Homologation

Cordless Assembly Tools

Model: CLBA203

Serial no.: ILJ1001

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Homologation: CLBA203 SN: ILJ1001

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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: **ILJ1001**

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

Hard joint (H)	73,48	Nm / Revolution	Angle degree	30°
Soft joint (L)	5,86	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	12,25 Nm	11,71 Nm
	Standard deviation	0,18 Nm	0,10 Nm
	Torque scatter (99,73%)	1,08 Nm	0,61 Nm
	C_m	2,24	3,94
	C_{mk}	1,99	2,64

b)	Min. C_m hard/soft (lowest value)	2,24
	Min. C_{mk} hard/soft (lowest value)	1,99

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

Note:

Machine Capability Study
Control System

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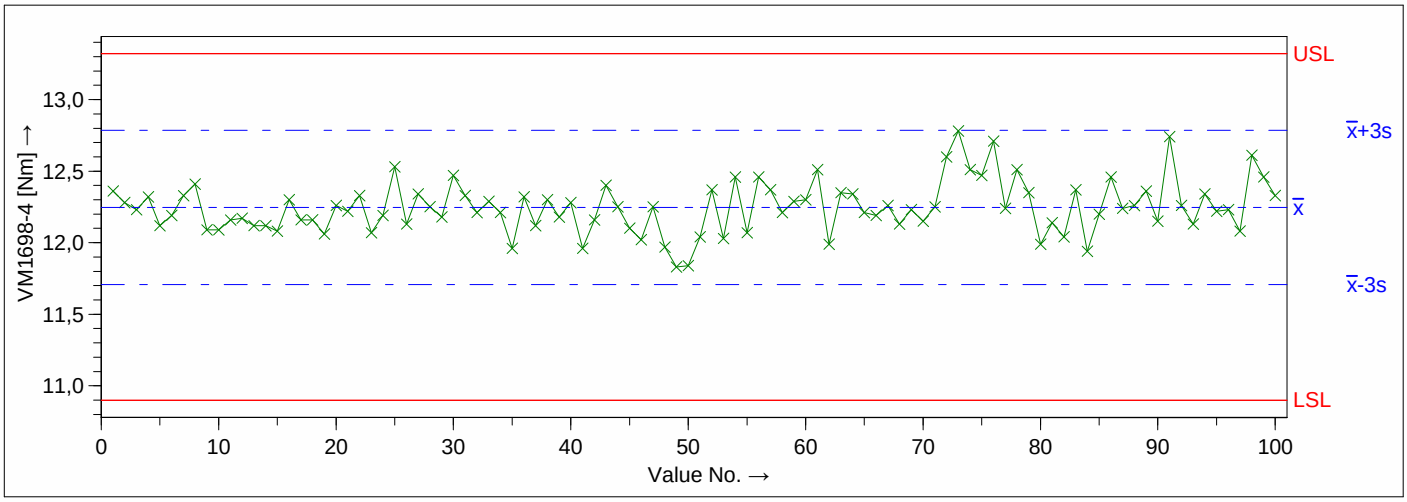
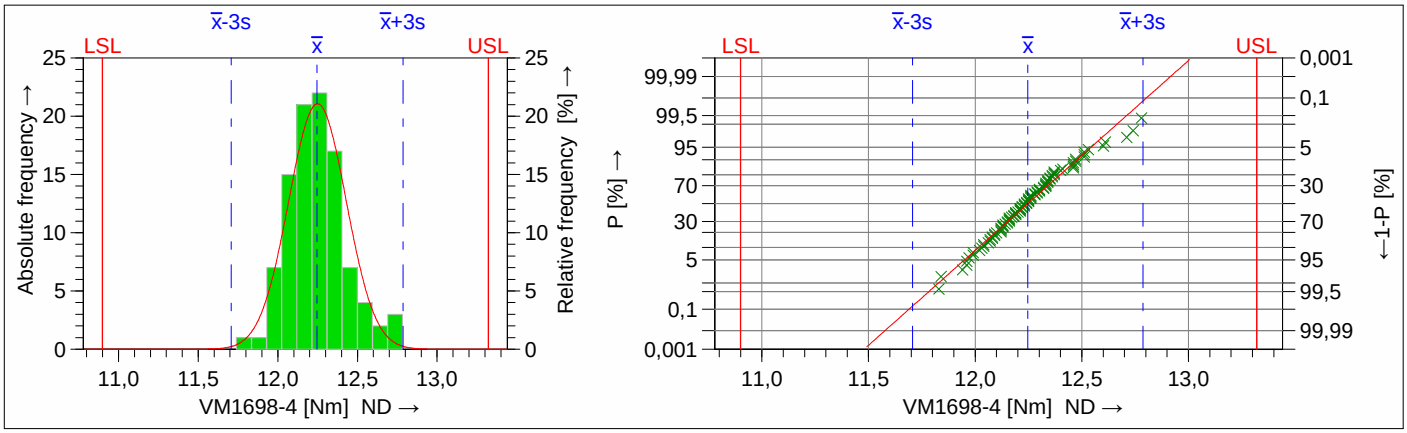
Plant	ATG Westhausen	Operator Name	Sorg
Date	16.02.2024		

Ord. No.	CLBA203	Part type	CLBA203	Contr.item	yes
Serial No.	ILJ1001_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	CLECO	Reference System	VM1698-4	Test Electronic	---
Contr.No.	Homologation	Reference Transducer	50/1024729	nges.	100

Evaluation from 16.02.2024 11:37:05 to 16.02.2024 11:48:39

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





Drawing Values		Collected Values		Statistics	
T_m	12.11			$\bar{x}$	12.2463
LSL	10.90	x_{min}	11.83	$\bar{x}$-3s	11.7066
USL	13.32	x_{max}	12.78	$\bar{x}$+3s	12.7860
T	2.42	R	0.95	6s	1.0795
		$n_{<T>}$	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	2.24
Critical capability index	=	C_{mk}	1.99

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

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Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 16.02.2024

Serial No.	ILJ1001_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	12,36	12,28	12,23	12,32	12,12	12,19	12,33	12,41	12,09	12,09
1024210	VM1698-4	Grad	31,00	31,50	33,00	30,25	30,50	28,75	30,00	30,50	29,25	27,75

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	12,16	12,17	12,12	12,12	12,08	12,30	12,16	12,16	12,06	12,26
1024210	VM1698-4	Grad	30,25	29,00	28,75	29,75	30,50	30,50	28,00	30,50	30,25	31,75

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	12,22	12,33	12,07	12,19	12,53	12,13	12,34	12,25	12,18	12,47
1024210	VM1698-4	Grad	31,25	30,50	31,75	30,25	32,25	30,25	31,50	30,75	29,75	32,25

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	12,33	12,21	12,29	12,21	11,96	12,32	12,12	12,30	12,18	12,28
1024210	VM1698-4	Grad	28,50	29,25	30,25	30,00	28,00	29,75	30,00	30,25	29,50	30,25

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	11,96	12,16	12,40	12,25	12,10	12,02	12,25	11,97	11,83	11,84
1024210	VM1698-4	Grad	27,25	29,25	28,75	29,50	29,25	28,50	30,00	28,00	26,50	27,50

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	12,04	12,37	12,03	12,46	12,07	12,46	12,37	12,21	12,29	12,30
1024210	VM1698-4	Grad	30,00	31,25	30,50	31,25	29,50	32,25	31,75	29,75	31,00	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	12,51	11,99	12,35	12,34	12,21	12,19	12,26	12,13	12,23	12,15
1024210	VM1698-4	Grad	32,00	29,25	30,50	31,00	30,50	29,75	31,75	30,00	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	12,25	12,60	12,78	12,51	12,47	12,71	12,24	12,51	12,35	11,99
1024210	VM1698-4	Grad	31,00	33,50	32,25	32,00	30,75	32,50	30,50	27,25	30,50	27,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 16.02.2024

Serial No.	ILJ1001_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	12,14	12,04	12,37	11,94	12,20	12,46	12,24	12,26	12,36	12,15
1024210	VM1698-4	Grad	28,25	27,00	28,00	20,00	28,50	30,00	30,25	29,75	30,25	29,75

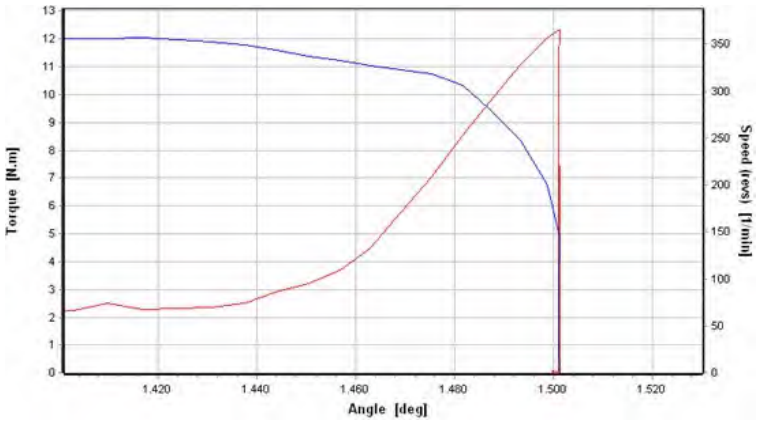
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	12,74	12,26	12,13	12,34	12,22	12,23	12,08	12,61	12,46	12,33
1024210	VM1698-4	Grad	32,25	29,50	29,75	30,25	29,50	30,50	29,50	33,25	31,75	31,25

Torque graphs

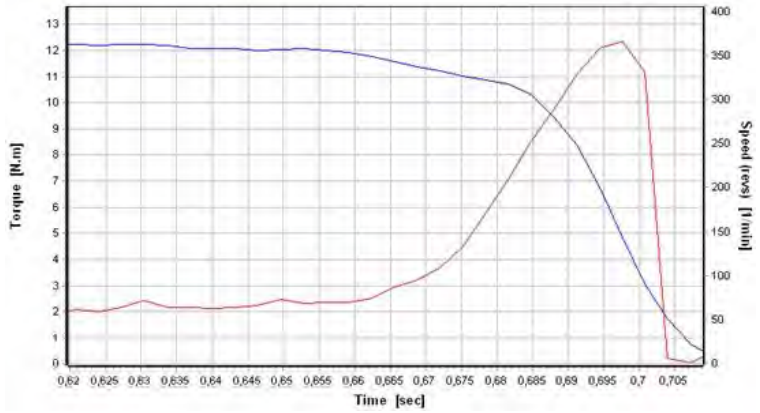
Machine Capability Study 30 %

Model: **CLBA203**
Serial no: **ILJ1001**

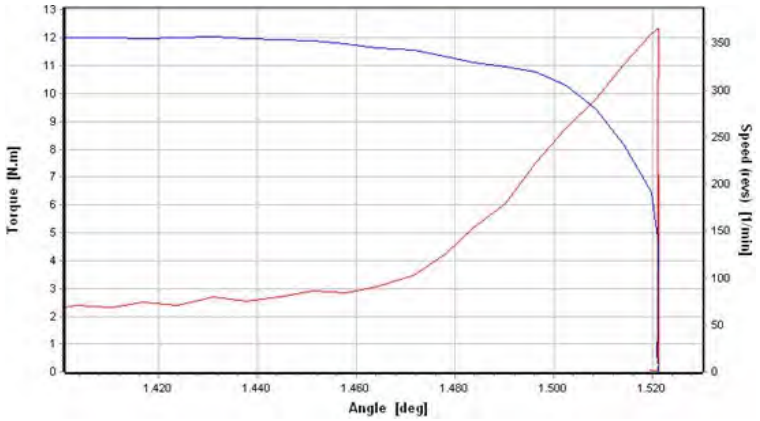
Angle degree: **30°**
Test torque: **12,1 Nm**



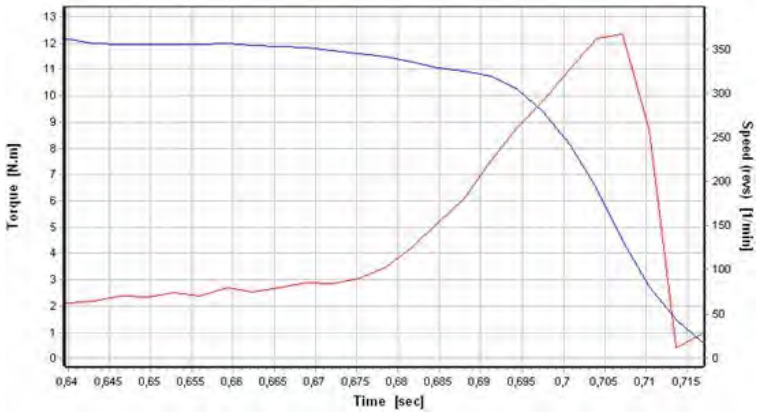
Value no. 1
Graph
Torque / Angle / Speed



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

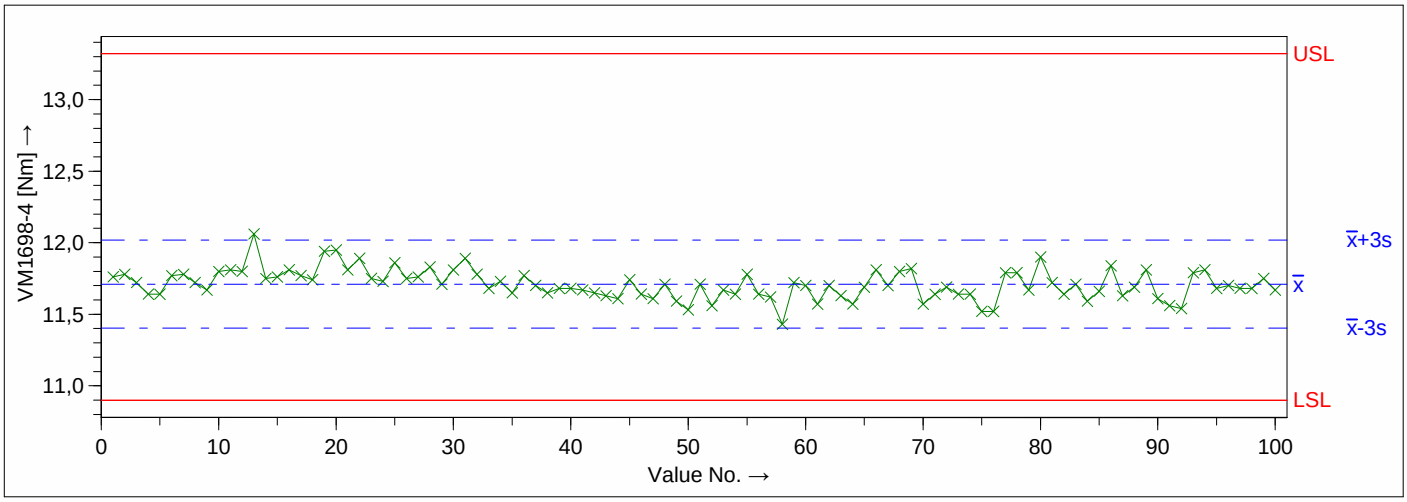
Cleco Production Tools

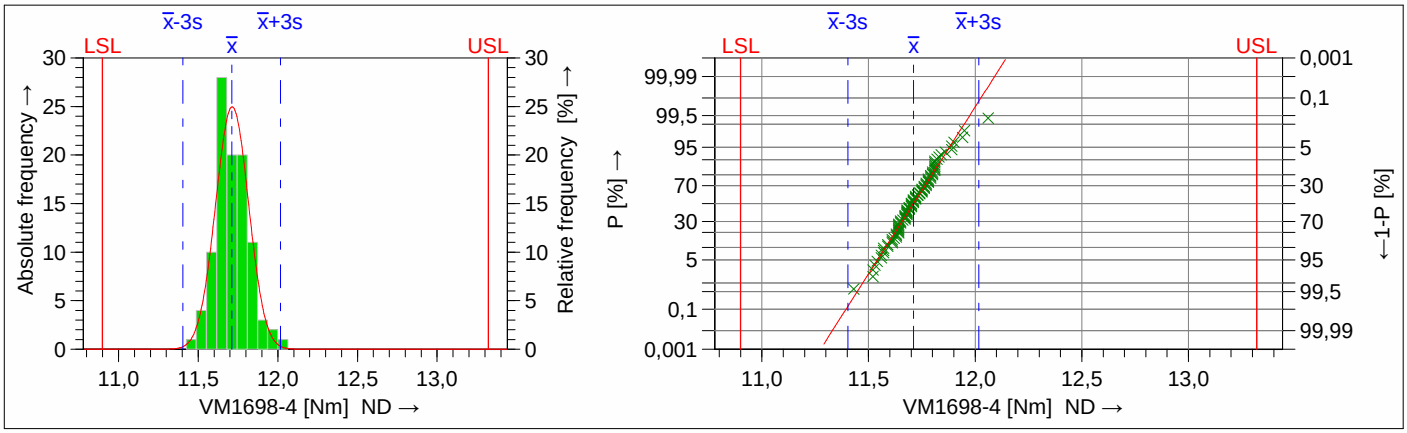
Plant	ATG Westhausen	Operator Name	Sorg
Date	16.02.2024		

Ord. No.	CLBA203	Part type	CLBA203	Contr.item	yes
Serial No.	ILJ1001_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	CLECO	Reference System	VM1698-4	Test Electronic	---
Contr.No.	Homologation	Reference Transducer	50/1024729	nges.	100

Evaluation from 16.02.2024 11:19:25 to 16.02.2024 11:30:59

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





Drawing Values		Collected Values		Statistics	
T_m	12.11			x̄	11.7105
LSL	10.90	x_{min}	11.43	x̄-3s	11.4038
USL	13.32	x_{max}	12.06	x̄+3s	12.0172
T	2.42	R	0.63	6s	0.6134
		$n_{<T>}$	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	3.94
Critical capability index	=	C_{mk}	2.64

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 16.02.2024

Serial No.	ILJ1001_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	11,76	11,78	11,72	11,64	11,64	11,77	11,78	11,72	11,67	11,80
1024210	VM1698-4	Grad	362,50	344,00	362,25	357,00	361,25	363,00	349,25	367,50	376,75	381,50

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	11,81	11,80	12,06	11,75	11,76	11,81	11,77	11,74	11,94	11,95
1024210	VM1698-4	Grad	367,75	355,75	367,00	364,25	369,75	372,00	354,50	351,50	369,00	368,75

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	11,81	11,89	11,75	11,73	11,86	11,75	11,76	11,83	11,71	11,81
1024210	VM1698-4	Grad	358,25	369,75	347,50	345,25	361,00	350,00	351,50	350,50	348,75	348,75

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	11,89	11,78	11,68	11,73	11,65	11,77	11,70	11,65	11,68	11,68
1024210	VM1698-4	Grad	362,50	369,00	349,25	360,75	354,50	368,75	361,50	361,25	350,25	361,50

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	11,67	11,65	11,63	11,61	11,74	11,64	11,61	11,71	11,59	11,53
1024210	VM1698-4	Grad	364,25	363,50	361,50	345,25	346,00	349,75	371,00	362,25	354,25	343,00

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	11,71	11,56	11,67	11,64	11,78	11,64	11,62	11,43	11,72	11,70
1024210	VM1698-4	Grad	358,75	378,25	364,50	354,00	373,00	365,25	373,00	346,75	390,50	359,75

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	11,57	11,70	11,63	11,57	11,69	11,81	11,70	11,80	11,82	11,57
1024210	VM1698-4	Grad	356,50	361,00	356,75	349,00	361,25	368,75	375,75	387,50	369,00	347,50

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	11,64	11,69	11,64	11,64	11,52	11,52	11,79	11,79	11,67	11,90
1024210	VM1698-4	Grad	354,25	362,75	358,00	360,00	360,50	351,50	351,00	371,25	364,25	364,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 16.02.2024

Serial No.	ILJ1001_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				

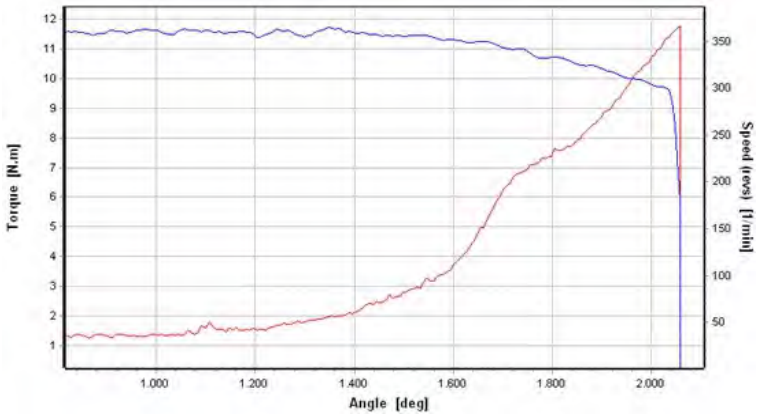
Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	Nm	11,72	11,64	11,71	11,59	11,66	11,84	11,63	11,69	11,81	11,61
1024210	VM1698-4	Grad	351,00	346,00	341,25	349,50	352,25	354,00	382,25	367,00	367,00	367,00

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	11,56	11,54	11,79	11,81	11,68	11,70	11,68	11,68	11,75	11,67
1024210	VM1698-4	Grad	361,00	336,50	383,50	363,00	361,00	369,75	349,25	347,25	348,75	355,50

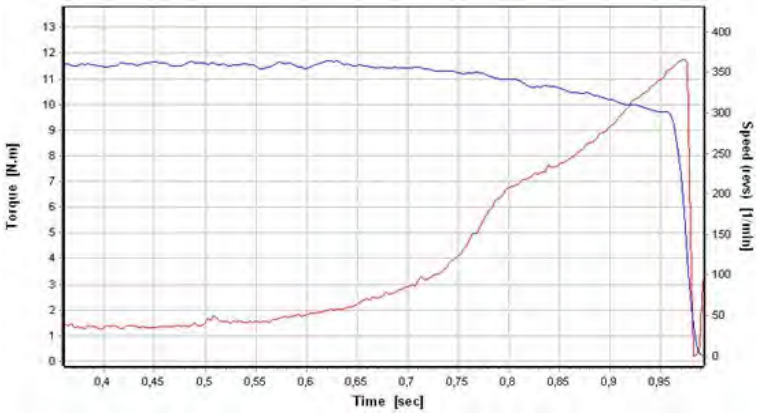
Machine Capability Study 30 %

Model: **CLBA203**
Serial no: **ILJ1001**

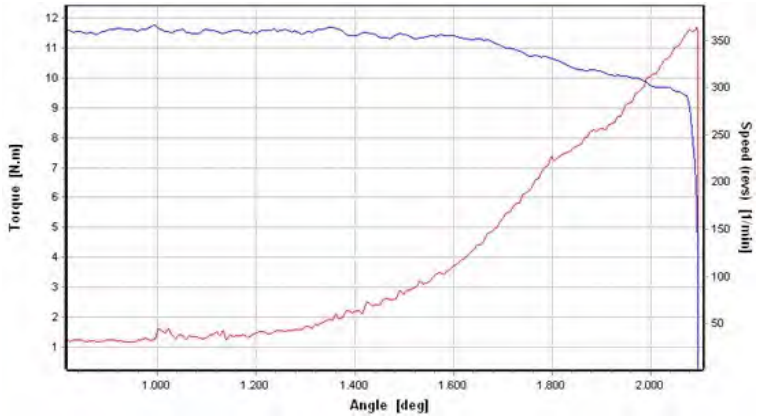
Angle degree: **360°**
Test torque: **12,1 Nm**



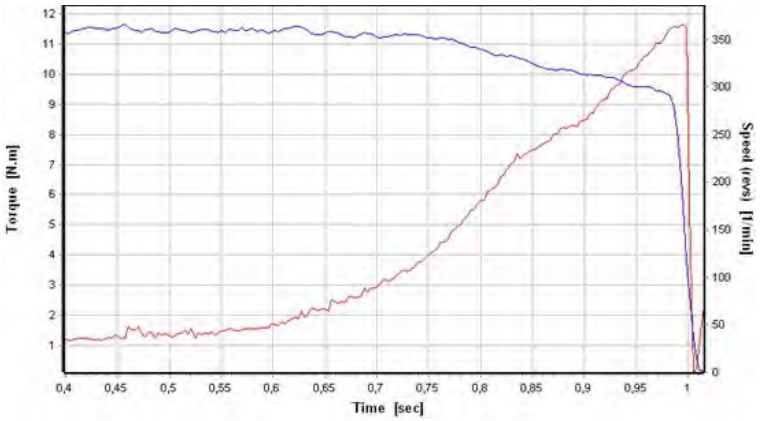
Value no. 1
Graph
Torque / Angle / Speed



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: **ILJ1001**

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

Hard joint (H)	112,22	Nm / Revolution	Angle degree	30°
Soft joint (L)	9,03	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	18,70 Nm	18,06 Nm
	Standard deviation	0,25 Nm	0,12 Nm
	Torque scatter (99,73%)	1,49 Nm	0,75 Nm
	C_m	2,49	4,95
	C_{mk}	2,16	3,89

b)	Min. C_m hard/soft (lowest value)	2,49
	Min. C_{mk} hard/soft (lowest value)	2,16

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

Note:

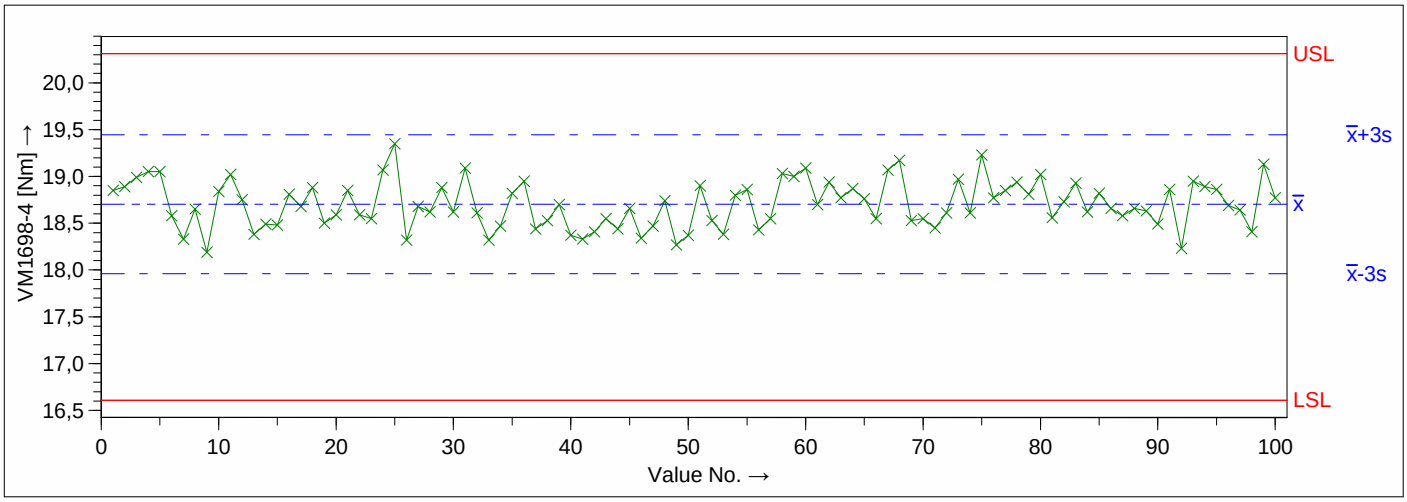
Machine Capability Study
Control System

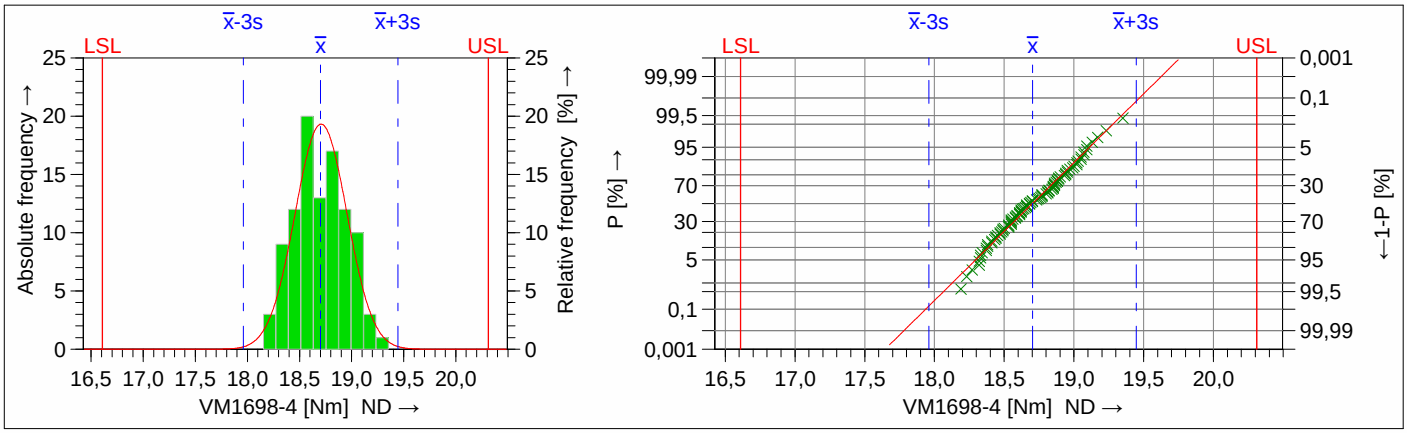
Plant	ATG Westhausen	Operator Name	Sorg
Date	16.02.2024		

Ord. No.	CLBA203	Part type	CLBA203	Contr.item	yes
Serial No.	ILJ1001_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	CLECO	Reference System	VM1698-4	Test Electronic	---
Contr.No.	Homologation	Reference Transducer	50/1024729	nges.	100

Evaluation from 16.02.2024 12:03:58 to 16.02.2024 12:15:31

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





Drawing Values		Collected Values		Statistics	
T_m	18.46			$\bar{x}$	18.7026
LSL	16.61	x_{min}	18.19	$\bar{x}$-3s	17.9594
USL	20.31	x_{max}	19.35	$\bar{x}$+3s	19.4458
T	3.70	R	1.16	6s	1.4863
		$n_{<T>}$	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}	2.16

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 16.02.2024

Serial No.	ILJ1001_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	18,85	18,89	18,99	19,05	19,05	18,58	18,33	18,65	18,19	18,84
1024210	VM1698-4	Grad	30,50	30,50	30,75	32,25	30,25	29,25	29,50	29,50	28,00	30,25

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	19,02	18,75	18,38	18,49	18,48	18,81	18,68	18,88	18,50	18,59
1024210	VM1698-4	Grad	30,50	30,75	29,00	29,00	30,00	29,75	29,75	30,50	29,00	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	18,85	18,59	18,55	19,07	19,35	18,32	18,68	18,62	18,88	18,62
1024210	VM1698-4	Grad	29,25	28,25	29,00	31,75	31,75	28,75	29,75	29,75	30,50	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	19,09	18,61	18,32	18,47	18,82	18,95	18,44	18,53	18,70	18,37
1024210	VM1698-4	Grad	31,25	29,50	28,50	29,25	29,75	31,25	29,25	29,75	29,75	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	18,33	18,41	18,55	18,44	18,66	18,34	18,47	18,74	18,27	18,37
1024210	VM1698-4	Grad	28,75	29,50	30,00	30,50	30,75	28,75	30,50	30,75	30,00	29,50

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	18,90	18,53	18,38	18,80	18,86	18,43	18,55	19,03	19,00	19,09
1024210	VM1698-4	Grad	29,75	30,75	29,75	31,00	31,00	29,00	30,00	31,50	31,25	30,75

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	18,70	18,94	18,77	18,87	18,76	18,55	19,07	19,17	18,53	18,55
1024210	VM1698-4	Grad	30,00	30,00	29,75	29,75	29,75	31,00	30,50	30,25	30,00	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	18,45	18,61	18,97	18,61	19,23	18,77	18,85	18,94	18,81	19,02
1024210	VM1698-4	Grad	30,25	30,75	31,00	30,00	32,25	29,75	30,50	30,75	29,50	29,50

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 16.02.2024

Serial No.	ILJ1001_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	18,56	18,73	18,93	18,62	18,82	18,66	18,58	18,66	18,63	18,49
1024210	VM1698-4	Grad	30,50	30,00	30,25	29,00	29,75	29,00	30,25	29,00	29,25	28,75

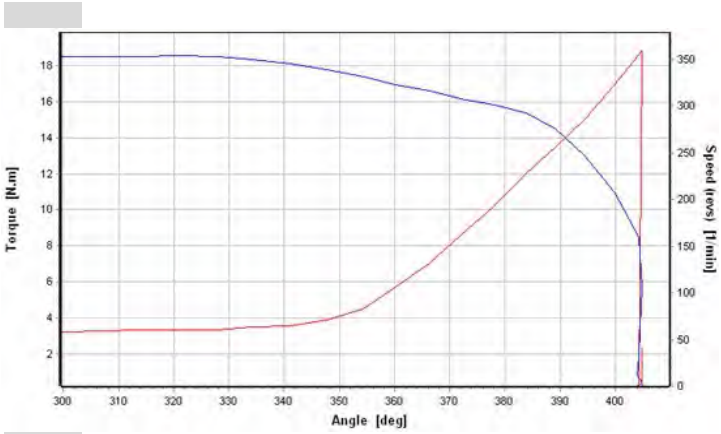
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	18,86	18,23	18,95	18,89	18,86	18,69	18,64	18,41	19,13	18,77
1024210	VM1698-4	Grad	30,75	28,50	30,25	30,50	30,25	30,25	31,00	29,75	32,00	30,25

Torque graphs

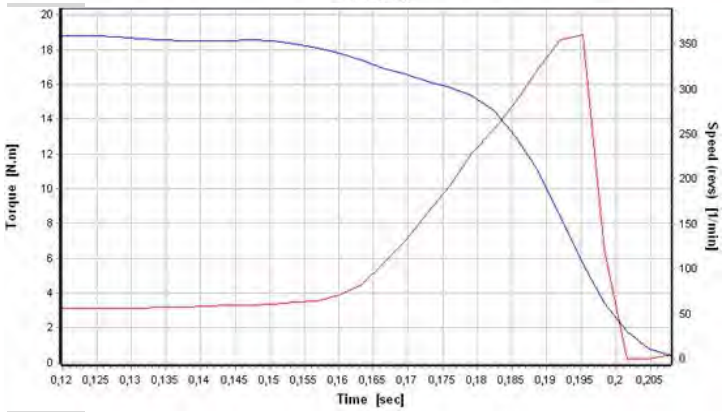
Model: **CLBA203**
Serial no: **ILJ1001**

Machine Capability Study 80 %

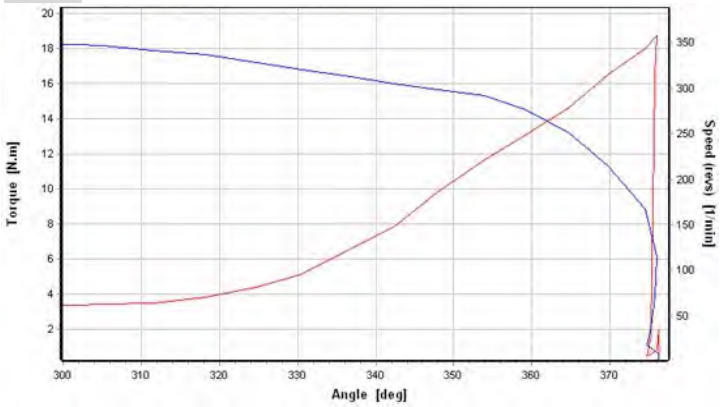
Angle degree: **30°**
Test torque: **18,5 Nm**



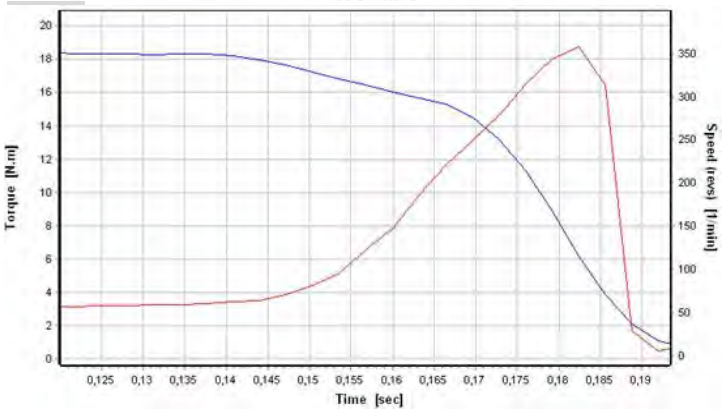
Value no. 1
Graph
Torque / Angle / Speed



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

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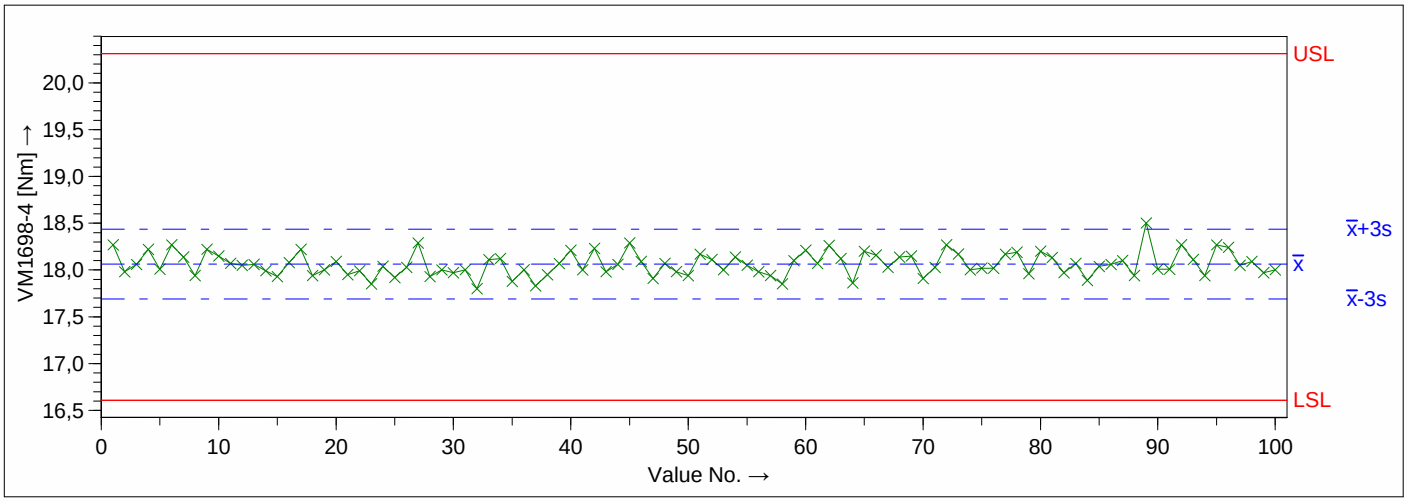
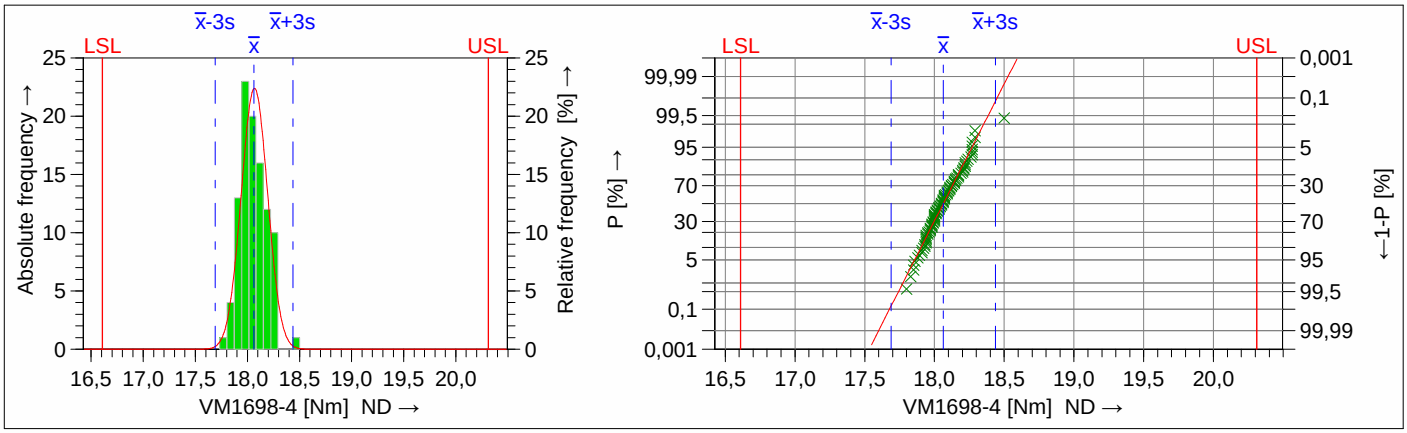
Plant	ATG Westhausen	Operator Name	Sorg
Date	16.02.2024		

Ord. No.	CLBA203	Part type	CLBA203	Contr.item	yes
Serial No.	ILJ1001_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	CLECO	Reference System	VM1698-4	Test Electronic	---
Contr.No.	Homologation	Reference Transducer	50/1024729	nges.	100

Evaluation from 16.02.2024 12:16:37 to 16.02.2024 12:28:11

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





Drawing Values		Collected Values		Statistics	
T_m	18.46			$\bar{x}$	18.0632
LSL	16.61	x_{min}	17.80	$\bar{x}$-3s	17.6893
USL	20.31	x_{max}	18.50	$\bar{x}$+3s	18.4371
T	3.70	R	0.70	6s	0.7479
		$n_{<T>}$	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	4.95
Critical capability index	=	C_{mk}	3.89

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 16.02.2024

Serial No.	ILJ1001_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	18,27	17,98	18,06	18,22	18,01	18,27	18,14	17,94	18,22	18,15
1024210	VM1698-4	Grad	364,50	355,25	351,00	352,25	352,25	353,50	354,75	343,25	352,00	350,75

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	18,07	18,05	18,06	17,99	17,93	18,08	18,22	17,94	18,00	18,09
1024210	VM1698-4	Grad	347,50	350,50	346,75	340,25	343,50	349,75	348,75	345,50	349,00	345,50

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	17,95	17,99	17,85	18,04	17,92	18,03	18,29	17,93	18,00	17,97
1024210	VM1698-4	Grad	349,25	346,25	350,50	357,00	352,50	354,00	363,25	353,25	353,75	356,25

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	18,00	17,80	18,11	18,12	17,88	18,00	17,83	17,95	18,07	18,21
1024210	VM1698-4	Grad	356,00	352,00	370,75	350,75	351,50	356,75	355,25	352,25	360,50	363,50

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	18,00	18,23	17,98	18,06	18,29	18,09	17,91	18,07	17,98	17,94
1024210	VM1698-4	Grad	351,75	363,25	351,00	356,00	359,50	356,75	357,75	356,75	358,50	353,00

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	18,17	18,11	18,00	18,14	18,05	17,98	17,94	17,85	18,10	18,21
1024210	VM1698-4	Grad	365,50	358,50	356,50	357,50	351,00	345,00	352,25	344,25	355,00	371,25

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	18,07	18,26	18,12	17,86	18,20	18,16	18,03	18,14	18,15	17,91
1024210	VM1698-4	Grad	353,50	359,00	353,25	351,75	356,00	358,50	352,00	361,25	355,75	349,25

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	18,03	18,27	18,17	18,00	18,02	18,02	18,17	18,19	17,96	18,20
1024210	VM1698-4	Grad	353,75	367,75	354,25	353,00	356,25	347,00	350,50	357,25	352,25	359,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 16.02.2024

Serial No.	ILJ1001_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	18,13	17,97	18,07	17,89	18,04	18,06	18,10	17,94	18,50	18,01
1024210	VM1698-4	Grad	358,25	351,75	355,25	346,00	354,25	356,50	353,75	351,00	359,25	353,00

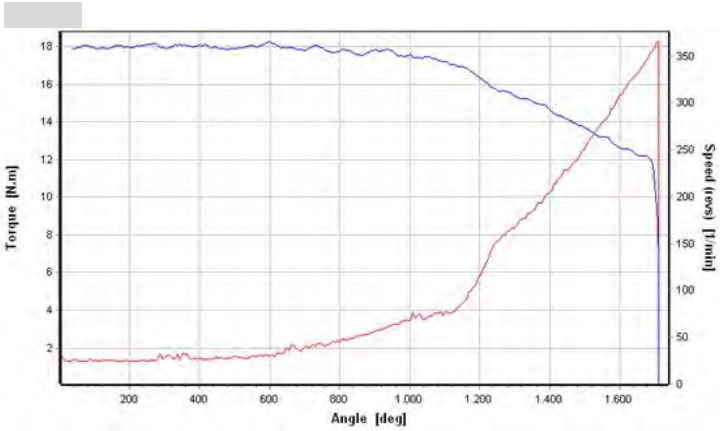
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	18,01	18,27	18,11	17,94	18,27	18,24	18,05	18,09	17,97	18,00
1024210	VM1698-4	Grad	349,50	364,50	360,00	349,25	359,00	359,50	353,25	360,00	360,00	353,00

Torque graphs

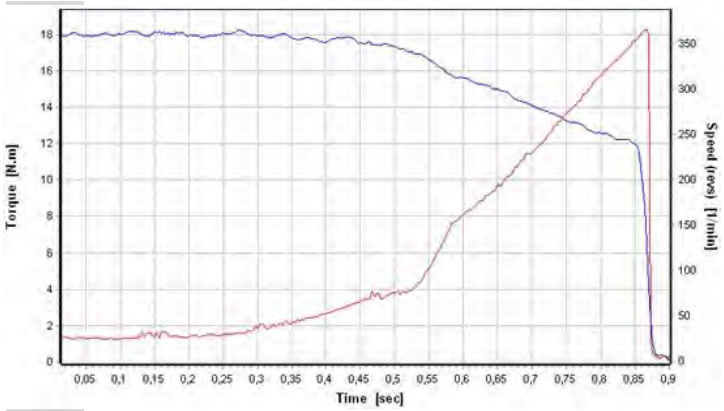
Model: **CLBA203**
Serial no: **ILJ1001**

Machine Capability Study 80 %

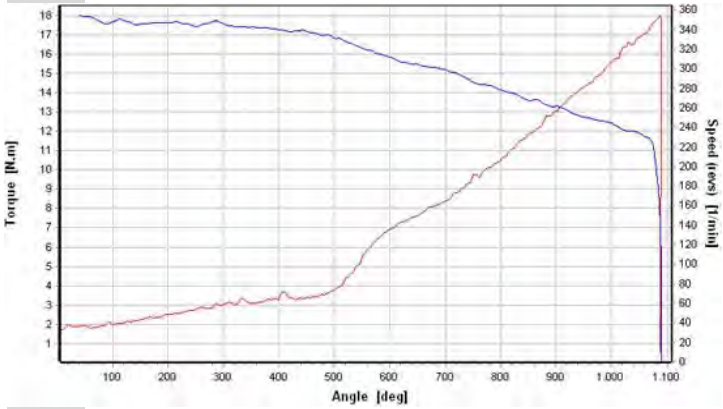
Angle degree: **360°**
Test torque: **18,5 Nm**



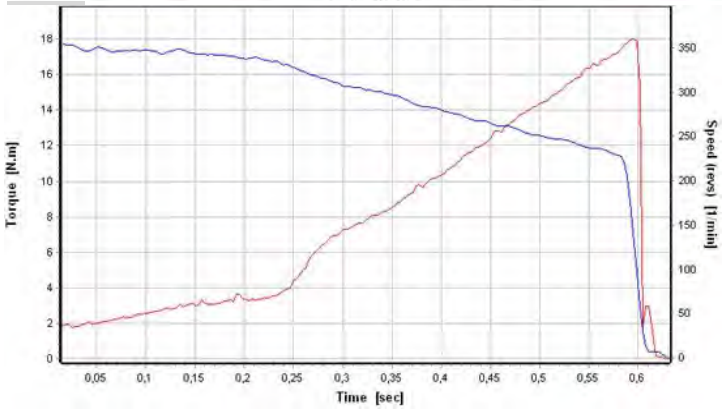
Value no. 1
Graph
Torque / Angle / Speed



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: **ILJ1001**

Test torque: Tq max. 21,00 Nm

Hard joint (H)	126,93	Nm / Revolution	Angle degree	30°
Soft joint (L)	10,25	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	21,15 Nm	20,50 Nm
	Standard deviation	0,23 Nm	0,16 Nm
	Torque scatter (99,73%)	1,40 Nm	0,98 Nm
	C_m	2,99	4,30
	C_{mk}	2,77	3,27

b)	Min. C_m hard/soft (lowest value)	2,99
	Min. C_{mk} hard/soft (lowest value)	2,77

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

Note:

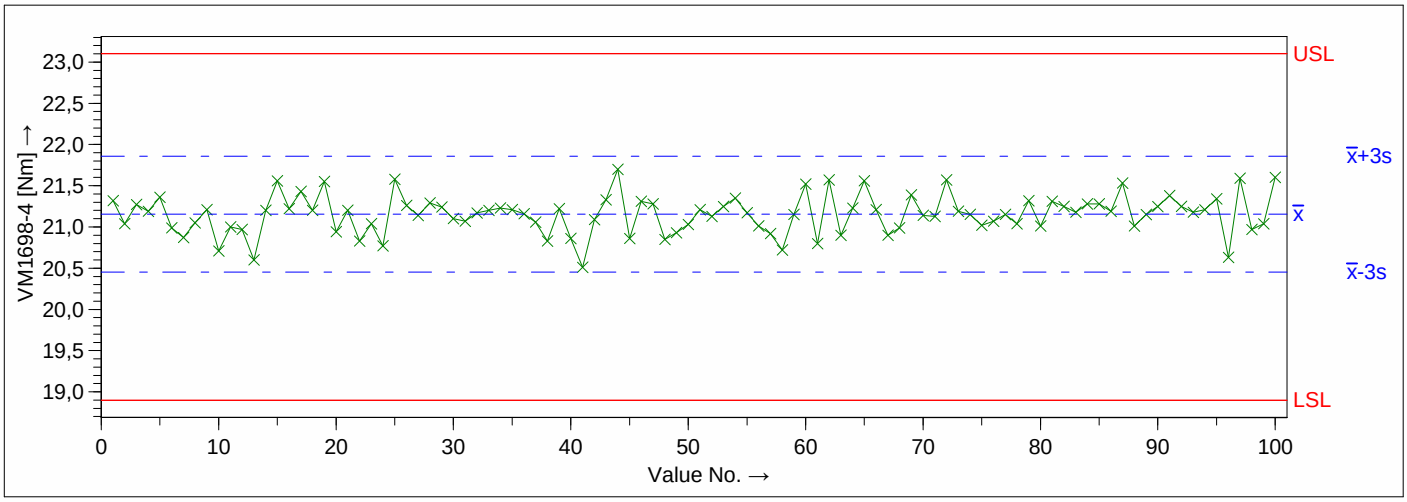
Machine Capability Study
Control System

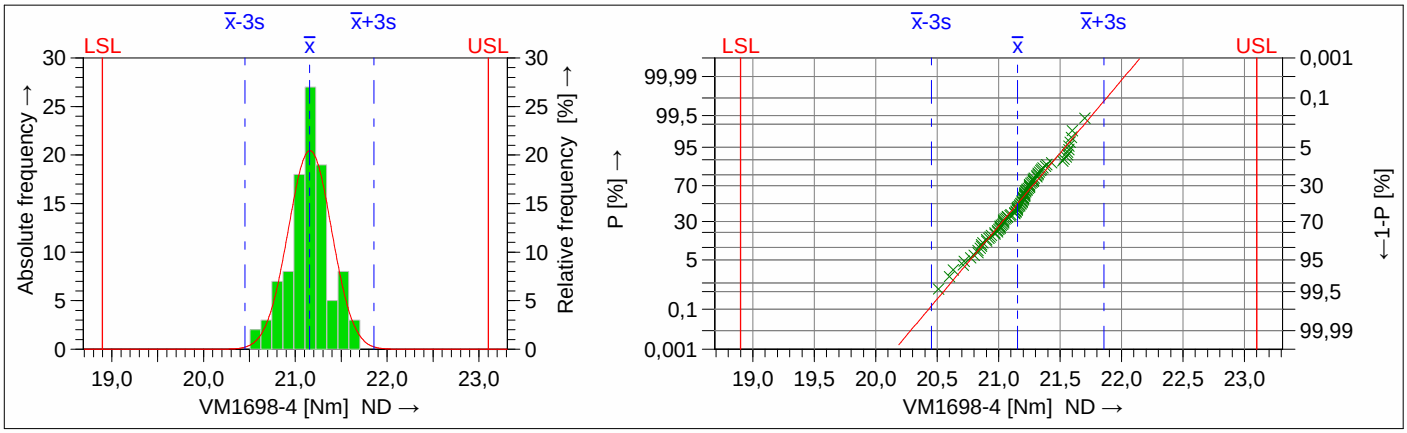
Plant	ATG Westhausen	Operator Name	Sorg
Date	19.02.2024		

Ord. No.	CLBA203	Part type	CLBA203	Contr.item	yes
Serial No.	ILJ1001_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	CLECO	Reference System	VM1698-4	Test Electronic	---
Contr.No.	Homologation	Reference Transducer	50/1024729	nges.	100

Evaluation from 19.02.2024 10:54:20 to 19.02.2024 11:05:54

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





Drawing Values		Collected Values		Statistics	
T_m	21.00			$\bar{x}$	21.1542
LSL	18.90	x_{min}	20.51	$\bar{x}$-3s	20.4522
USL	23.10	x_{max}	21.70	$\bar{x}$+3s	21.8562
T	4.20	R	1.19	6s	1.4039
		$n_{<T>}$	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	2.99
Critical capability index	=	C_{mk}	2.77

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 19.02.2024

Serial No.	ILJ1001_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	21,32	21,04	21,27	21,19	21,36	20,99	20,87	21,05	21,21	20,71
1024210	VM1698-4	Grad	30,25	29,75	30,50	30,25	30,00	29,25	29,75	29,75	30,00	28,25

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	21,00	20,97	20,60	21,20	21,56	21,22	21,43	21,20	21,55	20,94
1024210	VM1698-4	Grad	29,00	28,75	28,25	29,75	31,25	30,25	30,25	30,25	31,25	29,50

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	21,20	20,83	21,04	20,77	21,58	21,26	21,14	21,29	21,24	21,10
1024210	VM1698-4	Grad	30,25	29,00	29,50	29,25	31,75	30,00	30,75	30,75	29,75	30,25

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	21,07	21,17	21,20	21,23	21,21	21,16	21,06	20,83	21,22	20,86
1024210	VM1698-4	Grad	30,00	30,50	29,75	30,75	30,25	29,25	29,25	29,25	30,00	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	20,51	21,09	21,33	21,70	20,86	21,31	21,28	20,85	20,93	21,03
1024210	VM1698-4	Grad	28,75	29,25	31,00	30,75	29,25	30,00	30,25	28,75	29,25	29,75

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	21,21	21,13	21,25	21,35	21,17	21,01	20,92	20,72	21,15	21,52
1024210	VM1698-4	Grad	30,25	29,50	30,00	29,50	30,50	30,00	29,50	29,75	30,00	31,25

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	20,80	21,57	20,90	21,23	21,56	21,21	20,90	20,99	21,39	21,14
1024210	VM1698-4	Grad	28,75	30,75	28,75	30,50	31,75	29,75	29,50	29,50	30,75	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	21,13	21,57	21,19	21,15	21,02	21,07	21,15	21,04	21,32	21,01
1024210	VM1698-4	Grad	30,50	30,75	31,00	29,50	29,00	29,50	30,00	29,25	30,75	29,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 19.02.2024

Serial No.	ILJ1001_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	21,31	21,25	21,18	21,28	21,28	21,19	21,53	21,01	21,15	21,25
1024210	VM1698-4	Grad	30,75	31,00	29,75	30,75	31,50	30,25	31,25	30,00	30,25	30,00

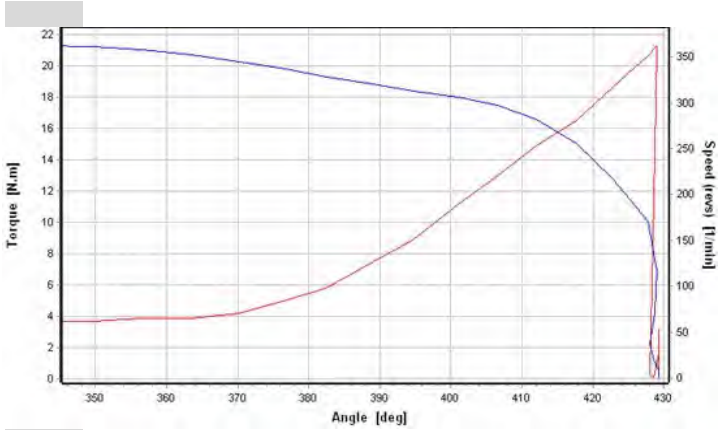
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	21,38	21,25	21,18	21,21	21,34	20,63	21,59	20,97	21,04	21,60
1024210	VM1698-4	Grad	29,75	30,50	30,25	30,25	30,50	29,50	31,50	30,00	30,25	32,00

Torque graphs

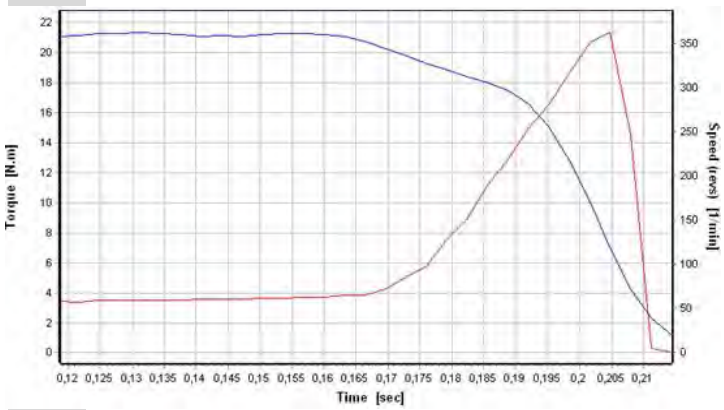
Machine Capability Study 100 %

Model: **CLBA203**
Serial no: **ILJ1001**

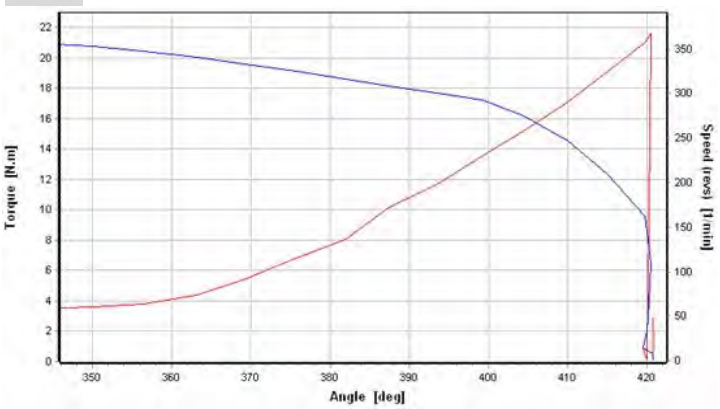
Angle degree: **30°**
Test torque: **21,0 Nm**



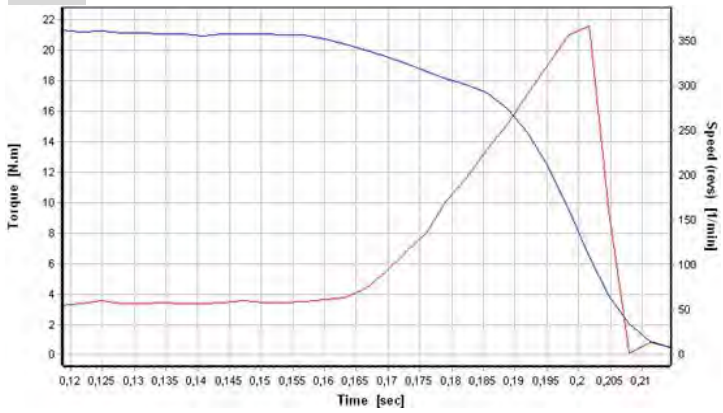
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

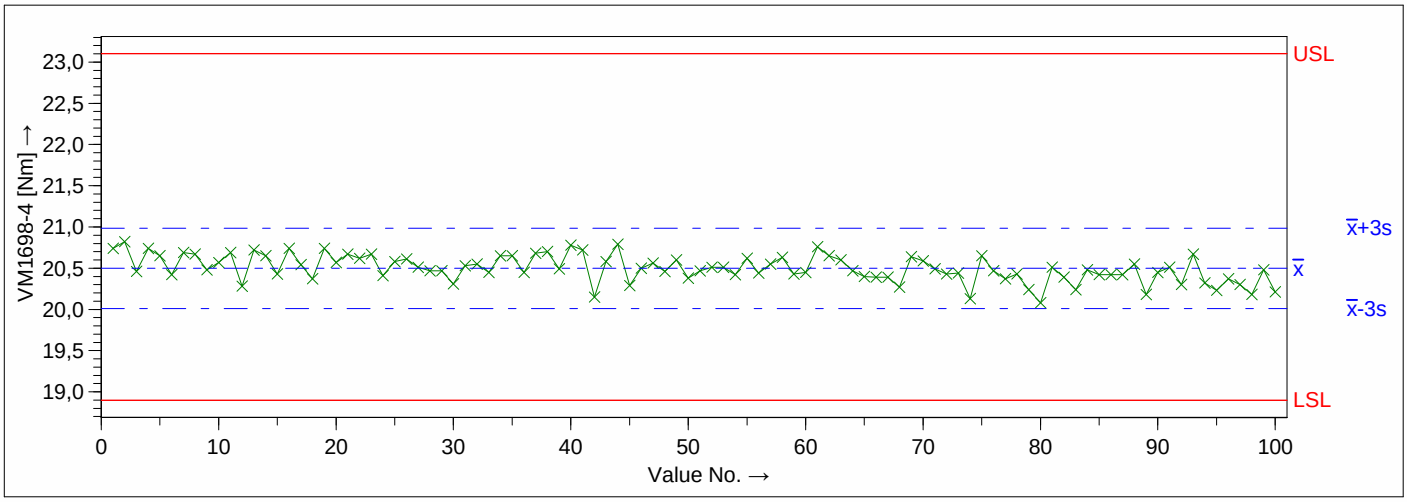
Machine Capability Study
Control System

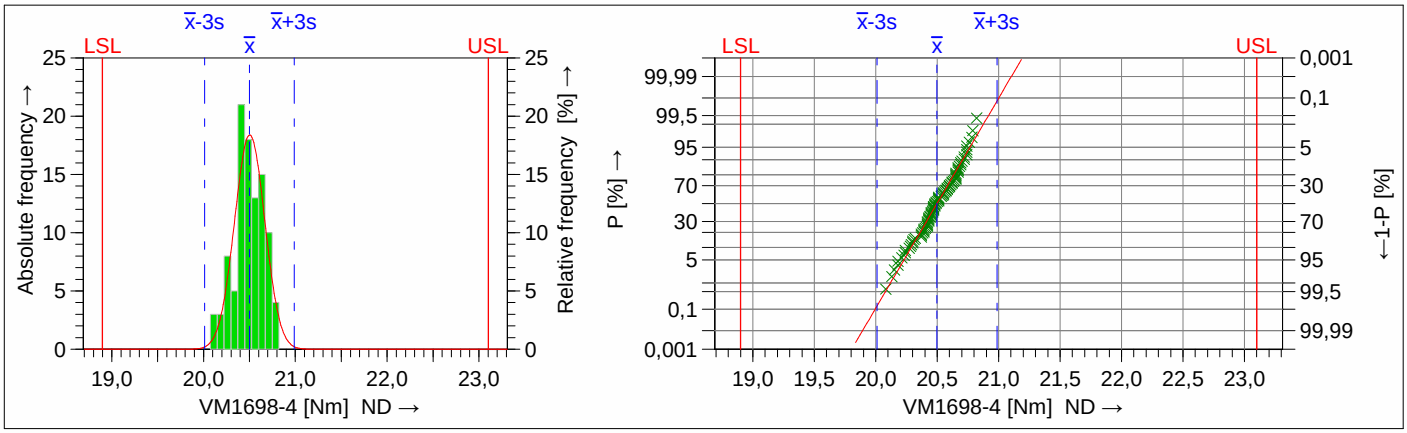
Plant	ATG Westhausen	Operator Name	Sorg
Date	19.02.2024		

Ord. No.	CLBA203	Part type	CLBA203	Contr.item	yes
Serial No.	ILJ1001_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	CLECO	Reference System	VM1698-4	Test Electronic	---
Contr.No.	Homologation	Reference Transducer	50/1024729	nges.	100

Evaluation from 19.02.2024 11:12:39 to 19.02.2024 11:24:12

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





Drawing Values		Collected Values		Statistics	
T_m	21.00			$\bar{x}$	20.4980
LSL	18.90	x_{min}	20.08	$\bar{x}$-3s	20.0099
USL	23.10	x_{max}	20.82	$\bar{x}$+3s	20.9861
T	4.20	R	0.74	6s	0.9762
		$n_{<T>}$	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}	3.27

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 19.02.2024

Serial No.	ILJ1001_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	20,74	20,82	20,46	20,74	20,65	20,42	20,69	20,67	20,48	20,57
1024210	VM1698-4	Grad	380,50	373,50	363,75	376,00	364,75	357,50	367,00	363,25	355,25	360,00

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	20,69	20,28	20,72	20,65	20,43	20,74	20,54	20,37	20,74	20,57
1024210	VM1698-4	Grad	363,00	359,75	363,25	356,75	349,75	362,25	357,25	344,25	368,00	353,25

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	20,67	20,62	20,67	20,41	20,58	20,61	20,51	20,47	20,47	20,31
1024210	VM1698-4	Grad	364,25	355,00	365,00	348,75	361,75	353,50	359,00	353,50	351,50	355,25

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	20,53	20,55	20,45	20,65	20,65	20,45	20,68	20,70	20,49	20,78
1024210	VM1698-4	Grad	354,25	358,00	348,00	364,50	355,25	346,50	362,75	355,25	357,25	358,50

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	20,72	20,15	20,58	20,79	20,29	20,50	20,56	20,46	20,60	20,38
1024210	VM1698-4	Grad	360,25	337,75	350,25	361,00	344,75	351,25	361,50	354,50	358,75	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	20,47	20,51	20,51	20,42	20,62	20,44	20,55	20,63	20,43	20,45
1024210	VM1698-4	Grad	354,75	359,50	358,50	352,75	359,50	352,25	356,50	360,50	353,00	352,50

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	20,76	20,65	20,60	20,47	20,40	20,39	20,39	20,27	20,64	20,59
1024210	VM1698-4	Grad	365,00	356,25	355,25	350,75	353,00	356,50	358,50	353,75	365,50	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	20,49	20,43	20,44	20,13	20,65	20,47	20,37	20,43	20,24	20,08
1024210	VM1698-4	Grad	358,75	358,00	357,00	346,00	359,00	356,50	352,75	352,75	354,00	350,50

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 19.02.2024

Serial No.	ILJ1001_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	20,51	20,39	20,24	20,48	20,42	20,42	20,42	20,55	20,18	20,45
1024210	VM1698-4	Grad	358,25	353,00	344,25	354,25	349,25	349,50	357,25	360,25	343,75	356,00

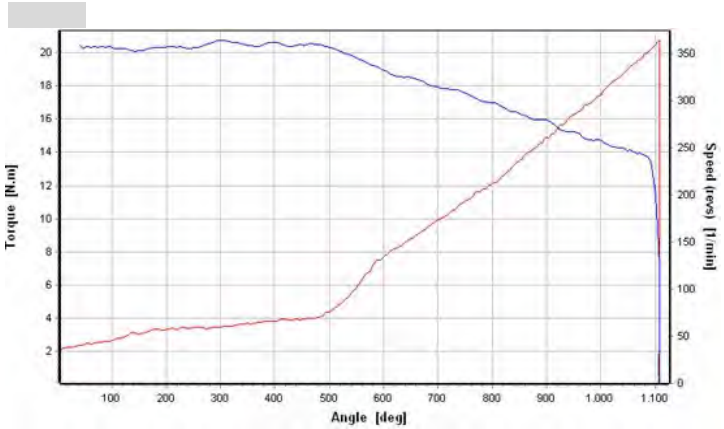
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	20,51	20,30	20,67	20,32	20,23	20,37	20,30	20,18	20,48	20,21
1024210	VM1698-4	Grad	353,50	354,00	366,50	353,50	350,00	355,50	350,75	350,50	362,25	355,00

Torque graphs

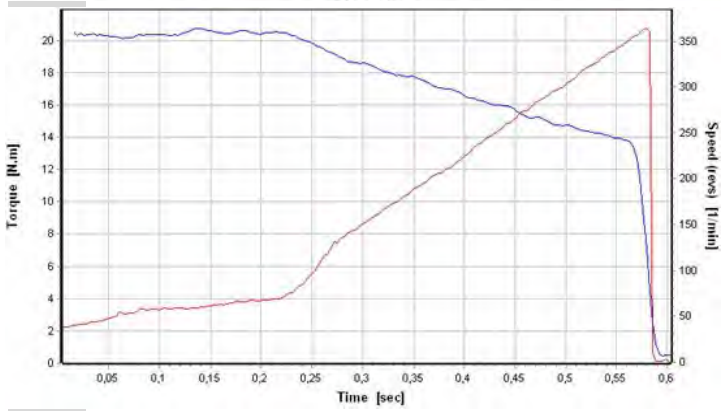
Model: **CLBA203**
Serial no: **ILJ1001**

Machine Capability Study 100 %

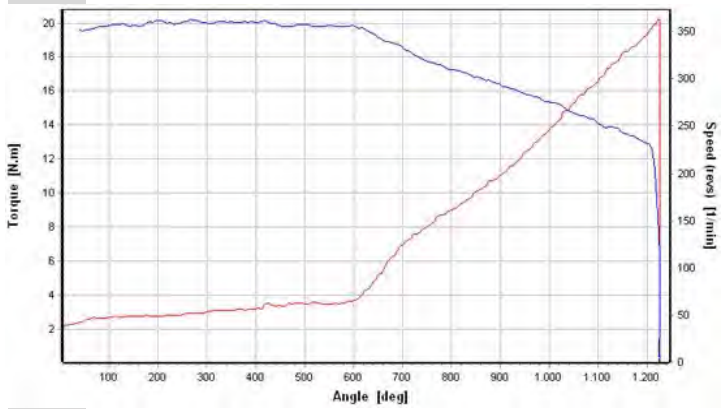
Angle degree: **360°**
Test torque: **21,0 Nm**



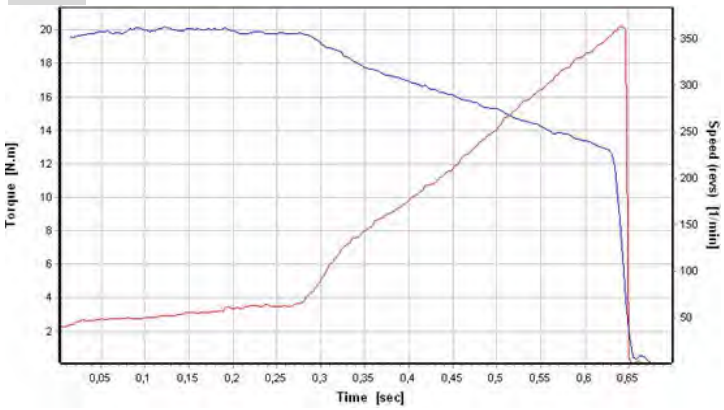
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed