Homologation

Fixtured Spindle

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

Serial no.: 756056

Contents

Homologation: 2BD-2B200A-2K3D-2ZB SN: 756056

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Test sheet no. 2

Machine Capability Study 30 %

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

Manufacturer: Apex Tool Group Serial no: **756056**

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

Hard joint (H)	450,84	Nm / Revolution	Angle degree	30°
Soft joint (L)	37,04	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	75,14	74,08 Nm
	Standard deviation	0,16	0,12 Nm
	Torque scatter (99,73%)	0,96	0,71 Nm
	C_m	10,79	14,50
	C_{mk}	8,42	14,27

b)	Min. C_m hard/soft (lowest value)	10,79
	Min. C_{mk} hard/soft (lowest value)	8,42

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

Note:

Machine Capability Study
Control System

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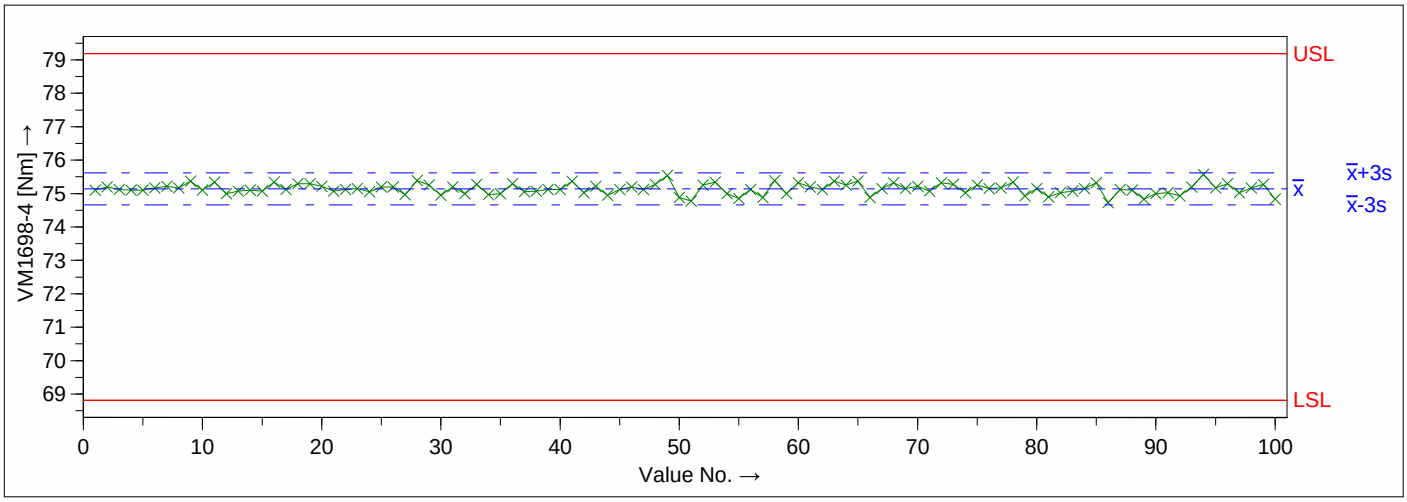
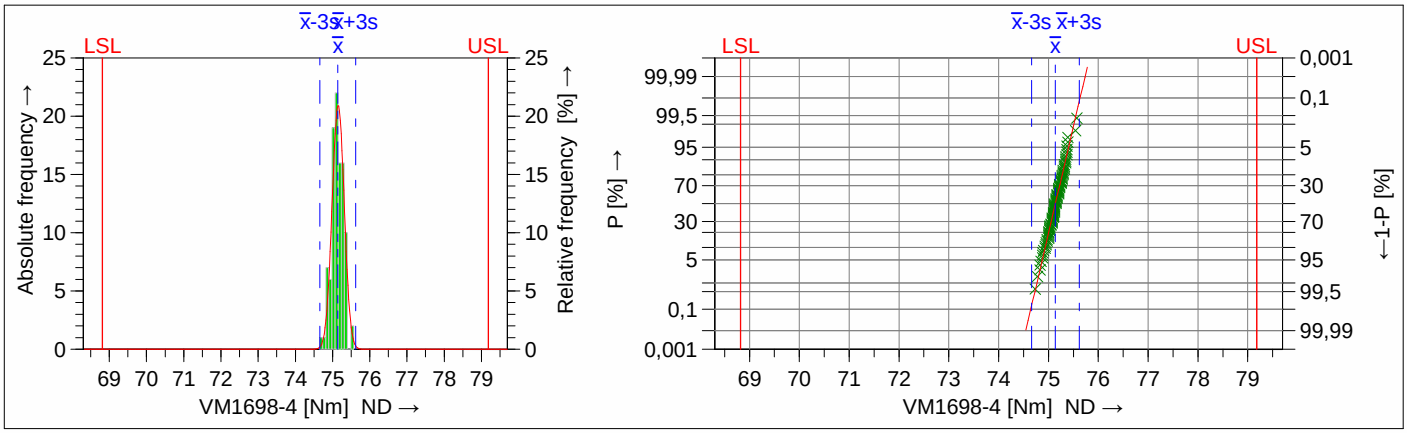
Plant	ATG Westhausen	Operator Name	Sünder
Date	27.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756056_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 27.04.2022 10:56:24 to 27.04.2022 11:09:33

Rem. TQ 30% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.736 Nm/A; Speed 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	74.00			$\bar{x}$	75.1396
LSL	68.82	x_{min}	74.73	$\bar{x}$-3s	74.6596
USL	79.18	x_{max}	75.57	$\bar{x}$+3s	75.6196
T	10.36	R	0.84	6s	0.9600
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			M1.1.4 $\hat{\sigma} = S_{tot}$
Potential Capability index	=	C_m	10.79
Critical capability index	=	C_{mk}	8.42

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 27.04.2022

Serial No.	756056_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.: 5.736 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	75,10	75,20	75,12	75,10	75,10	75,17	75,22	75,17	75,37	75,10
1024210	VM1698-4	Grad	30,75	29,75	30,25	29,50	31,00	30,00	31,00	31,25	30,00	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}
1024210	VM1698-4	Nm	75,34	75,00	75,07	75,10	75,07	75,34	75,12	75,29	75,29	75,22
1024210	VM1698-4	Grad	30,00	30,25	29,75	29,25	30,75	30,00	29,50	30,75	30,50	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	75,07	75,12	75,15	75,05	75,20	75,20	74,97	75,39	75,25	74,95
1024210	VM1698-4	Grad	29,75	29,75	30,25	29,75	29,50	29,75	30,50	29,75	29,75	30,25

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	75,20	75,00	75,27	74,97	75,00	75,29	75,05	75,07	75,12	75,12
1024210	VM1698-4	Grad	29,75	29,25	30,00	28,75	31,00	30,00	30,75	30,50	31,00	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	75,37	75,02	75,22	74,95	75,12	75,20	75,12	75,27	75,54	74,88
1024210	VM1698-4	Grad	30,75	30,00	30,00	29,75	29,75	29,75	30,50	30,00	31,25	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	74,78	75,25	75,34	75,00	74,85	75,12	74,88	75,39	75,00	75,32
1024210	VM1698-4	Grad	31,00	29,25	30,75	29,75	29,25	29,75	31,50	30,25	30,75	30,75

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	Nm	75,20	75,12	75,37	75,25	75,37	74,88	75,15	75,32	75,15	75,22
1024210	VM1698-4	Grad	30,50	31,50	29,75	29,00	29,75	29,75	29,25	30,25	30,50	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}
1024210	VM1698-4	Nm	75,07	75,32	75,27	75,02	75,25	75,15	75,17	75,34	74,93	75,15
1024210	VM1698-4	Grad	29,25	29,00	30,00	30,25	29,50	29,75	29,25	30,75	29,50	29,50

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 27.04.2022

Serial No.	756056_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.: 5.736 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	74,90	75,02	75,07	75,15	75,32	74,73	75,12	75,10	74,83	75,00
1024210	VM1698-4	Grad	30,50	29,75	29,25	29,50	29,75	29,75	30,00	29,75	29,00	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	75,02	74,93	75,20	75,57	75,17	75,29	75,02	75,17	75,27	74,83
1024210	VM1698-4	Grad	30,50	30,00	29,75	30,25	30,50	30,00	31,25	29,75	30,00	28,50

Machine Capability Study
Tool System

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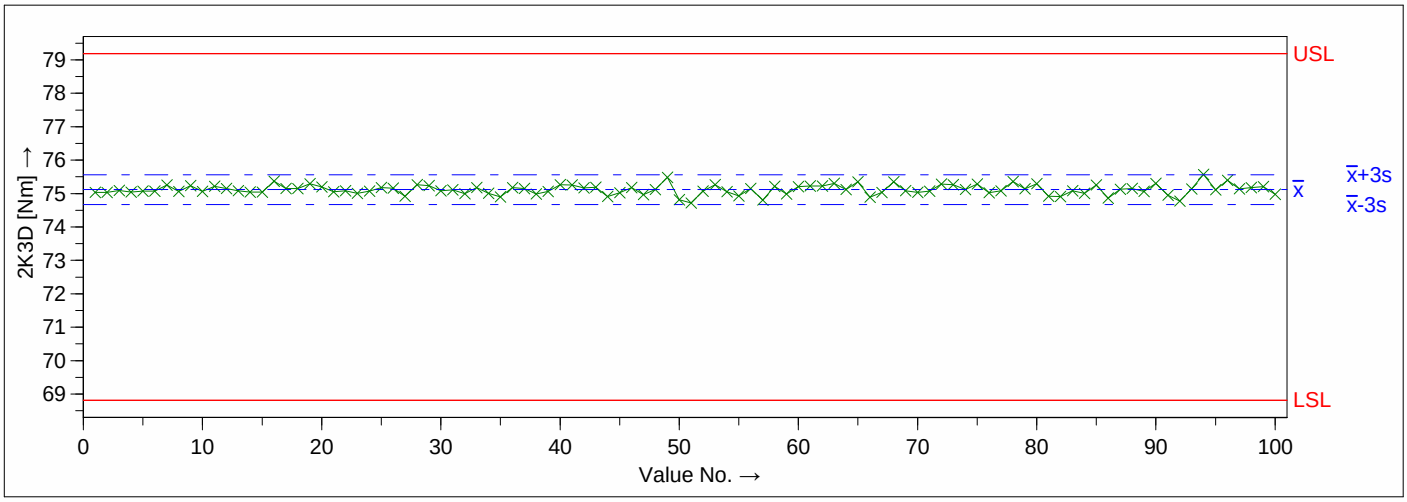
Plant ATG Westhausen		Operator Name Sünder	Date 27.04.2022

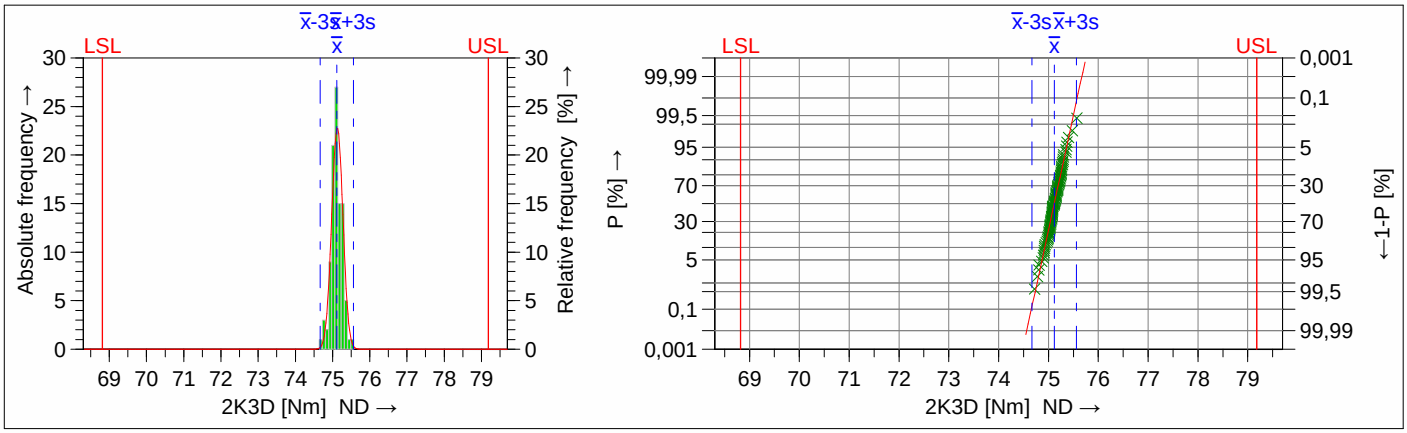
Ord. No. 2BD200T1S-A	Part type 2BD-2B200A-2K3D-2ZB				Contr.item yes
Serial No. 756056_d	Char.Descr. 2K3D	Nom.val.	74,00	5,18	USL 79,18
	Serial No. 206284	Unit	Nm	-5,18	LSL 68,82
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2

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

Evaluation from 27.04.2022 10:56:25 to 27.04.2022 11:09:34

Rem. TQ 30% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.736 Nm/A; Speed 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	74.00			$\bar{x}$	75.1166
LSL	68.82	x_{min}	74.72	$\bar{x}$-3s	74.6705
USL	79.18	x_{max}	75.57	$\bar{x}$+3s	75.5627
T	10.36	R	0.85	6s	0.8922
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			M1.1.4 $\hat{\sigma} = S_{tot}$
Potential Capability index	=	C_m	11.61
Critical capability index	=	C_{mk}	9.11

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 27.04.2022

Serial No.	756056_d	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	74,00
Ord. No.	2BD200T1S-A	Serial No.	206284	LSL	68,82
				USL	79,18
Remark	TQ 30% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.736 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}
206284	2K3D	Nm	75,03	75,03	75,09	75,04	75,07	75,07	75,25	75,06	75,24	75,06
206284	2K3D	Grad	31,00	30,00	30,00	30,00	31,00	30,00	31,00	32,00	30,00	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}
206284	2K3D	Nm	75,22	75,15	75,08	75,04	75,04	75,37	75,15	75,15	75,29	75,20
206284	2K3D	Grad	30,00	30,00	30,00	29,00	31,00	30,00	30,00	31,00	31,00	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}
206284	2K3D	Nm	75,05	75,08	75,01	75,07	75,18	75,16	74,92	75,26	75,24	75,08
206284	2K3D	Grad	30,00	30,00	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}
206284	2K3D	Nm	75,11	75,00	75,18	75,01	74,90	75,18	75,15	74,99	75,06	75,26
206284	2K3D	Grad	30,00	29,00	30,00	30,00	31,00	30,00	31,00	31,00	32,00	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}
206284	2K3D	Nm	75,25	75,17	75,19	74,91	75,02	75,18	74,97	75,12	75,48	74,81
206284	2K3D	Grad	31,00	30,00	30,00	30,00	30,00	30,00	31,00	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}
206284	2K3D	Nm	74,72	75,07	75,26	75,05	74,93	75,15	74,80	75,22	74,99	75,21
206284	2K3D	Grad	31,00	30,00	31,00	30,00	30,00	30,00	32,00	30,00	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}
206284	2K3D	Nm	75,23	75,23	75,30	75,12	75,35	74,89	75,03	75,35	75,08	75,03
206284	2K3D	Grad	31,00	32,00	30,00	29,00	30,00	30,00	29,00	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}
206284	2K3D	Nm	75,07	75,28	75,26	75,12	75,28	75,02	75,08	75,36	75,14	75,29
206284	2K3D	Grad	29,00	30,00	30,00	31,00	30,00	30,00	30,00	31,00	30,00	30,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 27.04.2022

Serial No.	756056_d	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	74,00
Ord. No.	2BD200T1S-A	Serial No.	206284	LSL	68,82
				USL	79,18
Remark	TQ 30% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.736 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}
206284	2K3D	Nm	74,92	74,91	75,08	75,01	75,25	74,86	75,13	75,15	75,06	75,30
206284	2K3D	Grad	31,00	30,00	29,00	30,00	30,00	30,00	30,00	30,00	30,00	31,00

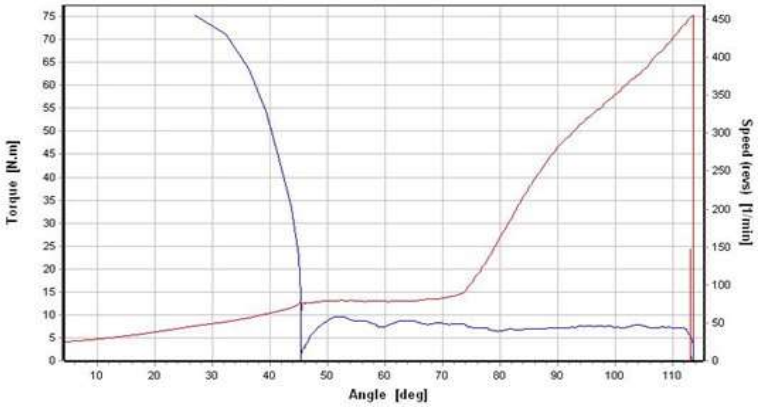
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206284	2K3D	Nm	74,95	74,78	75,14	75,57	75,11	75,40	75,14	75,18	75,21	74,98
206284	2K3D	Grad	31,00	30,00	30,00	30,00	30,00	30,00	31,00	30,00	30,00	29,00

Torque graphs

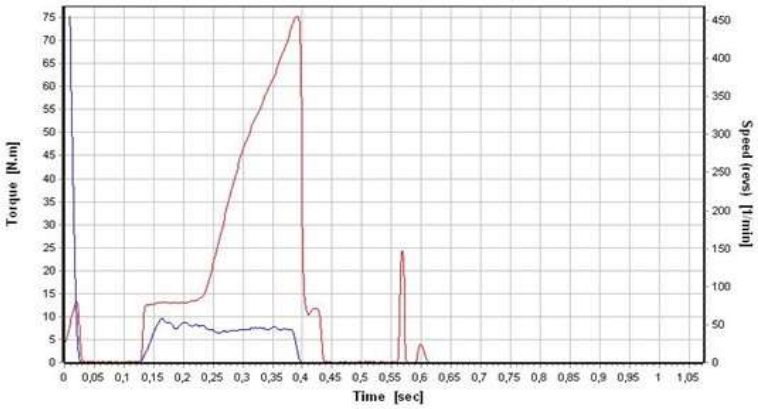
Machine Capability Study 30 %

Model: **2BD-2B200A-2K3D-2ZB**
Serial no: **756056**

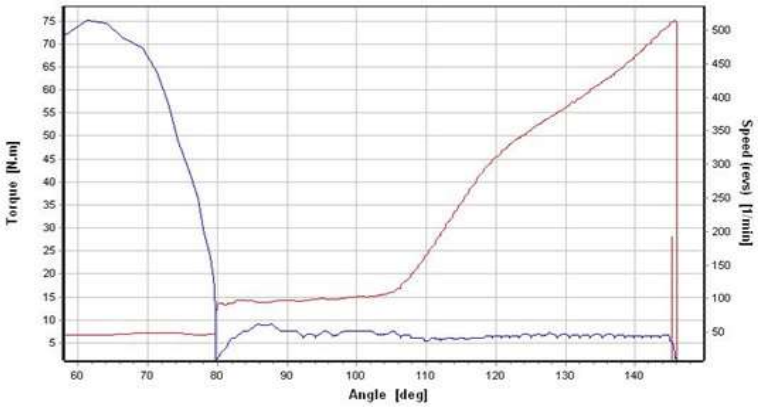
Angle degree: **30°**
Test torque: **74,0 Nm**



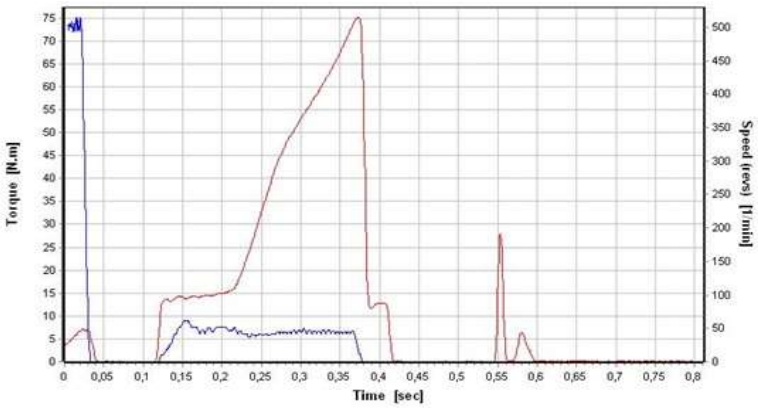
Value no. 1
Graph
Torque / Angle / Speed



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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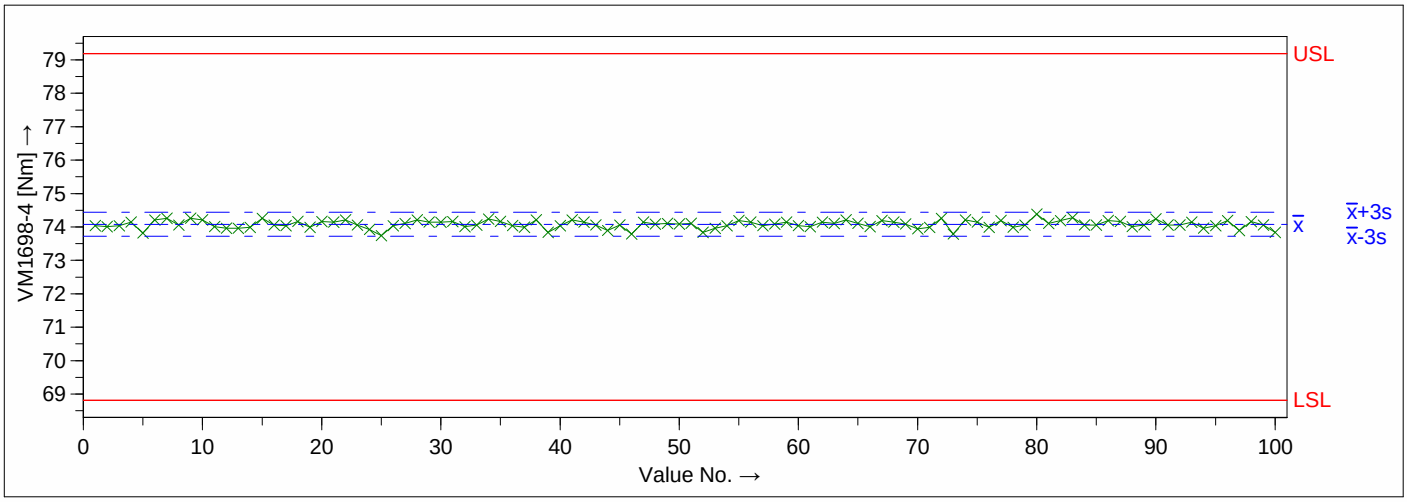
Plant	ATG Westhausen	Operator Name	Sünder
Date	27.04.2022		

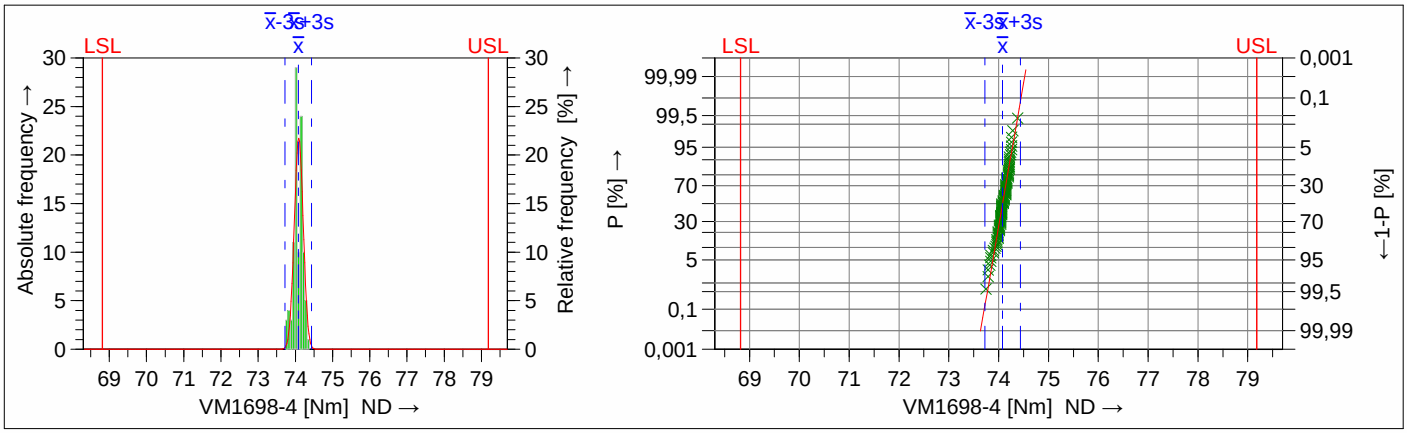
Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756056_c	Char.Descr.	VM1698-4	Nom.val. 74,00 5,18	USL 79,18
		Serial No.	1024210	Unit Nm -5,18	LSL 68,82
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2

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

Evaluation from 27.04.2022 10:34:25 to 27.04.2022 10:51:18

Rem. TQ 30% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.736 Nm/A; Speed 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	74.00			$\bar{x}$	74.0798
LSL	68.82	x_{min}	73.74	$\bar{x}$-3s	73.7225
USL	79.18	x_{max}	74.38	$\bar{x}$+3s	74.4371
T	10.36	R	0.64	6s	0.7146
		$n_{<T>}$	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	14.50
Critical capability index	=	C_{mk}	14.27

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 27.04.2022

Serial No.	756056_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.: 5.736 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	74,04	74,01	74,04	74,14	73,82	74,21	74,26	74,06	74,26	74,21
1024210	VM1698-4	Grad	350,50	353,75	351,75	371,00	354,75	368,00	342,00	365,25	356,75	358,00

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	Nm	74,01	73,96	73,96	73,99	74,26	74,06	74,04	74,16	73,99	74,16
1024210	VM1698-4	Grad	361,50	365,50	337,50	330,75	345,50	349,75	363,50	354,50	346,00	347,00

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	74,14	74,21	74,06	73,92	73,74	74,04	74,11	74,21	74,14	74,14
1024210	VM1698-4	Grad	357,25	353,75	367,25	363,00	371,25	362,25	358,25	366,75	367,75	354,50

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	74,16	74,01	74,06	74,24	74,16	74,04	73,99	74,21	73,84	74,04
1024210	VM1698-4	Grad	351,00	373,00	343,00	359,00	349,25	358,25	356,00	360,75	351,75	363,25

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	74,21	74,14	74,06	73,89	74,06	73,79	74,14	74,09	74,11	74,09
1024210	VM1698-4	Grad	366,00	356,50	358,00	369,75	365,25	345,25	368,25	340,75	371,25	370,75

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	74,11	73,84	73,96	74,04	74,19	74,14	74,04	74,09	74,14	74,04
1024210	VM1698-4	Grad	356,50	374,50	358,75	364,50	363,75	346,25	358,00	357,50	354,50	359,00

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	74,01	74,14	74,11	74,21	74,11	74,01	74,19	74,14	74,09	73,94
1024210	VM1698-4	Grad	348,75	355,50	364,00	348,25	356,25	357,00	376,25	343,25	341,25	363,75

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	73,99	74,26	73,79	74,21	74,14	73,99	74,19	73,99	74,06	74,38
1024210	VM1698-4	Grad	354,50	363,00	355,50	354,25	353,75	367,00	353,50	376,50	351,50	358,50

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 27.04.2022

Serial No.	756056_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.: 5.736 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	74,11	74,19	74,28	74,06	74,06	74,19	74,16	74,01	74,06	74,24
1024210	VM1698-4	Grad	349,00	360,75	360,00	352,00	365,75	367,50	340,25	337,25	343,50	351,00

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	74,06	74,06	74,14	73,96	74,04	74,19	73,89	74,16	74,06	73,84
1024210	VM1698-4	Grad	361,25	367,75	365,00	366,75	355,25	371,25	357,75	364,50	348,25	362,25

Machine Capability Study
Tool System

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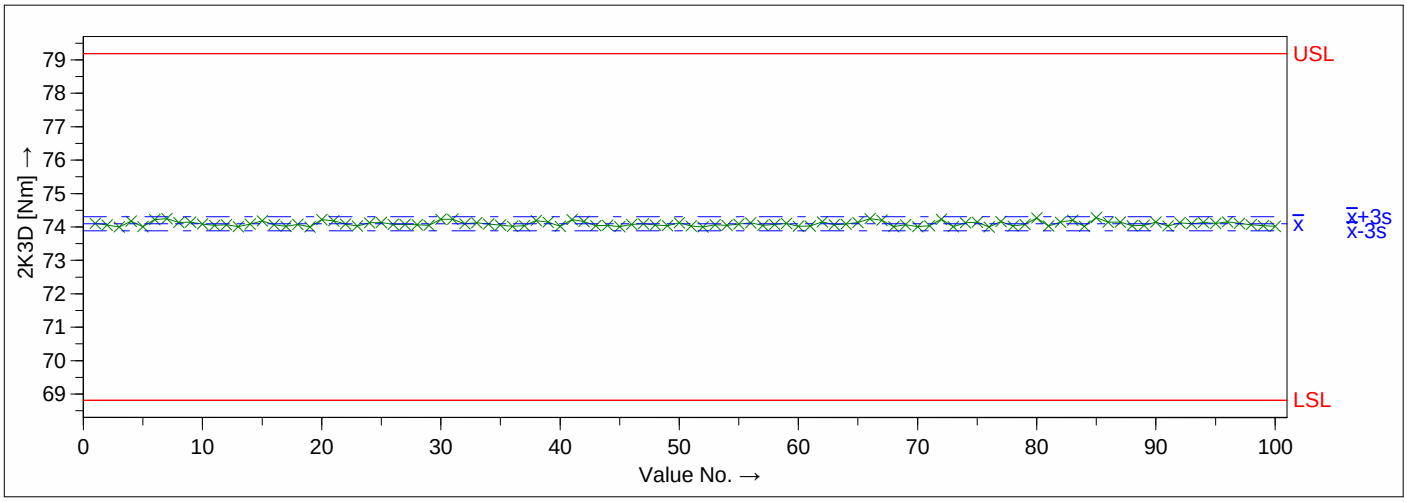
Plant ATG Westhausen		Operator Name Sünder	Date 27.04.2022

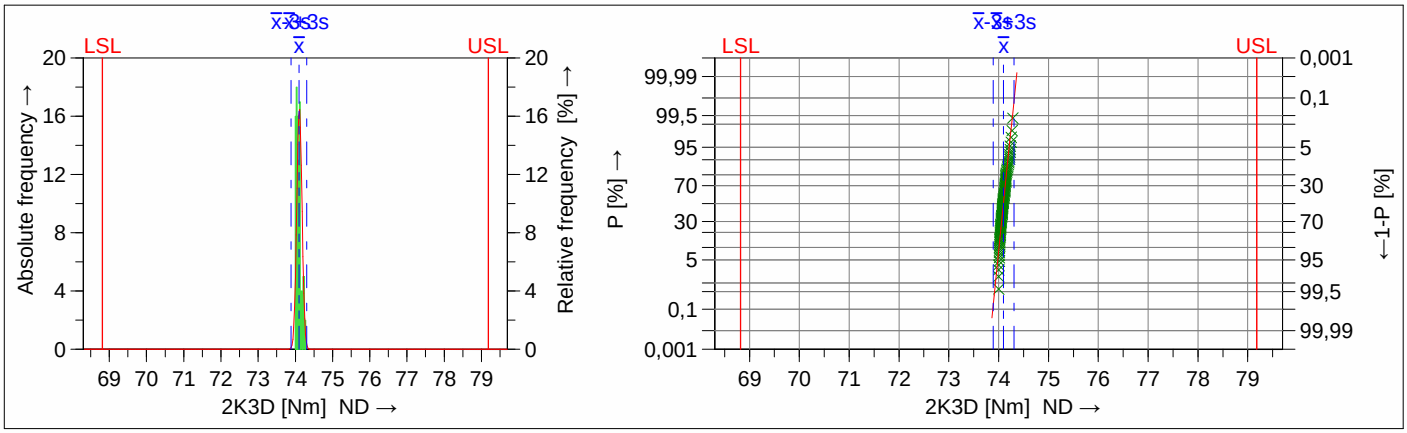
Ord. No. 2BD200T1S-A	Part type 2BD-2B200A-2K3D-2ZB				Contr.item yes
Serial No. 756056_c	Char.Descr. 2K3D	Nom.val.	74,00	5,18	USL 79,18
	Serial No. 206284	Unit	Nm	-5,18	LSL 68,82
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2

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

Evaluation from 27.04.2022 10:34:26 to 27.04.2022 10:51:19

Rem. TQ 30% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.736 Nm/A; Speed 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	74.00			$\bar{x}$	74.0969
LSL	68.82	x_{min}	74.00	$\bar{x}$-3s	73.8876
USL	79.18	x_{max}	74.28	$\bar{x}$+3s	74.3062
T	10.36	R	0.28	6s	0.4186
		$n_{<T>}$	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	24.75
Critical capability index	=	C_{mk}	24.28

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\Appdata\QW\QWE\Messwert\2022\756056_c1.DFD

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 27.04.2022

Serial No.	756056_c	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	74,00
Ord. No.	2BD200T1S-A	Serial No.	206284	LSL	68,82
				USL	79,18
Remark	TQ 30% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.736 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}
206284	2K3D	Nm	74,11	74,06	74,00	74,17	74,01	74,22	74,25	74,13	74,14	74,09
206284	2K3D	Grad	351,00	354,00	352,00	370,00	357,00	367,00	342,00	365,00	358,00	357,00

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}
206284	2K3D	Nm	74,05	74,07	74,01	74,09	74,18	74,07	74,02	74,08	74,00	74,22
206284	2K3D	Grad	362,00	365,00	338,00	331,00	345,00	349,00	362,00	355,00	347,00	348,00

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}
206284	2K3D	Nm	74,18	74,09	74,03	74,12	74,13	74,08	74,08	74,07	74,05	74,23
206284	2K3D	Grad	358,00	353,00	368,00	368,00	377,00	363,00	361,00	367,00	368,00	355,00

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}
206284	2K3D	Nm	74,23	74,10	74,12	74,09	74,06	74,02	74,04	74,19	74,14	74,02
206284	2K3D	Grad	352,00	374,00	344,00	358,00	350,00	358,00	356,00	361,00	353,00	362,00

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}
206284	2K3D	Nm	74,22	74,16	74,04	74,05	74,01	74,08	74,10	74,06	74,04	74,12
206284	2K3D	Grad	366,00	357,00	357,00	370,00	366,00	357,00	369,00	343,00	370,00	372,00

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}
206284	2K3D	Nm	74,03	74,00	74,07	74,05	74,09	74,12	74,05	74,08	74,11	74,02
206284	2K3D	Grad	356,00	376,00	359,00	364,00	362,00	347,00	359,00	358,00	356,00	359,00

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}
206284	2K3D	Nm	74,03	74,15	74,07	74,09	74,13	74,25	74,20	74,01	74,07	74,01
206284	2K3D	Grad	350,00	356,00	364,00	349,00	356,00	360,00	377,00	343,00	341,00	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}
206284	2K3D	Nm	74,04	74,23	74,01	74,12	74,14	74,00	74,16	74,03	74,08	74,27
206284	2K3D	Grad	355,00	362,00	357,00	354,00	355,00	367,00	355,00	377,00	351,00	359,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 27.04.2022

Serial No.	756056_c	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	74,00
Ord. No.	2BD200T1S-A	Serial No.	206284	LSL	68,82
				USL	79,18
Remark	TQ 30% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.736 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}
206284	2K3D	Nm	74,03	74,14	74,20	74,02	74,28	74,14	74,14	74,04	74,05	74,14
206284	2K3D	Grad	350,00	363,00	364,00	353,00	368,00	367,00	340,00	337,00	345,00	351,00

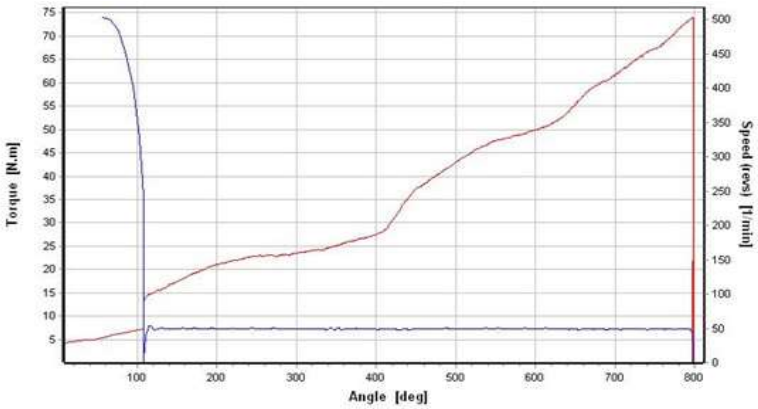
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206284	2K3D	Nm	74,03	74,12	74,10	74,13	74,11	74,15	74,11	74,07	74,04	74,02
206284	2K3D	Grad	361,00	368,00	364,00	371,00	356,00	371,00	358,00	365,00	348,00	365,00

Torque graphs

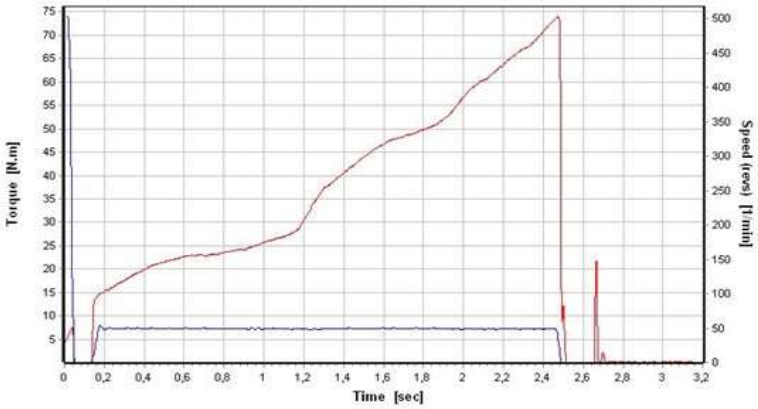
Machine Capability Study 30 %

Model: **2BD-2B200A-2K3D-2ZB**
Serial no: **756056**

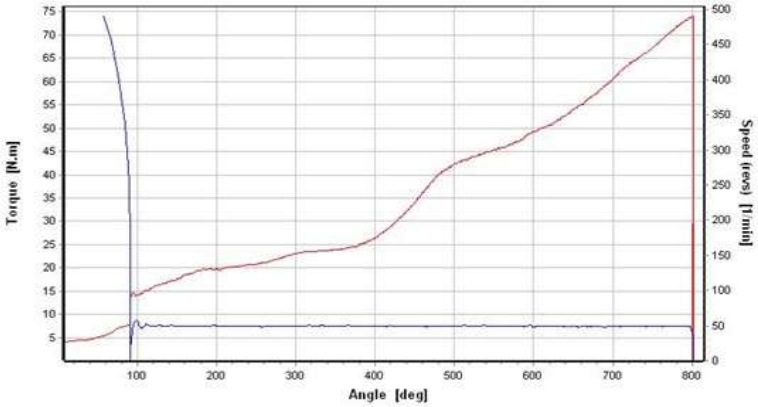
Angle degree: **360°**
Test torque: **74,0 Nm**



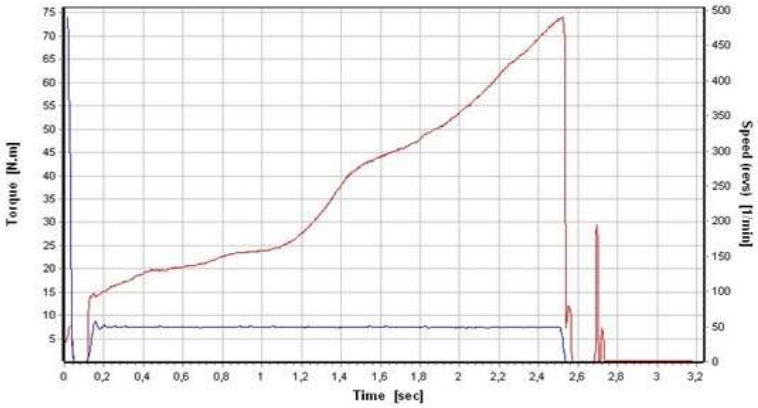
Value no. 1
Graph
Torque / Angle / Speed



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: **756056**

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

Hard joint (H)	999,67	Nm / Revolution	Angle degree	30°
Soft joint (L)	82,54	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	166,61	165,07 Nm
	Standard deviation	0,20	0,18 Nm
	Torque scatter (99,73%)	1,21	1,11 Nm
	C_m	19,03	20,74
	C_{mk}	14,70	18,80

b)	Min. C_m hard/soft (lowest value)	19,03
	Min. C_{mk} hard/soft (lowest value)	14,70

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

Note:

Machine Capability Study
Control System

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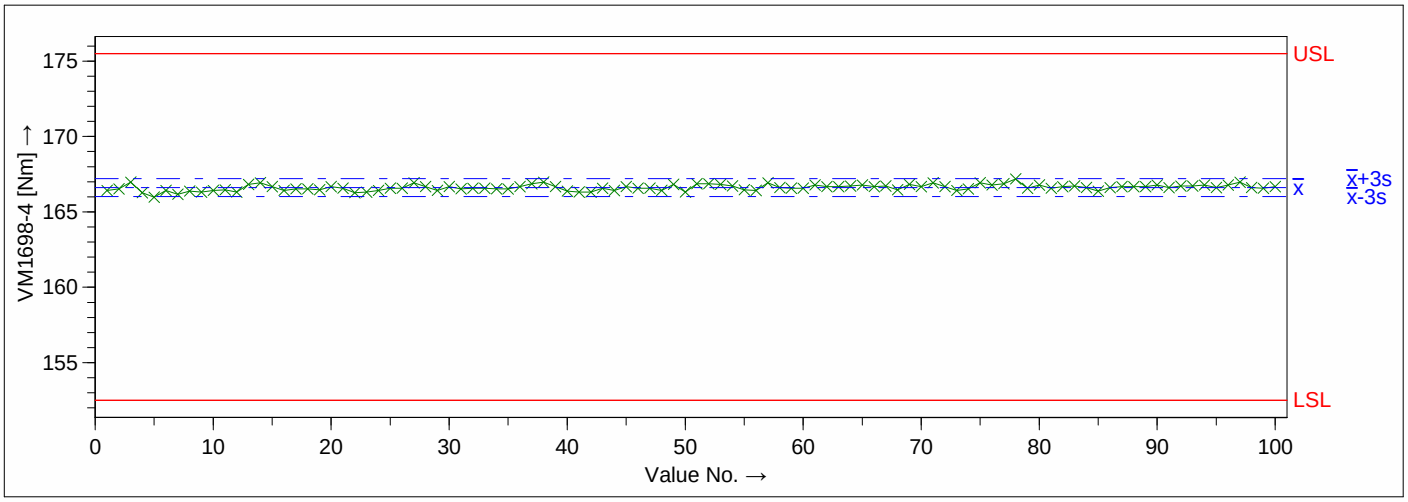
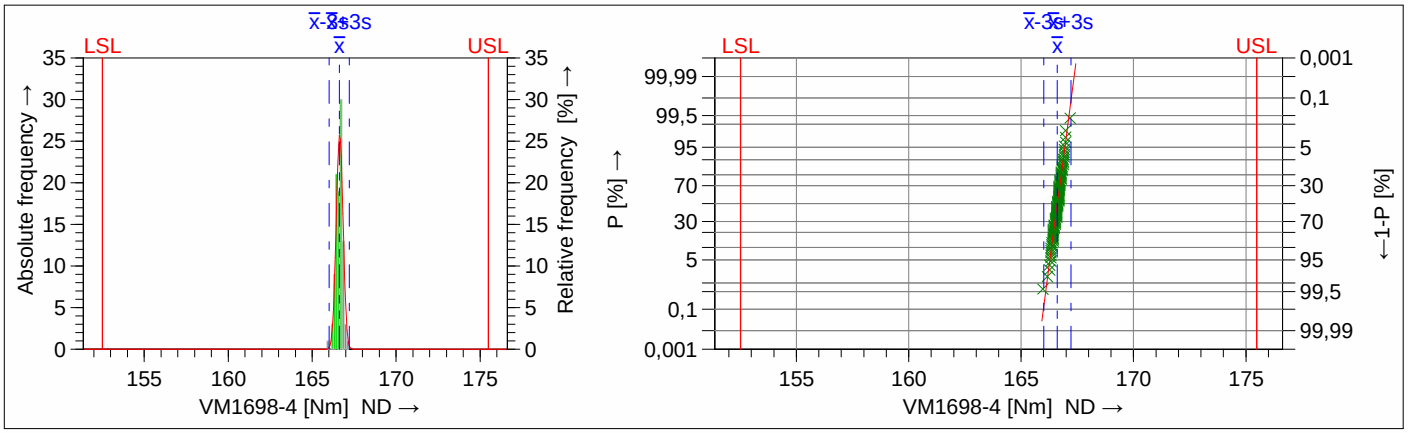
Plant	ATG Westhausen	Operator Name	Sünder
Date	27.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756056_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 27.04.2022 11:42:20 to 27.04.2022 11:57:38

Rem. TQ 80% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.566 Nm/A; Speed: 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	164.00			$\bar{x}$	166.6114
LSL	152.52	x_{min}	165.97	$\bar{x}$-3s	166.0080
USL	175.48	x_{max}	167.18	$\bar{x}$+3s	167.2148
T	22.96	R	1.21	6s	1.2068
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			M1.1.4 $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	19.03
Critical capability index	=	C_{mk}	14.70

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 27.04.2022

Serial No.	756056_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.: 5.566 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	166,42	166,52	166,98	166,27	165,97	166,42	166,17	166,37	166,32	166,42
1024210	VM1698-4	Grad	30,50	28,75	30,00	30,00	28,25	29,75	29,75	28,25	29,75	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	166,47	166,32	166,82	166,92	166,67	166,42	166,52	166,52	166,47	166,67
1024210	VM1698-4	Grad	28,50	29,00	28,00	27,50	30,00	30,00	28,25	29,75	29,50	29,75

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	Nm	166,57	166,27	166,32	166,42	166,57	166,57	166,92	166,67	166,42	166,67
1024210	VM1698-4	Grad	29,75	29,75	29,25	27,75	29,50	29,50	29,00	28,25	29,75	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	166,52	166,57	166,57	166,52	166,52	166,67	166,87	166,98	166,67	166,37
1024210	VM1698-4	Grad	30,25	30,00	30,50	29,75	30,00	29,75	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	166,32	166,32	166,57	166,42	166,67	166,57	166,57	166,42	166,82	166,32
1024210	VM1698-4	Grad	29,50	30,25	29,75	29,50	29,75	29,50	29,75	29,25	29,50	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	166,87	166,87	166,82	166,72	166,47	166,42	166,92	166,62	166,57	166,57
1024210	VM1698-4	Grad	29,50	30,25	29,50	29,75	29,75	29,50	29,50	29,50	29,50	30,00

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	Nm	166,77	166,67	166,67	166,72	166,77	166,67	166,72	166,47	166,82	166,67
1024210	VM1698-4	Grad	29,50	29,50	29,75	27,75	29,50	29,25	30,00	28,25	28,25	29,75

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	Nm	166,92	166,67	166,42	166,52	166,92	166,77	166,87	167,18	166,57	166,77
1024210	VM1698-4	Grad	28,75	28,50	30,00	30,25	30,00	30,75	30,75	30,75	30,75	30,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 27.04.2022

Serial No.	756056_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.: 5.566 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	166,57	166,67	166,72	166,62	166,37	166,62	166,67	166,67	166,67	166,77
1024210	VM1698-4	Grad	29,00	29,00	30,25	29,00	29,50	29,25	30,25	30,25	30,50	28,50

Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	166,62	166,72	166,72	166,77	166,62	166,77	166,98	166,62	166,57	166,67
1024210	VM1698-4	Grad	30,25	28,75	30,25	29,75	29,75	29,75	28,50	28,50	30,00	29,25

Machine Capability Study
Tool System

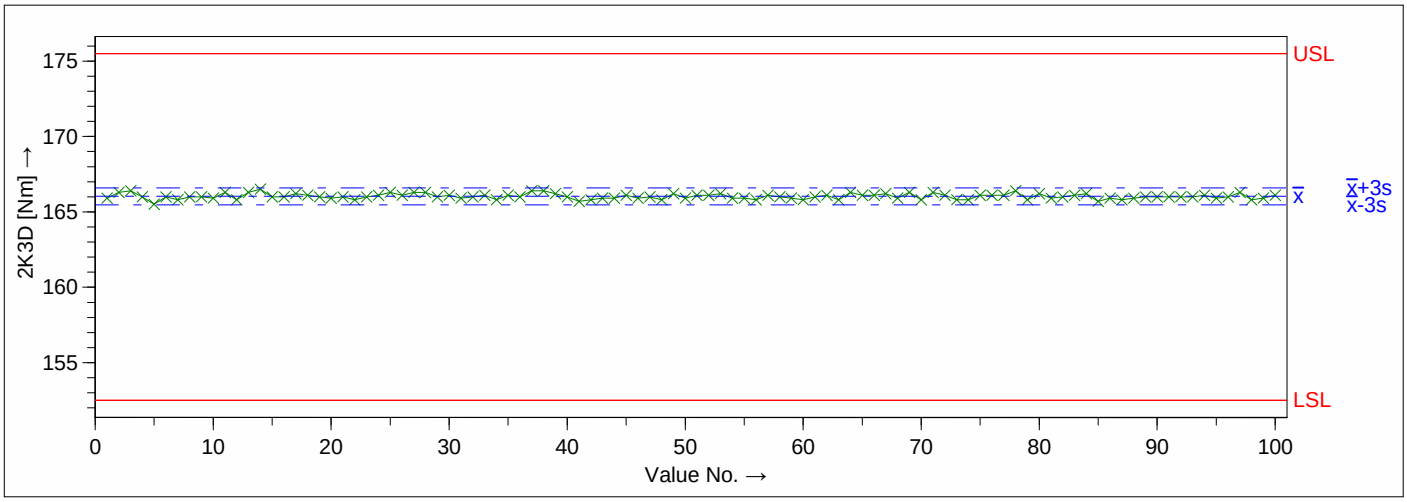
Page 1 / 1

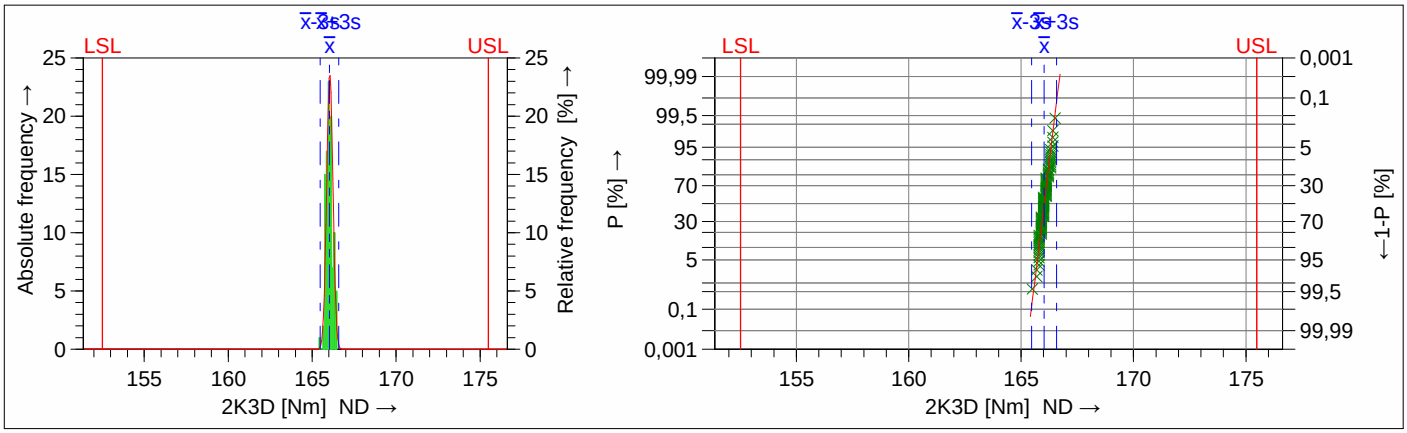
Plant	ATG Westhausen	Operator Name	Sünder
Date	27.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756056_h	Char.Descr.	2K3D	Nom.val. 164,00	11,48 USL 175,48
		Serial No.	206284	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 27.04.2022 11:42:21 to 27.04.2022 11:57:39

Rem. TQ 80% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.566 Nm/A; Speed: 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	164.00			$\bar{x}$	166.0270
LSL	152.52	x_{min}	165.50	$\bar{x}$-3s	165.4713
USL	175.48	x_{max}	166.50	$\bar{x}$+3s	166.5827
T	22.96	R	1.00	6s	1.1114
		$n_{<T>}$	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	20.66
Critical capability index	=	C_{mk}	17.01

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 27.04.2022

Serial No.	756056_h	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	164,00
Ord. No.	2BD200T1S-A	Serial No.	206284	LSL	152,52
				USL	175,48
Remark	TQ 80% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.566 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}
206284	2K3D	Nm	165,90	166,30	166,40	166,00	165,50	166,00	165,80	166,00	166,00	165,90
206284	2K3D	Grad	31,00	30,00	31,00	31,00	29,00	31,00	30,00	29,00	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}
206284	2K3D	Nm	166,30	165,80	166,30	166,50	166,00	166,00	166,20	166,10	166,00	165,90
206284	2K3D	Grad	29,00	30,00	29,00	28,00	31,00	31,00	29,00	31,00	31,00	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}
206284	2K3D	Nm	166,00	165,80	166,00	166,10	166,30	166,10	166,30	166,30	166,00	166,10
206284	2K3D	Grad	31,00	31,00	30,00	29,00	30,00	30,00	30,00	29,00	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}
206284	2K3D	Nm	165,90	166,00	166,10	165,80	166,10	166,00	166,40	166,40	166,20	166,00
206284	2K3D	Grad	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	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}
206284	2K3D	Nm	165,70	165,80	165,90	165,90	166,10	165,90	166,00	165,80	166,20	165,90
206284	2K3D	Grad	31,00	31,00	30,00	30,00	30,00	31,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
206284	2K3D	Nm	166,10	166,10	166,20	165,90	165,90	165,80	166,10	166,00	165,90	165,80
206284	2K3D	Grad	30,00	31,00	31,00	31,00	31,00	30,00	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}
206284	2K3D	Nm	166,00	166,10	165,80	166,30	166,10	166,10	166,20	165,90	166,30	165,80
206284	2K3D	Grad	30,00	31,00	30,00	29,00	30,00	30,00	31,00	29,00	29,00	31,00

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}
206284	2K3D	Nm	166,30	166,10	165,80	165,80	166,10	166,10	166,10	166,40	165,80	166,20
206284	2K3D	Grad	30,00	30,00	31,00	31,00	31,00	31,00	31,00	32,00	32,00	31,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 27.04.2022

Serial No.	756056_h	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	164,00
Ord. No.	2BD200T1S-A	Serial No.	206284	LSL	152,52
				USL	175,48
Remark	TQ 80% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.566 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}
206284	2K3D	Nm	165,90	166,00	166,10	166,20	165,70	165,90	165,80	165,90	166,00	166,00
206284	2K3D	Grad	30,00	30,00	31,00	30,00	30,00	30,00	31,00	31,00	31,00	29,00

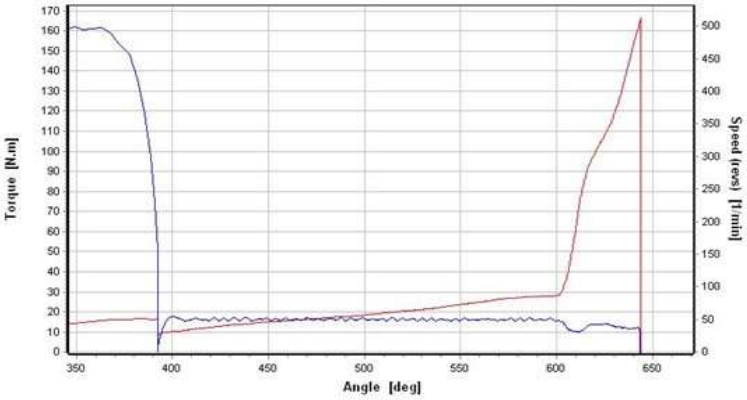
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206284	2K3D	Nm	166,00	166,00	166,00	166,10	165,90	166,00	166,30	165,80	165,90	166,10
206284	2K3D	Grad	31,00	29,00	31,00	31,00	31,00	31,00	29,00	29,00	31,00	30,00

Torque graphs

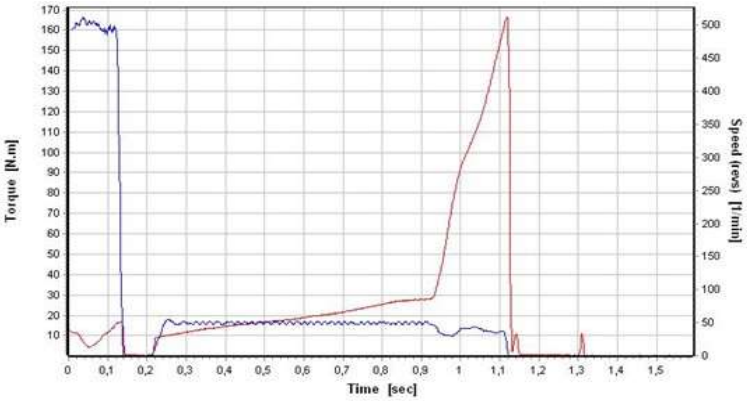
Machine Capability Study 80 %

Model: **2BD-2B200A-2K3D-2ZB**
Serial no: **756056**

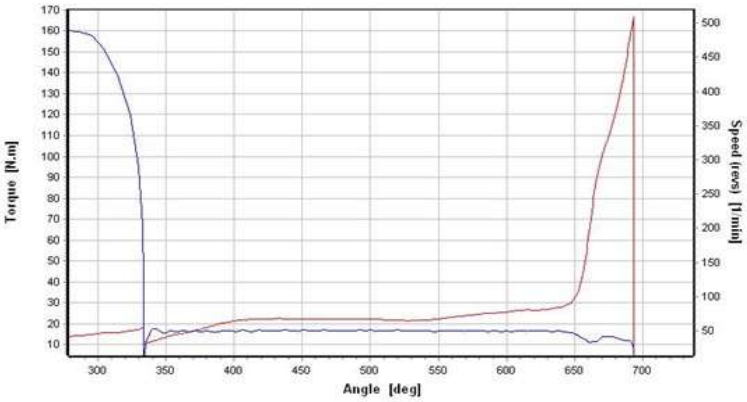
Angle degree: **30°**
Test torque: **164,0 Nm**



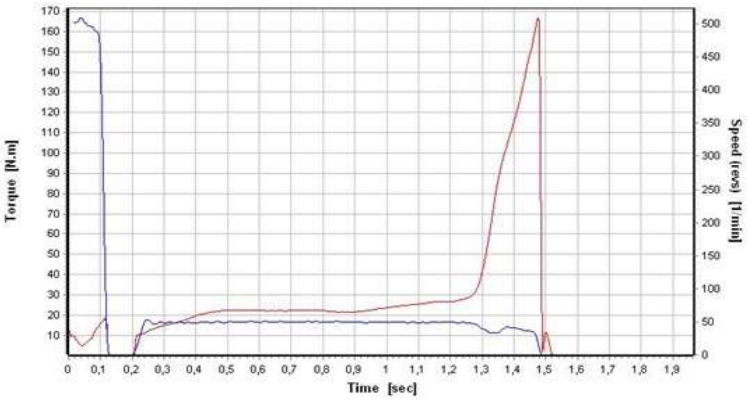
Value no. 1
Graph
Torque / Angle / Speed



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

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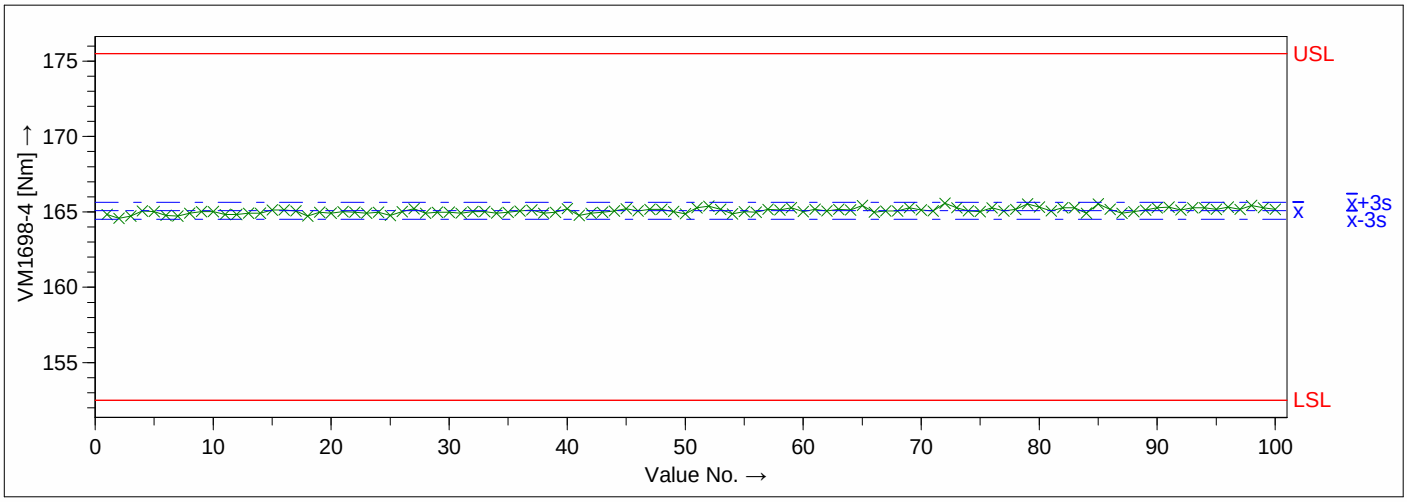
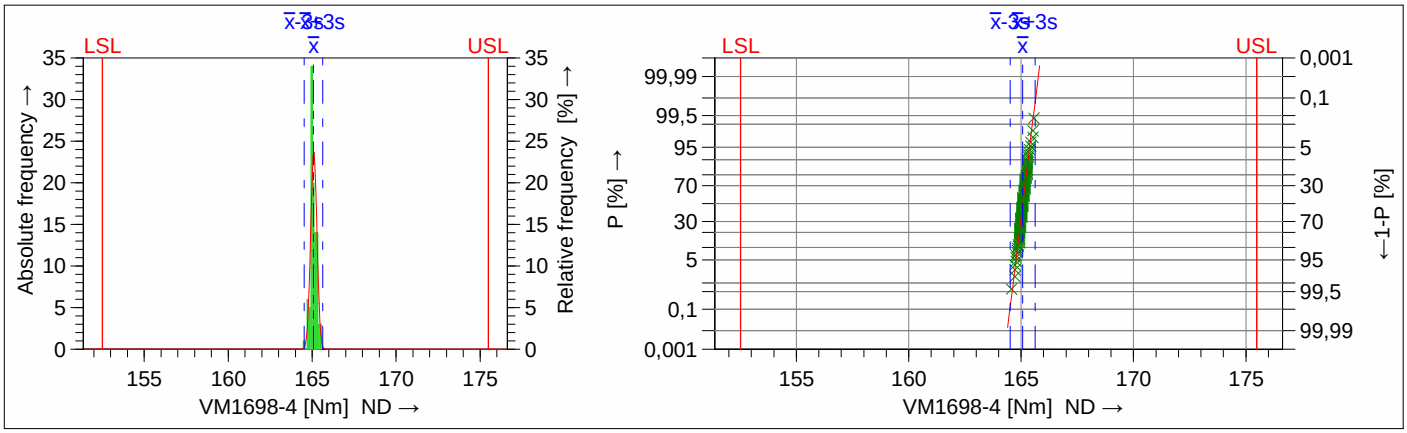
Plant	ATG Westhausen	Operator Name	Sünder
Date	27.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756056_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 27.04.2022 12:22:19 to 27.04.2022 13:22:26

Rem. TQ 80% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.566 Nm/A; Speed: 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	164.00			$\bar{x}$	165.0730
LSL	152.52	x_{min}	164.57	$\bar{x}$-3s	164.5196
USL	175.48	x_{max}	165.57	$\bar{x}$+3s	165.6264
T	22.96	R	1.00	6s	1.1069
		$n_{<T>}$	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	20.74
Critical capability index	=	C_{mk}	18.80

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\Appdata\QW\QWE\Messwert\2022\756056_gM.DFD

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 27.04.2022

Serial No.	756056_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.: 5.566 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	164,57	164,72	165,07	165,02	164,77	164,72	164,92	165,02	165,02
1024210	VM1698-4	Grad	352,25	341,25	356,50	352,75	339,75	338,00	344,75	335,00	345,25	345,25

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	164,82	164,82	164,92	164,92	165,12	165,12	165,07	164,72	164,97	164,92
1024210	VM1698-4	Grad	341,50	340,00	338,00	341,00	347,75	345,00	340,25	354,00	350,25	346,75

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	165,02	164,97	164,92	164,97	164,77	165,02	165,22	164,92	164,97	164,97
1024210	VM1698-4	Grad	341,50	352,50	353,50	358,50	356,75	354,75	351,00	350,50	345,75	358,25

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	164,92	165,02	165,02	164,92	164,97	165,07	165,12	164,92	164,97	165,22
1024210	VM1698-4	Grad	358,00	355,00	354,75	352,25	354,00	355,00	352,00	358,25	356,25	352,50

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	164,77	164,92	164,97	165,07	165,22	165,07	165,17	165,17	165,02	164,87
1024210	VM1698-4	Grad	351,50	352,50	349,50	349,00	352,00	348,50	351,00	356,75	349,75	362,00

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	165,27	165,37	165,17	164,87	165,02	164,97	165,17	165,12	165,27	165,02
1024210	VM1698-4	Grad	357,25	352,50	364,25	358,50	354,00	350,50	357,25	358,00	365,25	354,75

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	165,17	165,07	165,17	165,12	165,42	164,97	165,07	165,07	165,27	165,12
1024210	VM1698-4	Grad	362,75	354,25	357,75	364,00	356,50	351,75	353,00	354,25	354,25	349,50

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	165,07	165,57	165,27	165,07	165,02	165,27	165,07	165,17	165,52	165,32
1024210	VM1698-4	Grad	352,00	354,75	351,50	360,75	356,50	355,25	354,25	356,75	350,25	350,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 27.04.2022

Serial No.	756056_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.: 5.566 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	165,07	165,27	165,27	164,92	165,52	165,17	164,92	165,02	165,12	165,27
1024210	VM1698-4	Grad	360,75	346,00	351,50	358,00	351,25	356,00	356,50	360,75	363,75	351,75

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	165,32	165,12	165,27	165,27	165,17	165,32	165,17	165,42	165,27	165,17
1024210	VM1698-4	Grad	362,25	359,50	354,75	352,50	359,25	361,75	356,50	352,75	353,75	356,25

Machine Capability Study
Tool System

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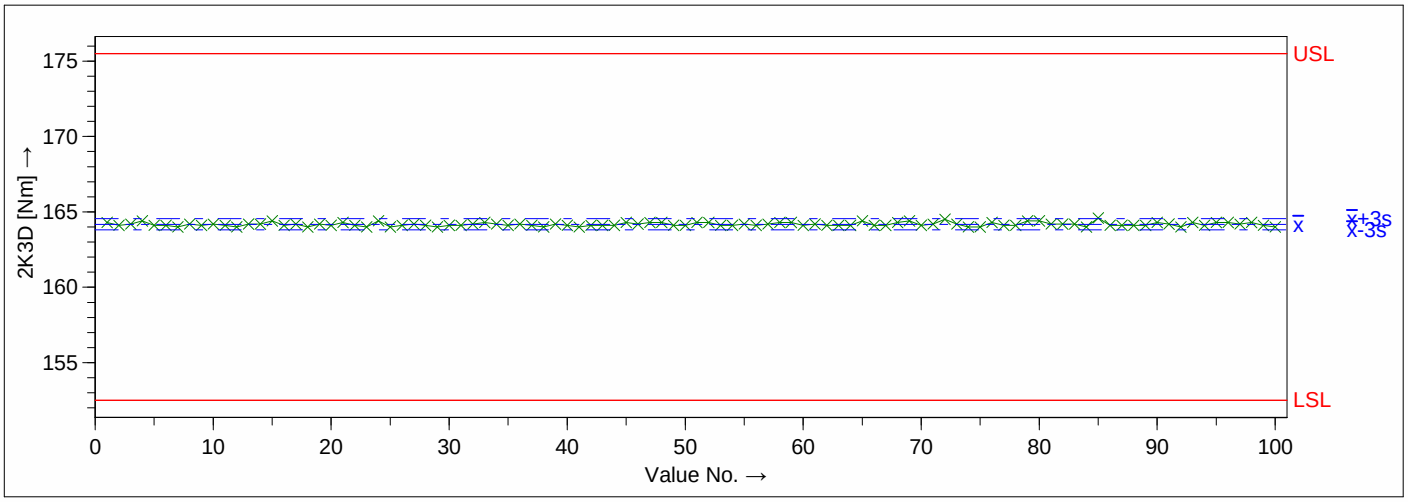
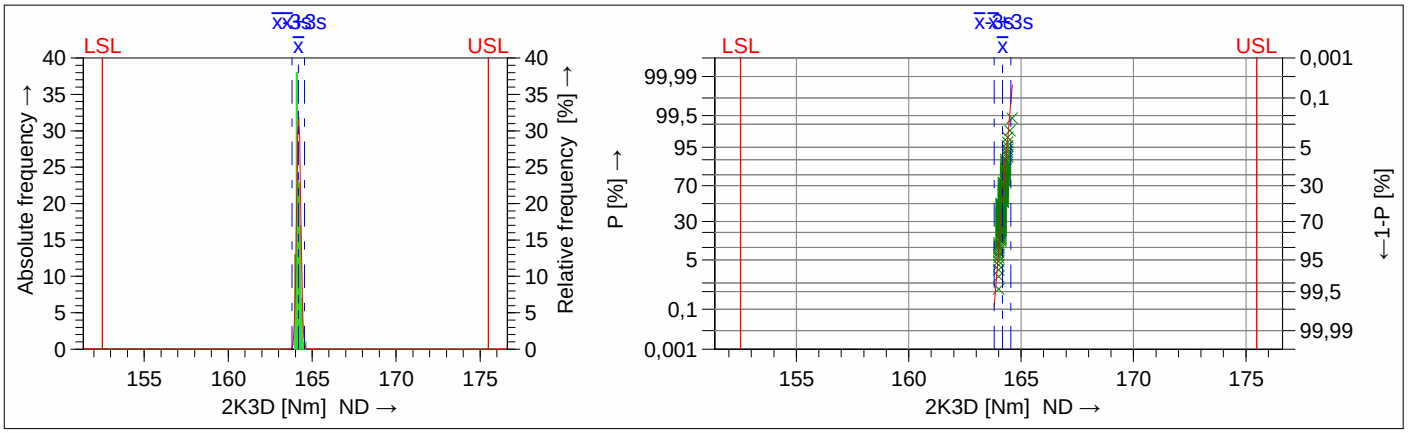
Plant	ATG Westhausen	Operator Name	Sünder
Date	27.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756056_g	Char.Descr.	2K3D	Nom.val. 164,00 11,48	USL 175,48
		Serial No.	206284	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 27.04.2022 12:22:21 to 27.04.2022 13:22:28

Rem. TQ 80% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.566 Nm/A; Speed: 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	164.00			$\bar{x}$	164.1740
LSL	152.52	x_{min}	164.00	$\bar{x}$-3s	163.8008
USL	175.48	x_{max}	164.60	$\bar{x}$+3s	164.5472
T	22.96	R	0.60	6s	0.7465
		$n_{<T>}$	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	30.76
Critical capability index	=	C_{mk}	30.29

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\Appdata\QW\QWE\Messwert\2022\756056_g1.DFD

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 27.04.2022

Serial No.	756056_g	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	164,00
Ord. No.	2BD200T1S-A	Serial No.	206284	LSL	152,52
				USL	175,48
Remark	TQ 80% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.566 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}
206284	2K3D	Nm	164,30	164,10	164,20	164,40	164,10	164,10	164,00	164,20	164,10	164,20
206284	2K3D	Grad	352,00	341,00	356,00	352,00	339,00	337,00	344,00	332,00	344,00	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}
206284	2K3D	Nm	164,10	164,00	164,20	164,20	164,40	164,10	164,20	164,00	164,20	164,10
206284	2K3D	Grad	340,00	339,00	337,00	339,00	348,00	344,00	338,00	353,00	349,00	345,00

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}
206284	2K3D	Nm	164,30	164,10	164,00	164,40	164,00	164,10	164,20	164,10	164,00	164,10
206284	2K3D	Grad	340,00	351,00	351,00	356,00	356,00	353,00	349,00	349,00	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}
206284	2K3D	Nm	164,10	164,20	164,30	164,20	164,10	164,20	164,10	164,00	164,20	164,10
206284	2K3D	Grad	357,00	353,00	353,00	351,00	352,00	353,00	350,00	357,00	354,00	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}
206284	2K3D	Nm	164,00	164,10	164,10	164,10	164,30	164,20	164,30	164,30	164,10	164,10
206284	2K3D	Grad	350,00	352,00	349,00	347,00	352,00	347,00	350,00	356,00	347,00	361,00

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}
206284	2K3D	Nm	164,30	164,30	164,10	164,10	164,20	164,10	164,20	164,30	164,30	164,10
206284	2K3D	Grad	356,00	352,00	364,00	358,00	353,00	348,00	356,00	357,00	364,00	352,00

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}
206284	2K3D	Nm	164,20	164,10	164,10	164,10	164,40	164,10	164,10	164,30	164,40	164,10
206284	2K3D	Grad	362,00	353,00	357,00	362,00	355,00	350,00	352,00	353,00	353,00	348,00

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}
206284	2K3D	Nm	164,20	164,50	164,20	164,00	164,00	164,30	164,10	164,10	164,40	164,40
206284	2K3D	Grad	350,00	353,00	350,00	359,00	355,00	355,00	353,00	354,00	349,00	349,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 27.04.2022

Serial No.	756056_g	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	164,00
Ord. No.	2BD200T1S-A	Serial No.	206284	LSL	152,52
				USL	175,48
Remark	TQ 80% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.566 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}
206284	2K3D	Nm	164,20	164,20	164,20	164,00	164,60	164,10	164,10	164,10	164,10	164,30
206284	2K3D	Grad	359,00	345,00	349,00	356,00	350,00	355,00	355,00	359,00	363,00	351,00

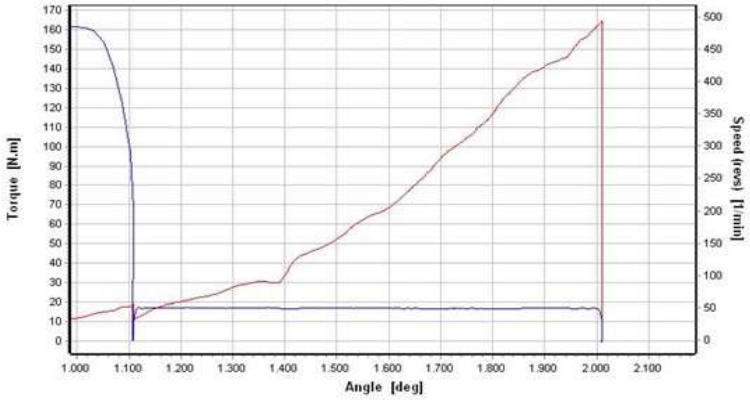
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206284	2K3D	Nm	164,20	164,00	164,30	164,10	164,30	164,30	164,20	164,30	164,10	164,00
206284	2K3D	Grad	360,00	359,00	353,00	351,00	359,00	361,00	355,00	352,00	352,00	356,00

Torque graphs

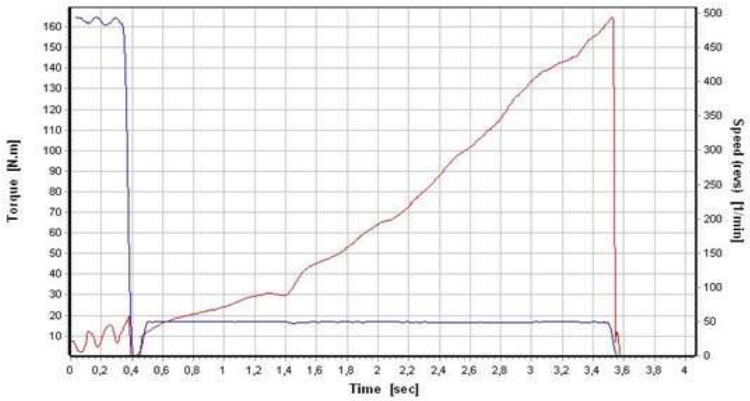
Machine Capability Study 80 %

Model: **2BD-2B200A-2K3D-2ZB**
Serial no: **756056**

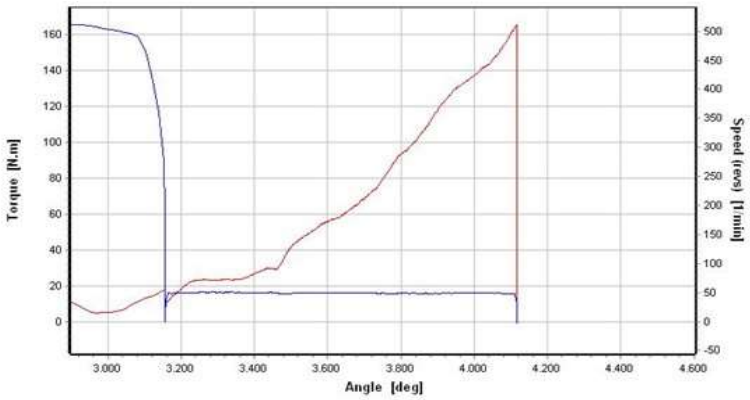
Angle degree: **360°**
Test torque: **164,0 Nm**



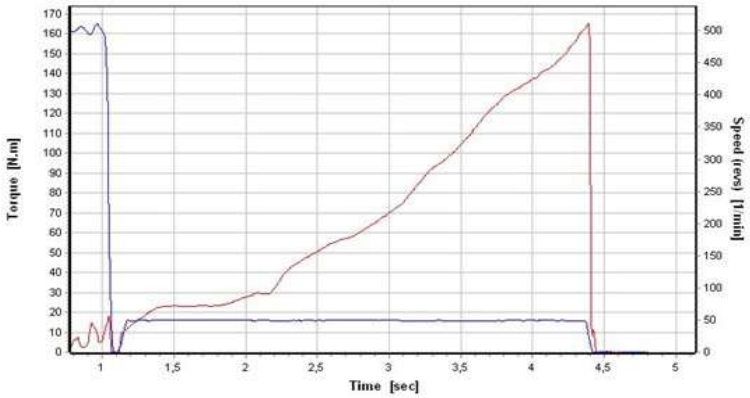
Value no. 1
Graph
Torque / Angle / Speed



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: **756056**

Test torque: Tq max. 200,00 Nm

Hard joint (H)	1215,45	Nm / Revolution	Angle degree	30°
Soft joint (L)	100,56	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	202,58	201,13 Nm
	Standard deviation	0,25	0,20 Nm
	Torque scatter (99,73%)	1,49	1,19 Nm
	C_m	18,75	23,53
	C_{mk}	15,30	21,63

b)	Min. C_m hard/soft (lowest value)	18,75
	Min. C_{mk} hard/soft (lowest value)	15,30

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

Note:

Machine Capability Study
Control System

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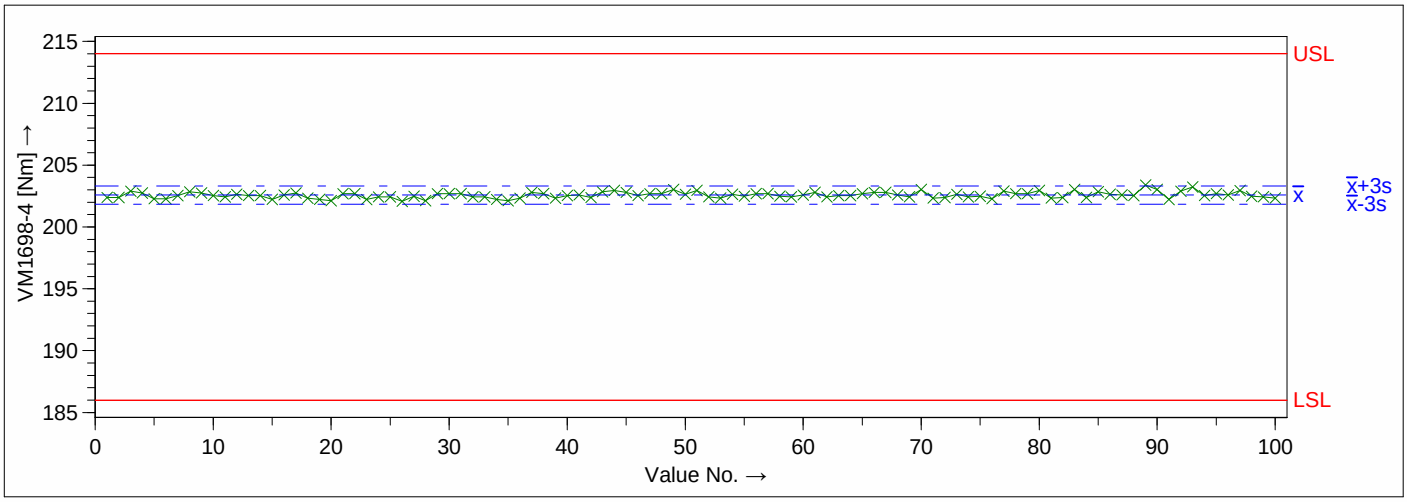
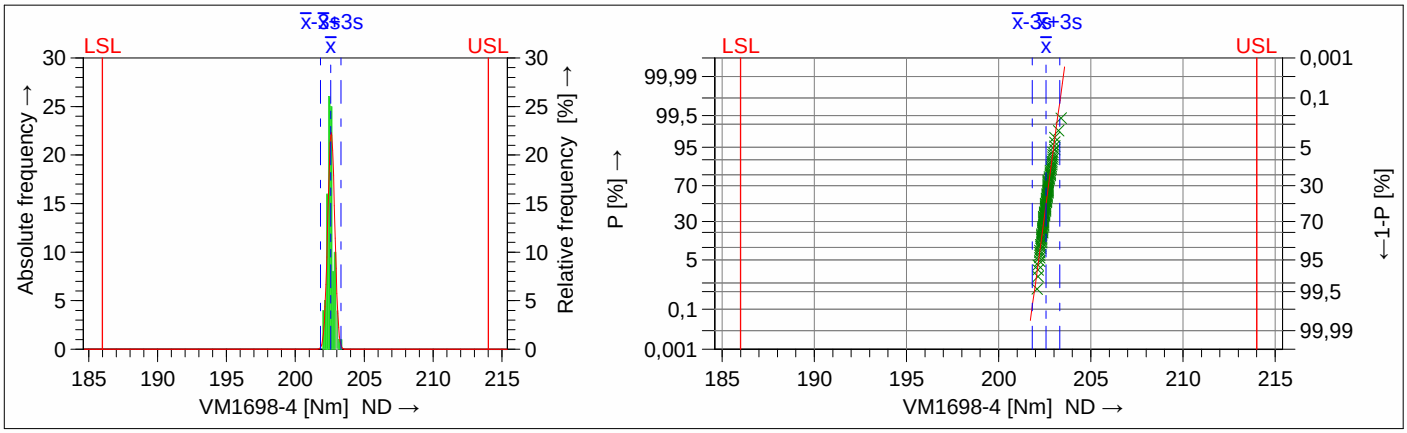
Plant	ATG Westhausen	Operator Name	Sünder
Date	27.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756056_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 27.04.2022 14:01:23 to 27.04.2022 14:15:32

Rem. TQ 100% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.370 Nm/A; Speed: 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	200.00			$\bar{x}$	202.5754
LSL	186.00	x_{min}	202.08	$\bar{x}$-3s	201.8286
USL	214.00	x_{max}	203.39	$\bar{x}$+3s	203.3222
T	28.00	R	1.31	6s	1.4937
		$n_{<T>}$	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	18.75
Critical capability index	=	C_{mk}	15.30

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\Appdata\QW\QWE\Messwert\2022\756056_bM.DFD

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 27.04.2022

Serial No.	756056_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.: 5.370 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	202,38	202,38	202,89	202,74	202,28	202,28	202,53	202,84	202,74	202,53
1024210	VM1698-4	Grad	29,25	29,50	29,25	30,00	29,75	29,25	30,00	29,75	29,50	29,00

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	Nm	202,43	202,63	202,53	202,53	202,23	202,58	202,74	202,33	202,23	202,13
1024210	VM1698-4	Grad	29,00	29,00	29,50	29,50	29,25	29,25	30,00	30,00	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	202,68	202,68	202,23	202,43	202,43	202,08	202,48	202,13	202,68	202,68
1024210	VM1698-4	Grad	29,00	29,50	29,50	30,25	29,75	29,50	29,75	30,00	30,00	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	202,68	202,43	202,43	202,23	202,13	202,33	202,79	202,68	202,33	202,53
1024210	VM1698-4	Grad	30,00	29,50	29,50	29,75	29,75	29,50	29,75	30,00	30,00	29,75

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	Nm	202,58	202,38	202,84	202,94	202,79	202,53	202,68	202,68	203,04	202,63
1024210	VM1698-4	Grad	29,50	29,25	29,75	29,25	29,00	29,25	30,00	29,50	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	202,94	202,43	202,33	202,63	202,48	202,68	202,68	202,48	202,43	202,58
1024210	VM1698-4	Grad	29,25	29,50	30,00	29,50	30,00	30,25	30,00	29,75	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}
1024210	VM1698-4	Nm	202,79	202,43	202,53	202,53	202,68	202,79	202,79	202,58	202,43	203,04
1024210	VM1698-4	Grad	29,25	29,25	30,50	29,50	30,25	29,25	30,00	30,00	29,25	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}
1024210	VM1698-4	Nm	202,33	202,38	202,63	202,43	202,48	202,28	202,89	202,68	202,68	202,94
1024210	VM1698-4	Grad	29,25	29,00	29,75	29,75	29,50	29,75	29,75	30,25	30,25	30,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 27.04.2022

Serial No.	756056_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.: 5.370 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	202,33	202,38	203,04	202,38	202,84	202,63	202,58	202,53	203,39	203,04
1024210	VM1698-4	Grad	30,00	29,50	30,25	30,00	29,75	29,50	30,00	29,75	29,75	30,25

Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	202,23	202,89	203,24	202,53	202,68	202,58	202,94	202,48	202,43	202,33
1024210	VM1698-4	Grad	29,25	30,50	29,25	30,00	29,50	30,00	30,25	30,25	29,25	29,75

Machine Capability Study
Tool System

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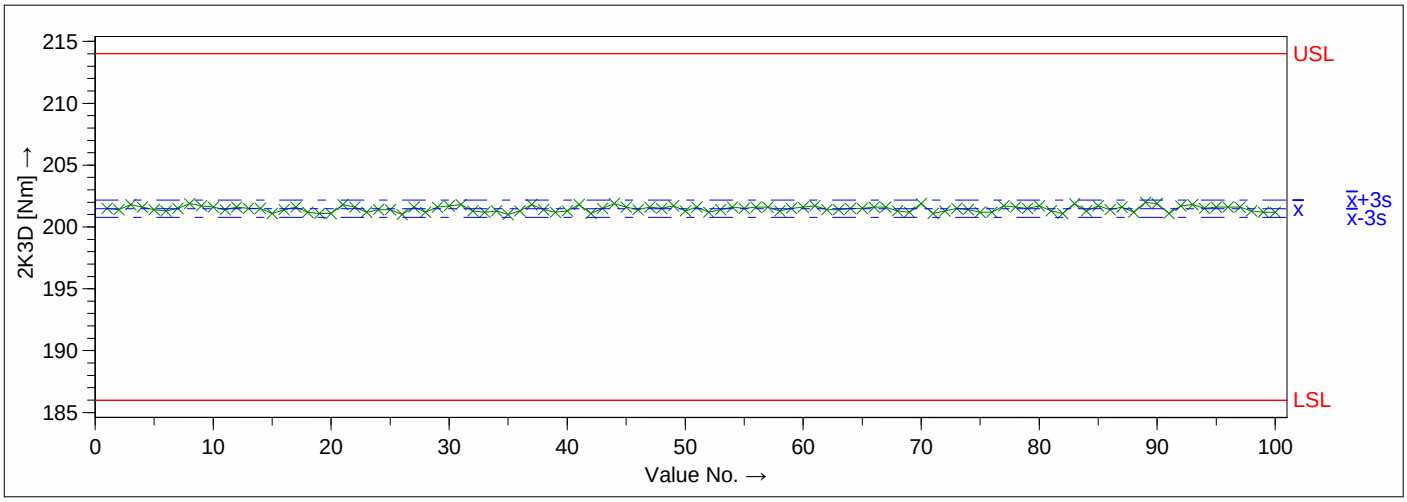
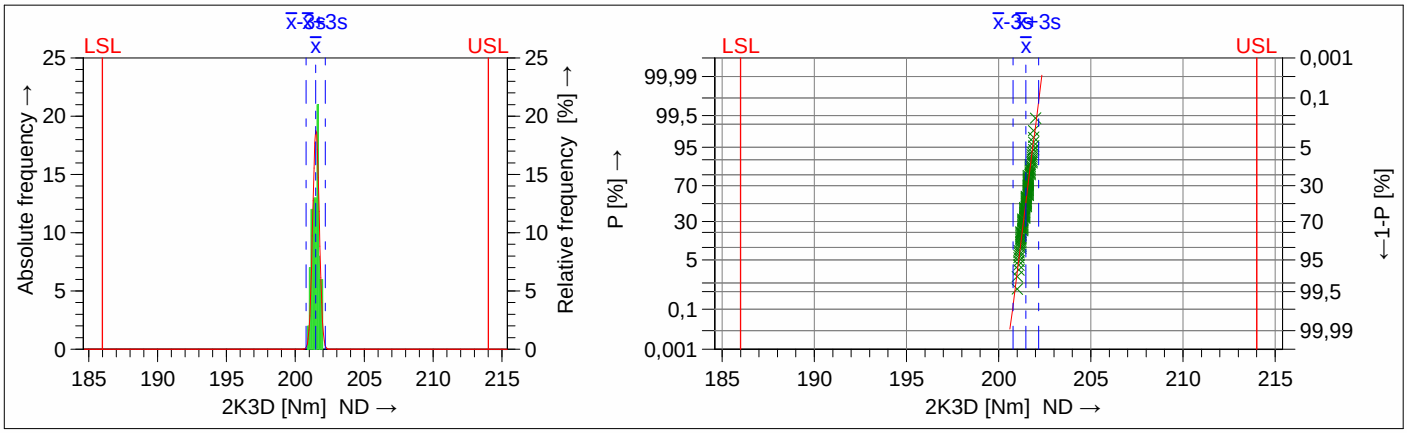
Plant	ATG Westhausen	Operator Name	Sünder
Date	27.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756056_b	Char.Descr.	2K3D	Nom.val.	200,00 14,00
		Serial No.	206284	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 27.04.2022 14:01:24 to 27.04.2022 14:15:33

Rem. TQ 100% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.370 Nm/A; Speed: 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	200.00			$\bar{x}$	201.4690
LSL	186.00	x_{min}	201.00	$\bar{x}$-3s	200.7727
USL	214.00	x_{max}	202.00	$\bar{x}$+3s	202.1653
T	28.00	R	1.00	6s	1.3927
		$n_{<T>}$	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	20.10
Critical capability index	=	C_{mk}	18.00

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 27.04.2022

Serial No.	756056_b	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	200,00
Ord. No.	2BD200T1S-A	Serial No.	206284	LSL	186,00
				USL	214,00
Remark	TQ 100% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.370 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}
206284	2K3D	Nm	201,50	201,40	201,80	201,60	201,40	201,30	201,50	201,90	201,70	201,60
206284	2K3D	Grad	30,00	31,00	31,00	31,00	30,00	30,00	31,00	30,00	30,00	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}
206284	2K3D	Nm	201,40	201,60	201,50	201,50	201,10	201,40	201,60	201,20	201,10	201,10
206284	2K3D	Grad	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
206284	2K3D	Nm	201,80	201,60	201,20	201,40	201,40	201,00	201,60	201,20	201,60	201,70
206284	2K3D	Grad	30,00	30,00	30,00	31,00	30,00	31,00	30,00	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}
206284	2K3D	Nm	201,80	201,30	201,20	201,30	201,00	201,30	201,80	201,40	201,20	201,30
206284	2K3D	Grad	30,00	30,00	30,00	30,00	30,00	31,00	31,00	31,00	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}
206284	2K3D	Nm	201,80	201,10	201,50	201,90	201,60	201,40	201,60	201,50	201,70	201,30
206284	2K3D	Grad	30,00	30,00	30,00	30,00	30,00	30,00	31,00	31,00	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}
206284	2K3D	Nm	201,60	201,20	201,40	201,60	201,50	201,60	201,60	201,30	201,50	201,60
206284	2K3D	Grad	31,00	30,00	31,00	30,00	31,00	31,00	31,00	31,00	31,00	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}
206284	2K3D	Nm	201,70	201,40	201,40	201,50	201,50	201,60	201,60	201,30	201,20	201,90
206284	2K3D	Grad	30,00	30,00	31,00	31,00	31,00	30,00	30,00	30,00	30,00	31,00

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}
206284	2K3D	Nm	201,10	201,30	201,50	201,40	201,20	201,20	201,70	201,60	201,50	201,70
206284	2K3D	Grad	30,00	30,00	30,00	30,00	30,00	30,00	31,00	31,00	31,00	31,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 27.04.2022

Serial No.	756056_b	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	200,00
Ord. No.	2BD200T1S-A	Serial No.	206284	LSL	186,00
				USL	214,00
Remark	TQ 100% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.370 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}
206284	2K3D	Nm	201,30	201,10	201,90	201,30	201,70	201,40	201,60	201,20	202,00	201,90
206284	2K3D	Grad	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00

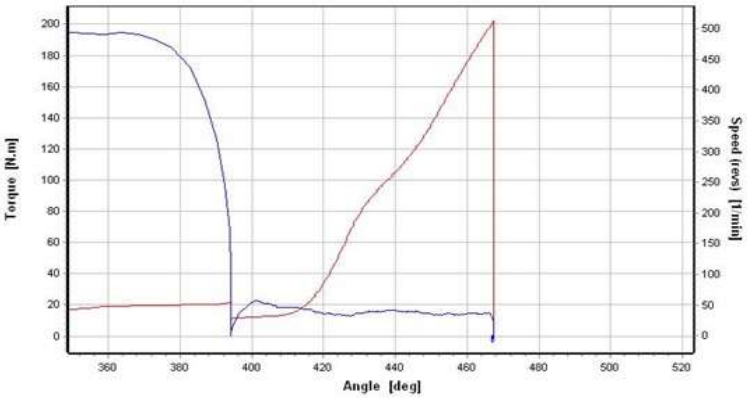
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206284	2K3D	Nm	201,10	201,70	201,80	201,50	201,60	201,60	201,60	201,30	201,20	201,20
206284	2K3D	Grad	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	30,00	31,00

Torque graphs

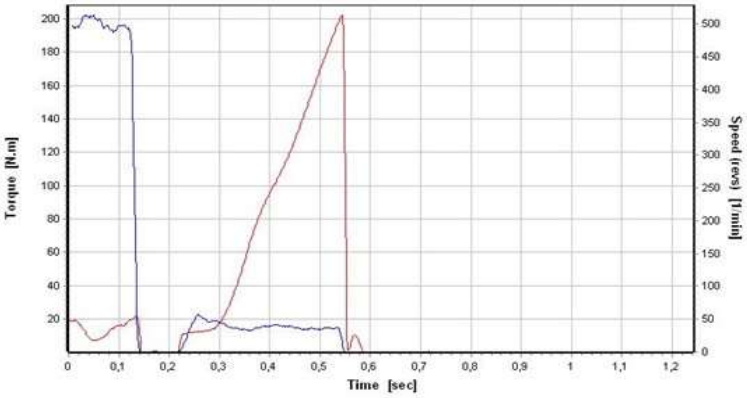
Machine Capability Study 100 %

Model: **2BD-2B200A-2K3D-2ZB**
Serial no: **756056**

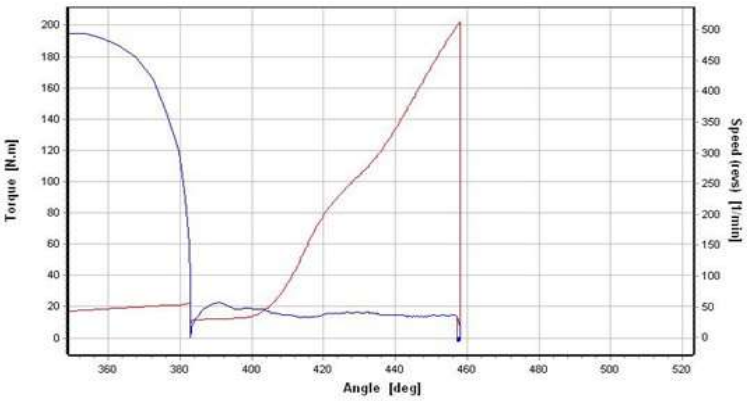
Angle degree: **30°**
Test torque: **200,0 Nm**



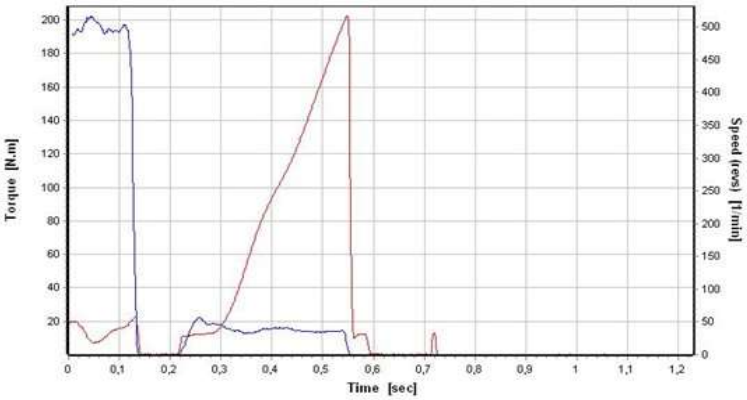
Value no. 1
Graph
Torque / Angle / Speed



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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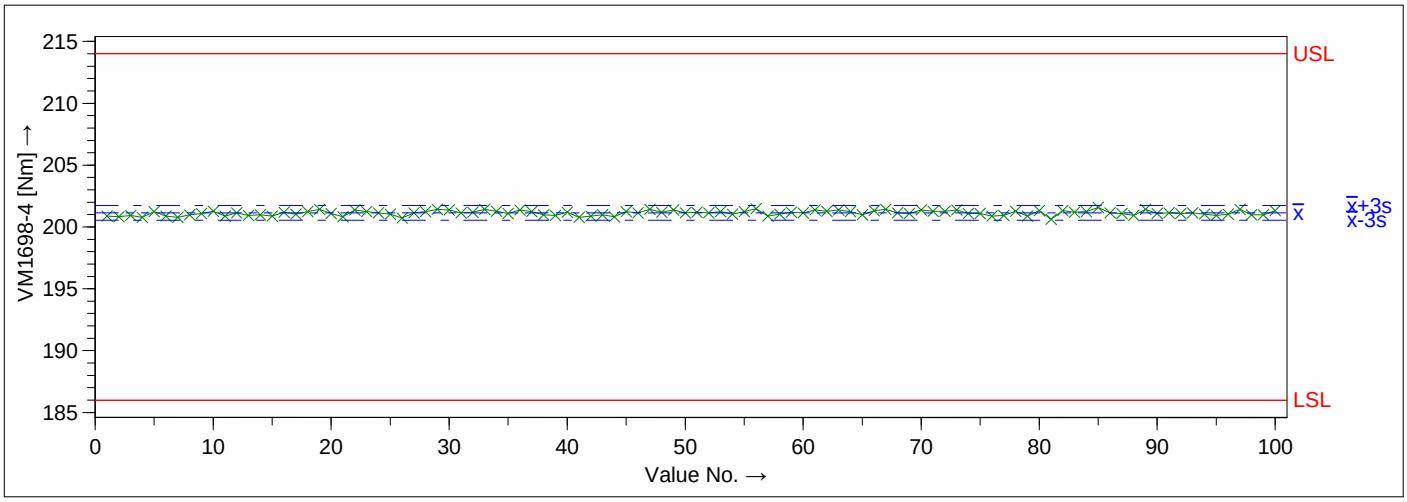
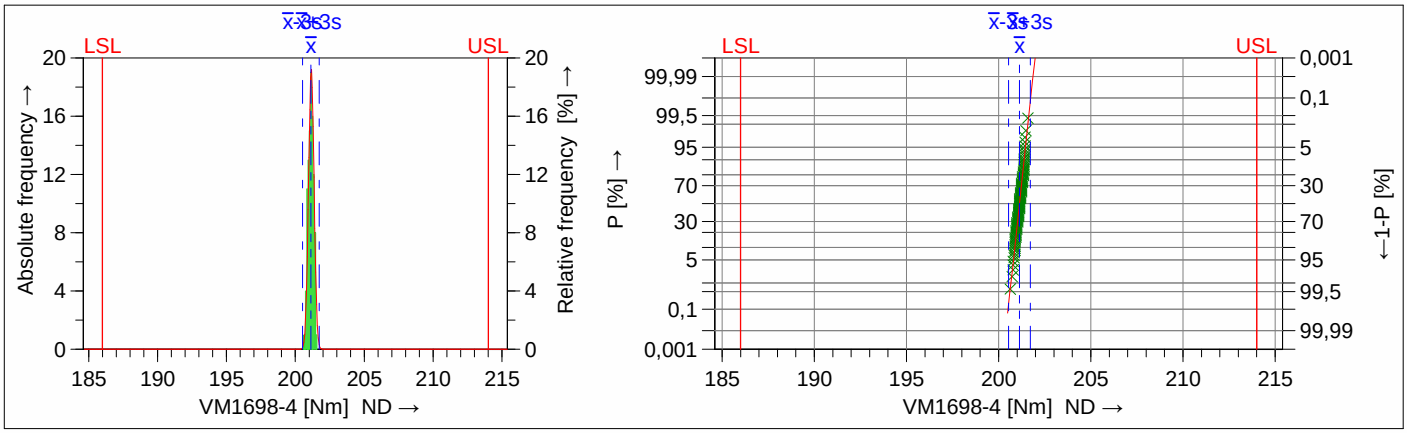
Plant	ATG Westhausen	Operator Name	Sünder
Date	27.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756056_a	Char.Descr.	VM1698-4	Nom.val. 200,00 14,00	USL 214,00
		Serial No.	1024210	Unit Nm -14,00	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 27.04.2022 15:22:17 to 27.04.2022 16:55:41

Rem. TQ 100% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.370 Nm/A; Speed: 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	200.00			$\bar{x}$	201.1280
LSL	186.00	x_{min}	200.63	$\bar{x}$-3s	200.5330
USL	214.00	x_{max}	201.58	$\bar{x}$+3s	201.7230
T	28.00	R	0.95	6s	1.1900
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			M1.1.4 $\hat{\sigma} = S_{tot}$
Potential Capability index	=	C_m	23.53
Critical capability index	=	C_{mk}	21.63

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 27.04.2022

Serial No.	756056_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.: 5.370 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	200,88	200,83	200,93	200,78	201,23	200,88	200,78	200,98	201,08	201,28
1024210	VM1698-4	Grad	360,75	360,50	364,00	360,75	354,50	350,75	361,00	354,00	352,00	355,25

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	200,88	201,13	200,93	200,98	200,88	201,18	201,03	201,23	201,43	201,08
1024210	VM1698-4	Grad	356,50	353,00	358,75	354,25	347,00	359,50	350,50	358,50	353,25	350,50

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	200,83	201,38	201,23	201,13	201,03	200,73	201,13	201,23	201,43	201,38
1024210	VM1698-4	Grad	357,25	355,75	356,50	356,75	346,25	351,50	356,25	355,50	356,00	357,75

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	201,13	201,18	201,43	201,28	201,08	201,38	201,23	200,98	200,93	201,18
1024210	VM1698-4	Grad	349,75	356,50	349,75	347,25	350,00	356,75	352,00	354,00	347,25	355,00

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	200,78	200,88	200,98	200,83	201,23	201,13	201,43	201,18	201,38	201,13
1024210	VM1698-4	Grad	353,50	362,00	354,50	364,00	354,00	357,75	358,50	359,00	359,50	358,75

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	201,18	201,13	201,23	201,03	201,23	201,48	200,88	201,03	201,18	201,13
1024210	VM1698-4	Grad	357,25	360,25	361,25	360,75	351,00	355,75	357,75	354,00	353,50	359,25

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	201,38	201,28	201,38	201,23	200,98	201,33	201,43	201,13	201,08	201,38
1024210	VM1698-4	Grad	355,50	355,75	358,50	358,75	350,50	354,75	353,75	348,00	354,50	352,50

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	201,28	201,28	201,38	201,08	201,08	200,88	200,93	201,28	200,88	201,33
1024210	VM1698-4	Grad	356,75	359,25	352,75	349,75	356,75	353,25	349,75	357,50	356,75	358,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 27.04.2022

Serial No.	756056_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.: 5.370 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	200,63	201,33	201,18	201,23	201,58	201,13	201,08	200,93	201,43	201,08
1024210	VM1698-4	Grad	361,00	362,50	357,25	358,75	358,25	357,75	356,75	359,50	356,25	358,25

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	201,13	201,08	201,13	201,03	200,93	201,03	201,43	200,98	200,98	201,33
1024210	VM1698-4	Grad	355,50	356,25	361,00	354,50	353,25	357,00	361,00	343,25	354,75	360,00

Machine Capability Study
Tool System

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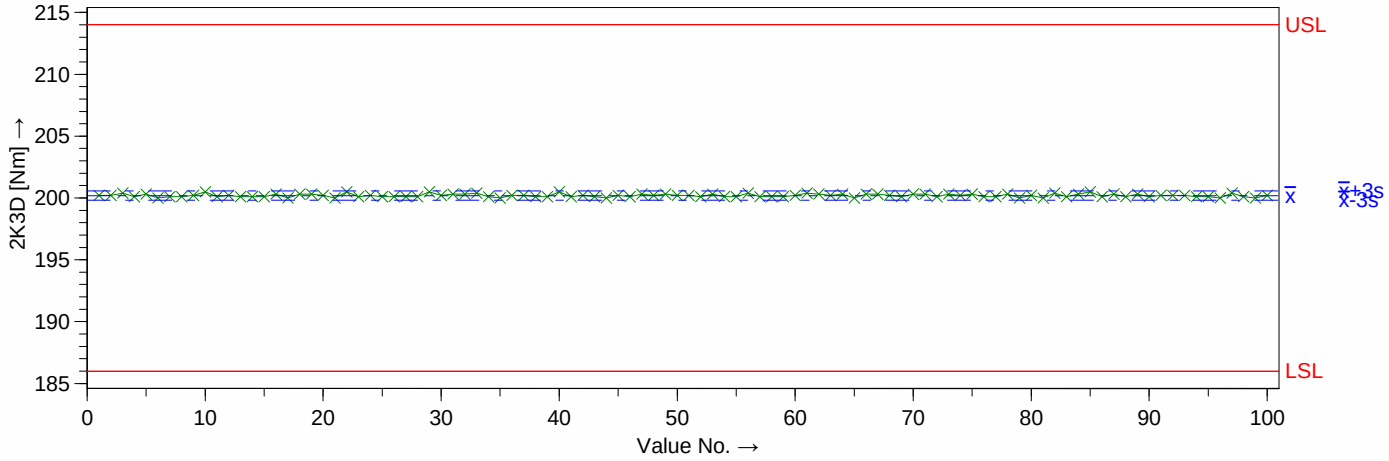
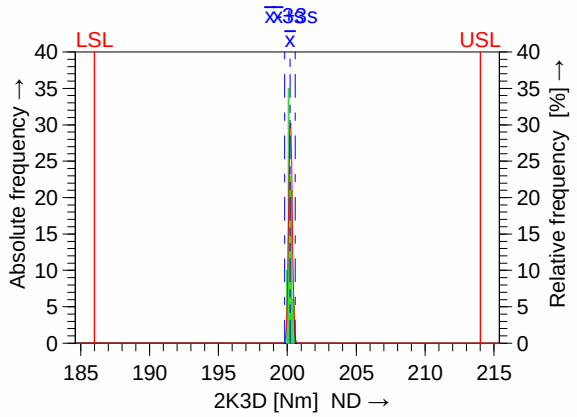
Plant	ATG Westhausen	Operator Name	Sünder
Date	27.04.2022		

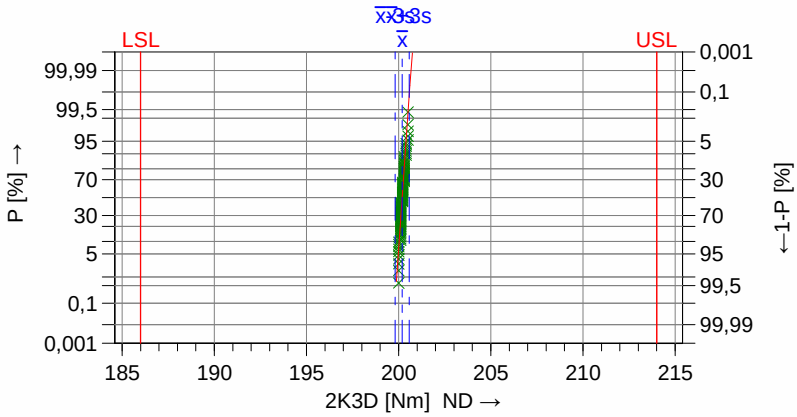
Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756056_a	Char.Descr.	2K3D	Nom.val. 200,00 14,00	USL 214,00
		Serial No.	206284	Unit Nm -14,00	LSL 186,00
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	250 / 5537037	nges.	100

Evaluation from 27.04.2022 15:22:19 to 27.04.2022 16:55:42

Rem. TQ 100% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.370 Nm/A; Speed: 502/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	200.00			$\bar{x}$	200.1930
LSL	186.00	x_{min}	200.00	$\bar{x}$-3s	199.8063
USL	214.00	x_{max}	200.50	$\bar{x}$+3s	200.5797
T	28.00	R	0.50	6s	0.7734
		$n_{<T>}$	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	36.20
Critical capability index	=	C_{mk}	35.70

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 27.04.2022

Serial No.	756056_a	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	200,00
Ord. No.	2BD200T1S-A	Serial No.	206284	LSL	186,00
				USL	214,00
Remark	TQ 100% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.370 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}
206284	2K3D	Nm	200,20	200,20	200,40	200,10	200,30	200,00	200,10	200,10	200,20	200,50
206284	2K3D	Grad	361,00	360,00	362,00	360,00	354,00	351,00	360,00	353,00	351,00	354,00

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}
206284	2K3D	Nm	200,10	200,20	200,10	200,10	200,10	200,30	200,00	200,30	200,30	200,20
206284	2K3D	Grad	355,00	352,00	358,00	354,00	346,00	359,00	350,00	358,00	352,00	350,00

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}
206284	2K3D	Nm	200,00	200,50	200,10	200,20	200,10	200,10	200,10	200,10	200,50	200,20
206284	2K3D	Grad	356,00	356,00	356,00	356,00	345,00	351,00	354,00	354,00	354,00	358,00

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}
206284	2K3D	Nm	200,30	200,30	200,40	200,10	200,00	200,20	200,20	200,10	200,10	200,50
206284	2K3D	Grad	349,00	356,00	349,00	347,00	349,00	357,00	352,00	353,00	347,00	355,00

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}
206284	2K3D	Nm	200,10	200,20	200,10	200,00	200,20	200,10	200,30	200,20	200,30	200,20
206284	2K3D	Grad	352,00	361,00	354,00	363,00	352,00	357,00	358,00	358,00	359,00	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}
206284	2K3D	Nm	200,20	200,10	200,30	200,10	200,10	200,40	200,10	200,10	200,10	200,20
206284	2K3D	Grad	356,00	359,00	361,00	360,00	351,00	354,00	357,00	354,00	352,00	357,00

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}
206284	2K3D	Nm	200,40	200,30	200,20	200,30	200,00	200,30	200,30	200,20	200,10	200,30
206284	2K3D	Grad	354,00	354,00	358,00	358,00	349,00	353,00	353,00	347,00	354,00	351,00

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}
206284	2K3D	Nm	200,30	200,10	200,30	200,20	200,30	200,10	200,10	200,30	200,00	200,20
206284	2K3D	Grad	355,00	359,00	352,00	349,00	355,00	352,00	349,00	356,00	355,00	357,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 27.04.2022

Serial No.	756056_a	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	200,00
Ord. No.	2BD200T1S-A	Serial No.	206284	LSL	186,00
				USL	214,00
Remark	TQ 100% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.370 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}
206284	2K3D	Nm	200,00	200,40	200,10	200,30	200,50	200,10	200,30	200,10	200,30	200,10
206284	2K3D	Grad	360,00	361,00	357,00	358,00	356,00	356,00	356,00	358,00	354,00	358,00

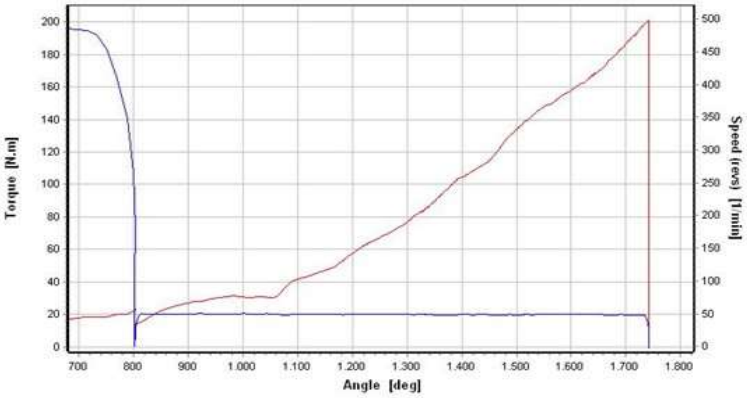
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206284	2K3D	Nm	200,20	200,20	200,20	200,10	200,10	200,00	200,40	200,10	200,00	200,20
206284	2K3D	Grad	354,00	355,00	358,00	355,00	353,00	356,00	361,00	342,00	354,00	358,00

Torque graphs

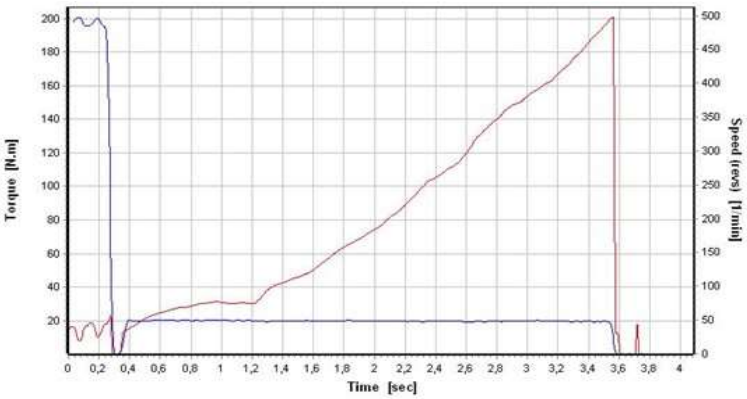
Machine Capability Study 100 %

Model: **2BD-2B200A-2K3D-2ZB**
Serial no: **756056**

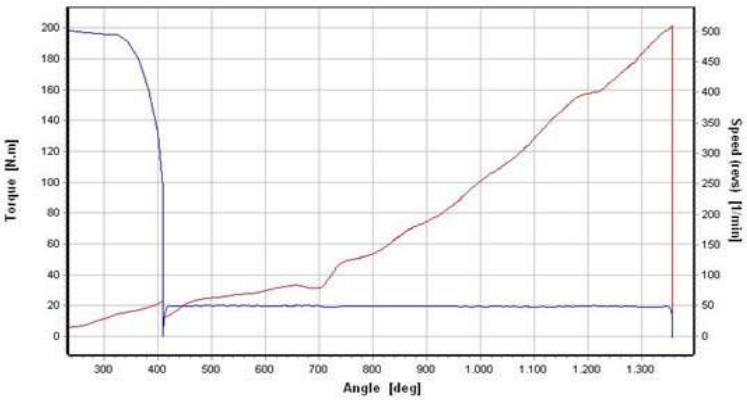
Angle degree: **360°**
Test torque: **200,0 Nm**



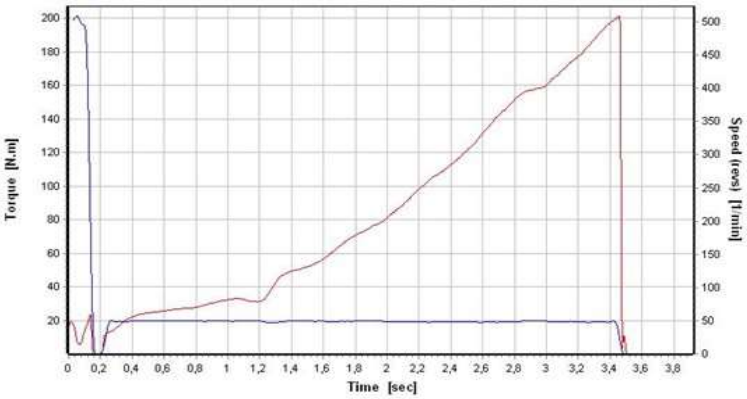
Value no. 1
Graph
Torque / Angle / Speed



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:** 756056

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: 0,55 % ± **0,27 %**

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

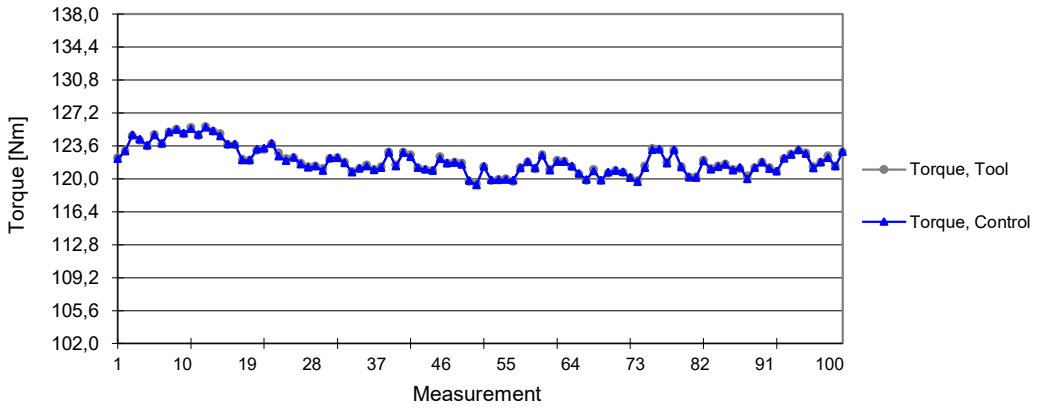
Formula derivation: $C_m = \frac{T}{6\,s}$ $T = C_m * 6\,s$

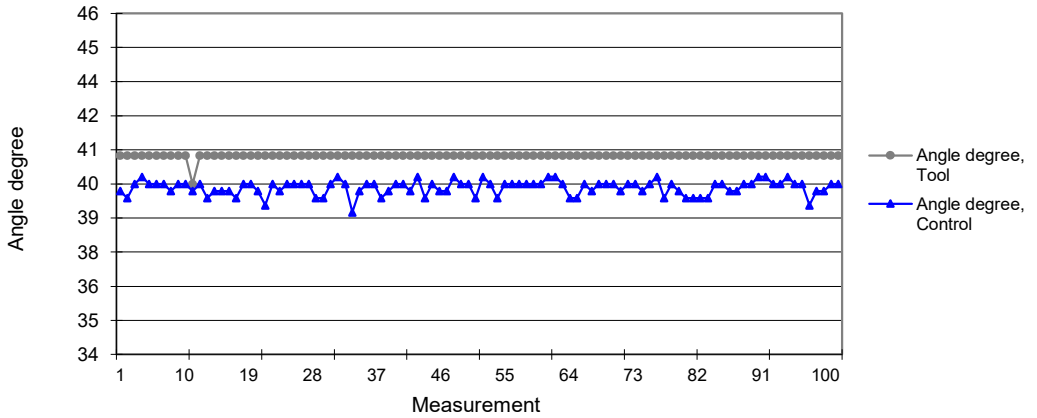
Tool without angle correction

Measurement	Tool data		Control data		Difference	
No.	Torque	Angle	Torque	Angle	Torque	Angle
1	122,30	41,00	122,18	39,75	0,12	1,25
2	123,00	41,00	123,00	39,50	0,00	1,50
3	124,70	41,00	124,82	40,00	0,12	1,00
4	124,20	41,00	124,33	40,25	0,13	0,75
5	123,60	41,00	123,64	40,00	0,04	1,00
6	124,80	41,00	124,75	40,00	0,05	1,00
7	123,80	41,00	123,86	40,00	0,06	1,00
8	125,10	41,00	125,07	39,75	0,03	1,25
9	125,40	41,00	125,36	40,00	0,04	1,00
10	124,90	41,00	124,99	40,00	0,09	1,00
11	125,60	40,00	125,46	39,75	0,14	0,25
12	124,70	41,00	124,85	40,00	0,15	1,00
13	125,70	41,00	125,61	39,50	0,09	1,50
14	125,20	41,00	125,22	39,75	0,02	1,25
15	124,90	41,00	124,67	39,75	0,23	1,25
16	123,70	41,00	123,79	39,75	0,09	1,25
17	123,70	41,00	123,79	39,50	0,09	1,50
18	122,10	41,00	122,04	40,00	0,06	1,00
19	122,00	41,00	122,04	40,00	0,04	1,00
20	123,10	41,00	123,24	39,75	0,14	1,25
21	123,20	41,00	123,32	39,25	0,12	1,75
22	123,80	41,00	123,86	40,00	0,06	1,00
23	122,80	41,00	122,46	39,75	0,34	1,25
24	122,20	41,00	121,96	40,00	0,24	1,00
25	122,30	41,00	122,33	40,00	0,03	1,00
26	121,70	41,00	121,59	40,00	0,11	1,00
27	121,30	41,00	121,25	40,00	0,05	1,00
28	121,40	41,00	121,35	39,50	0,05	1,50
29	121,10	41,00	120,90	39,50	0,20	1,50
30	122,20	41,00	122,26	40,00	0,06	1,00
31	122,30	41,00	122,28	40,25	0,02	0,75
32	121,80	41,00	121,74	40,00	0,06	1,00
33	120,80	41,00	120,73	39,00	0,07	2,00
34	121,10	41,00	121,13	39,75	0,03	1,25
35	121,50	41,00	121,37	40,00	0,13	1,00
36	121,00	41,00	120,95	40,00	0,05	1,00
37	121,30	41,00	121,22	39,50	0,08	1,50
38	122,90	41,00	122,90	39,75	0,00	1,25
39	121,50	41,00	121,35	40,00	0,15	1,00
40	122,90	41,00	122,83	40,00	0,07	1,00
41	122,60	41,00	122,41	39,75	0,19	1,25
42	121,20	41,00	121,17	40,25	0,03	0,75
43	121,00	41,00	121,00	39,50	0,00	1,50
44	120,90	41,00	120,90	40,00	0,00	1,00
45	122,40	41,00	122,16	39,75	0,24	1,25
46	121,70	41,00	121,72	39,75	0,02	1,25
47	121,80	41,00	121,77	40,25	0,03	0,75
48	121,70	41,00	121,57	40,00	0,13	1,00
49	119,70	41,00	119,79	40,00	0,09	1,00
50	119,40	41,00	119,33	39,50	0,07	1,50
51	121,30	41,00	121,32	40,25	0,02	0,75
52	119,80	41,00	119,89	40,00	0,09	1,00
53	119,90	41,00	119,87	39,50	0,03	1,50
54	120,00	41,00	119,92	40,00	0,08	1,00
55	119,70	41,00	119,84	40,00	0,14	1,00
56	121,20	41,00	121,15	40,00	0,05	1,00
57	121,80	41,00	121,89	40,00	0,09	1,00
58	121,10	41,00	121,15	40,00	0,05	1,00
59	122,60	41,00	122,55	40,00	0,05	1,00
60	121,00	41,00	120,93	40,25	0,07	0,75
61	122,00	41,00	121,89	40,25	0,11	0,75
62	121,90	41,00	121,84	40,00	0,06	1,00
63	121,30	41,00	121,40	39,50	0,10	1,50
64	120,50	41,00	120,56	39,50	0,06	1,50
65	119,80	41,00	119,92	40,00	0,12	1,00
66	121,00	41,00	120,85	39,75	0,15	1,25
67	119,80	41,00	119,84	40,00	0,04	1,00
68	120,60	41,00	120,73	40,00	0,13	1,00
69	120,90	41,00	120,90	40,00	0,00	1,00
70	120,70	41,00	120,76	39,75	0,06	1,25
71	120,10	41,00	120,12	40,00	0,02	1,00
72	119,80	41,00	119,67	40,00	0,13	1,00
73	121,40	41,00	121,22	39,75	0,18	1,25
74	123,30	41,00	123,15	40,00	0,15	1,00
75	123,20	41,00	123,24	40,25	0,04	0,75
76	121,80	41,00	121,69	39,50	0,11	1,50
77	123,10	41,00	123,15	40,00	0,05	1,00
78	121,30	41,00	121,27	39,75	0,03	1,25
79	120,20	41,00	120,14	39,50	0,06	1,50
80	120,20	41,00	120,12	39,50	0,08	1,50
81	122,00	41,00	121,94	39,50	0,06	1,50
82	121,10	41,00	121,05	39,50	0,05	1,50
83	121,40	41,00	121,30	40,00	0,10	1,00
84	121,60	41,00	121,57	40,00	0,03	1,00
85	121,00	41,00	120,93	39,75	0,07	1,25
86	121,10	41,00	121,25	39,75	0,15	1,25
87	120,30	41,00	119,99	40,00	0,31	1,00
88	121,20	41,00	121,17	40,00	0,03	1,00
89	121,80	41,00	121,79	40,25	0,01	0,75
90	121,20	41,00	121,10	40,25	0,10	0,75
91	120,80	41,00	120,80	40,00	0,00	1,00
92	122,20	41,00	122,23	40,00	0,03	1,00
93	122,70	41,00	122,63	40,25	0,07	0,75
94	123,10	41,00	123,17	40,00	0,07	1,00
95	122,80	41,00	122,73	40,00	0,07	1,00
96	121,30	41,00	121,15	39,25	0,15	1,75
97	121,80	41,00	121,79	39,75	0,01	1,25
98	122,50	41,00	122,28	39,75	0,22	1,25
99	121,40	41,00	121,35	40,00	0,05	1,00
100	122,90	41,00	122,95	40,00	0,05	1,00
				Standard deviation:	**0,066**	**0,269**

Graphical representation

Model:	**2BD-2B200A-2K3D-2ZB**	Serial no:	**756056**
Target torque:	**120,00 Nm**	60 % of max. torque	
Angle degree:	**40°**	Tool without angle correction	





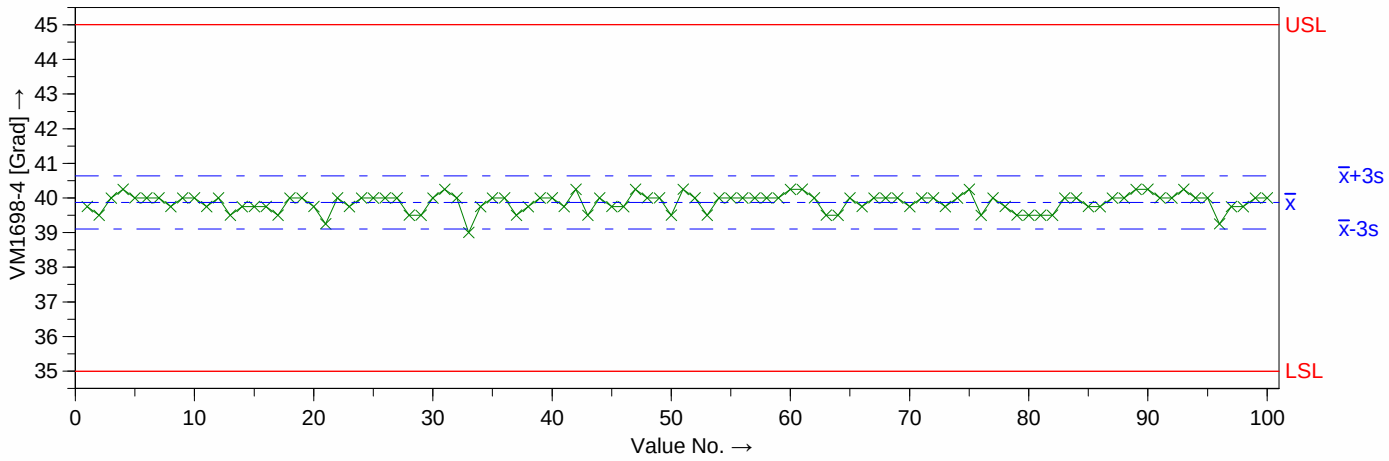
Machine Capability Study
Control System

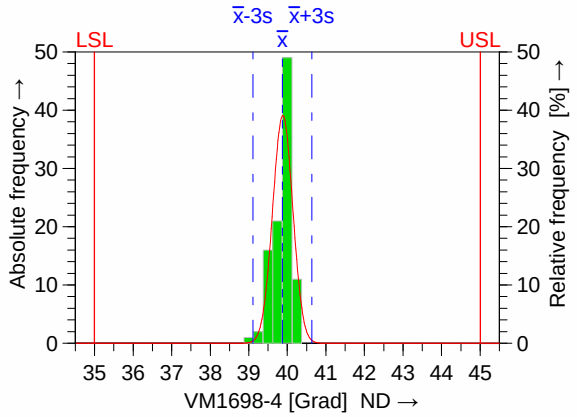
Plant	ATG Westhausen	Operator Name	Sünder
Date	27.04.2022		

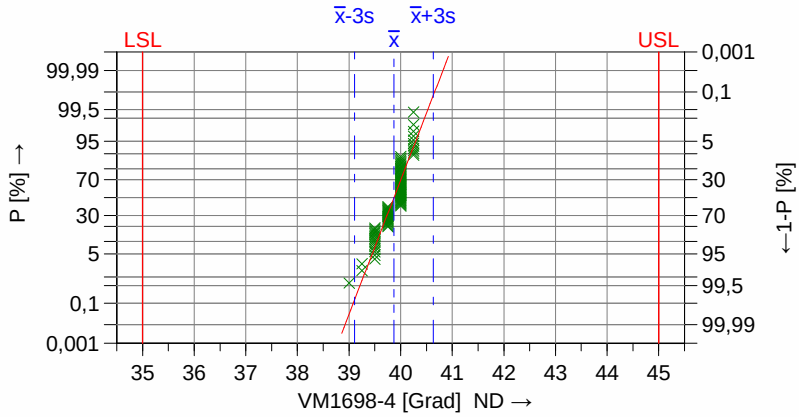
Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756056_k	Char.Descr.	VM1698-4	Nom.val. 40,00 5,00	USL 45,00
		Serial No.	1024210	Unit Grad -5,00	LSL 35,00
Char.Type	variable			Tolerance value 12 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	120 / 1019923	nges.	100

Evaluation from 27.04.2022 11:16:32 to 27.04.2022 11:30:39

Rem. TQ 60% Angle 40° +/-5° * TQ-Cal.: 200 Nm; Cur-Cal.: 5.574 Nm/A; Speed 300/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	40.00			$\bar{x}$	39.8700
LSL	35.00	x_{min}	39.00	$\bar{x}$-3s	39.1051
USL	45.00	x_{max}	40.25	$\bar{x}$+3s	40.6349
T	10.00	R	1.25	6s	1.5297
		$n_{<T>}$	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	6.54
Critical capability index	=	C_{mk}	6.37

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 27.04.2022

Serial No.	756056_k	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	122,05
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	94,72
				USL	150,84
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 200 Nm; Cur -Cal.: 5.574 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	122,18	123,00	124,82	124,33	123,64	124,75	123,86	125,07	125,36	124,99
1024210	VM1698-4	Grad	39,75	39,50	40,00	40,25	40,00	40,00	40,00	39,75	40,00	40,00

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	125,46	124,85	125,61	125,22	124,67	123,79	123,79	122,04	122,04	123,24
1024210	VM1698-4	Grad	39,75	40,00	39,50	39,75	39,75	39,75	39,50	40,00	40,00	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	123,32	123,86	122,46	121,96	122,33	121,59	121,25	121,35	120,90	122,26
1024210	VM1698-4	Grad	39,25	40,00	39,75	40,00	40,00	40,00	40,00	39,50	39,50	40,00

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	122,28	121,74	120,73	121,13	121,37	120,95	121,22	122,90	121,35	122,83
1024210	VM1698-4	Grad	40,25	40,00	39,00	39,75	40,00	40,00	39,50	39,75	40,00	40,00

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	122,41	121,17	121,00	120,90	122,16	121,72	121,77	121,57	119,79	119,33
1024210	VM1698-4	Grad	39,75	40,25	39,50	40,00	39,75	39,75	40,25	40,00	40,00	39,50

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	121,32	119,89	119,87	119,92	119,84	121,15	121,89	121,15	122,55	120,93
1024210	VM1698-4	Grad	40,25	40,00	39,50	40,00	40,00	40,00	40,00	40,00	40,00	40,25

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	121,89	121,84	121,40	120,56	119,92	120,85	119,84	120,73	120,90	120,76
1024210	VM1698-4	Grad	40,25	40,00	39,50	39,50	40,00	39,75	40,00	40,00	40,00	39,75

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	120,12	119,67	121,22	123,15	123,24	121,69	123,15	121,27	120,14	120,12
1024210	VM1698-4	Grad	40,00	40,00	39,75	40,00	40,25	39,50	40,00	39,75	39,50	39,50

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 27.04.2022

Serial No.	756056_k	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	122,05
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	94,72
				USL	150,84
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 200 Nm; Cur -Cal.: 5.574 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	121,94	121,05	121,30	121,57	120,93	121,25	119,99	121,17	121,79	121,10
1024210	VM1698-4	Grad	39,50	39,50	40,00	40,00	39,75	39,75	40,00	40,00	40,25	40,25

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	120,80	122,23	122,63	123,17	122,73	121,15	121,79	122,28	121,35	122,95
1024210	VM1698-4	Grad	40,00	40,00	40,25	40,00	40,00	39,25	39,75	39,75	40,00	40,00

Machine Capability Study
Control System

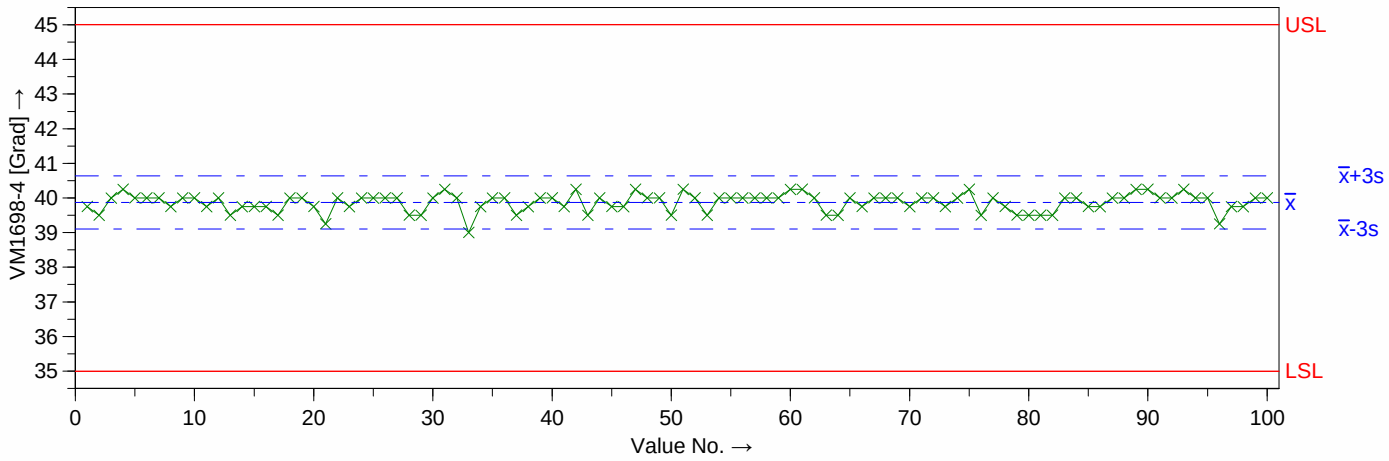
Page 1 / 1

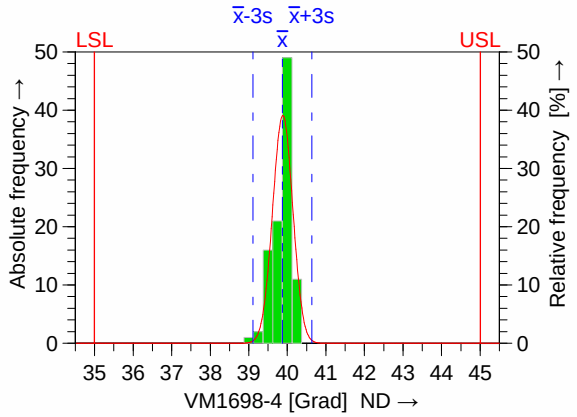
Plant	ATG Westhausen	Operator Name	Sünder
Date	27.04.2022		

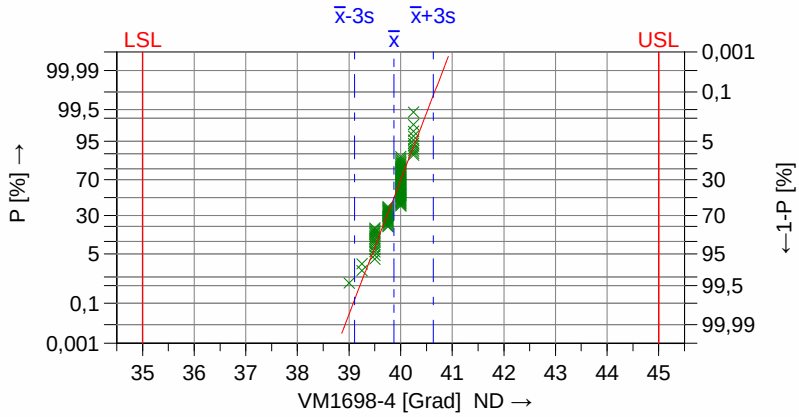
Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756056_k	Char.Descr.	VM1698-4	Nom.val. 40,00 5,00	USL 45,00
		Serial No.	1024210	Unit Grad -5,00	LSL 35,00
Char.Type	variable			Tolerance value 12 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	120 / 1019923	nges.	100

Evaluation from 27.04.2022 11:16:32 to 27.04.2022 11:30:39

Rem. TQ 60% Angle 40° +/-5° * TQ-Cal.: 200 Nm; Cur-Cal.: 5.574 Nm/A; Speed 300/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	40.00			$\bar{x}$	39.8700
LSL	35.00	x_{min}	39.00	$\bar{x}$-3s	39.1051
USL	45.00	x_{max}	40.25	$\bar{x}$+3s	40.6349
T	10.00	R	1.25	6s	1.5297
		$n_{<T>}$	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	6.54
Critical capability index	=	C_{mk}	6.37

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 27.04.2022

Serial No.	756056_k	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	62,85
Ord. No.	2BD200T1S-A	Serial No.	206284	LSL	0,00
				USL	150,84
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 200 Nm; Cur -Cal.: 5.574 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}
206284	2K3D	Nm	122,30	123,00	124,70	124,20	123,60	124,80	123,80	125,10	125,40	124,90
206284	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}
206284	2K3D	Nm	125,60	124,70	125,70	125,20	124,90	123,70	123,70	122,10	122,00	123,10
206284	2K3D	Grad	40,00	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}
206284	2K3D	Nm	123,20	123,80	122,80	122,20	122,30	121,70	121,30	121,40	121,10	122,20
206284	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}
206284	2K3D	Nm	122,30	121,80	120,80	121,10	121,50	121,00	121,30	122,90	121,50	122,90
206284	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}
206284	2K3D	Nm	122,60	121,20	121,00	120,90	122,40	121,70	121,80	121,70	119,70	119,40
206284	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}
206284	2K3D	Nm	121,30	119,80	119,90	120,00	119,70	121,20	121,80	121,10	122,60	121,00
206284	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}
206284	2K3D	Nm	122,00	121,90	121,30	120,50	119,80	121,00	119,80	120,60	120,90	120,70
206284	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}
206284	2K3D	Nm	120,10	119,80	121,40	123,30	123,20	121,80	123,10	121,30	120,20	120,20
206284	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 27.04.2022

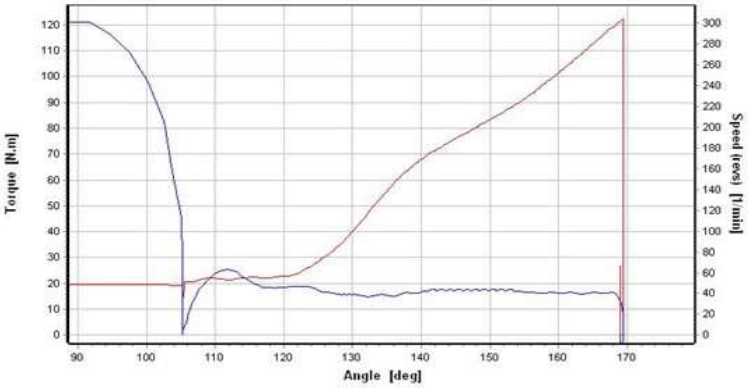
Serial No.	756056_k	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	62,85
Ord. No.	2BD200T1S-A	Serial No.	206284	LSL	0,00
				USL	150,84
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 200 Nm; Cur -Cal.: 5.574 Nm/A; Speed 300/50 rpm;				

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}
206284	2K3D	Nm	122,00	121,10	121,40	121,60	121,00	121,10	120,30	121,20	121,80	121,20
206284	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

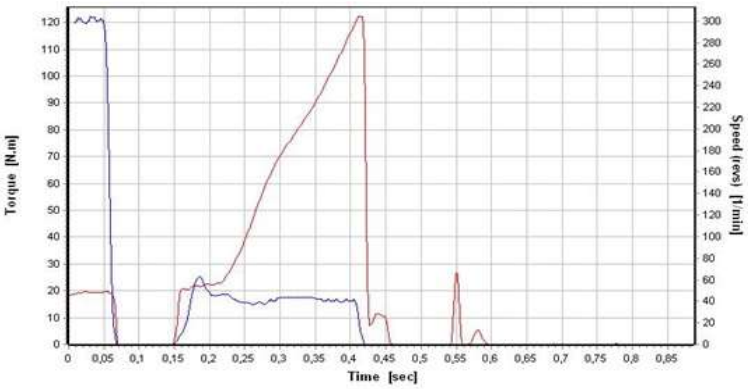
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206284	2K3D	Nm	120,80	122,20	122,70	123,10	122,80	121,30	121,80	122,50	121,40	122,90
206284	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Torque graphs

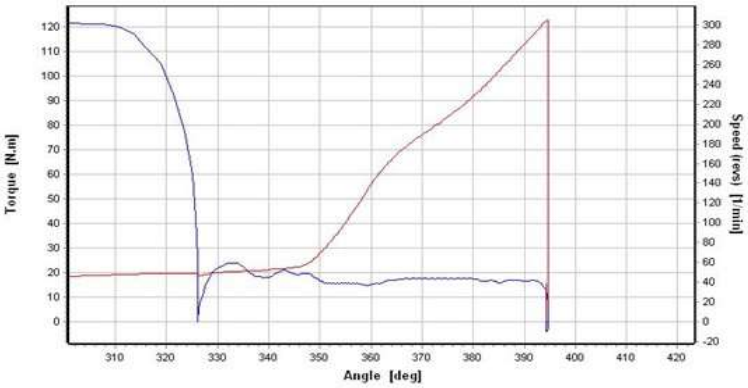
Model:	**2BD-2B200A-2K3D-2ZB**	Serial no:	**756056**
Target torque:	**120,00 Nm**	60 % of max. torque	
Angle degree:	**40°**	Tool without angle correction	



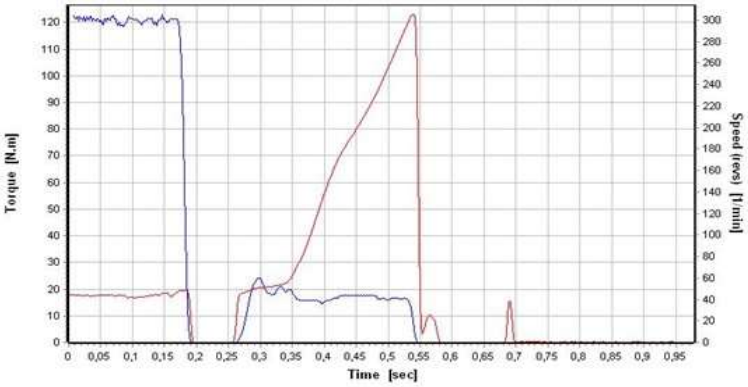
Value no. 1
Graph
Torque / Angle / Speed



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:** 756056

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: 0,93 % ± **0,46 %**

Angle degree: 180° Tolerance: 2,9° ± **1,5°**

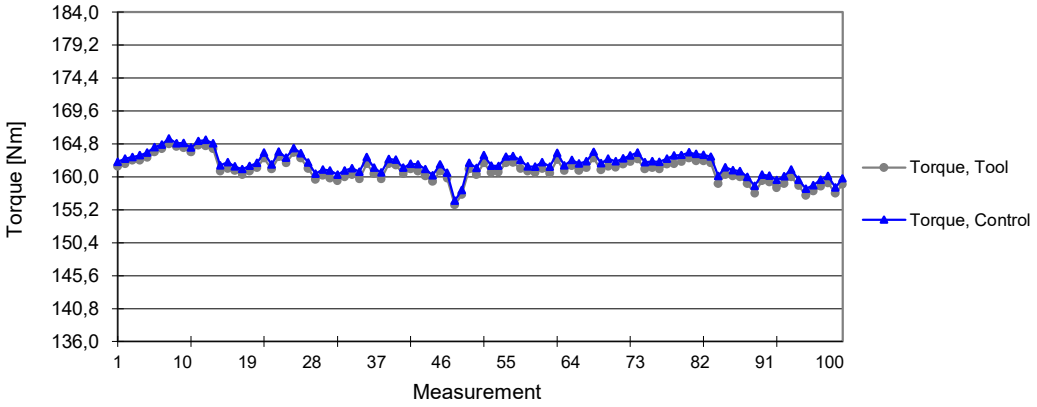
Formula derivation: $C_m = \frac{T}{6\,s}$ $T = C_m * 6\,s$

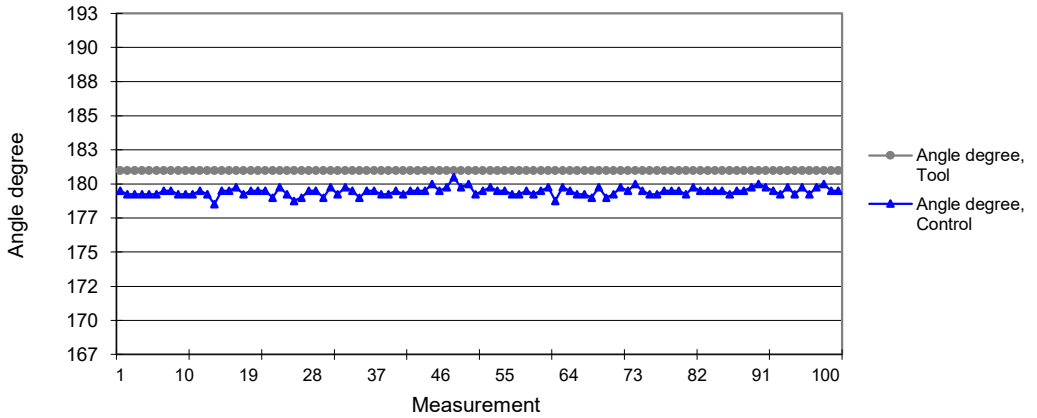
Tool without angle correction

Measurement	Tool data		Control data		Difference	
No.	Torque	Angle	Torque	Angle	Torque	Angle
1	161,50	181,00	162,17	179,50	0,67	1,50
2	161,90	181,00	162,62	179,25	0,72	1,75
3	162,40	181,00	162,87	179,25	0,47	1,75
4	162,40	181,00	163,12	179,25	0,72	1,75
5	162,80	181,00	163,52	179,25	0,72	1,75
6	163,60	181,00	164,32	179,25	0,72	1,75
7	164,10	181,00	164,67	179,50	0,57	1,50
8	164,80	181,00	165,57	179,50	0,77	1,50
9	164,40	181,00	164,87	179,25	0,47	1,75
10	164,20	181,00	164,92	179,25	0,72	1,75
11	163,60	181,00	164,27	179,25	0,67	1,75
12	164,60	181,00	165,22	179,50	0,62	1,50
13	164,50	181,00	165,37	179,25	0,87	1,75
14	164,10	181,00	164,87	178,50	0,77	2,50
15	160,80	181,00	161,67	179,50	0,87	1,50
16	161,20	181,00	162,12	179,50	0,92	1,50
17	160,90	181,00	161,52	179,75	0,62	1,25
18	160,30	181,00	161,12	179,25	0,82	1,75
19	160,80	181,00	161,57	179,50	0,77	1,50
20	161,30	181,00	162,02	179,50	0,72	1,50
21	162,70	181,00	163,52	179,50	0,82	1,50
22	161,10	181,00	161,77	179,00	0,67	2,00
23	162,90	181,00	163,67	179,75	0,77	1,25
24	162,00	181,00	162,77	179,25	0,77	1,75
25	163,50	181,00	164,17	178,75	0,67	2,25
26	162,70	181,00	163,42	179,00	0,72	2,00
27	161,20	181,00	162,07	179,50	0,87	1,50
28	159,60	181,00	160,46	179,50	0,86	1,50
29	160,20	181,00	161,02	179,00	0,82	2,00
30	159,80	181,00	160,91	179,75	1,11	1,25
31	159,40	181,00	160,31	179,25	0,91	1,75
32	160,00	181,00	160,91	179,75	0,91	1,25
33	160,30	181,00	161,22	179,50	0,92	1,50
34	159,70	181,00	160,71	179,00	1,01	2,00
35	161,90	181,00	162,87	179,50	0,97	1,50
36	160,40	181,00	161,32	179,50	0,92	1,50
37	159,70	181,00	160,61	179,25	0,91	1,75
38	161,90	181,00	162,57	179,25	0,67	1,75
39	161,70	181,00	162,47	179,50	0,77	1,50
40	160,40	181,00	161,32	179,25	0,92	1,75
41	161,10	181,00	161,87	179,50	0,77	1,50
42	160,80	181,00	161,82	179,50	1,02	1,50
43	160,10	181,00	161,12	179,50	1,02	1,50
44	159,30	181,00	160,21	180,00	0,91	1,00
45	160,80	181,00	161,82	179,50	1,02	1,50
46	159,80	181,00	160,56	179,75	0,76	1,25
47	155,90	181,00	156,51	180,50	0,61	0,50
48	157,40	181,00	158,06	179,75	0,66	1,25
49	161,10	181,00	162,02	180,00	0,92	1,00
50	160,30	181,00	161,27	179,25	0,97	1,75
51	162,00	181,00	163,12	179,50	1,12	1,50
52	160,60	181,00	161,62	179,75	1,02	1,25
53	160,70	181,00	161,57	179,50	0,87	1,50
54	162,00	181,00	162,92	179,50	0,92	1,50
55	162,10	181,00	163,02	179,25	0,92	1,75
56	161,20	181,00	162,42	179,25	1,22	1,75
57	160,80	181,00	161,52	179,50	0,72	1,50
58	160,60	181,00	161,47	179,25	0,87	1,75
59	161,20	181,00	162,12	179,50	0,92	1,50
60	160,50	181,00	161,47	179,75	0,97	1,25
61	162,50	181,00	163,47	178,75	0,97	2,25
62	160,90	181,00	161,67	179,75	0,77	1,25
63	161,60	181,00	162,42	179,50	0,82	1,50
64	160,90	181,00	161,92	179,25	1,02	1,75
65	161,30	181,00	162,22	179,25	0,92	1,75
66	162,70	181,00	163,62	179,00	0,92	2,00
67	161,00	181,00	161,97	179,75	0,97	1,25
68	161,50	181,00	162,62	179,00	1,12	2,00
69	161,40	181,00	162,22	179,25	0,82	1,75
70	161,80	181,00	162,67	179,75	0,87	1,25
71	162,20	181,00	163,07	179,50	0,87	1,50
72	162,60	181,00	163,52	180,00	0,92	1,00
73	161,10	181,00	162,12	179,50	1,02	1,50
74	161,30	181,00	162,22	179,25	0,92	1,75
75	161,10	181,00	162,17	179,25	1,07	1,75
76	161,80	181,00	162,62	179,50	0,82	1,50
77	161,90	181,00	163,07	179,50	1,17	1,50
78	162,20	181,00	163,17	179,50	0,97	1,50
79	162,70	181,00	163,57	179,25	0,87	1,75
80	162,30	181,00	163,32	179,75	1,02	1,25
81	162,30	181,00	163,22	179,50	0,92	1,50
82	162,00	181,00	162,92	179,50	0,92	1,50
83	159,00	181,00	160,11	179,50	1,11	1,50
84	160,30	181,00	161,37	179,50	1,07	1,50
85	160,10	181,00	160,96	179,25	0,86	1,75
86	160,00	181,00	160,81	179,50	0,81	1,50
87	159,00	181,00	160,01	179,50	1,01	1,50
88	157,60	181,00	158,66	179,75	1,06	1,25
89	159,40	181,00	160,31	180,00	0,91	1,00
90	159,20	181,00	160,16	179,75	0,96	1,25
91	158,40	181,00	159,51	179,50	1,11	1,50
92	159,00	181,00	160,06	179,25	1,06	1,75
93	160,00	181,00	161,02	179,75	1,02	1,25
94	158,70	181,00	159,56	179,25	0,86	1,75
95	157,30	181,00	158,26	179,75	0,96	1,25
96	157,90	181,00	158,76	179,25	0,86	1,75
97	158,60	181,00	159,56	179,75	0,96	1,25
98	159,10	181,00	160,11	180,00	1,01	1,00
99	157,60	181,00	158,46	179,50	0,86	1,50
100	158,90	181,00	159,76	179,50	0,86	1,50
				Standard deviation:	**0,148**	**0,293**

Graphical representation

Model:	**2BD-2B200A-2K3D-2ZB**	Serial no:	**756056**
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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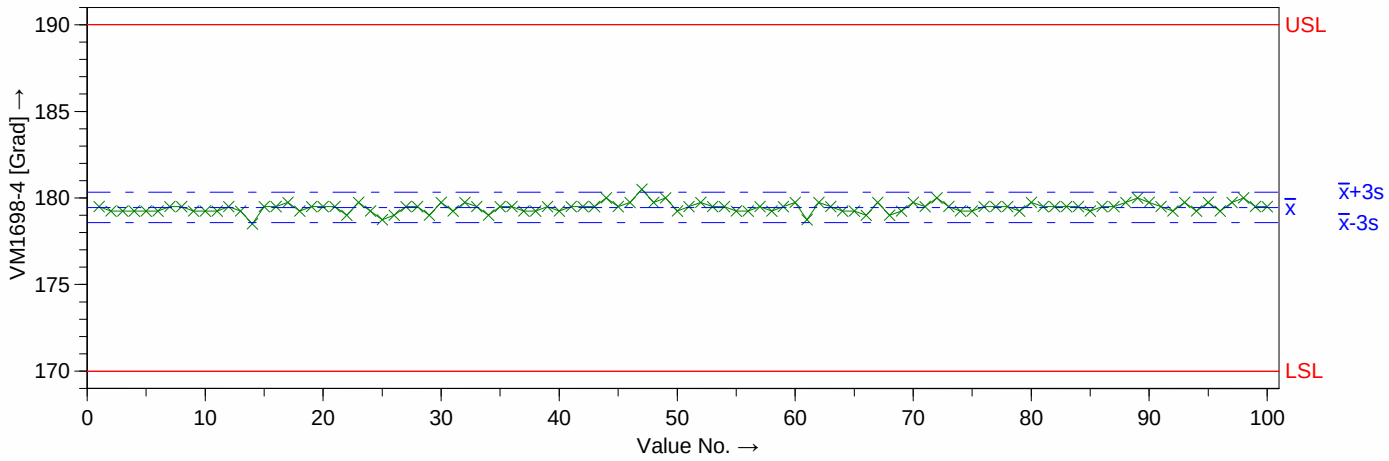
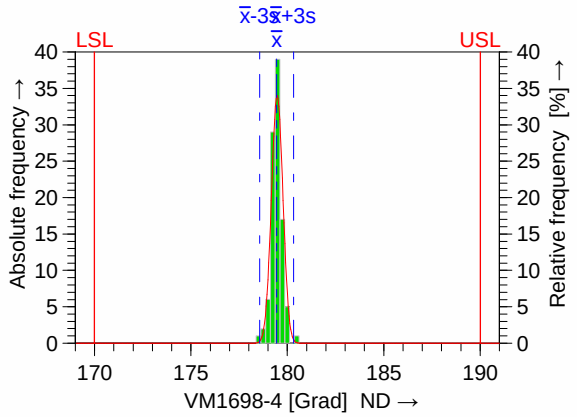
Plant	ATG Westhausen	Operator Name	Sünder
Date	27.04.2022		

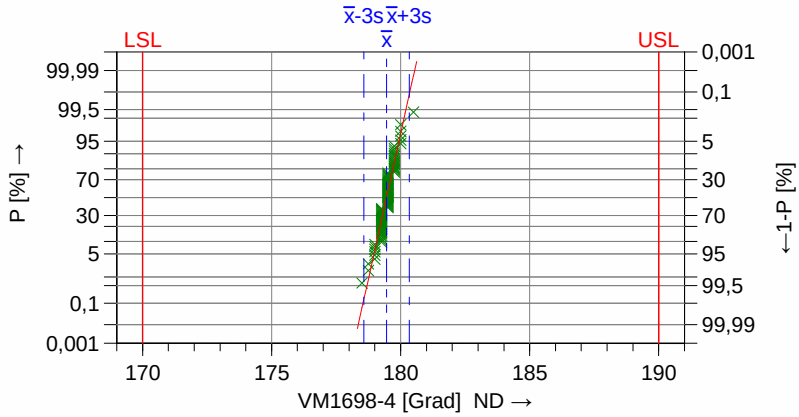
Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756056_l	Char.Descr.	VM1698-4	Nom.val. 180,00 10,00	USL 190,00
		Serial No.	1024210	Unit Grad -10,00	LSL 170,00
Char.Type	variable			Tolerance value 6 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	250 / 5537037	nges.	100

Evaluation from 27.04.2022 13:39:32 to 27.04.2022 13:55:14

Rem. TQ 80% Angle 180° +/-10° * TQ-Cal.: 200 Nm; Cur-Cal.: 5.486 Nm/A; Speed: 300/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	180.00			$\bar{x}$	179.4500
LSL	170.00	x_{min}	178.50	$\bar{x}$-3s	178.5710
USL	190.00	x_{max}	180.50	$\bar{x}$+3s	180.3290
T	20.00	R	2.00	6s	1.7581
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution		Normal Distribution	
Calculation method		M1.1.4 $\hat{\sigma} = S_{tot}$	
Potential Capability index	=	C_m	11.38
Critical capability index	=	C_{mk}	10.75

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 27.04.2022

Serial No.	756056_I	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	160,49
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	124,32
				USL	198,68
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 200 Nm; C ur-Cal.: 5.486 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	162,17	162,62	162,87	163,12	163,52	164,32	164,67	165,57	164,87	164,92
1024210	VM1698-4	Grad	179,50	179,25	179,25	179,25	179,25	179,25	179,50	179,50	179,25	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	164,27	165,22	165,37	164,87	161,67	162,12	161,52	161,12	161,57	162,02
1024210	VM1698-4	Grad	179,25	179,50	179,25	178,50	179,50	179,50	179,75	179,25	179,50	179,50

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	163,52	161,77	163,67	162,77	164,17	163,42	162,07	160,46	161,02	160,91
1024210	VM1698-4	Grad	179,50	179,00	179,75	179,25	178,75	179,00	179,50	179,50	179,00	179,75

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	160,31	160,91	161,22	160,71	162,87	161,32	160,61	162,57	162,47	161,32
1024210	VM1698-4	Grad	179,25	179,75	179,50	179,00	179,50	179,50	179,25	179,25	179,50	179,25

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	161,87	161,82	161,12	160,21	161,82	160,56	156,51	158,06	162,02	161,27
1024210	VM1698-4	Grad	179,50	179,50	179,50	180,00	179,50	179,75	180,50	179,75	180,00	179,25

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	163,12	161,62	161,57	162,92	163,02	162,42	161,52	161,47	162,12	161,47
1024210	VM1698-4	Grad	179,50	179,75	179,50	179,50	179,25	179,25	179,50	179,25	179,50	179,75

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	163,47	161,67	162,42	161,92	162,22	163,62	161,97	162,62	162,22	162,67
1024210	VM1698-4	Grad	178,75	179,75	179,50	179,25	179,25	179,00	179,75	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	163,07	163,52	162,12	162,22	162,17	162,62	163,07	163,17	163,57	163,32
1024210	VM1698-4	Grad	179,50	180,00	179,50	179,25	179,25	179,50	179,50	179,50	179,25	179,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 27.04.2022

Serial No.	756056_I	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	160,49
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	124,32
				USL	198,68
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 200 Nm; C ur-Cal.: 5.486 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	163,22	162,92	160,11	161,37	160,96	160,81	160,01	158,66	160,31	160,16
1024210	VM1698-4	Grad	179,50	179,50	179,50	179,50	179,25	179,50	179,50	179,75	180,00	179,75

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	159,51	160,06	161,02	159,56	158,26	158,76	159,56	160,11	158,46	159,76
1024210	VM1698-4	Grad	179,50	179,25	179,75	179,25	179,75	179,25	179,75	180,00	179,50	179,50

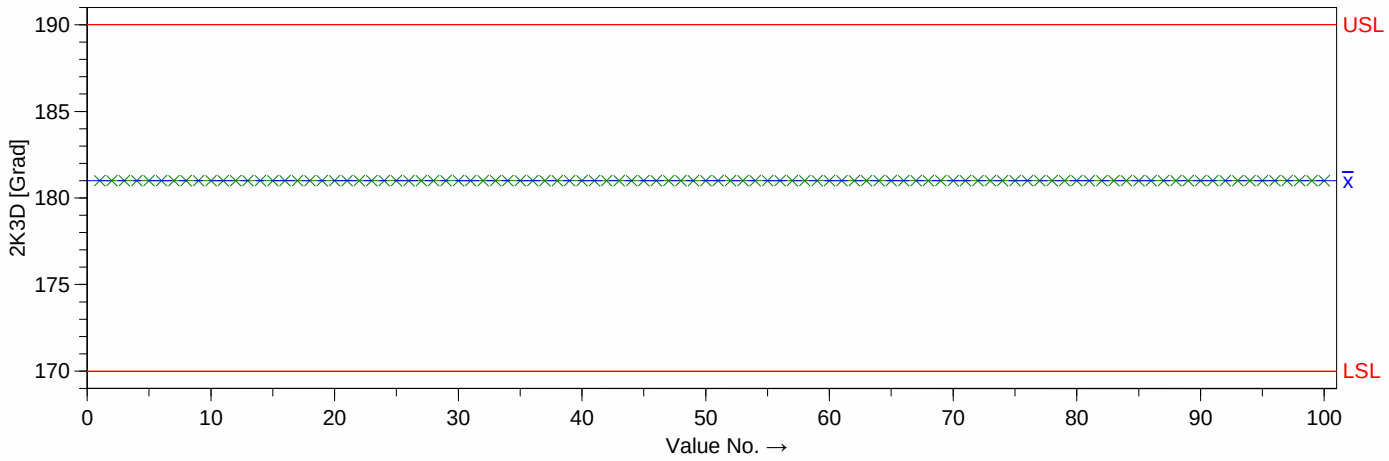
Machine Capability Study
Tool System

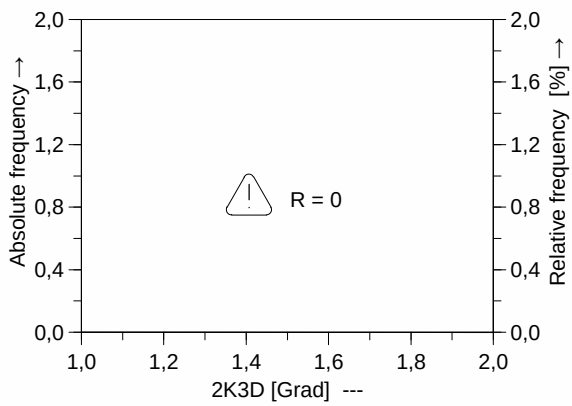
Plant	ATG Westhausen	Operator Name	Sünder
Date	27.04.2022		

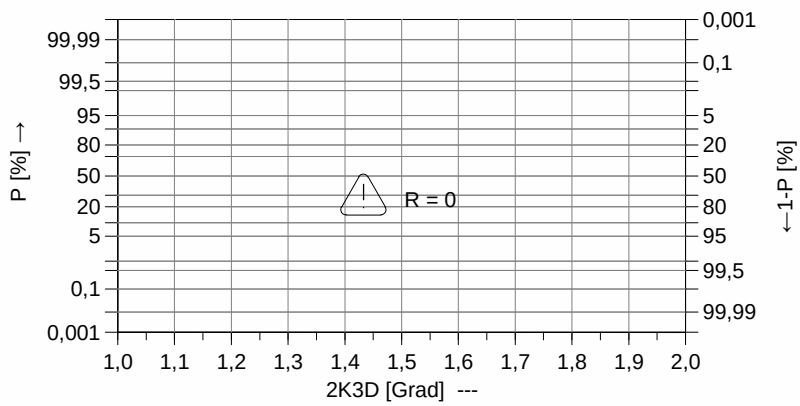
Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756056_l	Char.Descr.	2K3D	Nom.val. 180,00 10,00	USL 190,00
		Serial No.	206284	Unit Grad -10,00	LSL 170,00
Char.Type	variable			Tolerance value 6 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	250 / 5537037	nges.	100

Evaluation from 27.04.2022 13:39:33 to 27.04.2022 13:55:15

Rem. TQ 80% Angle 180° +/-10° * TQ-Cal.: 200 Nm; Cur-Cal.: 5.486 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 27.04.2022

Serial No.	756056_I	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	82,60
Ord. No.	2BD200T1S-A	Serial No.	206284	LSL	0,00
				USL	198,24
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 200 Nm; C ur-Cal.: 5.486 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}
206284	2K3D	Nm	161,50	161,90	162,40	162,40	162,80	163,60	164,10	164,80	164,40	164,20
206284	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}
206284	2K3D	Nm	163,60	164,60	164,50	164,10	160,80	161,20	160,90	160,30	160,80	161,30
206284	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}
206284	2K3D	Nm	162,70	161,10	162,90	162,00	163,50	162,70	161,20	159,60	160,20	159,80
206284	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}
206284	2K3D	Nm	159,40	160,00	160,30	159,70	161,90	160,40	159,70	161,90	161,70	160,40
206284	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}
206284	2K3D	Nm	161,10	160,80	160,10	159,30	160,80	159,80	155,90	157,40	161,10	160,30
206284	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}
206284	2K3D	Nm	162,00	160,60	160,70	162,00	162,10	161,20	160,80	160,60	161,20	160,50
206284	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}
206284	2K3D	Nm	162,50	160,90	161,60	160,90	161,30	162,70	161,00	161,50	161,40	161,80
206284	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}
206284	2K3D	Nm	162,20	162,60	161,10	161,30	161,10	161,80	161,90	162,20	162,70	162,30
206284	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 27.04.2022

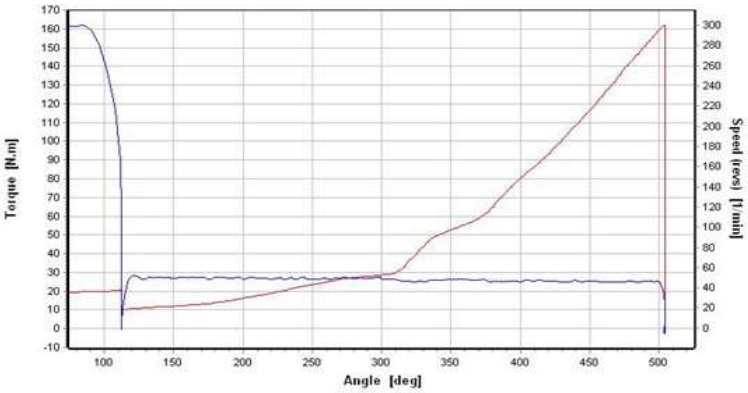
Serial No.	756056_I	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	82,60
Ord. No.	2BD200T1S-A	Serial No.	206284	LSL	0,00
				USL	198,24
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 200 Nm; C ur-Cal.: 5.486 Nm/A; Speed: 300/50 rpm;				

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}
206284	2K3D	Nm	162,30	162,00	159,00	160,30	160,10	160,00	159,00	157,60	159,40	159,20
206284	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

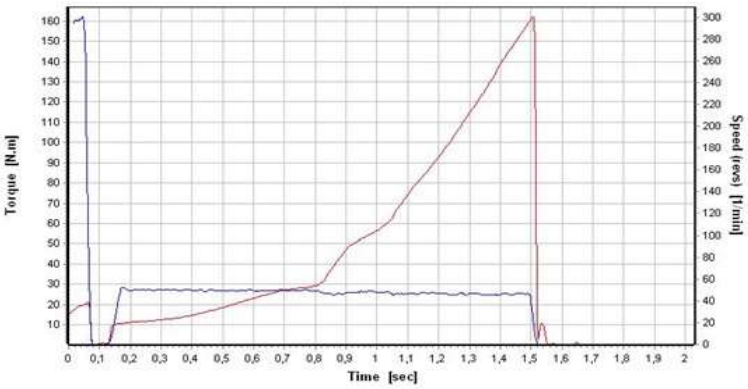
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206284	2K3D	Nm	158,40	159,00	160,00	158,70	157,30	157,90	158,60	159,10	157,60	158,90
206284	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Torque graphs

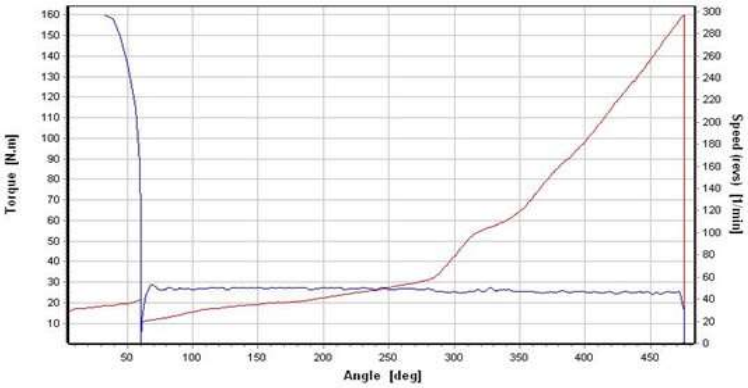
Model:	**2BD-2B200A-2K3D-2ZB**	Serial no:	**756056**
Target torque:	**160,00 Nm**	80 % of max. torque	
Angle degree:	**180°**	Tool without angle correction	



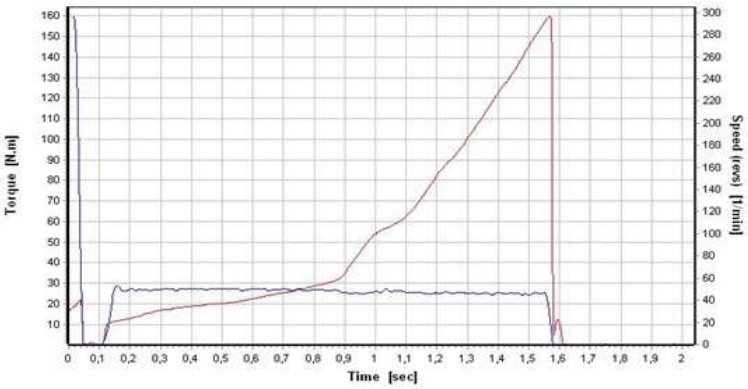
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed