

Test report: Machinery capability investigation
from industry screwdriver



C. & E. FEIN GmbH
Schwäbisch Gmünd
Hans-Fein-Str. 81, D-73529 Schwäbisch Gmünd-Bargau

Maschine typ : Mid-mounted handle

Date : 18.10.2019

Model variant : ASM 18-3-PC

Manufacturer : C.&E. Fein GmbH



Stage of development : Series

MCI - Typ : Homologation

Number of steps : 1-step

Test bench - ID : 1026164

Screw connection class : 2

Fitting tolerance : 10,0%

1	2	3	4	5	6
5,0%	10,0%	12,0%	15,0%	20,0%	25,0%

Torque range : $M_{min} = 0,50$ Nm

$M_{max} = 3,00$ Nm

Idle speed : $n = 600$ min⁻¹

Weight incl. Battery : $m = 1,50$ kg

Battery voltage : $U = 18,0$ V

Sound pressure level : $L_{pA} = 80$ dB(A)

Battery capacity : $Q = 6000$ mAh

Undervoltage detection : ☒

Torque range investigation :

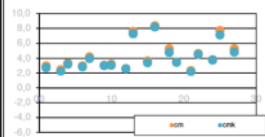
Testing machine : 3 Stück

$M_{max} = 30\% \rightarrow M_{30\%} = M_{min} + 30\% \times (M_{max} - M_{min}) = 1,25$ Nm
 $80\% \rightarrow M_{80\%} = M_{min} + 80\% \times (M_{max} - M_{min}) = 2,50$ Nm
 $100\% \rightarrow M_{100\%} = M_{min} + 100\% \times (M_{max} - M_{min}) = 3,00$ Nm

Information on all 3 test items

Load level		30%		80%		100%	
Test torque	$M_d =$	1,25		2,50		3,00	
Joints		hard	soft	hard	soft	hard	soft
		30°	360°	30°	360°	30°	360°
$c_{m, min} =$		2,315	2,976	2,976	3,333	3,030	4,167
$c_{mk, min} =$		2,167	2,714	2,845	3,187	3,010	3,958

		Name :	Date :
Carried out by	:	M. Mueck	06.09.2019
Test report prepared by	:	M. Burkhardt	18.10.2019

Testbench Measuring				MCS for FEIN-Project : 0				Homologation		Date: 18.10.2019	
ASM 18-8PC				ScrewdriverType ASM		Accuracy-Class 10,0%		Class : 2		f _{mess} = 300 Hz	
				Variant :		18-8PC				M _{range} = 0,50 up to 3,00 Nm	
										n _{given} = 600 rpm U = 18,00 V	
										cycles: 100	
MCS	M _d [Nm]	Angle [°]	M _q [Nm]	ΔM _{q 1/2} [Nm]	s [Nm]	C _m [1]	C _{mk} [1]	n [min ⁻¹]	Remarks		
1	1,25	360°	1,239	0,002	0,014	2,976	2,714	604	2019-07.029782	30%	
1	1,25	30°	1,237		0,017	2,451	2,196	605			
1	2,50	360°	2,511	0,022	0,025	3,333	3,187	600		80%	
1	2,50	30°	2,489		0,028	2,976	2,845	602			
1	3,00	360°	2,985	0,017	0,024	4,167	3,958	601		100%	
1	3,00	30°	3,002		0,033	3,030	3,010	598			
2	1,25	360°	1,244	0,005	0,013	3,205	3,051	605	2019-07.029783	30%	
2	1,25	30°	1,249		0,016	2,604	2,583	608			
2	2,50	360°	2,489	0,006	0,011	7,576	7,242	599		80%	
2	2,50	30°	2,483		0,023	3,623	3,377	604			
2	3,00	360°	2,994	0,035	0,012	8,333	8,167	603		100%	
2	3,00	30°	3,029		0,019	5,263	4,754	586			
3	1,25	360°	1,251	0,007	0,012	3,472	3,444	610	2019-07.029784	30%	
3	1,25	30°	1,258		0,018	2,315	2,167	603			
3	2,50	360°	2,507	0,010	0,018	4,630	4,500	609		80%	
3	2,50	30°	2,497		0,022	3,788	3,742	593			
3	3,00	360°	2,977	0,048	0,013	7,692	7,103	607		100%	
3	3,00	30°	3,025		0,019	5,263	4,825	599			
Start of measurement:								09:00			
End of measurement:								16:00			
Homologation : 3 Machines out of a series, each 30%, 80% and 100% the torque-ranges.											
Waitingtime between Load changes 2 sec.											
Series of measurement per machine, Nominal Torque and Screwinghardness each 100 Load changes (LW).											
Measurment based on VDI 2647 February 2013											
C _{m min} = 2,315		C _{m q} = 4,261		C _{m max} = 8,333		S _{cm} = 1,816					
C _{mk min} = 2,167		C _{mk q} = 4,048		C _{mk max} = 8,167		n _{MFU} = 18					
Name: #WERT!				Project: 0 : ASM 18-8PC							
		C. & E. FEIN GmbH Schwäbisch Gmünd		Stage of Development :		Series		C_{m min} = C_m - Minimum Value C_{mk min} = C_{mk} - Minimum Value C_{m q} = C_m - Mid Value C_{mk q} = C_{mk} - Mid Value C_{m max} = C_m - Maximum Value C_{mk max} = C_{mk} - Maximum Value S_{cm} = C_m - Standard deviation S_{cmk} = C_{mk} - Standard deviation n_{MCS} = No. of Machine Capability Study (MCS) c = correction value			

Appendix documentation and presentation of data

18.10.2019

A1 General information on the test item 1

Manufacturer : C.&E. Fein GmbH Model: 18-3 / PC Ident-No. : 2019-07.029782

Modell variant: ASM begin: 09:00 Serial-No. : 0
end: 11:00

Torque range from M_{min} =	0,50	Nm	to M_{max} =	3,00	Nm
Weight incl. Battery :	1,500	kg	Sound pressure level :	80	dB(A)
Battery voltage :	18,00	V	Undervoltage detection :	☒	
Battery capacity :	6000	mAh	Idle speed :	600	min ⁻¹

Number of screwed connections with battery at 100% rated power		
Turn rate low (soft) :	1602	LC
Turn rate high (hard) :	1845	LC

Temperature measurement for power tools after 100 measurements		
At the handle :	27	°C
at the engine :	36	°C

A2 General information test equipment and test conditions

Description of test equipment, design and function:

Schatz cerTest 2.5 5413-5392/303

Brake 10 Nm 0

ASM firmly and positively clamped

2 sec. wait between two load changes

Measurability test	No.: D-K-17572-01-00-9487	Date: 07.05.2019
Certificate according to VDI/VDE 2646:		

A3.1 Data per test item

Torque-range	from M_{min} =	0,50	Nm	to M_{max} =	3,00	Nm
Test torque 30%	$M_{30\%}$ =	1,25	Nm			
Test torque 80%	$M_{80\%}$ =	2,50	Nm			
Test torque 100%	$M_{100\%}$ =	3,00	Nm			
Fitting tolerance	2	in %	± 10,0%			

Load level		30%		80%		100%		Nm		
Test torque	M _d =	1,25		2,50		3,00				
Joints		hard	soft	hard	soft	hard	soft			
		30°	360°	30°	360°	30°	360°			
Tolerance : Upper limit		:	M _{zul max} =	1,38		2,75		3,30		Nm
Tolerance : Lower limit		:	M _{zul min} =	1,13		2,25		2,70		Nm
Medium torque		:	M _q =	1,24	1,24	2,49	2,51	3,00	2,99	Nm
Standard deviation		:	s =	0,02	0,01	0,03	0,03	0,03	0,02	Nm
6s torque scattering		:	6s/M _q =	8,25%	6,78%	6,75%	5,97%	6,60%	4,82%	
Ability index		:	c _m =	2,45	2,98	2,98	3,33	3,03	4,17	
Ability index		:	c _{mk} =	2,20	2,71	2,85	3,19	3,01	3,96	
Mean speed		:	n =	605	604	602	600	598	601	min ⁻¹

Appendix documentation and presentation of data

18.10.2019

A1 General information on the test item 2

Manufacturer : C.&E. Fein GmbH Model: 18-3 / PC Ident-No. : 2019-07.029783

Modell variant: ASM begin: 11:00 Serial-No. : 0
end: 13:00

Torque range from M_{min} =	0,50	Nm	to M_{max} =	3,00	Nm
Weight incl. Battery :	1,500	kg	Sound pressure level :	80,1	dB(A)
Battery voltage :	18,00	V	Undervoltage detection :	☒	
Battery capacity :	6000	mAh	Idle speed :	600	min ⁻¹

Number of screwed connections with battery at 100% rated power		
Turn rate low (soft) :	1602	LC
Turn rate high (hard) :	1845	LC

Temperature measurement for power tools after 100 measurements	
At the handle :	27 °C
at the engine :	36 °C

A2 General information test equipment and test conditions

Description of test equipment, design and function:

Schatz cerTest 2.5 5413-5392/303

Brake 10 Nm

ASM firmly and positively clamped

2 sec. wait between two load changes

Measurability test	No.: D-K-17572-01-00-9487	Date: 07.05.2019
Certificate according to VDI/VDE 2646:		

A3.1 Data per test item

Torque-range	from M_{min} =	0,50	Nm	to M_{max} =	3,00	Nm
Test torque 30%	$M_{30\%}$ =	1,25	Nm			
Test torque 80%	$M_{80\%}$ =	2,50	Nm			
Test torque 100%	$M_{100\%}$ =	3,00	Nm			
Fitting tolerance	2	in %	± 10,0%			

Load level			30%		80%		100%		Nm			
Test torque	M_d	=	1,25		2,50		3,00					
Joints			hard	soft	hard	soft	hard	soft				
			30°	360°	30°	360°	30°	360°				
Tolerance : Upper limit			:	$M_{zul\ max}$	=	1,38		2,75	3,30	Nm		
Tolerance : Lower limit			:	$M_{zul\ min}$	=	1,13		2,25	2,70	Nm		
Medium torque			:	M_q	=	1,25	1,24	2,48	2,49	3,03	2,99	Nm
Standard deviation			:	s	=	0,02	0,01	0,02	0,01	0,02	0,01	Nm
6s torque scattering			:	$6s/M_q$	=	7,69%	6,27%	5,56%	2,65%	3,76%	2,40%	
Ability index			:	c_m	=	2,60	3,21	3,62	7,58	5,26	3,62	
Ability index			:	c_{mk}	=	2,58	3,05	3,38	7,24	4,75	3,44	
Mean speed			:	n	=	608	605	604	599	586	603	min ⁻¹

Appendix documentation and presentation of data

18.10.2019

A1 General information on the test item 3

Manufacturer : C.&E. Fein GmbH Model: 18-3 / PC Ident-No. : 2019-07.029784

Modell variant: ASM begin: 13:00 Serial-No. : 0
end: 16:00

Torque range from M_{min} =	0,50	Nm	to M_{max} =	3,00	Nm
Weight incl. Battery :	1,500	kg	Sound pressure level :	80,1	dB(A)
Battery voltage :	18,00	V	Undervoltage detection :	☒	
Battery capacity :	6000	mAh	Idle speed :	600	min ⁻¹

Number of screwed connections with battery at 100% rated power		
Turn rate low (soft) :	1602	LC
Turn rate high (hard) :	1845	LC

Temperature measurement for power tools after 100 measurements	
At the handle :	27 °C
at the engine :	36 °C

A2 General information test equipment and test conditions

Description of test equipment, design and function:

Schatz cerTest 2.5 5413-5392/303

Brake 10 Nm

ASM firmly and positively clamped

2 sec. wait between two load changes

Measurability test	No.: D-K-17572-01-00-9487	Date: 07.05.2019
Certificate according to VDI/VDE 2646:		

A3.1 Data per test item

Torque-range	from M_{min} =	0,50	Nm	to M_{max} =	3,00	Nm
Test torque 30%	$M_{30\%}$ =	1,25	Nm			
Test torque 80%	$M_{80\%}$ =	2,50	Nm			
Test torque 100%	$M_{100\%}$ =	3,00	Nm			
Fitting tolerance	2	in %	±	10,0%		

Load level		30%		80%		100%		Nm		
Test torque	M _d =	1,25		2,50		3,00				
Joints		hard	soft	hard	soft	hard	soft			
		30°	360°	30°	360°	30°	360°			
Tolerance : Upper limit		:	M _{zul max} =	1,38		2,75		3,30		Nm
Tolerance : Lower limit		:	M _{zul min} =	1,13		2,25		2,70		Nm
Medium torque		:	M _q =	1,26	1,25	2,50	2,51	3,03	2,98	Nm
Standard deviation		:	s =	0,02	0,01	0,02	0,02	0,02	0,01	Nm
6s torque scattering		:	6s/M _q =	8,59%	5,76%	5,29%	4,31%	3,77%	2,62%	
Ability index		:	c _m =	2,31	3,47	3,79	4,63	5,26	7,69	
Ability index		:	c _{mk} =	2,17	3,44	3,74	4,50	4,82	7,10	
Mean speed		:	n =	603	610	593	609	599	607	min ⁻¹

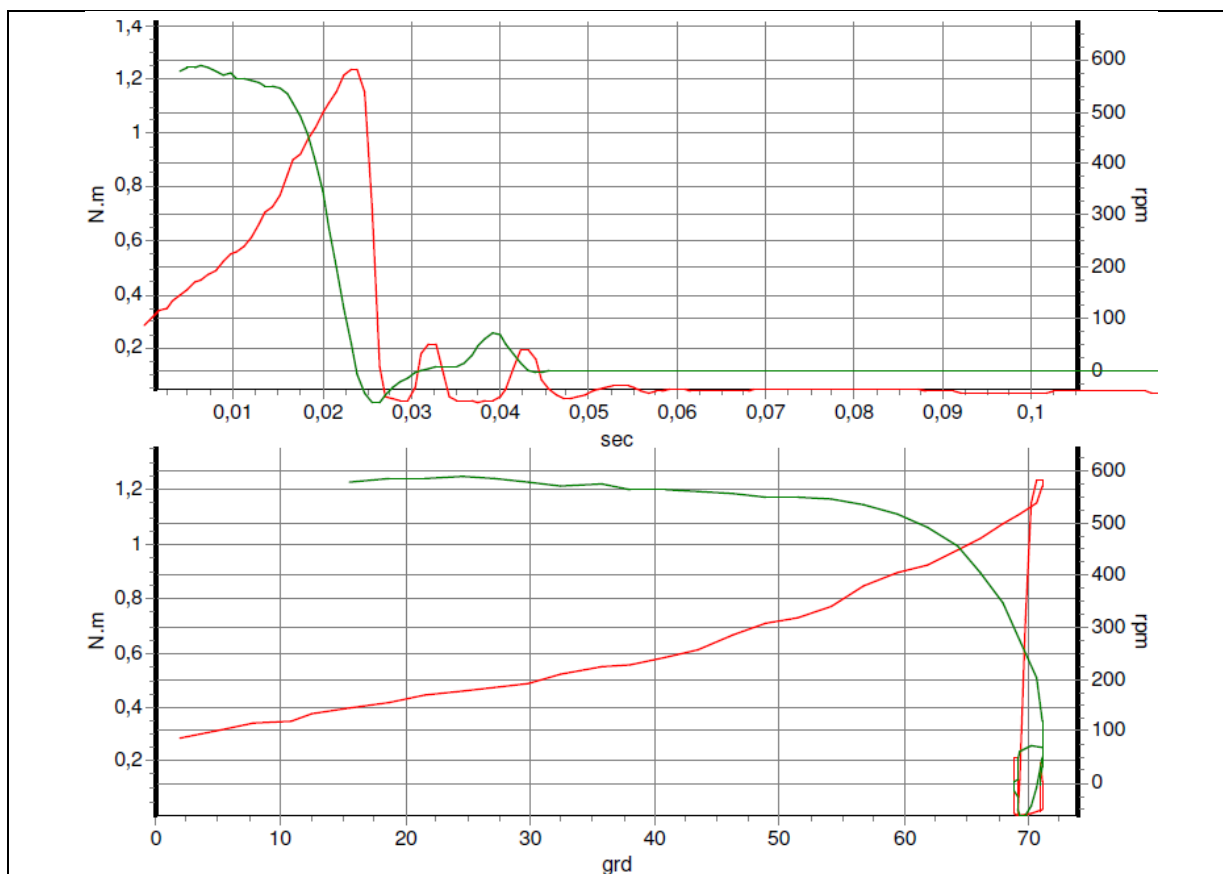


Illustration 1: 30° hard joint 1,25 Nm first measurement point

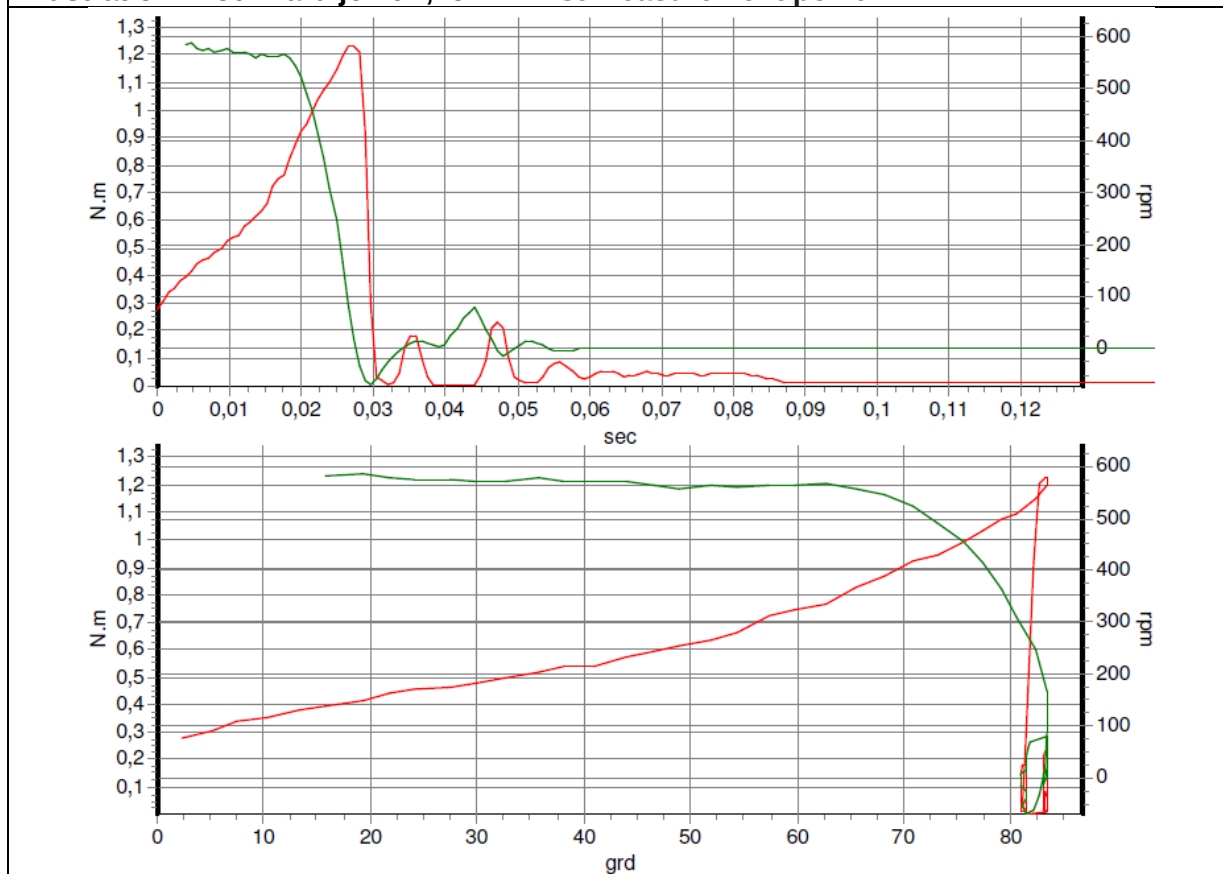


Illustration 2: 30° hard joint 1,25 Nm last measurement point

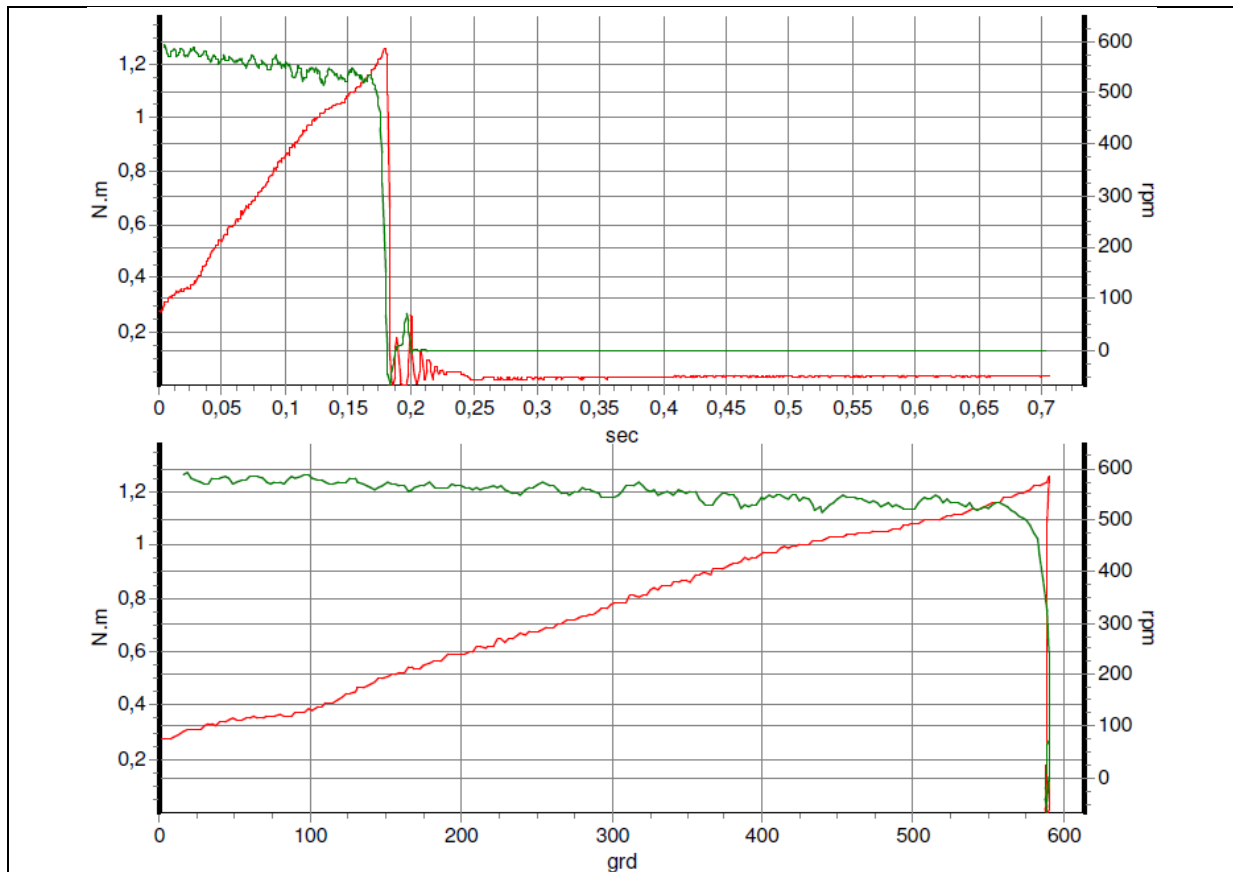


Illustration 3: 360° hard joint 1,25 Nm first measurement point

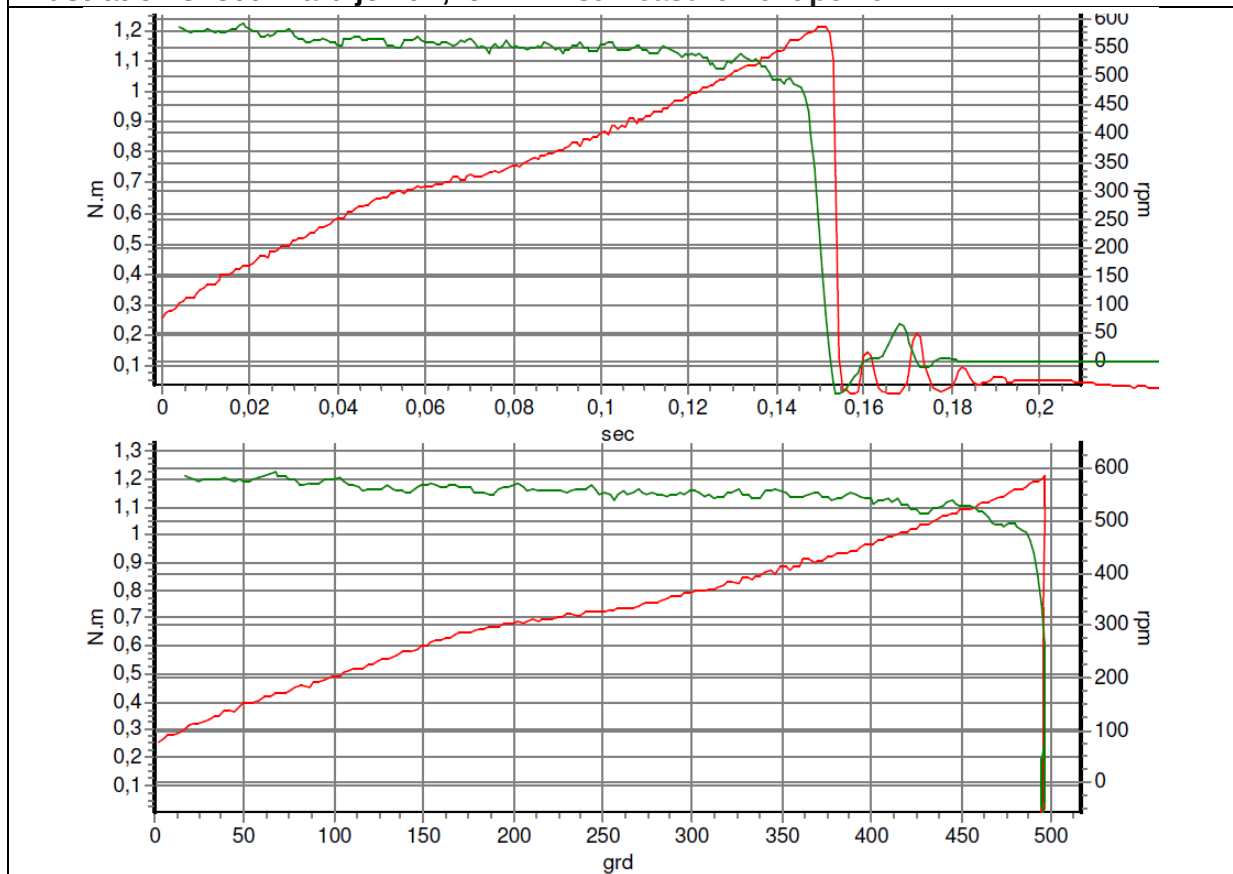


Illustration 4: 360° hard joint 1,25 Nm last measurement point

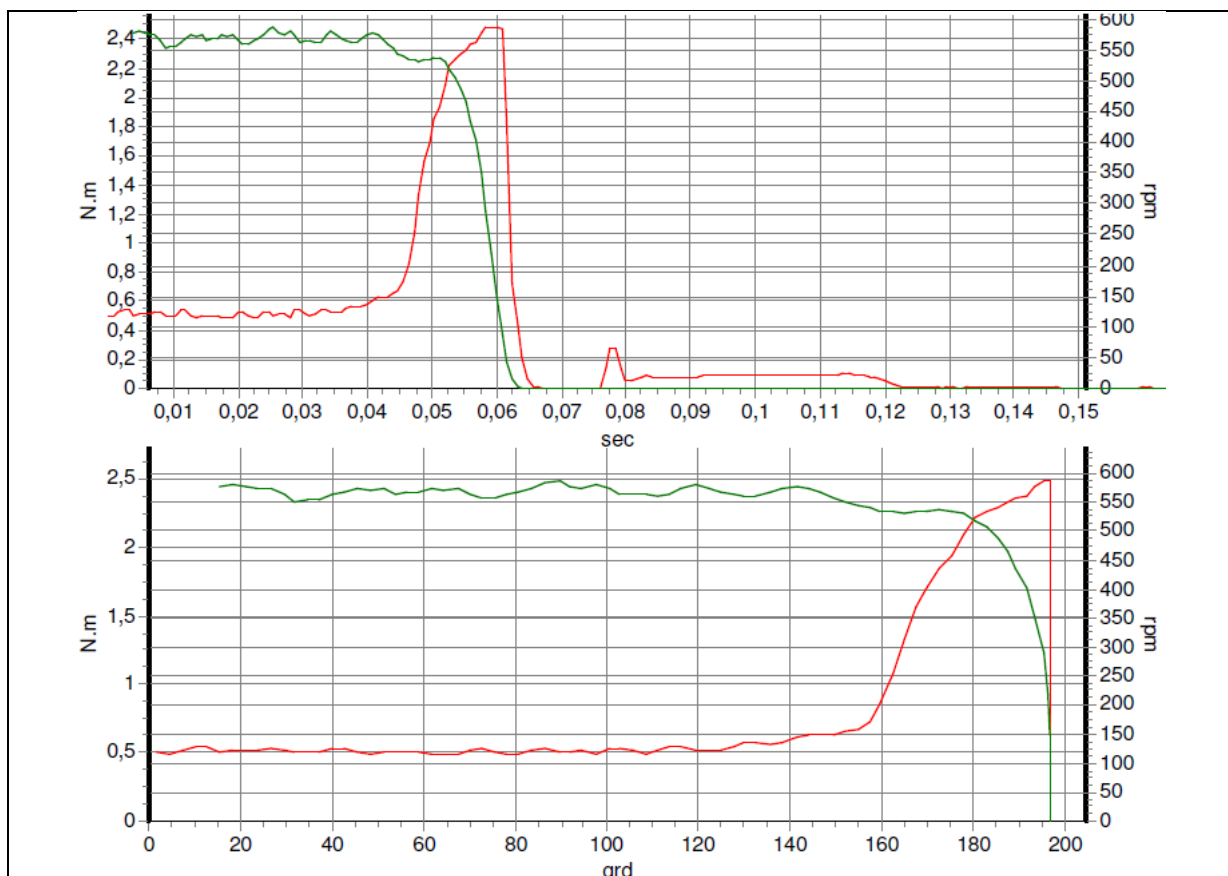


Illustration 5: 30° hard joint 2,5 Nm first measurement point

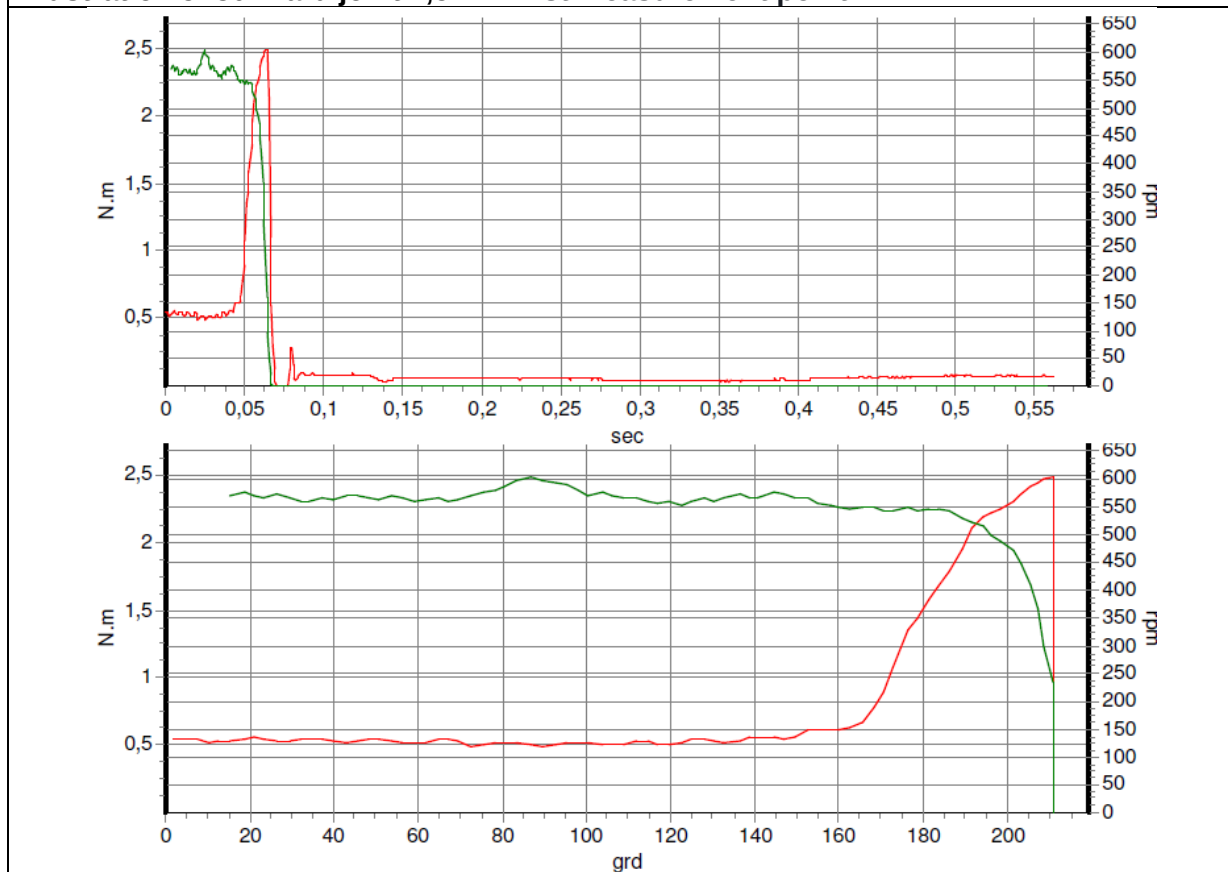


Illustration 6: 30° hard joint 2,5 Nm last measurement point

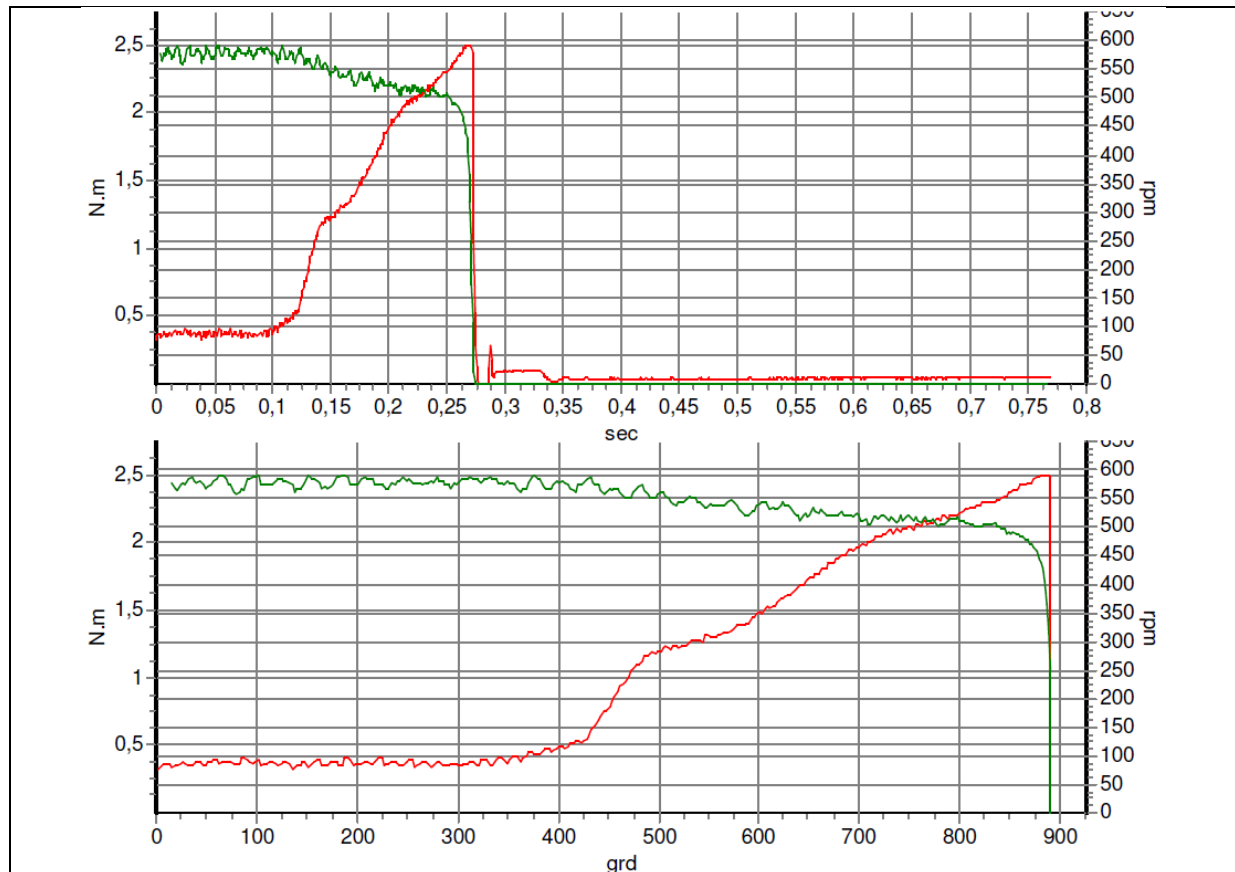


Illustration 7: 360° hard joint 2,5 Nm first measurement point

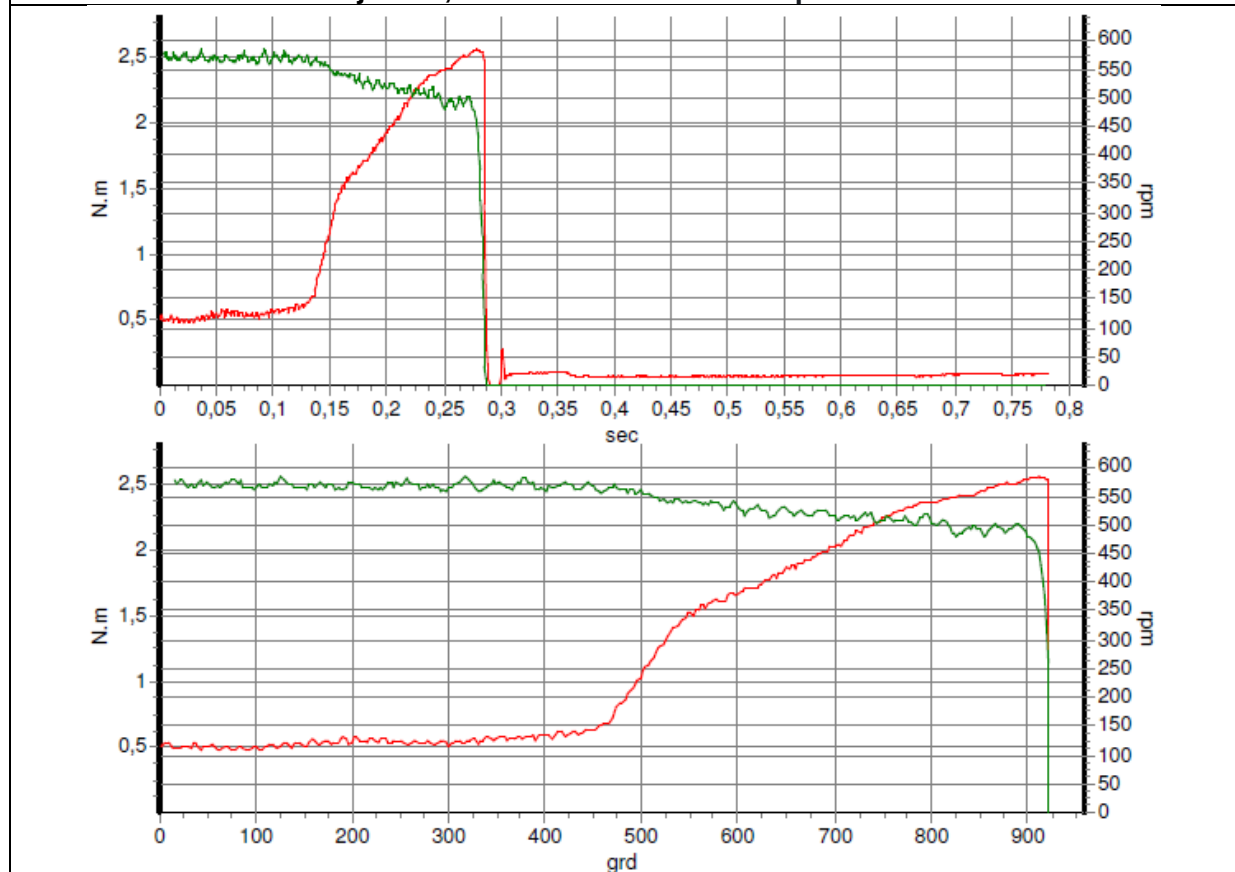


Illustration 8: 360° hard joint 2,5 Nm last measurement point

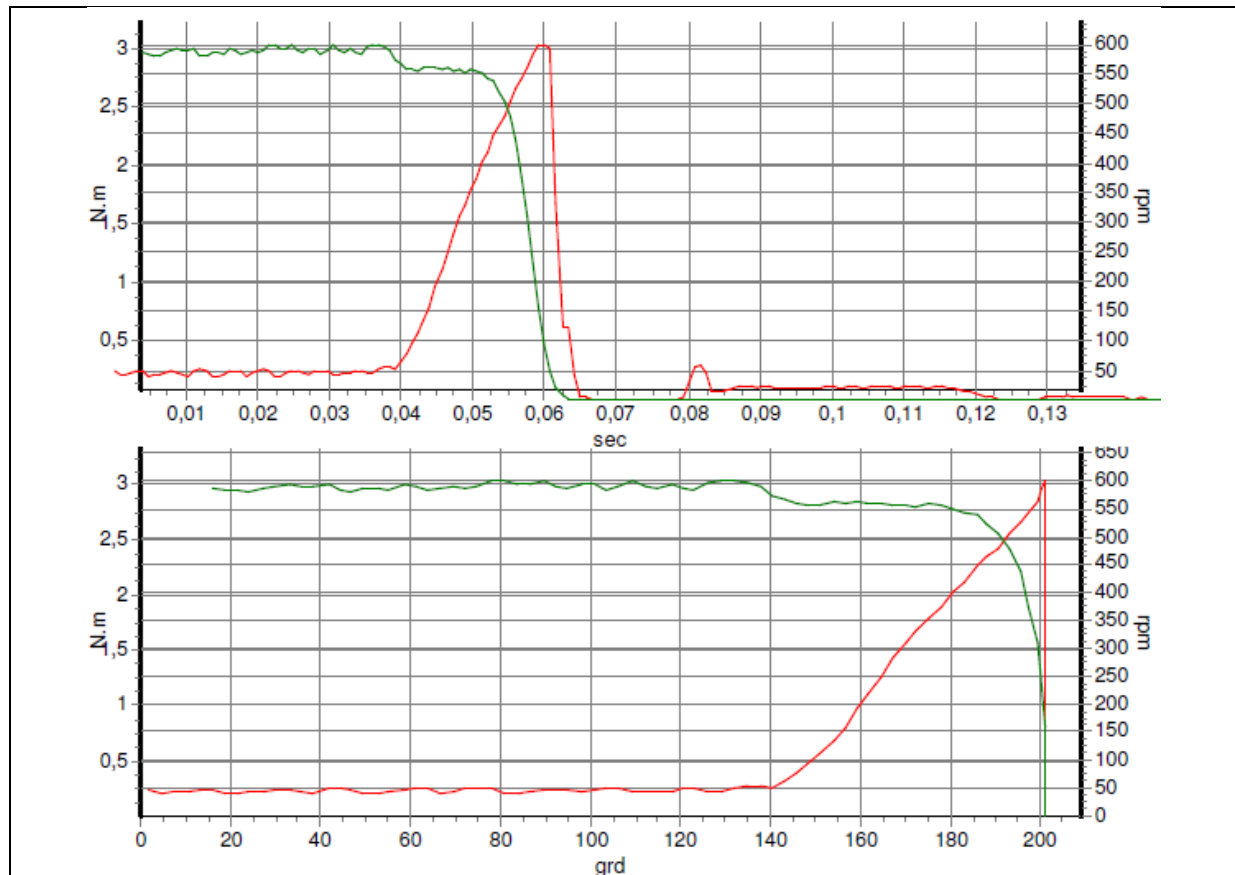


Illustration 9: 30° hard joint 3 Nm first measurement point

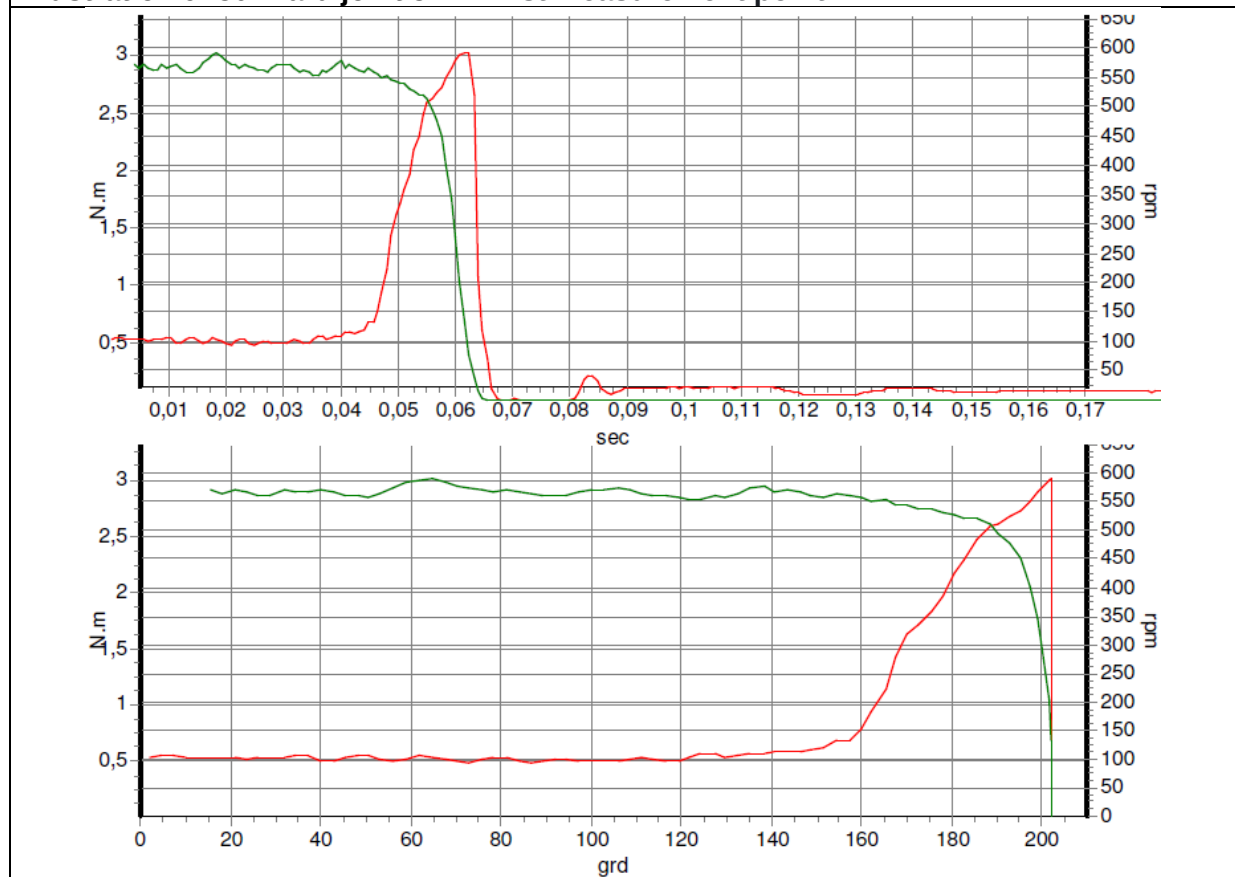


Illustration 10: 30° hard joint 3 Nm last measurement point

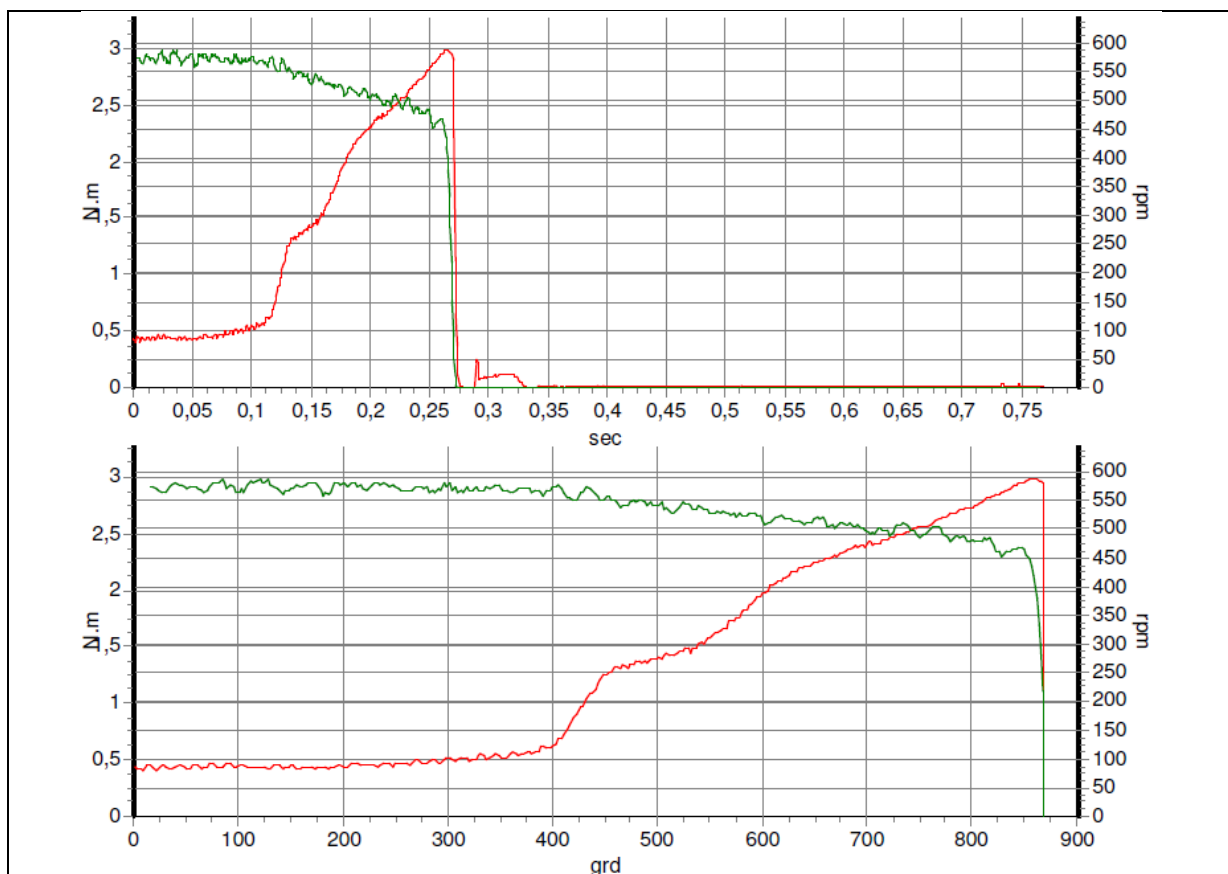


Illustration 11: 360° hard joint 3 Nm first measurement point

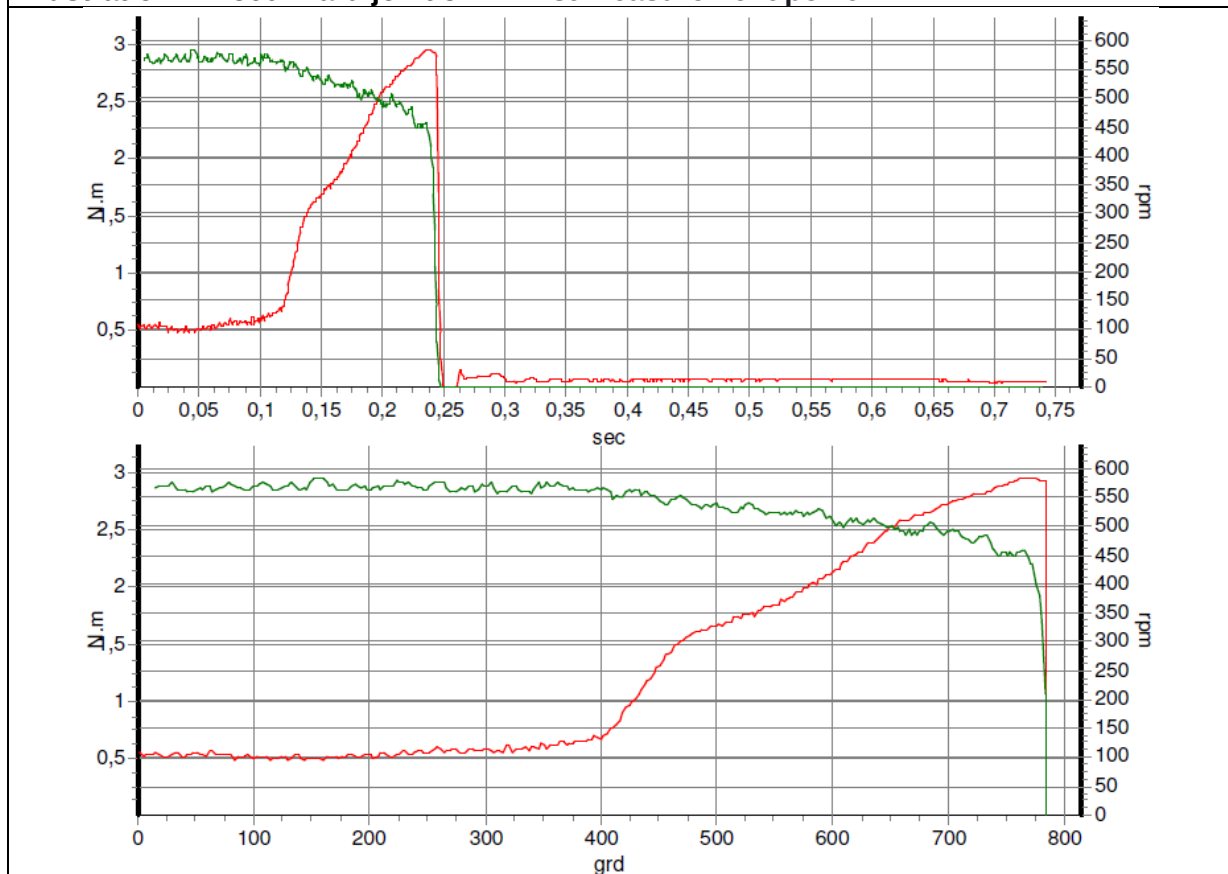


Illustration 12: 360° hard joint 3 Nm last measurement point

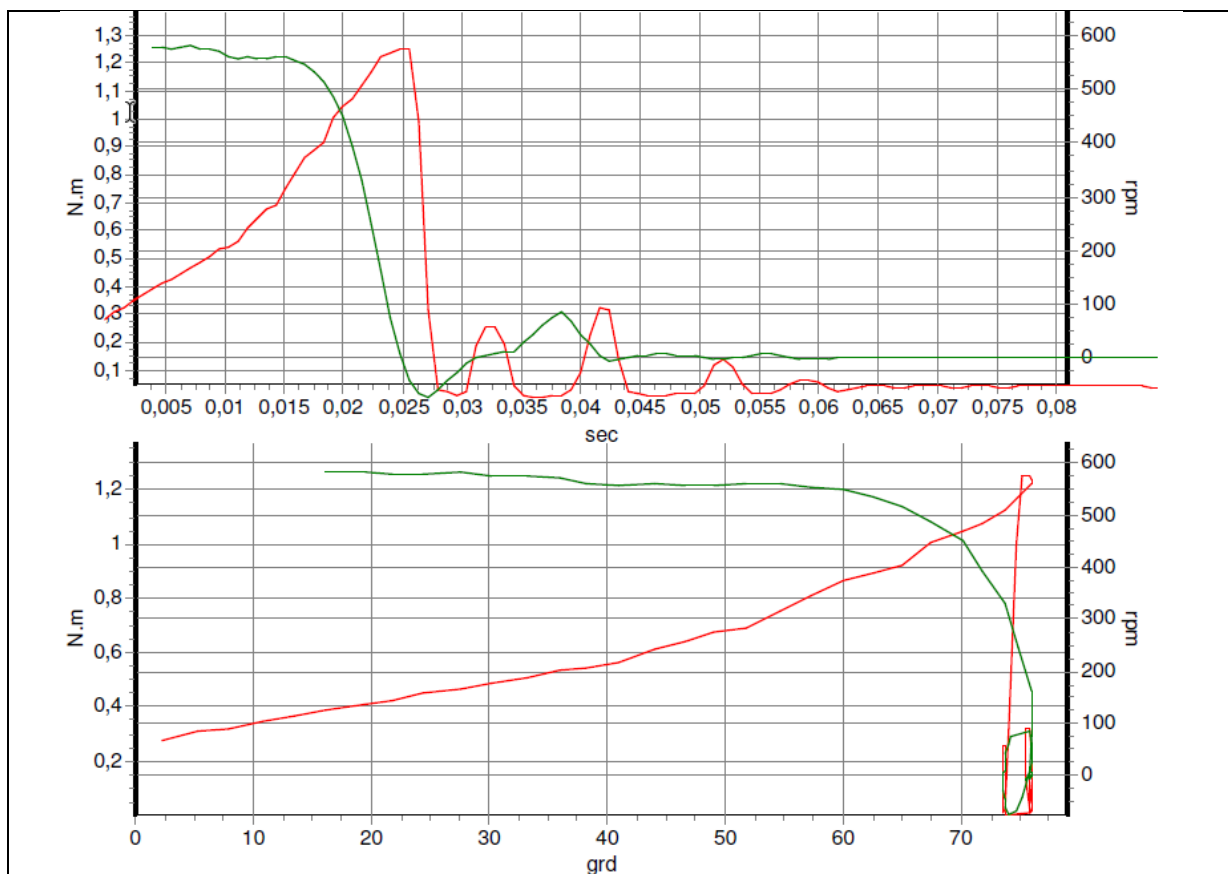


Illustration 1: 30° hard joint 1,25 Nm first measurement point

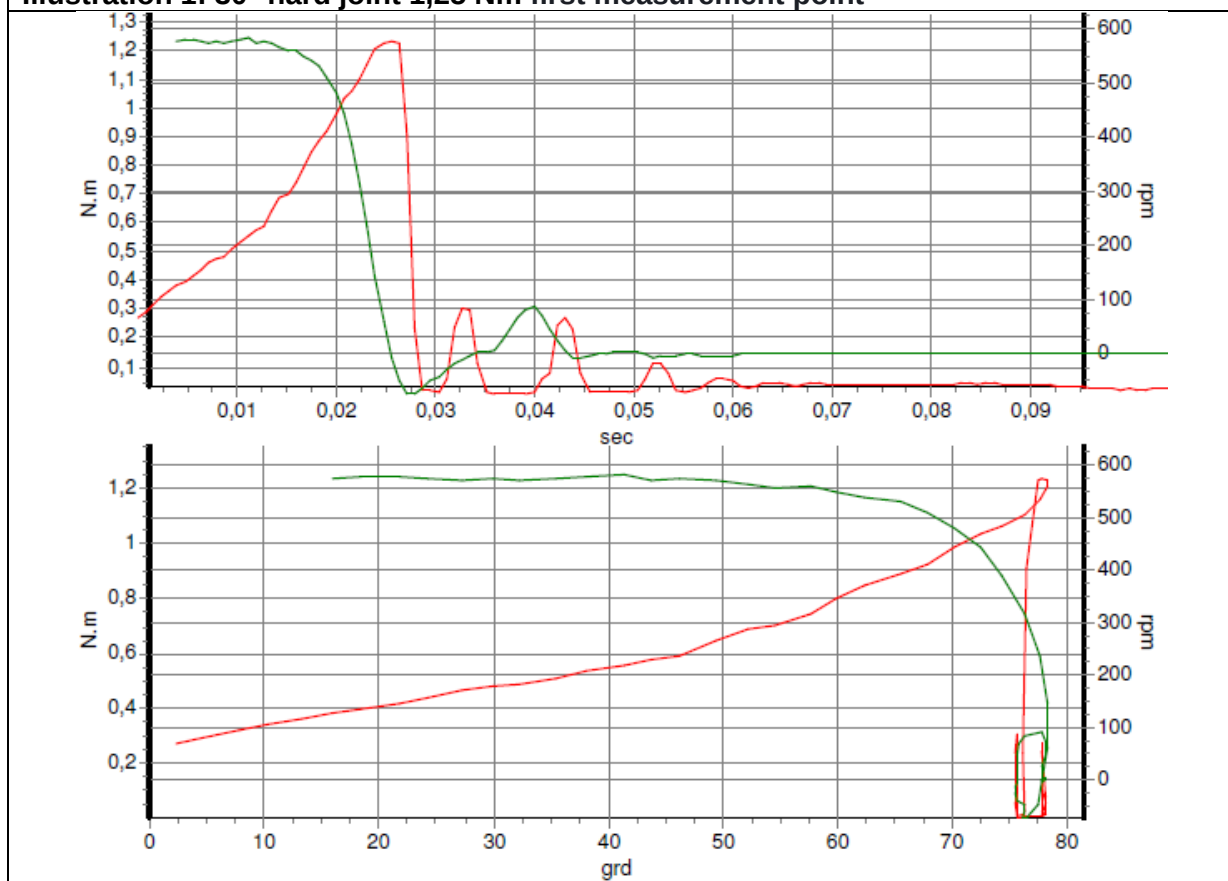


Illustration 2: 30° hard joint 1,25 Nm last measurement point

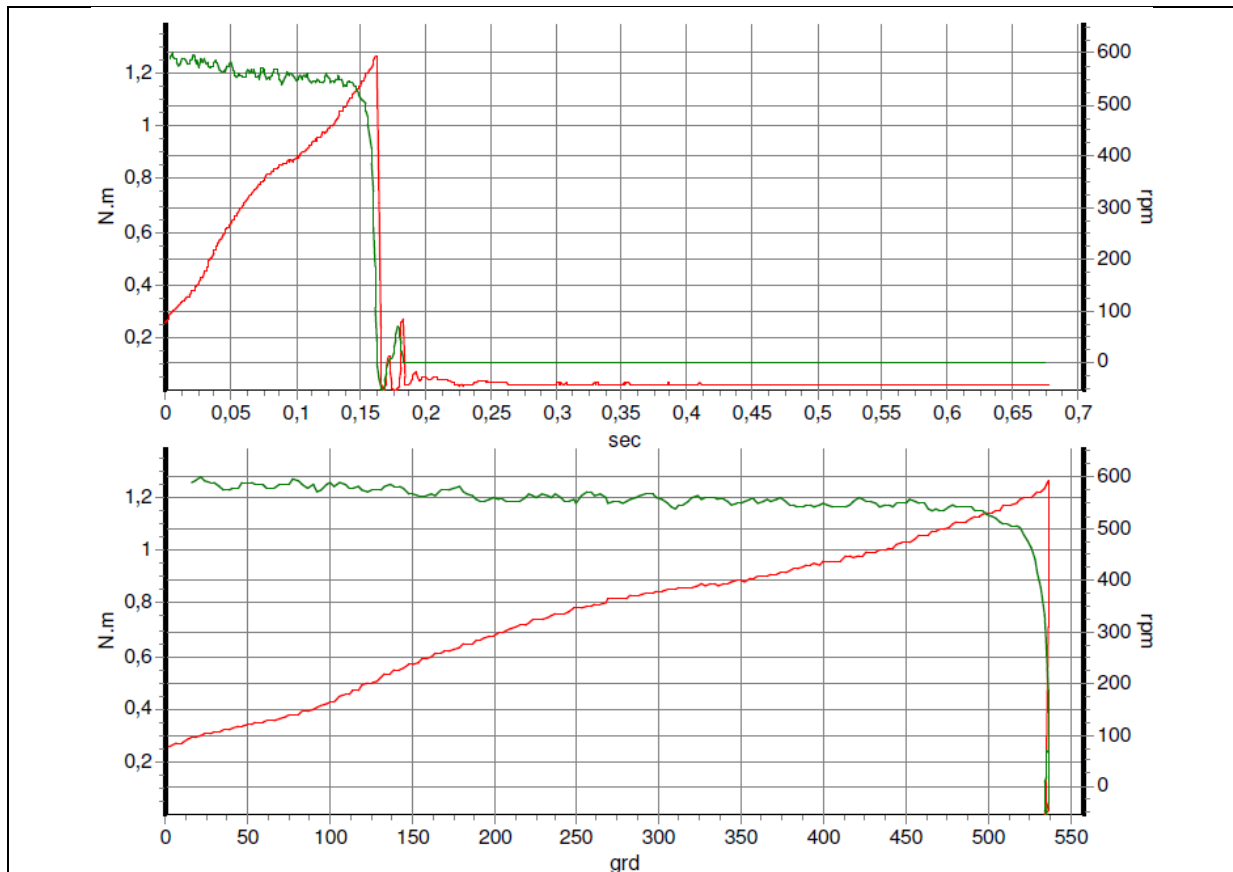


Illustration 3: 360° hard joint 1,25 Nm first measurement point

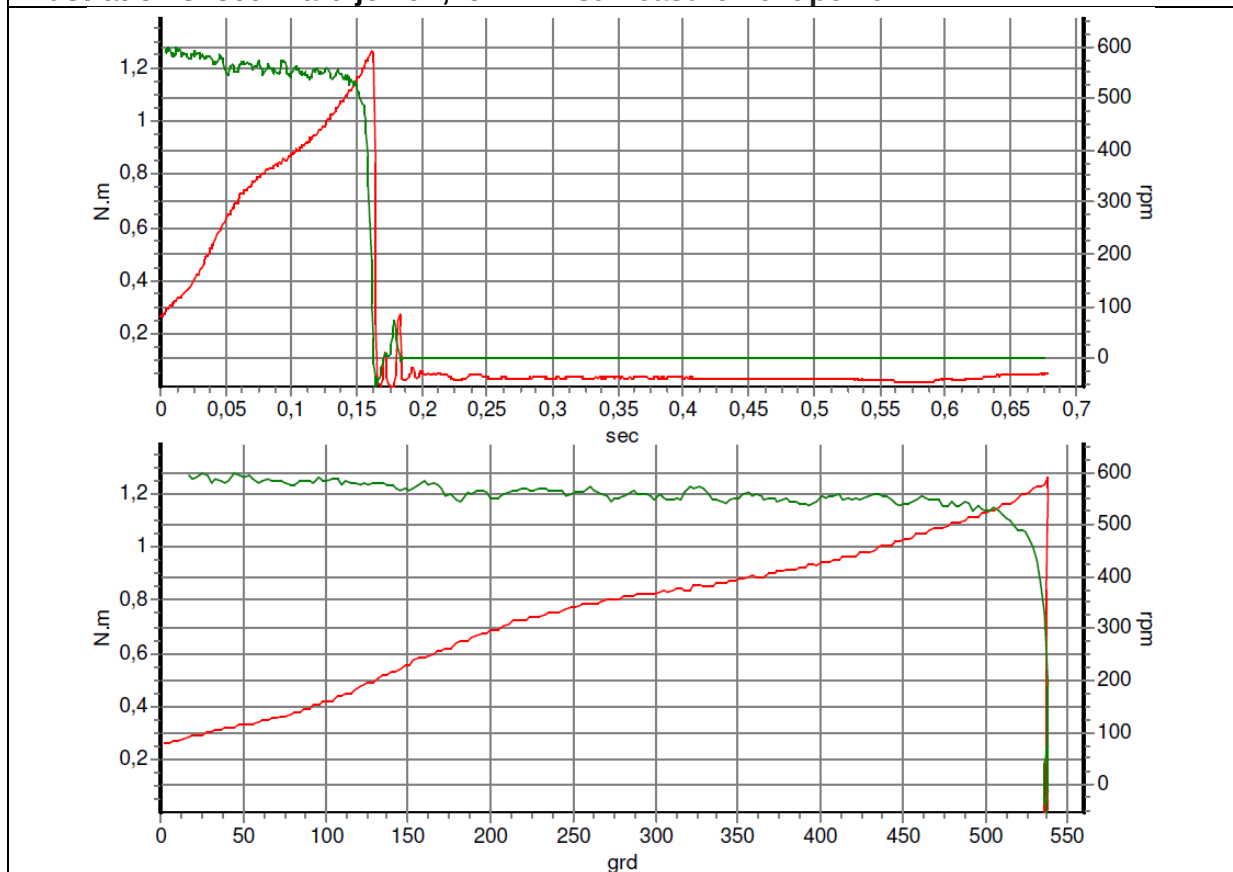


Illustration 4: 360° hard joint 1,25 Nm last measurement point

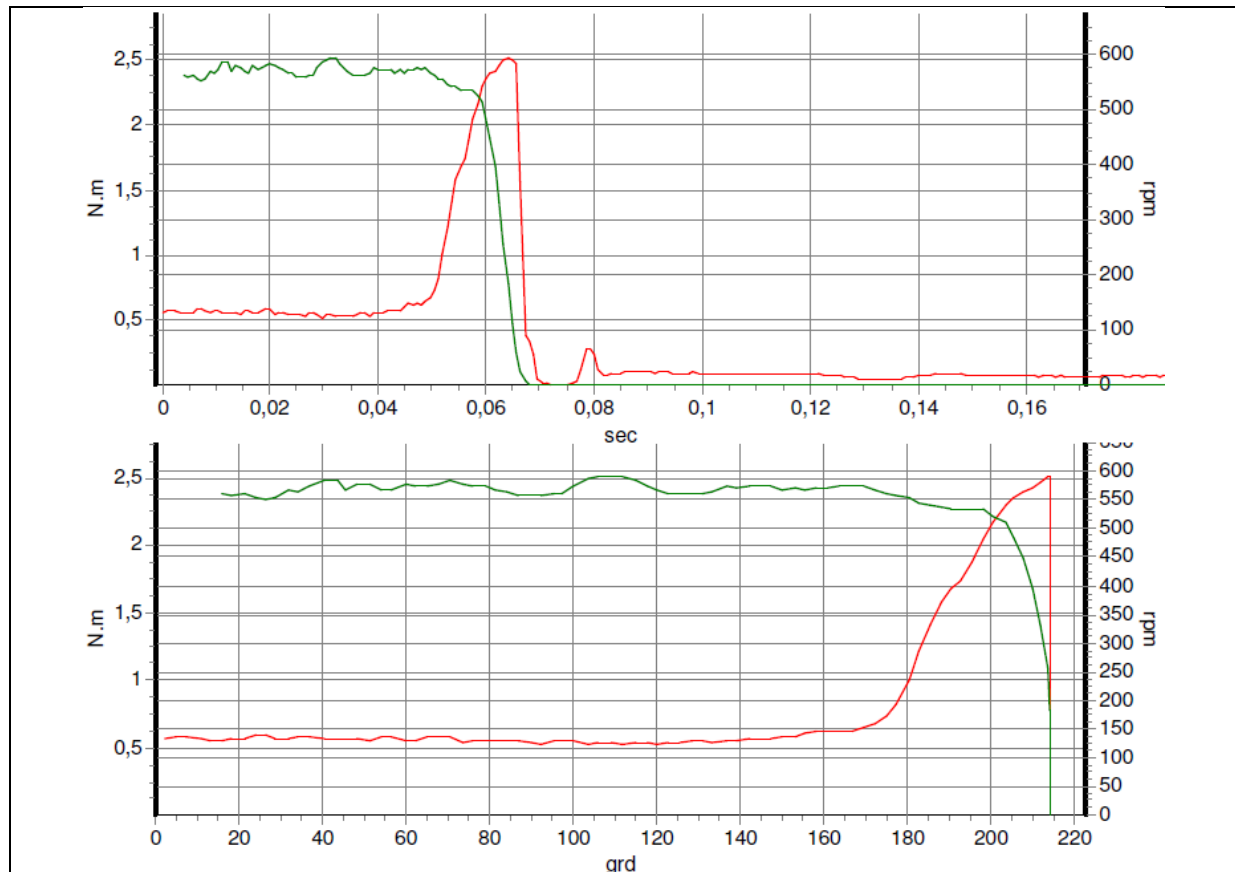


Illustration 5: 30° hard joint 2,5 Nm first measurement point

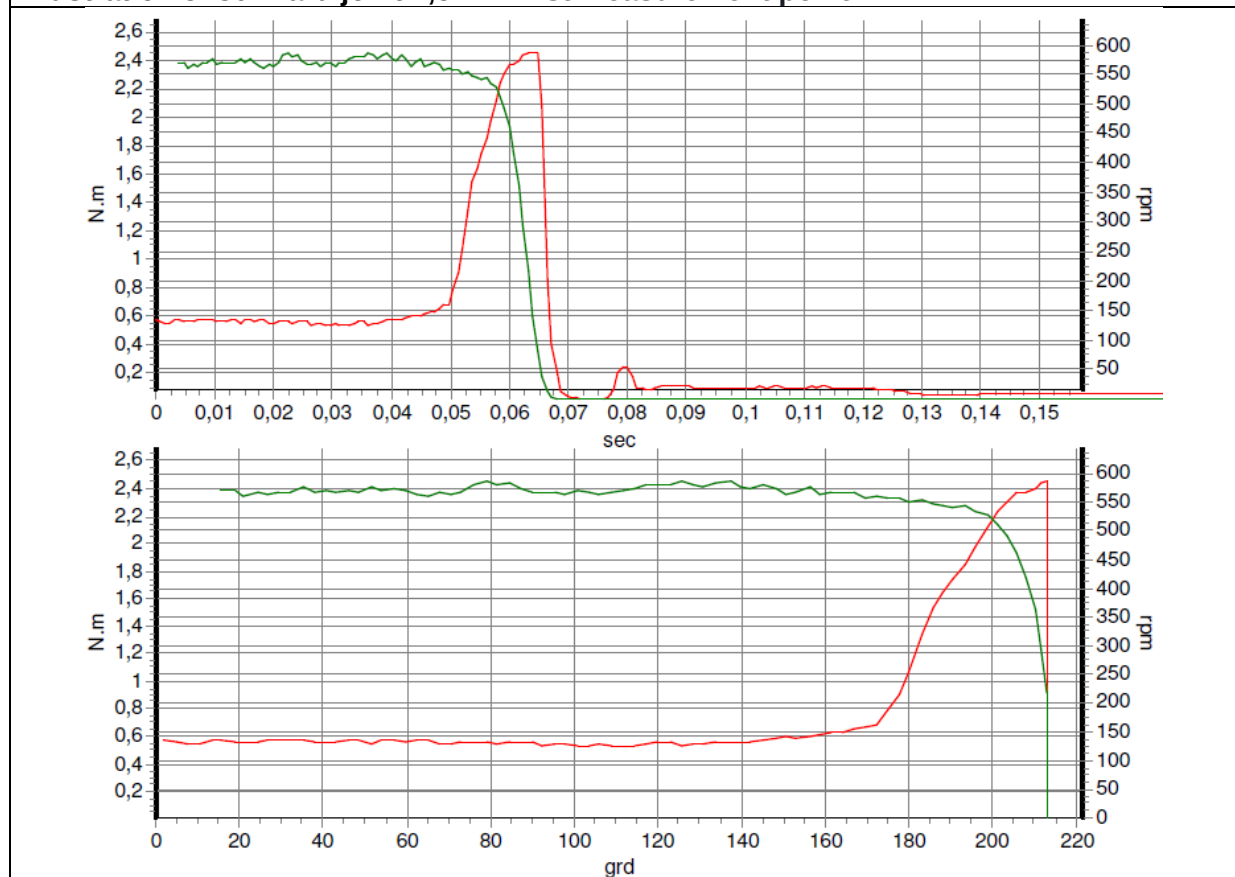


Illustration 6: 30° hard joint 2,5 Nm last measurement point

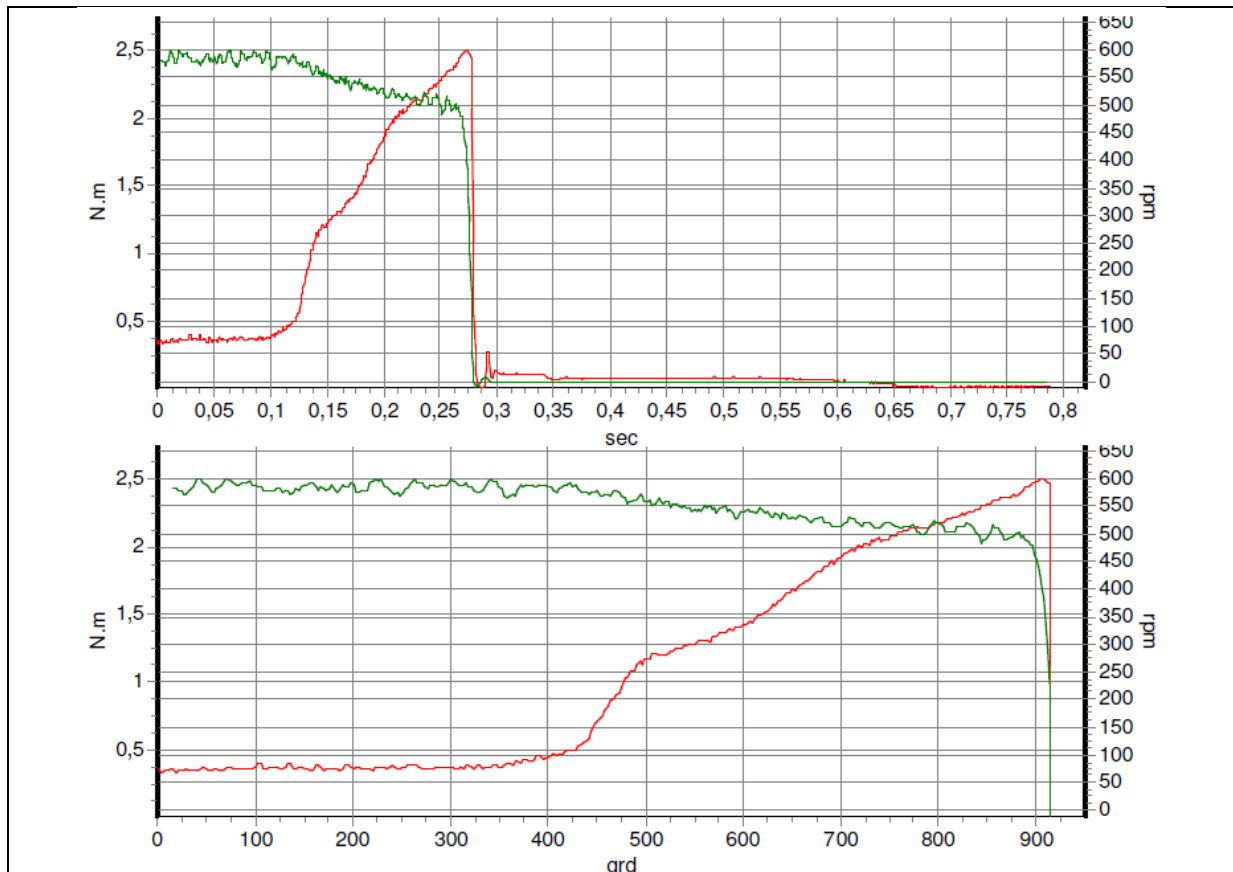


Illustration 7: 360° hard joint 2,5 Nm first measurement point

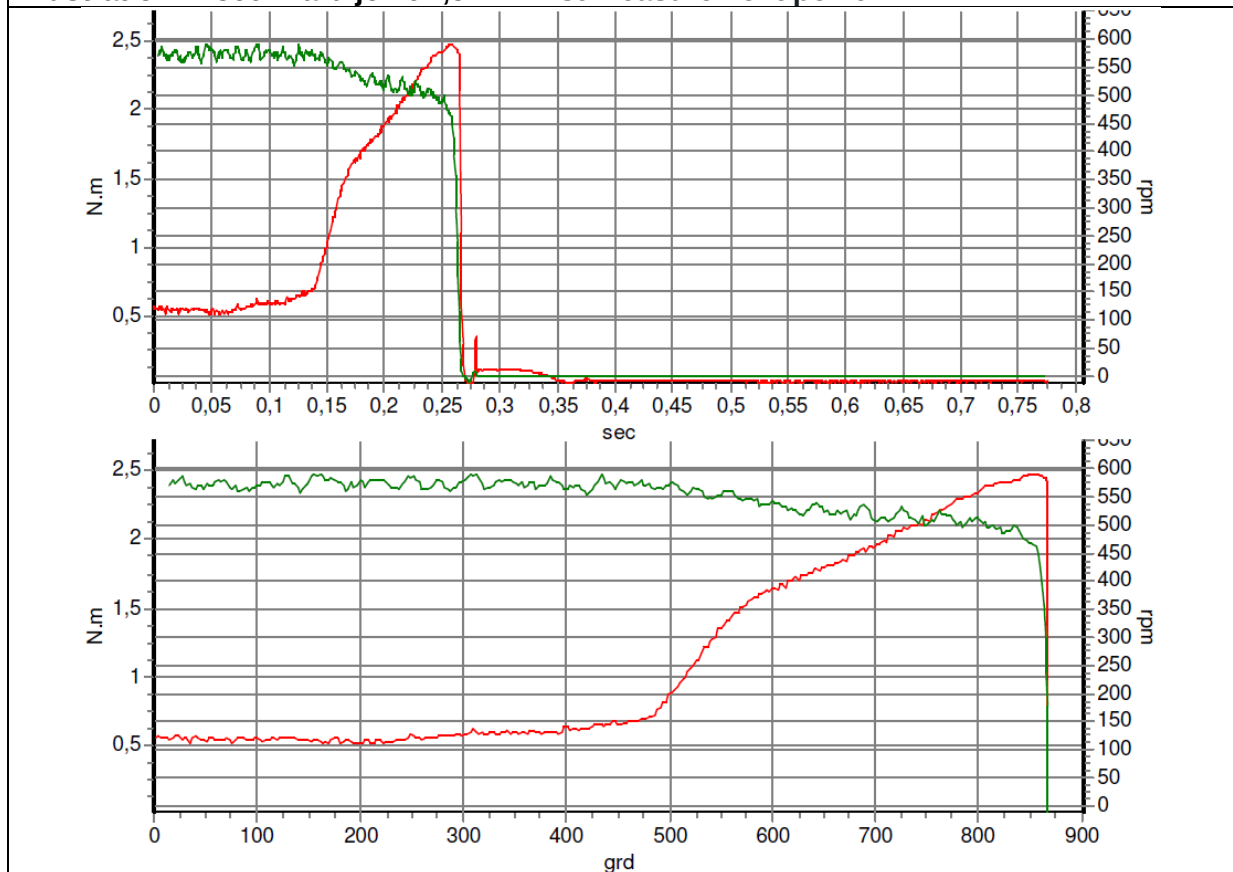


Illustration 8: 360° hard joint 2,5 Nm last measurement point

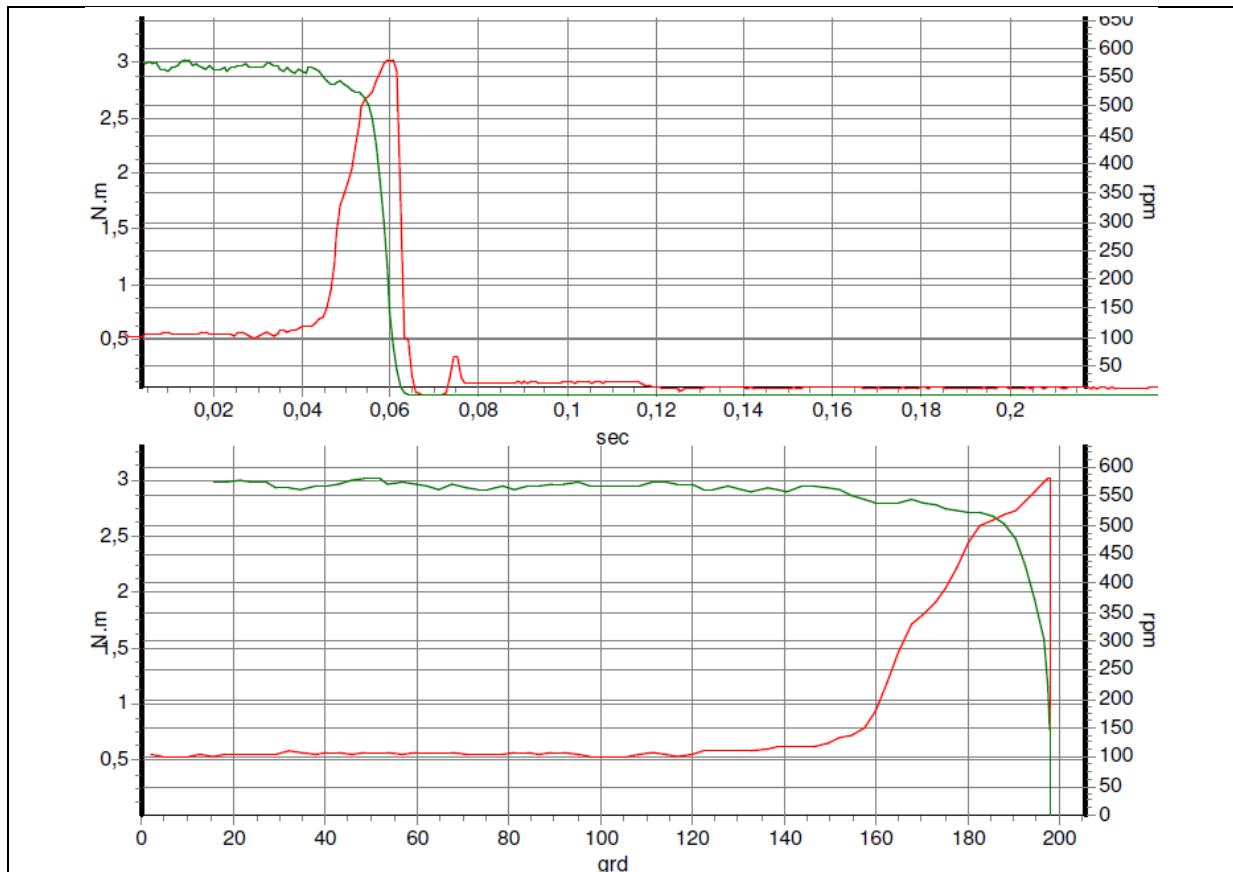


Illustration 9: 30° hard joint 3 Nm first measurement point

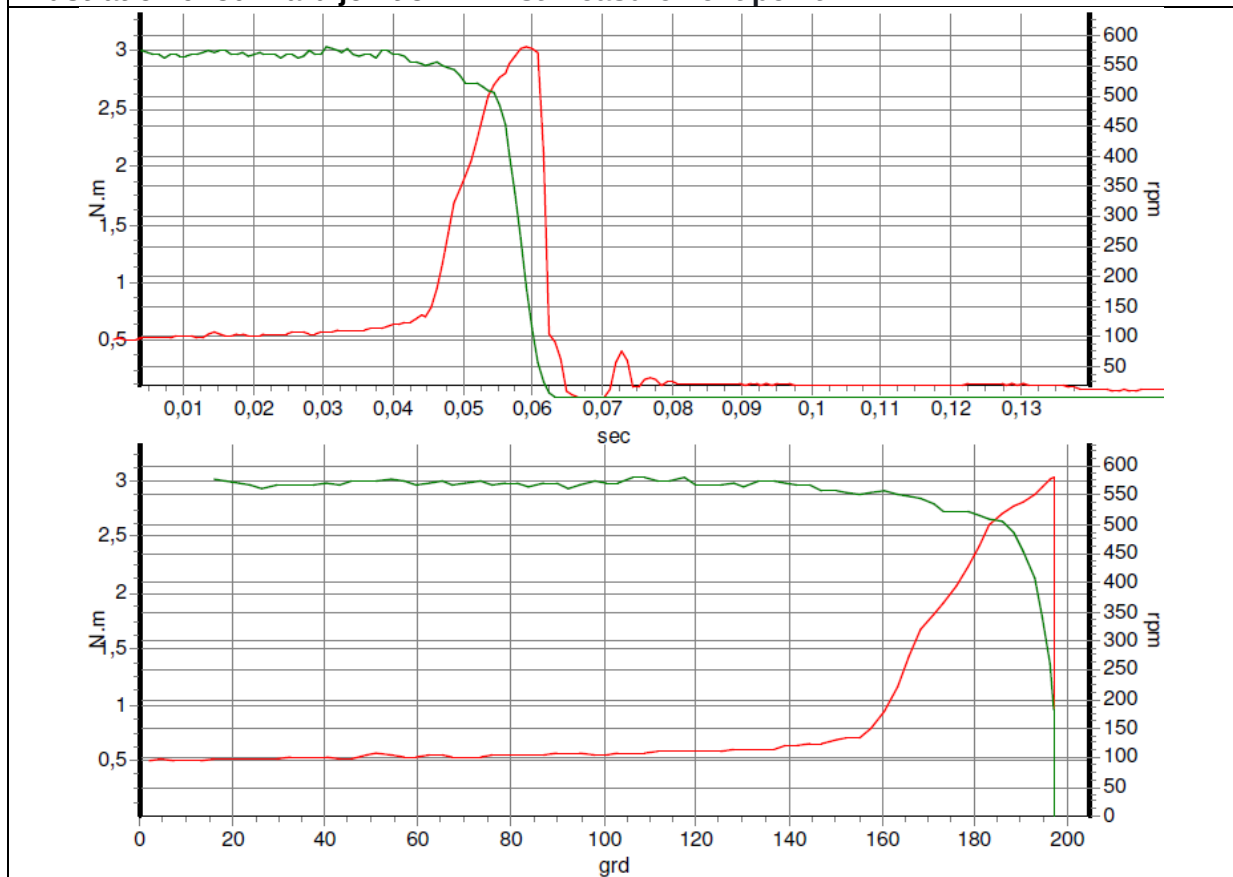


Illustration 10: 30° hard joint 3 Nm last measurement point

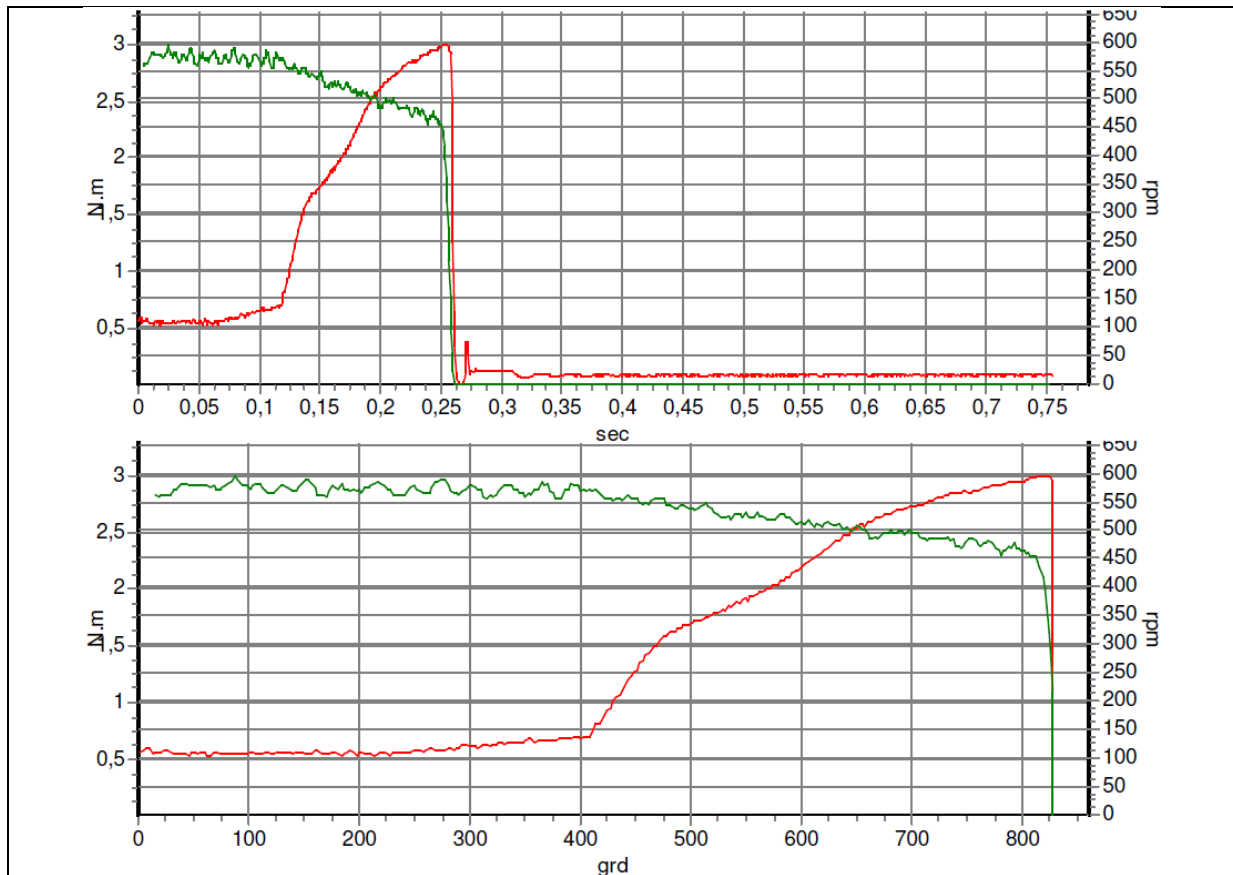


Illustration 11: 360° hard joint 3 Nm first measurement point

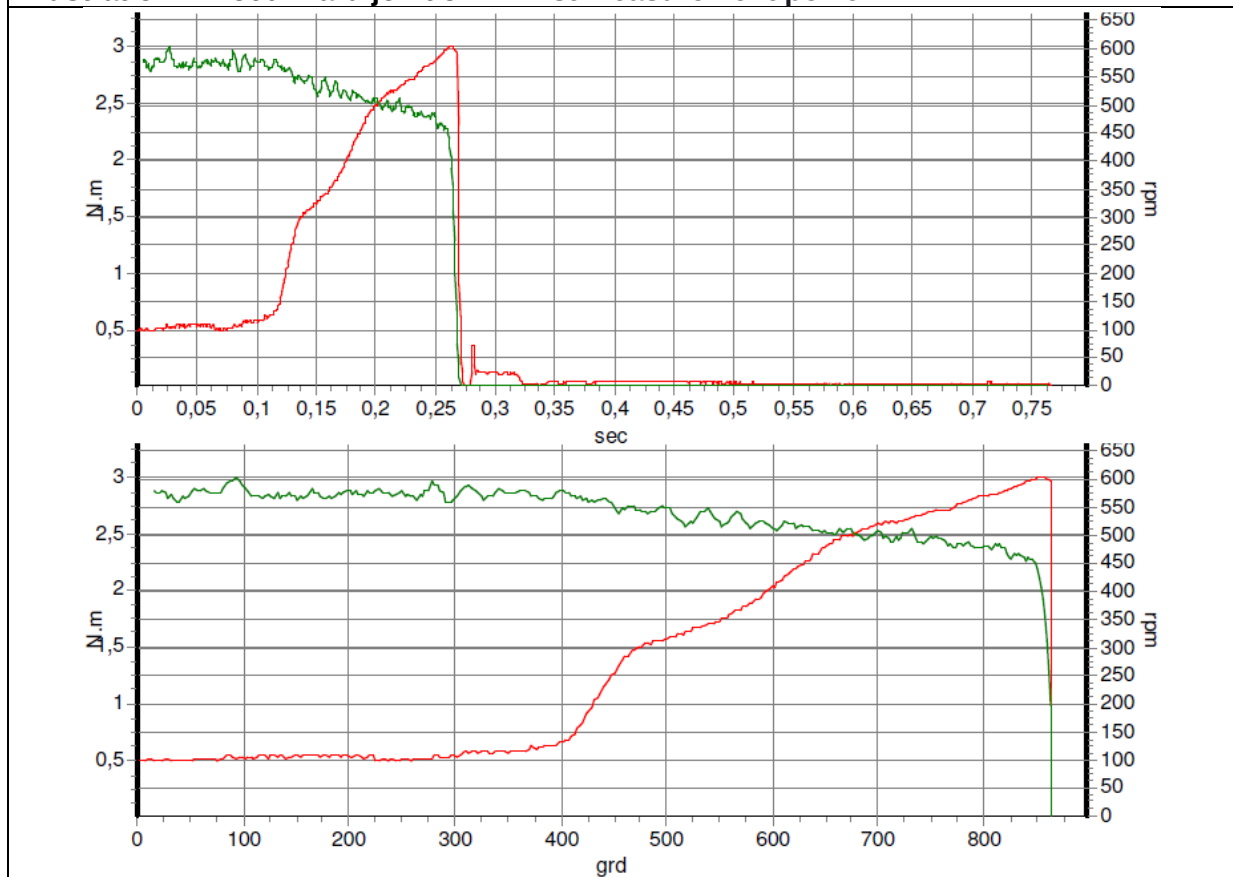


Illustration 12: 360° hard joint 3 Nm last measurement point

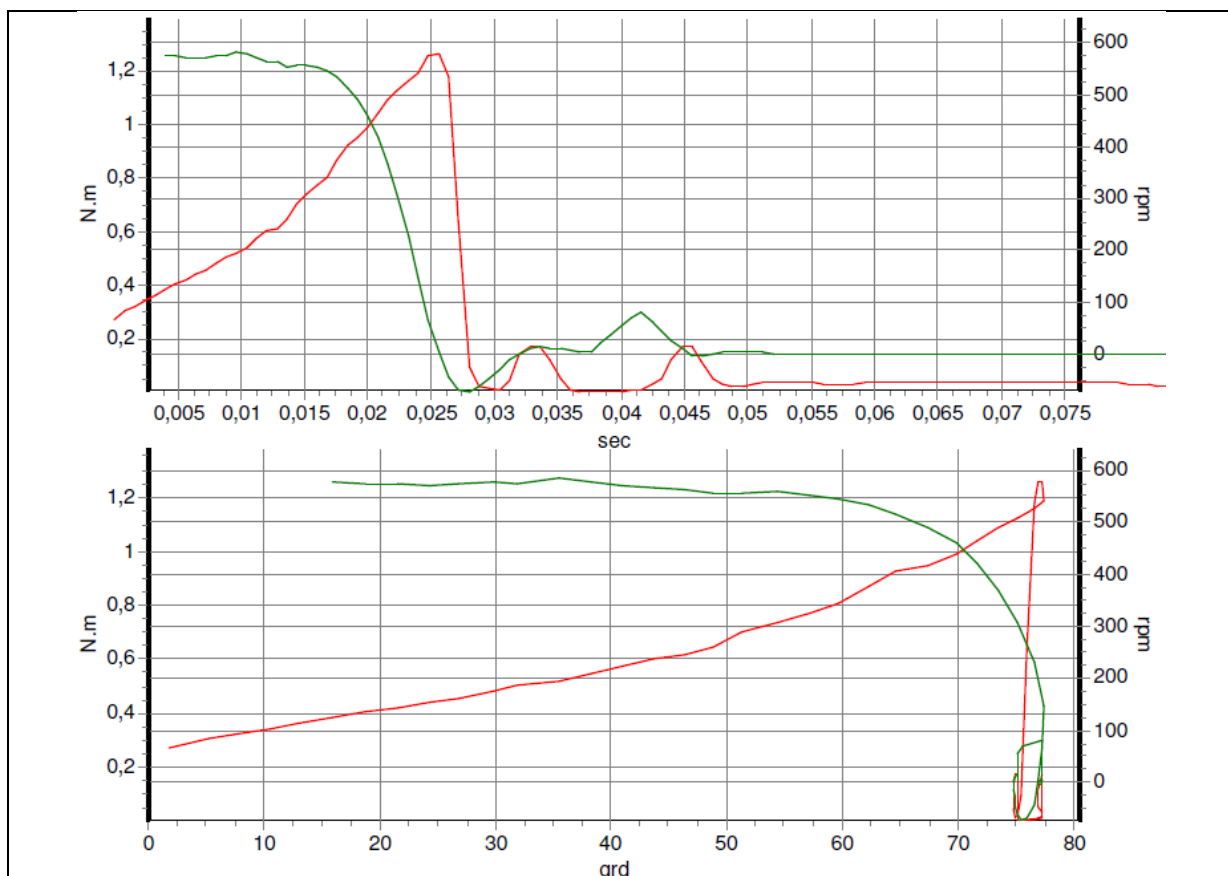


Illustration 1: 30° hard joint 1,25 Nm first measurement point

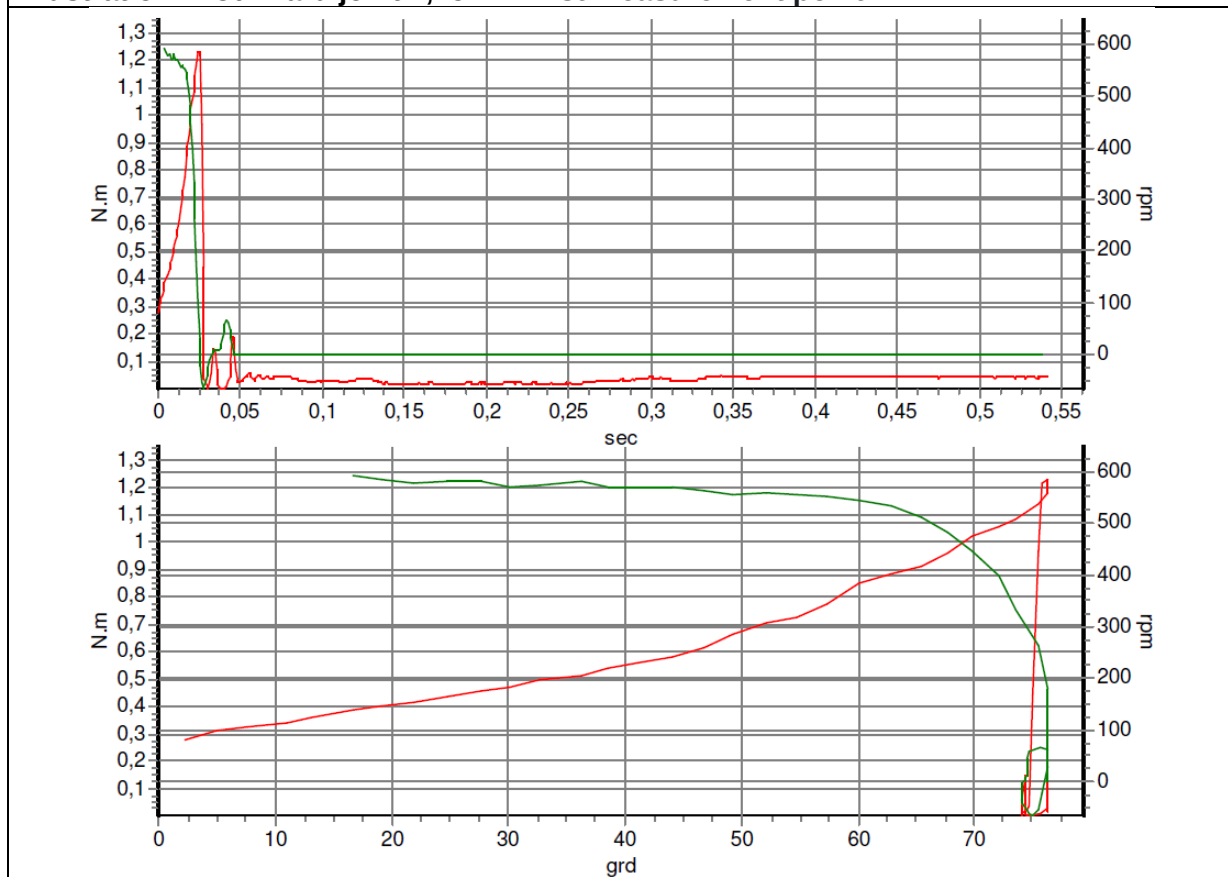


Illustration 2: 30° hard joint 1,25 Nm last measurement point

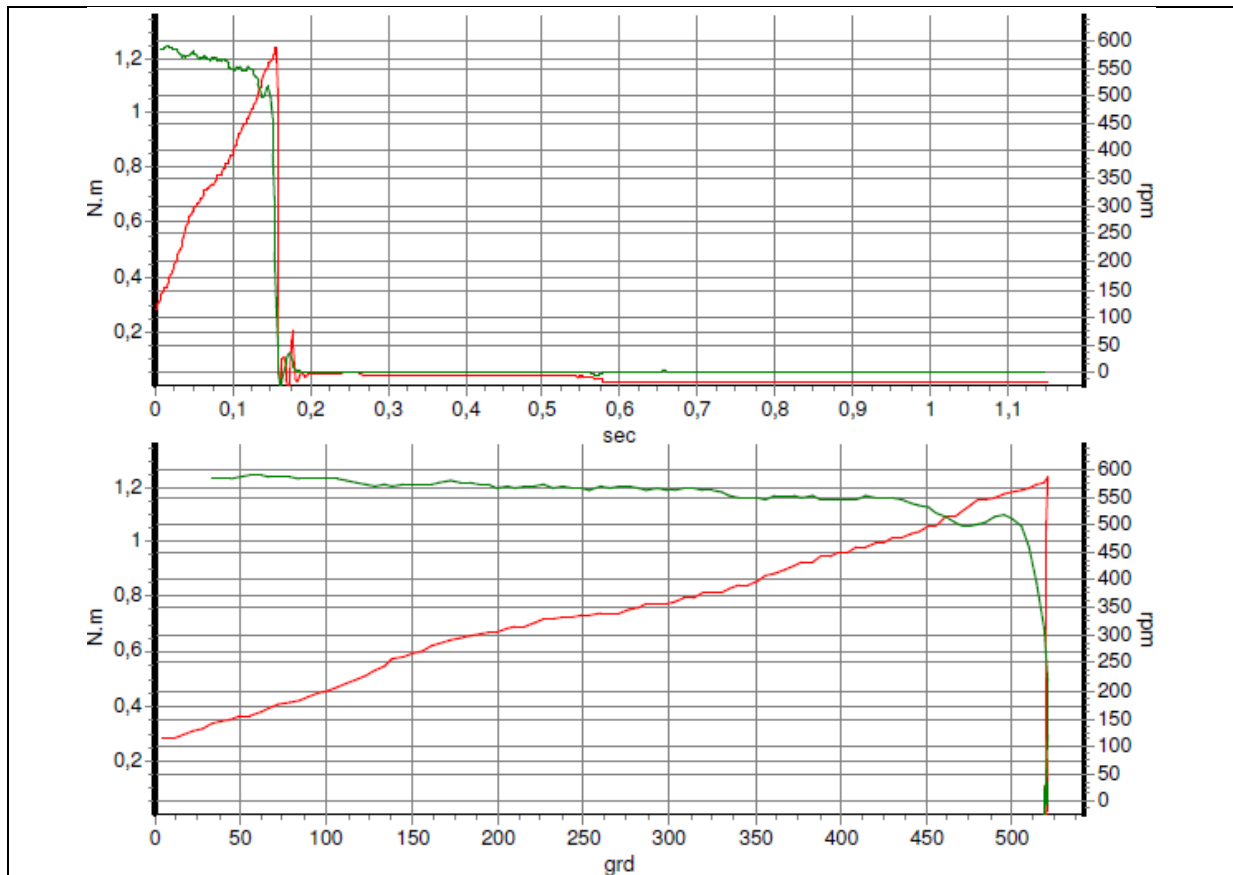


Illustration 3: 360° hard joint 1,25 Nm first measurement point

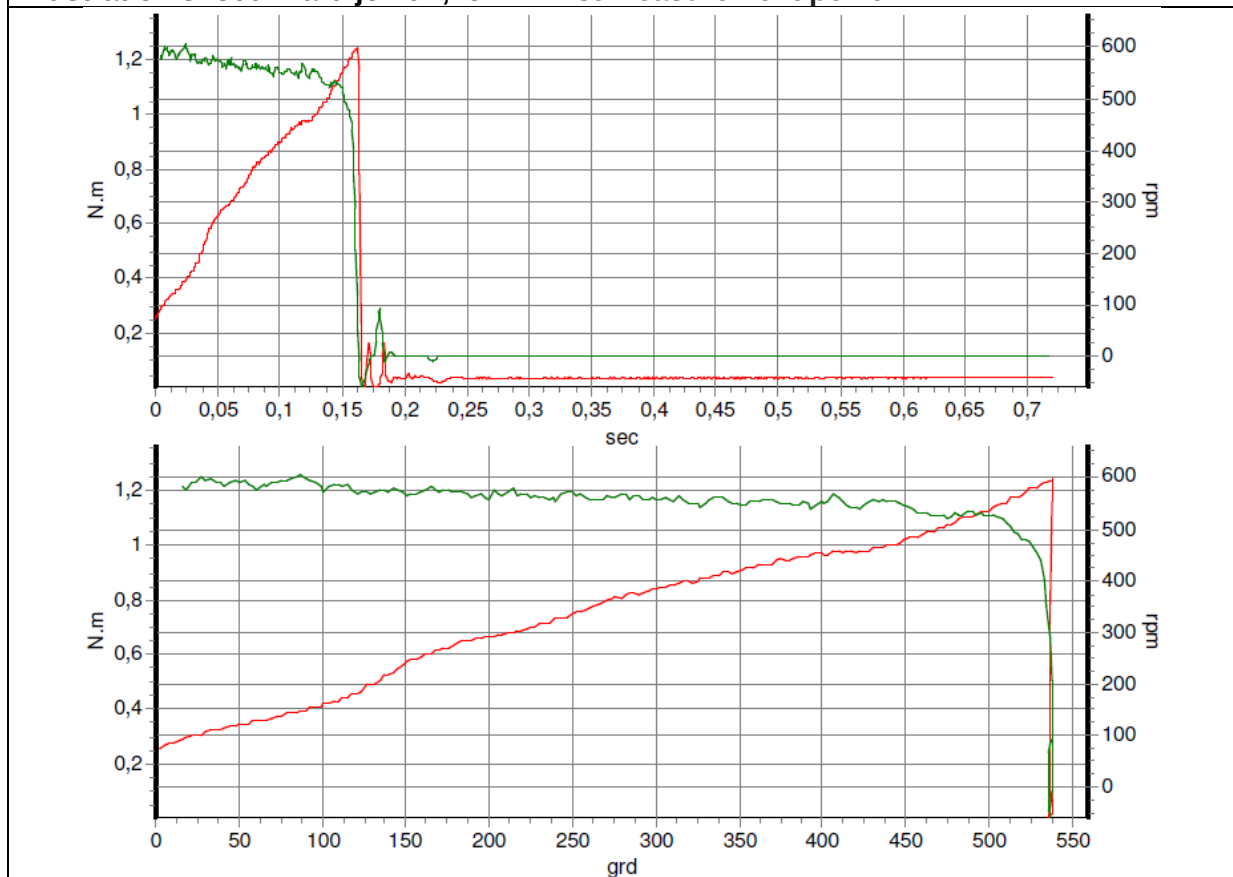


Illustration 4: 360° hard joint 1,25 Nm last measurement point

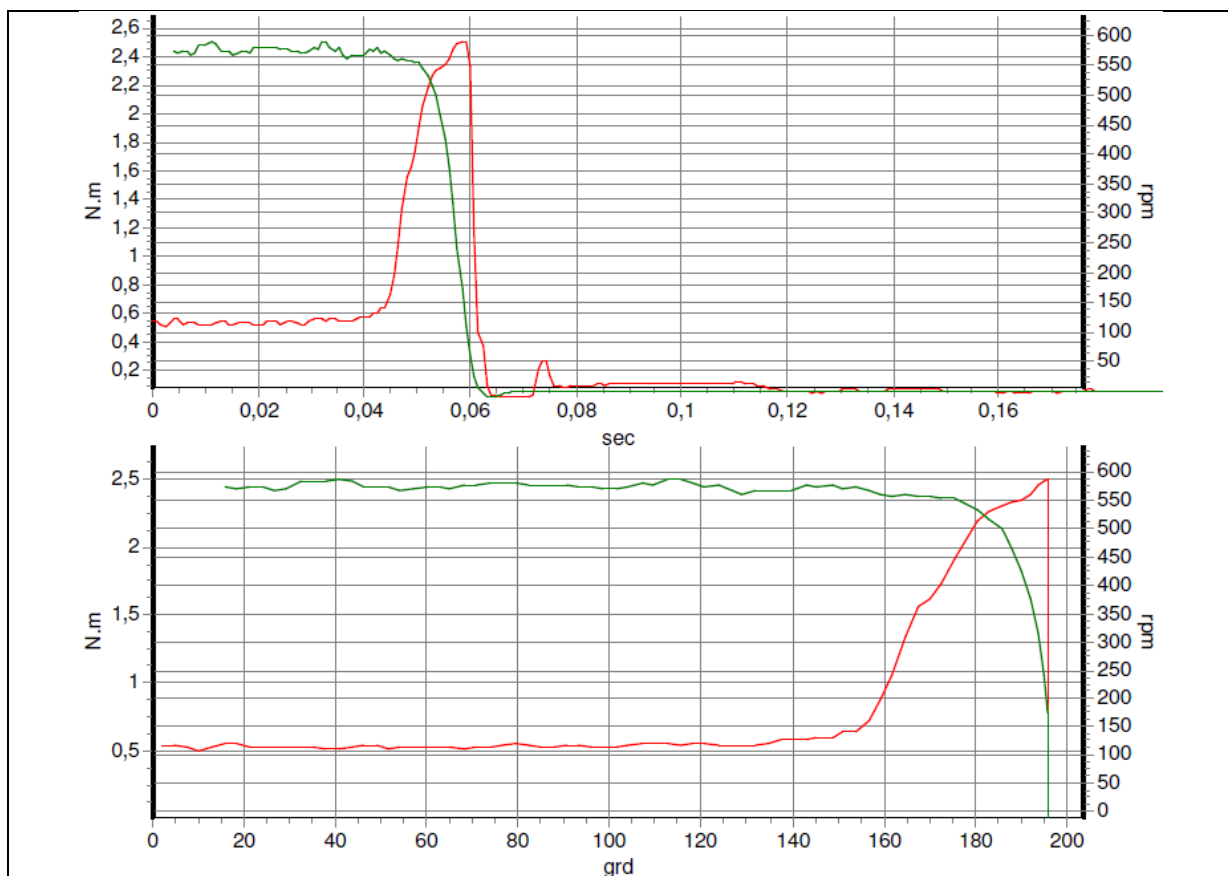


Illustration 5: 30° hard joint 2,5 Nm first measurement point

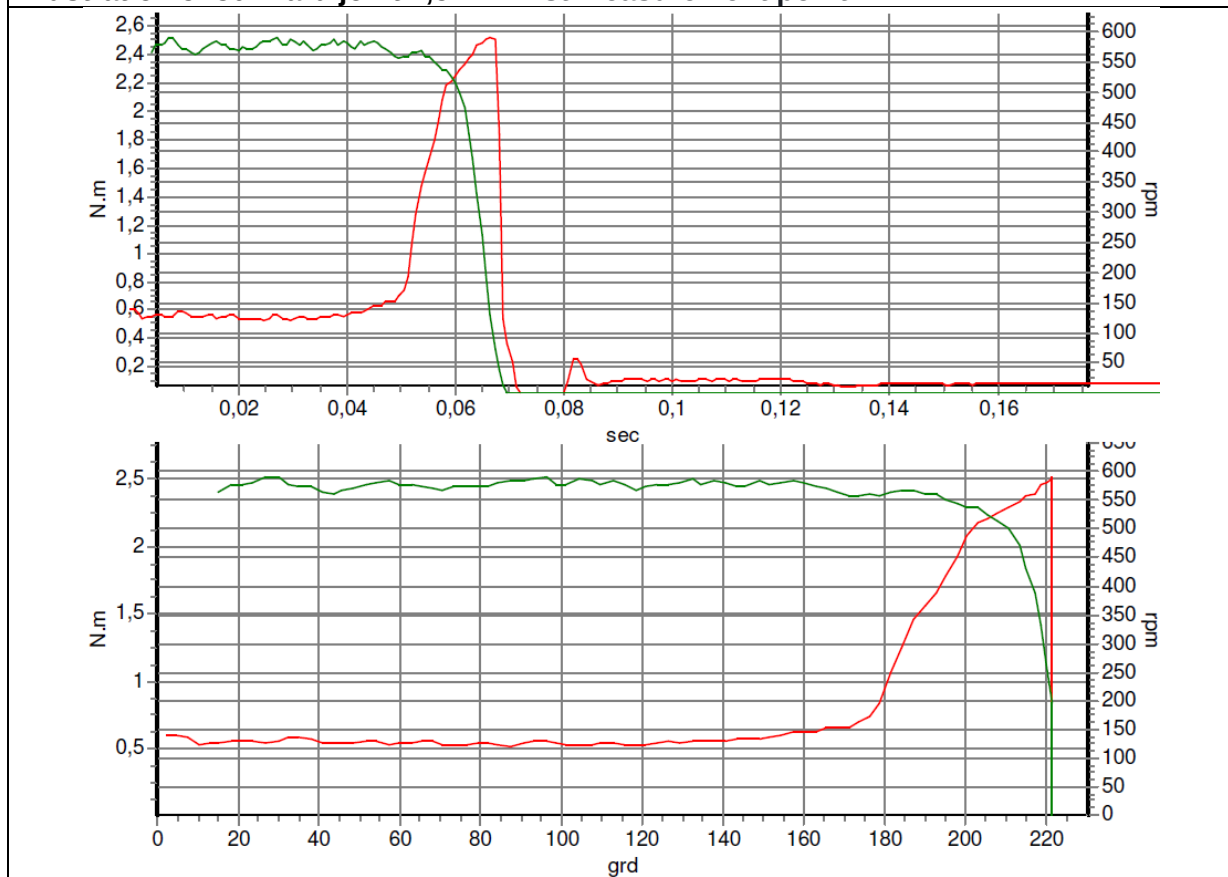


Illustration 6: 30° hard joint 2,5 Nm last measurement point

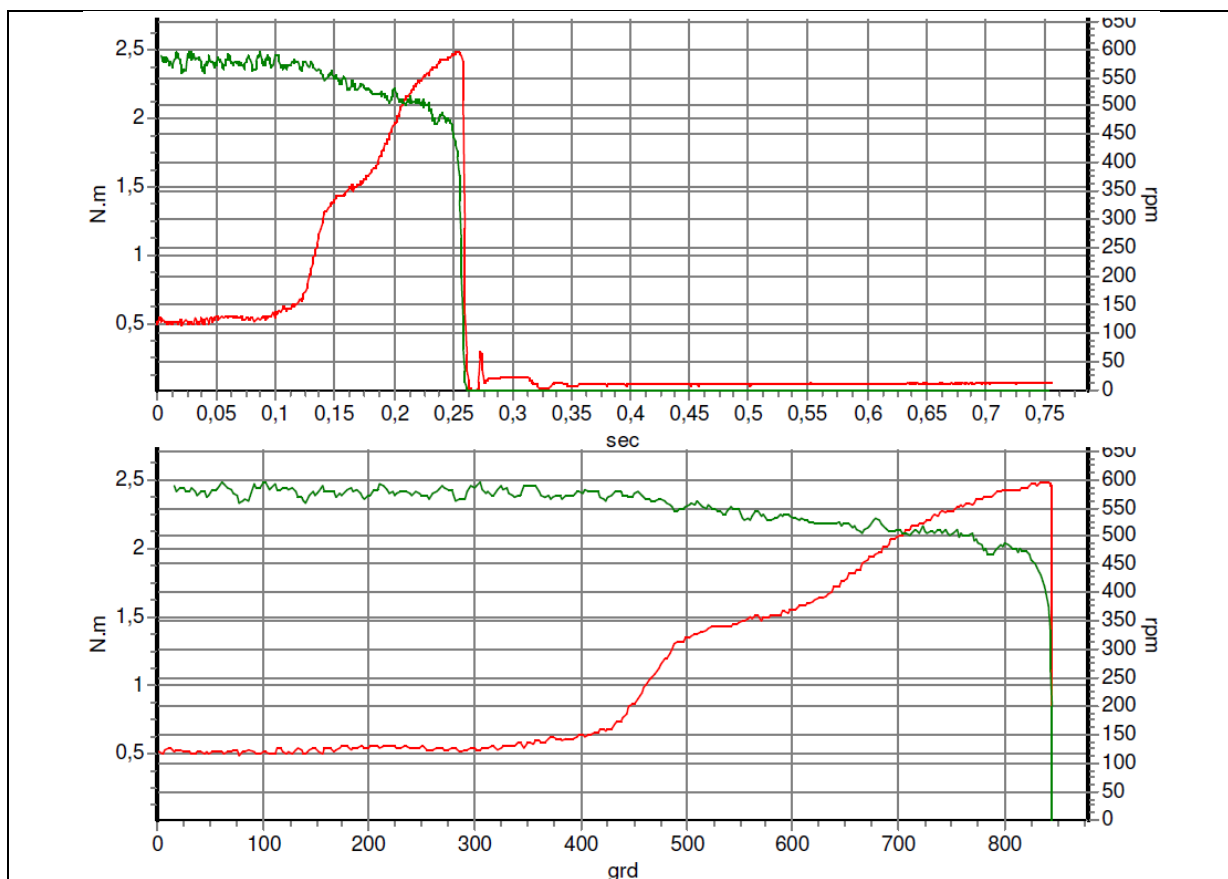


Illustration 7: 360° hard joint 2,5 Nm first measurement point

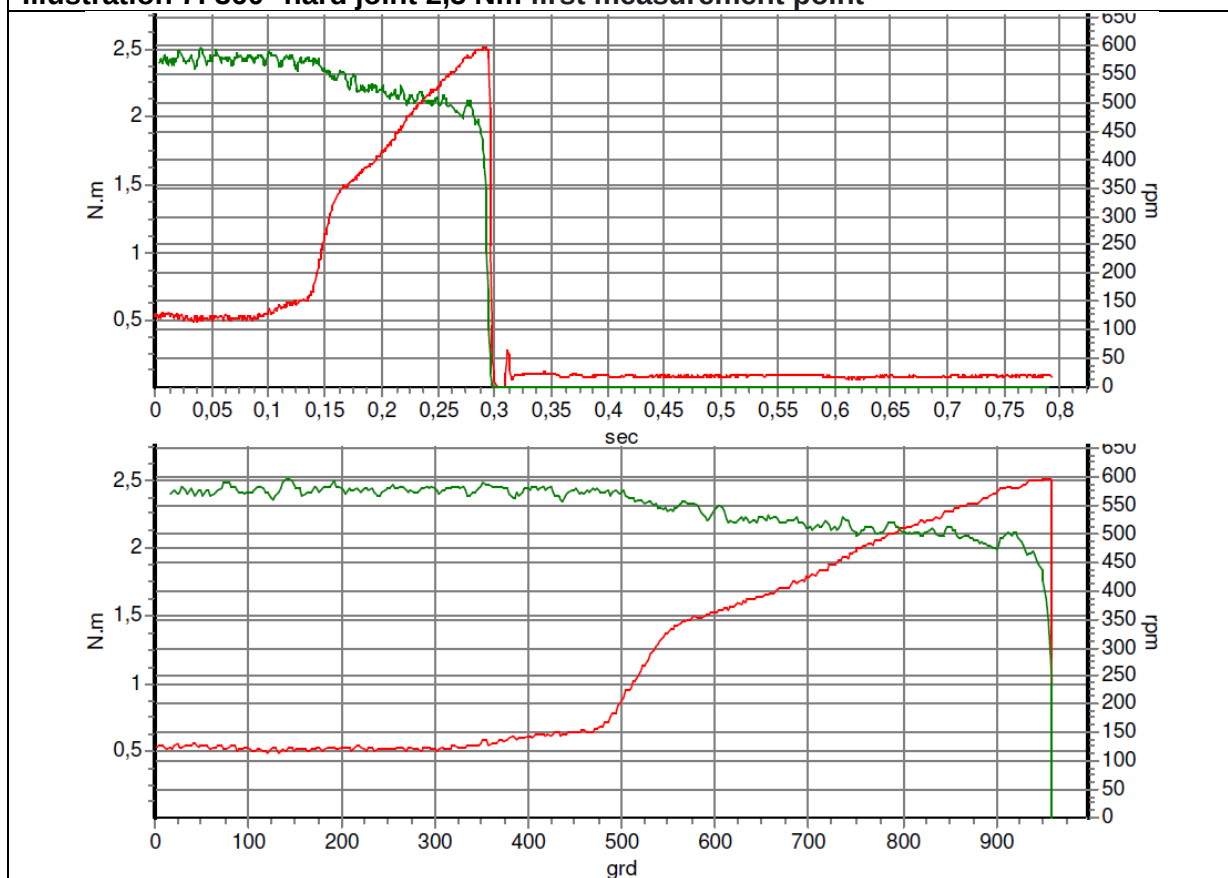


Illustration 8: 360° hard joint 2,5 Nm last measurement point

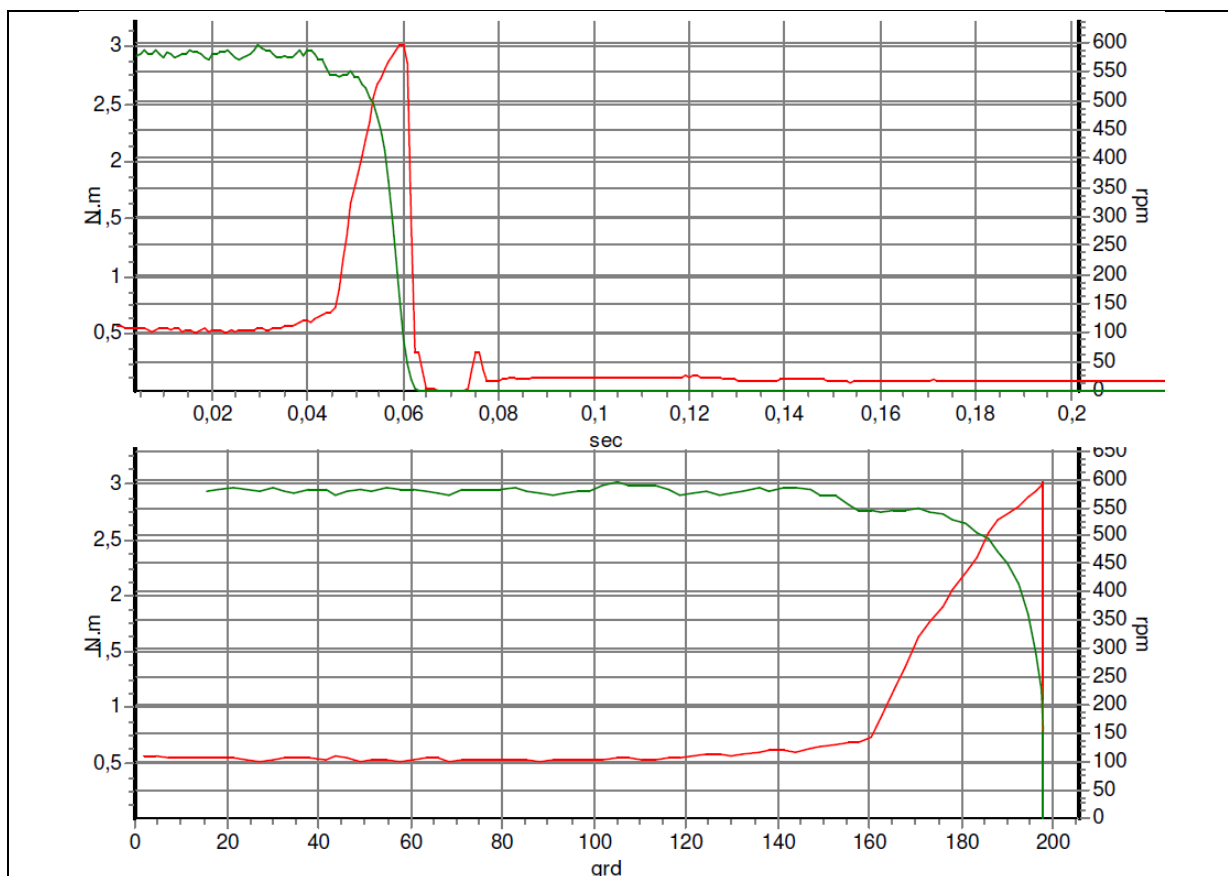


Illustration 9: 30° hard joint 3 Nm first measurement point

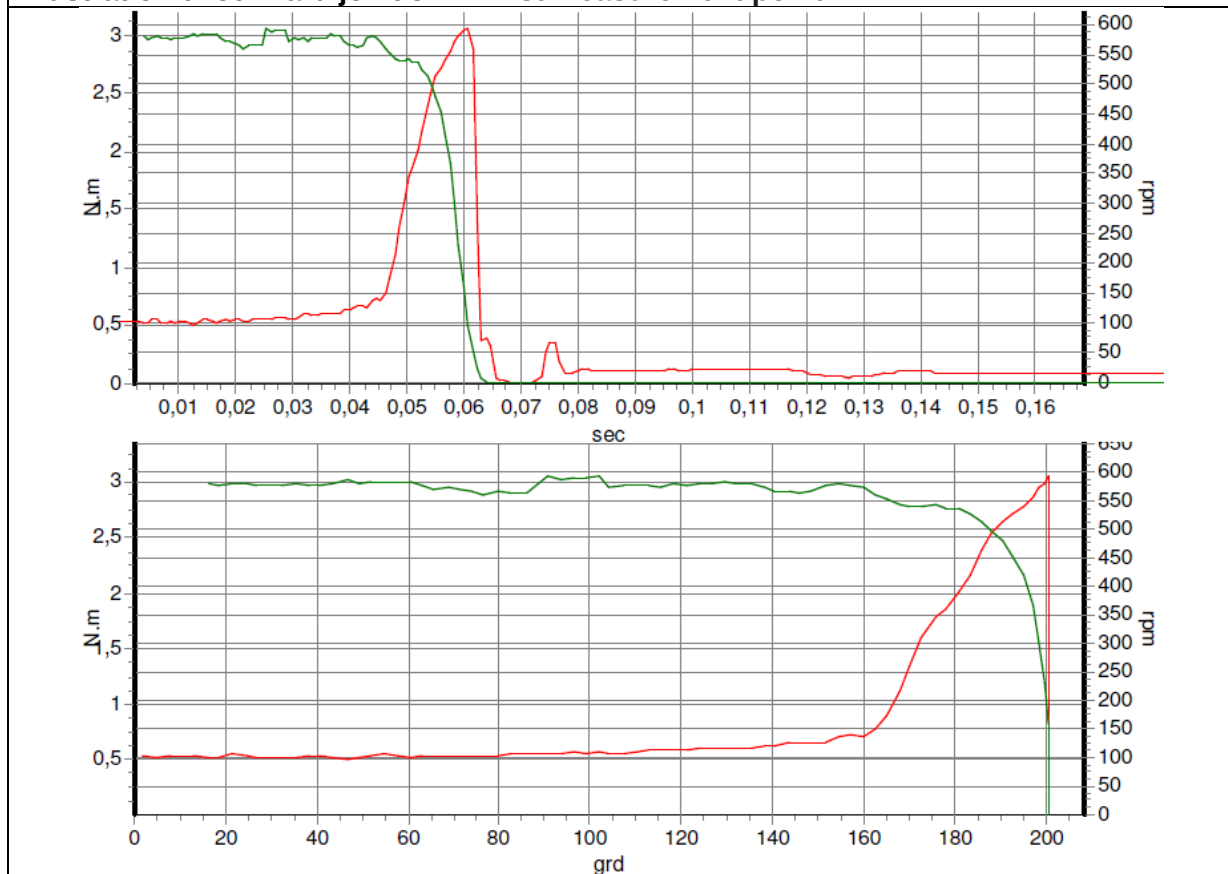


Illustration 10: 30° hard joint 3 Nm last measurement point

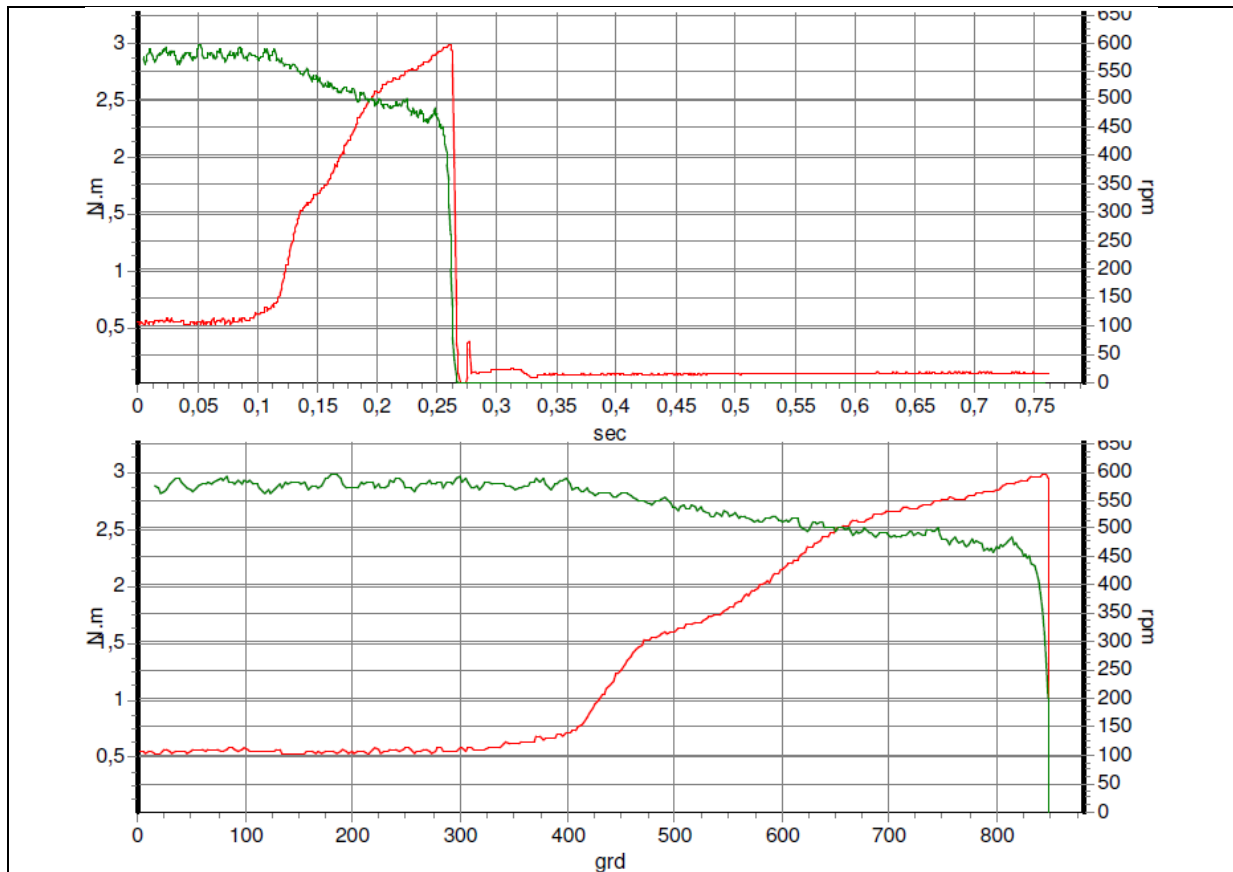


Illustration 11: 360° hard joint 3 Nm first measurement point

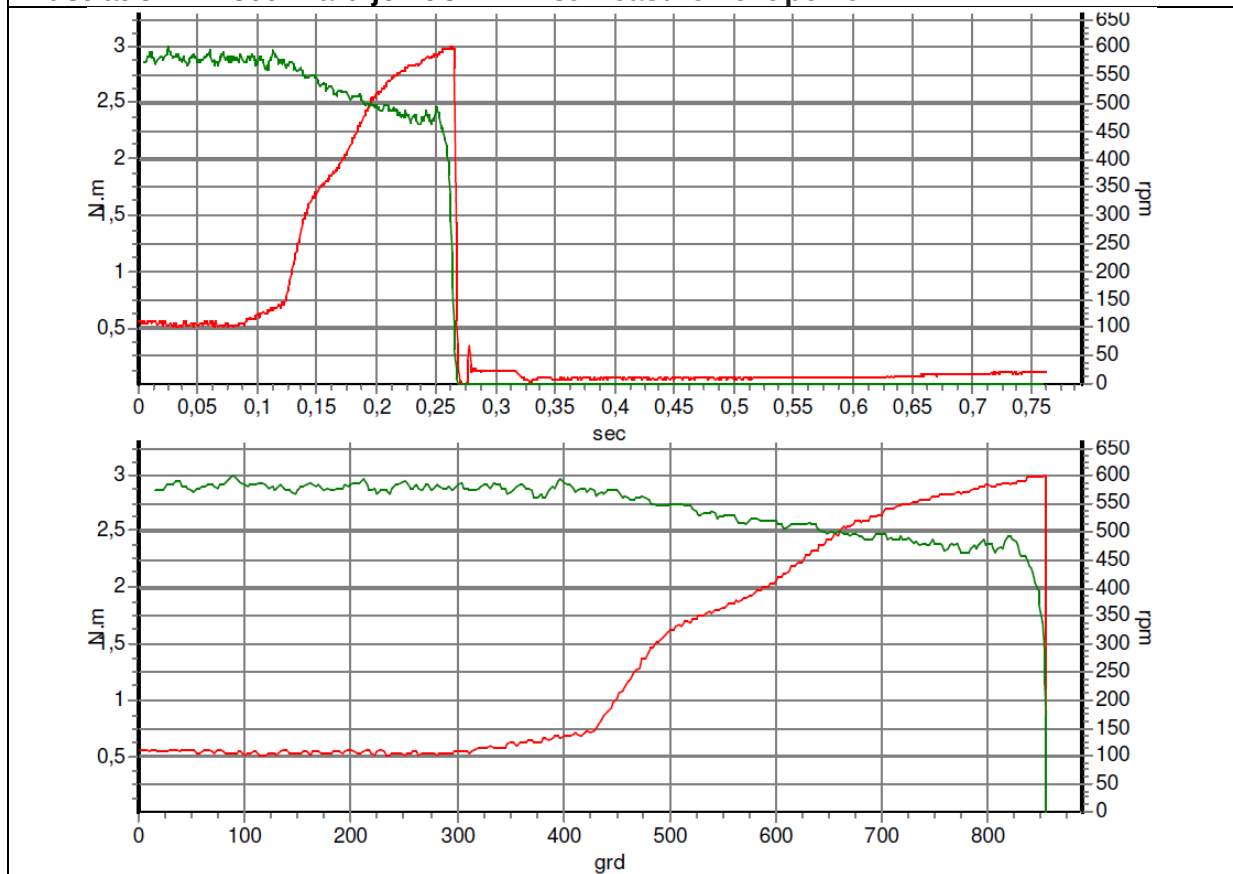


Illustration 12: 360° hard joint 3 Nm last measurement point