Homologation

Cordless Assembly Tools

Model: CLBA403

Serial no.: ILJ1088

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Homologation: CLBA403 SN: ILJ1088

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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: **ILJ1088**

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

Hard joint (H) 139,14 Nm / Revolution Angle degree 30°

Soft joint (L) 11,16 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	23,19 Nm	22,32 Nm
	Standard deviation	0,34 Nm	0,14 Nm
	Torque scatter (99,73%)	2,04 Nm	0,83 Nm
	C_m	2,24	5,49
	C_{mk}	1,93	4,17

b) Min. C_m hard/soft (lowest value) 2,24
Min. C_{mk} hard/soft (lowest value) 1,93

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

Note:

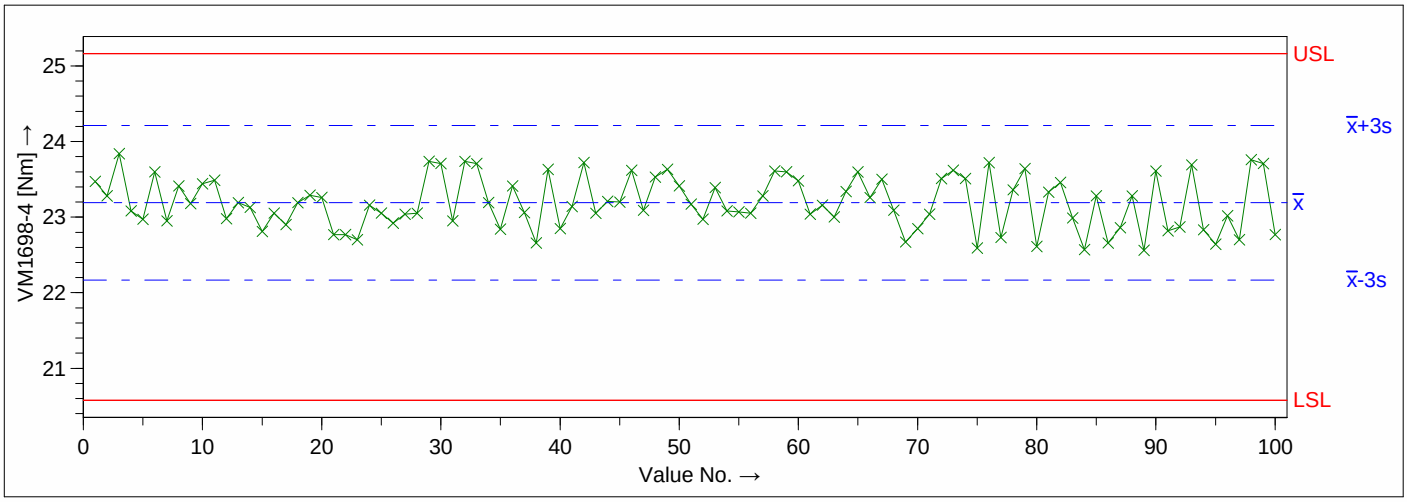
Machine Capability Study
Control System

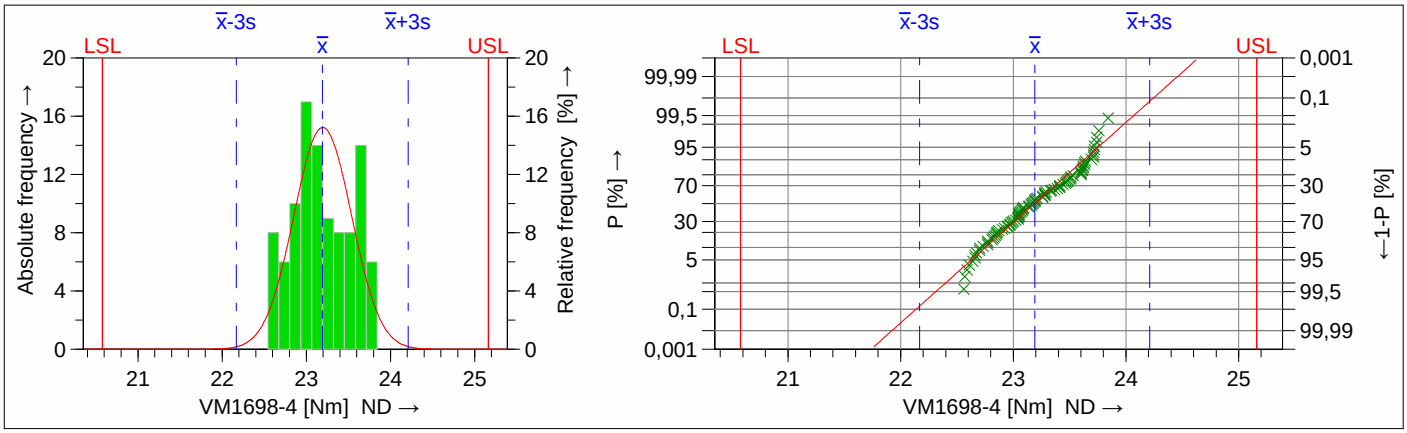
Plant	ATG Westhausen	Operator Name	Sorg
Date	22.01.2024		

Ord. No.	CLBA403	Part type	CLBA403	Contr.item	yes
Serial No.	ILJ1088_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 22.01.2024 10:16:04 to 22.01.2024 10:29:16

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





Drawing Values		Collected Values		Statistics	
T_m	22.87			x̄	23.1901
LSL	20.58	x_{min}	22.56	x̄-3s	22.1684
USL	25.16	x_{max}	23.84	x̄+3s	24.2118
T	4.58	R	1.28	6s	2.0434
		$n_{<T>}$	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}	1.93

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 22.01.2024

Serial No.	ILJ1088_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	23,28	23,84	23,08	22,97	23,60	22,95	23,41	23,18	23,44
1024210	VM1698-4	Grad	30,25	29,50	30,25	29,50	28,75	29,50	28,50	29,75	29,25	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	23,49	22,98	23,19	23,13	22,81	23,05	22,90	23,19	23,29	23,26
1024210	VM1698-4	Grad	29,50	28,50	28,75	29,75	28,75	28,50	29,00	30,00	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	22,77	22,77	22,70	23,16	23,05	22,92	23,04	23,05	23,74	23,71
1024210	VM1698-4	Grad	28,75	29,00	28,25	30,00	29,75	28,75	30,00	30,50	31,00	31,25

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	22,95	23,74	23,71	23,19	22,84	23,41	23,06	22,66	23,63	22,85
1024210	VM1698-4	Grad	29,75	31,00	32,00	30,25	28,50	30,50	29,50	28,75	31,00	28,25

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	23,14	23,72	23,05	23,21	23,20	23,62	23,09	23,53	23,63	23,41
1024210	VM1698-4	Grad	30,25	31,00	29,00	29,50	29,75	31,25	29,25	31,00	30,00	30,00

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	23,17	22,97	23,39	23,08	23,07	23,05	23,28	23,61	23,60	23,48
1024210	VM1698-4	Grad	29,50	29,25	30,00	29,75	29,25	29,75	30,50	30,50	30,75	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	23,04	23,16	23,00	23,34	23,60	23,26	23,50	23,09	22,67	22,85
1024210	VM1698-4	Grad	29,00	30,00	29,25	30,00	30,00	29,75	31,00	29,50	28,00	28,75

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	23,04	23,51	23,62	23,51	22,59	23,72	22,73	23,36	23,64	22,61
1024210	VM1698-4	Grad	29,25	30,75	30,00	29,50	28,00	30,75	28,00	30,75	30,75	27,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 22.01.2024

Serial No.	ILJ1088_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	23,33	23,46	22,99	22,57	23,28	22,66	22,86	23,28	22,56	23,61
1024210	VM1698-4	Grad	29,75	30,25	29,00	28,75	30,25	28,75	28,50	29,75	28,25	31,75

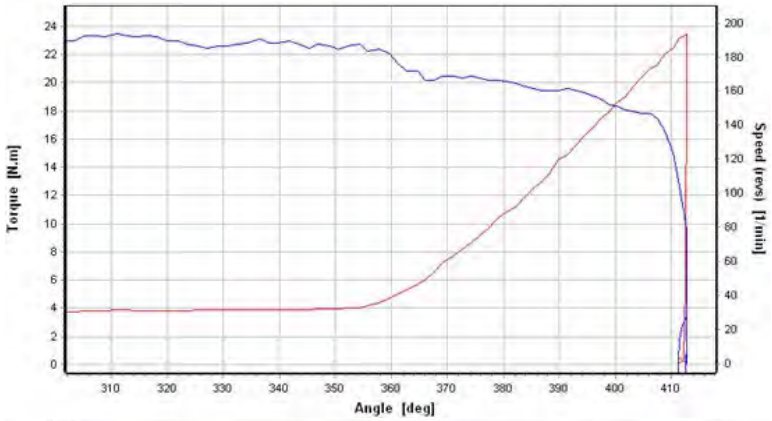
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	22,82	22,87	23,69	22,83	22,64	23,02	22,70	23,76	23,71	22,77
1024210	VM1698-4	Grad	29,25	30,00	31,00	28,25	28,25	29,50	28,75	32,75	32,25	29,75

Torque graphs

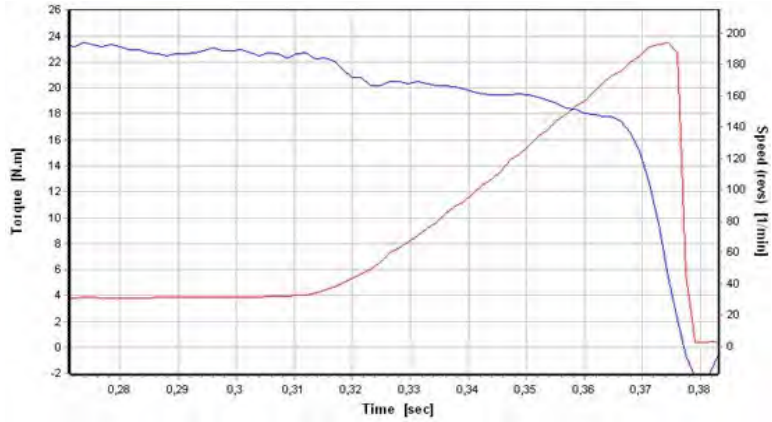
Machine Capability Study 30 %

Model: **CLBA403**
Serial no: **ILJ1088**

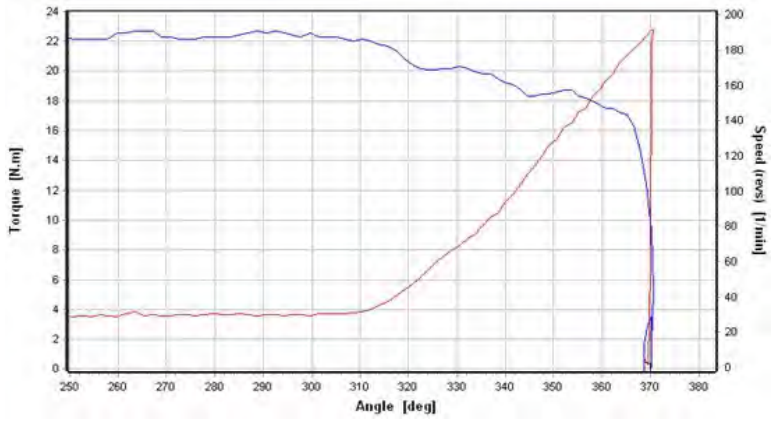
Angle degree: **30°**
Test torque: **22,9 Nm**



Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



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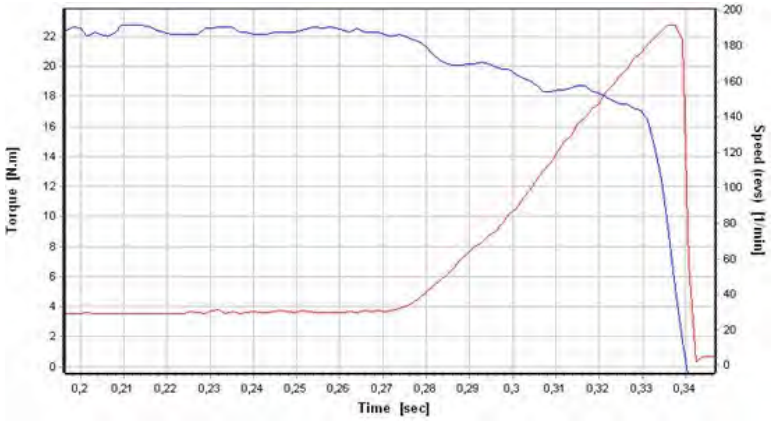
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

Machine Capability Study
Control System

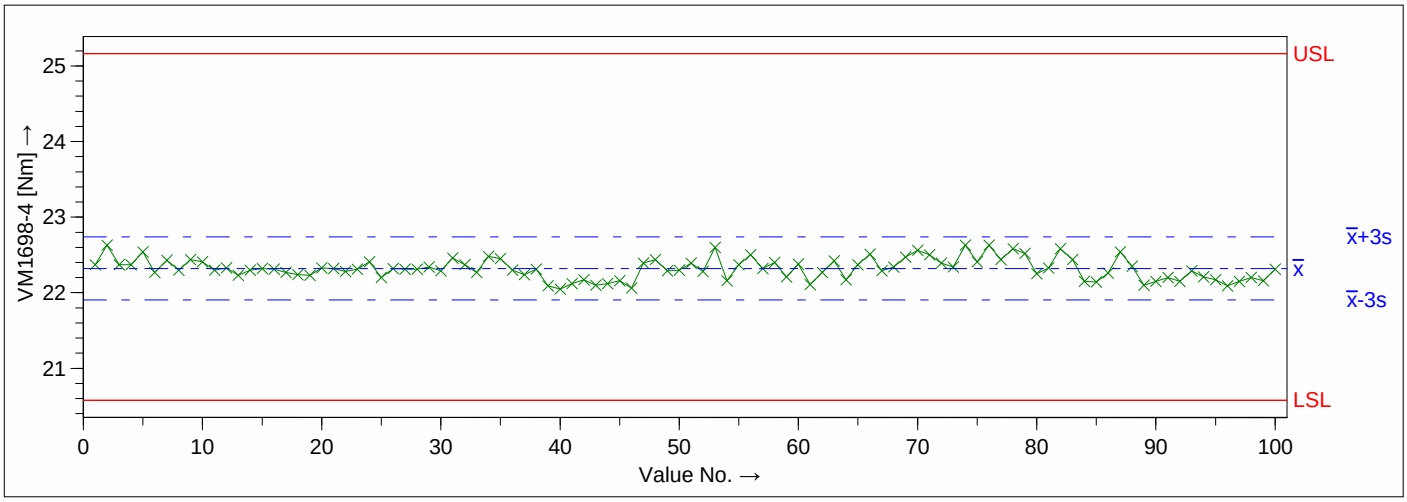
Cleco Production Tools

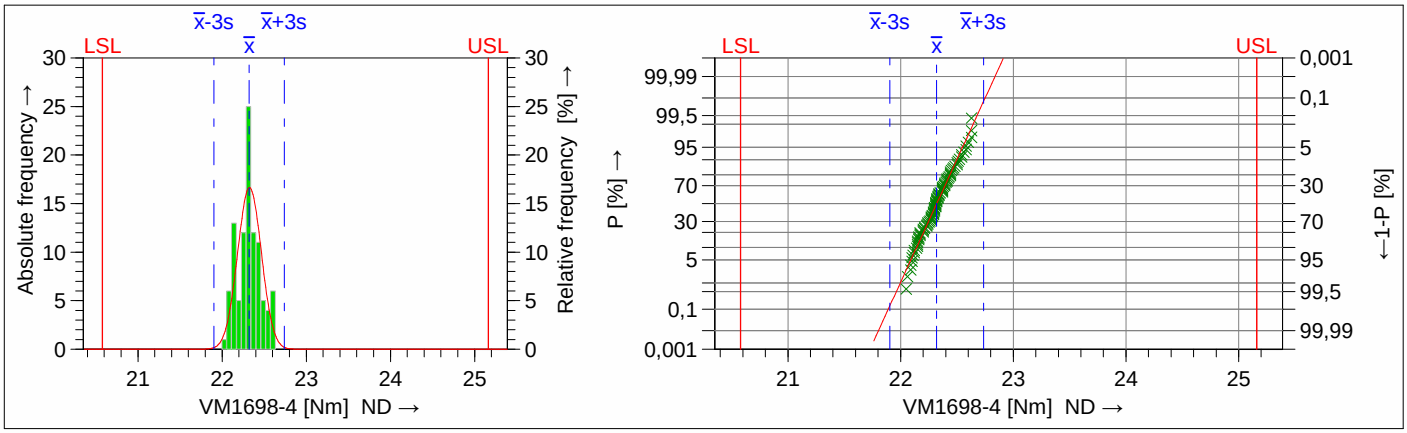
Plant	ATG Westhausen	Operator Name	Sorg
Date	22.01.2024		

Ord. No.	CLBA403	Part type	CLBA403	Contr.item	yes
Serial No.	ILJ1088_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 22.01.2024 10:29:47 to 22.01.2024 10:42:59

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





Drawing Values		Collected Values		Statistics	
T_m	22.87			$\bar{x}$	22.3203
LSL	20.58	x_{min}	22.05	$\bar{x}$-3s	21.9034
USL	25.16	x_{max}	22.63	$\bar{x}$+3s	22.7372
T	4.58	R	0.58	6s	0.8338
		$n_{<T>}$	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	5.49
Critical capability index	=	C_{mk}	4.17

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 22.01.2024

Serial No.	ILJ1088_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	22,37	22,63	22,37	22,37	22,54	22,27	22,43	22,30	22,44	22,41
1024210	VM1698-4	Grad	363,75	374,00	365,75	365,75	369,00	360,50	367,50	360,25	368,25	365,00

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	22,30	22,33	22,23	22,30	22,32	22,31	22,27	22,24	22,23	22,33
1024210	VM1698-4	Grad	360,75	364,50	361,00	361,25	363,75	360,75	361,75	361,00	361,00	363,75

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	22,32	22,28	22,31	22,41	22,20	22,32	22,31	22,31	22,34	22,29
1024210	VM1698-4	Grad	366,50	363,75	363,00	368,25	362,00	365,75	361,75	362,75	372,75	365,75

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	Nm	22,46	22,37	22,27	22,48	22,45	22,30	22,24	22,31	22,09	22,05
1024210	VM1698-4	Grad	367,50	365,75	370,00	372,00	364,50	359,50	360,50	360,50	357,25	358,00

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	22,12	22,17	22,10	22,12	22,16	22,06	22,39	22,44	22,29	22,30
1024210	VM1698-4	Grad	358,25	360,25	358,75	358,50	358,75	359,25	369,50	374,00	366,00	362,25

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	22,39	22,28	22,60	22,16	22,37	22,50	22,32	22,40	22,21	22,38
1024210	VM1698-4	Grad	359,25	357,00	363,00	352,50	359,00	361,25	359,00	360,25	356,25	360,50

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	22,11	22,27	22,42	22,17	22,37	22,51	22,29	22,34	22,47	22,56
1024210	VM1698-4	Grad	349,50	355,75	362,25	351,75	358,75	362,50	358,00	360,25	361,50	366,00

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	22,50	22,39	22,34	22,63	22,41	22,63	22,44	22,58	22,52	22,25
1024210	VM1698-4	Grad	365,50	363,00	356,25	364,75	362,00	364,50	360,75	363,25	362,75	356,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 22.01.2024

Serial No.	ILJ1088_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	22,33	22,58	22,44	22,15	22,14	22,26	22,54	22,35	22,10	22,15
1024210	VM1698-4	Grad	362,50	364,50	363,75	355,50	354,25	357,50	364,75	359,25	352,25	353,50

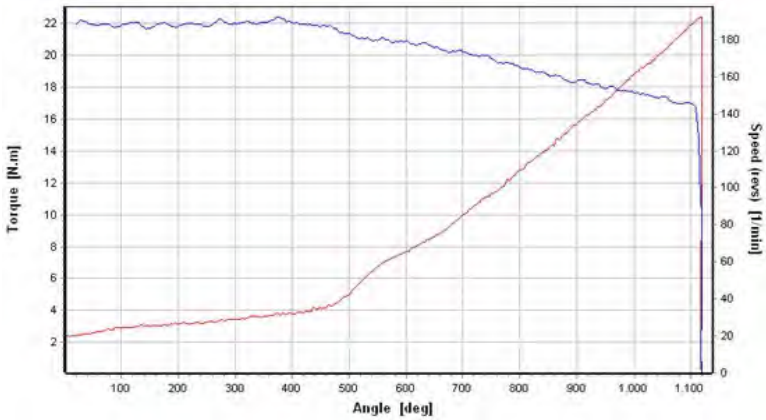
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	22,20	22,15	22,29	22,21	22,17	22,09	22,15	22,20	22,16	22,31
1024210	VM1698-4	Grad	355,00	354,25	357,75	357,50	353,50	351,75	351,25	355,75	350,50	358,00

Torque graphs

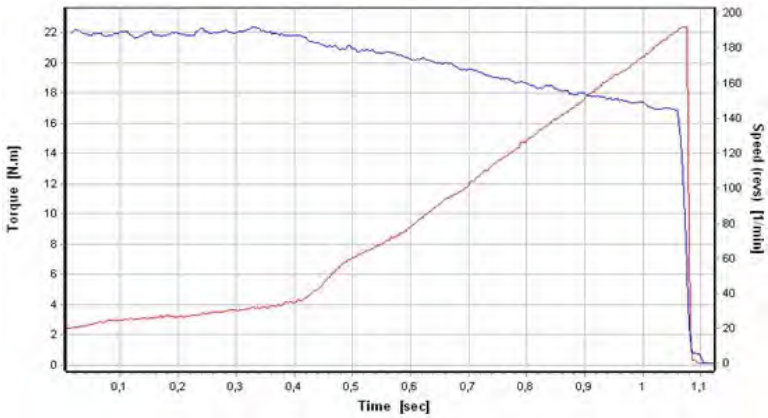
Machine Capability Study 30 %

Model: **CLBA403**
Serial no: **ILJ1088**

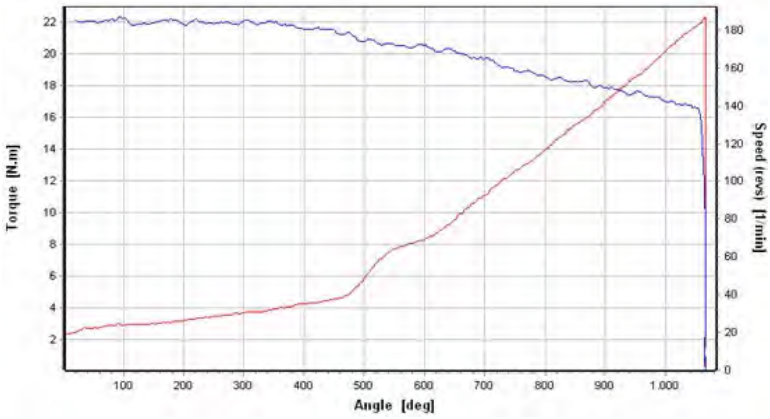
Angle degree: **360°**
Test torque: **22,9 Nm**



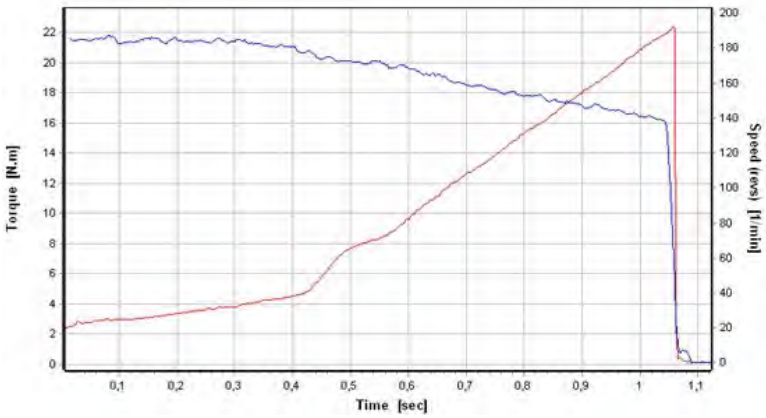
Value no. 1
Graph
Torque / Angle / Speed



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: **ILJ1088**

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

Hard joint (H) 215,45 Nm / Revolution Angle degree 30°

Soft joint (L) 17,28 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	35,91 Nm	34,57 Nm
	Standard deviation	0,48 Nm	0,23 Nm
	Torque scatter (99,73%)	2,89 Nm	1,39 Nm
	C_m	2,48	5,13
	C_{mk}	2,42	3,34

b)	Min. C_m hard/soft (lowest value)	2,48
	Min. C_{mk} hard/soft (lowest value)	2,42

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

Note:

Machine Capability Study
Control System

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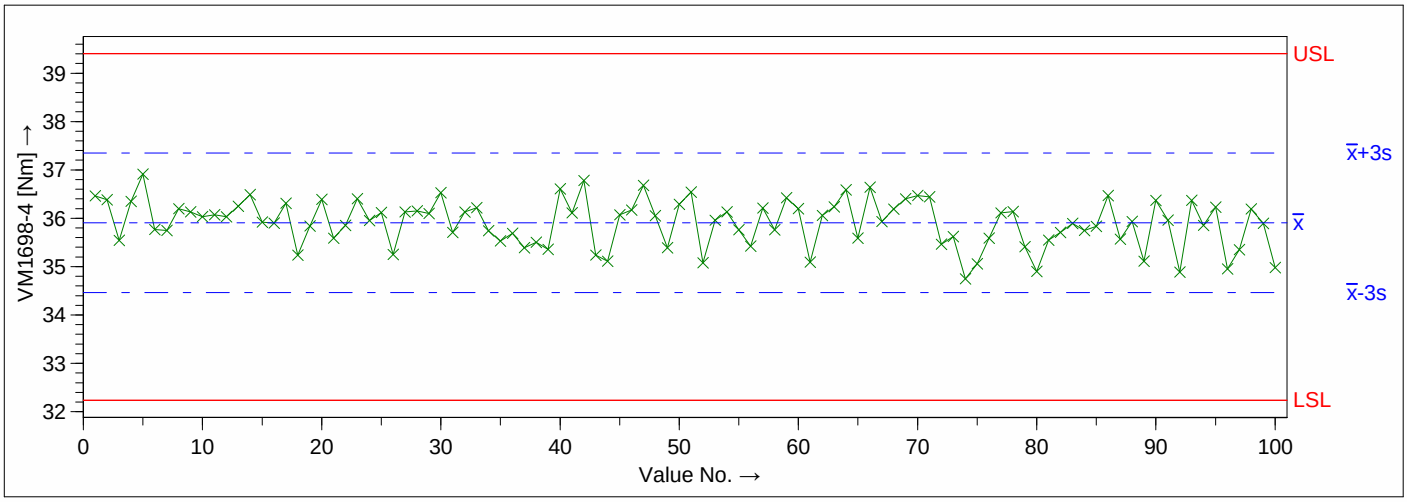
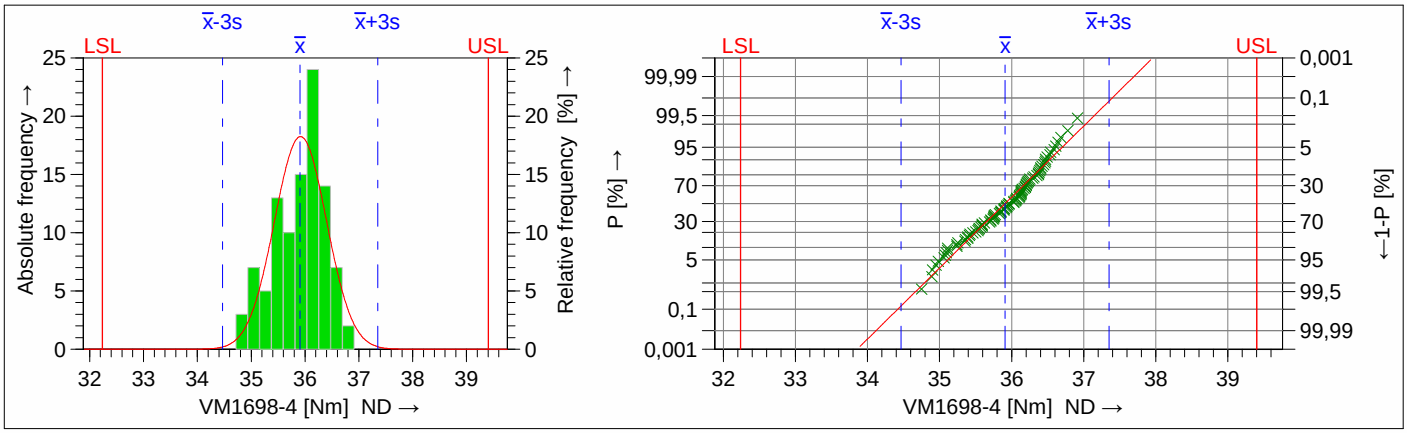
Plant	ATG Westhausen	Operator Name	Sorg
Date	31.01.2024		

Ord. No.	CLBA403	Part type	CLBA403	Contr.item	yes
Serial No.	ILJ1088_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 31.01.2024 09:26:55 to 31.01.2024 09:40:07

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





Drawing Values		Collected Values		Statistics	
T_m	35.82			$\bar{x}$	35.9080
LSL	32.24	x_{min}	34.75	$\bar{x}$-3s	34.4654
USL	39.40	x_{max}	36.91	$\bar{x}$+3s	37.3506
T	7.16	R	2.16	6s	2.8853
		$n_{<T>}$	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	2.48
Critical capability index	=	C_{mk}	2.42

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 31.01.2024

Serial No.	ILJ1088_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	36,46	36,38	35,54	36,35	36,91	35,77	35,75	36,20	36,13	36,03
1024210	VM1698-4	Grad	30,25	30,75	28,50	30,25	31,00	28,75	28,75	29,75	29,75	29,00

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	36,07	36,03	36,25	36,49	35,92	35,90	36,31	35,24	35,84	36,39
1024210	VM1698-4	Grad	29,50	30,00	30,00	30,25	29,25	29,00	29,75	27,75	29,50	30,50

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	Nm	35,59	35,85	36,40	35,95	36,12	35,25	36,13	36,15	36,10	36,53
1024210	VM1698-4	Grad	29,25	29,50	30,50	30,00	29,75	28,50	30,00	29,75	29,75	30,75

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	35,71	36,13	36,22	35,74	35,53	35,69	35,39	35,50	35,36	36,61
1024210	VM1698-4	Grad	29,50	30,00	30,00	29,25	29,00	29,00	28,50	28,50	28,75	31,25

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	36,11	36,78	35,24	35,11	36,07	36,17	36,68	36,05	35,39	36,29
1024210	VM1698-4	Grad	30,25	31,75	28,75	28,75	30,50	30,50	31,50	30,50	29,25	31,00

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	36,54	35,08	35,96	36,13	35,76	35,42	36,21	35,76	36,42	36,20
1024210	VM1698-4	Grad	31,25	28,50	30,25	30,50	29,75	29,00	30,50	29,50	30,75	31,00

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	35,09	36,06	36,24	36,59	35,59	36,64	35,93	36,19	36,40	36,47
1024210	VM1698-4	Grad	28,50	30,25	30,25	31,75	29,50	31,25	29,75	30,50	31,00	31,25

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	36,44	35,46	35,62	34,75	35,06	35,59	36,11	36,14	35,41	34,90
1024210	VM1698-4	Grad	31,00	29,25	29,00	27,75	28,75	30,25	31,25	31,00	29,50	28,50

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 31.01.2024

Serial No.	ILJ1088_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	35,55	35,71	35,89	35,75	35,83	36,47	35,57	35,93	35,11	36,37
1024210	VM1698-4	Grad	30,25	30,25	30,75	30,00	30,50	31,50	29,50	30,25	29,00	31,50

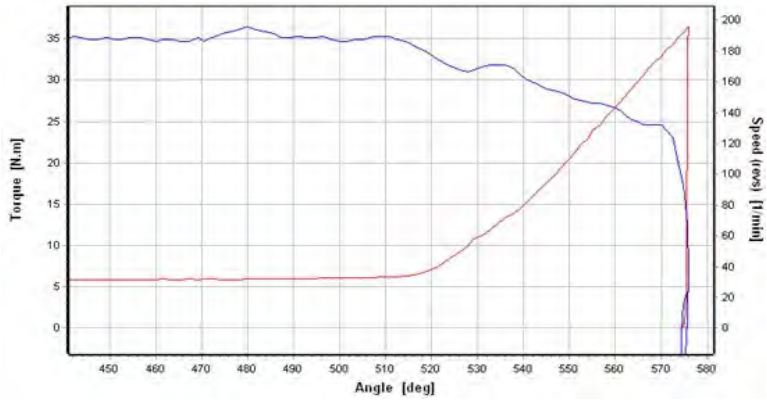
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	35,96	34,89	36,37	35,85	36,23	34,95	35,35	36,19	35,89	34,98
1024210	VM1698-4	Grad	30,50	29,00	31,25	30,25	31,00	28,50	29,00	30,75	30,50	28,75

Torque graphs

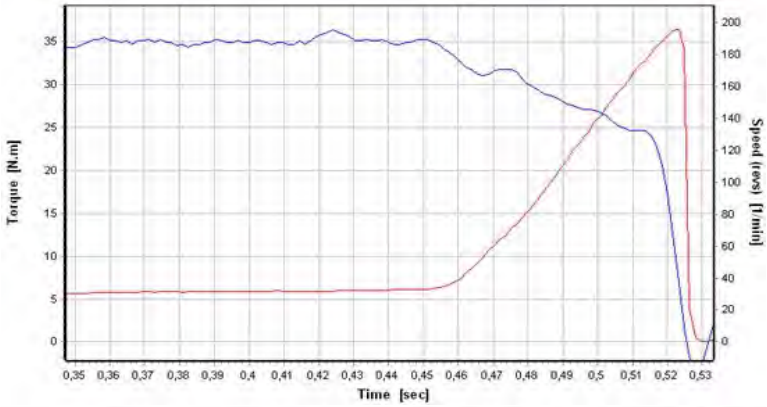
Machine Capability Study 80 %

Model: **CLBA403**
Serial no: **ILJ1088**

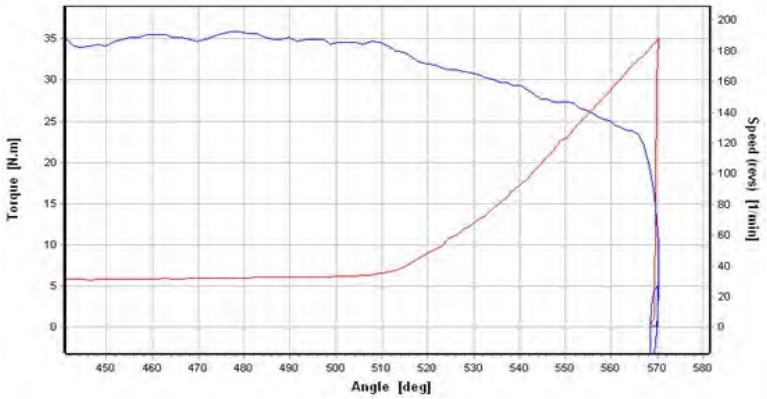
Angle degree: **30°**
Test torque: **35,8 Nm**



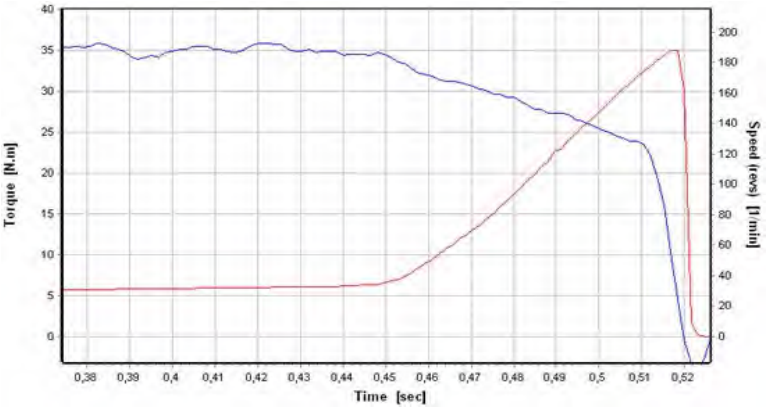
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

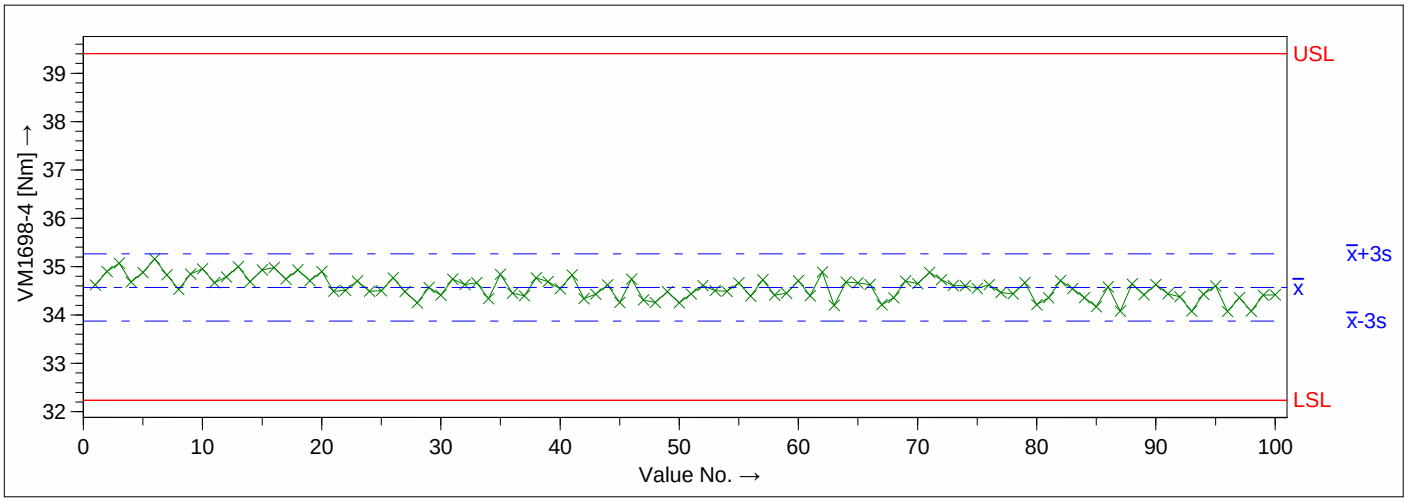
Machine Capability Study
Control System

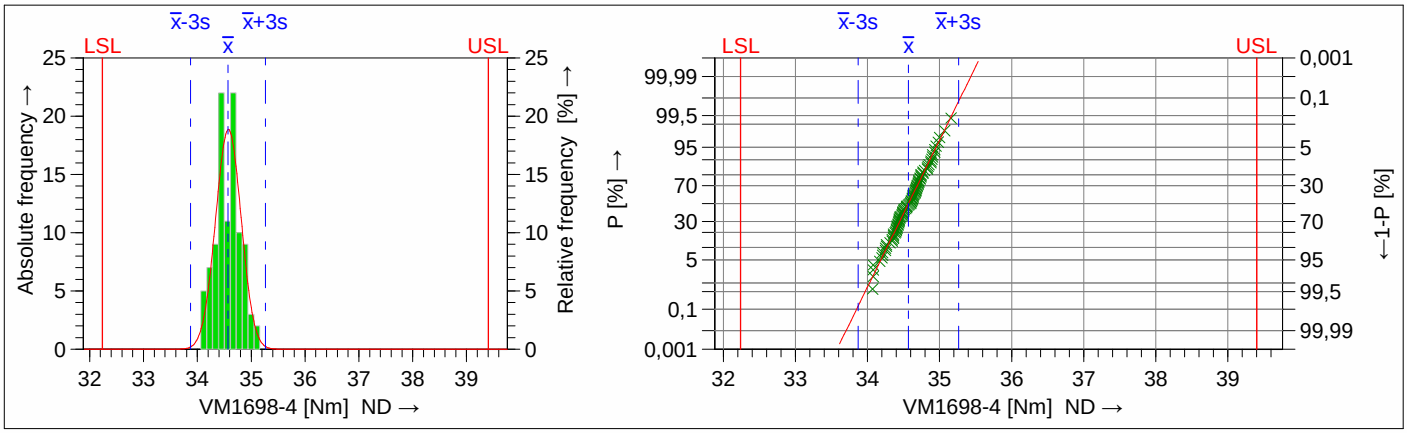
Plant	ATG Westhausen	Operator Name	Sorg
Date	31.01.2024		

Ord. No.	CLBA403	Part type	CLBA403	Contr.item	yes
Serial No.	ILJ1088_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 31.01.2024 09:52:32 to 31.01.2024 10:05:44

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





Drawing Values		Collected Values		Statistics	
T_m	35.82			$\bar{x}$	34.5687
LSL	32.24	x_{min}	34.07	$\bar{x}$-3s	33.8712
USL	39.40	x_{max}	35.16	$\bar{x}$+3s	35.2662
T	7.16	R	1.09	6s	1.3949
		$n_{<T>}$	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	5.13
Critical capability index	=	C_{mk}	3.34

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 31.01.2024

Serial No.	ILJ1088_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	34,62	34,90	35,07	34,68	34,88	35,16	34,83	34,53	34,85	34,95
1024210	VM1698-4	Grad	351,25	358,50	353,50	351,50	351,50	364,25	357,00	352,75	353,00	359,50

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	34,67	34,79	35,00	34,69	34,93	34,98	34,74	34,93	34,71	34,90
1024210	VM1698-4	Grad	351,50	357,25	353,75	354,00	353,75	354,25	354,25	355,25	353,75	353,75

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	34,49	34,51	34,70	34,49	34,50	34,77	34,48	34,25	34,57	34,41
1024210	VM1698-4	Grad	349,25	348,75	359,00	354,25	352,75	358,25	350,50	351,75	353,25	353,25

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	34,74	34,63	34,67	34,34	34,84	34,45	34,40	34,77	34,69	34,54
1024210	VM1698-4	Grad	360,75	364,00	357,25	357,00	361,50	360,50	354,75	368,00	363,00	356,75

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	34,83	34,34	34,43	34,62	34,26	34,74	34,31	34,26	34,48	34,25
1024210	VM1698-4	Grad	366,25	355,25	360,50	358,25	357,75	363,75	356,50	360,00	356,50	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	34,44	34,61	34,50	34,49	34,66	34,39	34,73	34,41	34,45	34,71
1024210	VM1698-4	Grad	362,00	362,00	365,75	359,75	370,25	362,00	368,25	361,75	362,75	372,75

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	34,40	34,89	34,20	34,68	34,66	34,63	34,21	34,36	34,70	34,65
1024210	VM1698-4	Grad	361,25	371,00	362,25	366,25	375,00	370,75	354,75	362,25	364,00	365,25

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	34,88	34,73	34,61	34,60	34,55	34,62	34,46	34,44	34,67	34,21
1024210	VM1698-4	Grad	371,50	363,00	362,75	366,75	360,00	362,50	365,75	358,75	363,75	361,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 31.01.2024

Serial No.	ILJ1088_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	34,36	34,71	34,54	34,36	34,17	34,58	34,08	34,64	34,42	34,63
1024210	VM1698-4	Grad	356,25	362,00	366,50	358,50	353,75	365,00	352,75	361,00	364,25	362,75

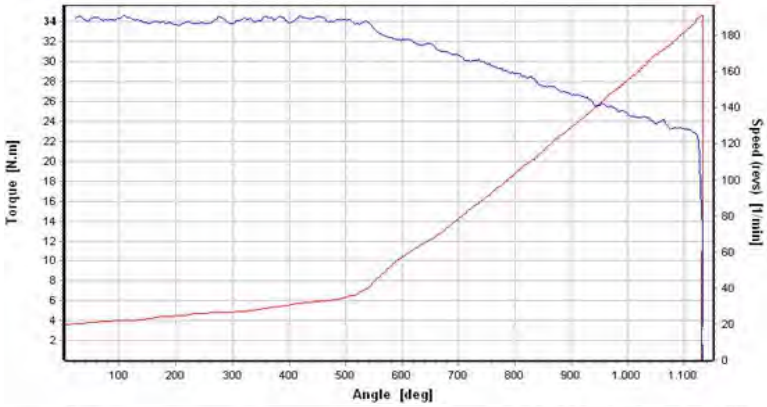
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	34,44	34,38	34,08	34,43	34,60	34,07	34,36	34,08	34,41	34,42
1024210	VM1698-4	Grad	356,50	365,75	355,25	361,75	366,75	353,50	358,75	356,75	362,50	357,00

Torque graphs

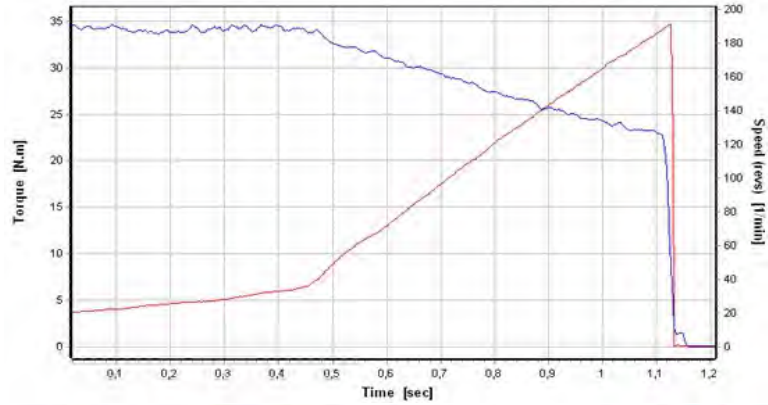
Machine Capability Study 80 %

Model: **CLBA403**
Serial no: **ILJ1088**

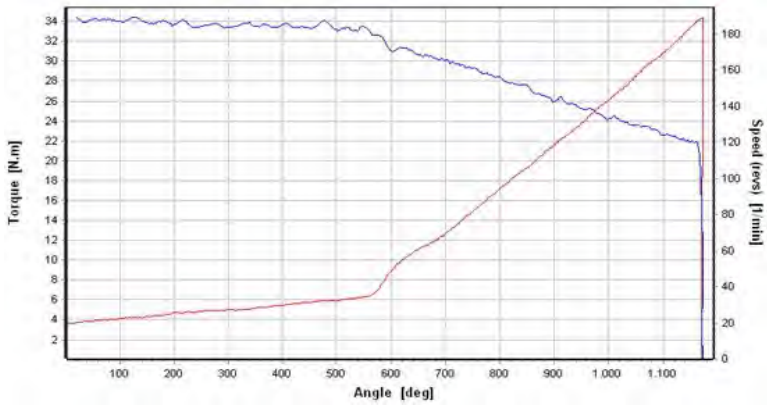
Angle degree: **360°**
Test torque: **35,8 Nm**



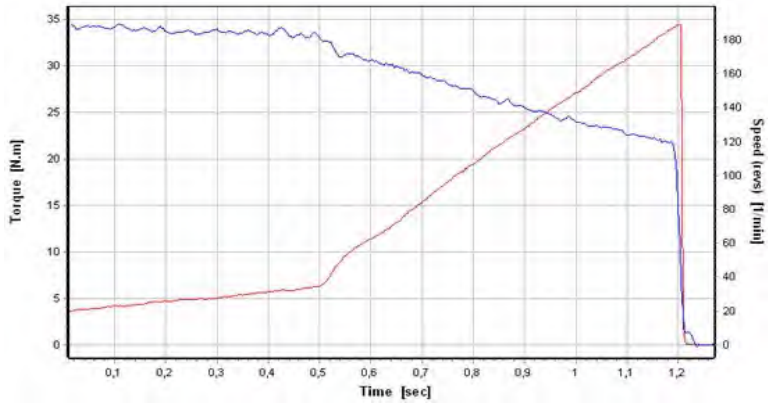
Value no. 1
Graph
Torque / Angle / Speed



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: **ILJ1088**

Test torque: Tq max. 41,00 Nm

Hard joint (H) 246,47 Nm / Revolution Angle degree 30°

Soft joint (L) 19,77 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	41,08 Nm	39,55 Nm
	Standard deviation	0,64 Nm	0,22 Nm
	Torque scatter (99,73%)	3,84 Nm	1,32 Nm
	C_m	2,13	5,93
	C_{mk}	2,09	3,83

b)	Min. C_m hard/soft (lowest value)	2,13
	Min. C_{mk} hard/soft (lowest value)	2,09

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

Note:

Machine Capability Study
Control System

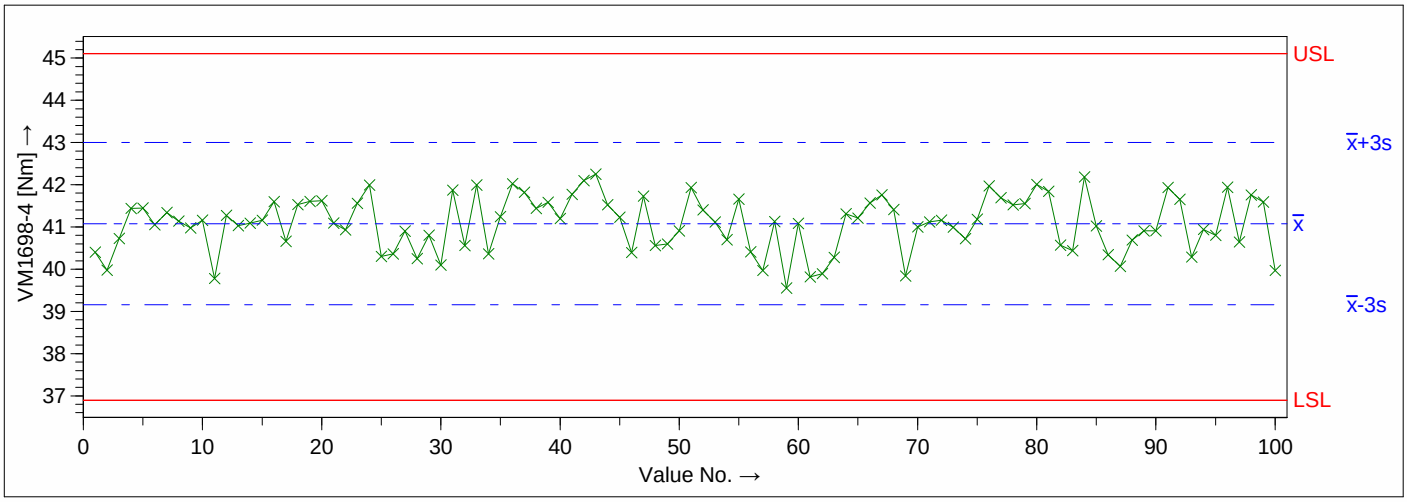
Cleco Production Tools

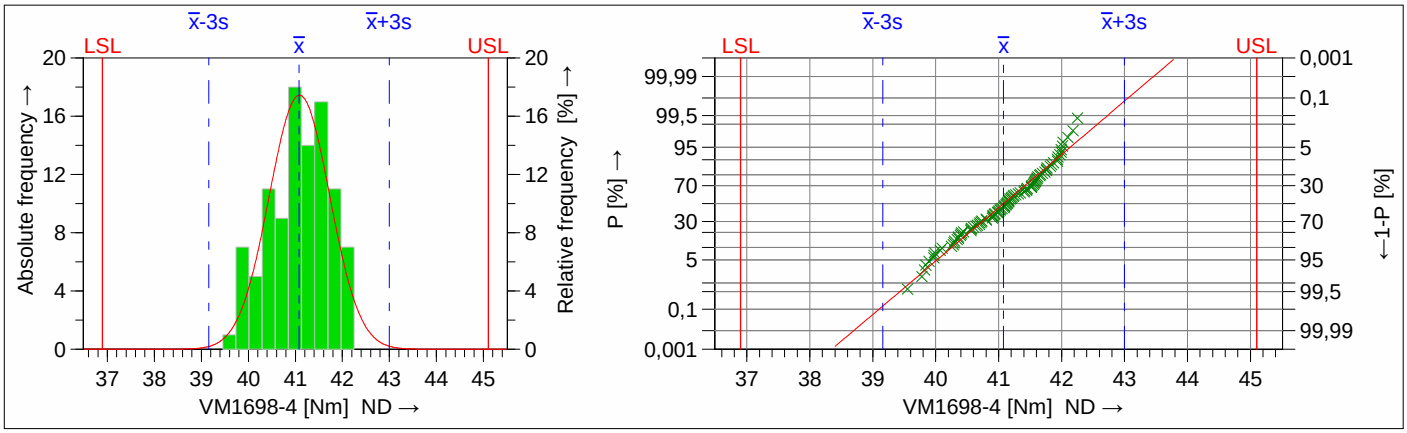
Plant	ATG Westhausen	Operator Name	Sorg
Date	24.01.2024		

Ord. No.	CLBA403	Part type	CLBA403	Contr.item	yes
Serial No.	ILJ1088_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 24.01.2024 07:53:33 to 24.01.2024 08:08:24

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





Drawing Values		Collected Values		Statistics	
T_m	41.00			$\bar{x}$	41.0786
LSL	36.90	x_{min}	39.55	$\bar{x}$-3s	39.1576
USL	45.10	x_{max}	42.25	$\bar{x}$+3s	42.9996
T	8.20	R	2.70	6s	3.8419
		$n_{<T>}$	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	2.13
Critical capability index	=	C_{mk}	2.09

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 24.01.2024

Serial No.	ILJ1088_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	40,40	39,98	40,73	41,44	41,45	41,05	41,34	41,14	40,98	41,16
1024210	VM1698-4	Grad	30,00	29,25	30,50	31,75	32,00	31,25	31,75	31,25	31,25	31,00

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	39,78	41,27	41,03	41,09	41,16	41,60	40,66	41,53	41,61	41,62
1024210	VM1698-4	Grad	29,25	31,75	31,00	31,50	31,25	31,75	30,25	31,50	31,00	30,75

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	41,09	40,93	41,56	41,99	40,30	40,36	40,90	40,25	40,80	40,10
1024210	VM1698-4	Grad	30,00	29,75	31,25	32,00	29,00	29,25	30,00	29,25	30,00	28,50

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	41,87	40,56	41,99	40,36	41,24	42,02	41,82	41,44	41,58	41,20
1024210	VM1698-4	Grad	31,75	29,50	32,00	29,50	30,75	32,50	32,00	31,00	30,25	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	41,77	42,10	42,25	41,52	41,23	40,39	41,73	40,56	40,60	40,91
1024210	VM1698-4	Grad	31,25	32,25	32,00	30,00	30,00	28,50	30,25	28,25	28,50	29,00

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	41,93	41,40	41,11	40,70	41,66	40,41	39,97	41,13	39,55	41,08
1024210	VM1698-4	Grad	31,50	30,50	30,25	29,00	31,75	28,50	28,25	30,25	27,00	29,25

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	Nm	39,82	39,89	40,28	41,31	41,21	41,57	41,76	41,41	39,84	41,00
1024210	VM1698-4	Grad	27,75	27,50	29,00	31,00	30,75	31,25	32,00	31,50	28,50	30,75

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	41,12	41,16	40,99	40,72	41,18	41,97	41,69	41,52	41,55	42,01
1024210	VM1698-4	Grad	31,00	30,75	30,25	29,00	30,50	32,50	31,75	31,50	31,00	31,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 24.01.2024

Serial No.	ILJ1088_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	41,84	40,57	40,44	42,18	41,02	40,34	40,07	40,69	40,91	40,91
1024210	VM1698-4	Grad	31,25	29,25	28,50	31,75	29,50	28,25	27,75	28,50	29,00	29,25

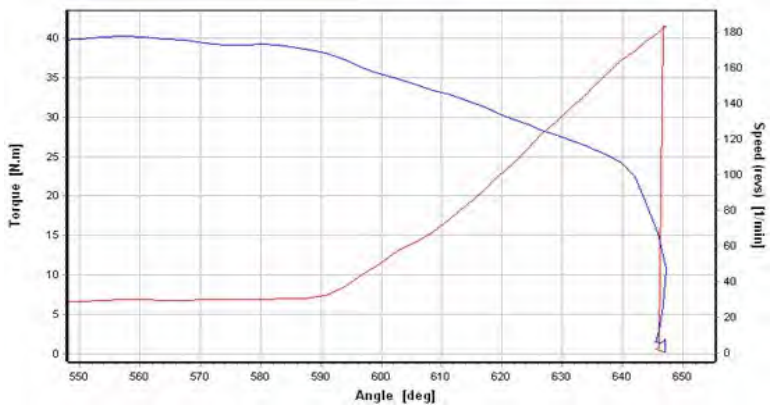
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	41,93	41,65	40,29	40,94	40,80	41,94	40,64	41,76	41,59	39,97
1024210	VM1698-4	Grad	32,00	31,25	29,00	30,00	29,50	32,00	29,50	31,50	31,00	27,75

Torque graphs

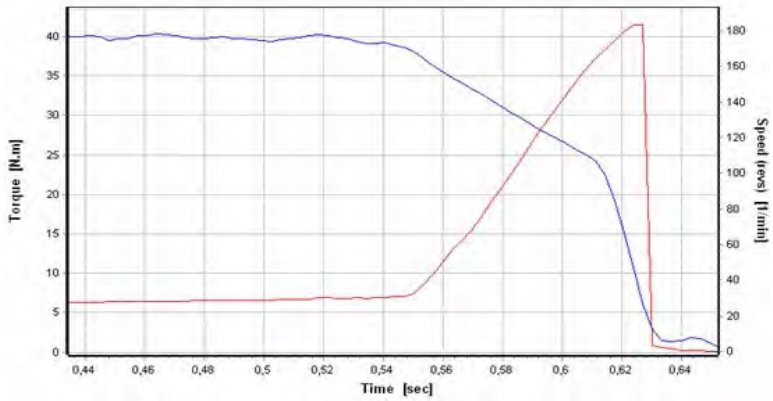
Machine Capability Study 100 %

Model: **CLBA403**
Serial no: **ILJ1088**

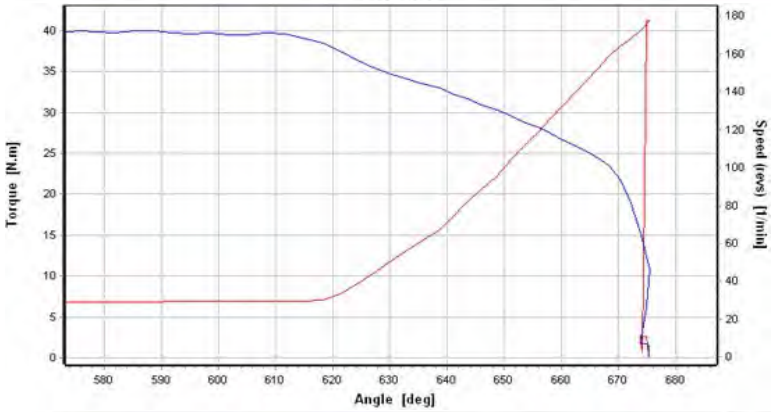
Angle degree: **30°**
Test torque: **41,0 Nm**



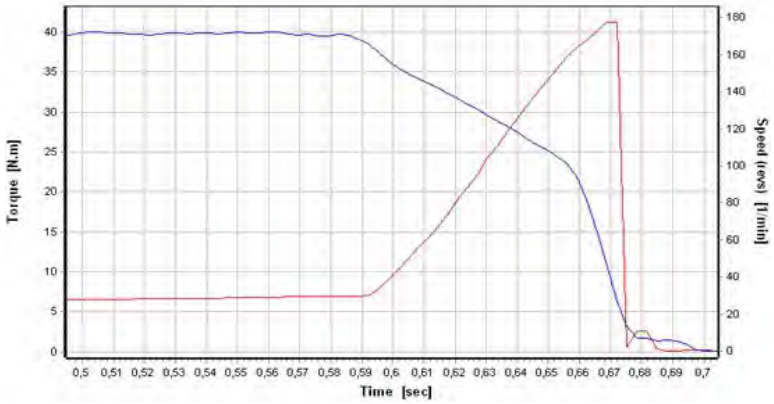
Value no. 1
Graph
Torque / Angle / Speed



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

Cleco Production Tools

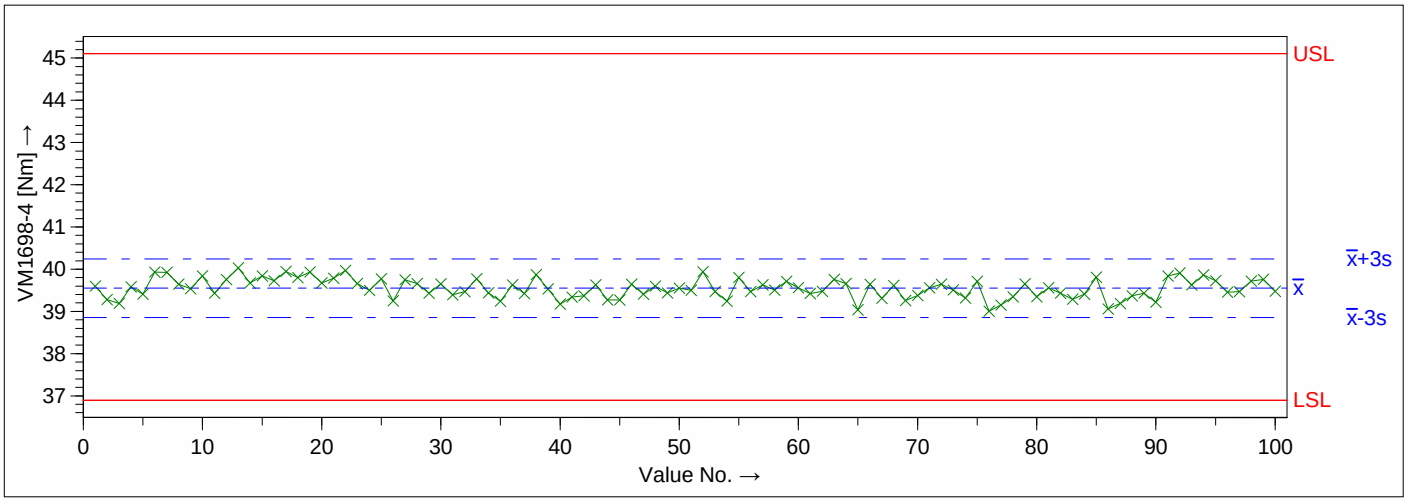
Plant ATG Westhausen		Operator Name Sorg	Date 24.01.2024

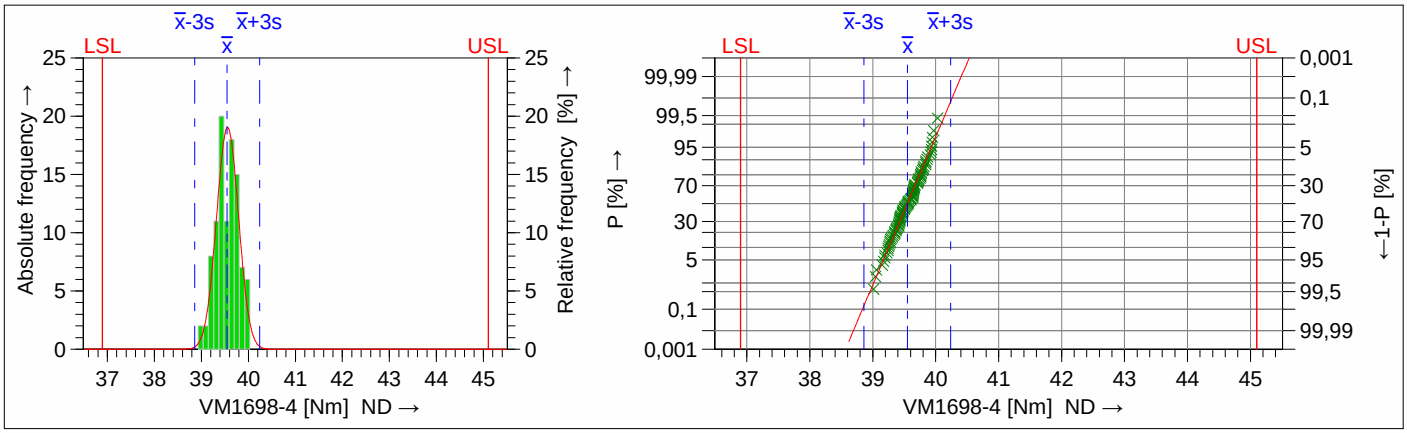
Ord. No. CLBA403	Part type CLBA403				Contr.item yes
Serial No. ILJ1088_a	Char.Descr. VM1698-4	Nom.val.	41,00	4,10	USL 45,10
	Serial No. 1024210	Unit	Nm	-4,10	LSL 36,90
Char.Type variable		Tolerance value	10 %		Decimal Pl. 2

Cust.Name ATG	Reference System VM1698-4	Test Electronic ---
Contr.No. Homologation	Reference Transducer 50/1024729	nges. 100

Evaluation from 24.01.2024 08:48:34 to 24.01.2024 09:12:35

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





Drawing Values		Collected Values		Statistics	
T_m	41.00			$\bar{x}$	39.5488
LSL	36.90	x_{min}	39.01	$\bar{x}$-3s	38.8578
USL	45.10	x_{max}	40.03	$\bar{x}$+3s	40.2398
T	8.20	R	1.02	6s	1.3820
		$n_{<T>}$	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	5.93
Critical capability index	=	C_{mk}	3.83

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 24.01.2024

Serial No.	ILJ1088_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				

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	39,60	39,28	39,19	39,58	39,41	39,93	39,92	39,64	39,54	39,84
1024210	VM1698-4	Grad	359,25	358,25	356,75	360,75	353,00	365,25	365,75	371,25	369,00	369,25

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	39,43	39,76	40,03	39,67	39,84	39,73	39,95	39,80	39,93	39,67
1024210	VM1698-4	Grad	356,75	364,00	370,00	366,00	372,00	362,75	371,00	370,75	367,75	358,00

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	39,79	39,97	39,66	39,50	39,77	39,25	39,75	39,66	39,43	39,65
1024210	VM1698-4	Grad	360,75	367,25	368,75	358,50	361,75	353,75	367,25	360,50	355,25	369,00

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	39,39	39,47	39,77	39,44	39,24	39,63	39,42	39,87	39,53	39,17
1024210	VM1698-4	Grad	363,50	359,00	361,00	357,75	361,00	362,75	354,50	365,25	366,75	361,25

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	39,34	39,37	39,63	39,27	39,27	39,64	39,41	39,60	39,44	39,55
1024210	VM1698-4	Grad	356,75	358,50	364,00	362,75	359,75	363,50	357,25	369,25	365,75	363,00

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	39,50	39,94	39,47	39,24	39,80	39,47	39,63	39,51	39,71	39,56
1024210	VM1698-4	Grad	358,75	367,50	367,00	356,25	366,00	366,75	370,25	362,00	362,50	367,75

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	39,42	39,48	39,76	39,66	39,04	39,64	39,31	39,61	39,26	39,38
1024210	VM1698-4	Grad	359,75	359,00	366,50	365,75	351,50	367,25	358,75	365,00	363,25	360,75

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	39,56	39,64	39,51	39,32	39,71	39,01	39,15	39,35	39,65	39,35
1024210	VM1698-4	Grad	363,00	368,00	368,25	360,00	362,00	357,25	355,75	356,50	369,25	360,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 24.01.2024

Serial No.	ILJ1088_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				

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	39,56	39,43	39,29	39,41	39,81	39,06	39,19	39,37	39,43	39,22
1024210	VM1698-4	Grad	361,75	364,75	363,25	360,00	364,50	356,75	361,75	360,00	359,50	362,00

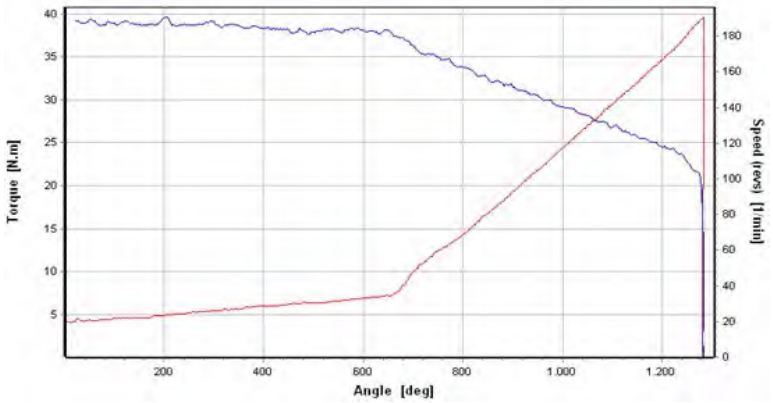
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	39,84	39,91	39,63	39,86	39,73	39,45	39,47	39,72	39,76	39,48
1024210	VM1698-4	Grad	366,00	379,50	366,25	369,50	362,75	355,00	356,00	368,00	362,00	358,50

Torque graphs

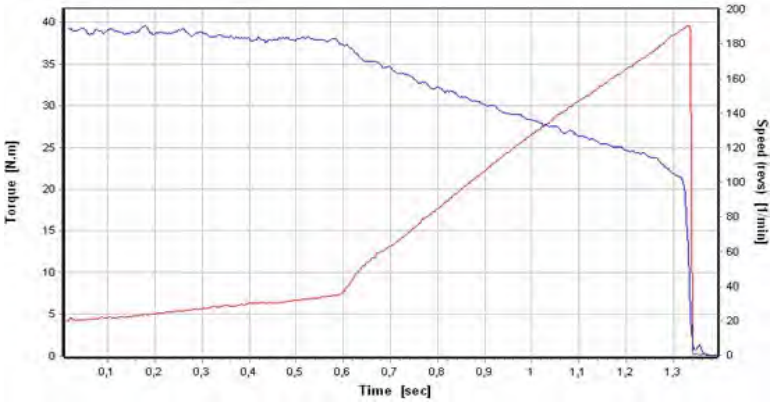
Machine Capability Study 100 %

Model: **CLBA403**
Serial no: **ILJ1088**

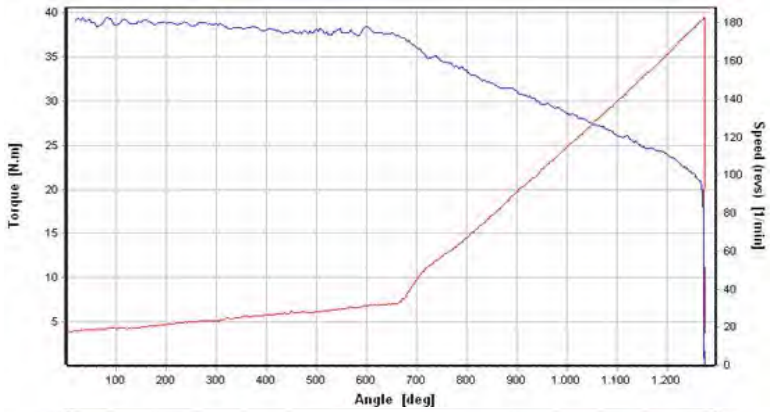
Angle degree: **360°**
Test torque: **41,0 Nm**



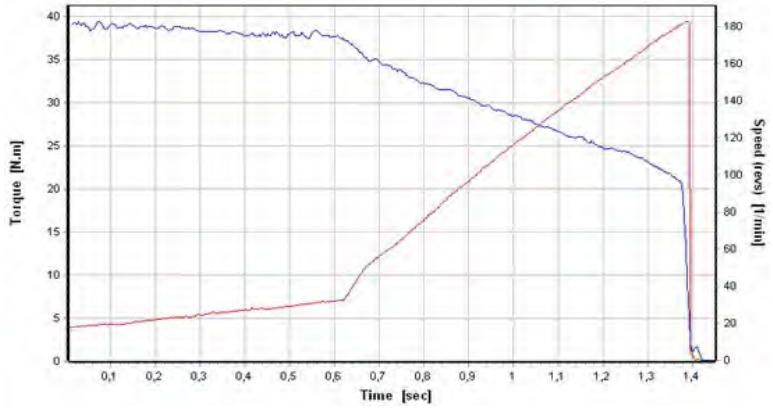
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed