Homologation

Cordless Assembly Tools

Model: CLBA203

Serial no.: ILJ1000

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Homologation: CLBA203 SN: ILJ1000

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Document no: 001/2024
Date: 20.02.2024

Test sheet no. 2

Machine Capability Study 30 %

Multi-stage tightening system ☑ Speed = 360 rpm 100,00 %

Single-stage tightening system ☐

Manufacturer: Apex Tool Group Serial no: **ILJ1000**

Test torque: Tq min. + 0.3 (Tq max. - Tq min.) 12,11 Nm

Hard joint (H) 72,87 Nm / Revolution Angle degree 30°

Soft joint (L) 5,79 Nm / Revolution Angle degree 360°

		H	**L**
a)	Tolerance down / up	10,90 - 13,32 Nm	10,90 - 13,32 Nm
	Tolerance down / up	10 %	10 %
	Average torque	12,15 Nm	11,58 Nm
	Standard deviation	0,17 Nm	0,10 Nm
	Torque scatter (99,73%)	1,02 Nm	0,62 Nm
	C_m	2,38	3,89
	C_{mk}	2,31	2,20

b) Min. C_m hard/soft (lowest value) 2,38
Min. C_{mk} hard/soft (lowest value) 2,20

Capability is reached if minimum C_{mk} value ≥1.67

Note:

Machine Capability Study
Control System

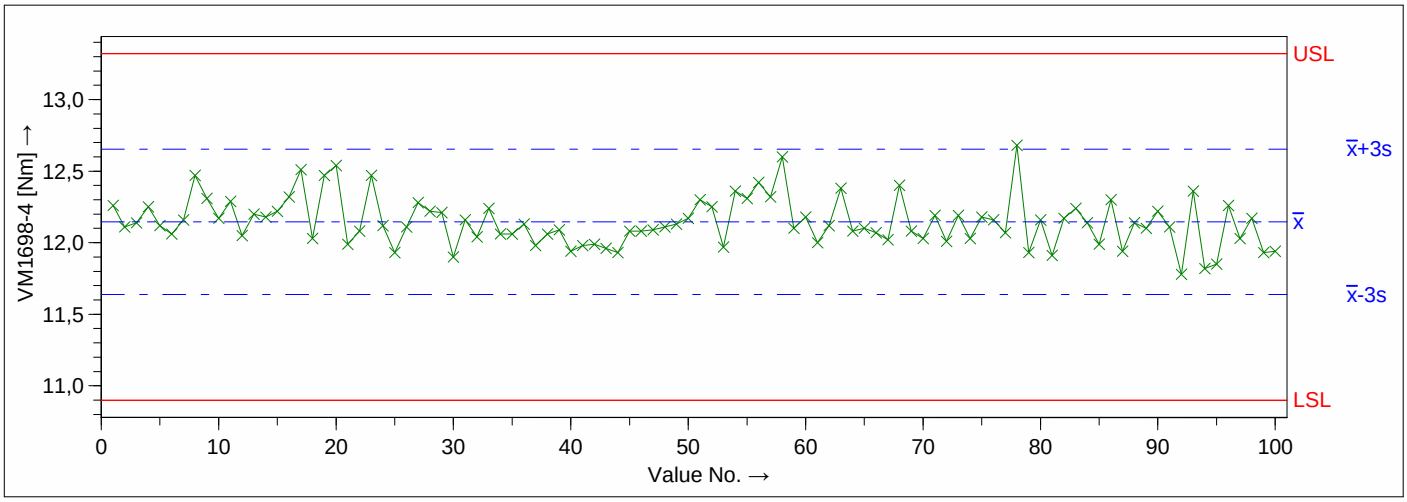
Cleco Production Tools

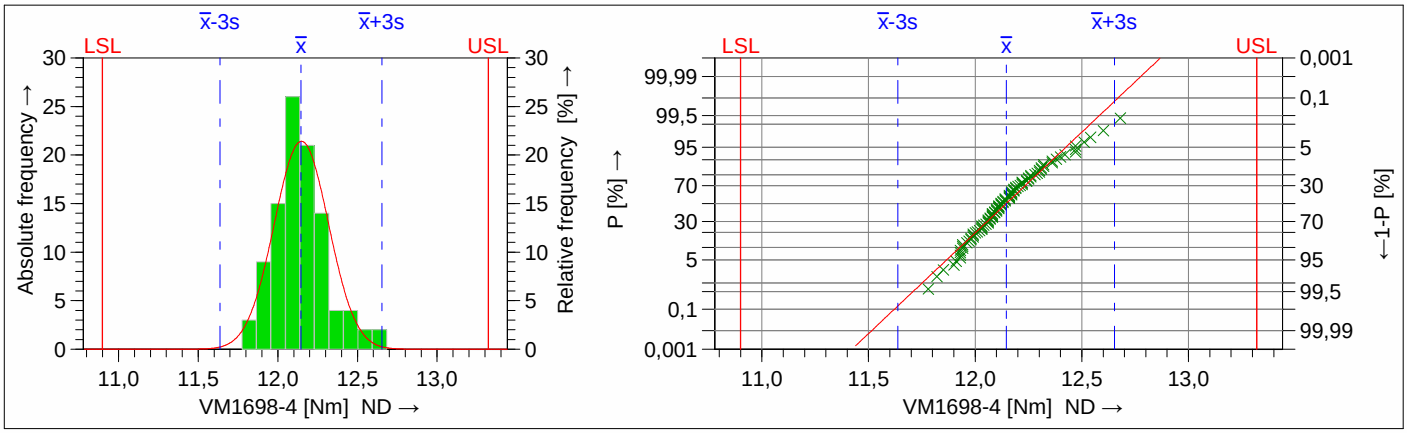
Plant	ATG Westhausen	Operator Name	Stölzle
Date	09.01.2024		

Ord. No.	CLBA203	Part type	CLBA203	Contr.item	yes
Serial No.	ILJ1000_d	Char.Descr.	VM1698-4	Nom.val. 12,11 1,21	USL 13,32
		Serial No.	1024210	Unit Nm -1,21	LSL 10,90
Char.Type	variable			Tolerance value 10 %	Decimal Pl. 2
Cust.Name	ATG	Reference System	VM1698-4	Test Electronic	---
Contr.No.	Homologation	Reference Transducer	50/1024729	nges.	100

Evaluation from 09.01.2024 16:02:40 to 09.01.2024 16:14:13

Rem. TQ 30% hard +/-10% * Speed 360 rpm





Drawing Values		Collected Values		Statistics	
T_m	12.11			$\bar{x}$	12.1454
LSL	10.90	x_{min}	11.78	$\bar{x}$-3s	11.6369
USL	13.32	x_{max}	12.68	$\bar{x}$+3s	12.6539
T	2.42	R	0.90	6s	1.0170
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution		Normal Distribution	
Calculation method		M1.1.4 $\hat{\sigma} = S_{tot}$	
Potential Capability index	=	C_m	2.38
Critical capability index	=	C_{mk}	2.31

The requirements were met (C_m,C_{mk})

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Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Stölzle	Date 09.01.2024

Serial No.	ILJ1000_d	Characteristic			
Part type	CLBA203	Char.Descr.	VM1698-4	Nom.val.	12,11
Ord. No.	CLBA203	Serial No.	1024210	LSL	10,90
				USL	13,32
Remark	TQ 30% hard +/-10% * Speed 360 rpm				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	Nm	12,26	12,11	12,14	12,25	12,12	12,06	12,16	12,47	12,31	12,17
1024210	VM1698-4	Grad	29,25	27,00	28,00	29,50	28,00	29,25	27,50	28,25	28,75	28,75

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	Nm	12,29	12,05	12,20	12,18	12,22	12,32	12,51	12,03	12,47	12,54
1024210	VM1698-4	Grad	27,50	27,00	29,75	28,75	29,50	29,00	29,75	30,00	29,75	30,50

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	Nm	11,99	12,08	12,47	12,12	11,93	12,11	12,28	12,22	12,21	11,90
1024210	VM1698-4	Grad	30,25	28,25	29,25	30,25	28,75	28,25	29,00	29,50	28,75	29,25

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	Nm	12,16	12,04	12,24	12,06	12,06	12,13	11,98	12,06	12,09	11,94
1024210	VM1698-4	Grad	28,00	26,75	28,00	27,50	28,25	28,75	28,50	26,50	28,50	27,75

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	Nm	11,98	11,99	11,96	11,93	12,08	12,08	12,09	12,11	12,13	12,17
1024210	VM1698-4	Grad	28,25	28,75	28,50	27,00	31,25	30,00	28,50	29,75	30,00	30,25

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	12,30	12,25	11,97	12,36	12,31	12,42	12,32	12,60	12,10	12,18
1024210	VM1698-4	Grad	30,50	29,50	31,00	30,75	30,50	32,00	29,75	32,00	30,75	29,25

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	Nm	12,00	12,12	12,38	12,08	12,10	12,07	12,02	12,40	12,08	12,03
1024210	VM1698-4	Grad	28,75	29,00	32,25	30,00	29,50	30,00	28,50	31,75	29,75	30,25

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	Nm	12,19	12,01	12,19	12,03	12,18	12,16	12,07	12,68	11,93	12,16
1024210	VM1698-4	Grad	29,75	29,25	31,50	28,25	29,00	29,75	30,25	28,50	28,50	29,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Stölzle	Date 09.01.2024

Serial No.	ILJ1000_d	Characteristic			
Part type	CLBA203	Char.Descr.	VM1698-4	Nom.val.	12,11
Ord. No.	CLBA203	Serial No.	1024210	LSL	10,90
				USL	13,32
Remark	TQ 30% hard +/-10% * Speed 360 rpm				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	Nm	11,91	12,17	12,24	12,14	11,99	12,30	11,94	12,14	12,10	12,22
1024210	VM1698-4	Grad	27,00	28,50	27,75	27,75	28,75	29,25	28,75	29,00	30,75	29,75

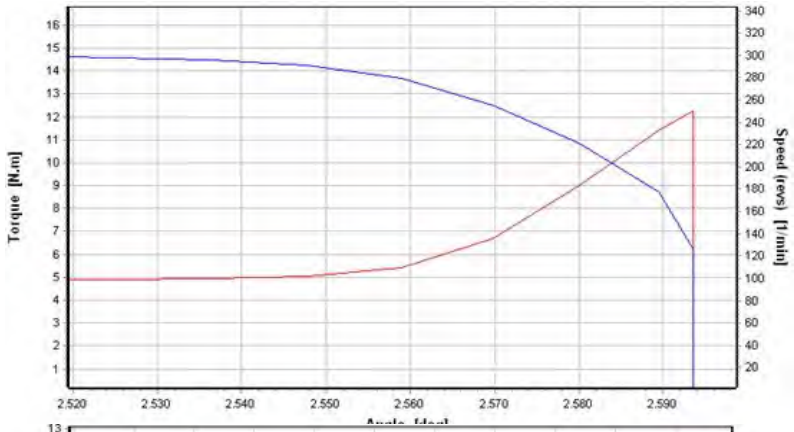
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	12,11	11,78	12,36	11,82	11,85	12,26	12,03	12,17	11,93	11,94
1024210	VM1698-4	Grad	28,75	28,75	30,00	27,25	27,75	30,00	28,25	29,25	30,00	28,75

Torque graphs

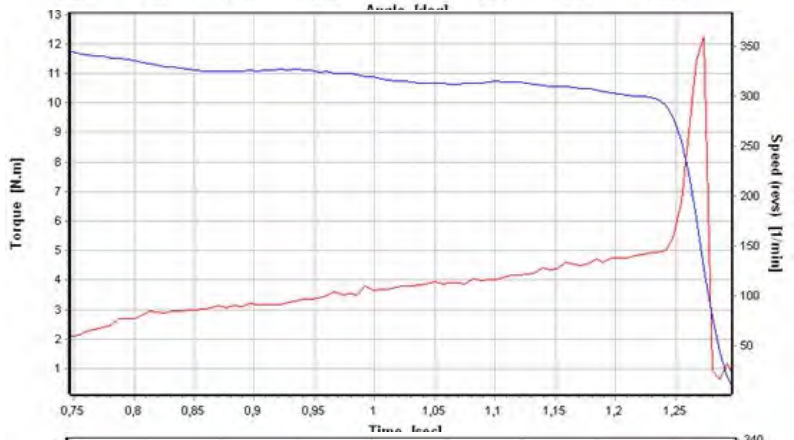
Machine Capability Study 30 %

Model: **CLBA203**
Serial no: **ILJ1000**

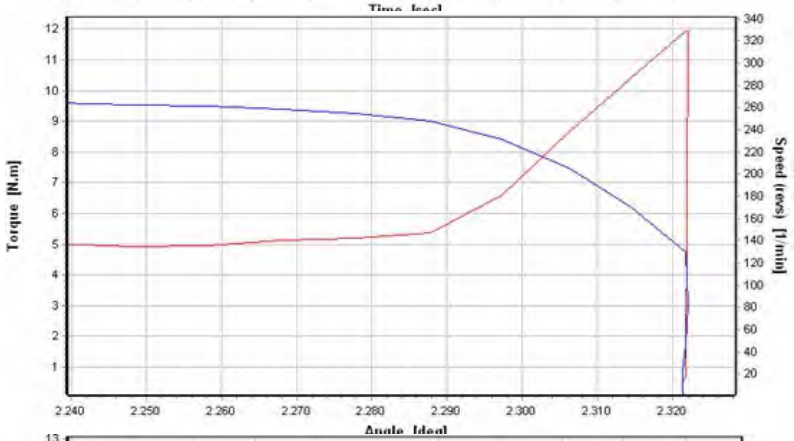
Angle degree: **30°**
Test torque: **12,1 Nm**



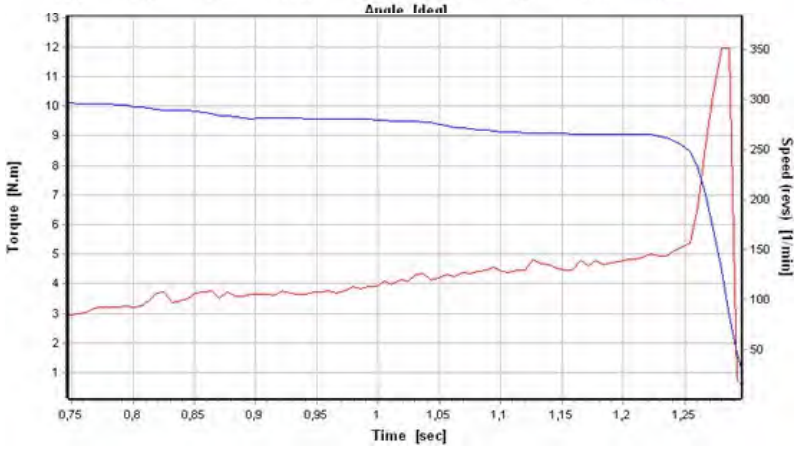
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

Machine Capability Study
Control System

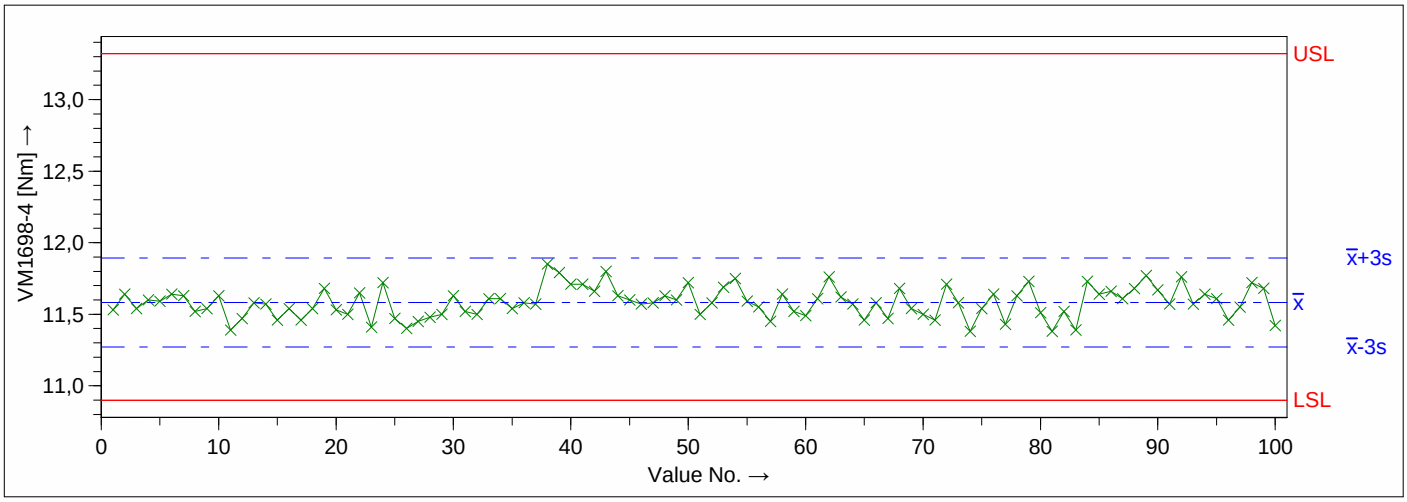
Cleco Production Tools

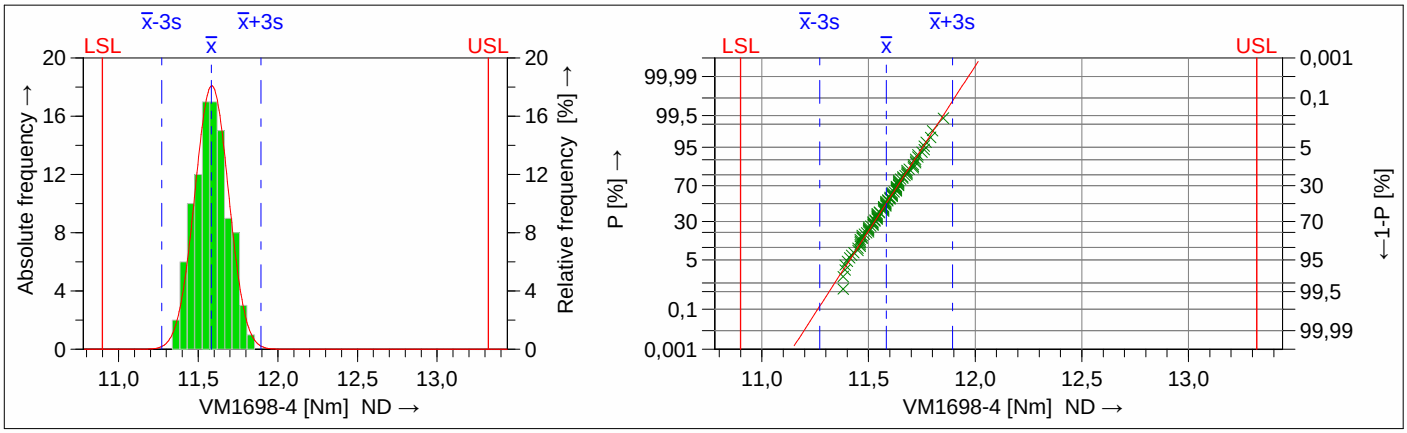
Plant	ATG Westhausen	Operator Name	Stölzle
Date	09.01.2024		

Ord. No.	CLBA203	Part type	CLBA203	Contr.item	yes
Serial No.	ILJ1000_c	Char.Descr.	VM1698-4	Nom.val. 12,11 1,21	USL 13,32
		Serial No.	1024210	Unit Nm -1,21	LSL 10,90
Char.Type	variable			Tolerance value 10 %	Decimal Pl. 2
Cust.Name	ATG	Reference System	VM1698-4	Test Electronic	---
Contr.No.	Homologation	Reference Transducer	50/1024729	nges.	100

Evaluation from 09.01.2024 16:17:08 to 09.01.2024 16:28:41

Rem. TQ 30% soft +/-10% * Speed 360 rpm





Drawing Values		Collected Values		Statistics	
T_m	12.11			$\bar{x}$	11.5826
LSL	10.90	x_{min}	11.38	$\bar{x}$-3s	11.2718
USL	13.32	x_{max}	11.85	$\bar{x}$+3s	11.8934
T	2.42	R	0.47	6s	0.6216
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution		Normal Distribution	
Calculation method		$M1_{1,4}$ $\hat{\sigma} = S_{tot}$	
Potential Capability index	=	C_m	3.89
Critical capability index	=	C_{mk}	2.20

The requirements were met (C_m,C_{mk})

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Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Stölzle	Date 09.01.2024

Serial No.	ILJ1000_c	Characteristic			
Part type	CLBA203	Char.Descr.	VM1698-4	Nom.val.	12,11
Ord. No.	CLBA203	Serial No.	1024210	LSL	10,90
				USL	13,32
Remark	TQ 30% soft +/-10% * Speed 360 rpm				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	Nm	11,53	11,64	11,54	11,60	11,59	11,64	11,63	11,52	11,54	11,63
1024210	VM1698-4	Grad	352,75	362,50	357,25	352,25	357,50	364,75	367,25	358,00	358,50	364,00

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	Nm	11,39	11,47	11,58	11,57	11,46	11,54	11,46	11,54	11,68	11,53
1024210	VM1698-4	Grad	371,50	359,75	360,75	360,75	364,50	383,25	359,50	368,25	348,75	361,75

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	Nm	11,50	11,65	11,41	11,72	11,47	11,40	11,45	11,48	11,50	11,63
1024210	VM1698-4	Grad	360,75	347,50	348,00	352,00	350,75	343,75	373,25	367,75	361,00	365,75

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	Nm	11,52	11,50	11,61	11,61	11,54	11,58	11,57	11,85	11,79	11,71
1024210	VM1698-4	Grad	378,00	374,00	379,00	373,00	360,50	361,50	367,75	370,75	372,00	372,75

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	Nm	11,71	11,66	11,80	11,63	11,60	11,57	11,58	11,63	11,60	11,72
1024210	VM1698-4	Grad	362,50	360,00	364,75	372,50	351,75	354,50	359,50	364,25	354,75	365,25

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	11,50	11,58	11,69	11,75	11,59	11,55	11,45	11,64	11,52	11,49
1024210	VM1698-4	Grad	355,00	358,75	369,50	353,50	366,00	350,00	363,50	343,00	356,00	350,25

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	Nm	11,61	11,76	11,62	11,57	11,46	11,58	11,47	11,68	11,54	11,50
1024210	VM1698-4	Grad	349,25	364,00	352,75	349,25	342,00	349,50	359,00	353,75	365,50	357,25

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	Nm	11,46	11,71	11,58	11,38	11,54	11,64	11,43	11,63	11,73	11,51
1024210	VM1698-4	Grad	353,00	367,25	349,25	355,00	356,25	360,75	353,75	361,00	359,75	362,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Stölzle	Date 09.01.2024

Serial No.	ILJ1000_c	Characteristic			
Part type	CLBA203	Char.Descr.	VM1698-4	Nom.val.	12,11
Ord. No.	CLBA203	Serial No.	1024210	LSL	10,90
				USL	13,32
Remark	TQ 30% soft +/-10% * Speed 360 rpm				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	Nm	11,38	11,52	11,39	11,73	11,64	11,66	11,61	11,68	11,77	11,67
1024210	VM1698-4	Grad	359,50	368,75	353,00	357,00	354,25	360,75	362,00	359,00	370,50	365,00

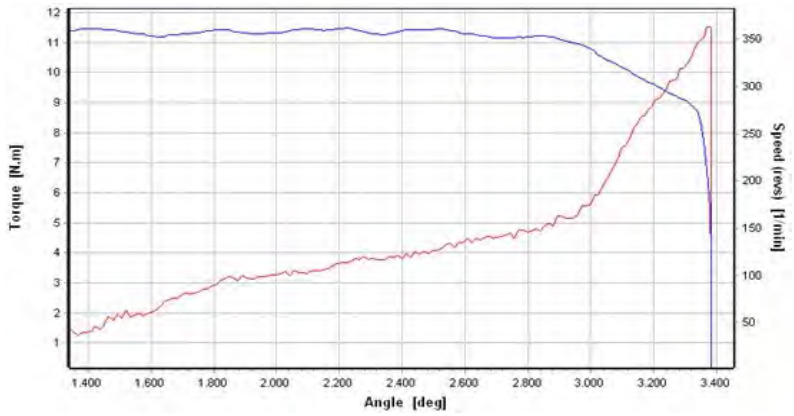
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	11,57	11,76	11,57	11,64	11,61	11,46	11,55	11,72	11,68	11,42
1024210	VM1698-4	Grad	356,75	368,25	359,75	362,50	362,25	364,25	367,50	369,00	358,50	358,50

Torque graphs

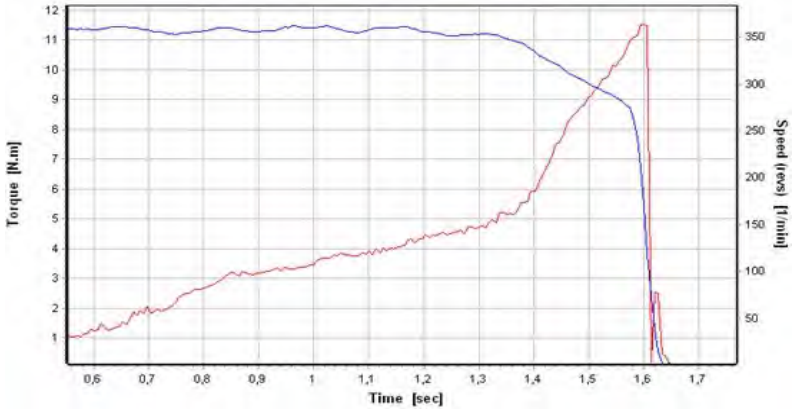
Machine Capability Study 30 %

Model: **CLBA203**
Serial no: **ILJ1000**

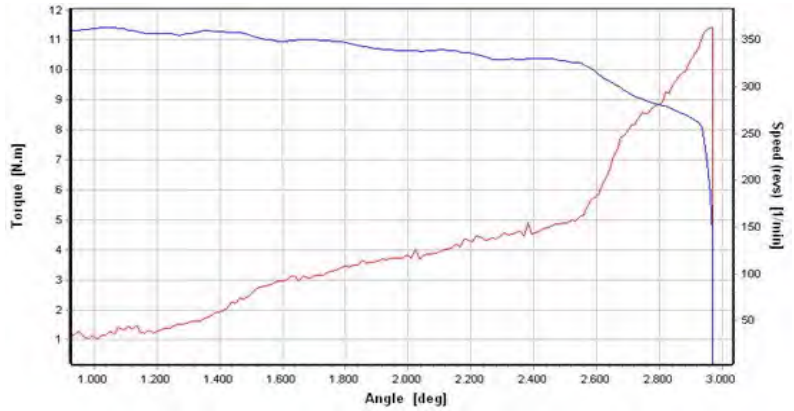
Angle degree: **360°**
Test torque: **12,1 Nm**



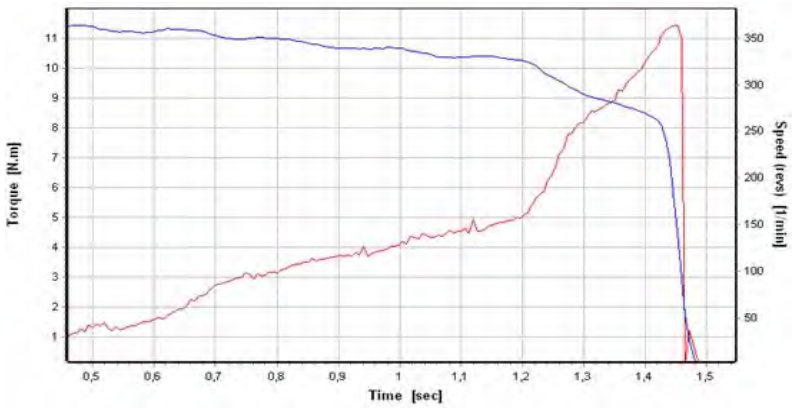
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

Test sheet no. 3

Machine Capability Study 80 %

Multi-stage tightening system ☑ Speed = 360 rpm 100,0 %

Single-stage tightening system ☐

Manufacturer: Apex Tool Group Serial no: **ILJ1000**

Test torque: Tq min. + 0.8 (Tq max. - Tq min.) 18,46 Nm

Hard joint (H) 111,80 Nm / Revolution Angle degree 30°

Soft joint (L) 8,82 Nm / Revolution Angle degree 360°

		H	**L**
a)	Tolerance down / up	16,61 - 20,31 Nm	16,61 - 20,31 Nm
	Tolerance down / up	10 %	10 %
	Average torque	18,63 Nm	17,64 Nm
	Standard deviation	0,25 Nm	0,14 Nm
	Torque scatter (99,73%)	1,48 Nm	0,86 Nm
	C_m	2,49	4,30
	C_{mk}	2,26	2,39

b) Min. C_m hard/soft (lowest value) 2,49
Min. C_{mk} hard/soft (lowest value) 2,26

Capability is reached if minimum C_{mk} value ≥1.67

Note:

Machine Capability Study
Control System

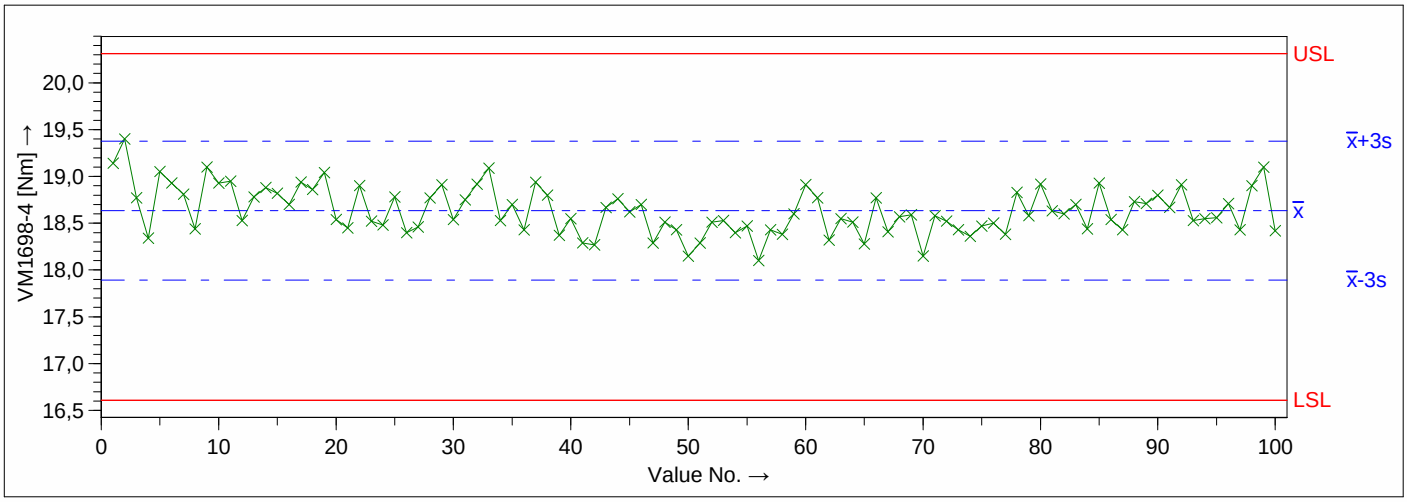
Cleco Production Tools

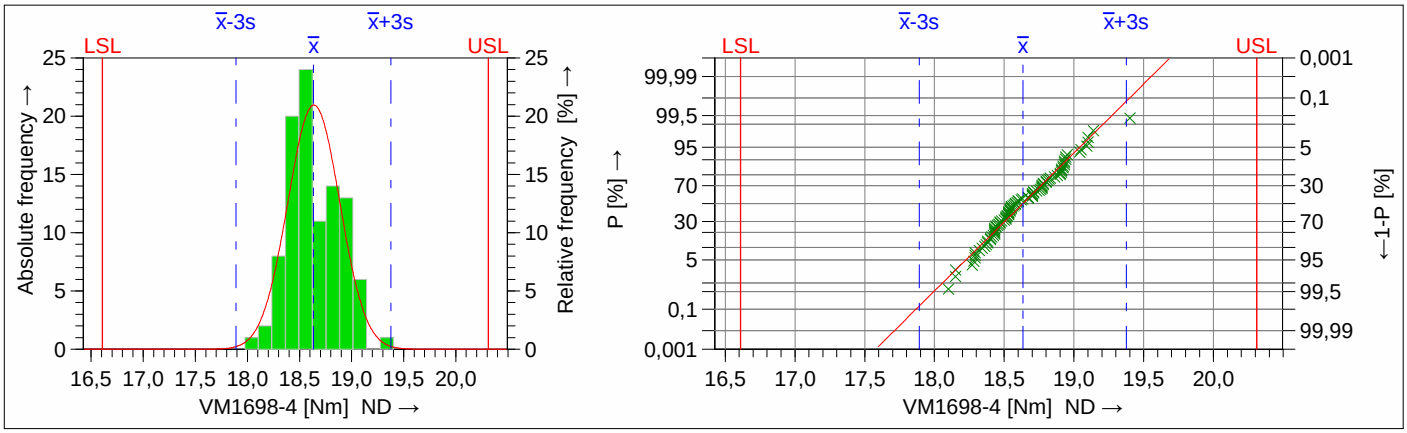
Plant	ATG Westhausen	Operator Name	Stölzle
Date	10.01.2024		

Ord. No.	CLBA203	Part type	CLBA203	Contr.item	yes
Serial No.	ILJ1000_h	Char.Descr.	VM1698-4	Nom.val. 18,46 1,85	USL 20,31
		Serial No.	1024210	Unit Nm -1,85	LSL 16,61
Char.Type	variable			Tolerance value 10 %	Decimal Pl. 2
Cust.Name	ATG	Reference System	VM1698-4	Test Electronic	---
Contr.No.	Homologation	Reference Transducer	50/1024729	nges.	100

Evaluation from 10.01.2024 06:12:41 to 10.01.2024 06:24:15

Rem. TQ 80% hard +/-10% * Speed 360 rpm





Drawing Values		Collected Values		Statistics	
T_m	18.46			$\bar{x}$	18.6333
LSL	16.61	x_{min}	18.10	$\bar{x}$-3s	17.8909
USL	20.31	x_{max}	19.40	$\bar{x}$+3s	19.3757
T	3.70	R	1.30	6s	1.4847
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			M1.1.4 $\hat{\sigma} = S_{tot}$
Potential Capability index	=	C_m	2.49
Critical capability index	=	C_{mk}	2.26

The requirements were met (C_m,C_{mk})

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Stölzle	Date 10.01.2024

Serial No.	ILJ1000_h	Characteristic			
Part type	CLBA203	Char.Descr.	VM1698-4	Nom.val.	18,46
Ord. No.	CLBA203	Serial No.	1024210	LSL	16,61
				USL	20,31
Remark	TQ 80% hard +/-10% * Speed 360 rpm				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	Nm	19,14	19,40	18,77	18,34	19,05	18,93	18,81	18,44	19,10	18,93
1024210	VM1698-4	Grad	30,75	32,00	29,25	29,00	30,50	30,25	29,75	28,75	31,25	30,50

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	Nm	18,95	18,53	18,78	18,88	18,82	18,70	18,94	18,86	19,04	18,54
1024210	VM1698-4	Grad	29,75	29,25	30,00	29,00	29,50	30,00	29,75	29,75	31,50	30,50

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	Nm	18,45	18,90	18,52	18,48	18,78	18,40	18,46	18,77	18,91	18,54
1024210	VM1698-4	Grad	28,75	30,50	29,75	30,25	31,00	28,75	28,75	30,25	30,25	29,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	Nm	18,75	18,92	19,09	18,53	18,70	18,43	18,94	18,80	18,37	18,55
1024210	VM1698-4	Grad	30,75	30,50	31,00	29,00	29,75	28,50	30,00	28,50	28,25	29,25

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	Nm	18,29	18,27	18,67	18,76	18,62	18,70	18,29	18,51	18,43	18,15
1024210	VM1698-4	Grad	28,75	28,75	29,50	30,50	30,00	30,00	29,00	29,50	30,00	30,00

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	18,29	18,51	18,53	18,40	18,47	18,10	18,43	18,38	18,60	18,91
1024210	VM1698-4	Grad	29,25	31,00	30,75	29,75	30,25	30,00	29,75	31,00	31,25	31,50

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	Nm	18,77	18,32	18,55	18,51	18,28	18,77	18,41	18,57	18,59	18,15
1024210	VM1698-4	Grad	31,25	30,25	29,75	30,00	30,00	29,75	29,50	30,00	28,75	29,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	Nm	18,58	18,52	18,43	18,36	18,47	18,50	18,38	18,83	18,58	18,92
1024210	VM1698-4	Grad	30,25	31,00	30,00	29,50	30,00	29,00	29,00	30,75	29,25	30,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Stölzle	Date 10.01.2024

Serial No.	ILJ1000_h	Characteristic			
Part type	CLBA203	Char.Descr.	VM1698-4	Nom.val.	18,46
Ord. No.	CLBA203	Serial No.	1024210	LSL	16,61
				USL	20,31
Remark	TQ 80% hard +/-10% * Speed 360 rpm				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	Nm	18,63	18,60	18,70	18,44	18,93	18,54	18,43	18,73	18,71	18,80
1024210	VM1698-4	Grad	31,00	29,75	29,25	28,75	31,00	30,00	30,25	29,50	29,00	30,25

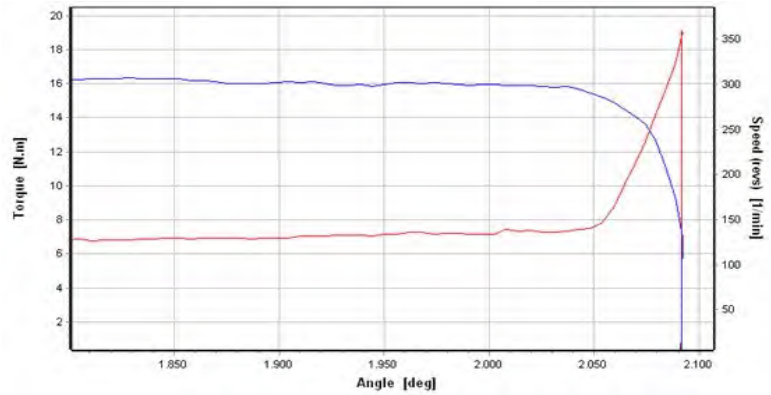
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	18,67	18,91	18,53	18,55	18,56	18,71	18,43	18,90	19,10	18,42
1024210	VM1698-4	Grad	31,00	30,75	29,75	29,75	29,00	29,25	29,75	30,25	31,00	28,25

Torque graphs

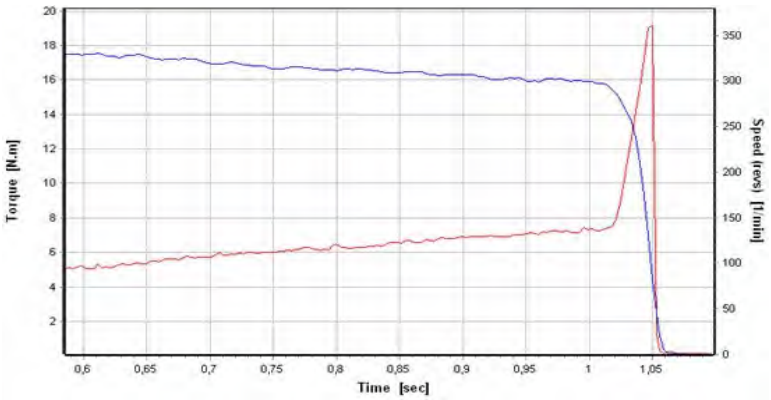
Machine Capability Study 80 %

Model: **CLBA203**
Serial no: **ILJ1000**

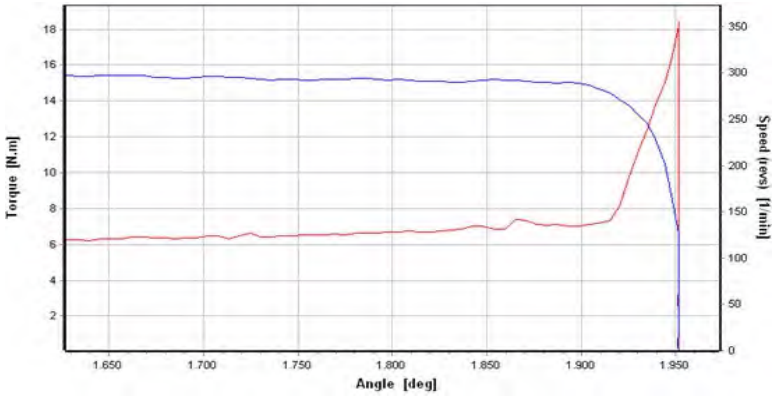
Angle degree: **30°**
Test torque: **18,5 Nm**



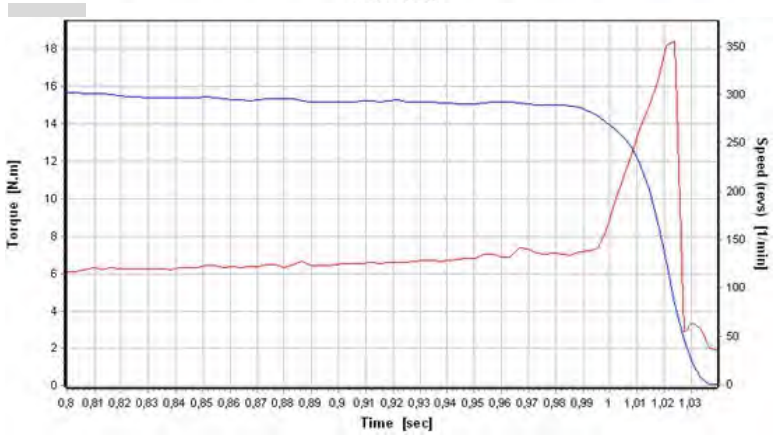
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

Machine Capability Study
Control System

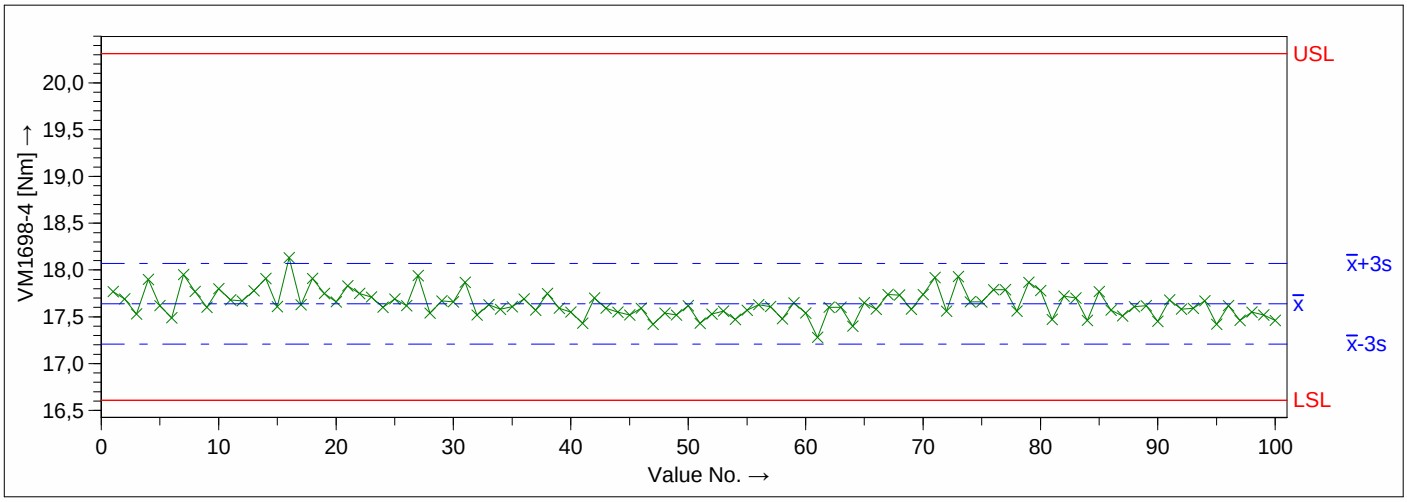
Cleco Production Tools

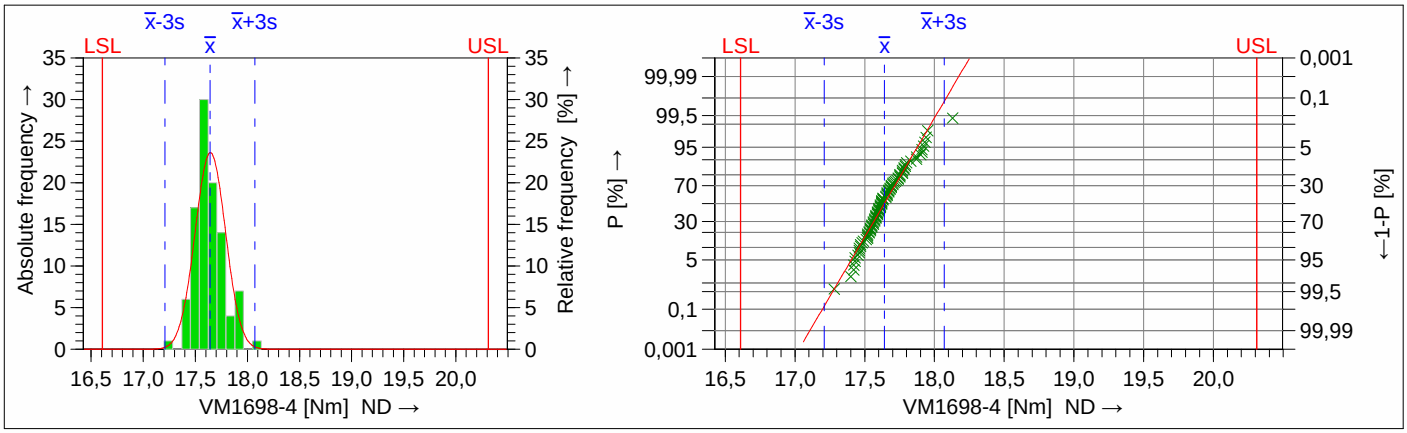
Plant	ATG Westhausen	Operator Name	Stölzle
Date	10.01.2024		

Ord. No.	CLBA203	Part type	CLBA203	Contr.item	yes
Serial No.	ILJ1000_g	Char.Descr.	VM1698-4	Nom.val. 18,46 1,85	USL 20,31
		Serial No.	1024210	Unit Nm -1,85	LSL 16,61
Char.Type	variable			Tolerance value 10 %	Decimal Pl. 2
Cust.Name	ATG	Reference System	VM1698-4	Test Electronic	---
Contr.No.	Homologation	Reference Transducer	50/1024729	nges.	100

Evaluation from 10.01.2024 06:28:29 to 10.01.2024 06:40:10

Rem. TQ 80% soft +/-10% * Speed 360 rpm





Drawing Values		Collected Values		Statistics	
T_m	18.46			$\bar{x}$	17.6402
LSL	16.61	x_{min}	17.28	$\bar{x}$-3s	17.2098
USL	20.31	x_{max}	18.13	$\bar{x}$+3s	18.0706
T	3.70	R	0.85	6s	0.8608
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution		Normal Distribution	
Calculation method		M1.1.4 $\hat{\sigma} = S_{tot}$	
Potential Capability index	=	C_m	4.30
Critical capability index	=	C_{mk}	2.39

The requirements were met (C_m,C_{mk})

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Stölzle	Date 10.01.2024

Serial No.	ILJ1000_g	Characteristic			
Part type	CLBA203	Char.Descr.	VM1698-4	Nom.val.	18,46
Ord. No.	CLBA203	Serial No.	1024210	LSL	16,61
				USL	20,31
Remark	TQ 80% soft +/-10% * Speed 360 rpm				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	Nm	17,77	17,69	17,53	17,90	17,62	17,49	17,95	17,77	17,60	17,80
1024210	VM1698-4	Grad	359,75	362,25	356,25	371,75	352,00	346,00	358,50	359,50	352,00	361,75

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	Nm	17,68	17,67	17,78	17,91	17,61	18,13	17,63	17,91	17,75	17,66
1024210	VM1698-4	Grad	356,75	352,50	364,00	364,50	356,75	364,75	358,00	357,50	357,50	353,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	Nm	17,83	17,75	17,71	17,60	17,69	17,62	17,94	17,54	17,67	17,66
1024210	VM1698-4	Grad	357,75	357,25	359,00	349,75	354,25	350,00	359,75	351,00	353,25	353,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	Nm	17,87	17,52	17,63	17,58	17,61	17,69	17,57	17,75	17,59	17,55
1024210	VM1698-4	Grad	352,50	349,75	359,75	364,50	355,25	356,00	355,50	352,00	349,00	348,50

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	Nm	17,43	17,70	17,59	17,55	17,52	17,59	17,42	17,54	17,52	17,62
1024210	VM1698-4	Grad	344,50	349,25	348,75	361,00	348,75	358,75	349,25	359,25	347,25	356,75

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	17,43	17,53	17,56	17,47	17,57	17,63	17,61	17,48	17,65	17,54
1024210	VM1698-4	Grad	351,75	355,50	358,00	349,00	354,75	359,50	358,25	355,50	357,00	353,75

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	Nm	17,28	17,60	17,60	17,40	17,65	17,58	17,74	17,73	17,58	17,74
1024210	VM1698-4	Grad	344,00	365,00	351,00	347,00	358,25	354,75	363,00	359,25	355,50	367,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	Nm	17,92	17,56	17,93	17,66	17,66	17,79	17,79	17,56	17,87	17,78
1024210	VM1698-4	Grad	365,25	353,50	372,25	357,25	354,50	364,25	360,75	356,25	374,25	357,50

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Stölzle	Date 10.01.2024

Serial No.	ILJ1000_g	Characteristic			
Part type	CLBA203	Char.Descr.	VM1698-4	Nom.val.	18,46
Ord. No.	CLBA203	Serial No.	1024210	LSL	16,61
				USL	20,31
Remark	TQ 80% soft +/-10% * Speed 360 rpm				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	Nm	17,47	17,72	17,70	17,46	17,77	17,57	17,51	17,61	17,62	17,45
1024210	VM1698-4	Grad	351,75	364,00	355,25	346,25	361,75	360,50	348,50	353,75	360,25	349,00

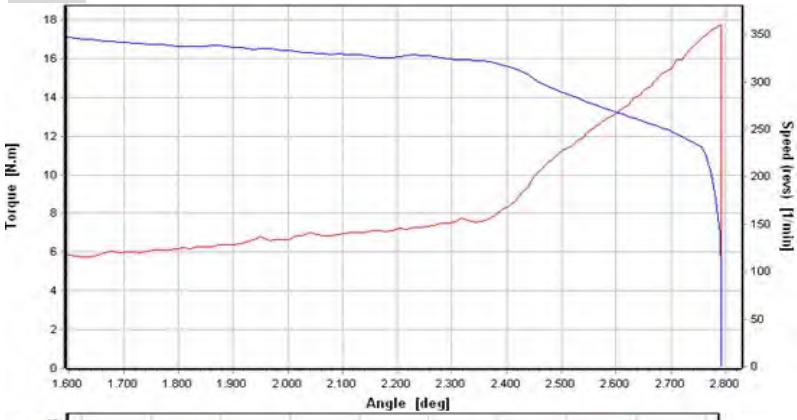
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	17,68	17,58	17,59	17,67	17,42	17,62	17,46	17,55	17,52	17,46
1024210	VM1698-4	Grad	357,50	352,50	354,25	354,00	345,75	363,25	353,00	356,25	358,50	360,25

ue graphs

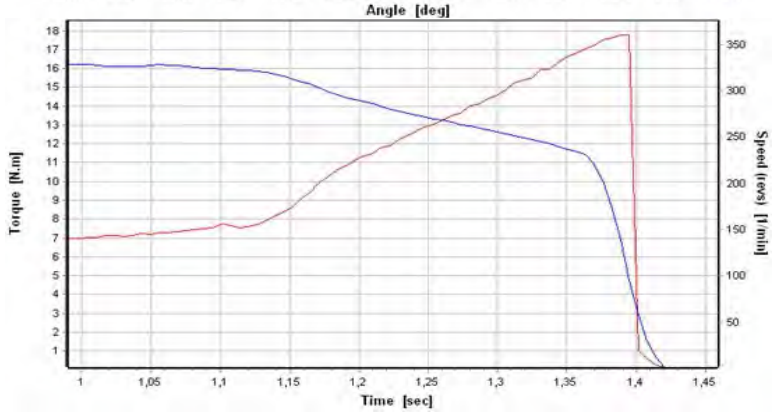
Machine Capability Study 80 %

Model: **CLBA203**
Serial no: **ILJ1000**

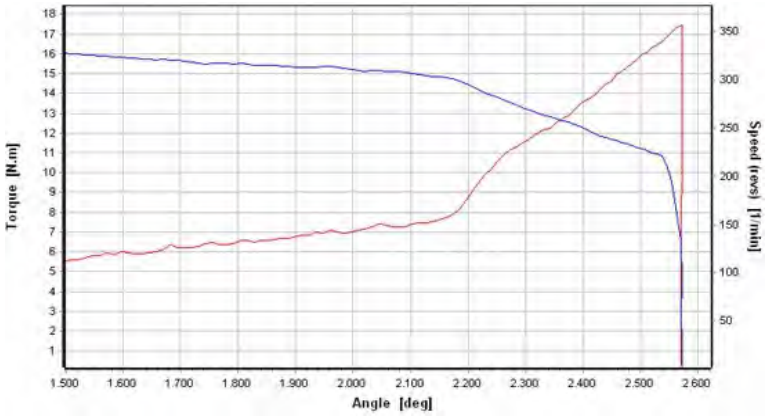
Angle degree: **360°**
Test torque: **18,5 Nm**



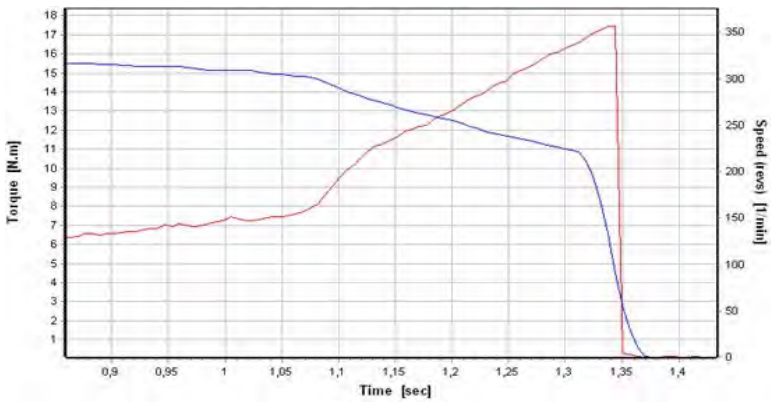
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

Test sheet no. 4

Machine Capability Study 100 %

Multi-stage tightening system	☑	Speed = 360 rpm	100,0 %
Single-stage tightening system	☐		

Manufacturer: Apex Tool Group Serial no: **ILJ1000**

Test torque: Tq max. 21,00 Nm

Hard joint (H)	125,46	Nm / Revolution	Angle degree	30°
Soft joint (L)	10,10	Nm / Revolution	Angle degree	360°

		H	L
a)	Tolerance down / up	18,90 - 23,10 Nm	18,90 - 23,10 Nm
	Tolerance down / up	10 %	10 %
	Average torque	20,91 Nm	20,20 Nm
	Standard deviation	0,26 Nm	0,17 Nm
	Torque scatter (99,73%)	1,56 Nm	1,01 Nm
	C_m	2,70	4,17
	C_{mk}	2,58	2,59

b)	Min. C_m hard/soft (lowest value)	2,70
	Min. C_{mk} hard/soft (lowest value)	2,58

Capability is reached if minimum C_{mk} value ≥1.67

Note:

Machine Capability Study
Control System

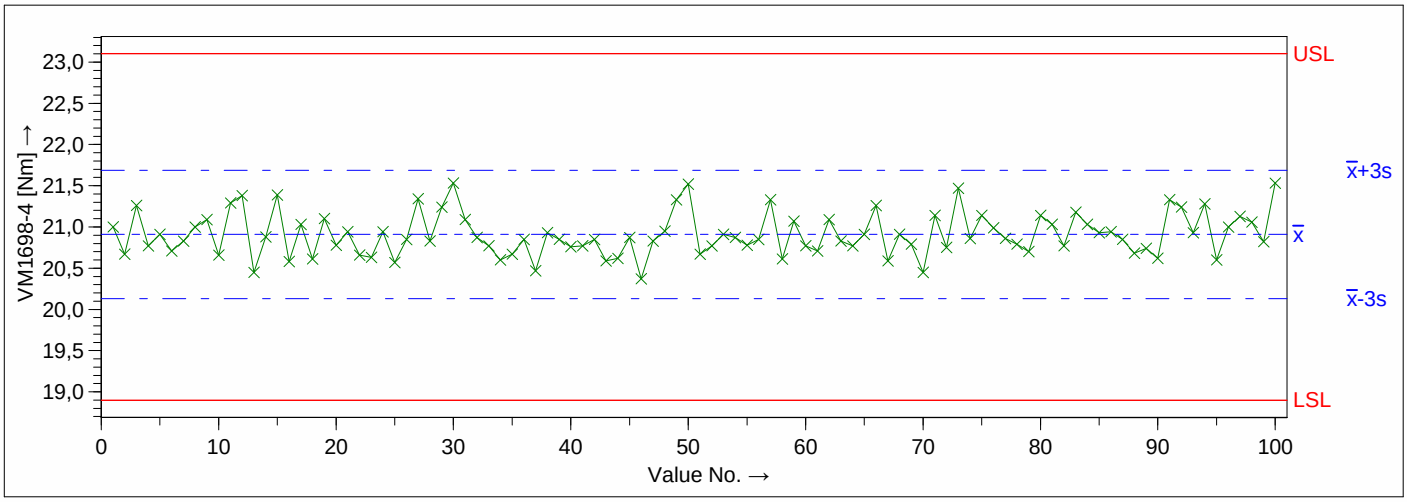
Cleco Production Tools

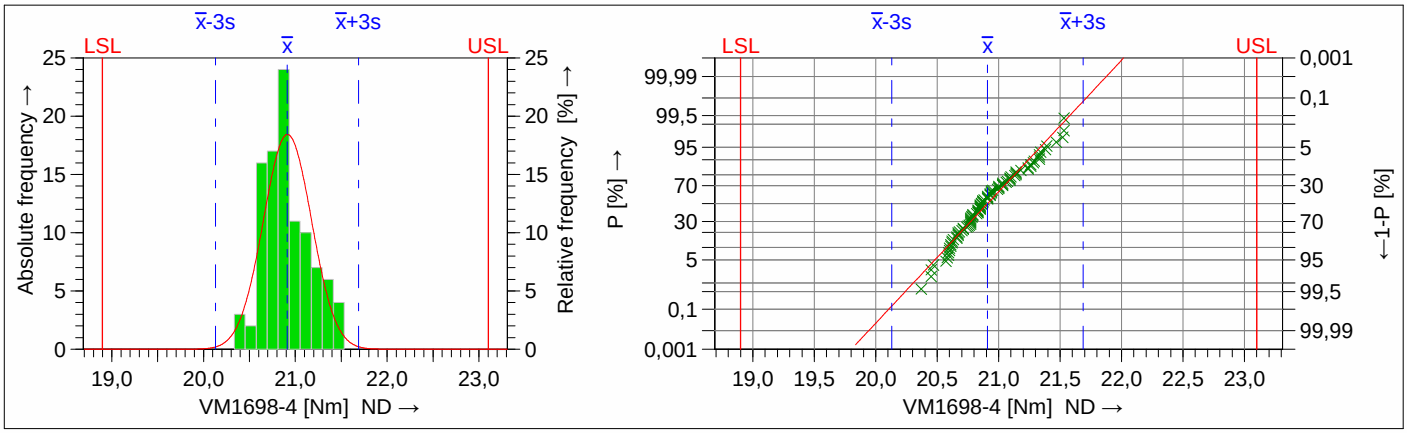
Plant	ATG Westhausen	Operator Name	Sorg
Date	26.01.2024		

Ord. No.	CLBA203	Part type	CLBA203	Contr.item	yes
Serial No.	ILJ1000_b	Char.Descr.	VM1698-4	Nom.val. 21,00 2,10	USL 23,10
		Serial No.	1024210	Unit Nm -2,10	LSL 18,90
Char.Type	variable			Tolerance value 10 %	Decimal Pl. 2
Cust.Name	ATG	Reference System	VM1698-4	Test Electronic	---
Contr.No.	Homologation	Reference Transducer	50/1024729	nges.	100

Evaluation from 26.01.2024 11:06:18 to 26.01.2024 11:19:30

Rem. TQ 100% hard +/-10% * Speed 360 rpm





Drawing Values		Collected Values		Statistics	
T_m	21.00			$\bar{x}$	20.9095
LSL	18.90	x_{min}	20.37	$\bar{x}$-3s	20.1303
USL	23.10	x_{max}	21.53	$\bar{x}$+3s	21.6887
T	4.20	R	1.16	6s	1.5584
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution		Normal Distribution	
Calculation method		M1.1.4 $\hat{\sigma} = S_{tot}$	
Potential Capability index	=	C_m	2.70
Critical capability index	=	C_{mk}	2.58

The requirements were met (C_m,C_{mk})

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 26.01.2024

Serial No.	ILJ1000_b	Characteristic			
Part type	CLBA203	Char.Descr.	VM1698-4	Nom.val.	21,00
Ord. No.	CLBA203	Serial No.	1024210	LSL	18,90
				USL	23,10
Remark	TQ 100% hard +/-10% * Speed 360 rpm				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	Nm	21,00	20,67	21,26	20,77	20,91	20,71	20,83	21,00	21,09	20,66
1024210	VM1698-4	Grad	30,00	29,75	31,00	30,00	30,25	29,50	29,50	30,25	30,25	30,00

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	Nm	21,29	21,38	20,45	20,88	21,39	20,58	21,03	20,61	21,10	20,78
1024210	VM1698-4	Grad	31,00	30,75	28,00	29,75	30,75	29,50	31,00	29,75	30,75	29,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	Nm	20,94	20,66	20,63	20,94	20,57	20,85	21,34	20,83	21,24	21,53
1024210	VM1698-4	Grad	29,25	28,75	29,25	30,75	29,00	30,50	32,00	29,75	31,25	31,50

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	Nm	21,09	20,87	20,77	20,60	20,67	20,85	20,47	20,93	20,85	20,76
1024210	VM1698-4	Grad	30,00	30,00	29,00	30,00	29,75	30,25	28,25	30,00	28,75	29,75

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	Nm	20,77	20,85	20,59	20,62	20,87	20,37	20,83	20,95	21,33	21,52
1024210	VM1698-4	Grad	29,25	29,00	29,50	28,75	30,00	29,25	30,50	30,25	31,00	31,75

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	20,67	20,77	20,91	20,87	20,78	20,85	21,33	20,61	21,07	20,77
1024210	VM1698-4	Grad	29,00	29,25	30,50	30,00	28,75	29,25	30,75	29,75	30,75	30,50

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	Nm	20,71	21,09	20,83	20,77	20,91	21,26	20,59	20,91	20,79	20,45
1024210	VM1698-4	Grad	29,00	29,75	30,00	29,50	30,00	30,75	29,00	30,00	29,50	28,25

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	Nm	21,14	20,75	21,47	20,86	21,14	20,99	20,86	20,79	20,70	21,14
1024210	VM1698-4	Grad	31,25	29,50	31,75	29,75	31,00	31,25	29,25	29,50	29,25	30,50

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 26.01.2024

Serial No.	ILJ1000_b	Characteristic			
Part type	CLBA203	Char.Descr.	VM1698-4	Nom.val.	21,00
Ord. No.	CLBA203	Serial No.	1024210	LSL	18,90
				USL	23,10
Remark	TQ 100% hard +/-10% * Speed 360 rpm				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	Nm	21,03	20,77	21,18	21,03	20,93	20,94	20,85	20,68	20,74	20,62
1024210	VM1698-4	Grad	30,25	29,00	30,25	30,00	30,50	30,00	30,00	28,75	29,25	29,00

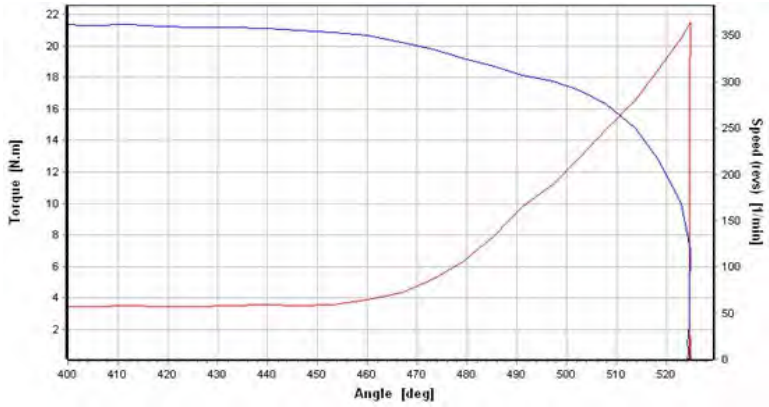
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	21,33	21,24	20,93	21,28	20,60	21,00	21,13	21,06	20,82	21,53
1024210	VM1698-4	Grad	31,75	30,75	31,25	31,75	28,25	30,50	31,75	30,25	29,50	31,75

Torque graphs

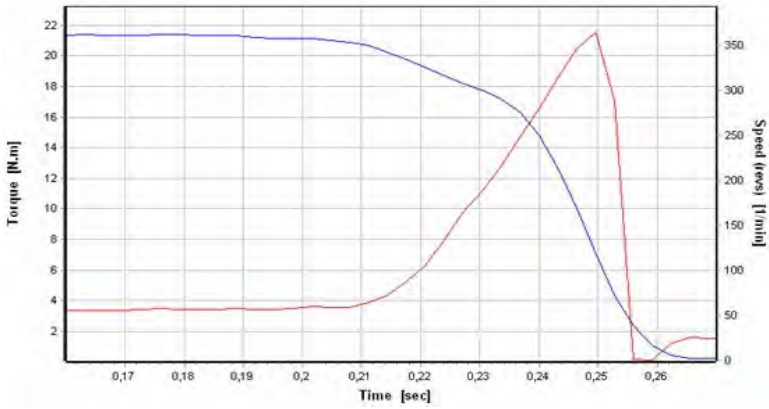
Machine Capability Study 100 %

Model: **CLBA203**
Serial no: **ILJ1000**

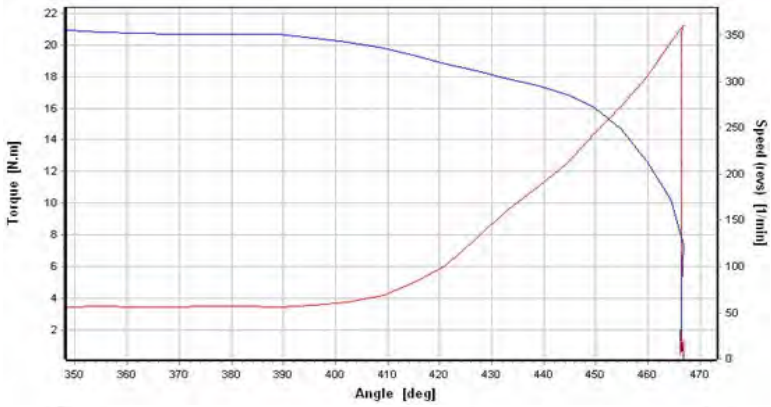
Angle degree: **30°**
Test torque: **21,0 Nm**



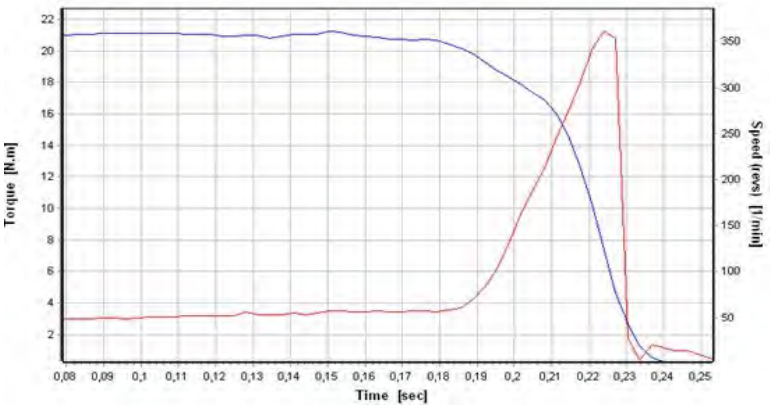
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

Machine Capability Study
Control System

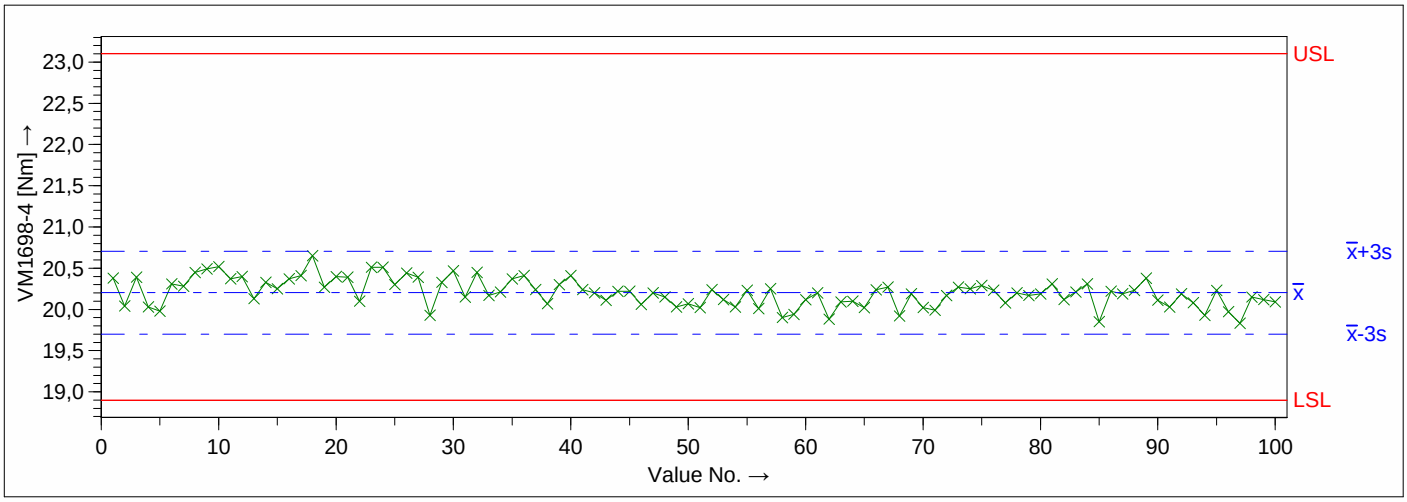
Cleco Production Tools

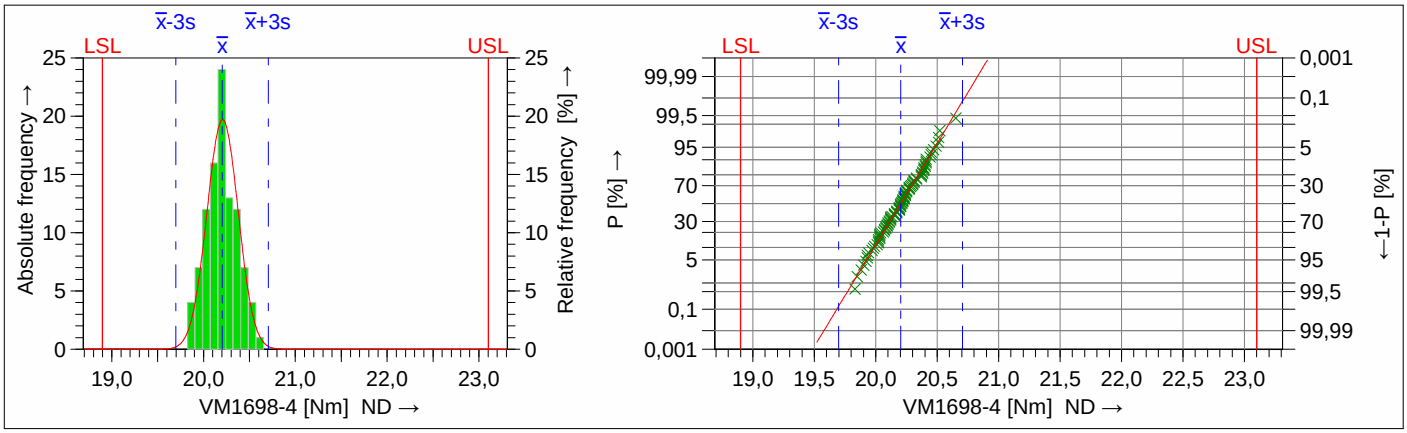
Plant	ATG Westhausen	Operator Name	Sorg
Date	29.01.2024		

Ord. No.	CLBA203	Part type	CLBA203	Contr.item	yes
Serial No.	ILJ1000_a	Char.Descr.	VM1698-4	Nom.val. 21,00 / 2,10	USL 23,10
		Serial No.	1024210	Unit Nm / -2,10	LSL 18,90
Char.Type	variable			Tolerance value 10 %	Decimal Pl. 2
Cust.Name	ATG	Reference System	VM1698-4	Test Electronic	---
Contr.No.	Homologation	Reference Transducer	50/1024729	nges.	100

Evaluation from 29.01.2024 08:06:48 to 29.01.2024 08:29:53

Rem. TQ 100% soft +/-10% * Speed 360 rpm; Pause 10 sec





Drawing Values		Collected Values		Statistics	
T_m	21.00			$\bar{x}$	20.2028
LSL	18.90	x_{min}	19.83	$\bar{x}$-3s	19.6989
USL	23.10	x_{max}	20.65	$\bar{x}$+3s	20.7067
T	4.20	R	0.82	6s	1.0079
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution		Normal Distribution	
Calculation method		M1.1.4 $\hat{\sigma} = S_{tot}$	
Potential Capability index	=	C_m	4.17
Critical capability index	=	C_{mk}	2.59

The requirements were met (C_m,C_{mk})

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 29.01.2024

Serial No.	ILJ1000_a	Characteristic			
Part type	CLBA203	Char.Descr.	VM1698-4	Nom.val.	21,00
Ord. No.	CLBA203	Serial No.	1024210	LSL	18,90
				USL	23,10
Remark	TQ 100% soft +/-10% * Speed 360 rpm; Pause 10 sec				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	Nm	20,38	20,04	20,39	20,03	19,98	20,31	20,28	20,45	20,49	20,52
1024210	VM1698-4	Grad	362,50	345,50	353,00	340,25	339,75	348,00	350,75	354,75	356,25	353,50

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	Nm	20,37	20,40	20,13	20,33	20,25	20,37	20,41	20,65	20,27	20,40
1024210	VM1698-4	Grad	352,00	350,75	344,00	351,50	353,75	348,25	355,50	362,50	347,25	356,50

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	Nm	20,39	20,10	20,51	20,51	20,30	20,44	20,39	19,93	20,33	20,47
1024210	VM1698-4	Grad	356,00	345,25	364,25	359,25	360,75	363,25	362,50	347,25	358,50	361,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	Nm	20,15	20,45	20,17	20,21	20,37	20,41	20,24	20,07	20,30	20,41
1024210	VM1698-4	Grad	347,25	365,25	353,25	348,75	359,75	360,25	349,75	348,50	352,50	359,75

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	Nm	20,24	20,20	20,11	20,22	20,22	20,06	20,20	20,15	20,03	20,07
1024210	VM1698-4	Grad	353,75	353,75	346,75	349,75	355,25	345,00	354,25	354,75	346,75	352,75

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	20,02	20,24	20,12	20,03	20,23	20,01	20,25	19,90	19,94	20,12
1024210	VM1698-4	Grad	359,00	356,25	358,25	352,25	364,25	353,25	360,00	352,75	351,75	352,25

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	Nm	20,20	19,88	20,09	20,10	20,02	20,24	20,27	19,92	20,19	20,02
1024210	VM1698-4	Grad	361,50	352,25	355,00	351,50	352,25	360,25	364,25	350,00	356,00	352,25

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	Nm	19,99	20,17	20,27	20,25	20,29	20,23	20,08	20,20	20,17	20,19
1024210	VM1698-4	Grad	351,00	355,25	365,25	360,75	357,00	356,00	352,25	351,50	356,25	351,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 29.01.2024

Serial No.	ILJ1000_a	Characteristic			
Part type	CLBA203	Char.Descr.	VM1698-4	Nom.val.	21,00
Ord. No.	CLBA203	Serial No.	1024210	LSL	18,90
				USL	23,10
Remark	TQ 100% soft +/-10% * Speed 360 rpm; Pause 10 sec				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	Nm	20,31	20,12	20,21	20,31	19,85	20,22	20,19	20,23	20,38	20,11
1024210	VM1698-4	Grad	359,00	350,75	357,00	359,75	345,25	355,00	356,50	351,25	363,25	355,00

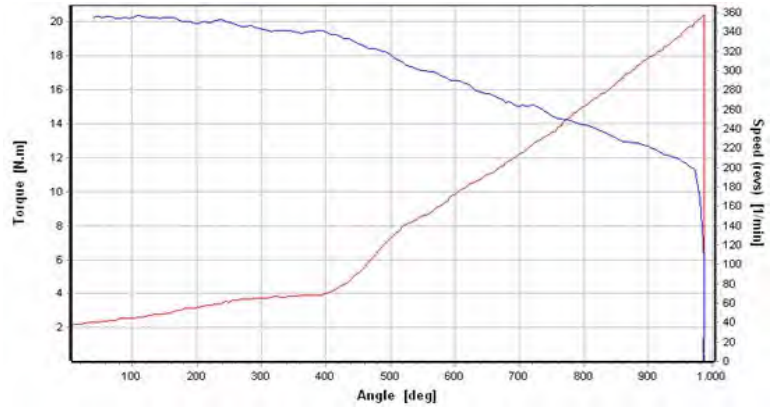
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	20,03	20,19	20,08	19,93	20,23	19,97	19,83	20,15	20,12	20,09
1024210	VM1698-4	Grad	346,25	354,75	354,50	344,75	363,25	355,00	347,50	356,25	357,25	355,75

Torque graphs

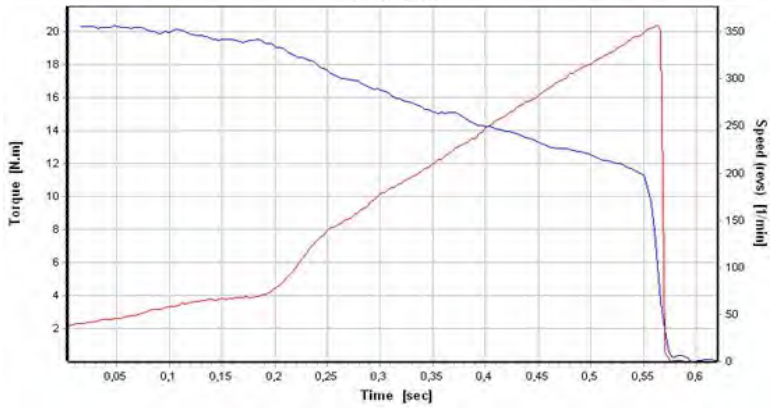
Machine Capability Study 100 %

Model: **CLBA203**
Serial no: **ILJ1000**

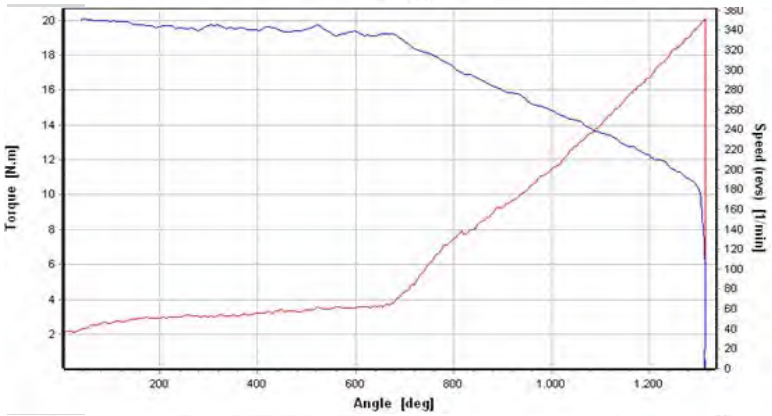
Angle degree: **360°**
Test torque: **21,0 Nm**



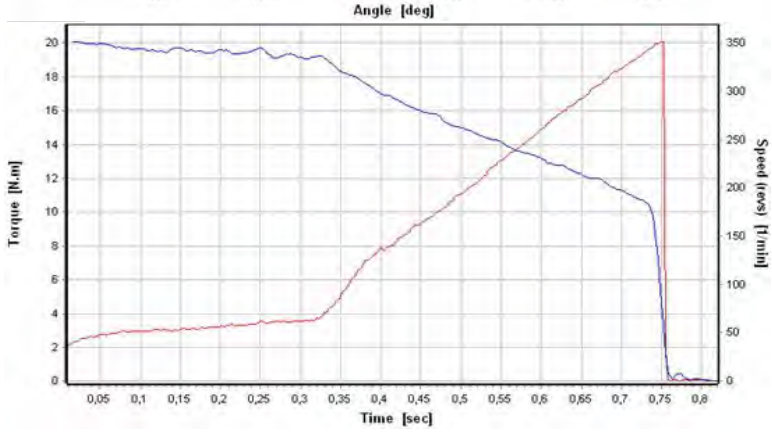
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed