Homologation

Cordless Assembly Tools

Model: CLBA403

Serial no.: ILJ1093

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Homologation: CLBA403 SN: ILJ1093

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Document no: 003/2024
Date: 08.02.2024

Test sheet no. 2

Machine Capability Study 30 %

Multi-stage tightening system ☑ Speed = 189 rpm 100,0 %

Single-stage tightening system ☐

Manufacturer: Apex Tool Group Serial no: **ILJ1093**

Test torque: Tq min. + 0.3 (Tq max. - Tq min.) 22,87 Nm

Hard joint (H) 139,11 Nm / Revolution Angle degree 30°

Soft joint (L) 11,36 Nm / Revolution Angle degree 360°

		H	**L**
a)	Tolerance down / up	20,58 - 25,16 Nm	20,58 - 25,16 Nm
	Tolerance down / up	10 %	10 %
	Average torque	23,18 Nm	22,72 Nm
	Standard deviation	0,22 Nm	0,13 Nm
	Torque scatter (99,73%)	1,30 Nm	0,76 Nm
	C_m	3,53	6,01
	C_{mk}	3,04	5,61

b) Min. C_m hard/soft (lowest value) 3,53
Min. C_{mk} hard/soft (lowest value) 3,04

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

Note:

Machine Capability Study
Control System

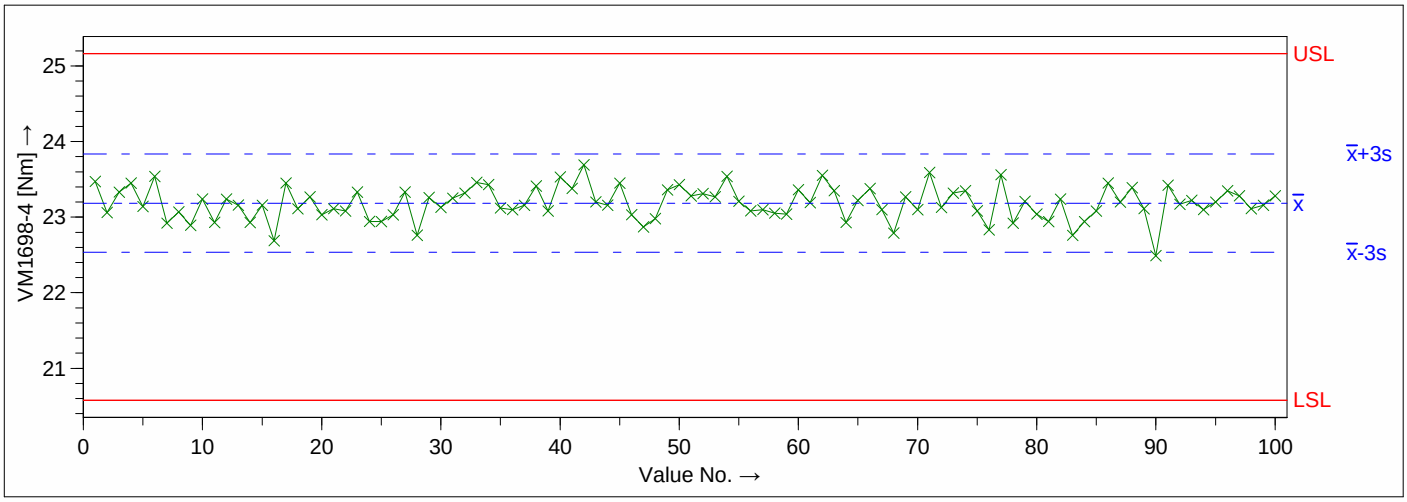
Cleco Production Tools

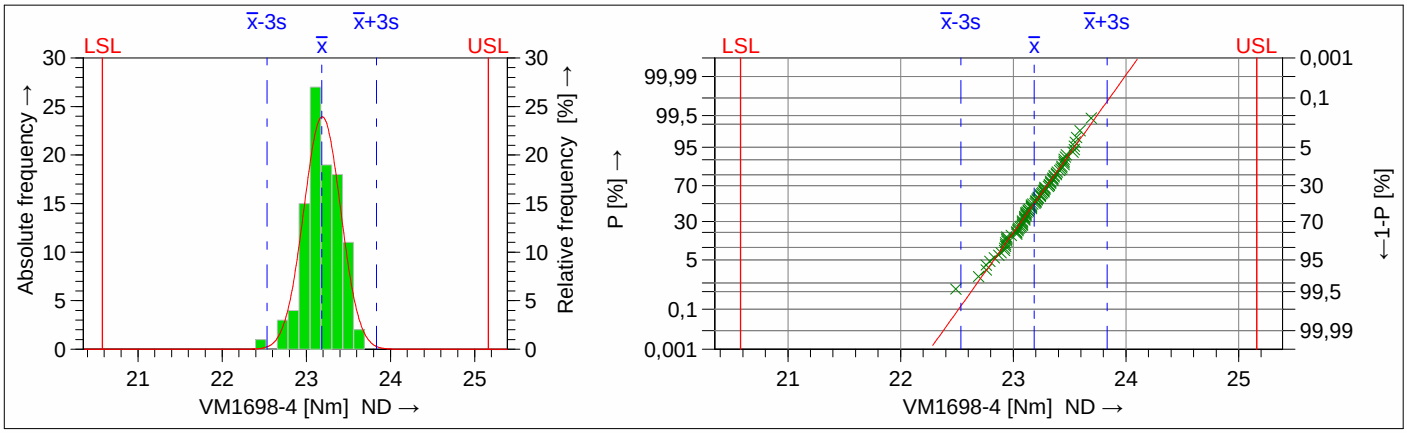
Plant	ATG Westhausen	Operator Name	Sorg
Date	25.01.2024		

Ord. No.	CLBA403	Part type	CLBA403	Contr.item	yes
Serial No.	ILJ1093_d	Char.Descr.	VM1698-4	Nom.val. 22,87 2,29	USL 25,16
		Serial No.	1024210	Unit Nm -2,29	LSL 20,58
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 25.01.2024 11:15:41 to 25.01.2024 11:28:53

Rem. TQ 30% hard +/-10% * Speed 189 rpm





Drawing Values		Collected Values		Statistics	
T_m	22.87			$\bar{x}$	23.1844
LSL	20.58	x_{min}	22.49	$\bar{x}$-3s	22.5348
USL	25.16	x_{max}	23.69	$\bar{x}$+3s	23.8340
T	4.58	R	1.20	6s	1.2992
		$n_{<T>}$	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	3.53
Critical capability index	=	C_{mk}	3.04

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

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Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 25.01.2024

Serial No.	ILJ1093_d	Characteristic			
Part type	CLBA403	Char.Descr.	VM1698-4	Nom.val.	22,87
Ord. No.	CLBA403	Serial No.	1024210	LSL	20,58
				USL	25,16
Remark	TQ 30% hard +/-10% * Speed 189 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	23,47	23,06	23,33	23,45	23,14	23,54	22,92	23,07	22,89	23,24
1024210	VM1698-4	Grad	30,50	29,25	30,75	29,75	28,75	31,25	28,75	29,25	28,25	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	22,93	23,24	23,16	22,93	23,16	22,69	23,45	23,11	23,27	23,03
1024210	VM1698-4	Grad	29,00	30,25	29,75	29,00	30,00	28,25	30,25	30,75	30,50	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	23,11	23,08	23,33	22,94	22,94	23,03	23,33	22,76	23,26	23,13
1024210	VM1698-4	Grad	30,00	29,75	30,50	30,00	29,00	30,00	30,50	29,50	30,75	30,50

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	23,25	23,32	23,46	23,43	23,12	23,10	23,16	23,41	23,08	23,53
1024210	VM1698-4	Grad	30,25	31,00	31,00	31,50	29,25	29,25	29,25	30,75	29,50	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	23,38	23,69	23,20	23,16	23,45	23,03	22,87	22,98	23,36	23,43
1024210	VM1698-4	Grad	30,50	30,50	29,50	30,25	30,50	29,25	28,75	29,00	30,50	30,75

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	23,28	23,31	23,27	23,54	23,21	23,08	23,10	23,05	23,04	23,36
1024210	VM1698-4	Grad	29,75	30,00	29,25	30,25	29,75	30,00	29,25	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	23,19	23,55	23,35	22,93	23,22	23,38	23,10	22,79	23,27	23,10
1024210	VM1698-4	Grad	30,25	30,00	30,25	29,50	29,25	30,00	29,25	29,00	29,00	28,50

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	23,59	23,13	23,32	23,35	23,08	22,83	23,56	22,92	23,21	23,04
1024210	VM1698-4	Grad	31,25	30,00	30,75	30,00	29,75	29,25	30,75	29,00	30,50	30,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 25.01.2024

Serial No.	ILJ1093_d	Characteristic			
Part type	CLBA403	Char.Descr.	VM1698-4	Nom.val.	22,87
Ord. No.	CLBA403	Serial No.	1024210	LSL	20,58
				USL	25,16
Remark	TQ 30% hard +/-10% * Speed 189 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	22,94	23,24	22,76	22,94	23,08	23,45	23,20	23,39	23,11	22,49
1024210	VM1698-4	Grad	29,25	30,00	28,50	29,00	29,75	30,50	30,75	30,75	30,00	28,50

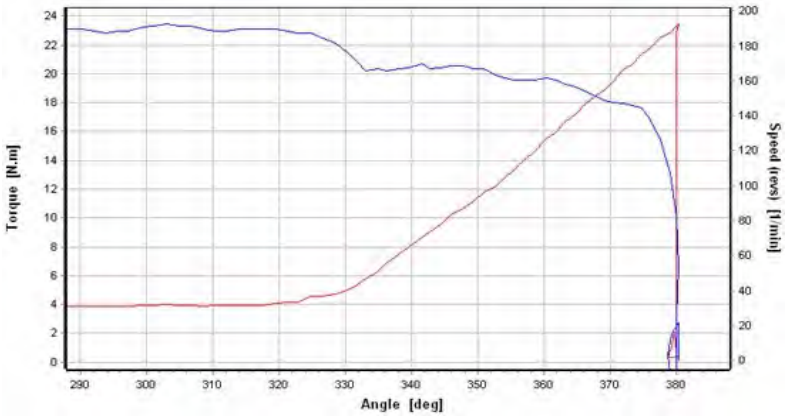
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	23,42	23,17	23,22	23,10	23,20	23,35	23,28	23,11	23,16	23,28
1024210	VM1698-4	Grad	31,50	30,25	30,75	30,00	29,75	31,25	30,75	29,75	30,50	31,00

Torque graphs

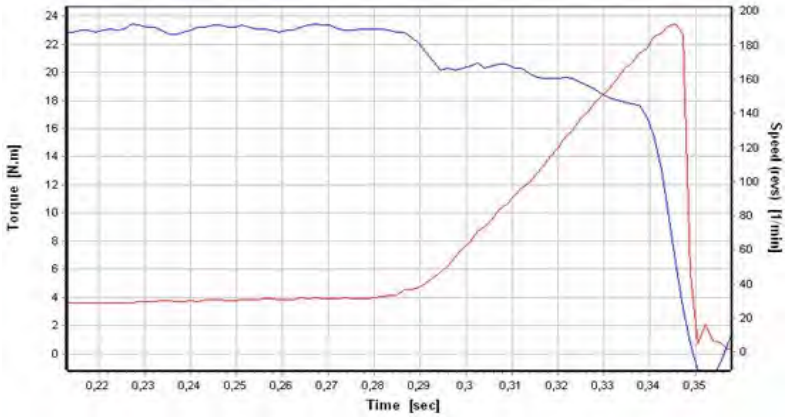
Machine Capability Study 30 %

Model: **CLBA403**
Serial no: **ILJ1093**

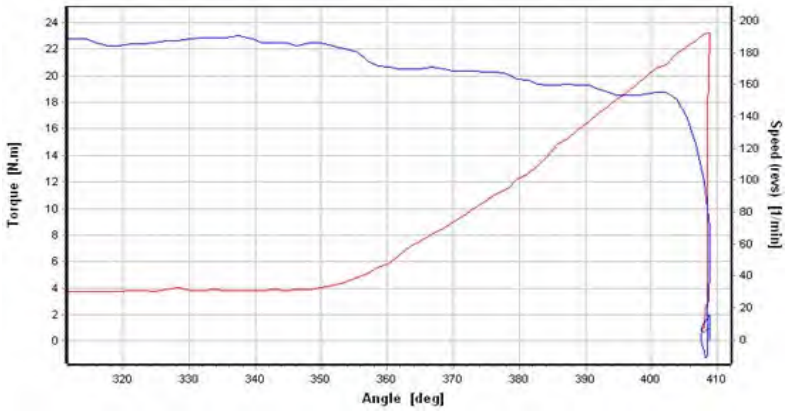
Angle degree: **30°**
Test torque: **22,9 Nm**



Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



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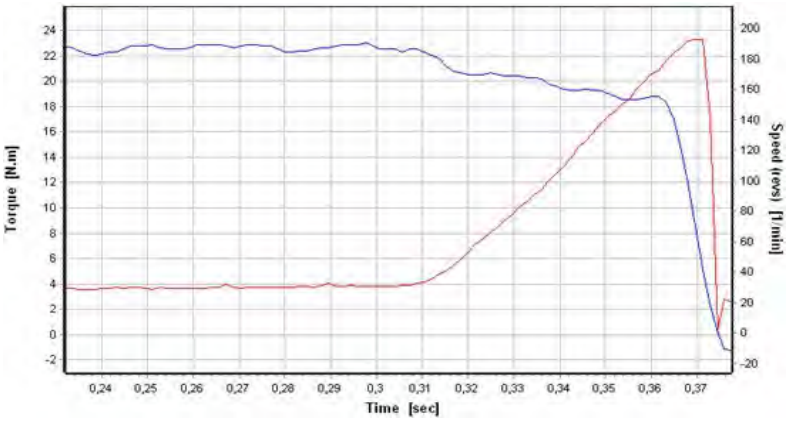
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

Machine Capability Study
Control System

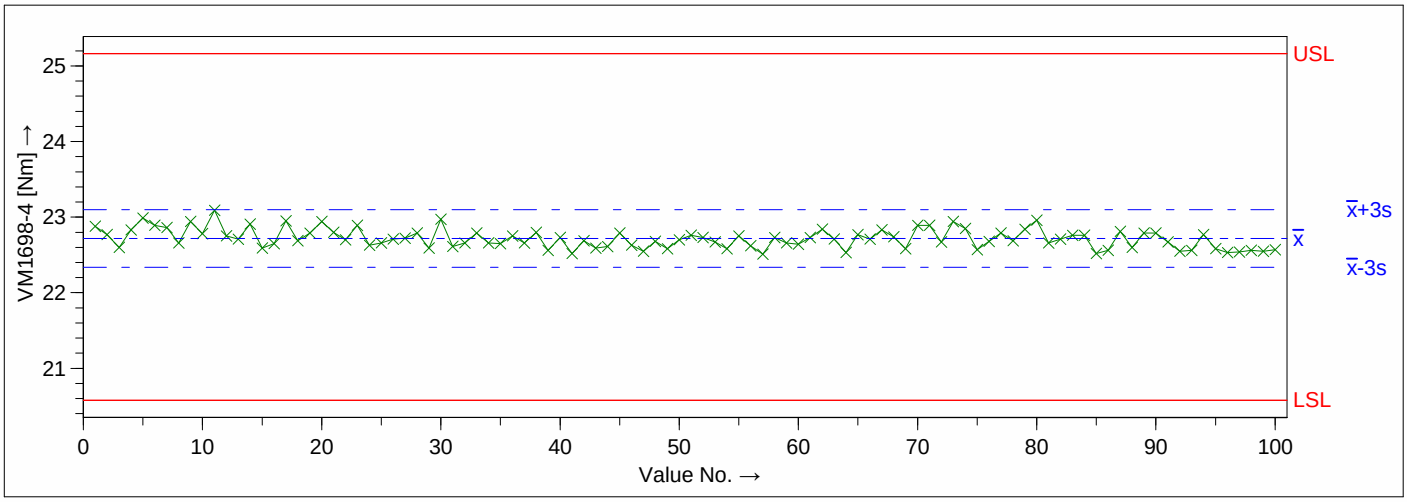
Cleco Production Tools

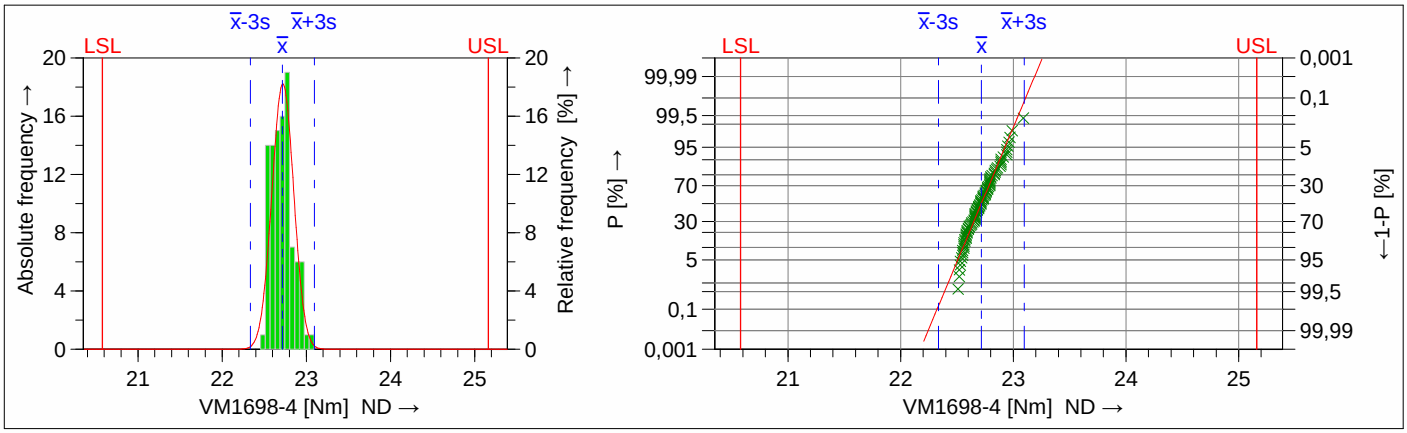
Plant	ATG Westhausen	Operator Name	Sorg
Date	25.01.2024		

Ord. No.	CLBA403	Part type	CLBA403	Contr.item	yes
Serial No.	ILJ1093_c	Char.Descr.	VM1698-4	Nom.val. 22,87	2,29 USL 25,16
		Serial No.	1024210	Unit Nm	-2,29 LSL 20,58
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 25.01.2024 11:01:58 to 25.01.2024 11:15:10

Rem. TQ 30% soft +/-10% * Speed 189 rpm





Drawing Values		Collected Values		Statistics	
T_m	22.87			$\bar{x}$	22.7164
LSL	20.58	x_{min}	22.51	$\bar{x}$-3s	22.3356
USL	25.16	x_{max}	23.09	$\bar{x}$+3s	23.0972
T	4.58	R	0.58	6s	0.7616
		$n_{<T>}$	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	6.01
Critical capability index	=	C_{mk}	5.61

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 25.01.2024

Serial No.	ILJ1093_c	Characteristic			
Part type	CLBA403	Char.Descr.	VM1698-4	Nom.val.	22,87
Ord. No.	CLBA403	Serial No.	1024210	LSL	20,58
				USL	25,16
Remark	TQ 30% soft +/-10% * Speed 189 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	22,88	22,77	22,60	22,83	22,99	22,89	22,86	22,66	22,94	22,78
1024210	VM1698-4	Grad	358,25	356,50	353,00	357,50	359,75	354,25	354,75	349,25	355,00	352,25

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	23,09	22,75	22,71	22,91	22,59	22,65	22,95	22,69	22,79	22,94
1024210	VM1698-4	Grad	361,75	355,50	351,00	354,50	347,75	349,00	354,25	355,75	362,50	362,50

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	22,80	22,70	22,89	22,63	22,66	22,71	22,72	22,79	22,59	22,97
1024210	VM1698-4	Grad	360,75	359,75	358,75	351,50	352,50	357,00	357,00	356,25	355,00	366,25

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	22,61	22,66	22,79	22,66	22,65	22,75	22,66	22,80	22,56	22,73
1024210	VM1698-4	Grad	357,50	361,00	363,75	362,00	359,00	360,25	352,75	361,50	351,50	356,25

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	22,52	22,69	22,59	22,61	22,79	22,63	22,55	22,68	22,58	22,70
1024210	VM1698-4	Grad	348,00	358,75	354,25	357,00	362,25	355,00	352,75	354,50	352,25	355,00

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	22,76	22,73	22,67	22,58	22,75	22,62	22,51	22,73	22,66	22,64
1024210	VM1698-4	Grad	359,25	359,75	362,75	355,75	358,25	356,75	355,00	361,25	359,75	356,50

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	22,73	22,84	22,71	22,53	22,77	22,71	22,83	22,74	22,58	22,89
1024210	VM1698-4	Grad	357,75	361,00	355,00	350,75	358,75	355,00	360,50	357,25	355,25	365,00

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	22,89	22,67	22,94	22,85	22,57	22,68	22,79	22,69	22,84	22,96
1024210	VM1698-4	Grad	364,25	352,50	361,75	358,75	349,75	353,00	359,75	357,25	366,00	365,50

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 25.01.2024

Serial No.	ILJ1093_c	Characteristic			
Part type	CLBA403	Char.Descr.	VM1698-4	Nom.val.	22,87
Ord. No.	CLBA403	Serial No.	1024210	LSL	20,58
				USL	25,16
Remark	TQ 30% soft +/-10% * Speed 189 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	22,66	22,71	22,76	22,76	22,52	22,56	22,81	22,60	22,79	22,79
1024210	VM1698-4	Grad	355,25	356,75	363,75	364,75	348,50	355,00	360,00	355,25	363,50	360,50

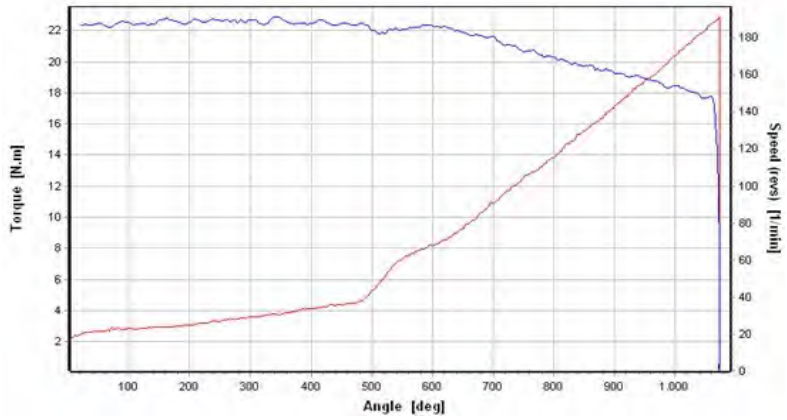
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	22,67	22,55	22,56	22,77	22,58	22,53	22,54	22,56	22,55	22,57
1024210	VM1698-4	Grad	355,75	352,50	352,25	353,25	359,00	352,25	354,50	352,25	352,50	352,00

Torque graphs

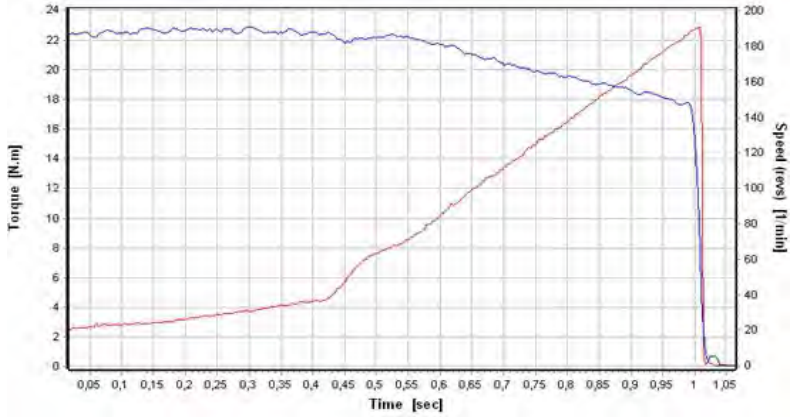
Machine Capability Study 30 %

Model: **CLBA403**
Serial no: **ILJ1093**

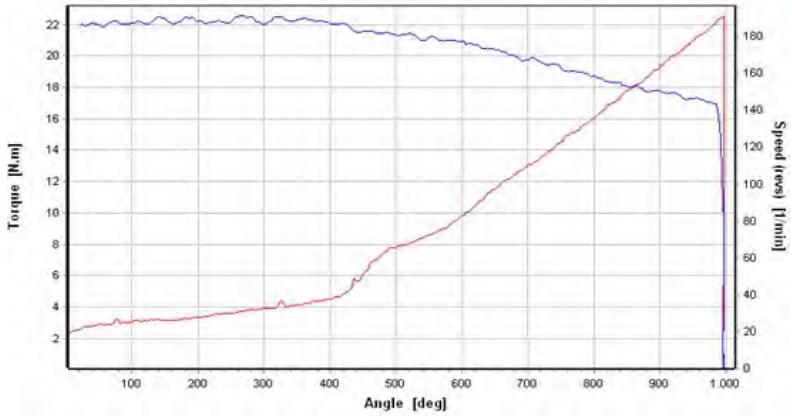
Angle degree: **360°**
Test torque: **22,9 Nm**



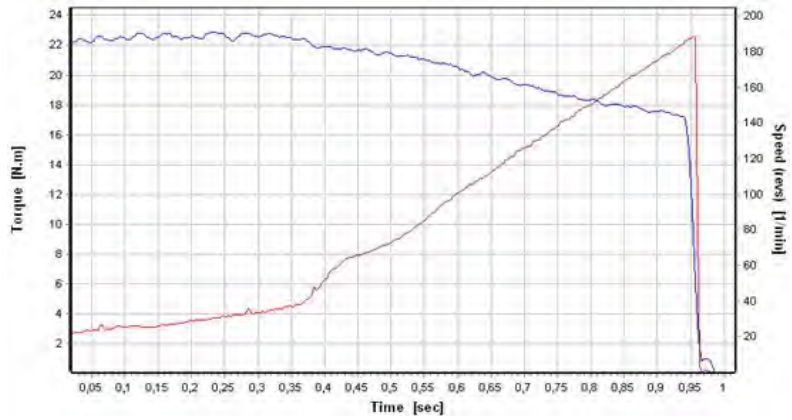
Value no. 1
Graph
Torque / Angle / Speed



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 = 189 rpm 100,0 %

Single-stage tightening system ☐

Manufacturer: Apex Tool Group Serial no: **ILJ1093**

Test torque: Tq min. + 0.8 (Tq max. - Tq min.) 35,82 Nm

Hard joint (H) 219,04 Nm / Revolution Angle degree 30°

Soft joint (L) 17,87 Nm / Revolution Angle degree 360°

		H	**L**
a)	Tolerance down / up	32,24 - 39,40 Nm	32,24 - 39,40 Nm
	Tolerance down / up	10 %	10 %
	Average torque	36,51 Nm	35,75 Nm
	Standard deviation	0,39 Nm	0,28 Nm
	Torque scatter (99,73%)	2,36 Nm	1,70 Nm
	C_m	3,04	4,20
	C_{mk}	2,46	4,12

b)	Min. C_m hard/soft (lowest value)	3,04
	Min. C_{mk} hard/soft (lowest value)	2,46

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

Note:

Machine Capability Study
Control System

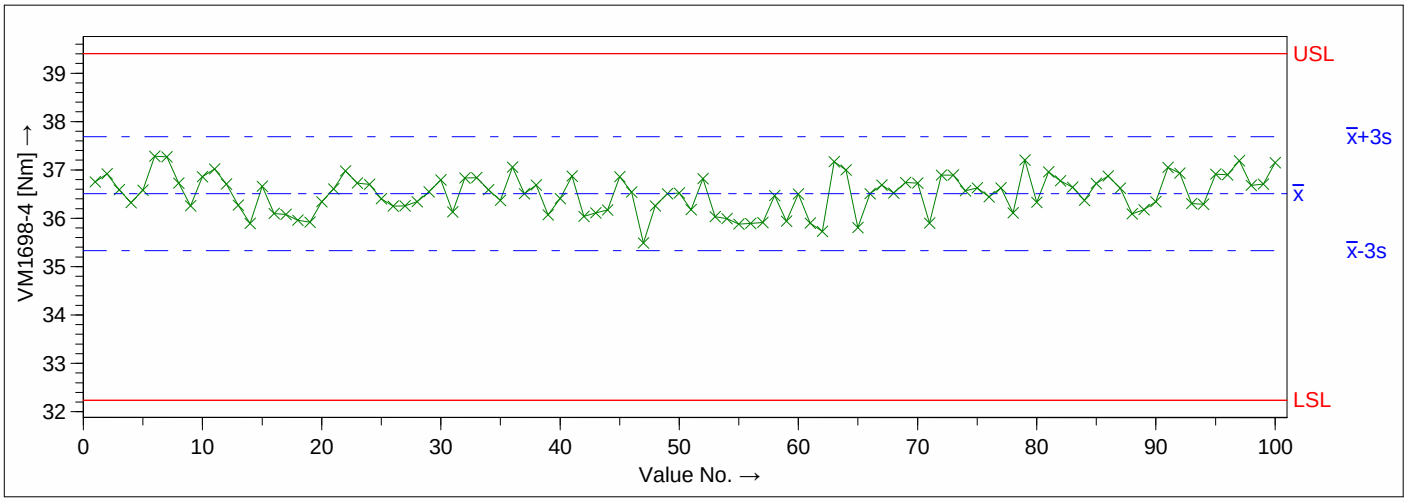
Cleco Production Tools

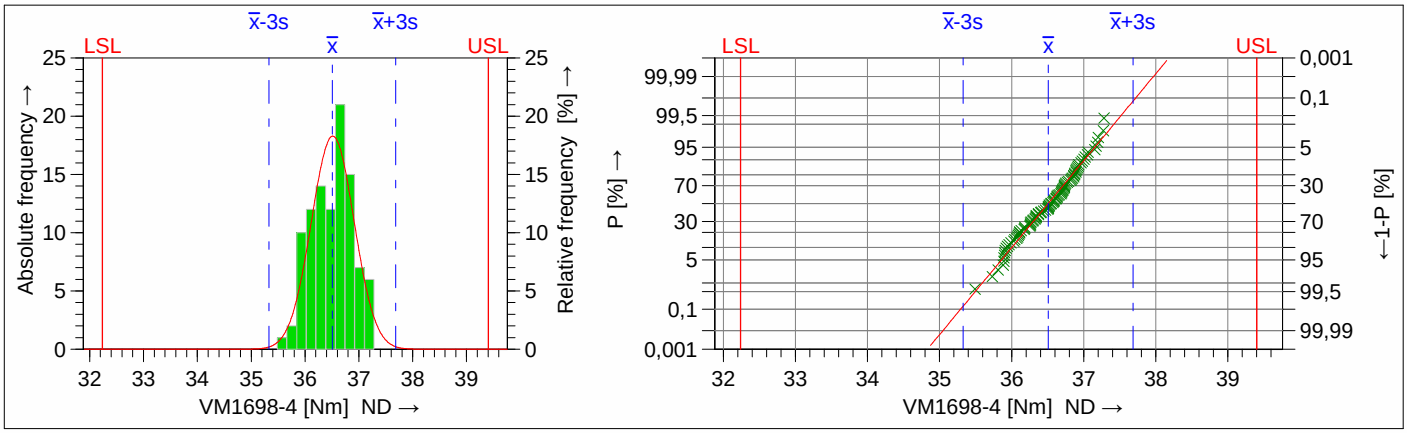
Plant	ATG Westhausen	Operator Name	Sorg
Date	25.01.2024		

Ord. No.	CLBA403	Part type	CLBA403	Contr.item	yes
Serial No.	ILJ1093_h	Char.Descr.	VM1698-4	Nom.val. 35,82 3,58	USL 39,40
		Serial No.	1024210	Unit Nm -3,58	LSL 32,24
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 25.01.2024 11:35:28 to 25.01.2024 11:48:40

Rem. TQ 80% hard +/-10% * Speed 189 rpm





Drawing Values		Collected Values		Statistics	
T_m	35.82			$\bar{x}$	36.5066
LSL	32.24	x_{min}	35.49	$\bar{x}$-3s	35.3291
USL	39.40	x_{max}	37.28	$\bar{x}$+3s	37.6841
T	7.16	R	1.79	6s	2.3551
		$n_{<T>}$	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	3.04
Critical capability index	=	C_{mk}	2.46

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 25.01.2024

Serial No.	ILJ1093_h	Characteristic			
Part type	CLBA403	Char.Descr.	VM1698-4	Nom.val.	35,82
Ord. No.	CLBA403	Serial No.	1024210	LSL	32,24
				USL	39,40
Remark	TQ 80% hard +/-10% * Speed 189 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	36,75	36,92	36,59	36,32	36,58	37,28	37,27	36,73	36,26	36,86
1024210	VM1698-4	Grad	31,00	32,50	30,75	30,50	30,75	32,25	31,75	31,50	30,25	31,25

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	37,02	36,71	36,27	35,89	36,66	36,10	36,08	35,96	35,92	36,34
1024210	VM1698-4	Grad	31,75	31,00	30,50	29,00	30,75	29,25	29,75	29,50	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	36,61	36,98	36,73	36,70	36,40	36,25	36,26	36,34	36,55	36,79
1024210	VM1698-4	Grad	30,50	31,75	31,00	30,75	30,00	29,25	29,75	29,75	29,75	30,50

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	36,13	36,83	36,84	36,59	36,37	37,06	36,51	36,69	36,07	36,41
1024210	VM1698-4	Grad	29,00	30,75	31,00	30,25	30,25	31,00	30,25	30,00	29,50	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	36,87	36,04	36,11	36,17	36,86	36,54	35,49	36,26	36,51	36,52
1024210	VM1698-4	Grad	31,50	29,00	29,50	29,75	31,00	30,25	29,00	29,50	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	36,18	36,82	36,03	35,99	35,88	35,89	35,91	36,47	35,94	36,50
1024210	VM1698-4	Grad	29,50	31,00	29,00	28,75	29,00	29,00	29,00	30,25	30,00	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	35,90	35,73	37,17	37,00	35,81	36,51	36,69	36,52	36,74	36,73
1024210	VM1698-4	Grad	29,50	29,50	31,75	31,25	29,00	31,00	30,25	30,00	30,25	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	35,90	36,89	36,89	36,57	36,63	36,44	36,63	36,11	37,20	36,33
1024210	VM1698-4	Grad	29,00	30,25	30,50	29,75	30,25	29,50	30,50	29,25	31,00	29,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 25.01.2024

Serial No.	ILJ1093_h	Characteristic			
Part type	CLBA403	Char.Descr.	VM1698-4	Nom.val.	35,82
Ord. No.	CLBA403	Serial No.	1024210	LSL	32,24
				USL	39,40
Remark	TQ 80% hard +/-10% * Speed 189 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	36,96	36,77	36,64	36,37	36,72	36,87	36,62	36,09	36,18	36,34
1024210	VM1698-4	Grad	31,25	30,75	30,25	30,00	29,75	30,50	30,00	29,00	29,00	29,75

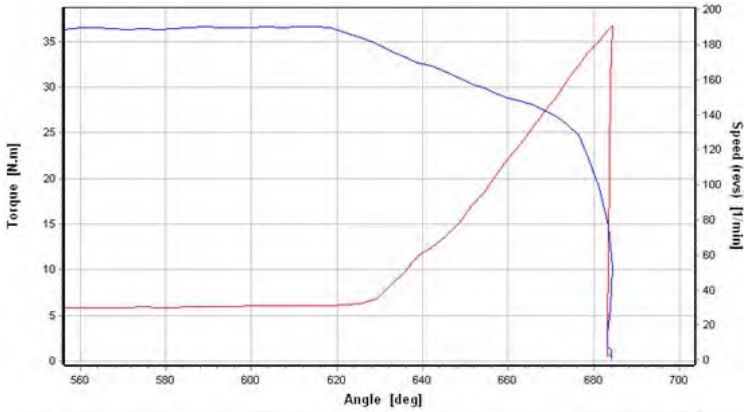
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	37,05	36,93	36,30	36,29	36,91	36,90	37,19	36,68	36,71	37,15
1024210	VM1698-4	Grad	31,50	31,25	30,00	30,25	30,50	30,75	31,00	30,75	29,50	29,75

Torque graphs

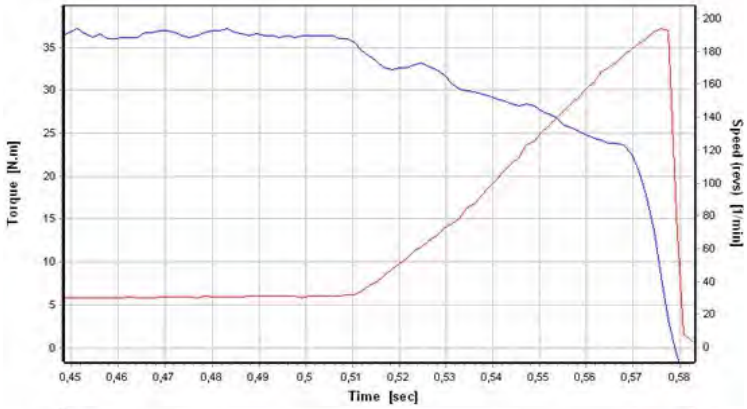
Machine Capability Study 80 %

Model: **CLBA403**
Serial no: **ILJ1093**

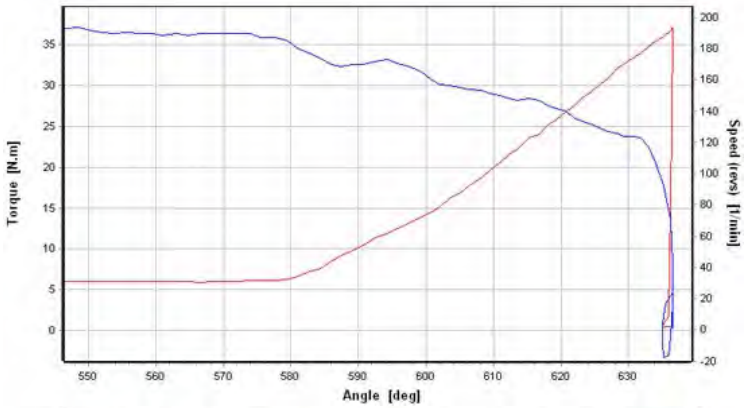
Angle degree: **30°**
Test torque: **35,8 Nm**



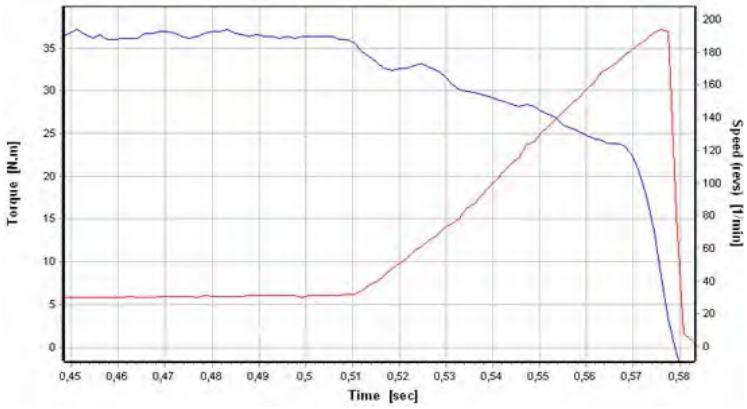
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

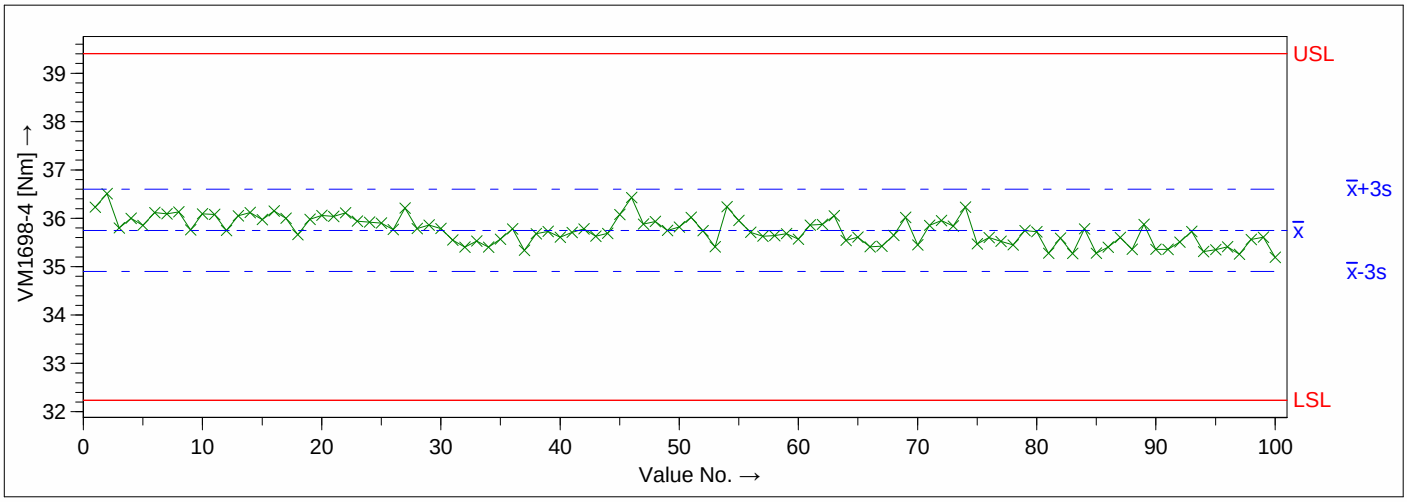
Machine Capability Study
Control System

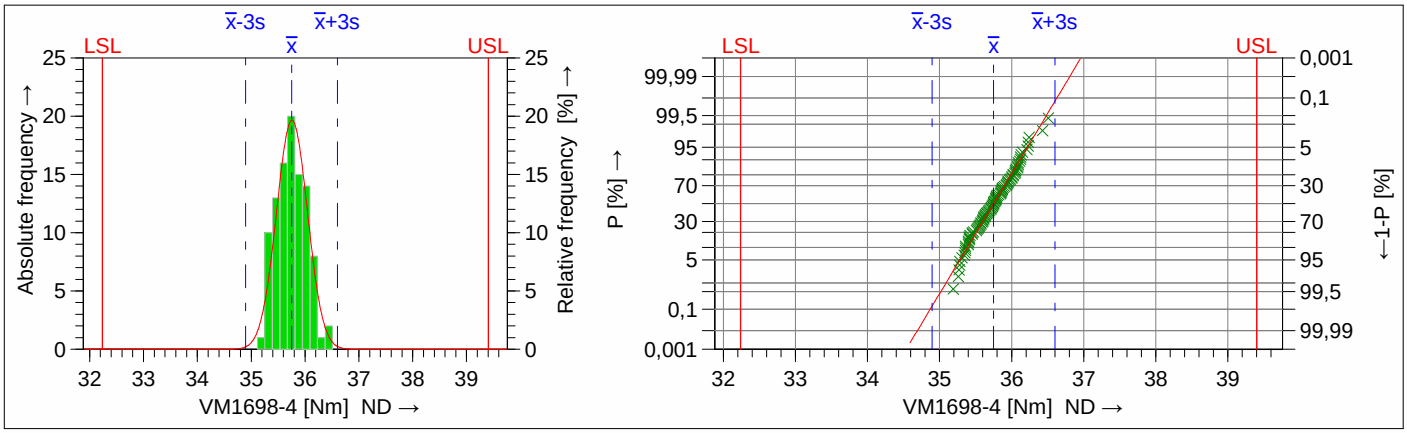
Plant	ATG Westhausen	Operator Name	Sorg
Date	26.01.2024		

Ord. No.	CLBA403	Part type	CLBA403	Contr.item	yes
Serial No.	ILJ1093_g	Char.Descr.	VM1698-4	Nom.val. 35,82 3,58	USL 39,40
		Serial No.	1024210	Unit Nm -3,58	LSL 32,24
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 07:14:17 to 26.01.2024 07:27:29

Rem. TQ 80% soft +/-10% * Speed 189 rpm





Drawing Values		Collected Values		Statistics	
T_m	35.82			$\bar{x}$	35.7495
LSL	32.24	x_{min}	35.19	$\bar{x}$-3s	34.8973
USL	39.40	x_{max}	36.51	$\bar{x}$+3s	36.6017
T	7.16	R	1.32	6s	1.7045
		$n_{<T>}$	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	4.20
Critical capability index	=	C_{mk}	4.12

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.	ILJ1093_g	Characteristic			
Part type	CLBA403	Char.Descr.	VM1698-4	Nom.val.	35,82
Ord. No.	CLBA403	Serial No.	1024210	LSL	32,24
				USL	39,40
Remark	TQ 80% soft +/-10% * Speed 189 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	36,23	36,51	35,80	36,00	35,85	36,12	36,09	36,13	35,76	36,09
1024210	VM1698-4	Grad	364,50	370,50	356,50	360,25	359,50	362,00	358,00	361,75	360,25	359,25

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	36,08	35,75	36,05	36,12	35,97	36,15	36,00	35,66	35,98	36,06
1024210	VM1698-4	Grad	361,00	360,75	368,50	363,25	362,25	367,00	359,25	359,50	368,25	366,50

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	36,04	36,11	35,94	35,92	35,90	35,77	36,21	35,79	35,86	35,79
1024210	VM1698-4	Grad	362,00	371,75	363,50	362,00	369,50	363,00	364,75	367,50	365,00	364,50

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	35,55	35,40	35,53	35,40	35,57	35,78	35,34	35,68	35,73	35,61
1024210	VM1698-4	Grad	360,75	361,00	360,00	357,00	361,50	370,50	360,00	361,75	363,25	365,75

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	35,71	35,78	35,63	35,69	36,08	36,43	35,88	35,93	35,75	35,82
1024210	VM1698-4	Grad	368,25	368,75	362,75	369,00	377,75	375,75	364,25	369,25	364,75	361,50

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	36,02	35,74	35,41	36,24	35,95	35,71	35,63	35,64	35,68	35,57
1024210	VM1698-4	Grad	362,25	359,50	356,50	367,50	359,75	362,50	362,50	356,00	356,00	357,25

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	35,86	35,87	36,05	35,54	35,61	35,41	35,42	35,65	36,02	35,45
1024210	VM1698-4	Grad	365,50	368,00	363,75	355,00	361,50	360,25	353,75	359,25	361,75	357,75

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	35,85	35,95	35,84	36,23	35,47	35,60	35,52	35,45	35,75	35,72
1024210	VM1698-4	Grad	366,75	361,75	360,00	369,00	358,25	362,50	361,25	355,00	357,00	358,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 26.01.2024

Serial No.	ILJ1093_g	Characteristic			
Part type	CLBA403	Char.Descr.	VM1698-4	Nom.val.	35,82
Ord. No.	CLBA403	Serial No.	1024210	LSL	32,24
				USL	39,40
Remark	TQ 80% soft +/-10% * Speed 189 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	35,28	35,59	35,27	35,78	35,28	35,40	35,60	35,36	35,87	35,36
1024210	VM1698-4	Grad	352,75	364,75	353,00	356,75	351,75	357,75	366,00	353,50	358,75	353,00

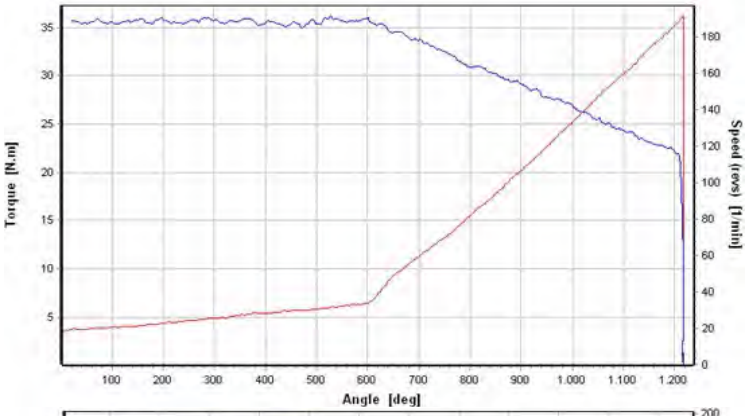
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	35,36	35,51	35,73	35,31	35,35	35,41	35,26	35,56	35,61	35,19
1024210	VM1698-4	Grad	357,75	356,25	357,25	351,75	354,00	357,25	357,75	356,50	356,50	351,00

ue graphs

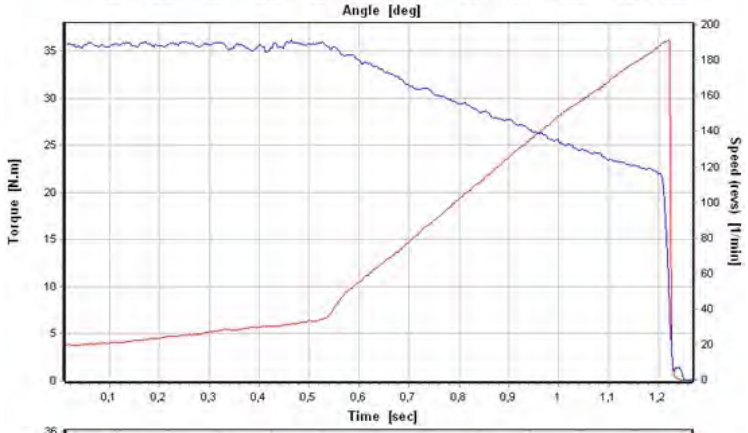
Machine Capability Study 80 %

Model: **CLBA403**
Serial no: **ILJ1093**

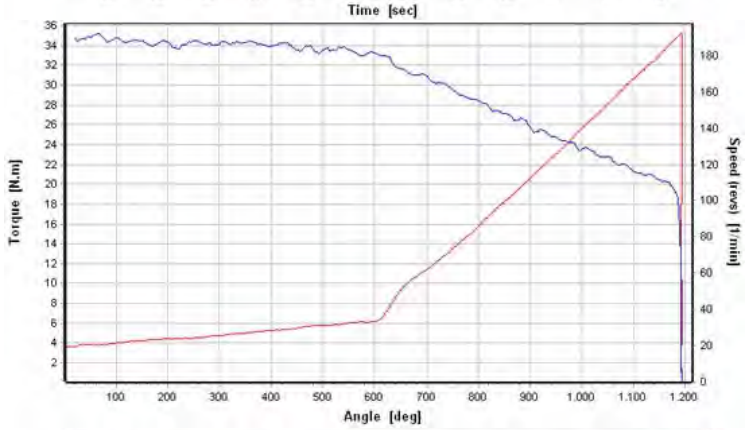
Angle degree: **360°**
Test torque: **35,8 Nm**



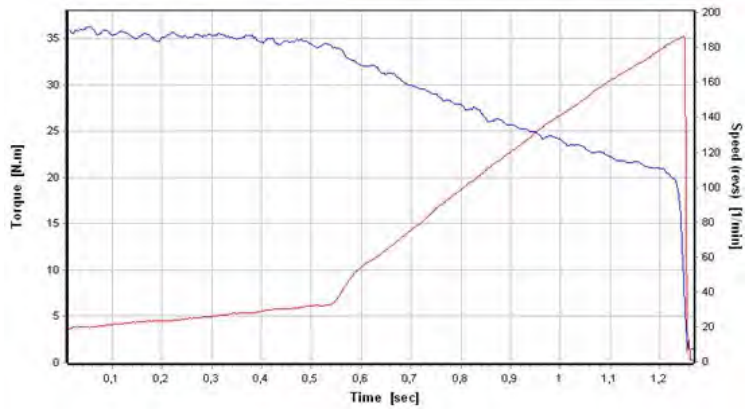
Value no. 1
Graph
Torque / Angle / Speed



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 = 189 rpm	100,0 %
Single-stage tightening system	☐		

Manufacturer: Apex Tool Group Serial no: **ILJ1093**

Test torque: Tq max. 41,00 Nm

Hard joint (H)	247,13	Nm / Revolution	Angle degree	30°
Soft joint (L)	20,11	Nm / Revolution	Angle degree	360°

		H	L
a)	Tolerance down / up	36,90 - 45,10 Nm	36,90 - 45,10 Nm
	Tolerance down / up	10 %	10 %
	Average torque	41,19 Nm	40,22 Nm
	Standard deviation	0,34 Nm	0,22 Nm
	Torque scatter (99,73%)	2,07 Nm	1,31 Nm
	C_m	3,96	6,28
	C_{mk}	3,78	5,08

b)	Min. C_m hard/soft (lowest value)	3,96
	Min. C_{mk} hard/soft (lowest value)	3,78

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

Note:

Machine Capability Study
Control System

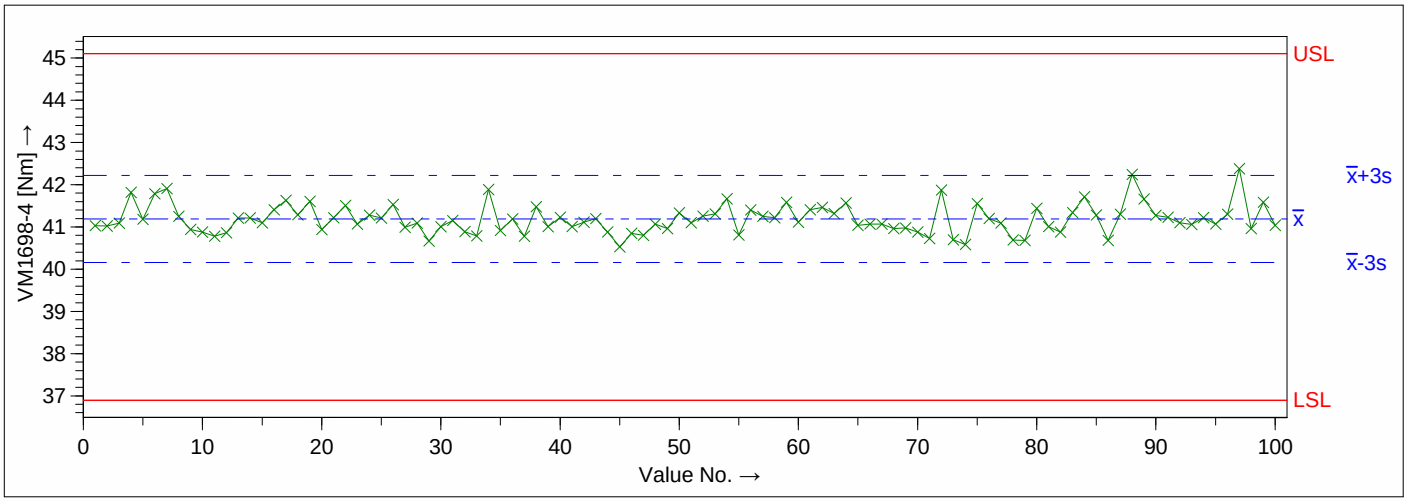
Page 1 / 1

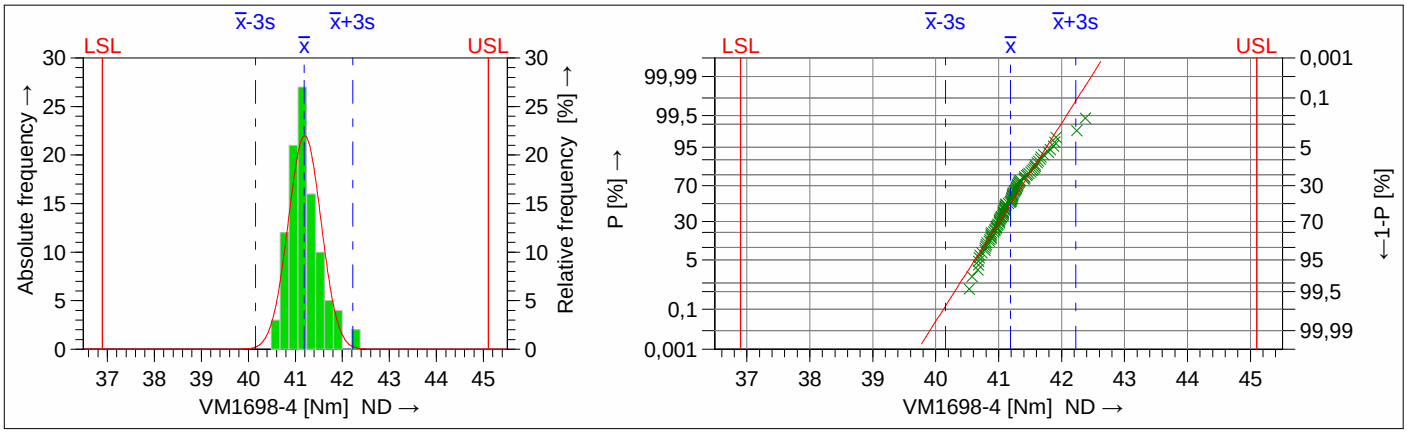
Plant	ATG Westhausen	Operator Name	Sorg
Date	26.01.2024		

Ord. No.	CLBA403	Part type	CLBA403	Contr.item	yes
Serial No.	ILJ1093_b	Char.Descr.	VM1698-4	Nom.val. 41,00 4,10	USL 45,10
		Serial No.	1024210	Unit Nm -4,10	LSL 36,90
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 07:42:21 to 26.01.2024 07:55:33

Rem. TQ 100% hard +/-10% * Speed 189 rpm





Drawing Values		Collected Values		Statistics	
T_m	41.00			$\bar{x}$	41.1891
LSL	36.90	x_{min}	40.53	$\bar{x}$-3s	40.1550
USL	45.10	x_{max}	42.38	$\bar{x}$+3s	42.2232
T	8.20	R	1.85	6s	2.0682
		$n_{<T>}$	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	3.96
Critical capability index	=	C_{mk}	3.78

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.	ILJ1093_b	Characteristic			
Part type	CLBA403	Char.Descr.	VM1698-4	Nom.val.	41,00
Ord. No.	CLBA403	Serial No.	1024210	LSL	36,90
				USL	45,10
Remark	TQ 100% hard +/-10% * Speed 189 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	41,03	41,02	41,09	41,82	41,18	41,79	41,91	41,25	40,94	40,88
1024210	VM1698-4	Grad	28,75	29,00	28,75	30,00	29,00	30,25	30,50	29,00	28,00	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	40,78	40,86	41,21	41,21	41,10	41,41	41,63	41,29	41,61	40,94
1024210	VM1698-4	Grad	28,25	28,75	29,25	29,25	29,25	30,25	30,75	30,25	30,75	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	41,22	41,51	41,07	41,28	41,21	41,53	40,99	41,09	40,67	41,01
1024210	VM1698-4	Grad	30,25	30,00	29,50	30,00	30,25	30,25	29,75	29,75	29,00	30,00

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	41,15	40,89	40,79	41,89	40,92	41,19	40,78	41,48	41,01	41,23
1024210	VM1698-4	Grad	29,75	29,75	29,75	31,25	29,50	30,00	29,00	30,25	29,75	30,00

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	41,01	41,11	41,20	40,88	40,53	40,85	40,80	41,07	40,96	41,33
1024210	VM1698-4	Grad	29,50	29,75	29,75	29,00	28,75	29,00	29,50	30,00	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	41,10	41,26	41,31	41,67	40,81	41,40	41,25	41,22	41,58	41,11
1024210	VM1698-4	Grad	30,50	30,25	30,50	31,50	29,75	30,75	30,50	30,75	31,25	30,00

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	41,41	41,46	41,32	41,57	41,04	41,07	41,07	40,96	40,98	40,88
1024210	VM1698-4	Grad	30,25	30,75	30,50	30,50	29,75	29,75	29,75	29,50	29,50	29,25

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	40,73	41,87	40,70	40,58	41,55	41,20	41,09	40,69	40,68	41,44
1024210	VM1698-4	Grad	29,00	31,50	29,00	29,25	30,75	30,25	30,00	29,75	29,25	30,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 26.01.2024

Serial No.	ILJ1093_b	Characteristic			
Part type	CLBA403	Char.Descr.	VM1698-4	Nom.val.	41,00
Ord. No.	CLBA403	Serial No.	1024210	LSL	36,90
				USL	45,10
Remark	TQ 100% hard +/-10% * Speed 189 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	41,01	40,88	41,34	41,71	41,28	40,68	41,30	42,24	41,66	41,27
1024210	VM1698-4	Grad	30,00	29,75	30,75	31,50	30,50	29,25	30,25	32,50	31,00	30,25

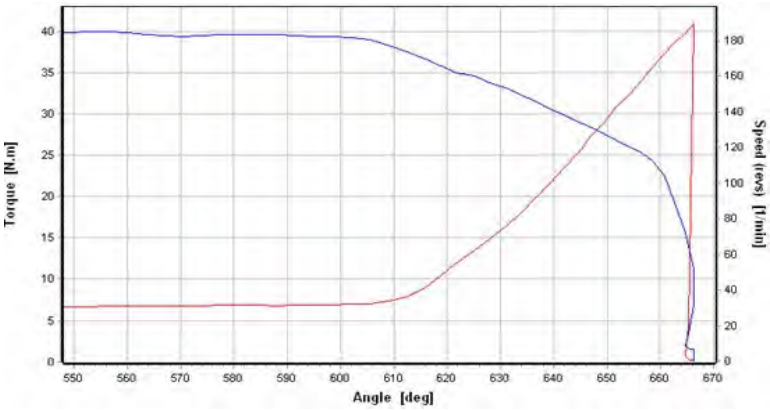
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	41,23	41,10	41,06	41,22	41,07	41,30	42,38	40,96	41,58	41,04
1024210	VM1698-4	Grad	30,00	29,75	30,00	30,25	29,75	30,00	32,00	29,50	30,25	29,25

Torque graphs

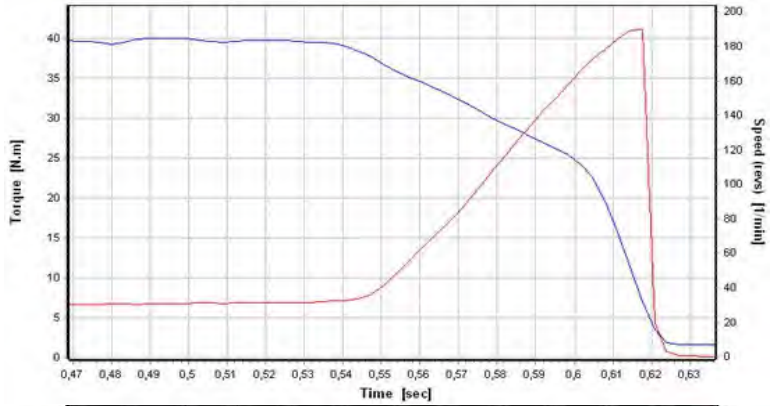
Machine Capability Study 100 %

Model: **CLBA403**
Serial no: **ILJ1093**

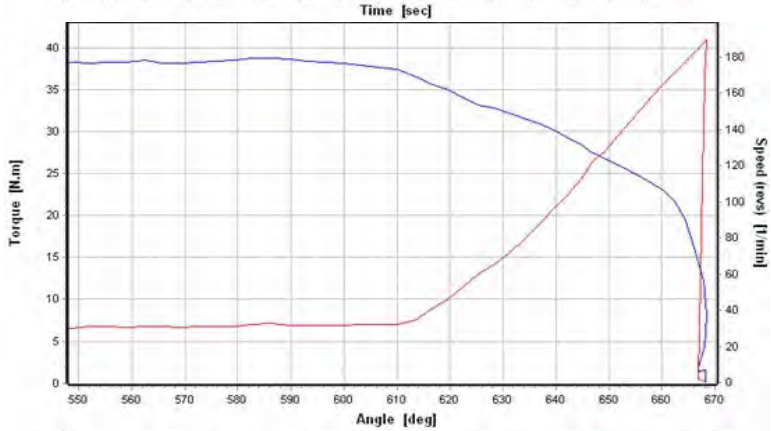
Angle degree: **30°**
Test torque: **41,0 Nm**



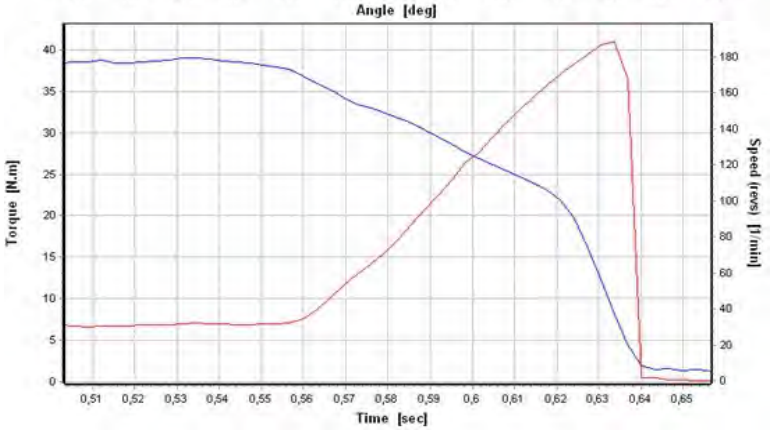
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

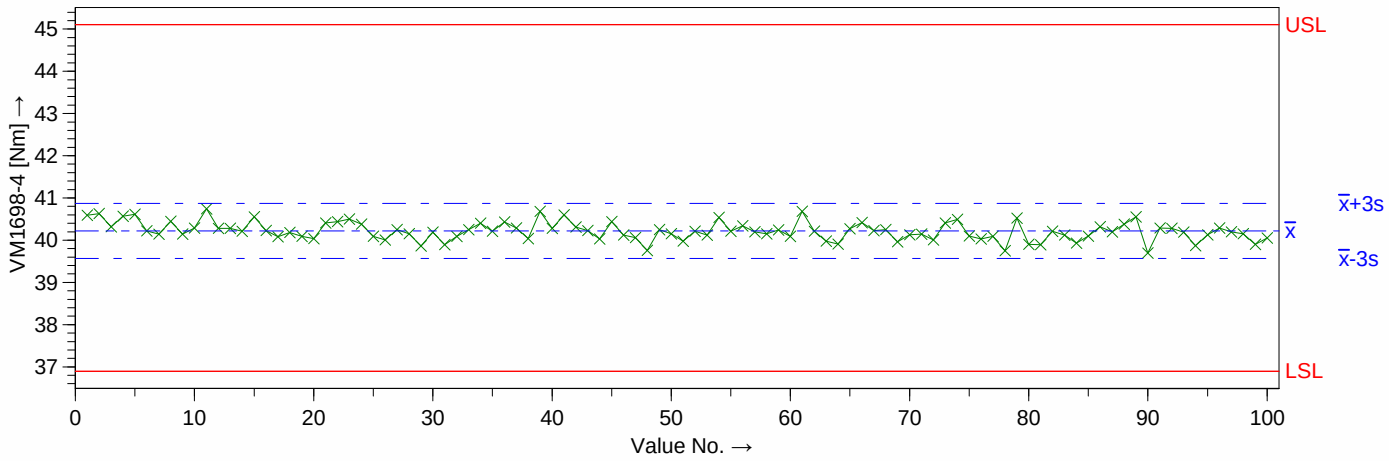
Machine Capability Study
Control System

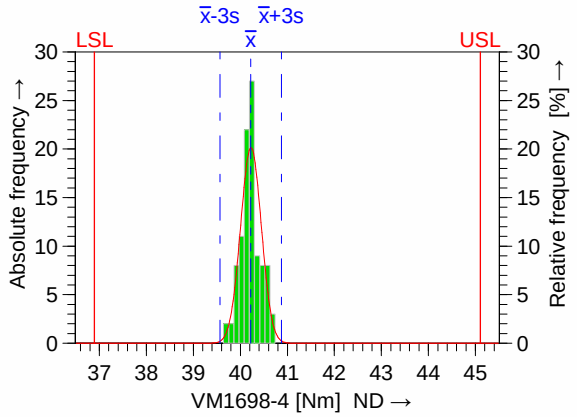
Plant	ATG Westhausen	Operator Name	Sorg
Date	26.01.2024		

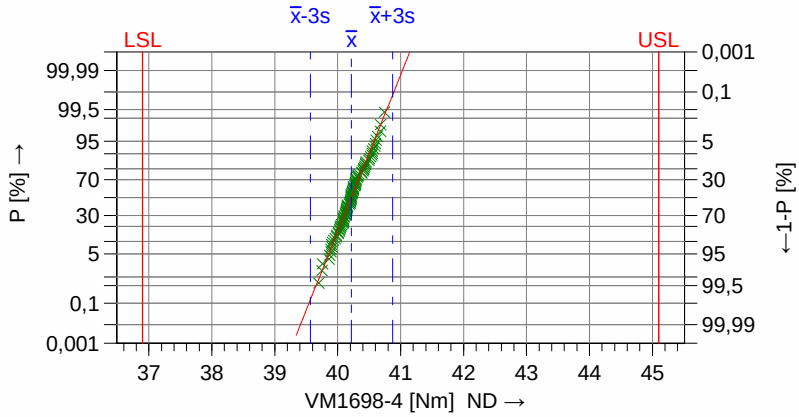
Ord. No.	CLBA403	Part type	CLBA403	Contr.item	yes
Serial No.	ILJ1093_a	Char.Descr.	VM1698-4	Nom.val. 41,00 4,10	USL 45,10
		Serial No.	1024210	Unit Nm -4,10	LSL 36,90
Char.Type	variable			Tolerance value 10 %	Decimal Pl. 2
Cust.Name	ATG	Reference System	VM1698-4	Test Electronic	---
Contr.No.	Homologation	Reference Transducer	50/1024729	nges.	100

Evaluation from 26.01.2024 08:12:17 to 26.01.2024 08:44:36

Rem. TQ 100% soft +/-10% * Speed 189 rpm; Pause 8 sec







Drawing Values		Collected Values		Statistics	
T_m	41.00			$\bar{x}$	40.2174
LSL	36.90	x_{min}	39.70	$\bar{x}$-3s	39.5641
USL	45.10	x_{max}	40.74	$\bar{x}$+3s	40.8707
T	8.20	R	1.04	6s	1.3066
		$n_{<T>}$	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	6.28
Critical capability index	=	C_{mk}	5.08

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 26.01.2024

Serial No.	ILJ1093_a	Characteristic			
Part type	CLBA403	Char.Descr.	VM1698-4	Nom.val.	41,00
Ord. No.	CLBA403	Serial No.	1024210	LSL	36,90
				USL	45,10
Remark	TQ 100% soft +/-10% * Speed 189 rpm; Pause 8 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	40,59	40,63	40,32	40,57	40,61	40,22	40,14	40,45	40,14	40,29
1024210	VM1698-4	Grad	355,00	355,00	350,75	360,75	370,00	354,25	354,75	359,75	349,50	356,00

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	40,74	40,28	40,28	40,21	40,55	40,23	40,08	40,18	40,09	40,04
1024210	VM1698-4	Grad	361,75	354,75	356,75	357,00	360,75	356,50	352,00	355,75	356,25	356,25

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	40,41	40,44	40,50	40,38	40,09	40,01	40,25	40,15	39,86	40,19
1024210	VM1698-4	Grad	364,00	365,00	360,00	371,00	355,00	361,50	361,25	362,25	352,75	353,75

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	39,89	40,09	40,25	40,40	40,21	40,43	40,29	40,04	40,68	40,28
1024210	VM1698-4	Grad	353,50	358,50	359,25	370,75	360,00	365,75	364,00	360,00	365,50	365,50

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	40,60	40,31	40,23	40,03	40,44	40,12	40,06	39,76	40,25	40,15
1024210	VM1698-4	Grad	367,50	361,25	369,75	358,50	364,75	361,50	366,25	353,00	359,75	366,75

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	39,98	40,21	40,12	40,54	40,21	40,34	40,20	40,15	40,24	40,09
1024210	VM1698-4	Grad	356,25	362,25	365,00	366,50	365,25	366,00	359,75	360,00	364,50	355,75

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	40,68	40,21	39,98	39,91	40,27	40,42	40,23	40,25	39,96	40,13
1024210	VM1698-4	Grad	368,00	367,75	354,25	362,25	361,00	366,75	367,50	362,75	357,00	361,00

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	40,14	40,01	40,41	40,49	40,10	40,03	40,09	39,75	40,52	39,90
1024210	VM1698-4	Grad	370,00	363,50	369,00	369,00	359,75	356,50	362,00	366,50	366,00	359,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 26.01.2024

Serial No.	ILJ1093_a	Characteristic			
Part type	CLBA403	Char.Descr.	VM1698-4	Nom.val.	41,00
Ord. No.	CLBA403	Serial No.	1024210	LSL	36,90
				USL	45,10
Remark	TQ 100% soft +/-10% * Speed 189 rpm; Pause 8 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	39,89	40,21	40,12	39,93	40,10	40,32	40,20	40,38	40,55	39,70
1024210	VM1698-4	Grad	363,00	360,75	360,75	367,50	361,00	368,75	363,00	363,75	370,50	354,25

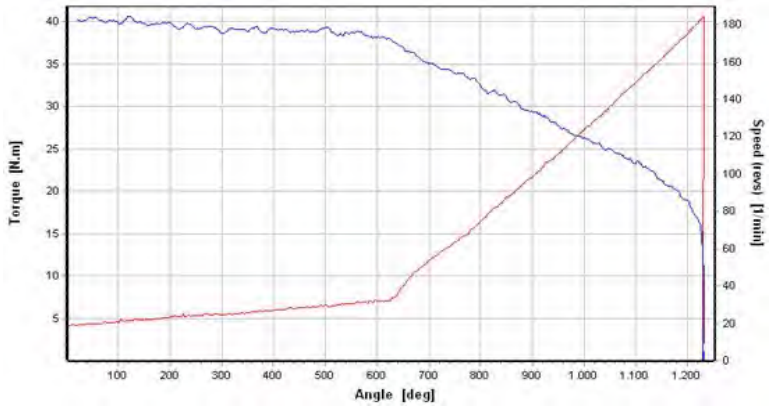
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	40,29	40,28	40,19	39,87	40,13	40,29	40,20	40,15	39,90	40,05
1024210	VM1698-4	Grad	361,75	363,75	368,75	356,25	365,00	362,75	363,75	370,75	357,50	361,50

Torque graphs

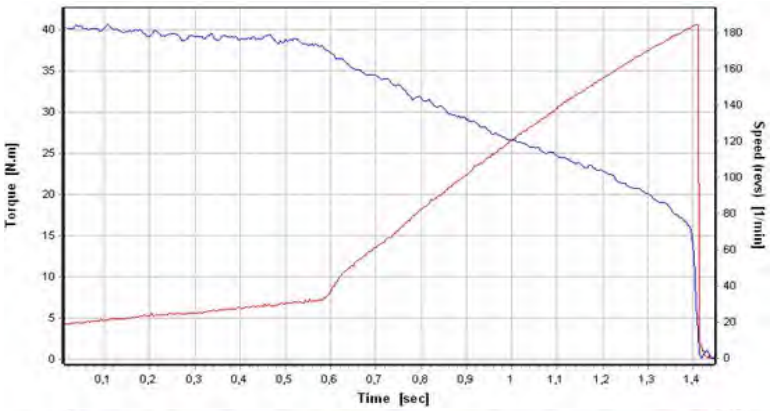
Machine Capability Study 100 %

Model: **CLBA403**
Serial no: **ILJ1093**

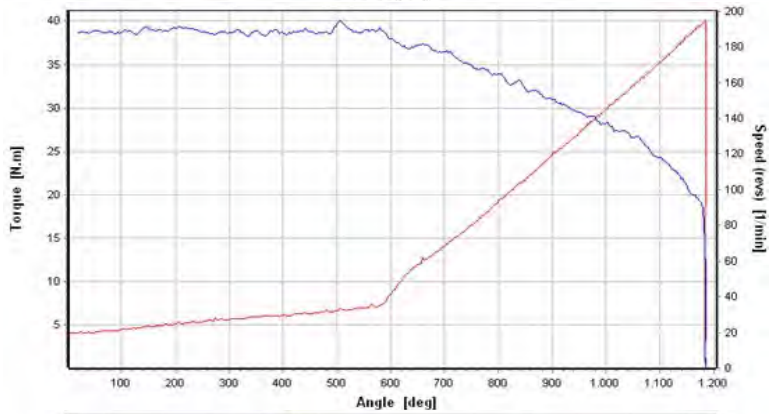
Angle degree: **360°**
Test torque: **41,0 Nm**



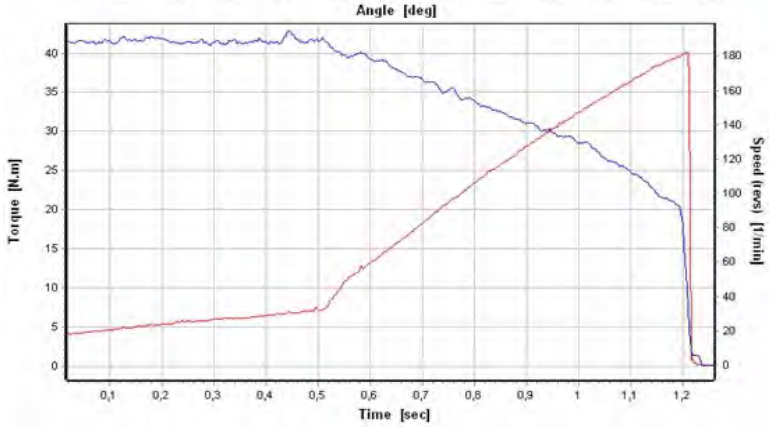
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed