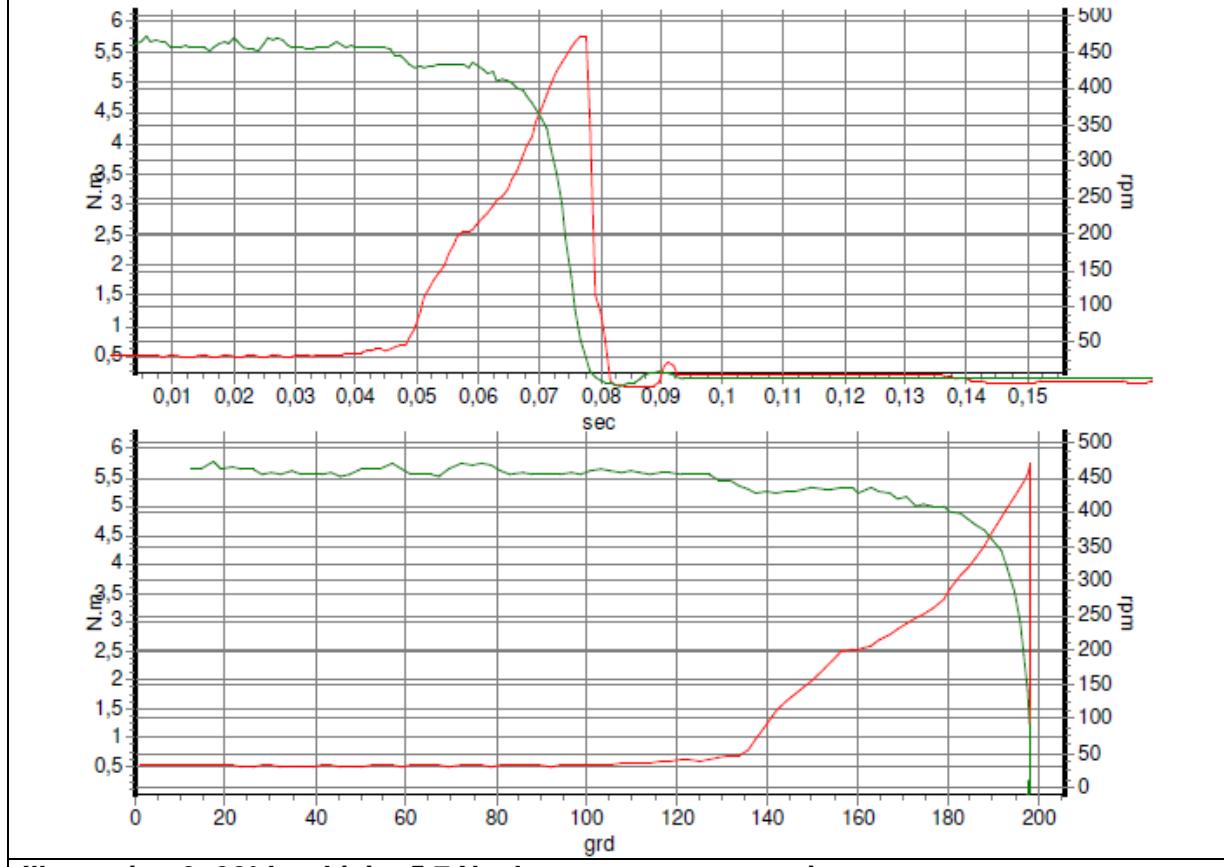

Illustration 1: 30° hard joint 5,7 Nm first measurement point

Illustration 2: 30° hard joint 5,7 Nm last measurement point

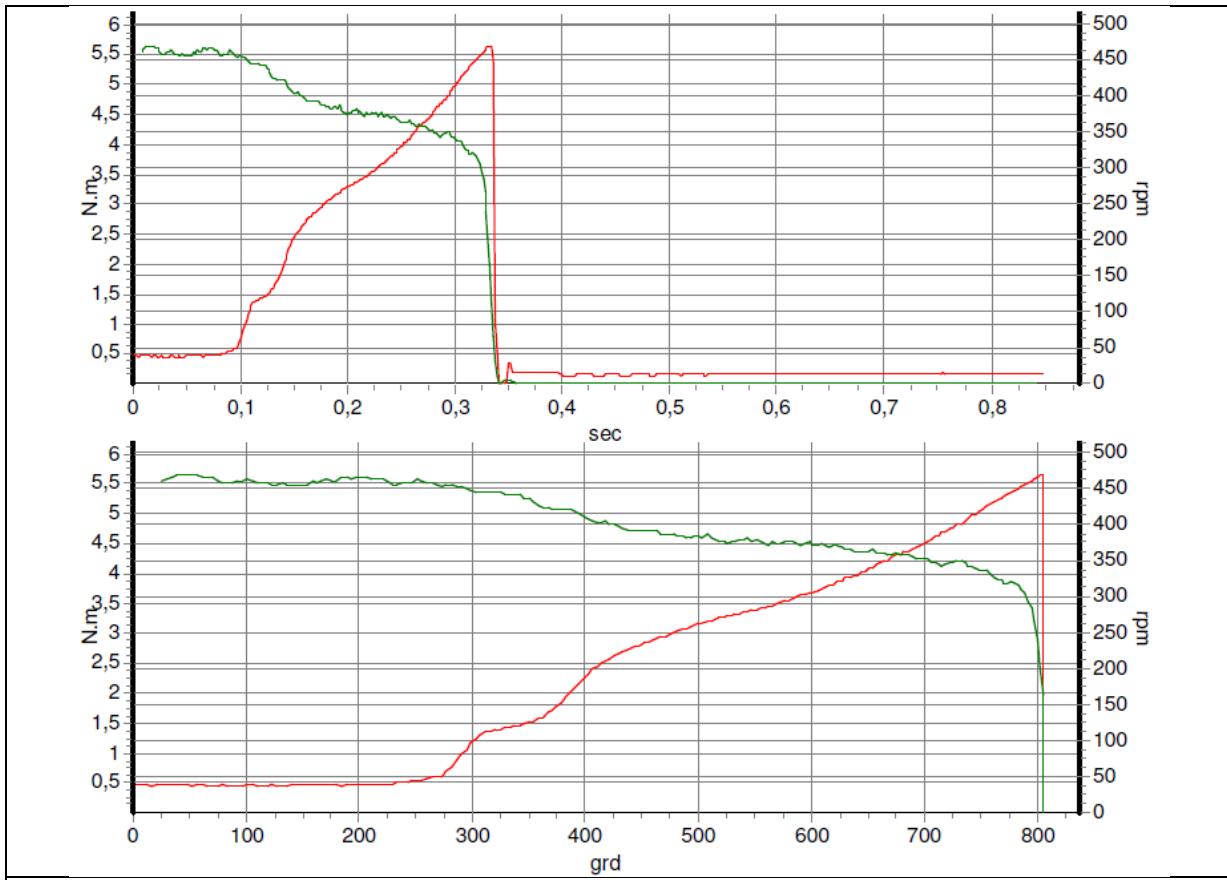


Illustration 3: 360° hard joint 5,7 Nm first measurement point

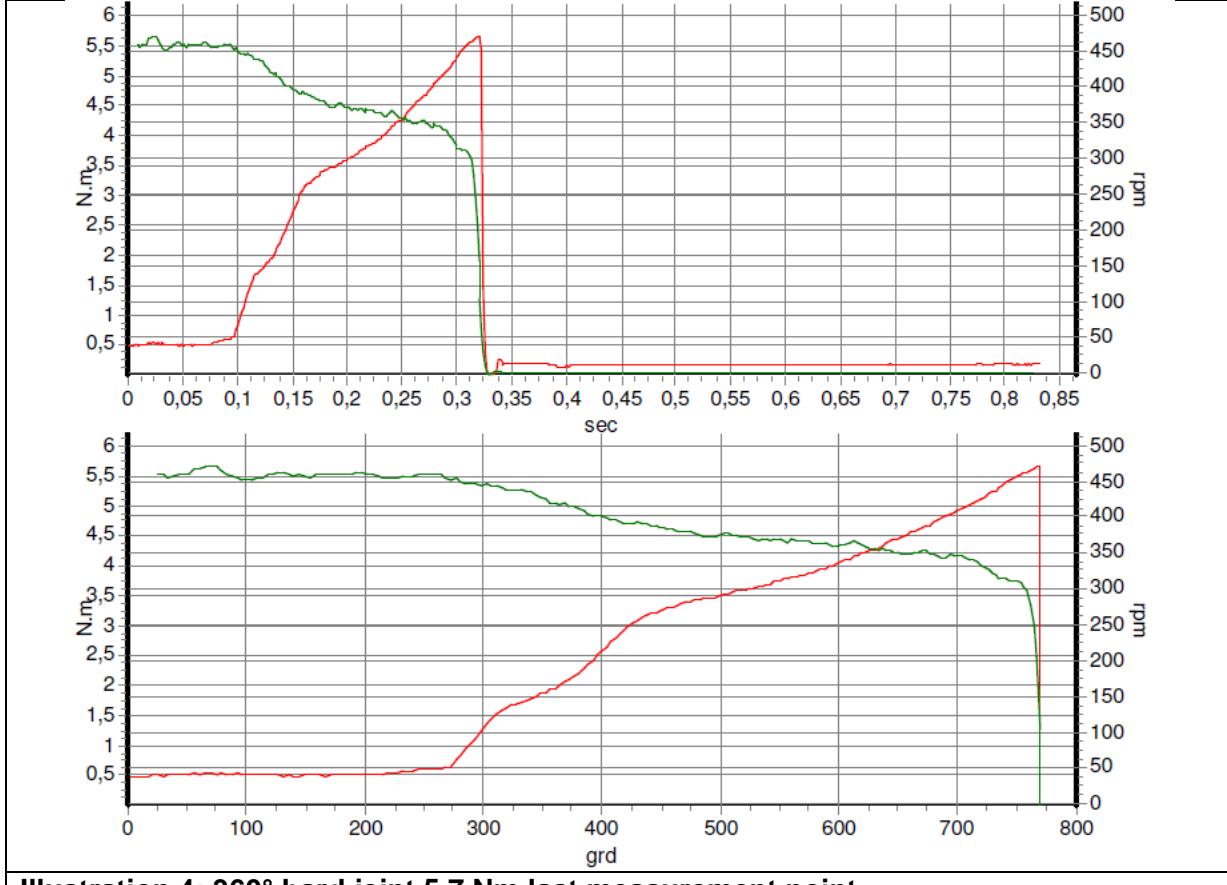


Illustration 4: 360° hard joint 5,7 Nm last measurement point

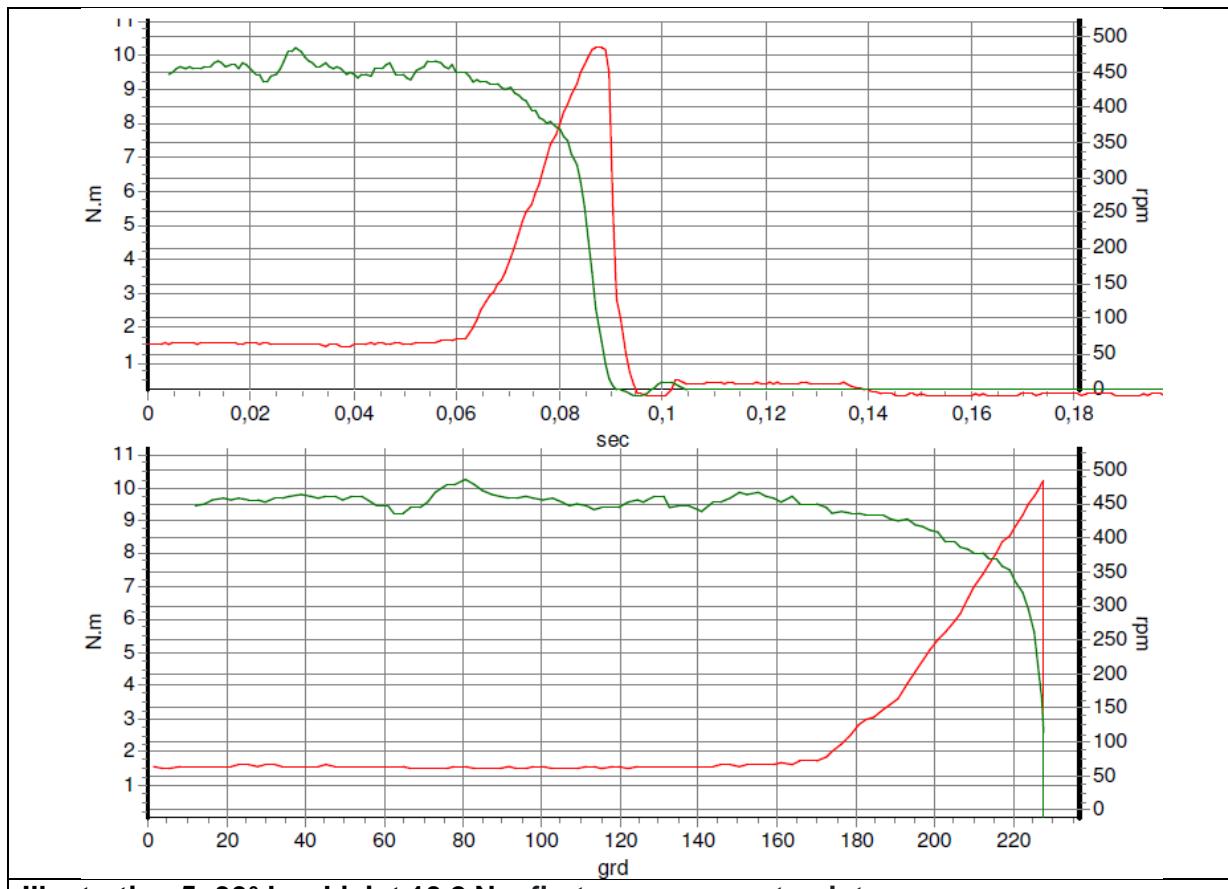


Illustration 5: 30° hard joint 10,2 Nm first measurement point

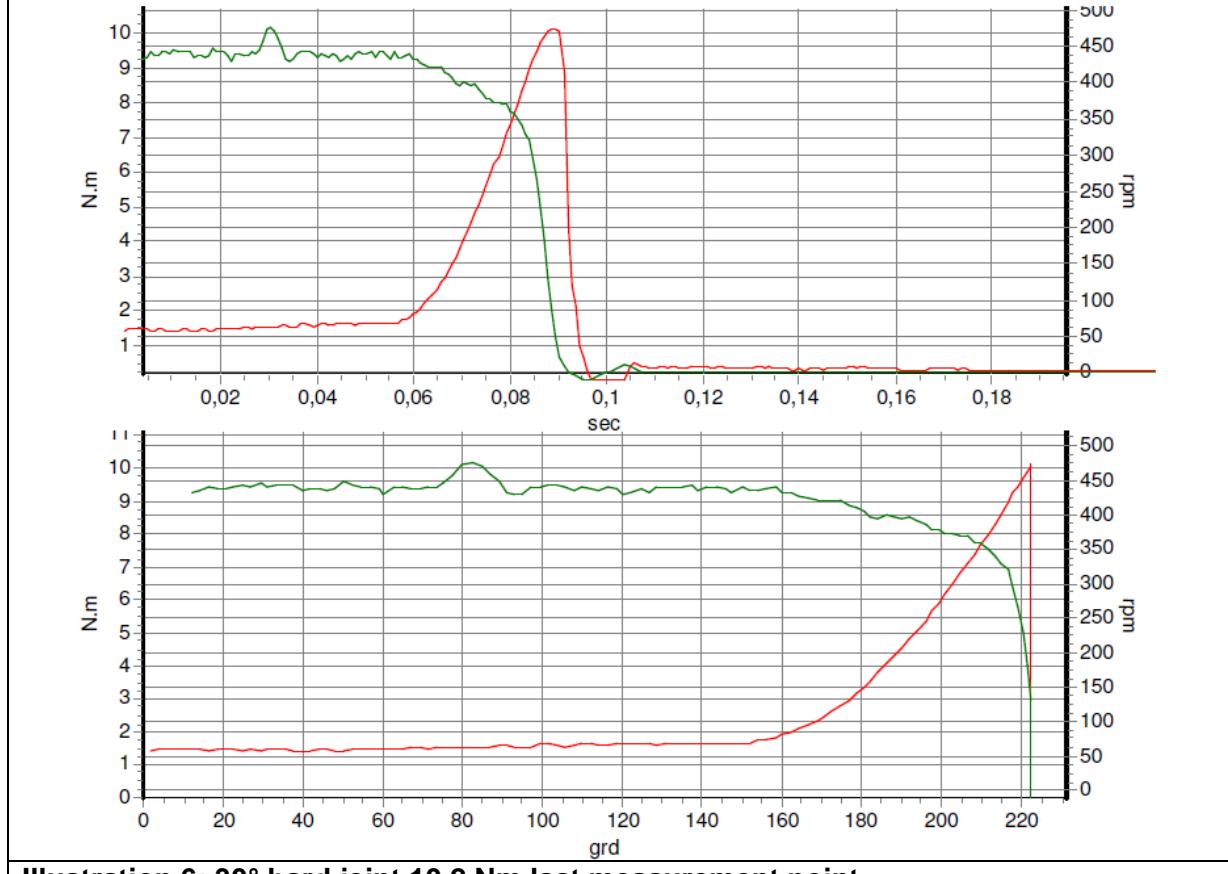
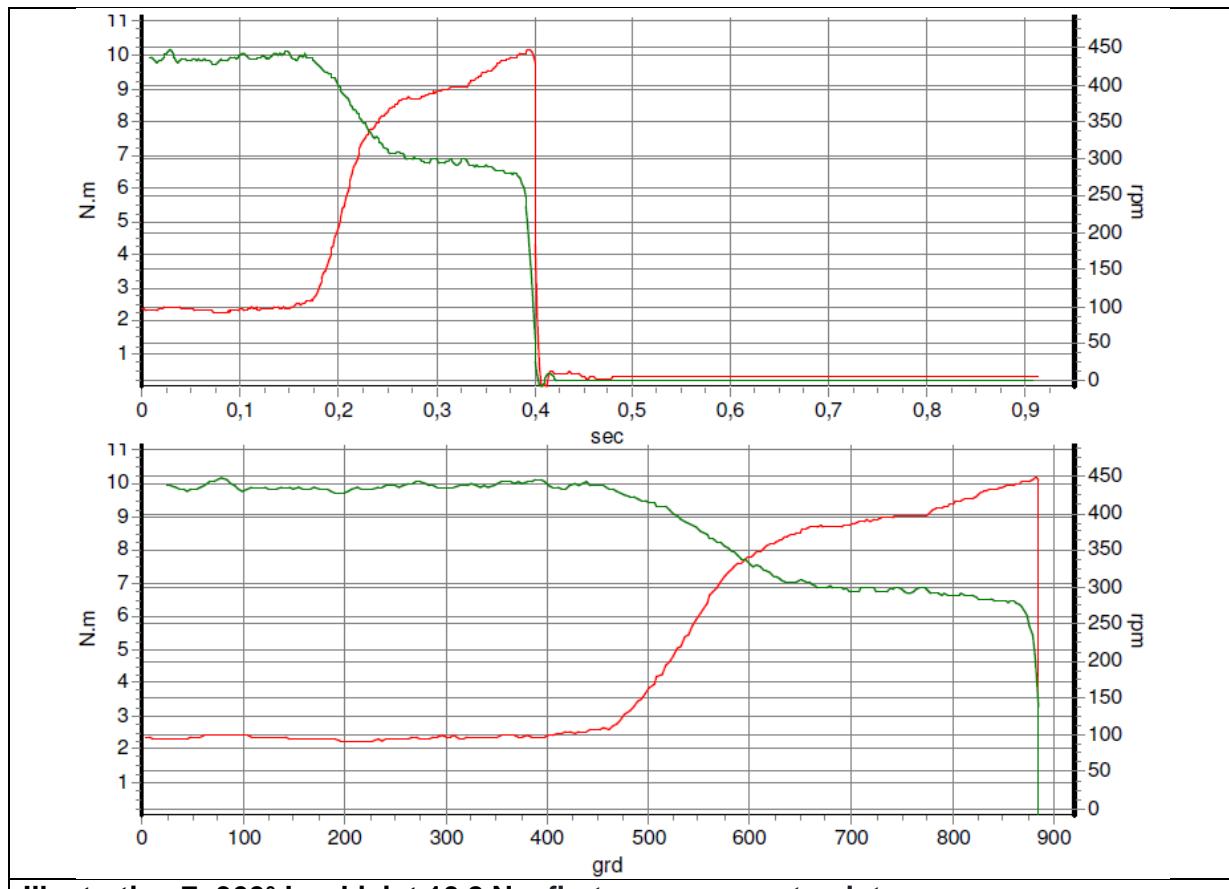
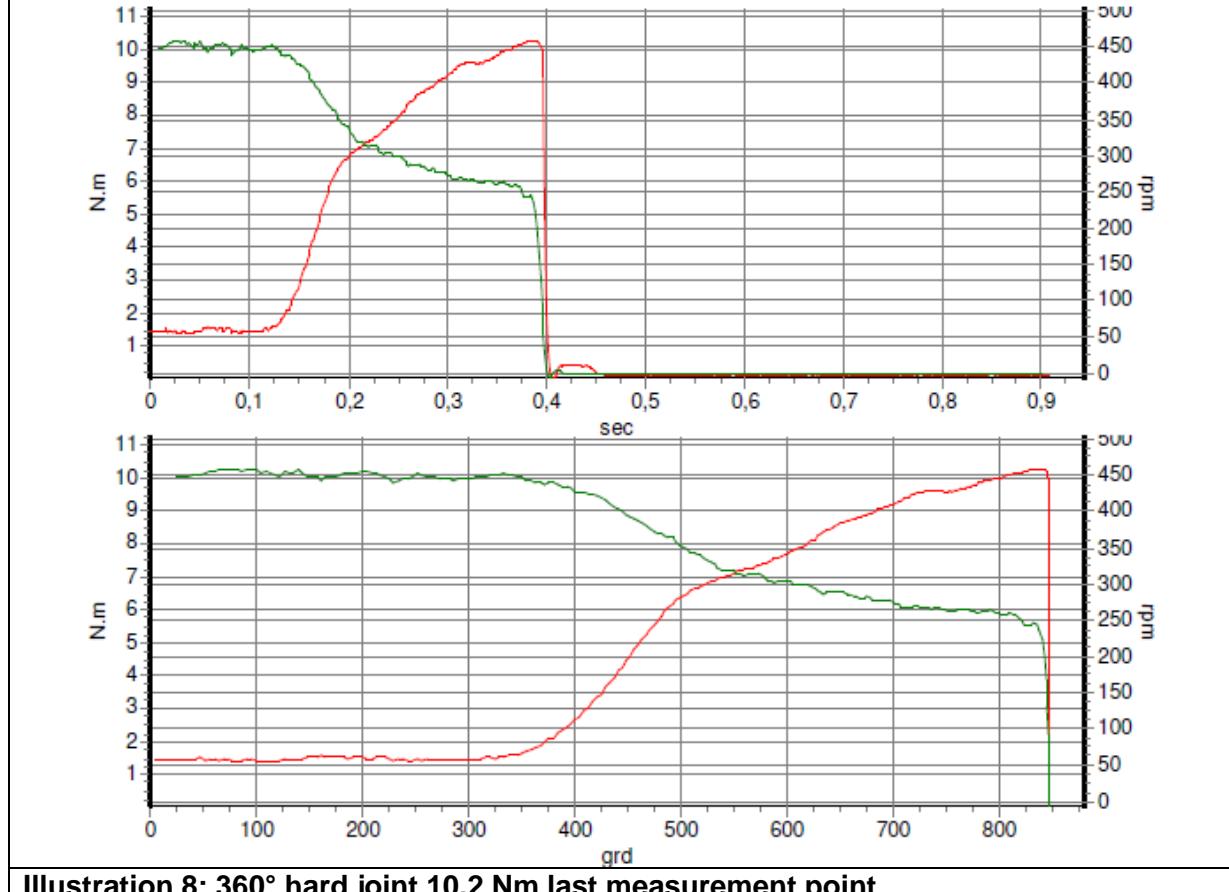
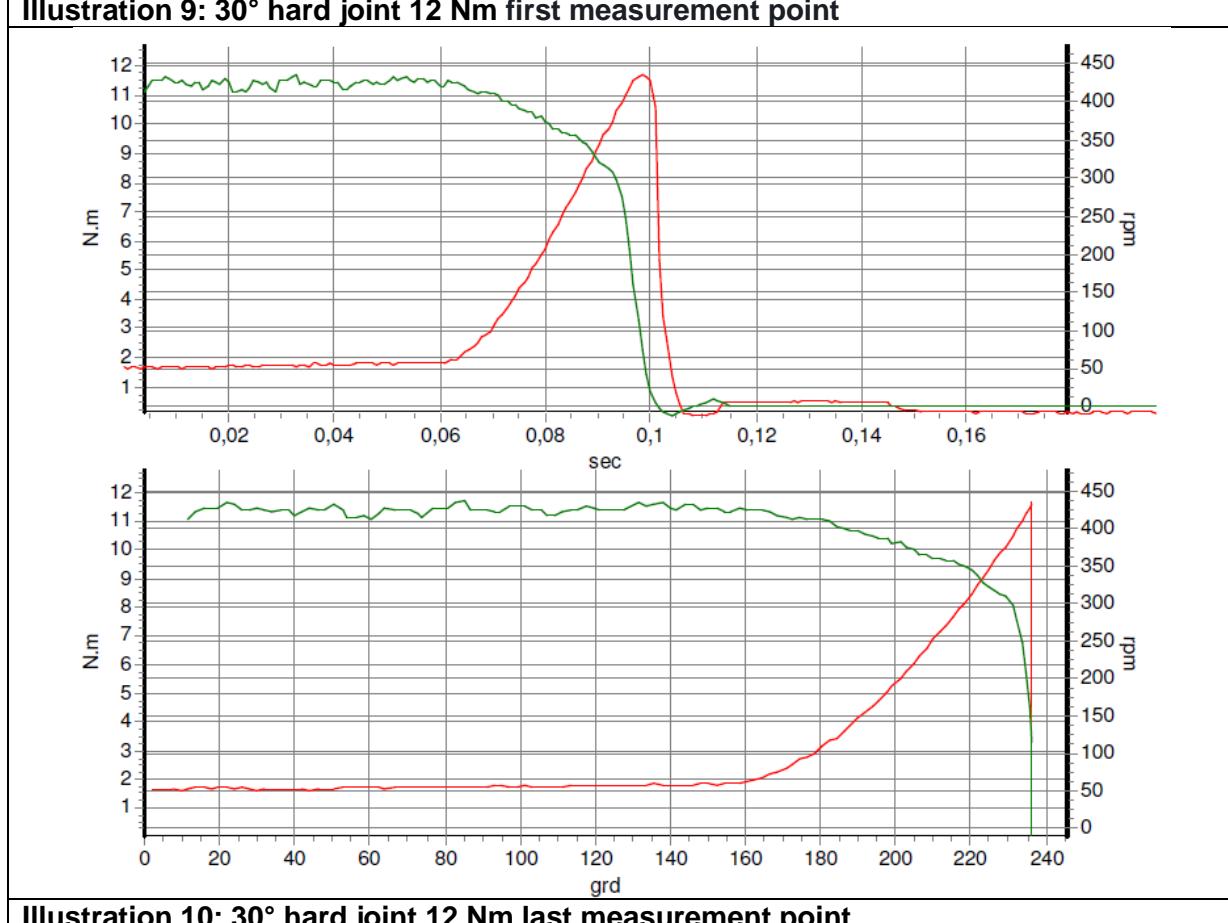
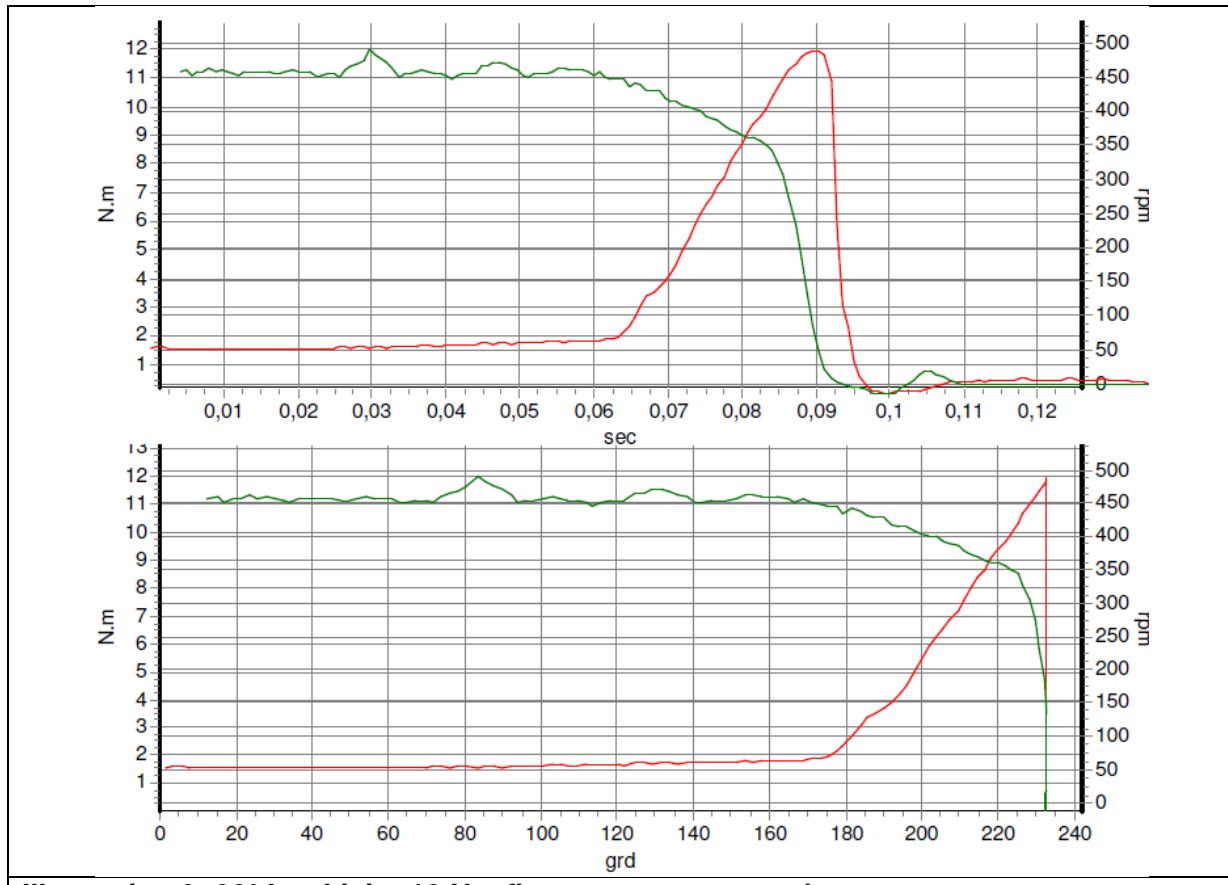
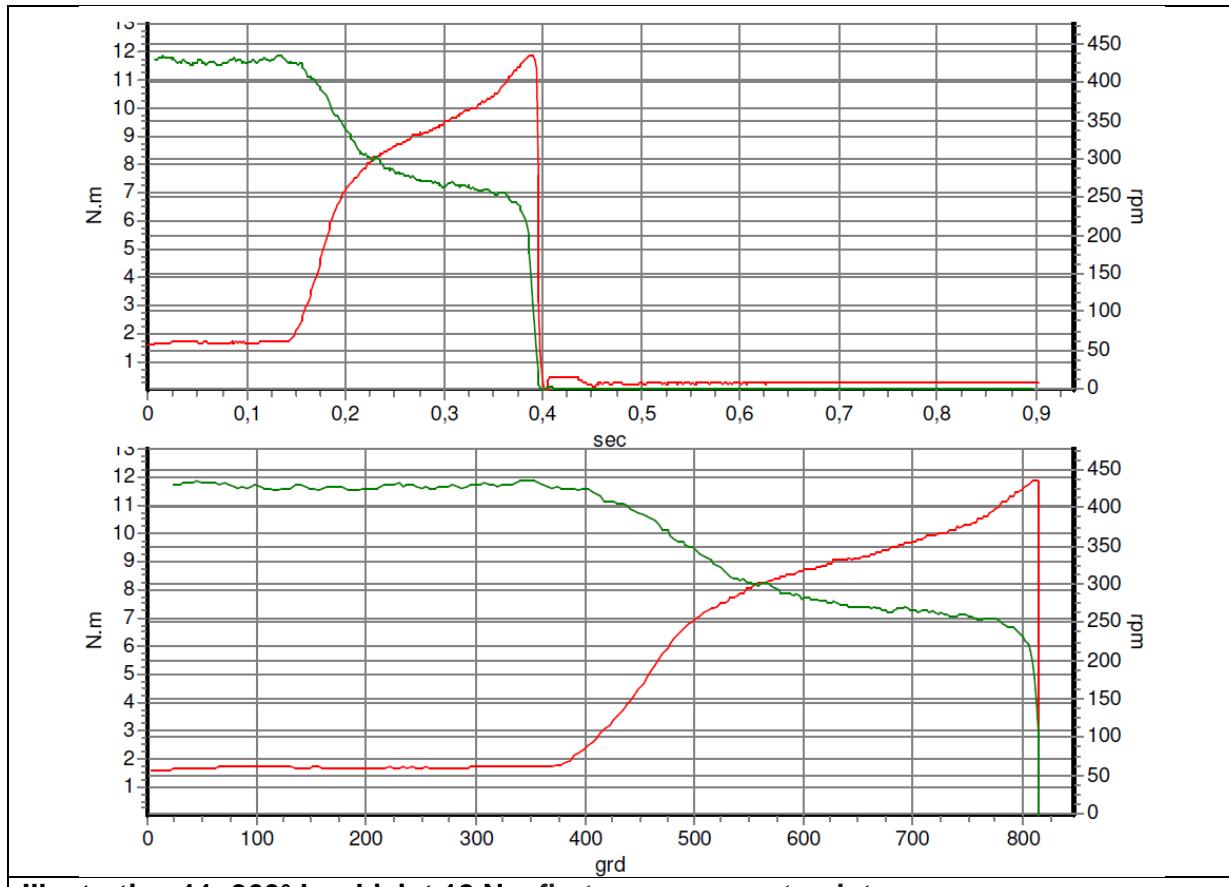
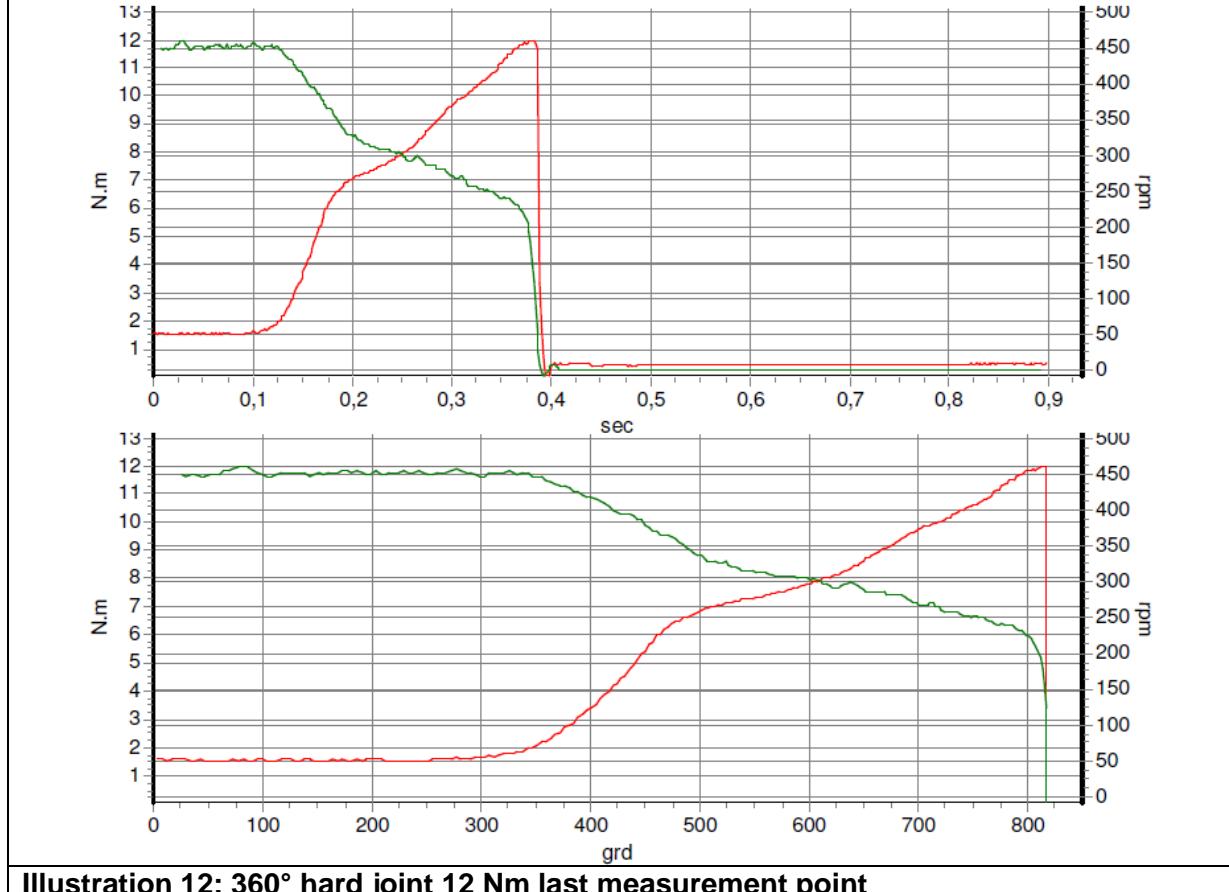
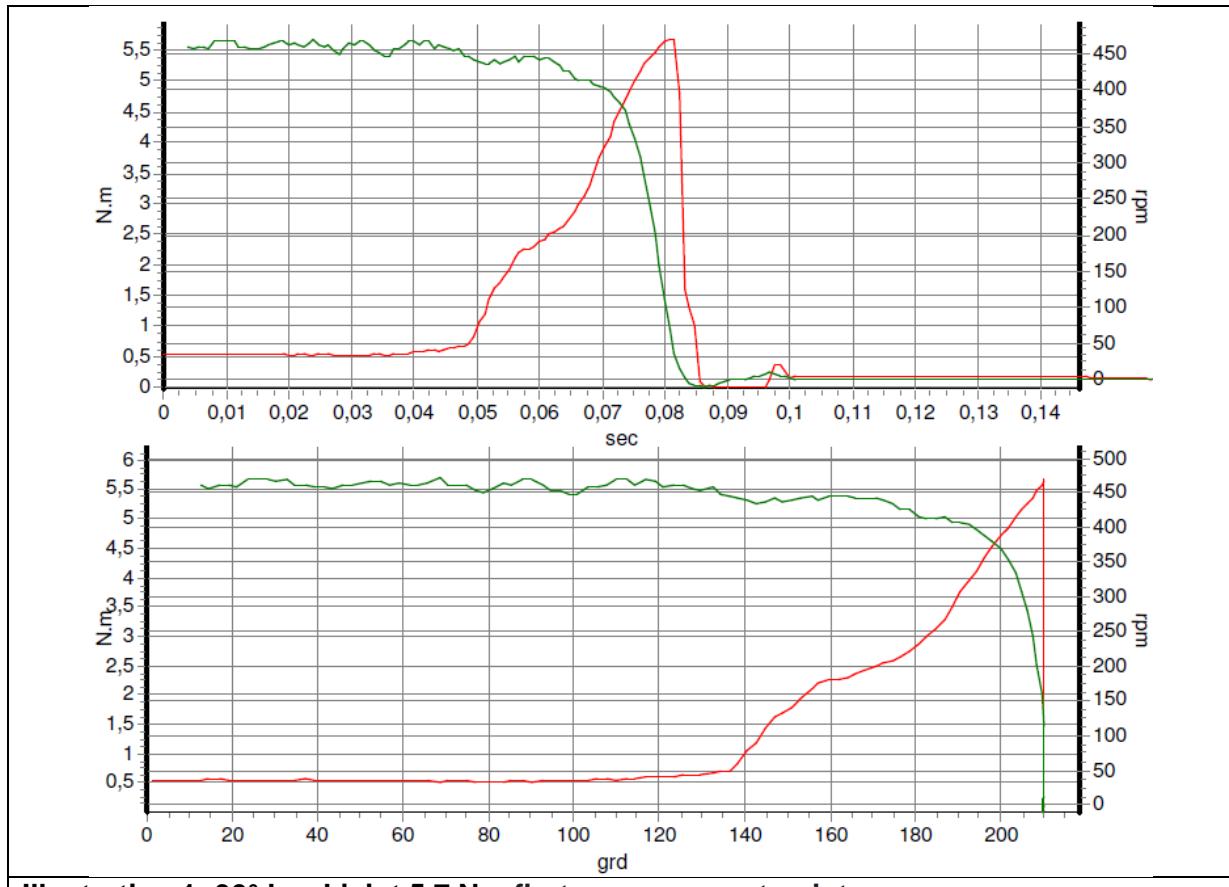
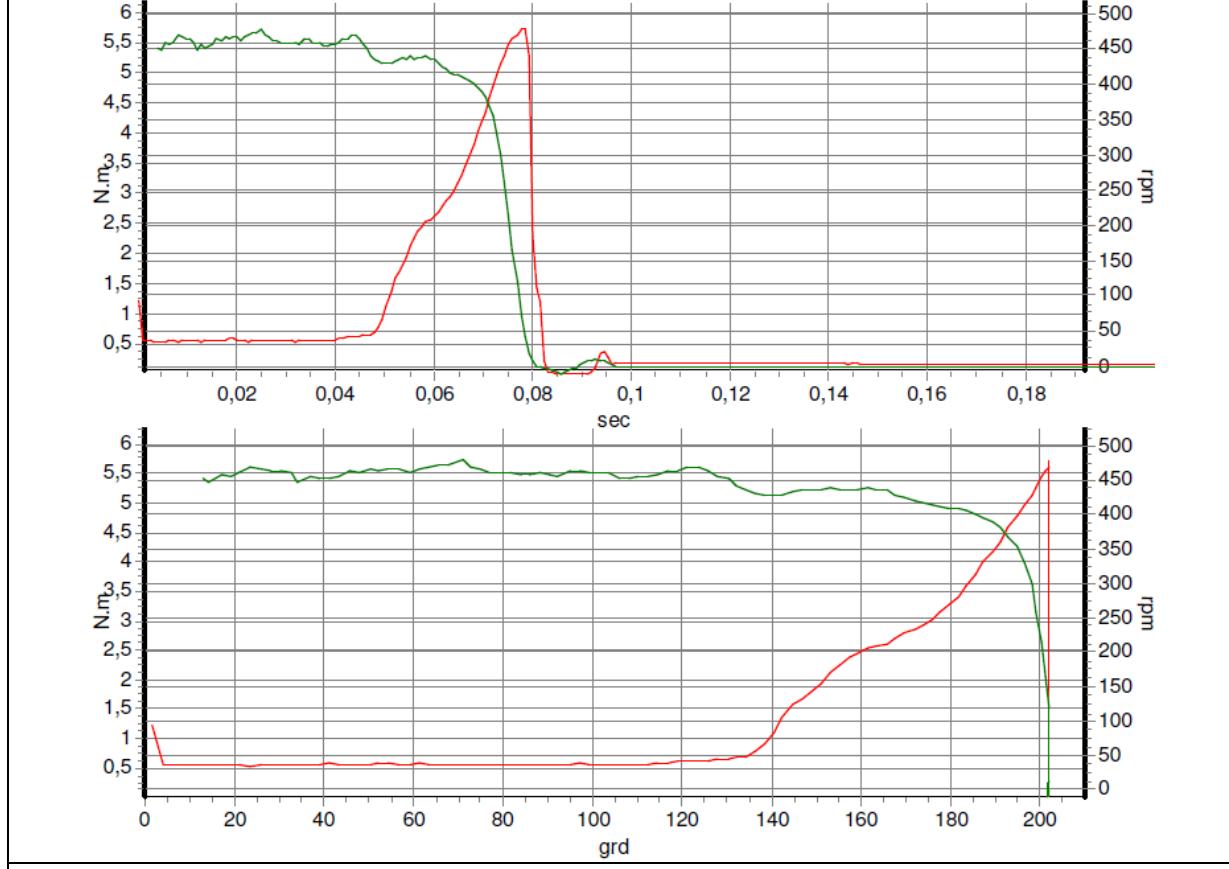


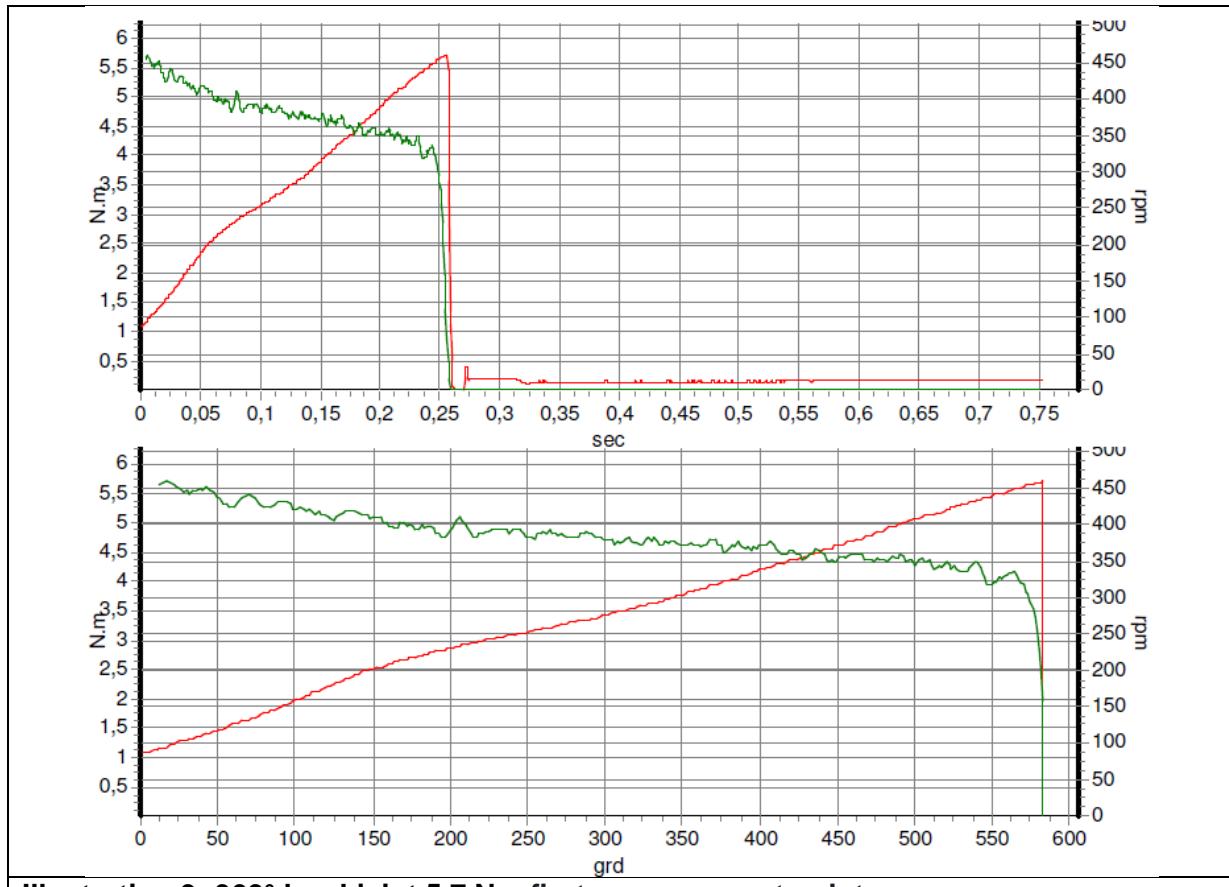
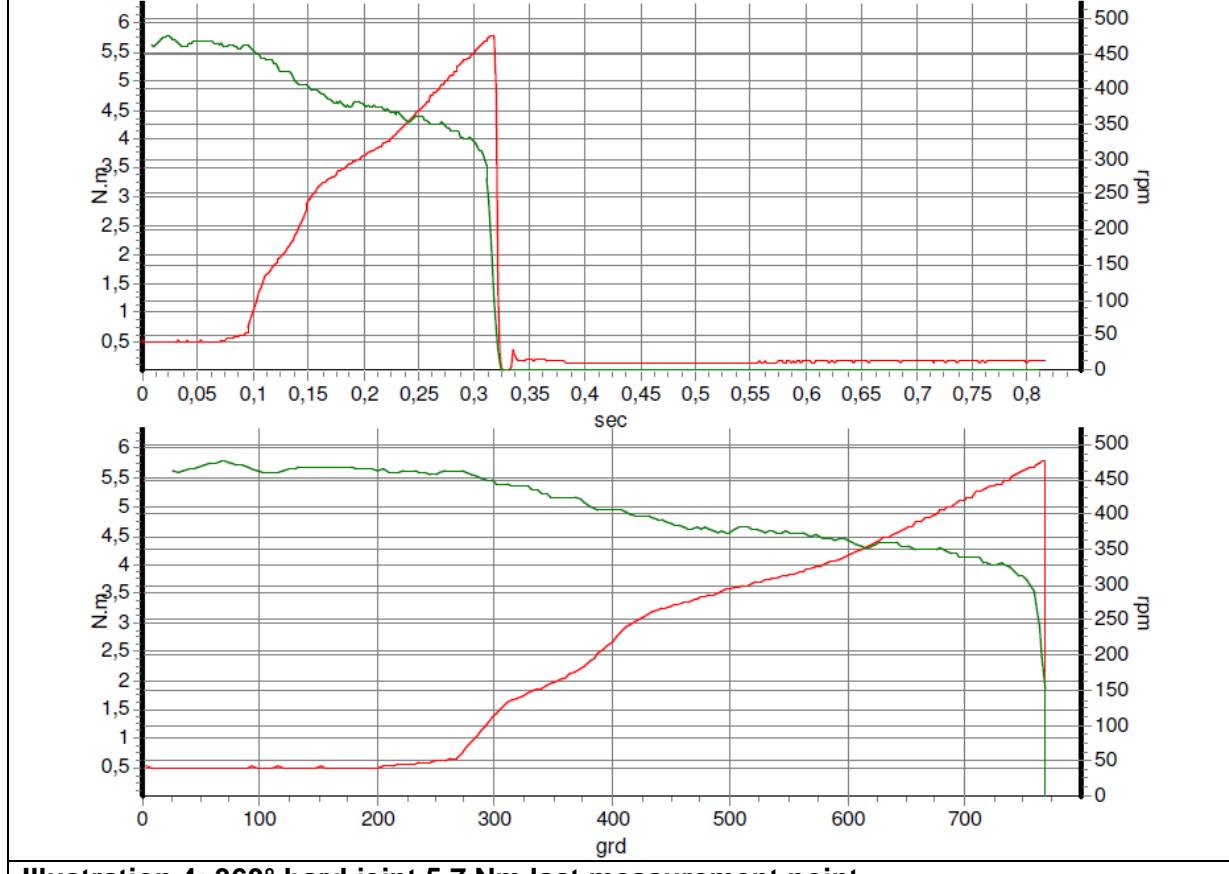
Illustration 6: 30° hard joint 10,2 Nm last measurement point


Illustration 7: 360° hard joint 10,2 Nm first measurement point

Illustration 8: 360° hard joint 10,2 Nm last measurement point




Illustration 11: 360° hard joint 12 Nm first measurement point

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


Illustration 1: 30° hard joint 5,7 Nm first measurement point

Illustration 2: 30° hard joint 5,7 Nm last measurement point


Illustration 3: 360° hard joint 5,7 Nm first measurement point

Illustration 4: 360° hard joint 5,7 Nm last measurement point

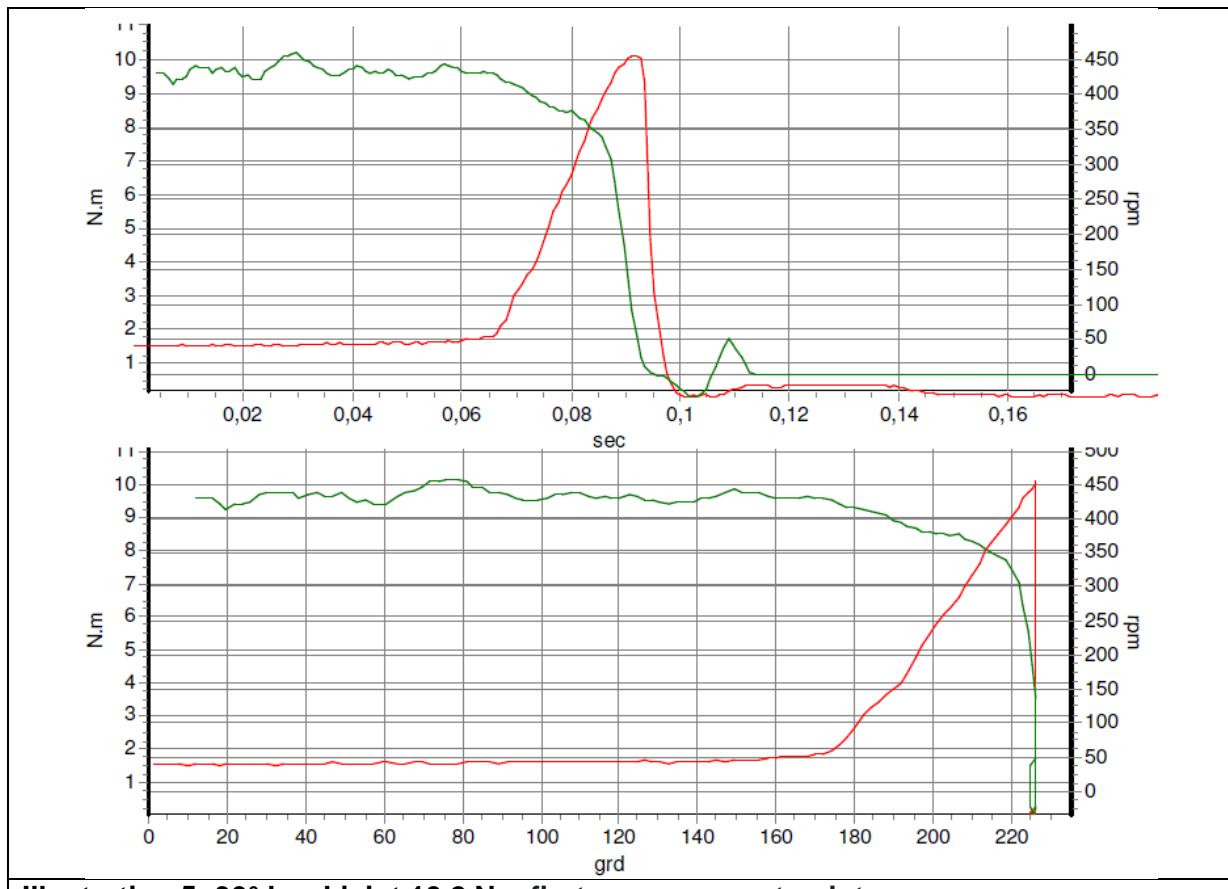


Illustration 5: 30° hard joint 10,2 Nm first measurement point

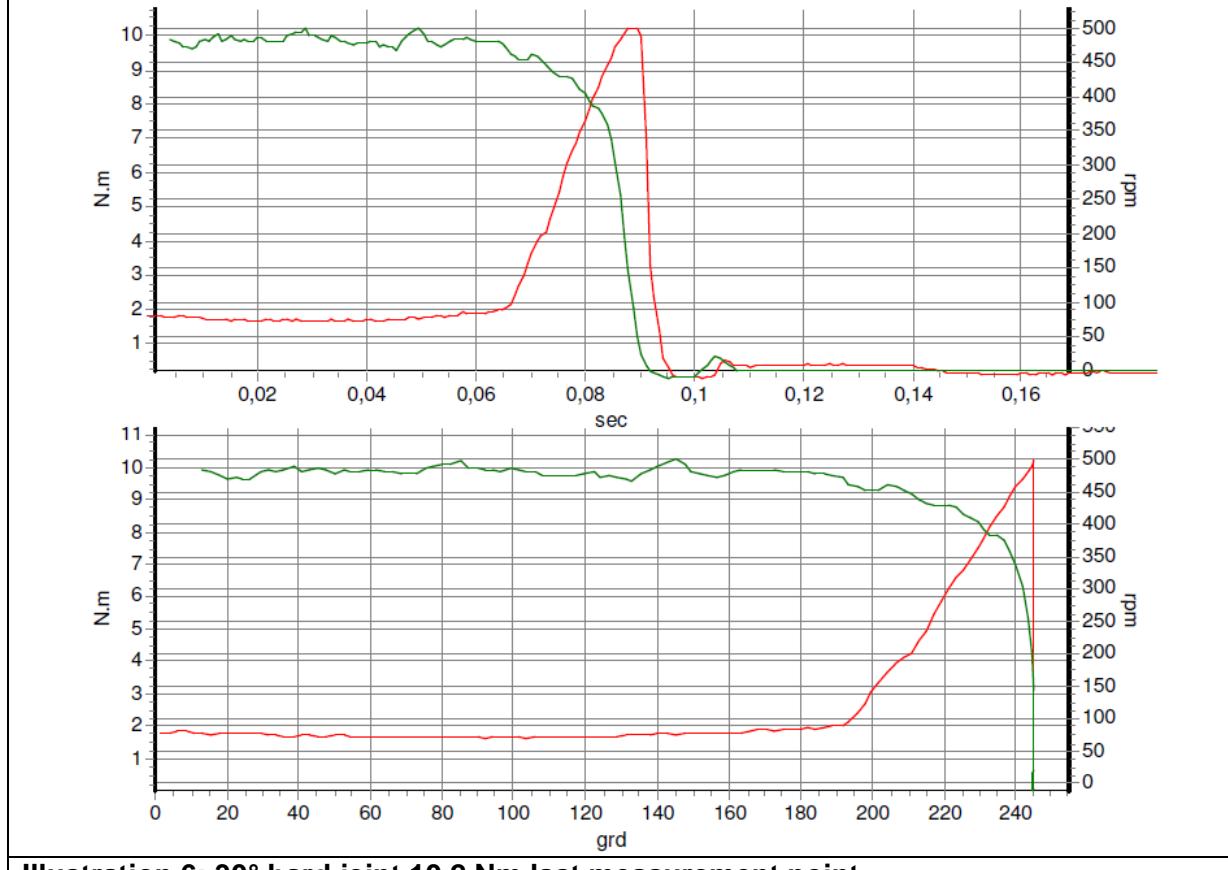
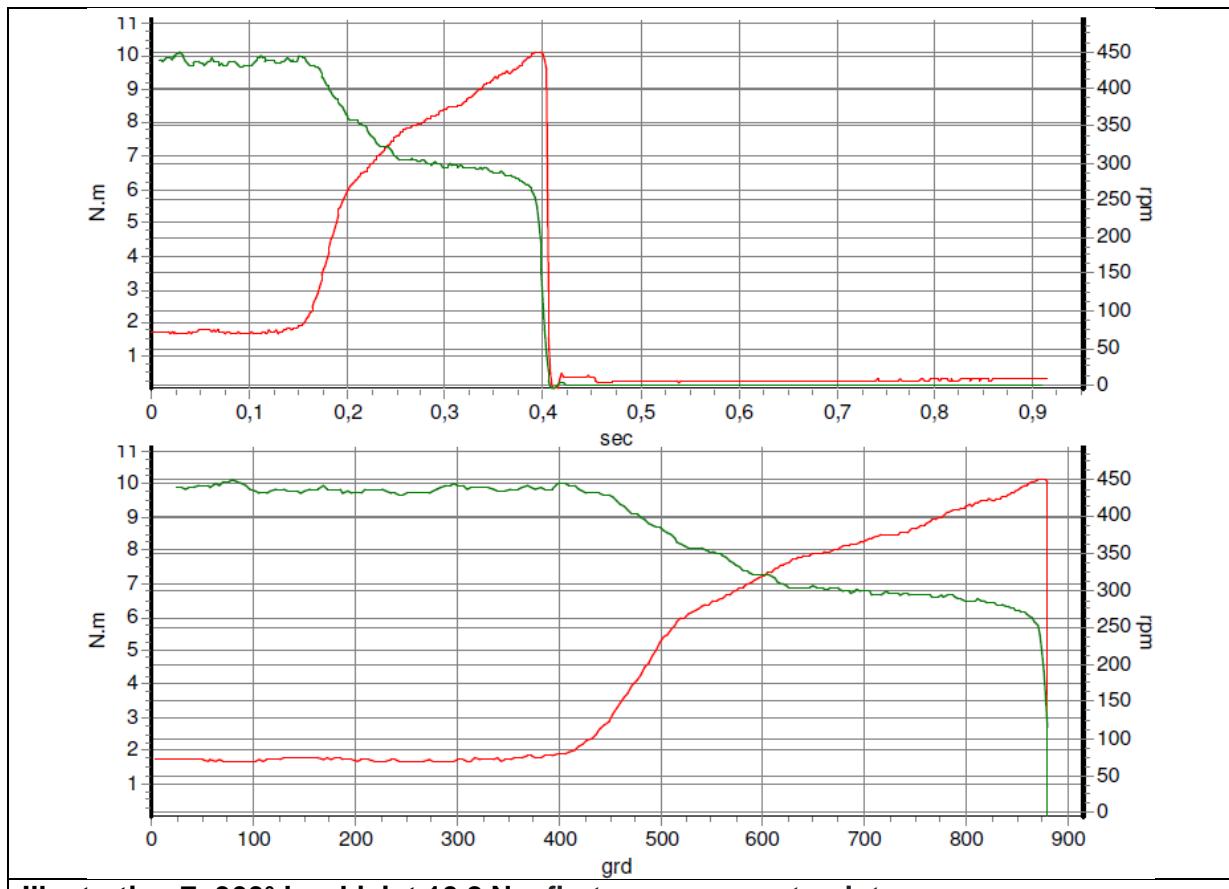
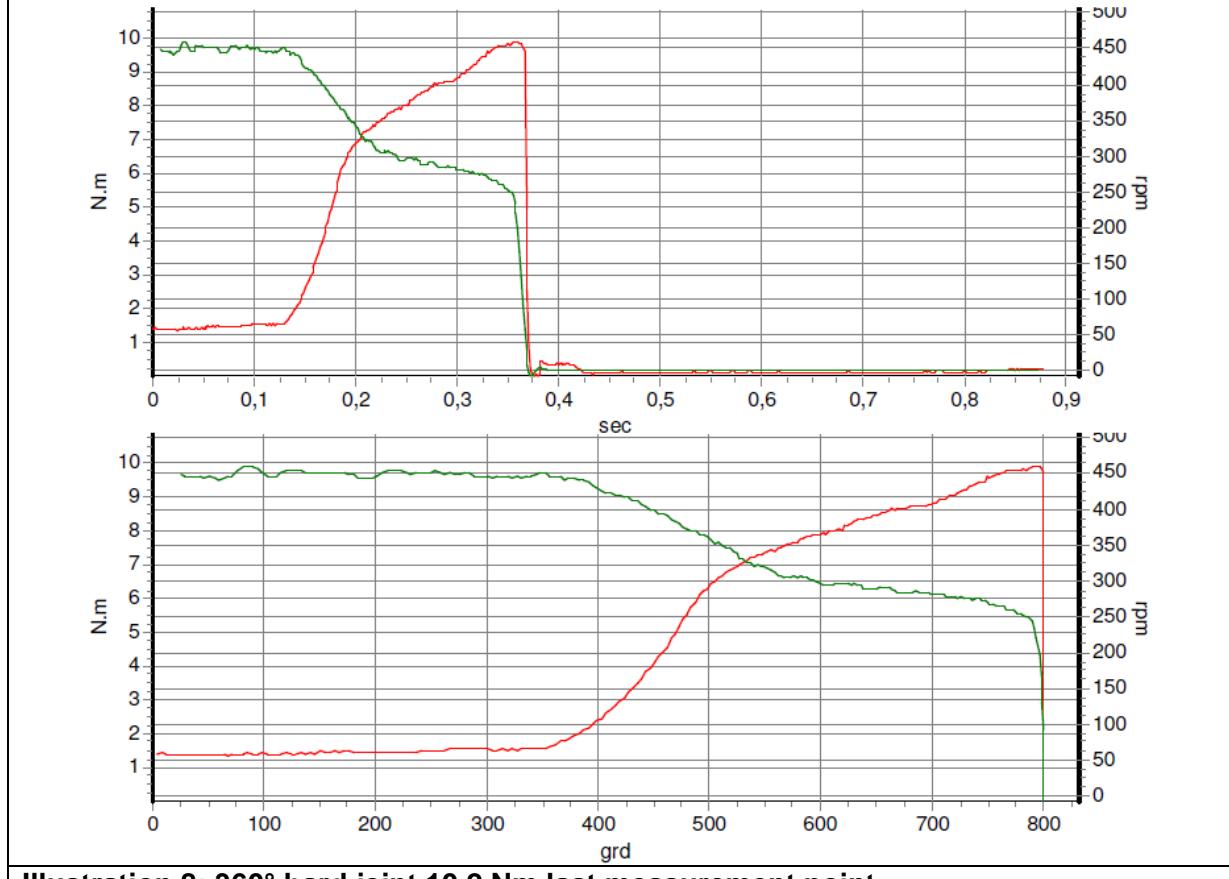
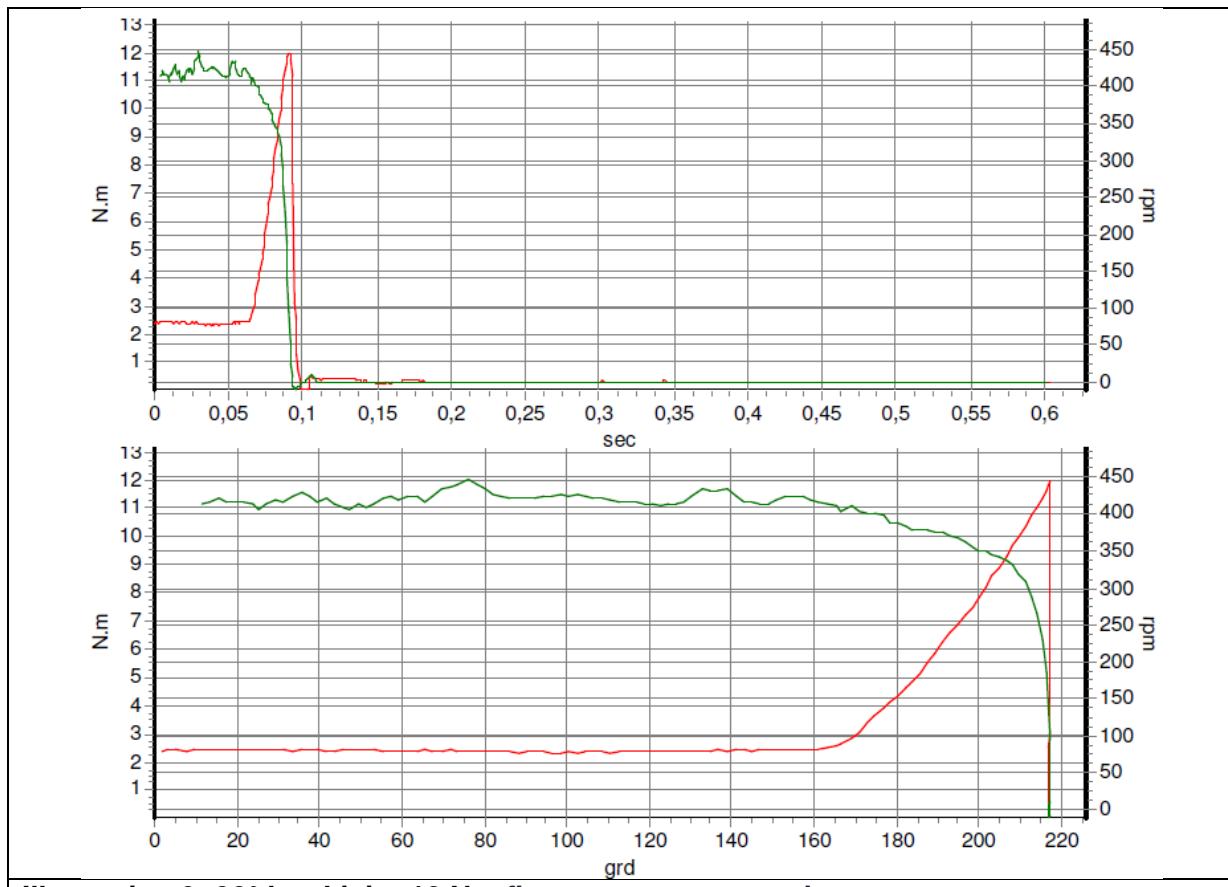
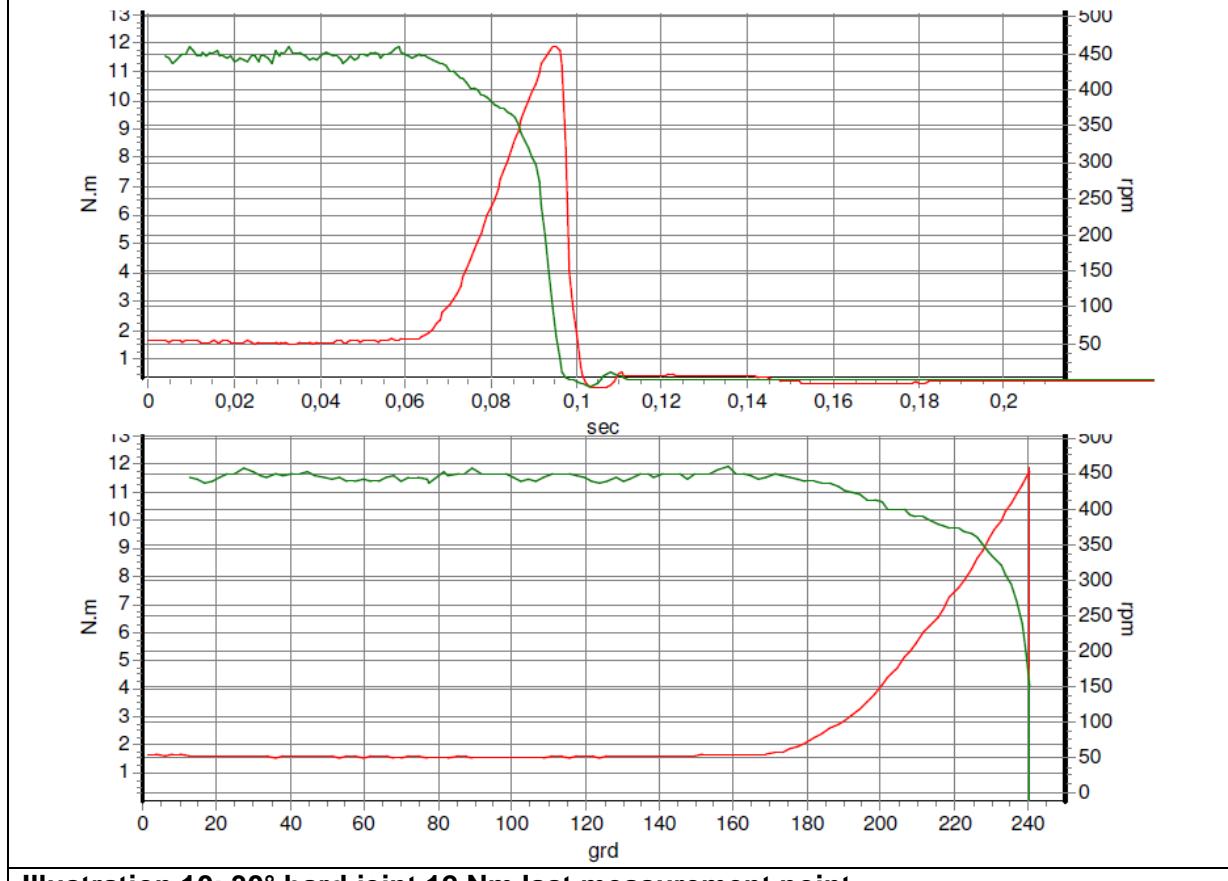
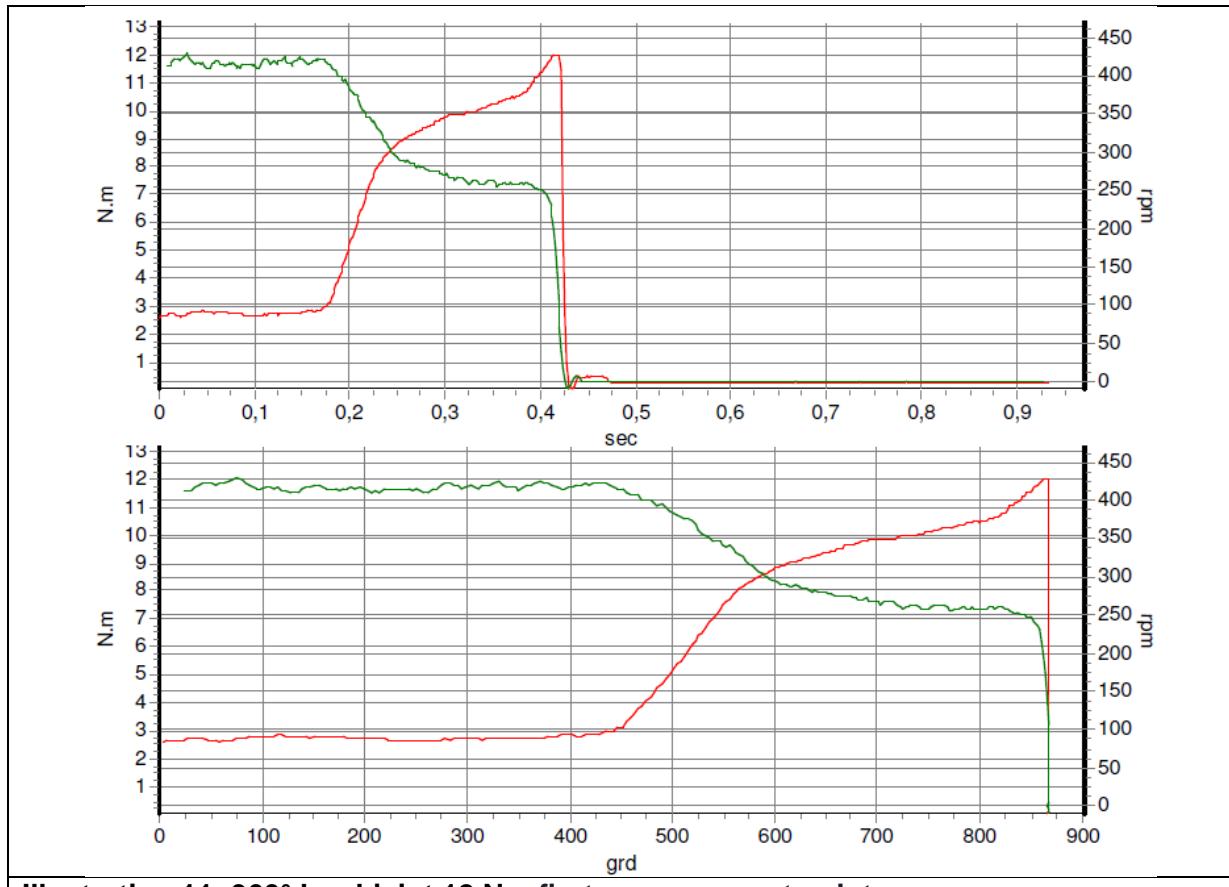
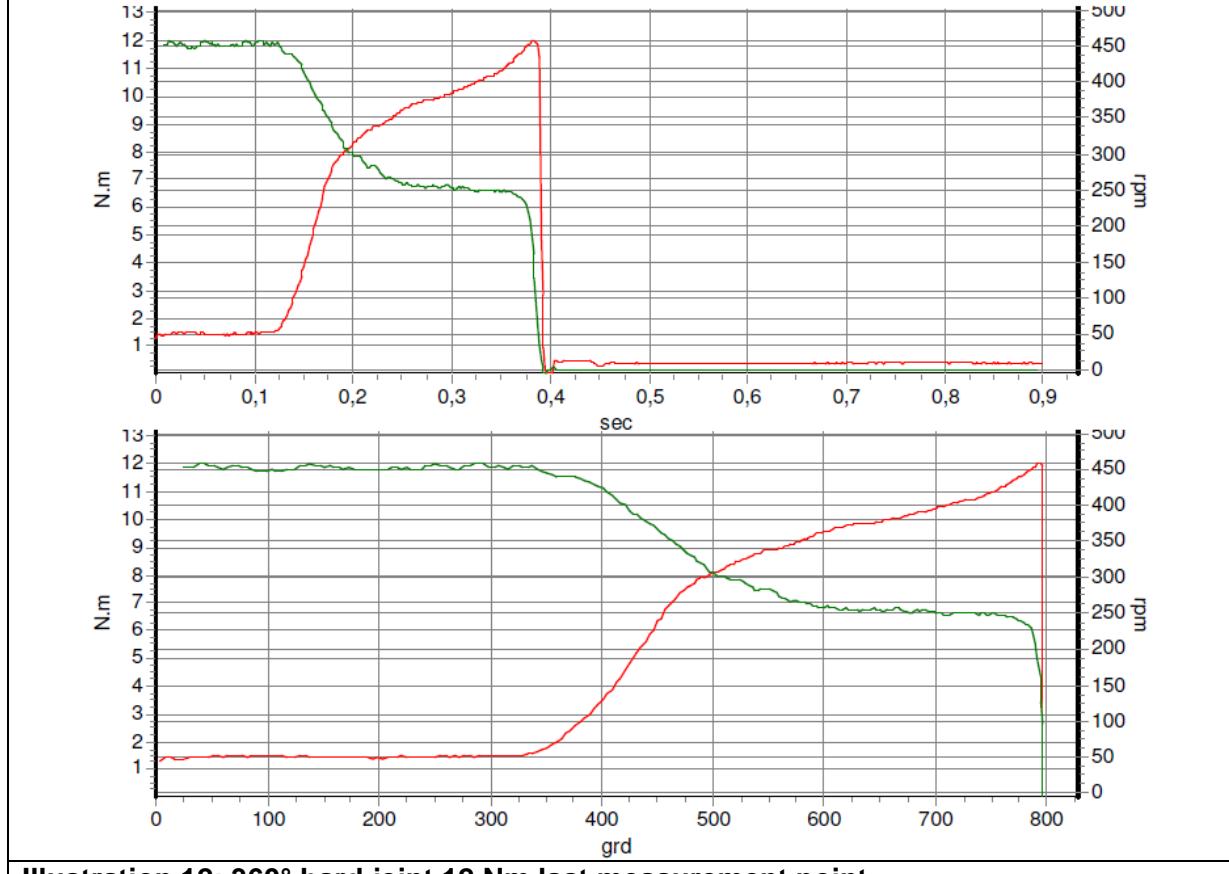
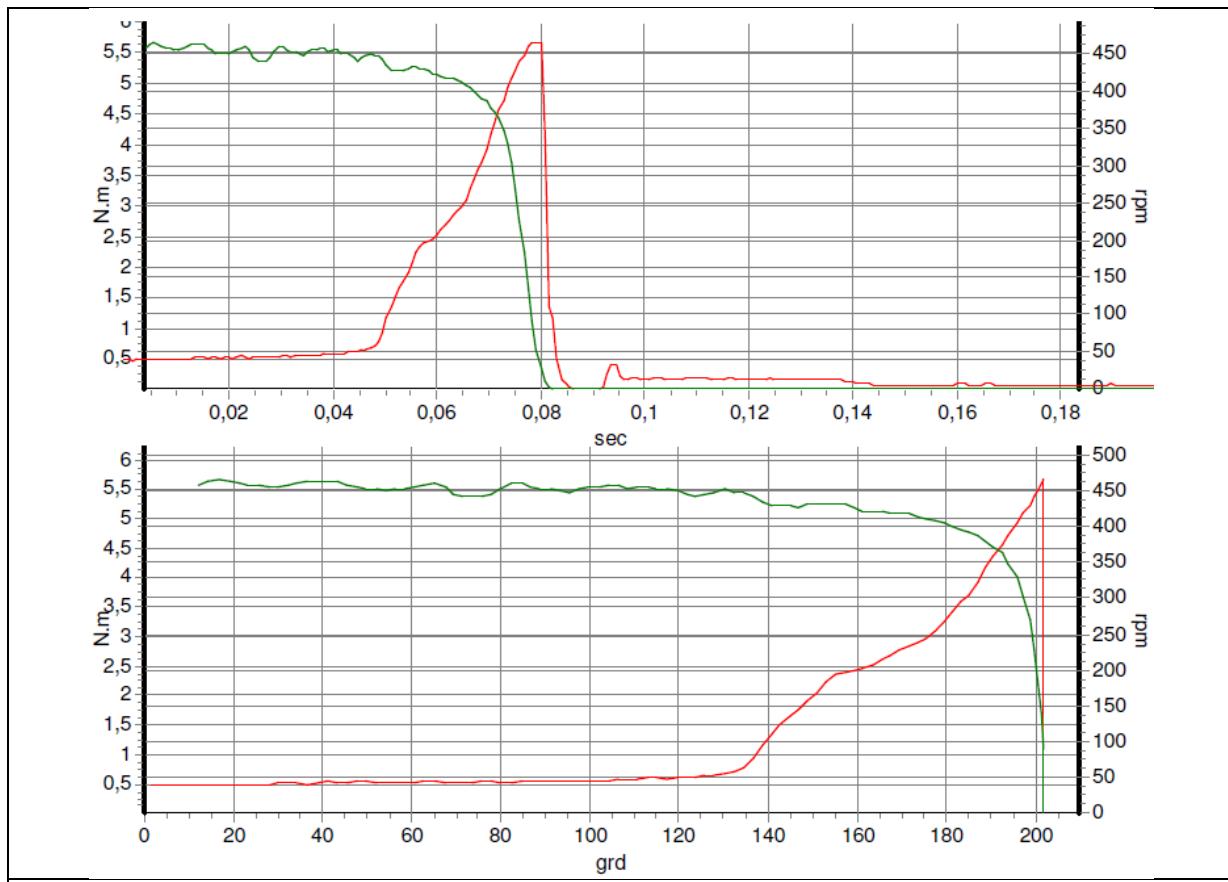
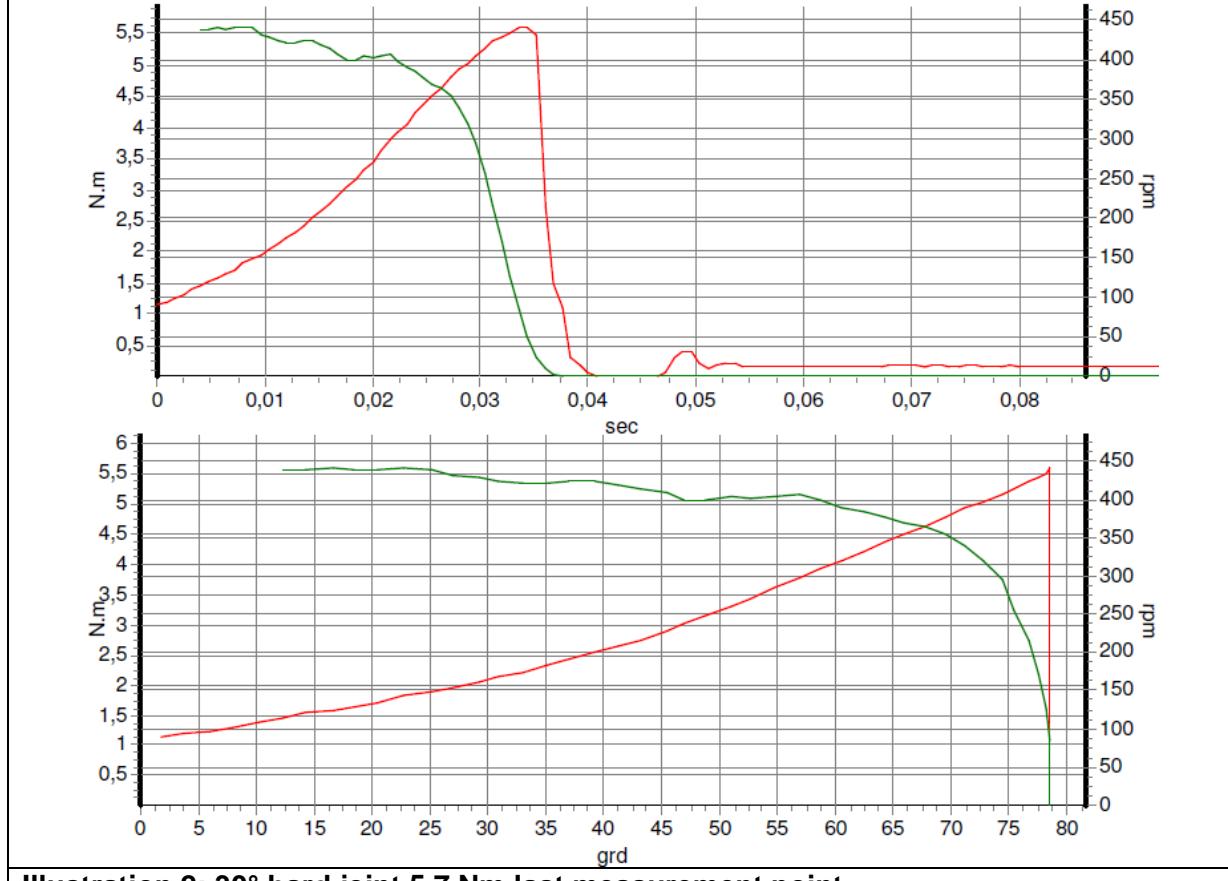


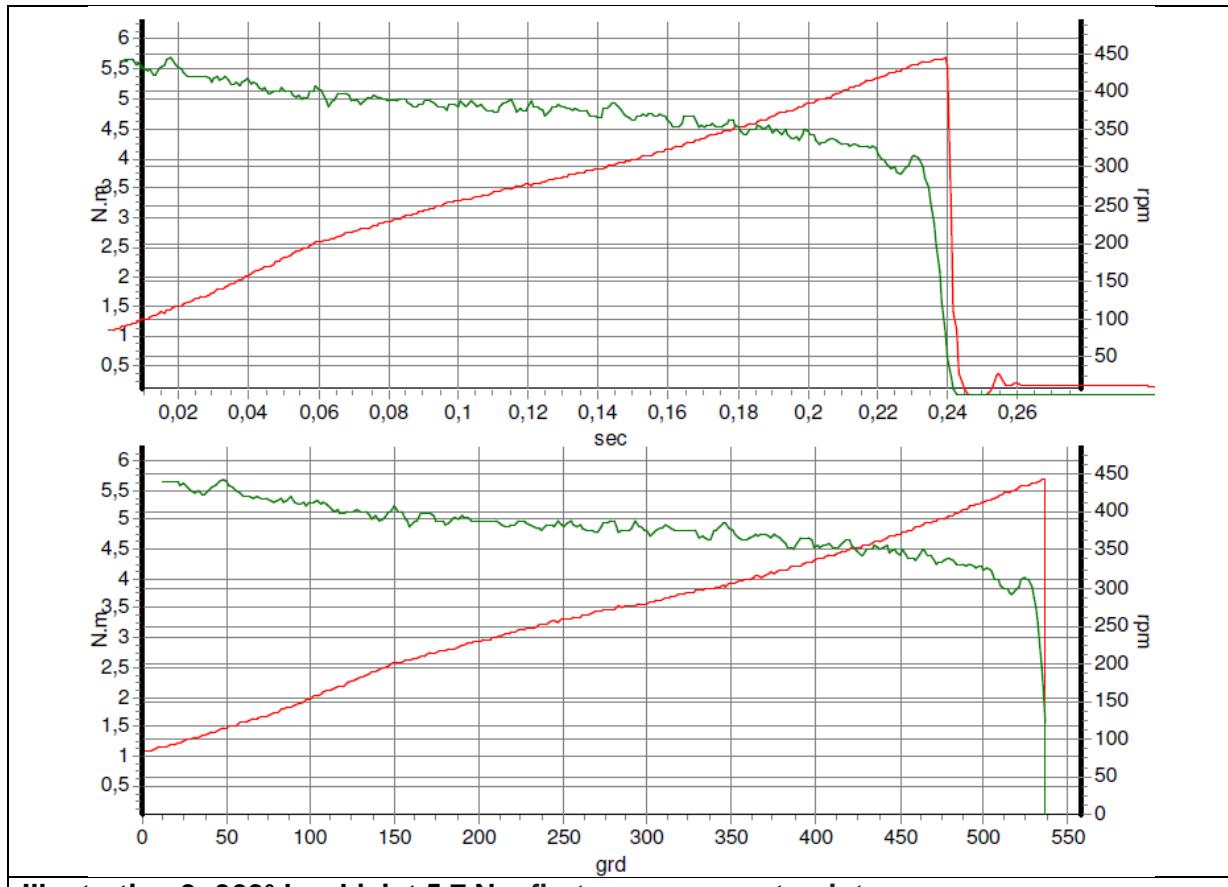
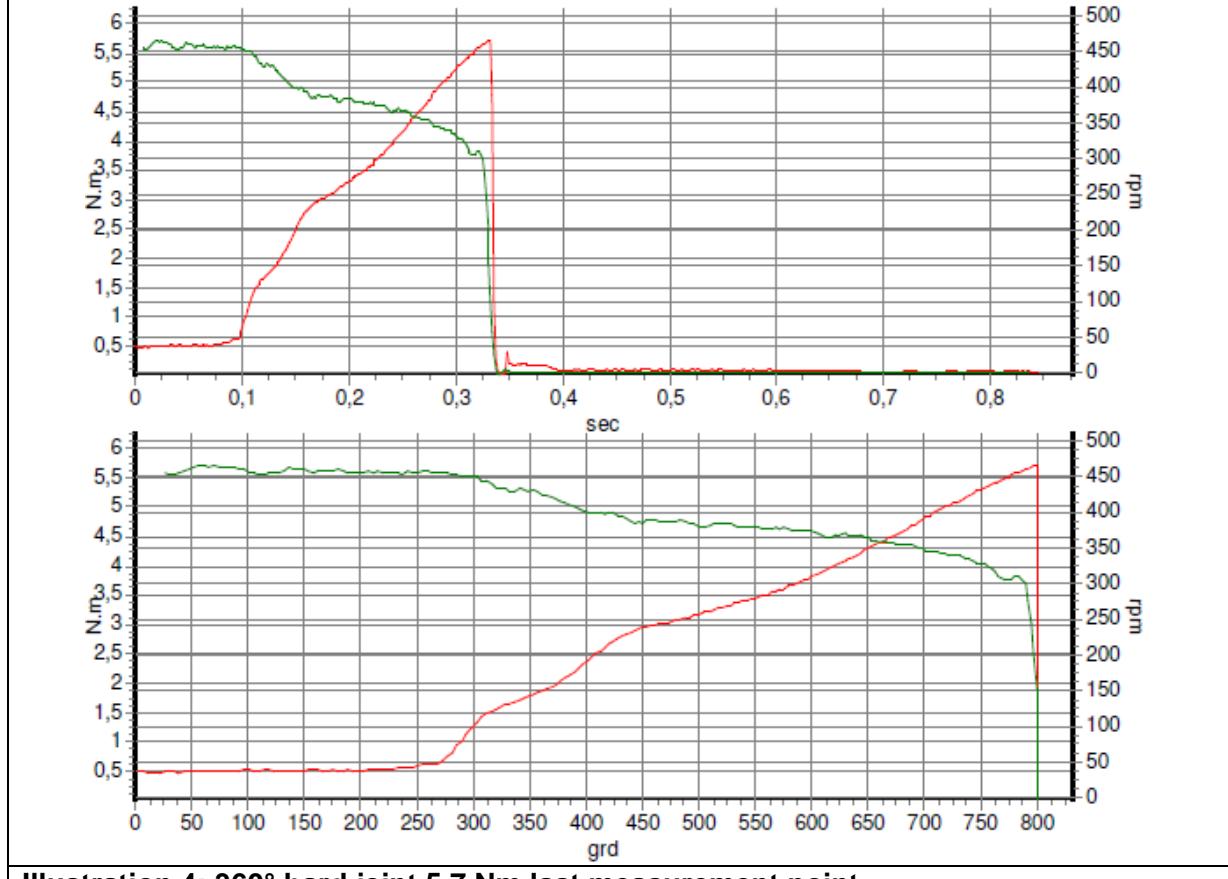
Illustration 6: 30° hard joint 10,2 Nm last measurement point

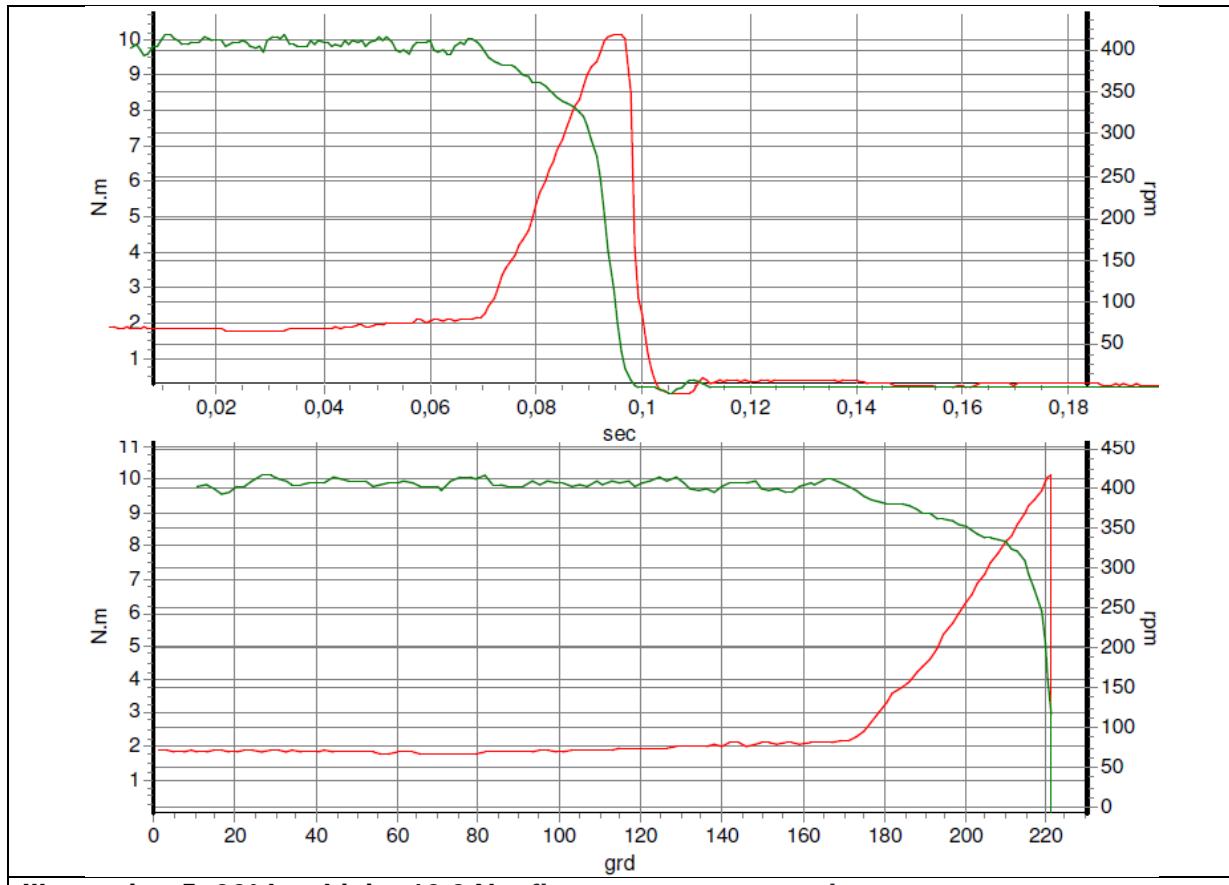
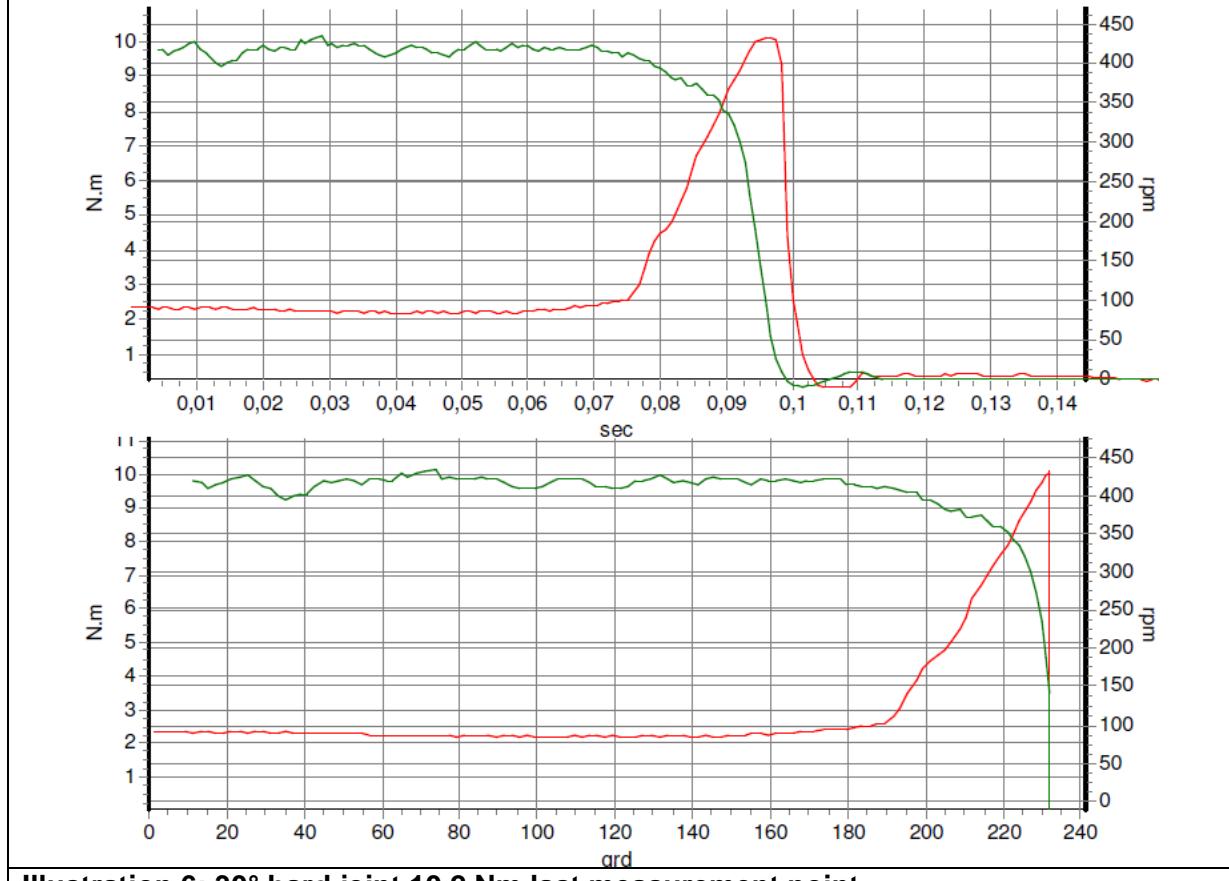

Illustration 7: 360° hard joint 10,2 Nm first measurement point

Illustration 8: 360° hard joint 10,2 Nm last measurement point

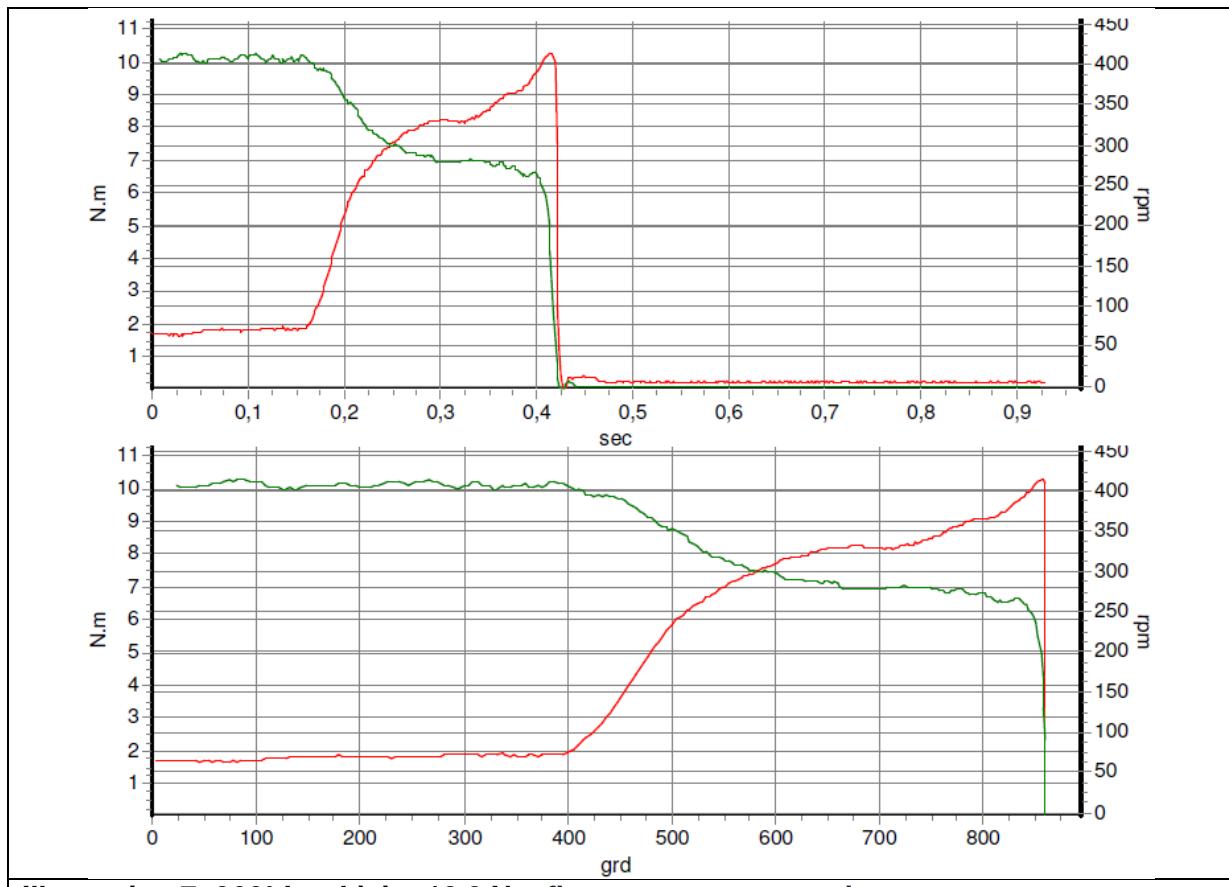
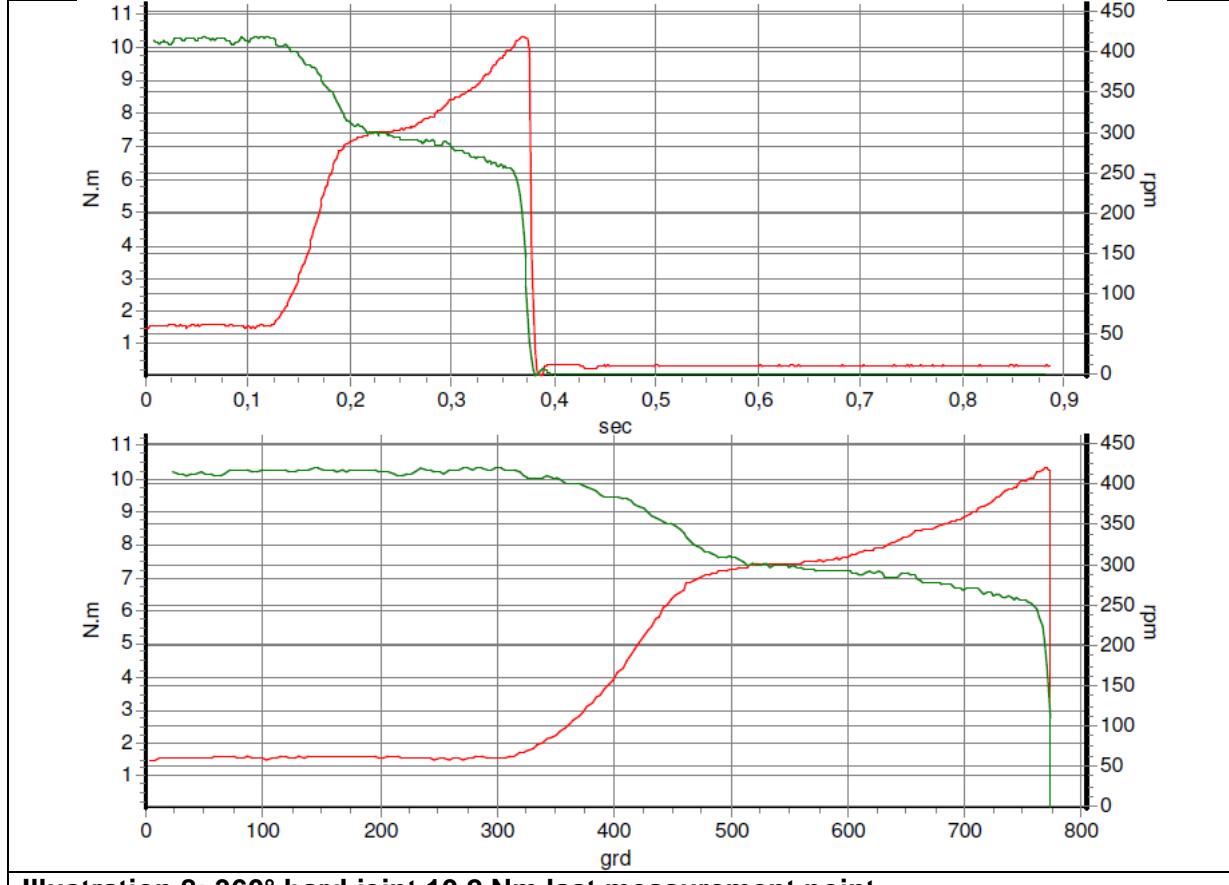

Illustration 9: 30° hard joint 12 Nm first measurement point

Illustration 10: 30° hard joint 12 Nm last measurement point

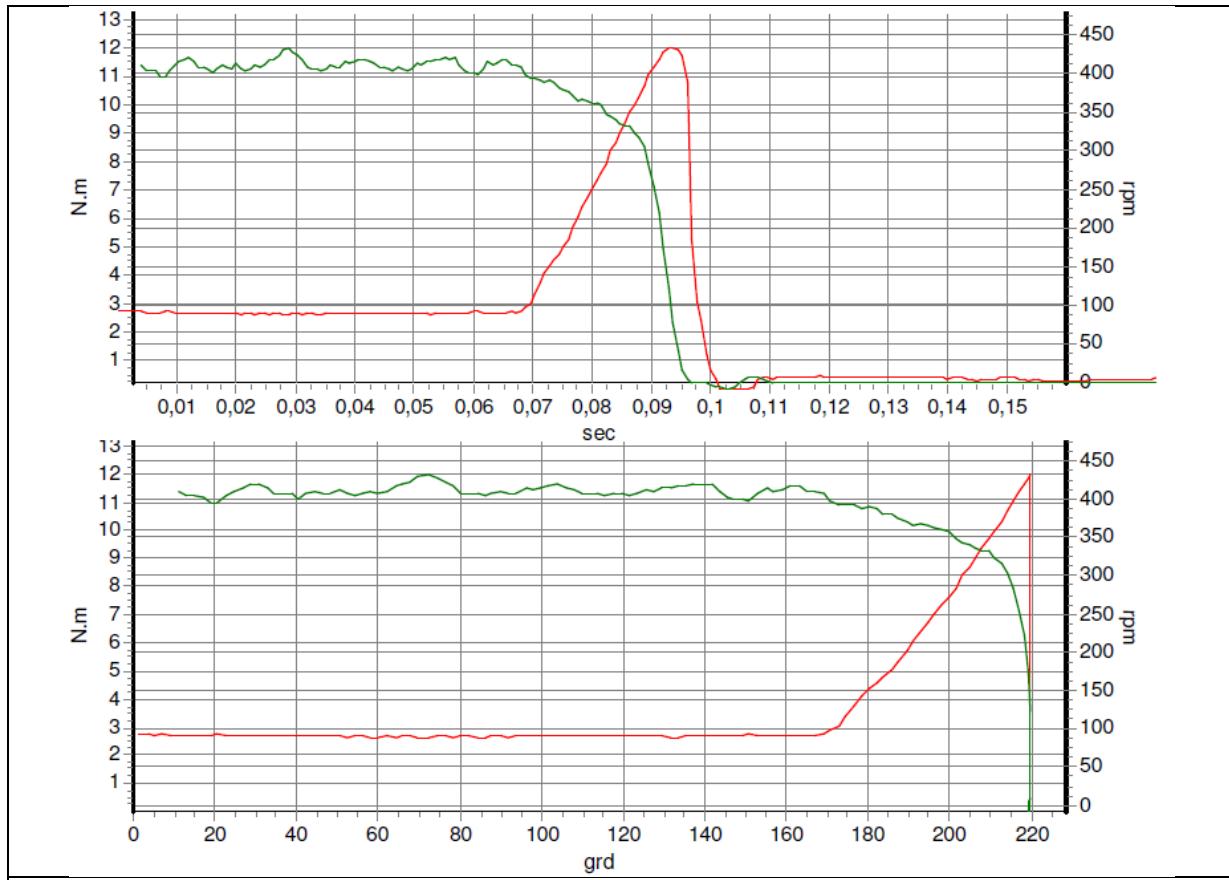
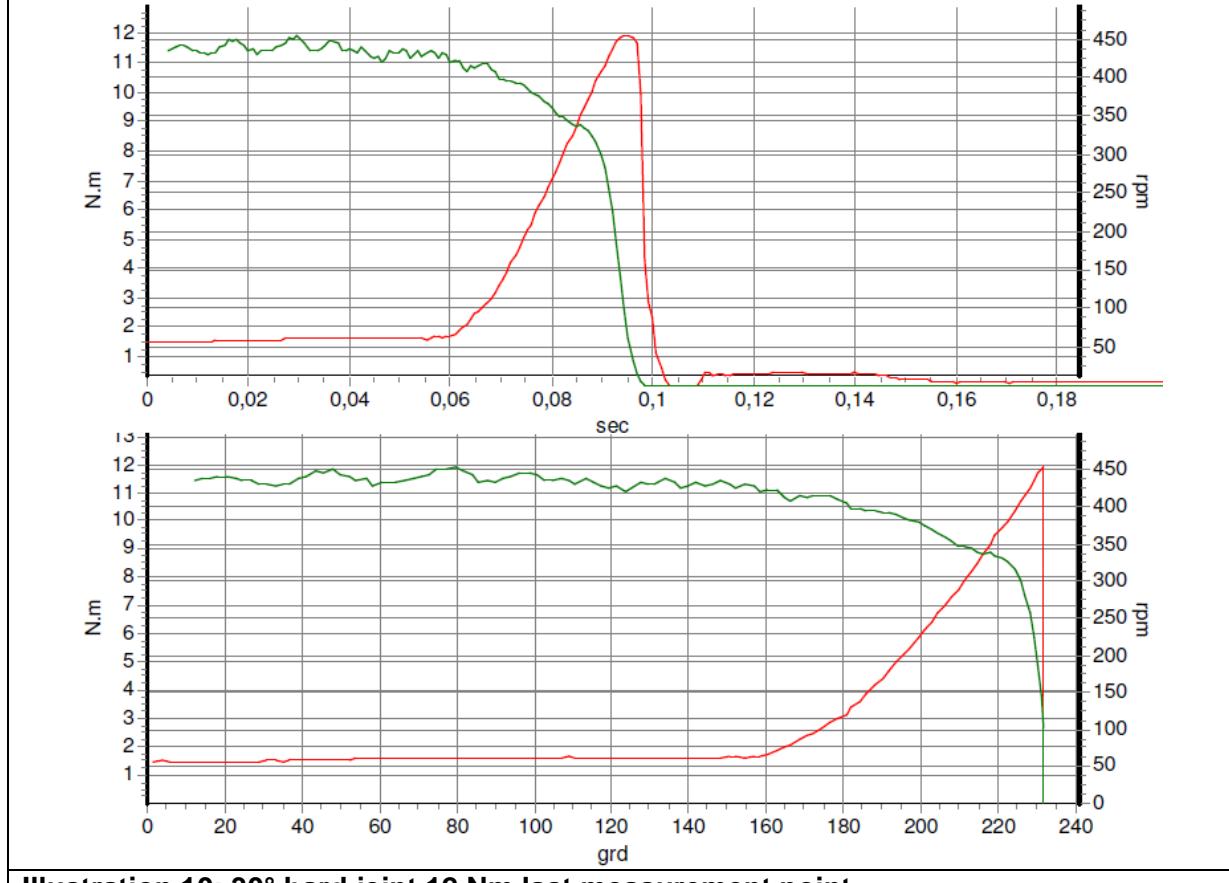

Illustration 11: 360° hard joint 12 Nm first measurement point

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

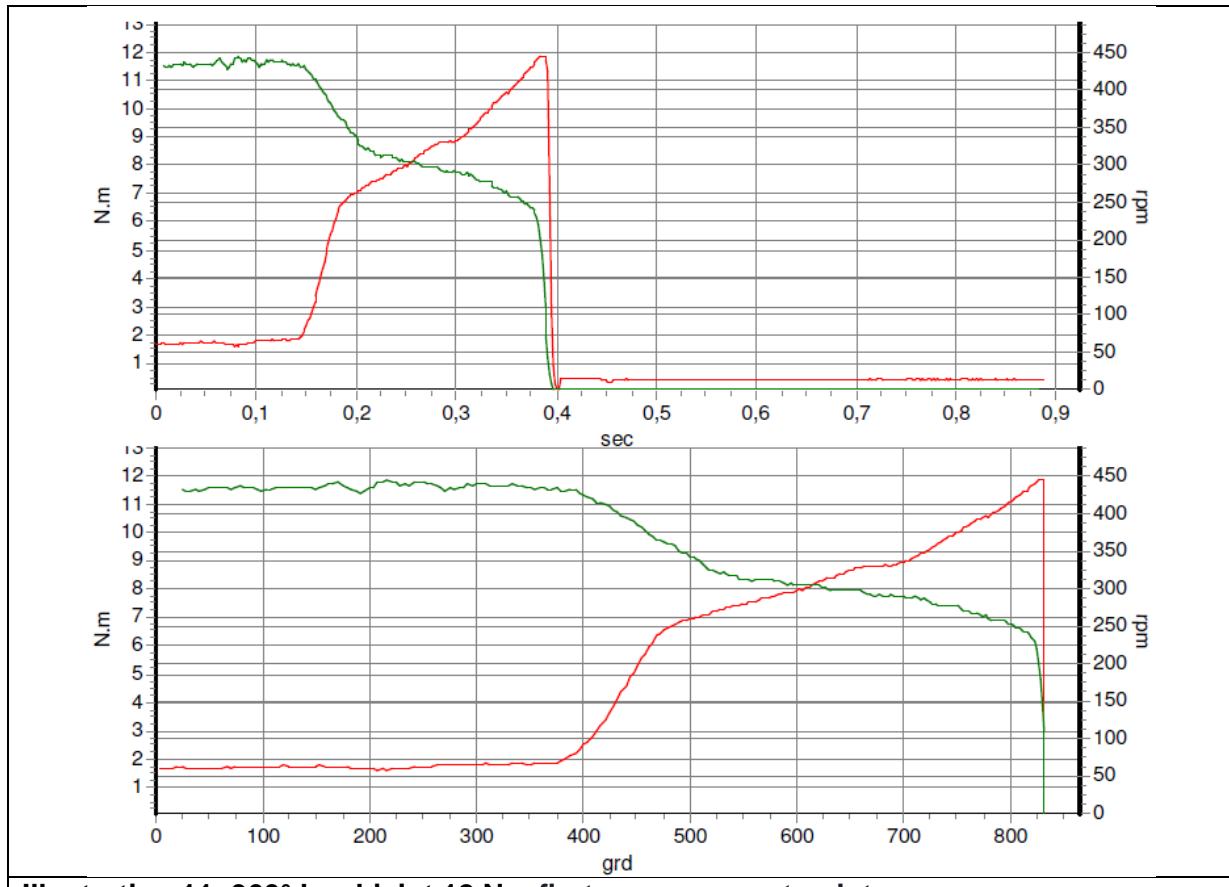
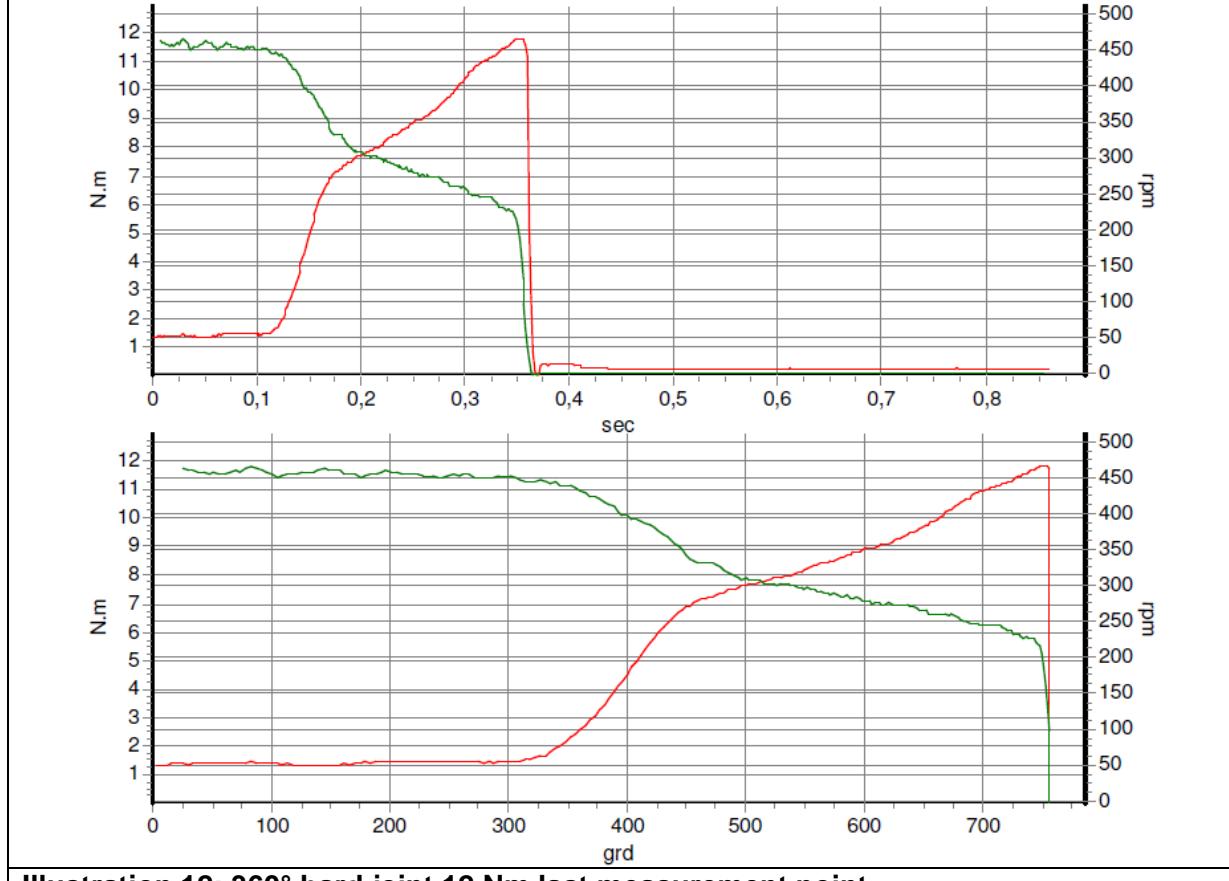

Illustration 1: 30° hard joint 5,7 Nm first measurement point

Illustration 2: 30° hard joint 5,7 Nm last measurement point


Illustration 3: 360° hard joint 5,7 Nm first measurement point

Illustration 4: 360° hard joint 5,7 Nm last measurement point


Illustration 5: 30° hard joint 10,2 Nm first measurement point

Illustration 6: 30° hard joint 10,2 Nm last measurement point


Illustration 7: 360° hard joint 10,2 Nm first measurement point

Illustration 8: 360° hard joint 10,2 Nm last measurement point


Illustration 9: 30° hard joint 12 Nm first measurement point

Illustration 10: 30° hard joint 12 Nm last measurement point


Illustration 11: 360° hard joint 12 Nm first measurement point

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

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 : **Date :**

Model variant :



Manufacturer :

Stage of development

MCI - Typ :

Number of steps :

Test bench - ID :

Screw connection class :

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

Fitting tolerance :

Torque range : $M_{\min} = \boxed{3,00}$ Nm $M_{\max} = \boxed{12,00}$ Nm

Idle speed : $n = \boxed{480}$ min⁻¹ **Weight incl. Battery** : $m = \boxed{1,50}$ kg

Battery voltage : $U = \boxed{18,0}$ V **Sound pressure level** : $L_{pA} = \boxed{77}$ dB(A)

Battery capacity : $Q = \boxed{6000}$ mAh **Undervoltage detection** :

Torque range investigation : **Testing maschine** : Stück

30% → M30%	= $M_{\min} + 30\% \times (M_{\max} - M_{\min}) =$	5,70	Nm
80% → M80%	= $M_{\min} + 80\% \times (M_{\max} - M_{\min}) =$	10,20	Nm
M_{max} = 100% → M100%	= $M_{\min} + 100\% \times (M_{\max} - M_{\min}) =$	12,00	Nm

Information on all 3 test items

Load level		30%		80%		100%	
Test torque	$M_d =$	5,70		10,20		12,00	
Joints	hard	soft	hard	soft	hard	soft	
	30°	360°	30°	360°	30°	360°	
$C_{m,\min} =$	4,634	5,588	2,982	2,208	3,252	2,778	
$C_{mk,\min} =$	4,553	5,275	2,944	2,175	2,986	2,759	

	Name :	Date :
Carried out by :	<input type="text" value="M. Mueck"/>	<input type="text" value="30.08.2019"/>
Test report prepared by :	<input type="text" value="M. Burkhardt"/>	<input type="text" value="08.10.2019"/>

Testbench Measuring				MCS for FEIN-Project : 0		Homologation		Date: 08.10.2019		
						f _{mess} = 300 Hz	M _{min}	M _{max}		
ASM 18-12PC		Screwdriver Type	ASM	Accuracy-Class	10,0%	Class : 2	M _{range} =	3,00	up to 12,00 Nm	
Variant :		18-12PC					n _{given} =	480 rpm	U = 18,00 V	
							cycles: 100			
MCSs	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	5,70	360°	5,732	0,022	0,034	5,588	5,275	485	2019-07-029789	30%
1	5,70	30°	5,710		0,041	4,634	4,553	484		
1	10,20	360°	10,185	0,028	0,154	2,208	2,175	422	2019-07-029791	80%
1	10,20	30°	10,213		0,114	2,982	2,944	412		
1	12,00	360°	11,992	0,090	0,144	2,778	2,759	413	2019-07-029792	100%
1	12,00	30°	11,902		0,123	3,252	2,986	452		
2	5,70	360°	5,714	0,006	0,019	10,000	9,754	487	2019-07-029791	30%
2	5,70	30°	5,708		0,021	9,048	8,921	486		
2	10,20	360°	10,298	0,065	0,054	6,296	5,691	400	2019-07-029792	80%
2	10,20	30°	10,233		0,053	6,415	6,208	401		
2	12,00	360°	11,932	0,002	0,097	4,124	3,890	424	2019-07-029792	100%
2	12,00	30°	11,930		0,065	6,154	5,795	406		
3	5,70	360°	5,775	0,059	0,024	7,917	6,875	485	2019-07-029792	30%
3	5,70	30°	5,716		0,019	10,000	9,719	479		
3	10,20	360°	10,096	0,151	0,078	4,359	3,915	428	2019-07-029792	80%
3	10,20	30°	10,247		0,048	7,083	6,757	414		
3	12,00	360°	11,982	0,052	0,097	4,124	4,062	408	2019-07-029792	100%
3	12,00	30°	11,930		0,091	4,396	4,139	416		

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 = 2,208	C _m q = 5,631	C _m max = 10,000	s _{cm} = 2,354			C _m min = C _m - Minimum Value
C _{mk min} = 2,175	C _{mk q} = 5,357	C _{mk max} = 9,754	n _{MFU} = 18			C _{mk min} = C _{mk} - Minimum Value
Name: M. Burkhardt		Project: 0 : ASM 18-12PC				C _{mk q} = C _{mk} - Mid Value
	C. & E. FEIN GmbH Schwäbisch Gmünd	Stage of Development :	Series			C _{mk max} = C _{mk} - Maximum Value
						s _{cm} = C _m - Standard deviation
						s _{cmk} = C _{mk} - Standard deviation
						ΔMCS = No. Machine Capability Study (MCS)
						c = correction value

Appendix documentation and presentation of data

08.10.2019

A1 General information on the test item 1

Manufacturer : C.&E. Fein GmbH Model: 18-12 / PC Ident-No. : 2019-07.029789

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

Torque range from M_{min} =	3,00	Nm	to M_{max} =	12,00	Nm
Weight incl. Battery :	1,500	kg	Sound pressure level :	77	dB(A)
Battery voltage :	18,00	V	Undervoltage detection :	<input checked="" type="checkbox"/>	
Battery capacity :	6000	mAh	Idle speed :	480	min ⁻¹

Number of screwed connections with battery at 100% rated power		
Turn rate low (soft) :	1325	LC
Turn rate high(hard) :	1532	LC

Temperature measurement for power tools after 100 measurements		
At the handle :	28	°C
at the engine :	35	°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	Brake 10 Nm	2
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:	D-K-17572-01-00 / 18056	Date: 08.05.2019

A3.1 Data per test item

Torque-range	from M_{min}	=	3,00	Nm	to M_{max}	=	12,00	Nm
Test torque 30%	$M_{30\%}$		=	5,70	Nm			
Test torque 80%	$M_{80\%}$		=	10,20	Nm			
Test torque 100%	$M_{100\%}$		=	12,00	Nm			
Fitting tolerance	2		in %	±	10,0%			

Load level	30%		80%		100%		Nm	
Test torque	M_d	=	5,70	10,20	12,00			
Joints	hard	soft	hard	soft	hard	soft		
	30°	360°	30°	360°	30°	360°		
Tolerance : Upper limit	$M_{zul\ max}$	=	6,27	11,22	13,20		Nm	
Tolerance : Lower limit	$M_{zul\ min}$	=	5,13	9,18	10,80		Nm	
Medium torque	M_q	=	5,71	5,73	10,21	10,19	11,90	11,99
Standard deviation	s	=	0,04	0,03	0,11	0,15	0,12	0,14
6s torque scattering	$6s/M_q$	=	4,31%	3,56%	6,70%	9,07%	6,20%	7,20%
Ability index	c_m	=	4,63	5,59	2,98	2,21	3,25	2,78
Ability index	c_{mk}	=	4,55	5,27	2,94	2,18	2,99	2,76
Mean speed	n	=	484	485	412	422	452	413 min ⁻¹

Appendix documentation and presentation of data

08.10.2019

A1 General information on the test item 2

Manufacturer : C.&E. Fein GmbH Model: 18-12 / PC Ident-No. : 2019-07.029791

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

Torque range from M_{min} =	3,00	Nm	to M_{max} =	12,00	Nm
Weight incl. Battery :	1,500	kg	Sound pressure level :	76,8	dB(A)
Battery voltage :	18,00	V	Undervoltage detection :	<input checked="" type="checkbox"/>	
Battery capacity :	6000	mAh	Idle speed :	480	min ⁻¹

Number of screwed connections with battery at 100% rated power		
Turn rate low (soft) :	1325	LC
Turn rate high(hard) :	1532	LC

Temperature measurement for power tools after 100 measurements		
At the handle :	28	°C
at the engine :	35	°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	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:	D-K-17572-01-00 / 18056	Date: 08.05.2019

A3.1 Data per test item

Torque-range	from M_{min}	=	3,00	Nm	to M_{max}	=	12,00	Nm
Test torque 30%	$M_{30\%}$		=	5,70	Nm			
Test torque 80%	$M_{80\%}$		=	10,20	Nm			
Test torque 100%	$M_{100\%}$		=	12,00	Nm			
Fitting tolerance	2	in %	±	10,0%				

Load level	30%		80%		100%		Nm	
Test torque	M_d	=	5,70	10,20	12,00			
Joints	hard	soft	hard	soft	hard	soft		
	30°	360°	30°	360°	30°	360°		
Tolerance : Upper limit	$M_{zul\ max}$	=	6,27	11,22	13,20		Nm	
Tolerance : Lower limit	$M_{zul\ min}$	=	5,13	9,18	10,80		Nm	
Medium torque	M_q	=	5,71	5,71	10,23	10,30	11,93	Nm
Standard deviation	s	=	0,02	0,02	0,05	0,05	0,07	Nm
6s torque scattering	$6s/M_q$	=	2,21%	2,00%	3,11%	3,15%	3,27%	4,88%
Ability index	c_m	=	9,05	10,00	6,42	6,30	6,15	6,42
Ability index	c_{mk}	=	8,92	9,75	6,21	5,69	5,79	6,87
Mean speed	n	=	486	487	401	400	406	424 min ⁻¹

Appendix documentation and presentation of data

08.10.2019

A1 General information on the test item 3

Manufacturer : C.&E. Fein GmbH Model: 18-12 / PC Ident-No. : 2019-07.029792

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

Torque range from M_{\min} =	3,00	Nm	to M_{\max} =	12,00	Nm
Weight incl. Battery :	1,500	kg	Sound pressure level :	76,8	dB(A)
Battery voltage :	18,00	V	Undervoltage detection :	<input checked="" type="checkbox"/>	
Battery capacity :	6000	mAh	Idle speed :	480	min ⁻¹

Number of screwed connections with battery at 100% rated power		
Turn rate low (soft) :	1325	LC
Turn rate high(hard) :	1532	LC

Temperature measurement for power tools after 100 measurements		
At the handle :	28	°C
at the engine :	35	°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	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:	D-K-17572-01-00 / 18056	Date: 08.05.2019

A3.1 Data per test item

Torque-range	from M_{\min}	=	3,00	Nm	to M_{\max}	=	12,00	Nm
Test torque 30%	$M_{30\%}$		=	5,70	Nm			
Test torque 80%	$M_{80\%}$		=	10,20	Nm			
Test torque 100%	$M_{100\%}$		=	12,00	Nm			
Fitting tolerance	2		in %	±	10,0%			

Load level	30%		80%		100%		Nm	
Test torque	M_d	=	5,70	10,20	12,00			
Joints	hard	soft	hard	soft	hard	soft		
	30°	360°	30°	360°	30°	360°		
Tolerance : Upper limit	$M_{zul\ max}$	=	6,27	11,22	13,20		Nm	
Tolerance : Lower limit	$M_{zul\ min}$	=	5,13	9,18	10,80		Nm	
Medium torque	M_q	=	5,72	5,78	10,25	10,10	11,93	11,98
Standard deviation	s	=	0,02	0,02	0,05	0,08	0,09	0,10
6s torque scattering	$6s/M_q$	=	1,99%	2,49%	2,81%	4,64%	4,58%	4,86%
Ability index	c_m	=	10,00	7,92	7,08	4,36	4,40	4,12
Ability index	c_{mk}	=	9,72	6,87	6,76	3,91	4,14	4,06
Mean speed	n	=	479	485	414	428	416	408