Homologation

Cordless Assembly Tools

Model: CLBA203

Serial no.: ILJ1002

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Homologation: CLBA203 SN: ILJ1002

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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 100,0 %

Single-stage tightening system ☐

Manufacturer: Apex Tool Group Serial no: **ILJ1002**

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

Hard joint (H) 73,43 Nm / Revolution Angle degree 30°

Soft joint (L) 5,76 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	12,24 Nm	11,51 Nm
	Standard deviation	0,08 Nm	0,09 Nm
	Torque scatter (99,73%)	0,50 Nm	0,54 Nm
	C_m	4,86	4,52
	C_{mk}	4,34	2,28

b)	Min. C_m hard/soft (lowest value)	4,52
	Min. C_{mk} hard/soft (lowest value)	2,28

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

Note:

Machine Capability Study
Control System

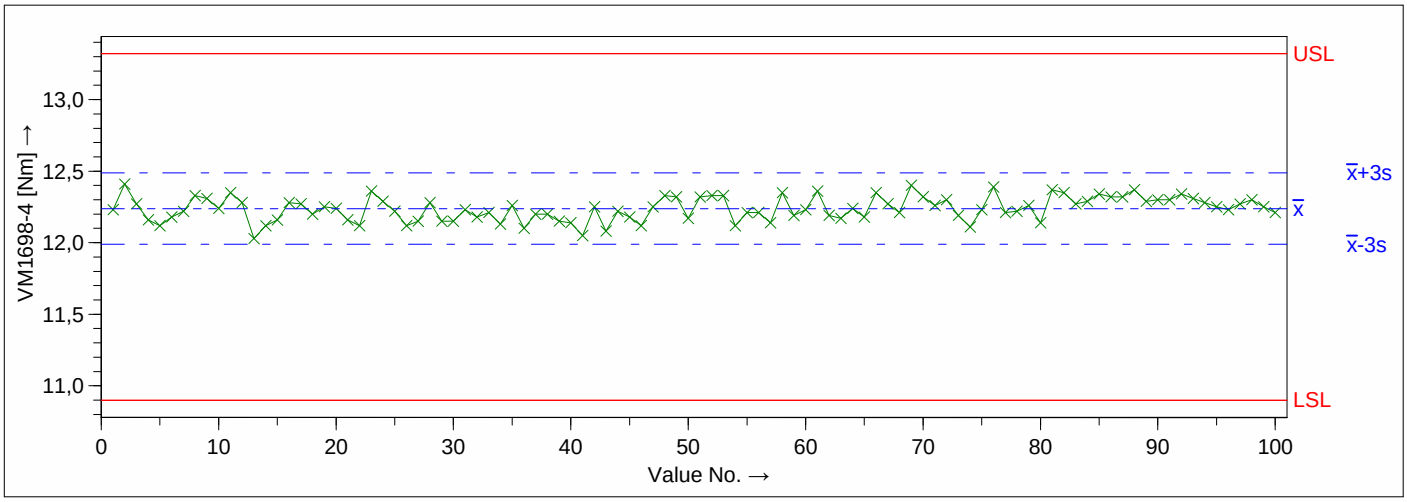
Cleco Production Tools

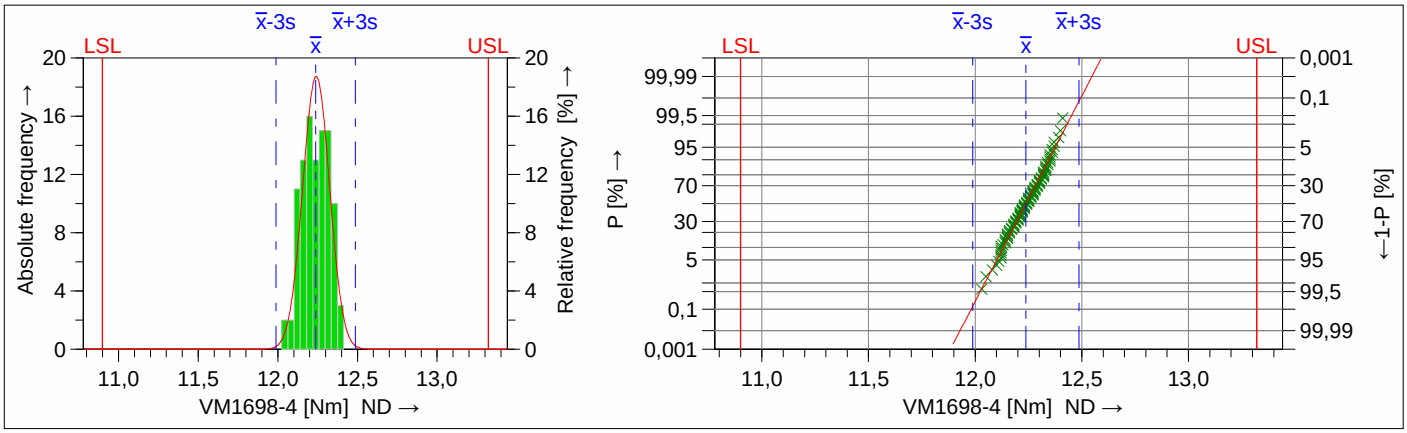
Plant	ATG Westhausen	Operator Name	Sorg
Date	15.01.2024		

Ord. No.	CLBA203	Part type	CLBA203	Contr.item	yes
Serial No.	ILJ1002_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 15.01.2024 10:05:47 to 15.01.2024 10:17:20

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





Drawing Values		Collected Values		Statistics	
T_m	12.11			$\bar{x}$	12.2381
LSL	10.90	x_{min}	12.03	$\bar{x}$-3s	11.9890
USL	13.32	x_{max}	12.41	$\bar{x}$+3s	12.4872
T	2.42	R	0.38	6s	0.4983
		$n_{<T>}$	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	4.86
Critical capability index	=	C_{mk}	4.34

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

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Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 15.01.2024

Serial No.	ILJ1002_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	12,23	12,41	12,27	12,16	12,12	12,18	12,22	12,33	12,31	12,24
1024210	VM1698-4	Grad	29,50	29,50	28,50	28,25	28,00	28,25	28,25	28,50	29,00	28,50

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	12,35	12,28	12,03	12,12	12,16	12,28	12,27	12,20	12,25	12,24
1024210	VM1698-4	Grad	28,50	30,00	28,50	28,00	30,25	29,75	29,25	29,00	28,75	30,00

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	12,16	12,12	12,36	12,29	12,22	12,12	12,15	12,28	12,15	12,15
1024210	VM1698-4	Grad	28,75	29,50	29,50	29,00	30,00	29,25	29,25	31,25	30,25	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	12,23	12,18	12,21	12,13	12,26	12,10	12,20	12,20	12,15	12,14
1024210	VM1698-4	Grad	30,75	30,25	30,25	30,00	31,25	30,50	30,50	31,25	29,25	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	12,05	12,25	12,08	12,22	12,18	12,12	12,25	12,33	12,32	12,17
1024210	VM1698-4	Grad	30,00	30,50	29,50	30,00	29,25	29,75	29,75	30,75	29,75	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	12,32	12,33	12,33	12,12	12,21	12,21	12,14	12,35	12,19	12,23
1024210	VM1698-4	Grad	29,50	30,50	29,75	29,00	29,75	30,00	29,50	30,50	30,25	29,75

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	12,36	12,19	12,17	12,24	12,18	12,35	12,27	12,21	12,40	12,32
1024210	VM1698-4	Grad	30,75	29,75	30,00	29,50	30,25	31,00	30,50	30,50	31,00	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	12,26	12,30	12,19	12,11	12,23	12,39	12,21	12,22	12,26	12,14
1024210	VM1698-4	Grad	31,00	30,00	30,00	29,75	31,25	31,00	31,75	30,75	30,00	29,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 15.01.2024

Serial No.	ILJ1002_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	12,37	12,35	12,27	12,29	12,34	12,32	12,32	12,37	12,29	12,30
1024210	VM1698-4	Grad	30,50	30,00	30,00	29,00	30,25	29,50	30,50	29,50	30,50	29,50

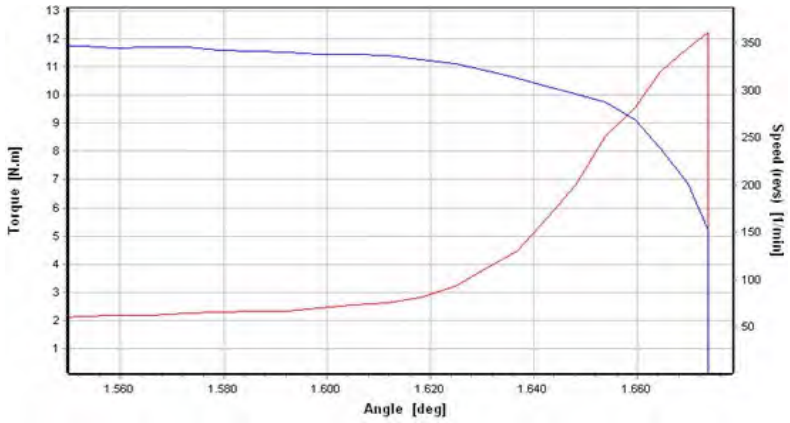
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	12,30	12,34	12,31	12,28	12,25	12,23	12,27	12,30	12,25	12,21
1024210	VM1698-4	Grad	30,25	30,00	30,00	30,75	30,25	30,50	29,75	30,50	30,50	30,25

Torque graphs

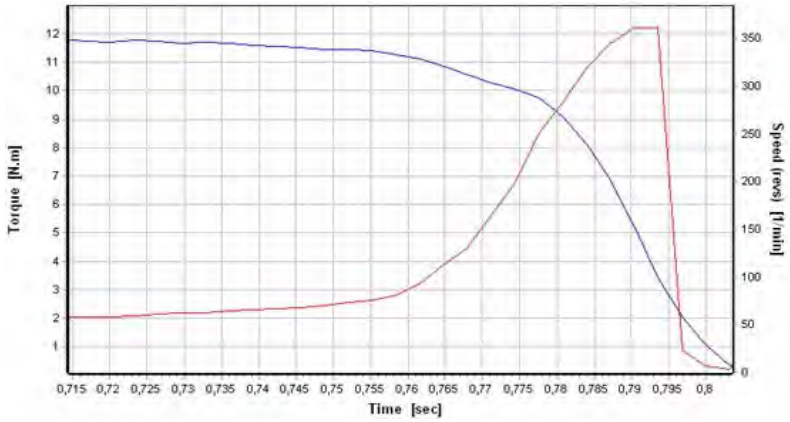
Machine Capability Study 30 %

Model: **CLBA203**
Serial no: **ILJ1002**

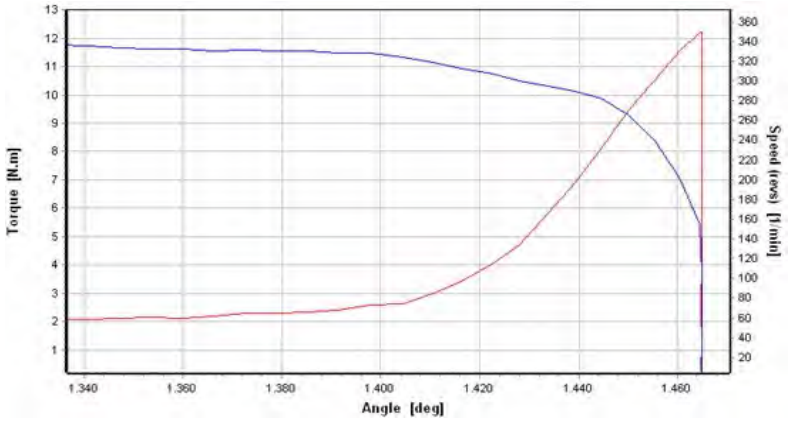
Angle degree: **30°**
Test torque: **12,1 Nm**



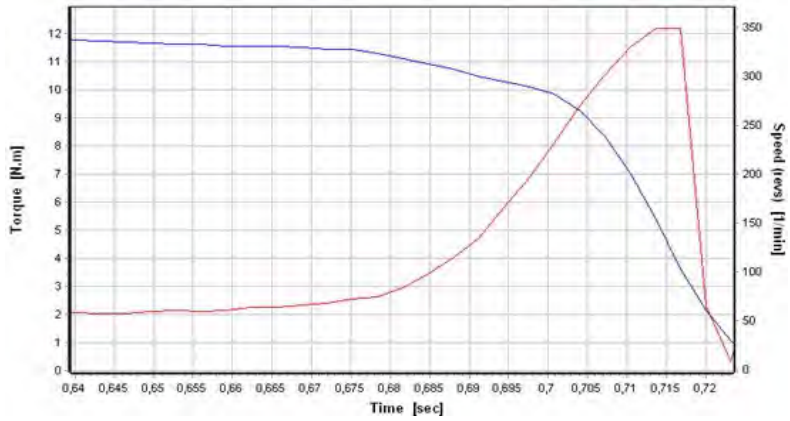
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

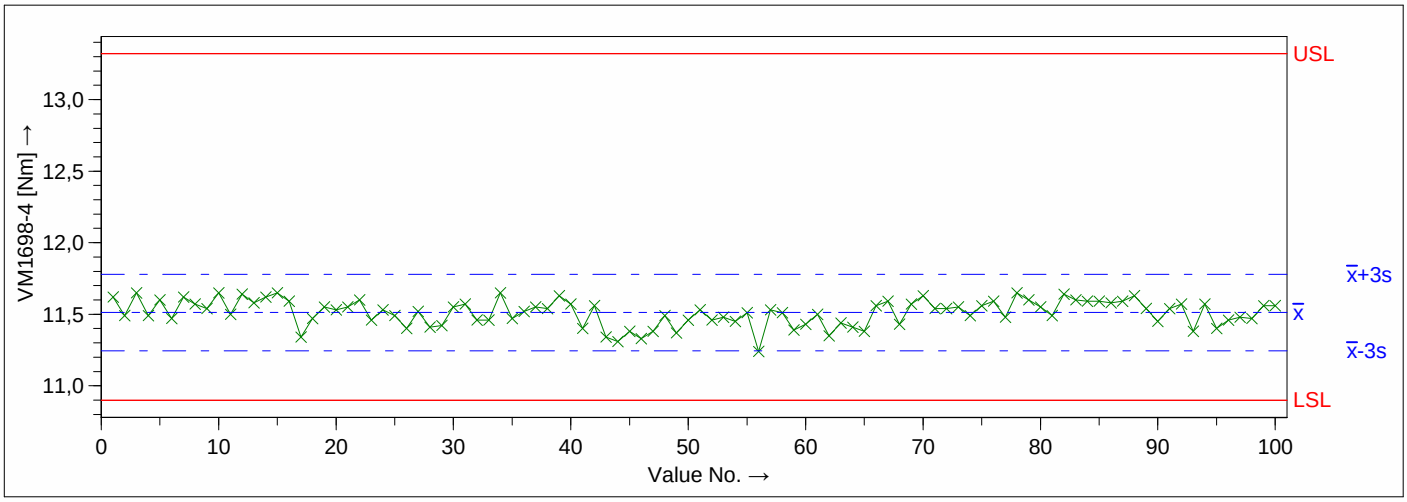
Machine Capability Study
Control System

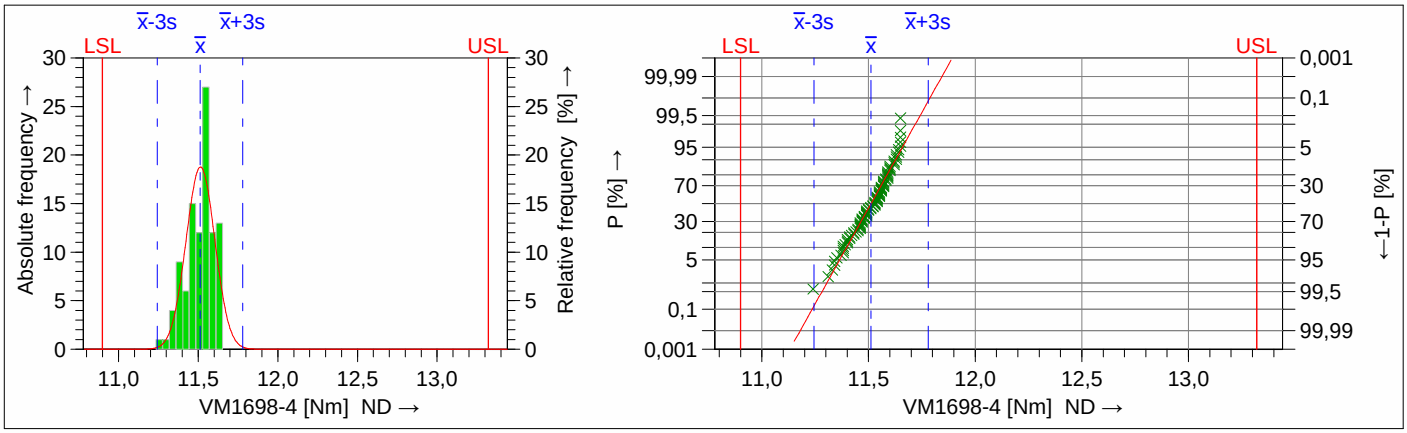
Plant	ATG Westhausen	Operator Name	Sorg
Date	15.01.2024		

Ord. No.	CLBA203	Part type	CLBA203	Contr.item	yes
Serial No.	ILJ1002_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 15.01.2024 09:47:33 to 15.01.2024 10:00:37

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





Drawing Values		Collected Values		Statistics	
T_m	12.11			$\bar{x}$	11.5117
LSL	10.90	x_{min}	11.24	$\bar{x}$-3s	11.2439
USL	13.32	x_{max}	11.65	$\bar{x}$+3s	11.7795
T	2.42	R	0.41	6s	0.5356
		$n_{<T>}$	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	4.52
Critical capability index	=	C_{mk}	2.28

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 15.01.2024

Serial No.	ILJ1002_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	11,62	11,49	11,65	11,49	11,60	11,47	11,62	11,57	11,54	11,65
1024210	VM1698-4	Grad	363,00	347,50	364,25	377,25	372,50	366,75	366,50	345,00	357,50	351,25

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	11,50	11,64	11,58	11,62	11,65	11,59	11,34	11,47	11,55	11,53
1024210	VM1698-4	Grad	350,50	349,25	341,00	368,25	366,75	364,75	365,75	377,25	369,50	356,00

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	11,55	11,60	11,46	11,53	11,49	11,40	11,52	11,41	11,42	11,55
1024210	VM1698-4	Grad	353,75	349,25	347,25	350,75	361,25	355,00	371,50	373,00	366,25	358,50

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	11,57	11,46	11,46	11,65	11,47	11,52	11,55	11,54	11,63	11,57
1024210	VM1698-4	Grad	360,75	356,50	360,25	369,00	365,00	375,25	370,00	359,25	360,75	364,50

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	11,40	11,56	11,34	11,31	11,38	11,33	11,38	11,49	11,37	11,46
1024210	VM1698-4	Grad	354,00	363,00	358,75	363,25	365,50	358,25	360,75	373,50	358,00	358,50

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	11,53	11,46	11,48	11,45	11,51	11,24	11,53	11,51	11,39	11,43
1024210	VM1698-4	Grad	339,50	338,75	339,25	341,50	363,50	369,25	352,50	357,25	333,75	346,75

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	11,50	11,35	11,44	11,41	11,38	11,56	11,59	11,43	11,57	11,63
1024210	VM1698-4	Grad	355,25	371,00	356,00	374,75	373,00	372,00	355,75	355,25	362,75	363,75

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	11,54	11,54	11,55	11,49	11,56	11,59	11,48	11,65	11,60	11,55
1024210	VM1698-4	Grad	359,25	384,25	383,50	354,00	361,25	362,50	349,50	371,00	381,00	344,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 15.01.2024

Serial No.	ILJ1002_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	11,49	11,64	11,60	11,59	11,59	11,58	11,59	11,63	11,54	11,45
1024210	VM1698-4	Grad	370,50	371,25	343,25	353,75	354,00	360,50	351,00	350,25	365,00	353,50

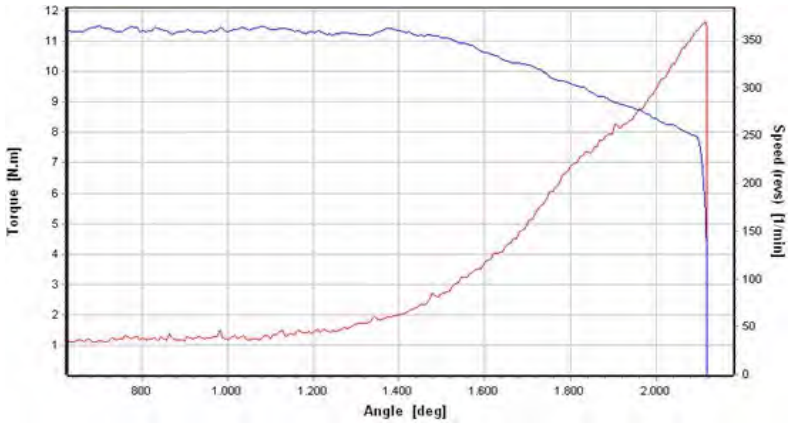
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	11,54	11,57	11,38	11,57	11,40	11,46	11,48	11,47	11,56	11,56
1024210	VM1698-4	Grad	341,50	347,50	348,75	362,75	374,25	344,00	344,25	354,50	352,00	370,00

Torque graphs

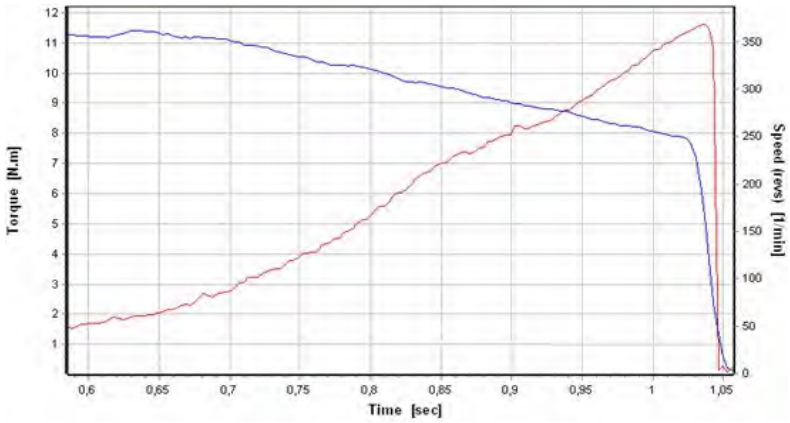
Machine Capability Study 30 %

Model: **CLBA203**
Serial no: **ILJ1002**

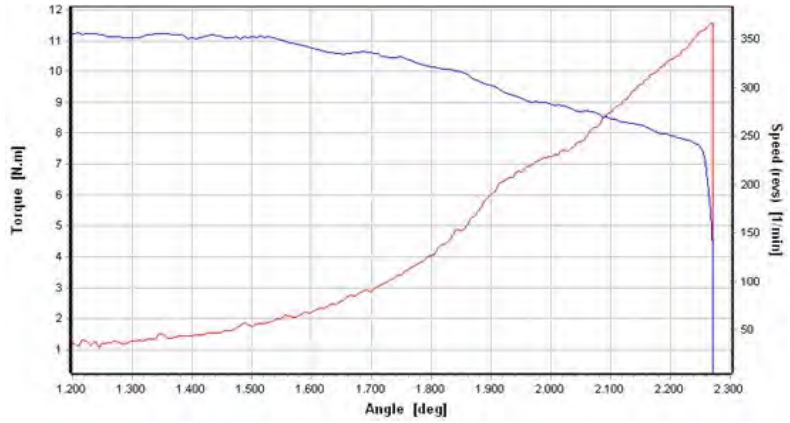
Angle degree: **360°**
Test torque: **12,1 Nm**



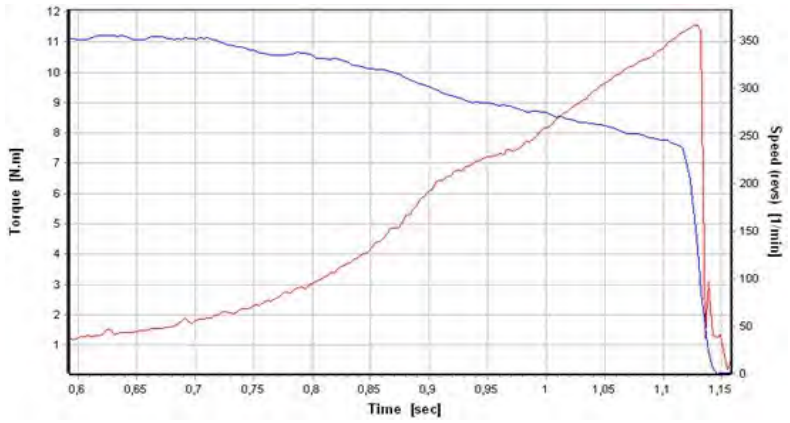
Value no. 1
Graph
Torque / Angle / Speed



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: **ILJ1002**

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

Hard joint (H) 113,55 Nm / Revolution Angle degree 30°

Soft joint (L) 8,97 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	18,92 Nm	17,94 Nm
	Standard deviation	0,14 Nm	0,08 Nm
	Torque scatter (99,73%)	0,85 Nm	0,47 Nm
	C_m	4,35	7,91
	C_{mk}	3,26	5,68

b) Min. C_m hard/soft (lowest value) 4,35
Min. C_{mk} hard/soft (lowest value) 3,26

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

Note:

Machine Capability Study
Control System

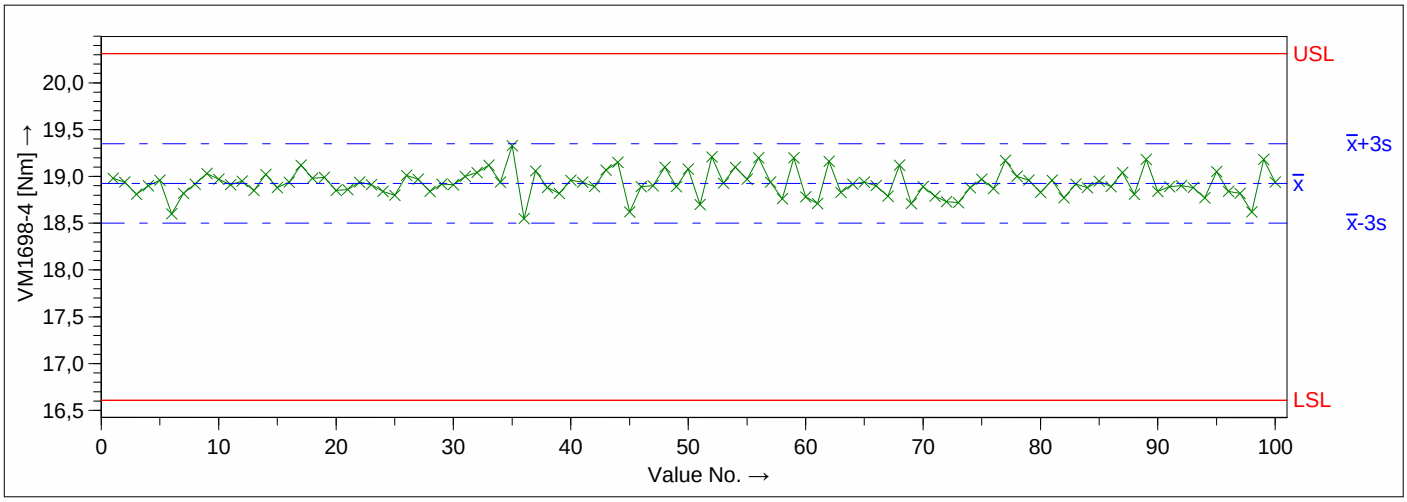
Cleco Production Tools

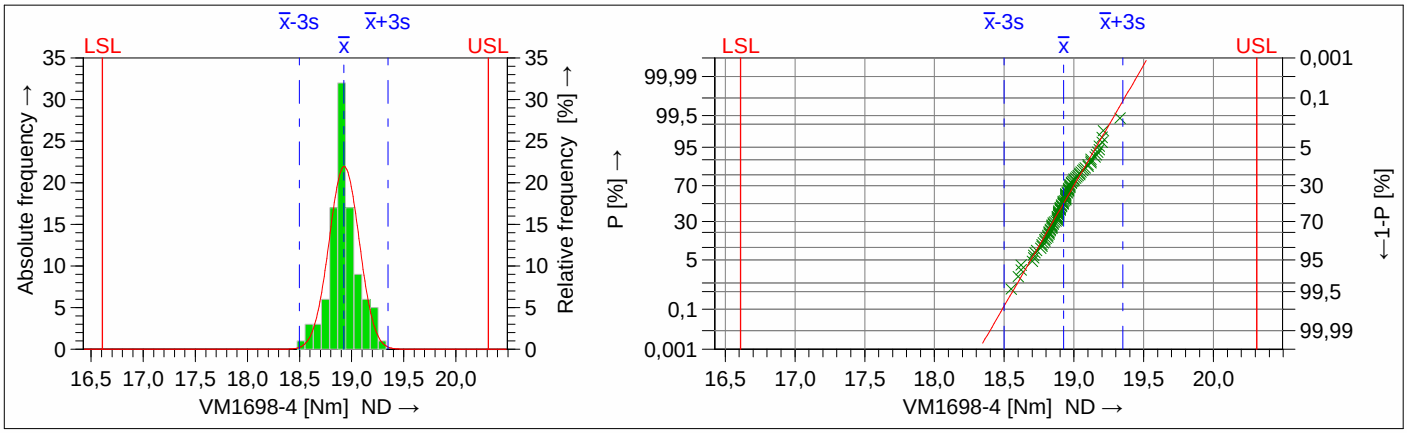
Plant	ATG Westhausen	Operator Name	Sorg
Date	15.01.2024		

Ord. No.	CLBA203	Part type	CLBA203	Contr.item	yes
Serial No.	ILJ1002_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 15.01.2024 10:24:04 to 15.01.2024 10:35:37

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





Drawing Values		Collected Values		Statistics	
T_m	18.46			$\bar{x}$	18.9246
LSL	16.61	x_{min}	18.55	$\bar{x}$-3s	18.4995
USL	20.31	x_{max}	19.33	$\bar{x}$+3s	19.3497
T	3.70	R	0.78	6s	0.8501
		$n_{<T>}$	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	4.35
Critical capability index	=	C_{mk}	3.26

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 15.01.2024

Serial No.	ILJ1002_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	18,98	18,94	18,81	18,90	18,96	18,60	18,82	18,92	19,03	18,97
1024210	VM1698-4	Grad	30,75	32,50	30,00	30,00	29,75	30,00	29,75	30,00	31,75	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	18,91	18,95	18,85	19,02	18,88	18,94	19,12	18,98	18,99	18,85
1024210	VM1698-4	Grad	29,75	29,75	30,25	30,75	31,00	29,75	31,75	31,00	30,25	29,75

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	18,86	18,94	18,91	18,84	18,80	19,01	18,97	18,84	18,92	18,91
1024210	VM1698-4	Grad	30,25	30,00	29,25	30,00	30,25	30,50	29,75	30,25	29,50	29,75

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	19,00	19,04	19,12	18,94	19,33	18,55	19,06	18,88	18,82	18,96
1024210	VM1698-4	Grad	31,25	31,50	31,25	30,75	30,25	29,00	29,00	30,00	28,75	29,50

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	18,94	18,89	19,07	19,15	18,62	18,89	18,90	19,10	18,89	19,08
1024210	VM1698-4	Grad	30,00	28,75	29,75	30,25	29,25	29,00	29,25	30,00	30,25	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	18,70	19,21	18,93	19,10	18,97	19,20	18,94	18,76	19,20	18,78
1024210	VM1698-4	Grad	29,75	30,25	30,75	30,00	30,75	30,25	29,25	30,00	30,25	29,50

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	18,71	19,16	18,83	18,92	18,94	18,90	18,79	19,12	18,71	18,89
1024210	VM1698-4	Grad	29,50	30,50	28,75	29,75	30,50	29,75	29,75	30,25	29,00	29,75

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	18,79	18,73	18,72	18,88	18,97	18,87	19,17	19,00	18,96	18,83
1024210	VM1698-4	Grad	30,50	28,75	29,00	29,50	30,00	29,50	30,25	30,25	30,50	29,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 15.01.2024

Serial No.	ILJ1002_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	18,96	18,77	18,92	18,88	18,95	18,89	19,04	18,81	19,18	18,84
1024210	VM1698-4	Grad	30,25	29,50	29,75	29,25	30,50	29,75	29,75	30,25	30,75	29,25

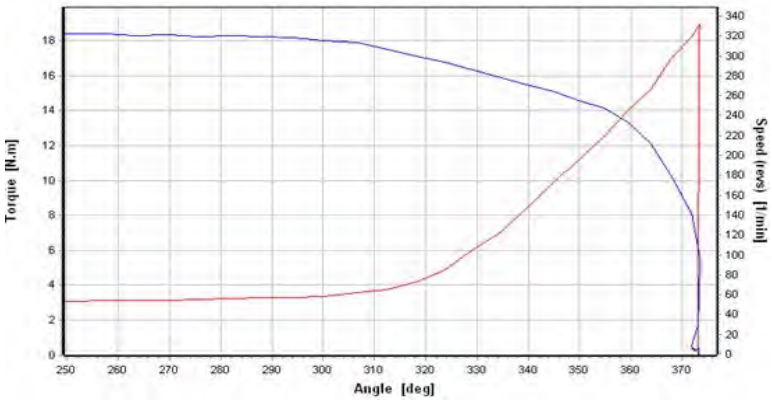
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	18,89	18,90	18,88	18,77	19,05	18,84	18,82	18,62	19,18	18,94
1024210	VM1698-4	Grad	30,25	29,25	30,75	30,25	30,50	29,25	29,75	30,25	30,25	31,00

Torque graphs

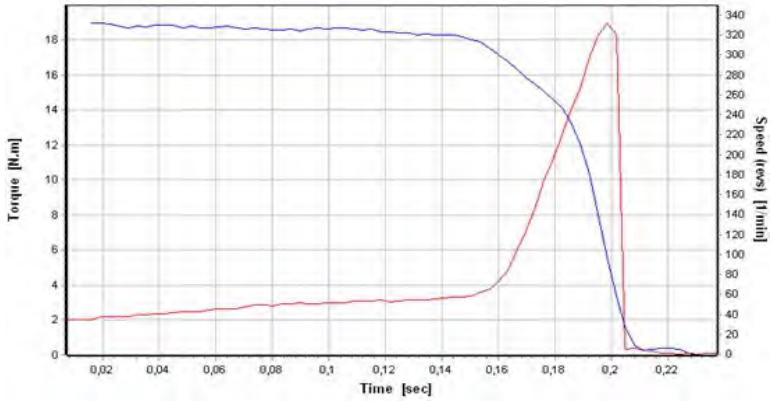
Machine Capability Study 80 %

Model: **CLBA203**
Serial no: **ILJ1002**

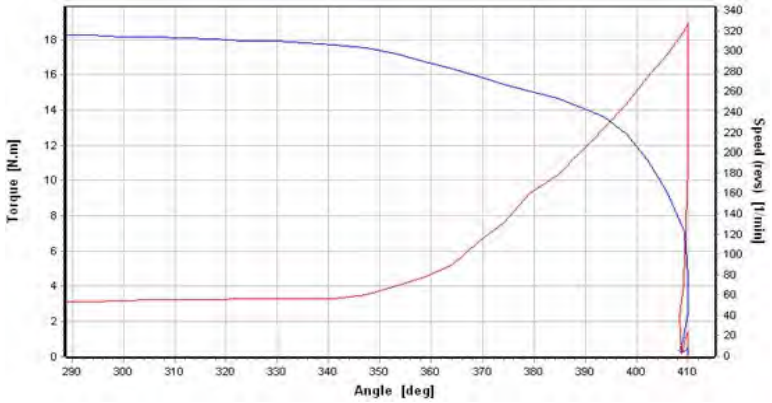
Angle degree: **30°**
Test torque: **18,5 Nm**



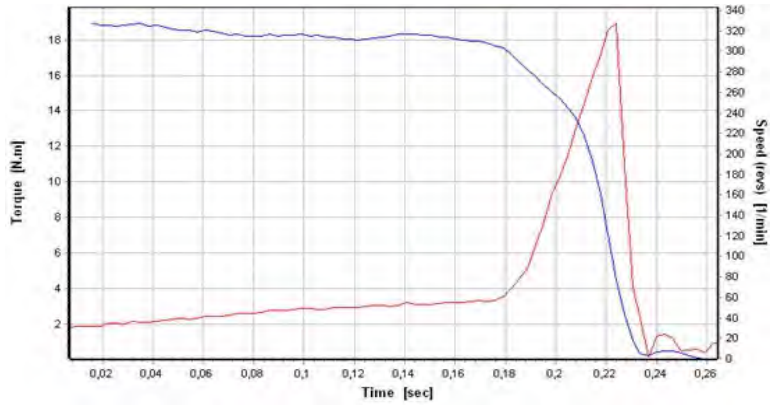
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

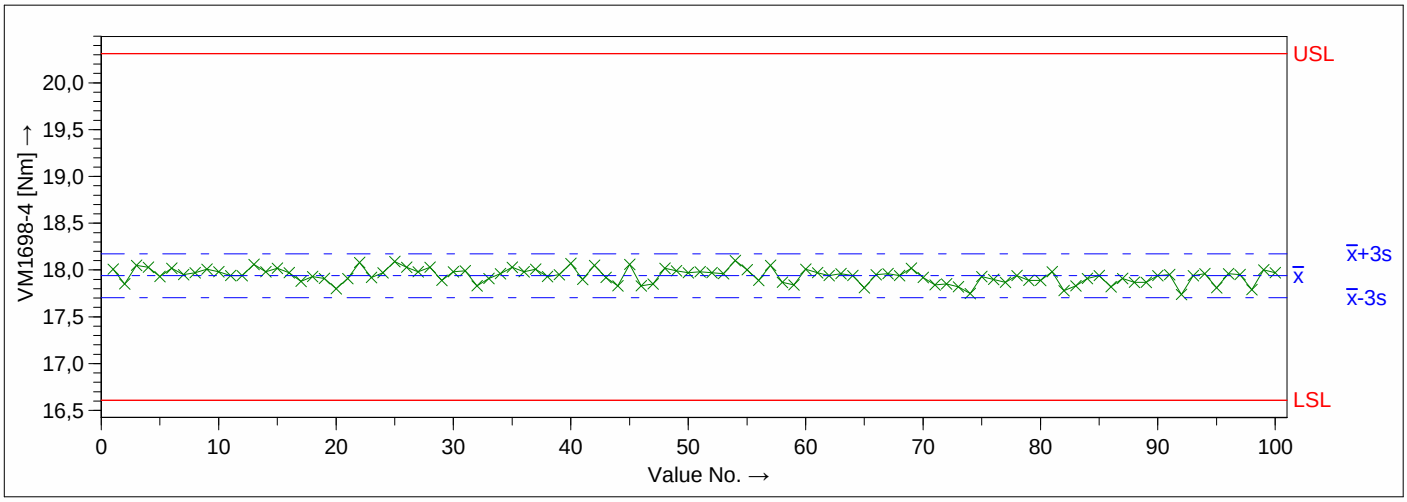
Machine Capability Study
Control System

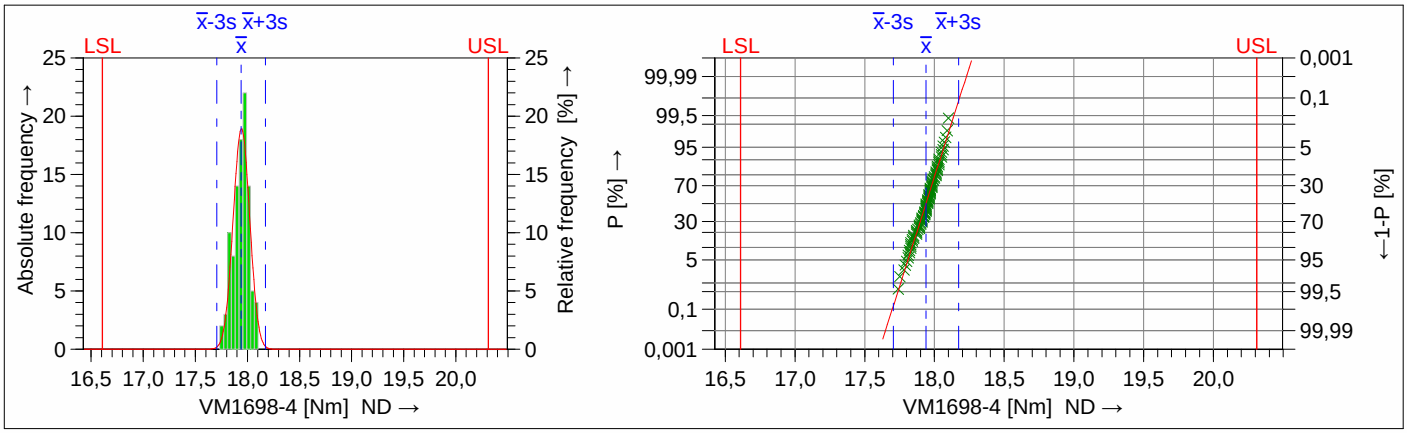
Plant	ATG Westhausen	Operator Name	Sorg
Date	15.01.2024		

Ord. No.	CLBA203	Part type	CLBA203	Contr.item	yes
Serial No.	ILJ1002_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 15.01.2024 10:50:08 to 15.01.2024 11:01:41

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





Drawing Values		Collected Values		Statistics	
T_m	18.46			$\bar{x}$	17.9387
LSL	16.61	x_{min}	17.74	$\bar{x}$-3s	17.7049
USL	20.31	x_{max}	18.10	$\bar{x}$+3s	18.1725
T	3.70	R	0.36	6s	0.4676
		$n_{<T>}$	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	7.91
Critical capability index	=	C_{mk}	5.68

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 15.01.2024

Serial No.	ILJ1002_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	18,01	17,85	18,05	18,03	17,93	18,02	17,95	17,97	18,01	17,98
1024210	VM1698-4	Grad	368,50	361,50	361,25	358,00	354,25	365,00	357,50	357,50	356,25	357,00

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	17,94	17,94	18,06	17,98	18,02	17,97	17,88	17,93	17,91	17,80
1024210	VM1698-4	Grad	354,50	359,50	355,75	358,50	360,25	354,50	354,75	355,00	351,50	352,25

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	17,91	18,08	17,92	17,97	18,09	18,03	17,98	18,03	17,89	17,98
1024210	VM1698-4	Grad	347,25	361,75	358,25	358,25	361,75	359,50	357,75	357,25	352,50	353,50

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	17,99	17,83	17,91	17,96	18,03	17,98	18,01	17,93	17,95	18,07
1024210	VM1698-4	Grad	358,25	349,00	352,25	351,50	354,75	354,25	356,50	354,00	358,50	360,75

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	17,90	18,05	17,92	17,83	18,06	17,83	17,85	18,02	17,99	17,97
1024210	VM1698-4	Grad	348,75	358,50	353,00	348,25	362,50	354,25	355,50	358,25	359,75	352,25

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	17,98	17,97	17,96	18,10	18,00	17,89	18,05	17,87	17,84	18,01
1024210	VM1698-4	Grad	354,50	357,25	356,25	361,25	357,50	349,25	353,25	353,25	346,75	356,75

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	17,97	17,94	17,96	17,94	17,81	17,95	17,96	17,94	18,02	17,92
1024210	VM1698-4	Grad	356,25	359,50	359,75	356,00	355,25	352,00	358,00	358,25	362,00	355,25

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	17,84	17,85	17,82	17,75	17,93	17,90	17,87	17,94	17,89	17,89
1024210	VM1698-4	Grad	354,25	354,00	355,00	348,75	357,75	352,75	351,00	361,75	363,50	359,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 15.01.2024

Serial No.	ILJ1002_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	17,98	17,78	17,83	17,91	17,94	17,82	17,91	17,87	17,87	17,94
1024210	VM1698-4	Grad	359,25	356,00	359,50	357,25	361,75	359,75	360,25	360,75	362,50	357,00

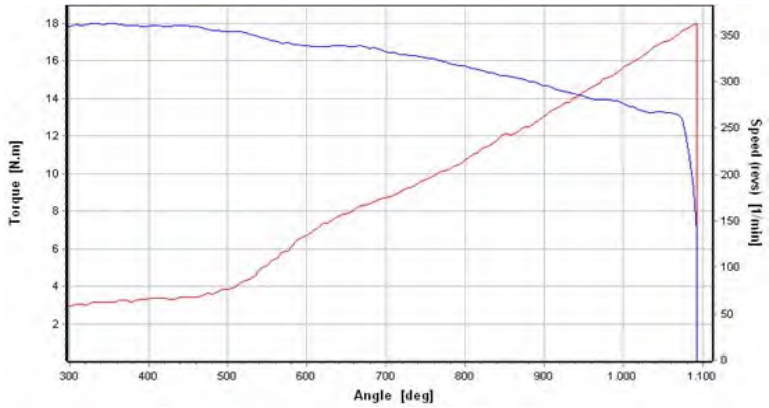
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	17,95	17,74	17,94	17,96	17,81	17,96	17,95	17,79	18,00	17,97
1024210	VM1698-4	Grad	361,00	352,00	359,00	359,00	350,50	358,50	360,50	355,75	362,25	359,25

Torque graphs

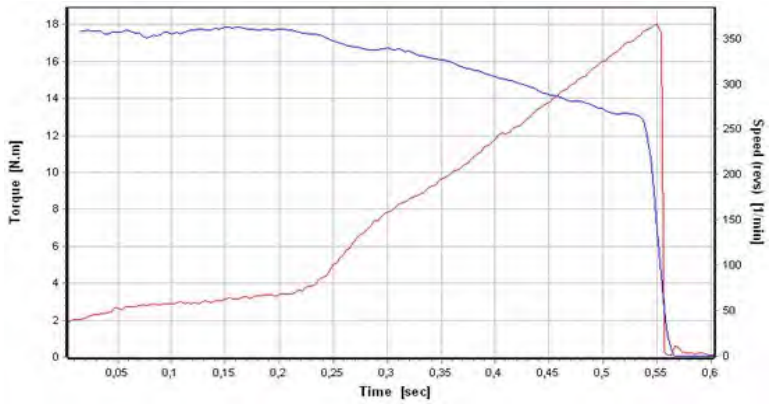
Machine Capability Study 80 %

Model: **CLBA203**
Serial no: **ILJ1002**

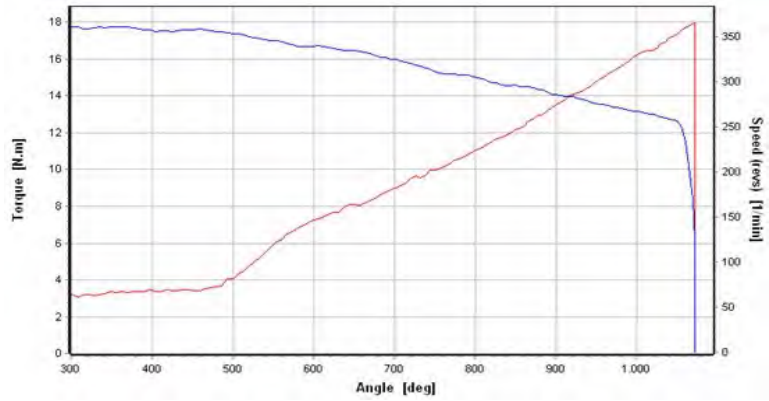
Angle degree: **360°**
Test torque: **18,5 Nm**



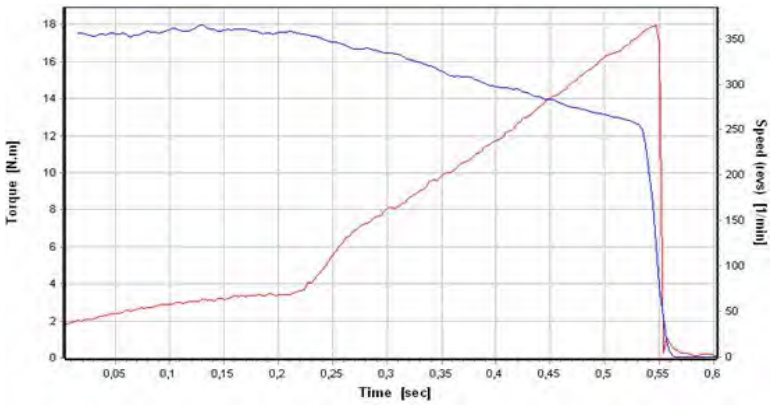
Value no. 1
Graph
Torque / Angle / Speed



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: **ILJ1002**

Test torque: Tq max. 21,00 Nm

Hard joint (H)	127,62	Nm / Revolution	Angle degree	30°
Soft joint (L)	10,28	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	21,27 Nm	20,56 Nm
	Standard deviation	0,20 Nm	0,13 Nm
	Torque scatter (99,73%)	1,19 Nm	0,76 Nm
	C_m	3,54	5,52
	C_{mk}	3,08	4,35

b)	Min. C_m hard/soft (lowest value)	3,54
	Min. C_{mk} hard/soft (lowest value)	3,08

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

Note:

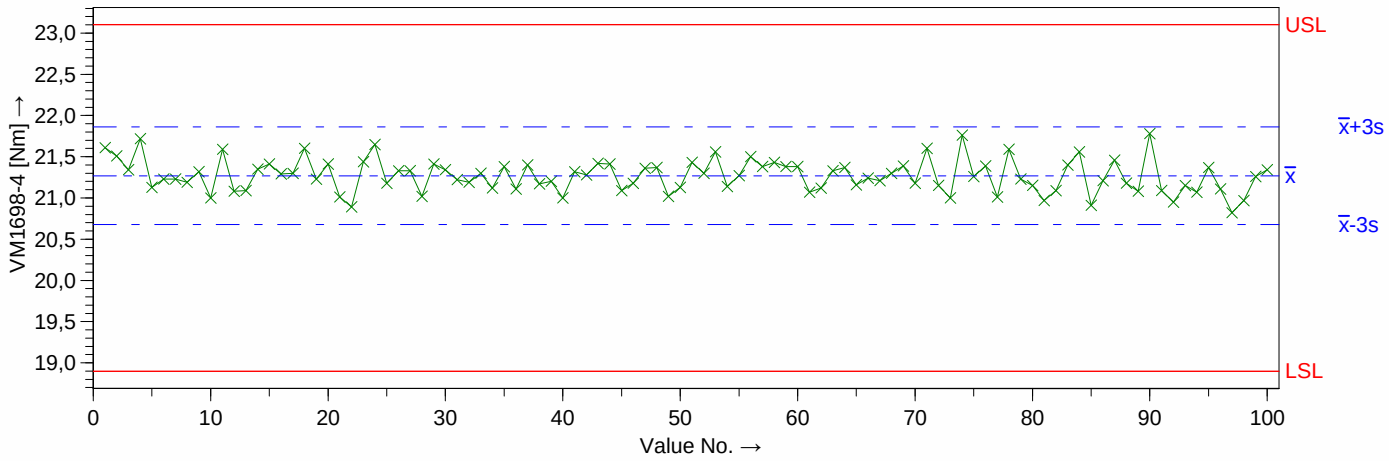
Machine Capability Study
Control System

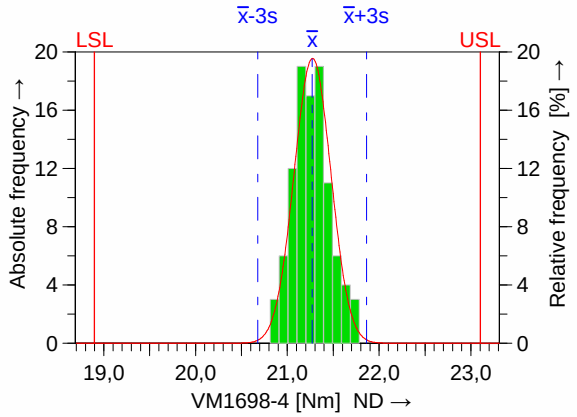
Plant	ATG Westhausen	Operator Name	Sorg
Date	15.01.2024		

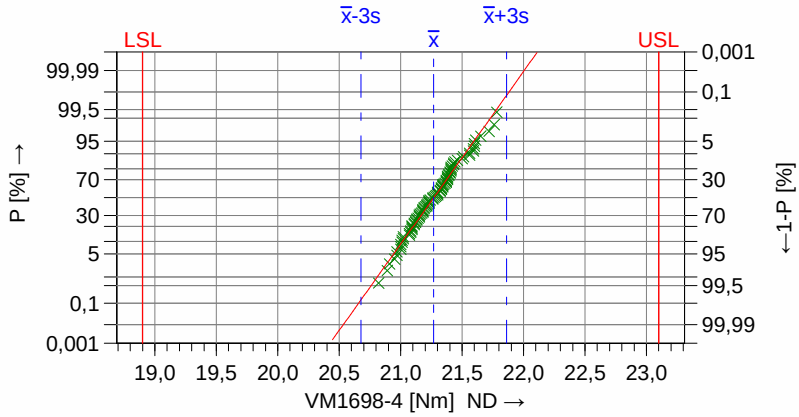
Ord. No.	CLBA203	Part type	CLBA203	Contr.item	yes
Serial No.	ILJ1002_b	Char.Descr.	VM1698-4	Nom.val. 21,00 / 2,10	USL 23,10
		Serial No.	1024210	Unit Nm / -2,10	LSL 18,90
Char.Type	variable			Tolerance value 10 %	Decimal Pl. 2
Cust.Name	ATG	Reference System	VM1698-4	Test Electronic	---
Contr.No.	Homologation	Reference Transducer	50/1024729	nges.	100

Evaluation from 15.01.2024 11:29:46 to 15.01.2024 11:41:19

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







Drawing Values		Collected Values		Statistics	
T_m	21.00			$\bar{x}$	21.2695
LSL	18.90	x_{min}	20.82	$\bar{x}$-3s	20.6759
USL	23.10	x_{max}	21.78	$\bar{x}$+3s	21.8631
T	4.20	R	0.96	6s	1.1872
		$n_{<T>}$	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	3.54
Critical capability index	=	C_{mk}	3.08

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 15.01.2024

Serial No.	ILJ1002_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	21,61	21,51	21,34	21,72	21,13	21,23	21,23	21,19	21,32	21,00
1024210	VM1698-4	Grad	31,50	30,75	30,75	30,75	29,50	28,75	29,00	29,25	29,00	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	21,59	21,08	21,09	21,35	21,41	21,29	21,30	21,60	21,23	21,41
1024210	VM1698-4	Grad	30,50	28,25	29,25	30,00	30,00	28,75	29,00	29,50	29,25	29,75

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	21,01	20,89	21,44	21,65	21,18	21,33	21,33	21,02	21,41	21,34
1024210	VM1698-4	Grad	29,50	29,50	30,00	30,50	29,00	28,75	29,50	28,75	29,25	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	21,22	21,19	21,30	21,12	21,38	21,11	21,40	21,17	21,20	21,00
1024210	VM1698-4	Grad	29,25	29,75	29,75	29,75	30,00	29,25	29,75	29,50	29,75	29,00

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	21,32	21,28	21,42	21,41	21,09	21,18	21,36	21,37	21,02	21,13
1024210	VM1698-4	Grad	30,00	29,00	30,50	30,00	29,50	29,00	30,00	29,75	29,50	29,25

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	21,43	21,30	21,56	21,14	21,27	21,50	21,38	21,43	21,38	21,38
1024210	VM1698-4	Grad	30,25	30,00	30,25	29,75	30,00	30,25	30,00	30,00	29,50	29,75

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	21,07	21,12	21,33	21,37	21,16	21,24	21,21	21,30	21,39	21,18
1024210	VM1698-4	Grad	29,00	29,75	30,25	30,00	29,75	30,00	29,50	29,75	29,75	29,75

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	21,60	21,15	21,00	21,76	21,26	21,39	21,01	21,59	21,23	21,15
1024210	VM1698-4	Grad	30,50	29,25	28,75	31,00	29,50	29,50	29,25	30,25	29,50	29,50

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 15.01.2024

Serial No.	ILJ1002_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	20,97	21,09	21,40	21,56	20,91	21,21	21,46	21,18	21,08	21,78
1024210	VM1698-4	Grad	28,75	29,75	31,00	31,00	29,00	29,75	30,00	29,75	29,50	30,75

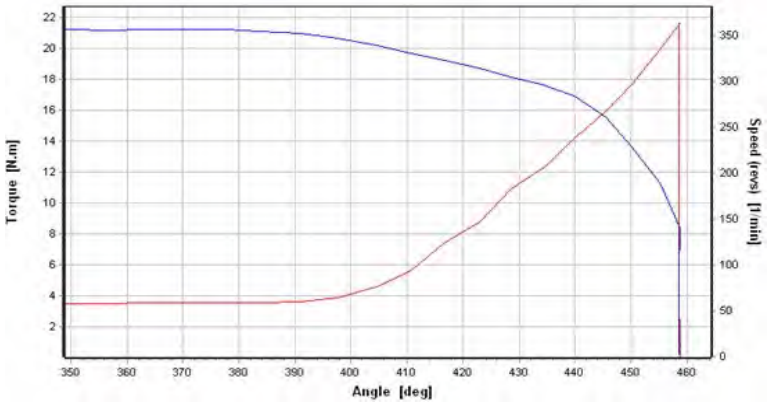
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	21,09	20,95	21,15	21,07	21,37	21,11	20,82	20,97	21,26	21,34
1024210	VM1698-4	Grad	29,00	29,75	30,25	29,75	30,00	29,25	28,75	30,50	30,25	30,25

Torque graphs

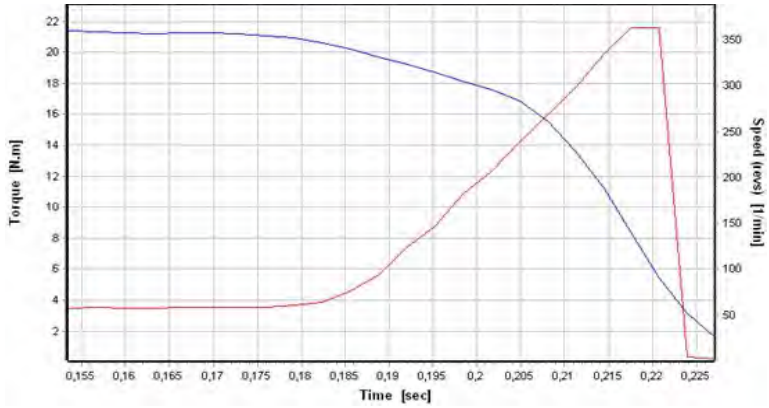
Machine Capability Study 100 %

Model: **CLBA203**
Serial no: **ILJ1002**

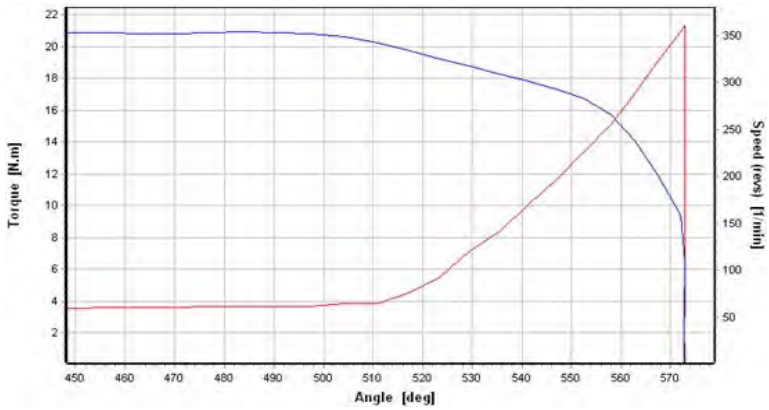
Angle degree: **30°**
Test torque: **21,0 Nm**



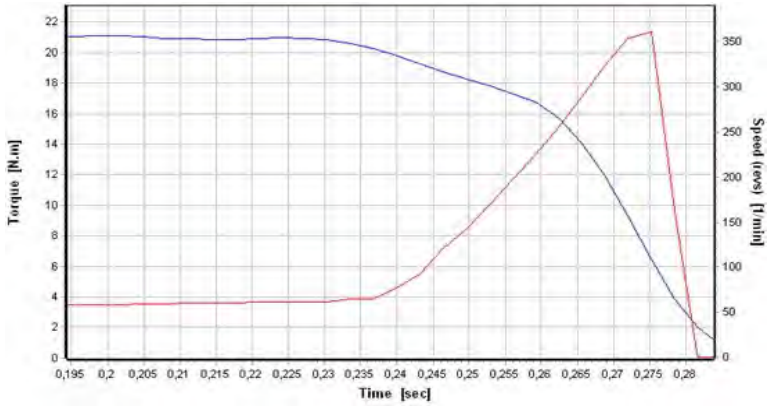
Value no. 1
Graph
Torque / Angle / Speed



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

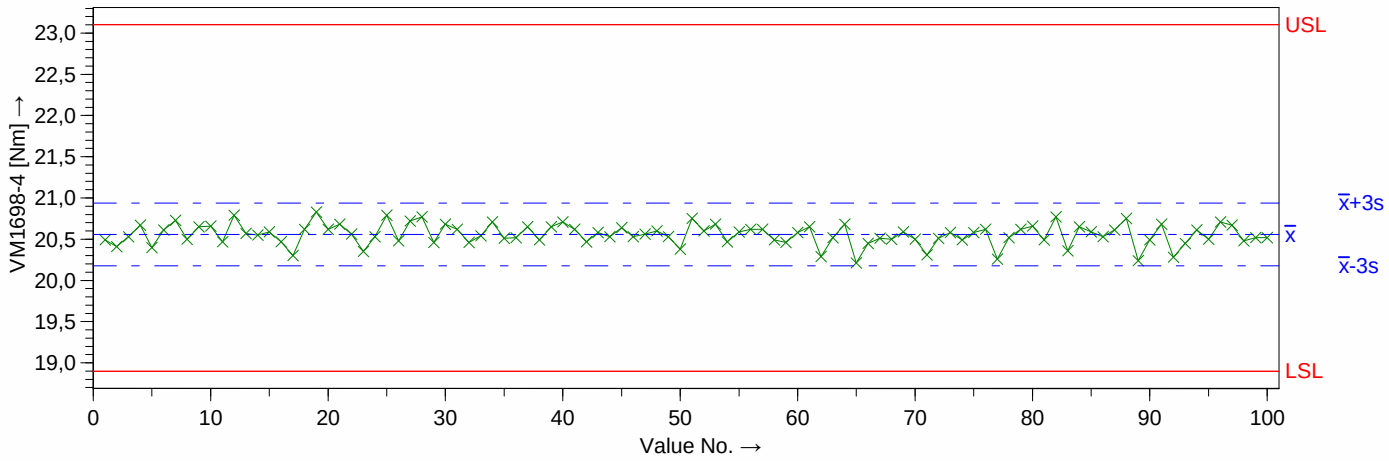
Cleco Production Tools

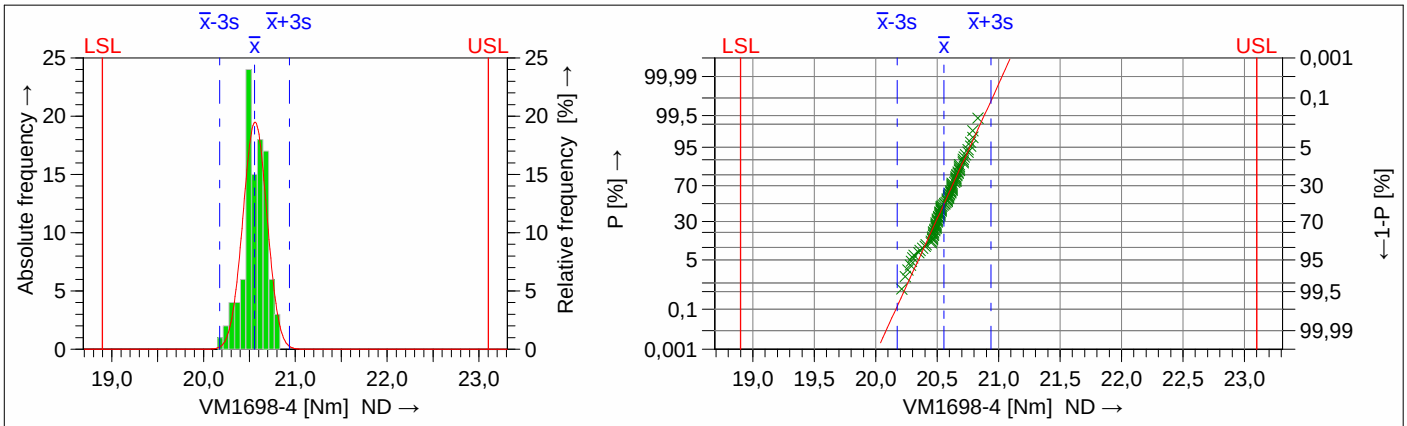
Plant	ATG Westhausen	Operator Name	Sorg
Date	15.01.2024		

Ord. No.	CLBA203	Part type	CLBA203	Contr.item	yes
Serial No.	ILJ1002_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 15.01.2024 11:13:46 to 15.01.2024 11:25:19

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





Drawing Values		Collected Values		Statistics	
T_m	21.00			$\bar{x}$	20.5559
LSL	18.90	x_{min}	20.21	$\bar{x}$-3s	20.1754
USL	23.10	x_{max}	20.83	$\bar{x}$+3s	20.9364
T	4.20	R	0.62	6s	0.7611
		$n_{<T>}$	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	5.52
Critical capability index	=	C_{mk}	4.35

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 15.01.2024

Serial No.	ILJ1002_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				

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	20,49	20,41	20,53	20,67	20,40	20,61	20,73	20,50	20,65	20,66
1024210	VM1698-4	Grad	355,50	357,50	354,25	360,00	350,75	361,75	358,50	352,25	359,50	357,75

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	20,47	20,79	20,57	20,55	20,59	20,47	20,30	20,62	20,83	20,62
1024210	VM1698-4	Grad	357,75	362,50	354,00	359,25	355,50	352,50	348,25	357,75	361,00	346,75

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	20,68	20,56	20,35	20,53	20,79	20,48	20,72	20,77	20,46	20,68
1024210	VM1698-4	Grad	357,00	355,50	350,00	354,75	359,50	347,00	355,50	358,00	353,75	354,25

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	20,62	20,46	20,54	20,71	20,51	20,52	20,65	20,49	20,65	20,71
1024210	VM1698-4	Grad	347,50	357,00	349,50	360,75	349,75	350,25	353,50	353,00	359,75	364,75

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	20,62	20,47	20,58	20,53	20,64	20,53	20,56	20,60	20,53	20,38
1024210	VM1698-4	Grad	361,75	348,75	359,75	356,75	360,00	355,50	360,75	358,50	358,25	351,25

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	20,75	20,60	20,68	20,47	20,59	20,62	20,62	20,49	20,46	20,58
1024210	VM1698-4	Grad	363,50	357,75	360,50	350,25	359,75	356,75	355,25	355,25	355,50	354,50

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	20,65	20,29	20,52	20,68	20,21	20,45	20,51	20,50	20,59	20,50
1024210	VM1698-4	Grad	360,50	347,75	357,50	357,75	345,00	350,75	353,25	353,75	356,50	351,00

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	20,31	20,51	20,58	20,49	20,58	20,62	20,26	20,52	20,62	20,66
1024210	VM1698-4	Grad	346,75	356,75	357,00	351,50	359,00	359,50	349,00	358,25	357,50	357,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 15.01.2024

Serial No.	ILJ1002_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				

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	20,49	20,77	20,36	20,65	20,59	20,53	20,61	20,75	20,24	20,49
1024210	VM1698-4	Grad	349,50	361,75	344,50	360,75	359,75	357,50	359,00	361,00	345,50	356,00

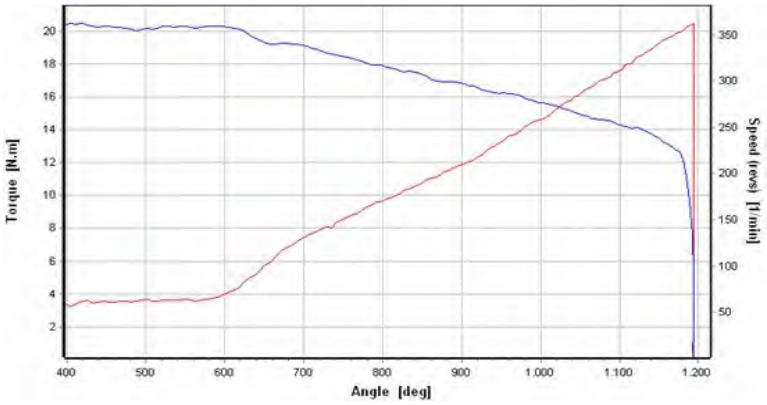
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	20,68	20,28	20,45	20,61	20,50	20,71	20,67	20,48	20,52	20,52
1024210	VM1698-4	Grad	359,75	347,25	355,00	357,00	358,75	360,25	360,25	349,75	349,75	352,50

Torque graphs

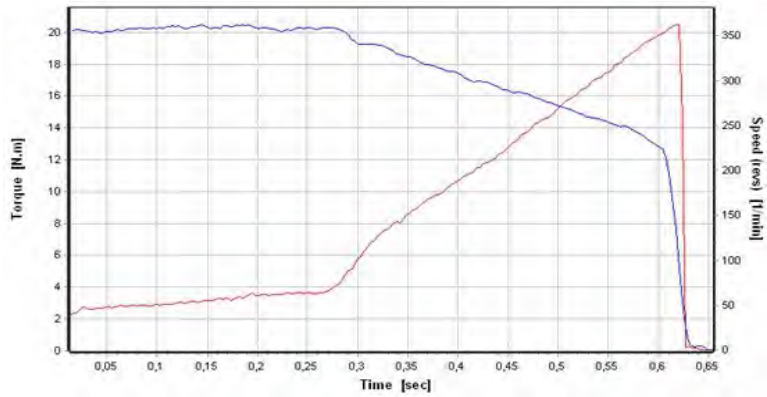
Machine Capability Study 100 %

Model: **CLBA203**
Serial no: **ILJ1002**

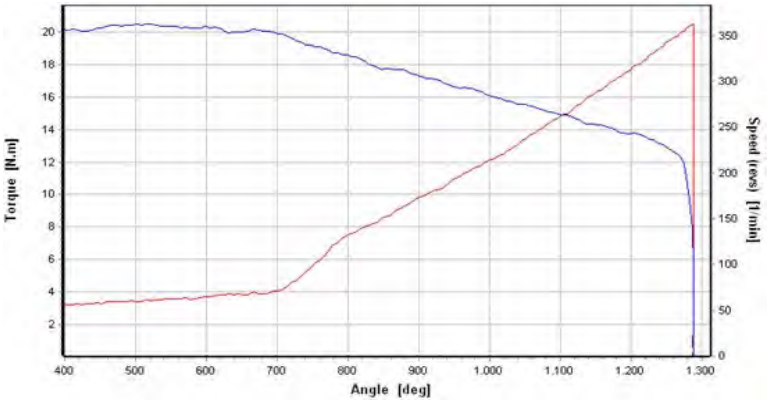
Angle degree: **360°**
Test torque: **21,0 Nm**



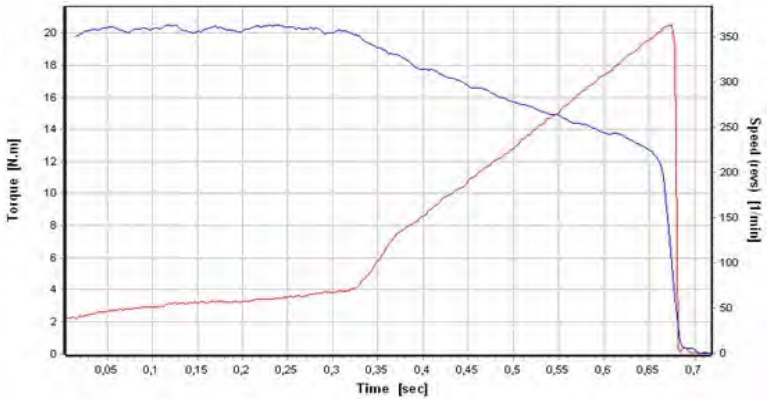
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed