Homologation

Fixtured Spindle

Model: 2BD-2B200A-2K3D-2ZB

Serial no.: 756055

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Homologation: 2BD-2B200A-2K3D-2ZB SN: 756055

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Test sheet no. 2

Machine Capability Study 30 %

Multi-stage tightening system	☑	Speed 50 rpm	9,96 %
Single-stage tightening system	☐	Speed 100 %	502 rpm

Manufacturer: Apex Tool Group Serial no: **756055**

Test torque: Tq min. + 0.3 (Tq max. - Tq min.) 74,00 Nm

Hard joint (H)	447,20	Nm / Revolution	Angle degree	30°
Soft joint (L)	36,73	Nm / Revolution	Angle degree	360°

		H	L
a)	Tolerance down / up	68,82 79,18 Nm	68,82 - 79,18 Nm
	Tolerance down / up	7	7 %
	Average torque	74,53	73,46 Nm
	Standard deviation	0,13	0,12 Nm
	Torque scatter (99,73%)	0,76	0,73 Nm
	C_m	13,72	14,11
	C_{mk}	12,30	12,63

b)	Min. C_m hard/soft (lowest value)	13,72
	Min. C_{mk} hard/soft (lowest value)	12,30

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

Note:

Machine Capability Study
Control System

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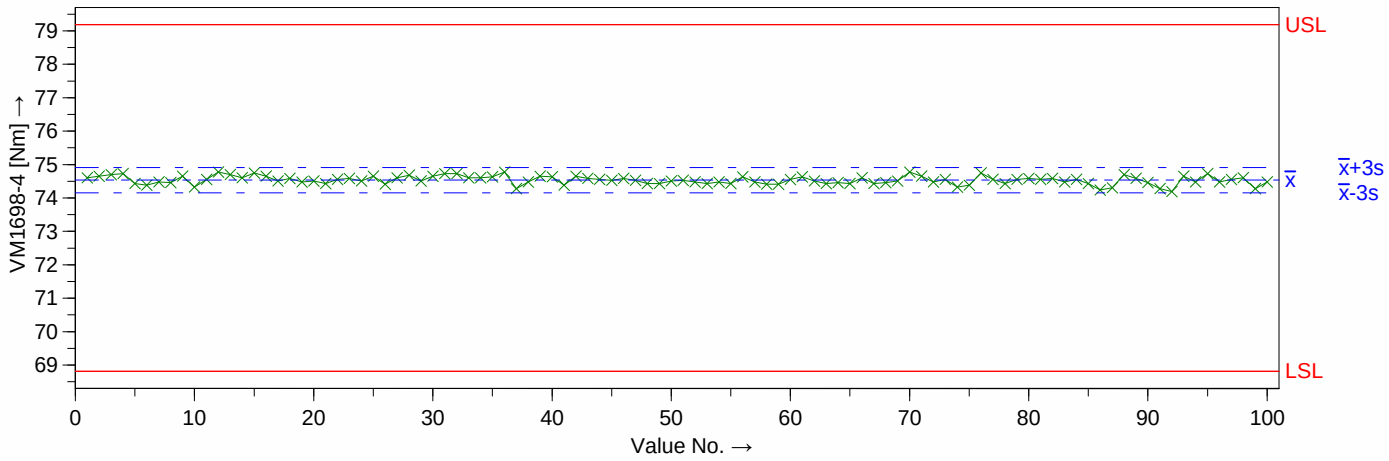
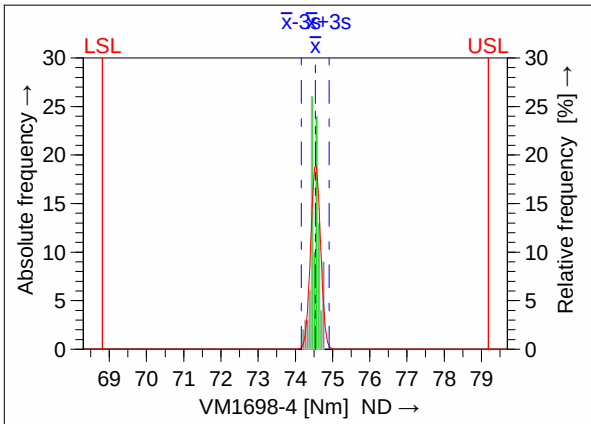
Plant	ATG Westhausen	Operator Name	Sünder
Date	26.04.2022		

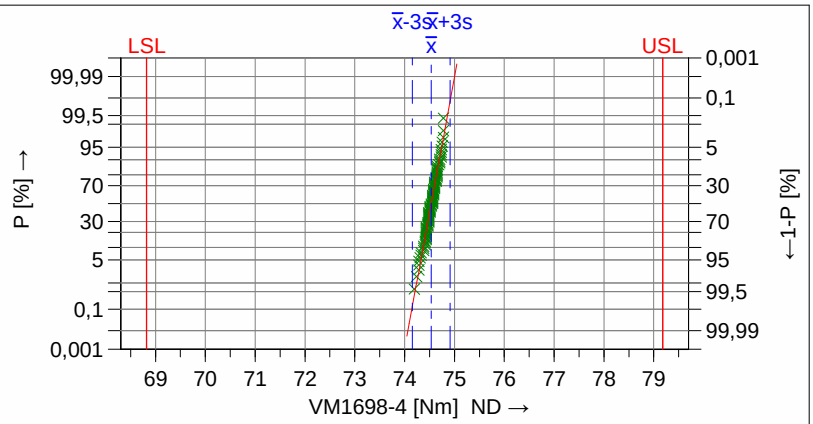
Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756055_d	Char.Descr.	VM1698-4	Nom.val. 74,00 5,18	USL 79,18
		Serial No.	1024210	Unit Nm -5,18	LSL 68,82
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	120 / 1019923	nges.	100

Evaluation from 26.04.2022 13:48:38 to 26.04.2022 14:01:39

Rem. TQ 30% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.879 Nm/A; Speed 502/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	74.00			$\bar{x}$	74.5339
LSL	68.82	x_{min}	74.19	$\bar{x}$-3s	74.1563
USL	79.18	x_{max}	74.78	$\bar{x}$+3s	74.9115
T	10.36	R	0.59	6s	0.7552
		$n_{<T>}$	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	13.72
Critical capability index	=	C_{mk}	12.30

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 26.04.2022

Serial No.	756055_d	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	74,00
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	68,82
				USL	79,18
Remark	TQ 30% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.879 Nm/A; Speed 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	Nm	74,60	74,65	74,70	74,73	74,43	74,38	74,48	74,46	74,65	74,33
1024210	VM1698-4	Grad	29,75	30,00	29,50	30,50	29,75	29,25	30,25	29,50	30,25	29,75

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	Nm	74,56	74,78	74,70	74,60	74,75	74,65	74,51	74,58	74,48	74,51
1024210	VM1698-4	Grad	29,50	29,75	29,50	29,25	29,75	29,75	29,25	29,00	29,50	29,50

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	Nm	74,43	74,56	74,58	74,51	74,65	74,41	74,60	74,68	74,51	74,65
1024210	VM1698-4	Grad	30,00	30,25	29,75	30,00	30,00	29,75	30,25	29,25	30,00	29,75

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	Nm	74,73	74,73	74,60	74,60	74,63	74,78	74,28	74,48	74,65	74,63
1024210	VM1698-4	Grad	30,25	29,75	30,00	28,75	29,00	30,25	29,75	29,75	30,00	29,50

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	Nm	74,38	74,65	74,58	74,56	74,53	74,58	74,53	74,43	74,43	74,51
1024210	VM1698-4	Grad	29,50	29,25	30,00	29,75	30,00	29,50	29,75	29,75	28,75	29,75

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	74,53	74,48	74,43	74,48	74,43	74,63	74,48	74,41	74,41	74,56
1024210	VM1698-4	Grad	29,75	29,50	29,75	29,75	29,25	28,75	30,00	29,75	29,75	30,00

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	Nm	74,63	74,51	74,43	74,46	74,43	74,60	74,43	74,46	74,51	74,78
1024210	VM1698-4	Grad	30,50	30,25	30,25	30,00	30,25	30,00	30,00	29,75	29,25	30,25

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	Nm	74,65	74,48	74,56	74,33	74,38	74,75	74,56	74,43	74,56	74,58
1024210	VM1698-4	Grad	30,25	30,50	30,25	30,25	29,50	30,00	30,75	30,00	30,25	29,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 26.04.2022

Serial No.	756055_d	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	74,00
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	68,82
				USL	79,18
Remark	TQ 30% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.879 Nm/A; Speed 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	Nm	74,56	74,58	74,48	74,56	74,43	74,24	74,31	74,70	74,58	74,46
1024210	VM1698-4	Grad	30,25	29,25	30,00	30,00	29,75	29,50	29,75	29,50	28,50	30,75

Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	74,28	74,19	74,65	74,48	74,73	74,48	74,56	74,60	74,28	74,48
1024210	VM1698-4	Grad	29,50	30,25	30,25	30,25	29,75	30,00	30,00	29,75	29,75	29,75

Machine Capability Study
Tool System

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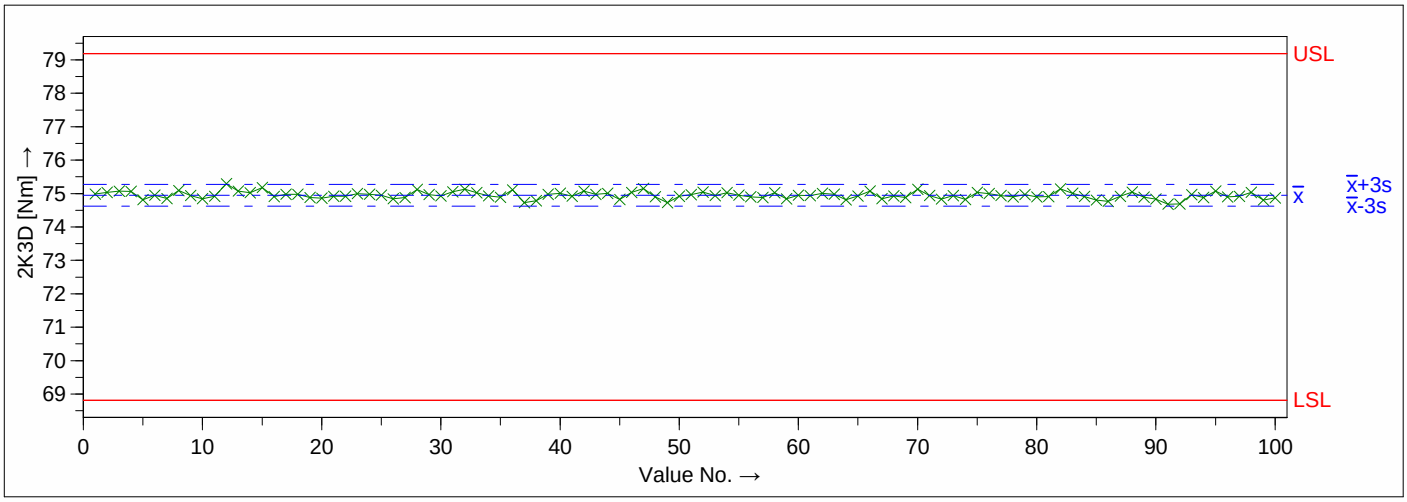
Plant ATG Westhausen		Operator Name Sünder	Date 26.04.2022

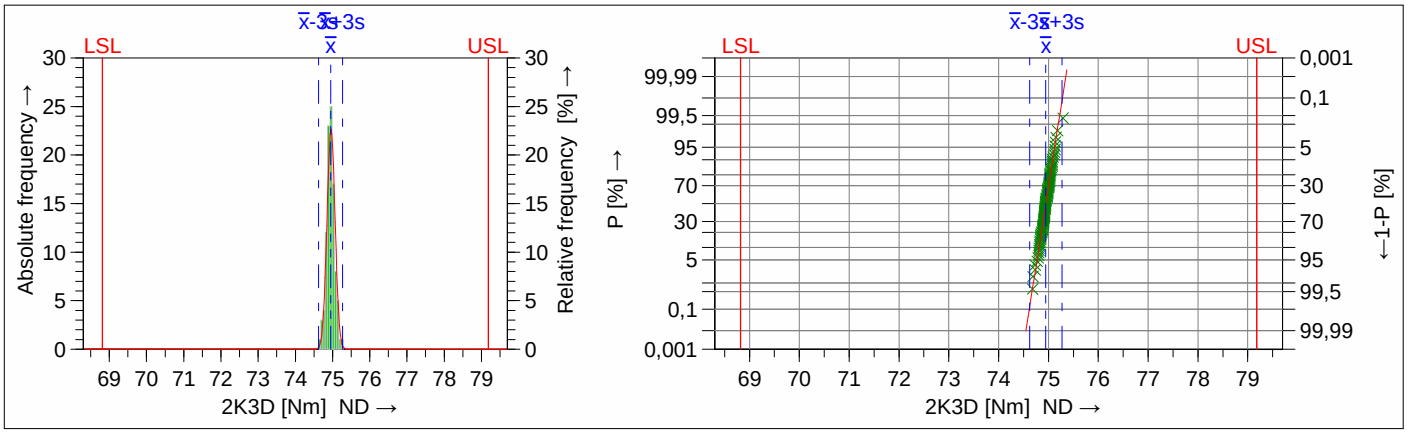
Ord. No. 2BD200T1S-A	Part type 2BD-2B200A-2K3D-2ZB				Contr.item yes
Serial No. 756055_d	Char.Descr. 2K3D	Nom.val.	74,00	5,18	USL 79,18
	Serial No. 206285	Unit	Nm	-5,18	LSL 68,82
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2

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

Evaluation from 26.04.2022 13:48:38 to 26.04.2022 14:01:39

Rem. TQ 30% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.879 Nm/A; Speed 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	74.00			$\bar{x}$	74.9473
LSL	68.82	x_{min}	74.68	$\bar{x}$-3s	74.6255
USL	79.18	x_{max}	75.29	$\bar{x}$+3s	75.2691
T	10.36	R	0.61	6s	0.6435
		$n_{<T>}$	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	16.10
Critical capability index	=	C_{mk}	13.16

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 26.04.2022

Serial No.	756055_d	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	74,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	68,82
				USL	79,18
Remark	TQ 30% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.879 Nm/A; Speed 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
206285	2K3D	Nm	74,99	75,03	75,07	75,06	74,81	74,95	74,85	75,09	74,94	74,84
206285	2K3D	Grad	30,00	30,00	30,00	31,00	30,00	30,00	30,00	30,00	31,00	30,00

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
206285	2K3D	Nm	74,92	75,29	75,07	75,02	75,18	74,91	74,98	74,98	74,88	74,86
206285	2K3D	Grad	30,00	30,00	30,00	30,00	30,00	30,00	29,00	29,00	30,00	29,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
206285	2K3D	Nm	74,92	74,92	75,00	74,98	74,95	74,84	74,88	75,12	74,97	74,93
206285	2K3D	Grad	30,00	31,00	30,00	30,00	30,00	30,00	31,00	30,00	30,00	30,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
206285	2K3D	Nm	75,05	75,13	75,02	74,93	74,89	75,11	74,73	74,79	74,98	75,01
206285	2K3D	Grad	30,00	30,00	30,00	29,00	29,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
206285	2K3D	Nm	74,92	75,07	74,98	75,01	74,82	75,03	75,15	74,90	74,73	74,92
206285	2K3D	Grad	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	29,00	30,00

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
206285	2K3D	Nm	74,97	75,04	74,94	75,02	74,95	74,90	74,88	75,02	74,84	74,95
206285	2K3D	Grad	30,00	30,00	30,00	30,00	30,00	29,00	30,00	30,00	30,00	31,00

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
206285	2K3D	Nm	74,94	75,01	74,98	74,81	74,93	75,07	74,84	74,93	74,88	75,13
206285	2K3D	Grad	31,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
206285	2K3D	Nm	74,94	74,83	74,94	74,82	75,03	75,00	74,94	74,90	74,97	74,90
206285	2K3D	Grad	31,00	31,00	31,00	31,00	30,00	31,00	31,00	30,00	30,00	29,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 26.04.2022

Serial No.	756055_d	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	74,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	68,82
				USL	79,18
Remark	TQ 30% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.879 Nm/A; Speed 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
206285	2K3D	Nm	74,91	75,14	75,01	74,91	74,80	74,77	74,92	75,04	74,89	74,83
206285	2K3D	Grad	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	29,00	31,00

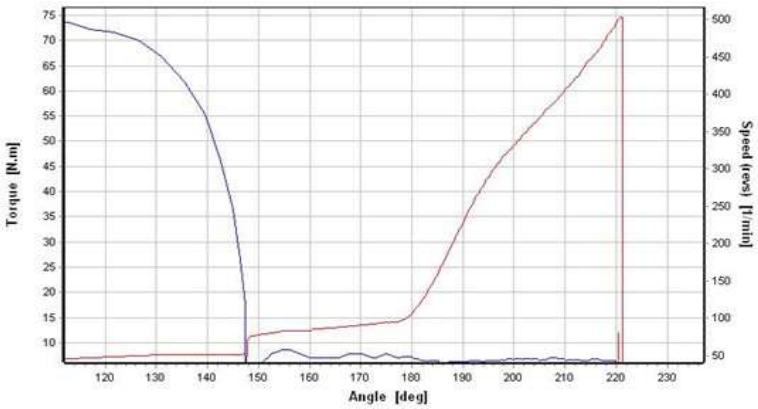
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206285	2K3D	Nm	74,68	74,69	74,97	74,88	75,07	74,90	74,92	75,03	74,80	74,87
206285	2K3D	Grad	30,00	31,00	31,00	30,00	30,00	30,00	31,00	30,00	30,00	30,00

Torque graphs

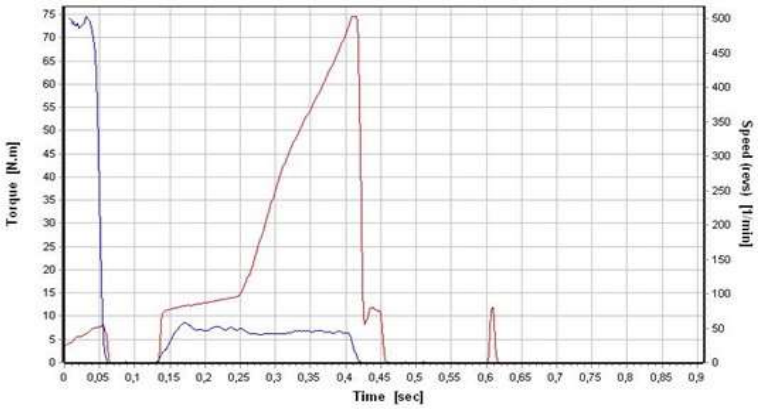
Machine Capability Study 30 %

Model: **2BD-2B200A-2K3D-2ZB**
Serial no: **756055**

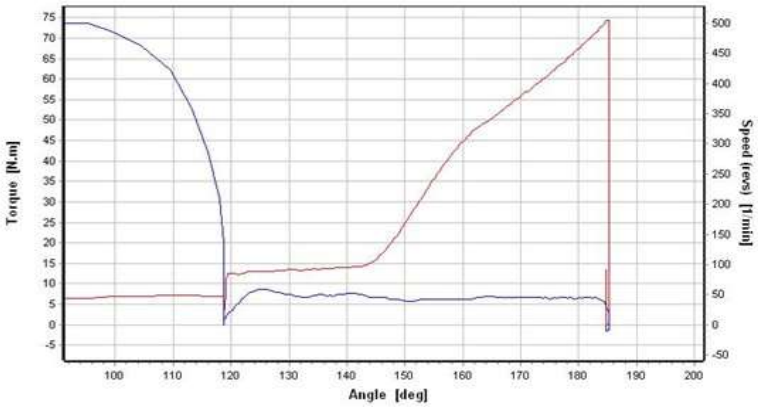
Angle degree: **30°**
Test torque: **74,0 Nm**



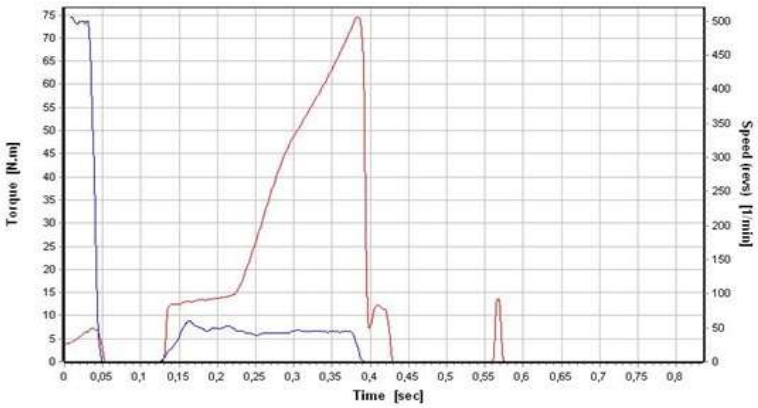
Value no. 1
Graph
Torque / Angle / Speed



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

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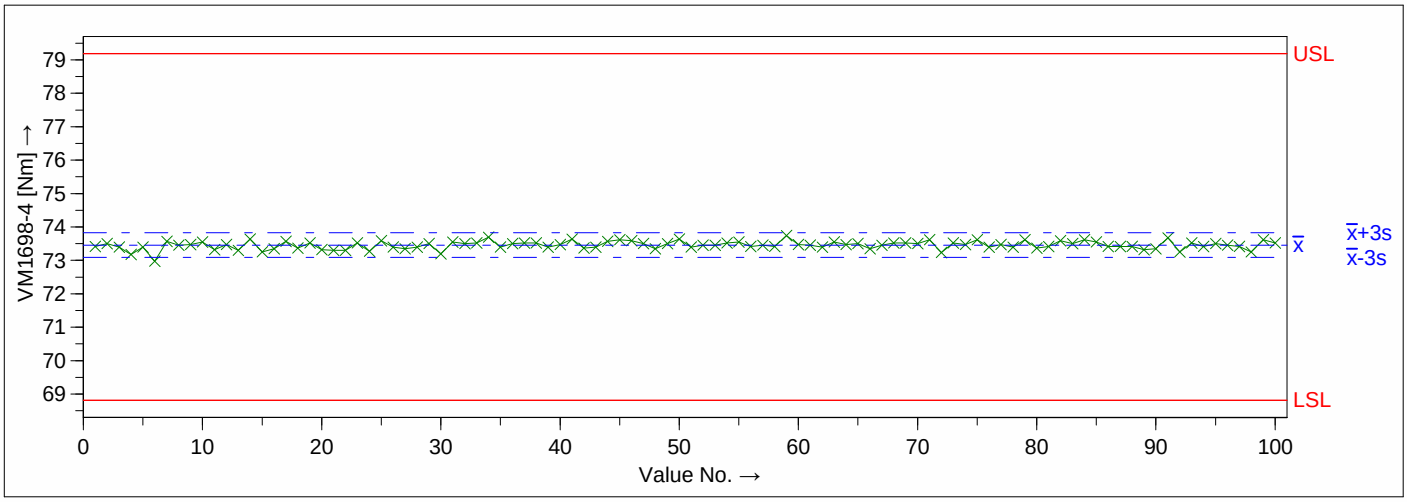
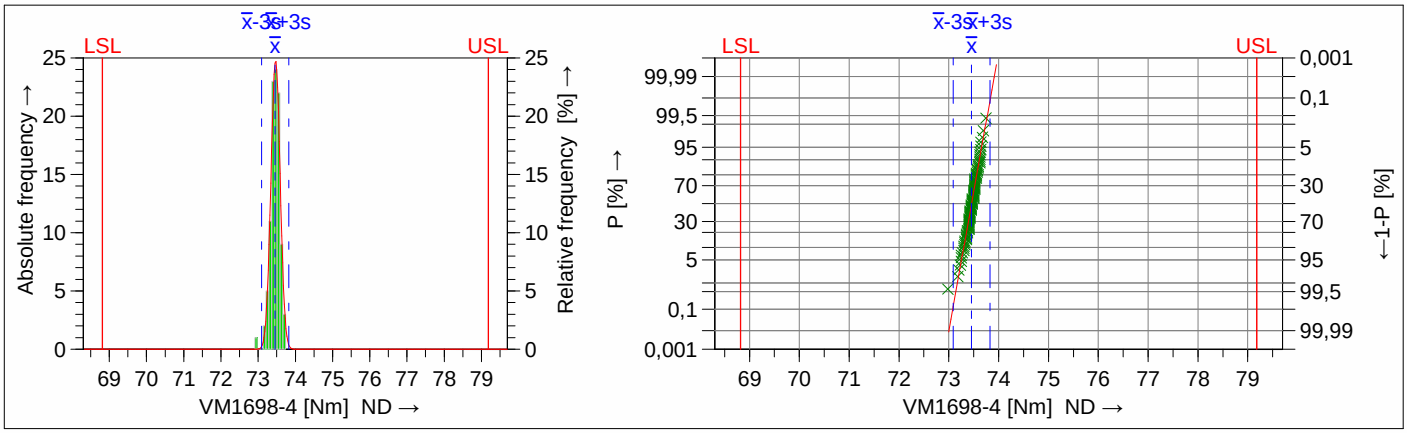
Plant	ATG Westhausen	Operator Name	Sünder
Date	28.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756055_c	Char.Descr.	VM1698-4	Nom.val. 74,00 / 5,18	USL 79,18
		Serial No.	1024210	Unit Nm / -5,18	LSL 68,82
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 28.04.2022 09:31:22 to 28.04.2022 09:48:18

Rem. TQ 30% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.879 Nm/A; Speed: 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	74.00			$\bar{x}$	73.4564
LSL	68.82	x_{min}	72.98	$\bar{x}$-3s	73.0894
USL	79.18	x_{max}	73.74	$\bar{x}$+3s	73.8234
T	10.36	R	0.76	6s	0.7340
		$n_{<T>}$	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	14.11
Critical capability index	=	C_{mk}	12.63

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 28.04.2022

Serial No.	756055_c	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	74,00
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	68,82
				USL	79,18
Remark	TQ 30% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.879 Nm/A; Speed: 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	Nm	73,42	73,50	73,40	73,18	73,40	72,98	73,57	73,45	73,47	73,55
1024210	VM1698-4	Grad	357,00	357,50	361,00	349,25	360,00	349,75	355,50	356,25	354,00	361,00

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	Nm	73,32	73,47	73,30	73,64	73,25	73,35	73,57	73,37	73,52	73,32
1024210	VM1698-4	Grad	353,00	328,00	351,00	344,00	335,75	335,50	350,00	351,50	348,50	352,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	Nm	73,30	73,30	73,52	73,27	73,59	73,40	73,35	73,40	73,50	73,20
1024210	VM1698-4	Grad	341,75	341,25	361,25	339,75	352,75	359,75	352,00	346,50	351,75	346,50

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	Nm	73,55	73,50	73,52	73,69	73,40	73,50	73,52	73,52	73,40	73,47
1024210	VM1698-4	Grad	352,75	360,00	342,25	358,75	337,00	366,25	347,75	359,25	345,75	370,50

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	Nm	73,64	73,37	73,40	73,57	73,62	73,59	73,50	73,35	73,50	73,64
1024210	VM1698-4	Grad	361,00	368,00	346,75	360,00	345,25	366,00	353,00	363,00	345,75	355,50

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	73,40	73,45	73,45	73,52	73,55	73,42	73,45	73,42	73,74	73,47
1024210	VM1698-4	Grad	362,00	361,50	331,25	357,00	369,00	342,00	354,75	336,25	352,00	375,50

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	Nm	73,45	73,40	73,55	73,47	73,50	73,35	73,45	73,52	73,52	73,50
1024210	VM1698-4	Grad	346,75	354,25	351,50	358,00	355,75	362,75	366,50	358,00	365,50	358,50

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	Nm	73,62	73,23	73,52	73,47	73,62	73,40	73,47	73,40	73,62	73,37
1024210	VM1698-4	Grad	372,00	349,00	371,75	351,25	371,00	331,00	370,75	337,75	356,75	363,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 28.04.2022

Serial No.	756055_c	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	74,00
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	68,82
				USL	79,18
Remark	TQ 30% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.879 Nm/A; Speed: 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	Nm	73,42	73,59	73,50	73,62	73,55	73,42	73,42	73,42	73,32	73,35
1024210	VM1698-4	Grad	354,00	365,25	370,00	356,50	366,00	352,00	358,25	361,25	352,75	361,25

Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	73,67	73,25	73,52	73,42	73,50	73,45	73,42	73,25	73,62	73,52
1024210	VM1698-4	Grad	355,00	329,50	359,00	366,75	359,75	375,50	361,75	375,50	361,25	347,50

Machine Capability Study
Tool System

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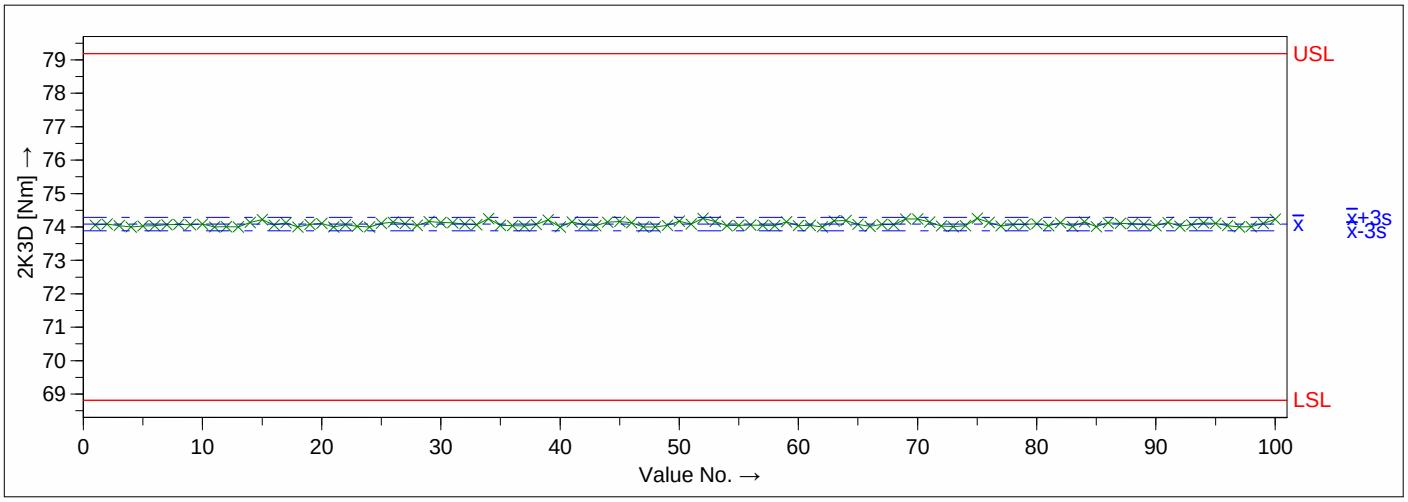
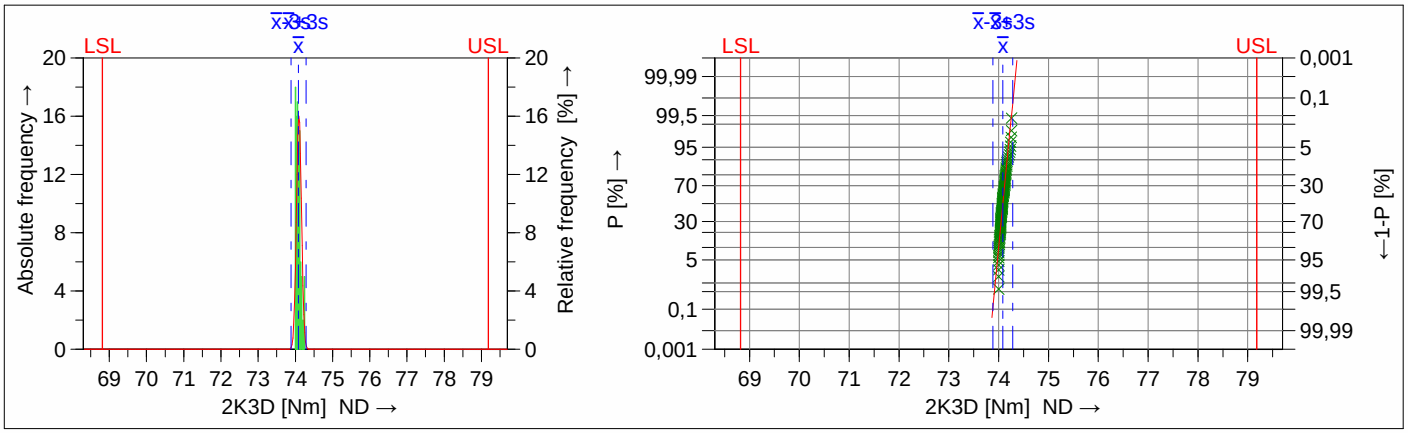
Plant	ATG Westhausen	Operator Name	Sünder
Date	28.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756055_c	Char.Descr.	2K3D	Nom.val. 74,00 5,18	USL 79,18
		Serial No.	206285	Unit Nm -5,18	LSL 68,82
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 28.04.2022 09:31:23 to 28.04.2022 09:48:19

Rem. TQ 30% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.879 Nm/A; Speed: 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	74.00			$\bar{x}$	74.0854
LSL	68.82	x_{min}	74.00	$\bar{x}$-3s	73.8854
USL	79.18	x_{max}	74.26	$\bar{x}$+3s	74.2854
T	10.36	R	0.26	6s	0.3999
		$n_{<T>}$	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	25.90
Critical capability index	=	C_{mk}	25.48

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 28.04.2022

Serial No.	756055_c	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	74,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	68,82
				USL	79,18
Remark	TQ 30% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.879 Nm/A; Speed: 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
206285	2K3D	Nm	74,06	74,09	74,04	74,00	74,03	74,04	74,07	74,08	74,07	74,09
206285	2K3D	Grad	361,00	366,00	364,00	356,00	363,00	356,00	360,00	359,00	358,00	364,00

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
206285	2K3D	Nm	74,00	74,01	74,00	74,13	74,22	74,06	74,12	74,00	74,08	74,11
206285	2K3D	Grad	357,00	335,00	354,00	352,00	340,00	338,00	353,00	354,00	353,00	354,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
206285	2K3D	Nm	74,00	74,07	74,02	74,00	74,11	74,14	74,10	74,05	74,16	74,13
206285	2K3D	Grad	344,00	348,00	364,00	342,00	356,00	363,00	355,00	349,00	358,00	352,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
206285	2K3D	Nm	74,12	74,09	74,07	74,25	74,05	74,04	74,03	74,08	74,21	74,00
206285	2K3D	Grad	359,00	368,00	348,00	360,00	339,00	368,00	349,00	360,00	351,00	372,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
206285	2K3D	Nm	74,15	74,07	74,04	74,14	74,16	74,12	74,00	74,00	74,05	74,17
206285	2K3D	Grad	363,00	371,00	353,00	362,00	349,00	370,00	356,00	368,00	349,00	357,00

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
206285	2K3D	Nm	74,09	74,26	74,16	74,04	74,05	74,06	74,05	74,04	74,15	74,04
206285	2K3D	Grad	364,00	365,00	334,00	359,00	372,00	347,00	357,00	340,00	353,00	379,00

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
206285	2K3D	Nm	74,05	74,00	74,18	74,19	74,08	74,02	74,08	74,07	74,24	74,24
206285	2K3D	Grad	350,00	356,00	358,00	361,00	360,00	367,00	370,00	359,00	370,00	364,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
206285	2K3D	Nm	74,14	74,03	74,01	74,04	74,26	74,13	74,03	74,07	74,08	74,10
206285	2K3D	Grad	374,00	352,00	374,00	353,00	377,00	335,00	373,00	341,00	359,00	366,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 28.04.2022

Serial No.	756055_c	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	74,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	68,82
				USL	79,18
Remark	TQ 30% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.879 Nm/A; Speed: 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
206285	2K3D	Nm	74,04	74,12	74,02	74,15	74,01	74,12	74,11	74,10	74,08	74,04
206285	2K3D	Grad	356,00	367,00	372,00	362,00	368,00	355,00	371,00	366,00	355,00	363,00

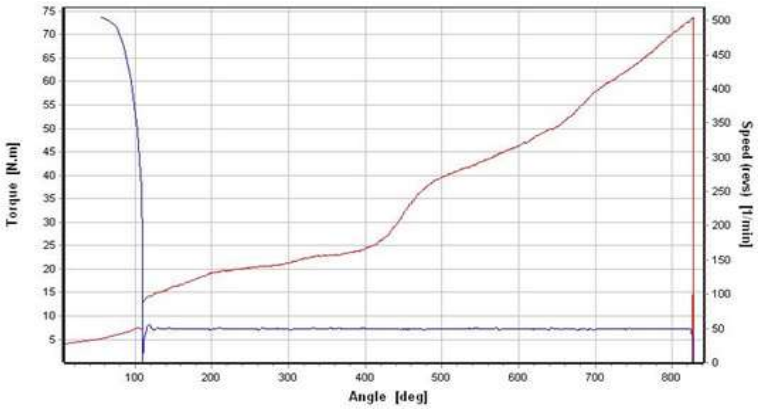
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206285	2K3D	Nm	74,13	74,03	74,07	74,12	74,11	74,04	74,00	74,01	74,11	74,23
206285	2K3D	Grad	356,00	333,00	360,00	369,00	361,00	379,00	364,00	379,00	364,00	351,00

Torque graphs

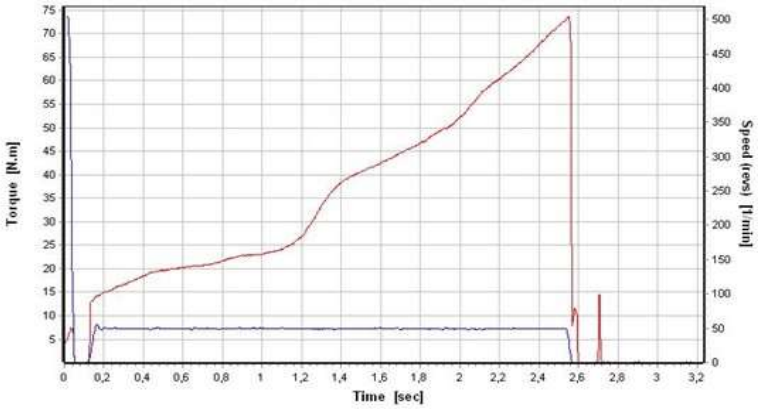
Machine Capability Study 30 %

Model: **2BD-2B200A-2K3D-2ZB**
Serial no: **756055**

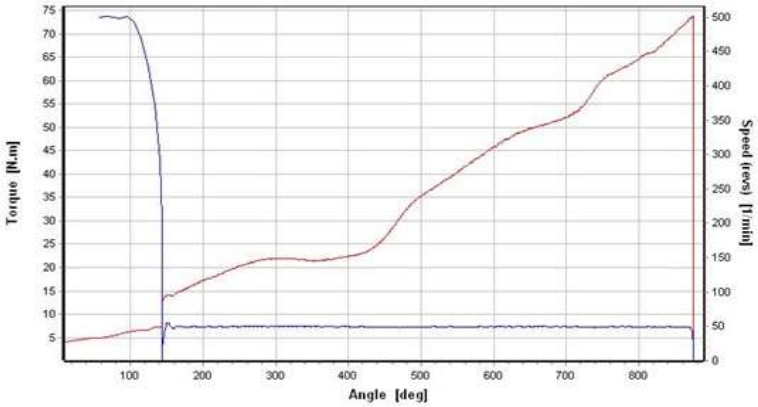
Angle degree: **360°**
Test torque: **74,0 Nm**



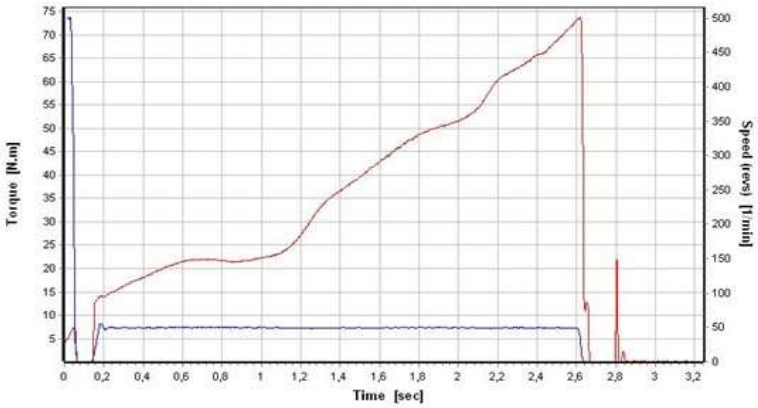
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

Test sheet no. 3

Machine Capability Study 80 %

Multi-stage tightening system	☑	Speed 50 rpm	10,0 %
Single-stage tightening system	☐	Speed 100 %	502 rpm

Manufacturer: Apex Tool Group

Serial no: **756055**

Test torque: Tq min. + 0.8 (Tq max. - Tq min.) 164,00 Nm

Hard joint (H)	987,67	Nm / Revolution	Angle degree	30°
Soft joint (L)	82,03	Nm / Revolution	Angle degree	360°

		H	L
a)	Tolerance down / up	152,52 175,48 Nm	152,52 - 175,48 Nm
	Tolerance down / up	7	7 %
	Average torque	164,61	164,05 Nm
	Standard deviation	0,19	0,15 Nm
	Torque scatter (99,73%)	1,13	0,93 Nm
	C_m	20,28	24,80
	C_{mk}	19,20	24,69

b)	Min. C_m hard/soft (lowest value)	20,28
	Min. C_{mk} hard/soft (lowest value)	19,20

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

Note:

Machine Capability Study
Control System

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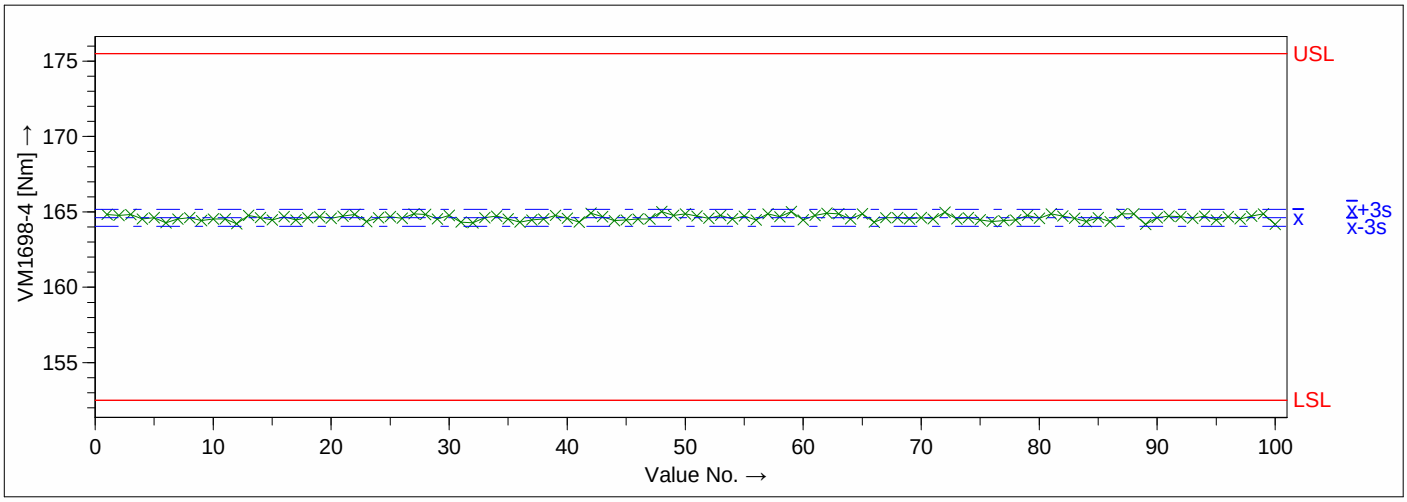
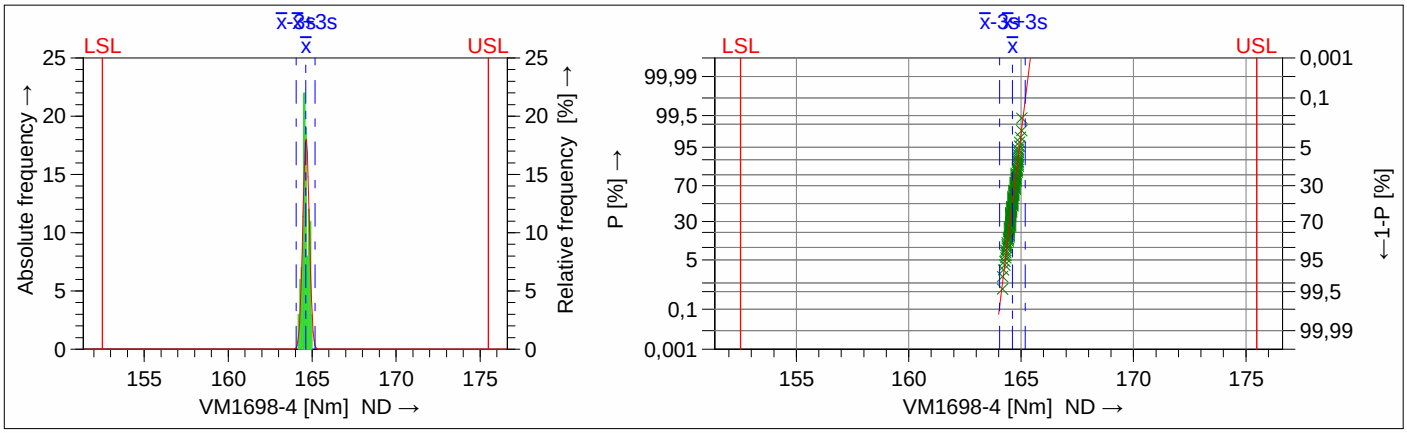
Plant	ATG Westhausen	Operator Name	Sünder
Date	26.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756055_h	Char.Descr.	VM1698-4	Nom.val. 164,00 11,48	USL 175,48
		Serial No.	1024210	Unit Nm -11,48	LSL 152,52
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	250 / 5537037	nges.	100

Evaluation from 26.04.2022 08:58:53 to 26.04.2022 09:15:09

Rem. TQ 80% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.594 Nm/A; Speed 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	164.00			$\bar{x}$	164.6115
LSL	152.52	x_{min}	164.17	$\bar{x}$-3s	164.0454
USL	175.48	x_{max}	165.02	$\bar{x}$+3s	165.1776
T	22.96	R	0.85	6s	1.1322
		$n_{<T>}$	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	20.28
Critical capability index	=	C_{mk}	19.20

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 26.04.2022

Serial No.	756055_h	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	164,00
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	152,52
				USL	175,48
Remark	TQ 80% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.594 Nm/A; Speed 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	Nm	164,82	164,77	164,82	164,52	164,62	164,27	164,52	164,62	164,42	164,52
1024210	VM1698-4	Grad	32,25	30,50	30,50	30,50	31,00	30,50	30,75	30,50	29,75	30,50

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	Nm	164,52	164,22	164,77	164,62	164,47	164,67	164,47	164,62	164,67	164,57
1024210	VM1698-4	Grad	30,25	30,50	29,75	29,75	30,00	30,00	29,75	29,75	29,75	30,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	Nm	164,72	164,82	164,37	164,62	164,67	164,57	164,87	164,82	164,52	164,77
1024210	VM1698-4	Grad	29,75	29,75	30,00	30,25	29,25	31,50	30,25	30,00	29,75	29,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	Nm	164,32	164,27	164,62	164,72	164,52	164,32	164,47	164,52	164,77	164,57
1024210	VM1698-4	Grad	30,00	29,75	29,25	29,75	29,75	29,75	29,25	29,50	29,75	29,50

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	Nm	164,32	164,92	164,67	164,42	164,47	164,52	164,52	165,02	164,77	164,87
1024210	VM1698-4	Grad	29,50	29,00	28,50	29,50	29,50	30,00	29,75	29,00	30,25	29,75

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	164,72	164,57	164,77	164,52	164,72	164,47	164,87	164,67	165,02	164,47
1024210	VM1698-4	Grad	30,50	32,00	31,00	30,25	30,50	30,00	30,00	30,00	29,75	30,00

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	Nm	164,77	164,92	164,87	164,52	164,87	164,32	164,62	164,62	164,52	164,62
1024210	VM1698-4	Grad	29,50	29,75	29,75	29,75	29,75	29,25	29,50	29,50	29,75	29,75

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	Nm	164,52	164,97	164,52	164,62	164,47	164,37	164,42	164,47	164,77	164,57
1024210	VM1698-4	Grad	29,00	29,75	29,25	29,50	29,75	30,00	30,00	30,00	31,00	30,50

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 26.04.2022

Serial No.	756055_h	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	164,00
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	152,52
				USL	175,48
Remark	TQ 80% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.594 Nm/A; Speed 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	Nm	164,87	164,72	164,57	164,37	164,62	164,37	164,87	164,87	164,17	164,62
1024210	VM1698-4	Grad	30,50	30,50	31,75	31,00	31,00	32,50	29,00	30,25	30,00	29,50

Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	164,72	164,67	164,57	164,72	164,47	164,67	164,52	164,72	164,87	164,17
1024210	VM1698-4	Grad	31,00	30,00	30,00	30,00	29,50	29,75	29,75	29,75	29,25	29,25

Machine Capability Study
Tool System

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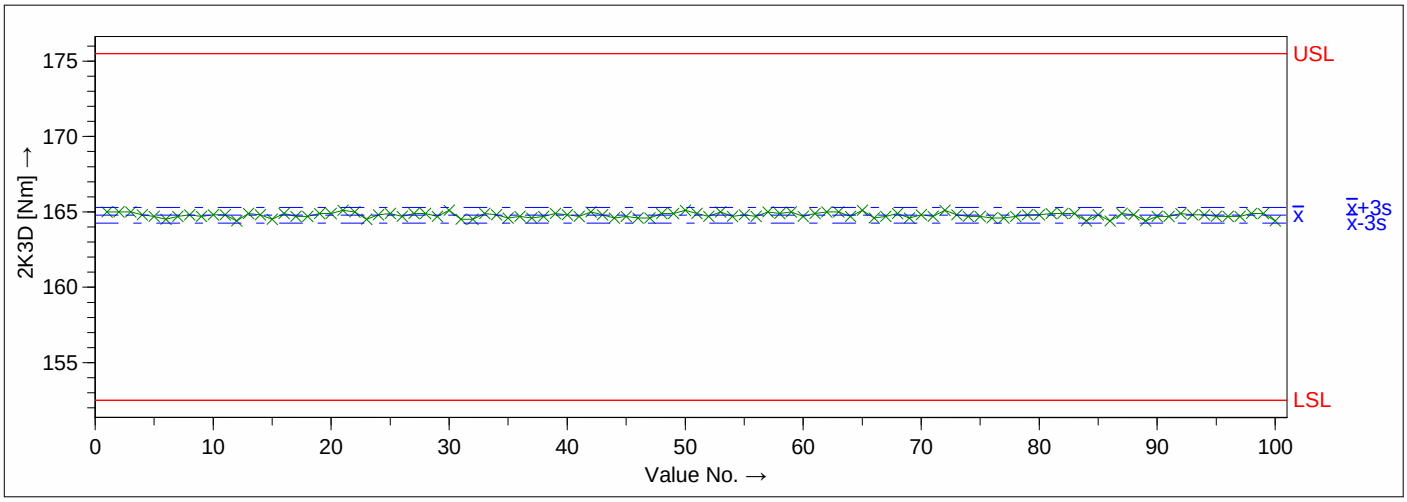
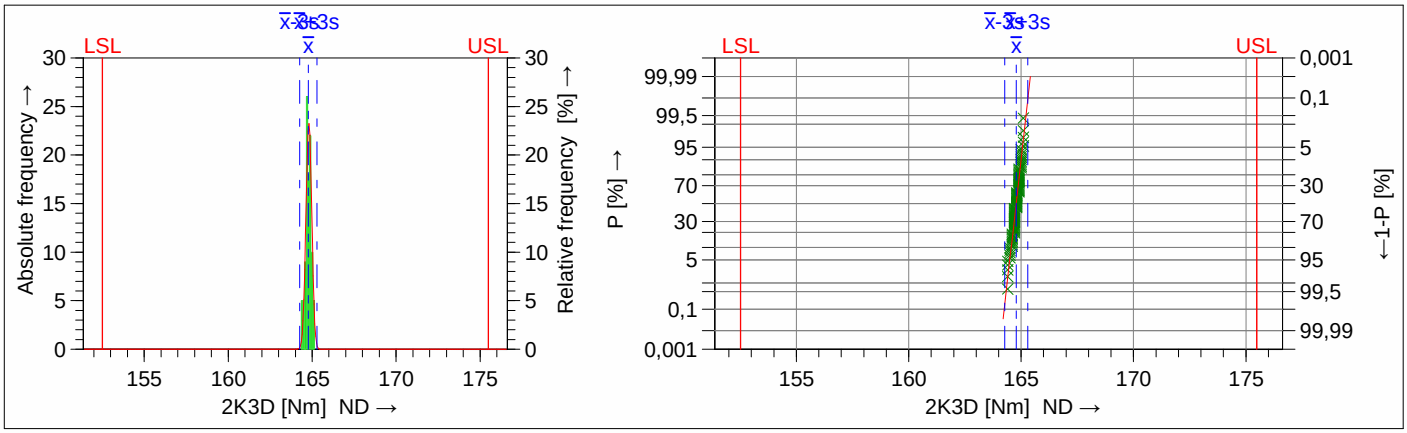
Plant	ATG Westhausen	Operator Name	Sünder
Date	26.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756055_h	Char.Descr.	2K3D	Nom.val. 164,00	11,48 USL 175,48
		Serial No.	206285	Unit Nm	-11,48 LSL 152,52
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	250 / 5537037	nges.	100

Evaluation from 26.04.2022 08:58:53 to 26.04.2022 09:15:09

Rem. TQ 80% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.594 Nm/A; Speed 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	164.00			$\bar{x}$	164.7780
LSL	152.52	x_{min}	164.40	$\bar{x}$-3s	164.2653
USL	175.48	x_{max}	165.10	$\bar{x}$+3s	165.2907
T	22.96	R	0.70	6s	1.0254
		$n_{<T>}$	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	22.39
Critical capability index	=	C_{mk}	20.87

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 26.04.2022

Serial No.	756055_h	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	164,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	152,52
				USL	175,48
Remark	TQ 80% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.594 Nm/A; Speed 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
206285	2K3D	Nm	165,00	165,00	165,00	164,80	164,70	164,50	164,70	164,80	164,70	164,80
206285	2K3D	Grad	33,00	32,00	32,00	32,00	32,00	31,00	32,00	31,00	31,00	31,00

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
206285	2K3D	Nm	164,80	164,40	164,90	164,80	164,50	164,90	164,70	164,70	164,90	164,90
206285	2K3D	Grad	31,00	32,00	31,00	31,00	31,00	31,00	31,00	30,00	30,00	31,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
206285	2K3D	Nm	165,10	165,00	164,50	164,80	164,90	164,70	164,90	164,90	164,70	165,10
206285	2K3D	Grad	31,00	31,00	31,00	31,00	30,00	32,00	31,00	31,00	30,00	30,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
206285	2K3D	Nm	164,50	164,50	164,90	164,80	164,60	164,70	164,60	164,70	164,90	164,80
206285	2K3D	Grad	31,00	30,00	30,00	31,00	30,00	30,00	30,00	30,00	31,00	30,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
206285	2K3D	Nm	164,70	165,00	164,80	164,60	164,70	164,60	164,60	164,90	164,90	165,10
206285	2K3D	Grad	30,00	30,00	29,00	30,00	30,00	31,00	30,00	30,00	31,00	31,00

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
206285	2K3D	Nm	164,90	164,70	165,00	164,70	164,80	164,70	165,00	164,90	165,00	164,70
206285	2K3D	Grad	32,00	32,00	32,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
206285	2K3D	Nm	164,90	165,00	165,00	164,70	165,10	164,60	164,70	164,90	164,60	164,80
206285	2K3D	Grad	31,00	31,00	31,00	31,00	31,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
206285	2K3D	Nm	164,70	165,10	164,80	164,70	164,70	164,60	164,60	164,70	164,80	164,80
206285	2K3D	Grad	30,00	30,00	30,00	30,00	31,00	31,00	31,00	31,00	32,00	31,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 26.04.2022

Serial No.	756055_h	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	164,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	152,52
				USL	175,48
Remark	TQ 80% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.594 Nm/A; Speed 502/50 rpm;				

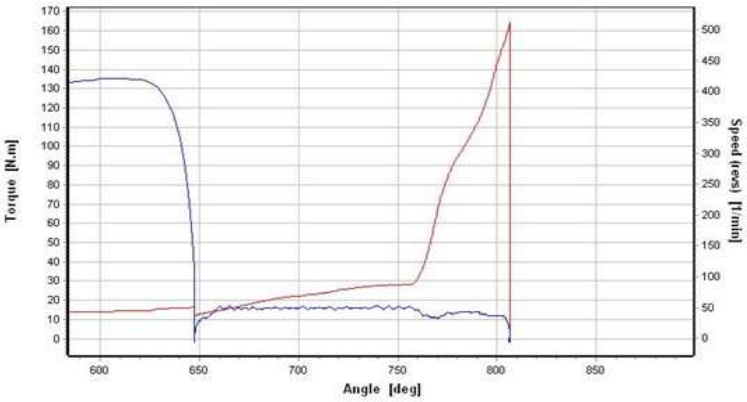
Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
206285	2K3D	Nm	164,90	164,90	164,90	164,40	164,80	164,40	164,90	164,80	164,40	164,70
206285	2K3D	Grad	32,00	32,00	33,00	32,00	32,00	33,00	30,00	31,00	31,00	30,00

Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206285	2K3D	Nm	164,70	164,90	164,80	164,80	164,70	164,70	164,70	164,90	164,90	164,40
206285	2K3D	Grad	32,00	31,00	31,00	31,00	30,00	30,00	31,00	31,00	30,00	30,00

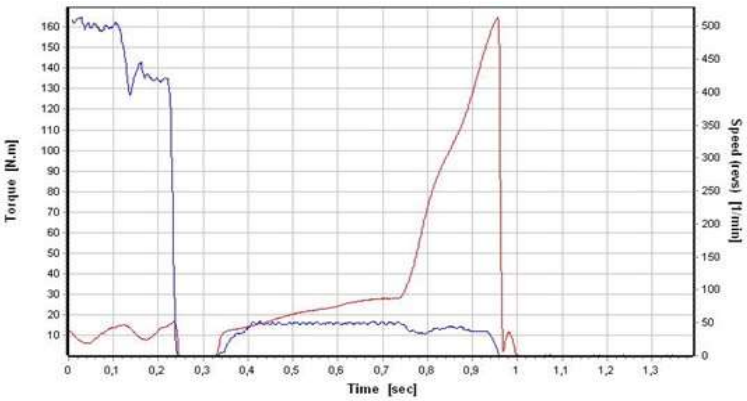
Torque graphs

Model: **2BD-2B200A-2K3D-2ZB**
Serial no: **756055**

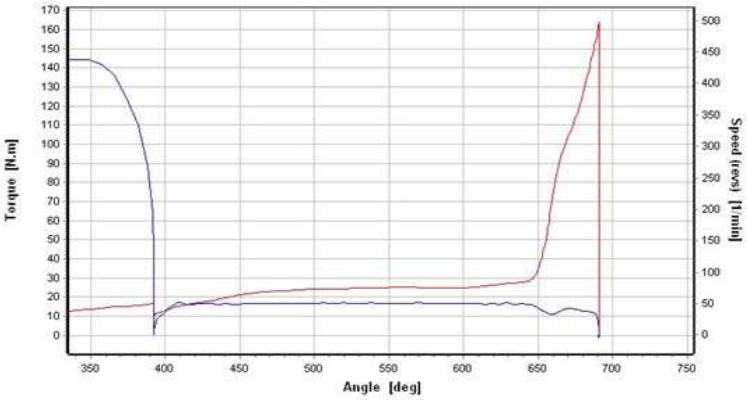
Machine Capability Study 80 %
Angle degree: **30°**
Test torque: **164,0 Nm**



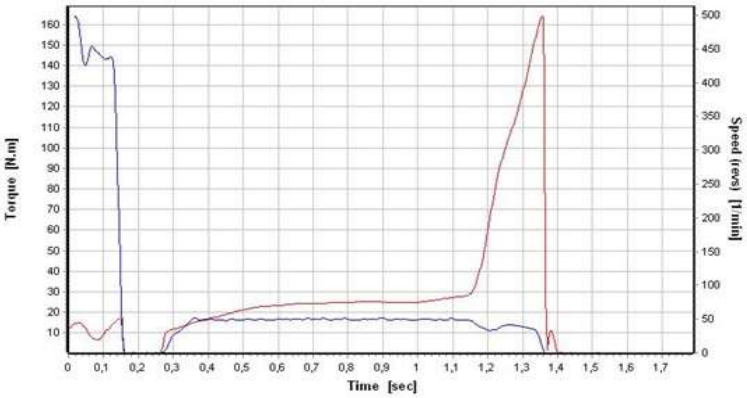
Value no. 1
Graph
Torque / Angle / Speed



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

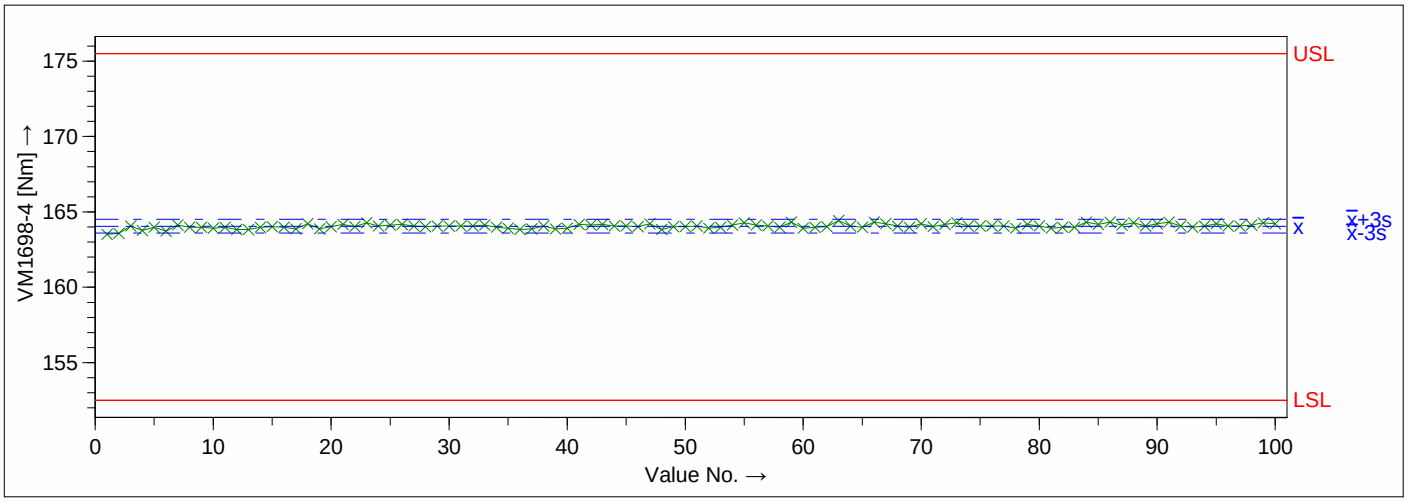
Cleco Production Tools

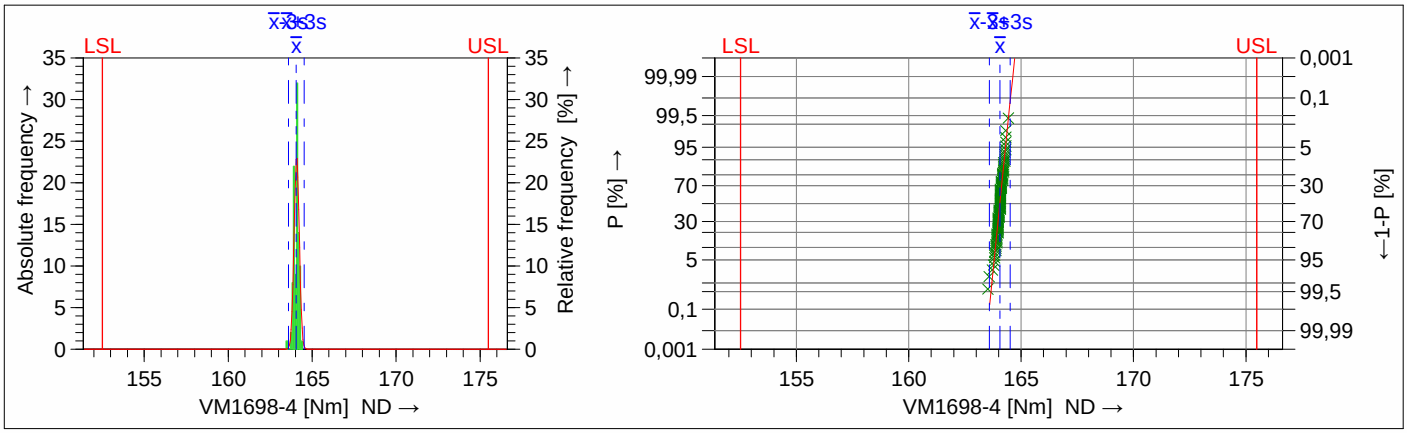
Plant	ATG Westhausen	Operator Name	Sünder
Date	26.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756055_g	Char.Descr.	VM1698-4	Nom.val.	164,00 11,48
		Serial No.	1024210	Unit	Nm -11,48
				USL	175,48
				LSL	152,52
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	250 / 5537037	nges.	100

Evaluation from 26.04.2022 10:26:56 to 26.04.2022 11:20:07

Rem. TQ 80% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.594 Nm/A; Speed 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	164.00			$\bar{x}$	164.0525
LSL	152.52	x_{min}	163.52	$\bar{x}$-3s	163.5896
USL	175.48	x_{max}	164.42	$\bar{x}$+3s	164.5154
T	22.96	R	0.90	6s	0.9258
		$n_{<T>}$	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	24.80
Critical capability index	=	C_{mk}	24.69

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 26.04.2022

Serial No.	756055_g	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	164,00
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	152,52
				USL	175,48
Remark	TQ 80% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.594 Nm/A; Speed 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	Nm	163,52	163,57	164,07	163,77	163,97	163,72	164,12	163,97	163,97	163,92
1024210	VM1698-4	Grad	355,00	360,50	371,50	357,25	351,75	345,00	339,00	341,50	363,25	341,00

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	Nm	163,97	163,82	163,82	163,97	164,02	163,97	163,87	164,22	163,87	164,02
1024210	VM1698-4	Grad	340,75	339,50	336,75	340,25	341,50	346,50	348,25	381,75	355,50	337,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	Nm	164,17	164,02	164,27	164,07	164,12	164,17	164,07	164,02	164,07	164,07
1024210	VM1698-4	Grad	349,25	338,25	370,25	361,00	338,25	349,50	346,50	334,75	341,25	356,50

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	Nm	164,07	164,07	164,12	163,97	163,92	163,82	163,87	164,07	163,87	163,92
1024210	VM1698-4	Grad	353,50	355,50	347,50	353,50	356,25	342,25	352,00	352,25	342,25	351,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	Nm	164,17	164,12	164,17	164,07	164,07	164,02	164,22	163,82	164,02	164,02
1024210	VM1698-4	Grad	351,25	356,75	350,00	350,50	355,25	363,25	361,50	351,75	355,75	359,75

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	164,07	163,92	163,97	164,12	164,27	164,12	164,07	163,97	164,32	163,92
1024210	VM1698-4	Grad	349,75	360,00	359,75	354,00	355,50	356,00	354,50	352,25	357,75	356,50

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	Nm	163,97	164,02	164,42	164,07	163,97	164,32	164,22	164,07	163,97	164,22
1024210	VM1698-4	Grad	352,25	355,25	345,75	354,50	357,75	354,50	340,50	360,25	355,75	359,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	Nm	164,02	164,17	164,27	164,07	164,07	164,07	164,07	163,92	164,17	164,07
1024210	VM1698-4	Grad	348,50	350,00	350,75	356,75	358,75	380,25	354,50	355,25	354,00	354,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 26.04.2022

Serial No.	756055_g	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	164,00
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	152,52
				USL	175,48
Remark	TQ 80% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.594 Nm/A; Speed 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	Nm	163,92	163,97	163,97	164,32	164,17	164,32	164,12	164,27	164,07	164,22
1024210	VM1698-4	Grad	376,25	350,75	342,75	371,00	360,75	361,00	356,50	360,25	360,00	362,25

Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	164,32	164,07	163,97	164,07	164,22	164,07	164,07	164,12	164,27	164,22
1024210	VM1698-4	Grad	354,25	356,25	358,75	351,50	367,50	347,75	356,25	363,50	360,25	367,00

Machine Capability Study
Tool System

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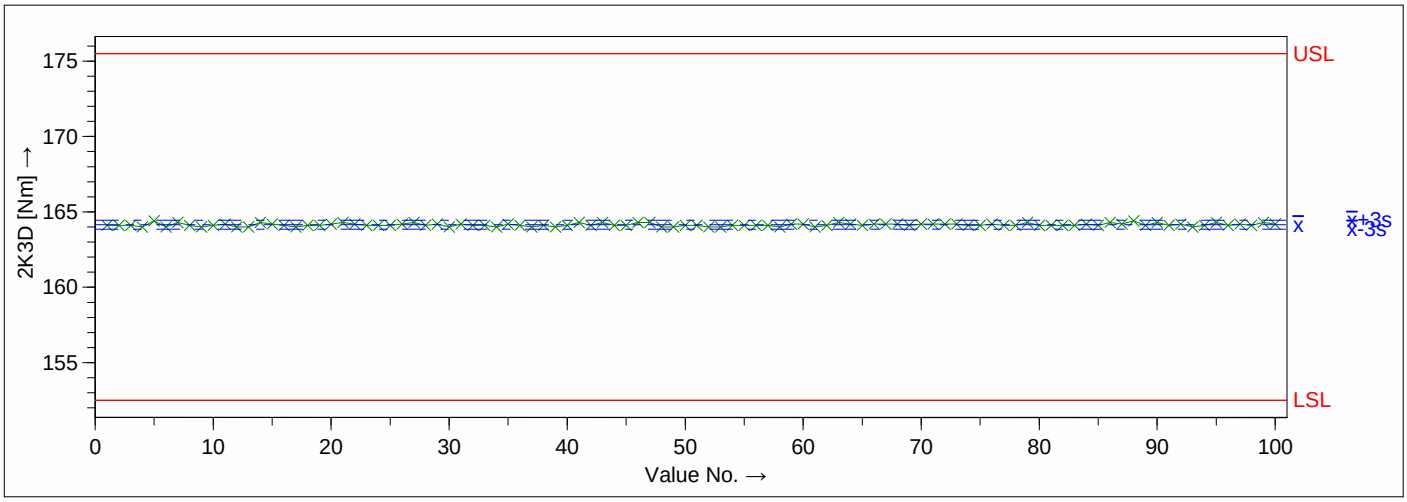
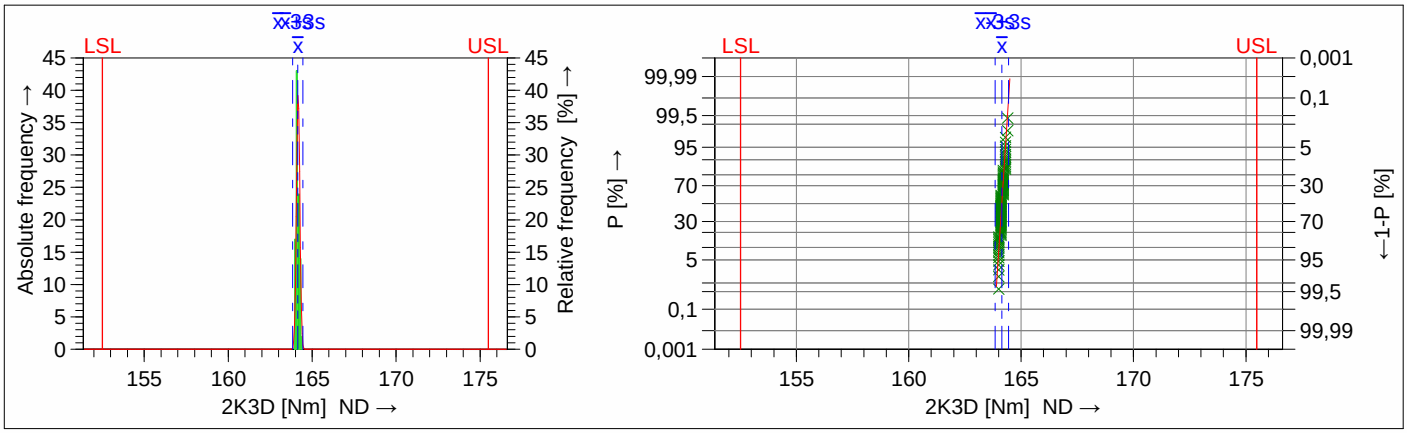
Plant	ATG Westhausen	Operator Name	Sünder
Date	26.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756055_g	Char.Descr.	2K3D	Nom.val.	164,00 11,48
		Serial No.	206285	Unit	Nm -11,48
				USL	175,48
				LSL	152,52
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	250 / 5537037	nges.	100

Evaluation from 26.04.2022 10:26:56 to 26.04.2022 11:20:07

Rem. TQ 80% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.594 Nm/A; Speed 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	164.00			$\bar{x}$	164.1410
LSL	152.52	x_{min}	164.00	$\bar{x}$-3s	163.8422
USL	175.48	x_{max}	164.40	$\bar{x}$+3s	164.4398
T	22.96	R	0.40	6s	0.5975
		$n_{<T>}$	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	38.42
Critical capability index	=	C_{mk}	37.95

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 26.04.2022

Serial No.	756055_g	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	164,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	152,52
				USL	175,48
Remark	TQ 80% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.594 Nm/A; Speed 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
206285	2K3D	Nm	164,10	164,10	164,10	164,00	164,40	164,00	164,30	164,10	164,00	164,10
206285	2K3D	Grad	357,00	362,00	371,00	358,00	353,00	346,00	340,00	343,00	363,00	342,00

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
206285	2K3D	Nm	164,20	164,00	164,00	164,30	164,20	164,10	164,00	164,10	164,10	164,20
206285	2K3D	Grad	342,00	341,00	338,00	341,00	342,00	348,00	350,00	381,00	356,00	338,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
206285	2K3D	Nm	164,30	164,20	164,10	164,10	164,10	164,20	164,30	164,10	164,20	164,00
206285	2K3D	Grad	350,00	339,00	369,00	362,00	338,00	350,00	347,00	336,00	343,00	357,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
206285	2K3D	Nm	164,20	164,10	164,10	164,00	164,20	164,10	164,00	164,10	164,00	164,10
206285	2K3D	Grad	354,00	356,00	349,00	354,00	357,00	343,00	353,00	352,00	344,00	353,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
206285	2K3D	Nm	164,30	164,10	164,30	164,10	164,10	164,30	164,30	164,00	164,00	164,10
206285	2K3D	Grad	352,00	358,00	351,00	351,00	356,00	364,00	362,00	352,00	357,00	360,00

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
206285	2K3D	Nm	164,10	164,00	164,00	164,10	164,10	164,10	164,10	164,00	164,20	164,20
206285	2K3D	Grad	351,00	361,00	361,00	355,00	357,00	357,00	355,00	352,00	358,00	358,00

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
206285	2K3D	Nm	164,00	164,10	164,30	164,20	164,10	164,20	164,20	164,20	164,10	164,20
206285	2K3D	Grad	353,00	356,00	347,00	355,00	358,00	356,00	341,00	360,00	357,00	359,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
206285	2K3D	Nm	164,20	164,20	164,20	164,10	164,10	164,20	164,10	164,10	164,30	164,10
206285	2K3D	Grad	349,00	351,00	352,00	356,00	359,00	382,00	355,00	356,00	355,00	355,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 26.04.2022

Serial No.	756055_g	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	164,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	152,52
				USL	175,48
Remark	TQ 80% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.594 Nm/A; Speed 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
206285	2K3D	Nm	164,10	164,10	164,10	164,20	164,10	164,30	164,20	164,40	164,10	164,30
206285	2K3D	Grad	377,00	352,00	343,00	370,00	362,00	361,00	358,00	361,00	361,00	363,00

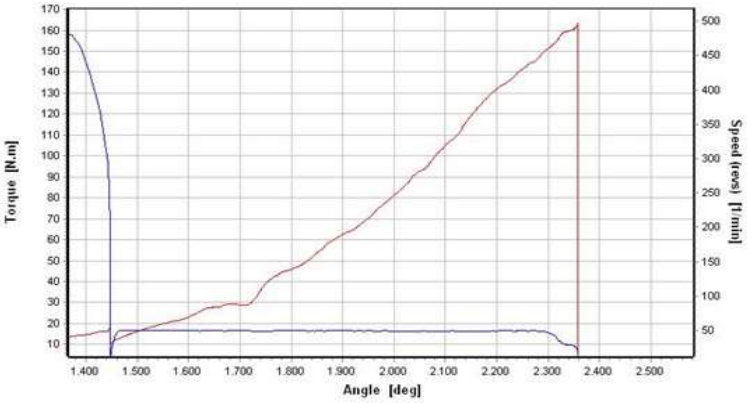
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206285	2K3D	Nm	164,10	164,20	164,00	164,10	164,30	164,10	164,20	164,10	164,30	164,20
206285	2K3D	Grad	356,00	357,00	360,00	352,00	368,00	349,00	357,00	363,00	361,00	367,00

Torque graphs

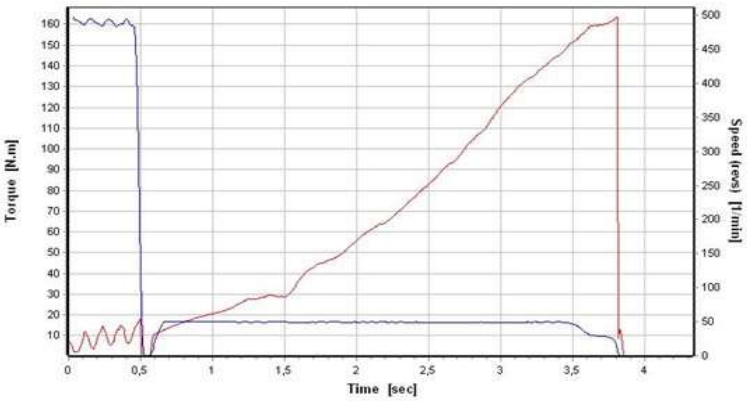
Machine Capability Study 80 %

Model: **2BD-2B200A-2K3D-2ZB**
Serial no: **756055**

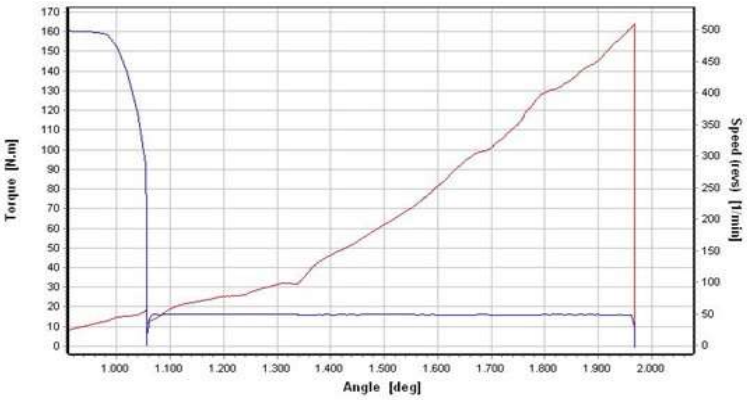
Angle degree: **360°**
Test torque: **164,0 Nm**



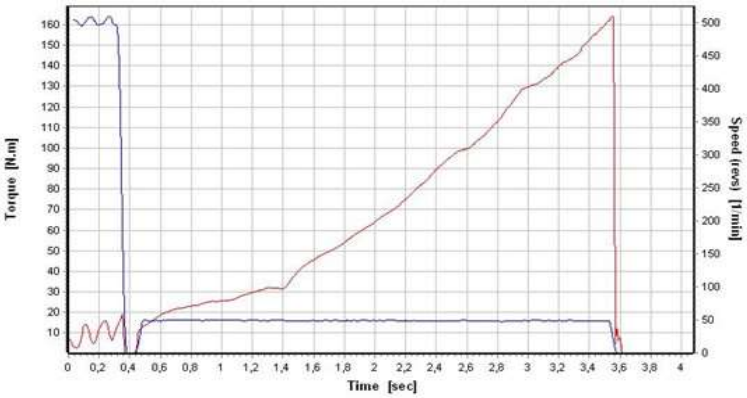
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

Test sheet no. 4

Machine Capability Study 100 %

Multi-stage tightening system	☑	Speed 50 rpm	10,0 %
Single-stage tightening system	☐	Speed 100 %	502 rpm

Manufacturer: Apex Tool Group Serial no: **756055**

Test torque: Tq max. 200,00 Nm

Hard joint (H)	1208,61	Nm / Revolution	Angle degree	30°
Soft joint (L)	99,99	Nm / Revolution	Angle degree	360°

		H	L
a)	Tolerance down / up	186,00 214,00 Nm	186,00 - 214,00 Nm
	Tolerance down / up	7	7 %
	Average torque	201,43	199,98 Nm
	Standard deviation	0,30	0,17 Nm
	Torque scatter (99,73%)	1,78	1,00 Nm
	C_m	15,71	27,98
	C_{mk}	14,10	27,95

b)	Min. C_m hard/soft (lowest value)	15,71
	Min. C_{mk} hard/soft (lowest value)	14,10

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

Note:

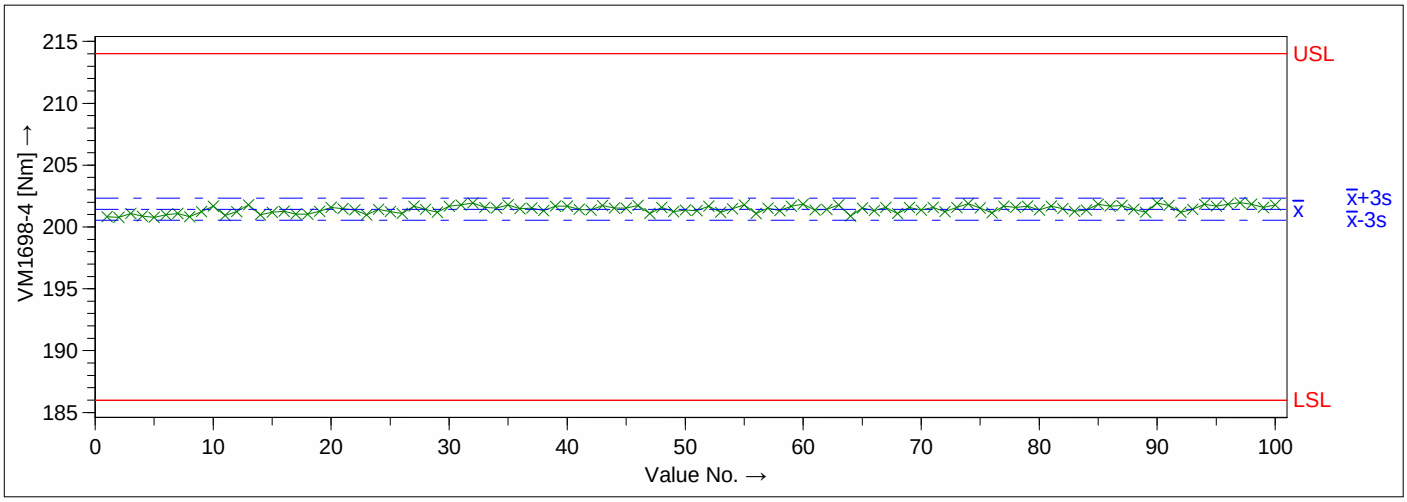
Machine Capability Study
Control System

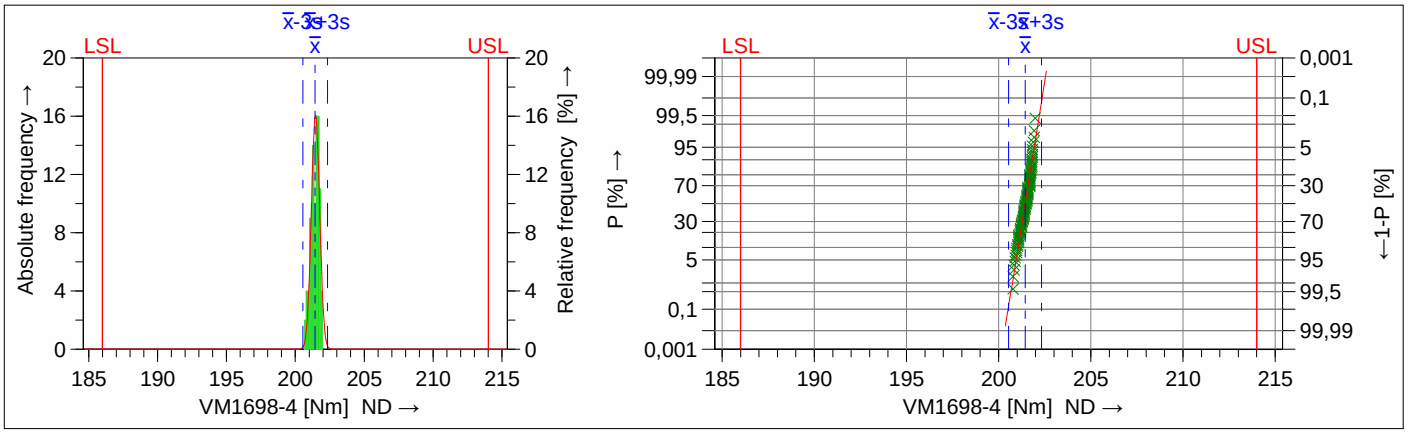
Plant	ATG Westhausen	Operator Name	Sünder
Date	26.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756055_b	Char.Descr.	VM1698-4	Nom.val.	200,00 14,00
		Serial No.	1024210	Unit	Nm -14,00
				USL	214,00
				LSL	186,00
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	250 / 5537037	nges.	100

Evaluation from 26.04.2022 07:54:07 to 26.04.2022 08:08:55

Rem. TQ 100% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.691 Nm/A; Speed 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	200.00			$\bar{x}$	201.4345
LSL	186.00	x_{min}	200.78	$\bar{x}$-3s	200.5431
USL	214.00	x_{max}	201.98	$\bar{x}$+3s	202.3259
T	28.00	R	1.20	6s	1.7828
		$n_{<T>}$	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	15.71
Critical capability index	=	C_{mk}	14.10

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 26.04.2022

Serial No.	756055_b	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	200,00
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	186,00
				USL	214,00
Remark	TQ 100% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.691 Nm/A; Speed 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	Nm	200,83	200,78	201,08	200,88	200,78	200,98	201,08	200,83	201,23	201,68
1024210	VM1698-4	Grad	30,00	30,25	29,75	29,75	29,75	29,75	30,00	30,00	30,00	30,25

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	Nm	200,93	201,23	201,78	200,98	201,18	201,28	201,03	201,03	201,28	201,58
1024210	VM1698-4	Grad	29,75	29,75	30,25	29,75	29,75	30,00	29,25	29,50	29,25	29,75

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	Nm	201,48	201,38	200,98	201,43	201,23	201,08	201,68	201,43	201,18	201,68
1024210	VM1698-4	Grad	29,00	29,75	30,50	30,25	30,25	30,00	30,50	30,00	30,00	30,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	Nm	201,78	201,93	201,58	201,53	201,78	201,48	201,53	201,33	201,68	201,68
1024210	VM1698-4	Grad	30,25	30,00	30,00	30,50	30,00	30,00	29,75	29,75	30,00	30,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	Nm	201,43	201,38	201,73	201,53	201,53	201,73	201,08	201,58	201,23	201,38
1024210	VM1698-4	Grad	30,00	30,00	30,00	29,50	29,75	29,75	30,00	29,75	29,75	29,50

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	201,33	201,68	201,18	201,48	201,78	201,08	201,53	201,33	201,68	201,83
1024210	VM1698-4	Grad	29,50	30,00	29,50	29,75	30,00	29,75	29,75	29,50	29,50	29,50

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	Nm	201,38	201,43	201,78	200,88	201,53	201,33	201,58	201,08	201,58	201,38
1024210	VM1698-4	Grad	29,50	29,75	29,50	29,25	29,25	29,25	29,75	30,00	29,75	29,50

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	Nm	201,58	201,23	201,58	201,88	201,53	201,13	201,68	201,58	201,68	201,38
1024210	VM1698-4	Grad	29,25	29,50	29,75	29,75	30,00	29,75	29,75	29,50	30,00	29,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 26.04.2022

Serial No.	756055_b	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	200,00
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	186,00
				USL	214,00
Remark	TQ 100% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.691 Nm/A; Speed 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	Nm	201,68	201,48	201,28	201,38	201,83	201,68	201,73	201,43	201,18	201,93
1024210	VM1698-4	Grad	29,75	29,25	29,25	29,25	29,50	29,75	29,75	29,75	29,50	30,00

Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	201,73	201,18	201,43	201,83	201,68	201,83	201,98	201,83	201,58	201,78
1024210	VM1698-4	Grad	30,00	30,00	30,00	30,00	29,75	30,25	29,75	29,75	30,00	29,50

Machine Capability Study
Tool System

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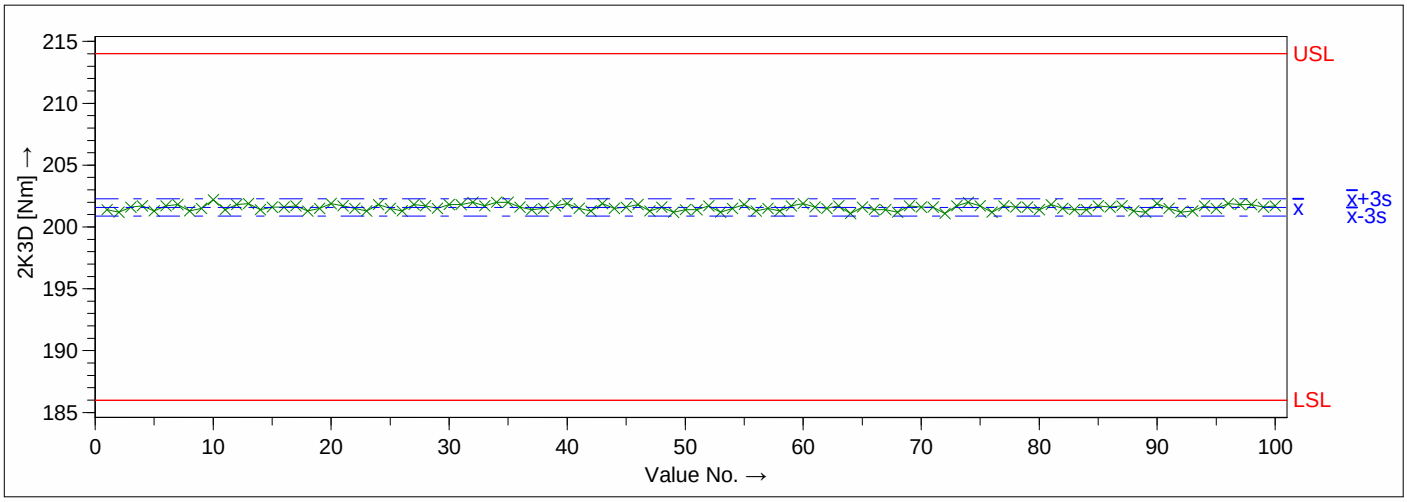
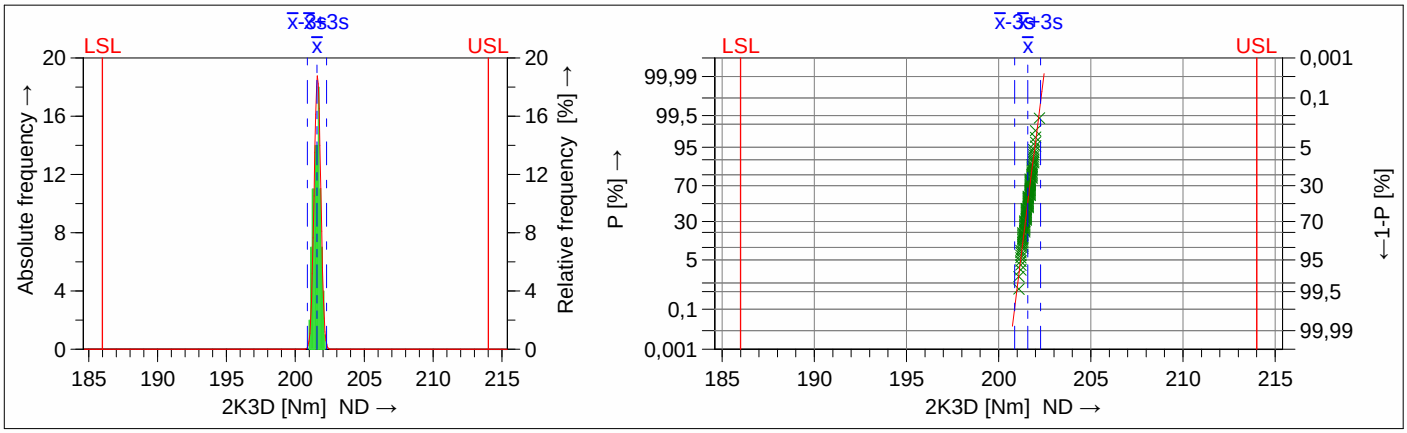
Plant	ATG Westhausen	Operator Name	Sünder
Date	26.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756055_b	Char.Descr.	2K3D	Nom.val.	200,00 14,00
		Serial No.	206285	Unit	Nm -14,00
				USL	214,00
				LSL	186,00
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	250 / 5537037	nges.	100

Evaluation from 26.04.2022 07:54:07 to 26.04.2022 08:08:56

Rem. TQ 100% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.691 Nm/A; Speed 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	200.00			$\bar{x}$	201.5760
LSL	186.00	x_{min}	201.10	$\bar{x}$-3s	200.8765
USL	214.00	x_{max}	202.20	$\bar{x}$+3s	202.2755
T	28.00	R	1.10	6s	1.3990
		$n_{<T>}$	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	20.01
Critical capability index	=	C_{mk}	17.76

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 26.04.2022

Serial No.	756055_b	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	200,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	186,00
				USL	214,00
Remark	TQ 100% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.691 Nm/A; Speed 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
206285	2K3D	Nm	201,40	201,20	201,60	201,70	201,30	201,70	201,80	201,30	201,50	202,20
206285	2K3D	Grad	31,00	31,00	31,00	31,00	30,00	31,00	31,00	30,00	31,00	31,00

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
206285	2K3D	Nm	201,40	201,80	201,90	201,40	201,60	201,60	201,70	201,30	201,50	201,90
206285	2K3D	Grad	31,00	31,00	31,00	31,00	31,00	31,00	30,00	30,00	30,00	31,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
206285	2K3D	Nm	201,70	201,50	201,30	201,80	201,50	201,30	201,80	201,70	201,50	201,80
206285	2K3D	Grad	30,00	30,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	30,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
206285	2K3D	Nm	201,80	202,00	201,70	202,00	202,00	201,60	201,40	201,50	201,70	201,90
206285	2K3D	Grad	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
206285	2K3D	Nm	201,50	201,30	201,90	201,50	201,60	201,80	201,30	201,60	201,20	201,40
206285	2K3D	Grad	31,00	31,00	30,00	30,00	30,00	30,00	31,00	30,00	31,00	30,00

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
206285	2K3D	Nm	201,40	201,70	201,20	201,50	201,80	201,30	201,50	201,30	201,70	201,90
206285	2K3D	Grad	30,00	31,00	31,00	30,00	31,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
206285	2K3D	Nm	201,60	201,50	201,70	201,10	201,60	201,40	201,40	201,20	201,70	201,60
206285	2K3D	Grad	30,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00	31,00	30,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
206285	2K3D	Nm	201,60	201,10	201,70	202,00	201,70	201,20	201,70	201,60	201,60	201,40
206285	2K3D	Grad	30,00	30,00	31,00	30,00	31,00	30,00	30,00	30,00	30,00	30,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 26.04.2022

Serial No.	756055_b	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	200,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	186,00
				USL	214,00
Remark	TQ 100% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.691 Nm/A; Speed 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
206285	2K3D	Nm	201,80	201,50	201,40	201,40	201,70	201,60	201,70	201,30	201,20	201,90
206285	2K3D	Grad	30,00	30,00	30,00	30,00	30,00	30,00	30,00	31,00	30,00	30,00

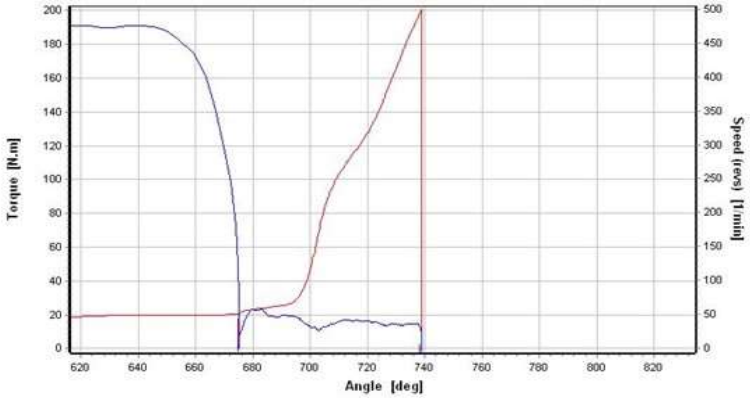
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206285	2K3D	Nm	201,50	201,20	201,30	201,70	201,50	201,90	201,80	201,80	201,60	201,70
206285	2K3D	Grad	31,00	31,00	31,00	31,00	30,00	31,00	30,00	30,00	31,00	30,00

Torque graphs

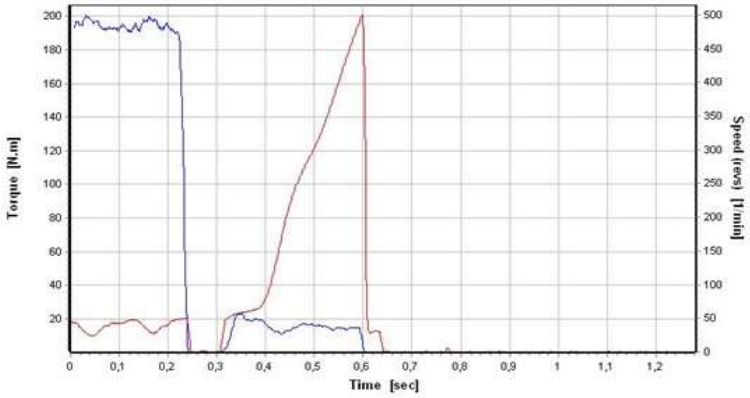
Machine Capability Study 100 %

Model: **2BD-2B200A-2K3D-2ZB**
Serial no: **756055**

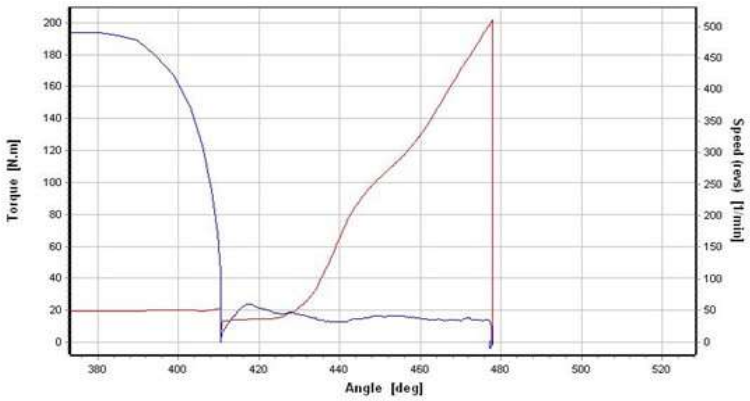
Angle degree: **30°**
Test torque: **200,0 Nm**



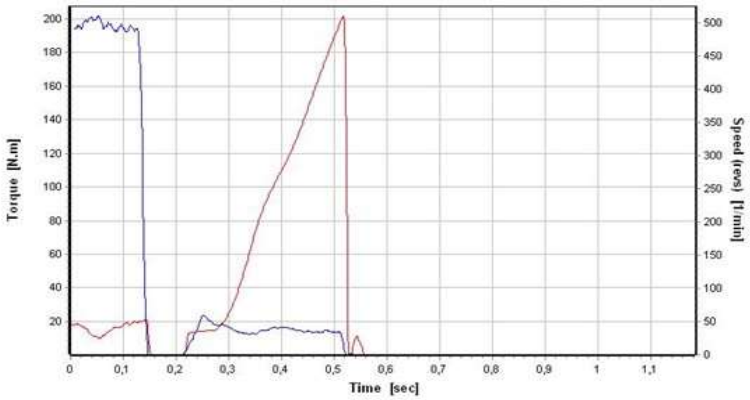
Value no. 1
Graph
Torque / Angle / Speed



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

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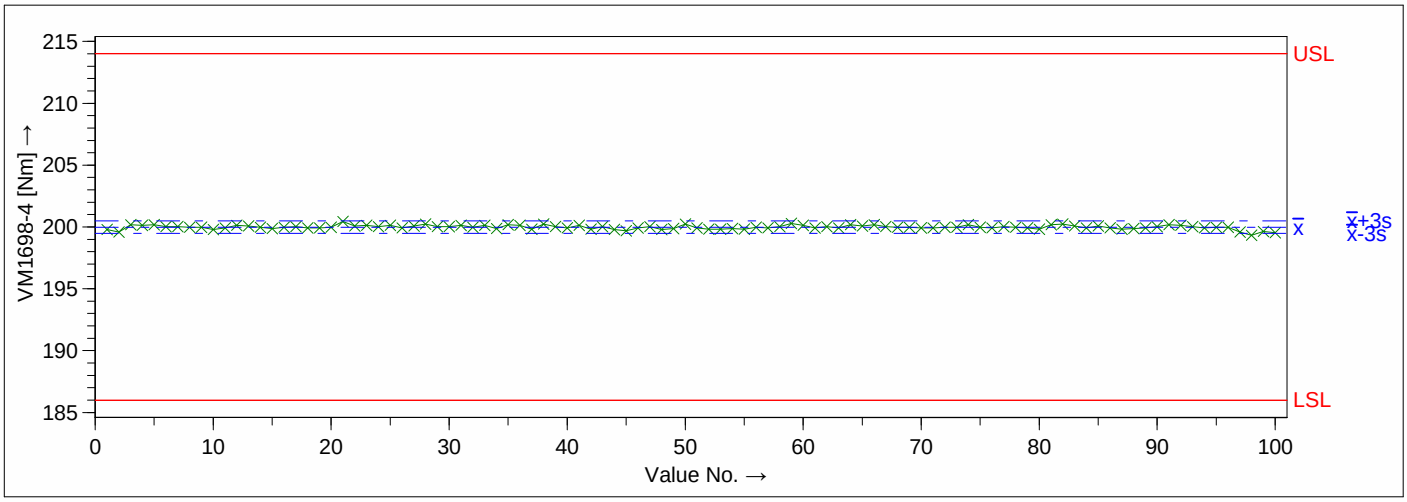
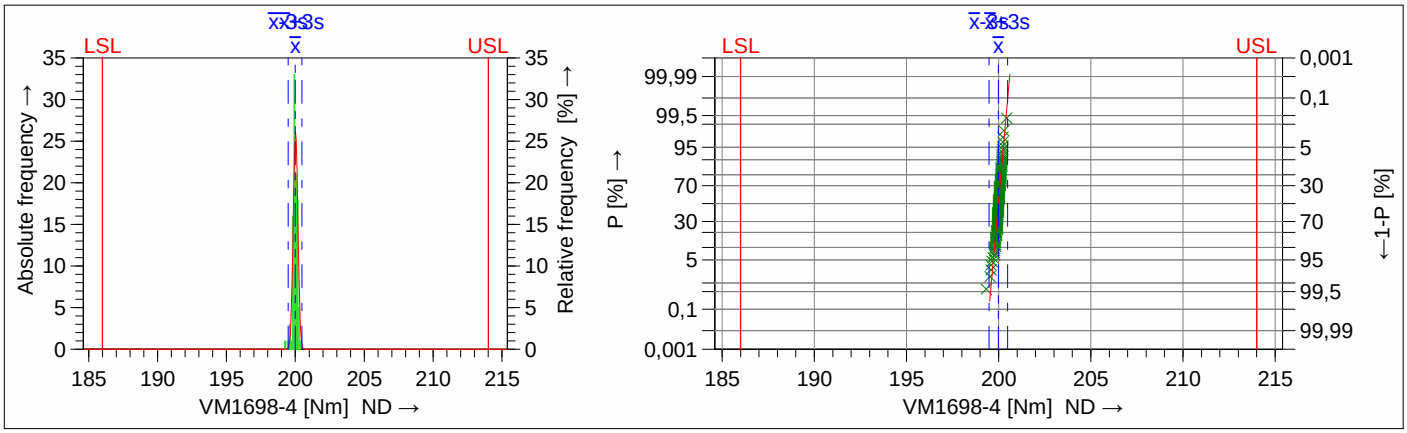
Plant	ATG Westhausen	Operator Name	Sünder
Date	26.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756055_a	Char.Descr.	VM1698-4	Nom.val.	200,00 14,00
		Serial No.	1024210	Unit	Nm -14,00
				USL	214,00
				LSL	186,00
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	250 / 5537037	nges.	100

Evaluation from 25.04.2022 15:27:59 to 26.04.2022 07:39:13

Rem. TQ 100% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.691 Nm/A; Speed 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	200.00			$\bar{x}$	199.9840
LSL	186.00	x_{min}	199.33	$\bar{x}$-3s	199.4837
USL	214.00	x_{max}	200.43	$\bar{x}$+3s	200.4843
T	28.00	R	1.10	6s	1.0006
		$n_{<T>}$	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	27.98
Critical capability index	=	C_{mk}	27.95

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 26.04.2022

Serial No.	756055_a	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	200,00
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	186,00
				USL	214,00
Remark	TQ 100% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.691 Nm/A; Speed 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	Nm	199,78	199,58	200,18	200,13	200,18	200,03	200,03	199,98	199,98	199,78
1024210	VM1698-4	Grad	346,00	364,25	346,00	340,00	345,00	329,75	329,25	329,75	319,50	342,50

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	Nm	199,93	200,13	200,08	199,98	199,88	199,98	200,03	199,93	199,93	199,98
1024210	VM1698-4	Grad	329,75	324,25	332,75	325,50	324,00	326,25	325,50	330,00	317,75	319,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	Nm	200,43	200,08	200,13	200,03	200,13	199,93	200,08	200,23	200,03	200,03
1024210	VM1698-4	Grad	329,00	333,75	329,75	331,50	337,75	336,00	335,00	335,00	338,00	334,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	Nm	200,13	199,98	200,13	199,88	200,18	200,13	199,83	200,23	200,03	199,93
1024210	VM1698-4	Grad	339,25	337,75	345,25	338,75	346,25	339,00	339,25	339,75	347,75	342,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	Nm	200,13	199,83	200,03	199,78	199,68	199,93	200,03	199,78	199,88	200,23
1024210	VM1698-4	Grad	355,50	356,00	353,25	352,75	357,75	351,50	356,25	351,75	352,50	343,50

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	199,93	199,83	199,83	199,88	199,83	199,98	199,93	200,03	200,28	200,13
1024210	VM1698-4	Grad	344,25	354,50	360,25	351,50	358,00	352,00	356,25	353,75	352,75	335,25

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	Nm	199,93	200,03	199,93	200,18	200,08	200,18	200,03	199,98	199,98	199,93
1024210	VM1698-4	Grad	360,00	354,75	361,00	348,25	359,00	351,50	360,50	360,25	359,75	356,75

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	Nm	199,93	199,98	199,98	200,18	199,98	199,93	200,03	199,98	199,93	199,83
1024210	VM1698-4	Grad	348,00	349,00	353,25	351,00	344,25	348,25	360,00	355,25	360,75	354,50

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 26.04.2022

Serial No.	756055_a	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	200,00
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	186,00
				USL	214,00
Remark	TQ 100% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.691 Nm/A; Speed 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	Nm	200,18	200,23	200,08	199,93	200,08	199,93	199,83	199,88	199,93	200,03
1024210	VM1698-4	Grad	353,00	355,00	351,00	355,25	357,00	357,75	353,00	353,50	352,75	352,00

Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	200,18	200,13	200,03	199,93	199,98	199,98	199,58	199,33	199,63	199,53
1024210	VM1698-4	Grad	355,00	350,25	357,25	353,25	356,50	354,00	365,50	370,25	376,25	383,00

Machine Capability Study
Tool System

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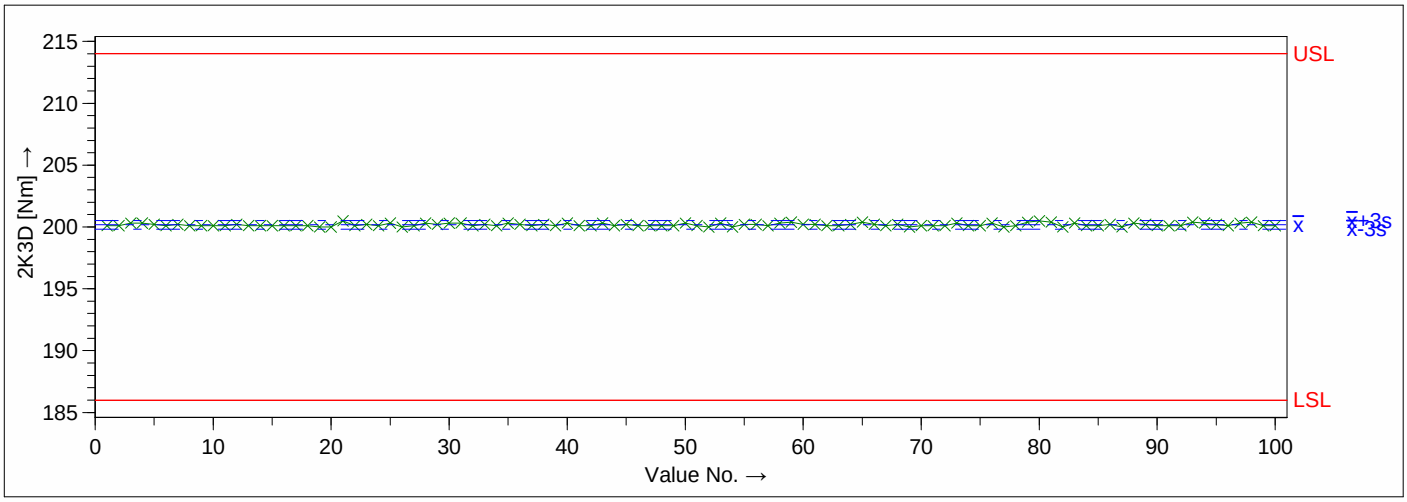
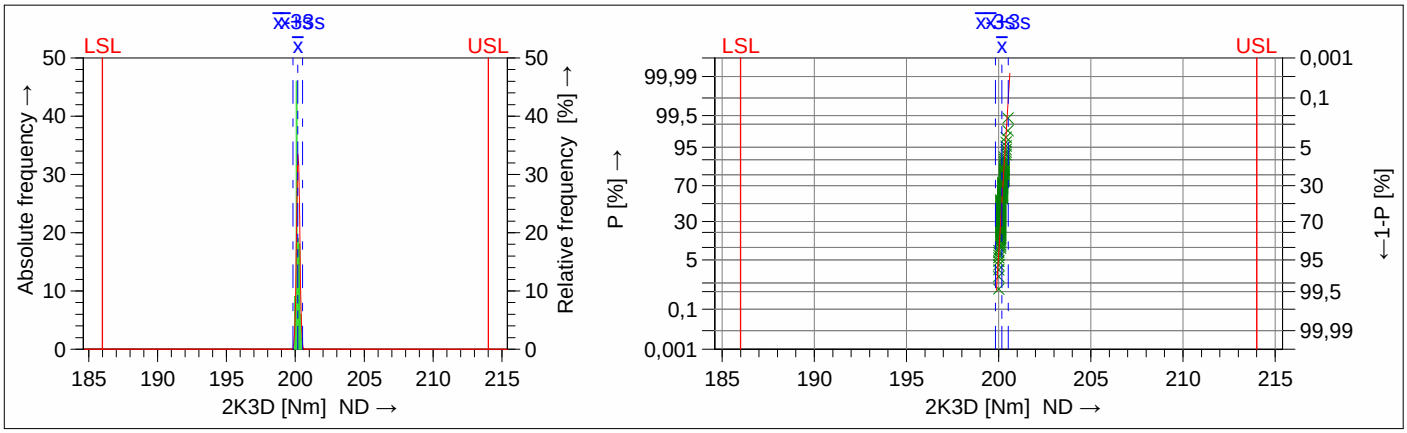
Plant	ATG Westhausen	Operator Name	Sünder
Date	26.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756055_a	Char.Descr.	2K3D	Nom.val.	200,00 14,00
		Serial No.	206285	Unit	Nm -14,00
				USL	214,00
				LSL	186,00
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	250 / 5537037	nges.	100

Evaluation from 25.04.2022 15:27:59 to 26.04.2022 07:39:14

Rem. TQ 100% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.691 Nm/A; Speed 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	200.00			$\bar{x}$	200.1720
LSL	186.00	x_{min}	200.00	$\bar{x}$-3s	199.8228
USL	214.00	x_{max}	200.50	$\bar{x}$+3s	200.5212
T	28.00	R	0.50	6s	0.6985
		$n_{<T>}$	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	40.09
Critical capability index	=	C_{mk}	39.60

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 26.04.2022

Serial No.	756055_a	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	200,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	186,00
				USL	214,00
Remark	TQ 100% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.691 Nm/A; Speed 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
206285	2K3D	Nm	200,10	200,10	200,30	200,30	200,20	200,10	200,20	200,10	200,10	200,10
206285	2K3D	Grad	347,00	365,00	346,00	341,00	345,00	331,00	330,00	331,00	320,00	344,00

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
206285	2K3D	Nm	200,10	200,20	200,10	200,10	200,10	200,10	200,10	200,10	200,00	200,00
206285	2K3D	Grad	330,00	324,00	334,00	326,00	325,00	326,00	325,00	331,00	319,00	320,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
206285	2K3D	Nm	200,50	200,10	200,20	200,10	200,30	200,00	200,10	200,30	200,20	200,30
206285	2K3D	Grad	330,00	335,00	330,00	331,00	339,00	337,00	336,00	335,00	339,00	336,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
206285	2K3D	Nm	200,30	200,10	200,20	200,10	200,30	200,20	200,10	200,20	200,10	200,30
206285	2K3D	Grad	340,00	339,00	347,00	340,00	347,00	340,00	340,00	341,00	349,00	343,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
206285	2K3D	Nm	200,10	200,10	200,30	200,10	200,20	200,10	200,10	200,10	200,10	200,30
206285	2K3D	Grad	356,00	357,00	354,00	354,00	359,00	353,00	358,00	353,00	354,00	344,00

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
206285	2K3D	Nm	200,10	200,00	200,30	200,00	200,20	200,20	200,10	200,30	200,40	200,20
206285	2K3D	Grad	345,00	355,00	362,00	352,00	359,00	354,00	357,00	355,00	354,00	336,00

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
206285	2K3D	Nm	200,20	200,10	200,10	200,20	200,40	200,20	200,10	200,20	200,00	200,10
206285	2K3D	Grad	361,00	356,00	362,00	349,00	360,00	352,00	361,00	361,00	361,00	349,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
206285	2K3D	Nm	200,10	200,10	200,30	200,10	200,10	200,30	200,00	200,10	200,40	200,50
206285	2K3D	Grad	350,00	354,00	352,00	349,00	361,00	357,00	362,00	356,00	354,00	356,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 26.04.2022

Serial No.	756055_a	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	200,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	186,00
				USL	214,00
Remark	TQ 100% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.691 Nm/A; Speed 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
206285	2K3D	Nm	200,40	200,00	200,30	200,10	200,10	200,20	200,00	200,30	200,20	200,10
206285	2K3D	Grad	352,00	356,00	358,00	359,00	354,00	354,00	353,00	355,00	358,00	354,00

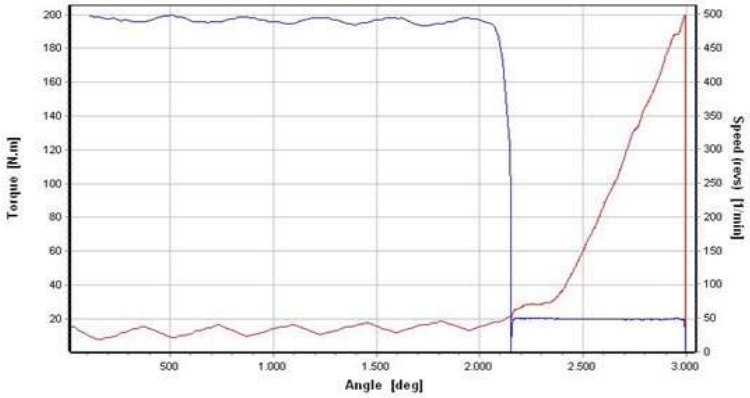
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206285	2K3D	Nm	200,10	200,10	200,40	200,30	200,20	200,10	200,30	200,40	200,10	200,10
206285	2K3D	Grad	357,00	354,00	350,00	359,00	355,00	355,00	367,00	372,00	377,00	384,00

Torque graphs

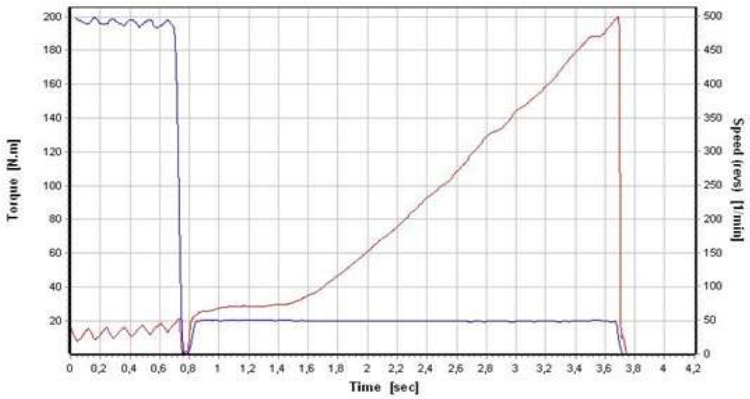
Machine Capability Study 100 %

Model: **2BD-2B200A-2K3D-2ZB**
Serial no: **756055**

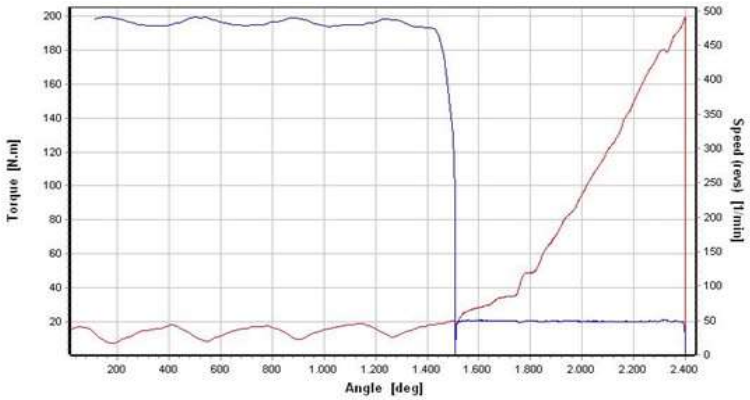
Angle degree: **360°**
Test torque: **200,0 Nm**



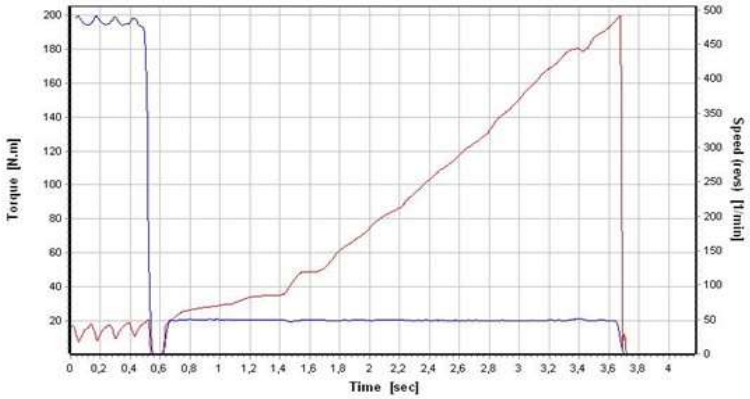
Value no. 1
Graph
Torque / Angle / Speed



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-2B200A-2K3D-2ZB **Serial no:** 756055

Torque range: **20 Nm to 200 Nm**

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

Capability examination

Snugfit value: 40 Nm **Torque tolerance ±** 7 %

Target torque: 120 Nm Tolerance: 1,22 % ± **0,61 %**

Angle degree: 40° Tolerance: 2,7° ± **1,3°**

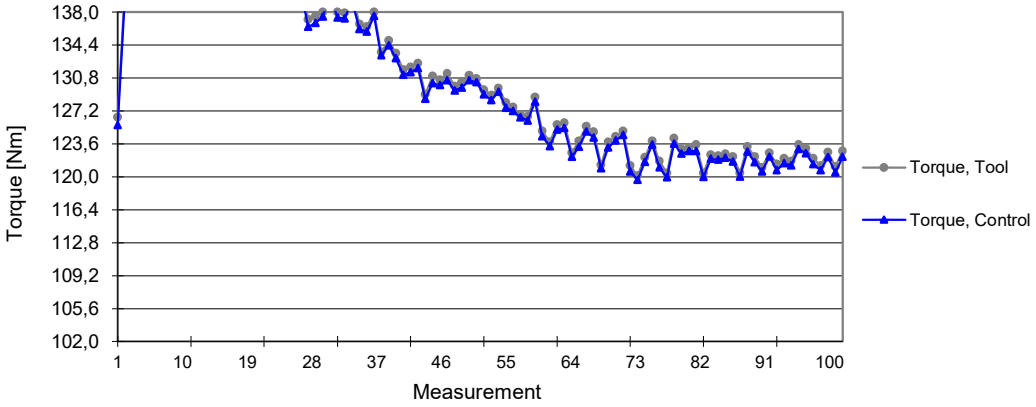
Formula derivation: $C_m = \frac{T}{6\,s}$ $T = C_m * 6\,s$

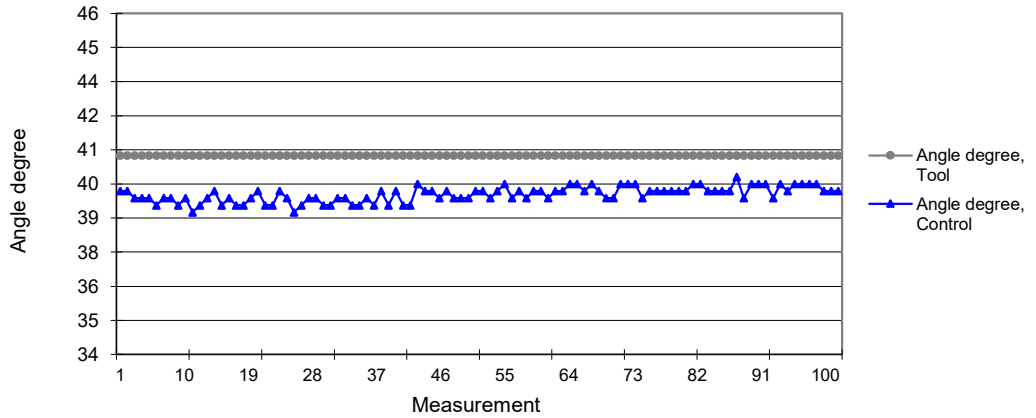
Tool without angle correction

Measurement	Tool data		Control data		Difference	
No.	Torque	Angle	Torque	Angle	Torque	Angle
1	126,50	41,00	125,66	39,75	0,84	1,25
2	140,90	41,00	140,00	39,75	0,90	1,25
3	141,50	41,00	140,52	39,50	0,98	1,50
4	141,90	41,00	140,91	39,50	0,99	1,50
5	142,00	41,00	141,18	39,50	0,82	1,50
6	141,90	41,00	141,23	39,25	0,67	1,75
7	142,60	41,00	141,97	39,50	0,63	1,50
8	142,80	41,00	142,00	39,50	0,80	1,50
9	141,90	41,00	141,21	39,25	0,69	1,75
10	142,30	41,00	141,70	39,50	0,60	1,50
11	143,80	41,00	142,93	39,00	0,87	2,00
12	143,30	41,00	142,54	39,25	0,76	1,75
13	142,70	41,00	141,85	39,50	0,85	1,50
14	144,00	41,00	143,23	39,75	0,77	1,25
15	142,20	41,00	141,50	39,25	0,70	1,75
16	140,30	41,00	139,73	39,50	0,57	1,50
17	142,30	41,00	141,60	39,25	0,70	1,75
18	141,80	41,00	141,11	39,25	0,69	1,75
19	140,50	41,00	139,78	39,50	0,72	1,50
20	141,20	41,00	140,47	39,75	0,73	1,25
21	140,80	41,00	140,02	39,25	0,78	1,75
22	141,90	41,00	141,06	39,25	0,84	1,75
23	139,60	41,00	138,99	39,75	0,61	1,25
24	139,00	41,00	138,37	39,50	0,63	1,50
25	139,80	41,00	139,14	39,00	0,66	2,00
26	141,30	41,00	140,49	39,25	0,81	1,75
27	137,20	41,00	136,38	39,50	0,82	1,50
28	137,50	41,00	136,82	39,50	0,68	1,50
29	138,00	41,00	137,51	39,25	0,49	1,75
30	140,40	41,00	139,80	39,25	0,60	1,75
31	138,00	41,00	137,41	39,50	0,59	1,50
32	137,90	41,00	137,31	39,50	0,59	1,50
33	140,00	41,00	139,26	39,25	0,74	1,75
34	136,70	41,00	136,13	39,25	0,57	1,75
35	136,40	41,00	135,86	39,50	0,54	1,50
36	138,00	41,00	137,56	39,25	0,44	1,75
37	133,60	41,00	133,27	39,75	0,33	1,25
38	134,90	41,00	134,36	39,25	0,54	1,75
39	133,50	41,00	132,95	39,75	0,55	1,25
40	131,70	41,00	131,15	39,25	0,55	1,75
41	132,00	41,00	131,42	39,25	0,58	1,75
42	132,40	41,00	131,87	40,00	0,53	1,00
43	129,00	41,00	128,49	39,75	0,51	1,25
44	131,00	41,00	130,24	39,75	0,76	1,25
45	130,60	41,00	130,02	39,50	0,58	1,50
46	131,30	41,00	130,54	39,75	0,76	1,25
47	129,90	41,00	129,43	39,50	0,47	1,50
48	130,30	41,00	129,75	39,50	0,55	1,50
49	131,10	41,00	130,54	39,50	0,56	1,50
50	130,70	41,00	130,32	39,75	0,38	1,25
51	129,50	41,00	129,01	39,75	0,49	1,25
52	128,90	41,00	128,39	39,50	0,51	1,50
53	129,70	41,00	129,28	39,75	0,42	1,25
54	128,10	41,00	127,53	40,00	0,57	1,00
55	127,60	41,00	127,19	39,50	0,41	1,50
56	126,80	41,00	126,50	39,75	0,30	1,25
57	126,60	41,00	126,15	39,50	0,45	1,50
58	128,70	41,00	128,20	39,75	0,50	1,25
59	125,00	41,00	124,45	39,75	0,55	1,25
60	123,80	41,00	123,34	39,50	0,46	1,50
61	125,70	41,00	125,17	39,75	0,53	1,25
62	125,90	41,00	125,34	39,75	0,56	1,25
63	122,60	41,00	122,18	40,00	0,42	1,00
64	123,90	41,00	123,27	40,00	0,63	1,00
65	125,50	41,00	124,92	39,75	0,58	1,25
66	124,90	41,00	124,30	40,00	0,60	1,00
67	121,30	41,00	120,93	39,75	0,37	1,25
68	123,80	41,00	123,20	39,50	0,60	1,50
69	124,40	41,00	123,96	39,50	0,44	1,50
70	125,00	41,00	124,55	40,00	0,45	1,00
71	121,20	41,00	120,56	40,00	0,64	1,00
72	120,10	41,00	119,65	40,00	0,45	1,00
73	122,10	41,00	121,62	39,50	0,48	1,50
74	123,90	41,00	123,52	39,75	0,38	1,25
75	121,70	41,00	121,00	39,75	0,70	1,25
76	120,40	41,00	119,94	39,75	0,46	1,25
77	124,20	41,00	123,61	39,75	0,59	1,25
78	123,00	41,00	122,51	39,75	0,49	1,25
79	123,20	41,00	122,80	39,75	0,40	1,25
80	123,50	41,00	122,80	40,00	0,70	1,00
81	120,40	41,00	119,97	40,00	0,43	1,00
82	122,40	41,00	121,96	39,75	0,44	1,25
83	122,30	41,00	121,84	39,75	0,46	1,25
84	122,50	41,00	122,09	39,75	0,41	1,25
85	122,20	41,00	121,64	39,75	0,56	1,25
86	120,40	41,00	120,02	40,25	0,38	0,75
87	123,30	41,00	122,75	39,50	0,55	1,50
88	122,20	41,00	121,59	40,00	0,61	1,00
89	121,00	41,00	120,58	40,00	0,42	1,00
90	122,60	41,00	122,21	40,00	0,39	1,00
91	121,40	41,00	120,73	39,50	0,67	1,50
92	122,00	41,00	121,47	40,00	0,53	1,00
93	121,70	41,00	121,25	39,75	0,45	1,25
94	123,50	41,00	123,00	40,00	0,50	1,00
95	123,10	41,00	122,58	40,00	0,52	1,00
96	122,00	41,00	121,35	40,00	0,65	1,00
97	121,20	41,00	120,71	40,00	0,49	1,00
98	122,70	41,00	122,14	39,75	0,56	1,25
99	121,10	41,00	120,46	39,75	0,64	1,25
100	122,80	41,00	122,16	39,75	0,64	1,25
				Standard deviation:	**0,146**	**0,267**

Graphical representation

Model:	**2BD-2B200A-2K3D-2ZB**	Serial no:	**756055**
Target torque:	**120,00 Nm**	60 % of max. torque	
Angle degree:	**40°**	Tool without angle correction	





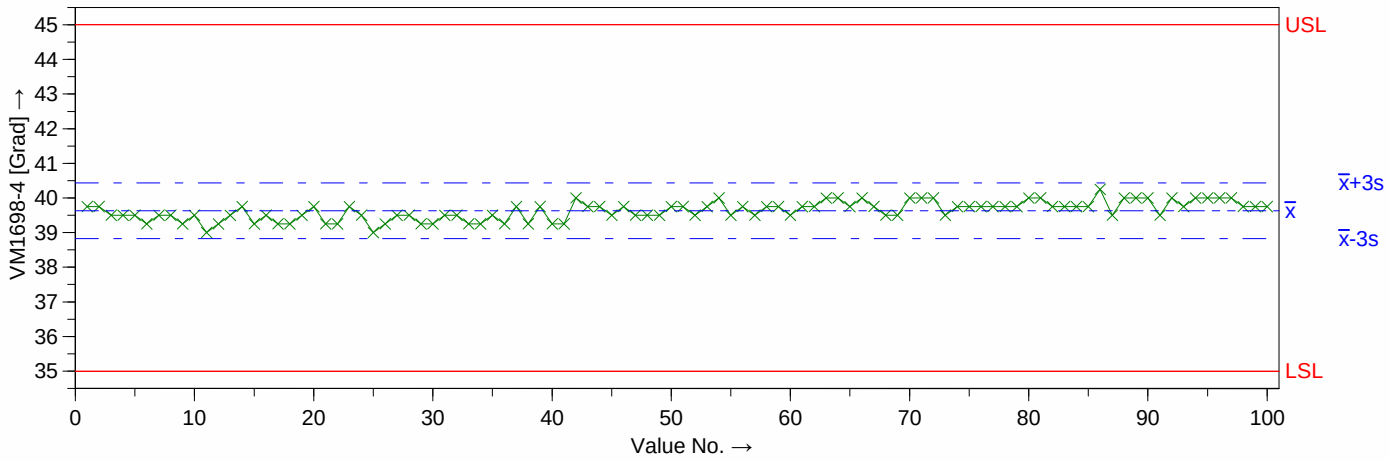
Machine Capability Study
Control System

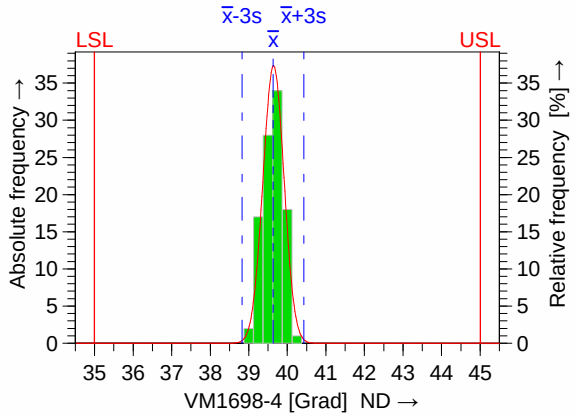
Plant	ATG Westhausen	Operator Name	Sünder
Date	26.04.2022		

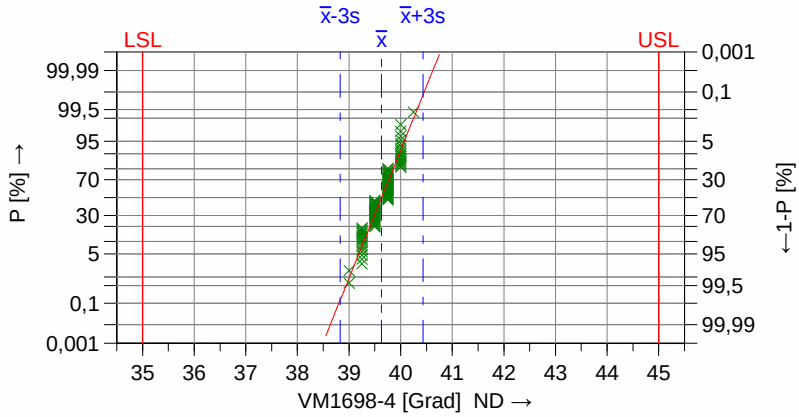
Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756055_k	Char.Descr.	VM1698-4	Nom.val. 40,00 5,00	USL 45,00
		Serial No.	1024210	Unit Grad -5,00	LSL 35,00
Char.Type	variable			Tolerance value 12 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	120 / 1019923	nges.	100

Evaluation from 26.04.2022 13:06:41 to 26.04.2022 13:21:18

Rem. TQ 60% Angle 40° +/-5° * TQ-Cal.: 200 Nm; Cur-Cal.: 5.808 Nm/A; Speed 300/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	40.00			$\bar{x}$	39.6300
LSL	35.00	x_{min}	39.00	$\bar{x}$-3s	38.8289
USL	45.00	x_{max}	40.25	$\bar{x}$+3s	40.4311
T	10.00	R	1.25	6s	1.6023
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			M1.1.4 $\hat{\sigma} = S_{tot}$
Potential Capability index	=	C_m	6.24
Critical capability index	=	C_{mk}	5.78

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 26.04.2022

Serial No.	756055_k	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	132,77
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	95,72
				USL	175,08
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 200 Nm; Cur -Cal.: 5.808 Nm/A; Speed 300/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	Nm	125,66	140,00	140,52	140,91	141,18	141,23	141,97	142,00	141,21	141,70
1024210	VM1698-4	Grad	39,75	39,75	39,50	39,50	39,50	39,25	39,50	39,50	39,25	39,50

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	Nm	142,93	142,54	141,85	143,23	141,50	139,73	141,60	141,11	139,78	140,47
1024210	VM1698-4	Grad	39,00	39,25	39,50	39,75	39,25	39,50	39,25	39,25	39,50	39,75

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	Nm	140,02	141,06	138,99	138,37	139,14	140,49	136,38	136,82	137,51	139,80
1024210	VM1698-4	Grad	39,25	39,25	39,75	39,50	39,00	39,25	39,50	39,50	39,25	39,25

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	Nm	137,41	137,31	139,26	136,13	135,86	137,56	133,27	134,36	132,95	131,15
1024210	VM1698-4	Grad	39,50	39,50	39,25	39,25	39,50	39,25	39,75	39,25	39,75	39,25

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	Nm	131,42	131,87	128,49	130,24	130,02	130,54	129,43	129,75	130,54	130,32
1024210	VM1698-4	Grad	39,25	40,00	39,75	39,75	39,50	39,75	39,50	39,50	39,50	39,75

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	129,01	128,39	129,28	127,53	127,19	126,50	126,15	128,20	124,45	123,34
1024210	VM1698-4	Grad	39,75	39,50	39,75	40,00	39,50	39,75	39,50	39,75	39,75	39,50

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	Nm	125,17	125,34	122,18	123,27	124,92	124,30	120,93	123,20	123,96	124,55
1024210	VM1698-4	Grad	39,75	39,75	40,00	40,00	39,75	40,00	39,75	39,50	39,50	40,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	Nm	120,56	119,65	121,62	123,52	121,00	119,94	123,61	122,51	122,80	122,80
1024210	VM1698-4	Grad	40,00	40,00	39,50	39,75	39,75	39,75	39,75	39,75	39,75	40,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 26.04.2022

Serial No.	756055_k	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	132,77
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	95,72
				USL	175,08
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 200 Nm; Cur -Cal.: 5.808 Nm/A; Speed 300/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	Nm	119,97	121,96	121,84	122,09	121,64	120,02	122,75	121,59	120,58	122,21
1024210	VM1698-4	Grad	40,00	39,75	39,75	39,75	39,75	40,25	39,50	40,00	40,00	40,00

Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	120,73	121,47	121,25	123,00	122,58	121,35	120,71	122,14	120,46	122,16
1024210	VM1698-4	Grad	39,50	40,00	39,75	40,00	40,00	40,00	40,00	39,75	39,75	39,75

Machine Capability Study
Tool System

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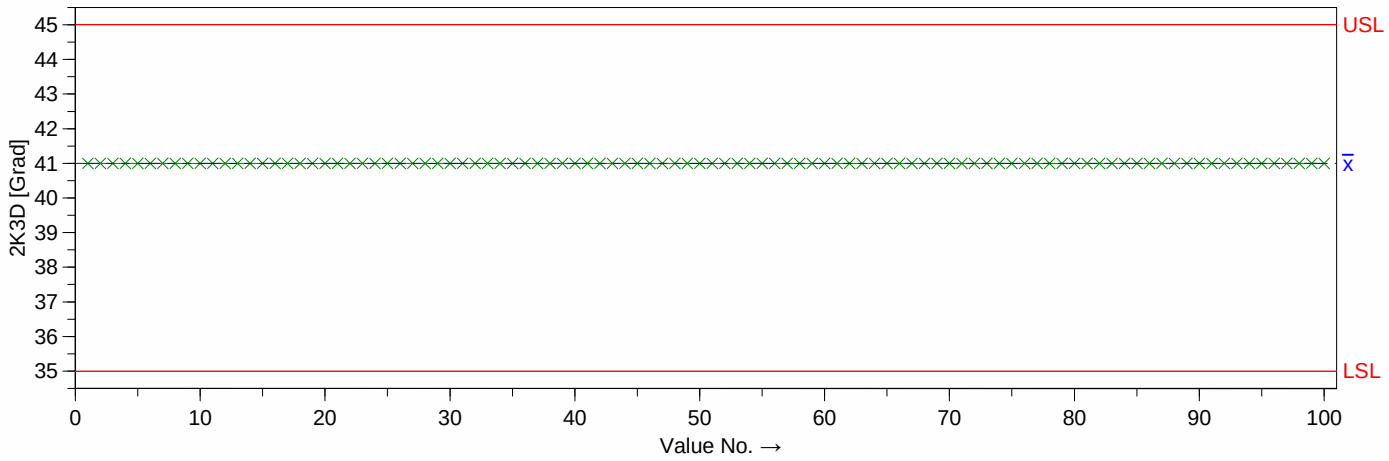
Plant ATG Westhausen		Operator Name Sünder	Date 26.04.2022

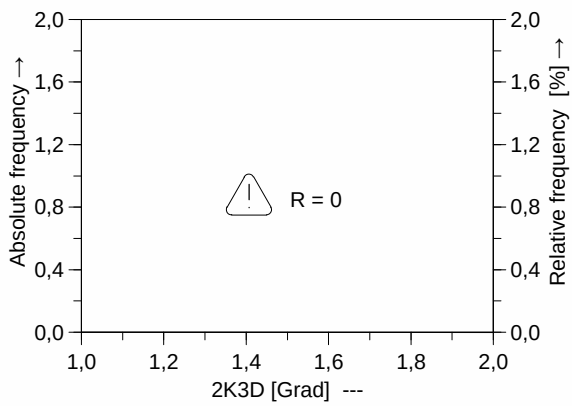
Ord. No. 2BD200T1S-A	Part type 2BD-2B200A-2K3D-2ZB				Contr.item yes
Serial No. 756055_k	Char.Descr. 2K3D	Nom.val.	40,00	5,00	USL 45,00
	Serial No. 206285	Unit	Grad	-5,00	LSL 35,00
Char.Type variable		Tolerance value	12 %		Decimal Pl. 2

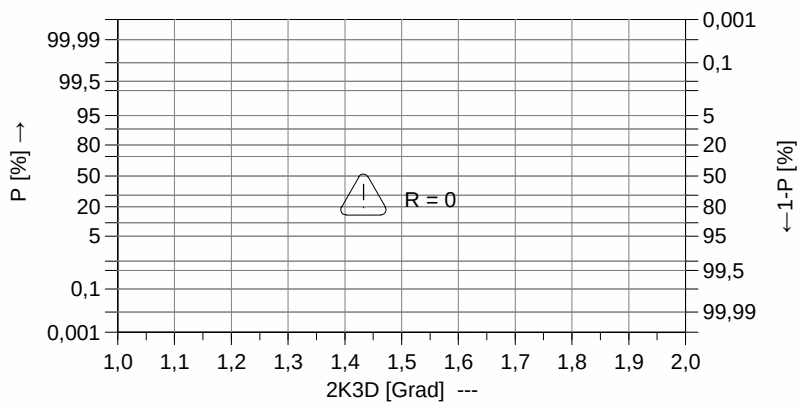
Cust.Name Cleco	Reference System VM1698-4	Test Electronic MPRO400GCD-P
Contr.No. Homologation	Reference Transducer 120 / 1019923	nges. 100

Evaluation from 26.04.2022 13:06:41 to 26.04.2022 13:21:18

Rem. TQ 60% Angle 40° +/-5° * TQ-Cal.: 200 Nm; Cur-Cal.: 5.808 Nm/A; Speed 300/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	40.00			$\bar{x}$	41.0000
LSL	35.00	x_{min}	41.00		
USL	45.00	x_{max}	41.00		
T	10.00	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 26.04.2022

Serial No.	756055_k	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	72,95
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	0,00
				USL	175,08
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 200 Nm; Cur -Cal.: 5.808 Nm/A; Speed 300/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
206285	2K3D	Nm	126,50	140,90	141,50	141,90	142,00	141,90	142,60	142,80	141,90	142,30
206285	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
206285	2K3D	Nm	143,80	143,30	142,70	144,00	142,20	140,30	142,30	141,80	140,50	141,20
206285	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
206285	2K3D	Nm	140,80	141,90	139,60	139,00	139,80	141,30	137,20	137,50	138,00	140,40
206285	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
206285	2K3D	Nm	138,00	137,90	140,00	136,70	136,40	138,00	133,60	134,90	133,50	131,70
206285	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
206285	2K3D	Nm	132,00	132,40	129,00	131,00	130,60	131,30	129,90	130,30	131,10	130,70
206285	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
206285	2K3D	Nm	129,50	128,90	129,70	128,10	127,60	126,80	126,60	128,70	125,00	123,80
206285	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
206285	2K3D	Nm	125,70	125,90	122,60	123,90	125,50	124,90	121,30	123,80	124,40	125,00
206285	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
206285	2K3D	Nm	121,20	120,10	122,10	123,90	121,70	120,40	124,20	123,00	123,20	123,50
206285	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 26.04.2022

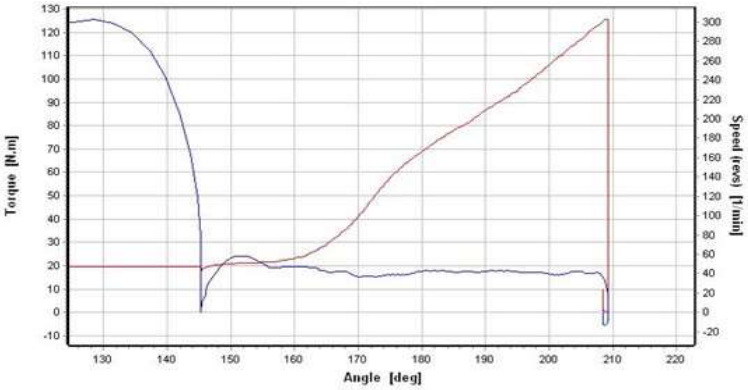
Serial No.	756055_k	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	72,95
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	0,00
				USL	175,08
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 200 Nm; Cur -Cal.: 5.808 Nm/A; Speed 300/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
206285	2K3D	Nm	120,40	122,40	122,30	122,50	122,20	120,40	123,30	122,20	121,00	122,60
206285	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

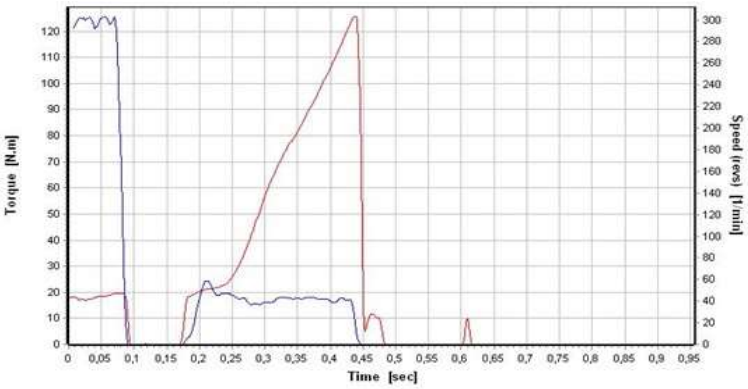
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206285	2K3D	Nm	121,40	122,00	121,70	123,50	123,10	122,00	121,20	122,70	121,10	122,80
206285	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Torque graphs

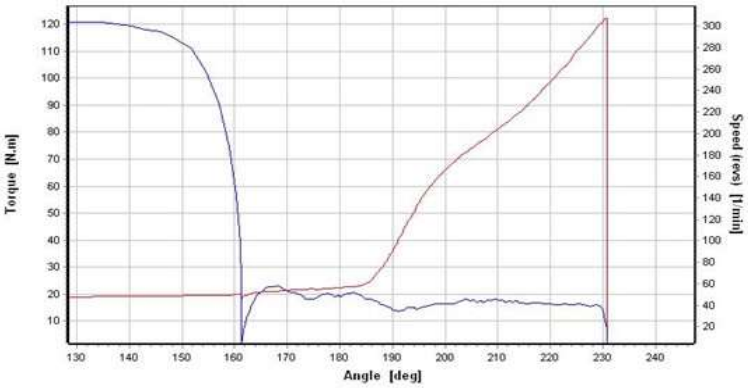
Model:	**2BD-2B200A-2K3D-2ZB**	Serial no:	**756055**
Target torque:	**120,00 Nm**	60 % of max. torque	
Angle degree:	**40°**	Tool without angle correction	



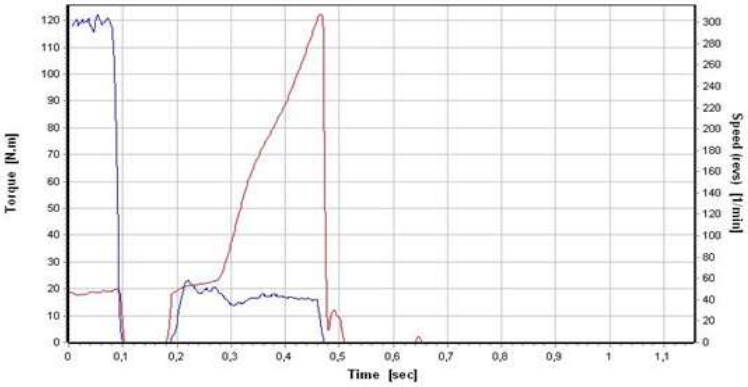
Value no. 1
Graph
Torque / Angle / Speed



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-2B200A-2K3D-2ZB **Serial no:** 756055

Torque range: **20 Nm to 200 Nm**

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

Capability examination

Snugfit value: 40 Nm **Torque tolerance ±** 7 %

Target torque: 160 Nm Tolerance: 0,66 % ± **0,33 %**

Angle degree: 180° Tolerance: 4,5° ± **2,2°**

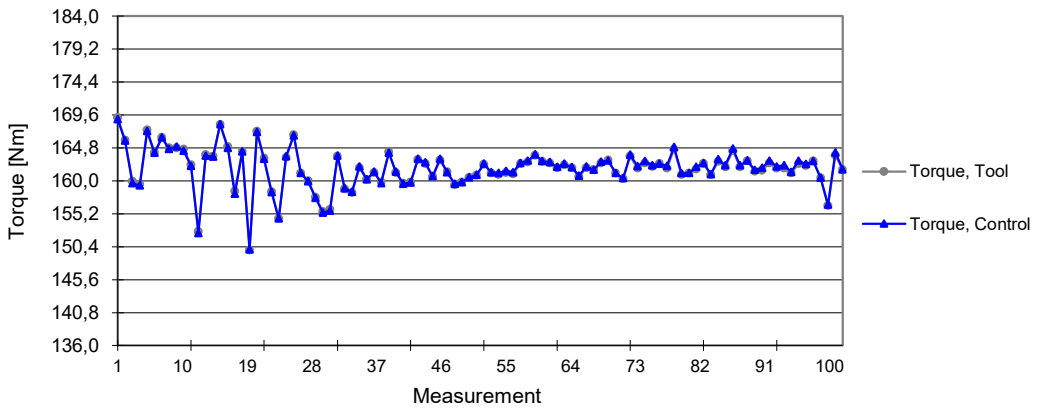
Formula derivation: $C_m = \frac{T}{6\,s}$ $T = C_m * 6\,s$

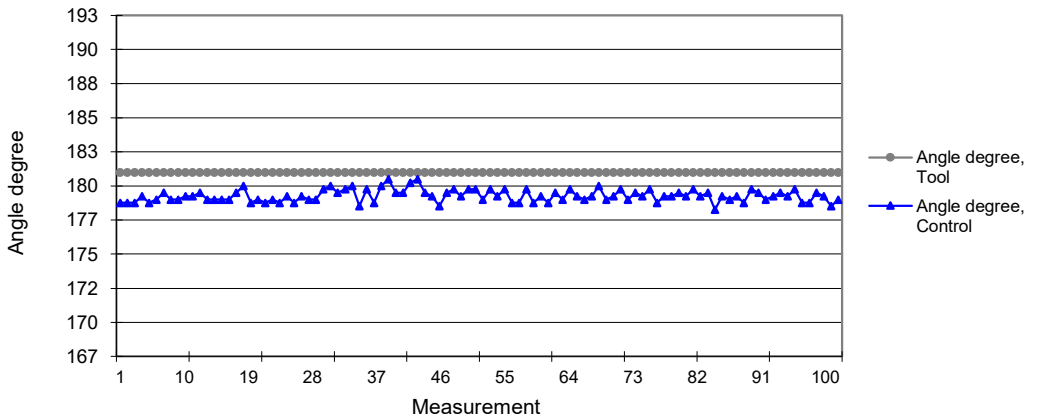
Tool without angle correction

Measurement	Tool data		Control data		Difference	
No.	Torque	Angle	Torque	Angle	Torque	Angle
1	169,20	181,00	168,98	178,75	0,22	2,25
2	165,90	181,00	165,82	178,75	0,08	2,25
3	159,90	181,00	159,66	178,75	0,24	2,25
4	159,50	181,00	159,31	179,25	0,19	1,75
5	167,40	181,00	167,23	178,75	0,17	2,25
6	164,10	181,00	164,07	179,00	0,03	2,00
7	166,30	181,00	166,32	179,50	0,02	1,50
8	164,80	181,00	164,62	179,00	0,18	2,00
9	164,80	181,00	164,97	179,00	0,17	2,00
10	164,60	181,00	164,37	179,25	0,23	1,75
11	162,30	181,00	162,17	179,25	0,13	1,75
12	152,60	181,00	152,35	179,50	0,25	1,50
13	163,80	181,00	163,62	179,00	0,18	2,00
14	163,60	181,00	163,52	179,00	0,08	2,00
15	168,20	181,00	168,23	179,00	0,03	2,00
16	165,00	181,00	164,77	179,00	0,23	2,00
17	158,50	181,00	158,11	179,50	0,39	1,50
18	164,30	181,00	164,27	180,00	0,03	1,00
19	149,90	181,00	150,00	178,75	0,10	2,25
20	167,20	181,00	167,13	179,00	0,07	2,00
21	163,30	181,00	163,17	178,75	0,13	2,25
22	158,40	181,00	158,31	179,00	0,09	2,00
23	154,50	181,00	154,50	178,75	0,00	2,25
24	163,40	181,00	163,57	179,25	0,17	1,75
25	166,70	181,00	166,62	178,75	0,08	2,25
26	161,10	181,00	161,17	179,25	0,07	1,75
27	160,00	181,00	159,91	179,00	0,09	2,00
28	157,60	181,00	157,51	179,00	0,09	2,00
29	155,50	181,00	155,36	179,75	0,14	1,25
30	155,80	181,00	155,61	180,00	0,19	1,00
31	163,60	181,00	163,67	179,50	0,07	1,50
32	158,80	181,00	158,91	179,75	0,11	1,25
33	158,30	181,00	158,41	180,00	0,11	1,00
34	161,90	181,00	162,07	178,50	0,17	2,50
35	160,20	181,00	160,21	179,75	0,01	1,25
36	161,20	181,00	161,32	178,75	0,12	2,25
37	159,80	181,00	159,66	180,00	0,14	1,00
38	164,20	181,00	164,07	180,50	0,13	0,50
39	161,20	181,00	161,32	179,50	0,12	1,50
40	159,60	181,00	159,56	179,50	0,04	1,50
41	159,80	181,00	159,71	180,25	0,09	0,75
42	163,10	181,00	163,22	180,50	0,12	0,50
43	162,50	181,00	162,67	179,50	0,17	1,50
44	160,60	181,00	160,66	179,25	0,06	1,75
45	163,00	181,00	163,22	178,50	0,22	2,50
46	161,30	181,00	161,22	179,50	0,08	1,50
47	159,40	181,00	159,56	179,75	0,16	1,25
48	159,80	181,00	159,81	179,25	0,01	1,75
49	160,50	181,00	160,51	179,75	0,01	1,25
50	160,80	181,00	160,86	179,75	0,06	1,25
51	162,40	181,00	162,47	179,00	0,07	2,00
52	161,10	181,00	161,22	179,75	0,12	1,25
53	160,90	181,00	161,17	179,25	0,27	1,75
54	161,20	181,00	161,42	179,75	0,22	1,25
55	161,00	181,00	161,22	178,75	0,22	2,25
56	162,50	181,00	162,57	178,75	0,07	2,25
57	162,70	181,00	162,92	179,75	0,22	1,25
58	163,70	181,00	163,82	178,75	0,12	2,25
59	162,80	181,00	162,87	179,25	0,07	1,75
60	162,60	181,00	162,72	178,75	0,12	2,25
61	161,90	181,00	162,02	179,50	0,12	1,50
62	162,30	181,00	162,47	179,00	0,17	2,00
63	161,90	181,00	161,97	179,75	0,07	1,25
64	160,60	181,00	160,71	179,25	0,11	1,75
65	161,90	181,00	162,07	179,00	0,17	2,00
66	161,60	181,00	161,57	179,25	0,03	1,75
67	162,60	181,00	162,77	180,00	0,17	1,00
68	163,00	181,00	162,92	179,00	0,08	2,00
69	161,10	181,00	161,12	179,25	0,02	1,75
70	160,30	181,00	160,36	179,75	0,06	1,25
71	163,60	181,00	163,77	179,00	0,17	2,00
72	161,80	181,00	162,12	179,50	0,32	1,50
73	162,60	181,00	162,87	179,25	0,27	1,75
74	162,10	181,00	162,27	179,75	0,17	1,25
75	162,50	181,00	162,52	178,75	0,02	2,25
76	161,80	181,00	162,17	179,25	0,37	1,75
77	164,60	181,00	164,92	179,25	0,32	1,75
78	160,90	181,00	161,12	179,50	0,22	1,50
79	161,10	181,00	161,12	179,25	0,02	1,75
80	161,70	181,00	162,02	179,75	0,32	1,25
81	162,50	181,00	162,57	179,25	0,07	1,75
82	160,90	181,00	160,96	179,50	0,06	1,50
83	162,80	181,00	163,12	178,25	0,32	2,75
84	162,00	181,00	162,27	179,25	0,27	1,75
85	164,40	181,00	164,67	179,00	0,27	2,00
86	162,00	181,00	162,22	179,25	0,22	1,75
87	162,90	181,00	162,97	178,75	0,07	2,25
88	161,40	181,00	161,57	179,75	0,17	1,25
89	161,50	181,00	161,87	179,50	0,37	1,50
90	162,60	181,00	162,92	179,00	0,32	2,00
91	161,80	181,00	162,07	179,25	0,27	1,75
92	161,80	181,00	162,27	179,50	0,47	1,50
93	161,10	181,00	161,27	179,25	0,17	1,75
94	162,50	181,00	162,92	179,75	0,42	1,25
95	162,20	181,00	162,42	178,75	0,22	2,25
96	162,90	181,00	162,87	178,75	0,03	2,25
97	160,40	181,00	160,41	179,50	0,01	1,50
98	156,40	181,00	156,51	179,25	0,11	1,75
99	163,70	181,00	164,12	178,50	0,42	2,50
100	161,60	181,00	161,67	179,00	0,07	2,00
				Standard deviation:	**0,106**	**0,446**

Graphical representation

Model:	**2BD-2B200A-2K3D-2ZB**	Serial no:	**756055**
Target torque:	**160,00 Nm**	80 % of max. torque	
Angle degree:	**180°**	Tool without angle correction	





Machine Capability Study
Control System

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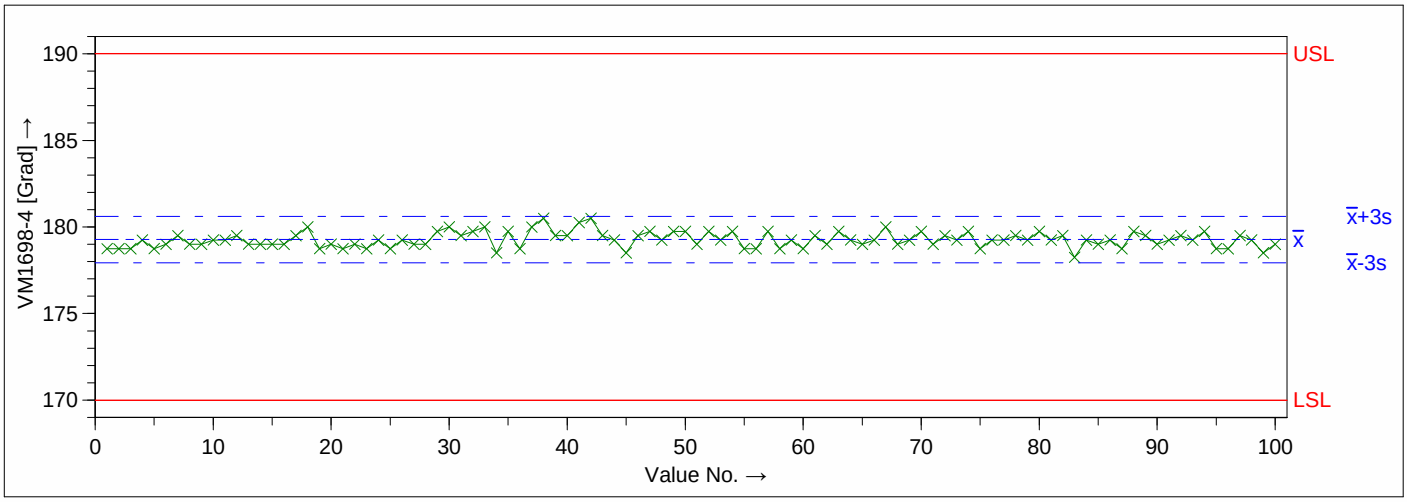
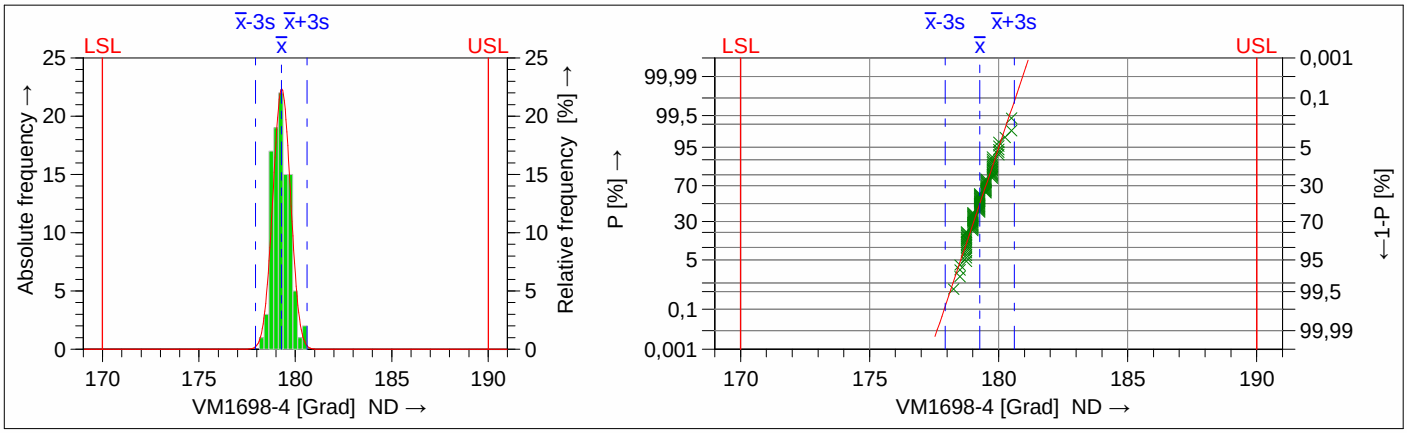
Plant	ATG Westhausen	Operator Name	Sünder
Date	26.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756055_l	Char.Descr.	VM1698-4	Nom.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	250 / 5537037	nges.	100

Evaluation from 26.04.2022 11:45:01 to 26.04.2022 12:05:26

Rem. TQ 80% Angle 180° +/-10° * TQ-Cal.: 200 Nm; Cur-Cal.: 5.571 Nm/A; Speed 300/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	180.00			x̄	179.2700
LSL	170.00	x_{min}	178.25	x̄-3s	177.9314
USL	190.00	x_{max}	180.50	x̄+3s	180.6086
T	20.00	R	2.25	6s	2.6772
		$n_{<T>}$	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	7.47
Critical capability index	=	C_{mk}	6.93

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 26.04.2022

Serial No.	756055_I	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	160,00
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	118,96
				USL	202,78
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 200 Nm; C ur-Cal.: 5.571 Nm/A; Speed 300/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	Nm	168,98	165,82	159,66	159,31	167,23	164,07	166,32	164,62	164,97	164,37
1024210	VM1698-4	Grad	178,75	178,75	178,75	179,25	178,75	179,00	179,50	179,00	179,00	179,25

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	Nm	162,17	152,35	163,62	163,52	168,23	164,77	158,11	164,27	150,00	167,13
1024210	VM1698-4	Grad	179,25	179,50	179,00	179,00	179,00	179,00	179,50	180,00	178,75	179,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	Nm	163,17	158,31	154,50	163,57	166,62	161,17	159,91	157,51	155,36	155,61
1024210	VM1698-4	Grad	178,75	179,00	178,75	179,25	178,75	179,25	179,00	179,00	179,75	180,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	Nm	163,67	158,91	158,41	162,07	160,21	161,32	159,66	164,07	161,32	159,56
1024210	VM1698-4	Grad	179,50	179,75	180,00	178,50	179,75	178,75	180,00	180,50	179,50	179,50

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	Nm	159,71	163,22	162,67	160,66	163,22	161,22	159,56	159,81	160,51	160,86
1024210	VM1698-4	Grad	180,25	180,50	179,50	179,25	178,50	179,50	179,75	179,25	179,75	179,75

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	162,47	161,22	161,17	161,42	161,22	162,57	162,92	163,82	162,87	162,72
1024210	VM1698-4	Grad	179,00	179,75	179,25	179,75	178,75	178,75	179,75	178,75	179,25	178,75

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	Nm	162,02	162,47	161,97	160,71	162,07	161,57	162,77	162,92	161,12	160,36
1024210	VM1698-4	Grad	179,50	179,00	179,75	179,25	179,00	179,25	180,00	179,00	179,25	179,75

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	Nm	163,77	162,12	162,87	162,27	162,52	162,17	164,92	161,12	161,12	162,02
1024210	VM1698-4	Grad	179,00	179,50	179,25	179,75	178,75	179,25	179,25	179,50	179,25	179,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 26.04.2022

Serial No.	756055_I	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	160,00
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	118,96
				USL	202,78
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 200 Nm; C ur-Cal.: 5.571 Nm/A; Speed 300/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	Nm	162,57	160,96	163,12	162,27	164,67	162,22	162,97	161,57	161,87	162,92
1024210	VM1698-4	Grad	179,25	179,50	178,25	179,25	179,00	179,25	178,75	179,75	179,50	179,00

Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	162,07	162,27	161,27	162,92	162,42	162,87	160,41	156,51	164,12	161,67
1024210	VM1698-4	Grad	179,25	179,50	179,25	179,75	178,75	178,75	179,50	179,25	178,50	179,00

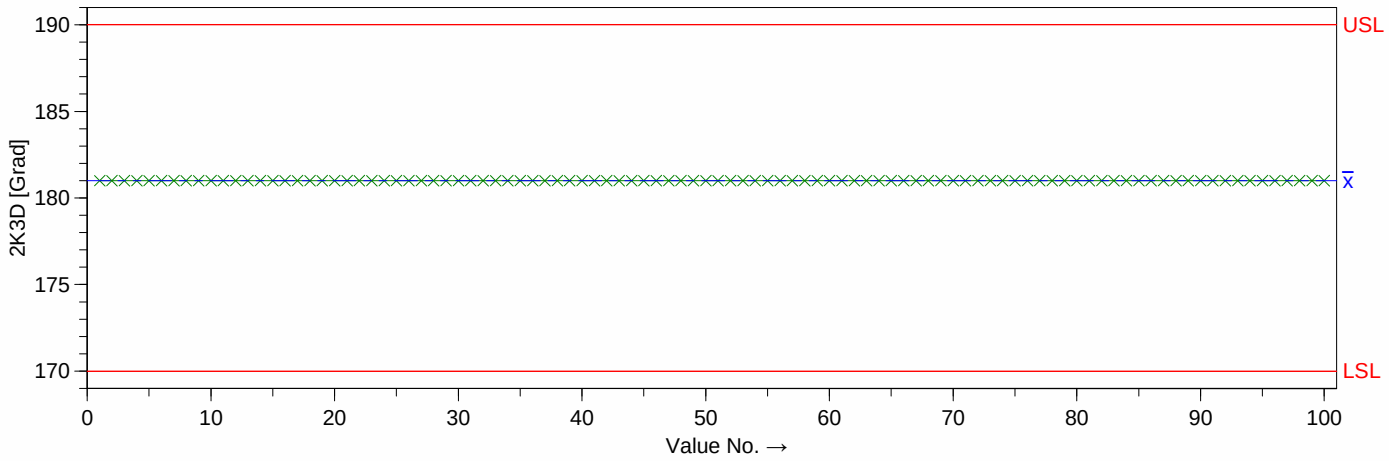
Machine Capability Study
Tool System

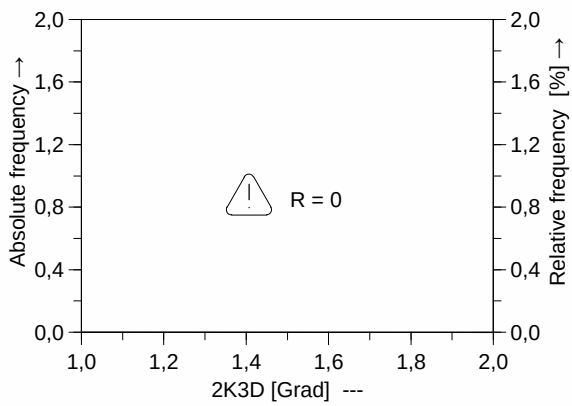
Plant	ATG Westhausen	Operator Name	Sünder
Date	26.04.2022		

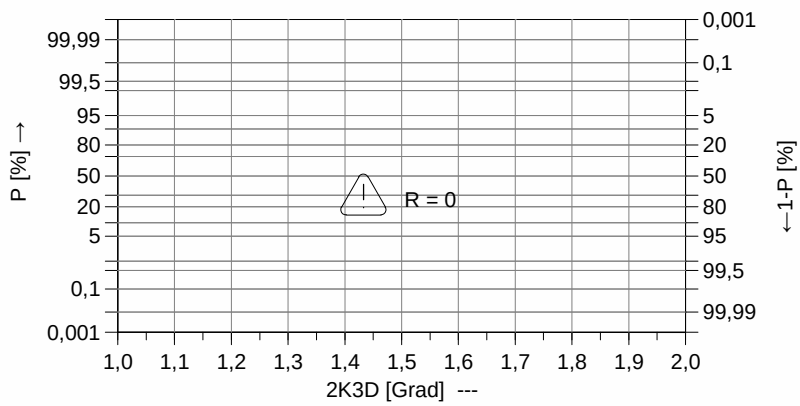
Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756055_l	Char.Descr.	2K3D	Nom.val. 180,00 10,00	USL 190,00
		Serial No.	206285	Unit Grad -10,00	LSL 170,00
Char.Type	variable			Tolerance value 6 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	250 / 5537037	nges.	1

Evaluation from 26.04.2022 11:45:01 to 26.04.2022 12:05:26

Rem. TQ 80% Angle 180° +/-10° * TQ-Cal.: 200 Nm; Cur-Cal.: 5.571 Nm/A; Speed 300/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	180.00			$\bar{x}$	181.0000
LSL	170.00	x_{min}	181.00		
USL	190.00	x_{max}	181.00		
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 26.04.2022

Serial No.	756055_I	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	160,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	0,00
				USL	181,68
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 200 Nm; C ur-Cal.: 5.571 Nm/A; Speed 300/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
206285	2K3D	Nm	169,20	165,90	159,90	159,50	167,40	164,10	166,30	164,80	164,80	164,60
206285	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
206285	2K3D	Nm	162,30	152,60	163,80	163,60	168,20	165,00	158,50	164,30	149,90	167,20
206285	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
206285	2K3D	Nm	163,30	158,40	154,50	163,40	166,70	161,10	160,00	157,60	155,50	155,80
206285	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
206285	2K3D	Nm	163,60	158,80	158,30	161,90	160,20	161,20	159,80	164,20	161,20	159,60
206285	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
206285	2K3D	Nm	159,80	163,10	162,50	160,60	163,00	161,30	159,40	159,80	160,50	160,80
206285	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
206285	2K3D	Nm	162,40	161,10	160,90	161,20	161,00	162,50	162,70	163,70	162,80	162,60
206285	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
206285	2K3D	Nm	161,90	162,30	161,90	160,60	161,90	161,60	162,60	163,00	161,10	160,30
206285	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
206285	2K3D	Nm	163,60	161,80	162,60	162,10	162,50	161,80	164,60	160,90	161,10	161,70
206285	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 26.04.2022

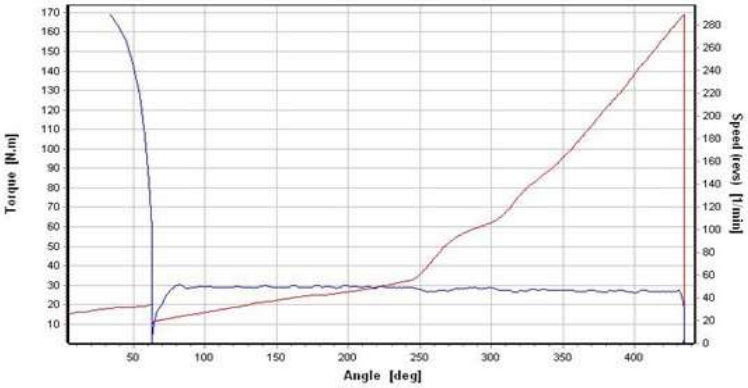
Serial No.	756055_I	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	160,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	0,00
				USL	181,68
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 200 Nm; C ur-Cal.: 5.571 Nm/A; Speed 300/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
206285	2K3D	Nm	162,50	160,90	162,80	162,00	164,40	162,00	162,90	161,40	161,50	162,60
206285	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

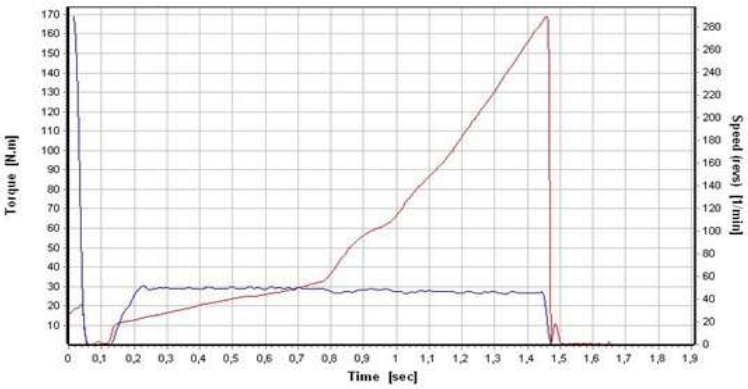
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206285	2K3D	Nm	161,80	161,80	161,10	162,50	162,20	162,90	160,40	156,40	163,70	161,60
206285	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Torque graphs

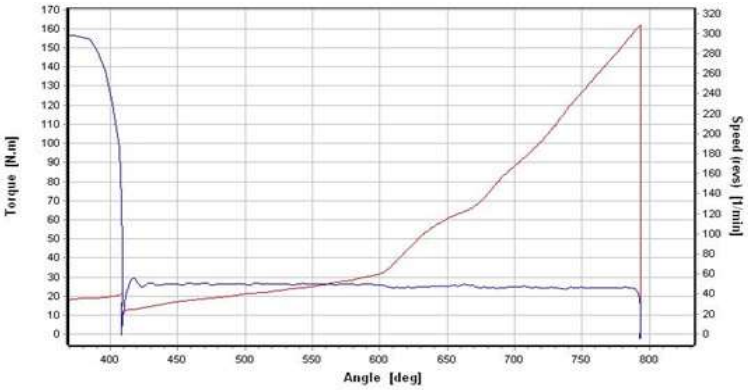
Model:	**2BD-2B200A-2K3D-2ZB**	Serial no:	**756055**
Target torque:	**160,00 Nm**	80 % of max. torque	
Angle degree:	**180°**	Tool without angle correction	



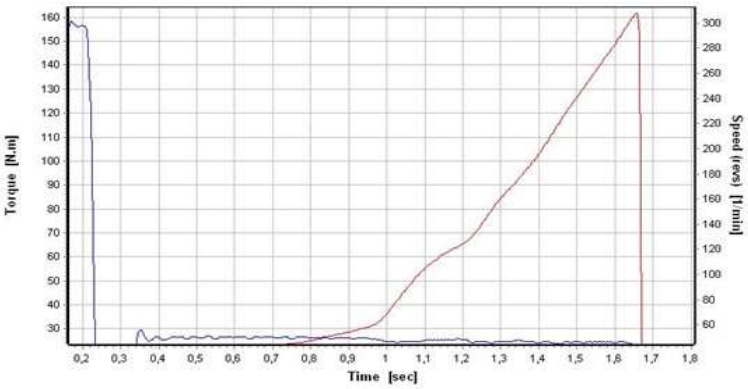
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed