Homologation

Cordless Assembly Tools

Model: CLBA403

Serial no.: ILJ1089

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Homologation: CLBA403 SN: ILJ1089

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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: **ILJ1089**

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

Hard joint (H) 138,50 Nm / Revolution Angle degree 30°

Soft joint (L) 11,25 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	23,08 Nm	22,51 Nm
	Standard deviation	0,25 Nm	0,12 Nm
	Torque scatter (99,73%)	1,50 Nm	0,75 Nm
	C_m	3,06	6,11
	C_{mk}	2,78	5,14

b) Min. C_m hard/soft (lowest value) 3,06
Min. C_{mk} hard/soft (lowest value) 2,78

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

Note:

Machine Capability Study
Control System

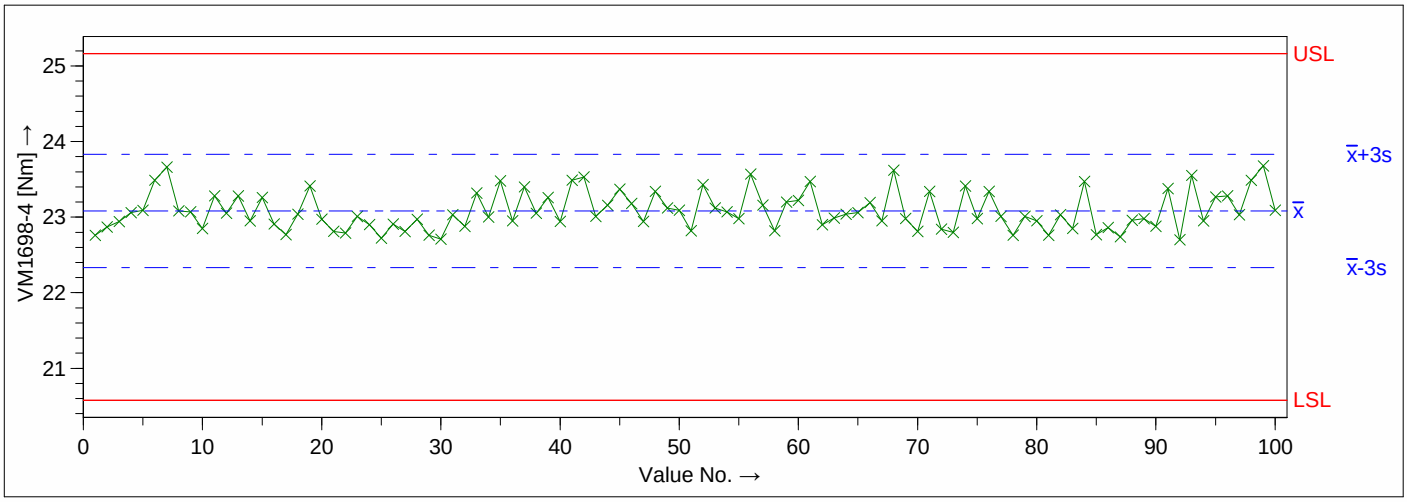
Cleco Production Tools

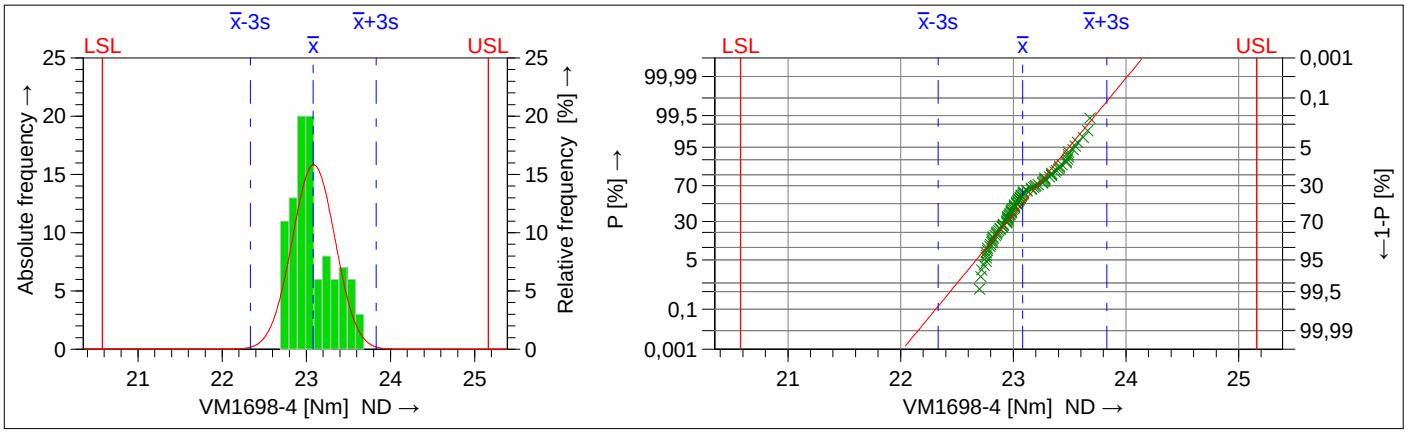
Plant	ATG Westhausen	Operator Name	Sorg
Date	24.01.2024		

Ord. No.	CLBA403	Part type	CLBA403	Contr.item	yes
Serial No.	ILJ1089_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 24.01.2024 10:34:56 to 24.01.2024 10:49:47

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





Drawing Values		Collected Values		Statistics	
T_m	22.87			x̄	23.0828
LSL	20.58	x_{min}	22.70	x̄-3s	22.3343
USL	25.16	x_{max}	23.68	x̄+3s	23.8313
T	4.58	R	0.98	6s	1.4970
		$n_{<T>}$	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	3.06
Critical capability index	=	C_{mk}	2.78

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

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Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 24.01.2024

Serial No.	ILJ1089_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	22,76	22,87	22,94	23,06	23,09	23,49	23,66	23,08	23,07	22,85
1024210	VM1698-4	Grad	29,75	29,75	30,25	30,50	30,25	31,75	31,50	30,50	30,25	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	23,28	23,05	23,28	22,95	23,26	22,91	22,77	23,04	23,41	22,97
1024210	VM1698-4	Grad	31,25	30,50	31,50	30,50	31,25	30,25	29,50	30,00	30,25	29,75

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	Nm	22,81	22,79	23,01	22,90	22,72	22,91	22,81	22,97	22,76	22,71
1024210	VM1698-4	Grad	29,00	29,75	30,00	30,00	28,50	29,75	29,50	30,00	29,50	29,75

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	Nm	23,03	22,88	23,32	23,00	23,48	22,95	23,40	23,05	23,26	22,94
1024210	VM1698-4	Grad	30,25	30,00	31,50	29,75	31,75	30,00	30,75	29,50	30,00	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	23,49	23,53	23,01	23,16	23,37	23,18	22,94	23,34	23,12	23,09
1024210	VM1698-4	Grad	31,00	31,25	29,25	30,25	30,00	30,25	29,50	30,75	29,75	29,25

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	22,82	23,43	23,12	23,07	22,98	23,57	23,16	22,82	23,20	23,22
1024210	VM1698-4	Grad	29,25	30,50	29,25	29,75	29,50	31,25	30,50	29,00	29,50	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	23,47	22,90	22,99	23,04	23,06	23,19	22,95	23,62	22,98	22,81
1024210	VM1698-4	Grad	30,75	29,25	29,50	29,50	29,75	29,75	29,75	31,50	30,25	29,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	Nm	23,34	22,84	22,80	23,41	22,98	23,34	23,01	22,76	23,01	22,95
1024210	VM1698-4	Grad	30,75	28,75	28,50	30,25	29,00	30,50	29,25	28,50	29,25	28,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 24.01.2024

Serial No.	ILJ1089_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	22,76	23,03	22,85	23,47	22,77	22,86	22,74	22,96	22,98	22,88
1024210	VM1698-4	Grad	29,00	30,50	29,50	31,25	29,75	29,50	29,50	29,75	29,75	29,75

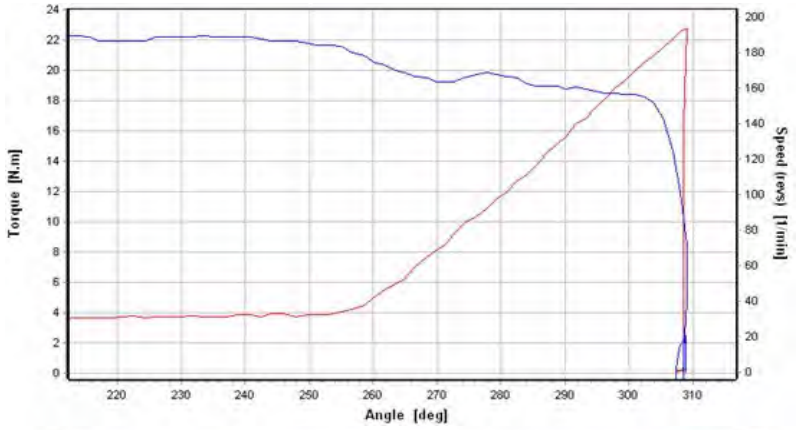
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	23,38	22,70	23,55	22,95	23,27	23,28	23,03	23,49	23,68	23,09
1024210	VM1698-4	Grad	31,25	29,75	31,25	29,75	30,50	31,00	30,25	31,50	32,00	30,50

Torque graphs

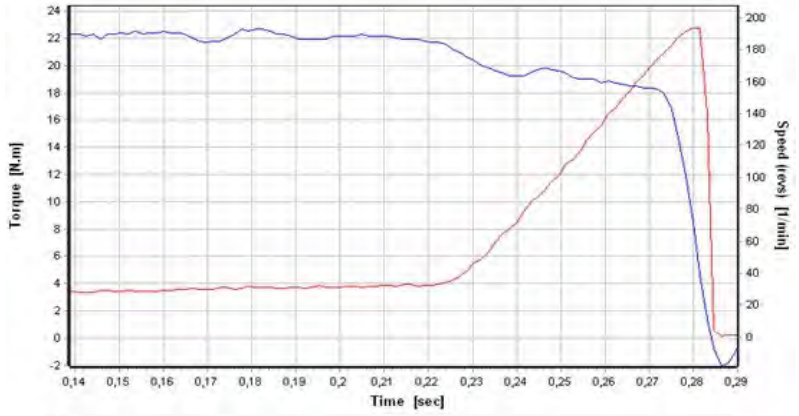
Machine Capability Study 30 %

Model: **CLBA403**
Serial no: **ILJ1089**

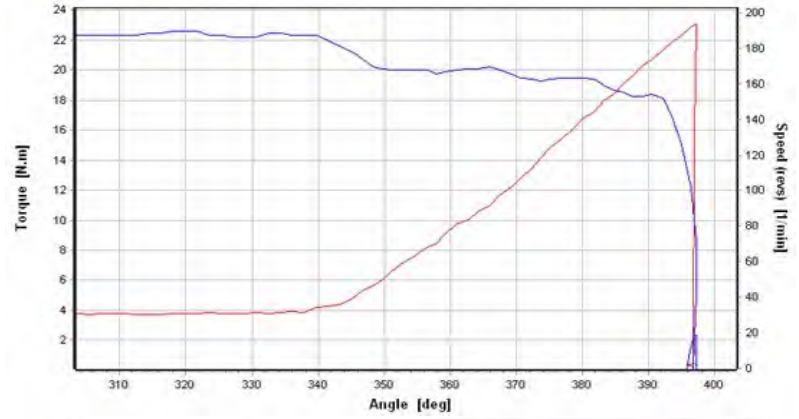
Angle degree: **30°**
Test torque: **22,9 Nm**



Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



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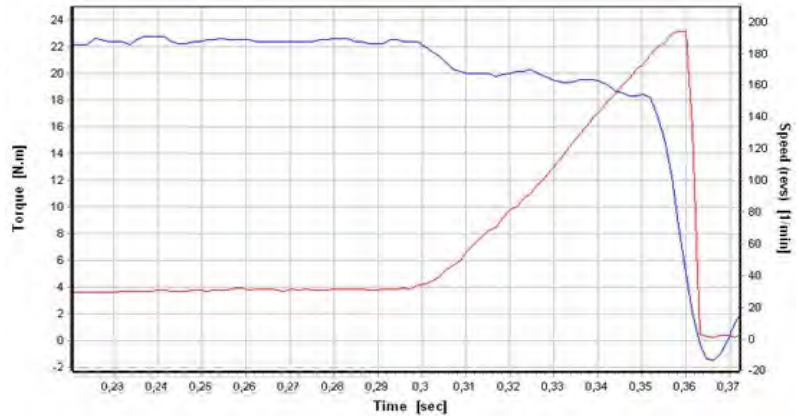
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

Machine Capability Study
Control System

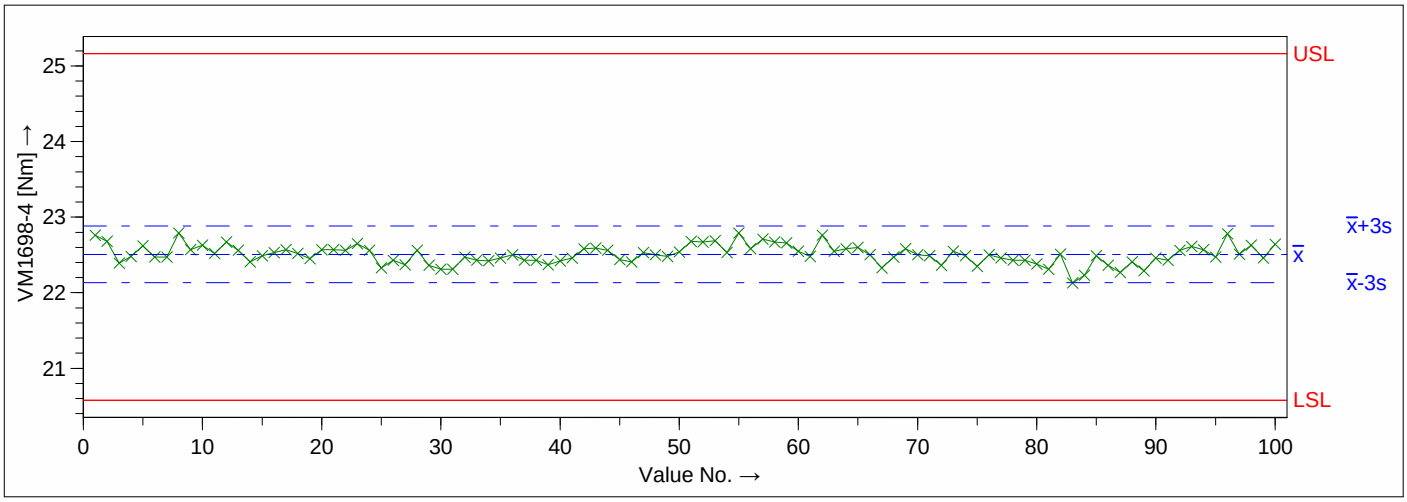
Cleco Production Tools

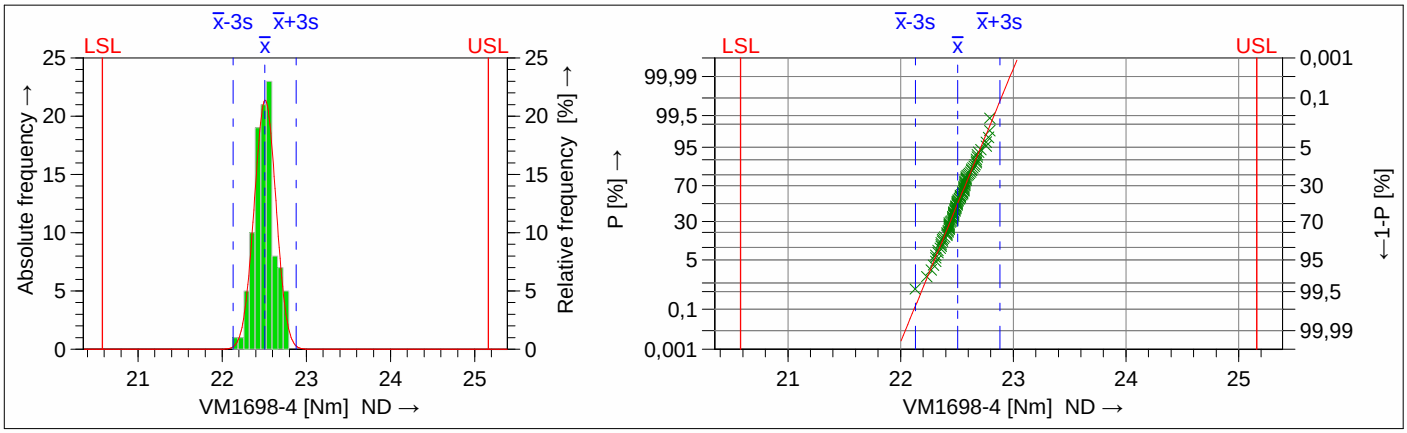
Plant	ATG Westhausen	Operator Name	Sorg
Date	24.01.2024		

Ord. No.	CLBA403	Part type	CLBA403	Contr.item	yes
Serial No.	ILJ1089_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 24.01.2024 10:51:22 to 24.01.2024 11:06:13

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





Drawing Values		Collected Values		Statistics	
T_m	22.87			$\bar{x}$	22.5062
LSL	20.58	x_{min}	22.13	$\bar{x}$-3s	22.1313
USL	25.16	x_{max}	22.79	$\bar{x}$+3s	22.8811
T	4.58	R	0.66	6s	0.7499
		$n_{<T>}$	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	6.11
Critical capability index	=	C_{mk}	5.14

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

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Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 24.01.2024

Serial No.	ILJ1089_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	22,76	22,68	22,39	22,48	22,62	22,47	22,47	22,79	22,57	22,63
1024210	VM1698-4	Grad	368,25	367,75	356,00	358,00	360,75	359,25	356,25	368,25	358,25	361,25

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	22,52	22,67	22,56	22,41	22,49	22,53	22,57	22,52	22,45	22,57
1024210	VM1698-4	Grad	355,50	356,50	359,25	354,00	359,00	360,25	358,75	355,25	359,50	358,25

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	22,57	22,56	22,65	22,56	22,33	22,43	22,37	22,56	22,36	22,31
1024210	VM1698-4	Grad	361,75	359,50	354,75	357,75	350,00	352,25	351,00	354,75	350,00	352,25

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	22,31	22,47	22,43	22,42	22,46	22,50	22,43	22,43	22,37	22,42
1024210	VM1698-4	Grad	355,25	367,75	365,50	360,75	363,25	363,00	367,75	363,50	361,50	363,00

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	22,46	22,58	22,59	22,56	22,44	22,41	22,53	22,50	22,48	22,54
1024210	VM1698-4	Grad	357,50	367,50	364,25	360,75	357,75	362,00	366,50	362,25	361,25	361,25

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	22,68	22,67	22,69	22,53	22,79	22,58	22,71	22,67	22,66	22,55
1024210	VM1698-4	Grad	371,00	372,50	375,25	367,25	343,75	363,00	370,75	364,00	365,00	364,75

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	22,48	22,76	22,55	22,58	22,60	22,50	22,33	22,47	22,58	22,50
1024210	VM1698-4	Grad	358,00	367,75	362,75	359,25	361,25	359,00	355,75	360,25	365,50	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	22,49	22,36	22,55	22,49	22,35	22,50	22,46	22,43	22,43	22,38
1024210	VM1698-4	Grad	360,50	354,75	357,00	357,75	351,50	356,50	359,50	354,50	352,50	352,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 24.01.2024

Serial No.	ILJ1089_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	22,31	22,51	22,13	22,23	22,49	22,36	22,27	22,41	22,29	22,46
1024210	VM1698-4	Grad	345,25	354,25	347,00	349,25	360,75	356,00	354,50	361,75	352,75	357,00

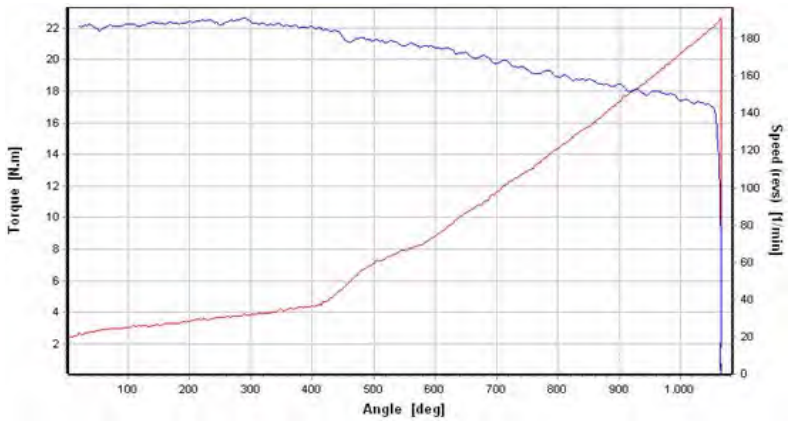
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	22,43	22,56	22,61	22,57	22,47	22,78	22,51	22,63	22,46	22,64
1024210	VM1698-4	Grad	361,25	366,25	371,50	364,00	362,25	372,25	360,75	366,75	363,25	365,75

Torque graphs

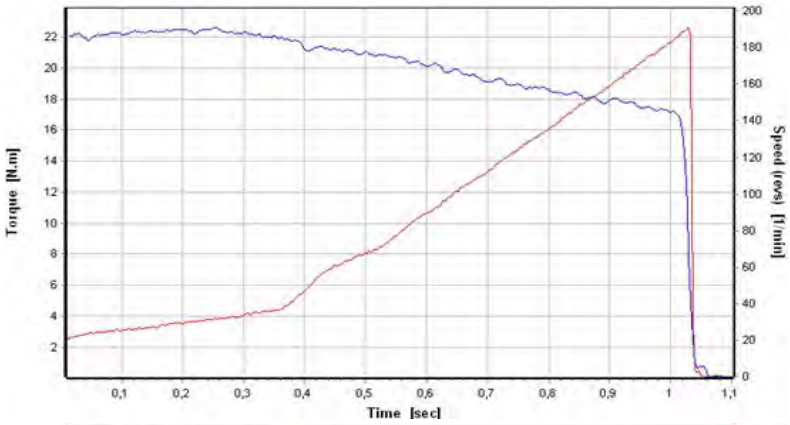
Machine Capability Study 30 %

Model: **CLBA403**
Serial no: **ILJ1089**

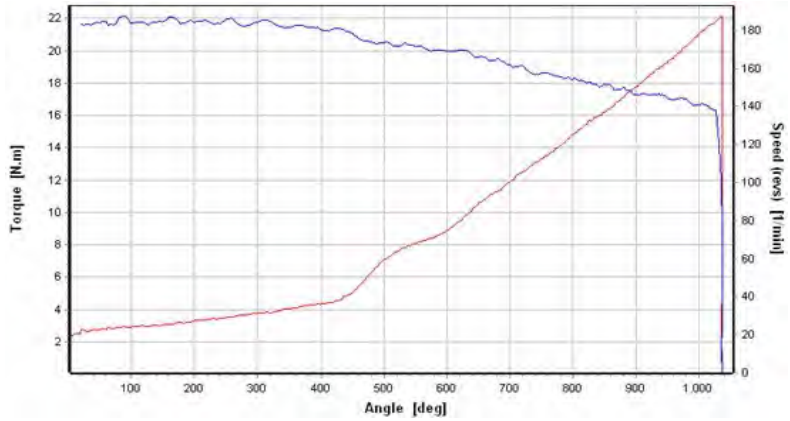
Angle degree: **360°**
Test torque: **22,9 Nm**



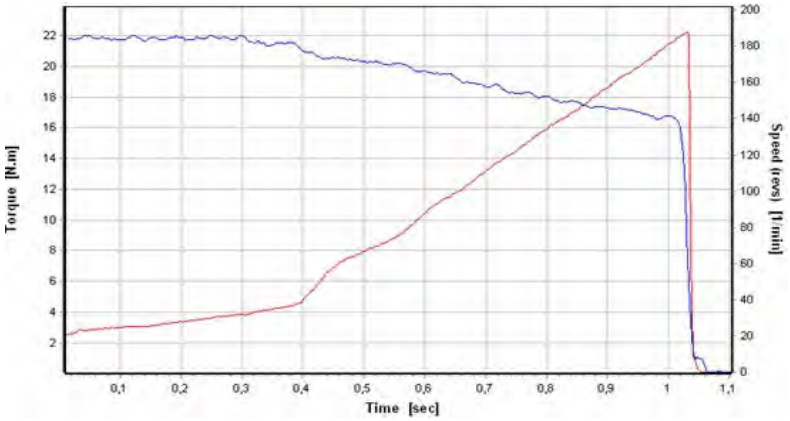
Value no. 1
Graph
Torque / Angle / Speed



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: **ILJ1089**

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

Hard joint (H) 213,88 Nm / Revolution Angle degree 30°

Soft joint (L) 17,27 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	35,65 Nm	34,54 Nm
	Standard deviation	0,53 Nm	0,25 Nm
	Torque scatter (99,73%)	3,17 Nm	1,51 Nm
	C_m	2,26	4,73
	C_{mk}	2,15	3,04

b) Min. C_m hard/soft (lowest value) 2,26
Min. C_{mk} hard/soft (lowest value) 2,15

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

Note:

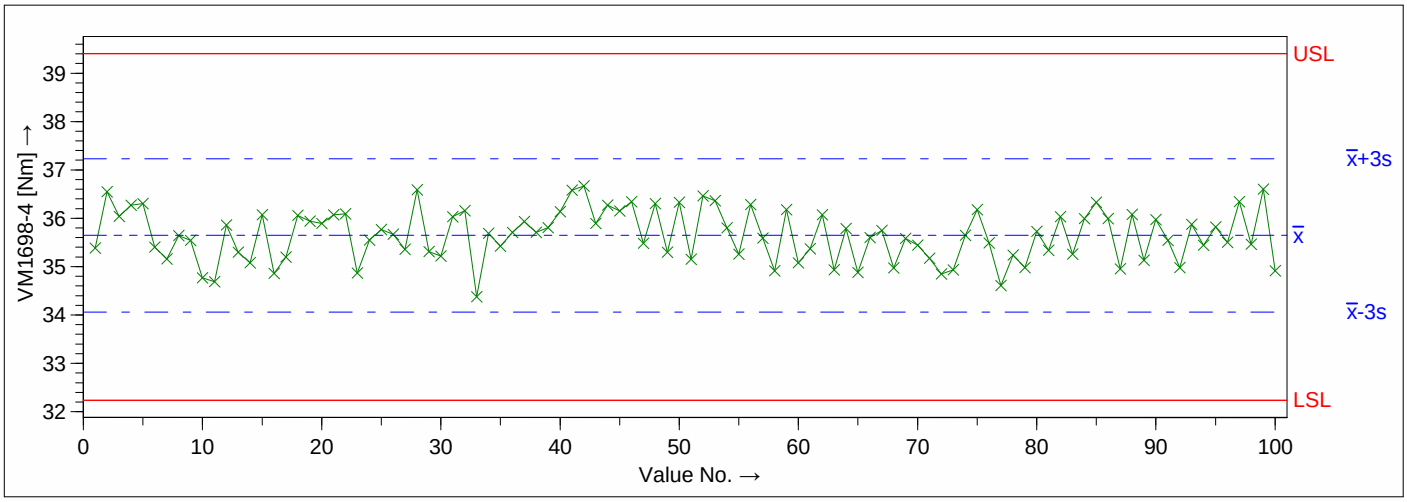
Machine Capability Study
Control System

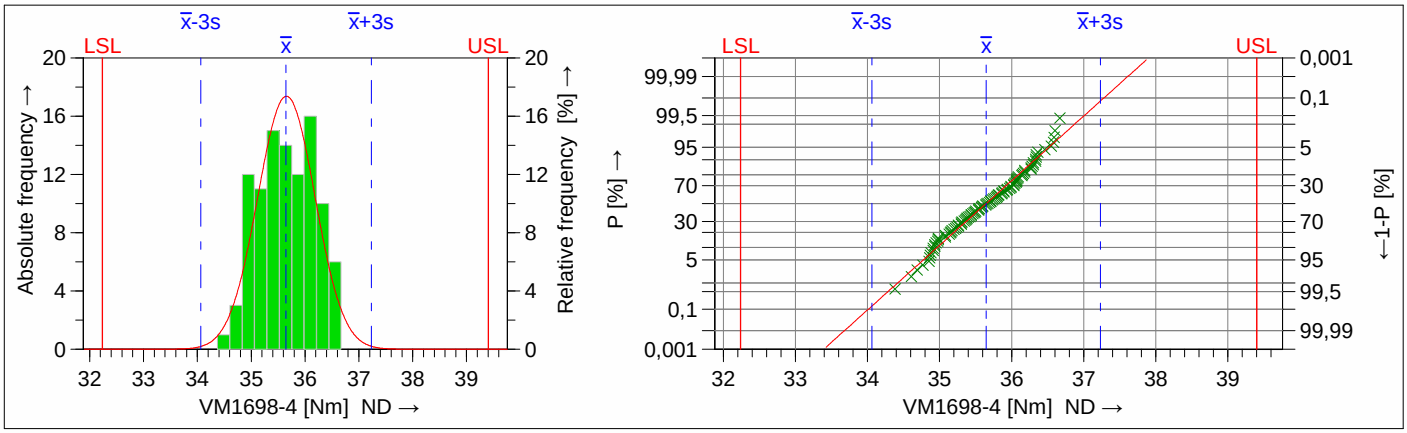
Plant	ATG Westhausen	Operator Name	Sorg
Date	25.01.2024		

Ord. No.	CLBA403	Part type	CLBA403	Contr.item	yes
Serial No.	ILJ1089_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 07:44:37 to 25.01.2024 07:59:28

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





Drawing Values		Collected Values		Statistics	
T_m	35.82			$\bar{x}$	35.6460
LSL	32.24	x_{min}	34.38	$\bar{x}$-3s	34.0617
USL	39.40	x_{max}	36.67	$\bar{x}$+3s	37.2303
T	7.16	R	2.29	6s	3.1686
		$n_{<T>}$	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	2.26
Critical capability index	=	C_{mk}	2.15

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.	ILJ1089_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	35,38	36,55	36,04	36,27	36,30	35,40	35,16	35,64	35,54	34,77
1024210	VM1698-4	Grad	28,50	30,75	30,00	30,25	29,50	29,00	28,00	28,25	28,50	27,50

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	34,69	35,86	35,30	35,08	36,07	34,86	35,20	36,06	35,94	35,89
1024210	VM1698-4	Grad	27,50	29,75	28,25	28,75	30,25	28,00	29,00	29,75	30,50	31,00

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	36,07	36,09	34,87	35,55	35,77	35,67	35,36	36,59	35,31	35,22
1024210	VM1698-4	Grad	31,00	31,00	28,75	30,50	29,75	30,25	29,25	31,75	29,25	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	36,03	36,16	34,38	35,69	35,42	35,71	35,93	35,71	35,81	36,14
1024210	VM1698-4	Grad	31,25	31,25	27,75	30,25	29,00	30,50	30,00	30,50	30,25	31,00

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	36,58	36,67	35,89	36,27	36,15	36,34	35,48	36,30	35,30	36,33
1024210	VM1698-4	Grad	32,50	31,50	29,75	31,25	30,75	30,50	29,50	30,75	28,25	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	35,15	36,46	36,36	35,80	35,26	36,28	35,59	34,91	36,18	35,08
1024210	VM1698-4	Grad	28,25	30,00	30,25	29,50	28,00	30,25	28,75	28,00	31,00	27,75

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	35,37	36,07	34,93	35,79	34,88	35,60	35,75	34,97	35,58	35,44
1024210	VM1698-4	Grad	29,00	30,75	28,50	30,25	28,75	30,25	30,00	29,25	29,50	29,50

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	35,17	34,85	34,93	35,65	36,18	35,49	34,61	35,24	34,98	35,73
1024210	VM1698-4	Grad	29,00	28,00	29,00	30,50	31,50	30,00	28,75	29,75	29,25	31,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 25.01.2024

Serial No.	ILJ1089_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	35,34	36,03	35,26	35,99	36,33	35,99	34,95	36,08	35,13	35,97
1024210	VM1698-4	Grad	29,25	31,50	29,50	31,00	32,00	31,00	28,75	31,25	29,00	31,00

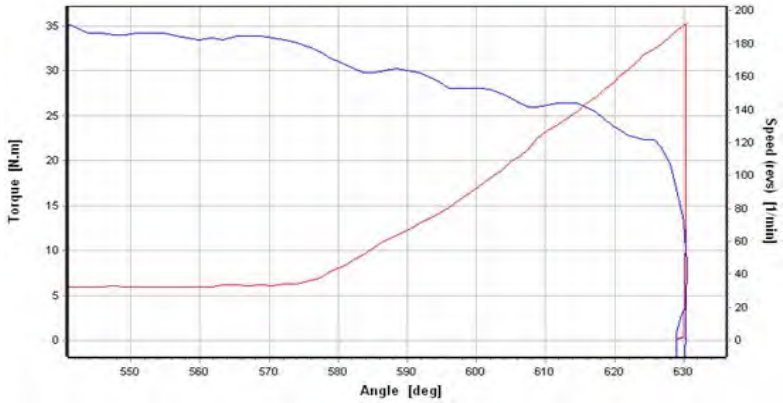
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	35,54	34,98	35,87	35,44	35,82	35,50	36,34	35,46	36,60	34,91
1024210	VM1698-4	Grad	29,75	28,25	30,75	29,25	30,75	29,75	31,50	29,25	31,75	28,50

Torque graphs

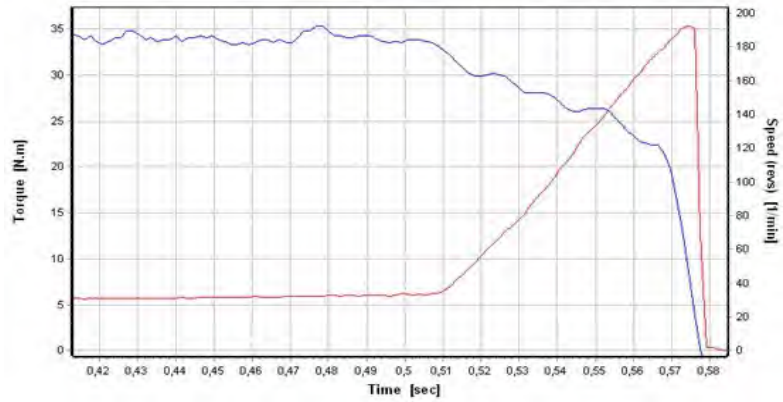
Machine Capability Study 80 %

Model: **CLBA403**
Serial no: **ILJ1089**

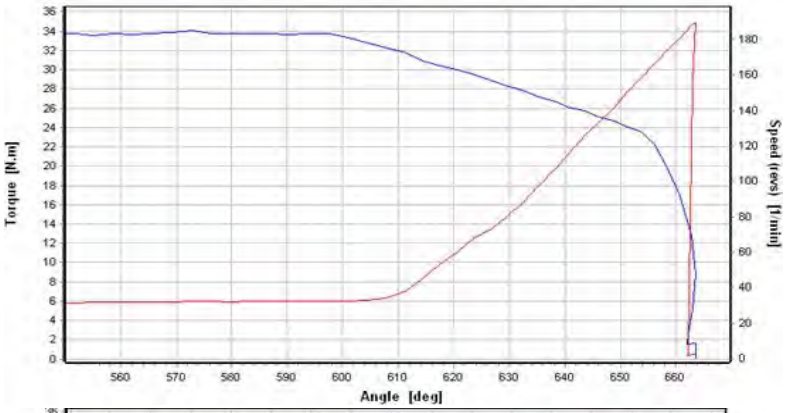
Angle degree: **30°**
Test torque: **35,8 Nm**



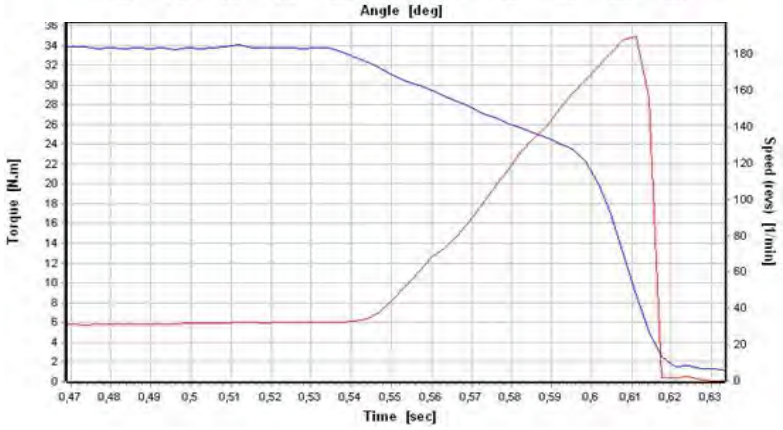
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

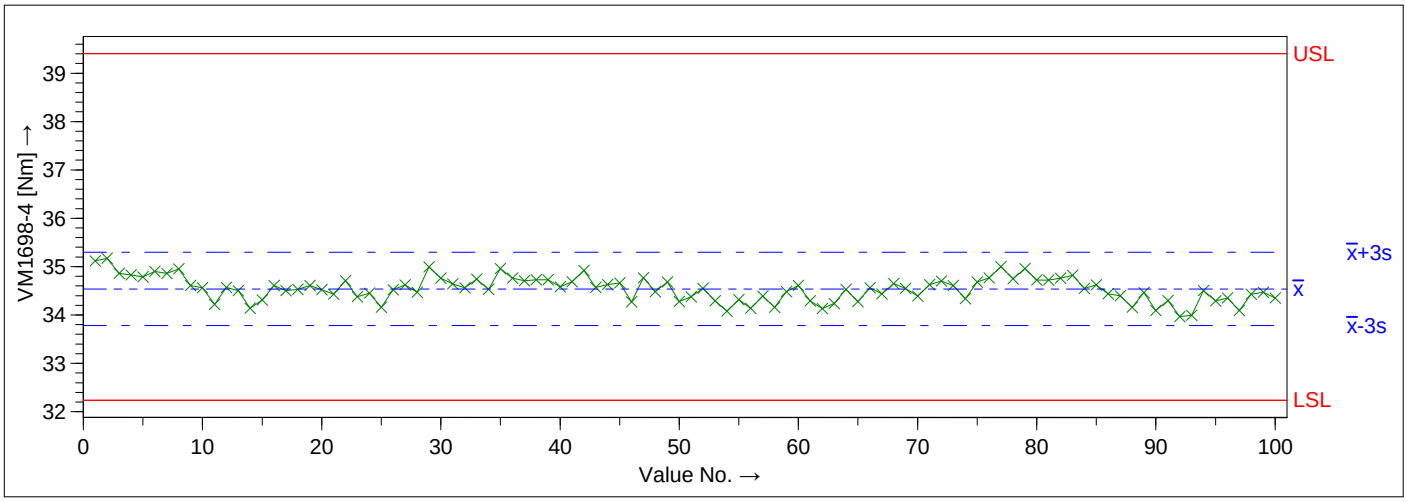
Machine Capability Study
Control System

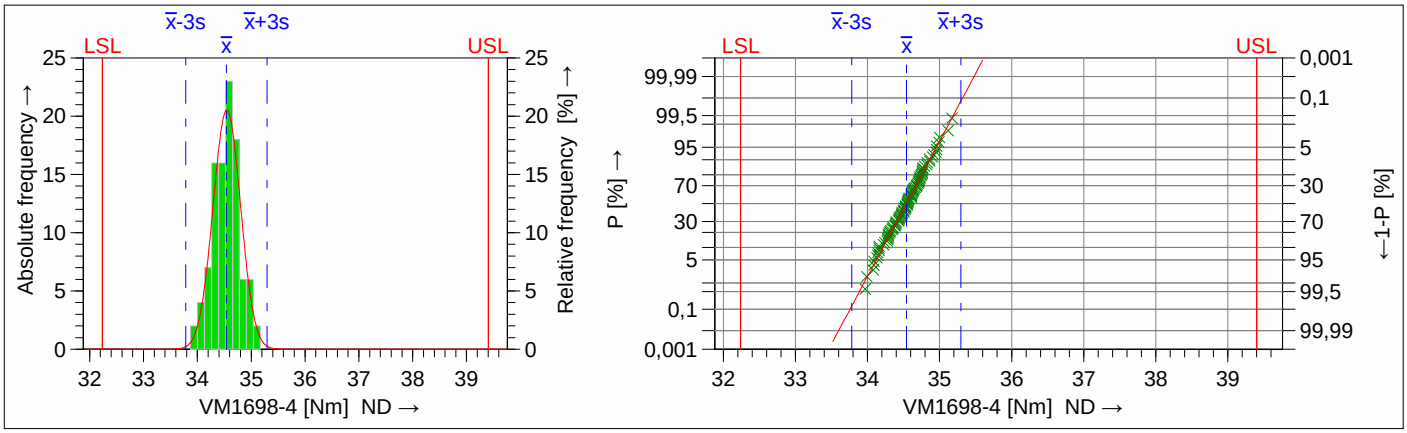
Plant	ATG Westhausen	Operator Name	Sorg
Date	25.01.2024		

Ord. No.	CLBA403	Part type	CLBA403	Contr.item	yes
Serial No.	ILJ1089_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 25.01.2024 08:05:30 to 25.01.2024 08:20:21

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





Drawing Values		Collected Values		Statistics	
T_m	35.82			$\bar{x}$	34.5392
LSL	32.24	x_{min}	33.97	$\bar{x}$-3s	33.7821
USL	39.40	x_{max}	35.17	$\bar{x}$+3s	35.2963
T	7.16	R	1.20	6s	1.5143
		$n_{<T>}$	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	4.73
Critical capability index	=	C_{mk}	3.04

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.	ILJ1089_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	35,12	35,17	34,86	34,83	34,79	34,90	34,86	34,95	34,61	34,56
1024210	VM1698-4	Grad	370,50	367,25	364,75	358,00	360,75	362,75	356,50	360,75	354,50	349,50

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	34,22	34,57	34,50	34,14	34,31	34,61	34,50	34,53	34,61	34,52
1024210	VM1698-4	Grad	350,25	355,00	352,75	343,75	356,00	359,00	360,25	361,00	365,75	360,25

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	34,43	34,71	34,38	34,45	34,16	34,52	34,62	34,47	34,99	34,76
1024210	VM1698-4	Grad	357,50	366,50	364,25	355,50	357,50	364,50	363,00	360,00	374,25	365,00

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	34,64	34,56	34,74	34,53	34,96	34,76	34,71	34,73	34,73	34,58
1024210	VM1698-4	Grad	362,75	365,50	367,25	365,50	373,75	364,75	369,75	369,25	358,25	363,00

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	34,69	34,92	34,57	34,63	34,66	34,27	34,77	34,48	34,68	34,28
1024210	VM1698-4	Grad	361,50	366,25	364,50	361,50	358,75	356,25	364,00	363,50	357,50	356,75

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	34,38	34,55	34,29	34,08	34,32	34,14	34,39	34,16	34,48	34,61
1024210	VM1698-4	Grad	357,50	357,50	351,50	353,25	356,50	349,25	355,25	355,50	361,00	359,50

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	34,29	34,13	34,24	34,53	34,28	34,56	34,44	34,65	34,55	34,39
1024210	VM1698-4	Grad	353,00	357,00	356,25	359,25	351,25	364,75	358,25	358,75	357,50	361,75

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	34,63	34,70	34,61	34,34	34,68	34,77	35,00	34,75	34,96	34,72
1024210	VM1698-4	Grad	364,75	361,50	364,00	357,50	363,75	365,25	372,50	365,50	369,25	365,50

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 25.01.2024

Serial No.	ILJ1089_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	34,72	34,76	34,82	34,55	34,62	34,44	34,40	34,16	34,46	34,09
1024210	VM1698-4	Grad	370,00	363,00	362,00	366,50	363,75	355,25	357,25	356,00	360,00	346,75

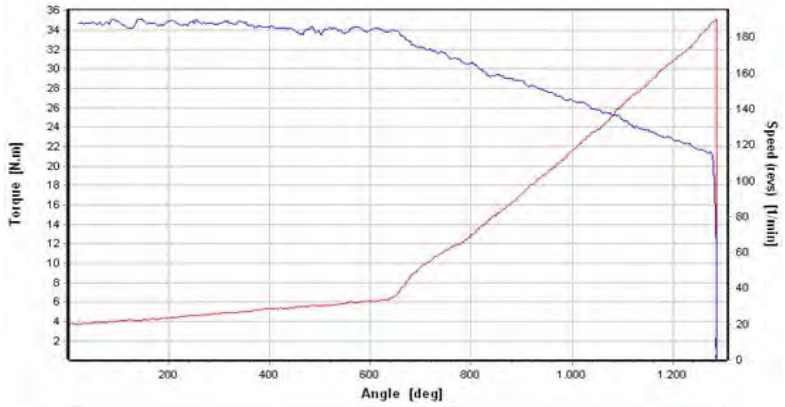
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	34,30	33,97	33,99	34,50	34,29	34,35	34,09	34,43	34,47	34,35
1024210	VM1698-4	Grad	357,25	352,50	349,75	359,50	353,00	362,50	352,75	359,25	354,50	357,50

Torque graphs

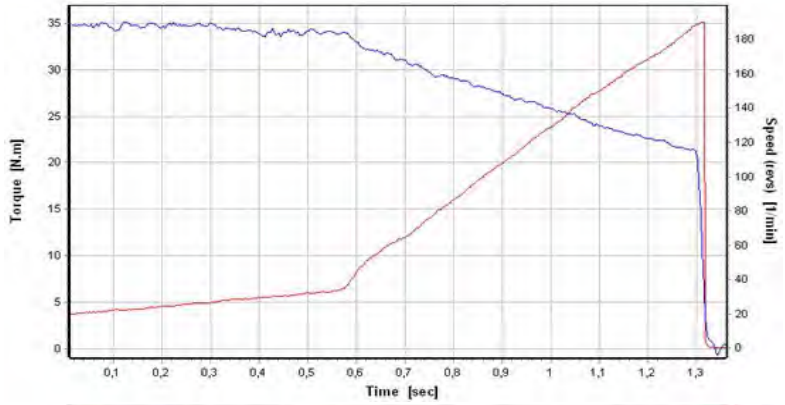
Machine Capability Study 80 %

Model: **CLBA403**
Serial no: **ILJ1089**

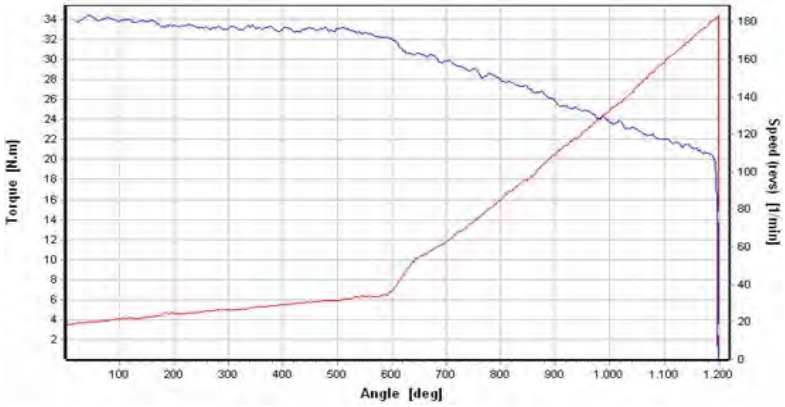
Angle degree: **360°**
Test torque: **35,8 Nm**



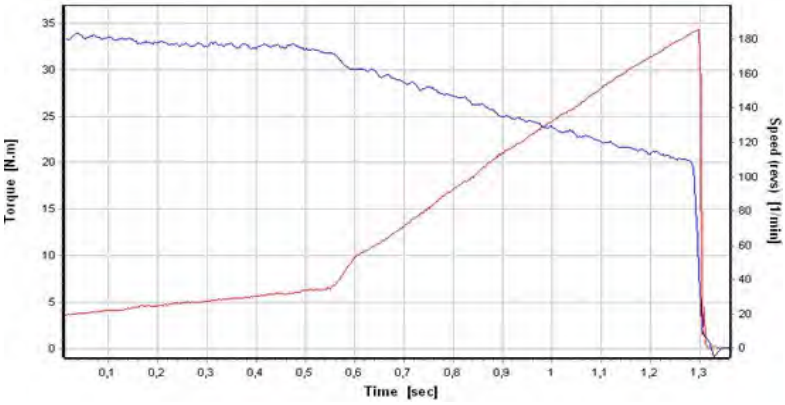
Value no. 1
Graph
Torque / Angle / Speed



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: **ILJ1089**

Test torque: Tq max. 41,00 Nm

Hard joint (H)	248,28	Nm / Revolution	Angle degree	30°
Soft joint (L)	20,19	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	41,38 Nm	40,37 Nm
	Standard deviation	0,55 Nm	0,29 Nm
	Torque scatter (99,73%)	3,27 Nm	1,71 Nm
	C_m	2,50	4,78
	C_{mk}	2,27	4,05

b)	Min. C_m hard/soft (lowest value)	2,50
	Min. C_{mk} hard/soft (lowest value)	2,27

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

Note:

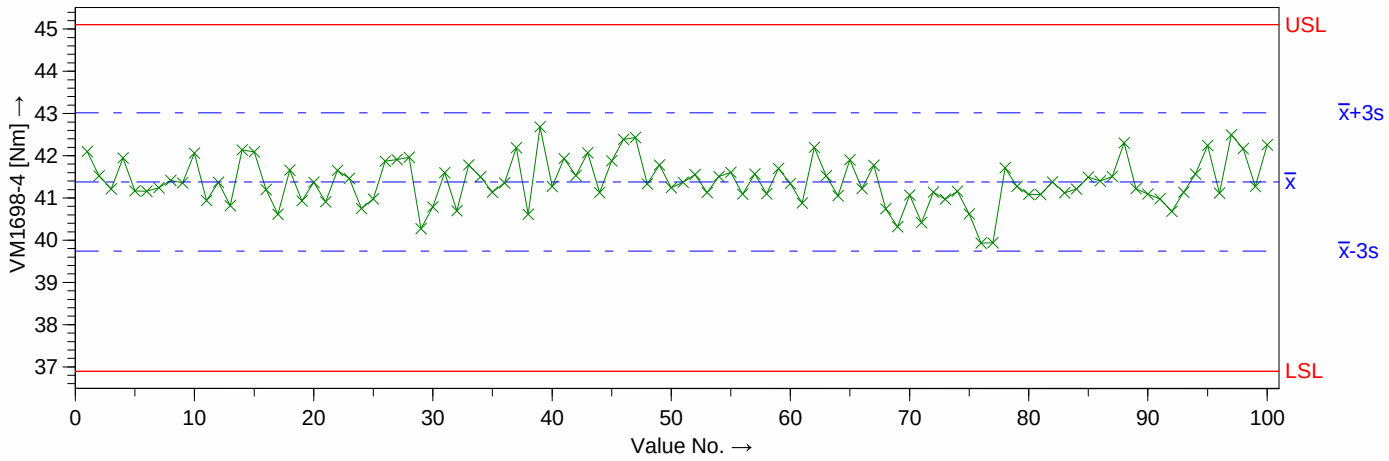
Machine Capability Study
Control System

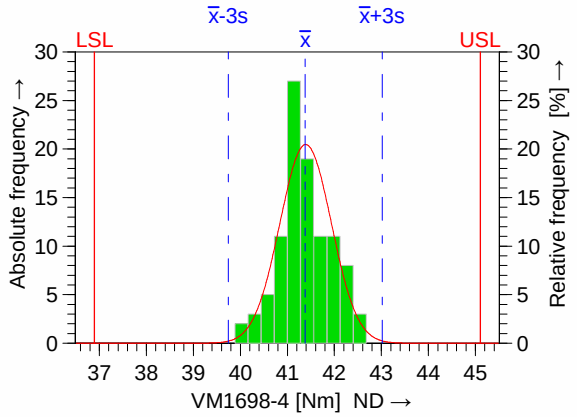
Plant	ATG Westhausen	Operator Name	Sorg
Date	25.01.2024		

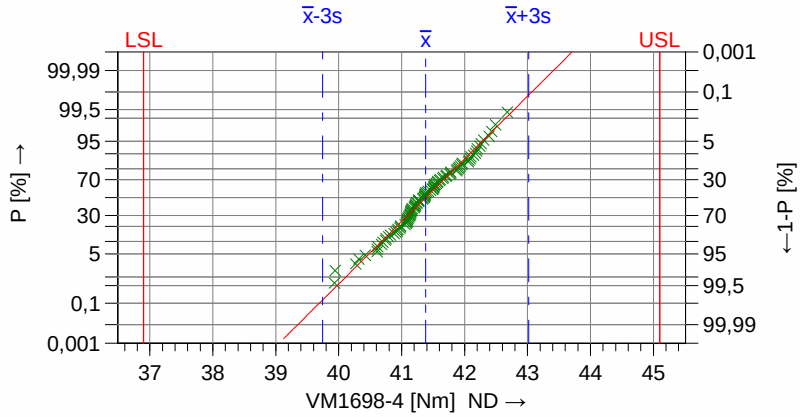
Ord. No.	CLBA403	Part type	CLBA403	Contr.item	yes
Serial No.	ILJ1089_b	Char.Descr.	VM1698-4	Nom.val. 41,00 4,10	USL 45,10
		Serial No.	1024210	Unit Nm -4,10	LSL 36,90
Char.Type	variable			Tolerance value 10 %	Decimal Pl. 2
Cust.Name	ATG	Reference System	VM1698-4	Test Electronic	---
Contr.No.	Homologation	Reference Transducer	50/1024729	nges.	100

Evaluation from 25.01.2024 08:33:13 to 25.01.2024 08:48:05

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







Drawing Values		Collected Values		Statistics	
T_m	41.00			$\bar{x}$	41.3800
LSL	36.90	x_{min}	39.93	$\bar{x}$-3s	39.7425
USL	45.10	x_{max}	42.68	$\bar{x}$+3s	43.0175
T	8.20	R	2.75	6s	3.2749
		$n_{<T>}$	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	2.50
Critical capability index	=	C_{mk}	2.27

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 25.01.2024

Serial No.	ILJ1089_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	42,10	41,52	41,21	41,95	41,17	41,16	41,24	41,42	41,36	42,06
1024210	VM1698-4	Grad	33,00	30,50	30,00	32,00	29,75	30,25	30,50	30,75	30,75	32,00

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	40,94	41,37	40,82	42,14	42,09	41,20	40,61	41,66	40,93	41,37
1024210	VM1698-4	Grad	30,00	31,00	29,50	32,50	31,50	29,75	28,25	30,25	28,75	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	40,91	41,65	41,46	40,75	40,98	41,87	41,91	41,96	40,27	40,79
1024210	VM1698-4	Grad	28,50	30,75	30,75	29,25	30,00	31,50	31,50	31,75	28,50	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	41,60	40,70	41,78	41,50	41,14	41,36	42,19	40,61	42,68	41,27
1024210	VM1698-4	Grad	31,25	29,25	31,50	30,75	30,00	30,25	31,75	28,50	32,25	29,75

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	Nm	41,93	41,53	42,07	41,13	41,88	42,39	42,43	41,33	41,78	41,24
1024210	VM1698-4	Grad	30,75	30,25	30,50	29,00	31,00	32,00	32,25	29,50	31,00	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	41,37	41,55	41,13	41,51	41,61	41,09	41,57	41,10	41,70	41,34
1024210	VM1698-4	Grad	29,75	30,25	29,75	29,50	29,50	29,00	29,75	29,00	31,00	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	40,88	42,20	41,52	41,05	41,90	41,22	41,77	40,74	40,32	41,07
1024210	VM1698-4	Grad	29,50	32,25	30,00	29,25	31,25	29,25	30,25	28,50	27,50	29,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	Nm	40,42	41,14	40,97	41,16	40,62	39,93	39,94	41,71	41,27	41,08
1024210	VM1698-4	Grad	28,25	30,25	29,25	29,25	28,75	27,75	27,50	32,00	31,75	31,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 25.01.2024

Serial No.	ILJ1089_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	41,08	41,38	41,12	41,21	41,49	41,40	41,51	42,30	41,22	41,09
1024210	VM1698-4	Grad	30,75	31,25	30,00	30,00	31,25	30,75	31,25	33,00	30,50	29,50

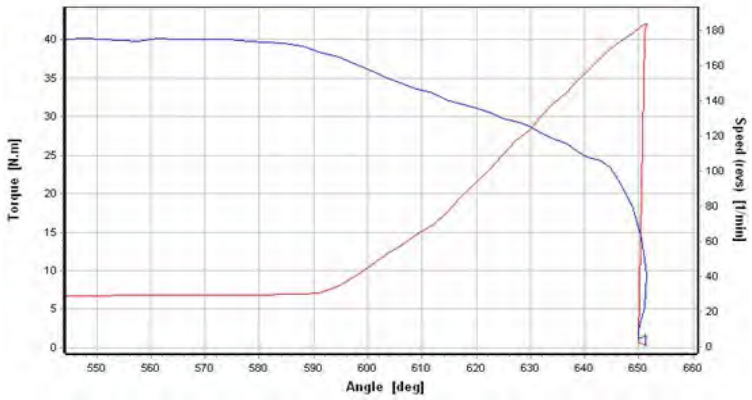
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	40,98	40,68	41,14	41,57	42,24	41,11	42,49	42,17	41,27	42,26
1024210	VM1698-4	Grad	28,75	28,50	29,75	30,75	33,50	30,50	33,50	32,50	29,50	32,00

Torque graphs

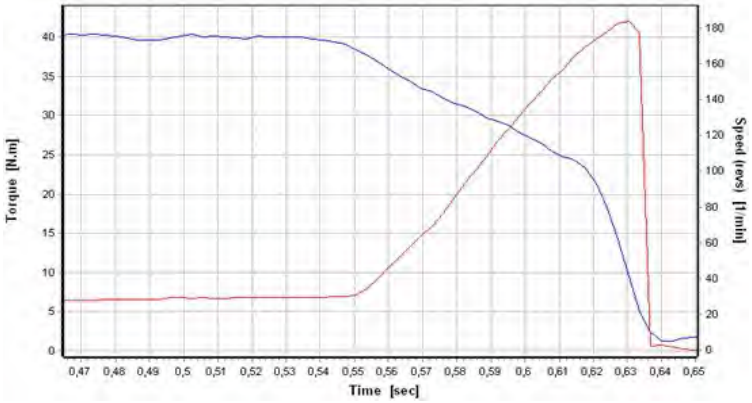
Machine Capability Study 100 %

Model: **CLBA403**
Serial no: **ILJ1089**

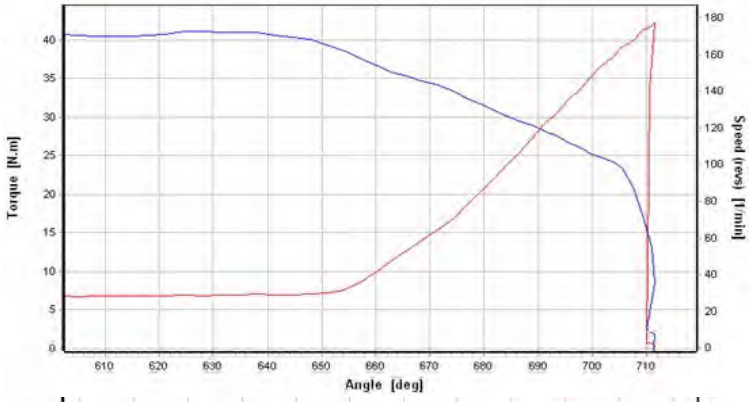
Angle degree: **30°**
Test torque: **41,0 Nm**



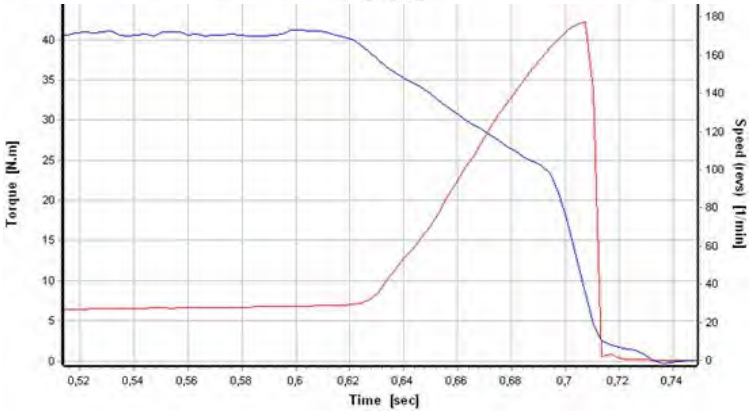
Value no. 1
Graph
Torque / Angle / Speed



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

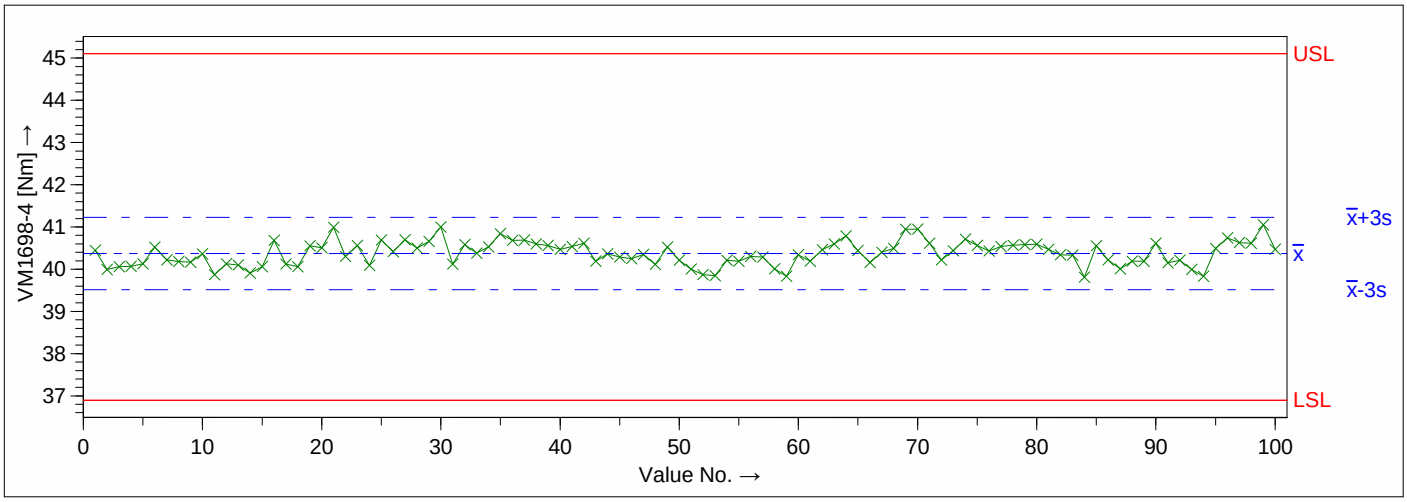
Cleco Production Tools

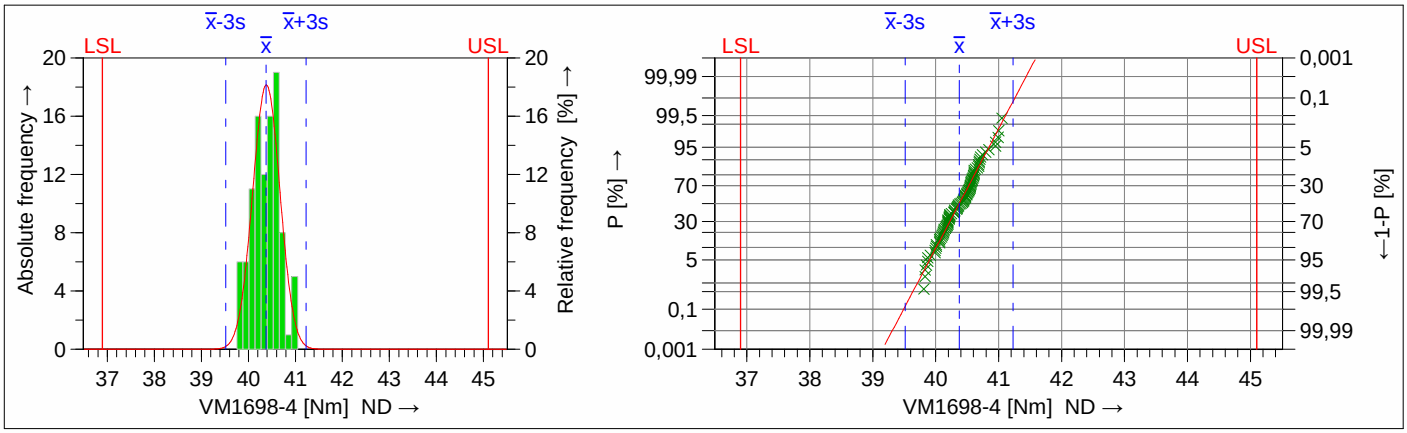
Plant	ATG Westhausen	Operator Name	Sorg
Date	25.01.2024		

Ord. No.	CLBA403	Part type	CLBA403	Contr.item	yes
Serial No.	ILJ1089_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 25.01.2024 08:53:09 to 25.01.2024 09:30:34

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





Drawing Values		Collected Values		Statistics	
T_m	41.00			$\bar{x}$	40.3739
LSL	36.90	x_{min}	39.81	$\bar{x}$-3s	39.5168
USL	45.10	x_{max}	41.05	$\bar{x}$+3s	41.2310
T	8.20	R	1.24	6s	1.7142
		$n_{<T>}$	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	4.78
Critical capability index	=	C_{mk}	4.05

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.	ILJ1089_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	40,45	39,99	40,06	40,07	40,13	40,52	40,22	40,18	40,17	40,36
1024210	VM1698-4	Grad	364,00	347,25	355,25	348,25	348,00	365,00	351,75	360,25	353,00	358,00

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	39,87	40,13	40,10	39,91	40,06	40,68	40,12	40,06	40,55	40,51
1024210	VM1698-4	Grad	355,25	354,25	354,25	352,75	351,75	368,50	349,75	359,25	361,75	363,50

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	40,99	40,30	40,56	40,09	40,69	40,42	40,70	40,50	40,66	41,00
1024210	VM1698-4	Grad	375,25	358,25	364,50	357,00	361,00	368,75	366,50	364,75	373,25	364,75

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	40,12	40,58	40,38	40,53	40,84	40,68	40,69	40,60	40,56	40,47
1024210	VM1698-4	Grad	356,50	370,75	358,50	364,25	373,50	363,50	366,25	371,50	360,75	357,75

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	40,54	40,61	40,19	40,36	40,29	40,25	40,35	40,11	40,52	40,21
1024210	VM1698-4	Grad	365,50	363,25	349,50	356,75	362,25	356,25	356,75	353,75	365,25	357,50

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	40,00	39,87	39,85	40,21	40,19	40,30	40,29	40,01	39,83	40,34
1024210	VM1698-4	Grad	347,00	352,00	352,25	352,75	359,00	365,75	363,75	352,75	352,00	364,75

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	40,19	40,46	40,60	40,79	40,44	40,16	40,40	40,49	40,95	40,95
1024210	VM1698-4	Grad	363,00	369,50	368,75	367,25	359,75	361,00	369,00	371,25	381,25	375,50

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	40,61	40,22	40,44	40,71	40,56	40,43	40,54	40,57	40,58	40,59
1024210	VM1698-4	Grad	363,50	357,75	360,75	368,75	370,00	373,00	367,75	363,50	356,00	355,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sorg	Date 25.01.2024

Serial No.	ILJ1089_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	40,47	40,34	40,33	39,81	40,55	40,22	40,01	40,19	40,19	40,61
1024210	VM1698-4	Grad	351,00	350,25	352,25	346,00	354,75	351,75	351,75	357,75	355,00	362,50

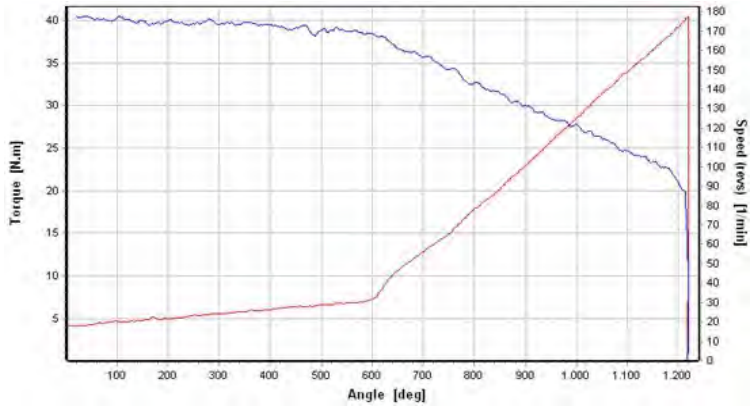
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	40,15	40,21	39,99	39,83	40,49	40,74	40,63	40,61	41,05	40,47
1024210	VM1698-4	Grad	354,75	358,00	359,50	352,50	365,75	371,25	368,00	364,00	372,00	369,75

Torque graphs

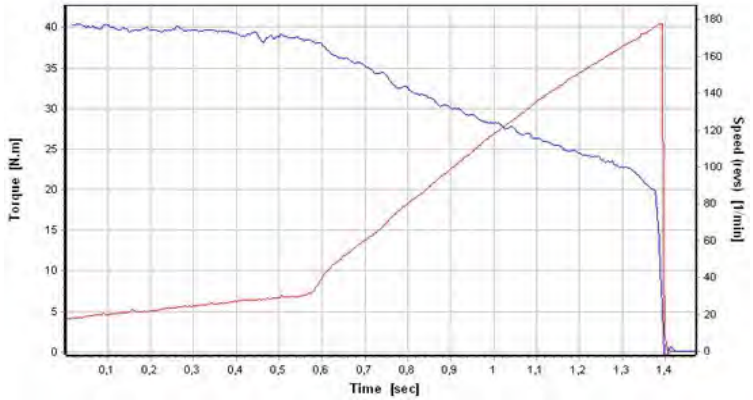
Machine Capability Study 100 %

Model: **CLBA403**
Serial no: **ILJ1089**

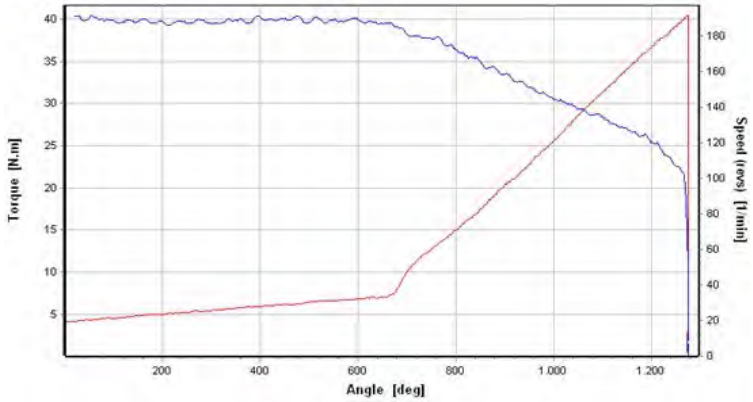
Angle degree: **360°**
Test torque: **41,0 Nm**



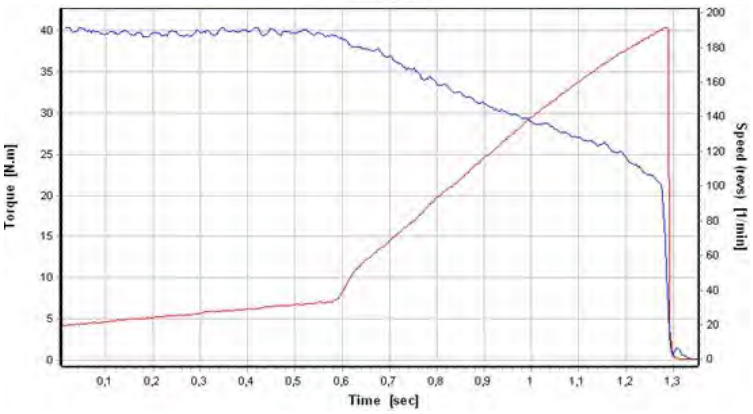
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed