Homologation

Fixtured Spindle

Model: 2BD-2B110A-2K1D-2ZB

Serial no.: 1015970

Contents

Homologation: 2BD-2B110A-2K1D-2ZB SN: 1015970

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Test sheet no. 2

Machine Capability Study 30 %

Multi-stage tightening system	☑	Speed 50 rpm	5,6 %
Single-stage tightening system	☐	Speed 100 %	890 rpm

Manufacturer: Apex Tool Group Serial no: **1015970**

Test torque: Tq min. + 0.3 (Tq max. - Tq min.) 40,70 Nm

Hard joint (H)	246,78	Nm / Revolution	Angle degree	30°
Soft joint (L)	20,40	Nm / Revolution	Angle degree	360°

		H	L
a)	Tolerance down / up	37,85 43,55 Nm	37,85 - 43,55 Nm
	Tolerance down / up	7	7 %
	Average torque	41,13	40,80 Nm
	Standard deviation	0,09	0,06 Nm
	Torque scatter (99,73%)	0,55	0,34 Nm
	C_m	10,42	17,00
	C_{mk}	8,84	16,40

b)	Min. C_m hard/soft (lowest value)	10,42
	Min. C_{mk} hard/soft (lowest value)	8,84

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

Note:

Machine Capability Study
Control System

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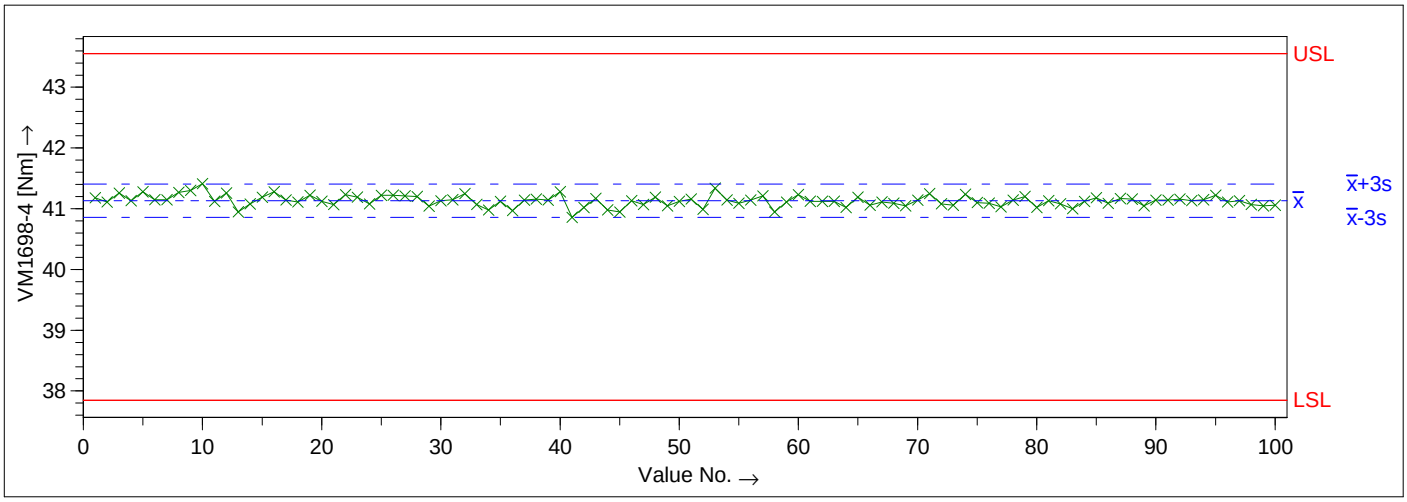
Plant ATG Westhausen		Operator Name Sünder	Date 07.03.2022

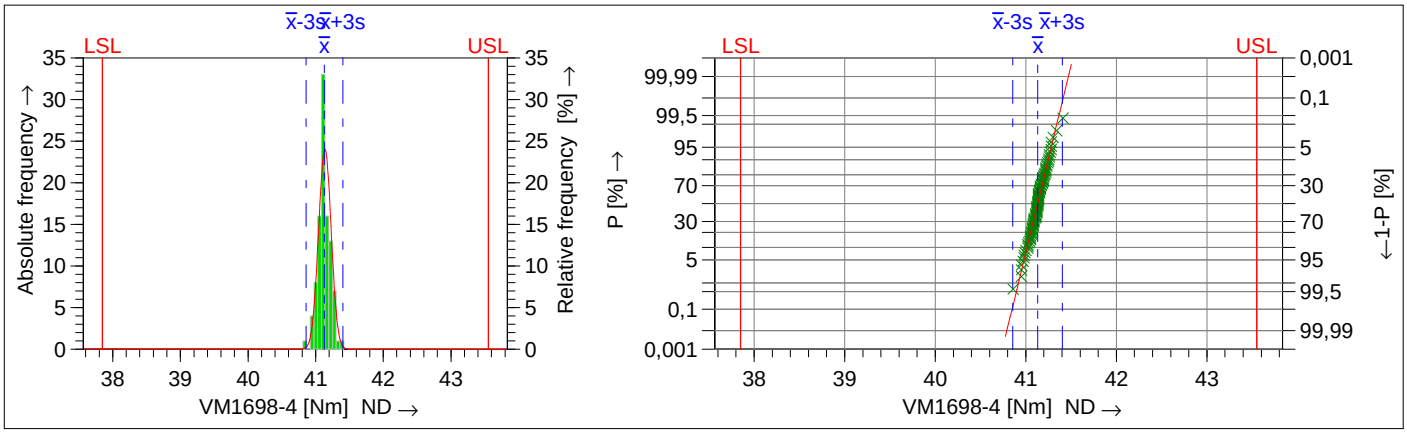
Ord. No. 2BD110T1S-A	Part type 2BD-2B110A-2K1D-2ZB				Contr.item yes
Serial No. 1015970_d	Char.Descr. VM1698-4	Inspection Val.	40,70	2,85	USL 43,55
	Serial No. 1024210	Unit	Nm	-2,85	LSL 37,85
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2

Cust.Name Cleco	Reference System VM1698-4	Test Electronic MPRO400GCD-P
Contr.No. Homologation	Reference Transducer 50 / 1024729	nges. 100

Evaluation from 07.03.2022 15:10:13 to 07.03.2022 15:26:28

Rem. TQ 30% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.326 Nm/A; Speed 890/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	40.70			$\bar{x}$	41.1303
LSL	37.85	x_{min}	40.86	$\bar{x}$-3s	40.8567
USL	43.55	x_{max}	41.41	$\bar{x}$+3s	41.4039
T	5.70	R	0.55	6s	0.5472
		$n_{<T>}$	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	10.42
Critical capability index	=	C_{mk}	8.84

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

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Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_d	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	VM1698-4	Inspection Val.	40,70
Ord. No.	2BD110T1S-A	Ser.No.	1024210	LSL	37,85
				USL	43,55
Remark	TQ 30% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.326 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	41,18	41,11	41,26	41,13	41,28	41,15	41,15	41,27	41,30	41,41
1024210	VM1698-4	29,50	29,75	30,00	30,25	30,25	30,25	30,25	30,25	30,00	30,75

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	41,12	41,26	40,95	41,08	41,19	41,28	41,14	41,11	41,22	41,12
1024210	VM1698-4	30,00	30,50	30,00	29,75	30,50	30,25	30,25	30,00	30,50	30,50

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	41,07	41,23	41,19	41,08	41,22	41,22	41,21	41,20	41,04	41,13
1024210	VM1698-4	30,00	30,00	30,25	29,75	30,50	30,00	30,25	30,50	30,25	30,50

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	41,15	41,25	41,07	40,98	41,12	40,97	41,14	41,16	41,14	41,28
1024210	VM1698-4	30,75	31,25	30,25	29,75	30,25	30,25	30,75	30,50	30,25	31,00

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	40,86	41,02	41,17	40,98	40,95	41,13	41,07	41,19	41,05	41,12
1024210	VM1698-4	30,00	29,75	30,50	30,25	30,00	30,00	31,00	30,50	30,50	30,00

Char.No	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	41,16	40,99	41,34	41,14	41,09	41,14	41,21	40,95	41,11	41,23
1024210	VM1698-4	31,00	30,50	30,75	30,50	30,75	30,75	30,50	30,25	30,25	30,50

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	41,12	41,12	41,12	41,02	41,19	41,06	41,11	41,09	41,05	41,14
1024210	VM1698-4	30,50	30,75	30,50	30,25	30,50	30,50	30,25	30,50	30,25	31,00

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	41,25	41,08	41,06	41,24	41,10	41,09	41,03	41,14	41,20	41,02
1024210	VM1698-4	30,75	30,00	30,50	31,00	30,50	31,00	30,50	30,75	29,75	30,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_d	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	VM1698-4	Inspection Val.	40,70
Ord. No.	2BD110T1S-A	Ser.No.	1024210	LSL	37,85
				USL	43,55
Remark	TQ 30% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.326 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	41,13	41,08	41,00	41,12	41,18	41,09	41,17	41,16	41,05	41,14
1024210	VM1698-4	30,25	29,75	29,75	30,00	30,25	30,25	30,00	30,50	30,00	30,25

Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	41,14	41,16	41,13	41,15	41,22	41,11	41,13	41,07	41,05	41,06
1024210	VM1698-4	30,00	30,00	30,25	30,25	30,25	30,00	30,25	29,75	29,75	30,00

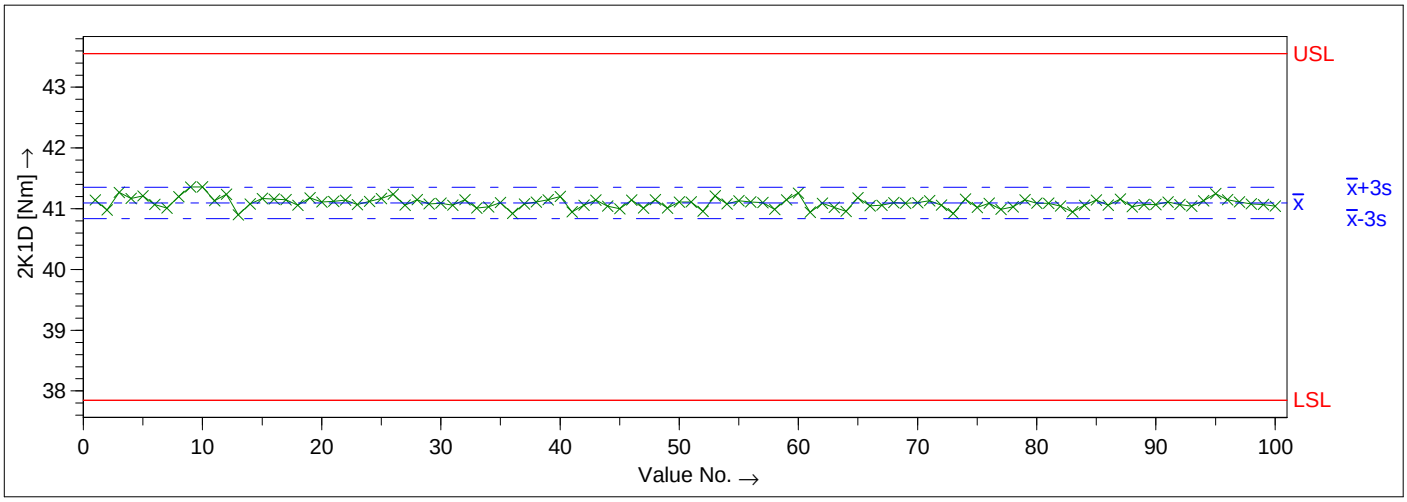
Machine Capability Study
Tool System

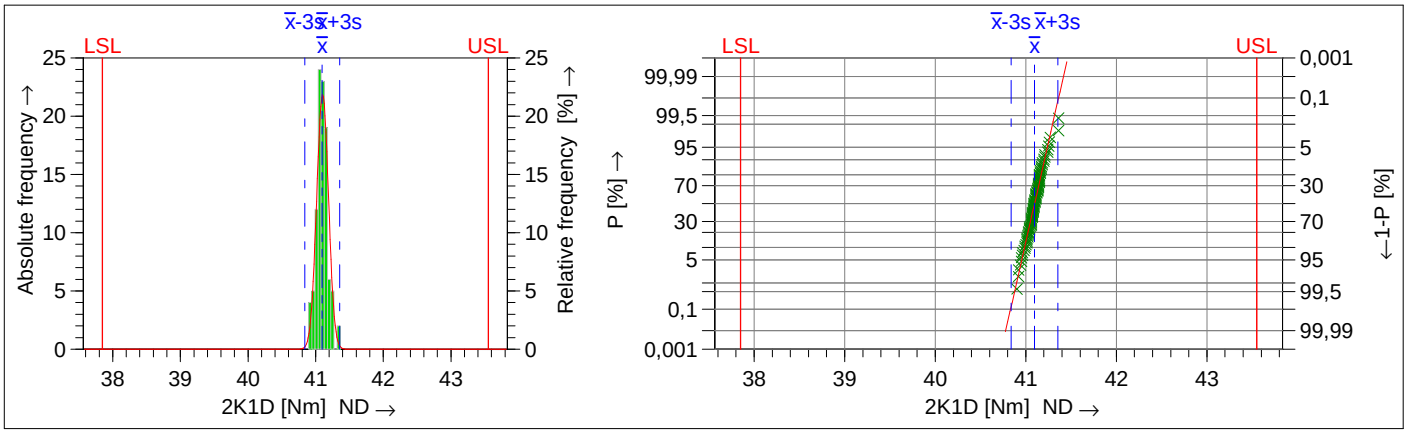
Plant	ATG Westhausen	Operator Name	Sünder
Date	07.03.2022		

Ord. No.	2BD110T1S-A	Part type	2BD-2B110A-2K1D-2ZB	Contr.item	yes
Serial No.	1015970_d	Char.Descr.	2K1D	Inspection Val. 40,70 2,85	USL 43,55
		Serial No.	204570	Unit Nm -2,85	LSL 37,85
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 07.03.2022 15:10:14 to 07.03.2022 15:26:28

Rem. TQ 30% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.326 Nm/A; Speed 890/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	40.70			$\bar{x}$	41.0966
LSL	37.85	x_{min}	40.90	$\bar{x}$-3s	40.8396
USL	43.55	x_{max}	41.36	$\bar{x}$+3s	41.3536
T	5.70	R	0.46	6s	0.5140
		$n_{<T>}$	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	11.09
Critical capability index	=	C_{mk}	9.55

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

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Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_d	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	2K1D	Inspection Val.	40,70
Ord. No.	2BD110T1S-A	Ser.No.	204570	LSL	37,85
				USL	43,55
Remark	TQ 30% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.326 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
204570	2K1D	41,14	40,98	41,27	41,17	41,21	41,07	41,01	41,20	41,36	41,36
204570	2K1D	30,00	30,00	30,00	31,00	30,00	31,00	30,00	31,00	30,00	31,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
204570	2K1D	41,13	41,24	40,90	41,08	41,17	41,16	41,15	41,06	41,18	41,11
204570	2K1D	30,00	31,00	31,00	30,00	30,00	31,00	30,00	31,00	31,00	31,00

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
204570	2K1D	41,12	41,14	41,07	41,12	41,17	41,24	41,06	41,15	41,08	41,09
204570	2K1D	30,00	30,00	30,00	30,00	31,00	30,00	31,00	31,00	30,00	31,00

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
204570	2K1D	41,06	41,15	41,01	41,03	41,10	40,92	41,08	41,11	41,15	41,20
204570	2K1D	31,00	31,00	31,00	30,00	31,00	31,00	31,00	30,00	31,00	31,00

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
204570	2K1D	40,95	41,06	41,14	41,04	41,00	41,14	41,01	41,15	41,01	41,11
204570	2K1D	30,00	30,00	31,00	30,00	30,00	31,00	31,00	30,00	30,00	30,00

Char.No	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
204570	2K1D	41,11	40,96	41,21	41,08	41,13	41,11	41,10	40,99	41,15	41,26
204570	2K1D	31,00	30,00	31,00	30,00	31,00	31,00	31,00	30,00	31,00	31,00

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
204570	2K1D	40,94	41,09	41,02	40,96	41,18	41,05	41,06	41,10	41,09	41,10
204570	2K1D	30,00	31,00	31,00	30,00	31,00	31,00	30,00	31,00	30,00	31,00

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
204570	2K1D	41,13	41,06	40,92	41,16	41,02	41,09	40,99	41,03	41,15	41,09
204570	2K1D	31,00	30,00	31,00	31,00	31,00	31,00	30,00	31,00	30,00	30,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_d	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	2K1D	Inspection Val.	40,70
Ord. No.	2BD110T1S-A	Ser.No.	204570	LSL	37,85
				USL	43,55
Remark	TQ 30% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.326 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
204570	2K1D	41,09	41,04	40,95	41,06	41,14	41,06	41,16	41,03	41,07	41,07
204570	2K1D	30,00	30,00	30,00	30,00	30,00	31,00	30,00	30,00	30,00	31,00

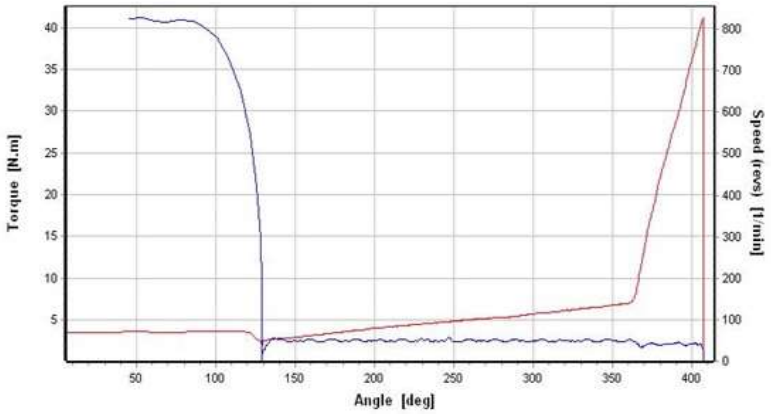
Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
204570	2K1D	41,11	41,07	41,04	41,13	41,25	41,15	41,11	41,08	41,07	41,04
204570	2K1D	30,00	30,00	30,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00

Torque graphs

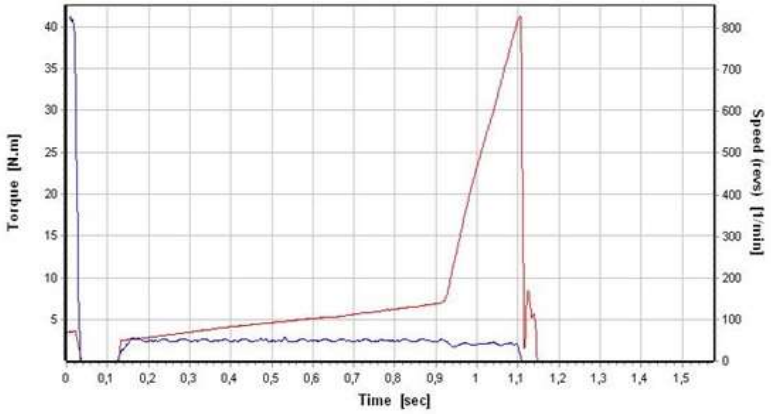
Machine Capability Study 30 %

Model: **2BD-2B110A-2K1D-2ZB**
Serial no: **1015970**

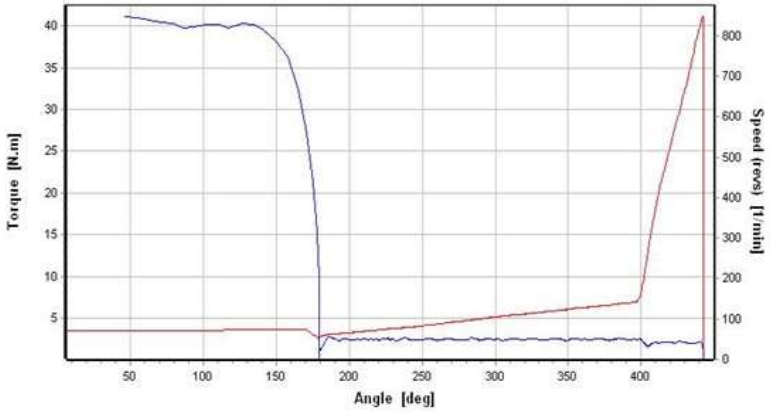
Angle degree: **30°**
Test torque: **40,7 Nm**



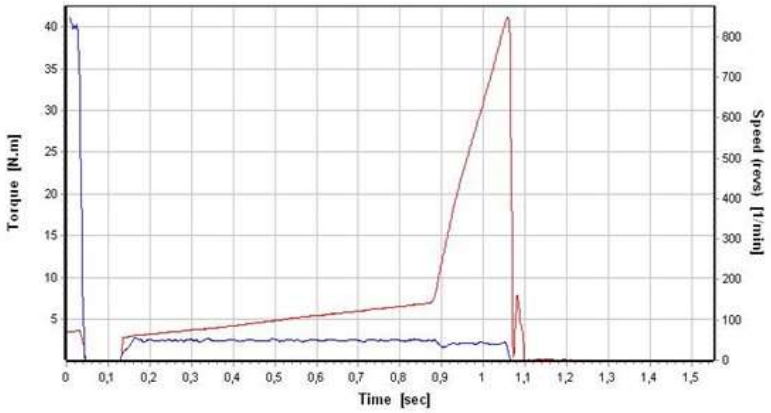
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

Machine Capability Study
Control System

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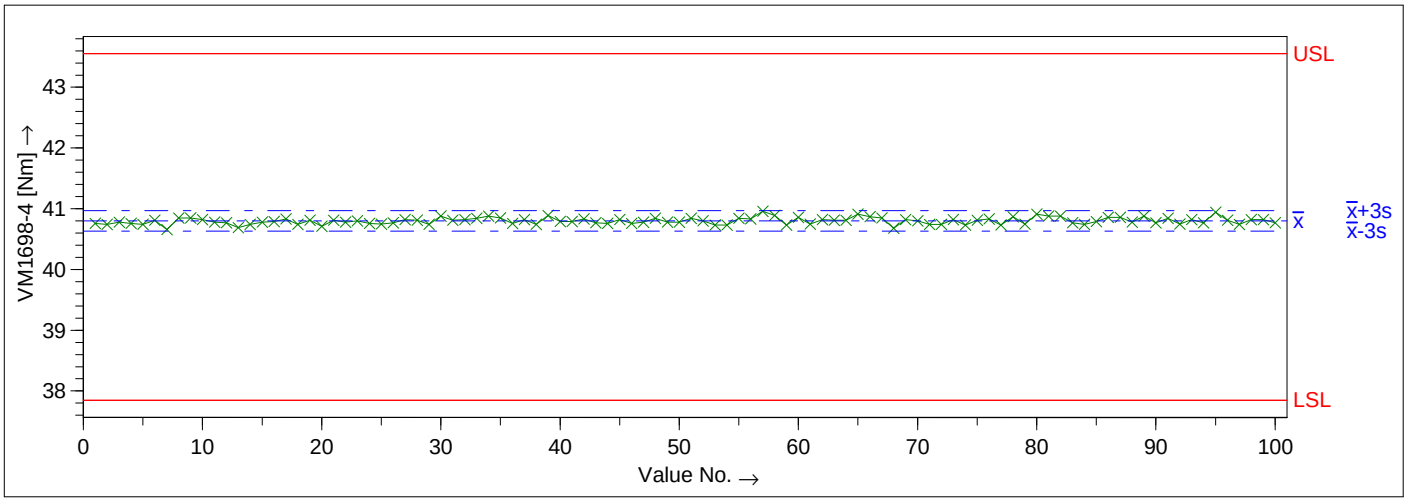
Plant ATG Westhausen		Operator Name Sünder	Date 07.03.2022

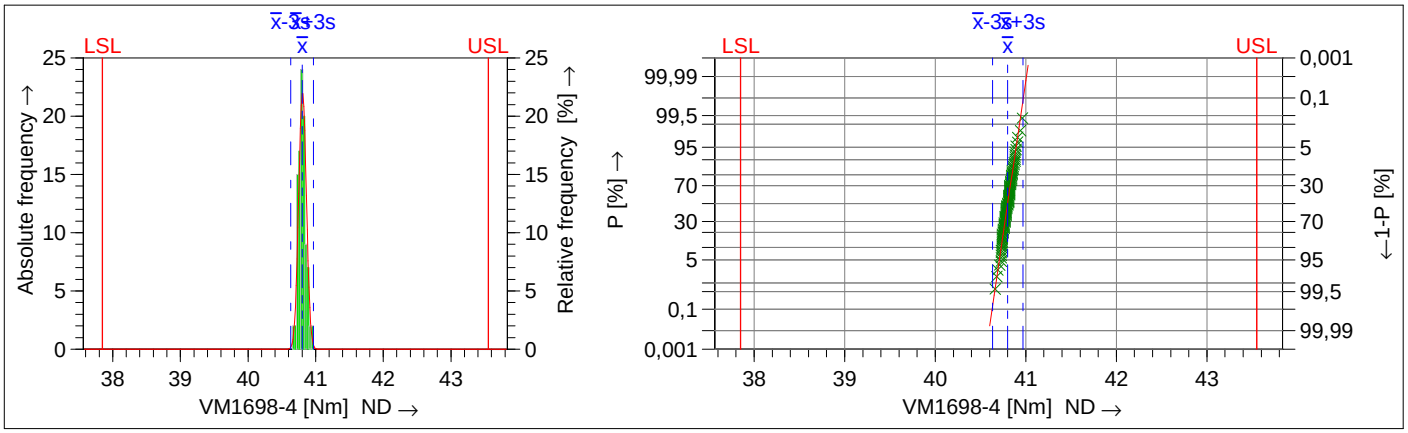
Ord. No. 2BD110T1S-A	Part type 2BD-2B110A-2K1D-2ZB				Contr.item yes
Serial No. 1015970_c	Char.Descr. VM1698-4	Inspection Val.	40,70	2,85	USL 43,55
	Serial No. 1024210	Unit	Nm	-2,85	LSL 37,85
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2

Cust.Name Cleco	Reference System VM1698-4	Test Electronic MPRO400GCD-P
Contr.No. Homologation	Reference Transducer 50 / 1024729	nges. 100

Evaluation from 07.03.2022 15:33:33 to 07.03.2022 15:53:08

Rem. TQ 30% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.326 Nm/A; Speed 890/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	40.70			$\bar{x}$	40.7999
LSL	37.85	x_{min}	40.66	$\bar{x}$-3s	40.6322
USL	43.55	x_{max}	40.96	$\bar{x}$+3s	40.9676
T	5.70	R	0.30	6s	0.3354
		$n_{<T>}$	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	17.00
Critical capability index	=	C_{mk}	16.40

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

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Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_c	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	VM1698-4	Inspection Val.	40,70
Ord. No.	2BD110T1S-A	Ser.No.	1024210	LSL	37,85
				USL	43,55
Remark	TQ 30% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.326 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	40,76	40,74	40,78	40,76	40,74	40,81	40,66	40,85	40,85	40,82
1024210	VM1698-4	364,75	368,50	369,50	367,75	368,75	370,25	365,25	370,50	370,00	377,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	40,78	40,77	40,69	40,74	40,78	40,79	40,83	40,74	40,81	40,71
1024210	VM1698-4	374,00	371,75	367,50	365,75	364,75	369,00	373,25	364,00	364,75	359,50

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	40,81	40,78	40,80	40,76	40,75	40,77	40,82	40,81	40,74	40,88
1024210	VM1698-4	362,25	358,75	364,00	361,00	358,25	364,00	366,75	361,25	364,00	362,25

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	40,81	40,82	40,84	40,88	40,85	40,76	40,82	40,74	40,89	40,79
1024210	VM1698-4	364,25	364,50	364,50	363,25	366,00	366,75	366,25	371,75	363,75	355,25

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	40,79	40,83	40,77	40,76	40,82	40,76	40,78	40,84	40,78	40,78
1024210	VM1698-4	360,75	363,50	356,00	355,75	361,50	357,00	361,25	358,00	358,50	361,00

Char.No	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	40,84	40,80	40,73	40,73	40,84	40,83	40,96	40,89	40,73	40,86
1024210	VM1698-4	359,75	362,50	361,00	362,25	364,00	363,25	362,00	362,25	363,00	367,25

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	40,75	40,82	40,81	40,81	40,91	40,87	40,85	40,68	40,82	40,80
1024210	VM1698-4	362,50	367,00	366,50	365,25	357,50	365,25	365,00	365,25	362,75	363,75

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	40,74	40,74	40,82	40,73	40,81	40,83	40,73	40,87	40,75	40,91
1024210	VM1698-4	365,50	361,25	369,50	362,75	367,00	368,50	364,00	367,25	367,75	365,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_c	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	VM1698-4	Inspection Val.	40,70
Ord. No.	2BD110T1S-A	Ser.No.	1024210	LSL	37,85
				USL	43,55
Remark	TQ 30% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.326 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	40,88	40,88	40,77	40,74	40,79	40,86	40,86	40,78	40,88	40,77
1024210	VM1698-4	366,50	367,00	362,00	362,50	359,50	363,75	364,75	536,75	361,25	362,25

Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	40,84	40,75	40,82	40,77	40,94	40,81	40,74	40,82	40,82	40,77
1024210	VM1698-4	355,75	359,25	356,25	355,00	359,75	355,00	354,50	357,25	357,25	354,00

Machine Capability Study
Tool System

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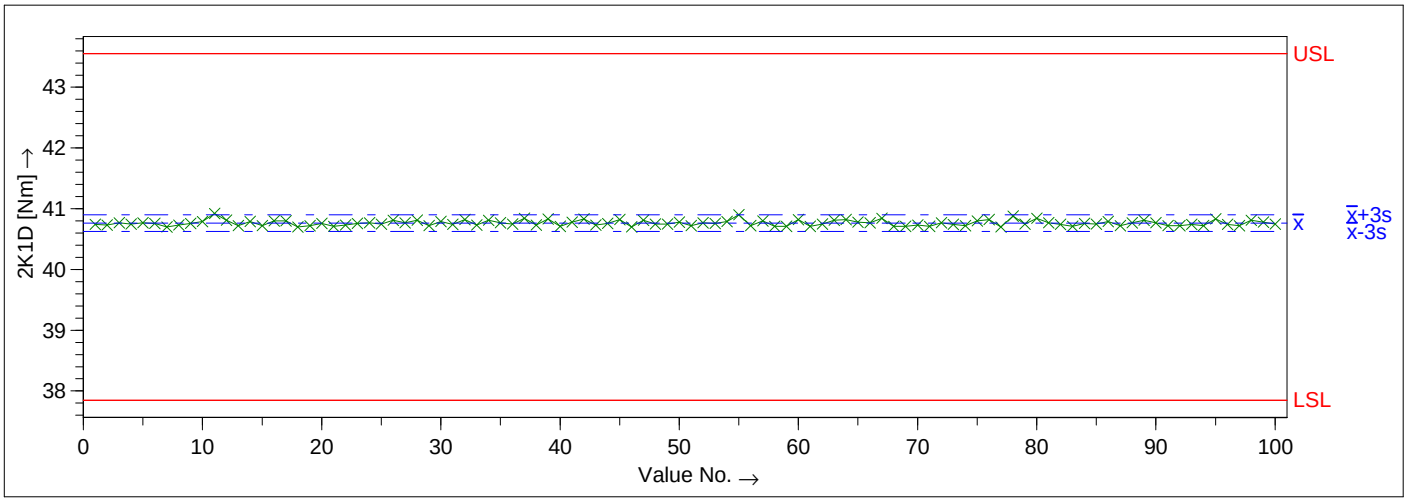
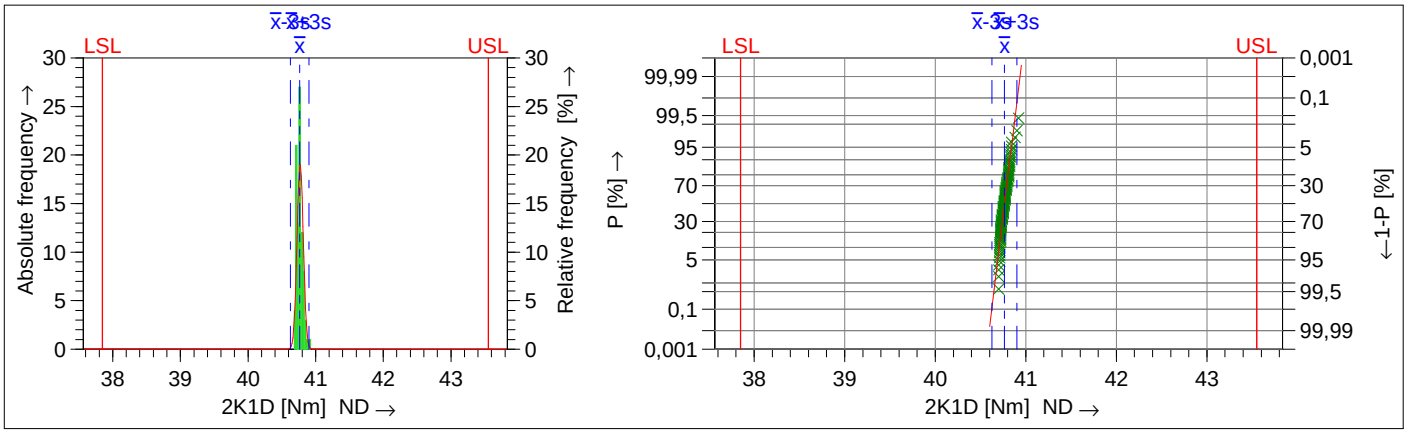
Plant ATG Westhausen		Operator Name Sünder	Date 07.03.2022

Ord. No. 2BD110T1S-A	Part type 2BD-2B110A-2K1D-2ZB				Contr.item yes
Serial No. 1015970_c	Char.Descr. 2K1D	Inspection Val.	40,70	2,85	USL 43,55
	Serial No. 204570	Unit	Nm	-2,85	LSL 37,85
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2
Cust.Name Cleco	Reference System VM1698-4	Test Electronic MPRO400GCD-P			
Contr.No. Homologation	Reference Transducer 50 / 1024729	nges. 100			

Evaluation from 07.03.2022 15:33:33 to 07.03.2022 15:53:08

Rem. TQ 30% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.326 Nm/A; Speed 890/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	40.70			$\bar{x}$	40.7648
LSL	37.85	x_{min}	40.70	$\bar{x}$-3s	40.6271
USL	43.55	x_{max}	40.92	$\bar{x}$+3s	40.9025
T	5.70	R	0.22	6s	0.2753
		$n_{<T>}$	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	20.70
Critical capability index	=	C_{mk}	20.23

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\AppData\QW\QWE\MessWert\2022\1015970_c1.DFD

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_c	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	2K1D	Inspection Val.	40,70
Ord. No.	2BD110T1S-A	Ser.No.	204570	LSL	37,85
				USL	43,55
Remark	TQ 30% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.326 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
204570	2K1D	40,74	40,73	40,77	40,75	40,77	40,76	40,70	40,73	40,76	40,79
204570	2K1D	366,00	372,00	372,00	369,00	370,00	372,00	367,00	370,00	372,00	377,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
204570	2K1D	40,92	40,81	40,72	40,79	40,72	40,80	40,80	40,70	40,72	40,76
204570	2K1D	374,00	372,00	370,00	366,00	364,00	371,00	374,00	368,00	366,00	361,00

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
204570	2K1D	40,71	40,73	40,76	40,77	40,75	40,81	40,77	40,81	40,72	40,79
204570	2K1D	363,00	360,00	364,00	362,00	359,00	366,00	368,00	364,00	368,00	364,00

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
204570	2K1D	40,74	40,82	40,73	40,81	40,77	40,75	40,84	40,73	40,83	40,71
204570	2K1D	366,00	365,00	366,00	363,00	366,00	367,00	367,00	372,00	364,00	357,00

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
204570	2K1D	40,78	40,83	40,73	40,76	40,82	40,70	40,81	40,75	40,75	40,78
204570	2K1D	361,00	363,00	357,00	355,00	363,00	357,00	363,00	359,00	359,00	361,00

Char.No	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
204570	2K1D	40,72	40,77	40,76	40,79	40,90	40,72	40,80	40,71	40,71	40,82
204570	2K1D	361,00	362,00	363,00	362,00	364,00	363,00	363,00	364,00	364,00	369,00

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
204570	2K1D	40,71	40,75	40,81	40,82	40,78	40,77	40,84	40,71	40,71	40,73
204570	2K1D	363,00	367,00	369,00	366,00	358,00	365,00	364,00	366,00	364,00	363,00

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
204570	2K1D	40,71	40,77	40,74	40,72	40,80	40,82	40,70	40,88	40,75	40,84
204570	2K1D	367,00	362,00	370,00	364,00	367,00	369,00	363,00	368,00	369,00	366,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_c	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	2K1D	Inspection Val.	40,70
Ord. No.	2BD110T1S-A	Ser.No.	204570	LSL	37,85
				USL	43,55
Remark	TQ 30% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.326 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
204570	2K1D	40,77	40,74	40,71	40,76	40,75	40,79	40,72	40,77	40,81	40,77
204570	2K1D	368,00	367,00	362,00	363,00	361,00	363,00	364,00	362,00	360,00	364,00

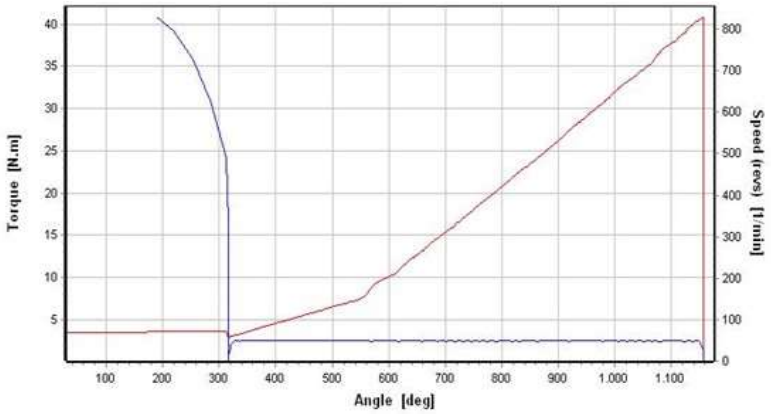
Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
204570	2K1D	40,72	40,72	40,74	40,72	40,83	40,74	40,72	40,81	40,78	40,75
204570	2K1D	356,00	359,00	357,00	355,00	359,00	357,00	354,00	359,00	357,00	354,00

Torque graphs

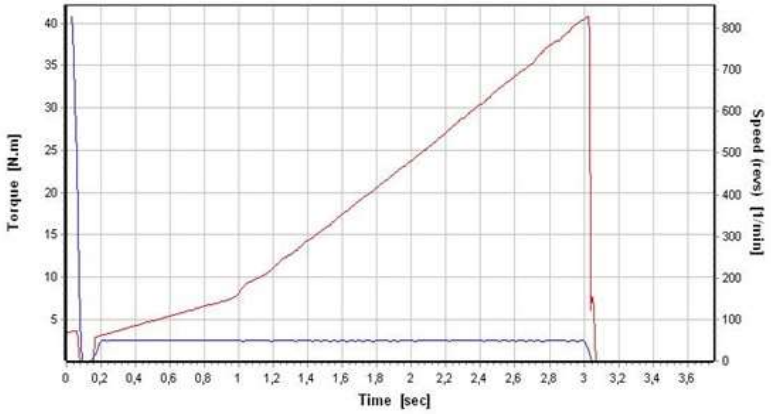
Machine Capability Study 30 %

Model: **2BD-2B110A-2K1D-2ZB**
Serial no: **1015970**

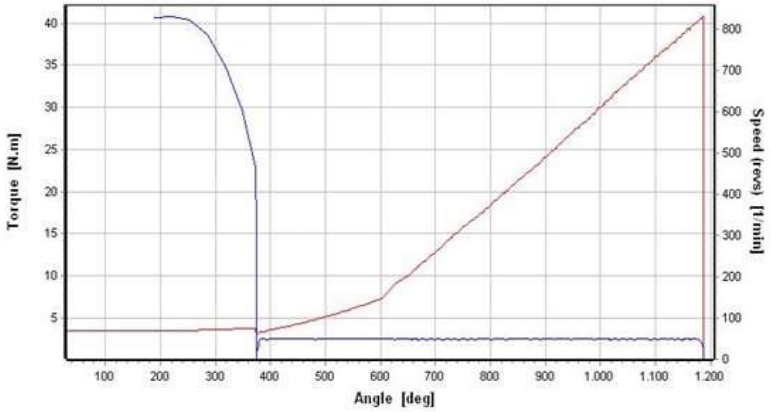
Angle degree: **360°**
Test torque: **40,7 Nm**



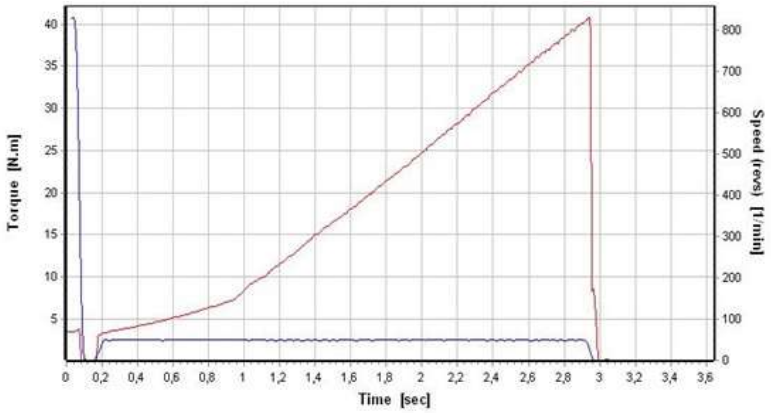
Value no. 1
Graph
Torque / Angle / Speed



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 50 rpm	5,6 %
Single-stage tightening system	☐	Speed 100 %	890 rpm

Manufacturer: Apex Tool Group

Serial no: **1015970**

Test torque: Tq min. + 0.8 (Tq max. - Tq min.) 90,20 Nm

Hard joint (H)	543,37	Nm / Revolution	Angle degree	30°
Soft joint (L)	45,11	Nm / Revolution	Angle degree	360°

		H	L
a)	Tolerance down / up	83,89 96,51 Nm	83,89 - 96,51 Nm
	Tolerance down / up	7	7 %
	Average torque	90,56	90,22 Nm
	Standard deviation	0,19	0,12 Nm
	Torque scatter (99,73%)	1,12	0,72 Nm
	C_m	11,25	17,64
	C_{mk}	10,60	17,58

b)	Min. C_m hard/soft (lowest value)	11,25
	Min. C_{mk} hard/soft (lowest value)	10,60

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

Note:

Machine Capability Study
Control System

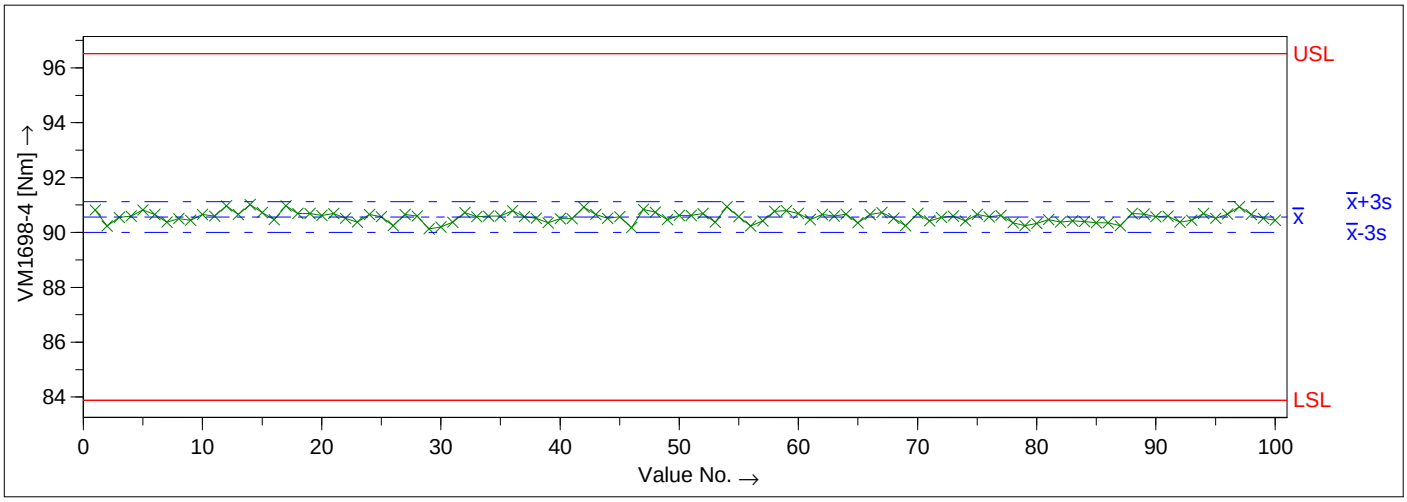
Cleco Production Tools

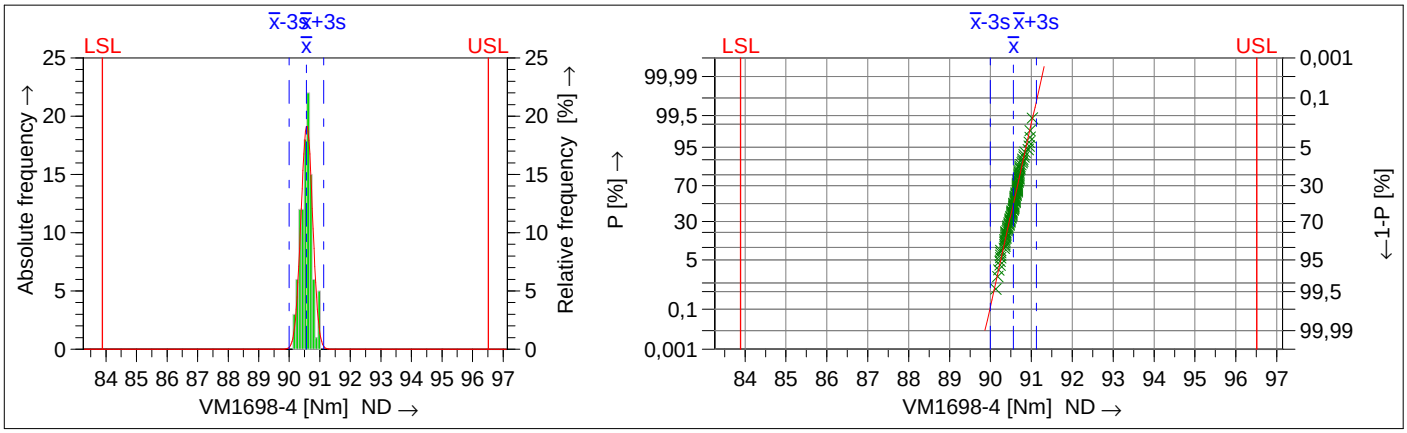
Plant	ATG Westhausen	Operator Name	Sünder
Date	07.03.2022		

Ord. No.	2BD110T1S-A	Part type	2BD-2B110A-2K1D-2ZB	Contr.item	yes
Serial No.	1015970_h	Char.Descr.	VM1698-4	Inspection Val. 90,20 6,31	USL 96,51
		Serial No.	1024210	Unit Nm -6,31	LSL 83,89
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	120 / 1019923	nges.	100

Evaluation from 07.03.2022 11:05:35 to 07.03.2022 11:20:47

Rem. TQ 80% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.178 Nm/A; Speed 890/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	90.20			$\bar{x}$	90.5609
LSL	83.89	x_{min}	90.13	$\bar{x}$-3s	89.9998
USL	96.51	x_{max}	91.02	$\bar{x}$+3s	91.1220
T	12.62	R	0.89	6s	1.1223
		$n_{<T>}$	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	11.25
Critical capability index	=	C_{mk}	10.60

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_h	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	VM1698-4	Inspection Val.	90,20
Ord. No.	2BD110T1S-A	Ser.No.	1024210	LSL	83,89
				USL	96,51
Remark	TQ 80% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.178 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	90,82	90,23	90,55	90,60	90,82	90,65	90,37	90,50	90,45	90,65
1024210	VM1698-4	30,25	29,75	30,25	30,50	30,25	30,75	30,75	29,75	29,25	29,75

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	90,60	90,97	90,65	91,02	90,72	90,47	90,97	90,69	90,69	90,62
1024210	VM1698-4	29,25	30,25	30,25	30,75	28,75	30,00	30,00	30,50	30,25	30,50

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	90,69	90,52	90,37	90,65	90,57	90,25	90,65	90,60	90,13	90,20
1024210	VM1698-4	30,25	29,00	30,00	29,50	29,75	30,50	29,50	29,50	29,50	29,75

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	90,37	90,72	90,57	90,60	90,60	90,79	90,57	90,52	90,35	90,50
1024210	VM1698-4	30,50	30,50	30,25	30,50	30,00	30,75	30,25	30,75	30,25	30,00

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	90,50	90,92	90,65	90,52	90,57	90,18	90,84	90,74	90,47	90,62
1024210	VM1698-4	30,75	30,75	30,25	30,50	30,00	30,75	30,75	30,50	30,50	30,50

Char.No	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	90,62	90,69	90,37	90,94	90,57	90,23	90,42	90,77	90,79	90,69
1024210	VM1698-4	30,25	30,75	31,00	30,50	30,25	30,00	30,75	29,50	29,50	31,25

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	90,47	90,65	90,60	90,67	90,35	90,65	90,72	90,52	90,25	90,69
1024210	VM1698-4	30,75	29,50	30,00	30,75	30,25	29,75	29,75	30,25	29,50	30,75

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	90,42	90,55	90,60	90,42	90,65	90,57	90,62	90,35	90,25	90,33
1024210	VM1698-4	31,25	31,25	30,75	30,75	30,75	30,50	30,25	30,50	30,25	29,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_h	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	VM1698-4	Inspection Val.	90,20
Ord. No.	2BD110T1S-A	Ser.No.	1024210	LSL	83,89
				USL	96,51
Remark	TQ 80% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.178 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	90,47	90,37	90,42	90,40	90,35	90,35	90,25	90,69	90,67	90,57
1024210	VM1698-4	29,75	30,00	30,50	29,75	31,00	30,00	30,25	29,50	29,75	30,00

Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	90,60	90,37	90,45	90,69	90,52	90,67	90,94	90,65	90,52	90,45
1024210	VM1698-4	29,75	30,00	29,50	30,25	30,00	30,50	30,25	31,00	29,00	30,00

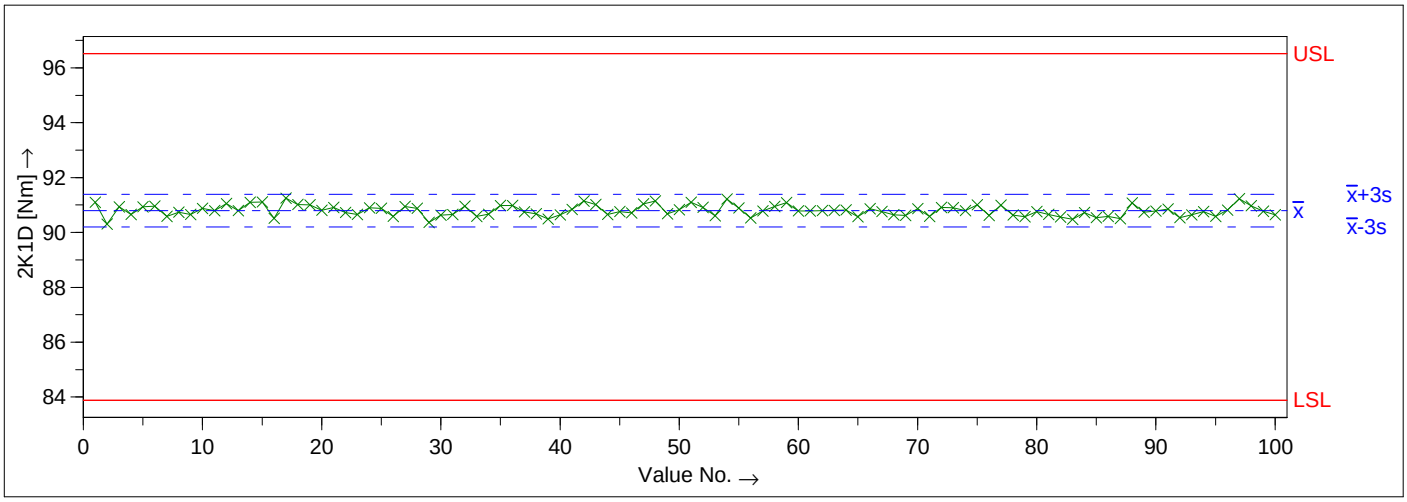
Machine Capability Study
Tool System

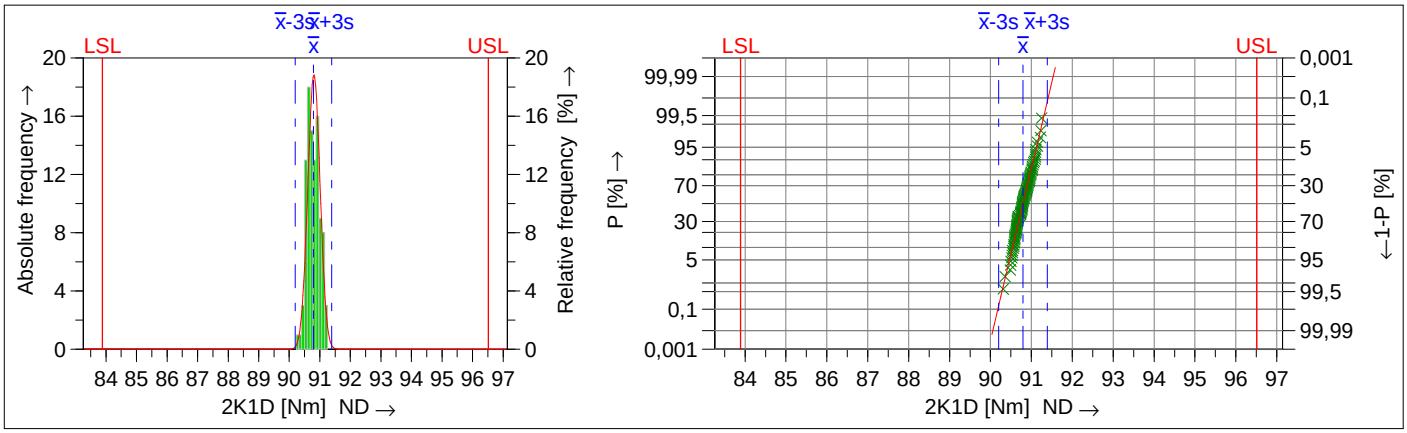
Plant	ATG Westhausen	Operator Name	Sünder
Date	07.03.2022		

Ord. No.	2BD110T1S-A	Part type	2BD-2B110A-2K1D-2ZB	Contr.item	yes
Serial No.	1015970_h	Char.Descr.	2K1D	Inspection Val. 90,20 6,31	USL 96,51
		Serial No.	204570	Unit Nm -6,31	LSL 83,89
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	120 / 1019923	nges.	100

Evaluation from 07.03.2022 11:05:35 to 07.03.2022 11:20:47

Rem. TQ 80% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.178 Nm/A; Speed 890/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	90.20			$\bar{x}$	90.7951
LSL	83.89	x_{min}	90.31	$\bar{x}$-3s	90.1984
USL	96.51	x_{max}	91.25	$\bar{x}$+3s	91.3918
T	12.62	R	0.94	6s	1.1933
		$n_{<T>}$	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	10.58
Critical capability index	=	C_{mk}	9.58

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_h	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	2K1D	Inspection Val.	90,20
Ord. No.	2BD110T1S-A	Ser.No.	204570	LSL	83,89
				USL	96,51
Remark	TQ 80% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.178 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
204570	2K1D	91,10	90,31	90,94	90,65	90,93	90,96	90,59	90,74	90,65	90,88
204570	2K1D	30,00	30,00	30,00	31,00	31,00	31,00	31,00	30,00	30,00	30,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
204570	2K1D	90,80	91,05	90,79	91,10	91,11	90,52	91,25	91,02	91,01	90,81
204570	2K1D	30,00	31,00	31,00	31,00	29,00	30,00	30,00	31,00	31,00	31,00

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
204570	2K1D	90,91	90,73	90,65	90,90	90,88	90,59	90,95	90,88	90,36	90,63
204570	2K1D	30,00	29,00	31,00	29,00	31,00	31,00	30,00	30,00	30,00	31,00

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
204570	2K1D	90,65	90,96	90,59	90,67	90,98	90,98	90,75	90,68	90,49	90,64
204570	2K1D	31,00	31,00	30,00	30,00	31,00	31,00	31,00	31,00	30,00	31,00

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
204570	2K1D	90,84	91,15	91,02	90,66	90,76	90,71	91,04	91,15	90,68	90,83
204570	2K1D	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00

Char.No	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
204570	2K1D	91,10	90,91	90,61	91,22	90,89	90,53	90,78	90,95	91,09	90,78
204570	2K1D	30,00	31,00	31,00	31,00	31,00	31,00	31,00	30,00	30,00	31,00

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
204570	2K1D	90,78	90,80	90,81	90,82	90,57	90,87	90,76	90,64	90,62	90,86
204570	2K1D	31,00	30,00	30,00	31,00	31,00	30,00	30,00	30,00	30,00	31,00

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
204570	2K1D	90,58	90,91	90,90	90,79	91,01	90,62	90,99	90,63	90,57	90,76
204570	2K1D	31,00	32,00	31,00	31,00	31,00	31,00	31,00	31,00	30,00	30,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_h	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	2K1D	Inspection Val.	90,20
Ord. No.	2BD110T1S-A	Ser.No.	204570	LSL	83,89
				USL	96,51
Remark	TQ 80% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.178 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
204570	2K1D	90,65	90,56	90,48	90,73	90,54	90,58	90,50	91,07	90,74	90,78
204570	2K1D	30,00	30,00	31,00	31,00	31,00	30,00	30,00	30,00	30,00	30,00

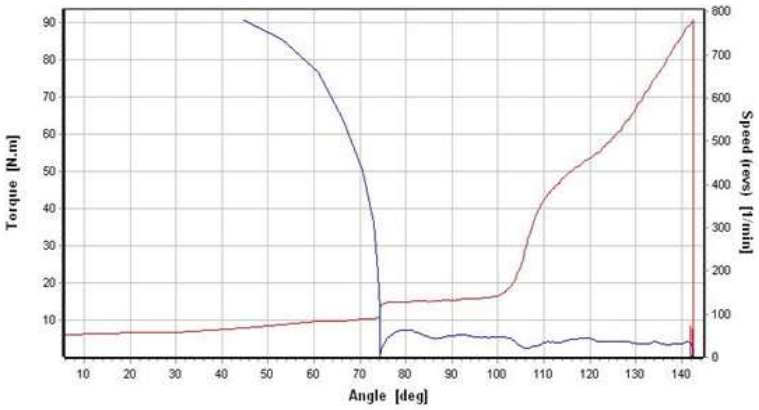
Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
204570	2K1D	90,85	90,54	90,64	90,76	90,59	90,82	91,23	90,97	90,77	90,64
204570	2K1D	31,00	30,00	30,00	31,00	30,00	31,00	31,00	31,00	29,00	30,00

Torque graphs

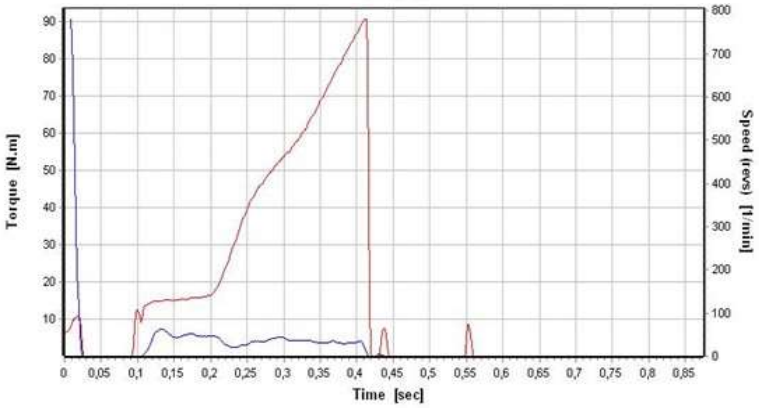
Machine Capability Study 80 %

Model: **2BD-2B110A-2K1D-2ZB**
Serial no: **1015970**

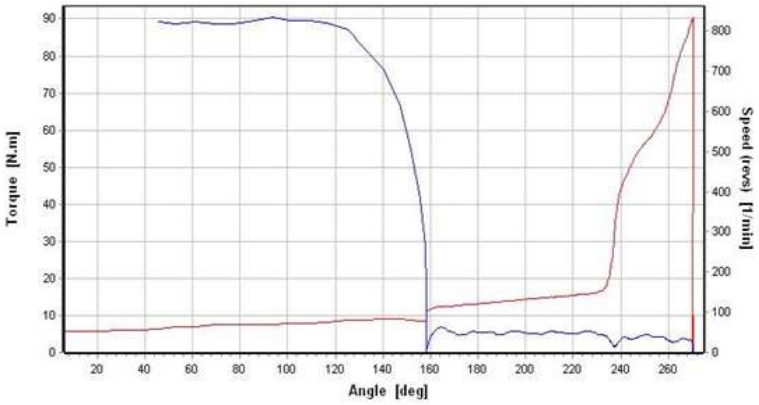
Angle degree: **30°**
Test torque: **90,2 Nm**



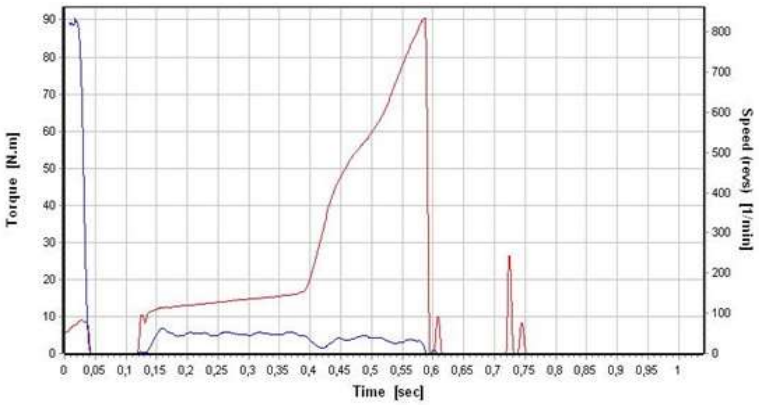
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

Machine Capability Study
Control System

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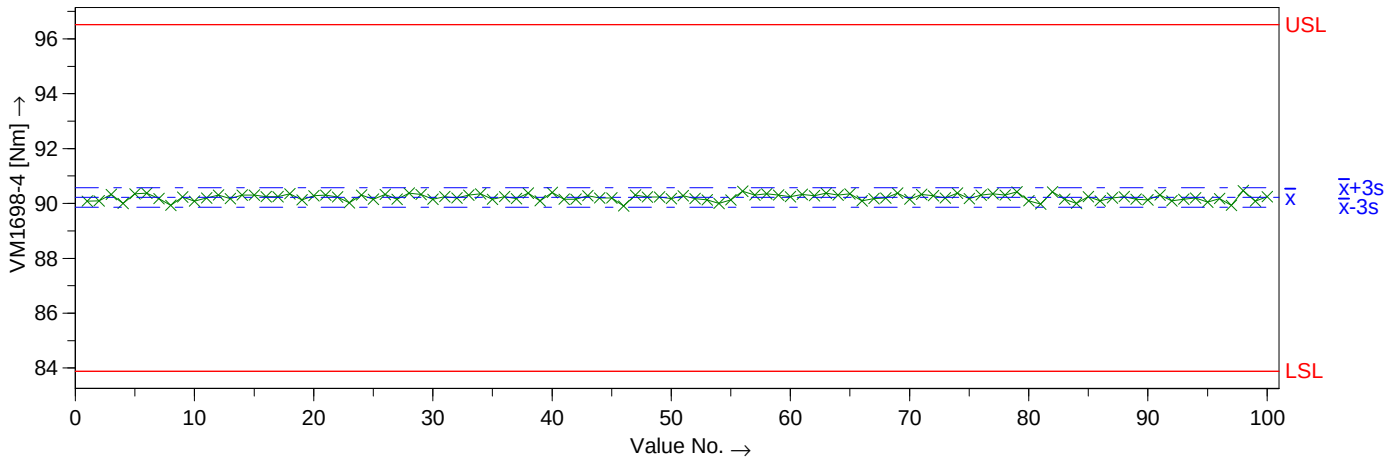
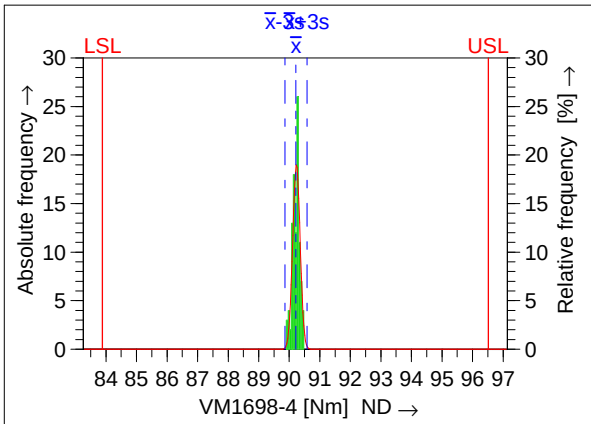
Plant	ATG Westhausen	Operator Name	Sünder
Date	07.03.2022		

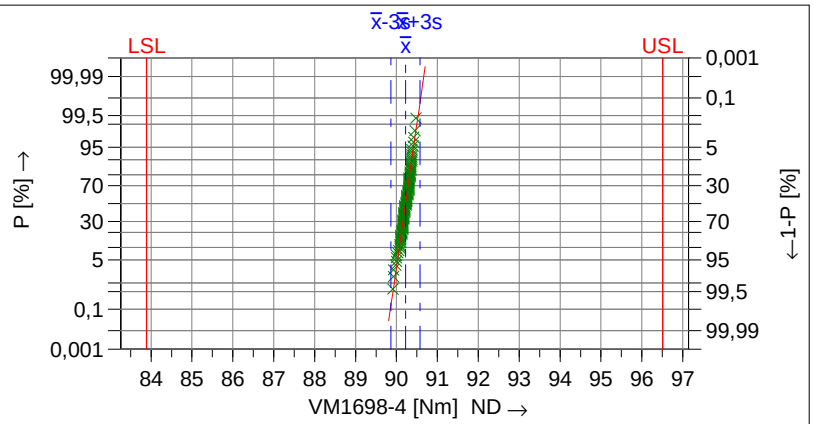
Ord. No.	2BD110T1S-A	Part type	2BD-2B110A-2K1D-2ZB	Contr.item	yes
Serial No.	1015970_g	Char.Descr.	VM1698-4	Inspection Val. 90,20 6,31	USL 96,51
		Serial No.	1024210	Unit Nm -6,31	LSL 83,89
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	120 / 1019923	nges.	100

Evaluation from 07.03.2022 11:59:39 to 07.03.2022 12:49:40

Rem. TQ 80% soft +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.178 Nm/A; Speed 890/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	90.20			$\bar{x}$	90.2208
LSL	83.89	x_{min}	89.91	$\bar{x}$-3s	89.8630
USL	96.51	x_{max}	90.47	$\bar{x}$+3s	90.5786
T	12.62	R	0.56	6s	0.7156
		$n_{<T>}$	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	17.64
Critical capability index	=	C_{mk}	17.58

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_g	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	VM1698-4	Inspection Val.	90,20
Ord. No.	2BD110T1S-A	Ser.No.	1024210	LSL	83,89
				USL	96,51
Remark	TQ 80% soft +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.178 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	90,08	90,10	90,33	90,00	90,35	90,37	90,18	89,93	90,23	90,08
1024210	VM1698-4	352,50	355,75	340,25	354,25	341,50	347,00	336,25	345,25	354,25	359,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	90,20	90,30	90,18	90,30	90,30	90,25	90,25	90,35	90,13	90,28
1024210	VM1698-4	340,25	334,00	342,25	341,25	338,50	341,50	356,25	352,25	344,75	342,25

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	90,30	90,23	90,03	90,30	90,15	90,33	90,15	90,37	90,33	90,15
1024210	VM1698-4	349,50	350,25	338,75	343,50	353,75	331,75	362,00	362,50	341,25	346,00

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	90,25	90,20	90,30	90,35	90,15	90,25	90,18	90,37	90,10	90,40
1024210	VM1698-4	376,00	349,50	353,25	355,75	347,25	341,75	359,00	345,25	363,75	357,75

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	90,15	90,15	90,28	90,20	90,20	89,91	90,30	90,23	90,23	90,18
1024210	VM1698-4	370,50	362,50	356,25	343,00	351,25	350,00	339,75	345,75	347,00	345,25

Char.No	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	90,28	90,18	90,13	90,00	90,13	90,45	90,30	90,35	90,30	90,25
1024210	VM1698-4	352,50	345,00	369,75	362,25	353,75	363,50	359,25	358,50	349,75	354,75

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	90,33	90,28	90,37	90,30	90,35	90,10	90,18	90,20	90,37	90,15
1024210	VM1698-4	358,00	357,00	351,50	349,50	356,50	346,75	358,00	367,00	352,00	336,00

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	90,33	90,28	90,20	90,37	90,18	90,30	90,35	90,30	90,42	90,10
1024210	VM1698-4	354,50	364,25	351,25	361,50	369,50	352,75	348,50	358,50	360,00	354,50

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_g	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	VM1698-4	Inspection Val.	90,20
Ord. No.	2BD110T1S-A	Ser.No.	1024210	LSL	83,89
				USL	96,51
Remark	TQ 80% soft +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.178 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	89,98	90,42	90,15	90,00	90,25	90,10	90,20	90,25	90,15	90,13
1024210	VM1698-4	350,00	359,75	365,50	353,25	352,75	373,50	364,25	362,00	342,00	346,25

Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	90,30	90,10	90,15	90,20	90,05	90,18	89,93	90,47	90,08	90,25
1024210	VM1698-4	361,25	353,25	357,25	356,00	350,25	363,25	365,25	371,75	355,25	352,50

Machine Capability Study
Tool System

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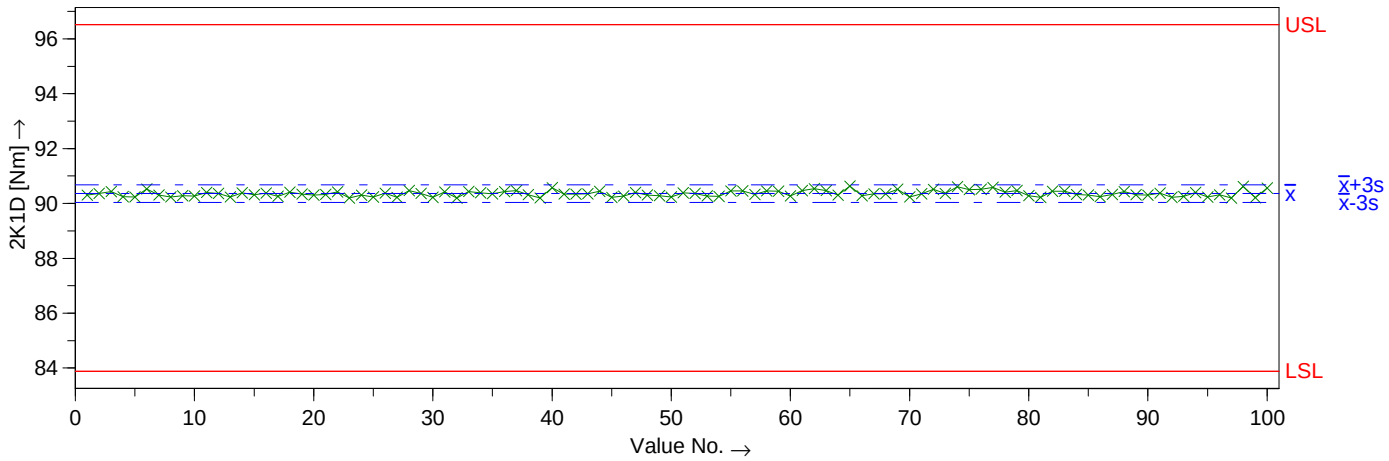
Plant ATG Westhausen		Operator Name Sünder	Date 07.03.2022

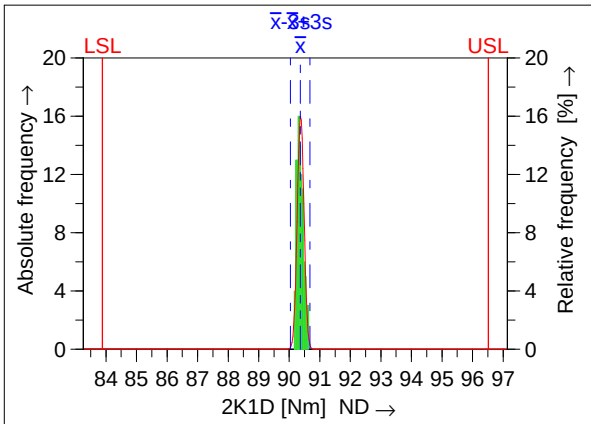
Ord. No. 2BD110T1S-A	Part type 2BD-2B110A-2K1D-2ZB				Contr.item yes
Serial No. 1015970_g	Char.Descr. 2K1D	Inspection Val.	90,20	6,31	USL 96,51
	Serial No. 204570	Unit	Nm	-6,31	LSL 83,89
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2

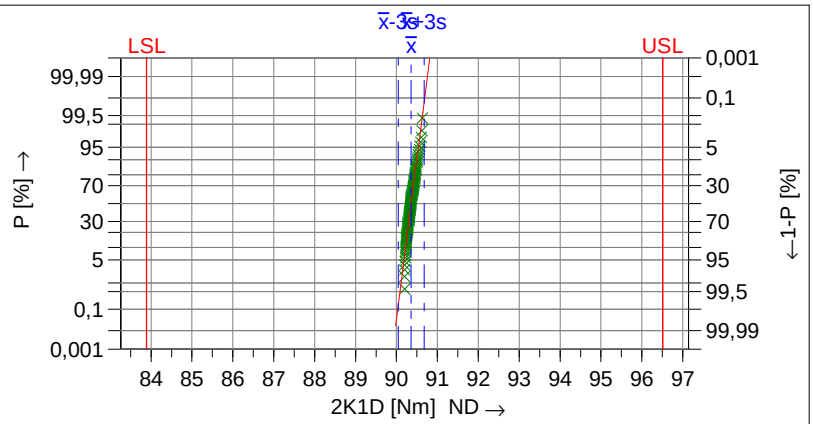
Cust.Name Cleco	Reference System VM1698-4	Test Electronic MPRO400GCD-P
Contr.No. Homologation	Reference Transducer 120 / 1019923	nges. 100

Evaluation from 07.03.2022 11:59:40 to 07.03.2022 12:49:41

Rem. TQ 80% soft +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.178 Nm/A; Speed 890/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	90.20			$\bar{x}$	90.3595
LSL	83.89	x_{min}	90.20	$\bar{x}$-3s	90.0396
USL	96.51	x_{max}	90.63	$\bar{x}$+3s	90.6794
T	12.62	R	0.43	6s	0.6398
		$n_{<T>}$	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	19.73
Critical capability index	=	C_{mk}	19.23

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_g	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	2K1D	Inspection Val.	90,20
Ord. No.	2BD110T1S-A	Ser.No.	204570	LSL	83,89
				USL	96,51
Remark	TQ 80% soft +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.178 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
204570	2K1D	90,31	90,36	90,43	90,25	90,23	90,53	90,30	90,24	90,28	90,27
204570	2K1D	354,00	355,00	341,00	354,00	341,00	348,00	336,00	346,00	354,00	359,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
204570	2K1D	90,40	90,36	90,24	90,39	90,32	90,37	90,26	90,41	90,34	90,30
204570	2K1D	340,00	335,00	343,00	342,00	337,00	343,00	356,00	353,00	345,00	343,00

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
204570	2K1D	90,33	90,42	90,20	90,30	90,24	90,38	90,22	90,47	90,36	90,22
204570	2K1D	350,00	351,00	339,00	342,00	354,00	332,00	362,00	362,00	341,00	346,00

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
204570	2K1D	90,42	90,20	90,43	90,39	90,35	90,43	90,47	90,32	90,20	90,57
204570	2K1D	376,00	350,00	353,00	356,00	346,00	343,00	360,00	345,00	364,00	358,00

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
204570	2K1D	90,34	90,34	90,35	90,44	90,22	90,27	90,40	90,30	90,28	90,24
204570	2K1D	371,00	364,00	356,00	344,00	351,00	351,00	340,00	347,00	347,00	346,00

Char.No	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
204570	2K1D	90,39	90,36	90,27	90,26	90,46	90,46	90,33	90,46	90,44	90,27
204570	2K1D	352,00	345,00	370,00	363,00	354,00	363,00	360,00	360,00	350,00	355,00

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
204570	2K1D	90,47	90,54	90,47	90,31	90,63	90,28	90,35	90,35	90,51	90,24
204570	2K1D	359,00	358,00	351,00	350,00	356,00	347,00	359,00	367,00	352,00	336,00

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
204570	2K1D	90,35	90,52	90,36	90,61	90,50	90,51	90,59	90,41	90,47	90,28
204570	2K1D	355,00	364,00	351,00	361,00	371,00	354,00	349,00	359,00	360,00	354,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_g	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	2K1D	Inspection Val.	90,20
Ord. No.	2BD110T1S-A	Ser.No.	204570	LSL	83,89
				USL	96,51
Remark	TQ 80% soft +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.178 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
204570	2K1D	90,22	90,45	90,45	90,33	90,31	90,25	90,33	90,43	90,32	90,31
204570	2K1D	351,00	360,00	367,00	353,00	356,00	374,00	365,00	362,00	343,00	347,00

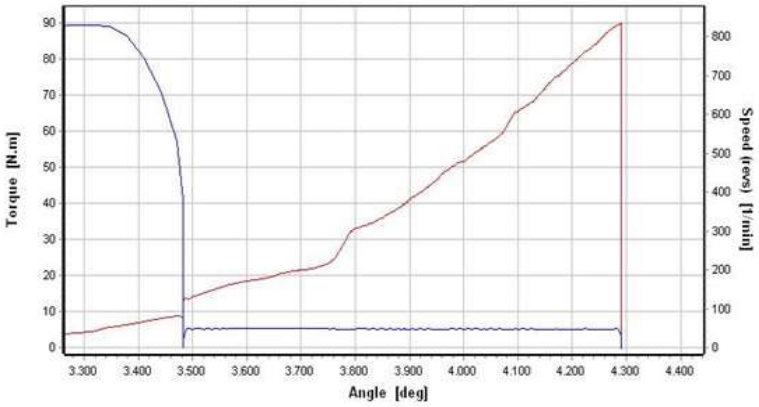
Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
204570	2K1D	90,38	90,22	90,26	90,40	90,24	90,32	90,20	90,62	90,21	90,56
204570	2K1D	361,00	354,00	357,00	357,00	351,00	363,00	365,00	374,00	355,00	353,00

Torque graphs

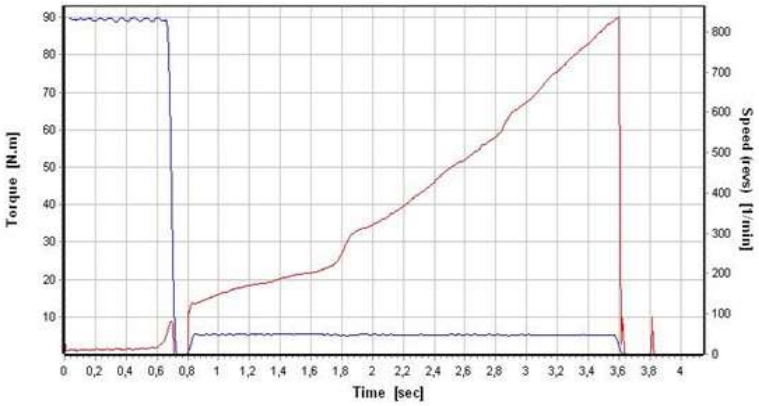
Machine Capability Study 80 %

Model: **2BD-2B110A-2K1D-2ZB**
Serial no: **1015970**

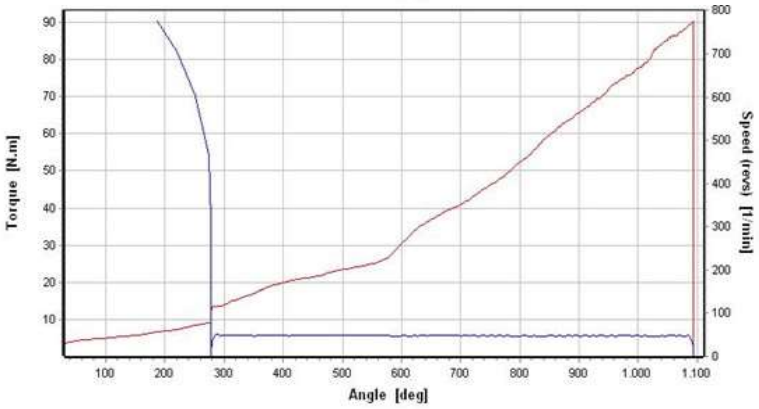
Angle degree: **360°**
Test torque: **90,2 Nm**



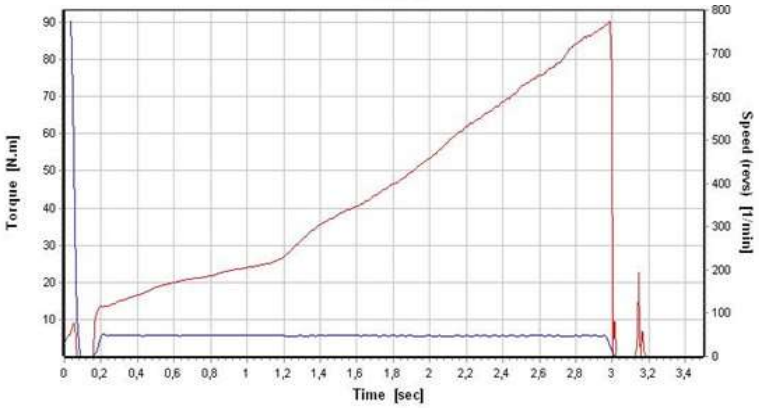
Value no. 1
Graph
Torque / Angle / Speed



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 50 rpm	5,6 %
Single-stage tightening system	☐	Speed 100 %	890 rpm

Manufacturer: Apex Tool Group

Serial no: **1015970**

Test torque: Tq max. 110,00 Nm

Hard joint (H)	662,69	Nm / Revolution	Angle degree	30°
Soft joint (L)	54,98	Nm / Revolution	Angle degree	360°

		H	L
a)	Tolerance down / up	102,30 117,70 Nm	102,30 - 117,70 Nm
	Tolerance down / up	7	7 %
	Average torque	110,45	109,97 Nm
	Standard deviation	0,24	0,11 Nm
	Torque scatter (99,73%)	1,43	0,67 Nm
	C_m	10,75	23,07
	C_{mk}	10,13	22,97

b)	Min. C_m hard/soft (lowest value)	10,75
	Min. C_{mk} hard/soft (lowest value)	10,13

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

Note:

Machine Capability Study
Control System

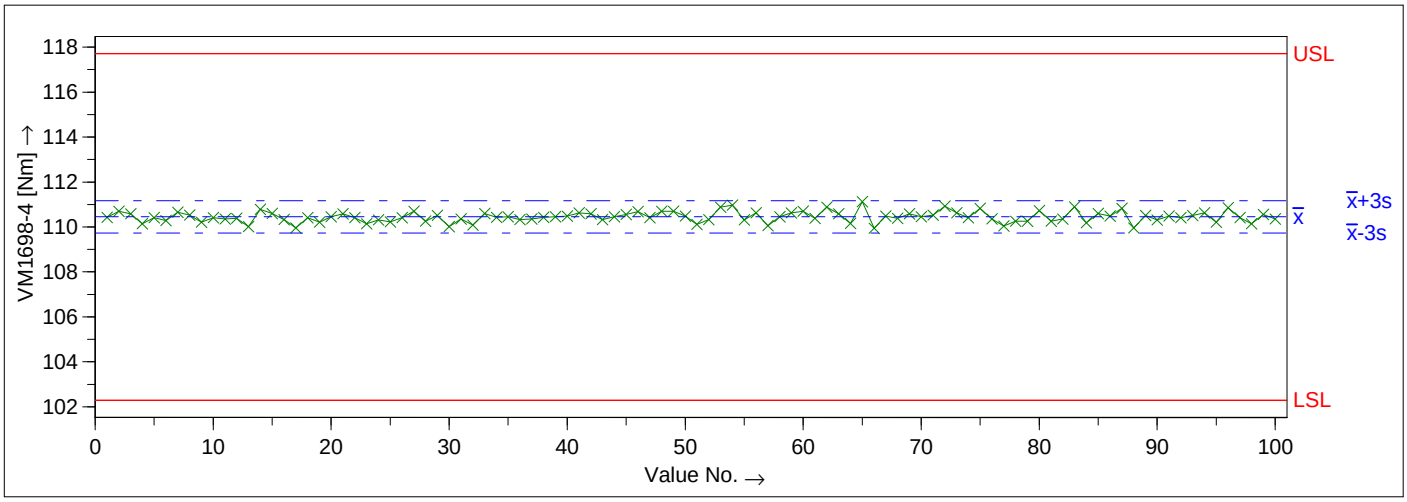
Cleco Production Tools

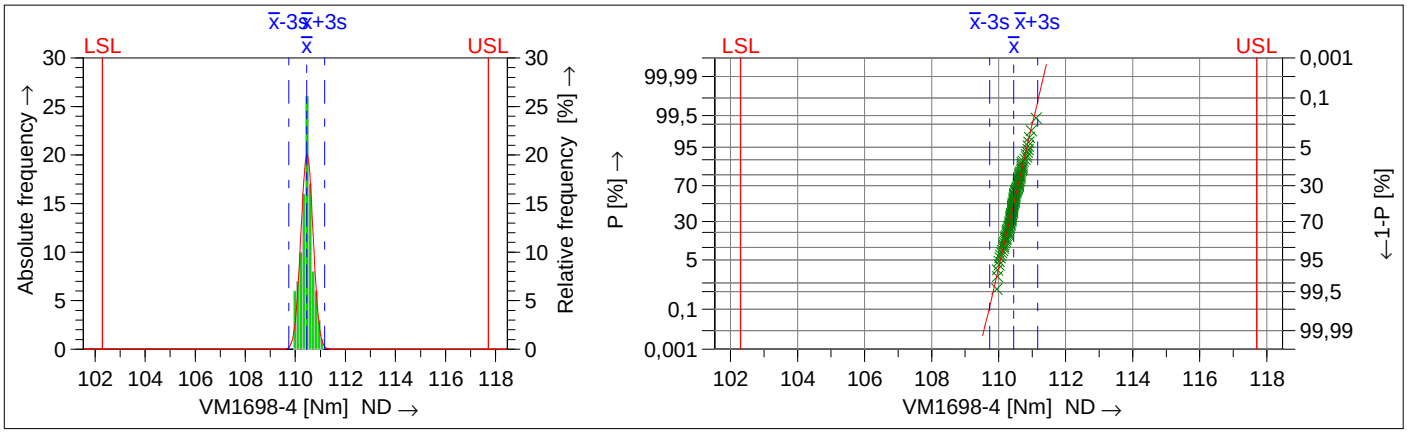
Plant	ATG Westhausen	Operator Name	Sünder
Date	07.03.2022		

Ord. No.	2BD110T1S-A	Part type	2BD-2B110A-2K1D-2ZB	Contr.item	yes
Serial No.	1015970_b	Char.Descr.	VM1698-4	Inspection Val. 110,00 7,70	USL 117,70
		Serial No.	1024210	Unit Nm -7,70	LSL 102,30
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	120 / 1019923	nges.	100

Evaluation from 07.03.2022 10:14:15 to 07.03.2022 10:30:14

Rem. TQ 100% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.164 Nm/A; Speed 890/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	110.00			$\bar{x}$	110.4488
LSL	102.30	x_{min}	109.94	$\bar{x}$-3s	109.7328
USL	117.70	x_{max}	111.12	$\bar{x}$+3s	111.1648
T	15.40	R	1.18	6s	1.4320
		$n_{<T>}$	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	10.75
Critical capability index	=	C_{mk}	10.13

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_b	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	VM1698-4	Inspection Val.	110,00
Ord. No.	2BD110T1S-A	Ser.No.	1024210	LSL	102,30
				USL	117,70
Remark	TQ 100% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.164 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	110,43	110,70	110,58	110,14	110,41	110,28	110,65	110,53	110,21	110,41
1024210	VM1698-4	28,50	29,50	29,75	29,50	23,50	31,00	30,25	29,75	30,00	29,75

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	110,36	110,38	110,01	110,78	110,60	110,33	109,96	110,41	110,21	110,46
1024210	VM1698-4	29,75	30,00	30,50	30,25	30,25	29,75	29,50	30,75	23,00	24,50

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	110,58	110,41	110,14	110,31	110,23	110,41	110,70	110,26	110,51	110,01
1024210	VM1698-4	23,25	30,50	30,50	30,00	30,00	29,75	30,00	30,75	30,75	30,25

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	110,36	110,09	110,60	110,43	110,46	110,33	110,36	110,43	110,46	110,48
1024210	VM1698-4	30,00	29,25	29,75	30,00	29,75	30,00	30,50	30,50	31,00	31,25

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	110,63	110,58	110,33	110,46	110,55	110,68	110,41	110,70	110,70	110,48
1024210	VM1698-4	23,50	31,25	30,25	30,00	30,25	30,00	30,75	31,50	31,00	30,75

Char.No	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	110,11	110,33	110,88	110,97	110,31	110,63	110,06	110,46	110,63	110,70
1024210	VM1698-4	28,75	30,75	30,50	22,75	25,50	24,25	31,00	32,00	31,50	30,50

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	110,38	110,88	110,58	110,16	111,12	109,94	110,48	110,38	110,58	110,46
1024210	VM1698-4	31,50	31,25	30,75	30,25	31,00	30,00	23,75	24,50	31,00	30,50

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	110,53	110,92	110,63	110,41	110,83	110,36	110,04	110,26	110,26	110,73
1024210	VM1698-4	31,25	31,00	30,75	31,00	31,00	30,50	30,75	30,50	30,50	30,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_b	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	VM1698-4	Inspection Val.	110,00
Ord. No.	2BD110T1S-A	Ser.No.	1024210	LSL	102,30
				USL	117,70
Remark	TQ 100% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.164 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	110,26	110,36	110,90	110,19	110,60	110,48	110,83	109,96	110,51	110,31
1024210	VM1698-4	30,25	30,75	30,75	30,25	31,25	31,75	30,50	30,50	30,25	30,00

Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	110,48	110,41	110,51	110,63	110,21	110,85	110,41	110,14	110,55	110,36
1024210	VM1698-4	30,75	30,75	30,25	30,50	30,50	30,75	29,75	29,75	30,00	30,00

Machine Capability Study
Tool System

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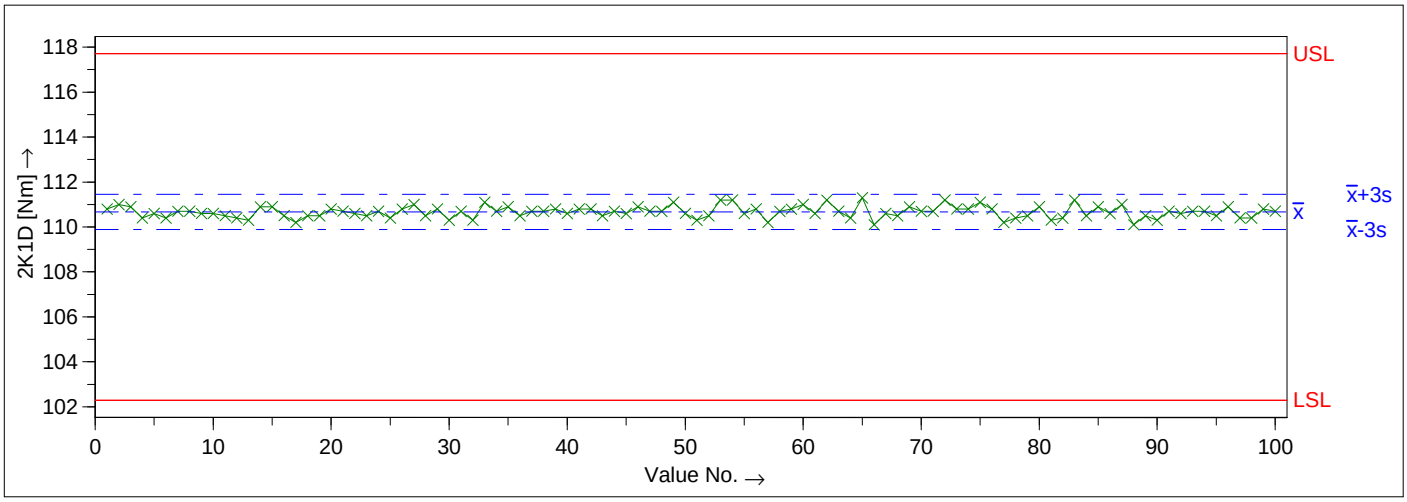
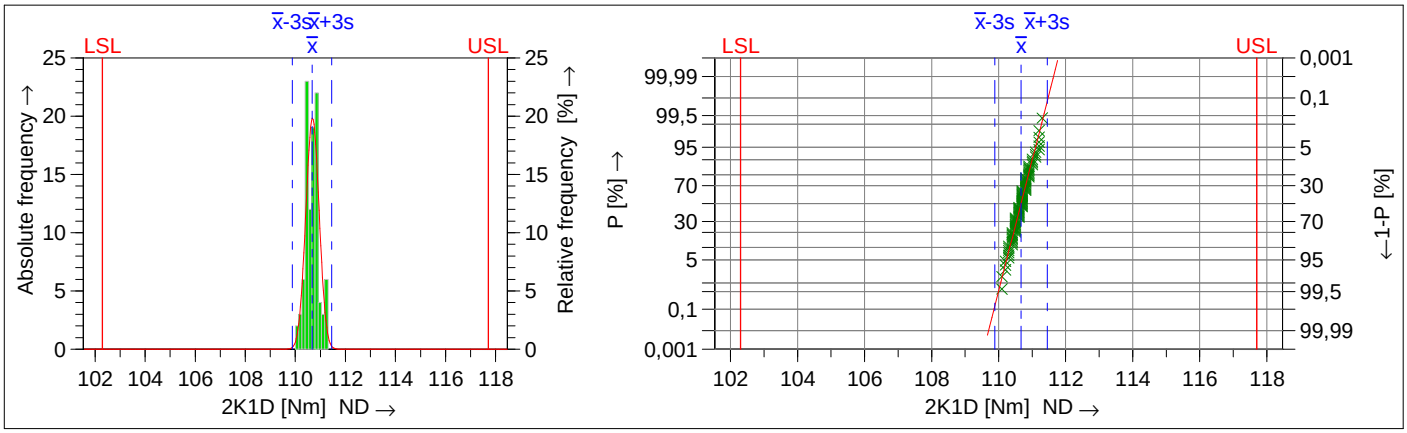
Plant ATG Westhausen		Operator Name Sünder	Date 07.03.2022

Ord. No. 2BD110T1S-A	Part type 2BD-2B110A-2K1D-2ZB				Contr.item yes
Serial No. 1015970_b	Char.Descr. 2K1D	Inspection Val.	110,00	7,70	USL 117,70
	Serial No. 204570	Unit	Nm	-7,70	LSL 102,30
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2
Cust.Name Cleco	Reference System VM1698-4				Test Electronic MPRO400GCD-P
Contr.No. Homologation	Reference Transducer 120 / 1019923				nges. 100

Evaluation from 07.03.2022 10:14:16 to 07.03.2022 10:30:15

Rem. TQ 100% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.164 Nm/A; Speed 890/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	110.00			$\bar{x}$	110.6680
LSL	102.30	x_{min}	110.10	$\bar{x}$-3s	109.8842
USL	117.70	x_{max}	111.30	$\bar{x}$+3s	111.4518
T	15.40	R	1.20	6s	1.5676
		$n_{<T>}$	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	9.82
Critical capability index	=	C_{mk}	8.97

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_b	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	2K1D	Inspection Val.	110,00
Ord. No.	2BD110T1S-A	Ser.No.	204570	LSL	102,30
				USL	117,70
Remark	TQ 100% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.164 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
204570	2K1D	110,80	111,00	110,90	110,40	110,60	110,40	110,70	110,70	110,60	110,60
204570	2K1D	29,00	30,00	30,00	30,00	24,00	32,00	31,00	31,00	30,00	30,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
204570	2K1D	110,50	110,40	110,30	110,90	110,90	110,50	110,20	110,50	110,50	110,80
204570	2K1D	31,00	31,00	31,00	31,00	31,00	30,00	30,00	31,00	23,00	25,00

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
204570	2K1D	110,70	110,60	110,50	110,70	110,40	110,80	111,00	110,50	110,80	110,30
204570	2K1D	24,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
204570	2K1D	110,70	110,30	111,10	110,70	110,90	110,50	110,70	110,70	110,80	110,60
204570	2K1D	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	32,00	32,00

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
204570	2K1D	110,80	110,80	110,50	110,70	110,60	110,90	110,70	110,70	111,10	110,60
204570	2K1D	24,00	32,00	32,00	31,00	31,00	31,00	31,00	32,00	32,00	31,00

Char.No	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
204570	2K1D	110,30	110,50	111,20	111,20	110,60	110,80	110,20	110,70	110,80	111,00
204570	2K1D	30,00	31,00	31,00	23,00	26,00	25,00	32,00	32,00	32,00	32,00

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
204570	2K1D	110,60	111,20	110,70	110,40	111,30	110,10	110,60	110,50	110,90	110,70
204570	2K1D	32,00	31,00	31,00	31,00	31,00	31,00	24,00	25,00	31,00	31,00

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
204570	2K1D	110,70	111,20	110,80	110,80	111,10	110,80	110,20	110,40	110,50	110,90
204570	2K1D	32,00	32,00	32,00	32,00	32,00	31,00	31,00	31,00	31,00	31,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_b	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	2K1D	Inspection Val.	110,00
Ord. No.	2BD110T1S-A	Ser.No.	204570	LSL	102,30
				USL	117,70
Remark	TQ 100% hard +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.164 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
204570	2K1D	110,30	110,40	111,20	110,50	110,90	110,60	111,00	110,10	110,50	110,30
204570	2K1D	31,00	31,00	32,00	31,00	32,00	32,00	31,00	31,00	31,00	31,00

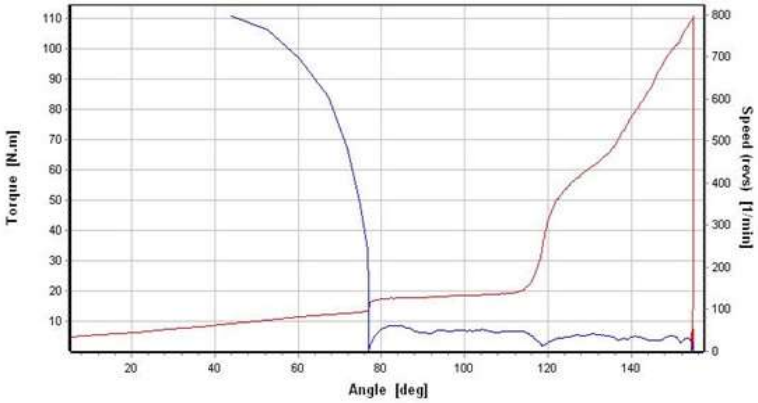
Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
204570	2K1D	110,70	110,60	110,70	110,70	110,50	110,90	110,40	110,40	110,80	110,70
204570	2K1D	31,00	32,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00

Torque graphs

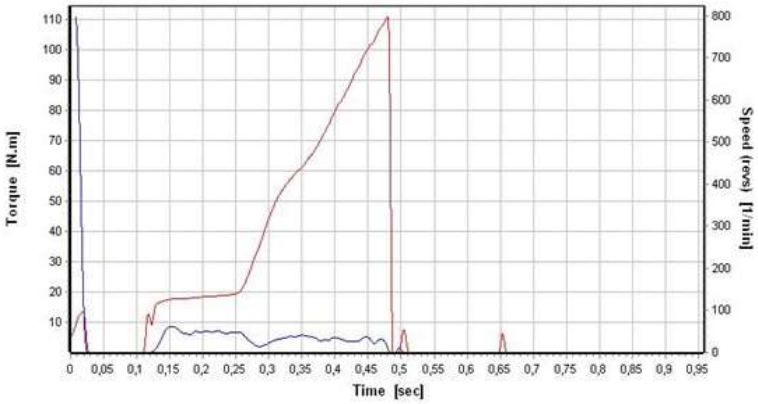
Machine Capability Study 100 %

Model: **2BD-2B110A-2K1D-2ZB**
Serial no: **1015970**

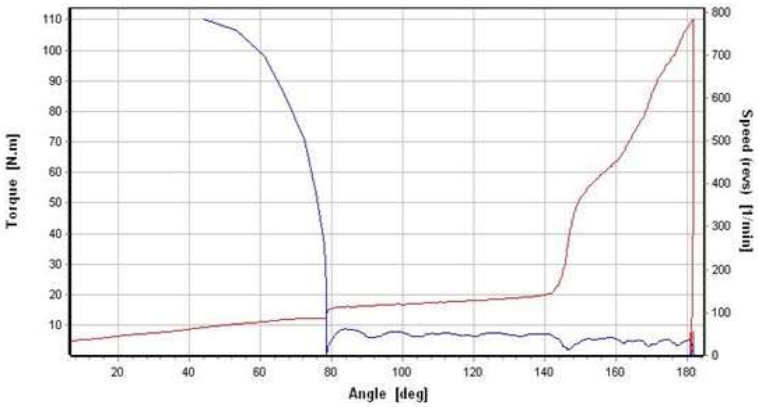
Angle degree: **30°**
Test torque: **110,0 Nm**



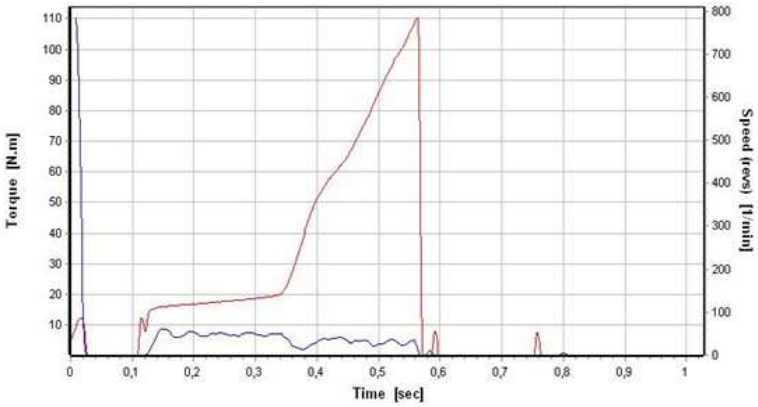
Value no. 1
Graph
Torque / Angle / Speed



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

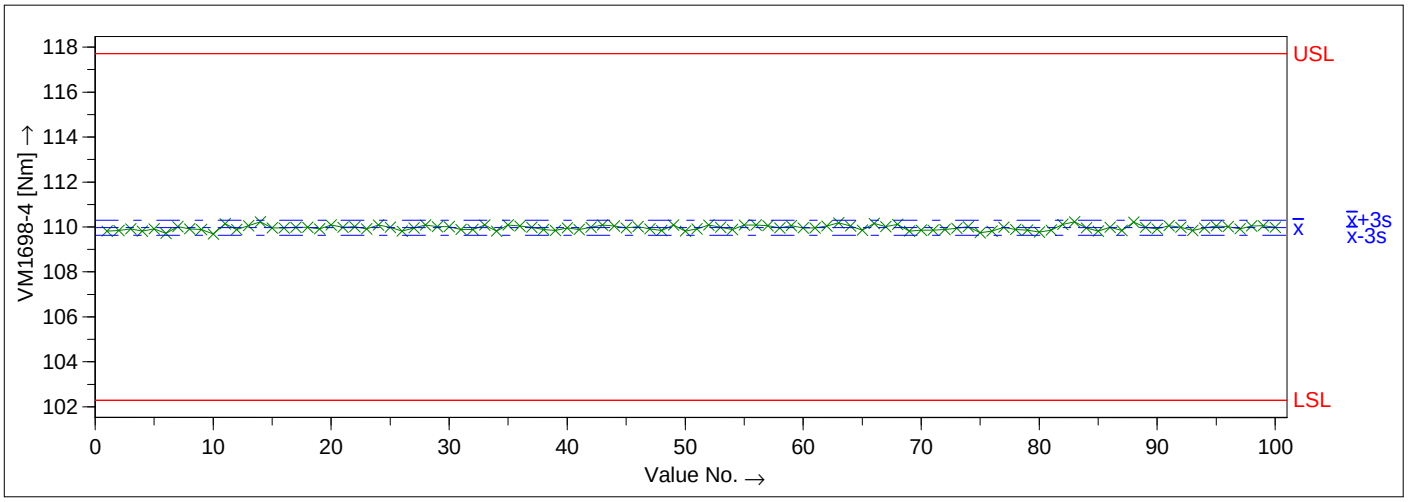
Cleco Production Tools

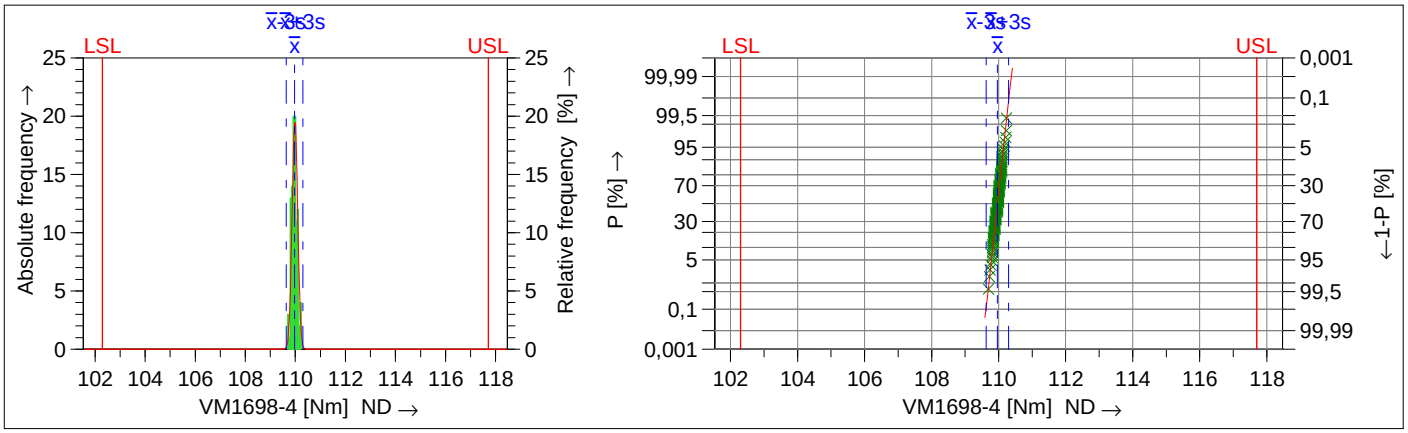
Plant	ATG Westhausen	Operator Name	Sünder
Date	07.03.2022		

Ord. No.	2BD110T1S-A	Part type	2BD-2B110A-2K1D-2ZB	Contr.item	yes
Serial No.	1015970_a	Char.Descr.	VM1698-4	Inspection Val. 110,00 7,70	USL 117,70
		Serial No.	1024210	Unit Nm -7,70	LSL 102,30
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	120 / 1019923	nges.	100

Evaluation from 07.03.2022 16:02:55 to 07.03.2022 17:53:05

Rem. TQ 100% soft +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.164 Nm/A; Speed 890/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	110.00			$\bar{x}$	109.9650
LSL	102.30	x_{min}	109.69	$\bar{x}$-3s	109.6313
USL	117.70	x_{max}	110.23	$\bar{x}$+3s	110.2987
T	15.40	R	0.54	6s	0.6675
		$n_{<T>}$	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	23.07
Critical capability index	=	C_{mk}	22.97

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_a	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	VM1698-4	Inspection Val.	110,00
Ord. No.	2BD110T1S-A	Ser.No.	1024210	LSL	102,30
				USL	117,70
Remark	TQ 100% soft +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.164 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	109,82	109,84	109,91	109,82	109,91	109,72	110,01	109,91	109,89	109,69
1024210	VM1698-4	338,25	340,75	341,00	341,50	347,25	338,75	340,00	346,75	336,00	337,50

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	110,14	109,89	110,06	110,23	109,96	109,96	109,99	109,99	109,91	110,09
1024210	VM1698-4	349,75	341,25	331,25	336,50	345,00	339,00	348,00	351,75	335,75	346,75

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	109,99	110,01	109,91	110,09	109,99	109,82	109,96	110,09	110,01	110,01
1024210	VM1698-4	344,50	349,25	346,50	350,75	347,25	359,00	342,00	349,25	350,25	358,25

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	109,89	109,89	110,09	109,82	110,09	110,04	109,99	109,89	109,84	109,96
1024210	VM1698-4	352,50	356,50	359,25	348,50	358,50	358,25	358,75	366,75	355,25	358,00

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	109,89	109,99	110,09	110,04	109,96	110,01	109,91	109,84	110,09	109,82
1024210	VM1698-4	345,00	374,25	357,00	352,50	362,00	347,75	344,25	348,00	357,50	366,50

Char.No	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	109,91	110,09	109,99	109,89	110,09	110,09	110,06	109,96	110,06	109,96
1024210	VM1698-4	358,00	357,00	355,25	365,75	362,75	361,25	372,25	367,00	362,00	360,75

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	109,96	110,04	110,19	110,04	109,86	110,16	110,01	110,11	109,82	109,86
1024210	VM1698-4	354,25	360,00	360,00	366,75	351,00	360,50	359,25	354,50	368,75	359,75

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	109,86	109,89	109,94	110,01	109,74	109,82	109,99	109,89	109,86	109,77
1024210	VM1698-4	347,50	349,75	350,25	361,75	356,25	354,75	352,00	373,25	351,50	348,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_a	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	VM1698-4	Inspection Val.	110,00
Ord. No.	2BD110T1S-A	Ser.No.	1024210	LSL	102,30
				USL	117,70
Remark	TQ 100% soft +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.164 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	109,86	110,11	110,23	109,96	109,82	109,99	109,84	110,21	109,99	109,91
1024210	VM1698-4	360,75	358,50	373,75	352,00	369,75	363,00	351,00	349,75	364,25	348,75

Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	110,06	109,99	109,84	109,96	110,04	110,01	109,91	110,04	110,06	109,99
1024210	VM1698-4	366,00	363,50	363,25	359,00	354,25	352,25	373,50	359,00	356,25	367,75

Machine Capability Study
Tool System

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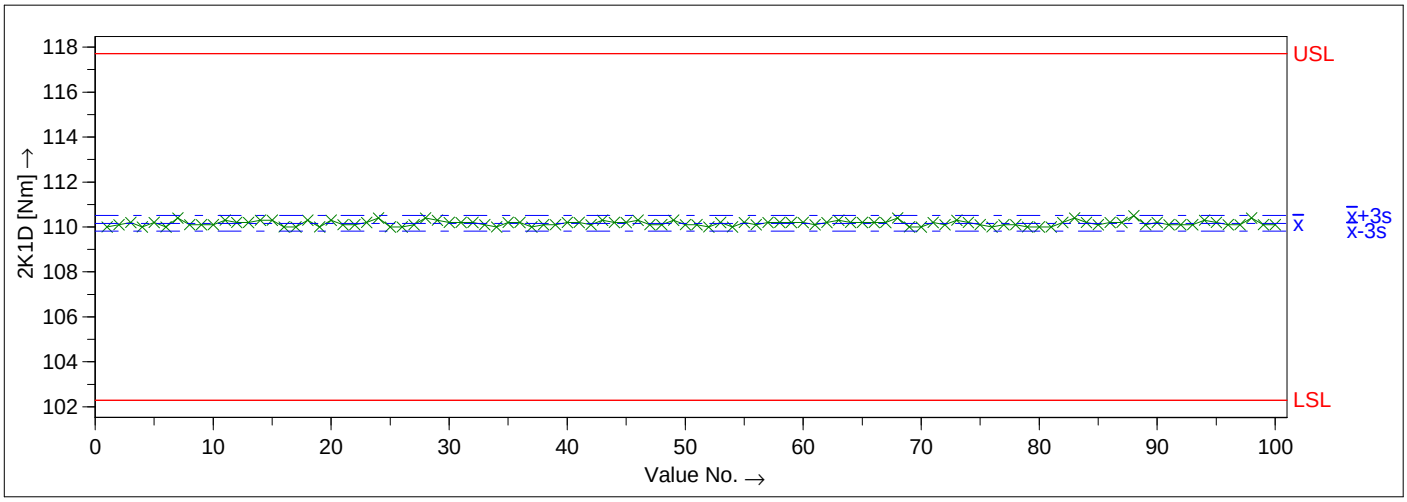
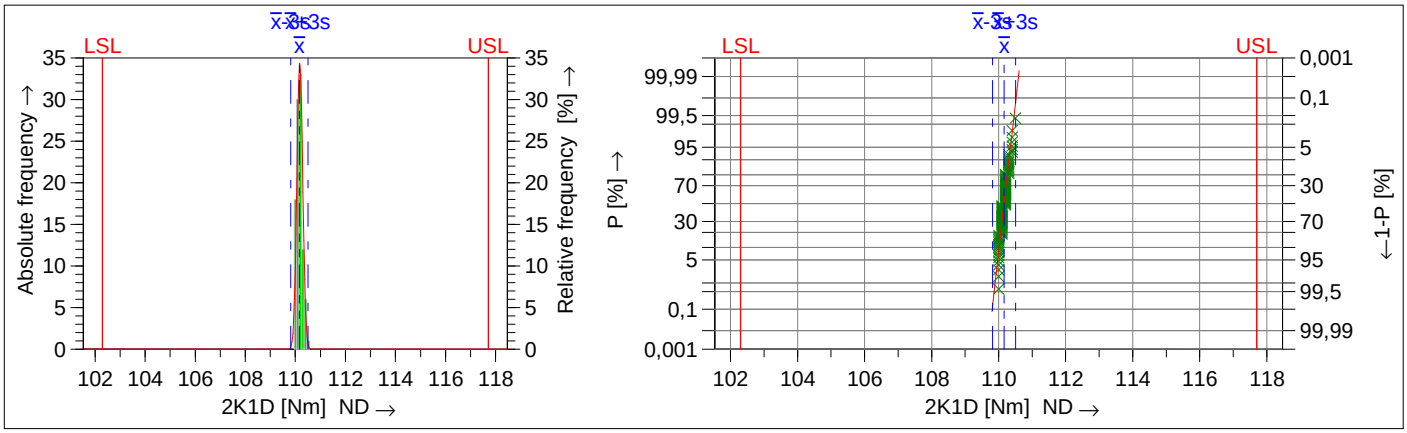
Plant ATG Westhausen		Operator Name Sünder	Date 07.03.2022

Ord. No. 2BD110T1S-A	Part type 2BD-2B110A-2K1D-2ZB				Contr.item yes
Serial No. 1015970_a	Char.Descr. 2K1D	Inspection Val.	110,00	7,70	USL 117,70
	Serial No. 204570	Unit	Nm	-7,70	LSL 102,30
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2
Cust.Name Cleco	Reference System VM1698-4	Test Electronic MPRO400GCD-P			
Contr.No. Homologation	Reference Transducer 120 / 1019923	nges. 100			

Evaluation from 07.03.2022 16:02:56 to 07.03.2022 17:53:05

Rem. TQ 100% soft +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.164 Nm/A; Speed 890/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	110.00			$\bar{x}$	110.1610
LSL	102.30	x_{min}	110.00	$\bar{x}$-3s	109.8149
USL	117.70	x_{max}	110.50	$\bar{x}$+3s	110.5071
T	15.40	R	0.50	6s	0.6923
		$n_{<T>}$	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	22.25
Critical capability index	=	C_{mk}	21.78

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_a	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	2K1D	Inspection Val.	110,00
Ord. No.	2BD110T1S-A	Ser.No.	204570	LSL	102,30
				USL	117,70
Remark	TQ 100% soft +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.164 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
204570	2K1D	110,00	110,10	110,20	110,00	110,20	110,00	110,40	110,10	110,10	110,10
204570	2K1D	339,00	342,00	343,00	344,00	350,00	340,00	342,00	348,00	338,00	338,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
204570	2K1D	110,30	110,20	110,20	110,30	110,30	110,00	110,00	110,30	110,00	110,30
204570	2K1D	351,00	343,00	335,00	340,00	346,00	340,00	351,00	353,00	337,00	348,00

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
204570	2K1D	110,10	110,10	110,20	110,40	110,00	110,00	110,10	110,40	110,30	110,20
204570	2K1D	348,00	351,00	346,00	352,00	349,00	361,00	343,00	350,00	352,00	360,00

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
204570	2K1D	110,20	110,20	110,10	110,00	110,20	110,20	110,00	110,10	110,10	110,20
204570	2K1D	354,00	357,00	360,00	350,00	363,00	360,00	360,00	370,00	359,00	360,00

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
204570	2K1D	110,20	110,10	110,30	110,20	110,20	110,30	110,10	110,10	110,30	110,10
204570	2K1D	348,00	376,00	358,00	354,00	363,00	349,00	348,00	351,00	359,00	369,00

Char.No	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
204570	2K1D	110,10	110,00	110,20	110,00	110,20	110,10	110,20	110,20	110,20	110,20
204570	2K1D	359,00	358,00	356,00	367,00	364,00	362,00	373,00	368,00	363,00	361,00

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
204570	2K1D	110,10	110,20	110,30	110,20	110,20	110,20	110,20	110,40	110,00	110,00
204570	2K1D	356,00	362,00	361,00	368,00	354,00	363,00	363,00	355,00	370,00	361,00

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
204570	2K1D	110,20	110,10	110,30	110,20	110,10	110,00	110,10	110,10	110,00	110,00
204570	2K1D	349,00	353,00	352,00	363,00	358,00	356,00	354,00	374,00	353,00	350,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_a	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	2K1D	Inspection Val.	110,00
Ord. No.	2BD110T1S-A	Ser.No.	204570	LSL	102,30
				USL	117,70
Remark	TQ 100% soft +/-7% * TQ-Cal.: 110 Nm; Cur-Cal.: 3.164 Nm/A; Speed 890/50 rpm;				

Char.No	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
204570	2K1D	110,00	110,20	110,40	110,20	110,10	110,20	110,20	110,50	110,10	110,20
204570	2K1D	362,00	359,00	376,00	353,00	372,00	365,00	352,00	351,00	367,00	350,00

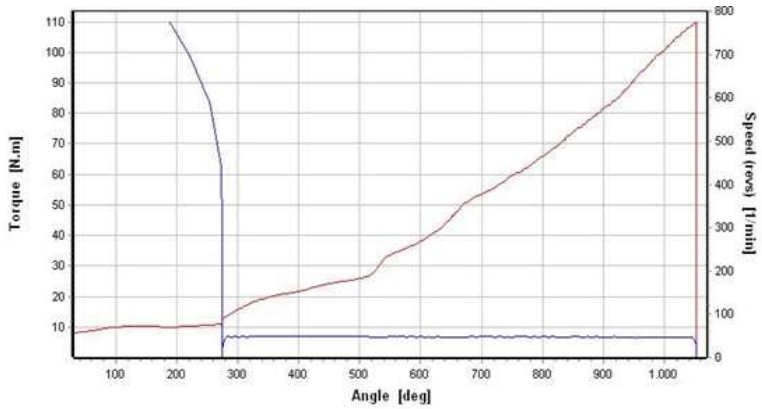
Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
204570	2K1D	110,10	110,10	110,10	110,30	110,20	110,10	110,10	110,40	110,10	110,10
204570	2K1D	367,00	365,00	365,00	360,00	357,00	356,00	375,00	362,00	360,00	369,00

Torque graphs

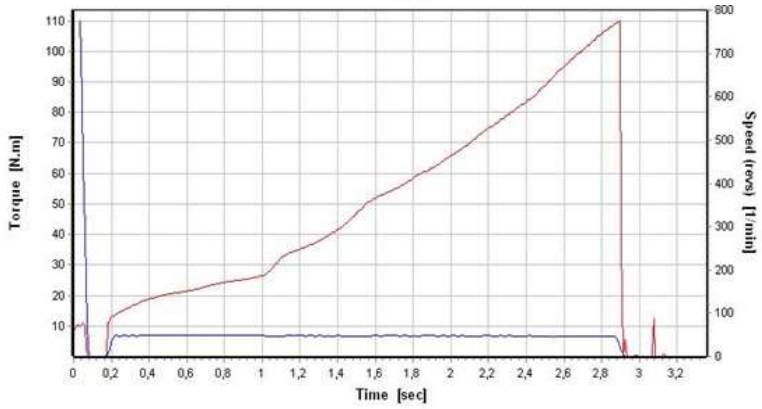
Machine Capability Study 100 %

Model: **2BD-2B110A-2K1D-2ZB**
Serial no: **1015970**

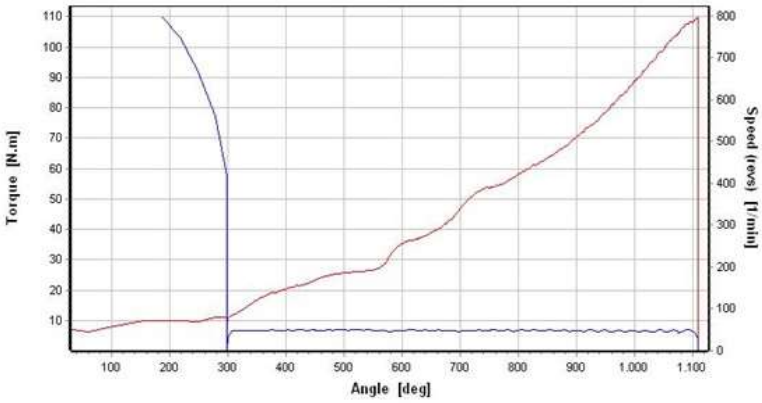
Angle degree: **360°**
Test torque: **110,0 Nm**



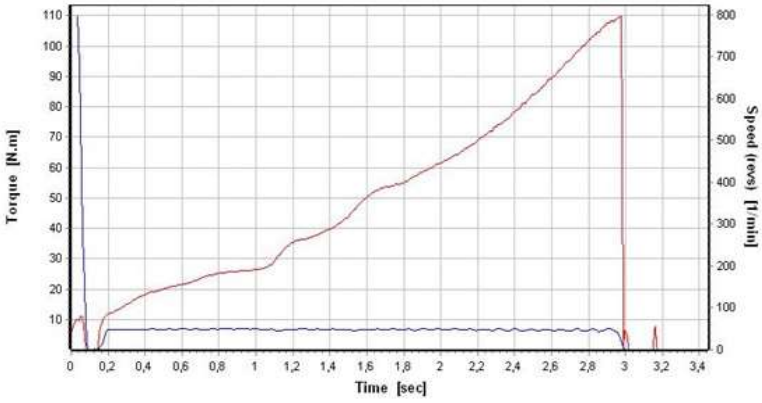
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

General Specifications

Manufacturer: Apex Tool Group **Tool type:** Fixtured Spindle

Model: 2BD-2B110A-2K1D-2ZB **Serial no:** 1015970

Torque range: **11 Nm to 110 Nm**

Difference evaluation: Reference/Tool at 40° / 60 %

Capability examination

Snugfit value: 22 Nm **Torque tolerance ±** 7 %

Target torque: 66 Nm Tolerance: 0,95 % ± **0,47 %**

Angle degree: 40° Tolerance: 3,0° ± **1,5°**

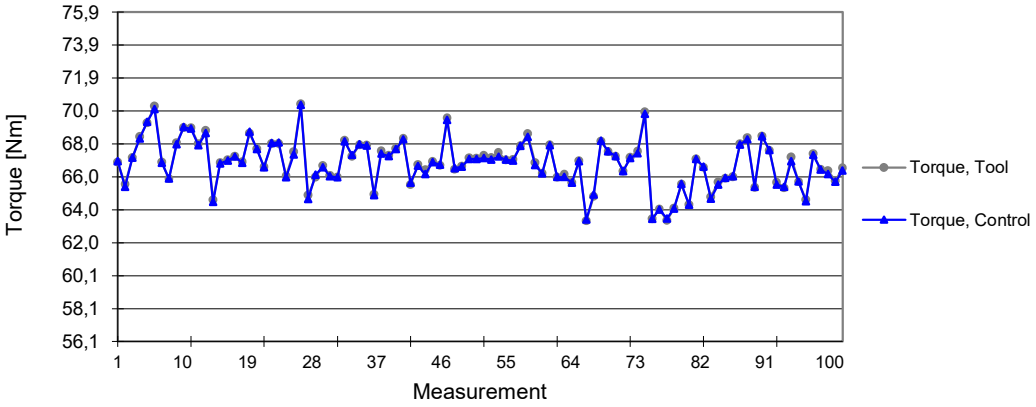
Formula derivation: $C_m = \frac{T}{6\,s}$ $T = C_m * 6\,s$

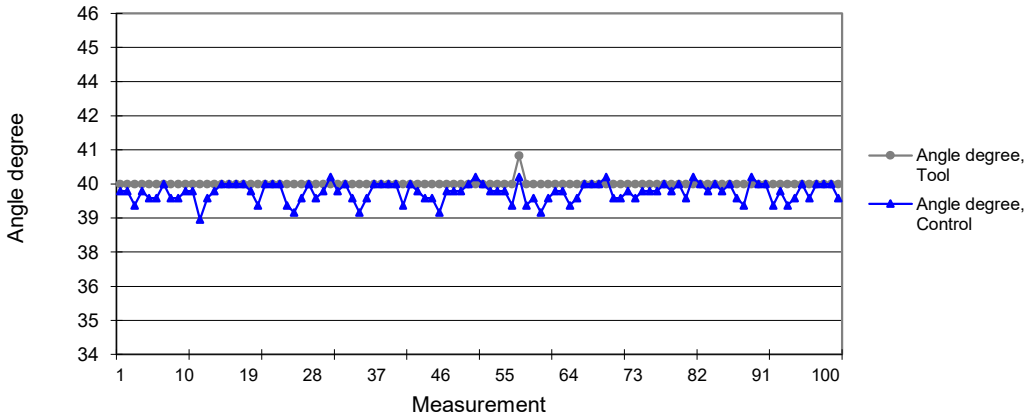
Tool without angle correction

Measurement	Tool data		Control data		Difference	
No.	Torque	Angle	Torque	Angle	Torque	Angle
1	66,88	40,00	66,94	39,75	0,06	0,25
2	65,55	40,00	65,39	39,75	0,16	0,25
3	67,14	40,00	67,14	39,25	0,00	0,75
4	68,41	40,00	68,30	39,75	0,11	0,25
5	69,24	40,00	69,31	39,50	0,07	0,50
6	70,24	40,00	70,07	39,50	0,17	0,50
7	66,87	40,00	66,84	40,00	0,03	0,00
8	65,88	40,00	65,88	39,50	0,00	0,50
9	68,04	40,00	67,95	39,50	0,09	0,50
10	68,95	40,00	68,99	39,75	0,04	0,25
11	68,93	40,00	68,89	39,75	0,04	0,25
12	67,98	40,00	67,90	38,75	0,08	1,25
13	68,78	40,00	68,62	39,50	0,16	0,50
14	64,60	40,00	64,48	39,75	0,12	0,25
15	66,84	40,00	66,79	40,00	0,05	0,00
16	67,02	40,00	66,97	40,00	0,05	0,00
17	67,23	40,00	67,21	40,00	0,02	0,00
18	66,89	40,00	66,84	40,00	0,05	0,00
19	68,61	40,00	68,69	39,75	0,08	0,25
20	67,67	40,00	67,66	39,25	0,01	0,75
21	66,58	40,00	66,57	40,00	0,01	0,00
22	68,00	40,00	68,03	40,00	0,03	0,00
23	68,00	40,00	68,05	40,00	0,05	0,00
24	66,04	40,00	65,96	39,25	0,08	0,75
25	67,49	40,00	67,34	39,00	0,15	1,00
26	70,38	40,00	70,32	39,50	0,06	0,50
27	64,89	40,00	64,65	40,00	0,24	0,00
28	65,97	40,00	66,13	39,50	0,16	0,50
29	66,67	40,00	66,57	39,75	0,10	0,25
30	66,08	40,00	66,03	40,25	0,05	0,25
31	65,98	40,00	65,96	39,75	0,02	0,25
32	68,19	40,00	68,12	40,00	0,07	0,00
33	67,23	40,00	67,31	39,50	0,08	0,50
34	67,92	40,00	67,95	39,00	0,03	1,00
35	67,89	40,00	67,88	39,50	0,01	0,50
36	64,95	40,00	64,90	40,00	0,05	0,00
37	67,55	40,00	67,39	40,00	0,16	0,00
38	67,29	40,00	67,24	40,00	0,05	0,00
39	67,69	40,00	67,66	40,00	0,03	0,00
40	68,29	40,00	68,25	39,25	0,04	0,75
41	65,52	40,00	65,64	40,00	0,12	0,00
42	66,73	40,00	66,65	39,75	0,08	0,25
43	66,41	40,00	66,15	39,50	0,26	0,50
44	66,91	40,00	66,87	39,50	0,04	0,50
45	66,69	40,00	66,72	39,00	0,03	1,00
46	69,52	40,00	69,41	39,75	0,11	0,25
47	66,45	40,00	66,50	39,75	0,05	0,25
48	66,64	40,00	66,60	39,75	0,04	0,25
49	67,13	40,00	67,07	40,00	0,06	0,00
50	67,10	40,00	67,07	40,25	0,03	0,25
51	67,28	40,00	67,11	40,00	0,17	0,00
52	67,15	40,00	67,04	39,75	0,11	0,25
53	67,45	40,00	67,21	39,75	0,24	0,25
54	67,00	40,00	67,02	39,75	0,02	0,25
55	67,03	40,00	66,97	39,25	0,06	0,75
56	67,85	41,00	67,85	40,25	0,00	0,75
57	68,59	40,00	68,40	39,25	0,19	0,75
58	66,85	40,00	66,70	39,50	0,15	0,50
59	66,21	40,00	66,20	39,00	0,01	1,00
60	67,92	40,00	67,90	39,50	0,02	0,50
61	65,97	40,00	65,98	39,75	0,01	0,25
62	66,14	40,00	65,98	39,75	0,16	0,25
63	65,65	40,00	65,64	39,25	0,01	0,75
64	66,96	40,00	66,94	39,50	0,02	0,50
65	63,35	40,00	63,42	40,00	0,07	0,00
66	64,82	40,00	64,92	40,00	0,10	0,00
67	68,13	40,00	68,17	40,00	0,04	0,00
68	67,51	40,00	67,53	40,25	0,02	0,25
69	67,23	40,00	67,24	39,50	0,01	0,50
70	66,33	40,00	66,33	39,50	0,00	0,50
71	67,16	40,00	67,11	39,75	0,05	0,25
72	67,53	40,00	67,41	39,50	0,12	0,50
73	69,90	40,00	69,78	39,75	0,12	0,25
74	63,47	40,00	63,47	39,75	0,00	0,25
75	64,05	40,00	64,03	39,75	0,02	0,25
76	63,38	40,00	63,49	40,00	0,11	0,00
77	64,11	40,00	64,08	39,75	0,03	0,25
78	65,55	40,00	65,56	40,00	0,01	0,00
79	64,32	40,00	64,31	39,50	0,01	0,50
80	67,07	40,00	67,07	40,25	0,00	0,25
81	66,55	40,00	66,60	40,00	0,05	0,00
82	64,79	40,00	64,68	39,75	0,11	0,25
83	65,67	40,00	65,54	40,00	0,13	0,00
84	65,90	40,00	65,93	39,75	0,03	0,25
85	65,99	40,00	66,03	40,00	0,04	0,00
86	67,98	40,00	67,93	39,50	0,05	0,50
87	68,35	40,00	68,25	39,25	0,10	0,75
88	65,36	40,00	65,39	40,25	0,03	0,25
89	68,44	40,00	68,44	40,00	0,00	0,00
90	67,58	40,00	67,61	40,00	0,03	0,00
91	65,66	40,00	65,51	39,25	0,15	0,75
92	65,33	40,00	65,39	39,75	0,06	0,25
93	67,18	40,00	66,94	39,25	0,24	0,75
94	65,70	40,00	65,71	39,50	0,01	0,50
95	64,62	40,00	64,53	40,00	0,09	0,00
96	67,38	40,00	67,31	39,50	0,07	0,50
97	66,45	40,00	66,42	40,00	0,03	0,00
98	66,36	40,00	66,15	40,00	0,21	0,00
99	65,76	40,00	65,69	40,00	0,07	0,00
100	66,53	40,00	66,38	39,50	0,15	0,50
				Standard deviation:	**0,062**	**0,298**

Graphical representation

Model:	**2BD-2B110A-2K1D-2ZB**	Serial no:	**1015970**
Target torque:	**66,00 Nm**	60 % of max. torque	
Angle degree:	**40°**	Tool without angle correction	





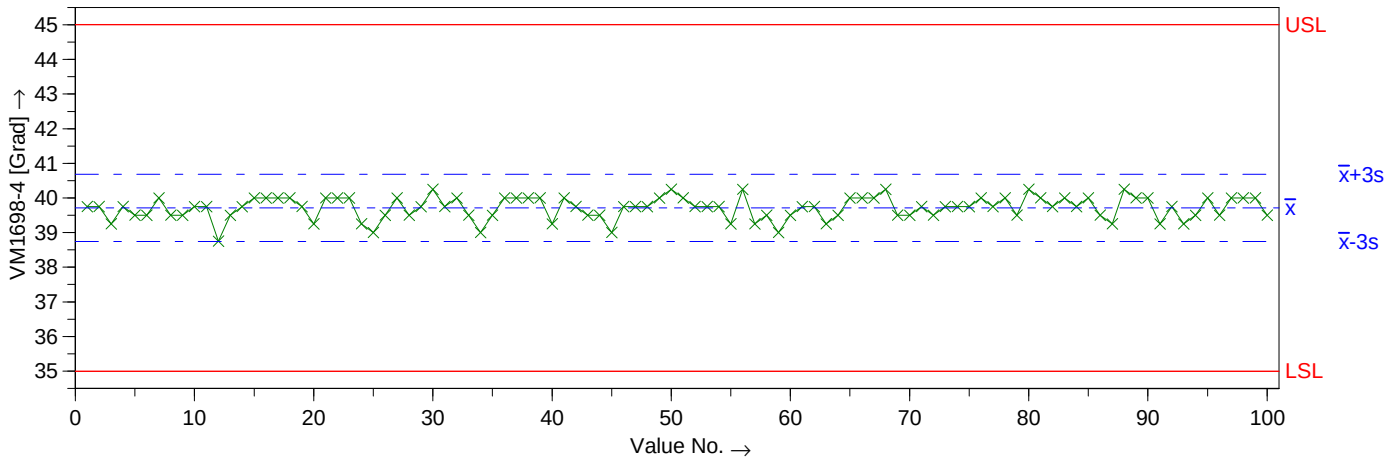
Machine Capability Study
Control System

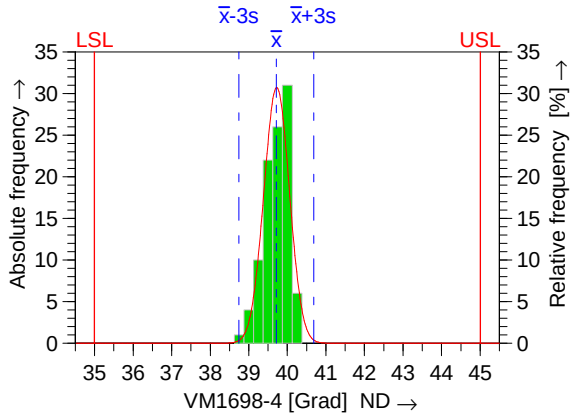
Plant	ATG Westhausen	Operator Name	Sünder
Date	07.03.2022		

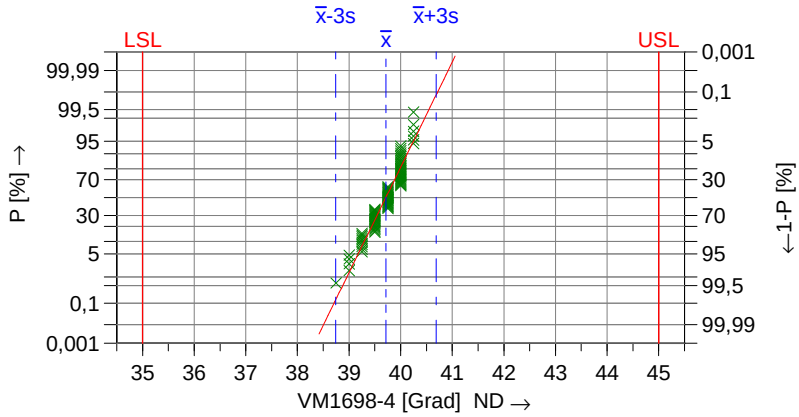
Ord. No.	2BD110T1S-A	Part type	2BD-2B110A-2K1D-2ZB	Contr.item	yes
Serial No.	1015970_k	Char.Descr.	VM1698-4	Inspection Val. 40,00 5,00	USL 45,00
		Serial No.	1024210	Unit Grad -5,00	LSL 35,00
Char.Type	variable			Tolerance value 12 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	120 / 1019923	nges.	100

Evaluation from 07.03.2022 13:03:32 to 07.03.2022 13:17:03

Rem. TQ 60% Angle 40° soft +/-5° * TQ-Cal.: 110 Nm; Cur-Cal.: 3.221 Nm/A; Speed 300/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	40.00			$\bar{x}$	39.7125
LSL	35.00	x_{min}	38.75	$\bar{x}$-3s	38.7391
USL	45.00	x_{max}	40.25	$\bar{x}$+3s	40.6859
T	10.00	R	1.50	6s	1.9467
		$n_{<T>}$	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	5.14
Critical capability index	=	C_{mk}	4.84

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_k	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	VM1698-4	Inspection Val.	66,00
Ord. No.	2BD110T1S-A	Ser.No.	1024210	LSL	61,38
				USL	70,62
Remark	TQ 60% Angle 40°soft +/-5°* TQ-Cal.: 110 Nm ; Cur-Cal.: 3.221 Nm/A; Speed 300/50 rpm;				

Char.No	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	66,94	65,39	67,14	68,30	69,31	70,07	66,84	65,88	67,95	68,99
1024210	VM1698-4	39,75	39,75	39,25	39,75	39,50	39,50	40,00	39,50	39,50	39,75

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	68,89	67,90	68,62	64,48	66,79	66,97	67,21	66,84	68,69	67,66
1024210	VM1698-4	39,75	38,75	39,50	39,75	40,00	40,00	40,00	40,00	39,75	39,25

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	66,57	68,03	68,05	65,96	67,34	70,32	64,65	66,13	66,57	66,03
1024210	VM1698-4	40,00	40,00	40,00	39,25	39,00	39,50	40,00	39,50	39,75	40,25

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	65,96	68,12	67,31	67,95	67,88	64,90	67,39	67,24	67,66	68,25
1024210	VM1698-4	39,75	40,00	39,50	39,00	39,50	40,00	40,00	40,00	40,00	39,25

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	65,64	66,65	66,15	66,87	66,72	69,41	66,50	66,60	67,07	67,07
1024210	VM1698-4	40,00	39,75	39,50	39,50	39,00	39,75	39,75	39,75	40,00	40,25

Char.No	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	67,11	67,04	67,21	67,02	66,97	67,85	68,40	66,70	66,20	67,90
1024210	VM1698-4	40,00	39,75	39,75	39,75	39,25	40,25	39,25	39,50	39,00	39,50

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	65,98	65,98	65,64	66,94	63,42	64,92	68,17	67,53	67,24	66,33
1024210	VM1698-4	39,75	39,75	39,25	39,50	40,00	40,00	40,00	40,25	39,50	39,50

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	67,11	67,41	69,78	63,47	64,03	63,49	64,08	65,56	64,31	67,07
1024210	VM1698-4	39,75	39,50	39,75	39,75	39,75	40,00	39,75	40,00	39,50	40,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_k	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	VM1698-4	Inspection Val.	66,00
Ord. No.	2BD110T1S-A	Ser.No.	1024210	LSL	61,38
				USL	70,62
Remark	TQ 60% Angle 40°soft +/-5°* TQ-Cal.: 110 Nm ; Cur-Cal.: 3.221 Nm/A; Speed 300/50 rpm;				

Char.No	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	66,60	64,68	65,54	65,93	66,03	67,93	68,25	65,39	68,44	67,61
1024210	VM1698-4	40,00	39,75	40,00	39,75	40,00	39,50	39,25	40,25	40,00	40,00

Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	65,51	65,39	66,94	65,71	64,53	67,31	66,42	66,15	65,69	66,38
1024210	VM1698-4	39,25	39,75	39,25	39,50	40,00	39,50	40,00	40,00	40,00	39,50

Machine Capability Study
Tool System

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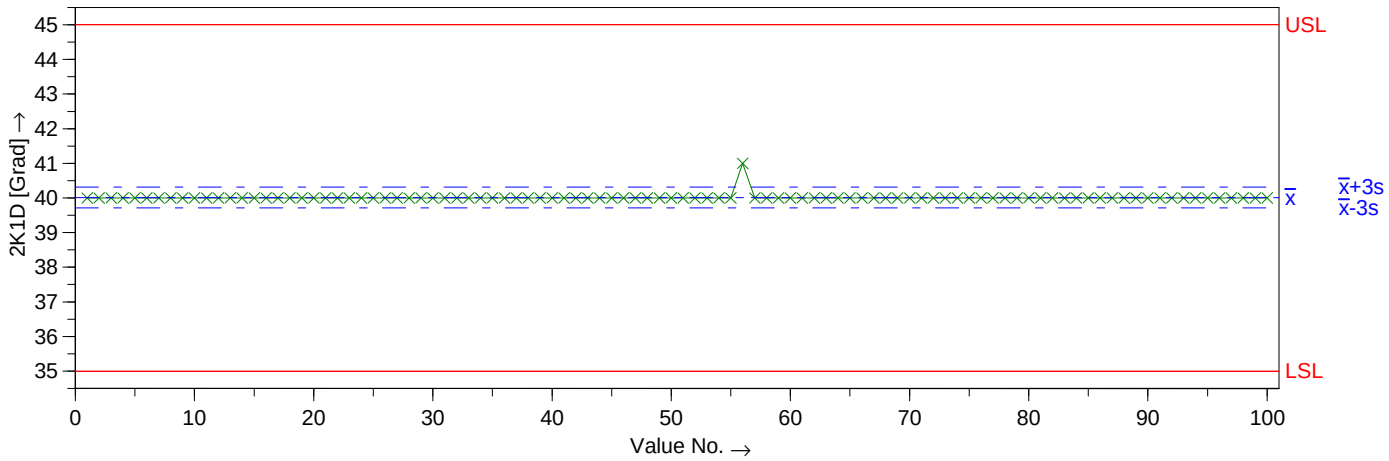
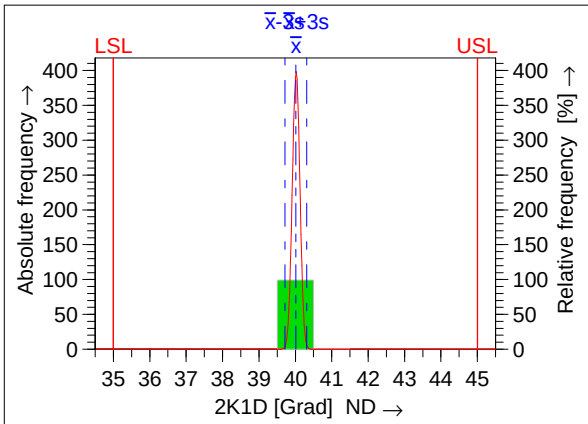
Plant	ATG Westhausen	Operator Name	Sünder
Date	07.03.2022		

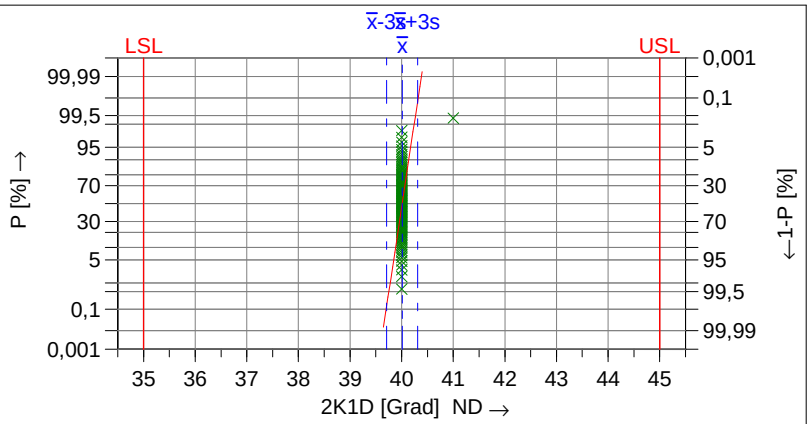
Ord. No.	2BD110T1S-A	Part type	2BD-2B110A-2K1D-2ZB	Contr.item	yes
Serial No.	1015970_k	Char.Descr.	2K1D	Inspection Val. 40,00 5,00	USL 45,00
		Serial No.	204570	Unit Grad -5,00	LSL 35,00
Char.Type	variable			Tolerance value 12 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	120 / 1019923	nges.	100

Evaluation from 07.03.2022 13:03:32 to 07.03.2022 13:17:03

Rem. TQ 60% Angle 40° +/-5° * TQ-Cal.: 110 Nm; Cur-Cal.: 3.221 Nm/A; Speed 300/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	40.00			$\bar{x}$	40.0100
LSL	35.00	x_{min}	40.00	$\bar{x}$-3s	39.7100
USL	45.00	x_{max}	41.00	$\bar{x}$+3s	40.3100
T	10.00	R	1.00	6s	0.6000
		$n_{<T>}$	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	16.67
Critical capability index	=	C_{mk}	16.63

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\AppData\QW\QWE\MessWert\2022\1015970_k1.DFD

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

Ser.No.	1015970_k	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	2K1D	Inspection Val.	66,00
Ord. No.	2BD110T1S-A	Ser.No.	204570	LSL	61,38
				USL	70,62
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 110 Nm; Cur -Cal.: 3.221 Nm/A; Speed 300/50 rpm;				

Char.No	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
204570	2K1D	66,88	65,55	67,14	68,41	69,24	70,24	66,87	65,88	68,04	68,95
204570	2K1D	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
204570	2K1D	68,93	67,98	68,78	64,60	66,84	67,02	67,23	66,89	68,61	67,67
204570	2K1D	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
204570	2K1D	66,58	68,00	68,00	66,04	67,49	70,38	64,89	65,97	66,67	66,08
204570	2K1D	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
204570	2K1D	65,98	68,19	67,23	67,92	67,89	64,95	67,55	67,29	67,69	68,29
204570	2K1D	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
204570	2K1D	65,52	66,73	66,41	66,91	66,69	69,52	66,45	66,64	67,13	67,10
204570	2K1D	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00

Char.No	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
204570	2K1D	67,28	67,15	67,45	67,00	67,03	67,85	68,59	66,85	66,21	67,92
204570	2K1D	40,00	40,00	40,00	40,00	40,00	41,00	40,00	40,00	40,00	40,00

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
204570	2K1D	65,97	66,14	65,65	66,96	63,35	64,82	68,13	67,51	67,23	66,33
204570	2K1D	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
204570	2K1D	67,16	67,53	69,90	63,47	64,05	63,38	64,11	65,55	64,32	67,07
204570	2K1D	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.03.2022

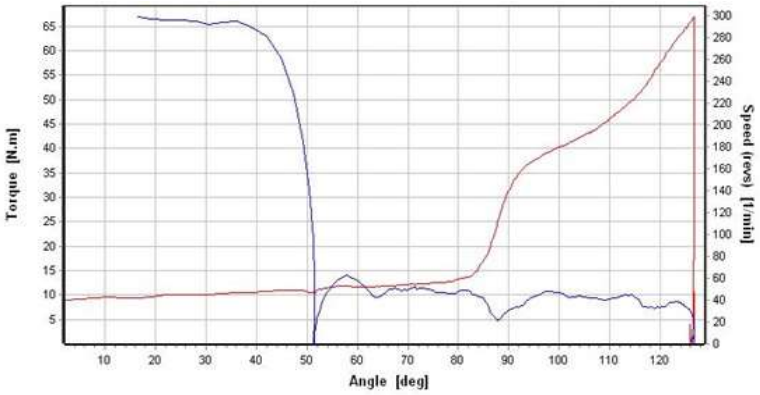
Ser.No.	1015970_k	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	2K1D	Inspection Val.	66,00
Ord. No.	2BD110T1S-A	Ser.No.	204570	LSL	61,38
				USL	70,62
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 110 Nm; Cur -Cal.: 3.221 Nm/A; Speed 300/50 rpm;				

Char.No	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
204570	2K1D	66,55	64,79	65,67	65,90	65,99	67,98	68,35	65,36	68,44	67,58
204570	2K1D	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00

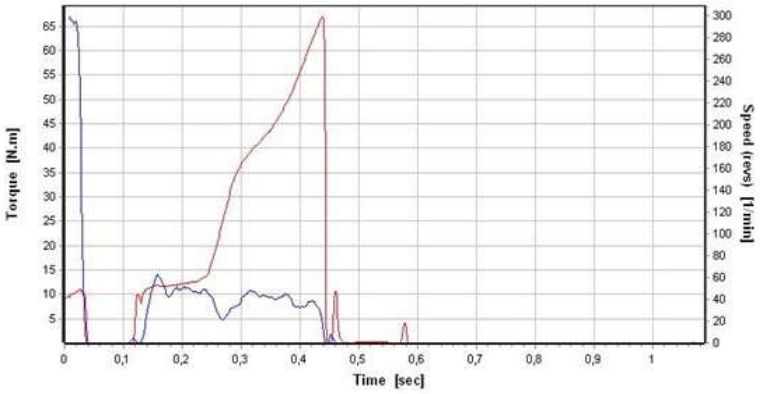
Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
204570	2K1D	65,66	65,33	67,18	65,70	64,62	67,38	66,45	66,36	65,76	66,53
204570	2K1D	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00

Torque graphs

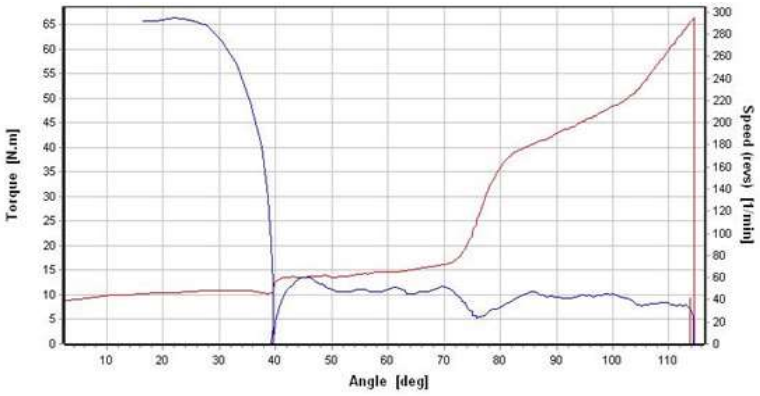
Model:	**2BD-2B110A-2K1D-2ZB**	Serial no:	**1015970**
Target torque:	**66,00 Nm**	60 % of max. torque	
Angle degree:	**40°**	Tool without angle correction	



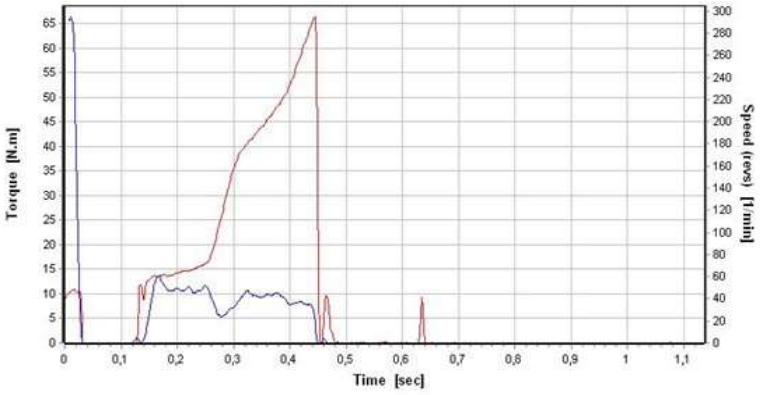
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

General Specifications

Manufacturer: Apex Tool Group **Tool type:** Fixtured Spindle

Model: 2BD-2B110A-2K1D-2ZB **Serial no:** 1015970

Torque range: **11 Nm to 110 Nm**

Difference evaluation: Reference/Tool at 180 ° / 80%

Capability examination

Snugfit value: 22 Nm **Torque tolerance ±** 7 %

Target torque: 88 Nm Tolerance: 1,06 % ± **0,53 %**

Angle degree: 180° Tolerance: 5,7° ± **2,8°**

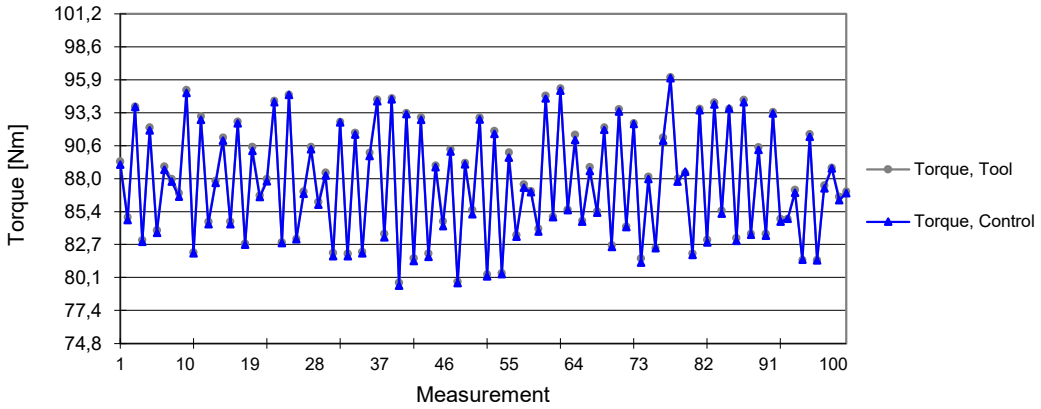
Formula derivation: $C_m = \frac{T}{6\,s}$ $T = C_m * 6\,s$

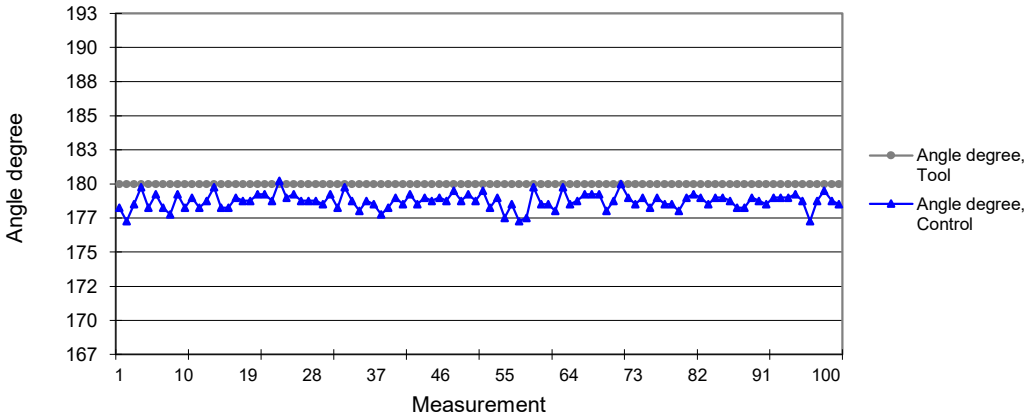
Tool without angle correction

Measurement	Tool data		Control data		Difference	
No.	Torque	Angle	Torque	Angle	Torque	Angle
1	89,37	180,00	89,12	178,25	0,25	1,75
2	84,90	180,00	84,68	177,25	0,22	2,75
3	93,76	180,00	93,73	178,50	0,03	1,50
4	83,06	180,00	82,93	179,75	0,13	0,25
5	92,10	180,00	91,85	178,25	0,25	1,75
6	83,86	180,00	83,67	179,25	0,19	0,75
7	88,96	180,00	88,70	178,25	0,26	1,75
8	87,97	180,00	87,76	177,75	0,21	2,25
9	86,83	180,00	86,56	179,25	0,27	0,75
10	95,10	180,00	94,86	178,25	0,24	1,75
11	82,08	180,00	82,02	179,00	0,06	1,00
12	92,98	180,00	92,72	178,25	0,26	1,75
13	84,54	180,00	84,34	178,75	0,20	1,25
14	87,82	180,00	87,66	179,75	0,16	0,25
15	91,28	180,00	91,06	178,25	0,22	1,75
16	84,56	180,00	84,34	178,25	0,22	1,75
17	92,57	180,00	92,44	179,00	0,13	1,00
18	82,79	180,00	82,71	178,75	0,08	1,25
19	90,53	180,00	90,23	178,75	0,30	1,25
20	86,64	180,00	86,51	179,25	0,13	0,75
21	87,96	180,00	87,79	179,25	0,17	0,75
22	94,22	180,00	94,12	178,75	0,10	1,25
23	82,89	180,00	82,83	180,25	0,06	0,25
24	94,71	180,00	94,71	179,00	0,00	1,00
25	83,18	180,00	83,13	179,25	0,05	0,75
26	86,97	180,00	86,80	178,75	0,17	1,25
27	90,54	180,00	90,35	178,75	0,19	1,25
28	86,13	180,00	85,89	178,75	0,24	1,25
29	88,47	180,00	88,23	178,50	0,24	1,50
30	82,04	180,00	81,80	179,25	0,24	0,75
31	92,54	180,00	92,49	178,25	0,05	1,75
32	81,99	180,00	81,78	179,75	0,21	0,25
33	91,66	180,00	91,53	178,75	0,13	1,25
34	82,14	180,00	82,00	178,00	0,14	2,00
35	90,06	180,00	89,81	178,75	0,25	1,25
36	94,33	180,00	94,19	178,50	0,14	1,50
37	83,57	180,00	83,30	177,75	0,27	2,25
38	94,44	180,00	94,34	178,25	0,10	1,75
39	79,66	180,00	79,43	179,00	0,23	1,00
40	93,25	180,00	93,16	178,50	0,09	1,50
41	81,61	180,00	81,38	179,25	0,23	0,75
42	92,90	180,00	92,72	178,50	0,18	1,50
43	82,01	180,00	81,73	179,00	0,28	1,00
44	89,04	180,00	88,92	178,75	0,12	1,25
45	84,58	180,00	84,19	179,00	0,39	1,00
46	90,35	180,00	90,18	178,75	0,17	1,25
47	79,74	180,00	79,63	179,50	0,11	0,50
48	89,26	180,00	89,14	178,75	0,12	1,25
49	85,49	180,00	85,15	179,25	0,34	0,75
50	92,87	180,00	92,74	178,75	0,13	1,25
51	80,33	180,00	80,17	179,50	0,16	0,50
52	91,81	180,00	91,58	178,25	0,23	1,75
53	80,42	180,00	80,35	179,00	0,07	1,00
54	90,10	180,00	89,68	177,50	0,42	2,50
55	83,48	180,00	83,35	178,50	0,13	1,50
56	87,54	180,00	87,27	177,25	0,27	2,75
57	86,98	180,00	86,92	177,50	0,06	2,50
58	83,98	180,00	83,75	179,75	0,23	0,25
59	94,64	180,00	94,42	178,50	0,22	1,50
60	84,93	180,00	84,90	178,50	0,03	1,50
61	95,22	180,00	95,06	178,00	0,16	2,00
62	85,51	180,00	85,47	179,75	0,04	0,25
63	91,51	180,00	91,09	178,50	0,42	1,50
64	84,62	180,00	84,56	178,75	0,06	1,25
65	88,92	180,00	88,60	179,25	0,32	0,75
66	85,36	180,00	85,27	179,25	0,09	0,75
67	92,10	180,00	91,90	179,25	0,20	0,75
68	82,67	180,00	82,51	178,00	0,16	2,00
69	93,57	180,00	93,36	178,75	0,21	1,25
70	84,15	180,00	84,12	180,00	0,03	0,00
71	92,44	180,00	92,37	179,00	0,07	1,00
72	81,59	180,00	81,28	178,50	0,31	1,50
73	88,15	180,00	87,96	179,00	0,19	1,00
74	82,43	180,00	82,42	178,25	0,01	1,75
75	91,28	180,00	91,06	179,00	0,22	1,00
76	96,11	180,00	96,04	178,50	0,07	1,50
77	87,99	180,00	87,74	178,50	0,25	1,50
78	88,45	180,00	88,55	178,00	0,10	2,00
79	82,00	180,00	81,87	179,00	0,13	1,00
80	93,58	180,00	93,48	179,25	0,10	0,75
81	83,09	180,00	82,88	179,00	0,21	1,00
82	94,09	180,00	93,95	178,50	0,14	1,50
83	85,42	180,00	85,20	179,00	0,22	1,00
84	93,58	180,00	93,60	179,00	0,02	1,00
85	83,23	180,00	83,01	178,75	0,22	1,25
86	94,30	180,00	94,12	178,25	0,18	1,75
87	83,57	180,00	83,50	178,25	0,07	1,75
88	90,51	180,00	90,30	179,00	0,21	1,00
89	83,57	180,00	83,43	178,75	0,14	1,25
90	93,33	180,00	93,23	178,50	0,10	1,50
91	84,77	180,00	84,56	179,00	0,21	1,00
92	84,76	180,00	84,76	179,00	0,00	1,00
93	87,10	180,00	86,85	179,00	0,25	1,00
94	81,47	180,00	81,50	179,25	0,03	0,75
95	91,57	180,00	91,34	178,75	0,23	1,25
96	81,47	180,00	81,45	177,25	0,02	2,75
97	87,45	180,00	87,22	178,75	0,23	1,25
98	88,85	180,00	88,82	179,50	0,03	0,50
99	86,54	180,00	86,28	178,75	0,26	1,25
100	86,96	180,00	86,83	178,50	0,13	1,50
				Standard deviation:	**0,093**	**0,568**

Graphical representation

Model:	**2BD-2B110A-2K1D-2ZB**	Serial no:	**1015970**
Target torque:	**88,00 Nm**	80 % of max. torque	
Angle degree:	**180°**	Tool without angle correction	





Machine Capability Study
Control System

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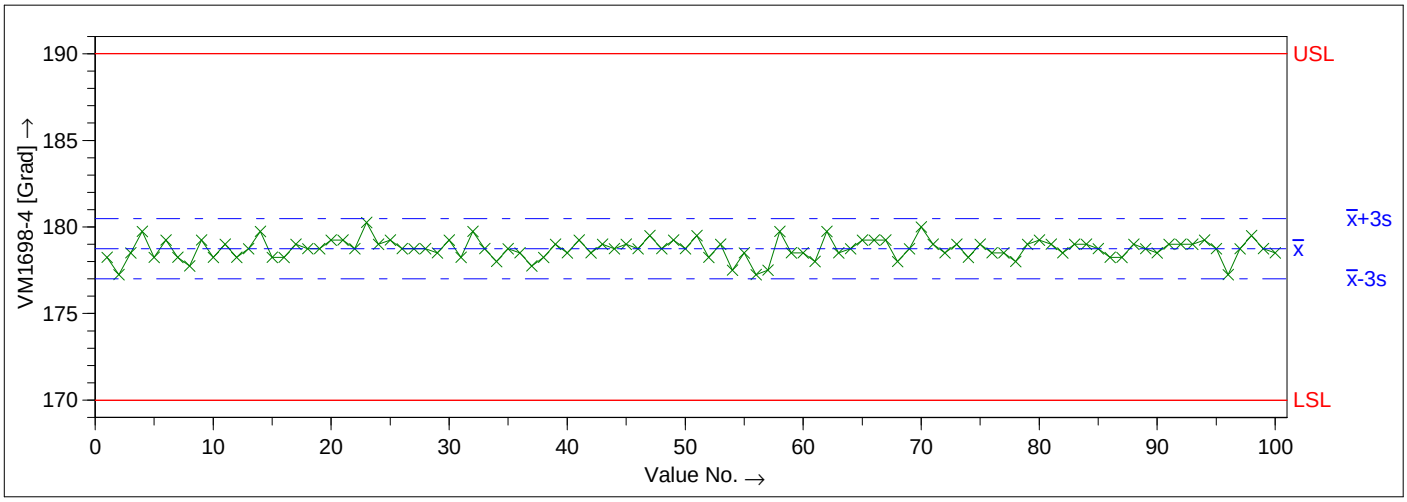
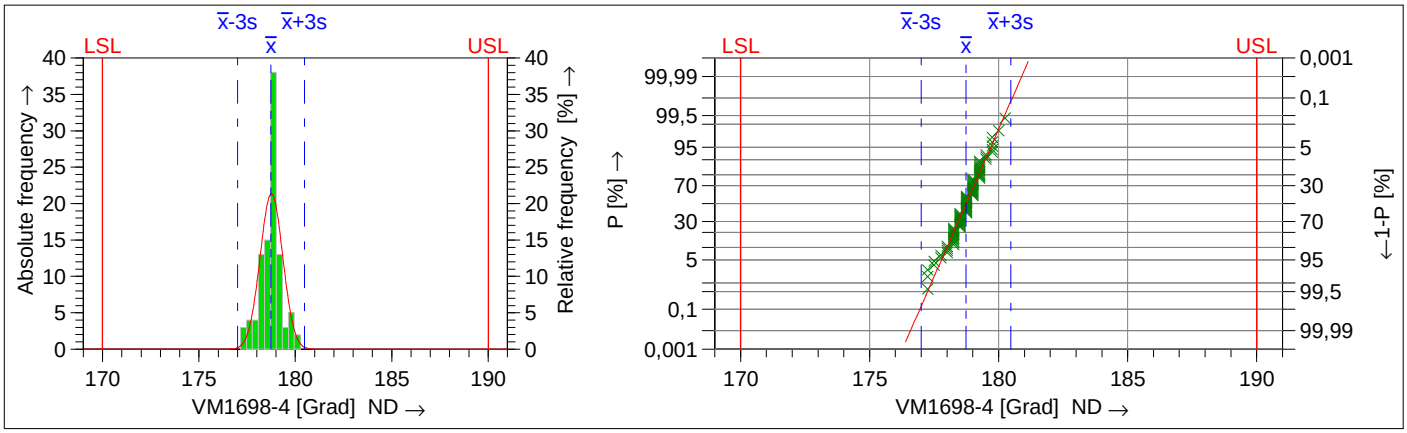
Plant	ATG Westhausen	Operator Name	Sünder
Date	09.03.2022		

Ord. No.	2BD110T1S-A	Part type	2BD-2B110A-2K1D-2ZB	Contr.item	yes
Serial No.	1015970_l	Char.Descr.	VM1698-4	Inspection Val. 180,00 10,00	USL 190,00
		Serial No.	1024210	Unit Grad -10,00	LSL 170,00
Char.Type	variable			Tolerance value 6 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	120 / 1019923	nges.	100

Evaluation from 09.03.2022 09:32:25 to 09.03.2022 09:46:42

Rem. TQ 80% Angle 180° +/-10° * TQ-Cal.: 110 Nm; Cur-Cal.: 3.250 Nm/A; Speed 300/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	180.00			$\bar{x}$	178.7375
LSL	170.00	x_{min}	177.25	$\bar{x}$-3s	177.0009
USL	190.00	x_{max}	180.25	$\bar{x}$+3s	180.4741
T	20.00	R	3.00	6s	3.4731
		$n_{<T>}$	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	5.76
Critical capability index	=	C_{mk}	5.03

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\AppData\QW\QWE\MessWert\2022\1015970_lM.DFD

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 09.03.2022

Ser.No.	1015970_I	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	VM1698-4	Inspection Val.	88,00
Ord. No.	2BD110T1S-A	Ser.No.	1024210	LSL	81,84
				USL	94,16
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 110 Nm; C ur-Cal.: 3.250 Nm/A; Speed 300/50 rpm;				

Char.No	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	89,12	84,68	93,73	82,93	91,85	83,67	88,70	87,76	86,56	94,86
1024210	VM1698-4	178,25	177,25	178,50	179,75	178,25	179,25	178,25	177,75	179,25	178,25

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	82,02	92,72	84,34	87,66	91,06	84,34	92,44	82,71	90,23	86,51
1024210	VM1698-4	179,00	178,25	178,75	179,75	178,25	178,25	179,00	178,75	178,75	179,25

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	87,79	94,12	82,83	94,71	83,13	86,80	90,35	85,89	88,23	81,80
1024210	VM1698-4	179,25	178,75	180,25	179,00	179,25	178,75	178,75	178,75	178,50	179,25

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	92,49	81,78	91,53	82,00	89,81	94,19	83,30	94,34	79,43	93,16
1024210	VM1698-4	178,25	179,75	178,75	178,00	178,75	178,50	177,75	178,25	179,00	178,50

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	81,38	92,72	81,73	88,92	84,19	90,18	79,63	89,14	85,15	92,74
1024210	VM1698-4	179,25	178,50	179,00	178,75	179,00	178,75	179,50	178,75	179,25	178,75

Char.No	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	80,17	91,58	80,35	89,68	83,35	87,27	86,92	83,75	94,42	84,90
1024210	VM1698-4	179,50	178,25	179,00	177,50	178,50	177,25	177,50	179,75	178,50	178,50

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	95,06	85,47	91,09	84,56	88,60	85,27	91,90	82,51	93,36	84,12
1024210	VM1698-4	178,00	179,75	178,50	178,75	179,25	179,25	179,25	178,00	178,75	180,00

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	92,37	81,28	87,96	82,42	91,06	96,04	87,74	88,55	81,87	93,48
1024210	VM1698-4	179,00	178,50	179,00	178,25	179,00	178,50	178,50	178,00	179,00	179,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 09.03.2022

Ser.No.	1015970_l	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	VM1698-4	Inspection Val.	88,00
Ord. No.	2BD110T1S-A	Ser.No.	1024210	LSL	81,84
				USL	94,16
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 110 Nm; C ur-Cal.: 3.250 Nm/A; Speed 300/50 rpm;				

Char.No	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	82,88	93,95	85,20	93,60	83,01	94,12	83,50	90,30	83,43	93,23
1024210	VM1698-4	179,00	178,50	179,00	179,00	178,75	178,25	178,25	179,00	178,75	178,50

Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	84,56	84,76	86,85	81,50	91,34	81,45	87,22	88,82	86,28	86,83
1024210	VM1698-4	179,00	179,00	179,00	179,25	178,75	177,25	178,75	179,50	178,75	178,50

Machine Capability Study
Tool System

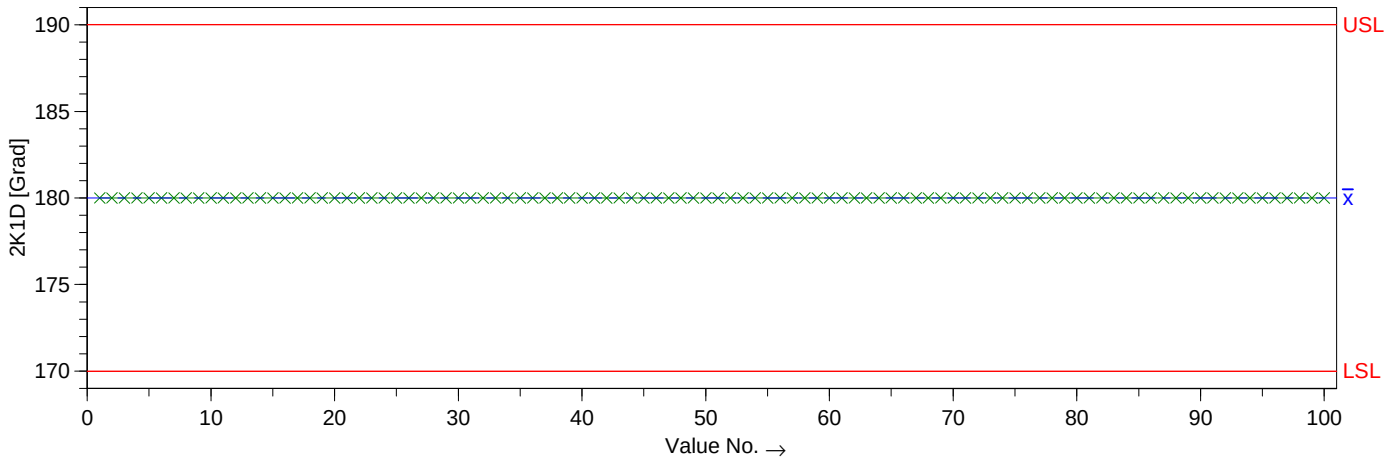
Plant	ATG Westhausen	Operator Name	Sünder
Date	09.03.2022		

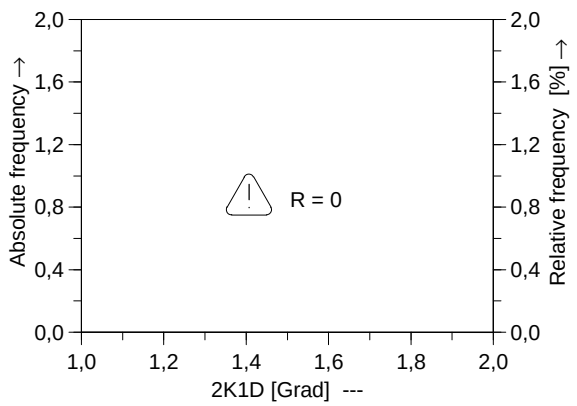
Ord. No.	2BD110T1S-A	Part type	2BD-2B110A-2K1D-2ZB	Contr.item	yes
Serial No.	1015970_l	Char.Descr.	2K1D	Inspection Val. 180,00 10,00	USL 190,00
		Serial No.	204570	Unit Grad -10,00	LSL 170,00
Char.Type	variable			Tolerance value 6 %	Decimal Pl. 2

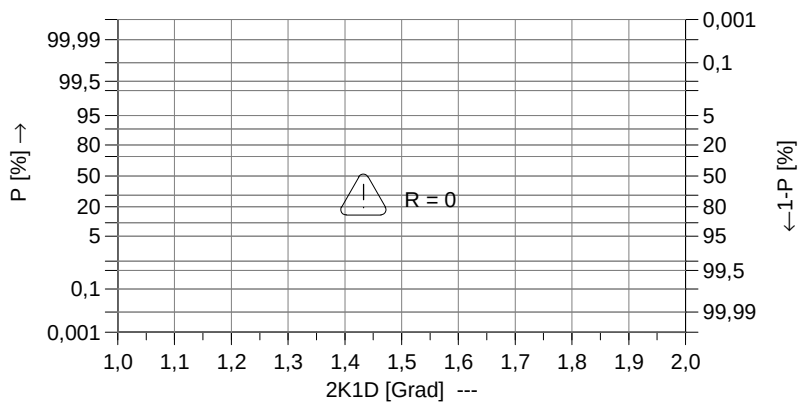
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	120 / 1019923	nges.	100

Evaluation from 09.03.2022 09:32:25 to 09.03.2022 09:46:42

Rem. TQ 80% Angle 180° +/-10° * TQ-Cal.: 110 Nm; Cur-Cal.: 3.250 Nm/A; Speed 300/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	180.00			$\bar{x}$	180.0000
LSL	170.00	x_{min}	180.00		
USL	190.00	x_{max}	180.00		
T	20.00	R	0.00		
		$n_{<T>}$	100		
		$n_{>USL}$	0		
		$n_{<LSL}$	0		
		n_{eff}	100		
		n_{tot}	100		

--- R = 0 ---

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 09.03.2022

Ser.No.	1015970_l	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	2K1D	Inspection Val.	88,00
Ord. No.	2BD110T1S-A	Ser.No.	204570	LSL	81,84
				USL	94,16
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 110 Nm; C ur-Cal.: 3.250 Nm/A; Speed 300/50 rpm;				

Char.No	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
204570	2K1D	89,37	84,90	93,76	83,06	92,10	83,86	88,96	87,97	86,83	95,10
204570	2K1D	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
204570	2K1D	82,08	92,98	84,54	87,82	91,28	84,56	92,57	82,79	90,53	86,64
204570	2K1D	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
204570	2K1D	87,96	94,22	82,89	94,71	83,18	86,97	90,54	86,13	88,47	82,04
204570	2K1D	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
204570	2K1D	92,54	81,99	91,66	82,14	90,06	94,33	83,57	94,44	79,66	93,25
204570	2K1D	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
204570	2K1D	81,61	92,90	82,01	89,04	84,58	90,35	79,74	89,26	85,49	92,87
204570	2K1D	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00

Char.No	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
204570	2K1D	80,33	91,81	80,42	90,10	83,48	87,54	86,98	83,98	94,64	84,93
204570	2K1D	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
204570	2K1D	95,22	85,51	91,51	84,62	88,92	85,36	92,10	82,67	93,57	84,15
204570	2K1D	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
204570	2K1D	92,44	81,59	88,15	82,43	91,28	96,11	87,99	88,45	82,00	93,58
204570	2K1D	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 09.03.2022

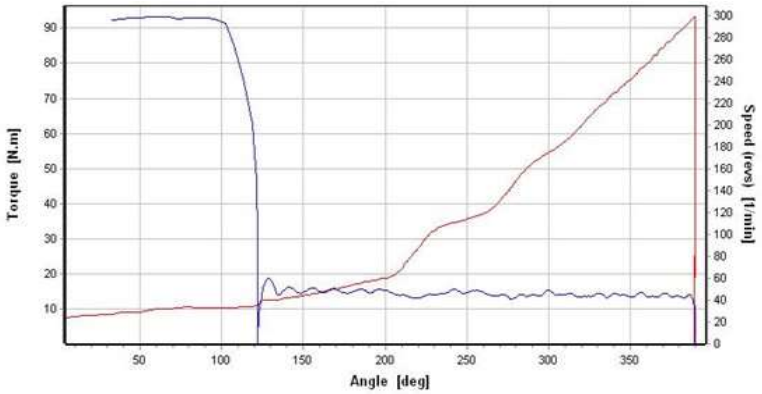
Ser.No.	1015970_l	Characteristic			
Type	2BD-2B110A-2K1D-2ZB	Char.Descr.	2K1D	Inspection Val.	88,00
Ord. No.	2BD110T1S-A	Ser.No.	204570	LSL	81,84
				USL	94,16
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 110 Nm; C ur-Cal.: 3.250 Nm/A; Speed 300/50 rpm;				

Char.No	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
204570	2K1D	83,09	94,09	85,42	93,58	83,23	94,30	83,57	90,51	83,57	93,33
204570	2K1D	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00

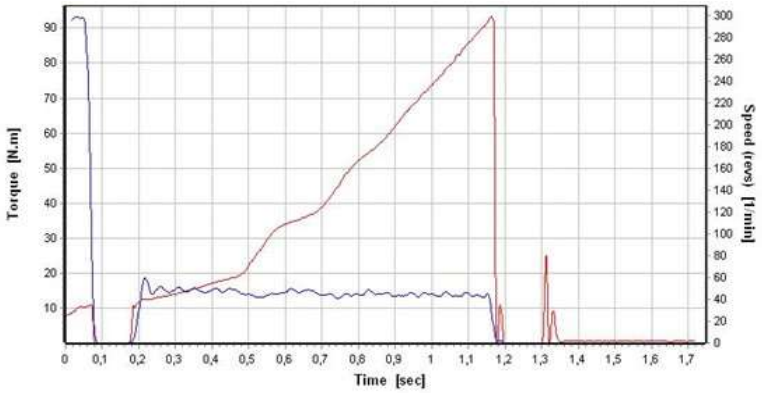
Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
204570	2K1D	84,77	84,76	87,10	81,47	91,57	81,47	87,45	88,85	86,54	86,96
204570	2K1D	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00	180,00

Torque graphs

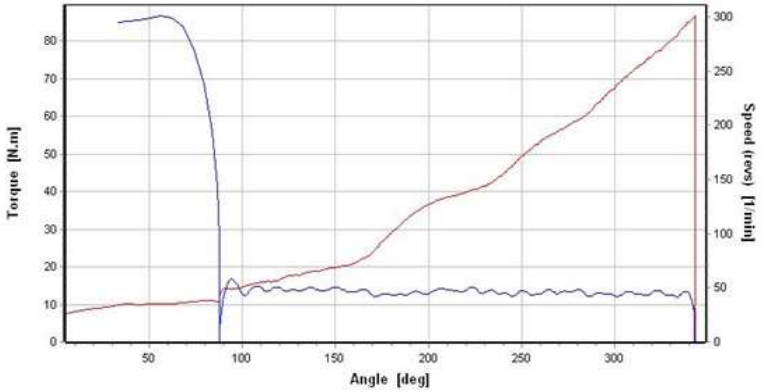
Model:	**2BD-2B110A-2K1D-2ZB**	Serial no:	**1015970**
Target torque:	**88,00 Nm**	80 % of max. torque	
Angle degree:	**180°**	Tool without angle correction	



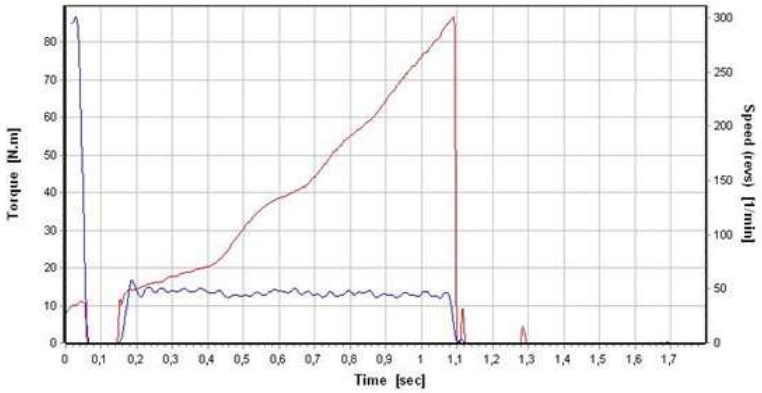
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed