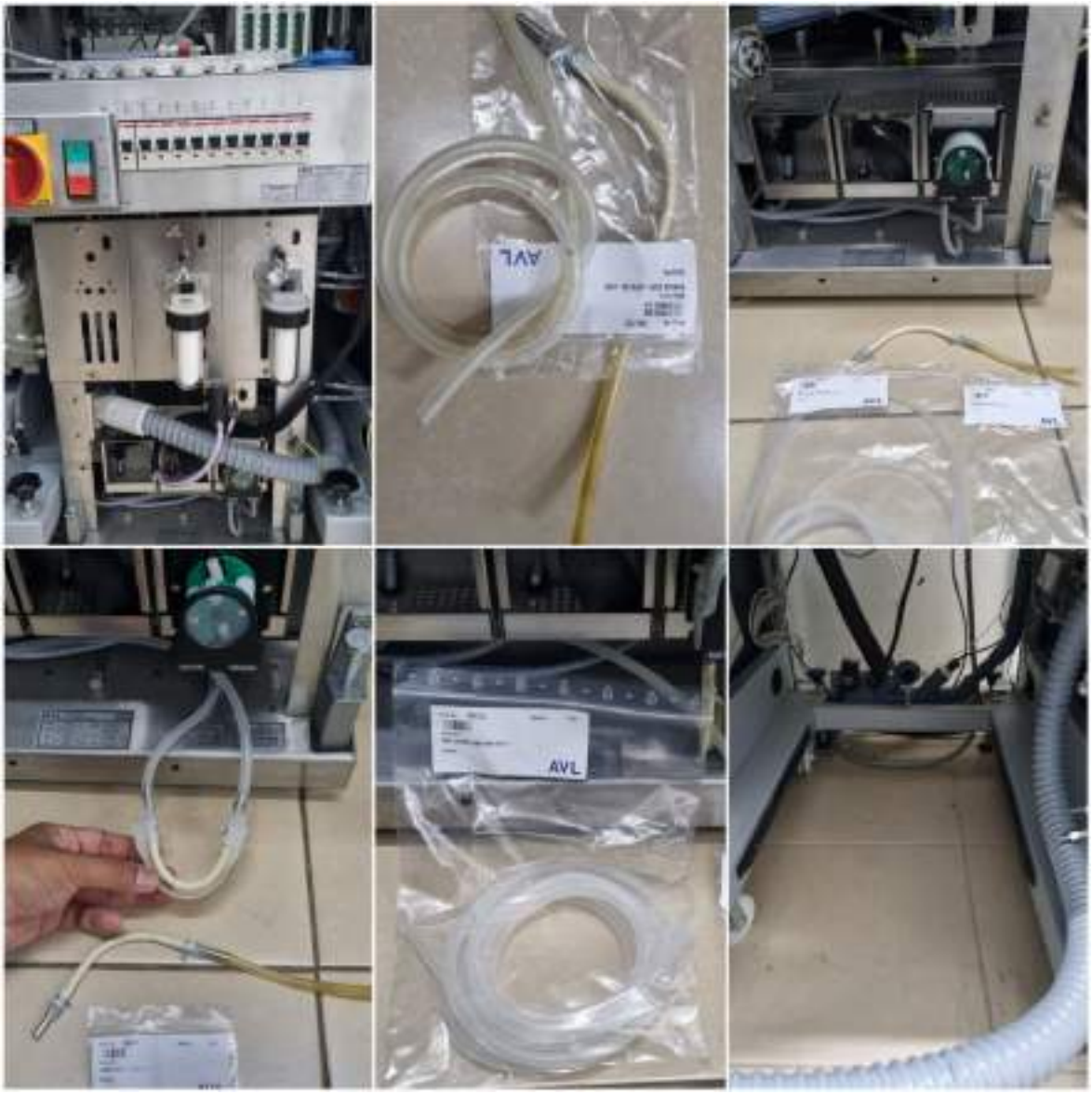

AVL
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AVL
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AVL CLD 160 HH


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